



ECO CANADA

Environmental Careers Organization



Building Operator Scoping Study

LABOUR MARKET RESEARCH STUDY

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Canada

Funded by the Government of Canada's Sector Council Program

ECO CANADA

ECO Canada develops programs that help individuals build meaningful environmental careers, provides employers with resources to find and keep the best environmental practitioners, and informs educators and governments of employment trends to ensure the ongoing prosperity of this growing sector.



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The opinions and interpretations in this publication are those of the author and do not necessarily reflect those of the Government of Canada.

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2. EXECUTIVE SUMMARY

2.1 KEY FINDINGS

The Building Operator Scoping Study examined the current labour market of building operators in the commercial and institutional sectors with the goals of defining the occupation and identifying mechanisms to assist building operators in adapting to the requirements of a sustainably built and operated environment.

The research identified a number of challenges and gaps within the building operator profession which should be addressed in order to build a strong, qualified and valued workforce for the future. These challenges include a lack of consistent definitions, professional qualifications and standards, as well as gaps in training and education, and human resource practices. Addressing these challenges will enhance the value of building operators by preparing them to operate high performing buildings in the present and future.

The research found that a clear definition of 'building operator' does not exist. Definitions range from a "jack of all trades" who caters to the requests of occupants and the basic operational requirements of a building to a highly specialized technician who oversees overall building health and plays a strategic role in increasing the efficiency of building operations. Furthermore, there is no common framework for defining the positions, roles, responsibilities and requisite qualifications of building operators. This context, along with the common yet misinformed perception that building operators have responsibilities similar to custodians, has limited the ability of the profession to attract skilled and qualified candidates.



There is general agreement that as the profession becomes increasingly technical and specialized, we will be facing a labour shortage in five to ten years if significant changes are not made.



Findings indicate that various educational and training programs for building operators exist in both public and private spheres, but they remain fragmented and do not appear to be meeting the needs of industry. There is no recognized certification system for building operators and confusion exists amongst employers and operators about the appropriate qualifications and training required. Education and training of building operators is also hindered by an industry culture that does not encourage training. One key challenge in this area is that educational programming is lagging behind technological advances in building systems. As such, employers rely on in-house and manufacturer training to fill the gaps. While this is often high quality training that meets the immediate needs of current operators and systems, the skills acquired through such training are not broadly transferable and there is often no ongoing education provided. While most agree that one single framework is not possible due to the variability within the profession, there is clearly a need for a more coordinated approach to training to meet the emerging needs of building operators and to enhance the credibility of the profession.

There is general agreement that as the profession becomes increasingly technical and specialized, we will be facing a labour shortage in five to ten years if significant changes are not made. The building operator population is aging rapidly and if the profession is to attract new skilled and qualified operators, it needs to boost its profile through formalized accreditation, better entry-level salaries, incentives and opportunities for advancement. Moreover, very few building operators are women or come from visible minorities.

Finally, the study found a need for increased collaboration among sector stakeholders including governments, associations, industry and educational institutions. There is a perception that this is contributing to the fragmented nature of the profession. There is an equal failure to integrate building operators into the overall management of buildings and to address aspects of the job, such as occupant relations, both of which are limiting the potential contribution of building operators towards optimizing building performance.

2.2 RECOMMENDATIONS

As outlined in the conclusions section of this report, there are several challenges that need to be addressed to create a workforce of operators that are sufficiently qualified and skilled to operate the high performance buildings of the present and the future. Devising strategies to address these challenges will require the input of all stakeholders. To that end, there was interest among many interviewees to create a national task force comprised of government, industry, associations and educational institutions to develop a business case and implement a strategy to achieve the following recommendations:

1. Establish a partnership between government, industry and educational institutions to develop a national training and certification strategy that is adaptable to the latest advances in building systems technologies, and provides benchmarks to ensure that the next generation of building operators are armed with more consistent, comprehensive and relevant skill sets.
2. Establish a national framework for tracking labour market information on the building operator profession. Possible approaches could include refining the unit groups within the National Occupational Classification Statistics (NOCS) for stationary engineers, tracking education and training metrics in the Statistics Canada (Stats Can) Post-Secondary Student Information System, and aligning metrics used by the private sector to provide ongoing, comparative industry intelligence (i.e. demographics, labour supply, etc). Supplement gaps in a robust data acquisition framework through detailed primary quantitative research, with particular emphasis on barriers to entry identified in this report. Having this information is essential to deciding how the profession should be defined and what policy and regulatory steps should be taken, such as the creation of a formal certification system and regulatory framework.
3. Under the auspices of the trilateral partnership, develop strategies to address barriers to entry into the profession. Specifically, develop communications campaigns that promote the profession of building operator targeting high school and post-secondary graduates, related professions, and underrepresented communities that face barriers to entry (i.e., women and visible minorities). Collaboration with stakeholders and trades organizations (i.e., Canadian Apprenticeship Forum) will be key, as these issues are common across many skilled trades.



3. INTRODUCTION

3.1 ABOUT ECO CANADA

ECO Canada is a not-for-profit organization that was first established in 1992 under the Government of Canada's Sector Council Program. Its mission is "to ensure an adequate supply of people with the demonstrated skills and knowledge required to meet the environmental human resource needs of the public and private sectors".

Over the years, ECO Canada has grown into its own as an organization focused on supporting Canada's environment industry by communicating with industry stakeholders, conducting research and creating the necessary resources required to address human resource needs in order to ensure the success of this dynamic sector.

ECO Canada:

- Is an industry-led human resources organization that develops programs that help individuals build meaningful environmental careers;
- Provides employers with resources to find and keep the best environmental professionals; and
- Informs educators and governments of employment trends to ensure the ongoing prosperity of this growing sector.



The energy consumed by existing buildings and resulting carbon emissions are significant.



3.2 PROJECT CONTEXT

Energy conservation and the reduction of greenhouse gas emissions have been identified as primary environmental objectives for the 21st century. These objectives are recognized as both necessary to mitigate adverse environmental impacts and as financially prudent measures to be taken by business. All levels of government have identified the performance of existing buildings as critical to achieving energy and emission reduction targets as part of climate change strategies. The achievement of these goals in the face of an increasing number of buildings and rising energy consumption levels rests to a great extent on the ability of building operators to maintain and operate increasingly sophisticated building equipment, systems and technologies. While Canadian building owners and managers have begun the task of retrofitting existing building systems to varying degrees, less attention has been focused on who is operating buildings and whether they possess the ability and knowledge to manage high performance systems efficiently.

The energy consumed by existing buildings and resulting carbon emissions are significant. According to the National Roundtable on the Environment and Economy, buildings account for 14% of end-use energy consumption and 13% of the country's carbon emissions.¹ A Natural Resources Canada (NRCAN) report estimates that energy use is expected to grow by 44 % (2.4 % per year) to reach 1,635 PJ. The report also cites that "between 1990 and 2005, energy efficiency saved the commercial and institutional sector \$1.6 billion in energy costs, or 75.4 PJ of energy."²

In addition, as stipulated in their report, 20 by '15, the Real Property Association of Canada (REALpac) is adopting an energy consumption target for office buildings of 20 equivalent kilowatt-hours of total energy use per square foot of rentable area per year (20 ekWh/ft²/year), to be achieved by 2015, representing a reduction of up to one half of today's energy use in Canadian office buildings. According to REALpac, "achieving the target will lead to estimated energy cost savings in the order of \$1.85 billion/year, and greenhouse gas emissions savings of 7.5 Megatonnes/year, contributing to 5% of Canada's national 2020 goal."³

¹ "Geared For Change: energy efficiency in Canada's commercial building sector" a report by the National Round Table on the Environment and the Economy and Sustainable Development Technology Canada, 2009.

² *Natural Resources Canada, Energy Efficiency Trends in Canada, 1990 to 2005* (2009), ch.4 (commercial and institutional sector). Available online at <http://oee.nrcan.gc.ca/publications/statistics/trends07/chapter4.cfm?attr=0>.

³ Ian Jarvis, 20 by '15: *Achieving the Office Building Target of 20 ekWh/ft²/year by 2015* (Real Property Association of Canada, September 2009), p.3. ¹⁰ According to key informants with in-depth knowledge of Statistics Canada's Bi-Annual Survey of the Waste Management Industry.

Industry stakeholders recognize that building operators will play a primary role in achieving these targets. But before a strategy is put in place to harness the potential of this target audience in pursuing green objectives, the profession of building operator itself must be more clearly defined. Without the benefit of clearly defined professional classification for building operators, the parameters of the profession continue to be subjectively defined by stakeholders in the building operations industry. Even within the building operator profession itself, definitions include a broad spectrum of opinions based on many determining factors, including - but not limited to - building types, HVAC (Heating, Ventilation, and Air Conditioning) system types, the particular focus of the building owner or building management company, and the region in which the building operator is employed. What is clear from this study's findings is that most stakeholders believe there is an impending crisis in the supply of building operators with the skills and experience to effectively and efficiently shepherd Canada's fast-evolving building inventory.

Finally, it is important to note the many dynamics and drivers affecting the employment and occupational outlook of building operators today. The following is a list of the most recognized factors, many of which are explored in this report:

- An increasing number of buildings;
- Industry focus on reducing operational costs;
- Energy and resource prices;
- Building owners seeking to improve the profile of their buildings through higher green ratings and improved energy performance;
- Labour shortages and a corresponding competitive compensation environment;
- Disparity in the cost of living between jurisdictions limiting workforce mobility resulting in concentration of workforce in certain cities and shortages in others;
- Limited exposure of the profession to high school students and prospective labour market leading to poor awareness of career opportunities;
- Poor marketing of the profession, particularly educational and training opportunities;
- Limits on publicly available data about building operators resulting in no public reporting about the profession; and
- No formal national certification or recognition of the profession.

3.3 RESEARCH OBJECTIVES

The main objective of this scoping exercise was to survey the present state of the building operator profession in Canada, and identify mechanisms to assist building operators in adapting to the requirements of a sustainably built and operated environment in the commercial and institutional sector. Specifically, the study sought to document the occupational profile, composition, qualifications and institutional framework supporting building operators in Canada. It also aimed to identify gaps in existing education and training, as well as industry support and recognition, in order to ensure that building operators actively participate in the emergence of a new culture of energy efficiency and conservation in Canadian buildings. As a scoping document, the intention was not necessarily to yield answers to questions regarding market demand, education programming and human resource questions, but rather to identify what information is available on these subjects and to note where further research is required.



What is clear from this study's findings is that most stakeholders believe there is an impending crisis in the supply of building operators with the skills and experience to effectively and efficiently shepherd Canada's fast-evolving building inventory.



3.4 SUMMARY OF RESEARCH METHODOLOGY

In the absence of any formal research on building operators, this study's methodology was designed as a preliminary exploration of the scope of the building operator occupation and industry, as well as how the occupation is responding to an increased emphasis and focus on efficient and environmentally friendly buildings. The needs of the current labour pool of building operators was canvassed in order to identify deficiencies in the training and education system with the intention of discovering what is required to enhance the skill set of existing operators and to draw more qualified candidates into the field.

The study was divided into two phases – a literature review followed by a qualitative survey of key industry stakeholders. The literature review included an exhaustive survey of both published and unpublished sources, as well as labour market statistics and related research to identify:

- Relevant existing occupations in the green building industry;
- A list of existing educational and training programs for building operators; and
- A preliminary understanding of the scope of activities involved for a building operator.

The primary research phase involved 31 in-depth phone interviews with key industry stakeholders to obtain a thorough understanding of stakeholders' views and their knowledge base about the profession (see Appendix A for a detailed outline of the study's methodology). In order to ensure the findings were representative of a broad range of industry stakeholders, specific quotas for respondent audiences were established prior to recruitment. As well, care was taken to ensure respondents were based throughout the country so the findings would not be entirely region-specific, though British Columbia and Ontario were disproportionately represented because of the number of key stakeholders located in those regions.

In the interest of maintaining respondent confidentiality, stakeholders and their responses were grouped in the following categories⁴:

Building Operators

This category included participants employed in managing a building, a group of buildings and shared building systems, or a particular system within a building or group of buildings. Some of them worked alone or with a very small team, while some managed a staff of hundreds.

Building Owners and Managers

(represented by professionals and association executives)

This category was comprised of senior executives in building management firms or corporate representatives of building owners who employ and manage building operators.

Policy, Regulatory and Union

This category included representatives of external institutions that influence the responsibilities and work environment of the building operator. This includes representatives from all levels of government responsible for developing energy efficiency policy for buildings and who regulate certain aspects of the building operator industry, specifically power engineers and union executives representing the interests of building operators as workers.

Educators

This group included professors, trainers, professionals and industry association management involved in building operator education and training. They represented a wide spectrum of organizations and viewpoints: some involved in highly technical full-time community college programs whose students may already have a secondary education, and others representing private entities providing training designed by industry associations focused on upgrading skill sets for existing building operators.

⁴ Many people interviewed filled multiple roles and therefore spoke from several different perspectives on the same issue. When referencing direct quotations, we attribute the comment to the broad stakeholder category to which the speaker self identified.



4. REPORT FINDINGS

4.1 SCOPE AND BOUNDARIES OF ENERGY EFFICIENCY AND OPERATIONS

Building design today is focused on 'intelligent', 'energy efficient' and/or 'high performance' building. This ranges from the introduction of high-efficiency equipment and systems, integrated resource management software and the design and operation of building systems to optimize overall environmental performance. Educators and industry stakeholders have identified the recent evolution of 'green' buildings as the most significant development to influence the operation of buildings, and consequently the profession of building operator.

The operation of 'green' buildings involves an understanding of independent systems and their successful integration. While many professions are engaged in the maintenance and operation of buildings, building operators are distinguished in that they are positioned to consider how various building systems interact to obtain maximum efficiencies.⁵ Building operators are not necessarily 'experts' with respect to each technology or system, but should have an appreciation and competency in all areas.

While there are some uniquely 'green' elements to high-performance building operations (e.g., alternative energy technologies), energy efficiency and conservation is part of good building operation management, ensuring the functionality, and optimizing the performance and interaction of traditional building systems, including heating, air conditioning and ventilation, boilers, electrical, and mechanical systems. The scope may also extend to commissioning and periodic recommissioning of equipment. Accordingly, this study looked at the profession of building operator in a comprehensive manner to consider every aspect of the role that ties into energy efficiency and conservation objectives.

4.2 BUILDING OCCUPATIONS

With the exception of a few occupations related to alternative energy and green building rating system verification, the vast majority of occupations associated with building operations are traditional professions, such as the trades and power engineers. Appendix L provides a schematic of the various occupations related to building operations.



⁵ Gary Johnson, Building Environmental Systems Program Seneca College (phone interview, September 14, 2010).

Table 1
NOCS Unit Groups That Include Building Operators

| NOCS UNIT GROUP | PROFESSIONAL DESCRIPTION |
|-----------------|--|
| 7351 | Stationary Engineers and Auxiliary Equipment Operators |
| 6663 | Janitors, Caretakers and Building Superintendents |

Source: National Occupational Classification System

4.2.1 NATIONAL OCCUPATIONAL CLASSIFICATION SYSTEM (NOCS)

There is currently no distinct occupational unit group in the occupational classification for building operators in Canada. The National Occupations Classification System (NOCS) includes two unit groups that capture the roles and responsibilities of the building operator (Table 1).

This study focused on the role of building operator in relation to systems maintenance and operations and was therefore principally interested in unit group 7351.⁶ However for statistical purposes, it must be recognized that some building operators, particularly those who are not certified as power engineers or maintain smaller buildings, are likely captured under unit group 6663.⁷

The NOCS defines the occupation of stationary engineer (NOCS 7351) as follows:

"Stationary engineers and auxiliary equipment operators operate and maintain various types of stationary engines and auxiliary equipment to provide heat, light, power and other utility services for commercial, industrial and institutional buildings and other work sites. They are employed in industrial and manufacturing plants, hospitals, universities, government, utilities, hotels and other commercial establishments."⁸

While the NOCS classification encompasses building operators, information provided about the unit group indicates that it captures a much broader range of occupations. First, the list of alternative job titles under the unit group includes other professions (e.g., power engineer) (see Appendix F). Second, while the stationary engineer's list of duties detailed under NOCS 7351 clearly captures the central responsibilities of a building operator, the educational requirements for this occupational group requires a power engineer certification, which is only a requirement for a building operator where the building has a boiler (see Appendix I). Therefore, building operators without certification are not captured under NOCS 7351.

Given the scope of occupational classifications employed by Statistics Canada, statistical data regarding stationary engineers provided in this report should be interpreted and applied with caution in the context of building operators. Care should also be taken in using NOCS classifications for building operators because of the variation in job titles used by employers in the labour market.

⁶ NOCS has a unit group 0721 for "facility operations and maintenance managers", however this unit group does not cover the roles and responsibilities of a building operator as defined in this study. See <http://www5.hrsdc.gc.ca/NOC/English/NOC/2006/QuickSearch.aspx?val65=0721>.

⁷ The NOCS also includes six classifications for related trades, including electricians, plumbers, gas fitters, boilermakers, insulators, refrigeration and air conditioning mechanics. See definitions under Appendix G of this report. While some building operators come from a trades background and trades are involved in building operations, building operators are not captured under these classifications. These related professions are therefore beyond the scope of this study.

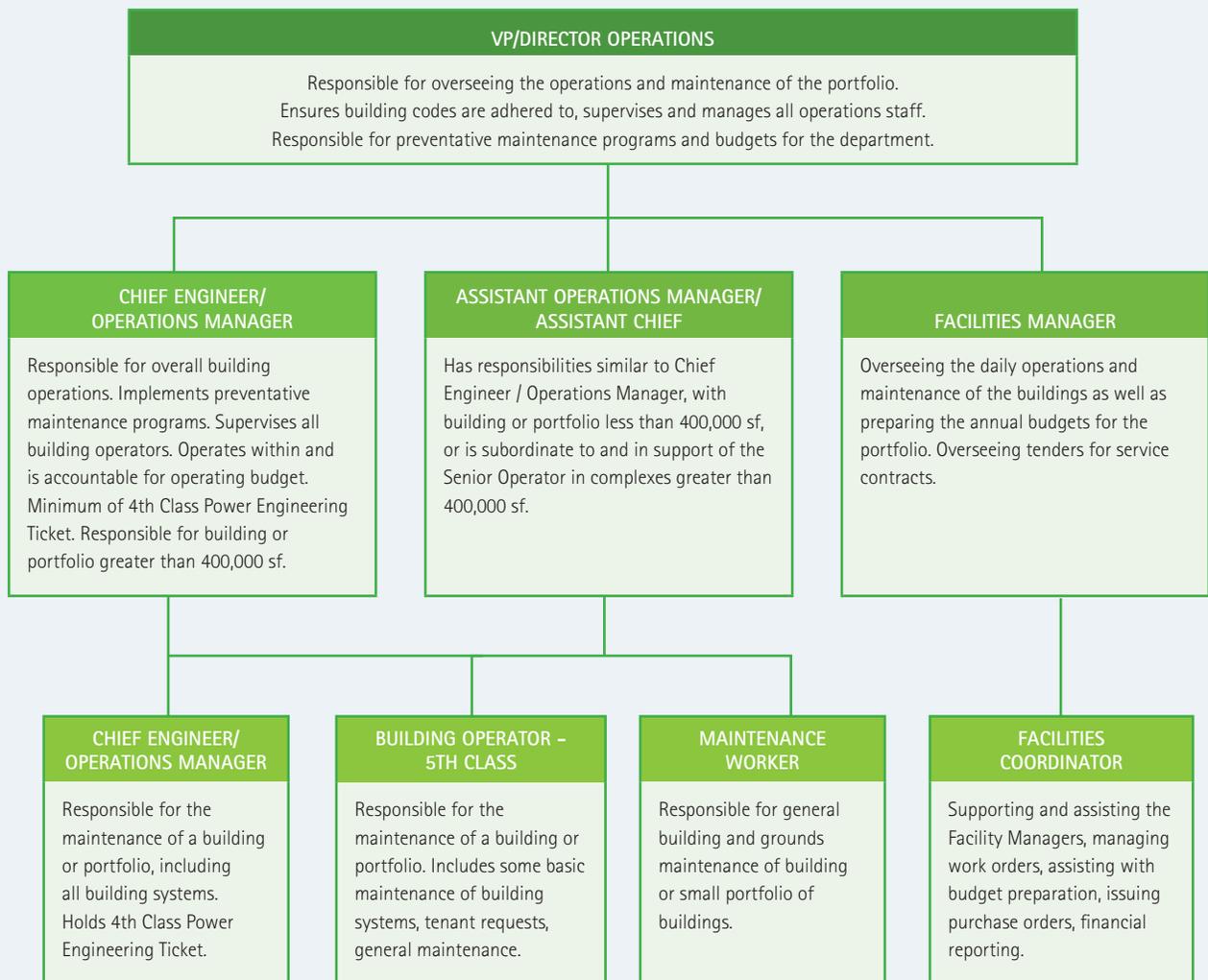
⁸ Available from HRDC at <http://www5.hrsdc.gc.ca/NOC/English/NOC/2006/Profile.aspx?val=7&val1=7351>. Downloaded September 16, 2010.

