



Energy Efficiency in University Buildings

The Bottom Line on Conservation

In many respects, Ontario's businesses have led the way in creating a culture of conservation in the province. Companies, both large and small and across all sectors, are investing in energy saving and seeing the results in their bottom line. In 2014 alone, business conservation efforts through the IESO's saveONenergy programs resulted in almost 600 GWh of energy savings.

The business case for conservation is pretty clear – it cuts costs. But conservation also delivers broader benefits for all Ontarians – reducing the need to build new infrastructure and lowering the wholesale price of electricity. We are helping to make our province more competitive for business while also contributing to a cleaner environment.

That's why the province has moved to new a framework that puts conservation first before all other supply options. This opens up a myriad of opportunities for businesses that are able to shift or reduce their demand for electricity. Through the IESO's saveONenergy programs, there are numerous opportunities for businesses to reduce their overhead costs through retrofits, energy audits, lighting and equipment upgrades and participating in demand response.

This success, however, is only possible by business, industry, associations and public agencies working together to use their collective strengths to increase our conservation and business competitiveness.

We need this collaboration to continue. Over the past four years, we have seen businesses step up their conservation efforts – not only to capture cost savings but also capture the strategic value that conservation can offer their organizations.

Now we need to push further. The province has set new conservation targets – ones that are more ambitious than in previous years. Our research shows that there remain more than enough opportunities for us to work with businesses to achieve these results. We need to develop more comprehensive solutions – including embedding sound energy management practices within the very core of business decisions.

This publication aims to further this conversation. There are many dedicated individuals with great ideas about how to enhance our province's conservation capability – you will learn their stories here.

To find out what conservation can do for your business, visit saveonenergy.ca/getstarted.

Terry Young

Vice-President, Conservation and Corporate Relations
Independent Electricity System Operator



(L-R) Barry Sampson, partner, Baird Sampson Neuert Architects; Paul Leitch, Director, Sustainability Operations and Services, University of Toronto; Sean O'Leary, president, Energreen Technologies; Peter Sobchak, Editor, Building magazine; Mark Cammisuli, Energy Solutions Consultant, Enbridge Gas Distribution; John Maiorano, OISE / School of the Environment, University of Toronto; Mary Quintana, Energy & Water Projects, Facilities Management, Western University; Mike Williams, Rowan Williams Davies & Irwin Inc.; Mike Szabo, principal, Diamond Schmitt Architects (photos by David Lasker).



The Energy-Efficient University

If there is any doubt that universities are akin to self-sufficient towns, let's look at a few facts. Take any major post-secondary institution in Ontario, and when the population of students, faculty and staff are combined it is often in the tens of thousands, equal to that of a small urban centre. Scores of buildings dot their campuses, varying in purpose from office and student accommodation to classrooms and libraries, sports and theatre facilities, museums and research labs, even ancillary restaurants and shops. The age of these buildings varies too, depending on the school: some are brand new; some can date back to the school's founding in the 1800s; and then, of course, many are renovated hybrids.

A whole lot of energy is required to run these little "towns." According to a 2003 National Resources Canada report, universities across Canada that year "consumed a total of nearly 37 million gigajoules, an amount equal to the annual average consumption of approximately 320,000 Canadian households, or of all the private dwellings in the metropolitan area of Québec."

The numbers surely have risen in the ensuing years – and that was the crux of a roundtable held in early March to discuss energy efficiency in university buildings. Made possible by Independent Electricity System Operator (IESO), at the table were experts from a spectrum of industries including university administration, utility providers, architects, researchers, equipment vendors and more, debating questions such as how do we keep consumption figures from rising further, and what it

A powerful primer for institutes of higher learning

by Leslie C. Smith

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QUINTANA: It definitely affects our competitiveness, how we are able to manage our energy costs. And they are becoming so significant that I think the best example of it is that so many universities have turned into generators themselves to manage the energy costs.

SAMPSON: Most universities are moving to a budget model where basically the divisions are given an allocation and they budget everything. And so, they will become responsible for their utilities.



would take to get them to flat-line or even drop? Solving these questions would mean enormous cost savings for the universities themselves, and greater ecological good for our society. Yet barriers to achieving the answers are many and complex.

