Barriers to Energy Efficiency Projects and the Uptake of Green Revolving Funds in Canadian Universities

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BACKGROUND PAPER

Background Report:
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Abstract

This report investigates the barriers to the implementation of energy efficiency projects in Canadian Universities including: access to capital, bounded rationality, hidden costs, imperfect information, risk and split incentives. Methods to overcome these barriers were also investigated, including the use of revolving funds, which provide a mechanism to prioritize and fund energy efficiency measures.

Senior university administrators of fifteen universities of varying size, located throughout Canada, were interviewed. A series of structured questions allowed for quantitative analysis of results. Universities on the whole indicated 'Access to Capital' as the leading barrier to implementing energy efficiency projects. Though respondents agree, on average, that revolving funds are an effective method to address capital funding constraints only 4 of the 83 universities in Canada are known to be currently implementing revolving funds.[1] Universities agreed on the following barriers to implementing revolving funds, including, in order of priority: multi-constituent committees representing a challenge to current administrative practices, and in particular the autonomy of operational staff decisions, accounting issues associated with tracking costs and savings of projects, and the administrative and staff burden associated with managing the fund.

The interviews and results indicate a wide range of progress on the operationalization of energy efficiency amongst Canadian Universities. Though all universities are implementing energy efficiency projects, the process to implement these projects, and the resources and funding available to do so, vary.

Small and mid-size universities strongly agreed that revolving funds may be an effective method to implement energy conservation projects at their university, though large universities were, on average neutral, due to the concerns outlined above, along with their preference for the status quo.

When compared with current processes for funding and implementing energy efficiency projects, revolving funds: prioritize energy efficiency within institutions, act as an effective method to address capital funding constraints, increase tracking of energy and water use and other sustainability data, foster collaboration among offices of finance, sustainability, facilities, faculty, and students, and offer opportunities for both institutional assessment, and interdisciplinary education and research on sustainability.

It is recommended that Canadian university senior administrators:

- develop formal commitments to energy efficiency through the creation and adoption of a formal energy policy; and,
- establish multi-party committees to develop and implement the energy policy and to source the necessary funding to create and implement revolving funds.

[1] As identified by both this study and in *Greening the Bottom Line* by the Sustainable Endowments Institute, 2011.

Introduction

Worldwide, 30-40% of all primary energy is used in buildings (UNEP, 2007). Universities are 60 percent more energy intensive than commercial offices and more than twice as energy intensive as manufacturing premises (Sorrell, 2004). As improving energy efficiency is regarded as the fastest and most cost-effective method to achieve global greenhouse gas emission targets (IEA, 2008), and promote cost savings, environmental protection, better public health and economic sustainability, Canadian universities are improving their energy efficiency. Wright (2009) did find, however, that Canadian university presidents and vice-presidents considered 'Energy Issues' to be seventh among key issues facing their university in the next ten years, behind other infrastructure issues such as 'Physical space/building expansion' and 'Maintenance of existing buildings'. Barriers to implementing energy efficiency projects continue to exist. The aim of this research is to both identify these barriers, and to share methods of overcoming these barriers at Canadian universities.

Revolving funds, used to fund energy efficiency projects, have been shown to: outperform market returns, reduce energy consumption, resource use, waste generation, and pollution levels, increase tracking of energy and water use and other sustainability data on campus, foster collaboration among offices of finance, sustainability, facilities, faculty, and students, and provide opportunities for interdisciplinary education and research on sustainability and institutional assessment. (SEI, 2011). Revolving funds can also address funding constraints, as the structure of the fund acts such that a one-time fund can perpetually fund more projects. The City of Phoenix[2], which started a small revolving fund in the late 1970s with $50,000 of seed capital, has produced $63 million in energy savings as of 2001 (Kallapos, 2005). Revolving funds exhibit reliability and longevity of purpose, with Kallapos (2005) stating, regarding municipal revolving funds, "to ensure that energy savings can be consistently reallocated to energy efficiency projects, it helps to make the energy efficiency fund separate from the municipality's operating and capital budgets…if they are not exclusively dedicated to energy efficiency, the revolving fund may find itself in jeopardy during budgetary challenges".

Between 2008-2011, the number of North American University institutions with Green Revolving Funds more than quadrupled, with 35 new funds established in the US, and only 2 in Canada (Sustainable Endowments Institute (SEI), 2011). Given this increased use of revolving funds at American colleges and universities to provide a mechanism to prioritize and fund energy efficiency measures, the research also seeks to understand the efficacy of revolving funds in confronting barriers to energy efficiency.

Barriers to Energy Efficiency

There is strong evidence that universities are committed to sustainability and energy efficiency. Wright (2009), interviewed presidents and vice presidents of 17 Canadian universities and found that all believed universities could model sustainability and lead by example in the way they conduct their business and operate physically. The study also found that 9 of the 17 universities

[2] http://phoenix.gov/greenphoenix/sustainability/summary/green.html.

interviewed foresee making sustainability a top priority at the university, but many offered stipulations to their answers, which included political will, financial and governmental support. Only 3 of the 17 universities stated sustainability will never be a priority. Respondents identified the top two concepts most related to a "sustainable university" as physical greening and reduction in energy consumption.