4.2.2 INVENTORY OF EXISTING BUILDING OCCUPATIONS

There are a wide range of occupations that contribute to the efficient operation of buildings. Depending on the size of the facility, each position may be filled by one or more individuals. Building operators are part of an operations team that may include a VP of Operations down to custodial staff. These positions may be supported by facilities managers and staff responsible for the administrative side of building operations. While there is no standardized inventory of job titles and descriptions, Table 2 illustrates a typical hierarchy of common positions.

Building operations are supported by at least four trades recognized under the NOCS. Definitions for these professions are provided in Appendix G. Available data on the various trades includes involvement in work beyond building operations and is beyond the scope of this study.

Table 2
Job Titles and Descriptions in Building Operations



4.3 BUILDING OPERATORS DEFINED

There is no formal national definition for the role of building operator and the skills associated with that role. While all stakeholders identify common responsibilities for the profession of building operators, there are enough differences that pose problems when creating a national definition. Further compounding the issue, lines are often blurred between building operators and occupations such as stationary engineers, power engineers, and custodians. Differences in definition, a lack of segmentation, and regional differences further complicate the use of a common definition of the term building operator. This subsection explores the origins and defining qualities of the building operator, provides a working definition of the profession for the purposes of this study, and documents how industry stakeholders view the role.

4.3.1 GENERAL DEFINITION OF BUILDING OPERATOR

The occupation of building operator has its origins in the custodial professions. Prior to the 1960s, building operators used to be responsible for general building maintenance. Gradually, building operators started to be assigned additional responsibilities related to building systems, such as heating and ventilation. These skills were generally acquired on-the-job.⁹ Gradually, the building operator position has become more situated in the maintenance and operation of building systems, although most jobs continue to include custodial responsibilities, especially in the case of smaller buildings. The role has become more structured and complex in recent years with the introduction of regulations requiring certification to operate various equipment, digital control and computerized systems and technologies, and dedicated education and training offerings for building operators.

There is no national definition of 'building operator', and only Alberta and Ontario have recognized occupations regarding building operations.¹⁰ Alberta has developed an occupation profile for building operators, which states that "building operators are responsible for the day-to-day maintenance and operation of large buildings that have complex heating, mechanical and electrical systems."¹¹ Historically, this has been limited to ensuring that these systems functioned and operated in accordance with prevailing regulation. Alberta's profile expands on this to include "report[ing] problems and recommend[ing] changes to improve efficiency, reduce operating costs or comply with environmental, building and safety codes."

However, current job postings suggest that few employers understand, appreciate and are seeking individuals who can fulfill this expanded role.¹² Of 18 job postings reviewed, only three (all from the same employer) set out conservation-related responsibilities and were limited to "supervising energy management practices for lighting and HVAC and seek [sic] to identify areas for improvement."¹³ The remaining building owners and property managers did not identify such priorities for building operators in their job postings.

Building operators are not necessarily experts with respect to each system, but understand their interrelationship and oversee the general maintenance, operation and interplay of systems. While intelligent buildings require an ability to work with computer-based systems, the evolving role for the building operator does not necessarily mean a broader set of responsibilities, but rather a deeper understanding of the interrelatedness of traditional building equipment and systems to achieve greater operational efficiencies through equipment commissioning and systems optimization.

⁹ Phone interview, Gary Johnson, Building Environmental Specialist instructor, Seneca College (September 14, 2010).

¹⁰ ASHRAE is currently developing a number of standards dealing with energy efficiency in existing and new high-performance buildings which spell out the role of the building operator. See ASHRAE SPC 100 (Energy Efficiency in Existing Buildings) and SPC 189.1 (Standard for the Development of High-Performance Green Buildings Except Low-Rise Residential Buildings). See <http://www.ashrae.org/technology/page/331>.

¹¹ Government of Alberta, Employment and Immigration, *Alberta Occupational Profiles: Building Operator* (OCCinfo). Available at <http://alis.alberta.ca/occinfo>.

¹² One possibility is that employers are looking to external experts to provide support in dealing with the increasing complexity of building systems and equipment optimization. ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers – arose in the 1950s in response to these developments. This issue will be explored further time permitting.

¹³ Great West Life, job posting for building operator dated July 19, 2010. Copy on file with Light House.



This study therefore defines the building operator as “a person who has the appropriate skills needed for the day-to-day maintenance and operation of large facilities that have complex heating, mechanical, and electrical systems along with specific knowledge of how to operate the facility in a way that takes into consideration the interplay of building systems to maximize energy and resource efficiency, reduce waste, provide superior indoor air qualities, and the requirements of building tenants”.

Finally, defining the position of building operator is complicated by the random use of job titles — such as power engineer, operating engineer and stationary engineer — to describe the occupation which has their roots in the historical evolution of the position. Buildings originally used steam to provide heat and energy. Accordingly, stationary engineers were employed for this position. Today, few buildings use steam but the term ‘stationary engineer’ continues to encompass the role of building operator in the minds of many employers and government agencies tracking building occupations (i.e., Stats Canada). Similarly, most buildings historically had boilers which required a certified power engineer to operate them. Heating systems in more modern buildings no longer require boilers, yet many within the industry see the position of power engineer as a proxy for the role of building operator even where the credential is not required to operate a particular building by law. To make things more confusing, many provinces and territories use to refer to 5th level power engineers as ‘building operators’ in their respective legislation and policy.¹⁴ It is the overlap of these professional designations that has left the lines blurred regarding the parameters of the occupation of building operator. Section 3.7.5 of this report considers employer awareness of these professional distinctions and whether power engineer certification continues to be listed as a job requirement based on historical practice or real need.

Interviews conducted with key stakeholders confirmed that confusion exists within the industry. While all stakeholders agreed on several basic elements of the definition, each audience defined the role of building operator differently. For all interviewees, building operators were responsible for the operation of systems in a building to ensure that the building functioned in a way that was satisfactory to its occupants and the building owner. Most made the distinction between janitorial/custodial/maintenance staff and building operators, expressing concern that these two occupations are often confused and should be distinguished. They indicated that building operators direct the work of custodians rather than doing the manual labour themselves. Stakeholders agreed that building operators were described as generalists who are mechanically inclined.

Beyond this basic universal definition, various differences in the understanding of the definition of building operators emerged among the various audiences interviewed. The greatest variation was in the building operator's role in relation to maximizing the efficiency of buildings. The definition of building operator is examined in the following subsections from the perspective of each audience type (see section 2.8 for summary of audience types).

¹⁴ See e.g. Yukon' Territory's *Power Engineers Regulation*, O.I.C. 2010/167 (Amended September 2010). Available at http://www.gov.yk.ca/legislation/regs/oic1980_303.pdf.

4.3.2 BUILDING OPERATORS DEFINE THEMSELVES

First and foremost, building operator participants defined themselves as being the stewards of the heating, ventilation and air conditioning (HVAC) systems for their building or buildings. For many, the only accreditation required for them to apply for their job is the accreditation necessary for them to operate their building's boiler or heat plant, most often a provincially regulated power engineer designation. Therefore, they tended to define themselves initially by this accreditation and the specific aspect of their job where the certification was necessary.

As noted here, the building operator defines himself or herself as a generalist, with knowledge that is much broader than it is deep. Though some building operators start out in a specific trade, knowledge of all building systems and their connectivity is critical to success. Whereas a plumber can stop a leak, a building operator must understand how shutting down any part of his or her building's system to fix that leak will affect the rest of the building's systems and occupants.

"We are more generalist, and we will deal with all aspects of commercial building including to a degree, plumbing or electricity maintenance, and tenant complaints, and air balancing [and] lighting requests. The other professions, like plumbers or electricians, are really task specific and the building operator is an intermediary."

BUILDING OPERATOR

Advances in technology are changing building operators' perceptions of themselves. Whereas the traditional definition of a building operator is of an adept generalist, new complex technologies associated with automated systems and the constant monitoring of the effects of those systems on a building's environment are creating a need for the talented generalist to be more technically proficient. Respondents indicated that these advances are driving segmentation of the profession more than has ever been necessary before, affecting many building operators in a significant way.

"I think it's had a huge impact – going from basic duties to having to monitor utilities and detect when costs are out of whack...systems are changing, and we are constantly trying to improve. Their job require[s] a lot more thought and education – they need to understand how everything fits together [and it's a] different way of thinking all together. We are going through the process of getting all of the training together... with green waste management all the systems are intertwined taking heat rejected from one area to pre-heat another. The systems are much more complicated."

BUILDING OPERATOR

Building operators also define themselves as being the primary conduit between the building owners or managers and the occupants. They are the face of the company on a day-to-day basis and can have a significant impact on occupant relations, which are key to the successful operation of any building. For some, their primary responsibility is to the occupant, not the owner or real estate management firm that employs them. This can have a direct impact on building owner priorities, including energy management.



4.3.3 BUILDING OWNERS' AND MANAGERS' VIEWS ON BUILDING OPERATORS

For building owners and property managers, the building operator is the employee who manages their key assets: buildings. They define them as the employee responsible for the dynamic systems in the building – HVAC, fire and life safety, plumbing, and electrical – as well as their primary client or occupant contact. They also understand the importance of the building operator role in affecting energy efficiency, building performance and profit.

"[Building operators are] mostly putting out fires and dealing with comfort complaints. And so they respond to them and depending on how well they are trained they can lessen the energy efficiency of the building in dealing with the complaints and leave it that way for months on end, so they have a huge impact."

BUILDING OWNER OR MANAGER

Building owners and managers expressed a growing concern that a shortage of skilled and qualified building operators is looming. The skill sets required are changing: a comfort with technology and a level of computer proficiency are a prerequisite for buildings operating with ever-more complex system controls. Many building operators are learning these skills on-the-job as new systems are introduced, but as they retire, new operators are not moving into the profession to take their places. This was a concern not only because of the potential negative ramifications on energy efficiency and profitability, but also because of the potential risks to building assets and occupants.

"You are going to have significant gaps or you will have an unqualified or unskilled person not properly trained, and [consequently] you are putting yourself at high risk; not just the tenants but the asset itself."

BUILDING OWNER OR MANAGER

Some also recognized that the industry as a whole has to change its perception of the building operator and adjust responsibilities and compensation levels accordingly.

"[The attitude is] you have so much for the asset manager, the property manager, the office people and whatever is left over can go to operations. I think there needs to be a focus on recognizing the importance of that employee... The industry is taking notice and the five big players are paying well, but a lot of the industry isn't."

BUILDING OWNER OR MANAGER

4.3.4 EDUCATORS: THEIR STUDENTS INFLUENCE THEIR PERCEPTIONS

The types of students that educators encountered in their particular educational stream or program seemed to shape their views about building operators. Educators tended to view the profession more positively and as a more structured, well-respected career if they taught career-oriented students passionate about using their technical abilities to drive a green agenda. Conversely, those who worked with building operators to upgrade skills to meet minimum requirements were more concerned about the attitude of the industry. They questioned the extent to which management acknowledged the importance of the building operator role, and their commitment to compensate operators appropriately for managing their key assets.

"Senior management doesn't always listen to them [building operators] because they don't have credibility. The importance of their role is not accepted by senior management."

EDUCATOR

4.3.5 POLICY, REGULATORY AND UNION REPRESENTATIVES

Those involved with policy development and regulation of the industry understood that the building operator is not necessarily a power engineer, and most acknowledged that the complexity and scope of the building operator as a profession is not covered by this designation. In particular, regulatory respondents voiced general support for the creation of a distinct regulatory framework governing building operators.

"They [building operators] want to make their occupations more of an occupation than power engineer and [the] power engineer [designation] is really directed toward boiler ops and heavily weighted there... The building operator people... represent a big property management company and they are seeing a need for a little diversity and truly building systems... They are looking to get their guys well rounded... and make it a true building operator classification... They have my ear and I agree with what they are trying to do and how it works with power engineering certification. They may have to splinter off and get a regulation around it."

POLICY, REGULATORY AND UNION

4.3.6 LACK OF FORMAL SEGMENTATION WITHIN THE PROFESSION

There was general consensus that the building operator profession must be segmented, but stakeholders were not in agreement regarding how or to what extent segmentation is necessary or beneficial. Moreover, stakeholder responses indicated no agreement on common division of roles and responsibilities or associated job titles. For example, the Executive Director of Maintenance at one facility may share the same responsibilities as the Mechanical Superintendent at another. The Building Owners and Managers Association's (BOMA) professional categories for building operators mirror the classification structure for power engineers and were relatively well known among stakeholders (see Appendix M). However, respondents also suggested that the profession might be segmented based on building typology. For a discussion on segmentation in the context of certification see s.3.5.6.

"I am a building technician and I do the work of senior building technician in my corporation, but it can't be based on occupation it has to be based on the dynamic[s] of [a] company. We have several different designations for building operators."

BUILDING OPERATOR

4.3.7 REGIONAL DIFFERENCES

Adding to the complexities in defining the role of building operator are the profound differences in regional perspectives.¹⁵ Though not enough specific research has been done to definitively capture the opinions and viewpoints from different regions, one thing was clear: government authorities in some regions, specifically Atlantic Canada, have not even recognized the informal existence of the profession of building operator because of the limited building infrastructure. Additional research is required to determine whether this is unique to specific regions, or a function of scale, applicable to any community with smaller and fewer buildings.

"So 'building operator' is a western Canadian concept, and I am not saying it is a bad concept, but in the Maritimes...- other than Halifax - we have smaller buildings... In Toronto you have large and complex building systems like the Air Canada Centre...so we don't have a definition [for 'building operator'] and we are the regulatory authority to deal with things defined."

POLICY, REGULATORY AND UNION

¹⁵ This study did not encompass stakeholders from every Canadian province and territory, but did include representation from Western Canada, Ontario, Quebec and Atlantic Canada.



4.4 BUILDING OPERATOR JOB DESCRIPTION & QUALIFICATIONS

The profession of building operator currently exists in arguably a de-regulated, or at most semi-regulated, environment with minimal formalized job descriptions or qualifications. Where buildings have boilers beyond a prescribed size, a certain level of power engineering certificate is required dependant on the size of the boiler. Building operators are also often required to maintain certification in Workplace Hazardous Materials Information System (WHMIS), First Aid and other areas not directly related to the maintenance and operation of equipment. Consideration of these additional qualifications is beyond the scope of this study. However, when it comes to the rest of the building operator's responsibilities, no certification or level of education is required. This section details the various points of confusion and uncertainty for respondents regarding building operator qualifications, including the lack of recognized accreditation and standards for building operators, the absence of clear differentiation between various 'classes' of building operator, and the importance of experience and on-the-job training.

4.4.1 BUILDING OPERATOR JOB DESCRIPTION

A wide survey of job postings for entry-level building operators (level 4) as well as formal job descriptions provided by one major building management firm revealed a number of common responsibilities for building operators, as well as a significant number of less common ones.¹⁶ The majority of job descriptions identified some or all of the following typical duties:

- Providing minor routine and preventative maintenance and repairs on building systems, including HVAC, plumbing and electrical;
- Responding to occupant complaints and performing repairs;
- Performing building checks and maintaining operations and maintenance logs;
- Liaising with contractors and trades; and
- Monitoring, inspecting and testing environmental, safety and security systems.

Some postings specified one or more of the following additional responsibilities:

- Experience operating Building Automation Systems (BAS) such as Honeywell Delta 1000, Excel and Graphic Central;
- Ability to read schematics and line diagrams;
- Commissioning and troubleshooting systems;
- Scheduling and prioritizing work;
- Obtaining contractor estimates and costs;
- Ensuring compliance with health and safety legislation and standards;
- Providing technical advice and information on code related issues;
- Participating in operating cost budget;
- Coaching and training maintenance team members; and
- Varying degrees of cleaning and custodial responsibilities.

Of all the postings reviewed, only one employer explicitly stated that the position involved participation in and improvement on energy management practices.

4.4.2 INDUSTRY RECOGNIZED PROGRAMS AND QUALIFICATIONS

Audiences recognized most of the major educational offerings for building operators, including Building Environmental Systems (BES) certificate programs, and BOMA and Building Owners and Managers Institute's (BOMI) programs including Systems Maintenance Technician (SMT) training. However, many programs known to exist did not receive mention (see section 3.7.1 for information about the various program offerings).

Certification from these programs is a recognized criterion for the building operator profession, and in some jurisdictions they are often a part of the qualifications included in job postings. However, for much of the industry these certifications, or certifications of any sort (other than regulated power engineer requirements), are a "nice to have" as opposed to a job requirement. According to one building manager, a key reason for this is that the present number of graduates from these programs cannot meet employer demand.

¹⁶ A review of job descriptions for senior level building operation positions was beyond the scope of this study.

4.4.3 EXPERIENCE AND ON-THE-JOB TRAINING

A key requirement identified by all audiences was the need for broad, on-the-job training and experience applicable to all building systems. Building operators need a large tool kit of skills to qualify to do their jobs. In many cases, on-the-job training must be done to bring a semi-qualified building operator up to the requisite level of proficiency. Stakeholders believed that qualifications earned in the classroom must be complemented with hands-on training or experience. Some property managers had developed internal courses to train building operators on their specific systems and to ensure a minimum level of competency.

4.4.4 COMPETENCY ASSESSMENTS

In addition to formalized certification and regulatory frameworks, some educator respondents also expressed the need for a process to assess the competency of building operators, apparently unaware of BOMI's competency assessment requirements (see s.3.7.2).

"I really hope that it will be compulsory for them to prove through examinations and courses and so on that they are capable and competent. Right now there is no challenge to a building operator to prove his or her competency... Somehow there has to be some kind of pride, a legal requirement in this profession. And there isn't one."

EDUCATOR

4.4.5 PROFESSIONAL STANDARDS

Respondents expressed their belief that educational programs that exist for building operators can assist them in obtaining employment or better compensation. However, they also recognized the absence of any minimum industry or regulatory standards when it comes to building operator qualifications.

"Building Environmental Systems operator is a college course... It has been formalized on the educational side, but I don't believe there is any code or requirement. It really sets building operator apart and down the road you'll see more requirement for that. Usually, something happens – a disaster – and then we realize that 'uh oh', we need properly qualified people. Your hospitals, arenas, buildings with public and children – a lot of these buildings don't have requirements for this [building operator standards]."

POLICY, REGULATORY AND UNION

In the absence of formalized standards and requirements, respondents indicated that employer expectations with respect to qualifications are based on many factors, including regulatory requirements for boiler operators, specific knowledge required to operate systems in their building, particular preferences, and last but certainly not least, availability. It is one thing to want to hire someone with a BOMA or BOMI certificate, it may be an entirely different thing to actually find someone who has one.

"There are more jobs than there are people. You can't ask for too much. There aren't the people out there. We would hire anybody. We just hired a guy a year ago and we had a heck of time finding him."

