



(Robertson, 2016)

The Price of Gold:

An Analysis of the Financial Costs of LEED Certification and the Role of LEED in Meeting Dalhousie's Sustainability Objectives

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Submitted: April 11, 2016

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A special thank you to everyone who made this project possible:

Tarah Wright
Nathan Ayer
Rochelle Owen
Solterre Design
Kristen Morse

Executive Summary

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System, now plays a major part in the design process of many major construction projects. Dalhousie University is no exception, having a Sustainable Building policy aiming for the second highest level of LEED certification on all new building projects since the policy was implemented in 2011 (Dalhousie University, 2011). This research project looked at LEED on Dalhousie's Halifax campus, and specifically LeMarchant Place - a current LEED Gold candidate.

Our findings indicated that the total cost for LEED certification for LeMarchant Place is between \$480,000 and \$2.4 million from the total building budget. These expansive results come from the findings that LEED costs can be anywhere from one percent to five percent of a construction project's overall costs and with the knowledge that LeMarchant Place was a \$48 million project (R. Owen, Personal Communication, March 30, 2016) & (Solterre Personnel, Personal Communication, March 31, 2016).

The money spent on LEED is not just for the certification. The process involves paying consultants, paying registration fees, certifying/check ups on contractors, and paying for the features that qualify your building. Each of these contribute to the cost, and each is unique for every project. Despite the process being complex, LEED appeals to many projects because:

- LEED is recognized as the universal standard for excellence for green buildings across 150 countries worldwide (CaGBC, 2015).
- The LEED rating system requires all projects to meet mandatory thresholds, typically based on additional third-party, industry-recognised reference standards (ASHRAE, US EPA 1992, et. al).
- LEED has had the greatest market penetration in North America, likely due to its adaptability for varying types of projects (Solterre Personnel, personal communications, March 31, 2016).
- LEED is a tool to help achieve green building goals (R. Owen, personal communication, March 30, 2016).

Even in light of the large costs associated with LEED, after speaking to active experts and delving into the topic, we conclude that Dalhousie should continue to use the LEED system and recommend the University works towards integrating it further into their future construction projects.

Introduction

2.1 Objective

This project aims to explore LEED certification in Dalhousie's LeMarchant Place building. We will seek out an overview of how the LEED process is integrated within the University's policy, and what amount of money is spent on a project to obtain LEED standards. Our primary research questions are:

1. How much money was required to go through the process of obtaining LEED certification for LeMarchant Place, including consultation, registration and certification fees?
2. What are the perceived benefits and/or drawbacks to LEED certification from a Dalhousie University administrative standpoint?
3. Were the costs associated with obtaining LEED certification high enough that they could have been used to include additional sustainability features for LeMarchant Place? If so, what are some possible alternatives?

Within the Dalhousie Sustainable Building Policy, a sustainable building is defined as: "the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction" (USEPA, 2010).

These criteria for sustainable building designs can be pursued without LEED certification; therefore, it is important to consider if and why LEED is the most effective allocation of funds in meeting Dalhousie's Sustainability Objectives. We decided that if our research found that the cost of LEED certification on LeMarchant Place was higher than \$25,000 we would follow up with a secondary question:

1. How can the expenses from LEED certification can be directed towards other sustainable options such as alternate building design features on LeMarchant Place or other Dalhousie building projects?

Our goals and objectives then are to:

- Identify Dalhousie's policies regarding LEED certification
- Discover the costs associated with LEED at Dalhousie, specifically with LeMarchant Place
- Understand the reasoning behind the choice of LEED certification, broadly and from the Dalhousie lens
- Outline the costs associated and how that money may be spent in other ways to promote sustainability
- Clearly outline our conclusion to be understood by the reading public

2.2 Rationale

Dalhousie's Sustainable Building Policy mandates that all new major building projects should be designed, constructed and certified to meet at minimum LEED Gold certification standards (Dalhousie University, 2011). Certification is based on the total credit points achieved, following a third-party review (Dalhousie University, 2011). There are four possible levels of certification; certified, silver, gold, and platinum. To meet gold standards, buildings must satisfy between 60 and 79 credit points out of a total possible 110 points (CaGBC, 2015). According to the Dalhousie Sustainable Building Policy: the University is committed to pursuing sustainable goals and objectives, including green building (Dalhousie University, 2011). This commitment is reflected in the design and construction of LEED buildings found on campus today, including the new LeMarchant Place building (Dalhousie University, 2011). Dalhousie uses the LEED Rating system because it is an internationally accepted and understood standard for sustainable design, construction, and operation of high performance green buildings (Dalhousie University, 2011).

However, Dalhousie's Policy requiring LEED certification is not a simple one; the process of LEED certification requires the coordination of consultants, an application, and construction. Like any policy there is room for criticism. Criticisms of LEED tend to focus on this investment of resources and look at alternatives for sustainable initiatives (Alter, 2009). In terms of alternative sustainable building frameworks, there are other potentially more rigorous rating systems such as Living Building Challenge and Passive House in existence (Solterre Personnel, Personal Communication, March 31, 2016). However, LEED has had the greatest market penetration in North America, likely due to its ability to adapt to different types of projects (Solterre Personnel, Personal Communication, March 31, 2016). Despite LEED potentially being one of the best sustainable building frameworks, it is still important to consider and evaluate alternatives, which will be addressed in our report.

Within Dalhousie there have been several LEED buildings constructed, including:

- Mona Campbell Building (opened September 2010, LEED Gold Certified)
- Life Sciences Research Institute (opened June 2011, LEED Silver Certified)
- Ocean Sciences Building (LEED Silver Certification Candidate)
- Wallace McCain Learning Commons (LEED Gold Certification Candidate)
(Dalhousie University, 2015).

For the purposes of our research we will be focusing on one of the most recent building projects on campus: LeMarchant Place (Dalhousie University, 2011). Having just opened in September 2014, LeMarchant Place is still pending final certification for Gold level (Dalhousie University, 2016). The building is designed with a multitude of LEED friendly features, such as energy efficient fixtures, solar capability, and cycling facilities (Dalhousie University, 2015). Dalhousie invested \$48 million in the construction of LeMarchant Place (Dalhousie University, 2015) and designed the building working alongside Solterre Design, a LEED consulting firm.

The understanding of the LEED, its affordability, and the implications of certification makes for more effective decision making by administrators. LEED is used for sustainable construction standards by many institutions, and understanding the costs and benefits of this process will help to clarify its effectiveness in meeting Dalhousie's sustainability objectives.

2.3 Literature Review

LEED Overview

According to the Canadian Green Building Council (CaGBC) (2016), Leadership in Energy and Environmental Design (LEED) is a rating system, which is internationally recognized as the mark of excellence for green buildings in more than 150 countries. The CaGBC acknowledges that buildings generate up to 35 per cent of total greenhouse gases, 35 per cent of landfill waste from construction and demolition activities, and buildings use 70 per cent of municipal water (CaGBC, 2016). LEED-certification is often viewed as an outstanding green rating system because it addresses sustainability in its design, construction and operation (CaGBC, 2016).

Benefits of LEED

In a survey researching the benefits of LEED certified health buildings such as hospitals, participants of the survey were asked to rank the benefits of having a building LEED-certified. The top benefits in the survey results include: "civic leadership, occupant health and safety, community benefit, environmental performance, operational efficiency and reduced cost, funding requirements and regulatory requirements" (Glazer Guenther, & Vittori, 2014). According to this survey, LEED certification carries a successful reputation in fields of environment and costs. Another key advantage of certification is business and marketing advantage. Glazer et al. (2014) stated that forty percent of firms that responded in their survey hoped to gain a competitive edge by achieving LEED certification. Since the CaGBC has certified 1800 LEED buildings and registered more than 5000 in Canada, the second highest number in the world, it is clear that LEED is recognized and respected (CaGBC, 2016). Regardless of certification costs we understand that LEED has had green building success.