There is evidence that organizations fail to invest in energy efficiency even though it is profitable under current economic conditions to do so; a phenomenon referred to as the "energy efficiency gap" (Jaffe and Stavins, 1994). This paper defines a barrier according to Sorrell (2004) as, "a mechanism that inhibits a decision or behavior that appears to be both energy efficient and economically efficient." The taxonomy developed in Sorrell (2004), and summarized by Schleich (2009) provides the following six categories to comprehensively describe barriers to energy efficiency: Access to capital, bounded rationality, hidden costs, imperfect information, risk and uncertainty and split incentives. Below is a brief outline of each, and how they apply to universities.

Access to capital

A university may have insufficient capital through internal funds, and have difficulty raising additional funds through borrowing. As a result, energy efficient investments may not be implemented. Investment may be inhibited by internal capital budgeting procedures, investment appraisal rules or by managers favouring other strategic projects over energy management activities.

Bounded rationality

Orthodox neoclassical economics assumes a rational decision maker choosing the optimal solution given available information on alternatives. In particular, the decision is not tainted by cognitive limits or biases. Owing to constraints on time, attention, and the ability to process information, individuals do not make decisions in the matter assumed in economic models, and as a consequence, may neglect energy efficiency opportunities, even when given good information and appropriate incentives. Bounded rationality includes reliance on routines and unwillingness to consider change. "Actions and decisions require a greater justification than inaction, than failing to decide. If our actions do not pan out, or cause a loss, we regret having acted. If, instead, we do not act, if we leave things as they are, and our investment does not pan our, or we lose, we still suffer regret though the regret is *lesser*". (Piattelli-Palmarini, 1994, pp.27-8 – Sorrell, 81). These factors lead to favouring the status quo, and neglecting potential improvements in energy efficiency, when other market and organizational failures are absent (Sorrell et al, 2004, p.81).

Hidden costs

Organizations may fail to invest in seemingly profitable energy-efficient technologies because there are additional costs associated with their use, which are hidden to the observer, but not to the organization. That is, decision makers may be very well aware of those hidden costs, but they cannot easily be observed or adequately quantified. Examples include overhead costs for management, disruptions to production, staff replacement and training, and the costs associated with gathering, analyzing and applying information. Hidden costs include those costs not clearly associated with energy efficiency projects by external sources. These may be site-specific issues or loss of utility such as increased noise, reduced service quality, problems with safety, working conditions, extra maintenance or lower reliability.

Imperfect information

If individuals lack adequate information on either energy efficiency opportunities or the energy performance of technologies, they may invest too little in energy efficiency.

Risk and uncertainty

The rejection of particular energy-efficient technologies may represent a rational response to perceived risk. This may result from financial risks such as business specific risk, regulatory risk, or general economic risk caused by the business cycle, fluctuation of exchange rates and energy prices.

Split incentives

If actors cannot appropriate the benefits of the investment in energy efficiency, opportunities are likely to be forgone. For example, if individual departments within a university are not accountable for their energy use, they will have less incentive to improve energy efficiency.

The taxonomy further proposes 21 barriers to describe both the market and non-market barriers embedded in the six barrier categories, as outlined in Table 2.1 below:

Table 2.1: Barriers to Energy Efficiency in the University Sector (Sorrell, 2004)

Access to Capital	Lack of Capital Other priorities for Capital Investment Strict Adherence to Capital Budgets
Bounded Rationality	Energy manager lacks influence Lack of technical skills Low priority given to energy management Low priority given to environmental performance Technology inappropriate at this site
Hidden Costs	Cost of disruptions/hassle/inconvenience Cost of identifying opportunities, analyzing cost effectiveness and tendering Cost of staff replacement, retirement, retraining Lack of time/other priorities Poor technology performance
Imperfect Information	Difficulty/cost of obtaining information on the energy consumption of purchased equipment Lack of information/poor quality information on energy efficiency opportunities Lack of staff awareness
Risk	Business/market uncertainty Technical risk
Split Incentives	Conflicts of interest within the organization Departments not accountable for energy costs Energy objectives not integrated into operating, maintenance or purchasing procedures

Methods

Fifteen decision makers of universities of various sizes and locations throughout Canada, with roles such as, 'Head of Facilities and Services', 'Lead Engineer', or 'Energy Manager', were interviewed using both qualitative and structured questions. The participants composed a cross-sectional sample of universities as outlined in Table 3.1 below. Note that the sample of both small and mid sized universities interviewed was quite small. For some measures, the responses of small and mid size universities are combined to increase the sample for more appropriate comparison with the large university sample.