BUILDING OPERATOR

4.4.6 NATIONAL OCCUPATIONAL STANDARD OR CERTIFICATION PROCESS

Industry stakeholders saw a national certification process or occupation standard as the key cornerstone required to move the building operator profession forward, though some reservations were expressed regarding the appropriate governance mechanism to oversee it. The rationale is simple: many aspects of building operations are certified and subject to regulatory oversight, but the people operating the building systems are not. This leads to inefficiency and potential adverse impacts to occupant health and safety. As well, respondents recognized that in order to attract new operators into the profession and fill the gap in the number of qualified building operators there must be a clear recognition and affirmation of the profession by a regulatory or quasi-regulatory entity to elevate the profile of the profession. Some believed that the BES and BOMI's SMT courses are the new de facto standard, but industry stakeholders believed a de facto standard is not enough. Of the frameworks being considered, an industry driven model supported by government was identified as the most popular option.

"I know for most trades there is an interprovincial qualification that basically you do your apprenticeship and then write the qualifications for an interprovincial ticket. I would see the same thing for a building operator. A building operator needs to be separated and raised several levels above custodian. In some people[s] minds a building operator is a glorified custodian and that mindset has to change."

BUILDING OPERATOR

Further to the discussion on segmentation under section 3.4.6, respondents expressed a need for both vertical and horizontal segmentation within any certification scheme to reflect the varying types of buildings and expertise required to operate them. Vertical segmentation would recognize the different levels of knowledge and experience required to operate buildings systems of different sizes and complexity, similar to the way the power engineering certification scheme is currently structured. Horizontal segmentation would differentiate between commercial/institutional and industrial buildings, or some other breakdown of building types, although stakeholders did express reservations about over-segmenting the profession. Today, operating commercial/institutional buildings requires a higher level of technical expertise and therefore, at the very least, a separation of the building operator profession from the industrial operator profession is seen to be a necessity. Stakeholders agreed that there will remain, at the bottom of the delineation, a basic 'old school' building operator classification working with older buildings that have not been retrofitted.

"I think you need a level of classification for the general conditions of the building... If you are in a more modern building with more sophisticated equipment including the controls and possibly heat recovery on the ventilation system maybe that's another level of classification or sophistication. Maybe if you are supporting major equipment such as large data centres, maybe those are specialty classifications, so you need some sub-categories like a rider on your certificate."

BUILDING OPERATOR

Concerns about a national certification system were focused on creating an overly bureaucratic system. Respondents stated that the market must, by necessity, drive the process because the market can only bear what it can bear. Standards that cannot be met because of a lack of available human resources or pay grades which small-scale building owners cannot meet within their operating budgets are not a solution. Concerns were also expressed that a new building operator standard could supersede the regulatory standards surrounding power and heating plants that are now in place.

"I don't disagree, but I am concerned when I hear the term national I hear government involvement and my spidey sense tells me it could be more of a hindrance. If it is properly administered with the understanding it is there to provide some sort of retraining and some form of a standard of training [that's fine], but if we are going to get into accreditation and certification and if there are all these standards that could be put into place that would thwart the process that is what I am concerned about."

BUILDING OWNER AND MANAGER

4.4.7 EMPLOYER RISK

One of the chief concerns expressed in relation to the lack of industry standards is the potential risk to occupant safety and building assets, including poor energy performance, resulting from unqualified building operation staff. If air quality standards are not adhered to because an operator makes mistakes while an automated building is on override, a building can develop mold and occupants can get sick. The systems may require expensive repair. The building may even need to be shut down while repairs are being made.

"...I use this in my class... Perhaps they are working on loading dock, next day operating the vent system with 2000 people in building, controlling the air, the filtration, the humidity testing, the life safety fire panel, and they just moved in. I find this scary."

EDUCATOR

4.5 BUILDING OPERATOR MARKET INTELLIGENCE

There is no publicly available data on building managers and operators. Industry associations do collect data on these occupations, but it is not generally publicly available, although a limited amount was accessed for the purpose of this report and is documented below. Statistics Canada does collect occupational data on stationary and power engineers, as well as custodians. While these historic classifications may encompass building operators, the classifications are broader and building operators overlap classifications making it impossible to identify those who match the definition of a modern building operator. Therefore, caution should be exercised in applying these statistics to building operators (see Appendix O and section 3.3.1).

4.5.1 NUMBER OF BUILDING OPERATORS IN CANADA

There is no record of the number of building operators in Canada. This study attempted to estimate the number of building operators based on the number of commercial and institutional buildings and their square footage as reported in Natural Resource Canada's *Commercial and Institutional Consumption of Energy Survey 2005*.¹⁷ However, concerns regarding the accuracy and validity of the data made it impossible to provide an estimate with any acceptable degree of accuracy.

4.5.2 AGE

BOMA Calgary has estimated the average age of building operators in Alberta to be 55.¹⁸ Aside from this lone reference, no empirical data was available on the average age of the building operator workforce in Canada. StatsCan data on stationary engineers (see Appendix O) does indicate that this broader segment is aging rapidly with insufficient new entries to meet demand in the long term.

¹⁷ Office of Energy Efficiency, Natural Resources Canada, *Commercial and Institutional Consumption of Energy Survey 2005* (2007). Available at <http://oe.nrcan.gc.ca/Publications/statistics/cices06/index.cfm>.

¹⁸ BOMA Calgary, Powerpoint presentation, *ibid*.

4.5.3 INCOME DISTRIBUTION

There are disparities between income levels across provinces and between sexes. BOMA Canada released its first annual national compensation survey in 2010 showing modest variations in salary levels between Eastern and Western Canada, due in part to differences in the cost of living and demand for labour between regions (see Appendix P).

A 2008 compensation survey conducted by BOMA BC found "the main cited area in particular demand [sic] and presenting an ongoing challenge is in sourcing maintenance and building operators with experience."¹⁹ The survey identified high staff turnover due to market demand as a primary driver within the industry. However, the 2010 national survey indicates that this demand has lessened, accompanied by a leveling off of compensation rates since the economic downturn in late 2008, with the exception of Toronto and Ottawa.²⁰

BOMA's salary levels are significantly lower and show less regional variation than those reported for stationary engineers in 2006 census data (see Appendix O). Insufficient information was available to explain the differences in average compensation, but may be explained, in part, because the category of stationary engineer likely encompasses all occupational categories reported by BOMA.

Industry stakeholders expressed concern about the criteria used to set compensation levels. There was also a belief that the entry-level building operator position is undervalued and entry-level thus, the industry is not attracting the quality of individuals needed for the profession. Others believed that current wages are sufficient to attract good people to the profession, although this view may be region-specific.

4.5.4 LABOUR DEMAND

Data on the labour market for building operators in Canada was very limited. BOMA Calgary has identified a shortage of qualified building operators in Alberta. There is a requirement for 1,700 building operators in Alberta's major cities. With a reported average age of 55 for existing building operators and a 10% retirement rate and 10% attrition rate, they anticipate a need for 340 new building operators annually (100 to 150 in Calgary alone). At present, approximately 100 new operators are entering the Alberta market annually.²¹

Industry stakeholders also perceived a shortage of skilled operators in the marketplace. As one very influential industry stakeholder noted, it is what keeps the big players in the industry up at night: trying to find replacements for property managers and building operators.

"Even high end employers paying top dollar have looked for over a year before finding someone."

POLICY, REGULATORY AND UNION



¹⁹ BOMA BC, *Building Owners & Managers Association - 2008 Salary Guide* (2008, available through BOMA BC, pdf copy on file with LH). The survey polled 850 individuals at companies in the property and facilities sector in December 2007.

²⁰ BOMA Canada, *Building Teams Building Value: 2010 BOMA Annual Industry Compensation Survey Report*, p.13.

²¹ BOMA Calgary, powerpoint presentation "Building Operator & Training Development" (not dated, copy with LH).

4.6 EDUCATION AND TRAINING

Historically, building operators have come from two primary educational paths. In many instances, building operators fulfilled a janitorial/custodial role and grew into the role of building operator on the job. These operators generally have no formal training and apprenticed on the job. The other stream originates through the certified trades of power engineering and traditional building trades. Educational and training programs are well established for these professions and are regulated by provincial safety authorities.²² Today, programs in post-secondary institutions offer certificates in building operation (i.e., Building Environmental Science programs) that focus on energy efficiency. Additionally, industry associations are also beginning to offer training directly relating to efficiently operating buildings (e.g., BOMI's Systems Maintenance Technician program). And while apprenticeship programs exist for stationary engineers in some provinces, no such program exists for building operators. Also, although these training methods exist, some lack of awareness and usage of the programs by employers make it challenging to understand if they are being successful at filling the needs of the industry.

4.6.1 EXISTING PROGRAMS

Educational programs targeted specifically at building operators have existed since the 1970s with the creation of Seneca College's Building Environmental Systems (BES) program. BES is well established and offered through career colleges across the country. BOMA later established Building Operator Training (BOT) courses modeled on BES. These two programs form the core of educational offerings for building operators in Canada (see Appendix E for a complete list of all programs offered related to building operations).

4.6.1.1 BUILDING ENVIRONMENTAL SYSTEMS (BES)

The Building Environmental Systems (BES) certificate program originated through Seneca College of Applied Arts and Technology and is now offered in both official languages under license agreements through numerous other career colleges across Canada (see Appendix I).

The BES program is a comprehensive energy efficiency multi-skills training program for building managers, operators and technicians. It offers three certificate levels: BES Class I & II, and Facility Manager. Class I & II enable graduates "the ability to operate buildings of any size efficiently and economically by developing a full range of practical knowledge reinforced by workplace competencies."²³ The Facility Manager Certificate "provides graduates with the necessary skills to control and manage buildings effectively."²⁴ Programs include 15 subjects (see course requirements under Appendix J) with 600 hours of total training time offered in a variety of formats (short seminars, classroom lectures, online modules, distance learning and other alternative modes). The BES program is recognized by Natural Resources Canada through the Office of Energy Efficiency as the preferred comprehensive training resource for building operators. Graduates are eligible for IFTAC/CAIFE recognition (the Interprovincial Facility Training Accreditation Council/ Conseil d'Accréditation Inter-Provincial de Facilité d'Entrainement).

The program takes an integrated systems approach where students learn about different building systems in relation to each other. Rather than focusing on a specific subject area, students appreciate the building as a system, finding creative solutions to improve overall energy efficiency and environmental management by understanding how decisions and actions in one area impact the entire building.

In addition to the BES courses, Seneca College offers a three-year certificate program in Mechanical Engineering Technology in Building Sciences. The program includes courses in: building environmental systems, air conditioning, refrigeration, heating, electricity, air handling, water treatment, systems controls, renewable energy, energy efficiency, computer assisted drafting and design, environmental management system standards, and intelligent and automated building operations. Completion of this program includes Class I & II certification.²⁵

²² A review of power engineer educational and training programs is beyond the scope of this study.

²³ Seneca College's online site for BES program: <http://bes.senecac.on.ca/index.html>. Accessed September 17, 2010.

²⁴ *Ibid.*

²⁵ See <http://www.senecac.on.ca/fulltime/MBT.html>.

4.6.1.2 BOMA/BOMI PROGRAMS

The Building Operators and Managers Association (BOMA) and its educational wing, the Building Operators and Managers Institute (BOMI) offer a series of nationally recognized courses for building operators through BOMA's Building Operator Training Program and BOMI's Systems Maintenance Technician (SMT) and Systems Maintenance Administrator (SMA) certificate programs.

The Building Operator Training program envisions five levels linked to power engineer certification equivalencies. Courses for the first three levels are currently offered (see program flowchart in Appendix M).

BOMI's Systems Maintenance Technician (SMT) is the entry-level course for building operators requiring completion of five courses. The program covers all building systems and is intended to equip graduates with the ability "to raise a building's efficiency while reducing operating costs."²⁶ The Systems Maintenance Administrator (SMA) course builds on SMT, requiring completion of an additional three courses providing advanced knowledge in administration, energy management and environmental health and safety issues.²⁷ Cross-certification is offered for some BES and BOMI courses.

4.6.1.3 OTHER EDUCATIONAL AND TRAINING PROGRAMS

There are also several regional programs that offer building operator training, although these programs are neither accredited nor as comprehensive as BES, SMT or SMA. It appears they are limited to Saskatchewan and Alberta, possibly because of the presence of the BES program in other jurisdictions.

Table 3
Regional Educational and Training Programs

| EDUCATIONAL INSTITUTION | PROGRAM |
|--|--|
| Saskatchewan Environmental Society | Building Operator Training |
| Saskatchewan Institute of Applied Science and Technology (SIAST) | Building Systems Technician |
| Southern Alberta Institute of Technology | Residential Building Operator Certificate Program/ Calgary Apartment Association |

²⁶ BOMI website at <http://www.bomicanada.com/Designations.html>.

²⁷ Insufficient curriculum information was available to compare the content of BES, BOMA BOT, and BOMI SMT/SMA courses.

Table 4
Energy Technician Diploma Courses

| EDUCATIONAL INSTITUTION | PROGRAM |
|--|--|
| Cambrian College of Applied Arts and Technology | Energy Systems Technology |
| Centennial College | Energy Systems Engineering Technician |
| Humber College Institute of Technology & Advanced Learning | Sustainable Energy & Building Technology |

There are also various diploma programs to qualify as an energy technician. Graduates of these programs generally serve as consultants to facilities managers, but the curriculum of these programs address some of the existing and emerging responsibilities of building operators. These programs appear limited to Ontario.

4.6.1.4 COURSES DEALING WITH ENERGY MANAGEMENT

In response to the focus on responsible energy management, various educational providers have introduced training focused exclusively on energy efficiency practices. In BC, the British Columbia Institute of Technology in partnership with BC Hydro offers a Sustainable Energy Management Associate Certificate (SEMAC) program with funding support from the Natural Resources Canada - Office of Energy Efficiency. This associate certificate is a part-time studies program targeted at individuals already working in building operations and maintenance to provide the skills and knowledge of sustainable energy management principles, approaches, techniques, and tools in order to be able to function quickly and effectively in the position of energy manager or energy coordinator at their company or building. Classes take place in the evenings and on weekends to accommodate work schedules of the students.

Similar to SEMAC, BOMA offers e-Energy Training for building operators through the Green Buildings Foundation. The program is not a full certification program for building operators, but is intended to supplement BOMA's Building Operator Certificate Program.²⁸ According to the program's website:

"BOMA e-Energy Training is an energy management course for building operators and managers of commercial and institutional buildings. Delivered online, in a self-learning format, participants learn at their own pace, and have access from remote locations. Upon completion of the course, participants will understand basic energy principles, identify energy reduction opportunities, develop strategies and learn how to influence stakeholders to adopt energy savings behaviour. The program highlights operational and capital project energy management opportunities. Course topics include: Energy Management Overview, Behavioural Opportunities, Energy Basics, Metering and Billing, Lighting Systems, Electrical Systems, HVAC Systems, Heating Systems, Cooling Systems, Building Controls, Selling the Project. Participants have up to 6 months to complete the course. It is estimated that 20 - 30 or more hours are needed to complete the entire course."²⁹

²⁸ BOMA states it is an equivalent to the 'Energy and Management Controls' SMT course.

²⁹ <http://www.greenbuildingsfoundation.org/training/energy.php>. Accessed: September 17, 2010.

4.6.2 COMPETENCY ASSESSMENTS

BOMA's Building Operator Training program is a competency-based program. In order to obtain a Certificate of Competence, participants must demonstrate their skills associated with building operations to an independent third-party validator who confirms that the participant possesses the requisite skills and knowledge or competencies necessary to perform the tasks associated with that occupation. Certificates remain valid for three years and are renewable without reassessment provided there are no changes in the prescribed competencies.³⁰

4.6.3 EXISTING GAPS AND CURRENT AND FUTURE NEEDS

A review of the existing literature points to gaps with respect to the administration, tracking and success of existing programs. One of the critical gaps evident from the review of secondary sources is the absence of any tracking of building operator education and training programs. Statistics Canada does not capture BES or other programs in their Post-Secondary Student Information System, nor do government agencies provide any oversight. This has a negative ripple effect on the profession and labour market. For example, failure to capture this profession in occupational statistics results in the omission of such programs in studies evaluating the education and training needs of the green economy.³¹ In short, since it isn't measured, it isn't being managed.

Furthermore, there is evidence that programs have not been successful at producing sufficient graduates to meet market demand. According to BOMA Calgary, there is only a 45% success rate among students in the BOMA Building Operator Training Level 2 program (Level 5 power engineer equivalent), which is not satisfying market demand.³² Reasons for these poor performance levels are not clearly understood and merit further exploration.

The gap most often identified by stakeholders in education and training for today's operators was that they are not prepared to operate new energy efficient technologies. Several stakeholders noted more basic deficiencies such as a lack of basic computer skills, which are becoming more and more critical in order to carry out their responsibilities in an increasingly automated industry dependent on formal computer-generated reporting. This is particularly the case for building operators working for large real estate management companies or in LEED® certified buildings. Comments also indicated that older building operators found new technologies challenging to grasp. Some operators noted they feel that they don't have enough communications training to effectively deal with occupants, not to mention their employers. This is not to say they are incapable, but there is a growing concern that the issue of education and training is coming to a head, and that it could have a profound impact on Canada's building industry.

Another concern expressed was that the rapid evolution of increasingly complex, inter-dependant and high tech building systems is resulting in training gaps. Essentially, training programs are not keeping up with technological change in the industry. One participant said that, rather than being ahead of the curve in terms of adapting educational opportunities to new building systems, the education system seems to be lagging behind significantly. Those opportunities that were available were viewed by some as ad hoc in nature. Some were concerned that this ad hoc approach of developing training programs after new systems were already in place didn't allow time for the training to be carried out effectively and often produced training programs that were not up to par.

"We need to do a better job of training as equipment evolves. Especially if it's new/high efficiency [equipment]. We have an aging employee base. We are talking still today about a lot of engineers and building operators who are still operating the way they always have even though the systems are changing. They need to be kept up to date. They kind of muddle through on their own."

POLICY, REGULATORY AND UNION

³⁰ See <http://www.boma.ca/BuildingOperations/>. Accessed January 28, 2011.

³¹ See e.g. Eco Canada, *Post-Secondary Graduation Research: Enrolment and Graduation Rates from Environment-Related College and University Programs* (2010). Available online at www.eco.ca/pdf/Post-Secondary-Graduation-Research-2010.pdf.

³² BOMA Calgary, *ibid.*

Several participants said that this problem is not as visible as it should be today because the implementation of these new systems is often slow and manufacturers were acting as stop-gaps by providing on-site training specific to their systems. While most agreed that this is an acceptable approach today, they were concerned that, as things evolve, this approach would not be sufficient. They saw an opportunity to develop programs now that will ensure the skill sets are there in the future.

"The training and knowledge is coming in [sic] an ad hoc fashion and the needs of the building they are looking after; if it happens to have that need, they get the knowledge. Otherwise, they get no exposure to it."

BUILDING OWNERS AND MANAGERS

On a related note, there was a serious deficiency of tools available to provide building operators with meaningful feedback on system and building performance, regardless of the level of building complexity (although the issue is certainly exacerbated with complex systems). Along with current training, building operators need tools that are able to provide the monitoring and analysis required in modern building operations.

Responses also suggested a disconnect between the willingness of companies to invest in hugely expensive building certification and retrofits, while investing less in training their building operators to effectively manage the systems they have installed. Some stakeholders pointed to a lack of training availability, some pointed to a lack of budget, and some also pointed to the fact that some of these systems are so new that training programs have not yet been developed. This disconnect illustrates the tension between the interests of building owners and managers to profile their buildings as being 'green', while neglecting the internal issue of properly training staff. Certainly, the efficiency of the systems being installed is being compromised.

"I don't always think we make time for people to train. From a management perspective, it is one of the biggest weaknesses and people ask to go on courses and [we say] there isn't a replacement if they do that. But they can take vacation and the same situation exists. So it is short-sighted. 'We don't have training budget!' If the opportunity to save dollars by running the building more efficiently is there then not spending it on training is short-sighted. The biggest gap in training is affording [building operators] an opportunity."

