
Based on the Interfaith Symposium on Energy Efficiency held June 24, Halifax

Climate Change Centre
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Inspiring environmental change

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1.0 Introduction

Welcome to the Guide to Energy Efficiency for Religious Buildings in Nova Scotia. The purpose of this guide is to provide congregations with information and suggestions on energy efficiency and how to retrofit their place of worship. This guide complements the information provided at the Interfaith Symposium on Energy Efficiency hosted at St. Patrick’s Roman Catholic Church in Halifax on June 24, 2006. The organizer of this Symposium was the Climate Change Centre (hosted at Clean Nova Scotia). Funding for the event was generously provided by the Nova Scotia Department of Energy.

The format of this guide follows the theme of the presentations made at the Symposium. The issues addressed in this workbook include:

- energy efficiency and the “bigger picture”;
- basic retrofitting tips;
- the financial issues of retrofitting;
- how to engage youth groups in energy issues and;
- a case study: The KAIROS Ecumenical Energy Project (Cape Breton)

For more information on this guide, or to order a copy, please contact Clean Nova Scotia at (902) 420-3474, or email cns@clean.ns.ca.

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Churches around the world are beginning to acknowledge their role, as people of faith, in helping to protect the environment. Such a realization, that caring for the earth can be part of people's worship, can invigorate a congregation with a renewed sense of wonder; uniting the church and surrounding community in a common cause. And one way a church can start to move forward on this shared concern for the environment is through making their buildings more energy efficient.

Making a church building energy efficient may not seem like a big deal, but wasted energy not only increases building operational costs, it also adds to the amount of greenhouse gases being pumped into our atmosphere. As we are currently seeing, the resultant global warming can have huge effects on our lives and the lives of our loved ones. For example, global warming has been shown to increase the frequency of severe hurricanes, cause the spread of disease-carrying organisms in areas they had never before been able to live, and even destroy some of God's most awe-inspiring creations like the coral reefs. Although it may not seem like a lot, reducing the amount of energy that your church uses will go a long way to protecting the environment and the people who live in it.

The good news is, cutting back on energy can be easy, and is, in fact, one way that we can worship God! The first command that God gave humans was to “rule over” the earth (Genesis 1:28). Sometimes people think that means that we're to dominate it, but the Hebrew word translated as “rule” indicates that we are to rule the earth in the same way that God rules over us, through loving service. God has placed this world in our hands to take care of it; this is an awesome and tremendous responsibility. And as many churches have been finding out, honouring God by taking care of our environment, just like any other ministry the church sets itself to doing, gets blessed in surprising ways.

Don't miss out on the blessings God has for your community. Read on to find out how your church can serve through energy efficiency.

Opening Address

by Matthew Morris, youth pastor, Christian Church

“How many are your works, O Lord!
In wisdom you made them all;
the earth is full of your creatures…
I will sing to the Lord all my life;
I will sing praise to my God as long as I live.”

(Psalm 104:24,33)
2.0 Getting Started

Three Important Aspects

When getting started on energy efficiency projects within your place of worship, there are three essential aspects to consider: commitment and boundaries; your building as a holistic system; and health and safety.

2.1 Commitment and Boundaries

Making your building more energy efficient will require commitment on three levels:

2.1.1 Organizational Commitment:

• The more people who commit to action within a place of worship, the stronger the project. Having a project champion(s) is essential.
• Concerted action within an organization will lead to more resources, ideas, and creative ways to move forward on energy efficiency. Time may be needed to get consensus, but it will be worth it.

2.1.2 Technological Commitment:

• When doing retrofits, there is a good chance that new technology will have to be purchased, such as energy efficient light bulbs, weatherstripping, or a new furnace. Commitment to technological change (along with the financial planning for such changes) is essential.

2.1.3 Commitment to Behavioural Change:

• If people have poor energy management habits (such as leaving lights on, cranking up the heat, or wasting water), it takes away from the benefits of retrofitting. Educating and inspiring the congregation to change behaviour is therefore an important step.

2.1.4 Boundaries

• You need to determine where your retrofit process begins and ends: for example, does your place of worship have only one building, or does it include several?
• What are the organizational boundaries of your place of worship? Is there a provincial or national organization that is in part responsible for your building? Might cost-sharing be a possibility?
• Boundaries can also be extended to thinking about where all the resources that your building uses—from heating fuel to paper—come from. If local materials and fuels are used as much as possible, some costs may be saved.
2.2 The Building as a Holistic System

It is important to realize that a building functions as a holistic, integrated system.

