Energy Innovators Initiative
Retail and Shopping Centre Sectors

Saving Energy Dollars
in Stores, Supermarkets and Malls

Natural Resources Canada
Ressources naturelles Canada

Canada

This digital mosaic of Canada, produced by Natural Resources Canada (Canada Centre for Remote Sensing), is a composite of individual satellite images. The differences in the density of vegetation are illustrated through shading.

To obtain additional free copies of this publication, please write to the following:
Energy Publications
Office of Energy Efficiency
Natural Resources Canada
c/o S.J.D.S.
Ottawa ON K1G 6S3
Fax: (819) 779-2833

Aussi disponible en français sous le titre : Profitez des économies d'énergie dans les magasins, les supermarchés et les centres commerciaux

Recycled paper

Cat No. M144-23/2003E
ISBN 0-662-35666-7

In This Guide

Throughout this guide, we list Web sites that offer useful energy efficiency information for stores, supermarkets and shopping malls. Just look for the ☞ symbol. All Web addresses are in bold.

Although some of these sites sell goods or services, Natural Resources Canada (NRCan) does not endorse one company over another. We identify these Web sites solely for the informative content they provide.

This publication and others from NRCan's Office of Energy Efficiency (OEE) are available in HTML, PDF or hard copy at **oee.nrcan.gc.ca/publications** and **oee.nrcan.gc.ca/eii/publications.cfm**.

Please note: Facts and figures in this document are drawn from several sources. All financial payback figures are estimates based on real examples, and may not be true for your facility size or area of the country.

Thanks to the following energy management firms for their help in preparing this guide:
Finn Projects, Toronto, Ontario
Prism Engineering Ltd., Vancouver, British Columbia
Roche ltée, Groupe-conseil, Québec, Quebec

Saving Energy Dollars:

Retail and Shopping Centre Energy Statistics

The retail and shopping centre sectors account for about 3 percent of Canada's secondary energy use, equating to about $3.6 billion in energy bills, 254.4 million gigajoules (70 667 million equivalent kilowatt hours) of energy consumption and 14.5 million tonnes of greenhouse gas (GHG) emissions each year.

Getting Started

Among all your operating costs, energy utilities are one of the most controllable. Through energy-efficient equipment and practices, even new facilities can save 20 percent or more. This degree of cost cutting can improve your bottom line, increase profits and put your facility in a more price-competitive position – allowing you to concentrate on sales.

Besides the advantage of utility savings, energy efficiency measures can

- improve customer and tenant comfort and satisfaction levels;
- add to the aesthetic appeal of your facility and merchandise;
- reduce maintenance costs and system failures;
- increase equipment life and building value; and
- enhance corporate citizenship – building retrofits and other energy efficiency measures help reduce GHG emissions that contribute to climate change.

This guide is written for retail and shopping centre managers and is an introduction to energy efficiency. It will help expand your knowledge so you can successfully work with engineers, energy consultants and other contractors to develop and implement an energy management plan (see the box on energy management plans on page 7 and, in "Step 3: Determine Where You Use Energy," the box on page 17 entitled "You Cannot Manage What You Do Not Measure").

On the following pages, you will learn the basics of how to

- calculate your facility's current energy use;
- compare your operation with others in Canada;
- adopt measures that could lead to both cost and energy savings; and
- calculate those potential savings.

The guide also includes many low- and no-cost "Energy Tips" compiled for the retail industry.

Whether you operate a corner store or a mega-mall, this information should give you ideas on how to save energy dollars in your organization.

A Change in Thinking: Steps in the Right Direction

In most cases, a successful energy efficiency program will require your facility to make some basic changes in the way you use technology, in the way staff acts and in the way you set internal policies or procedures. These changes need not be drastic or costly and, in fact, even minor improvements can often result in savings. Most importantly, remember that none of these changes alone will deliver substantial savings. The greatest benefits of an energy efficiency program will be realized only when you have senior management support and implement the following changes concurrently throughout your entire operation.

Technological Change Lighting; motor; heating, ventilating and air conditioning (HVAC); domestic-water; energy-control and building-envelope technologies are constantly improving and becoming more efficient.

Behavioural Change The habits of your employees and tenants can affect whether energy gets used wisely. There are opportunities to save energy dollars by influencing behaviours, improving knowledge and skills – and offering rewards.

Organizational Change Policies and procedures can help drive down utility costs, and support from senior management is crucial. Set up an energy committee, include energy-reduction goals in job-accountability forms, present cost-reduction progress reports in staff meetings and regularly track utility costs through a bill-monitoring program in your accounting department.

Employees: Your Energy Efficiency Ambassadors

In the retail industry, customers seldom contribute directly to energy consumption and waste, but your employees and tenants often can.

If employees are to consider themselves a part of an *energy-efficient organization*, they need clear and factual information to help improve their understanding. Familiarize your team with your facility's heating, lighting and ventilation systems. Make sure they know the location of major pieces of energy-consuming equipment. Tell staff in advance about any new initiatives and retrofits. The better informed employees are, the more qualified and effective they will be as energy efficiency ambassadors to your customers.

Encourage your employees to participate in an energy efficiency campaign by asking for their input, establishing clear and realizable goals, and agreeing on responsibilities. Acting without consultation will discourage their participation.

Employees are your eyes and ears. In their front-line roles, they are ideally positioned not only to identify drafts, leaks, unnecessary lighting and other signs of energy waste in your facility, but also to provide energy efficiency advice. Listening to staff could help you save even more money.

Remember to report results. Let employees know when their efforts have contributed to energy savings that benefit the company and the environment. Show them "what's in it for them" with incentive and recognition programs – paid directly out of your energy savings.

Check out the "Energy Tips" section of this guide for other staff-related hints.

Training and Awareness

Staff and/or tenant training and awareness can cut your energy costs – often from 2 to 10 percent – in addition to other energy efficiency measures.

Consider specialized training for operations and maintenance staff. Courses in building systems and energy efficiency will enable technical staff to modify operations and increase efficiencies. Non-technical staff will benefit from in-house seminars, staff meetings and demonstrations that target energy efficiency in your facility. Internal communication programs can employ a variety of tools – including posters, flyers and newsletters – to create awareness of energy efficiency and its relation to saving money and the environment.

Communicate your energy concerns and achievements to customers and tenants as well. As their awareness of energy efficiency and the environment increases, so do their expectations of you as the property owner or manager. You could provide information on how a recent energy retrofit is helping the environment and keeping prices low. You might even show them techniques they can use at home. Remember: you can increase customer satisfaction and loyalty by showing that you care about energy efficiency and climate change.

Energy and Climate Change

Energy efficiency helps protect the environment by reducing GHG emissions that contribute to climate change. The more energy we produce and fuels we burn, the more we release carbon dioxide, methane, nitrous oxide and other harmful gases into the atmosphere – gases that add to the global warming potential. GHG emissions calculations differ across the country, due to the different methods of electrical generation and types of fuel.

Learn more about these environmental and energy issues at **www.climatechange.gc.ca**.

The Energy Management Matrix

At the end of this guide, you will find an energy management matrix. Each column pertains to a key aspect of organizational energy management, and the five rows indicate levels of achievement. Follow these steps to determine your organization's current energy management rating and to track your progress over time:

- Photocopy the matrix on pages 46 and 47.
- Complete the matrix by marking an "X" in each square that corresponds most closely with your current energy practices (mark only one "X" per category).
- Join the selected "Xs" to form your profile. Any dips in the profile indicate areas that need the most attention. Aim to climb the matrix in a balanced fashion rather than committing yourself in too many areas at once.
- Ask others in your facility, including engineering and cleaning staff, to complete clean copies of the matrix. Their individual perspectives will ensure a more detailed view of your operation.
- Conduct this exercise once a year to help gauge your progress.

Energy Management Plans (EMPs) are tools that help organizations initiate, monitor and track energy savings. These plans focus on activities that will lead to real, measurable results that will save you money. EMPs also offer guidance as you seek commitments from staff and key decision-makers. You can view a sample plan at the Energy Innovators Initiative (EII) Web site at **oee.nrcan.gc.ca/eii/tools.cfm**.

NRCan offers one-day workshops across the country on developing energy management plans and related topics through **Dollars to $ense** at **oee.nrcan.gc.ca/workshops**.

Seneca College's **Building Environmental Systems** diploma course is available across the country through distance learning. Find out more at **www.senecac.on.ca/bes**.

View EMPs from other organizations at the Web site for **Canada's Climate Change Voluntary Challenge and Registry Inc.** (VCR Inc.) at **www.vcr-mvr.ca**.

Step 1:
Calculate Your Energy Costs and Consumption



To prepare an energy management plan, you must first know the types and amounts of energy your facility uses. The chart on page 9 will help you and, since your energy consumption is measured in a number of different ways, it will also convert your consumption to a common figure – gigajoules (GJ). (See "What Is a GJ?" on page 9.) The results will help you compare your facility against others in Canada in Step 2.

Use your records from any recent 12-month period (last 12 months, calendar year or fiscal year). If you or your accounting department do not have the necessary energy information, most utilities retain customer data for at least 12 months. To create a *baseline* from which you can track your progress, fill out the chart every year and compare it with these initial numbers.

For a more detailed analysis, consider hiring an energy consultant to conduct an energy audit of your facility (see "You Cannot Manage What You Do Not Measure" in Step 3). A GJ calculator can be found at oee.nrcan.gc.ca/eii/tools.cfm.

What Is a GJ?

A gigajoule (GJ) is the equivalent to 1 billion joules. A joule is a measure of the energy required to send an electrical current of one ampere through a resistance of one ohm for one second. One GJ is equal to 277.8 kilowatt hours (kWh), 1.055 million British thermal units (Btu) or 0.17 barrels of oil. Burning 1 million wooden matches completely at one time releases one GJ of energy. One GJ of electricity could make 1000 pots of coffee or keep a 60-watt light bulb continuously lit for six months.