BUILDING OPERATOR

4.6.4 APPRENTICESHIP

Apprenticeship opportunities for building operators are limited in Canada. Ontario offers an apprenticeship program for Facilities Technicians and Facilities Managers, akin to the role of building operator.³³ Apprenticeship training programs also exist for stationary engineers in Quebec, New Brunswick and Nova Scotia.³⁴ Unfortunately, performance data for this program was not available.³⁵ However, in most cases power engineering is regulated by boiler and technical safety organizations, not the apprenticeship authority.³⁶

Most stakeholders accepted apprenticeship as a training approach in principle. Many spoke of the importance of hands-on training for building operators aligned with a formalized classification structure for the profession, citing a concern that when a building operator only learns in a classroom setting, they do not develop the skill sets required to adeptly handle complex – and sometimes dangerous – building systems.

³³ See www.tcu.gov.on.ca/eng/employmentontario/training/pdf/255B_Eng.pdf. For program requirements see Ellis Chart at <http://www.ellischart.ca/h.4m.2@-eng.jsp>.

³⁴ See Ellis Chart at <http://www.ellischart.ca/h.4m.2@-eng.jsp>. Accessed January 28, 2011.

³⁵ StatCan's National Apprenticeship Survey (2007) does not breakdown findings by program type. See <http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=81-598-X&lang=eng>.

³⁶ A discussion of apprenticeship programs for stationary and power engineers is beyond the scope of this study.

4.6.5 AVAILABLE EDUCATION AND TRAINING: STAKEHOLDERS LACK INFORMATION

"One problem I see, which wasn't a problem when I went to school, [was] we had a hands-on system of learning and now it is classroom based. We work on dangerous equipment that can hurt you, and now the students do not have that hands-on experience though the schools. Now you only have to take a test you don't even have to look at a boiler and someone is going to get hurt."

BUILDING OPERATOR

However, there is some concern that a formal apprenticeship, akin to the apprenticeship programs tied to the trades, would be difficult to manage. Budgets and human resources are the primary obstacles: building owners cannot pay for two operators when one is sufficient. Some believe that formalization of the profession accepted and adopted by industry and regulated by an overarching body would provide a good framework for a structured apprenticeship program. However, most agreed that developing this framework will be a lengthy and time-consuming effort and, therefore, should it be undertaken, do not expect to see it realized for several years.

"Apprenticeship would work, but you would have to have an official designation. That might be building operator 1, 2, 3, 4, but I think the industry needs to establish those categories... Those change as new technology comes along and then you could apprentice your way up. Maybe BOMA and some other sectors could get together and form the consensus on what the qualifications should be and then you could have an apprenticeship."

BUILDING OWNERS AND MANAGERS

Among many stakeholders, there was a perception that excellent training exists for building operators in Canada, with the exception of a gap in higher level training for more experienced operators. Yet, most agreed that many building owners and operators did not take advantage of that training. And stakeholders – in some cases quite surprisingly, considering their positions – did not know what specific training was available.

"I think the only gap that is out there is more advanced training. It is now geared to entry-level and there is nothing for a building operator who wants to become a chief engineer facility manager. There is no formal training available for them to step up. They have to rely on experience."

BUILDING OWNERS AND MANAGERS

Industry stakeholders were more aware of BOMA Canada training than any other building operator training. While many other courses or programs related to building operators tend to be an adjunct to other training or education and draw students from a wide variety of backgrounds, BOMA's courses have been designed for building operators specifically.

"I am not aware of very many [training programs]. I know there are technical courses or trades courses for steam plant operators. That is a little specialized, but as far as a building operator organization...? BOMA has some training...."

BUILDING OPERATOR



Other specific training and educational programs that were relatively well known included specialty equipment courses provided by developers and suppliers, power engineering programs, and Leadership in Energy and Environmental Design (LEED®) certification courses (although the later does not provide operator training). Well respected for-profit training modules in the United States were also identified. As well, the SEMAC program operating out of BCIT in partnership with BC Hydro received some mention; that program is aimed at current building operators and is region-specific. Other energy management courses offered through various career colleges were mentioned by the educators interviewed for this study, but were not well known in the building industry, and their student base did not include any actual building operators.

"Right now we have an interesting mix [of students]: engineers, MBA's, people with a technical trade background. We have people who did commerce degrees and work in marketing.... no, not any building operators."

EDUCATOR

Nearly all interviewees who mentioned the BES (Building Environmental Systems) certificate program were in agreement that it is the industry standard for comprehensive building operator education. While they tended to describe the program in a positive light, they also tended to agree that this one program is not sufficient to fill the critical labour force gaps most saw looming on the horizon. Those familiar with it said that it appeals mainly to building operators who aspire to be building managers, or engineers who aspire to operate major commercial complexes, and its participants often already had some secondary education on their resume.

4.6.6 ON-THE-JOB TRAINING

One of the most widely acknowledged sources of building operator training and education was that received on the job or from their employer. Responses received suggest multiple reasons for the emphasis on in-house training, including a reaction to a perceived lack of external training programs, respect for existing programs, or as a necessity to respond to the unique qualities and specifications of technologies in a particular building or building complex. One stakeholder, representing a major Canadian municipality, revealed that they were in the process of developing their own building operator training, focusing on new energy efficient technologies. That this major municipality saw a need to create its own training regime points to a lack of training opportunities, or at the very least, a lack of relevant training. Similarly, representatives from private companies and institutions indicated that they set up their own training in-house because they did not believe the training their building operators needed was available in their jurisdiction. Regardless, on-the-job training is undoubtedly one of the primary ways that building operators receive education or training.

"We have an internship that we run that is very successful for grooming people for an operat[or position] and then we often hire them."

BUILDING OWNERS AND MANAGERS

Respondents also acknowledged the provision of supplier training and ongoing in-house training programs as valuable professional development tools. Supplier training provides current and practical information to building operators regarding their particular building systems, however respondents cautioned that obtaining timely and reliable follow-up support can be a challenge.

4.6.7 LACK OF EMPLOYER INCENTIVES

Some stakeholders observed that building operators who are given the opportunity to train sometimes do not take advantage of such opportunities because they see limited possibility for advancement or increased compensation to merit investing the necessary time and energy.

"Advancing their training is fantastic unless after my training I am in the same place. You [are] kind of stuck where you are. I have actually heard the words, 'Why take training? I can't advance.' I am going to advance and I am not staying here [in this job] and my company pays for my training. [But some guys think] why take more training if I have nowhere to go from here? Not everyone works for a company my size and for a lot of guys there is nowhere for them to go and in smaller companies it's not feasible."

BUILDING OPERATOR

4.7 BUILDING OPERATORS AND THE FUTURE

During the course of this study, a number of significant issues were identified that are shaping, and in some instances potentially constraining, the evolution of the building operator profession. An underlying theme identified was the profession of building operators being undervalued despite the considerable impact that building operators can have on energy reduction targets. Promoting the profession and addressing social barriers were identified as potential ways to elevate the profession.

4.7.1 TECHNOLOGY IS TRANSFORMING THE PROFESSION

Respondents universally acknowledged that the building operator profession is indisputably changing in response to technological advances to include more skilled and qualified professionals. Some hold engineering degrees and wander high-rise complexes, iPad in hand, directing their team to adjust systems based on a minute-by-minute analysis of the heat loss and air quality and occupant usage of every single room in that complex. Building owners and managers, building operators themselves, and other stakeholders in the building industry are beginning to understand their potential impact and ability to drive change.

"I would bet that a number of building operators in commercial buildings, if you went to their office, it would look like you are going into a stockbroker's office. They have three LED screens and interactive systems telling them when to do maintenance and they have the tablet PCs."

EDUCATOR

4.7.2 ELEVATING AND PROMOTING THE PROFESSION

Industry stakeholders stressed the need to elevate the profession's profile in order to attract a new generation of educated and skilled operators. Stakeholders surmised that people aren't attracted to the profession because they really don't understand that the profession exists. Some questioned whether the very term 'building operator' lends the profession enough cache. Others recognized the need to promote the profession to students and professionals in related industries as a reputable career alternative with advancement opportunities.

"I think that not promoting our discipline is probably the biggest barrier."

BUILDING OPERATOR

Promotion of the profession as a career option, segmentation to clarify potential for career advancement, and fair remuneration reflecting the true value of the building operator were referenced as key steps for the advancement of the building operator profession. Stakeholders also believed that these are the primary barriers keeping people from entering the profession at the present time: people do not understand what a building operator is, they do not believe the profession offers the potential for a career, and they don't think they will earn fair wages for the work. Respondents stated that without clearly addressing these barriers it will be difficult to attract ambitious, career oriented people to the industry.

"A level of awareness of the complexity and the fact it is a pretty interesting job. It is not a dull boring job. There are a lot of opportunities."

BUILDING OPERATOR

Many stakeholders spoke of the importance of promoting the profession as a respected career path in the school system. Others questioned whether the industry needs to implement professional standards prior to embarking on an organized promotional effort in the schools. BOMA and BOMI were recognized for the work they are doing on this front, but their activities were not well known by industry stakeholders, likely because of the scale of their outreach programs.

"I think you have to use the high school system. I asked my students...'did anyone hear in grade ten about the building operator profession' and... it is just not out there... I know BOMI and BOMA have several committees [that] go to the college and high school system to attract individuals to study what they should know to become a better property manager or facility manager...[but] I don't know if there are that many in the high school that even know it [the building operator profession] exists."

EDUCATOR

4.7.3 ADDRESSING SOCIAL BARRIERS

Some stakeholders pointed out the need to address various social barriers to attracting new human resource pools, including women and new immigrants.

"I think there are still barriers to women entering the profession. There aren't many women facility operators... I don't know if that goes back to the types of trades people pull from or what the root cause [is]."

BUILDING OPERATOR

Indeed, census data on stationary engineers indicates very few women or visible minorities work in this profession, as well as a significant disparity between the wages of men and women (see Appendix O). These issues merit further study to determine their impact on the profession, including the potential for meeting current and future labour shortages.

4.7.4 THE BUILDING OPERATOR IS KEY TO ACHIEVING GREEN OBJECTIVES

Can building operators have an impact on the energy efficiency of a building? According to participants, they most definitely can. Every category of stakeholder acknowledged that the building operator is the key driver of energy efficiency no matter what a building's systems are: new or old, outdated or advanced. They can make a system work, or they can make a system "dance" -- at any level. Regardless of their role and responsibilities -- controlling the heat and lights, the air quality or any other system or function -- the building operator has more potential to have an effect on a building's function than anyone else associated with building operations. Furthermore, if the building operator is not properly resourced, trained, and motivated to conserve energy, it will not happen.

"[Building operators play] a huge role [in making a building energy efficient]. There are so many things that can go wrong in terms of how a building is operating. Even though everything is still comfortable and you could think it is just fine,... you are using twice as much energy as you need to. You need to know how the systems work."

BUILDING OWNERS AND MANAGERS

4.7.5 WHO CAN AFFECT CHANGE?

What is the potential path for the future of the building operator profession and who can affect change? Some level of unspecified government involvement was expected, but stakeholders stated that any solutions should be driven by industry, with government support. Some stakeholders offered mixed reviews about past and existing financial incentives to assist industry in providing educational and training for building operators, especially for training specific to energy efficiency, as well as for funding energy retrofits. However, respondents were clear that these programs have very decentralized administration, are not well publicized and are hard to find. Program approval timelines are often too slow for industry.



Some stakeholders also noted that mandated energy and green building goals are effective at getting industry to react. Most stakeholders, though, felt that legislation would be too big a burden on industry, especially considering the present economic climate. Rather, it was suggested that government could lead by example through policy governing the construction and retrofitting of their own buildings.

"There needs to be some legislation and buy-in on LEED® standards or green building standards on a national level, or at least... federal buy-in.... Look at some of the successes in the United States. The big reason is the new government buildings must be built to LEED® standards. Every state has a green building standard... [There needs to be someone] employed in Ottawa tasked to getting the federal government involved. There needs to be buy-in... from the top and [a rationale articulated about] why we care about it and GHG emissions."

BUILDING OWNERS AND MANAGERS

Building owners and managers are key to enacting change within the profession. Many expressed commitment to change, in part driven by their concerns about filling their building operator positions with qualified people. Some stakeholders, though, feel that building owners overall do not understand the potential benefits of hiring skilled building operators and paying them a fair salary and that only when building owners and managers start paying better salaries and demanding higher standards in qualifications will the market begin to change.

"We need to be able to speak to them in their language and have business people saying this makes sense. The next time there is a recession, don't reduce training. Twenty-two per cent of the operating costs of an office building are energy costs. That business case needs to be made that this [building operations] is not [currently] a cost centre."

EDUCATOR

What seems clear is that there is no one group – association, private sector, or government – who can drive these fundamental changes on their own. BOMA Canada was cited by many of the stakeholders interviewed as the best organization to house and coordinate such an initiative. The organization has the respect of the industry, understands the building operator profession, and operates well-known and well-respected building operator education programs itself and in conjunction with its educational wing, BOMI.

"I see that on this particular issue there needs to be some sort of meeting of the minds with respect to government and private sector... It is valid because if the private sector were going to do it on their own they would still need to develop the programs through universities or high schools, and if government were to do it on their own you wouldn't get private sector support. So the approach needs to be simple yet effective."

BUILDING OWNERS AND MANAGERS

4.7.6 OTHER CONSIDERATIONS

As previously noted, building operators can greatly affect energy consumption, but their potential is far from being maximized. Respondents identified a number of key barriers facing building operators in contributing to better building performance.

4.7.6.1 LACK OF INTEGRATION INTO BUILDING OPERATIONAL PLANNING

According to some stakeholders, the involvement of building operators in retrofit and recommissioning projects at an early stage can assist in value-engineering a project, potentially saving owners and managers thousands – or millions – of dollars at the design stage. Some stakeholders believed that if the industry better understood the value of the building operator, and used their expertise appropriately, it could increase efficiency exponentially.

"I think...people need to be involved in the process of when the green building technology [is chosen], whether it's a new building or retrofit. They need to be involved from the beginning and then they understand the design intent and the pros and cons of why they have that system. If you are involved you are more willing to make it work."

BUILDING OPERATOR

4.7.6.2 OCCUPANT RELATIONS

Respondents noted that occupant retention is one of the most important factors in a building's bottom line. Consequently, maintaining positive occupant relations and addressing occupant concerns are a top priority for building operators often requiring significant time that takes away from time spent on maintaining and improving systems. Furthermore, numerous stakeholders observed that occupant interests often contradict energy efficiency priorities. However, participants suggested that there are ways to satisfy occupants and maximize energy efficiency simultaneously. Building operator and occupant training and education were cited as important parts of the solution.

"They have a great opportunity to affect... energy consumption, but they are under-resourced and tasked with keeping tenants happy and that contradicts energy efficiency."

BUILDING OWNERS AND MANAGERS



5. ANALYSIS

This study's research findings represent the first formal attempt to scope out the profession of building operator in Canada. This section analyzes these findings and identifies a number of challenges and gaps in the shaping of the profession. It explores the central questions of the study, namely defining the role and place of the building operator and gaps in education and training. It concludes with some observations about areas identified in the research that could further enhance the value of building operators in achieving operational goals such as energy efficiency, good occupant relations and comfort, and profitability. As a scoping exercise, the study was mandated to articulate the issues and identify where further study or action is required.

5.1 PROFESSIONAL QUALIFICATIONS

This study identified an issue in regards to the qualifications of building operators. Due to the lack of standards and segmentation within the industry, there is much confusion regarding the qualifications for the building operator profession.

5.1.1 CONFUSION REGARDING PROFESSIONAL QUALIFICATIONS

Confusion exists within the industry regarding the necessary and appropriate qualifications for building operators. Study findings indicate this is due to the absence of a universally recognized certification framework for building operators, the historical evolution of the profession and the misapplication of the power engineer certification as a proxy for building operator certification. The power engineer designation has become intrinsically tied to the building operator industry because in many jurisdictions this is the only recognized professional designation affiliated with building operators. However, the power engineer certification considers only the knowledge required to run a boiler, which is becoming a diminishing requirement as more modern buildings do not have boilers.

5.1.2 LACK OF STANDARDS

Currently, there is no nationally accepted set of qualification standards for building operators. Power engineer certification is standardized and regulated, however its relevance is limited to a subset of building operators. In this vacuum, educational institutions, both public and private, have developed programs that are acknowledged randomly by employers in job postings. Some employers demand a BES certificate, some 'like to see' that their operators have taken the introductory BOMA Building Operating Training Course, and some simply want someone who is technically proficient and has their grade 12 diploma. Employers also indicate that the lack of universal professional standards to date may be a consequence of the building-specific nature of building operations. Employers often provide on-the-job training to address the specific needs of a building.

5.1.3 SEGMENTATION

Related to a lack of standards is the absence of formal segmentation within the profession and corresponding codification of job titles. BOMA has attempted to establish levels of building operator that mirror those of power engineer 5th class (unticketed) through to 1st class (Director of Operations) (see Appendix M). However, these are still under development and have not been universally adopted by industry.³⁷ The result is ad-hoc delineations based on management decision and operational considerations such as the size of the building and the equipment being operated. While respondents indicated general support for greater segmentation within the profession, there was no clear consensus on what that should look like or how it could be achieved. Further consultations are required to assess interest in formalizing classes and job titles within the building operator profession.

³⁷ Interestingly, BOMA's annual compensation survey does not follow its own classification system.

5.2 EDUCATION AND TRAINING

The findings in this study indicate that current educational offerings are not entirely meeting industry expectations for a variety of reasons. Employers often do not know the benefit that they stand to gain from sending employees to further their education, or by hiring employees that have certain training. There is also a lack of awareness on the employees' part about the educational offerings that exist, and the benefits they would receive by pursuing them. There is also the issue of the pace at which new technologies are changing the responsibilities and duties of building operators, and the perception that some educational offerings do not include enough information on these new technologies.

5.2.1 EDUCATION AND EMPLOYMENT DISCONNECT

There is an apparent disconnect between educational offerings and employer requirements. This is undoubtedly due in large part to the lack of formal certification and standardization of educational programs, however study findings suggest other factors may be at play. The disparity in the qualifications spelled out in job postings by major building operators suggest that either (a) employers are misinformed about the required qualifications for the position, or (b) educational and training programs do not reflect the needs of the market. In turn, those wanting to enter the profession are not certain whether to respond to the qualifications demanded by specific employers or to pursue a building operator certificate through an educational institution, since they do not necessarily correspond and may not even reflect the actual skills required for the position. For example, many job postings for building operator require applicants to have a power engineer certificate level 5 rather than a diploma in Building Operating Systems (BES) or BOMA's Systems Management Technician (SMT) certificate.

It is also important to comment on LEED® as an educational tool, given the repeated reference by employers to the LEED® Accredited Professional (LEED® AP) designation as a desired requirement for building operators. A distinction must be drawn at the outset between LEED® accreditation for the building operator and LEED® certification for the building. LEED® accreditation provides insight into sustainable building design, construction and operation. However, it does not provide a technical understanding of how building systems operate or integrate. LEED® for Existing Buildings (LEED®-EB) certification focuses on the performance and ongoing operation and maintenance of buildings. While it offers building operators a deeper understanding of sustainable building operation principles by providing a checklist of sustainable practices, it does not train the operator on how to accomplish them, nor does it address the technical operation and integration of building systems per se. LEED® for Existing Buildings starts with the presumption that the operator has the knowledge to accomplish tasks such as optimizing energy efficiency, ongoing commissioning and emissions reductions reporting.³⁸ While the process of obtaining LEED® accreditation or certification is undoubtedly valuable to anyone interested in sustainable building practices, it is arguably not a primary training tool for building operators.

With respect to the current population of building operators, census data and interviewee responses both indicated that many have no formal education and learned on the job or entered the profession through a recognized trade or a custodial/janitorial role. Educators corroborated this by noting that few building operators are enrolled in diploma or certificate programs. It therefore begs the questions of what are the preferred methods of training by employers and building operators, where are building operators currently obtaining ongoing training, and should ongoing training and competency assessments be required to ensure that building operators are keeping their skills current? Only through more systematic tracking of data on building operator training and detailed feedback from employers and operators will these questions be answered.

³⁸ See LEED®-EB Operations and Maintenance Checklist at <http://buildinginformationmanagement.wordpress.com/2010/01/25/usgbc-lead-for-existing-buildings/>.