“One of the most important lessons is that a house works as a system. Each part of the house is related to all other parts, and making a change in one place causes an effect elsewhere.” (Natural Resources Canada, EnerGuide, Keeping the Heat In, pg.4).

Moisture, air and heat flow all interact within this building system, so a change that affects one element, such as heat flow, could impact other elements (such as the moisture level).

2.3 Health and Safety Considerations

The information provided in this workbook will encourage you, as members of your place of worship, to engage in simple, “do-it-yourself” steps in making your building more energy efficient.

However! It is essential that proper safety measures are taken when engaging in such steps. Electric hazards, exposure to insulation, falls from ladders or accidents with power tools are all real dangers that should be considered. People with chemical sensitivities, asthma, or allergies may wish to be particularly cautious when working on retrofitting projects. For more information on this issue, you can contact Clean Nova Scotia, or consult various websites such as Health Canada’s information on vermiculite: www.hc-sc.gc.ca/iyh-vsv/prod/insulation-isolant_e.html.

Issues to Consider in Retrofitting Projects

Though this manual focuses on retrofitting tips, there are other issues that your congregation will want to consider when doing a retrofitting project in your place of worship. For more information on these issues, please contact Clean Nova Scotia or see the reference page at the end of this workbook.

- **An Energy or Retrofitting Policy** can sometimes complement the retrofitting plan by providing guiding principles.
- **Occupancy** of the religious building—who uses it, for what purpose, when, and how often?
- **Examine Records of Past & Present Energy Use**: examining your energy costs in the past and present will help you plan for the future.
- **Financial Planning** for how the retrofitting process will be paid for; also, it can be helpful to determine the pay-back for various technological retrofits.
- **Monitoring and Tracking** of past and present energy use is important. This will help to establish benchmarks for energy use in your building.
3.0 The Walk-Through Audit

Your past and present energy use data for your building will help create an energy use baseline.

Your energy team will need to decide which members will actually conduct the walk-through audit. Some aspects to consider include:

- Will one or two people be responsible for the entire audit, or will portions be divided amongst the team?
- Who has the most building or energy expertise to do the audit?
- What sort of timeline does your energy team have planned for the audit?
- Is there an opportunity to get youth involved?

How the Walk-Through Audit is Structured

For the walk-through audit, the following aspects of your religious building will need to be considered:

- **The Building Envelope**
- **The Heating, Ventilation and Air-conditioning Systems (HVAC)**
- **Electricity Use**
- **Water**
- **Green Space**

For each of the above aspects of the walk-through audit, the following information will be provided:

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Assemble your Energy Team!

Some basic tips to remember for your team:

- You need a champion(s) for this project.
- A committee should be established (the building committee can be an ideal starting point).
- You need to inspire, educate and engage the congregation (including the youth).
- Consider ways that your church’s actions may “ripple” to the home, community, etc.

Once you have your energy efficiency team assembled, you can begin your walk-through energy audit. This audit will help determine what retrofitting changes could be done to improve the building’s energy efficiency.
Basic Definition and Concept of the aspect of the building being examined, (ex. the building envelope).

The Walk-Through Audit: What to Look For and specific points to consider when doing the walk-through audit of your building. A master checklist that summarizes the six areas to be examined in the walk-through audit is included at the end of this workbook.

Technology & Action that can be taken either directly by a congregation in terms of “do-it-yourself” changes or by a professional contractor.

Behavioural Change that can be engaged by congregation members to enhance any technological changes that are made.

### 3.1 The Building Envelope

**3.1.1 Basic Definition and Concept: Building Envelope**

The building envelope refers to the shell of the building that protects occupants from the elements. The basement walls and floor, above-grade walls, the roof, windows and doors all comprise the building envelope.

