REALpac
Real Property Association of Canada | Association des biens immobiliers du Canada

20 BY '15

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Achieving the Office Building Target of

20 ekWh/ft^2/year by 2015

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About REALpac

REALpac, the Real Property Association of Canada is Canada's senior national real property association whose mission is to bring together the country's real property investment leaders to collectively influence public policy, to educate government and the public, and to ensure stable and beneficial real estate capital and property markets in Canada. REALpac members currently own in excess of CDN $150 Billion in real estate assets located in the major centres across Canada and include real estate investment trusts (REITs), publicly traded and large private companies, banks, brokerages, crown corporations, investment dealers, life companies, and pension funds. Visit REALpac at www.realpac.ca

About Enerlife Consulting Inc.

Enerlife Consulting is a Canadian-owned management consulting firm, based in Toronto, Canada. Enerlife provides a range of services which enable property owners and managers to achieve and sustain high levels of energy and environmental performance in their individual buildings and whole building portfolios. Visit Enerlife at www.enerlife.com

About the Author

Ian Jarvis has been President of Enerlife Consulting since 2001, and is an authority in the fields of energy efficiency, green building performance and sustainable communities. From 1992-1999 he was CEO of a leading energy performance contractor responsible for several of the largest energy retrofit projects in North America. From 2003-2007, Ian served as founding chair of the Canada Green Building Council. He is also a member of the National Advisory Council on Energy Efficiency which advises the federal Office of Energy Efficiency, and of the Ontario Energy Minister's Advisory Committee. Contact Ian at ian.jarvis@enerlife.com

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Executive Summary

The Real Property Association of Canada (REALpac) is adopting an energy consumption target for office buildings of 20 equivalent kilowatt-hours of total energy use per square foot of rentable area per year (20 ekWh/ft^2/year), to be achieved by 2015. In other words, " *20 by '15* ". The target represents a reduction of up to one half of today's energy use in Canadian office buildings. Achieving the target will lead to estimated energy cost savings in the order of $1.85 billion/year, and greenhouse gas emissions savings of 7.5 Megatonnes/year contributing 5% of Canada's national 2020 goal.

The REALpac target is derived from national, large-scale pilot projects conducted by the Canada Green Building Council (CaGBC) in 2008. The projects engaged more than 40 commercial office and government real property owners with 144 buildings totalling 48 million ft^2, and created a large, detailed database of Canadian office building energy performance. Audits were conducted of top-performing buildings to document their building system characteristics, leading to identification of best practice design standards. Workshops have also been conducted with participants to document best operational practices. Combining these design and operations best practices yields target energy use in the range of 16-20 ekWh/ft^2/year.

The CaGBC pilot projects produced a number of remarkable conclusions. The range between the highest and lowest office building energy users per ft^2 is more than 2.5:1. The range of lighting power density (Watts/ft2) is also more than 2.5:1 in new and retrofitted office buildings using similar technology for similar office space lighting applications. There is no apparent correlation between building age and performance – several of the top-performing buildings are more than 40 years old. A number of office buildings are already operating at or close to the REALpac target, and even top-performing buildings were shown to have room to improve.

The pilot project workshops, and the continuing engagement of many owners in CaGBC's ongoing Green Up program, have also helped clarify how individual buildings and portfolios can work towards achieving the target. The common perception has been that improving energy efficiency in buildings is all about technology, retrofitting and capital expenditure. The emerging new understanding is that policy, process and people are in fact at the heart of achieving and sustaining high levels of energy efficiency and deep reductions in greenhouse gas emissions. Financial returns should be greater than has previously been

expected, but significant organizational change is required to align policy, management, leasing, procurement, and HR programs with the demands of consistent energy efficient practice.

A roadmap is presented for achieving and sustaining high levels of energy performance in individual buildings and portfolios. The roadmap begins with benchmarking, and works through to performance monitoring, feedback and continuous improvement. Canada's real estate industry is positioned to have a meaningful impact on the climate change mitigation agenda, through both its own potential to demonstrate greenhouse gas emission reductions, and the example it can provide. The methodology, metrics, standards and tools described in this paper did not exist a year ago. The commercial office sector and government real property departments have shown leadership, through their participation in the CaGBC pilot projects, in both substantiating the opportunity for deep cuts in energy use and emissions, and developing the means to achieve and sustain them. REALpac's " *20 by '15* " target takes this leadership to the next level.