5.2.2 LACK OF AWARENESS OF EDUCATIONAL OPPORTUNITIES

The findings indicate a pervasive lack of awareness of the educational programs and opportunities that exist for building operators. Responses suggest various reasons for this including inadequate marketing of programs and industry confusion about relevant training. There also seems to be a lack of motivation on the part of employers and employees to seek out educational opportunities. This lack of motivation, in turn, may be due to lack of opportunities for advancement and the provision of on-the-job training by employers and suppliers. Obviously, when building owners, managers and operators are not aware that a training opportunity exists they are not going to take advantage of it. On this point, multi-lateral stakeholder discussions coupled with better promotion of existing programs and the development of new training or modification of existing training programs to better address industry's needs is warranted.

5.2.3 CURRENCY OF EDUCATIONAL PROGRAMMING

It is a challenge for any educational program to stay abreast of current industry developments. This is especially so in relation to new building systems technologies. While this study did not review the curriculum of existing educational programming in detail, comments received from stakeholders indicate a gap between instruction offered in the classroom and the knowledge requirements of the job. It may be that educational programs are to provide a foundation with specialized training offered in the workplace. However, educational programs do need to stay current with emerging (energy efficient) technologies, and education providers need to work more closely with employers to understand current needs in education if these programs are to remain relevant. The continuing emergence of new programs, such as Douglas College's Building Energy and Resource Management (BERM) certificate program in 2011 (see Appendix N), as well as the lack of employer and employee awareness of other existing programs, suggest current programs are not perceived as relevant or sufficient by many within the industry. One possible opportunity is to link programs with the LEED® accreditation system, specifically LEED® for Existing Buildings to both raise the profile and appeal of such offerings. Regardless, further work is required to explore the gaps in existing education and training programs, including the need for training in basic communication skills, such as occupant relations and computer literacy.

Supplier training does compensate for the existing knowledge gap to some extent by providing specific and current information to building operators regarding their particular building systems. It also offers the potential to connect building operators with the rest of the industry. However this approach also has its challenges and limitations, such as obtaining timely, consistent and reliable follow-up support from suppliers.

5.2.4 TRACKING OF FEEDER SOURCES AND POST-EDUCATION EMPLOYMENT STATISTICS

Educators indicated that virtually no building operators are taking formal building operator certificate or diploma programs. Rather, most participants who take such programs are coming from outside the profession.³⁹ It is important to track where students are coming from and where they are ending up after training to better assess the role of programs and their effectiveness in meeting industry's needs as well as to help secure employment for graduates. Stakeholders could implement a reporting requirement for all public and private institutions to track and consolidate such information.

5.2.5 EMPLOYER INVESTMENT IN BUILDING OPERATOR TRAINING

Responses indicate a disparity between building owner investment in building technologies and investment in the training of building operators. This is affecting the professional competency of building operators and compromising the efficiency of building systems. Respondents affirm that more attention needs to be paid to working with building owners and managers to present the relevancy and currency of educational programs, and the business case for adequately training building operators. Employers need to commit to operational budgets and not allow them to be reduced based on cost overruns in earlier stages. Finally, building owners and managers need to ensure that manufacturers and installers factor in sufficient time to provide ongoing operator training and support on new technologies.

³⁹ Phone interview with Gary Johnston, BES Program, Seneca College (September 14, 2010).

A related issue that needs to be addressed is the concern that building owners and managers have about replacing operators who are absent for training or other professional reasons. Numerous interviewees noted that building owners and managers are reluctant to bring on apprentices or relief staff to facilitate training because they generally have only one operator for a building. However, building operators observe that the same issue arises when they take vacation time or sick leave. It is important that this point be addressed in order to establish an environment that encourages regular training opportunities for operators.

5.3 CHALLENGES FACING THE INDUSTRY

This study focused primarily on scoping out the role of the building operator and the gaps in education and training required by building operators to operate high performance buildings. However, during the course of the research a number of issues became evident that are having an affect how industry is addressing the profession. These include differing perceptions regarding the health of the labour market, a lack of recognition of the profession by industry, weak and fragmented industry recruitment practices, and various endemic barriers to entry for prospective recruits.

5.3.1 LABOUR SHORTAGE: MYTH OR REALITY?

There is disagreement regarding the size of the existing and potential pool of qualified building operators in Canada. BOMA's recent 2010 compensation survey indicates labour needs are being met in virtually all jurisdictions (with the possible exception of Toronto and Ottawa) and that compensation levels are remaining stable or dropping. On the other hand, property owners and managers expressed significant difficulty in finding qualified operators. BOMA and industry representatives both indicate that graduates from educational programs are and will continue to be insufficient to meet demand in the coming years. Census figures corroborate industry projections that labour shortages will become more acute within the coming decade as the majority of current building operators retire and the number of buildings continues to increase.

The distinction may be explained, in part, by studies identifying all available recruits versus what industry perceives as 'qualified' individuals with the capacity to operate, or to learn to operate, high performance equipment. Better quality data and consistency in tracking is required in order to accurately assess labour market conditions.

5.3.2 RECOGNITION: BUILDING OPERATORS ARE PROFESSIONALS

The availability of skilled and experienced building operators is partially due to lack of recognition of the profession by industry. The absence of a formal certification scheme for building operators, the absence of commitment to provide necessary training and attractive compensation, limited opportunities for advancement, and historical preconceptions regarding the role of the building operator all contribute to making the profession less attractive to new recruits and limiting the motivation of building operators to improve their skills and strive for excellence. Building owners and managers know that the building operators are the cornerstone of their real estate asset management team, but it remains to be seen whether they adequately recognize their contribution.



Building owners and managers know that the building operators are the cornerstone of their real estate asset management team, but it remains to be seen whether they adequately recognize their contribution.



5.3.3 RECRUITMENT

Aside from any current shortage in skilled building operators, census figures indicate that twenty per cent of stationary engineers will reach retirement age in six years and an additional forty per cent by 2016 – these numbers may be used as a proxy for building operators (see Appendix O). Therefore, attracting new, skilled employees to the profession is critical. It has been recognized that industry associations (e.g., BOMA) and industry-based educational programs (e.g., BOMI) cannot be expected to achieve this on their own. Rather, a collective effort involving government, industry, educational institutions, unions and other interested stakeholders is required to elevate the profile of and market the profession. Respondents suggested this could involve changing the profession's title, accrediting the profession, and providing better workplace conditions and incentives. Ultimately, it is important that potential new recruits understand the full scope of what the profession can offer them. They need to appreciate, for example, that the individual running the systems in a high profile building like the Toronto Dominion Centre in downtown Toronto is a first level building operator.

5.3.4 BARRIERS TO ENTRY

This study identified a number of barriers to entry into the profession as well as conditions that limited performance (see section 3.8). There is clearly an under-representation of women and visible minorities in the building operator profession. Whether this is a function of historical biases within the trades and custodial professions, wage disparity, or other factors, is unclear and worthy of additional study that potentially extends to consider the issue in the context of all trades and related professions. It is clear that taking steps to open up the profession to women and visible minorities through more targeted marketing and recruitment practices, could help to address industry's labour challenges.

Stakeholder responses also indicated language and computer literacy challenges facing building operators in the current operating environment are compromising their performance and may also pose a barrier to entry into the profession for some. No educational programs for building operators currently address these issues. Further study is recommended to explore these issues and identify ways to address these barriers.

5.4 INTEGRATION

Aside from the general issues of professional designations and training, this study identified a number of systemic issues at both the operational and industry levels that are impacting the ability of building operators to play a more meaningful role in achieving energy efficiency gains and greenhouse gas reductions.

5.4.1 THE ROLE OF THE BUILDING OPERATOR IN ENERGY EFFICIENCY

There appears to be a difference in the way different stakeholders view the role of building operators and the importance they ascribe to the position. Building owners and managers indicate they appreciate the importance of building operators in maximizing energy efficiency and profit, yet compensation surveys show building operator salaries are quite low and departments are understaffed.

In addition, while the employers interviewed stressed the importance of building operators in operating buildings in an energy efficient manner, job descriptions for building operators of larger buildings ignore this responsibility (see s.3.5.1). The reasons for this omission are unclear, but research findings suggest employers are not stipulating energy efficiency as a job requirement for one or more of the following reasons:

- (1) They are not setting efficiency objectives as a requirement for building operators;
- (2) They are concerned that individuals will not apply because they don't have the requisite skills and experience;
- (3) They only recognize these responsibilities implicitly; or
- (4) They assign these responsibilities to more senior positions in larger buildings.

5.4.2 INVOLVEMENT IN BUILDING OPERATIONAL PLANNING

It is generally acknowledged that building operators understand the particular idiosyncrasies of their buildings better than anyone. And yet, despite this detailed understanding, the building operator is often left out of the loop when buildings are retrofitted or when systems are being chosen for new buildings. This speaks to a lack of understanding of the role they could potentially play in driving the efficiency of the new systems, and it devalues their knowledge base. This can have a negative impact on their enthusiasm for their work as well as their understanding of building systems under their control.

5.4.3 INDUSTRY LEADERSHIP

From an industry perspective, there is a vacuum in leadership within the profession. BOMA is the sole industry association representing building owners and operators, however the organization does not currently have the capacity to oversee policy development, monitoring and regulation of the profession. Government has never played a significant role in this area aside from regulating certified power engineers and inspecting boilers. However, there is now American precedent for a governmental role with the recent enactment of the *Federal Buildings Personnel Act of 2010*.⁴⁰ Leadership is going to be required to move the profession forward in a coordinated manner. Some have suggested BOMA as the appropriate organization to lead a multi-stakeholder committee tasked with reordering the building operator profession to the benefit of building operators, building owners and managers, and Canada's energy conservation and other green building goals (see s.3.10).



It is generally acknowledged that building operators understand the particular idiosyncrasies of their buildings better than anyone. And yet, despite this detailed understanding, the building operator is often left out of the loop when buildings are retrofitted or when systems are being chosen for new buildings.



⁴⁰ The *Federal Buildings Personnel Act of 2010* enacted on December 14, 2010 aims to ensure that building personnel are trained to properly run and maintain more than 500,000 federal buildings and facilities. The Act requires the General Services Administration to increase the competencies of personnel in building operations and maintenance, energy management, sustainability, water efficiency, safety and building performance measures. Under the new law, the GSA is required to develop and identify relevant courses, certifications, degrees, licenses and registrations that could increase the competency of building personnel, including any need for ongoing training. Both federal and non-federal employees would be required to demonstrate competencies one year after they have been hired.



6. CONCLUSIONS

While there is informal consensus on the main roles and responsibilities of building operators, there is significant variation across employers and building types, which is confusing for those seeking to enter the profession. All stakeholders recognize the need for greater clarity regarding professional qualifications and responsibilities, but consensus does not yet exist on what that should look like or how it is to be achieved. Similarly, there is no clear indication that building operators are sufficiently qualified. Rather, the findings suggest that building operators come from a wide variety of backgrounds, receive training in a myriad of ways, and exhibit varying degrees of competency as a result. In the absence of clear benchmarks, such as such as formal educational and certification frameworks, it is difficult to assess the qualifications and abilities of those currently in the profession. It is clear that the existing ad-hoc framework is in need of significant change if we are to have a profession capable of operating high performing buildings in the future. In most instances, the findings of this study do not make it possible to specify the approaches to take or who should be responsible for addressing the issues identified. This needs be the subject of further research, consultation and action. The study does, however, identify a significant number of issues that are summarized below. Based on the results of this study, ECO Canada suggests further research and efforts to generate:

- More quality and consistent data on labour market conditions, building operator demographics, educational statistics (uptake of educational and training programs, educational performance and competency assessments), and employment statistics.
- A nationally recognized framework detailing professional categories, qualifications and responsibilities of building operator that also addresses energy management and an appreciation of the building operator as an integral part of building operations planning and management.
- A nationally recognized accreditation and certification scheme for building operators that recognizes various educational and training programs and incorporates ongoing training and competency assessment.
- A detailed gap analysis of existing educational and training opportunities, including on-the-job training, to identify their ability to meet the educational needs of building operators going forward.
- A survey of employers and building operators to determine preferred learning methods and to encourage a culture of learning within the industry.
- Greater employer recognition of and investment in building operators through fair compensation, training and advancement opportunities, good workplace conditions and incentives.
- Collective stakeholder effort to raise the profile of the profession and promote it to the labour market.
- Addressing under-representation of women and visible minorities in the profession, as well as barriers to entry such as language and computer literacy.



APPENDICES

APPENDIX A: DETAILED RESEARCH METHODOLOGY

PHASE I: SECONDARY RESEARCH

The first phase of research involved a comprehensive review of published and unpublished literature on building operators, including:

- An extensive review of online literature, including published reports, industry websites, and educational and training websites.
- Conversations with key stakeholders to identify unpublished resources, seek clarification and identify stakeholders to interview during subsequent phases of the study.
- A review of current job postings for building operators across Canada to identify professional qualifications required by employers.
- Analysis of available statistical data pertaining to building operators and related professions (stationary engineers and power engineers).

In addition to traditional searches of published materials and online sources, representatives from all stakeholders, including industry and government, were consulted to identify any unpublished information.

PHASE II: QUALITATIVE SURVEY RESEARCH

The second phase of the study focused on qualitative interviews with key stakeholders. The interviews were conducted between November 10th and November 29th of 2010. Each interview lasted between 40 and 70 minutes. All interviews were conducted by telephone by senior research consultants in the Ipsos Ottawa office.

Ipsos worked in close collaboration with Light House and ECO Canada to develop an interview guide that would elicit feedback from each interview audience on all of the research objectives. In order to ensure that the research instrument covered all of the objectives, Ipsos first developed a framework document that cross-referenced all objectives with the audiences of interest. This document was then refined in coordination with Light House. The final document is below.

| RESEARCH ISSUES | | RESEARCH AUDIENCES | | | | | | | | |
|---------------------------------|---|--------------------------|--------------------------|--------------------------|--------------------------|----------------------------------|-----------------------------|--------------------------|--------------------------|--------------------------|
| | | BUILDING MANAGERS | BUILDING OPERATORS | GOVERNMENT REGULATORY | GOVERNMENT POLICY | INDUSTRY ASSOCIATIONS/ UTILITIES | EDUCATION – PRIVATE/ PUBLIC | UNION | PROFESSIONALS | SECTOR COUNCILS |
| CHALLENGES AND OBSTACLES | Assess the range and scope of challenges faced in the conversion of existing buildings into high performance buildings and achieving significant energy conservation targets. Need to focus this more around building operations and operators. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| SKILLS AND EDUCATION | Assess current availability of skills, training and education opportunities and identify gaps. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| QUALIFICATIONS | Identify current required qualifications for green building operators as well as perceptions of these. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| INDUSTRY PERCEPTIONS | Evaluate industry perceptions of green building operators and the perceptions of building operators themselves. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| COMMUNICATION AND RELATIONSHIPS | Understand relationship between operators, associations and regulatory actors to evaluate current views and identify gaps and opportunities for improvement. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Ipsos then developed a draft interview guide that was refined in coordination with ECO Canada, Light House and the National Steering Committee.

Sampling

The sample was developed during the secondary research and provided to Ipsos by Light House. The sample included representatives of each of the audiences of interest and was stratified to ensure full representation of the diverse audiences.

Many of the stakeholders interviewed currently occupy or previously occupied multiple positions in the field. As such, several interviewees offered responses from more than one perspective.

Respondents were selected from all regions of Canada to ensure that we obtained a national perspective. British Columbia and Ontario are disproportionately represented because of the number of key stakeholders located in those regions.

Quota Count by Respondent Profile

| RESPONDENT GROUP | QUOTA | COMPLETED |
|-----------------------|-----------|-----------|
| Building Managers | 6 | 6 |
| Building Operators | 6 | 8 |
| Educators | 5 | 5 |
| Policy | 3 | 2 |
| Regulators | 5 | 4 |
| Industry Associations | 3 | 4 |
| Union | 1 | 1 |
| Professional | 1 | 1 |
| TOTAL | 30 | 31 |

| REGION | NUMBER |
|------------------|-----------|
| Alberta | 3 |
| Atlantic Canada | 2 |
| British Columbia | 10 |
| Ontario | 12 |
| Quebec | 2 |
| Saskatchewan | 2 |
| TOTAL | 31 |

Recruitment

Respondents were recruited by telephone.

Analysis and Reporting

The analysis and reporting phase for the primary research began during the field window. The researchers responsible for conducting the interviews took detailed notes during each interview. These notes were supplemented by reviewing recordings of the interviews when possible. The research team met periodically throughout the field window to discuss findings, compare notes and make further refinements to the prompts in the interview guide to ensure that all findings were thoroughly explored. Towards the end of the field window, the research team created a report framework that reflected the findings of the research and began to develop the analysis on a section-by-section basis. The analysis was derived primarily from direct respondent quotations. The primary challenges encountered during the analysis and reporting phase were:

1. The large amount of data collected;
2. The interconnectedness of the findings.

The original targeted interview length was to be 30 minutes. However, interviewees were particularly engaged and the scope of the research questions became much broader than anticipated. This presented a challenge in terms of analyzing the sheer volume of comments collected. This led to more time being spent on the analysis.

In terms of the interconnectedness of the findings, we found that it was difficult to analyze and report on the various findings separately. This was due to both the exploratory nature of the research as well as the overlapping mandates of several of the respondents. In order to overcome this challenge, the report was written using either a thematic or audience-based approach where appropriate. For example, section 3.4 (Building Operator Defined) is organized according to audience perspective, whereas section 3.5 (Building Operator Job Description and Qualifications) is organized by theme.

Limitations of the Research: Primary Research

The primary research conducted for this project was qualitative in nature. The findings are to be viewed as directional only and cannot be extrapolated to a larger population.

APPENDIX B: GLOSSARY OF KEY TERMS

Building Operator: "a person who has the appropriate skills needed for the day-to-day maintenance and operation of large facilities that have complex heating, mechanical, and electrical systems along with specific knowledge of how to operate the facility in a way that takes into consideration the interplay of building systems to maximize energy and resources efficiency, reduce waste, and provide superior indoor air and other qualities".

BOMA: Building Owners and Managers Association
(www.bomacanada.ca)

BOMI: Building Owners and Managers Institute
(www.bomicanada.com)

IPEC: Institute of Power Engineers of Canada (www.nipe.ca)

Power Engineer: "generally employed in industrial and manufacturing plants, hospitals, universities, government and commercial establishments. These workers usually operate and maintain various types of stationary engines and auxiliary equipment, such as boilers, turbines, generators, compressors and other equipment that provide heat, ventilation, refrigeration, light and power for buildings, industrial plants and other work sites."⁴¹

Stationary Engineer: "operate and maintain various types of stationary engines and auxiliary equipment to provide heat, light, power and other utility services for commercial, industrial and institutional buildings and other work sites. They are employed in industrial and manufacturing plants, hospitals, universities, government, utilities, hotels and other commercial establishments."⁴²

SOPEEC: Standardization of Power Engineers Examination Committee
(www.sopec.org)

⁴¹ Human Resources Partnerships Directorate, *Occupational Analyses Series: Power Engineer* (Minister of Public Works and Government Services Canada: Ottawa, 1997), p.xx.

⁴² Human Resources and Skills Development Canada, National Occupational Classification System 7351 (Stationary Engineers and Auxiliary Equipment Operators). Accessed at <http://www5.hrsdc.gc.ca/NOC/English/NOC/2006/QuickSearch.aspx?val65=7351>.

APPENDIX C: SECONDARY RESEARCH SOURCES

Alberta Government, *Alberta Occupational Profiles: Building Operator*.

Provides summary of job description, compensation range, educational requirements, and other information pertaining to the position of building operator.

BOMA BC, *Building Operations and Managers 2008 Salary Guide* (BOMA BC, 2008).

Provides compensation data for various positions related to building operations along with supporting commentary on related market conditions and trends.

BOMA Calgary, Powerpoint presentation entitled *Building Operator and Training Program* (undated).

Provides industry data on building operators in Alberta as well as a roadmap for BOMA's building operator training program.

BOMA Canada, *2010 BOMA Industry Compensation Report Study*

This survey conducted by Hays Recruiting provides information on compensation levels and trends within the property management sector.