A GJ can measure energy from various types of power, such as electricity, natural gas and oil. Similar to *equivalent kilowatt hours*, the GJ provides a standard measurement that lets you calculate a single energy-intensity figure – a number you can then use to compare with those of other facilities.

To convert from kWh to GJ, multiply by 0.0036. To convert GJ to kWh, multiply by 277.8. There is a GJ calculator at **oee.nrcan.gc.ca/eii/tools.cfm**.

Chart 1. Calculating Your Facility's Energy Costs and Consumption

Source	Annual Cost	Annual Consumption With Conversion Factor		Annual Consumption (gigajoules)	
Electricity*	$ _____	_____	kWh × 0.0036	= _____	GJ/yr.
Oil No. 2 (light)	$ _____	_____	L × 0.0387	= _____	GJ/yr.
Propane**	$ _____	_____	L × 0.0266	= _____	GJ/yr.
Natural Gas***	$ _____	_____	m^3 × 0.0372	= _____	GJ/yr.
Steam**	$ _____	_____	kg × 0.0023	= _____	GJ/yr.
Other	$ _____	_____		= _____	GJ/yr.
Total	**$** _____			_____	**GJ/yr.**

Annual Energy Intensity by Floor Area****

Total cost ÷ _____ m^2 = **$** _____ **per m^2/yr.**

Total GJ/yr. ÷ _____ rooms = _____ **GJ/m^2/yr.**

* Electricity prices are blended costs that include demand charges (kW or kilovolt amperes [kV·A]) and other service charges billed by electrical utilities above the regular cost per unit in kilowatt hours (kWh).

** Propane and steam figures are typical factors.

*** Some utilities bill in GJ, no conversion required.

**** To convert sq. ft. to m^2, divide your total floor area in sq. ft. by 10.76.

Calculations Example

Here are the calculations for a department store that has a floor area of 14 000 m^2. The facility uses 2 500 000 kWh of electricity (at $0.07 per kWh, including demand charges) and 200 000 m^3 of natural gas (at $0.26 per m^3) every 12 months.

Source	Annual Cost	Annual Consumption With Conversion Factor	Annual Consumption (gigajoules)
Electricity	$175,000	2 500 000 kWh × 0.0036	= 9000 GJ/yr.
Natural Gas	$52,000	200 000 m^3 × 0.0372	= 7440 GJ/yr.
Total	**$227,000**		= **16 440 GJ/yr.**

Annual Energy Intensity by Floor Area

$227,000 ÷ 14 000 m^2 = **$16.21 per m^2/yr.**

16 440 GJ/yr. ÷ 14 000 m^2 = **1.17 GJ/m^2/yr.**

How to Read Your Energy Bill

Some retailers never see an energy bill. Instead, you may pay fixed or variable energy costs to your landlord as part of your lease. If you do receive a bill, the following explanations may help.

Energy consumption charges reflect *the amount of energy you consume*. This is usually charged in dollars per kilowatt hour (kWh) for electricity or dollars per cubic metre (m^3) for natural gas. Propane and fuel oil are usually sold on a per-litre basis. These calculations differ across the country and could also be influenced by other factors – such as time of year, size of facility, amount of consumption and customer discounts – depending on the policies and rate structures of your local utilities.

Demand charges reflect *the rate at which energy is used*. This is often listed in the electricity bills of large energy users as a cost per kilowatt (kW) or kilovolt ampere (kV·A). Utilities must be able to supply customers at all times, based on peak use. A 20-minute spike in your electricity consumption could result in a correspondingly high charge for the entire month. This demonstrates the need to reduce energy in your peak times during the day and assign energy-intensive activities to the middle of the night when possible.

Another major consideration is **power factor** (pf), which measures how effectively your equipment converts electricity to useful power. Power factor is expressed as a percentage or decimal (90 percent or 0.9, for example), which equals real power (the amount you use in kW) divided by the total power supplied to you (in kV·A). Ideally, your pf should be as close to 1.0 as possible since some utilities charge penalties when users fail to maintain power factors of 0.9 or greater. These lower percentages are sometimes referred to as *poor* or *low power factors*. The key to avoiding penalty charges is to control *reactive power*, which is the difference between the power supplied to you and the power you use, measured in kilovar hours (kVarh). Reactive power performs no useful work, but must be supplied to your facility to generate magnetic fields used in motors, transformers and lighting ballasts. One way to correct pf is to install pf correction capacitors, described in the "Motors and Drives" section.

Other bill items can include transportation or supply charges (usually the cost of producing energy or bringing a fuel like natural gas to your province or territory), distribution or delivery charges (usually the cost of bringing this source of energy to your facility) and basic monthly or service charges. It is your company's money, so ask your utility or check its Web site if you are not sure about all the items on your bill.

Talk to a business representative from your utility to see if you qualify for any discounts.

To simplify calculations in this guide, energy rates are averaged at the following:

- **$0.07 per kWh** or **$20 per GJ** for electricity (including demand and other charges); and
- **$0.26 per m^3** or **$7 per GJ** for natural gas (including all charges).

Step 2:
Compare With Other Facilities

Benchmarking is the practice of comparing your operation's energy consumption with that of similar facilities. Factors such as the building age and the number of "degree-days" in your region (a measurement of the energy required to heat or cool your facility to maintain a comfortable temperature) may differ. However, if you compare these figures with your calculations from Step 1, you should get a good idea of your energy performance.

Please note: Food retailers usually have higher energy uses due to refrigeration and food preparation costs, so if your big-box or department store also has a restaurant or grocery section, you can expect to have higher energy costs. Restaurants, for example, often have energy intensities as high as 10 GJ/m^2. Stores with lighting, appliance or home-entertainment sections will likely have higher consumptions if display units are left on all day. Large hardware and do-it-yourself stores will also likely have higher energy consumption, due to additional motors and wood-cutting equipment.

We can use the table on page 13 to compare the department store example described in Step 1 – a 14 000-m^2 non-food big box. Its energy use was calculated at 1.17 GJ/m^2 per year. The table shows that our example store is within the typical annual energy-consumption range compared with similar stores.

Typical energy costs in the retail industry range from $20/m^2 to $52/m^2. Although it may be tempting to measure energy performance in dollars, utility prices can vary from day to day, and those used to calculate the national averages in the tables on pages 13 and 14 likely differ from prices in your area. So while it is wise to track energy prices closely, the performance measure that truly responds to changes in technology, behaviour and procedures is consumption. When benchmarking, gigajoules – not dollars – really count.

Table 1. Retail and Shopping Centres: Energy Use and Intensities

Stores, Supermarkets and Malls	Typical Annual Energy-Consumption Range*	Average Annual Energy Intensity*
Non-Food Retailers	0.8–1.0 GJ/m^2	0.9 GJ/m^2
Non-Food Big Box	0.6–1.8 GJ/m^2	1.1 GJ/m^2
Food Retailers	2.5–3.4 GJ/m^2	2.8 GJ/m^2
Enclosed Shopping Malls	1.2–1.4 GJ/m^2	1.4 GJ/m^2
Strip Malls	1.2–1.9 GJ/m^2	1.2 GJ/m^2
Total	**0.8–3.4 GJ/m^2**	**1.5 GJ/m^2**

*Benchmarking figures from Roche ltée based on various sources.

These Web sites will help you compare your retail facilities with those in other countries:

ENERGY STAR®'s Energy Benchmarking for Supermarkets and Grocery Stores at www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager.

Cal-Arch California Building Energy Reference Tool at poet.lbl.gov/cal-arch/benchmark.html.

Table 2. Retail and Shopping Centres: CIBEUS Gross Annual Average Energy Intensities*

Region	Gross Annual Average Energy Intensity (GJ/m^2) <1000 m^2	Gross Annual Average Energy Intensity (GJ/m^2) >1000 m^2	Gross Annual Average Energy Intensity (GJ/m^2) Total
Non-Food Retailers	1.6	1.2	1.4
Food Retailers	3.0	2.5	2.8
Total Retail Average	**1.9**	**1.4**	**1.6**
Enclosed Shopping Mall	–	1.2	1.2
Strip Mall	2.0	1.4	1.4
Total Shopping Centres Average	**2.0**	**1.3**	**1.3**
Total	**2.0**	**1.3**	**1.5**

Region	Gross Annual Average Energy Intensity (GJ/m^2)
the Atlantic provinces	1.8
Quebec	1.5
Ontario	1.2
the Prairies	1.5
British Columbia	2.1

Gross Floor Space (m^2)	Gross Annual Average Energy Intensity (GJ/m^2)
90–459	1.8
460–929	2.0
930–4644	1.3
4645–9289	0.9
≥9290	1.5

Year Built	Gross Annual Average Energy Intensity (GJ/m^2)
1990–99	1.5
1980–89	1.2
1970–79	1.5
1960–69	1.3
Before 1960	1.8

* The *Commercial and Institutional Building Energy Use Survey* (CIBEUS) was completed in 2002 and was the first national energy survey in these sectors. More information is available at **oee.nrcan.gc.ca/neud**. Gross average annual energy intensity is determined by dividing the sector's total energy use (GJ) by its total area (m^2).

Real Examples

The following data describe a range of facilities across Canada. All are members of the Energy Innovators Initiative, a program within NRCan's OEE (see "Take the Next Step: Join Us").

Sears – Granby, Quebec

This one-storey department store is owned by Sears Canada Inc., Toronto, and contains a hair salon (no elevators, escalators or restaurant). Management can track energy consumption in real time over the Internet to better manage demand-side energy.

Built:	1974 (energy retrofit: 2000)	
Area:	10 827 m^2	
Energy types:	Electricity, gas	
Annual energy costs and consumption:	$176,243	8 574 GJ
Energy intensity per square metre:	$16.29	0.79 GJ

Rideau Centre – Ottawa, Ontario

With 180 stores, this three-storey shopping mall in downtown Ottawa is used most hours a day as part of the city's transit system and has a very low gas bill since it needs no space heating.