The flow of moisture, heat, and air is directly related to the building envelope. As mentioned in the introduction, these qualities are all interrelated, and a change in one may affect the others (the building is a holistic system). Care needs to be exercised when dealing with air flow, for example. Air-sealing a building is regarded as one of the most effective ways to reduce energy use and improve comfort levels. However, when you air-seal a building you trap moisture inside the envelope which can lead to condensation, mould and rot. In a church, where the building may sit empty for most of the week, as much air-sealing as possible should be done. However, you should monitor moisture levels on Sunday mornings as the arrival of the congregation can introduce a lot of moisture. In a home, should moisture become a problem, you would introduce mechanical ventilation. In a church, where this may only be a problem for a few hours it may only require that the building be “aired out” for half an hour after services.

In terms of the building envelope and the flow of air, moisture, and heat, three aspects are important when doing your walk-through audit: insulation, the vapour barrier, and sealing.

**a) Insulation**

- The main reason that insulation is used in a building is to prevent heat from escaping the building. Insulation therefore must be able to resist heat flow, be able to completely fill a space, resist heat and moisture exposure, and be durable.
- There are various types of insulating materials available which can be selected based on the specific purpose for which the insulation is needed, the location it is to be placed, and the cost factor.

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**RSI or the “R Value”**

A key term related to insulation is its RSI, or the thermal resistance value. This is a precise measurement of the insulation’s resistance to heat flow. The RSI is expressed in metric, and the imperial equivalent is the R-Value. Please note that it is the RSI or R value that dictates to what extent the insulation will control heat flow: as the resistance value increases, the rate of heat transfer through the insulation decreases. It is therefore not necessarily the thickness of the insulation which determines its resistance value.
Different Types of Insulation
There are four main types of insulation:

**Batt or Blanket Insulation:**
Used to insulate easily-accessible places like exposed walls and attics.

**Loose-Fill Insulation:** Since this type of insulation can be blown or poured, it is used to fill difficult to access and/or irregular spaces in a building.

**Rigid or Semi-Rigid Boards:**
An insulating material with a high RSI value that works best in easily-accessible locations. It can also be used for below-grade exterior use.

**Spray-Foam Insulation:** A type of insulation that is mixed on-site and sprayed or poured into the area to be insulated. Once sprayed, the foam expands and sets.

Safety Tips when working with Insulation
If members of your congregation’s building committee decide that they will fix any insulation issues themselves (rather than hiring a contractor), there are some essential safety tips that must be remembered when working with insulation.

- Many insulation materials contain glass fibre and/or mineral wool that are irritants to skin, eyes, and the respiratory system. Long-sleeved clothing, gloves, eye goggles and a mask are strongly recommended.
- Wearing a hard hat is also wise when doing insulation work to avoid head injuries and getting insulating particles in your hair.
- Keep a first aid kit and fire extinguisher nearby during any retrofitting work that takes place in the building.

Retrofitting Heritage Buildings
Asbestos, Vermiculite, and Lead Paint
Many of the churches in Nova Scotia are 100+ year old buildings that may contain hazardous materials such as asbestos, vermiculite, and lead paint. Asbestos is an older type of insulation material (as well as older forms of vermiculite insulation which may contain asbestos) that has a grey or white colour and is often in a powder or semi-fibrous form. If you come across any asbestos material, DO NOT DISTURB THE MATERIAL, as asbestos is extremely irritating to the respiratory system (causing such ailments as asbestosis, lung cancer and mesothelioma). The Canadian Mortgage and Housing Corporation (CMHC) website can be visited at http://www.cmhc-schl.gc.ca/ for more information.

Lead paint may also be found in pre-1950s buildings, particularly around windows and doors, trim work or wood siding. The CMHC has a publication on lead paint that can be ordered from their website for free.

b) Air-Barrier Materials (weatherstripping and caulking)
Weatherstripping and caulking are two techniques that are used to seal up areas in your building where air may be leaking to the outdoors. Cracks in the walls or floorboards, space around doors and windows and the space around electrical outlets are all examples of where air can be leaking out of your building, in effect “heating the outdoors.”

- Weatherstripping is done around movable building structures such as windows, doors, and attic hatches.
- Caulking is done in stable, non-moving areas such as cracks in the wall, around electrical openings, where the floor meets the wall, etc. Both caulking and weatherstripping materials are relatively inexpensive and can be an excellent contribution to the retrofitting process.
• For caulking, be sure to read the label in terms of the depth the caulking will fill to. Regular caulking usually fills up to \( \frac{1}{2} \) an inch, whereas expandable foam is good for 1-2 inches.