Table 3.1: University Sample

	Ontario	Québec	British Columbia	Alberta	Saskatchewan	Nova Scotia	Average
Small		1		1		1	**3**
Mid	1	1	2				**4**
Large	3	1	1	1	1	1	**8**
Total	**4**	**3**	**3**	**2**	**1**	**2**	**15**

The structured questions required participants to respond either: strongly agree (5), agree (4), neutral (3), disagree (2), strongly disagree (1) or don't know (no score) to each question, with the responses assigned the numerical score indicated in the parenthesis. Thus an average score above 3.0 indicated a level of agreement with the question on average, and a score below 3.0 indicated a level of disagreement with the question, on average. Results were then analyzed, as below.

Results

The current capacity for energy efficiency projects at universities was gauged. Table 4.1 indicates respondents agreed, scoring 3.5 on average, that a wide range of measures with paybacks less than four years could still be implemented at their university. Universities scored much lower, 1.9 on average, when asked if they were running out of energy efficiency projects to implement. These results indicate consistency in responses; universities are not at full capacity in implementing energy efficiency projects. There was general agreement that paybacks for electricity and gas projects were worthwhile, however payback periods for water scored low in both Quebec and Alberta, given the low costs of water in these provinces. Universities in these provinces indicated, "We don't pay for water" (Anonymous A, 2011) and "water projects are for sustainability reasons, not ROI" (Anonymous B, 2011).

Table 4.1 Capacity and Paybacks

Capacity/Paybacks	All	ON	QC	BC	AB	SK	NS
Have a range of energy efficient measures that could be implemented with paybacks less than 4 years	3.5	3.8	4.0	4.3	1.5	2.0	4.0
Running out of energy efficiency projects to implement	1.9	1.3	1.3	2.7	2.5	4.0	1.0
Payback periods for electricity projects make them worthwhile long term investments	3.9	4.3	3.7	4.0	4.5	1.0	4.5
Payback periods for water projects make them worthwhile long term investments	3.1	4.0	1.0	4.0	2.0	3.0	4.5
Payback periods for gas projects make them worthwhile long term investments	4.6	4.3	5.0	4.7	4.5	4.0	5.0

Above 3.0 - a level of Agreement | Neutral Score is 3.0 | Below 3.0 - a level of Disagreement

Table 4.2 below breaks down the average score of the 21 barriers, based on university size and province. Note, the average score of all barriers for all universities was low, at 2.5, and no province scored above 3.0 (neutral). Mid size universities on average scored the highest, though this sample was quite small. Large universities, and universities in Ontario (3 of 4 Ontario universities interviewed were large) had the lowest average instance of barriers at 2.2 and 2.1 respectively, indicating low perception of barriers to energy conservation.

Table 4.2: Average of All Proposed Barriers

	Ontario	Québec	British Columbia	Alberta	Saskatchewan	Nova Scotia	Average
Small		2.0		2.5		2.8	2.4
Mid	2.6	3.5	3.3				3.1
Large	2.0	1.9	2.2	2.3	2.4	2.8	2.2
Average	2.1	2.5	2.9	2.4	2.4	2.8	2.5

Above 3.0 - a level of Agreement | Neutral Score is 3.0 | Below 3.0 - a level of Disagreement

Table 4.3 below sheds light on the relevance of the barrier categories to universities. Access to capital was the only barrier category to have an average score above 3.0 for all universities in the sample, and the only barrier large and small universities on average indicated they currently experience. This does follow government funding trends, as revenues to support teaching and research per student in Canadian universities have fallen significantly since the 1980s and have remained virtually unchanged since 2000 (AUCC, 2008). Wright (2009) also found that the largest barrier to implementing various sustainability initiatives on campuses was financial. Mid-sized universities appear to experience more barriers on average, including Access to Capital, Split Incentives and Hidden Costs, though the sample for this is small.

Table 4.3: Average of Barrier Categories

Barrier	All	Large	Mid	Small
Access to Capital	3.4	3.3	3.7	3.1
Bounded Rationality	2.1	1.8	2.7	1.8
Hidden Costs	2.6	2.2	3.2	2.7
Imperfect Information	2.2	2.0	2.9	1.8
Risk	2.3	2.1	2.6	2.5
Split Incentives	2.4	1.8	3.7	2.6
Average	2.5	2.2	3.1	2.4

Above 3.0 - a level of Agreement | **Neutral Score is 3.0** | **Below 3.0 - a level of Disagreement**

Three of the top 4 highest scoring individual barriers, as indicated by Table 4.4 below, are in the 'Access to Capital' barrier category. 'Lack of time/other priorities' scored 3.5, and ranks as the second largest barrier, on average. The split incentives barrier, 'Departments not accountable for energy costs' is a very relevant barrier for small to mid size universities, scoring 4.1 on average, while scoring only 2.0 on average for large universities. This may be the result of limited ability to track energy use for small to mid size universities, which will be discussed in more detail below. 'Technology inappropriate at this site', 'Technical Risk' and 'Conflicts of Interest within the Organization' had similar discrepancies between large and small/mid size universities. Only "Business/Market Uncertainty" scored higher for large universities than for small to mid size universities.