Built:	1983 (no retrofits)	
Area:	70 194 m^2 (including anchor stores)	
Energy types:	Electricity, gas	
Annual energy costs and consumption:	$2,481,750	98 813 GJ
Energy intensity per square metre:	$35.36	0.71 GJ

Calgary Co-op – Calgary, Alberta

Most of these 18 full-service stores include a deli, bakery, pharmacy, floral department, meat department, community meeting room, liquor store and gas bar. Upgrades include new glass-door freezers, controls to reduce refrigeration head pressure and lighting.

Built:	1960–98 (retrofit 2003–2004)	
Area (18 facilities):	94 547 m^2 (average 6753 m^2)	
Energy types:	Electricity, gas	
Annual energy costs and consumption:	$5,213,031	326 729 GJ
Energy intensity per square metre:	$55.14	3.5 GJ

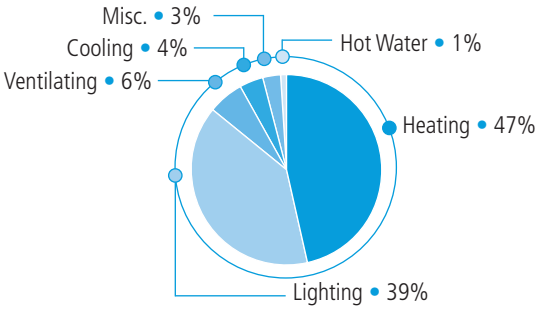
Step 3:
Determine Where You Use Energy

Before you can reduce consumption, you must determine how you are currently using energy. With this knowledge, you can identify areas in which you have the greatest opportunity to save.

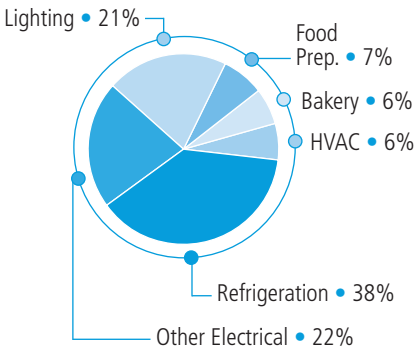
For most non-food retailers, the largest energy expenditures are lighting and HVAC. Food retailers usually have a different energy profile, with refrigeration as the largest energy expenditure followed by lighting, HVAC and food preparation (bakery and deli). Other miscellaneous costs for both types of retailers include electricity for cash registers and office equipment. Larger department stores and shopping malls also have additional motor costs for escalators and elevators. This guide presents more details on the sources of energy consumption and the retrofits that can decrease your consumption in "Step 4: Invest in Energy Efficiency Retrofits."

Without conducting an energy audit, it is difficult to calculate exact energy-use statistics, but the following charts can help, since they show typical energy-use breakdowns.*

Big-Box Retail



Supermarket



*Typical energy-use breakdown figures from Roche Itée based on various sources.

You Cannot Manage What You Do Not Measure

An audit by an energy professional can help you determine the amounts and types of energy consumed in your facilities, as well as feasible retrofit options. Audits provide the data needed to prepare an **Energy Management Plan** for your organization (see the box on page 7). Consult with an energy professional to determine the audit type that best suits your facility and budget:

- **Preliminary audits** are basic inspections in which utility and facility data are gathered and analysed. These audits establish baselines and define a building's average energy consumption.
- **Walk-through audits** involve a review of a facility's energy-use profiles, as well as overall assessments of energy-consuming systems.
- **Energy audits/feasibility studies** are the most complex audits – providing detailed analyses of facility energy-use profiles, as well as exhaustive descriptions of building systems and their operations and levels of performance. These audits can help you fully understand your facility's energy consumption, including the potential to deliver energy management savings.

You can find detailed descriptions in the publication ***Federal Buildings Initiative – Audit Standards Guidelines***, located at **oee.nrcan.gc.ca/publications**.

Step 4:

Invest in Energy Efficiency Retrofits

Cherry Picking Versus Multiple Measures

If leasing, you may be hesitant to conduct retrofits – especially those with longer payback periods. If you own the building, retrofits will not only save energy dollars, but they will also increase its value if you decide to sell your property. When conducting retrofits, there is a temptation to tackle each measure – one at a time – favouring those with the shortest paybacks. In energy management circles, this practice is known as "cherry picking." Once all short-payback retrofits have been completed, you are left facing a number of long-payback measures that will become increasingly difficult to justify. The wise approach is to bundle multiple short- and long-payback measures. You will be more likely to complete all retrofits sooner, and you will be able to subsidize long-payback projects with savings from fast-recouping capital improvements. See "Step 5. Calculate Your Savings" for definitions of simple and incremental paybacks.

Capital investments in equipment are almost sure to save you energy and money. In fact, energy retrofits can reduce your costs and consumption by an average of 20 percent or more. In addition to cost savings, these measures can add to your facility's aesthetics and increase comfort levels so customers are encouraged to stay longer, spend more and return again.

This section highlights some possible investments you may want to consider as you work to improve the energy efficiency of your retail store or shopping centre. At the beginning of each section, you will find a short description on the relevancy of the measure to you – depending on whether you have a **store**, **supermarket** or **mall**. Later in the guide, you will find a number of low- and no-cost "Energy Tips" for saving energy and money.

Table 3. Energy Retrofits: Typical Savings and Payback

System	Estimated Energy Savings* (GJ/m^2)	Approximate Payback* (years)
Lighting and Electrical	0.06	4
Food Refrigeration	0.16	4
Motors	0.02	5
HVAC	0.20	6
Domestic Water	0.09	4
Controls	0.07	5
Building Envelope	0.03	8

* Figures are estimates from projects that have received energy-retrofit financial incentives through the EII.

Lighting

Stores – In a retail business, lighting is crucial to your store's ambience, customer navigation, product presentation and sales strategy. It attracts the customer to your store, highlights the product and helps complete the sale. Managers of retail stores generally have little control of lighting measures, other than in back-of-store areas, such as employee lounges or storerooms. Since lighting can be such a critical factor in sales, head office or the franchiser typically set exact lighting specifications based on the advice of lighting consultants. If you do have control over your lighting, remember that natural lighting is important. Contrasting or non-uniform light levels are visually appealing and practical – jewellery displays should be well lit, while lighting around television displays should be dimmer. Prevent direct or indirect glare – off glass shelves or mirrors – into the eyes of your customer. With new lighting technologies, you can use less energy without reducing the quality and quantity of light.

Supermarkets – Supermarkets are usually built or renovated to match a model store designed by experts. As the case with retail stores, managers of supermarket stores do not choose lighting, but may have more control over employee break rooms and other back-of-store areas.

Malls – Managers of shopping centres may not have strict restrictions from owners, but they are generally responsible for lighting only in common areas and exteriors. With that said, of all your direct energy costs, lighting presents a key area for savings. Since lighting is often spread out over a large area, centrally controlled systems – such as those described in the "Control Systems" section – are crucial to overall lighting management.

The OEE offers a range of documents that provide additional or more complex technical information on specific energy efficiency measures:

- Buildings and Industry Publications and Products Catalogue
- Technical Fact Sheets
- Energy Management Series
- CADDET Analyses Series Reports (international)

You can order these and other documents through the EII's Publications Web site at **oee.nrcan.gc.ca/eii/publications.cfm** or the OEE Energy Publications Web site at **oee.nrcan.gc.ca/publications**.

Designed for Savings and Service

- **Exterior lighting** must create a positive impression not only to attract people to your store or mall, but also to provide a sense of comfort and security between the parking area and entrance. Use photocells to ensure that outside lights operate only at night. Metal halide and other high-intensity discharge (HID) lamps last longer than either incandescent or mercury-vapour sources. They also offer energy savings from 75 to 90 percent and provide the same safe and inviting illumination.

- **Interiors** are generally lit with incandescent tungsten bulbs or fluorescent systems with magnetic ballasts. T8 or T5 fluorescent bulbs are as much as 30 percent more efficient. If an area has more light than necessary, consider switching to a low-ballast-factor (LBF) fixture that uses standard bulbs with less light and less energy consumption. Traditional incandescent bulbs generate heat and, as a result, increase cooling loads that waste even more energy. Compact fluorescents can often use the same fixtures, giving the same degree of light while using up to 75 percent less electricity. The colour-rendering abilities of fluorescent and compact fluorescent bulbs improved significantly in the late 1990s. Moreover, fluorescents or metal halides can be used for ambient or wall lighting. You can save a lot by reducing the number of lights, such as switching from four- to two-tube fluorescent fixtures, and, with new lighting technologies, still maintain acceptable lighting levels.
- **Display lighting** is important for drawing attention to showcase items and enhancing aesthetics, but many retailers use inefficient incandescent spotlights. Halogen lighting provides a more controlled beam and can be brighter than traditional incandescent bulbs, while maintaining excellent colour rendition and saving you up to 50 percent on energy costs. Decorative halogen lights offer a similar quality of light and can be dimmed like incandescent bulbs, and the brighter white can add sparkle and a higher sense of quality – especially to glassware, crystal, china and chandeliers. Use light sensors in window displays to offer enough lighting in the day and night.
- **Washrooms** often use incandescent lamps that waste energy or cool-white fluorescent lamps that make customers' skin tones appear washed out. Higher-quality fluorescent lamps reflect true flesh tones and bring out the colours in the décor while saving energy.
- **Exit signs** offer the opportunity for significant savings. Light-emitting diode (LED), electroluminescent, photoluminescent and light-rope exit signs have approximate payback periods of less than two years.

