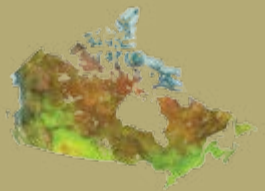




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Improve Your Building's Energy Performance: **Energy Benchmarking Primer**





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Aussi disponible en français sous le titre :

Améliorer le rendement énergétique de votre bâtiment: Introduction à l'analyse comparative énergétique

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1.0

Executive summary



Commercial and institutional building owners are under increasing pressure to improve the energy performance of their buildings. Increasing energy prices, growing public awareness of the relationship between energy and the environment, government interest and stakeholder knowledge are just a few of the reasons that energy performance is becoming an increasingly important issue in this sector. Fortunately, this is an area where the buildings sector can make a valuable contribution. Significant opportunities exist for buildings to save energy, improve performance and reduce carbon emissions. These improvements not only benefit the environment but also increase asset value and contribute to a better bottom line.

Several industry-led initiatives and certification programs engage building sectors in energy efficiency and sustainability, particularly in the commercial office sector. Some initiatives, including the Canada Green Building Council's Leadership in Energy and Environmental Design (LEED®) and the Building Owners and Managers Association (BOMA) of Canada's BOMA BEST, are using the metrics and data provided by benchmarking tools (such as ENERGY STAR Portfolio Manager) for certification.

Energy benchmarking can be a valuable best practice for buildings and for achieving greater energy conservation. You can't manage what you don't measure! Energy benchmarking can provide the road map to energy savings. It can inform energy efficiency goals, provide motivation for action and help create the business case for energy improvements or retrofits. Energy benchmarking can be a powerful driver for investing in energy efficiency measures.

Although it is not the only solution to address the challenge of energy management, energy benchmarking is an important starting point and a way of measuring ongoing improvement. It feeds a robust energy management process that helps building owners create and implement comprehensive energy management action plans, monitor and evaluate progress, and continuously improve.



2.0

Energy benchmarking



Energy benchmarking compares a building's energy performance in several ways:

- against past energy performance
- against similar buildings within a portfolio
- against an external data set of comparable buildings
- against areas in the same building

The aim is to evaluate or compare performance against past performance or against peers to identify high performance buildings and opportunities to save energy.

Benchmarking building energy consumption starts with the "energy usage intensity" (EUI) metric, which is the energy use for the whole building for one year divided by building area. The EUI is often expressed in either gigajoules per square metre (m²) or per square foot (sq. ft.) per year. This metric is also known as the building energy performance index.

Data is usually normalized or adjusted to remove weather effects and other building variables (e.g. anomalies in energy use, operating hours, vacancy, etc.) to account for substantive differences between buildings. With increased sophistication, more energy benchmarking metrics can be tracked, including metrics for processes, systems, etc. Some sectors may use additional metrics such as the number of students in a school or the number of beds in a hospital.

Internal and external energy benchmarking

Energy benchmarking can be either internal or external.

Internal benchmarking compares a building's energy performance against other buildings within the organization's portfolio or compares the energy performance of an individual building over time, whereas external benchmarking compares buildings against peers in the same sector.

The benefits of internal benchmarking include

- identifying buildings that have the greatest potential for improvement
- learning from best practices
- increasing the building manager's and operator's familiarity with energy performance
- informing management practice

External benchmarking

- provides external validation of benchmarks and improvement
- tracks performance against an industry or a sector
- identifies high performance buildings
- allows for recognition and certification from organizations such as LEED, BOMA BEST, etc.
- feeds positive competition

Most importantly, energy benchmarking

- identifies the potential for improving a building's energy efficiency
- informs goals
- motivates action

Reducing energy use requires an integrated energy management benchmarking process to

- absorb the energy benchmarking information
- collect additional data and indicators
- investigate the causes of poor performance
- create and implement an action plan
- monitor and evaluate progress
- make continuous improvements

Energy benchmarking data is also used in energy audit reports, which are a key element of any energy management plan or program.

3.0



The business case for benchmarking

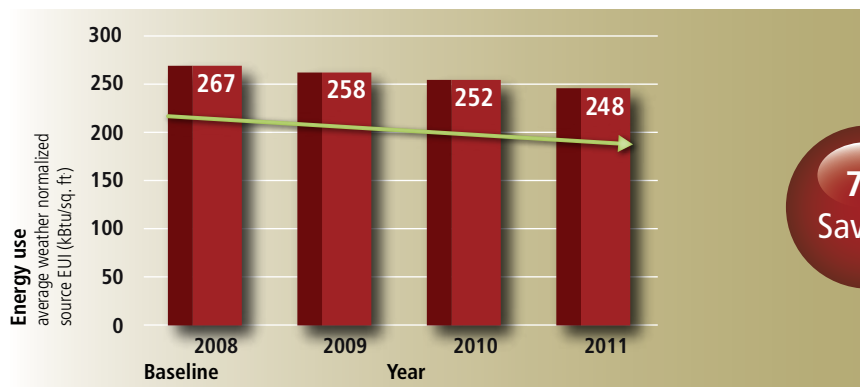
3.1 Business opportunity

Building owners should consider energy benchmarking their buildings for many reasons, primarily rising energy costs, increasing pressure from stakeholders, occupants and the general public to reduce energy consumption, and a growing desire for buildings to be third-party certified as “green.” In a recent survey about sustainability conducted by Ernst and Young and GreenBiz (including interviews with chief executive officers), 66 percent of the respondents reported an increase in interest from shareholders and investors in sustainability issues, with a particular focus on energy, as follows:

“The lion’s share of their inquiries, 70 percent, focused on energy and climate issues – company efforts to increase energy efficiency measures and renewable energy usage, and either reduce greenhouse gas [GHG] emissions or adopt quantitative goals to do so.”¹

Furthermore, the United States Environmental Protection Agency (U.S. EPA) released a data trends report,² which showed that organizations that benchmarked energy consistently saved 2.4 percent in energy costs annually over three years (see Figure 1).

Figure 1. Energy savings in Portfolio Manager



¹ Ernst and Young & GreenBiz Group (2012), *Six growing trends in corporate sustainability: An Ernst & Young survey in cooperation with GreenBiz Group*, [Online], Available: www.greenbiz.com/research/report/2012/03/01/six-growing-trends-corporate-sustainability

² United States Environmental Protection Agency (2012) Portfolio Manager Data Trends series: *Benchmarking and Energy Savings*, [Online], Available: www.energystar.gov/buildings/tools-and-resources/datatrends-benchmarking-and-energy-savings



For building owners to address energy consumption and costs, they must understand the full scope of the energy performance of each of their buildings. Often, building owners rely on estimates of savings from outside experts with no real means of comparison. Energy benchmarking provides a quantifiable means of determining the potential for improvement and how a building compares with its peers. Energy benchmarking is an energy management best practice that provides the road map for setting goals and improving the bottom line as well as increasing asset value.

3.2 Increased asset valuation

A U.S. study³ have shown that buildings with high rates of energy efficiency have numerous financial benefits. Because energy costs can be 30 percent of operating expenses, identifying energy savings and becoming energy-efficient will impact positively on the bottom line.