Arrested Development

A good way to start saving energy is by picking off low-hanging fruit. Easy fixes, such as improved lighting, daylighting upgrades and fine-tuning operational schedules can rein in overspending. Paul Leitch, the University of Toronto's director of sustainability operations and services on the St. George Campus, recalls one such example: "I was looking at the schedules for a building not that long ago [and found] that we had them flipped day for night ... The PM and the AM had gotten mixed up somehow. We fixed that and figure we're saving on that air-handling unit alone \$18,000 a year."

Of course, one has to measure energy usage before any corrections can be implemented. For example, in a report prepared in July 2014 by the Council of Ontario Universities titled *Growing Greener Campuses at Ontario Universities*, of 22 campuses canvassed across Ontario only 13 actually had installed energy meters in their buildings.

And, once such fruit has been plucked, things begin to grow more problematic. Uof T is large enough to have dedicated staff and executives such as Leitch sussing out ways to improve efficiency, but others may find their human resources don't stretch that far. A 2013 report, *Barriers to Energy Efficiency*, co-authored by grad student John Maiorano and Dr. Beth Savan, of U of T's School of the Environment, found that only 60 per cent of Canadian universities interviewed employ an energy manager, and only 40 per cent have formed a committee to consider energy-related issues. This study also discovered that, despite energy being considered seventh on the list of key issues facing universities over the next decade, "11 of 15 universities interviewed do not have an energy policy, and the process toward implementing energy efficiency projects at universities is generally considered on a case-by-case basis." One anonymous director outlined the process as follows: "When I have time to do them, I will do the economic analysis and approach administration for funding."

Studies show that because of their unique requirements, such as needing high air-exchange levels for labs and classrooms, universities are 60 per cent more energy-intensive than commercial offices and more than twice as energy-intensive as manufacturing premises. Concern about energy

issues therefore tends to rise exponentially when external pricing starts squeezing university budgets. But those budgets themselves can prove major stumbling blocks to saving.

Barry Sampson, principal with Toronto's Baird Sampson Neuert Architects, puts it this way: "The whole Canadian model of financing public sector infrastructure is a two-silo model. There's the capital silo – and it's always fixed; it's never flexible – and then there's the operating silo, and they do not cross-communicate. So you can't, for example, transfer extra capital costs for LED lighting into the operational silo because they don't communicate. Universities have all got huge deferred maintenance bills. They're basically scotch-taping together buildings to keep things operating. There's no capacity in that silo to finance components in the capital silo that would improve their energy efficiency."

Adequate access to capital remains a constant worry to university administrators. Internal budgeting procedures aside, they may find their funding coming up short. They may not want or even be able to raise additional funds through borrowing. They are rightly concerned about hidden energy reconfiguration costs, such as reduced service quality, safety and working conditions, extra maintenance, and staff training. And they may be hampered by an administrative rulebook that dictates return on investment over a too-short period of time. LED lights, for instance, are triple the cost of regular lighting, yet will more than make up for that over their eight-year lifespan. Many administrations, however, demand proof of ROI within a five- or even three-year cycle, effectively removing these lights from consideration.

Game Changers

Government policies can establish new ground rules that would push or oblige universities to remediate the status quo. These could be incremental in approach, such as Ontario's new Green Energy Act, which requires all public agencies to publish energy consumption reports online. Or they could involve actual regulation, such as Toronto's new Green Standards, which mandate energy- and ozone-saving baselines. Prestigious international projects like Architecture2030 and special industry certification, including BOMA BEST and LEED Gold, give designers and clients alike ambitious targets to aim for.

But all these apply only to new builds. Impetus for change to current building stock could indeed come from above, driven either by a university's administration or some government agency. Yet that's not so likely to happen, said

Power Up: Tools to spark energy efficiency projects

There are many reasons to focus on upgrading or modernizing systems for energy efficiency, ranging from reduced operating cost, increased sales, improved employee comfort and effectiveness. There are incentives, rebates, tools and resources available to ensure your business takes advantage of these opportunities to improve competitiveness. In Ontario, saveONenergy funding is available through a variety of programs, such as:



Funding for Energy Audits and Engineering Studies

Often a first step for a business, these are used to identify opportunities for improvements and provide business cases including: energy savings by potential projects; identify potential non-energy related improvements by project including productivity, safety, yield, sales, and so on; identify the capital cost of the projects; summarize the return on investment for each project and prioritize the projects based on capital cost, lifecycle cost savings and non-energy related financial benefits, then uses this to provide return on investment, savings to investment ratio, payback periods, and so on.