Globe Foundation, *BC's Green Economy* (February 2010).

Provides some baseline statistical data on the green building sector in the Province.

Human Resources Partnerships Directorate, *Occupational Analyses Series: Power Engineer* (Minister of Public Works and Government Services Canada: Ottawa, 1997).

Provides detailed breakdown of the various tasks of the Power Engineer.

James C. Martini, *Identification and Verification of the Duties and Tasks for the Occupation of Power Engineer* (Masters Thesis 2006).

Martini is a leading authority and academic on the power engineer profession. American thesis including national survey on the duties and tasks of power engineers.

Royal Institute of Chartered Surveyors, *Green Value: Green Building, Growing Assets* (2005)

The report identifies one barrier to green building being a shortage of engineers with experience of operating green building systems. No evidence provided to support this assertion.

Statistics Canada, *2006 Census data - Stationary Engineers and Auxiliary Equipment Operators (H221)*.

Census data provides breakdown of stationary engineers by province, age, sex, mobility, language and other variables. NOC-S classification likely includes a broader range of professions than just building operator.

Curricula and syllabi from various educational and training programs

Course curriculum were obtained online for all building operator programs from the responsible institutions.

Formal job descriptions

Employers provided formal job descriptions for a range of positions within their organization that deal with building maintenance and operations.

Published job postings

Job postings from various employers posted in July and August 2010 detailing educational requirements for building operator and related positions and compensation ranges in some instances

APPENDIX D: QUESTIONNAIRE

The following is the interview guide used by Ipsos Reid to conduct the stakeholder interviews for this study.

Hello, my name is _____. As you know, I am calling from Ipsos Reid, a public opinion research firm to conduct a 30 to 35 minute in-depth interview with you regarding the profession of building operator in Canada. Essentially, the interview will consist of a series of open-ended questions designed to elicit your feedback on a variety of issues relating to the profession today and its evolution going forward. I will read the questions and take notes throughout the interview. This is an interview and not a survey – rather than simply answering questions, this will be more of a conversation. Let's start with the first question...

Defining Building Operators and Qualifications

1. First, can you tell me, in your own words, your definition of what a building operator is?
2. In your opinion, what are the primary responsibilities and daily tasks of a building operator?
3. In your opinion, what role do building operators play in making buildings energy-efficient?
4. In what ways, if at all, does the position of "building operator" differ from other professions that deal with building operations? If yes: please outline how you think it is different? If no, why not?
5. What do you believe are the necessary qualifications of a building operator?

Future of Building Operators

6. How, if at all, do you see the current qualifications of the building operator changing in the future?
7. In your opinion, what role(s) should building operators play in making buildings energy-efficient?
8. Thinking about the growing complexity of building operations, does the traditional role of building operator need to be segmented to recognize various degrees of responsibility/qualifications? If so, how would you do it? If not, why not?

Current Training Effectiveness

9. As far as you know, what training or education programs currently exist for building operators? Educators only: What programs are offered for building operators and how do they compliment/compete with each other?
10. Educators only: In what ways, if at all, has your institution responded to the increased emphasis on green buildings? Have any changes in curriculum occurred? Are there any future plans for programs relating to this field?
11. What, if any, gaps exist in current training or education programs or elements of existing programs? If yes, what gaps?
12. In what way, if any, do you think the acquisition of additional skills related to energy efficiency and new "green" building technologies will have an impact on the profession of building operator? Will this have an impact on competitiveness in the labour market? Why? Why not?

Future Training Needs

13. In what ways do you think the industry as a whole can better prepare and train building operators to more adequately respond to market needs and advances in the operation of high performance buildings?
14. How important is it that apprenticeship plays a role in the training (and development?) of building operators?
 - Very important
 - Somewhat important
 - Not very important
 - Not at all important
15. To what extent would you support the creation of a national occupation standard or a certification process for building operators?
 - Support fully
 - Support somewhat
 - Would not support at all

Why would you [INSERT SELECTED RESPONSE] the creation of a national occupation standard or a certification process?
16. What are your views on a national occupation standard or certification process?

Labour Market Conditions

17. How would you describe the labour market demand for the profession of building operator?
18. To what extent do you think the current system and pool of candidates will be able to sufficiently cope with the transition to a greater emphasis on green buildings and technology?
- It will be more than sufficient
 - It will be sufficient
 - There will be a somewhat of a shortfall
 - There will be a significant shortfall

Please explain/elaborate?

19. What barriers, if any, exist to entering the profession of building operator?
20. What do you think is required to attract people to the profession of building operator?
21. How can the industry as a whole better retain current building operators and encourage them to enhance their skills to meet the needs of high performance buildings?
22. In your professional role, what contact, if any, do you have with other players in the industry regarding building operations? What associations do you reach out to in order to obtain specific information about this field? How can these relationships be improved / built? How have they been fruitful or deficient in the past?
23. In your opinion, how can government or industry associations improve the communication of their key environmental goals and programs (e.g. energy efficiency, GHG reductions) to the green building operator industry?
24. From your perspective, what are the biggest challenges facing building operators?
25. Do you have any other comments to add?

APPENDIX E: LIST OF EDUCATIONAL AND TRAINING PROGRAMS

The following is a list of all educational and training programs identified that relate in some manner to building operations. This list was compiled from an extensive online search. While the list is extensive, it is not represented to be exhaustive. A more detailed account of each program is contained in a separate Microsoft Excel document entitled "10.09.22 – education & training".

List of Educational and Training Programs

| INSTITUTION | PROGRAM |
|--|---|
| Algonquin College | Building Environmental Systems, Class II |
| Algonquin College | Heating, Refrigeration and Air Conditioning Technician |
| Algonquin College | Refrigeration and Air Conditioning Systems Mechanic |
| Algonquin College | Residential and ICI Air Conditioning Systems Mechanic Common Core |
| Algonquin College of Applied Arts and Technology | Heating, Ventilation & Air Conditioning Technician |
| Algonquin College of Applied Arts and Technology | Plumber |
| Ashworth College | Basic Electronics |
| Ashworth College | Electrician Training |
| Ashworth College | Heating & Air Conditioning |
| Ashworth College | Plumbing |
| Assiniboine Community College | Power Engineering - 4th Class |
| Aurora College - Thebacha Campus | Plumber, Gasfitter, Oil Burner Mechanic |
| BCIT | Green Roof Technology (ARSC 8210) |
| BCIT | Bachelor of Technology (Environmental Engineering Technology) Degree |
| BCIT | Green Roofs - Concepts, Systems and Incentives (GROW 0001) |
| BCIT | Green Roofs - Details, Installation and Maintenance (GROW 1000) |
| BCIT | Green Roofs - Planting in the Pacific Northwest (GROW 2000) |
| BCIT | Green Roofs & Living Walls for Environmental Solutions GROW 3000) |
| BCIT | Heating, Ventilating, Air Conditioning and Refrigeration Technician Diploma |
| BCIT | Power and Process Engineering (3rd Class) Diploma |
| BCIT | Power Engineering General (Certificate) Program |
| BCIT | Power Engineering Technical (Certificate) Program |
| BCIT | Sustainable Energy Management Associate Certificate (SEMAC) |
| BOMA | Building Energy Training Program |
| BOMA | Building Operator Training 1 |
| BOMA | Building Operator Training 2 |
| BOMA | Building Operator Training 3 |
| BOMI Canada | Building Systems Maintenance Certificate |
| BOMI Canada | Facilities Management Administrator (FMA) |
| BOMI Canada | Facilities Management Certificate |
| BOMI Canada | Systems Maintenance Administrator |
| BOMI Canada | Systems Maintenance Technician |
| Cambrian College of Applied Arts and Technology | Energy Systems Technology |
| Cambrian College of Applied Arts and Technology | Heating, Ventilation & Air Conditioning Technician |
| Cambrian College of Applied Arts and Technology | Power Engineering - 2nd Class |
| Cambrian College of Applied Arts and Technology | Refridgeration & Air Conditioning |
| Cambrian College of Applied Arts and Technology | Refrigeration & Air Conditioning Technician |

List of Educational and Training Programs (cont'd)

| INSTITUTION | PROGRAM |
|--|---|
| Canadian Institute for Energy Training | Training in Energy Management through Open Learning (TEMOL) |
| CanMET | Advanced Recommissioning Course |
| Cégep de l'Outaouais | Réfrigération, chauffage, ventilation et climatisation - ATE |
| Centennial College | Energy Systems Engineering Technician |
| Collège Communautaire du Nouveau Brunswick (CCNB) | Power Engineering Technology |
| Collège Communautaire du Nouveau Brunswick (CCNB) | Refrigeration Et Air Conditioning Technician |
| College of New Caledonia | Power Engineering and Gas Processing |
| College of the North Atlantic | Construction/Industrial Electrical Entry |
| College of the North Atlantic | Industrial Control (Electrical Engineering Technology) |
| College of the North Atlantic | Refridgeration Et Air Conditioning |
| College of the North Atlantic (CNA) | Power Engineering - 3rd Class |
| Conestoga College of Applied Arts and Technology | Building Environmental Systems Operator - Class I |
| Conestoga College of Applied Arts and Technology | Plumber |
| Confederation College of Applied Arts and Technology | Facilities Maintenance (Basic) |
| Confederation College of Applied Arts and Technology | Power Engineering Technician |
| Douglas College | Building Environment Et Resource Management (BERM) |
| Durham College | Facilities Maintenance Mechanic (Phase 1 and 2) Apprenticeship |
| Durham College | Heating, Ventilation and Air Conditioning Techniques - HVAC |
| Durham College | Power Engineering Technician |
| Fanshawe College of Applied Arts Et Technology | Industrial Controls (Electronics Engineering Technician) |
| Fanshawe College of Applied Arts and Technology | Air Conditioning |
| Fanshawe College of Applied Arts and Technology | Mechanical, Heating and Cooling Technician |
| Fleming College | Home and Building Automation Technician |
| George Brown College | Building Renovation Technician |
| George Brown College | Heating, Air Conditioning and Refrigeration Technician |
| Grande Prairie Regional College | Power Engineering |
| Granton Institute of Technology | Heating Et Air Conditioning |
| Great Plains College | Power Engineering - 3rd Class |
| Holland College | Heating, Ventilation and Air Conditioning Technology |
| Holland College | Power Engineering |
| Humber College Institute of Technology Et Advanced Learning | Sustainable Energy Et Building Technology |
| Humber College Institute of Technology and Advanced Learning | Air Conditioning Et Refridgeration Engineering Technician Co-op |
| Humber College Institute of Technology and Advanced Learning | Plumber Apprenticeship |
| Keyano College | Power Engineering |
| Lakeland College | Power Engineering - 4th and 5th Class Operators |
| Lambton College of Applied Arts and Technology | Industrial Apprentice - Building Maintenance Mechanic |
| Lambton College of Applied Arts and Technology | Industrial Management |
| Lethbridge College | Power Engineering - 5th Class |
| Malaspina University-College | Heating, Ventilation, Air Conditioning/Refridgeration |
| Medicine Hat College | Power Engineering - 3rd Class |
| Medicine Hat College | Power Engineering - 4th Class |
| Medicine Hat College | Power Engineering Technology |
| Mohawk College of Applied Arts and Technology | Building Renovation Technician |
| Mohawk College of Applied Arts and Technology | Electrical Engineering Technician - Power |

List of Educational and Training Programs (cont'd)

| INSTITUTION | PROGRAM |
|---|--|
| Mohawk College of Applied Arts and Technology | Heating, Air Conditioning and Refrigeration Techniques |
| Mohawk College of Applied Arts and Technology | Power Engineering - 3rd Class |
| Mohawk College of Applied Arts and Technology | Power Engineering Techniques |
| New Brunswick Community College | Industrial Control Technology |
| New Brunswick Community College - St. Andrews | Refridgeration Et Air Conditioning Technician |
| New Brunswick Community College (NBCC) | Air Conditioning Et Refrigeration Technician |
| New Brunswick Community College (NBCC) | Buildings, Energy and Environment(not currently offered) |
| New Brunswick Community College (NBCC) | Civil Engineering Technology - Building Services |
| New Brunswick Community College (NBCC) | Mechanical Engineering Technology - Buildings, Energy Et Environment |
| New Brunswick Community College (NBCC) | Mechanical Engineering Technology : HVAC Co-op |
| New Brunswick Community College (NBCC) | Power Engineering Technology |
| Niagara College | Electrical Engineering Technology - Power Systems |
| NorQuest College | Building Service Worker Program |
| NorQuest College | Industrial Careers: Building Service Worker |
| North Island College | Heating Technician Certificate |
| North Island College | Plumbing Et Heating Entry |
| Northern Alberta Institute of Technology | Electronic Service Technician |
| Northern Alberta Institute of Technology (NAIT) | Air Conditioning Engineering Technology |
| Northern Alberta Institute of Technology (NAIT) | Building Environmental Systems Technology |
| Northern Alberta Institute of Technology (NAIT) | HVAC Specialist |
| Northern Alberta Institute of Technology (NAIT) | Power Engineering - 3rd Class |
| Northern Alberta Institute of Technology (NAIT) | Power Engineering - 4th Class |
| Northern Alberta Institute of Technology (NAIT) | Power Engineering Technology |
| Northern Alberta Institute of Technology (NAIT) | Power System Electrician |
| Northern Lakes College | Power Engineering - 4th Class |
| Northern Lights College | Power Engineering and Gas Processing |
| Nova Scotia Community College | Heating Services Professional |
| Nova Scotia Community College | Heating, Ventilation, Air Conditioning/Refridgeration |
| Nova Scotia Community College | Plumbing |
| Nova Scotia Community College (NSCC) | Heating, Ventilation, Refrigeration Et Air Conditioning |
| Nova Scotia Community College (NSCC) | Power Engineering - 3rd Class |
| Nova Scotia Community College (NSCC) | Power Engineering - 4th Class |
| Nova Scotia Community College (NSCC) | Power Engineering Technology |
| Nunavut Arctic College | Building Operator A (not currently offered) |
| Pre-Apprenticeship Training Institute | Heating Et Air Conditioning |
| Real Estate Institute of Canada | Property Maintenance and Risk Management |
| Red Deer College | Plumber |
| Red River College of Applied Arts, Science and Technology | Industrial Electrical Maintenance |
| Red River College of Applied Arts, Science and Technology | Power Engineering - 2nd Class |
| Red River College of Applied Arts, Science and Technology | Power Engineering Technology |
| Red River College of Applied Arts, Science and Technology | Refrigeration and Air Conditioning Technician |
| Saskatchewan Environmental Society | Building Operator Training |
| Saskatchewan Institute of Applied Science and Technology | Plumber |

List of Educational and Training Programs (cont'd)

| INSTITUTION | PROGRAM |
|--|--|
| Saskatchewan Institute of Applied Science and Technology | Refridgeration Mechanic |
| Saskatchewan Institute of Applied Science and Technology (SIAST) | Building Systems Technician |
| Saskatchewan Institute of Applied Science and Technology (SIAST) | Power Engineering Technician |
| Saskatchewan Institute of Applied Science and Technology (SIAST) | Refrigeration and Air Conditioning |
| SEI (Solar Energy International) | Battery-based Solar Eletriv Systems and Code Criteria- Online |
| SEI (Solar Energy International) | Grid-Direct Solar Electric Systems and Code Criteria - Online |
| SEI (Solar Energy International) | PVOL202 Grid-Direct Solar Electric Systems and Code Criteria - Online |
| SEI (Solar Energy International) | Solar Electric Fundamentals and Grid-Direct Design - Online |
| Selkirk College | Automated Building Systems Technology Certificate |
| Seneca College of Applied Arts and Technology | Building Systems Engineering Technician |
| Seneca College of Applied Arts and Technology | Geothermal Energy Systems |
| Seneca FCET | Building Environmental Systems Operator (Class 1) |
| Sheridan College | Building Environmental Systems Operator Class 1 |
| Sheridan College | Building Environmental Systems Operator Class 2 |
| Southeast Regional College | Power Engineering |
| St. Clair College of Applied Arts and Technology | Heating, Refrigeration and Air Conditioning Technician |
| St. Clair College of Applied Arts and Technology | Power Engineering - 4th Class |
| St. Clair College of Applied Arts and Technology | Power Engineering Technology |
| University College of the North | Facilities Maintenance |
| Vancouver Career College | Plumber Foundation |
| Vancouver Community College | Building Manager Certificate Program |
| Vancouver Community College (VCC) | Building Service Worker (ESL) Certificate |
| Vancouver Community College (VCC) | Building Service Worker Certificate |
| Vancouver Island University | Green Building and Renewable Energy Technician |
| Vancouver Island University | Heating, Ventilation & Air-Conditioning/Refrigeration (HVAC/R) Certificate |
| Willis College of Business and Technology | Heating & Air Conditioning |
| Winnipeg Technical College | Industrial Control & Automation |

APPENDIX F: RELATED JOB TITLES FOR NOCS 7351 (STATIONARY ENGINEER)

air compressor operator
air conditioning system operator
apprentice power engineer
apprentice stationary engineer
auxiliary equipment operator
auxiliary plant operator
boiler operator
boilerhouse operator
building systems operator
building systems technician
cooling system operator
diesel engine operator, stationary
energy from waste plant operator
energy recovery incinerator plant operator
fifth-class stationary engineer
first-class power engineer
first-class stationary engineer
fourth-class power engineer
fourth-class stationary engineer
furnace boiler operator
heating and ventilation equipment tender
heating stationary engineer
heavy water steam plant operator
humidifying systems operator
mobile generator operator
operator, air conditioning systems
operator, boiler
operator, steam plant
plant maintenance engineer, stationary
plant maintenance stationary engineer
power engineer
power engineer apprentice
power engineer, first class
power engineer, fourth class
power engineer, second class
power engineer, third class
power plant stationary engineer
powerhouse operator
refrigeration plant operator
second-class stationary engineer
second-class power engineer
stationary engineer
stationary engineer - military
stationary engineer "A" and refrigeration plant operator
stationary engineer "B" and refrigeration plant operator
stationary engineer apprentice
stationary engineer, fifth class
stationary engineer, first class
stationary engineer, fourth class
stationary engineer, hospital
stationary engineer, plant maintenance
stationary engineer, second class
stationary engineer, steam power plant
stationary engineer, third class
stationary operating engineer
stationary power engineer
steam operator
steam plant operator
steam power plant stationary engineer
technician, building systems
tender, heating and ventilation equipment
thermal plant operator
third-class power engineer
third-class stationary engineer
turbine operator - stationary engines

APPENDIX G: NOCS DEFINITIONS FOR TRADES ASSOCIATED WITH BUILDING OPERATIONS

The following is a list of professional trades related to the position of building operator as defined by the National Occupational Classification System.

NOCS Definitions for Trades Associated with Building Operations

| NOCS GROUP UNIT | OCCUPATION | NOCS OCCUPATIONAL DEFINITIONS |
|-----------------|---|--|
| 7241 | Electricians (except industrial and power system) | Electricians in this unit group lay out, assemble, install, test, troubleshoot and repair electrical wiring, fixtures, control devices and related equipment in buildings and other structures. They are employed by electrical contractors and maintenance departments of buildings and other establishments, or they may be self-employed. |
| 7251 | Plumbers | Plumbers install, repair and maintain pipes, fixtures and other plumbing equipment used for water distribution and waste water disposal in residential, commercial and industrial buildings. They are employed in maintenance departments of factories, plants and similar establishments, by plumbing contractors, or they may be self-employed. |
| 7253 | Gas fitters | Gas fitters install, inspect, repair and maintain gas lines and gas equipment such as meters, regulators, heating units and appliances in residential, commercial and industrial establishments. They are employed by gas utility companies and gas servicing companies. |
| 7313 | Refrigeration and air conditioning mechanics | 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 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. |

Source: National Occupational Classification System

APPENDIX H: STATIONARY ENGINEER DUTIES UNDER NOCS 7351

The following is the list of possible duties for a stationary operator according to NOCS 7351:

- Operate automated or computerized control systems, stationary engines and auxiliary equipment such as boilers, turbines, generators, pumps, compressors, pollution control devices and other equipment to provide heat, ventilation, refrigeration, light and power for buildings, industrial plants and other work sites;
- Monitor and inspect plant equipment, computer terminals, switches, valves, gauges, alarms, meters and other instruments to measure temperature, pressure and fuel flow, to detect leaks or other equipment malfunctions and to ensure plant equipment is operating at maximum efficiency;
- Analyze and record instrument readings and equipment malfunctions;
- Troubleshoot and perform corrective action and minor repairs to prevent equipment or system failure;
- Clean and lubricate generators, turbines, pumps and compressors and perform other routine equipment maintenance duties using appropriate lubricants and hand, power and precision tools;
- Maintain a daily log of operation, maintenance and safety activities, and write reports about plant operation; and
- May assist in the development of operation, maintenance and safety procedures.