Furthermore, these studies indicate that energy-efficient buildings typically rent for about 3 percent more per square foot. In fact, a \$1 saving in energy costs is associated with a 95 cent increase in rents. Also, occupants and tenants report a higher degree of satisfaction and comfort in energy-efficient buildings.

Greater energy efficiency in buildings can also increase the selling price of a building by as much as 13 percent.⁴ For every \$1 in energy savings there is an associated 4.9 percent increase in market capitalization (equivalent to \$12/m² [\$13/sq. ft.]).

Energy benchmarking supports greater energy efficiency, increases market visibility and demonstrates good corporate responsibility.

³ Nils Kok, *The Economics of Green Building* (2011).

⁴ Nils Kok, *The Economics of Green Building* (2011).

3.3 Outcomes and benefits

Energy benchmarking provides a context for building owners to take action on improving the efficiency of their buildings. It also provides a means of tracking the progress and success of energy efficiency initiatives and comparison against others in the same sector.

The key outcomes of energy benchmarking are to

- identify and recognize high performing buildings
- identify buildings with the greatest opportunity to save energy
- inform and educate stakeholders (operators, building managers, occupants, senior management)
- establish desired performance levels for buildings
- monitor progress towards goals
- maintain the energy savings and look for new ways to improve
- identify anomalies in energy use that deserve further investigation

Energy benchmarking is a powerful tool that should be part of your organization's energy management best practices. It can identify opportunities to save energy. How effective energy benchmarking is within your organization depends on how well individuals within the organization can act on the information and how the information derived from benchmarking acts as a catalyst to or feeds existing mechanisms and processes. Energy benchmarking is your organization's first step on the road to energy savings and greater overall sustainability.

3.3.1 Building management and operations

Benchmarking provides context for building management, operations, and retrofits. Building managers and operators know the building best, so they can provide beneficial feedback and insight on your building's performance. However, you can't manage energy performance without a tool to measure it. Energy benchmarking and tracking software allows managers and operators to know their building's energy performance. Several leading organizations link employee compensation to meeting energy performance goals set by benchmarking.

3.3.2 Tenants and building occupants

Building occupants and their behaviours can play a significant role in the energy performance of a building. As building management further optimizes operations and implements retrofits, engaging tenants and increasing their energy efficiency awareness becomes increasingly important. A recent initiative, the Race to Reduce, from Greater Toronto CivicAction Alliance, illustrates the value in communicating energy benchmarking to tenants. The initiative rewards efforts from the landlord and tenant working together to reduce energy use and recognizes the office buildings with the lowest EUI. As a result, tenants are more conversant and knowledgeable about energy benchmarking, they participate in occupant engagement programs, and they have more say (and stake) in how the building performs.

3.3.3 Senior management

Energy benchmarking can be a very useful tool to convince senior management of the viability of pursuing energy savings opportunities to improve energy performance. Energy benchmarking provides senior management with objective feedback as to how well their buildings are being managed and which ones can be showcased, and it indicates if improvements to the building and management can be made. In some organizations, senior management has aligned compensation for building management with how the building performs in internal benchmarking. In schools, principals and facility managers can work together to integrate building performance into the curriculum, providing a means to educate, create a healthy environment for students and save money related to energy costs.

3.3.4 Sector-wide, external recognition and secondary benefits

A benefit of sector-wide benchmarking is the value of a reliable, independent means of comparison that can support sector, municipal, provincial and federal initiatives.

3.4 Approach

Energy benchmarking is most effective when it supports an existing energy management process built on continuous improvement. Obtaining and tracking key energy performance metrics informs the planning and implementation of improvements, which in turn can be verified through benchmarking. Figure 2 illustrates how this energy management process works with energy benchmarking.

Figure 2. An energy management process that includes benchmarking

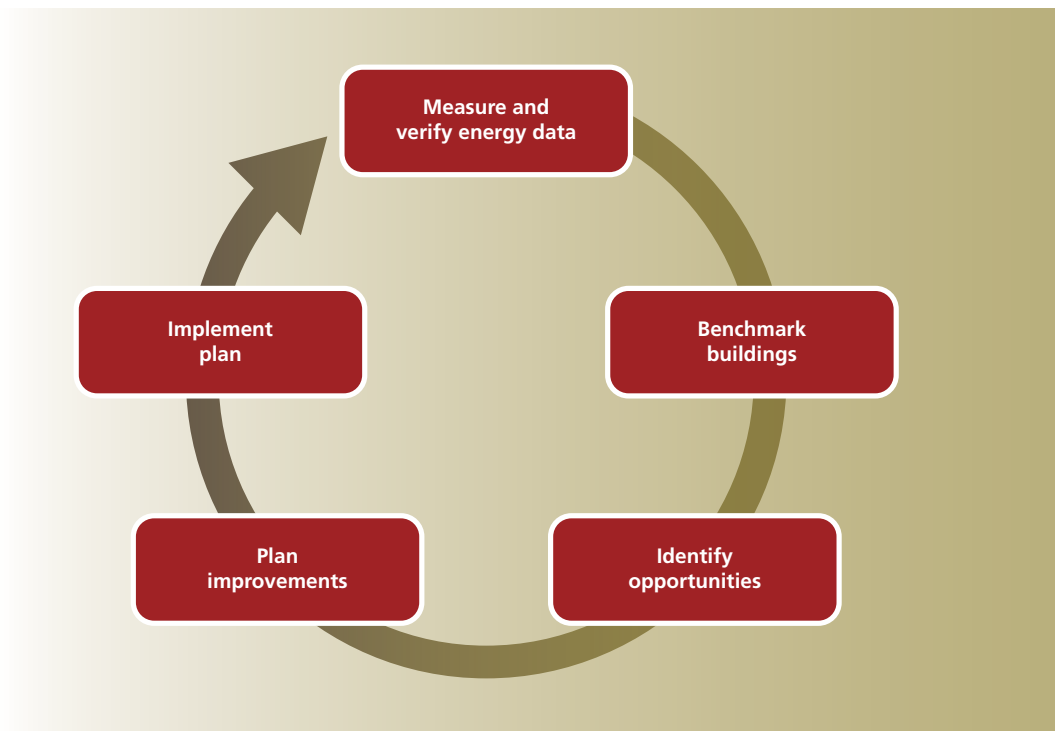


Table 1 summarizes initiatives that have legislated energy benchmarking for the commercial, education and other sectors. Table 2 summarizes similar United States initiatives.