20 by '15

Achieving the Office Building Target of 20 ekWh/ft^2/year by 2015

1. THE TARGET – 20 ekWh/ft^2/year by 2015

Experience in business, education and health care has demonstrated the power of target-setting for achieving substantial improvements in important fields of endeavour. Targets set by the executive, affirmed in governance, and written into policy, clarify goals and expectations, engage and empower individuals, and align organizations.

Climate change is one of today's critical fields of endeavour. Construction and operation of buildings directly account for between 30% - 40% of greenhouse gas emissions in Canada (Canada Green Building Council). Improved energy efficiency in buildings presents an attractive policy option for addressing climate change mitigation. Concerted action promises substantial cuts in emissions while adding to economic growth, creating healthier indoor environments and renewing infrastructure. Policy-makers are aware of this potential, leading to increased adoption of energy efficiency regulations and incentives across North America.

Following extensive research and consultation, the Real Property Association of Canada (REALpac) is adopting an energy consumption target for office buildings of 20 equivalent kilowatt-hours of total energy use per square foot of rentable area per year (20 ekWh/ft^2/year), to be achieved by 2015. In other words, " *20 by '15* ".

The REALpac target includes all energy used in the operation of buildings (electricity, natural gas and other thermal energy sources) converted to the common energy unit of equivalent kilowatt hours (eKWh)[1]. As described in this paper, the target is set at a level which is attainable by following current best practices, and represents a reduction of up to one half of today's median energy use in Canadian office buildings. The target is intended as an essential first step in demonstrating substantial, sector-wide emissions reductions and operating cost savings, while taking full advantage of incentives and enabling it to get in front of potential legislation and/or regulations.

[1] For example, one cubic meter of natural gas equals approximately 10.5 eKWh

> **"20 ekWh is achievable at reasonable cost, in Canada, today. The achievement of the *20 by '15* target will show real estate as a leadership industry in Canada and the world."**
>
> **S. Michael Brooks, CEO, REALpac**

Based on the results of the Canada Green Buildings Council's (CaGBC) national pilot projects described below, achieving the target would lower median energy use for commercial office and government office buildings by 48.1% and 34.9% respectively[2]. The potential operating cost and emissions savings for Canada are summarized in Table 1.

Table 1

Office Type	Total Floor Area in Canada (millions ft²)[1]	2007 Median[2] (ekWh/ft²)	Target (ekWh/ft²)	Median Percent Reduction	Potential Operating Cost Savings[3]		Emissions Savings (MT)
					Total (millions)	($/sq ft²)	
Commercial Office Buildings	1,059	38.5	20.0	48.1%	$1,652	$1.56	6.8
Government Administration Office Buildings	311	30.7	20.0	34.9%	$199	$0.64	0.7
Totals	**1,370**			**45%**	**$1,851**		**7.5**

[1]Source: *NRCAN Commercial and Institutional Consumption of Energy Survey - Summary Report June 2007*
[2]Based on 56 commercial office buildings at ~31 million ft² and 73 government administration office buildings at ~13 million ft²
[3]Target energy costs based on: $0.10/kWh electricity, $0.39/m3 gas

2. WHY 20?

In 2008, 14 commercial office landlords took part in CaGBC's national pilot project with 64 buildings totalling 32 million ft². A parallel project for government office and administration buildings engaged Public Works & Government Services Canada, five provincial government real property departments, and 22 cities with 80 buildings totalling 16 million ft[2]. The total area of these participating buildings is equivalent to more than 25 Toronto Eaton Centres.

The CaGBC initiative has created a large, dynamic database of actual energy and water use performance for Canadian office buildings, conducted workshops and teleconferences with participants, and developed metrics, standards, tools and templates to help owners improve the performance of their buildings. Top-

[2] Government administrative office building median based on larger sample size than benchmark Figure 2, which contains only buildings with complete utility data from every year between 2005-2007.

performing buildings were identified and documented, and participants were able to assess their own buildings' performance and plan individual building improvements accordingly.

> **"We were surprised that some of our best buildings were only around the median on the benchmark charts. External benchmarking has helped us identify the potential for improvement."**
>
> **CaGBC Pilot Project Participant**

Total energy use benchmarking, for 2005 and 2007 is shown for commercial and government buildings in Figures 1 and 2 respectively. These benchmark charts are normalized for weather differences across the country by adjusting the heating portion of gas or oil use, and the air conditioning portion of electricity use by the ratios of heating and cooling degree days respectively between the Environment Canada weather station closest to the building and the Toronto City weather station.