LEED certification is known to be associated with improved sustainability of buildings. In one case, a LEED certified hospital utilized methane from a local landfill as a thermal energy, reducing the total emissions of the town and the energy demand for the local power company (Glazer et al., 2014). This process provided the hospital with a carbon neutral energy source and demonstrates how sustainability projects can be pursued within LEED. Further research proves that LEED certified buildings are indeed more sustainable than conventional buildings. A LEED Gold certified hospital was designed to reduce energy costs by 20 per cent compared to a code compliant, baseline hospital (Glazer et al., 2014). During the first 10 years of occupancy, it is modelled to save \$7 million and reduce greenhouse gases by a CO² offset of 37,000 acres of forest (Glazer et al., 2014).

Dalhousie Sustainable Building Goals

Since this research project is aimed at understanding the possible alternative sustainable benefits that could be achieved with the money involved in the LEED process, we can better understand how to implement changes to LeMarchant Place by following Dalhousie's *Existing Buildings and Maintenance* guidelines to green building adaptation (Dalhousie University, n.d.). This document outlines the methods in which buildings on Dalhousie campus' that are not certified under LEED can pursue sustainable goals, including:

- Lowering the total cost of ownership
- Improving workplace wellbeing and productivity
- Reducing environmental and health impacts
- Supporting sustainable transport and landscapes
- Demonstrating reputational and community leadership
- Supporting teaching and research

These goals can be achieved through focusing on improving and making more sustainable the key focus areas of:

- Transportation
- Water reuse and efficiency
- Energy and atmosphere
- Materials
- Indoor environments
- Innovation and leadership

Further explanation of these goals can be found in Appendix A.

Research Methods

4.1 Data collection and analysis

Our methodology consisted of amalgamating a large amount of information from various sources to understand the impact of LEED in the context of Dalhousie University. Some of our sources came from a wide lens looking at LEED broadly, while our interviews allowed us to focus down the information to understand everything within the confines of our campus. Both of these methods allowed a thorough understanding while giving us the confidence to make supported conclusions. Our research was focused on information collection through personal interviews, and reviewing academic literature.

For the interviews, individuals were selected based on their involvement in the LEED consultation of the LeMarchant Place project, their expertise on the subject of LEED, and/or their involvement in drafting Dalhousie's Sustainable Building Policy. Throughout our research, we conducted a total of three interviews, speaking with five individuals. These personal

interviews used a non-probabilistic sampling method to strategically seek out key experts who would be able to provide us with relevant information and knowledge. We chose to use a purposive, expert sampling method because of the nature of our research question and LEED. The five individuals we were able to speak to were;

- Kristin Morse, director of Elemental Consulting
- Rochelle Owen, director of the Office of Sustainability at Dalhousie
- Three consultants at Solterre Design, the consulting firm for LeMarchant Place

We contacted these individuals initially through email to request an interview. We sent each a condensed list of the kinds of questions we would be asking them so they could prepare and get a sense of the purpose of our research. Kristin Morse was unable to meet with us in person, so she answered our questions via email. As for Rochelle Owen and the Solterre Personnel, interviews were conducted face-to-face and for approximately 30-minutes each. During both in-person interviews, one group member was the interviewer and two group members recorded responses by typing them into Microsoft Word, ensuring a thorough record. Additionally, one of the consultants at Solterre Design had prepared written answers to the questions that had been sent in advance and this additional resource was emailed to us following the interview.

As expected with a conversational style of interviewing, a single question led to responses addressing multiple. Instead of direct answers to our questions, the interviews involved more general explanations of how the LEED consultation process works, and the different elements that come into play with LEED design and construction, among other things. Communication was relatively informal and conversational, with questions arising as they expanded our knowledge of the LEED process.

In addition to interviews, academic literature was reviewed to increase our understanding and gain relevant information about the LEED process. In our review of academic literature, we found scholarly journals primarily from the databases GreenFILE, ScienceDirect, GeoRef, Web of Science, and Environmental Science and Pollution Management. These five databases, accessible through Dal Libraries, provided us with vast resources to review and collect information. Some of the keywords used in this online research were; “LEED Certification AND financial costs”, “LEED Certification AND requirements”, “LEED Consulting”, “LEED building features”, “LEED alternatives”, “LEED credits AND financial costs”, and “green building design AND financial costs”. This list is non-exhaustive; however provides an understanding of the kinds of keywords used in our online research.

4.2 Study Area Description

LeMarchant Place is a building belonging to Dalhousie University located on LeMarchant Street and South Street in Halifax, Nova Scotia. Its location is illustrated in Figure 1.



Figure 1: Map demonstrating the location of the LeMarchant Place building on Dalhousie Campus. Source: Dalhousie University. (2015). Facilities Management. Retrieved from <http://www.dal.ca/dept/facilities/parking-at-dal.html>

The \$48 million dollar building (Dalhousie University, 2015) is a multi-use facility with a total of seven floors housing an array of services including; Student Health Services, the Welcome Centre and Recruitment Office, the International Centre, and residence rooms accounting for over 300 students (Dalhousie University, 2015). The development team consisted of:

- Architect: DRSA Architecture with Zeidler Partnership Architects
- Mechanical & Electrical Consulting Engineers: O'Neill, Scriven & Assoc's Limited
- LEED Consultant: Solterre Design
- Construction Manager: Aecon Atlantic Group
- Project Manager: Eastin Projects Ltd. (Dalhousie University, 2014)

The building is a LEED Gold Candidate, with green building features including things like; a green roof, solar domestic hot water, low-flow faucets, a rainwater cistern, and a Variable Refrigerant Flow (VRF) heat-recovery heat-pump system (Dalhousie University, 2014).

4.3 Data Analysis

In determining if LEED certification is the best use of money to meet Dalhousie's Sustainability objectives, we compiled relevant information, including the estimated costs of the project, from interviews and reviewing the literature. Upon having this data, we compared the estimated costs of LEED certification against some alternative green building features that could be pursued with that money instead. To determine what alternatives could be supported with these funds, we looked to both Dalhousie's Sustainability Objectives and to some other LEED-credit items that were not pursued for the Gold standard certification of LeMarchant Place, but have been implemented by other post-secondary institutions in their building projects.

4.4 Limitations and Delimitations

4.4.1 Limitations

There are aspects of our project that are limiting and not within our control. A limitation to our analysis of LEED certification is being unable to quantify intangible benefits associated with LEED, such as its role in marketing and providing clear objectives in the building project. For example, our compiled data may demonstrate fees associated with LEED are high, however its reputation could bring in business and prestige and thus monetary amounts that are difficult to quantify. The inherent intangibility of brand-recognition is something we will have to remain aware of.

Furthermore, there was the limitation of scheduling with our interviewees. For example, we were unable to meet with the Solterre Design personnel that was recommended to us by Rochelle Owen due to the fact that he was out of town during the time we were conducting interviews. The busy lives of these Solterre Design personnel, in combination with our deadline, presented some difficulty.

4.4.2 Delimitations

Within our project, we have imposed a scope of study for simplification of our research and to allow for more in focused analysis. For this project, our scope will be remain to Dalhousie campus, specifically looking at LeMarchant Place. This constraint will serve to keep the scope of our project small, as well as facilitating our need to look at LEED certification costs on a case-by-case basis in order to help determine the most valuable use of the money being spent.

Additionally we have decided to conduct three interviews, all of which will provide us with valuable information and insight due to the individual expertise and experience. In the case where more information was required, we were open to scheduling interviews with more individuals.

4.5 Evaluating Methods

As with any research project, there were shortcomings to the methods that we chose. For one, we could have looked further into discovering roughly how much money a building can save over the course of its existence using LEED processes and methods. A cost-benefit analysis to see roughly how long a building would take to recuperate its initial investment, and to compare and contrast that amount of time to see whether it would be worth it to spend that money in other areas around Dalhousie campus would be valuable.

Additionally, it would have been wiser to have scheduled our interviews earlier than we did, which would allow us more time to better process and research the information given to us. Another way we could have streamlined our processes would have been to enter the interviewees information into a coding system to allow better sorting and processing of the given information. There was a lot of information to work with and this may have been more effective in organizing the data.