Table 1. Current Canadian buildings sector or municipal initiatives that use energy benchmarking

Initiative	Sector	Location	Summary
Race to Reduce	commercial office	greater Toronto area	This initiative of Greater Toronto CivicAction Alliance challenges office landlords and tenants to team up to collaborate on improving their buildings' energy efficiency over a four-year period. Awards are given for the most efficient buildings. This competition now uses ENERGY STAR Portfolio Manager as its primary tool for collecting energy data.
Mayors' Megawatt Challenge	municipal	Ontario	The Mayors' Megawatt Challenge brings municipalities together to improve energy efficiency and environmental management in their own buildings.
Greening Health Care	hospitals	Canada	Greening Health Care has more than 60 hospital sites across Canada working together to improve energy and water efficiency. Awards are given to hospital leaders in sustainability.
Local Authority Services Ltd. Municipal Energy Performance Benchmarking Project	municipal	Ontario	The Municipal Energy Performance Benchmarking Project enables municipal participants to compare the performance of their own facilities to various other benchmarks and provides an overview of how well the sector is doing in managing energy performance.
GREEN UP® CaGBC	commercial office, public administration, schools, arenas, non-food retail, bank branches	Canada	GREEN UP provides benchmarking dashboards, investment decision guides and resources to help building owners and operators measure, compare and improve the performance of building portfolios. The program helps participants find and track opportunities to achieve large reductions in energy use, water use and GHG emissions.
Real Property Association of Canada (REALpac) Energy Benchmarking	commercial office	Canada	This annual energy benchmarking survey is intended to establish a baseline of building energy use in Canada and begin to grow an energy performance database with a replicable methodology.
BOMA BEST Energy and Environmental Report (BBEER)	commercial office	Canada	This annual report summarizes the energy and environmental performance of office buildings certified to BOMA BEST.

Table 2. U.S. state and local initiatives that require energy benchmarking⁵

Initiative	Sector	Location	Summary
Assembly Bill 1103	commercial buildings	California	This bill requires the disclosure of an ENERGY STAR score and energy use data as part of commercial real estate transactions involving the sale, lease or financing of an entire building (entered into effect in 2012).
State bill 5854 – 2009-10	commercial buildings	Washington	This bill is similar to the California bill.
Greater Greener Buildings Plan	privately owned buildings >50 000 sq. ft and all municipal buildings >10 000 sq. ft.	New York City	This plan requires that building benchmarking is performed annually in Portfolio Manager.
<i>Clean and Affordable Energy Act of 2008</i>	privately-owned commercial buildings	Washington, D.C.	The Act requires that eligible privately-owned commercial buildings perform benchmarking annually by using Portfolio Manager.

3.5 Barriers

Surprisingly, there is little literature that addresses barriers to implementing energy benchmarking. One article in *Buildings* magazine in 2008 had a list, with suggestions of how to address the barriers. We have augmented this list from our experience and information gleaned from our case studies, as follows:

■ **They know nothing about it.**

Many smaller organizations may not understand or see the benefits of energy benchmarking. There may be no one in-house who is comfortable managing the energy data requirements.

Response: Fortunately, free online tools such as ENERGY STAR Portfolio Manager make this task simpler and provide comprehensive online support.

■ **Senior management does not support energy benchmarking.**

Support for energy management is critical to ensuring that actions are taken. Senior management can ensure the success of a benchmarking initiative through organizational buy-in to get reluctant building managers to participate.

Response: Communicating clearly in simple language will help explain energy benchmarking results and show how the information can support decisions. To gain the support of senior management, you have to build a business case for adopting energy benchmarking.

⁵ United States Environmental Protection Agency (2011), *EPA's ENERGY STAR Market Demand and Automated Benchmarking System*, [Online], Available: www.energystar.gov/ia/partners/spp_res/neprs/Market_Demand-and-ABS.pdf

■ **The motivation for energy benchmarking is not clear.**

There are many reasons to benchmark energy use.

Response: Every organization should be clear about its primary motivators. The three main reasons to benchmark are to identify energy efficiency opportunities, to establish investment priorities and to compare to other facilities or competitors.

■ **They do not know what to benchmark against.**

Several criteria can be benchmarked for each organization. The various sectors may have different criteria.

Response: A building can be compared against itself from year to year or compared against a peer group of buildings – either internally or externally. A building can also be compared against a static sample of buildings and given a score. In the Canadian commercial office sector, a building can also participate in BOMA BEST, REALpac Energy Benchmarking or GREEN UP. Building managers and sustainability experts see different programs as having different functions and benefits. In many cases, managers participate in more than one type of external benchmarking program so they can “compare with market” and stay competitive.

■ **They do not know what to do with the benchmarking data.**

Response: After an organization has obtained the necessary building data and has benchmarked the buildings' energy use, the value comes in creating a plan to lower energy consumption. As stated, “The value it [energy benchmarking] brings comes from using the information it reveals to justify and validate energy efficiency changes.”⁶

■ **They do not have time or resources.**

Benchmarking energy data can require collecting years of utility bills and detailed facility information. Missing utility bills can be particularly difficult to account for. Also, the data must be entered into a spreadsheet or benchmarking program. Finding time or resources to do this can be a challenge.

Response: To mitigate this concern, it is important to realize that for a relatively low cost (in terms of employee hours) significant energy savings can be realized. It is worth budgeting employee hours for your benchmarking initiative to ensure that these savings are not overlooked. If bills are missing, it is better to start benchmarking with the current data you have. There can be a benefit even with just one year of data.

⁶ Garris, L. B. (2008), “8 Energy Benchmarking Hurdles (and How to Get Over Them),” *Buildings*, July 2008, [Online], Available: www.buildings.com/tabid/3334/ArticleID/6208/Default.aspx#top



■ **They are concerned about the costs.**

The costs of energy benchmarking depend on several factors. Will free software such as ENERGY STAR Portfolio Manager be used or will software be purchased? How many hours will it take to enter the data? Will an employee enter the data or will a contractor be hired?

Response: Energy management training can address these questions to determine the best approach for your organization. Natural Resources Canada's (NRCan's) Dollars To \$ense workshops explain the value, benefits and approach to take to include benchmarking as a component of an effective energy management plan. For more information on these workshops, contact us at info.services@nrcan-rncan.gc.ca.

In the final analysis, when the costs of implementing energy benchmarking are compared with energy savings of 2.4 percent annually in the first three years (as cited in the U.S. Environmental Protection Agency's Data Trends series on page 5), it is obvious that for most buildings, these costs are a real investment in greater energy savings and a healthier bottom line.

■ **Human resources and time are not available.**

This complaint can originate from any level in the organization.

Response: Senior management support is essential to the success of an energy benchmarking program over the long term because they have to be prepared to dedicate resources and time to tracking performance and acting on the results. Some electrical utilities and some local distribution companies provide incentives to hire energy managers into organizations to address this concern. Contact your local utility to find out about the availability of such help.

■ **They are not sure which is the best benchmarking system for their organization's needs, or they have too many initiatives.**

This is a concern about choosing from the various software tools on the market.

Response: NRCan can explain external benchmarking and what ENERGY STAR Portfolio Manager offers in relation to other tools. Portfolio Manager can be used on its own or as a supplement to other tools. Partnering with other initiatives may also help address this objection.

■ **They are not sure what energy benchmarking tells them.**

Several sectors will require education on energy benchmarks and how they can be used.