- **Kitchens** must be well lit to ensure efficient food preparation, minimize the risk of accidents and encourage thorough housekeeping. T12 fluorescents are currently the most common kitchen-lighting fixtures, but switching to T5s or T8s with electronic ballasts will save you energy and provide short paybacks. Consider also installing timed switches or low-temperature occupancy sensors in walk-in refrigerators and freezers.
- **Back-of-store areas** – such as employee break rooms, storage areas and office space – rarely require light 24 hours a day. Occupancy sensors ensure lights are on only when someone is in a room. With many models priced from $50 to $100, these sensors can reduce energy consumption 15 to 80 percent, depending on usage. Replacing fixtures with T5 or T8 compact fluorescents will save even more energy.

Table 4. Energy-Efficient Lighting

Old System	Old Watts*	New System	New Watts*	Annual Open Hours	Savings (per unit)	Cost (per unit)	Approximate Savings (per unit)	Approximate Payback
Incandescent	100	26-W compact fluorescent	29	4380	311 kWh 1.1 GJ	$25	$21	1.2 years
Incandescent exit signs	50	LED exit signs	4	8760	403 kWh 1.5 GJ	$45	$28	1.6 years
Two T12 34-W fluorescents with magnetic ballasts	81	Two T8 32-W fluorescents with LBF electronic ballasts	51	4380	131 kWh 0.5 GJ (for the pair)	$70 (for the pair)	$9	7.8 years
400-W mercury-vapour security lighting	424	250-W metal halide	285	4380	609 kWh 2.2 GJ	$250	$43	5.4 years

* Ballast energy will increase power draw, so actual wattage – both old and new – may be higher than indicated on the bulb or system.

Assumes electricity costs of $0.07/kWh, including demand and service charges.
Prices are estimated, so actual results may vary. There are 8760 hours in one year.
This table does not reflect maintenance savings resulting from longer lamp lives.
Refer to "Step 5: Calculate Your Savings" to learn how to determine paybacks.

The Vocabulary of Lighting

Shape and size codes determine the many types and styles of bulbs on the market. For example, a *60A19* refers to a 60-watt *arbitrary* – or standard-shaped – incandescent bulb with a maximum diameter of 2⅜ in. (each unit equals ⅛ in., so 19 × ⅛ = 2⅜ in.). An *F32T8/841–48* is a 48-in.-long 32-watt tubular fluorescent bulb, 1 in. in diameter (8 × ⅛ in.), with a colour rendering index of 80 and a 4100 K colour temperature.

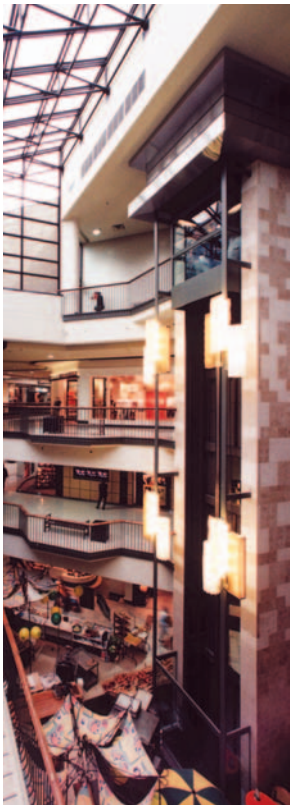
Light output (or luminous flux), measured in **lumens**, is the quantity of light per second. For example, a 100-W incandescent produces about 1750 lumens compared with a 25-W fluorescent at about 1550 lumens.

Lux is the amount of light that strikes a surface, such as a wall or floor, and is equivalent to lumens per square metre or 0.093 foot candles. In retail, lighting levels vary, from 150 lux for background lighting to 1000 lux for display lighting in big-box stores. Storeroom levels are typically low at 100 to 300 lux. These recommended lighting levels are rising to account for the *aging eyes* of the average Canadian – increasing the need for more energy-efficient lighting.

Efficacy measures the conversion of electrical energy into light in lumens per watt (lm/W). The efficacy of an incandescent bulb is only 10 to 20 lm/W compared with a compact fluorescent at 50 to 65 lm/W, T8 liner lamps at 80 to 100 lm/W, metal halide at 75 to 120 lm/W and a low-pressure sodium light at 120 to 190 lm/W.

Colour rendering index (CRI) is an objective measurement of how well colours can be seen. For example, incandescents have a rating of 97; fluorescents, 52 to 94; and metal halides, 65. As a rule of thumb, use bulbs with a CRI of at least 80 for merchandising. Fluorescent and other bulbs can come in a range of colours – from white to pink to yellow – and for aesthetics, you should take care not to mix bulb colours in one area.

Lamp life is important when choosing your lights since costs are incurred when you buy the bulbs and each time your maintenance staff must change them. Incandescent bulbs have the shortest life at only 2000 hours. Fluorescents, metal halides and other energy-efficient bulbs often last between 10 000 and 30 000 hours. Some bulbs will dim with age, so read the specifications to learn the characteristics before purchasing.



Ballasts are electrical devices that limit the current and control the voltage in fluorescent lamps. Magnetic ballasts are an older technology that often hum and flicker. If produced before 1979, these ballasts may contain harmful polychlorinated biphenyls (PCBs). Electronic ballast systems are often about 30 percent more efficient, eliminate flicker and noise and – unlike magnetic ballasts – can be dimmed for softer illumination and even greater energy savings.

Reflectors have mirror-like or reflective white surfaces that focus light and increase lumen output. By using reflectors, you can generally reduce the total wattage and number of lamps by 25 percent with no decrease in overall light levels.

Dimming controls are useful for providing supplemental illumination in areas where natural light is available during the day. Dimmers also help create an intimate atmosphere or control lighting levels for presentations. Dimming controls can extend lamp life and reduce lighting costs by 35 to 70 percent, with an approximate payback of 3.0 to 7.5 years. For more information, see the "Control Systems" section.

Daylighting refers to the use of natural light in interior and perimeter areas. Windows, skylights and translucent daylighting panels (described in the "Building Envelope" section) can reduce your daytime lighting requirements by over 50 percent. Research suggests that the presence of daylight also helps increase staff productivity and customer-satisfaction levels and sales. Use bright interior colours to maximize the daylighting effect.

These Web sites contain useful lighting information for stores, supermarkets and malls and include energy efficiency recommendations for different types of rooms and uses:

Alliance to Save Energy at
www.ase.org/programs/lighting.htm

Berkeley Labs Virtual Lighting Simulator at
gaia.lbl.gov/vls/

GE Lighting at
www.gelighting.com/na/business/retail_solutions.html

Lighting Research Centre at
lighting.lrc.rpi.edu

Philips' bulbs.com at
www.bulbs.com/lightingguide/retaillighting.asp

Food Refrigeration

Stores – Food refrigeration is not a factor for most retailers, but there are exceptions. A growing number of big-box stores are selling perishable and frozen food in addition to non-food dry goods, and many department stores contain restaurants with walk-in coolers or freezers. Florists and furriers also have requirements for cooled sections, but this is normally handled through air-conditioning units described in the "Heating, Ventilating and Air Conditioning" section.

Vocabulary of Refrigeration

Compressors have a refrigerant pump and motor resistance and are the main cooling components of any refrigeration system. They can be found locally within a cooler or freezer or centrally in a plant room.

Evaporators are the cold part of a fridge circuit and remove heat from a display cabinet.

Condensers are the warm part of a circuit and emit heat into the atmosphere. These units usually have a fan to help with heat loss and may be combined with a compressor in a "condensing unit."

Refrigerant is the fluid that is pumped through a system – evaporating to remove heat and condensing to release heat.

Chlorofluorocarbons (CFCs) are refrigerants that were internationally banned by the Montréal Protocol (1987) since they are harmful to the ozone layer. If you have not yet phased out older units, this provides another reason to replace older coolers and freezers.

Supermarkets – In a food store, refrigeration can account for over 50 percent of your energy consumption, so it should be one of your main targets for energy measures. As with lighting, head office usually makes decisions on refrigeration based on expert advice. As referenced in the "Heating, Ventilating and Air Conditioning" section, open-air coolers present special challenges since they cool the air while, at the same time, producing heat.

Malls – Tenants are usually the responsible for refrigeration but, since costs can be high, the individual metering of stores with food refrigeration is important.

Cool and Efficient

- **Doors** should be installed on open freezers and refrigerators. It is cost effective to replace old refrigeration units with energy-efficient new ones.
- **Night blinds** should be installed on all open cooling cabinets, if none exist already. For displays with goods that are accessed less often, consider **day covers** or **plastic strip curtains**.
- **Heavy plastic curtains** outside your walk-in cooler or freezer keep the cold air in and the warm air out.
- **Energy-efficient central compressors**, properly sized to match the load, can be one of your most important investments since compressors are one of the largest energy users.
- **Compressor and evaporator fan controllers** for walk-in coolers and freezers, such as the variable speed drives mentioned in the "Motors and Drives" and "Heating, Ventilating and Air Conditioning" sections, can cut the voltage to the motor and slow down the fan when full air flow is not needed. They are most useful in units that run between −2° to 4°C (28° to 40°F), with evaporator fans that run at full speed all the time. Different models include basic units that sense when the refrigerant has ceased flowing through the evaporator coil, mid-range units that monitor data over time and activate warning lights and top-end units that have a modem for remote or full-time monitoring. With investments as low as $100 per unit, savings can vary from 10 to 60 percent of overall refrigeration energy consumption and have paybacks as low as one year.
- **Remote condensers** allow for the rejection of heat to the building's exterior, instead of into the retail space when the air requires cooling.
- **Demand-defrost controls** initiate defrost cycles only when needed, instead of using automatic timers.
- **Dewpoint controls** on display cases prevent the buildup of fog on glass surfaces and the buildup of moisture on metal surfaces.
- **Larger heat exchangers** are more efficient than multiple, smaller units so when renovating, try to group cabinets together to better facilitate heat removal or recovery.
- **Fibre optic lighting** piped into cabinets minimizes heat input from traditional lighting.
- **Lighting occupancy sensors** for walk-in coolers or freezers will ensure that lights are only on when needed and will make it easier for employees to carry food in and out.
- **Insulation** in coolers and freezers should be inspected and upgraded regularly.