We also could have used a wider scope. It would have been insightful to interview someone with a dissenting opinion of either LEED or the certification of LeMarchant Place, as this could show us another perspective. Additionally, more than one building on Dalhousie Campus could be studied for a broader approach into LEED buildings.

In terms of ensuring trust throughout this process, we will be in contact with our interviewees to provide them with a copy of this report so that they may view it for themselves. At their request, we have also ensured the confidentiality of the individual Solterre Design Personnel at their request.

Results

5.1 Interviews

With one of our primary sources being interviews, we had an opportunity to harness the expertise and training of LEED without having to go through the long process ourselves. With how inherently complicated LEED is, it was vital to hear how it is applied daily from those trained in it. The following is a brief summary of each of our interviews, the full extent of which is included in our Appendix:

Interview 1: Kristen Morse, Director of Elemental Consulting

Main Interview Points:

- LEED is most established and used green building certification program in North America. Strict process ensures building meets green standards and avoids greenwashing.

- LEED consultants play many important roles in working with different members of the project including the general contractor to ensure all Indoor Air Quality (IAQ) targets are met, recycled regional materials are being purchased, and that documentation is provided to back up claims.
- LEED consultant works with design team to compile all of the documentation for each credit.
- Consultant acts as the liaison between the project owner and the CaGBC throughout review process. This continues until a final LEED designation is determined. This process takes between 2-6 years.
- LEED consultant fees usually range between \$20k-\$50k depending on length of construction time, size of the project, and complexity of the building. Average of \$25,000 per project.
- Additional fees are more difficult to quantify and include mechanical, structural, electrical engineering fees, energy model costs, and architects etc.
- If the design team does not respond to the initial review within 3 months, there is an additional cost of \$750 dollars and also a \$500/per credit if any of the credits are being appealed by the design team.
- Highly recommends LEED for future projects at Dalhousie (K. Morse, Personal Communication, March 23, 2016).

Key Takeaways:

Through our email correspondence with Kristen, we were able to take away a rough dollar value for the cost of LEED consultation. She also provided some insight into the different areas that LEED costs affect; from the mechanical, structural, and electrical engineering fees, to the costs of energy modelling, and the architects. Kristen was very knowledgeable about the role of the consultants and their contributions to the LEED process. Lastly, she informed us of some of the more technical costs that can be associated with certification if the process does not comply with LEED regulations.

Interview 2: Rochelle Owen, Director of the Office of Sustainability at Dalhousie University

Main Interview Points:

- Following LEED guidelines for new construction is a good way to keep work on track and keep goals in mind. The score sheet is very valuable and ensures everyone has the same target and forces everyone to comply. LEED criteria motivates the university to meet targets.
- These costs depend on the scale of the project and the work they do varies depending on the scale of the project.
- For LeMarchant, the registration fee was \$500 dollars. There is also additional fees to audit the building. These result in third party review submissions from LEED consultants.

- For existing buildings, LEED was not pursued due to cost vs. benefits. The investment would be best for recommissioning buildings. Throughout this process, Dalhousie would aim for LEED like criteria while not getting LEED certification.
- Dalhousie does not use tax credits in achieving LEED certification. However, Dalhousie actively sought out grants from Efficiency Nova Scotia which helps achieve energy parts of the LEED score sheet (R. Owen, Personal Communication, March 30, 2016).

Key Takeaways:

Rochelle gave us some valuable knowledge about the LEED registration fee for LeMarchant Place. Playing a large role in drafting Dalhousie's Sustainable Building Policy, Rochelle was able to inform us on the rationale behind the policy, and the reasoning for only including "New Construction" projects in the policy.

Interview 3: Solterre Design Personnel

Main Interview Points:

- LEED is easy for people to understand and is adaptable to various types of building projects.
- LEED is almost the standard practice for green building projects worldwide.
- Potentially more rigorous rating systems such as Living Building Challenge and Passive House are in existence, but LEED has had the greatest market penetration in North America, likely due to its adaptability for varying types of projects.
- LEED consultants provide professional assurance that documentation is up-to-code and compliant.
- Once a contractor has completed a project, they have been paid and will move on to other projects making it challenging to get them to get them back to review the project.
- Due to their experience and the approximation of a 3-5% increase over traditional construction, LEED projects seem to require higher consulting fees.
- Despite LEED consulting fees being estimated at 3-5% of total construction cost, another consultant said it is closer to 1-2% so there is some discrepancy.
- On the maintenance and operations, LEED will result in huge savings. The upfront costs are an investment, but in the long run, LEED buildings are economical.
- There is rarely if ever a fixed-cost associated with LEED initiatives/credits. They are integrated into the design and construction and there are no clear costs of a particular credit.
- It is an integrated design process. To break the costs down into each credit; they are all so interconnected. If you pull from one, it can affect another. Adding extra insulation leads to reducing the size of the mechanical structure etc.
- One goal of the LEED rating system is driving market change. In this regard, we have seen material costs specific to certain LEED applications, i.e: reflective roofing products,

become commonplace in the market such that there is no longer any significant premium between it and 'typical' roofing product.

- Assigning specific costs to LEED certification is really difficult because there is a lot of give and take. One of the Solterre Design Personnel was quoted saying, "Welcome to the world of LEED, it's one big grey area" (Solterre Personnel, Personal Communication, March 31, 2016).
- With New Construction projects, there is no re-certification or follow-up after the initial certification (Solterre Personnel, Personal Communication, March 31, 2016).

Key Takeaways

The Solterre Personnel helped us to understand the practicality of LEED, that it is a rating system that can be manipulated to fit various projects in a standard that is recognized, understood, and respected worldwide. Solterre confirmed our understanding the maximum range of the cost of LEED certification, which is 5 percent of a total project cost. While this cost is high, this interview confirmed the fact that the savings made by pursuing LEED in operation costs. The influence of LEED was pointed out a driving market force. Sustainable materials used in LEED become more commonplace in new construction projects. This is relevant to Dalhousie as a leader in sustainable design as an institution. This interview also made us realize that there are no follow ups that require LEED consultants to check up on their completed projects. We address this issue in our conclusion and recommendations for future action and research.

5.2 Understanding the Costs of LEED

Results from a combination of interviews, research and case study reveal that LEED certification of LeMarchant Place, in its entirety, has a cost that ranges from 1 to 5 percent of the total project cost (Nicolow, 2008). Our interview with Director of Sustainability at Dalhousie University, Rochelle Owen, revealed that the total cost of LeMarchant Place is \$48 million (personal communication, March 30, 2016). Interviews with the LEED consultant group, Solterre, on LeMarchant Place project revealed that they estimated the total cost of LEED certification would be more than Owen's estimate of 1% or less (personal communication, March 30, 2016) & (personal communication, March 31, 2016). Solterre believes that the cost of certification for LeMarchant Place is closer to 2-5 percent of the total cost of the project (personal communication, March 31, 2016). This means that their estimate of LEED certification cost from Solterre lies within the margins of \$1,440,000 - \$2,400,000. Combining these estimates with a range of 1-5% and considering the total project cost of \$48 million, LEED certification is estimated to cost between \$480,000 and \$2,400,000. This answers our primary research question as to how much money was required to go through the process of obtaining LEED certification for LeMarchant Place, including consultation, registration and certification fees.

Using the range of 1-5%, the extra cost in pursuing LEED for the other Dalhousie buildings was also calculated. As outlined in Dalhousie's Green Building Policy, five other buildings have been

built to meet LEED rating standards. These include the Mona Campbell Building, The Life Sciences Research Institute, the Ocean Sciences Building, LeMarchant Place, and the Wallace McCain Learning Commons are all either LEED certified or are candidates for obtaining certification (Dalhousie University, 2015). Information and calculations for these buildings can be seen in Table 1 and provides some broader context for the money Dalhousie University is spending on the LEED process.