The results are remarkable for the ranges between highest and lowest energy users (2.5:1 for commercial offices and 4:1 for government buildings), and the magnitude of savings already being recorded by many of the buildings.

Figure 1

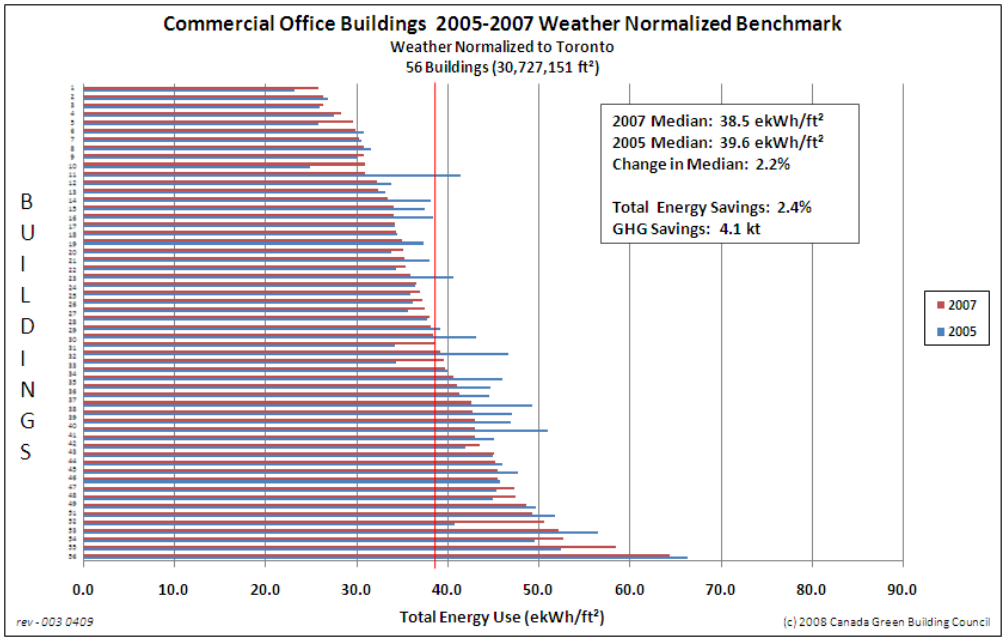
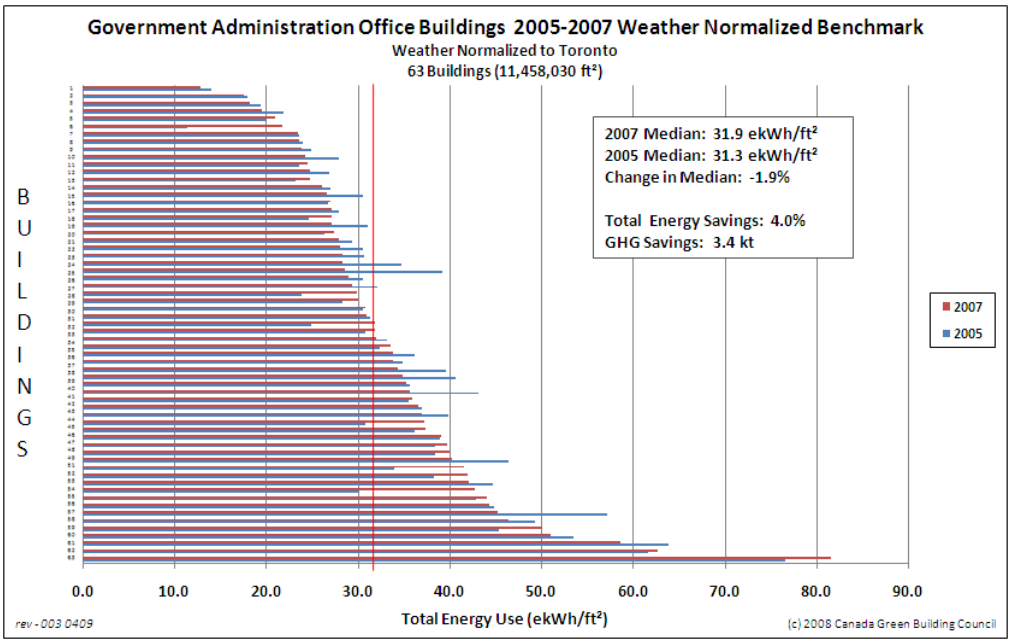


Figure 2



A normalization template was developed to account for material space, occupancy and energy source differences between buildings (such as data centres, retail space and electric heat). The template has been aligned with the U.S. Environmental Protection Agency's Portfolio Manager so that Energy Star scores can also be calculated. Normalization allowed the identification of top-performing buildings presented in Table 2. These results are interesting in a number of ways, including no apparent correlation between building age and performance, and the indicated room for further improvement in energy use components.