Table 4.4: Average of Proposed Barriers

Proposed Barrier	All	Large	Small/Mid
Other priorities for Capital Investment	3.7	3.3	4.1
Lack of time/other priorities	3.5	2.9	4.3
Lack of Capital	3.3	3.3	3.4
Strict Adherence to Capital Budgets	3.1	3.4	2.7
Departments not accountable for energy costs	3.0	2.0	4.1
Cost of disruptions/hassle/inconvenience	2.8	2.6	3.0
Technology inappropriate at this site	2.7	2.1	3.4
Technical risk	2.6	2.1	3.1
Poor technology performance	2.5	2.1	2.9
Difficulty/cost of obtaining information on the energy consumption of purchased equipment	2.4	2.3	2.6
Energy manager lacks influence	2.3	2.1	2.4
Lack of staff awareness	2.3	1.9	2.7
Conflicts of interest within the organization	2.3	1.5	3.1
Energy objectives not integrated into operating, maintenance or purchasing procedures	2.1	1.9	2.3
Low priority given to environmental performance	2.1	1.9	2.3
Business/market uncertainty	2.1	2.1	2.0
Low priority given to energy management	2.0	1.8	2.3
Cost of identifying opportunities, analyzing cost effectiveness and tendering	2.0	1.8	2.3
Lack of technical skills	1.9	1.6	2.3
Cost of staff replacement, retirement, retraining	1.9	1.8	2.1
Lack of information/poor quality information on energy efficiency opportunities	1.9	1.8	2.0
Average	2.5	2.2	2.8

Table 4.5 below indicates that, 'Access to Capital' is a barrier that, on average, universities in all provinces but Ontario experience. Interestingly, small universities score lowest on this barrier.

Access to capital

Table 4.5: Access to Capital as a Barrier

	Ontario	Québec	British Columbia	Alberta	Saskatchewan	Nova Scotia	Average
Small		2.7		3.7		3.0	3.1
Mid	2.7	4.0	4.0				3.7
Large	2.3	4.7	3.3	2.7	4.3	4.3	3.3
Average	2.4	3.8	3.8	3.2	4.3	3.7	3.4

Above 3.0 - a level of Agreement	Neutral Score is 3.0	Below 3.0 - a level of Disagreement

Cross-sectional results of the remaining five barrier categories can be found in Appendix A.

Process for Funding and Implementing Energy Conservation Projects

The process universities use to fund and implement energy conservation projects was investigated. It was found that 60% of universities interviewed have an Energy Manager at their institution. Table 5.1 outlines that 6 of the 8 large universities interviewed employ an Energy Manager, and 3 of the 4 mid size universities do, while none of the 3 small universities interviewed employ an Energy Manager, citing staffing limitations.

Table 5.1: Existence of a Campus Energy Manager

	Ontario	Québec	British Columbia	Alberta	Saskatchewan	Nova Scotia	Total
Small							
Mid		1	2				3
Large	3	1	1	1			6
Total	3	2	3	1			9

40% of universities interviewed have an Energy Committee. Table 5.2 below shows that this includes all of the universities interviewed in BC, 2 of the 4 universities interviewed in Ontario, and the lone university interviewed in Saskatchewan. None of the 3 small universities interviewed make use of an energy committee, while 50% of mid and 50% of large universities interviewed make use of an energy committee.

Universities from both BC and Quebec reported provincially mandated emissions reduction targets along with the receipt of provincial funding for energy efficiency measures. The two universities interviewed from Nova Scotia both mentioned the assistance of provincial grants to support the funding of projects. For the most part, universities indicated that smaller energy efficiency projects are internally funded through the facilities and services budget, while larger projects beyond the scope of the budget are brought to the governing board for approval.

Almost all of the universities interviewed rely on internal constituents to make decisions on energy projects. Though 6 of 15 universities interviewed have a formal energy committee, several other universities stated they have an "informal" committee of constituents. One university described the informal committee they use as consisting of six people:

"These people from design, project management, energy, operations & logistics and maintenance need to be involved in the process. We decided to have a director level position in utilities and energy management and another separate in operations. Each come with their own agenda – one is trying to conserve, the other defends needs – by doing so [we] can hear the overall story and can understand what is best for the university" (Anonymous C, 2011).

There were some other universities who have very few staff members who decide, with one Director outlining the process for energy efficiency projects as, "When I have time to do them, I will do the economic analysis and approach administration for funding" (Anonymous D, 2011). Several other universities stated that the technical staff act in an expert role to decide on projects internally.