Table 1: Information about several buildings at Dalhousie, constructed with the goal of LEED certification, their budget, and the cost of LEED associated with this project based on the 1-5% approximation

Dalhousie LEED Project Budget's	Date Completed	Size (Sq ft)	LEED Standard	Total Budget	LEED 1% Est	LEED 5% Est.	Range:	Source
Le Marchant Street Mixed-Use Building	Summer 2014	165,000	Gold Candidate	\$48,000,000	\$480,000.00	\$2,400,000.00	\$1,920,000.00	("Facilities Management: Projects," n.d.)
The Mona Campbell Building	Dall 2010	101,303	Gold Certified	\$33,000,000	\$330,000.00	\$1,650,000.00	\$1,320,000.00	("Dalhousie's Mona Campbell Building," n.d.)
Collaborative Health Sciences Building	Fall 2015	107,000	Gold Candidate	\$38,500,000	\$385,000.00	\$1,925,000.00	\$1,540,000.00	("Facilities Management: Projects," n.d.)
Wallace McCain Learning Commons	Fall 2015	13,600	Gold Candidate	\$6,000,000	\$60,000.00	\$300,000.00	\$240,000.00	("Facilities Management: Projects," n.d.)
Life Sciences Research Institute	Spring 2011	159,029	Aiming for LEED	\$65,000,000	\$650,000.00	\$3,250,000.00	\$2,600,000.00	("Facilities Management: Projects," n.d.)

It was discovered that the certification fees for LEED amount to an average of \$2,000 but can grow to far greater amounts depending upon square footage and membership to a green building council in North America (McCormick, p.36, 2008). However, it is the higher construction costs associated with completing the requirements of LEED credits, not the expense of certification itself, that often increases project costs and deters the pursuit of LEED (McCormick, p.36, 2008). This is generally a good thing, indicating that sustainable features are taking the majority of the spending on a LEED project.

LEED credits demand high standards of sustainability. Amongst the most expensive construction requirements that award LEED credits is a mechanical system that must function at 14 percent better efficiency than a conventional one (McCormick, p.36, 2008). According to the USGBC, the individual LEED credit designated to LEED Gold registration and certification often amounts to no more than 1 or 2 percent of the total cost of a project and that this amount could easily be redeemed within "one to two years of the lifecycle of the building" (McCormick, p.36, 2008). It is evident that a project cannot merely purchase LEED certification. Certification must be earned through meeting the requirements of LEED credits and by creating a truly sustainable building.

5.3 Comparative analysis of LEED Costs between Universities

Like Dalhousie, Carnegie Mellon University is committed to LEED certification for all new projects (Stegall & Dzombak, p.3, 2004). Recently Carnegie Mellon constructed a new residence building with a LEED Silver certification. It is determined that to achieve the Silver rating that an additional cost of \$129,700 to \$347,118 was added to the design and construction of the project that would not have been required for a conventional building without LEED certification (Stegall & Dzombak, p.2, 2004). The additional costs amount to approximately 1 to 2.8 percent

of the total cost of the project including design, construction, and documentation (Stegall & Dzombak, p.2, 2004). A higher cost can be expected with LeMarchant Place can be expected, since the size of the building was larger, and the aim was Gold certification. If more credits are required to reach Gold certification, there is a greater scope of work for the consultants and contractors, potentially resulting in higher fees, material and labour costs (Solterre Personnel, Personal Communication, March 31, 2016).

The estimation of LEED being, at minimum, an additional \$480,000 fits within our margins of cost estimated for LEED certification in comparison to Carnegie Mellon University thus far. In addition to this estimate, reviewing the costs recorded by Carnegie Mellon University's LEED credits can help determine the costs for credits that Dalhousie University is pursuing for LEED certification on LeMarchant Place. This will give us more confidence in the money we are looking at.

LeMarchant Place is pursuing LEED Gold certification through 42 individual credit sections. Carnegie Mellon University and Dalhousie University's LEED projects pursued and spent money 14 of the same LEED credits sections. By understanding that a LEED certified Gold project will have to pursue more LEED credits than a lower tier project we can assume that the Dalhousie project will cost more than the Carnegie Mellon LEED Silver project. By further understanding that the list below encompasses only 14 of LeMarchant Place's 42 LEED credit sections that the project will undoubtedly cost more than what is displayed in the total cost below. Therefore, analyzing the cost of the credits funded by Carnegie Mellon University we can understand approximately how the same credits have affected funding by Dalhousie for LeMarchant Place's quest for LEED.

LEED credits that Both Universities Funded:

- Heat Island Reduction, Non-Roof: **\$4,120**
- Heat Island Reduction, Roof: **\$6,750 - \$13,500**
- Enhanced Commissioning: **\$5,827 - \$15,000**
- Fundamental Building Systems Commissioning: **\$50,000**
- Optimize Energy Performance: **\$23,000**
- Certified Wood: **\$4,060 - \$19,817**
- Minimum IAQ Performance: **\$25,000 - \$100,000**
- IAQ Management, During Construction: **\$21,520**
- Low Emitting Adhesives and Sealants: **\$355**
- Low Emitting Paint: **\$4,190**
- Low Emitting Composite Wood: **\$4,060 - \$4,816**
- Cost of Compiling LEED Documentation: **\$25,000 - \$61,000**
- Cost of LEED registration and certification: **\$1,800**
- Extra Costs: **\$129,744 - \$347,118**

The total cost of these design features ranges between \$305,426 - \$666,236. From our interviews and research we have derived that the LEED consultant for LeMarchant Place adds a further cost between \$20,000 - \$50,000 (K., Morse, Personal Communication, March 23, 2016). Therefore, by adding consulting costs to the known 14 design feature costs, the LEED certification process for LeMarchant Place can also be estimated to have an approximate total cost between \$325,426 - \$716,236. When considering that this only accounts for the cost of 14 of a total of 42 LEED credit sections, it is safe to ascertain that the cost of LEED certification for LeMarchant Place rests between a minimum cost of \$480,000 (1 percent of total project cost) to a maximum cost of up to \$2.4 million (5 percent of total project cost).

A value of at least \$480,000, falling within estimate made from the design feature cost calculations, is the least amount of money we are looking at in analyzing alternatives. This range of money is greater than the \$25,000 we had initially decided was significant enough to require looking into alternative spending. Therefore, it was required that we consider what could have been pursued as an alternative to LEED certification.

5.4 The Benefits of LEED after Certification

A report produced by the *Engineering Management Journal* analyzed 160 LEED certified buildings throughout the United States to better understand the cost of sustainable design (Nyikos, et al., p.50, 2012). This report has found that “operating costs in LEED certified buildings were \$0.70 per square foot less than non-LEED buildings, energy costs were 31% lower, and cost premiums ranged from 2.5 to 9.4% with a mean of 4.1%” (Nyikos, et al., p.50, 2012). Long-term operations of a LEED certified building are more cost effective than a conventional building with higher energy use.

By investing more money into a LEED certified project, a wide range of benefits are acquired. Carnegie Mellon University invested more money into the LEED project than they would have a conventional project and now reap the rewards of LEED certification (Stegall & Dzombak, 2004). The additional costs resulted in benefits including improved quality of life for building occupants through reductions in indoor air pollution and access to exterior views (Stegall & Dzombak, 2004). There was also the benefit of lowering environmental impacts by choosing local manufacturers, recycled materials, sustainably harvested wood products, and using renewable energy (Stegall & Dzombak, 2004). The sustainable building practices that this residence building has achieved reflect the goals and requirements that are necessary to become LEED certified.

5.5 Considering Alternatives

LeMarchant Place is a prime example of two of the seven tenets in the Dalhousie Master Plan (“Dalhousie Campus Master Plan,” 2010). The building promotes sustainability and sustainable

design on campus and is one of the newest examples of how LEED is integrated into Dalhousie's Studley campus. A critical look at how this building operated within those principles then will serve as an example for future development.