Table 2

2008 Commercial and Government Administration Office Building Top Performers
(Weather Normalized to Toronto Lester B Pearson Int)

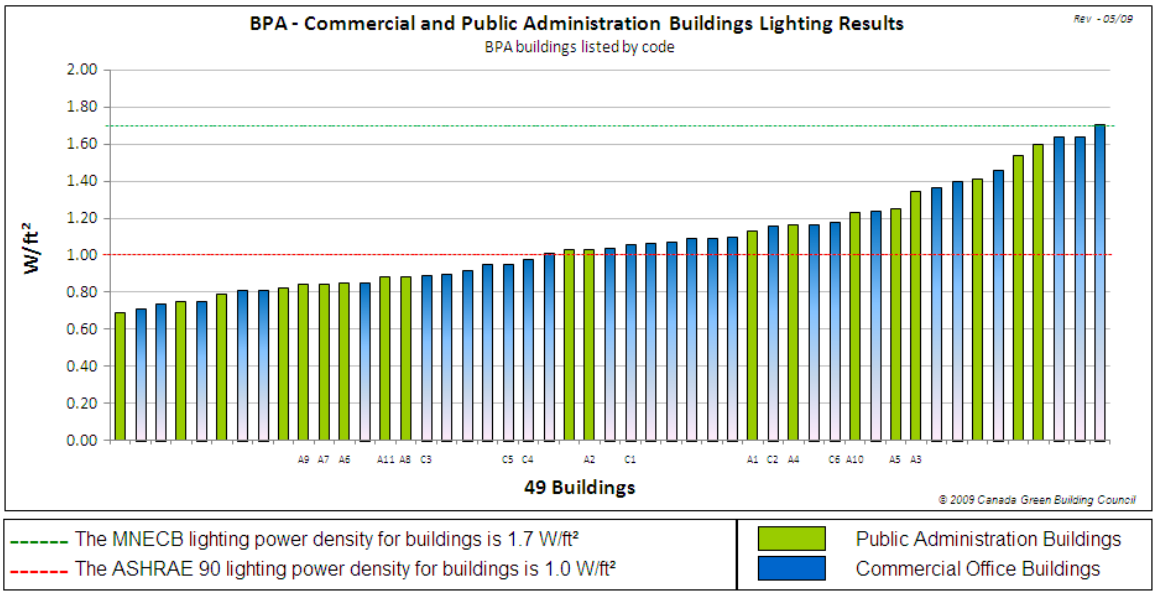
Building Characteristics				Total Energy		Electricity			Thermal
						Consumption	Demand	Load Factor	
Type	Location	Approximate Size (ft²)	Construction Decade	Space Normalized (ekWh/ft²)	Actual (ekWh/ft²)	kWh/ft²	W/ft²	Annual (hrs/day)	Consumption (ekWh/ft²)
PROV	QC	150,000	1980's	12.9	11.9	10.8	3.2	9.3	1.1*
PROV	ON	250,000	1980's	15.5	17.1	17.0	3.4	13.8	0.0*
FED	QC	200,000	2000's	17.5	17.0	15.9	2.7	16.2	1.1*
FED	ON	350,000	1930's	18.5	19.3	10.7	3.6	8.2	8.6
PROV	MB	50,000	1970's	19.5	19.2	11.1	2.8	10.9	8.1
PROV	MB	50,000	1970's	20.8	21.6	18.7	4.5	11.3	2.9*
MUNI	ON	200,000	1980's	22.0	22.0	14.4	3.2	12.3	7.7
COM	BC	200,000	1980's	22.4	25.1	19.4	4.3	12.3	5.7
MUNI	BC	200,000	2000's	22.8	21.6	14.5	-	-	7.0
COM	ON	400,000	1950's	23.7	28.5	28.2	5.4	14.4	0.3*
rev - 07/09									(c) 2008 Canada Green Building Council