Table 5.2: Existence of an Energy Committee

	Ontario	Québec	British Columbia	Alberta	Saskatchewan	Nova Scotia	Total
Small							
Mid			2				2
Large	2		1		1		4
Total	2		3		1		6

Beginning with the Stockholm Declaration of 1972, there has been a steady development of national and international sustainability declarations relevant to higher education. Today, universities and intergovernmental institutions have developed more than 31 Sustainability in Higher Education (SHE) declarations, and more than 1400 universities have signed a SHE declaration globally (Grindste, 2011). Many institutions of higher education attempt to become more sustainable by signing these declarations (Wright, 2002). Several studies show, however, that signing a declaration does not necessarily lead to implementation of the declaration's principles of sustainability, and that universities have either found themselves unable to implement the declaration's principles or have not made efforts towards their implementation (Clugston et al., 1999; Wright, 2002, Lidgren et al., 2006, Bekessy, 2007; Alshuwaikhat et al., 2008): "it is widely known that the adoption of sustainability declarations (…) does not necessarily translate into the implementation of their basic commitments" (Bekessy et al., 2007).

The 1993 report, 'Environmental responsibility: an agenda for further and higher education', addressing the UK Higher Education sector, recommend that universities adopt comprehensive environmental policy statements, including timetables, targets and the allocation of responsibilities for implementation. In addition, the report recommends integrating environmental considerations into capital programs and adopting environmental performance indicators. This resulted in thirty-nine institutions in the UK adopting an environmental policy while 21 appointed an environmental coordinator and 15 adopted an environmental budget. A study by Sorrell (2004) found that 81% of the 29 UK Higher Education institutions responding to a 1999 survey had an energy policy of some kind. In this study, only 27% of universities interviewed, or 4 out of the 15, have developed, or are in the process of developing an energy policy. Table 5.3 below shows that this consists of all three universities interviewed in BC, and one of the three universities interviewed in Quebec. Universities suggested that a policy would be helpful, though several were concerned about the time and resources required to draft the policy. Others were concerned about the expectations they may create, with one respondent stating, "It is difficult to meet targets even if you want to – there are other issues – energy savings you thought you might have that don't materialize. It is often very hard to predict targets / reductions and to deliver on them. And so they may be very conservative since reputation is important – want to be assured it can meet what it is set to" (Anonymous E, 2011). One respondent stated he saw the need for a policy, but was unsure what that would look like, as it would need to be effective and efficient. Another respondent stated he would be surprised if the policy isn't simply, "use less and make it cheaper" (Anonymous F, 2011).

Table 5.3: Existence of an Energy Policy

	Ontario	Québec	British Columbia	Alberta	Saskatchewan	Nova Scotia	Average
Small		1					1
Mid			2				2
Large			1				1
Total		1	3				4

Revolving Funds

Participants were sent an information document on revolving funds to ensure base knowledge on their operation. Based on responses, only 3 of 15 universities currently administer a green revolving fund, 40% of universities have a portion of their annual budget committed to energy efficiency improvements and 33% commit energy cost savings from efficiency improvement to future projects in some form.

Respondents were asked questions to gauge their impression of the benefits of revolving funds. Table 6.1 below indicates that on average, there was agreement by universities of all sizes regarding the benefits of revolving funds as outlined by SEI (2011). The exception were large universities scoring 2.9 who stated that revolving funds would not increase tracking of water use and other sustainability data on campus, as many large universities indicated they already track this data. There is evidence that in most cases, however, revolving funds do motivate increased tracking of data on campuses. Iowa State University, which administers a revolving fund, decentralized its management of utility payments. Energy use is now monitored and paid separately by each building. As a result, Green Revolving Fund (GRF) loans can be administered and tracked locally, allowing individual building budgets to benefit from cost-saving improvements (SEI, 2011). The University of Toronto was the only university interviewed in this study to also decentralize its utility payments. Not only does this allow universities to better track energy usage, but increasing measurability fosters accountability, thereby addressing the split incentives barrier that some universities continue to confront. Some universities stated that sending faculties bills that they do not have to pay, but communicate their energy use, helps to address the split incentives barrier and motivate energy efficiency.

Table 6.1 : Impression of Revolving Fund Benefits

Revolving Fund Benefits	All	Large	Mid	Small
Effective method to address capital funding constraints	4.0	3.7	4.0	5.0
Offers opportunities for interdisciplinary education, research on sustainability, institutional assessment	3.9	4.3	3.3	3.5
Increases tracking of water use and other sustainability data on your campus	3.3	2.9	3.3	5.0
Average	3.7	3.6	3.5	4.5

Above 3.0 - a level of Agreement	Neutral Score is 3.0	Below 3.0 - a level of Disagreement

Three universities in the sample currently implement a revolving fund. One of these universities based in Nova Scotia, addressed the impetus for the creation of the revolving fund by stating, "One of the real enablers was the province. They have a department we were working closely with, you identify a project, see how much you save, and they reimburse you or get rebates, and that funds another project. The province is a big partner." Also stating, "green funds target things we are not going to do normally, payback is figured out and we implement additional projects" (Anonymous G, 2011).

Another respondent that currently implements a revolving fund indicated they started to set aside funds to advance sustainability on campus, not so much for energy efficiency**,** but rather for water, waste, education and sustainability initiatives, as there was a lack of funding to do so. "It is in the first year. We awarded some projects in January, going to do more in 2012. Based on early indications it is doing quite well" (Anonymous H, 2011).