In order to implement the sustainable practices listed above, Dalhousie University has developed programs, plans, policies, and guidelines that provide direction for the key focus areas (Dalhousie University, n.d.). It is also important that the key focus areas are monitored in order to track progress and identify necessary adaptations (Dalhousie University, n.d.). All of these resources are accessible via Dalhousie's *Existing Buildings and Maintenance* document, and its definition of sustainability for these six focus areas is addressed in Appendix A. In looking at possible alternatives, Dalhousie's framework for sustainable practices was kept in mind.

Based on the monetary value ranging from \$480,000 to \$2,400,000, we used information from the interviews as well as the literature and case studies to develop some possible alternatives for this spending. One approach to alternatives is working with the LEED recommendations for credits that were not pursued as part of the LeMarchant Place project.

Several alternative LEED credits not pursued for LeMarchant Place and associated costs, based on data from Stegall & Dzombak, 2004 are as follows:

- Heat Island Effect, Non-Roof: \$4,120
- Optimize Energy Performance: \$0-\$23,000
- Measurement and Verification: Base Building: \$16,000-\$17,000

Since these alternatives are part of LEED, which is approved as sustainability framework for Dalhousie buildings, these are viable options. Additionally they meet Dalhousie goals in the sustainability focus area of Energy and Atmosphere, as outlined in Appendix A.

Another alternative would be implementing solar water heaters in LeMarchant. Through our research, we discovered that the cost of a 40-collector solar water heaters (SWH) system with 3600 L hot water storage was assessed as \$156,000, and the cost of a 20-collector SWH system with 1800 L hot water storage was assessed as \$96,000, including project and engineering costs, subject to a review of the mechanical room layout, piping configuration and the roof structure (Green Power Labs Inc, 2009). With a combined cost of both SWH's being \$252,000; this is still lower than our lowest boundary of \$480,000 for the cost of pursuing LEED certification. This also addresses Dalhousie's goals in Energy and Atmosphere.

Another alternative to consider is human resources. Rochelle Owen stated in her interview that the best possible alternative to pursuing LEED certification would be to fund a human component for LeMarchant Place that would act like a LEED consultant in that they would ensure sustainable practices are met in the building (R. Owen, Personal Communication, March 30, 2016). It is one thing to have a sustainable building plan in the design phase, but ensuring the follow through and the proper implementation of these sustainable practices and green building

features is much more difficult. Having that designated human capital to ensure none of the plans fall through the cracks is important to a successful construction phase. Being a leader in understanding, testing, and re-evaluating and implementing new systems to achieve the best performance in green building describes Innovation and Leadership in Dalhousie's sustainability goals (Dalhousie University, n.d.) and supports this alternative.

Discussion

The purpose of this research was to examine the costs associated with the LEED certification process and its integration within Dalhousie Policies. Since LeMarchant Place is one of the newest builds on Dalhousie Campus, we looked specifically at this building and its associated costs in achieving LEED certification. Based on the uncovered costs, we wanted to explore alternative options Dalhousie could invest in to achieve their sustainability goals.

Through interviews, literature and case studies, we aimed to answer these questions and found some interesting results. In terms of the rationale for pursuing LEED, the interviewees and the literature presented similar reasonings. The main reasons from Solterre Design Personnel, Rochelle Owens, and Kristen Morse included its adaptability for various types of projects, credibility due to strict guidelines, use in marketing since it is the most established green certification program in North America, and its provision of clear targets that force compliance from all involved parties. The Canada Green Building Council supports LEED since green buildings can significantly influence larger environmental goals and LEED recognizes that sustainability must be at the root of all the design, construction, and operation phases of the building process (CaGBC, 2015).

Dalhousie chooses to follow LEED (specifically for new and major projects) because it provided an easy framework for new projects to fit into. Rochelle Owens also emphasized the importance of the accountability the LEED system brought to their construction. Dalhousie, as an institution committed to sustainability leadership, felt it important to act in a way they were accountable. LEED also provides a valuable branding framework for Dalhousie to further promote itself as a sustainability leader.

The interviews involved key parties who had substantive knowledge of the LEED process, and several were involved specifically in LeMarchant Place. Some of the costs we discovered that are unique to the LEED process include registration, certification, consulting costs, and additional costs in pursuing LEED design features. Upon considering these aspects, a monetary value of at least \$480,000 ranging to \$2,400,000 accounts for the extra costs of LEED certification. This is an additional amount on top of the "regular" building process.

The literature revealed that over time operating a LEED certified building is more cost effective than a conventional building, with lower energy costs and expenses. The literature revealed that:

“operating costs in LEED certified buildings are \$0.70 per square foot less than non-LEED buildings, energy costs were 31% lower, and cost premiums ranged from 2.5 to 9.4% with a mean of 4.1%” (Nyikos, et al., p.50, 2012). The USGBC states further that the cost of the LEED Gold certification credit could easily be redeemed within “one to two years of the lifecycle of the building” because of energy cost efficiency (McCormick, p.36, 2008).

The interviews that we conducted also revealed the benefits of LEED certification. Though it is difficult to place a value on some intangible benefits associated with LEED, such as its role in marketing and providing clear objectives in the building project, this was important to address. From a Dalhousie University administration standpoint, it outlines targets clearly and ensures compliance throughout the project's construction to these sustainable guidelines (R. Owen, personal communication, March 30, 2016).

Additionally, by looking at the literature, as in the case study of Carnegie Mellon University, it is evident that the pursuit and certification under LEED brings a multitude of benefits towards the overarching outcome of sustainability and the Dalhousie campus. This case study looked at many environmental benefits and also benefits for the building occupant that made the extra cost involved with achieving LEED certification worth it.

In terms of looking at alternative and looking at how that money can be spent in other ways to promote sustainability, the costs associated with obtaining LEED certification have revealed that even the lowest amount in this range provides significant monetary resource that could potentially fund alternative sustainable practices at LeMarchant Place. Possibilities include, but are not restricted to; solar panels or solar water heating, a heat island effect reduction, optimizing energy performance, and/or investment into human resources. These alternatives fell under the categories Energy and Atmosphere, and Innovation and Leadership.

Our conclusions were favorable to LEED, even considering the large amount factored in from our estimates, the stated reasons for applying LEED seemed to justify the associated costs. LEED seems to be an effective rating system that should continue to be pursued at Dalhousie University.

Conclusions

Through conducting this research project we have achieved a better understanding of the costs associated with achieving LEED certification for Dalhousie University's LeMarchant Place. Through face-to-face interviews with Rochelle Owen, the Director of the Office of Sustainability at Dalhousie University and with several Solterre Design personnel, as well as an online correspondence with Kristen Morse, the Director of Elemental Design. Through these interactions we have come to understand the cost of LEED certification for Dalhousie University's LeMarchant Place to be within a range of one to five percent of the total project

cost. With a total project cost of \$48 million we see a cost range from a minimum of \$480,000 to a maximum cost of up to \$2,400,000. We find even the minimum amount within this range to be significant. The significance of this amount is that it has the potential to be used alternatively in order to further improve sustainability at Dalhousie.

5.1 Recommendations for Further Research

There is considerable existing research and literature that surrounds the overarching topic of LEED. We suggest that this research can be used to incorporate more sustainability in buildings on University campus' worldwide. Additionally, we recommend that further research be directed towards contributing to practices that incorporate sustainability into existing buildings and through renovations. We believe this to be important because new construction projects are seeing increasingly more sustainable practices that are being applied to new projects while old buildings are left behind - to continue unsustainable practices and building operation. Furthermore, for future research about better understanding LEED it would be interesting to see how cost of certification can be subsidized. Perhaps the Canada Green Building Council has the potential to cover LEED certification costs just as the United States Green Building Council returns all certification fees for projects certified as Platinum (McCormick, p.36, 2008).