A calculator to help determine if you should invest in walk-in cooler controllers is provided by the Los Angeles Department of Water and Power at www.ladwp.com/energyadvisor/PA_27.html.

Motors and Drives

Stores, Supermarkets and Malls – Motors are used to run HVAC systems, escalators, elevators, hardware-store tools (key cutters, saws) and other equipment, and can account for up to 50 percent of your facility's overall energy use. Over a typical 10-year operating life, a motor can consume electricity valued at 50 times the original cost of the equipment. Using this calculation, a $1,000 motor running continuously for a decade could cost you up to $50,000 in electricity. Store managers can sometimes have more decision-making power over replacing and upgrading motors than with standardized measures, such as those for lighting and refrigeration.

The Vocabulary of Motors

Motors are classified as **AC** (alternating current from outlets), **DC** (direct current, usually from a battery) or **universal** (operating as either AC or DC). A motor's mechanical power is measured in either **kilowatts (kW)** or **horsepower (hp)** (1 hp = 0.746 kW). The two factors that determine power are **torque** (measured in newton metres or pound feet) and **speed** (measured in revolutions per minute [rpm]). The slower a motor operates, the more torque it must produce to deliver the same amount of power. A motor's **efficiency** is a measure of the energy it delivers (output) relative to the energy it uses (input).

Assess Your Needs for Optimum Efficiency

- **Energy-efficient motors** are good investments. Even if they yield only 2 to 8 percent in energy savings, these motors generally achieve incremental paybacks in 2.5 to 5.0 years compared with buying less-efficient replacement motors.
- **Adjustable-speed drives** (ASDs) – sometimes referred to as **variable-speed drives** (VSDs) and **variable-frequency drives** (VFDs) – regulate motor speeds according to the amount of work required. Reducing motor speed by 10 percent can cut power consumption by 27 percent, and a 20 percent speed reduction can cut consumption by 49 percent. These drives are particularly useful when combined with high-efficiency motors since they tend to run faster than conventional motors. An added benefit is their ability to reduce noise – an important consideration in the retail industry. These drives can save on your facility's total energy consumption, but tend to be expensive, with approximate paybacks between two and eight years.
- **Power-factor correction capacitors** are devices that store electrical charges and reduce consumption of reactive power that motors need to generate magnetic fields. These are important only if you have demand charges on your electricity bills (see "How to Read Your Energy Bill" in Step 1).

- **Energy-efficient drive belts** have teeth or longitudinal grooves that improve grip, reduce slippage and are only slightly more expensive than standard V-belts. Ensure that drive-belt inspections are performed every few months as part of regular maintenance, and replace the belts when they wear out.
- **Choose the right motor** for the job. *Oversizing* is the inefficient practice of employing a larger motor than required for a task. This is a particular concern if the motor is loaded under 50 percent.

Heating, Ventilating and Air Conditioning

HVAC accounts for some of your highest energy expenses, but these systems are also critical to employee productivity and to the comfort and satisfaction of your customers and tenants. If your facility is too cold or too hot, you can expect complaints. HVAC systems also contribute to your facility's air quality, and fresh air is particularly important in enclosed or high-odour areas. For optimum efficiency, ensure that the functions of each HVAC component complements the others – especially when ventilation systems help distribute warm and cold air.

There are many types of HVAC systems, but the self-contained, packaged systems that combine heating, ventilating and air conditioning are most common in retail. **Rooftop HVAC units (RTUs)** are often used in single-zone, single-storey buildings. **Fan coil units** are a component of central systems often used in malls and larger department stores. In these systems, air is blown over coils that have been heated by **boilers** or cooled by **chillers** in a central plant. You can also realize savings with the efficient use of cooling towers, **air-to-air heat exchangers**, **air-handling units** (AHUs), **heat pumps** and other HVAC components.

Stores – For smaller retailers, the landlord generally supplies HVAC, although many stores have smaller supplemental systems in addition to packaged units. HVAC systems not only keep your customers comfortable, they also compensate for heat-producing lighting and for large exterior windows that can cause heat gain in summer and heat loss in winter. In department stores, HVAC requirements may change throughout a single facility, depending on the concentration of people, lighting density and use of space. For example, if your store contains a restaurant, a hair salon, a television/stereo section, a lighting section, a paint shop or washrooms, these areas have special needs. And florists and furriers must maintain cold rooms with a dedicated chiller unit. (Many of the measures listed in this section may not apply to stores that use packaged systems.)

Supermarkets – HVAC holds special challenges for supermarkets. Open refrigerated display cases cool the air, but compressors have to work harder and can give off extra heat if the store is too warm. Other equipment and in-store bakeries can generate unwelcome heat in the summer. At any one time, most staff and customers are concentrated at the checkout area at the front of the store, requiring increased ventilation. The front area also features large windows and exterior exits – features contributing to heat loss in winter and heat gain in summer. (Many of the measures listed in this section may not apply to food stores that use packaged units.)

Malls – Your system regulates HVAC in common areas and, in most cases, for your tenants. Different tenants have different needs, and you need to meet capacity under varying conditions. High ceilings in common areas, heated entrances and smells associated with food courts require special ventilation.

Common HVAC Measures

- **Pick the right system** when replacing your HVAC unit, usually at the end of its life cycle. In addition to energy efficiency, consider the size, weight, maintenance costs and noise levels.
- **Outdoor air economizers** should be included with air-handling units, so outdoor air can be used for *free cooling* during spring and fall or on cool summer nights when the humidity level is not too high.
- **Smart thermostats** provide preset limits for heating and cooling – overriding unnecessarily high or low settings by staff. These thermostats also feature digital controls and readouts that ensure greater accuracy than the sliding levers on traditional units.
- **Night temperature setbacks** involve the installation of an automatic thermostat that controls the temperature when the store is closed.
- **Scheduling** or **cycling** is the practice of shutting down your HVAC equipment for short periods throughout the day. For example, shutting down fans and other systems for three minutes an hour represents 5 percent of your consumption, but may not be noticed by customers or tenants. The trick is to reduce consumption without a perceptible change in temperature. If the temperature changes, your system will have to work harder to return to desirable temperature and humidity levels.
- **Heat recovery ventilators (HRVs)** and **energy recovery ventilators (ERVs)** have balanced exhaust and supply fans that meet all ventilation needs without creating drafts and air-pressure imbalances. HRVs can feature efficiencies as high as 85 to 95 percent, with payback in roughly 3.5 years. Consider these units whenever air is continuously exhausted and make-up or ventilation air is required.
- **Variable-speed drives (VSDs)**, described in the "Motors and Drives" section, can be used with **variable-air-volume (VAV) systems** to adjust fan speeds according to operating requirements at different times of the day. In kitchens, for example, fans can be linked to burners to reduce energy consumption during off-peak cooking periods. Be careful, however, not to cut exhaust to the point that kitchen odours permeate other areas of your facility.
- **Zone isolation** and **demand control ventilation (DCV)** reduce airflow when low carbon-dioxide levels indicate a room is not in use. Implementing these measures may involve the use of variable-frequency drives (see the "Motors and Drives" section) and shut-off dampers, as well as reductions in the amount of outside air used by your HVAC system. Energy is saved not only because air distribution is reduced, but also because less air must be heated or cooled.
- **Removable and re-usable insulation** for pipes, valves and fittings is made of non-combustible materials and can provide paybacks as short as four months. Traditional insulation is often not replaced once it has been removed or damaged during maintenance. This can lead to tremendous heat loss or gain, as well as condensation and safety hazards. Removable and re-usable insulation provides a solution by simplifying both maintenance access and thermal-barrier replacement.

- **Heat pumps** transfer heat from a lower-temperature source to a higher-temperature area. In the winter, they extract heat from the outside and transfer it to the interior; in the summer, they cool inside spaces by extracting heat from the inside and transferring it to the outside. High-efficiency units can operate 10 to 30 percent more efficiently. Depending on the heat source, a heat pump can produce two to three times the energy consumed. **Geothermal or ground-source heat pumps** (GSHPs) are particularly efficient in areas with cold winters, since ground temperature is usually warmer than outside air in winter and cooler than outside air in summer. This allows GSHPs to perform 45 to 70 percent more efficiently than conventional systems.
- **Proper maintenance** is critical to any system since it helps reduce operating costs, extend operating life and avoid costly repairs. This is especially true with cooling towers, which are subject to scale deposits, clogged nozzles, biological growth, poor airflow and poor pump performance. These factors can diminish performance and raise operating costs by 10 to 25 percent. For air-handling units, buying high-quality filters will reduce airborne dust and contaminants. In new boilers, proper maintenance can deliver savings of up to 20 percent. Look for more maintenance information in the "Energy Tips" section of this guide.

The Vocabulary of HVAC

Btu/h, or British thermal units per hour, measure heat produced by boilers and cold produced by chillers. A single unit is the equivalent of 0.000295 kW or 0.000001055 GJ/h (one millionth of a GJ per hour).

Boiler hp (horsepower) measures boiler power and is equal to 33 520 Btu/h, 9.8 kW, 15.7 kg/h of steam or 0.0353636 GJ.

Boiler efficiency is calculated according to the formula: output energy divided by input energy multiplied by 100. Calculations are affected by such factors as thermal efficiency and fuel-to-steam efficiency.

Chiller efficiency measures power input per ton of cooling produced by larger chillers. A lower number indicates higher efficiency. The unit of measurement is kW/ton, in which **ton** is the amount of cooling produced when one imperial ton of ice melts. One ton equals 12 000 Btu/h or 3.516 thermal kW.

Energy efficiency ratio (EER) measures the performance of smaller chillers and rooftop units (as opposed to the kW/ton, which is used to measure the power of larger chillers in room air conditioners). EER is calculated by dividing the cooling capacity in Btu/h by a chiller's power input in watts. The higher the EER, the more efficient the unit. Standard heat-pump units often have EER values of 8.9, whereas higher-efficiency units may reach 10.