** over 10% electric heat*

Note: coloured cells indicate potential for further improvement

Several of the top-performing buildings were then audited by engineering firms pre-qualified by CaGBC using a standard Building Performance Audit (BPA) template to test, document and compare design metrics such as Watts/ft^2 and plant capacity per thousand ft^2. The audit was applied to all major building systems - lighting, ventilation, heating, air conditioning, office equipment, building envelope and water fixtures – and reconciled test results with the actual electrical demand for the buildings. Figure 3 shows results for lighting, and includes buildings where participants used that part of the template themselves to see where they stood. The metrics shown for the 49 buildings are simply total installed lighting Watts on a typical floor divided by the rentable area. The remarkable findings are first the range of 2.5:1 in power density using similar technology for similar office space lighting applications, and secondly that industry good practice is substantially better than either Canada's Model National Energy Code or the current ASHRAE standard. The results also demonstrated that even the top-performing buildings have room to improve energy efficiency in one or more of their primary building systems.

Figure 3



"We thought we were doing the right thing retrofitting from T-12 to T-8 lighting until we found our building at the right hand end of the chart. Now we know we have to redesign, not just replace fixtures."

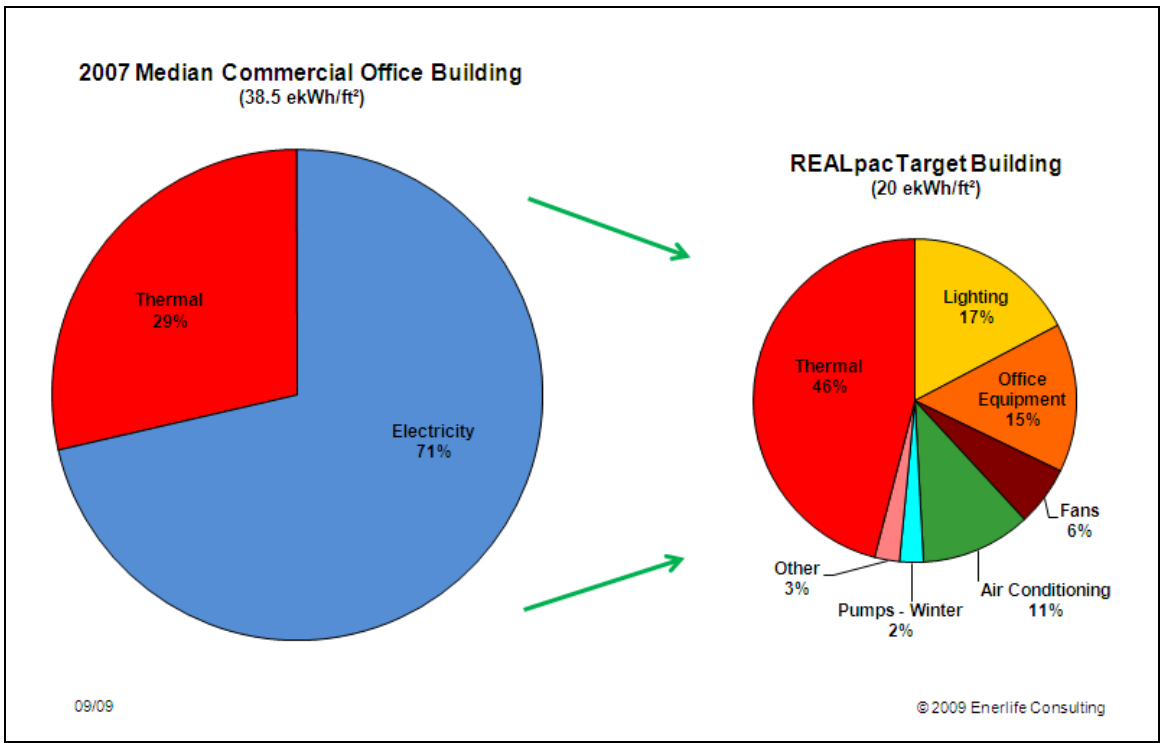
CaGBC Pilot Project Participant

"We have lowered our tenant lighting design standard from 1.1 to 0.85 Watts/sq ft based on these results from the pilot project."

CaGBC Pilot Project Participant

The results of the CaGBC pilot projects, which are being reinforced by the ongoing developments through their new Green Up initiative, are transforming the way that owners, managers and designers understand and think about the actual energy performance of buildings. Several buildings are already close to the REALpac *20 by '15* target, and even the top-performing buildings have been shown to have significant room to improve. Modelling the good practice design standards for each building system derived from the pilot project audits with typical office building occupancy periods yields total energy use in the range of 16-20 ekWh/ft²/year. Figure 4 presents the typical energy use breakdown of the 20 ekWh/ft²/year building compared with the 2007 median commercial office building.