5.2 Recommendations for Action

For further action involving LEED we recommend that better and more critical follow ups be incorporated into the LEED certification process, specifically the maintenance of LEED certification for buildings. Our interviews with LEED consultants revealed a surprise that follow ups or re-certification for new construction projects is not required (Solterre Personnel, personal communication, March 31, 2016). Once a new building has achieved a tier of LEED certification we suggest that follow ups by LEED consultants, contractors, or other qualified personnel could help ensure that the LEED credits that allowed projects to achieve their certification are maintained through sustainable building operation practices. If a building fails to continue to meet the LEED standards required to maintain its certification, we suggest that LEED certification be removed from non-complying and unsustainable buildings. Subsequently a building could potentially improve its sustainability and achieve a greater level of certification throughout its lifetime by completing the requirements of additional LEED credits and become more sustainable. It is our hope that Dalhousie University continues to pursue LEED certification for both new and existing buildings in order to make campus a more sustainable place to work, live, and study.

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Appendix A: Sustainability focus areas as outlined by Dalhousie University

Transportation: supporting sustainable transportation modes such as vehicle sharing, low-emitting and alternative vehicles, and active transportation (Dalhousie University, n.d.).

Water reuse and efficiency: reusing gray and rainwater and reducing total water consumption (Dalhousie University, n.d.).

Energy and atmosphere: Reducing carbon emissions, criteria air contaminants, and ozone depleting chemicals. This is achieved through the reduction of energy, using renewable energy, installing appropriate air quality controls, and reducing/eliminating the most potent types of ozone depleting chemicals (Dalhousie University, n.d.).

Materials: Sustainable purchasing of goods and services and reducing and diverting material from the landfill (Dalhousie University, n.d.).

Indoor environments: Following a green cleaning program that includes products and equipment, reducing indoor air contaminants and following best management practices, and considerations for occupant comfort (Dalhousie University, n.d.).

Innovation and leadership: Being a leader in understanding, testing, and re-evaluating and implementing new systems to achieve the best performance in green building. This includes a commitment to a detailed metering plan and building level meters for all utilities (water, heat/cooling, electricity, renewable energy). Sub-metering (electricity) is also advocated for buildings to understand different energy loads (Dalhousie University, n.d.).

Appendix B: List of interviewees and contact information

1. Kristen Morse
Director Elemental Consulting
902.488.5360
kmorse@elementalsustainability.com
2. Rochelle Owen
Director of the Office of Sustainability at Dalhousie University
rjowen@dal.ca
3. Solterre Design Personnel
902.492.1215
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Appendix C: Interview Questions and Ethics Review

For Rochelle Owen:

- What were the consulting costs associated with getting LeMarchant Place LEED certified?
- Can we see the breakdown of the costs associated with LeMarchant Place?
- Dalhousie's Sustainable Building Policy reads, "All new "major building projects" should be designed, constructed and certified to meet at least LEED Gold standards". What qualifies something as a "major building project"?
- Why do institutions choose to use LEED?
- Are the consulting fees for LEED certification greater than those involved in building projects not pursuing LEED certification?
- What were the LEED endorsed components of LeMarchant Place?
- Does Dalhousie take advantage of government incentives or tax credits when constructing LEED buildings?
- Are you aware of any additional projects or designs for LeMarchant Place that were considered but not implemented? If yes, why were they not implemented?
- How many LEED consultants were involved in the construction of LeMarchant Place?
- How long does the certification process typically take?

For Kristen Morse:

- Why do institutions choose to use LEED?
- What, in general, are the costs associated with LEED certification?
- Are there some unstated costs associated with getting a building LEED certified outside of registration fees?

- What is the dollar amount associated with hiring a LEED consultant?
- Does the price of LEED certification change based on its tier? (i.e. Gold certification vs Platinum Certification)?
- What is your role in ensuring a building becomes certified?
- Can we see the breakdown of the general costs associated with pursuing LEED certification?

Solterre Design Personnel:

- What were the consulting costs associated with getting LeMarchant Place LEED certified?
- Why do institutions choose to use LEED and your consulting services?
- How do the LEED consulting fees compare to consulting fees when not pursuing LEED certification?
- Does the price of LEED certification change based on its tier? (ie. Gold certification vs Platinum Certification)
- What were the chosen design features for LeMarchant Place that achieved LEED credits and their associated costs?
- Will the building be periodically inspected after certification to ensure it is still up to code?
If so, do these inspections cost money?
- How close is LeMarchant place to becoming LEED certified?
- What is your role in ensuring the building becomes certified?

Ethics Review:

The purpose of our interviews was to gather information on LEED certification, registration, and consulting costs. As such, we were dealing with purely factual information, nothing that was personal or opinion based. We will be in contact with our interviewees to provide them with a copy of this report so that they may view it for themselves. At their request, we have ensured the confidentiality of the individual Solterre Design Personnel.

Appendix D Interview Report

Reasoning for certification

Kristen Morse

LEED is one of the most established and used green building certification program in North America. It involves strict guidelines, for example having 3rd party reviews looking at water, site selection, IAQ, and materials selection. This strict process gives tenants a way to ensure the building being selected meets “green-ness” standards and may be important in avoiding greenwashing.

Solterre personnel

It started as an innovative certification program and now it is almost standard practice. It is easy for people to understand and communicate to the public.

LEED is internationally recognized and third party administered, so the standards and references that it uses are recognized by other institutions. Institutions choose LEED because of its adaptability to various projects. The LEED rating system requires all projects to meet mandatory thresholds, typically based on additional third-party, industry-recognized reference standards (ASHRAE, US EPA 1992, et. al). Targeting achievements beyond these prerequisites can be tailored to fit the design, function and location of the project. It can be used for a mixed-use academic building, business offices, or residential buildings. It also demonstrates quantifiable and qualitative environmental impacts of building design and construction. There are other, potentially more, rigorous rating systems such as Living Building Challenge and Passive House in existence, but LEED has had the greatest market penetration in North America, likely due to its adaptability for varying types of projects.

Developers are also seeing it as a marketing tool; especially in Halifax there is a lot of empty rentable space.

Rochelle Owen

Following LEED guidelines for new construction is a good way to keep work on track and keep goals in mind. The score sheet is very valuable and ensures everyone has the same target and forces everyone to comply. LEED criteria motivates the university to meet targets. Despite being more expensive, it is worth it for new constructions. LEED is not about having a design that uses passive energy and is innovative. LEED is a program and tool to help achieve green building goals.

Role of the consultants

Kristen Morse

LEED consultants work with the design team to facilitate a “design charrette” where ways to meet LEED targets are brainstormed and discussed. This is also where parts of the design that are already in line with LEED targets are looked at. This process gets everyone on the same page with what their responsibilities will be throughout the process. The consultant also looks at specific credits and determines

whether or not they are achievable and also implementing and documenting “innovation and design credits” to be pursued by the team.

Additionally, the LEED consultant works with the general contractor, which carries an additional fee, to ensure that all IAQ targets are being met, that recycled and regional materials are being purchased, and that documentation is provided to back up claims.

Following the construction period, the consultant works with the design team to compile all of the documentation for each credit. The consultant acts as the liaison between the project owner and the CaGBC throughout the review process. Upon submitting all the documentation to the CaGBC, they receive a review asking for more explanatory documentation, narratives etc. This continues until a final LEED designation is determined. This is when the consultant's role is complete and this process takes anywhere between 2-6 years.

Solterre Personnel

Project involvement begins from its initial design phase through-to and following its substantial completion and occupancy. Consultants work with the client and design team to establish a LEED “Scorecard” mapping potential and reasonable credits for the project to pursue. Energy can go up to 19 points (of 110 total), so it has by far the greatest influence. Throughout this process, we ensure the project’s design meets those requirements.

During the construction period they work with the contractor to ensure contractor-related credits remain on-track for achievement (e.g: Construction Waste Management, Recycled Content, Regional Materials). They also work with the client to develop initiatives that contribute to the project’s Innovation in Design credits (e.g.: Green Housekeeping Program, Reduced mercury Lighting Program).

The building reaches “substantial completion” phase where occupants can begin using the facility and then consultants are involved in compiling all the documents required to send to the Canadian Green Building Council (CGBC) to get LEED certification. They assemble the entire package and submit it to the CaGBC for review and CaGBC critiques it, often sending it back. The CGBC will look at the credits being pursued and ask for proof, which can be time consuming. Upon the issuing of this review report, consultants coordinate a response from all involved parties to satisfy the review team’s comments.