Coefficient of performance (COP) is energy output divided by energy input. The higher the COP, the more efficient the chiller or heat pump.

Seasonal energy efficiency ratio (SEER) applies to central rooftop air-conditioning units with cooling capacities of less than five tons. SEER is a seasonally adjusted rating based on representative residential loads.

Heating-Specific Measures

- **High-efficiency condensing boilers** will save you a great deal of energy when it is time to replace old boilers. These units can achieve seasonal efficiencies as high as 96 percent (compared with 75 percent for old boilers). Incremental paybacks of two to six years are common compared with purchasing mid-range replacement boilers, but initial costs can be twice as high. For example, the piping distribution and terminal-heating units may need to be redesigned for condensing boilers.
- **Boiler flue gas economizers** are heat exchangers that preheat water using boiler-stack and exhaust gases. With installed costs of about $35,000, economizers deliver a 5 to 10 percent increase in efficiency and, in large facilities, paybacks of four to 10 years.
- **Air preheaters** use hot stack gas to preheat fuel and air before combustion. These units cost about $15,000 and have payback periods from 2.5 to 3.5 years.
- **Boiler combustion** and **oxygen-trim systems** minimize energy loss by reducing the amount of excess air or fuel in a boiler stack. An automated oxygen-trim control system ensures that the proper fuel-to-air mixture is maintained. With a typical cost of $10,000 for a 300-hp boiler, these units deliver energy reductions of 1 to 5 percent and paybacks of approximately five years.
- **Boiler blowdown heat recovery** uses a heat exchanger to extract thermal energy from hot water that is continuously drained from a boiler. Prices range from $10,000 to $35,000, depending on the amount of steam supplied. Paybacks are about 6.5 years.
- **Continuous boiler blowdown monitoring and control systems** reduce the amount of hot water continuously drained from boilers. These systems typically cost $2,500 to $6,000, with approximate paybacks of five years.
- **Automatic vent dampers for boilers** prevent residual heat from being drawn up the warm stacks, reduce the amount of air that passes through furnaces or boiler-heat exchangers and improve comfort conditions during the winter by helping retain humidity in a building.

Cooling-Specific Measures

- **Energy-efficient chillers** have better controls, condensers and compressors than regular units. Their costs, however, may not always yield reasonable paybacks and may not make up for inefficiencies in other parts of air-conditioning systems, such as pumps, cooling towers and controls.
- **Refrigerants** themselves can save you energy. For example, chillers that use an HCFC-123 refrigerant have the highest energy efficiencies today, at 0.49 kW per ton.
- **Thermal energy storage** (TES) enables you to store cool water for later use as an air coolant. This function is particularly valuable for use at peak demand times during summer days. Approximate payback is 10 years.

Water

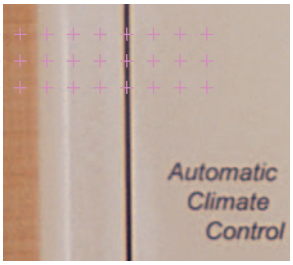
Stores, Supermarkets and Malls – Domestic hot water (DHW) – for washrooms, kitchen sinks and dishwashers – is supplied either by boilers within the HVAC system of larger facilities or, more commonly, through point-of-use water heaters. Domestic cold water is also an important consideration in larger stores and shopping malls, since energy is often required to pump water for toilets/urinals, fountains, faucets, landscaping, water-cooled air conditioners, cooling towers and humidification. Many drinking-water purification processes also consume energy.

Water-Saving Ideas

- **Pick the right system** for your facility. A unit that is too small may leave you without hot water, and too large a unit will consume more energy than necessary. You may be able to switch to a smaller system if you follow other water-saving actions listed in the "Energy Tips" section.
- **Water heater timers** ensure the heaters operate only during opening hours. **Insulating jackets** for water heaters are also an inexpensive investment with short paybacks.
- **Low-flow and/or low-temperature commercial dishwashers** save 35 to 60 percent on water and water-heating energy.
- **Low-flow toilets, waterless urinals, urinal sensors and other water management measures** can reduce cold-water use by over 20 percent. Talk to a water management consultant or your water utility for more information.

Control Systems

Stores, Supermarkets and Malls – Energy management control systems enable facility managers to improve energy efficiency by automating lighting, HVAC and other equipment. Simple controls can be used within any size of retail establishment, but the emphasis should be on simplicity so your retail staff can use them. More complex systems are important in shopping malls or larger stores with maintenance staff.



Help Manage Your Facility's Energy Use

- **Simple control systems** include time clocks, programmable electronic thermostats, programmable time controls, photocells and occupancy sensors. **Occupancy sensors**, which recognize the presence of people either through temperature change or motion, provide energy savings of 15 to 80 percent in rest rooms, small offices, storage or warehouse areas, staff rooms and other areas. Paybacks on most sensors are about five years. Although motion sensors mounted at light switches are the least expensive, they suit only small, open areas where occupants are constantly within range – not in large rooms or washrooms with stalls. The data network used by an electronic point-of-sale system can sometimes be used by the control system to share information within your facility and with head office. **Carbon-dioxide sensors** adjust ventilation depending on the number of people in a room.
- **Energy management systems (EMS)** are computerized systems that enable you to program various functions from a central point in your facility and provide early detection of operational problems. Some systems feature scheduling and monitoring functions that control temperatures and equipment in different zones – including fire or theft alarm systems. Many models can turn off equipment or activate backup generators at peak demand times. Some systems can be controlled centrally – enabling the activation of lighting and HVAC when stores open – while others are based on key-card access or occupancy sensors that manage lighting and HVAC based on room occupancy. A typical system for a shopping mall can cost $100,000 or less, with payback in as little as four years.
- **Individual metering** can ensure that you are paying only for your energy use – not your neighbour's – and that you see direct savings from your energy efficiency measures. Submetering within a large department store can help track your exact energy use.

Building Envelope

Stores, Supermarkets and Malls – The building's exterior is usually the landlord's responsibility. Many smaller retailers, if located in a mall or multi-use building, may have only an employee entrance or shipping door facing the exterior; some do not have exterior walls at all. Although a department store may have multiple customer entrances, even big-box stores and supermarkets generally have only one façade with windows. Most of the following heat-loss prevention measures apply to shopping malls and large chains. Better-quality windows, doors and insulation will help keep your utility costs down and also help reduce street noise – an important factor in the retail industry. Building-envelope improvements are generally more cost-effective when conducted as part of new construction or major retrofits.

Windows

- Various window options improve on the relative energy inefficiency of single-pane standard glazing. These include double- and triple-pane glazing, tinted glazing, reflective glazing, spectrally selective glazing and insulated glazing with inert gas between the layers. Wood and vinyl frames are more energy efficient than aluminum. Storm-window systems reduce heat loss in winter.
- A more cost-effective option than new windows is the installation of solar glazing or reflective film inside existing windows. Energy savings can be as high as 25 percent, with approximate paybacks in less than three years.
- Daylighting panels are translucent units that diffuse the light throughout the space and reduce glare, with higher R-values than conventional windows.
- Other window coverings such as shutters, shades and draperies provide insulation benefits, especially in summer when they reduce the amount of sunlight – and heat – entering rooms.

The Vocabulary of Building Envelopes

R-values measure the resistance to heat flow that occurs due to temperature differences between the interior and exterior (window and wall) of an envelope. The higher the R-value, the better the insulating properties.

U-values are the inverse of R-values (U = 1/R). In other words, they measure the amount of heat that will move through material rather than resistance to the movement.

Window performance is measured by shading coefficient (SC), solar heat-gain coefficient (SHGC), visible transmittance (T_{vis}), luminous efficacy (K_e) and R- or U-values.

Doors

- When replacing exterior doors, choose well-insulated, energy-efficient models.
- Revolving doors are the best choice for keeping wind and weather out of lobbies. Check these doors periodically to ensure there are no leaks along their edges or bottoms.
- High-quality weatherstripping that is durable and long lasting will help combat unwanted drafts.
- Install plastic secondary-door curtains inside delivery doors and bays.

Insulation

- Energy-efficient insulation types include fibre (usually available in loose-fill and batts) and foam (usually available in rigid sheets and sprays). Exterior reflective materials are also available, but offer poor insulation value.
- Seal air leaks and cracks by using foams, caulking and weatherstripping. Stuff fibreglass or glazier's foam *backer rod* insulation into areas too large to be caulked.
- Wall- and roof-insulation upgrades are best undertaken as part of larger renovation projects. Upgrades to insulation in basements and top-floor ceiling crawl spaces can be done anytime.
- If wet insulation is detected, replace it immediately once the source of the moisture has been identified and repaired.

Other Building-Envelope Measures

- Paint the exterior of your facility a light colour, if possible. This can help reflect summer heat, ease cooling loads and reduce energy consumption.
- Light-coloured roofing materials not only reduce cooling-energy consumption by 25 to 65 percent during the summer, they also extend roof life.
- A suspended ceiling reduces the area to be heated or cooled in big-box or other stores with high ceilings.
- "Living" or "green" roofs are becoming more common in Canada. Popular in Europe, these roofs are planted with grass and other vegetation. In addition to excellent insulating properties, this roof style could present multiple uses – and aesthetic appeal – in larger stores and malls.

Other Energy Efficiency Retrofits

Public Areas

- **Vending-machine controls** use passive infrared sensors to reduce energy consumption when traffic is low. These controls also monitor temperatures inside and outside machines to ensure quality products while consuming minimum energy. More importantly, the controls reduce the energy used by vending-machine lights by as much as 70 percent and save about $70 per year in low-traffic areas. Although soft-drink companies own most vending machines, you pay the power bills, so encourage your supplier to install only the latest and most efficient vending machines that contain energy controls.
- **Energy-efficient computer monitors**, including flat-panel LCDs, consume up to 90 percent less energy than models without power-management features such as sleep modes. Look for the ENERGY STAR® label.