Figure 4



In short, achieving the target requires only consistent application of good system design/retrofit standards for each building system identified through the CaGBC pilot project, together with operating periods and practices that are already in common practice.

3. GETTING THERE FROM HERE

3.1. It's Not What You Think

The common perception has been that improving energy efficiency is all about technology, retrofitting and capital expenditure. The emerging new understanding is that policy, process and people are in fact at the heart of achieving and sustaining high levels of energy efficiency and deep reductions in greenhouse gas emissions.

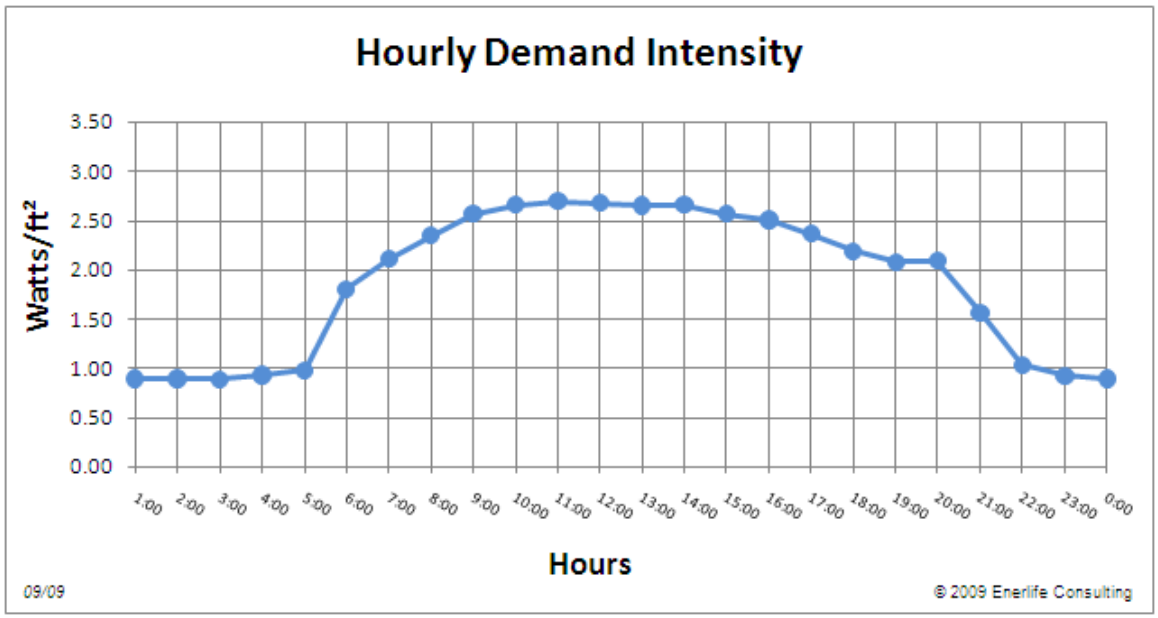
The good news is that operating cost savings should generally be greater and Capex less than had previously been expected, with higher rates of return on investments. The more challenging conclusion is that high levels of performance cannot be achieved and sustained without significant organizational change to align policy, management, leasing, procurement, and HR programs with the demands of consistent energy efficient practice. The recommended strategy for most owners and managers (which

fits well with today's capital constrained times) is to address organizational alignment first, before taking on capital retrofit projects. Introducing benchmarking, target-setting and performance monitoring into management practice builds internal capacity and confidence while generating significant savings at low cost through operational improvements and re-commissioning – getting the best out of the building as it is. With this experience, staff and service providers are then better able to contribute to defining future capital projects and ensuring their success.

3.2. A New Literacy

The foundation for addressing energy efficiency in individual buildings and portfolios is the seemingly mundane (and sometimes arcane) world of utility bills. While there is considerable room for improvement in billing reliability and clarity, unlocking the wealth of data contained in monthly utility bills is necessary for carbon reporting, and can also provide essential insight into current performance, point to areas for improvement, and verify the effectiveness of actions taken. New metering technology expands this potential. Interval meters and smart meters can provide real-time windows into daily, weekly and seasonal building operations and areas for improvement. Figure 5 shows clearly what time the building starts up and shuts down, how it is used through the day, and how much electrical load is left running all night long.