• A first step when deciding where to do weatherstripping and caulking is to find where the air is leaking out of your building. A simple, do-it-yourself test is described on page 10. When looking for areas of air leakage in your building, the following are good areas to consider:
  - Around doors & windows
  - Where floor and exterior walls meet
  - Electrical outlets (on exterior walls)
  - Exhaust fans and ducts
  - Where ceiling and walls meet
  - Chimneys
  - Cracks in walls & floors
  - Floor Drain
  - Attic hatches
  - Gaps around pipes & ducts
  - Plumbing stack
  - Recessed light fixtures
  - Electrical wires
  - Ceiling light fixtures

c) Vapour Barrier Materials
A vapour barrier provides protection from moisture damage to the building. Various materials such as vinyl wallpaper, exterior-grade plywood, polyethylene, aluminium foil and some types of paints can function as vapour barriers.

d) Windows and Doors
The retrofitting of windows and doors to prevent air leakage can often be easy and inexpensive to do and can lead to noticeable energy cost savings. It can also allow for heritage windows and doors to be maintained without having to replace them. Simple improvements such as caulking or weatherstripping around the door and window frame may help prevent air leakage.

Other options for windows and doors include the installation of interior or exterior storm windows, the installation of an extra set of interior doors behind the main exterior doors, permanently caulking windows that are not used, and so forth.

[CAUTION: There has been a lot of discussion on the advisability of adding storm windows to stained glass. There are very real concerns regarding trapping moisture against these windows and doing damage to the lead. Many churches have added exterior plastic windows over their stained glass as a security issue. In order to protect the windows from moisture damage a lot of ventilation is also added which often negates any energy savings. If this is being considered confer with dealers, manufacturers, and perhaps most importantly, with other churches.]
3.1.2 The Walk-Through Audit: What to Look for in the Building Envelope

How to Look for Air Leaks:
A simple, do-it-yourself way to check for air leaks in your building is to light two to three incense sticks and hold them near various locations that are susceptible to air leaks such as around windows and doors, near electrical outlets, light fixtures, vents and exhaust fans, etc; see checklist in section 9.0 (page 46). If there is a strong draft, the smoke from the incense sticks will dissipate, or the tips of the incense sticks will glow. A smaller leak may draw the incense smoke towards the leak or trail away.

It is best to do the air leakage test on a cool, windy day. Pay particular attention to the windward side of your building.

If you are aware of an EnerGuide for Houses advisor in your area, you may wish to approach them and ask for a blower door test. A blower door is a fan which fits snugly into a door frame and blows air out of a building. While the door is running it is very easy to check for air infiltration in the building and make note of all the areas which need sealing.

3.1.3 Technology and Action

Do-it-yourself
Weatherstripping and caulking materials are relatively inexpensive and easy for a building committee to install. Ensure that the proper material is purchased for the job—talk to your local building supply representative for some suggestions.

Basic insulation work can also be done by congregation building members, but please take into account the safety issues and hazards involved with this sort of work. For larger, more extensive jobs, it is wise to contract a professional.

When to Contact a Professional Contractor
- For larger insulation jobs
- If windows and doors will have to be replaced
- Roof work
- Any work on mechanical systems

Retrofitting Heritage Buildings

Challenges and Tips
(NRCan’s EnerGuide Keeping the Heat in Guide, pg. 22-23)

Many religious buildings in Nova Scotia are beautiful heritage buildings. This heritage can make retrofitting projects more challenging, as various aspects of a heritage building may be difficult to alter. Large, old stained glass windows, while a treasure, can be extremely drafty. The sheer size of some of the old buildings baffles efforts to make them more efficient. Also, when making changes to the structure, congregation members may wish to seek ways that will least alter the façade, or appearance, of the building.

Some energy efficiency tips when working with heritage buildings: air sealing is an easy and unobtrusive way to retrofit a heritage building. For special, older windows such as stained glass, custom storm windows or interior storm windows may be a good alternative. For heritage doors, weatherstripping and an enclosed, separate vestibule may be an alternative. Replacing insulation (for instance, with blown-in insulation) is often an unobtrusive way to make a heritage building more efficient without damaging the structure. Lastly, replacing an old and inefficient heating system is an excellent way to improve the efficiency of a heritage building without altering its appearance or structure.
3.1.4 Behavioural Change
Once changes are made to the building envelope, inform the entire congregation about the changes. The positive behavioural changes of an informed congregation will complement the retrofitting project.