- **Cogeneration** or combined heat and power (CHP) systems produce two useful forms of energy – usually electricity and steam heat – from a single fuel source. Although conversion to such a system can be expensive, overall efficiencies of 85 percent are often achieved. CHP fuel costs are up to 35 percent lower than those for separate generation systems.
- **Heat recovery systems** capture and re-use heat that would otherwise be lost from refrigeration systems and other appliances, especially units that are water cooled. Grey-water heat recovery can be highly cost-effective in operations where kitchens and laundries account for significant water-heating energy use. Compressors also generate heat that can be captured for other uses.
- **Compressed-air systems** power many tools, pneumatic controls and fire-control equipment, but they can waste as much as 40 percent of their overall operating costs. **Multiple-compressor control systems** are more efficient than independently controlled systems. Repairing leaks and regularly replacing filters can achieve additional efficiencies.

Remember: Energy efficiency measures do not have to be expensive. A list of low- and no-cost energy and maintenance measures is found in the "Energy Tips" section.

NRCan provides valuable information on energy-efficient equipment and appliances: **EnerGuide** at **oee.nrcan.gc.ca/energuide** and **ENERGY STAR®** at **oee.nrcan.gc.ca/energystar**.

NRCan's **Energy Resources Branch** offers information on renewable energy at **www2.nrcan.gc.ca/es/erb**.

Berkeley Labs offers a number of links to energy-simulation software packages for buildings, including DOE-2 and EnergyPlus at **gundog.lbl.gov**.

Find simple explanations about the inner workings of equipment – such as air conditioners, electric motors, light bulbs and refrigerators – at **How Stuff Works** at **www.howstuffworks.com/big.htm.**

.

Step 5:
Calculate Your Savings

Before deciding to go forward with an energy investment or retrofit, senior management usually wants to know the payback, or how many years it will take a measure to pay for itself.

If you are looking to install new equipment or adopt new measures, **simple payback** will indicate the amount of time needed for energy savings to equal the purchase price. For example, if a new energy-efficient measure costs $10,000 and will save you $1,000 in energy costs each year, its simple payback is 10 years.

If your old equipment is at the end of its life cycle, **incremental payback** is the amount of time needed to pay for the difference between an efficient and a less-efficient replacement unit. For example, an energy-efficient replacement model costs $700 and a less-efficient model costs $500. If you can save $100 a year by buying the efficient model, the incremental payback of the efficient replacement model is two years compared with buying the less-efficient replacement model.

Although more detailed formulas such as **rate of return** or **return on investment**, both incorporating life-cycle costing, are better measures for investment decisions, the template on page 37 can help you calculate approximate savings for each type of lighting upgrade in your facility. There is also an on-line simple-payback calculator at **oee.nrcan.gc.ca/eii/tools.cfm**.

Calculate Your Lighting Paybacks

A. Number of new units = _____ units
B. Purchase and installation costs per unit = $ _____
Multiply A × B **Total cost** = $ _____

C. Number of new units* = _____ units
D. Old wattage – New wattage ÷ 1000 = _____ kW saved
E. Usage in hours per day = _____ hours per day
F. Usage in days per week = _____ days per week
G. Usage in weeks per year = 52 weeks per year
H. Average local cost per kWh of electricity = $ _____ (including demand charges)
Multiply C through H **Annual savings** = $ _____

Simple payback = Total cost ÷ Annual savings = _____ **years**

*This assumes that the number of new lights is the same as the number of old lights.

For example, a store has forty 100-watt incandescent lamps that stay on 12 hours each day. The lamps are to be replaced with 25-watt compact fluorescents that cost $25 each, including installation. The average local cost of electricity is $0.07 per kWh, including demand charges. Calculations are as follows:

Total costs = 40 × $25 = **$1,000**
Annual savings = 40 units × 0.075 kW saved × 12 hours per day × 7 days per week × 52 weeks per year × 0.07 $ per kWh = **$917.28/year**
Simple payback = $1,000 ÷ $917.28/yr. = **1.1 years**

Energy Tips

Retrofits and equipment upgrades are important aspects of any utility cost-reduction strategy. However, you can also take several low- and no-cost actions to reduce energy consumption and save money. These tips are divided into two sections:

- Seasonal Checklist
- Year-Round Checklist

Carefully review the sections that apply to you, and consider compiling a list of measures to help guide energy efficiency procedures at your facility. You can copy and paste from this guide by accessing electronic HTML and PDF files found at **oee.nrcan.gc.ca/publications** or at **oee.nrcan.gc.ca/eii/publications.cfm**.

Seasonal Checklist

Spring

- ○ Adjust heating systems to ensure that they are comfortable, but not too warm (recommended: 20°C or 68°F).
- ○ Reset time switches where daylight-saving time is in effect.
- ○ Turn off heating earlier in the day, and ensure your building's warm-up period is shorter than in winter.
- ○ Service all chillers and pumps.
- ○ Check air-conditioning units in each room to ensure they are working efficiently and that controls are correctly set.
- ○ Avoid simultaneous heating and cooling, which often occurs when daily temperature fluctuations can lead to the activation of both systems.
- ○ Examine your building's external envelope for damage that could result in heat loss or gain.
- ○ Ensure ceiling insulation is dry and at the recommended thickness.
- ○ Check all external doors to ensure that they close and fit properly, and that automatic door-closing mechanisms are working efficiently.
- ○ Ensure all windows fit and close properly. Repair damaged handles and catches.
- ○ Install weatherstripping where required around external doors and windows, and check for damage to existing weatherstripping.

Summer

- ○ Consider maintaining temperatures in your facility 1° to 2°C higher than normal. Set your thermostats so that air conditioning does not engage until temperatures hit 23°C (73°F).
- ○ If possible, do not turn central air conditioning on and off, as systems will have to work harder and use more energy to re-cool and remove humidity. Maintaining a comfortable, consistent temperature will ensure optimum energy efficiency.
- ○ When buildings are closed for extended periods, ensure all non-essential HVAC and lighting systems are switched off.
- ○ Close curtains and blinds during the day to reduce heat buildup generated by sunlight.
- ○ Reverse the operation of heat recovery equipment to reduce energy consumed by air-conditioning systems.

Fall

- ○ Adjust heating systems to ensure temperatures are comfortable, but not too cool (recommended: 20°C or 68°F).
- ○ Check and reset timers at the end of daylight-saving time.
- ○ Activate heating not according to the calendar, but only when required to offset cold temperatures.
- ○ Once the heat is activated, ensure room temperatures are set to comfortable levels.
- ○ Avoid simultaneous heating and cooling, which often occurs when daily temperature fluctuations can lead to the activation of both systems.

Winter

- ○ Many customers wear their coats while shopping and will become uncomfortable if over-heated. Encourage your staff to dress warmly, or purchase company sweatshirts as a uniform.
- ○ Carpets or rubber mats at checkouts are warmer and more comfortable for staff than other types of floors.
- ○ Drop thermostat settings by 1°C for reductions in space-heating needs of 2 percent or more. Set your thermostat so that the heating does not kick in until the temperature hits 19°C (66°F).
- ○ Check heating-system controls to ensure they respond to weather changes. Minimize heating-energy consumption by setting temperatures at cool but comfortable levels.
- ○ Discourage the use of portable heaters.

Year-Round Checklist

General

- ○ The most energy-efficient lights and appliances are those that are not turned on. Make "Turn it off when not in use" your operation's catch phrase.
- ○ Negotiate contracts with your electricity supplier and other utilities and commit the savings toward retrofits.

Lighting

- ○ Keep background lights low so displays will seem brighter without being overly bright.
- ○ Zone light switches so they can be used selectively. Label or colour-code light switches to ensure lights are on only when and where required.
- ○ Set documented lighting shut-off procedures for closing and make an on-duty staff person responsible. Switch energy-intensive display lights off when the store closes. Add a "Last Person Out" switch.
- ○ Keep lights off in service areas – including storage rooms, employee lounges and walk-in refrigerators – when closed or unoccupied. Turning lights off even for a few minutes at a time will save energy over the long run.
- ○ Ensure that cleaning staff use lighting wisely. Lighting levels should provide minimum sufficient illumination for effective cleaning and staff's safe movement between work areas. Clean during daylight hours to take advantage of available natural light.
- ○ Relocate hidden and inconveniently placed light switches, if possible. People are more likely to turn lights off when switches are easy to find.
- ○ Make sure lighting controllers (time clocks and photocells) are well maintained and properly set. Check to ensure exterior lighting is off during the day.
- ○ Remove lamps where there is more lighting than needed, especially near windows.
- ○ Use task lighting whenever possible. Carefully focus directional and spot lighting to minimize the amount of spill light.
- ○ Open curtains and blinds to allow more natural light into your facility, especially in winter and at dawn or dusk when open curtains will not increase heating loads.
- ○ Reduce lighting during daylight and early-morning hours.
- ○ Dust lamps regularly. Dirty lamps and fixtures can reduce effective light output by as much as 50 percent.

HVAC

- ○ Purchase company sweatshirts for cleaning and after-hours staff so temperatures can be lowered in cool seasons.
- ○ Do not heat or cool storage areas that are seldom occupied, and use dampers to close off ducts to these areas. Reduce outside-air intake and circulation during periods of low occupancy to reduce the energy needed to warm or cool that air. Turn off ventilation when it is not required, such as during off-hours or while facilities are closed.