The third respondent implementing a revolving fund stated the reasons for doing so were to, "reduce environmental impact, save the institution money over time, educate and empower the university community to take action, and to illustrate the university is action oriented" (Anonymous I, 2011).

Table 6.2 below indicates that on average, universities agreed with the barriers outlined by SEI (2011), that the multi-constituent committees, tracking of costs and savings and the administrative burden of administering the fund all present barriers to implementing revolving funds. Exceptions were large universities on average responding neutrally on the administrative burden, and small universities on average disagreeing that accounting issues associated with tracking costs and savings were a barrier.

Table 6.2: Impression of Revolving Funds Barriers

Proposed Barrier	All	Large	Mid	Small
Multi-constituent committees problematic with administrative functions	3.7	3.6	3.5	4.5
Accounting issues associated with tracking costs and savings of projects	3.4	3.4	4.0	2.5
Administrative/staff burden of managing the fund	3.3	3.0	3.5	4.0
Average	3.5	3.3	3.7	3.7

Above 3.0 - a level of Agreement	Neutral Score is 3.0	Below 3.0 - a level of Disagreement

The overall impression of revolving funds was gauged and both mid and small universities agreed that 'A revolving fund may be an effective method to implement energy conservation projects at their university', scoring, on average, 4.5 and 5.0 respectively, while large universities were, on average, neutral, scoring 2.9. See Table 6.3 below.

Table 6.3: Impression of Revolving Funds Barriers

Overall Impression	All	Large	Mid	Small
A revolving fund may be an effective method to implement energy conservation projects at your university	3.6	2.9	4.5	5.0

Above 3.0 - a level of Agreement	Neutral Score is 3.0	Below 3.0 - a level of Disagreement

Discussion

The results offer a curious contradiction. Though respondents scored 'Access to Capital' as the largest barrier (3.4) to energy efficiency on average, and though respondents agree (4.0) that revolving funds are an effective method to address capital funding constraints, and that revolving funds may be an effective method to implement energy conservation projects at their university (3.6), only 4 out of the 83 universities in Canada are known to currently implement revolving funds as a tool to address this barrier[3]. The discussion below investigates these issues, and also outlines why large universities on average responded neutrally to the statement that a revolving fund may be an effective method to implement energy conservation projects (2.9).

One mid-sized university simplifies this contradiction, stating, "… to get this concept of revolving fund accepted by the administration, they are intelligent enough to see the benefit of it. The most important barrier is to put the funds initially in the fund" (Anonymous J, 2011). However for most universities, the barrier is not as straightforward.

In the case of one large university, which had a revolving fund, the fund acted as a tool, or a bridge to confront restrictions, build confidence and establish consensus on energy efficiency projects within the university. The university no longer implements the revolving fund. "It didn't fail, it was

[3] As identified by both this study and in *Greening the Bottom Line* by the Sustainable Endowments Institute, 2011.

successful, but we went in a different direction. It was a look at how we do our budgeting and simplifying the process. We are looking at it from a larger scale. It's a next step; we no longer need a revolving fund to justify the implementation. Once you have the belief, the management of the fund does become a complication" (Anonymous K, 2011).

Several large universities outlined that there was no need to do the accounting work behind projects once they are implemented. "We don't do the accounting process of making the money go in a circle" (Anonymous L, 2011).

An institution may appoint certain groups to identify projects for funding because it wants particular expertise, or has the aim of involving particular stakeholders. In some cases, the responsibility is shared among multiple stakeholder groups (SEI, 2011). Reluctance to have students on committees had one respondent stating, "If there was a pod of money available, we would be hesitant to have students decide where it goes" (Anonymous M, 2011). From a process perspective, in some cases Green Revolving Fund project identification and selection is left solely to staff with the greatest financial or technical expertise. In other cases, the process is highly collaborative and engages many campus stakeholders. The administration of green revolving funds can be structured to fit a wide variety of operational and organizational settings (SEI, 2011).

Another university stated though they do not use cost savings from past energy projects to invest in future projects, they do use the past success stories in order to promote additional measures. They stated, "having a more hard wired structure isn't necessary for us right now, we have had good success without it." However, the university does outline that revolving funds may play an important role as a tool for institutions to prioritize energy efficiency, stating "if there was a new person [in an administrative capacity], from a different world, where it was more formalized, [a revolving fund would be useful] to ensure [energy efficiency] is getting proper attention" (Anonymous N, 2011).

Another large university which currently has funding in their budget allocated for energy efficiency projects stated that revolving funds were, "unnecessary", as, "the accounting time, engineering time, funding that has to be shuffled, and exactly measured ... takes time and energy away from other projects" (Anonymous O, 2011). For the British Columbia Institute of Technology, however, its fund has "helped remove silos and has given isolated working groups the proper incentive — a budget — to collaborate." According to an administrator, "The perception had been that collaboration would make more work for people, but now because money is available from a common fund, it has created an incentive for departments, whose common interest is cost-savings, to work together" (SEI, 2011).