Response: Energy benchmarking is a tool to catalyze action. It is mainly motivational, providing comparisons across a portfolio or among peers. The real value comes in setting goals and creating an action plan.



4.0

Natural Resources Canada and ENERGY STAR Portfolio Manager



In response to requests from the Canadian commercial and institutional buildings sector, NRCan has collaborated with the U.S. EPA to adapt Portfolio Manager for the Canadian context.

This free online energy benchmarking software provides building operators and managers with an easy-to-use tool to benchmark their building's energy use. This is a starting point for any organization that is not currently using benchmarking software because the tool is free, and comprehensive support is available online at www.energystar.gov.

The Canadian adaptation is available in English and French, and includes Canadian metrics such as

- a reference database
- energy performance scores
- site-source energy factors
- GHG factors
- weather stations

Many tools are available for building managers and owners to use to meet their energy performance goals. However, there are a few key benefits to using Portfolio Manager. This tool

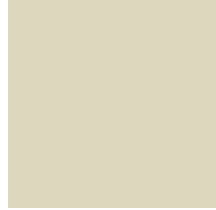
- uses a survey of commercial and institutional energy use as a comparison for the data. This means that a model is generated from nationally representative data (based on the *Survey of Commercial and Institutional Energy Use – Buildings 2009*, oee.nrcan.gc.ca/publications/statistics/scieiu09/scieiu_e.pdf).
- creates the only standard national platform for benchmarking energy consumption
- provides a consistent system of measurement for cross-border portfolios
- has gained widespread acceptance in the United States, often referred to as the de facto standard in the United States for energy benchmarking
- is free
- is Web-based and does not require the installation of dedicated software
- offers security – all data is stored on a secure server

For more information on Portfolio Manager, contact info.services@nrcan-rncan.gc.ca.



5.0

Case studies, testimonials and sector support



5.1 Case studies

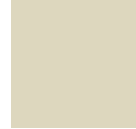
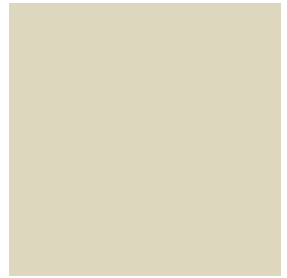
The following case studies are of organizations that have implemented or are employing one or more energy benchmarking programs.

Case study: Crown Realty Partners

Crown Realty Partners is a private co-owner and manager of mid-sized office buildings in the greater Toronto area. nrcan.gc.ca/energy/efficiency/buildings/energy-benchmarking/3775

Case study: EPIC Realty Partners

EPIC Realty Partners is a national commercial real estate services firm that owns and operates over 350 000 m² of commercial office property in Alberta, Ontario and Quebec. nrcan.gc.ca/energy/efficiency/buildings/energy-benchmarking/3779



Case study: University of Calgary

The University of Calgary has more than 31 000 students. The campus spans 200 hectares – an area larger than downtown Calgary. Its more than 60 buildings cover over 750 000 m². All the buildings are fully occupied, and most are 20 to 40 years old. With the economic boom in Alberta, enrolment is growing significantly and, as a result, the university has started a large capital expansion. nrcan.gc.ca/energy/efficiency/buildings/energy-benchmarking/3781

Table 3. Summary of energy benchmarking case studies

Organization	Benchmarking programs	Energy savings (%)	How benchmarking is used	Impacts
Crown Realty Partners	<ol style="list-style-type: none"> 1. internal program 2. ENERGY STAR Portfolio Manager 3. CaGBC's GREEN UP 4. REALpac Energy Benchmarking 	2% savings in total energy (2011 vs. 2010)	<ul style="list-style-type: none"> • Building performance is tracked month to month (internal). • Performance of buildings certifying to LEED EB:O&M⁷ is tracked (ENERGY STAR Portfolio Manager). • Buildings are compared with peers (GREEN UP, REALpac Energy Benchmarking). 	<ul style="list-style-type: none"> • Building operators are finding ways to save energy. • New and young operators are learning energy efficiency. • Energy and cost savings are providing better value for tenants. • Organizations are receiving utility incentives for energy savings they obtained through operational changes. • External benchmarking against peers is not used as a building management tool by operators.

⁷ LEED for Existing Buildings: Operations & Maintenance

Organization	Benchmarking programs	Energy savings (%)	How benchmarking is used	Impacts
Infrastructure Ontario	<ol style="list-style-type: none"> 1. internal program (through service provider, using Energy Cap®) 2. ENERGY STAR Portfolio Manager 3. CaGBC's GREEN UP 4. REALpac Energy Benchmarking 	5.6% savings in total energy (2011 vs. 2010) for 8 buildings in GREEN UP	<ul style="list-style-type: none"> • Different benchmarking programs are used for different purposes and do not inform each other. • Simple benchmarking is used to track how buildings are performing month to month (internal). • Consultants track the performance of buildings for certifying to LEED EB:O&M (ENERGY STAR Portfolio Manager). • A service provider benchmarked courthouses in ENERGY STAR Portfolio Manager for comparison with peers. • Office buildings are compared with peers (GREEN UP, REALpac Energy Benchmarking). 	<ul style="list-style-type: none"> • Internal benchmarking results are shared at regional energy meetings to identify potential anomalies and discuss what is happening in underperforming facilities. • External benchmarking against peers is not used as a building management tool by operators. • Energy benchmarking is an outcome of senior management leadership in sustainability and green buildings, and a strategic energy management plan.
EPIC Realty Partners	<ol style="list-style-type: none"> 1. ENERGY STAR Portfolio Manager 2. CaGBC's GREEN UP 	3.5% savings in total energy (2011 vs. 2010)	<ul style="list-style-type: none"> • Consultants track the performance of buildings that are certifying to LEED EB:O&M (ENERGY STAR Portfolio Manager). • Buildings are compared with peers (GREEN UP). 	<ul style="list-style-type: none"> • Comparison with peers is motivating improvement. • Energy benchmarking supports the management philosophy of staying current and continually improving buildings.
University of Calgary	<ol style="list-style-type: none"> 1. CaGBC's GREEN UP 	not available	<ul style="list-style-type: none"> • The results are used to identify performance targets for 35 buildings. • Key areas are prioritized for retrofits and potential operational improvements are identified. • The progress on two pilot buildings is monitored. 	<ul style="list-style-type: none"> • The identified operational savings and low-cost measures are implemented.

5.2 Testimonials

The following are testimonials from organizations that perform energy benchmarking.