Figure 5



Sub-metering of tenants and equipment can take this performance analysis and diagnosis further still. However, effective management of the data contained in monthly utility bills remains the starting point

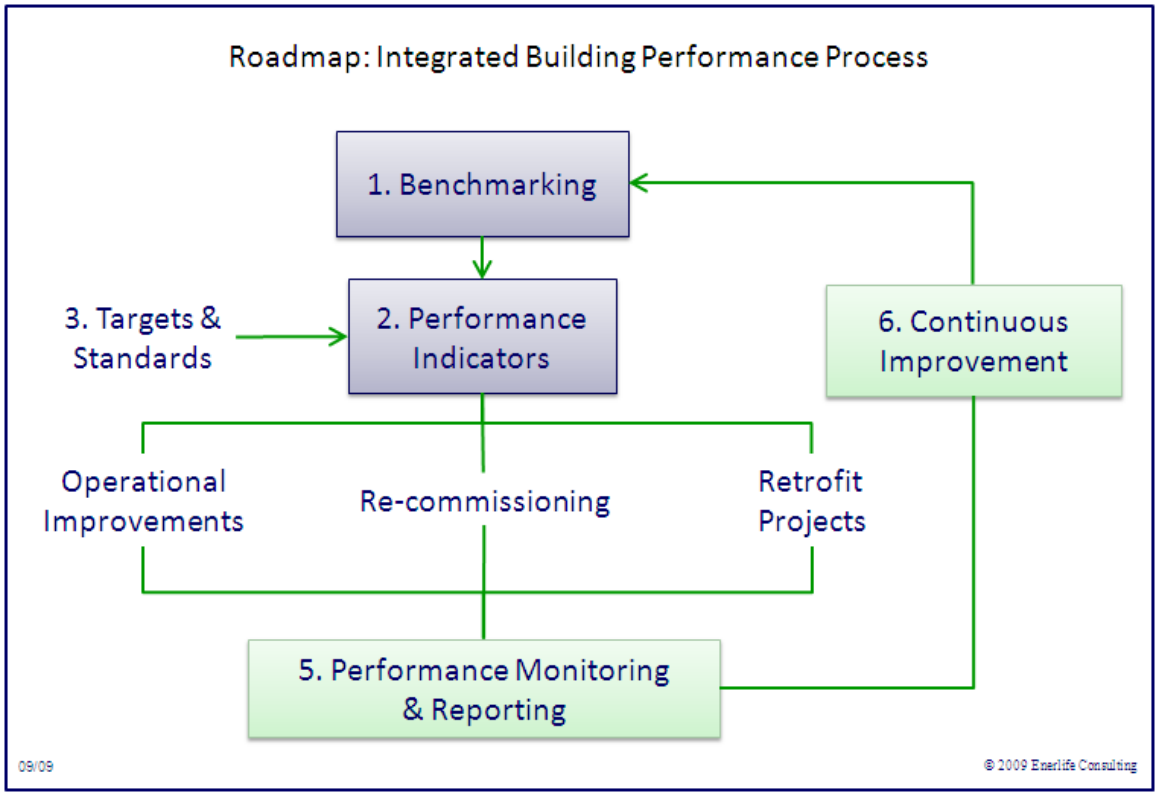
for energy performance management and carbon reporting. Similarly, building owners and managers need to become familiar with the building performance and system-level metrics developed by the CaGBC and referred to in this paper, and reflect current good standards in their specifications, leases and contracts with consultants, tenants, contractors and service providers.

This new literacy should be internalized within building owner and manager organizations in order to effectively set targets, develop strategy and plans, support good building operations, direct outside suppliers, and report on progress. It is an essential new skill in the pursuit of sustainability.

4. A ROADMAP TO 20 ekWh

Figure 6 presents the "Roadmap to 20 ekWh", which is described in the following sections.

Figure 6



4.1. Energy Use Benchmarking

It is 2009. Do you know the total energy performance of your building? Benchmarking is the starting point for addressing energy efficiency. High performance can be used by leasing agents to market a building.

Lower performance should factor into target setting and individual performance objectives. Executives should know how their properties compare with each other and with the office buildings market as a whole.