Both Newman and Abrams (2005) and Filho (2005) show that all levels of stakeholders within the university, including administrators, students, staff, and faculty, must be engaged in sustainability initiatives and decision-making processes in order to ensure their long-term success. (Clugston and Caldar, 1999; Hammond Creighton, 2001; Riggs, 1997) find that leadership is pivotal for institutional change, while (Jahiel and Harper, 2004) find the lack of it can also be a common barrier.

Calvert and Cohen (2011), outline the need for a more comprehensive energy strategy in Canada, including a much stronger government role, to shape Canada's energy future in order to address environmental issues such as Climate Change. These provincial measures are reflected in the actions of institutions like universities in those provinces, presented through the data above. Though the provinces of BC and Quebec have provided direction and funding, there has been less direction from other provinces, and at the federal level.

The study found that 11 of the 15 universities interviewed do not have an energy policy, and that the process towards energy efficiency at universities is generally considered on an incremental / case-by-case basis. The research found a reluctance to formalize processes to prioritize energy efficiency implementation – reluctance to create a formal energy policy to adopt comprehensive environmental policy statements, including timetables, targets and the allocation of responsibilities for implementation – and reluctance to involve multi-constituent committees within internal decision making processes, limiting the associated benefits of mechanisms such as revolving funds to institutionalize energy efficiency and reduce long term energy use at universities

Conclusion and Recommendations

The results of this study indicate a wide variation in progress on the operationalization of energy efficiency amongst Canadian Universities. Though all universities are implementing energy efficiency projects, the process to implement these projects, the resources and funding available to do so, vary.

Universities on the whole indicated 'Access to Capital' as the leading barrier to implementing energy efficiency projects. Though respondents agree that revolving funds are an effective method to address capital funding constraints, only 4 of the 83 universities in Canada are known to use this mechanism to address this barrier. Universities agree that multi-constituent committees may provide a challenge to existing administrative procedures in implementing revolving funds, though, even using less formal structures, only 33% of universities currently use energy savings to re-invest in new projects. Universities also agree that accounting issues associated with tracking costs and savings of projects represent a barrier, however, several universities indicated that tracking costs, and communicating them to faculties is an effective method to reduce the split incentives barrier.

Small and mid-size universities strongly agree that revolving funds may be an effective method to implement energy conservation projects at their universities, though large universities on average scored neutral, due to preference for current processes. When evaluated against current processes for funding and implementing energy efficiency projects, revolving funds: prioritize energy efficiency within institutions, act as an effective method to address capital funding constraints, increase tracking of water use and other sustainability data, foster collaboration between offices of finance, sustainability, facilities, faculty, and students, and offer opportunities for both institutional assessment, and interdisciplinary education and research on sustainability. As such the benefits of implementing revolving funds likely outweigh the resource requirements, depending on the current efficiency and operationalization of energy efficiency projects at the university. There may be more benefits in implementing revolving funds by universities in the preliminary stages of confronting restrictions, building confidence and establishing consensus to operationalize energy efficiency at their university. However, for universities that have achieved greater operational efficiency, reluctance to formalize processes to prioritize energy efficiency implementation, such as through an energy policy, or through engaging all stakeholders in decision-making processes will likely limit improvements in energy efficiency over the long term.

It is recommended that Canadian university senior administrators:

- develop formal commitments to energy efficiency through the creation and adoption of a formal energy policy; and,
- establish multi-party committees to develop and implement the policy and to source the necessary funding to create and implement revolving funds to provide environmental, social and financial benefits.

Appendix A: Cross-Sectional Results of Barrier Categories

The remaining barriers scored as follows:

Above 3.0 - a level of Agreement	Neutral Score is 3.0	Below 3.0 - a level of Disagreement

Table 4.6: Bounded Rationality

	Ontario	Québec	British Columbia	Alberta	Saskatchewan	Nova Scotia	Average
Small		1.0		1.8		2.6	1.8
Mid	2.6	3.3	2.8				2.7
Large	1.7	1.8	1.5	2.8	1.5	2.3	1.8
Average	1.8	2.0	2.3	2.3	1.5	2.5	2.1

Table 4.7: Hidden Costs

	Ontario	Québec	British Columbia	Alberta	Saskatchewan	Nova Scotia	Average
Small		2.5		2.8		2.8	2.7
Mid	2.8	3.5	3.3				3.2
Large	2.4	1.3	2.0	2.2	2.3	2.7	2.2
Average	2.5	2.4	2.8	2.5	2.3	2.8	2.6

Table 4.8: Imperfect Information

	Ontario	Québec	British Columbia	Alberta	Saskatchewan	Nova Scotia	Average
Small		1.3		1.7		2.3	1.8
Mid	2.7	3.3	2.8				2.9
Large	2.0	2.0	1.7	2.3	1.7	2.0	2.0
Average	2.2	2.2	2.4	2.0	1.7	2.2	2.2