Testimonial: Infrastructure Ontario

“Our organization has used ENERGY STAR Portfolio Manager on a building by building basis, not as a comprehensive program. We’ve certainly used it for the LEED participating buildings. Last year we did produce a number of ENERGY STAR scores for the courthouses – about 6 or 8 – because we saw it as a gap from an external standpoint. Other benchmarking programs weren’t addressing that building type.” – *Gavin Maher, Manager Building Services*

Testimonial: EPIC Realty Partners

“We participated in energy benchmarking because we wanted to see where we were within the industry and that we were competitive in the market. The benefit is that it shows us where we sit with our competition and where we need to start working. Nobody wants to look at the benchmarking and find that one or more of our buildings are lower than they should be.” – *Dwight Cooke, Regional Manager of Technical Services*

Testimonial: Crown Realty Partners

“We rely on energy benchmarking for continuous improvement in terms of building operations. This helps us lower costs, which benefits our existing or potential tenants. Our biggest success with energy benchmarking has been in the education of our staff. The fact that we are bringing visibility to energy and have been able to improve our energy consumption has really opened up a lot of doors in terms of staff development.” – *Mark Halkias, Sustainable Programs Coordinator*

Testimonial: Dufferin Peel Catholic District School Board

“I had no expectation of energy performance benchmarking, but I was very shocked to see that we weren’t doing as well as I thought we were doing. It threw up a red flag. We didn’t know that we weren’t doing well. I shared the results with the energy manager, and we scratched our heads because we had both the best and the worst performing schools in the country. When we looked, a lot were just purely operational factors.” – *Doug Duncombe, Manager of Maintenance Services*

Testimonial: Credit Valley Hospital

“As an organization, we really believe in benchmarking, and I think it’s a really good tool as long as you are given clear parameters of what you’re benchmarking against.” – *Stewart Dankner, Manager for Maintenance and Engineering Services*

Testimonial: University of Calgary

“Based on a pilot project with the Canada Green Building Council, we found that the systems level data and ability to benchmark performance helps us identify and prioritize energy conservation opportunities deeper within our building systems. We’re now scaling this up to include 35 buildings.”⁸ – *Joanne Perdue, Director of Sustainability*

⁸ Lemaire, R. (2011), “University of Calgary embraces GREEN UP,” *SUMMIT*, March/April 2011, [Online], Available: www.summitconnects.com/Articles_Columns/PDF_Documents/1402_lemaire.pdf

5.3 Sector support

The following testimonials are from key sector organizations in support of energy benchmarking and the need for improved energy efficiency in existing buildings.

5.3.1 Real Property Association of Canada

“Energy benchmarking has been quite successful – more than we thought it was going to be. Whether or not organizations are using benchmarking internally, an awareness and enthusiasm for energy conservation has been sparked. It has helped awaken the industry to these issues and helped align those who are already well underway.”

– *Julia St. Michael, Manager, Research & Environmental Programs*



5.3.2 Canada Green Building Council

“We initiated our GREEN UP Building Performance Program in 2008. Since then we have expanded applications for benchmarking beyond 3C (cost, carbon and consumption) management. Benchmarking practices now support project performance tracking, occupant engagement initiatives, CSR reporting, building certification and sustainable investment decisions.

We are encouraged by industry acceptance across Class A office and government buildings. Significant gains can also be achieved by scaling deployment in other building types, from pilot initiatives to portfolios. Small and mid-size buildings represent new market opportunities.”

– *Kirk Johnson, Manager, GREEN UP Program*



Canada Green Building Council
Every Building Greener

5.3.3 Building Owners and Managers Association of Canada

“Benchmarking gives the building owner and manager a baseline assessment of their building’s sustainability performance, which, in turn, helps them to understand its strengths and weaknesses and providing a path for further action.

Developing a shared understanding or definition of energy performance is critical. Although it is beneficial for the industry to have a choice about the path it takes to achieve high performance, standardization around normalization is a key element.

The BOMA BEST program provides a method for demonstrating, measuring and rewarding the progress made by building owners and managers toward a more sustainable built environment.”

– *John Smiciklas, Director, Energy and Environment Initiatives Management*





5.3.4 Greening Health Care and the Mayors' Megawatt Challenge

"Benchmarking provides an important context for energy savings decisions by providing sector-based targets for building energy intensity. Building managers can use analysis of benchmarking to gain a better understanding of how buildings need to perform and of where to invest resources to achieve sector-based energy intensity targets.

Since the 2004 launch of the Mayors' Megawatt Challenge and Greening Health Care, we have worked with Canadian municipalities and hospitals to show how benchmarking is the starting point for analysis of building energy use. Numerous case studies show that energy use targets, derived from sector-based benchmarking, can drive deeper energy savings."

– *Bernie McIntyre, Manager Community Transformation*

5.3.5 Race to Reduce – Greater Toronto CivicAction Alliance



"Recognizing leaders in energy benchmarking is a great way to tap into our collective competitive spirit and to leverage dynamics that are already happening in the marketplace. It is driving competition between buildings, even within portfolios, and definitely between companies. It is creating an expectation of tenants and landlords for data sharing and transparency of data. Empowering people with knowledge means that there are more people with the power to do something about it.

Landlords are gaining a greater understanding of their buildings' energy use and a sense of what is possible, helping them allocate resources and informing decisions about energy improvements. Over time, it informs people of what measures and actions make a difference. It establishes a foundation for tenant communications and collaboration, as they want to know how their space is performing and how actions translate into better energy management."

– *Linda Weichel, Vice-president Partnerships, CivicAction*

⁹ "Green Buildings – A Breath of Fresh Air," GREEN BUILDINGS Information Supplement in *Canadian Business* (12 September 2011), [Online], Available: c.yimcdn.com/sites/www.realpac.ca/resource/resmgr/industry_sustainability_-_research_reports/green-buildings-2011-edition.pdf

6.0

Implementing energy benchmarking



How an organization implements energy benchmarking will differ substantially from organization to organization depending on several factors, including senior management support, available resources, current energy management programs and initiatives, experience with energy data, and availability and accuracy of key metrics.

6.1 Key elements

The following are key elements of energy benchmarking:

COMMIT

■ Obtain senior management approval

A successful energy benchmarking initiative should ideally start with support for the initiative across the organization, starting with senior management support, all the way down to building operators. Senior management support is the most critical because their support will determine resources, cooperation, support and ability to act on the results.

■ Establish goals of energy benchmarking

Any energy benchmarking initiative should align with the organization's goals and support its strategic direction. It should be clear whether the entire portfolio will be included or just a sample building set. Decide whether the goal is best-in-class or a specific energy performance objective.

■ Identify the data set and benchmarks

Determine what data to benchmark and against what. There may be just a few buildings benchmarked initially or an entire portfolio. It may be just internal benchmarks or external ones.

ORGANIZE

■ **Establish a team**

One person cannot do it all. Energy benchmarking teams should include members from your various business units, operational areas and/or regions. Establishing a team will help you get organized more effectively and efficiently.

■ **Collect data and metrics**

Collecting the data is often one of the hardest tasks. A plan for storing and tracking the data must be created.

■ **Compare with benchmarks**

The data can be compared with benchmarks, and the organization can see how the buildings compare.

ACT

■ **Identify opportunities**

Rank buildings according to benchmark data. Identify top performers and areas for opportunity. Examine top performing buildings within the portfolio for best practices and share them with lower performing buildings.

■ **Plan improvements**

This information will help facility managers and operators decide which buildings would benefit from audits, operational improvements, recommissioning and training.

■ **Implement actions**

Identify the priority of taking actions based on impact, cost, simplicity of implementation and benefit.