The project then undergoes a second and final review following which LEED certification is awarded, provided all prerequisites have been met and a minimum of 40 points earned. The level of LEED certification is determined by the points total achieved.

Once a contractor has completed a project, they have been paid and will move on to other projects making it challenging to get them back to review the project. However, their motivation is maintaining good client relationships.

LEED consultants provide professional assurance that documentation is up-to-code and compliant.

LEED consultant fees

Kristen Morse

LEED consultant fees usually range between \$20k-\$50k depending on length of construction time, size of the project, and complexity of the building. Average of 25,000 per project.

Solterre Personnel

Due to their experience and the approximation of a 3-5% increase over traditional construction, LEED projects seem to require higher consulting fees. Undertaking a LEED project requires added coordination between design team members and increases the scope of work of each discipline. From a construction materials and management point of view, the general contractor must document and report more than a typical job, increasing their administrative costs. As well, augmented materials: insulation, HVAC, building materials may be specified to meet specific LEED requirements and these sometimes carry a premium.

Despite LEED consulting fees being estimated at 3-5% of total construction cost, another consultant said it is closer to 1-2% so there is some discrepancy. Specific credits can be added at the end of construction, such as “Green Power”, which is easy to identify how much it costs. More or less the same process will have to take place with all size buildings, so Economies of Scale applies to the consultation of LEED projects. Also, the value of the water not being used is difficult to quantify but should be considered.

On the maintenance and operations, LEED will result in huge savings. The upfront costs are an investment, but in the long run, LEED buildings are economical.

There is rarely if ever a fixed-cost associated with LEED initiatives/credits. They are integrated into the design and construction and there are no clear costs of a particular credit ie: Credit EAc1 – Optimize Energy Performance vs traditional design and construction. Credit EAc1 – Optimize Energy Performance requires design considerations from various disciplines including architectural (envelope design), mechanical (HVAC design, renewables) and electrical (lighting design, renewables).

Rochelle Owen

These costs depend on the scale of the project and the work they do varies depending on the scale of the project. LeMarchant was a 40 million dollar mixed use

facility build and was a long process for a building. For LeMarchant it would be in the range of less than 1% of building costs.

Design team additional fees

Kristen Morse

These additional fees are more difficult to quantify and include mechanical, structural, electrical engineering fees, energy model costs, and architects etc.

If the design team does not respond to the initial review within 3 months, there is an additional cost of \$750 dollars and also a \$500/per credit if any of the credits are being appealed by the design team.

Rochelle Owen

The fee for the CaGBC LEED review. In 2014, this review cost \$12,750. This is if you plug in LMU is 165,000 square feet or 15,329 metres.

Additional materials needed to fulfill LEED credit

Kristen Morse

These may include green roof materials, FSC wood, solar panels, holding tank for rainwater, and structural reinforcements for these materials. However, these capital costs need to be balanced with operational savings that include longer green roof life, reducing energy and water costs, and interest from tenants to rent a LEED space.

Rochelle Owen

See score sheet for LEED endorsed components. Energy credits are the most difficult to achieve. Green power was not pursued because buying credits did not seem to be the best route towards sustainability. Measuring and verification of the base building has still not been decided on with LeMarchant Place. Enhanced refrigerant management was not pursued for LeMarchant.

Solterre Personnel

It is an integrated design process. To break the costs down into each credit; they are all so interconnected. If you pull from one, it can affect another. Adding extra insulation leads to reducing the size of the mechanical structure etc.

One goal of the LEED rating system is driving market change. In this regard, we have seen material costs specific to certain LEED applications, i.e: reflective roofing products, become commonplace in the market such that there is no longer any significant premium between it and 'typical' roofing product.

Registration and Certification Fees

Kristen Morse

Registration and certification fees are calculated based on square footage.

Solterre Personnel

Assigning specific costs to LEED certification is really difficult because there is a lot of give and take. “Welcome to the world of LEED, it's one big grey area”. Solterre primarily works with “New Construction” rating system, which focus on the design and construction process, but there is another LEED rating system for “Existing Buildings: Operations & Maintenance (EBOM)” projects, for example. where they have to recertify every 5 years. With New Construction projects, there is no re-certification or follow-up after the initial certification.

Both fees are based on the project’s gross floor area and are exclusive of the project site area, location, and targeted tier of LEED certification.

Rochelle Owen

For LeMarchant, the registration fee was \$500 dollars. There is also additional fees to audit the building. These result in third party review submissions from LEED consultants.

If you plug in LeMarchant Place as 165,000 square feet or 15,329 metres, registration fees were \$2146 in 2014. Also a fee for LEED to audit, which is done by a LEED consultant.

Bypassing LEED certification

Kristen Morse

After going through the process of LEED with the Ocean Sciences Building at Dalhousie, Kristen Morse highly recommended that Dalhousie continue using it as its sustainability compass for building construction. For other building owners and developers, bypassing LEED is reasonable (NSLC is using LEED as a guiding principle but not going through the formal review process). She has often advised clients to use a similar “LEED-like process” to spare themselves money and time with the review process. However, a major downside is that LEED acts as an important metric for occupants/tenants. To say that a building is “kind of LEED” will not appeal in the same way.

Rochelle Owen

For existing buildings, LEED was not pursued due to cost vs. benefits. The investment would be best for recommissioning buildings. Throughout this process, Dalhousie would aim for LEED like criteria while not getting LEED certification. Also, in terms of what else could be done with the 1% building cost for LEED certification, Rochelle stated that this money would be needed in human time to design buildings to be sustainable. If individuals are not familiar with the process and it is not clearly laid out, there could be difficulties in the process that could be more costly.

Unstated costsKristen Morse

Costs can vary depending on how well the design team and the building owners are familiar with the LEED process. If they are unfamiliar, projects can get drawn out and require more energy if the consultants are unfamiliar with the requirements of LEED. Fees may be higher in this case.

Additional information on costsKristen Morse

The costs of certification and design features are capital or up-front costs and there are significant cost savings to be achieved through LEED through improved energy efficiency. Energy models can give you a more exact number for these savings. Additionally, but more difficult to quantify, would be an increase in worker productivity due to improved air quality. Building owners often focus only on capital costs and lose sight of the overall cost of LEED which often yields larger profit for them.

Rochelle Owen

Dalhousie does not use tax credits in achieving LEED certification. However, Dalhousie actively sought out grants from Efficiency Nova Scotia which helps achieve energy parts of the LEED score sheet.

Solterre Personnel

Certification under the LEED for New Construction & Major Renovation, LEED for Core & Shell, LEED for Homes, and LEED for Commercial Interiors are a snapshot of the building and are not inspected after certification nor do they require re-certification. These rating systems focus on the design and construction of a project rather than its operation.

The project's certification is based on declarations made by industry professionals in the form of LEED Letter Templates (LLTs). There is an LLT associated with each LEED Prerequisite and targeted credit. In addition, the project owner must confirm the project meets the LEED Minimum Project Requirements (MPRs).

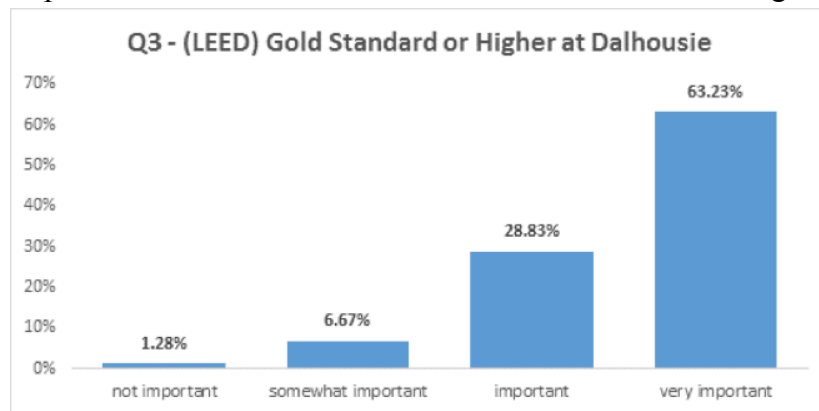
Experience of the building occupantKristen Morse

There are certain credits in the LEED program that directly enhance the occupants experience. An example of this is increased air flow that increases overall comfort and productivity. Other design features for this purpose include low VOC paints, proximity to public transit, energy and water consumption, and commissioning. Making LEED credits known is dependent on the building owner who can do this through an innovation credit called "Green Education". However, this is an optional credit so not all buildings showcase the work that has gone into pursuing LEED certification.