- saveONenergy covers up to 50 per cent of audits, and once opportunities are identified in the audits, more detailed engineering studies can define what exactly is required and provide more accuracy on the potential savings and costs. 100 per cent of the cost of engineering studies is covered by saveONenergy.



Funding for Retrofits

Once a business is ready to upgrade to high-efficiency systems like lighting, HVAC systems, pumps, motors, fans and other plant equipment, funding is available through saveONenergy. Companies can receive up to 50 per cent of their project costs through the program.



Funding for Energy Managers

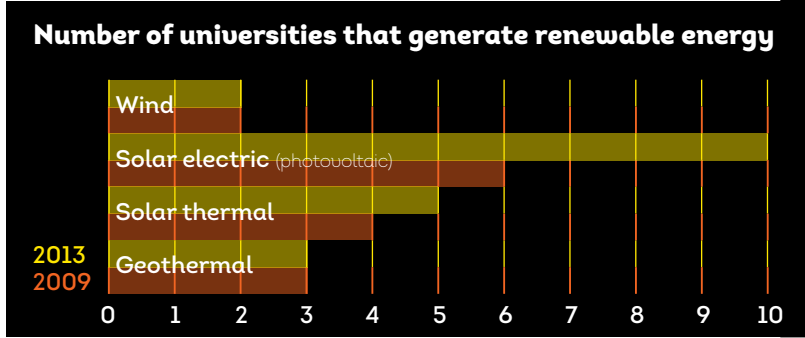
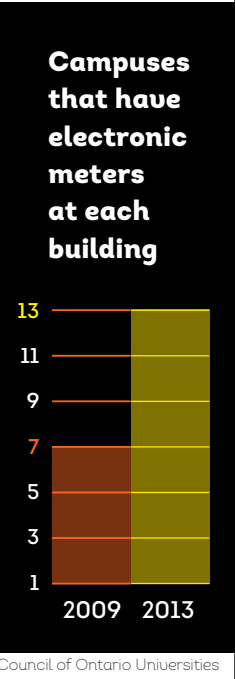
Free energy manager resources may be available through local utilities' Roving Energy Manager Program. Incentives worth up to 80 per cent of the salary of hiring a full time energy manager may also be available.



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LEITCH: We're lucky if we get to think of an ROI that includes anything down the pipe. Where all the buildings here are, in theory, going to be here for another 100 years, you'd think that we would do a little bit more lifecycle cost analysis, and we don't really.



WILLIAMS: I think if we're going to get to sustainability, zero-energy buildings, we're going to have to move away from having it be 21°, 60 per cent relative humidity all the time. And so I think we need to redefine expectations of clients.

Mike Williams, technical director at Rowan Williams Davies & Irwin Inc., a Canadian firm of consulting engineers and scientists: “I got to study in Europe and there it's very top-down. They have policies and they force people to do it. When I came back here, I found it's very grassroots and bottom-up.”

The grassroots level requires much more time to impact top decision-makers. Campuses, however, are a great place to find people who care about sustainability initiatives and to cultivate recruits to the cause. Several institutions, London's Western University for one, have turned the process into a learning experience by publishing real-time energy consumption information on publicly accessed dashboards. “Students, faculty, researchers – they can all go and see how much energy their building is using at that very time,” said Mary Quintana, the facilities management department's compliance coordinator. “They can see how it compares to other buildings on campus based on the energy-use intensity.”

The flipside of that public face is all the behind-the-scenes monitoring and analysis Western's freshly updated system allows: “We can detect leaks, we have alarms for backflows on the new meters. [It has] really helped Western manage energy and water. We're still behind. We have so many buildings that we have to get to. But we have been able to establish targets for the next five years,” said Quintana.

Targets help. And education can build champions for change. Even so, in the here-and-now more is required. Some specialized consultants – mostly engineers and architects – have already stepped up to the plate, undertaking the research and development necessary to solve energy-use conundrums for buildings both new and old. Many suppliers as well now act as partners to large institutions, bringing a wealth of professional expertise to the table.

One such supplier-partner is Sean O'Leary, president of Energreen Technologies, a high-efficiency engineering group. His opinion is that professional partnerships work best when the focus is on the big picture: “From an actual services standpoint – payback analysis, measurement and verification – that's one thing. But where we find it works the best is having a holistic approach, an overall analysis. We can work with a team and use our experiences at other places and say, ‘Look, here's what's working here. Here's what's working there.’”