■ **Track progress**

Make energy benchmarking part of your organization's energy management best practices. Benchmark continually to assess progress against defined goals and to ensure continuous improvement.

■ **Celebrate your achievements**

Formally recognize buildings that have achieved goals or top performance. Submit buildings for external awards for energy initiatives and reduction. Reward those in your organization who work diligently and contribute to your energy efficiency accomplishments. Celebrating your achievements will help build momentum within your organization, reinforce the importance of energy efficiency to tenants and employees, and increase engagement within your organization.

■ **Repeat the process**

Energy benchmarking is a continual process that must be repeated to maximize benefits.

6.2 Timelines

The time required to implement an energy benchmarking effort is dependent on the number of buildings, the amount of data to be collected, whether the data is coming from multiple sources and the benchmarks chosen. It also depends on the support within the organization and the accessibility of required building data. Generally, organizations will start with only a few buildings initially to test how long it will take to collect the data.

After the initial data is obtained, and the flow of energy use data is established, the energy benchmarking process should be straightforward. It may take between a few minutes and a couple of hours to update. Often the responsibility of updating the data will fall to building managers, especially if the organization does not have a dedicated resource. As a best practice, it is recommended that energy benchmarking be done at least annually, using monthly energy data. However, this can be done at more frequent intervals (monthly or quarterly) to reduce the amount of data entry for the individual(s) responsible. Your organization can determine the approach that best suits the resources you have available.



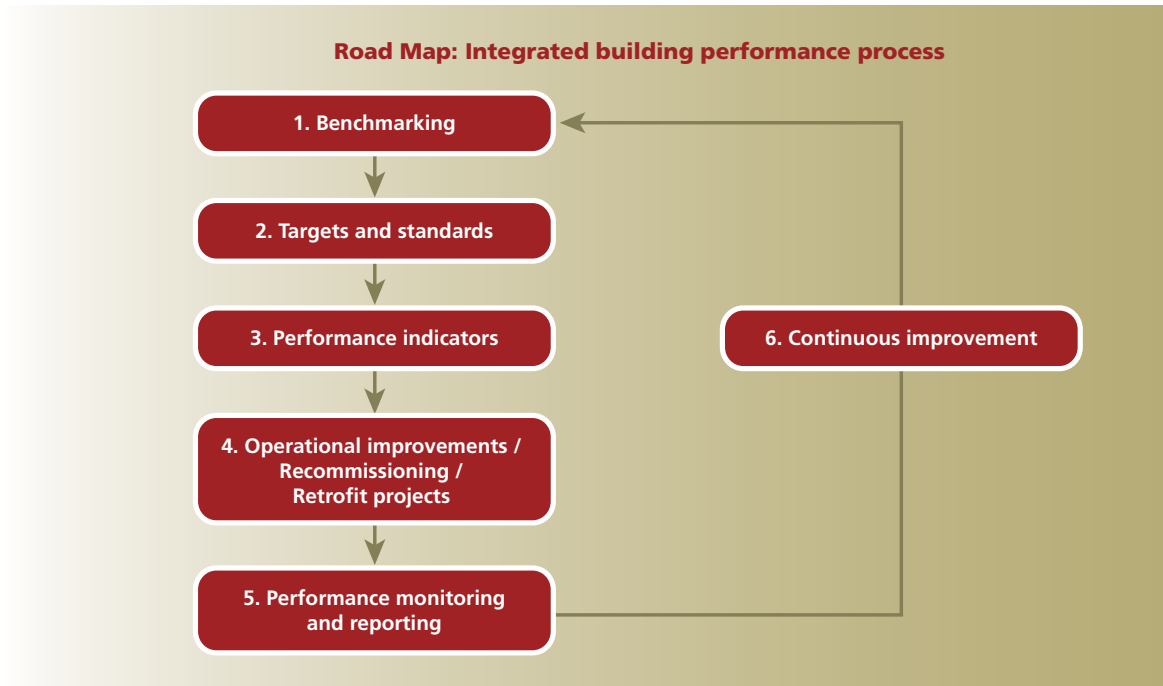
7.0

Using results and taking action



To achieve and sustain high performing buildings, energy benchmarking is one element in an integrated building performance process. Figure 3 illustrates the role of energy benchmarking as the starting point of an integrated building performance process to improve the performance of the building. Figure 4 illustrates how design, operational and occupant needs come together for higher energy performance. Figure 5 looks at the overlapping relationships between organizational changes, technological changes and behavioural changes that lead to success.

Figure 3. Using benchmarking to take action



To achieve high performance in a building, all three sides of the triangle must be addressed.