- ○ Ensure timer switches and thermostats are set to meet only minimum heating, ventilating and cooling loads – when and where needed.
- ○ Adjust HVAC equipment to accommodate changes both to building envelope and to heat gains and losses in a building.
- ○ Ensure that all vents – including return-air vents – are unobstructed by items such as boxes, curtains and displays. Blocking airflow reduces the efficiency of HVAC systems and increases energy costs.
- ○ Clean debris from outside air vents.
- ○ Avoid placing a lot of televisions, computers, lamps and other similar products near thermostats. The heat from these and other appliances or equipment may affect thermostat readings and lead to increased energy consumption for cooling.
- ○ Remove obstructions that restrict the free flow of air through heating and cooling units. Make sure air supply or return grilles are not blocked by furniture, books or magazines, which waste energy by making the air-handling units operate longer than necessary.
- ○ If pipe insulation is removed or damaged after maintenance, ensure it is replaced promptly or consider removable insulation.
- ○ Make sure a qualified technician regularly maintains your HVAC equipment. Ensure cooling towers are serviced regularly because they are subject to scale deposits, clogged nozzles, poor airflow and poor pump performance.
- ○ Cover and lock thermostats in common areas.

Compressed-Air Systems

- ○ Check regularly for the hissing sound of leaks and fix them promptly.
- ○ Check filters and drain traps, and watch for pressure drops as part of regular maintenance.
- ○ Monitor both use and pressure requirements. Every pressure reduction of 0.14 kilograms per square centimetre (two pounds per square inch) reduces total system horsepower by 1 percent.

Insulation

- ○ Keep windows and outside doors closed when the heating or air-conditioning equipment is on.
- ○ Seal air leaks and cracks with foam, caulking and weatherstripping. Use fibreglass or glazier's foam *backer rod* insulation in areas too large to be caulked.
- ○ Check for worn and cracked caulking and weatherstripping on doors and windows of all rooms, including those that have been permanently closed.
- ○ Watch for wet insulation and replace it immediately once the source of the moisture has been identified and repaired.

Motors

- ○ Ensure drive belts are replaced as part of regular maintenance.

Water

- ○ Monitor water use in landscaping operations to minimize waste.
- ○ Encourage cleaners to tighten all faucets and to report dripping faucets promptly.
- ○ Discourage cleaners from letting water run when washing.
- ○ A toilet that runs between flushes can waste about 750 litres (200 gallons) per day. Encourage cleaners to report leaks promptly. To test toilets, place dye or food colouring in the tank and check the bowl for colour after 15 minutes.
- ○ Place awareness stickers in every bathroom to remind customers and staff of the environmental benefits of wise water use.
- ○ Limit the general-use hot-water temperature to 43°C (110°F) except where sanitation is required, such as in dishwashers. If the faucet water is too hot, users will add cold water, which increases water and energy use.
- ○ Set back hot-water tanks to 60°C (140°F), and add insulation to hot-water supply lines at tanks.
- ○ Turn down gas water-heaters to 24°C (75°F) when closing kitchens. Turn them back up two hours before opening.
- ○ Check the insulation on hot-water storage tanks, pipes and steam lines. Look for missing and damaged insulation. Replace any insulation that is hot to the touch.
- ○ Drain and flush hot-water heater tanks semi-annually or more often if water is exceptionally hard.

Office Equipment

- ○ Shut down office equipment, such as photocopiers and computer monitors, when not in use.

Food Refrigeration

- ○ Refrigerators and freezers operate most efficiently when the refrigerator is set at 3.2°C (37°F) and the freezer is set between −18° and −15°C (0° and 5°F).
- ○ If you have night blinds, ensure they are closed at night after re-stocking. Do not overfill refrigerator shelves; proper cooling occurs when air can circulate freely throughout.
- ○ Schedule regular maintenance checks for fans, condensers and compressors. Clean these items regularly, since dirt build-up reduces efficiency.
- ○ Ensure doors fit and close properly. Maintain door gaskets and seals in good condition. Insert a piece of paper between a door and its frame – if the paper can be withdrawn easily, the gasket is not sealing properly.

- Ensure refrigerator compressor belts maintain proper tension. Replace damaged and worn belts promptly. Regularly inspect compressor lines since the presence of frost may indicate a breakdown in insulation.
- Defrost freezers frequently, since frost buildups reduce efficiency. Install a thermometer in each freezer to enable frequent temperature checks. Defrost and re-cool during off-peak hours.
- Ensure freezer curtains remain in a vertical position to retain cool air and keep out warm air.
- Oil stains near compressors may indicate leaks, which means that the compressor should be serviced promptly.

Bakery/Deli/Restaurant

- Establish and periodically review start-up and shut-down schedules for all major kitchen equipment, especially ovens.
- Most foods can be placed in ovens during preheating. Only bakery goods must wait until ovens reach the correct temperature.
- Load ovens to capacity whenever possible, but remember to maintain about a 5-cm (2-in.) clearance around pans in standard ovens to ensure proper air circulation. Forced-air convection ovens require less clearance.
- Load and unload ovens quickly, and do not open doors unnecessarily. Food cooks faster and loses less moisture when oven doors are kept closed. Temperatures drop approximately 5°C (10°F) for every second that oven doors are open.
- Clean interior oven walls and elements to improve heat transfer.
- Do not allow fans to blow directly onto cooking surfaces and equipment.
- Use sinks full of water rather than running water for washing pans and preparing food.
- Other restaurant tips are found in the publication *Saving Energy Dollars in Hotels, Motels and Restaurants*.

Take the Next Step: Join Us

You should be proud of your organization's efforts to reduce energy consumption. Display the details and results of your program to customers and competitors – after all, a commitment to saving energy and protecting the environment involves convincing others to do the same.

Another way you can demonstrate your commitment is by joining the Energy Innovators Initiative (EII). As part of NRCan's OEE, the EII encourages commercial businesses and public institutions to invest in energy efficiency. Energy retrofits help cut energy costs, increase competitiveness and reduce GHG emissions that contribute to climate change. By becoming a member of the EII, your organization will gain access to tools, publications and financial incentives for energy retrofits – delivered through an account manager assigned to work with you after you join.

Energy Innovators Initiative
Office of Energy Efficiency
Natural Resources Canada
580 Booth Street, 18th Floor
Ottawa ON K1A 0E4
Tel.: (613) 992-3245
Fax: (613) 947-4121
E-mail: info.services@nrcan.gc.ca
Web site: oee.nrcan.gc.ca/eii

Other OEE Resources

Information and knowledge are two of the keys to any successful venture, and the same holds true for energy efficiency programs. The more you know, the more energy – and money – you can save.

Publications, including this guide, are available from the OEE in HTML, PDF and hard-copy formats at **oee.nrcan.gc.ca/publications** and at **oee.nrcan.gc.ca/eii/publications.cfm**.

Dollars to $ense is a series of one-day workshops that provide practical information to help you identify opportunities to reduce energy consumption, implement energy efficiency strategies and realize energy savings throughout your organization. Held throughout the year in cities across the country, Dollars to $ense workshops can also be customized to meet the needs of individual associations and large companies. Workshop descriptions, locations and dates are available at **oee.nrcan.gc.ca/workshops**.

Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.) is a public-private partnership that encourages you to demonstrate your organization's commitment to reducing energy consumption and GHG emissions through voluntary measures. Register your energy management plan and GHG savings at **www.vcr-mvr.ca**.

Energy Management Matrix for

Refer to page 7 for instructions on how to use this chart.

Rating	Energy Policy	Information Analysis and Gathering	Implementing Energy and Water Management
4	• Senior management is committed to an environmental strategy that includes an energy policy and action plan with regular review ☐	• A comprehensive system is established to track both consumption and budget expenditures, and to identify faults and savings opportunities • Savings are reported to employees and customers ☐	• Excellent maintenance and purchasing practices • Positive discrimination in favour of *green* schemes that include investment appraisals of all new building and retrofit opportunities ☐
3	• Formal policy established, but with only minimal commitment from senior management • Policy reviewed irregularly • Limited knowledge among staff of policy's existence ☐	• Tracking system established for premises and major users, where possible • Savings are not reported to employees and customers ☐	• Very good maintenance and purchasing practices • Same payback criteria employed as in all other investments ☐
2	• The policy set by facility managers is not adopted ☐	• Consumption tracking is based on actual meter readings • Analysis of trends and input is part of budget planning ☐	• Reasonably good maintenance and purchasing practices • Energy efficiency investments based only on short-term payback criteria ☐
1	• An unwritten set of guidelines is used ☐	• Annual reporting of costs is based on analysis of utility bills, with some analysis of yearly trends ☐	• Limited, good maintenance and purchasing practices • No investments in energy efficiency upgrades ☐
0	• No explicit policy on energy management ☐	• Meter readings are not recorded, and bills are not analysed ☐	• Poor maintenance practices • No consideration of investments in energy efficiency or purchasing practices ☐

Stores, Supermarkets and Malls

Organizing for Energy Efficiency	Communications	Education
• Energy management fully integrated into operational structure • Clear delegation of responsibilities for monitoring energy consumption	• Formal and informal two-way channels of communications established among facility's energy coordinator, staff and customers	• Appropriate involvement of staff and customers in facility's energy management
☐	☐	☐
• Role of facility-resource manager is recognized • Resource manager is accountable to senior management on issues of energy efficiency	• Campaign established to raise awareness of energy efficiency; it includes regular publicity aimed at staff and customers	• Coordinated approach to energy efficiency education includes links to facility energy policy
☐	☐	☐
• An energy coordinator is in place, but line management and authority are unclear	• Some ad hoc awareness training exists for all building users	• Some opportunities to teach about energy efficiency are identified
☐	☐	☐
• Energy-management responsibilities have been identified, but are not coordinated	• Informal contacts established to communicate facility's performance on energy and water, as well as plans for improvement	• Uncoordinated delivery of energy efficiency education in the facility
☐	☐	☐
• No resource-management personnel, nor any formal delegation of responsibility for energy consumption	• No communication of facility's energy-consumption performance	• No teaching of energy-efficient practices
☐	☐	☐

Leading Canadians to Energy Efficiency at Home, at Work and on the Road

The Office of Energy Efficiency of Natural Resources Canada strengthens and expands Canada's commitment to energy efficiency in order to help address the challenges of climate change.

Canada