4.2. Performance Indicators

Beyond total energy use benchmarking, drilling down into component parts of energy use helps create building-specific targets, and identify which buildings are candidates for operational improvements, re-commissioning and/or retrofits. Interval meter profiles allow identification and quantification of operational improvements. The interpretation of utility data to guide conservation action is becoming an essential management capability.

4.3. Targets and Standards

Every building can have an individual energy target, based on its actual and potential energy performance. The target guides allocation of effort and resources, planning of improvements, and performance objectives for staff and service providers. Building owners should adopt good practice design/retrofit standards for individual building systems, as identified by the CaGBC program, to be incorporated into specifications and service agreements.

4.4. Implementation

There are typically three streams of activity involved in implementing energy efficiency improvements in existing buildings. First are operations – reducing "on-time" for building systems, shutting equipment off during unoccupied periods and adjusting building control "set-points". This is the least cost, highest payback stream, but requires training and accountability for operators and engagement of tenants. Second is re-commissioning – testing, diagnosing, repairing, upgrading and adjusting building systems to perform to their best potential. This is generally a relatively low cost stream with a good payback, and requires direct involvement of operators as a learning process, and to ensure high performance is maintained over time. The third stream is system redesign and retrofit projects – lighting, ventilation and hydronic system upgrades, and replacement of plant and equipment. This is the highest cost stream and requires a robust business case.

Every building has its own unique set of opportunities. The performance indicators derived from benchmarking point to which streams apply to which buildings. In general, the lower cost streams should be implemented first in order to gain immediate savings with high returns, engage and train operators, and build internal confidence and capacity for tackling large capital projects.

4.5. Performance Monitoring and Reporting

Transparency of performance maintains organizational engagement and commitment, and drives continuous improvement. Operators and property managers should have access to monthly changes and trends in energy use for their building so they can make the connections between cause and effect – how their actions and operating practices impact performance – and take appropriate measures for improvement. Executives should see quarterly progress reports compared with baselines and targets. High performing buildings and large improvements should be recognized and celebrated, and corporate reporting should include targets, actual savings, and profiles of measures implemented and improvements made.

4.6. Continuous Improvement

Energy performance management is a continuous management system which needs to respond to new standards and technology, and improved operating procedures. As the energy efficiency of the office building sector as a whole continues to rise, and better standards and practices continue to emerge, so individual building targets are raised and the cycle of continuous improvement takes us to *20 by '15* and beyond.

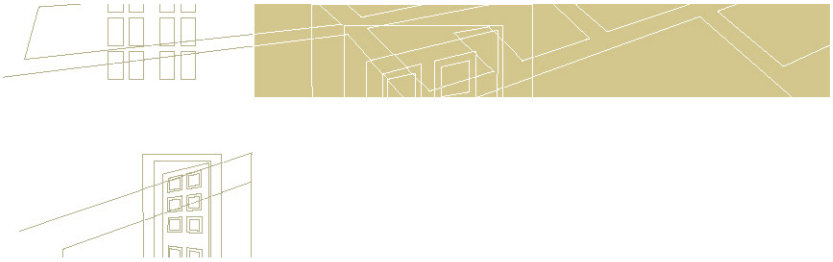
5. MAKING A DIFFERENCE

Canada's real estate industry is positioned to have a meaningful impact on the climate change mitigation agenda, through both its own potential to demonstrate greenhouse gas emission reductions, and the example it can provide to other building sectors, other parts of the economy, and other regions of the world. The methodology, metrics, standards and tools described in this paper did not exist a year ago. The commercial office sector and government real property departments have helped, through their participation in the CaGBC pilot projects, to both substantiate the opportunity for deep cuts in energy use and greenhouse gas emissions, and develop the means to achieve and sustain them. REALpac's *20 by '15* target takes this leadership to the next level.

> **"Ontario Realty Corporation is committed to systematically working towards energy efficiency targets for high performing buildings across its whole portfolio. The RealPac 2015 target is a useful development in moving this agenda forward."**
>
> **Gavin Maher, Senior Sustainability Program Specialist, Ontario Realty Corporation**

The common theme through this rapid evolution has been that nothing is what it had seemed. Use of more efficient technology does not necessarily achieve optimal performance – attention to system design and standards are equally important. Effective building operations and engagement of tenants are essential to high performance, and expected to provide at least half of the projected energy and emissions savings. There is no apparent correlation between building age and energy performance, and

even top-performing buildings today have significant room to improve. And the REALpac target can be reached, and median energy use level for the commercial and government office sectors reduced by up to one half, simply by consistently practicing what we already know how to do.



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