Figure 4. Achieving high performance in a building

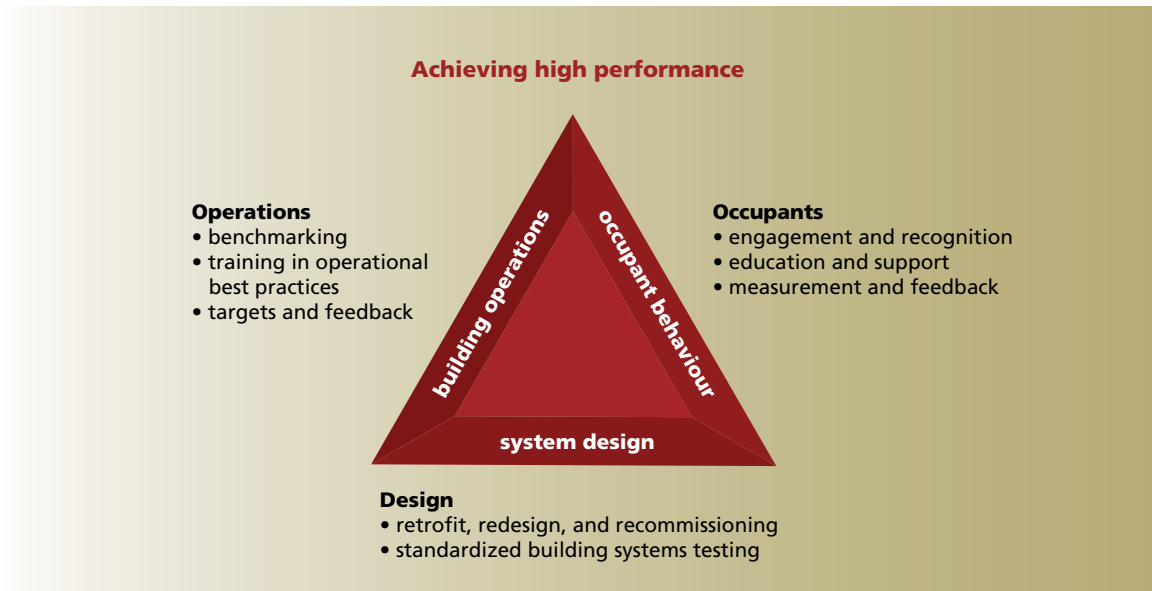
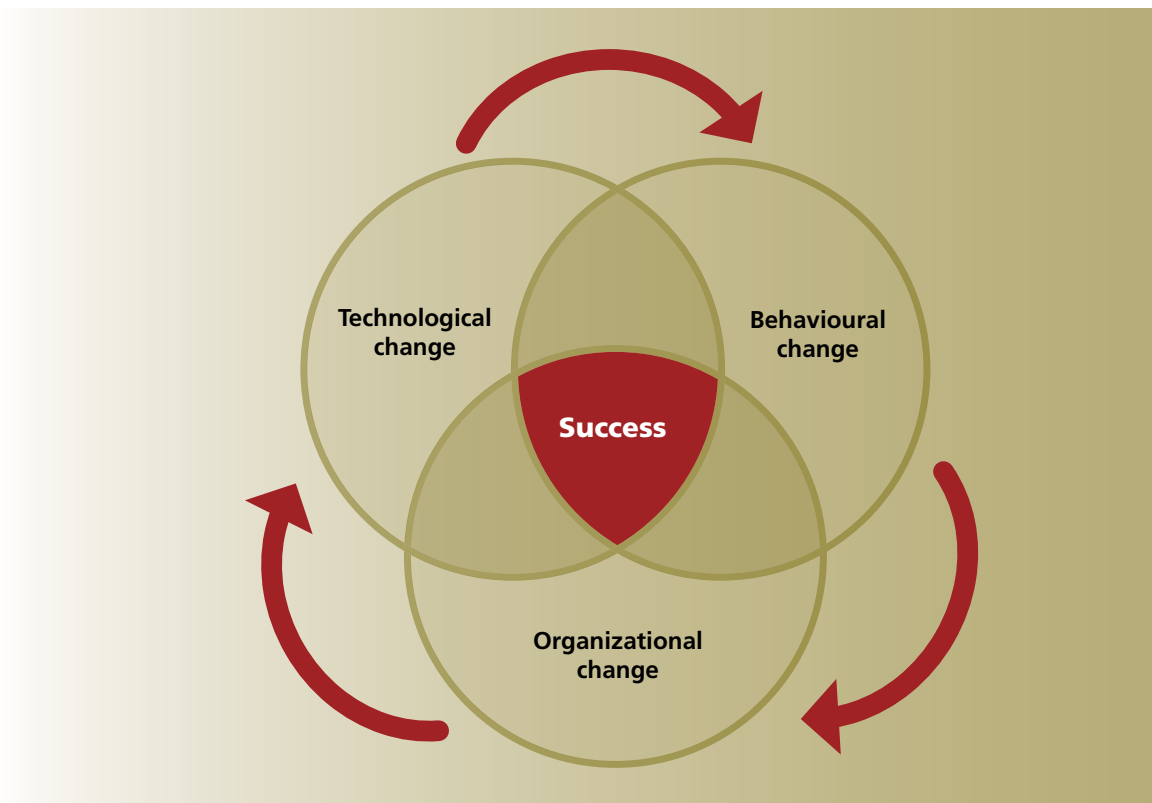


Figure 5. Interaction of behavioural, organizational and technological changes that impact energy savings



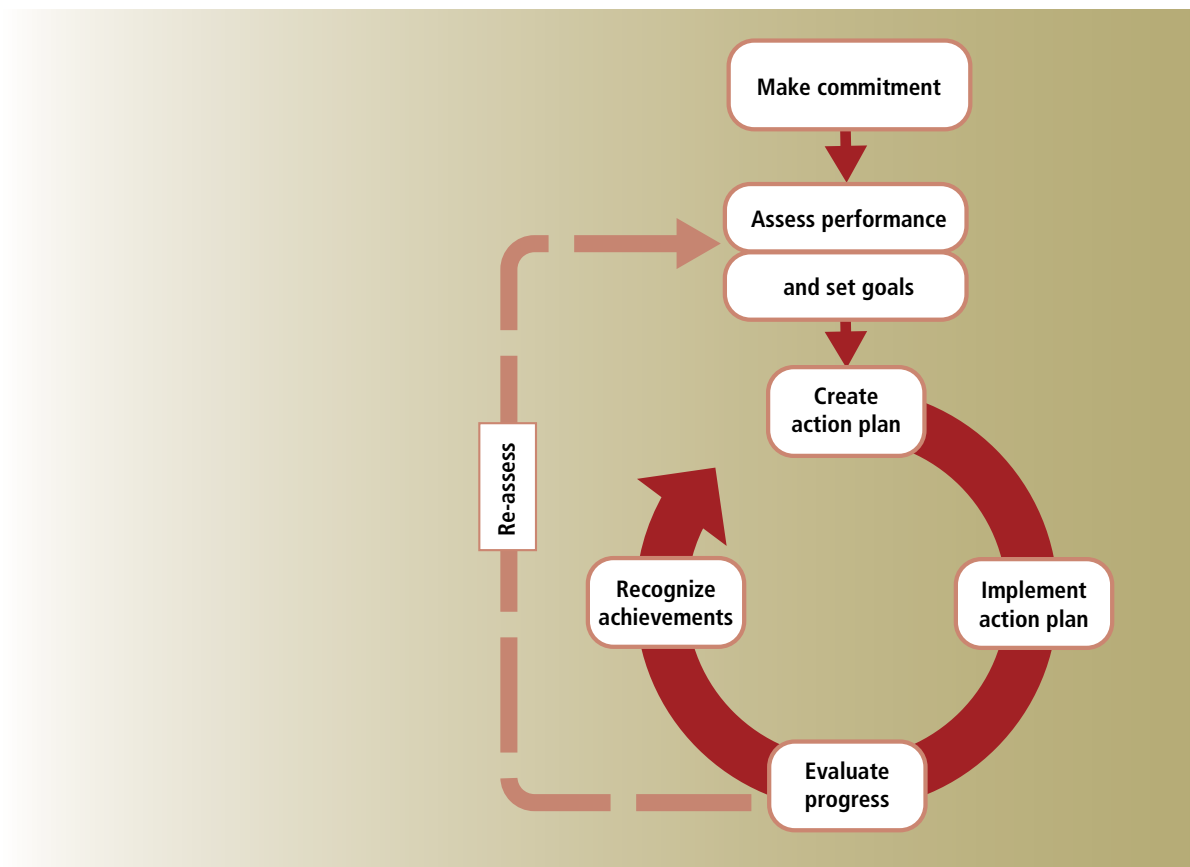
8.0

After energy benchmarking



Energy benchmarking is the starting point for the improvement of energy efficiency in a building or portfolio of buildings. The next steps are dependent on the capability of the organization to address potential operational and capital improvements, financial considerations for retrofits and occupant or tenant expectations. With executive commitment, a plan can be developed and then implemented, evaluated and reviewed to create a continuous cycle of improvement (see Figure 6).

Figure 6. Continuous improvement cycle



Source: Continuous Cycle of Improvement, [Online], Available: www.energystar.gov/index.cfm?c=guidelines.guidelines_index

To address all energy efficiency issues, engage occupants and educate and support staff. Achieving high performance in an existing building can be a slow, iterative process but ultimately a rewarding and cost-saving experience. In short, benchmarking is the road map to greater sustainability and a better bottom line.