The NOCS educational requirements for this class of occupation include:

- Completion of secondary school is usually required;
- Completion of a regulated apprenticeship program in stationary or power engineering;
or
- On-the-job training and additional courses or a college training program in stationary or power engineering or building systems operations are required;
- Provincial or territorial certification or licensing according to class (4th, 3rd, 2nd and 1st class and an additional 5th class in Manitoba, Saskatchewan, Nunavut and the Northwest Territories) is required; and
- Certification according to class (4th, 3rd, 2nd or 1st class for heating and steam engines and class B or A for refrigeration) is required in Quebec.

APPENDIX I: CAREER COLLEGES OFFERING BES CERTIFICATE PROGRAM IN CANADA

Seneca College
 Sheridan College
 Douglas College
 Conestoga College

Northern Alberta Institute of Technology (NAIT)
 Mohawk College
 Algonquin College

APPENDIX J: DETAILED SUBJECT DESCRIPTIONS FOR BES PROGRAM

Class I & II certification requires completion of the following courses. The Facility Manager Certificate requires completion of Class I & II course requirements plus eight additional courses.

Detailed Subject Descriptions for BES Program

| | LEVEL | SUBJECT |
|--------------------------------------|---|--|
| CLASS II | Entry | Practical overview of building systems |
| | Core | Heating |
| | | Air conditioning and refrigeration |
| | | Air handling |
| | | Electricity |
| | | Controls |
| | | Water treatment |
| CLASS I | Specialty (completion of one subject required only) | Pipe system design |
| | | Air systems design |
| | | Hospital systems |
| | Comprehensive | Energy management |
| | FACILITY MANAGER | Core |
| Site Maintenance and Building Safety | | |
| Strategic and Financial Planning | | |
| Human Relations | | |
| Operations | | Practical Overview of Building Systems |
| | | Energy Management |
| Options | | Photovoltaic Technology |
| | | Fire Safety |
| | | Computer Systems |
| | | Technical Writing |

CLASS II CERTIFICATE COURSE DESCRIPTIONS

HA Practical Overview of Building Systems

- An overview of major building functions, including heating, air conditioning, air handling, electricity, water treatment and controls.

Heating

- Identify the major means of heating distribution in a building and develop solutions to prevent energy waste;
- Describe the maintenance and operation of gas and oil burners;
- Analyze the dangers of incomplete combustion;
- Read/draw a diagram of a basic hydronic heating circuit;
- Describe the safe and energy-efficient operation of a standard hot water system and boiler; and
- Develop an appropriate maintenance schedule to ensure energy-efficient operation.

Air Conditioning and Refrigeration

- Perform simple calculations involving temperature, heat, and changes of state;
- Describe, using diagrams, the basic refrigeration cycle;
- Explain the purpose of compressors in refrigeration;
- Explain the purpose of heat exchangers in condensers and evaporators;
- Describe the purpose of metering devices in refrigeration;
- Interpret electrical control diagrams associated with air conditioning and refrigeration;
- Prepare an effective preventive maintenance schedule;
- State and explain regulations and procedures involving the safe use of refrigerants and refrigeration equipment.

Air Handling

- Identify indoor air quality problems in a building;
- Name/draw diagrams of many types of ductwork systems;
- Identify the types of fans by the blade configuration and outline the uses for each type;
- Describe the benefits of dehumidification, humidification and methods used to achieve them;
- Give a short description of what each line on a psychometric chart represents; and
- Develop an action plan to include the 3 R's of waste management and disposal.

Electricity

- Calculate Volts, Amperes and Ohms;
- Draw diagrams and graphs and perform simple calculations;
- Read and draw simple schematic and wiring diagrams;
- Outline how supply company charges are applied, and how energy can be used most efficiently;
- Describe the safety practices to be followed when doing preventive or predictive maintenance;
- Discuss how to select appropriate light sources for a given situation; and
- Describe the principle of operation of simple electronic devices.

Controls

- Describe in detail the differences between open loop and closed loop control systems;
- Describe the common energy types used in HVAC control systems;
- Describe in detail the three types of sensing devices used to measure temperature, pressure and humidity;
- Explain how a pneumatic control system operates;
- Identify the major auxiliary control device used for safety and for set point adjustment;
- List daily, weekly, monthly and periodic maintenance requirements for pneumatic, electric, and electronic control systems; and
- Give a detailed description of the operation of a master-sub master control system.

Water Treatment

- Identify the principal contaminants of untreated water from various sources and explain how their removal can provide economic benefits, energy conservation and water use efficiency in municipal and industrial settings;
- Describe the phenomenon of ionization;
- Describe the test procedures normally associated with water treatment;
- Describe the principal methods used in external water treatment;
- Explain how water treatment applies to health and safety, including sewage discharge; and
- Describe the application of water treatment to potable and domestic water systems and to pool and spa systems.

CLASS I CERTIFICATE COURSE DESCRIPTIONS

Pipe Systems Design

- A study of the design, application and operating characteristics of pipe systems, equipment and strategies for working with outside contractors and engineers.

Air Systems Design

- Prerequisites: Pipe Systems Design; and
- A study of the design, application and operating characteristics of air handling systems.

Hospital Systems

- An overview of hospital building-related systems and their effective maintenance.

Energy Management

- Concluding subject integrates information on energy efficiency strategies;
- Students design a project to implement an energy-saving or environmental project in their own building; and

FACILITY MANAGER CERTIFICATE COURSE DESCRIPTIONS

Property and Building Administration

- Acquiring the knowledge of different classifications of buildings and occupancies;
- Reviewing the different ways a Facility Manager functions in different building occupancies;
- Understanding the aspects of different Ministries and Government agencies regulating buildings; and
- Understanding the role of external services such as electricity, fuel, water supply and disposal, and emergency organizations.

Site Maintenance and Building Safety

- Familiarization with the components of the building envelope and its effect on energy efficiency and indoor environmental quality. Housekeeping and site maintenance are also covered;
- Awareness of the need for barrier-free access and addressing barrier-free access in both new constructions and retrofits;
- Acquiring knowledge of health and safety issues, codes and regulations governing such issues; and
- Understanding the environmental impacts of proper waste management/recycling and assessing and implementing such programs.

Strategic and Financial Planning

- Preparing cash, capital and operating budgets for a facility department;
- Recognizing and designing an effective materials procurement, management and control system;
- Recognizing how to effectively plan, schedule and control the work of a facility department;
- Recognizing the principles for designing an effective organizational structure for a facility department;
- Applying techniques to effectively control costs of operating an organization's physical facilities, including salaries and wages, costs of energy, fuel and oil, supplies, and other overhead costs; and
- Recognizing the importance of efficient energy and environmental management and related accounting or financial techniques.

Human Relations

- Recognizing how to recruit and hire workers, appraise, evaluate and improve staff performance;
- Recognizing the collective bargaining process and how to maintain good labour relations;
- Recognizing and applying effective management techniques in crisis management, conflict management and time management;
- Preparing an effective training and development program to satisfy employees' needs including energy and environmental management training; and
- Developing a system that considers an employee's performance in energy and environmental management, and occupational health and safety.

Energy Management

- Integrates information on energy efficiency strategies; and
- Students design a project to implement an energy saving or environmental project in their own building.

Options (select 1, technical writing required)

- Photovoltaic Technology;
- Fire Safety;
- Computer Systems; and
- Technical Writing (Required).

APPENDIX K: BOMI SMT/SMA COURSES

The following course information for BOMI's Systems Maintenance Technician (SMT) and Systems Maintenance Administration (SMA) programs has been taken verbatim from BOMI's website at www.bomicanada.com.

BOMI SMT/SMA Courses

| PROGRAM | COURSE |
|---------|---|
| SMT | Refrigeration systems and accessories |
| | Air handling, water treatment, and plumbing systems |
| | Electrical systems and illumination |
| | Boilers, heating systems, and applied mathematics |
| | Energy management and controls |
| SMA | Administration |
| | Building design and maintenance |
| | Environmental health and safety issues |

Refrigeration Systems and Accessories

Maintaining the proper comfort level in an office environment is essential for occupant satisfaction. Refrigeration equipment is a key component of an air-conditioning system that must be properly maintained and operated at maximum efficiency. This course reviews the basic refrigeration cycle and refrigeration system components, as well as how to operate and maintain reciprocating and absorption refrigeration systems. You will gain the skills and knowledge to describe the principles of refrigeration and identify the performance characteristics of refrigeration components. You will also learn how to establish maintenance processes and troubleshooting techniques. Major topics covered in this course:

- Refrigeration cycles and principles;
- Mechanical components of refrigeration systems;
- Systematic troubleshooting; and
- General maintenance procedures.

Air Handling, Water Treatment, and Plumbing Systems

Through this course, you will learn about climate control for human comfort, the components of HVAC systems, and the basics of water treatment and plumbing systems. You will gain knowledge about common water tests, water services, fire extinguishing systems, and the maintenance of air-conditioning systems. This course features dynamic illustrations and current resources, such as government and industry websites. Major topics covered in this course:

- HVAC systems;
- Air cleaning devices;
- Indoor air quality;
- Water conditioning and treatment;
- Plumbing; and
- Fire protection and alarm systems.

Electrical Systems and Illumination

To be able to safely operate and maintain a building's electrical equipment, you must thoroughly understand the components of electrical systems and how to measure the electricity your building consumes. This course provides you with a clear understanding of electricity basics, the skills needed to measure electrical consumption, and the ability to recognize, set up, and maintain reliable and effective maintenance and safety systems. Major topics covered in this course:

- Sources of electricity;
- Electrical safety;
- Electrical circuits;
- Electric meters;
- Cables, terminations, and conduits;
- Light sources, fixtures, and maintenance; and
- Electric motor basics and maintenance.

Boilers, Heating Systems, and Applied Mathematics

In this course, you will examine the inner workings of boilers, burners, controls, fittings, valves, and pumps, as well as how they connect and interrelate. This course will teach you how to operate and maintain steam, hot water, warm air, and radiant heating systems. You will also learn the principles of mathematics that are essential to operating these building systems. Major topics covered in this course:

- Heating system operations;
- Mechanical components of heating systems;
- Thermodynamics as applied to heating systems; and
- Basic mathematics needed to operate heating systems.

Energy Management and Controls

Understanding the key maintenance and energy management aspects of building management is critical to running a cost-effective operation. From everyday preventive maintenance tasks to the challenge of developing and selling an energy plan, this course provides you with the skills to evaluate and optimize your current system, the know-how to integrate new components, and the ability to communicate your needs to management.

This course covers heating, ventilation, and air conditioning (HVAC) control systems, and teaches you to develop energy management strategies for HVAC, electronic, and lighting systems. You will learn about the components, principles, adjustment, and maintenance of the system controller, auxiliary devices, and electronic, pneumatic, and computer control systems. You will develop an understanding of the operation of heating, cooling, humidification, and dehumidification control applications, and learn about variable air volume design and building pressurization control devices. You will develop the skills and knowledge to do cost/benefit analysis of HVAC, electric and lighting systems and to create an energy management program for your facility. Major topics covered in this course:

- Control systems basics;
- Auxiliary and electronic controls and their heating, cooling, humidifying dehumidifying, and volume control;
- Computerized automatic control systems;
- Factors determining energy consumption in HVAC electronic and lighting systems;
- Preventative maintenance measures in energy management; and
- Energy management control systems applications.

Administration

If you have a staff that reports to you, or are working towards a supervisory/management position then you will need to develop the professional ability to managing both people and your time. The focus of this course is on leadership skills, oral communications techniques, motivational, team building strategies and staff training needs. Through this course you will develop the skills required by managers in a maintenance environment, including the ability to plan organize, schedule, delegate, budget, monitor, inspect and document various projects and work processes. Major topics covered in this course:

- Prioritization;
- Needs analysis;
- Resource development;
- Resource management; and
- Time management.

Building Design and Maintenance

If you are involved in the repair and replacement of structural items such as floors, ceilings, interior walls, and windows, you need a basic understanding of building design, materials, codes, regulations, and structural systems and finishes. You also need to be familiar with maintenance procedures and equipment, grounds maintenance, and preventive maintenance, as well as construction documents. In this course, you will cover the characteristics, uses, and properties of common building materials, as well as building regulations, codes, and standards. You will learn to compare building system components and to identify appropriate inspection and maintenance techniques. You will develop the knowledge to establish procedures and standards for monitoring building operations, preventive maintenance, and cleaning. You will also learn to read and use construction documents, studying from a textbook that features a set of drawings and an architect's pocket scale. Featuring helpful new illustrations and current resources, such as governmental and industry websites, this course can help you design and maintain sound, safe buildings. Major topics covered in this course:

- Common building materials and systems in building foundations;
- Curtain walls;
- Windows;
- Roofing systems;
- Interior finishes;
- Flooring, interior walls, and ceilings;
- Vertical transportation;
- Grounds maintenance and inspection; and
- The reading, scaling, interpretation, care, and use of construction documents.

Environmental Health and Safety Issues

Protecting the environment and promoting worker health and safety are issues at the centre stage of today's property industry. This course provides you with an overview of the environmental health and safety considerations in building operations. You'll learn to develop and manage proactive environmental/occupational health and safety programs, comply with regulatory standards and guidelines governing facility health and safety issues, and assess when to obtain technical assistance. Major topics covered in this course:

- Regulatory overview;
- Hazard communication;
- Emergency response;
- Asbestos and lead management;
- Office and industrial ergonomics;
- Indoor air quality;
- Air emissions and pollution control;
- Storage tanks;
- Hazardous waste;
- Site assessment; and
- Audits, record keeping, and legal issues.

APPENDIX L: BUILDING OPERATIONS OCCUPATIONS SCHEMATIC

The following is one schematic illustrating the relationship between the role of building operator and other professions associated with building energy management. Other building operations responsibilities (e.g., waste management) are not represented here.

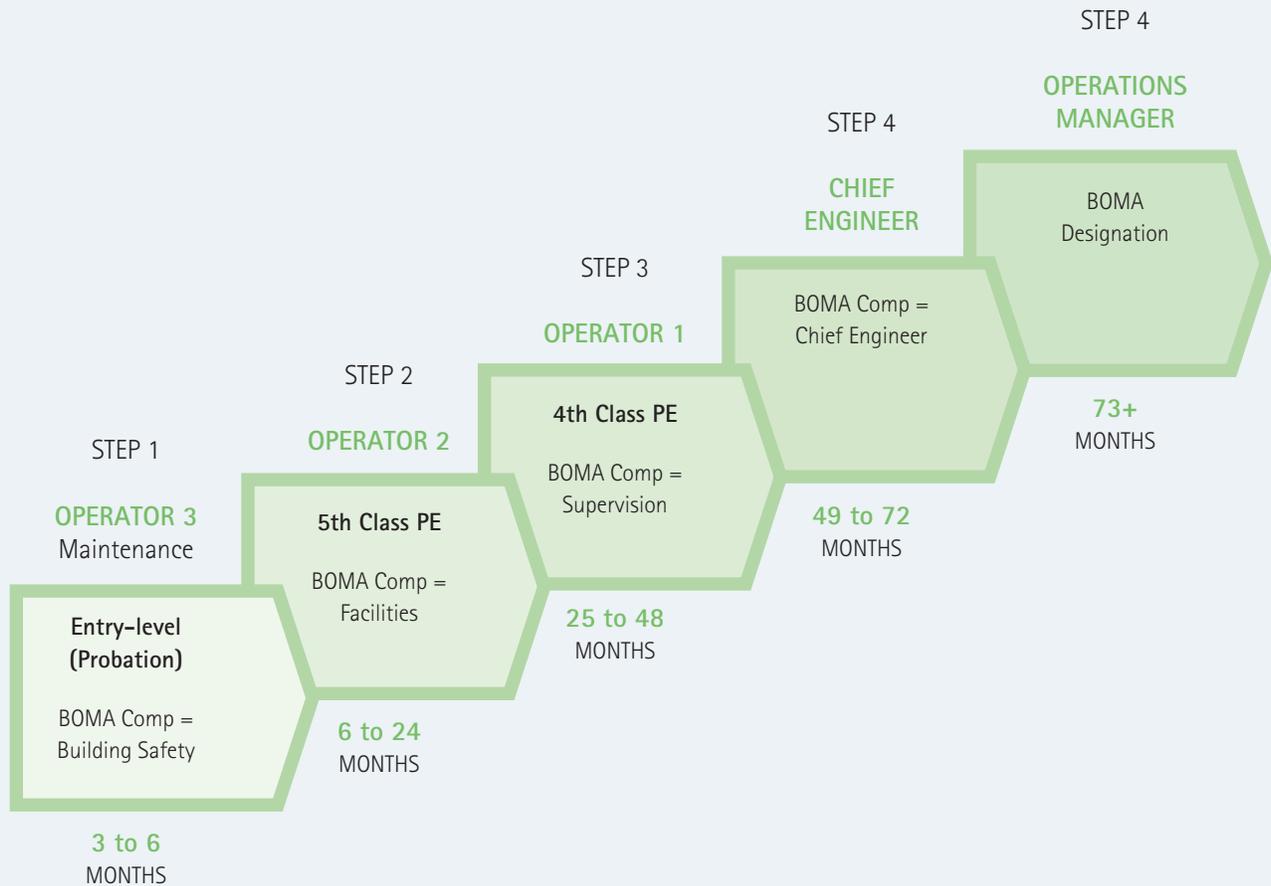
Building Operations Occupations Schematic



APPENDIX M: BOMA TRAINING SYSTEM (2008)

The following is a graphic representation of BOMA's training system. Steps 1-3 are in effect. Steps 4 and 5 have not been implemented. BOMA job titles are in violet. Qualifications or equivalents are in plum.

BOMA Training System (2008)



Source: BOMA Calgary, PowerPoint presentation slide "A New Career Path for Building Operators"

APPENDIX N: DOUGLAS COLLEGE'S BERM CERTIFICATE PROGRAM⁴³

PROGRAM OVERVIEW

While focused on traditional needs for energy management (HVAC and lighting conservation, heat flow, and utility rate structures), the BERM program will also expose students to principles of internal waste management programs (from paper to food), setting up transportation (carpool) programs, water conservation measures, understanding change management and GHG 'hidden' in building materials. We believe communication skills will be as important as hard technical skills and the criteria for and practice in writing policy and success stories will be part of this program. Students who complete the program will have an appreciation for the many avenues open to them for further education. This program addresses a shortage of people educated in Building Energy and Resource Management within British Columbia and across Canada.

PROGRAM OUTCOMES

Graduates of this program will:

- Become key players in the optimization of resource use in many areas; including electricity, natural gas, water and human labour in maintaining building systems;
- Participate in the set up of structural elements in an energy management plan, prioritize the specific issues in the organization, and develop parameters for an appropriate energy policy;
- Know typical sources for funders or rebates, understand how to optimize energy consumption in the rate structures or bulk utility contract purchases, find utility billing errors, understand how to validate consumption variances, and understand the benefits and pitfalls of energy service contracts;
- Possess a basic understanding of the skills needed and advantages of further training leading to Certification as an Energy Manager, a Certified Energy Auditor, an Accredited Green Roof Designer, or a LEED® Accredited Professional;
- Be able to set up an internal Energy Awareness Program, understand how to determine or confirm various financial Return-on-Investment analyses from projects, Payback periods or Lifecycle costs, and have gained experience in presenting these and other energy issues to management and other employees;
- Know the principles of energy auditing as well as critical analysis of building equipment processes & interaction, allowing them to identify and prioritize on-going saving opportunities;
- Understand variables and options in calculating GHG emissions and reductions, application of GHG offsets, and filing for regulatory agencies; and
- Understand the methods and process in developing, implementing and maintaining a multi-faceted and comprehensive Continuous Improvement Program to ensure savings and other benefits are sustainable and maintained.