Incentive programs from corporate energy partners can also assist universities by offsetting certain financial constraints, said Mark Cammisuli, a consultant with Enbridge Gas Distribution: “The fundamental purpose for incentives, both

from the electric side and from the gas side, is to encourage activity above and beyond standard practices.” One example would be window replacement: “If you decided to upgrade from single- to double-pane windows, I can't give you anything because if you're going to replace those windows, you're not going to put more single-pane windows in. We want to see you go with triple-pane, low-emissivity, argon-filled windows.”

This kind of incentivized solution offers a win-win for everybody. Or it would, if every Canadian university had the right fiscal structure in place. According to Leitch, however: “We are not allowed to carry off-book financing. It's a debt to us. That's the issue.... I'm going to meet a group today who wants to do all our lighting and they'll pay for it and they'll give us a three-year payback and they keep the money. It can't happen. I have to tell them [that].”

So how can universities break the constraints that have been holding back true energy efficiency? The answer may well lie in an entity known as the green revolving fund. This is a kind of a capital nest egg, a pool of money either raised or set aside solely to support energy-saving, ecology-friendly projects. Cost savings are measured and go back into this self-supporting fund and the cycle repeats itself, over and over again. In his research, John Mariano found that revolving funds not only reduce energy consumption, waste generation and pollution levels, their rate of return often outperforms the market.

He also learned that: “While respondents agreed that green revolving funds are both an effective method to address capital funding constraints, and may be an effective method to implement energy conservation projects at their university, only two out of the 15 universities interviewed and seven out of the 98 universities in Canada currently make use of [them].” His conclusion is that the lack of adoption for green revolving funds indicates a general reluctance at Canadian universities to formalize and prioritize energy efficiency processes. Perhaps this echoes our society as a whole. As Mike Szabo, principal at Diamond Schmitt Architects, put it: “Why is it that people will go out and buy a big-screen TV [that] costs \$2,000, \$3000, and nobody really says that's a ridiculous waste of money? But as soon as we talk about sustainability, the first thing that comes up is, ‘Well, will it pay for itself?’ ”

Or, in Sampson's words: “If one could stop talking about energy costs and talk more about energy balance – see this as a social project – I think we could have more sophisticated discussions about actions that need to be taken.”

Richard Thorne, conservation supervisor for Hydro Ottawa Limited, talks about partnering with regional post-secondary institutions to improve their energy efficiency:

“Because we are a sales-based organization, we have been able to go to institutions that didn't have the time and energy to apply for energy incentives and convert them to applicants.

“The University of Ottawa has been working with us for a long time. It's a natural relationship for us. The institution's mandate is to be as sustainable as possible. They have dedicated staff to support that. Having us help them make everything as easy as possible has maximized the savings. Mainly through incentive programs, we've helped the U of O save more than \$1 million in funding over the last four years. Not only have we done large projects for them, we've been able to hoover up all the small projects – hundreds of programs for lighting and motors and variable speed drives.

“They have also had a green revolving fund for years. The University of Ottawa has expanded in size four times since the mid-70s, and they've not increased their energy footprint one bit.

“It's been a longer journey with some other institutions. They may have operations managers but sustainability is not their first mandate. We've been able to increase their participation from nothing, in Algonquin College's case for example, to between \$300,000 to \$500,000, where they'd never have applied for anything without our assistance.

“What are we doing next? Proactive strategies involve a lot more work. For instance, when you do a large chiller project, replacing an inefficient chiller with a more efficient one, the M&V [measurement and verification] is relatively easy to attribute the savings to. The next level of savings that are more proactive are things like BAS [Building Automation Systems]. We might give them an incentive to run at certain hours. But the BAS can be changed. How do you know six months down the road if the original settings are still in place? We offer a longer period of M&V – measured over a year – and we offer engineers who come in and help the customer determine the savings on a much more granular level.

“We are a highly regulated industry. We're a monopoly. And we're here to help people. We don't stop people from converting to natural gas because part of our mandate is to reduce peak demand. Every time I give someone an incentive, I'm theoretically shooting myself in the foot. But our goal at the end of the day is conservation.”

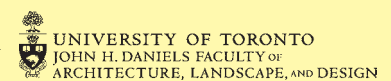
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