8.1 Resources

Energy management best practices

Energy Management Best Practices Guide: Energy management best practices can provide you with a road map to develop, implement and achieve best-in-class energy performance goals for your organization as part of a cycle of continuous improvement.

ENERGY STAR Portfolio Manager: This free, online energy benchmarking tool has been adapted for Canada. [Online], Available: nrcan.gc.ca/energy/efficiency/buildings/energy-benchmarking/3691

Energy management training

Dollars to \$ense workshops: Whether it is Energy Management Information Systems, Recommissioning for Buildings, Spot the Energy Savings Opportunities, Energy Monitoring, Energy Management Planning, Energy Efficiency Financing or a combination of these workshops, we will identify the issues related to energy management and sector-specific requirements. [Online], Available: nrcan.gc.ca/energy/efficiency/buildings/emt/dollars/4167

Occupant/tenant behaviour

Implementing an Energy Efficiency Awareness Program: This program provides all the information you need to get your energy efficiency awareness campaign underway, in an easy to follow, step-by-step approach. [Online], Available: nrcan.gc.ca/sites/www.nrcan.gc.ca/files/oeefiles/pdf/publications/commercial/Awareness_Program_e.pdf

Additional resources

Diagnostic Agent for Building Operators (DABO™) software, [Online], Available: nrcan.gc.ca/energy/efficiency/buildings/research/optimization/3821

ENERGY STAR, Tools and Resources Library, [Online], Available: energystar.gov/buildings/tools-and-resources

ENERGY STAR, *Guidelines for Energy Management*, [Online], Available: www.energystar.gov/index.cfm?c=guidelines.guidelines_index

Lawrence Berkeley Laboratories, *Energy Benchmarking for Buildings and Industries*, [Online], Available: energybenchmarking.lbl.gov/

Natural Resources Canada (2010), *Energy Efficiency in Buildings: Best Practices Guide for School Facility Managers*, [Online], Available: nrcan.gc.ca/energy/publications/efficiency/buildings/5945

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Portfolio Manager Quick Start Guide, [Online], Available: www.energystar.gov/buildings/tools-and-resources/portfolio-manager-quick-start-guide

RETScreen clean energy project analysis software, [Online], Available:
nrcan.gc.ca/energy/software-tools/7465

United States Environmental Protection Agency (2007), *ENERGY STAR® Building Upgrade Manual*, Chapter 2. Benchmarking, [Online], Available: www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/save-energy/comprehensive-approach/energy-star

8.2 Other industry-based, national energy benchmarking programs

BOMA Best (BOMA Canada)
www.bomabest.com/

Greening Health Care (Toronto and Region Conservation)
www.trca.on.ca/the-living-city/programs-of-the-living-city/greening-health-care.dot

Mayors' Megawatt Challenge (Toronto and Region Conservation)
www.trca.on.ca/the-living-city/programs-of-the-living-city/mayors-megawatt-challenge/

REALpac Energy Benchmarking Program (Real Property Association of Canada)
www.realpac.ca/?page=RPEBP1Intro

8.3 Other supporting programs for the schools and commercial office sector

Destination Conservation
www.dcplanet.ca/

Ontario EcoSchools
www.ontarioecoschools.org/index.html

Partners in Project Green (Toronto and Region Conservation)
www.partnersinprojectgreen.com/

Partners in Climate Protection (Federation of Canadian Municipalities)
www.fcm.ca/home/programs/partners-for-climate-protection.htm

Race to Reduce (Greater Toronto CivicAction Alliance)
www.racetoreduce.ca/



9.0

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Office of Energy Efficiency (2010), *Commercial and Institutional Consumption of Energy Survey, Summary Report, 2005*, [Online], Available: oee.nrcan.gc.ca/publications/statistics/cices06/index.cfm

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APPENDIX A: Major barriers to energy efficiency in the buildings sector (worldwide)

Barrier categories	Definition	Examples	Countries*	Possible remedies*	References
Economic / financial barriers	Ratio of investment costs to value of energy savings	Higher up-front costs for more efficient equipment Lack of access to financing Energy subsidies Lack of internalization of environmental, health and other external costs	Most countries Especially developing, but also developed countries	Fiscal and economic instruments such as tax rebates, subsidized loans, regulatory instruments Increase energy price, remove energy price subsidies.	Deringer <i>et al.</i> 2004 Carbon Trust 2005 IPCC 2007
Hidden costs / benefits	Cost or risks (real or perceived) that are not captured directly in financial flows	Costs and risks due to potential incompatibilities, performance risks, transaction costs, etc. Poor power quality, particularly in some developing countries	All countries	Appliance standards, building codes (to overcome high transaction costs), EPC/ ESCOs, public leadership programs	Carbon Trust 2005 IPCC 2007
Market failures	Market structures and constraints that prevent the consistent trade-off between specific energy-efficient investment and the energy saving benefits	Limitations of the typical building design process Fragmented market structure Landlord / tenant split and misplaced incentives Administrative and regulatory barriers (e.g., in the incorporation of distributed generation technologies) Imperfect information Unavailability of energy efficiency equipment locally	All countries	Fiscal instruments and incentives Product standards Regulatory-normative Regulatory-informative Economic instruments Technology transfer, mechanisms	Carbon Trust 2005 IPCC 2007

Barrier categories	Definition	Examples	Countries*	Possible remedies*	References
Behavioural and organizational barriers	Behavioural characteristics of individuals and organizational characteristics of companies that hinder energy efficiency technologies and practices	Tendency to ignore small opportunities for energy conservation Organizational failures (e.g., internal split incentives) Non-payment and electricity theft Tradition, behaviour, lack of awareness and lifestyle Corruption Transition in energy expertise: loss of traditional knowledge and non-suitability of Western techniques	Developed countries Developing countries	Support, information and voluntary action: voluntary agreements Information and training programs	Carbon Trust 2005 Deringer <i>et al.</i> 2004 IPCC 2007
Information barriers*	Lack of information provided on energy saving potentials	Lacking awareness of consumers, building managers, construction companies, politicians	Especially developing, but also developed countries	Awareness raising campaigns, training of building professionals, regulatory-informative	Carbon Trust 2005 Yao <i>et al.</i> 2005 Evander <i>et al.</i> 2004
Political and structural barriers*	Structural characteristics of the political, economic, energy systems that make energy investment difficult	Process of drafting local legislation is slow Gaps between regions at different economic levels Insufficient enforcement of standards Lack of detailed guidelines, tools and experts Lack of incentives for energy efficiency investments Lack of governance leadership / interest Lack of equipment testing / certification Inadequate energy service levels	Most developing (and some developed) countries	Enhance implementation of standards Incentive policy encouraging energy efficient building design Enhance international cooperation and technology transfer Public leadership programs	Yao <i>et al.</i> 2005 Deringer <i>et al.</i> 2004

Source : based on Carbon Trust (2005) and IPCC (2007 – forthcoming)

* These categories and columns were added