⁴³ Excerpted from Douglas College's website at <http://www.douglas.bc.ca/programs/continuing-education/programs-courses/science-tech/berm.html>. Referenced December 30, 2010.

COURSES

This program is designed to be completed in two semesters of full-time study. Students will complete 10 courses and one practicum.

BERM 1100: Introduction to Building Energy and Resource Management

An overview of energy management & resource conservation in buildings and on their sites. Reviews current economic, environmental, and social implications of building operations and systems management. Emphasis is on energy and conservation literacy (understanding of terms and concepts), the evolution of the modern building, market and external forces that impact building energy use, and the increasing need for skilled building managers.

BERM 1110: Building Science - Design and Building Performance

An overview of building design & construction with emphasis on energy efficiency and durability. Reviews current understandings about building envelopes, building assemblies, and interactions with building mechanical systems. Important concepts, technologies, and strategies of energy efficiency and indoor environmental quality will be explored. The course will underline the importance of understanding building performance expectations.

BERM 1120: Resource Management and Financial Planning

This course will provide an overview various energy management tools, financing of energy management projects, and tracking performance of energy management projects. Topics will include energy accounting, utility bill analysis, monitoring, targeting, and reporting, financial analysis, measurement and verification, financing energy management projects and developing a business case, and planning energy management projects.

BERM 1130: Building Mechanical Systems

This course will provide an introduction of building mechanical systems, their application, and associated energy saving opportunities. Topics will include building heating and cooling systems, their components, distribution systems, building ventilation systems, auxiliary building system, heat recovery systems, and domestic hot water systems.

BERM 1140: Building Electrical Systems

This course will give the student knowledge of basic electricity units of measure, terms, costs and savings methods. Motors will be reviewed with regard to determining the most efficient motor for specific applications. The motor as part of the system and not the only component will be reviewed. Lighting will be examined in detail and result in an understanding of how we see, how light is produced, controls for lighting, parameters needed for review of alternatives for efficiency and electrical savings, and upcoming lighting products and technologies.

BERM 1205: Operations Management

This course will provide an overview of various energy components of operations management and how they can identify energy saving opportunities in operations and help manage energy costs. Topics will include energy management control systems, energy system maintenance, re-commissioning and continuous optimization, and monitoring and reporting.

BERM 1215: Energy Auditing – Process & Procedure

An introduction to the principles, process and procedures involved in an energy audit. The student will learn the place and the value of an energy audit in the overall Resource Management action Plan. The student will learn how to define the scope of an audit, analyze the energy use, set objectives for the site tour, determine the Energy Conservation Measures, prioritize the ECM's, and write the report that will become part of the Resource Management Action Plan.

BERM 1225: Auditing for Other Resources

An in-depth look at management of water resources, materials, and transportation resources as relevant to building and facility management. Reviews the complex interrelationships between supplies, extraction, transportation, end usage, and cycles of resources, including GHG embodied in construction materials and LCA. Emphasis is on understanding end uses, conservation methods, measuring, auditing, and the importance of resource awareness.

BERM 1235: The Green Building

An in-depth review of sustainable design & green building. Emphasis on green building materials, green purchasing, green professional certifications, and healthy indoor spaces. Current trends in building innovation and the programs and rating systems that support these trends are examined. The student will come away with an understanding of why building green is an essential strategy for sustainable development. Students will learn how to collaborate in the successful operation and maintenance of a green building.

BERM 1245: Completing the Resource Management Plan

Emphasis will be on covering the various aspects of energy management programs and planning that fall outside more traditional areas: communication skills and writing success stories; policy writing; developing RFP's; Change Management; managing contracts and outsourcing; environmental regulations and barriers to energy management plans. This course will also bring earlier courses together to help the energy and resource manager develop usable take-away management plans for energy and resource conservation, auditing, and operations.

PRACTICUM

The practicum portion of this program will be completed during the last few weeks of BERM 1245. Students will apply the skills they've learned during classroom study in a 2-3 week placement with a company in the industry. The goal is that students will be completed the program and able to join the work force full-time by the end of May.

APPENDIX O: 2006 CENSUS DATA ON STATIONARY ENGINEERS

Data on stationary engineers comes from the 2006 Census which provides values from 2005. Please refer to discussion under section 4.3.1 regarding the limitations in applying this data in the context of building operators.

Number of Stationary Engineers in Canada

There are 15,445 stationary engineers in Canada. Certification is a prerequisite for being identified as a stationary engineer by StatCan.

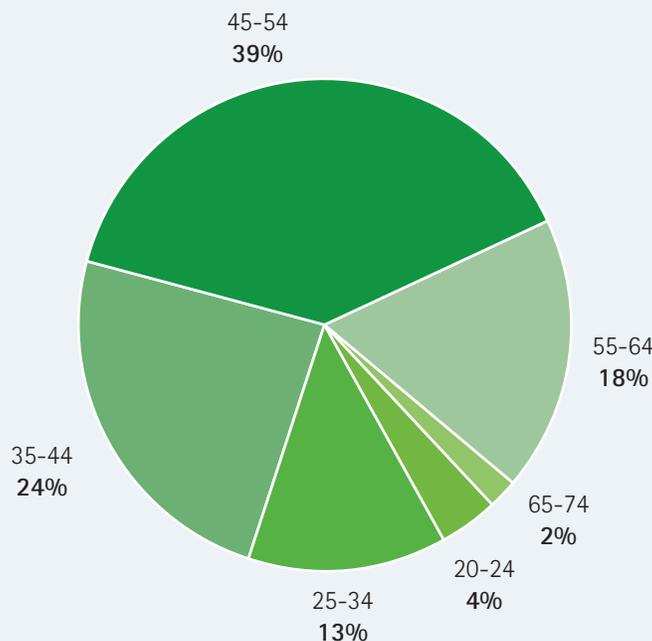
Employment Rates and Employment Status

Stationary engineers have a high rate of employment. The vast majority (90%) are currently employed, with the percentage of unemployed (3%) well below the national unemployment rate. Virtually all stationary engineers (98%) are employed within organizations rather than self-employed. While many property managers contract out building operation services, building operators working in those buildings are employed by the building management services provider.

Age

The majority of stationary engineers are above the age of 44, with a mere 17% below the age of 34, which reinforces concerns that there will be future shortages in skilled workers in this area.

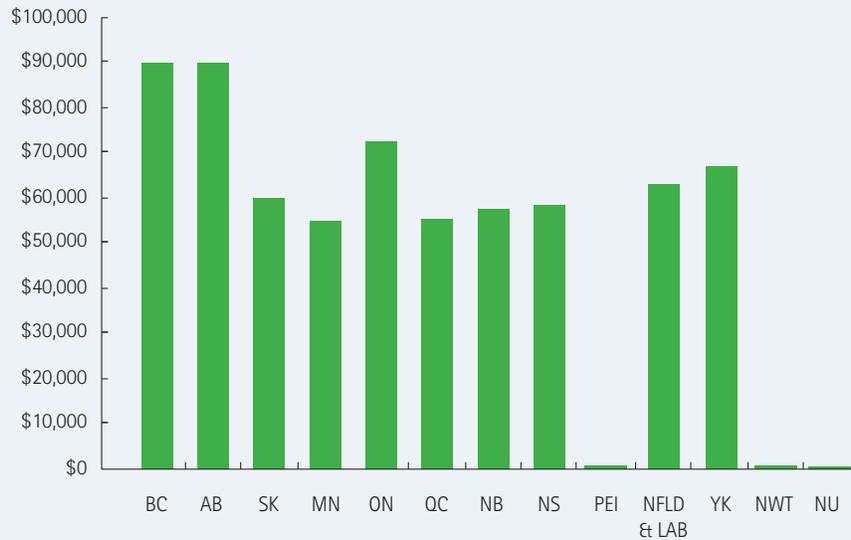
Age Distribution of Stationary Engineers



N= 15,455

Source: Statistics Canada, 2006 Census – H221 Stationary engineers and auxiliary equipment operators

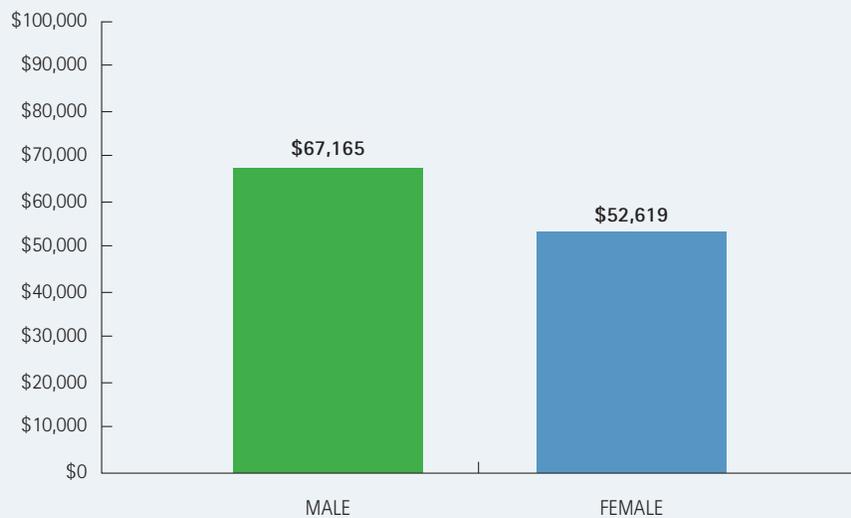
Income distribution of stationary engineers by jurisdiction (2005)



N= 15,455

Source: Statistics Canada, 2006 Census – H221 Stationary engineers and auxiliary equipment operators

Average income of stationary engineers in Canada by gender (2005)



N= 15,455

Source: Statistics Canada, 2006 Census – H221 Stationary engineers and auxiliary equipment operators

Gender and Ethnicity

Census data also reveals that this is an extremely male-dominated profession with only 3% of the workforce comprised of women. Similarly, only a small minority (7%) of stationary engineers come from visible ethnic minority groups in Canada.

Income Distribution

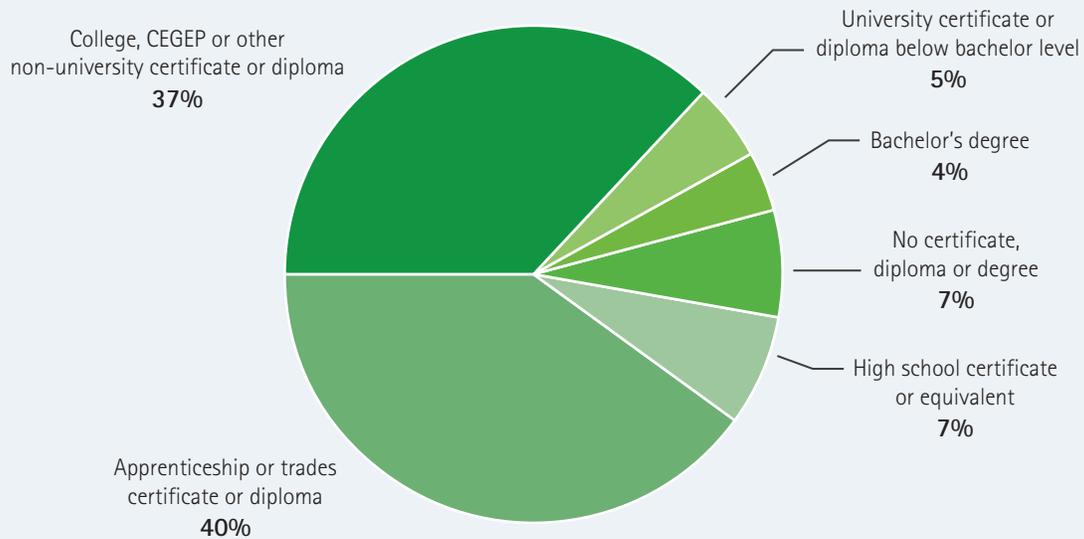
The average salary for a stationary engineer is greater than the average salary for a building operator in all Canadian jurisdictions.

Furthermore, female stationary engineers earn 4/5ths (77.7%) of the average male stationary engineer's wage.

Education and Skill Levels

Stationary engineers come with a wide variety of educational backgrounds. Figure 4 shows that the majority have some form of certificate or diploma from a college, CEGEP, apprenticeship or trades program (82%). A minority have a high school certificate or equivalent (7%) and a similar proportion have no formal education at all (7%). Few have university degrees and none have post-graduate credentials.

Educational backgrounds of stationary engineers (2005)



N= 15,455

Source: Statistics Canada, 2006 Census – H221 Stationary engineers and auxiliary equipment operators

APPENDIX P: 2010 BOMA ANNUAL INDUSTRY COMPENSATION SURVEY

| JOB TITLE & DESCRIPTION | EXPERIENCE | BRITISH COLUMBIA | CALGARY | EDMONTON | MANITOBA | NOVA SCOTIA | OTTAWA | QUEBEC | REGINA | TORONTO |
|---|--|--|--|--|--|--|--|--|--|--|
| DIRECTOR OF OPERATIONS/OPERATIONS MANAGER: Responsible for overseeing the operations and maintenance of the portfolio. Ensures building codes are adhered to, supervises and manages all operations staff. Responsible for preventative maintenance programs, OH&S programs, energy management and environmental controls. Contributes to and manages the operating budgets for the department. Minimum requirement 4th class Power Engineering Certificate or equivalent. | 0 - 5 years 5 - 10 years 10 - 15 years 15 years + | < 80 80 - 89 90 - 99 100 - 109 | 80 - 89 90 - 99 100 - 109 110 - 119 | < 80 80 - 89 90 - 99 100 - 109 | < 80 80 - 89 90 - 99 100 - 109 | < 80 80 - 89 90 - 99 100 - 109 | < 80 80 - 89 90 - 99 100 - 109 | < 80 80 - 89 90 - 99 100 - 109 | < 80 80 - 89 90 - 99 100 - 109 | < 80 80 - 89 90 - 99 100 - 109 |
| CHIEF ENGINEER/PLANT/ MAINTENANCE MANAGER: Assists the Operations Manager/ Director to provide technical support to all staff. Will oversee preventative maintenance, OH&S, life safety requirements and environmental programs within the portfolio. Coordinates training, performs annual reviews, ensures all documentation is complete and compliant with all by-laws, codes and regulations. Will contribute to the budgeting process. Will hold 4th or 5th class power engineering ticket or equivalent. | 0 - 5 years 5 - 10 years 10 - 15 years 15 years + | 55 - 64 65 - 69 70 - 79 80 - 84 | 70 - 74 75 - 79 80 - 84 85 - 89 | 65 - 69 70 - 74 75 - 79 80 - 84 | 60 - 64 65 - 69 70 - 74 75 - 79 | 60 - 64 65 - 69 70 - 74 75 - 79 | 60 - 64 65 - 69 70 - 74 75 - 79 | 55 - 59 60 - 64 65 - 69 70 - 74 | 65 - 69 70 - 74 75 - 79 80 - 84 | 55 - 59 60 - 64 65 - 69 70 - 74 |
| ASSISTANT OPERATIONS MANAGER/ASSISTANT CHIEF ENGINEER: Has responsibilities similar to Chief Engineer / Operations Manager, with building or portfolio less than 400,000 sf, or is subordinate to and in support of the senior operator in complexes greater than 400,000 sf. (For BC and Alberta will usually hold minimum 4th class power engineering ticket). | 0 - 5 years 5 - 10 years 10 - 15 years 15 years + | 50 - 54 55 - 59 60 - 64 65 - 69 | 60 - 64 65 - 69 70 - 74 75 - 79 | 50 - 54 55 - 59 60 - 64 65 - 69 | N/A N/A N/A N/A | 50 - 54 55 - 59 60 - 64 65 - 69 | 55 - 59 60 - 64 65 - 69 70 - 74 | N/A N/A N/A N/A | N/A N/A N/A N/A | 55 - 59 60 - 64 65 - 69 70 - 74 |
| SENIOR BUILDING OPERATOR: Senior level position must have a 5th or 4th class Power Engineer's certification or equivalent. Under the direction of a Chief Engineer or management personnel, will appropriately engage in the safe operations, maintenance and or direct contractors to do repairs on all equipment related to providing a comfortable work environment and to the physical plants equipment manufacturer recommendations. Will act as team leader for the building operators. May be required to fill in for Chief Engineers when absent. Ensures all governing authorities rules and regulations are followed and recorded. | 0 - 5 years 5 - 10 years 10 - 15 years 15 years + | 50 - 54 55 - 59 60 - 64 65 - 69 | 50 - 54 55 - 59 60 - 64 65 - 69 | 50 - 54 55 - 59 60 - 64 65 - 69 | < 50 50 - 54 55 - 59 60 - 64 | < 50 50 - 54 55 - 59 60 - 64 | < 50 50 - 54 55 - 59 60 - 64 | 50 - 54 55 - 59 60 - 64 65 - 69 | < 50 50 - 54 55 - 59 60 - 64 | < 50 50 - 54 55 - 59 60 - 64 |
| BUILDING OPERATOR: Intermediate level must have or obtain a 5th class Power Engineers Certification or equivalent. Reports to a Senior Operator or management personnel Responsible for the maintenance of a building or portfolio, including all building systems. Will deal with tenant requests. | 0 - 5 years 5 - 10 years 10 - 15 years 15 years + | 45 - 49 50 - 54 55 - 59 60 - 64 | 40 - 44 45 - 49 50 - 54 55 - 59 | 40 - 44 45 - 49 50 - 54 55 - 59 | < 40 40 - 44 45 - 49 50 - 54 | < 40 40 - 44 45 - 49 50 - 54 | < 40 40 - 44 45 - 49 50 - 54 | < 40 40 - 44 45 - 49 50 - 54 | < 40 40 - 44 45 - 49 50 - 54 | < 40 40 - 44 45 - 49 50 - 54 |
| JUNIOR BUILDING OPERATOR, NO TRADES CERTIFICATE: Entry level position no prerequisite required. Works under direct supervision of a Building Operator or higher. Responsible for the maintenance of a building or portfolio. Includes some basic maintenance of building systems, attending to the safe, clean and efficient operations of the property including tenant requests and general maintenance. | 0 - 5 years 5 - 10 years 10 - 15 years 15 years + | 40 - 44 45 - 49 50 - 54 55 - 59 | < 35 35 - 39 40 - 44 45 - 49 | 35 - 39 40 - 44 45 - 49 50 - 54 | < 35 35 - 39 40 - 44 45 - 49 | < 35 35 - 39 40 - 44 45 - 49 | < 35 35 - 39 40 - 44 45 - 49 | < 35 35 - 39 40 - 44 45 - 49 | < 35 35 - 39 40 - 44 45 - 49 | 35 - 39 40 - 44 45 - 49 50 - 54 |
| MAINTENANCE WORKER: Responsible for general building and grounds maintenance of building or small portfolio of buildings. May include basic plumbing, electrical and mechanical repairs. Will typically not hold a trade certificate. | 0 - 3 years 3 - 6 years 6 - 10 years 10 years + | 35 - 39 40 - 44 45 - 49 50 - 54 | 30 - 34 35 - 39 40 - 44 45 - 49 | 30 - 34 35 - 39 40 - 44 45 - 49 | 30 - 34 35 - 39 40 - 44 45 - 49 | < 30 30 - 34 35 - 39 40 - 44 | 30 - 34 35 - 39 40 - 44 45 - 49 | < 30 30 - 34 35 - 39 40 - 44 | < 30 30 - 34 35 - 39 40 - 44 | 30 - 34 35 - 39 40 - 44 45 - 49 |

N = 363 respondents Source: 2010 BOMA Annual Industry Compensation Survey Report, pp.11-12



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Building Operator Scoping Study

Labour Market Research.

Environmental Careers Organization of Canada.



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