Table 4.9: Risk

	Ontario	Québec	British Columbia	Alberta	Saskatchewan	Nova Scotia	Average
Small		2.5		2.0		3.0	2.5
Mid	1.5	3.5	2.8				2.6
Large	1.7	1.0	4.0	2.5	2.5	2.0	2.1
Average	1.6	2.3	3.2	2.3	2.5	2.5	2.3

Table 4.10: Split Incentives

	Ontario	Québec	British Columbia	Alberta	Saskatchewan	Nova Scotia	Average
Small		2.0		2.7		3.0	2.6
Mid	3.3	3.3	4.0				3.6
Large	1.4	1.0	1.7	1.3	2.7	3.3	1.9
Average	2.4	2.1	2.8	2.0	2.7	3.2	2.5

References

Alshuwaikhat, H., Abubakar, I. (2008). An integrated approach to achieving campus sustainability: assessment of the current campus environmental management practices, *Journal of Cleaner Production*, 16, pp. 1777-1785.

AUCC (2008), Trends in Higher Education – Finance, Vol. 3, Association of Universities and Colleges in Canada, Ottawa.

Bekessy, S., Samson, K., Clarkson R., 2007, The failure of non-binding declarations to achieve university sustainability– a need for accountability, *International Journal of Sustainability in Higher Education*, Vol. 8, No. 3, 30 p.

Booth, E., Doris, E., Knutson, D., Regenthal, S., Revised 2011, *Using Revolving Loan Funds to Finance Energy Savings Performance Contracts in State and Local Agency Applications,* National Renewable Energy Laboratory, USA.

Calvert, J. and Cohen, M., 2011, *Climate Change and the Canadian Energy Sector,* Canadian Centre for Policy Alternatives.

Clugston, R. and Caldar, W. (1999), "Critical dimensions of sustainability in higher education", in Filho, W.L. (Ed.), Sustainability and University Life: Environmental Education, Communication and Sustainability, Peter Lang, Berlin, pp. 31-46.

DeCanio, S.J., 1998. The efficiency paradox: bureaucratic and organizational barriers to profitable energy saving investments. Energy Policy 26, 441–454.

Filho, W.L. (2005), Handbook of Sustainability Research, Peter Lang, Frankfurt am Main.

Grindsted, T, 2011, Sustainable universities – from declarations on sustainability in higher education to national law, Environmental Economics, Volume 2, Issue 2, 29-36.

Hammond Creighton, S. (2001), Greening the Ivory Tower – Improving the Environmental Track Record of Universities, Colleges, and Other Institutions, MIT Press, Cambridge, MA.

International Energy Agency (IEA), 2007. Mind the Gap — Quantifying Principal-Agent Problems in Energy Efficiency. OECD/IEA, Paris.

International Energy Agency (IEA), 2008. World Energy Outlook 20088. OECD/IEA, Paris.

Jaffe, A.B., Stavins, R.N., 1994. The energy-efficiency gap: what does it mean? Energy Policy 22, 804–810.

Jahiel, A. and Harper, R. 2004, "Green task force: facing the challenges to environmental stewardship at a small liberal arts college", in Barlett, P. and Chase, G. (Eds), Sustainability on Campus – Stories and Strategies for Change, MIT Press, Cambridge, MA.

Kalapos, K. and Jessup, P., 2005, *Revolving Funds: Municipalities can turn their energy costs into gold,* Alternatives Journal 31:1.

Newman, J. and Abrams, E. (2005), "Reaching beyond compliance: obstacles to integrating sustainability into decision-making processes in an institution of higher education", in Filho, W.L. (Ed.), Handbook of Sustainability Research, Peter Lang, Frankfurt am Main,pp. 641-64.

Riggs, H. (1997), "Industrial strength academies", in Meyerson, J. and Massy, W. (Eds), New Models for Higher Education, Peterson's Princeton, Princeton, NJ.

Sustainable Endowments Institute (SEI), 2011, Greening *the* Bottom Line *The Trend toward Green Revolving Funds on Campus,* Cambridge, MA.

Schleich, J., 2009, *Barriers to energy efficiency: A comparison across the German commercial and services sector,* Fraunhofer ISI, Germany Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA.

Sorrell, S., O'Malley, E., Schleich, J., Scott, S., 2004. The Economics of Energy Efficiency — Barriers to Cost-effective Investment. Edward Elgar, Cheltenham.

United Nations Environment Programme (UNEP), 2007, Buildings and Climate Change: Status, Challenges and Opportunities.

Wright, T, 2002, Definitions and frameworks for environmental sustainability in higher education, International Journal of Sustainability in Higher Education, Vol. 3 No. 3 2002, pp. 203-220.

Wright, T, 2009, University presidents' conceptualizations of sustainability in higher education, International Journal of Sustainability in Higher Education, Vol. 11 No. 1 2010, pp. 61-73.