Rochelle Owen

An annual survey was done two years ago involving 1724 students, staff and faculty, who responded on the importance of LEED certification. There were five pages of comments on the topic.

Q. 3 Dalhousie's current administrative policy is that any new building should be constructed to Leadership in Energy and Environmental Design (LEED) Gold standard or higher. How important is it that Dalhousie is an innovator in the field of green building?



Price of Gold vs. Silver vs. Platinum

Solterre Personnel

The tiers of certification (certified, silver, gold, platinum) require a project achieve a threshold total of points (40-49, 50-59, 60-79, 80+ respectively). Points are awarded for meeting credit requirements with the points allotment being weighted based on the credit's environmental impact. If more credits are required to reach Gold, the greater the scope of work for the consultants and contractors increase, potentially resulting in higher fees, material and labour costs.

Reviews are a blind process; the reviewer only has a picture of what is sent to them, there is no communication and only have the reference standard to base it on.

Most typically due to energy credits, some buildings that are Silver Candidates actually turn out to be Gold Certified. Re-commissioning Dalhousie buildings has saved them a huge sum of money.

Time until certification

Solterre Personnel

Certification will typically come one year after the initial proposal is submitted. "If you see a LEED plaque on LeMarchant Place in the middle of next year, that will mean everything went smoothly." It can take a full year for the building to become certified. There is a lot of faith in the

process, in that the contractor signs a document saying they will do all of these certain things but they will not lose the certification if they do not comply.

Rochelle Owen

Building LeMarchant was a long process. Funding needed to be acquired, a feasibility study needed to be completed, board approval for schematic design and board approval for budget was necessary before this process began. The certification process typically takes 2-4 years. The documentation will likely be submitted early summer and it could take a year after this to be officially Gold certified.

Energy modeling

Solterre Personnel

Any building that you're constructing has to go through the "Model National Energy Code for Buildings" (MNECB), a national standard for building energy performance. Take the model and compare and contrast it with the LEED model. Energy modelling is very complicated, it takes into consideration a lot of factors. The modelling is usually done after things have got rolling.

LeMarchant Place has been difficult in modeling its water usage. Because of the fact that it's a multi-use facility with doctors on one level, the international centre, and then residences above; trying to calculate how many times a day people are using the washroom (flushing the toilet), for comparison of the MNECB against the LEED model. You need to have a number estimated to start somewhere in the modelling.

Additional information

Solterre Personnel

- Solterre Design is the LEED Consultant on this project. The project has not yet achieved LEED certification.
- The Mona Campbell building is LEED Gold certified (v1.1). The Steele Ocean Sciences building is targeting LEED Silver certification.
- Solterre Design has worked on more than 40 LEED certified projects, with an additional 30+ active projects. This is more certified projects in Atlantic Canada than any other and have developed excellent working relationships with clients, consultants and contractors over the years.
- It was estimated that LEED projects cost 3-5% more than traditional design and construction.
- LEED is not associated with the National Building Code. All LEED projects must meet applicable local, provincial and federal regulations (this is one of the MPRs).

Appendix E: LeMarchant Scoring Sheet Via Rochelle Owens

Not Submitted Yet

61	Targeted Points	Daihouse Mixed Use Facility - LEED® CANADA NC 2009	Possible Points
7	7		110

T	7	36	Materials & Resources	Available Points	14
P	1	1	Storage & Collection of Recyclables	1	1-3
P	1	1	Building Reuse, Maintain Existing Walls, Floors, and Roofs	1	1
P	1	1	Construction Waste Management	1	1-2
P	1	1	Material Reuse	1	1-2
P	1	1	Regional Materials	1	1-2
P	1	1	Rapidly Renewable Materials	1	1
P	1	1	Certified Wood	1	1

T	7	36	Sustainable Sites	Available Points	26
P	1	1	Construction Activity Pollution Prevention	1	1
P	1	1	Site Selection	3.5	RP1
P	1	1	Development Density and Community Connect	1	1
P	1	1	Brownfield Redevelopment	1	1
P	1	1	Alternative Transportation, Public Transportation A	3.6	3.6
P	1	1	Alternative Transportation, Bicycle Storage & Changing	1	1
P	1	1	Alternative Transportation, Low Emitting & Fuel Efficient	1	1
P	1	1	Alternative Transportation, Parking Capacity	2	2
P	1	1	Site Development, Protect or Restore Habitat	1	1
P	1	1	Site Development, Maximize Open Space	1	1
P	1	1	Stormwater Design, Quantity Control	1	1
P	1	1	Stormwater Design, Quality Control	1	1
P	1	1	Heat Island Effect, Non-Roof	1	1
P	1	1	Light Pollution Reduction	1	1

T	7	36	Water Efficiency	Available Points	10
P	1	1	Water Use Reduction	2	2,4
P	1	1	Water Efficient Landscaping	2	RP2
P	1	1	Innovative Wastewater Technologies	2-4	2-4

T	7	36	Energy & Atmosphere	Available Points	35
P	1	1	Fundamental Commissioning of Building Energy	1-19	RP3
P	1	1	Minimum Energy Performance	1-7	1-7
P	1	1	Fundamental Refrigerant Management	2	2
P	1	1	Optimize Energy Performance	2	2
P	1	1	On-Site Renewable Energy	2	2
P	1	1	Enhanced Commissioning	2	2
P	1	1	Enhanced Refrigerant Management	2	2
P	1	1	Measurement and Verification: Base Building	2	2
P	1	1	Green Power	2	2

T	7	36	Indoor Environmental Quality	Available Points	15
P	1	1	Minimum IAQ Performance	1	1
P	1	1	Environmental Tobacco Smoke (ETS) Control	1	1
P	1	1	Outdoor Air Delivery Monitoring	1	1
P	1	1	Increased Ventilation	1	1
P	1	1	Construction IAQ Management, During Construction	1	1
P	1	1	Low-Emitting Materials, Adhesives & Sealants	1	1
P	1	1	Low-Emitting Materials, Paints & Coatings	1	1
P	1	1	Low-Emitting Materials, Flooring Systems	1	1
P	1	1	Low-Emitting Materials, Composite Wood and Agrifit	1	1
P	1	1	Indoor Chemical & Pollutant Source Control	1	1
P	1	1	Controllability of Systems, Lighting	1	1
P	1	1	Thermal Comfort, Design	1	1
P	1	1	Thermal Comfort, Verification	1	1
P	1	1	Daylight and Views, Daylight	1	1
P	1	1	Daylight and Views, Views	1	1

T	7	36	Innovation & Design Pro	Available Points	6
P	1	1	Green Housekeeping	1	1
P	1	1	Green Building Demonstration/Education	1	1
P	1	1	Occupant Recycling Program	1	1
P	1	1	Exemplary Performance - WECS Switch for SSSCs	1	1
P	1	1	Exemplary Performance - MIRC4 (>30%)	1	1
P	1	1	LEED™ Accredited Professional	1	1

T	7	36	Regional Priority	Available Points	4
P	1	1	Durable Building	1	1
P	1	1	Regional Priority Credit	1-3	1-3

All credits are subject to review and approval by the Canada Green Building Council (CaGBC). Solterre Design can not guarantee that the points identified on this form will be awarded through the CaGBC's review process.

Solterre Design

2016-02-17