3.2 Heating, Ventilation, & Air-Conditioning Systems (HVAC)

3.2.1 Basic Definition and Concept
HVAC refers to the heating, ventilation and air-conditioning systems which are installed in a building in order to control and regulate temperatures; it includes both heating and cooling. HVAC systems are sometimes referred to as climate control systems.

Many different types of heating systems can be present in the HVAC system. These generally include hot water, hot air, or electric heat. A hot water system can be a furnace with a boiler, run by oil, electricity, gas, solar or wood, or a combination of these. A hot air system will typically be through a furnace powered by oil, gas, electricity, wood, a heat pump, or a combination. An electric heat system will be powered by electricity.

Ventilation refers to changing air to remove moisture, odours, smoke and heat. This can include air being exchanged to the outside as well as circulating air in a building, and can be through natural or forced methods.

An air conditioner is an appliance that removes heat from indoor air and releases it outside. This is done through a refrigeration cycle in which circulates indoor air—air is not brought in from outside as it is with ventilation.

The HVAC system involves both heating and cooling systems and therefore the different systems are very interrelated. Making a change in one place will cause an effect somewhere else. All ventilation systems will contribute to heat loss, and in doing so, can raise the heating costs of the building. As well, the more sealed the building is, the less air will be able to enter your home and therefore more ventilation will be needed.

HVAC systems should only be serviced and adjusted by qualified technicians. Most church buildings in Nova Scotia are heated with oil. These systems should be cleaned and adjusted at least once per year. Efficiency testing is done at that time and these numbers should be recorded. If there is a drastic decrease in efficiency from one year to the next, find the problem and correct it. Annual servicing of oil systems can reduce consumption between 5-10%.

There are a few things which can be done by your energy team in regards to HVAC systems:

- Wrap exposed hot water pipes with insulation.
- Ensure that all joints in your forced hot air ducting system are sealed with either foil backed duct tape or mastic cement.
- Practice thermostat set backs and/or install programmable thermostats.
- Change air filters in warm air units at least twice per heating season.

Managing site bookings to reduce energy use
Source: Eco-Congregation Scotland, Module 7, Greening the Cornerstone, pg.3

Reduce number of days that heat is on.
Many church premises, particularly halls and ancillary rooms, are used at different times by a variety of groups throughout the week. A church which heats the premises on Tuesday for a coffee morning, on Wednesday for an afternoon playgroup and on Thursday for an evening meeting is likely to use more heat than a church that combines the three bookings into one day.

Arrange bookings to maximize use of residual heat.
Some activities require less heat than other activities. A church which heats a hall for a sedentary afternoon activity might find that there is sufficient residual heat remaining to provide background heat for a later booking involving physical activity, such as an evening badminton club, without actually needing to extend the heating period.
3.2.2 Technology and Action

Simple Do-It-Yourself Steps:

- You can naturally and easily create a flow of air through a building. By opening one low level window and one high window, and keeping the rest of the building well sealed, will create a path for air to travel. This will provide good ventilation, at no cost. If there is only a single level to the building, opening two windows, each on opposite sides of the building, will have the same effect.
- If there is a fireplace in the building, try to keep a window open slightly when it is being used. This is because fireplaces use up household air through the combustion process, and will require the addition of air.
- If there is an old fireplace which is no longer used consider having the flue permanently blocked. If the fireplace is only used occasionally, then you can make a plug for the flue by filling a garbage bag with insulation and stuffing it up the flue. **NOTE:** Be sure to add a string and note which hangs down into the fireplace to warn others not to start a fire without removing the plug.
- Keep air vents and ducts clean, this will help increase the efficiency of the ventilation system.
- Remove any existing window air conditioning units in the fall/winter time when they will not be in use.
- Install ceiling fans as an alternative to air conditioning. Fans use less electricity than air conditioning units.
- Clean or change furnace filters once a month.

Professional Work:

- Install ventilation fans in bathrooms and kitchens if they are not already present.
- Install a central ventilation system which uses heat recovery ventilators. These systems can recover 70% of the heat from the exhaust air and can then transfer the heat to incoming air or hot water supply.
- Ensure that a qualified maintenance technician cleans and inspects heating equipment annually. This will make sure that the equipment is operating at peak efficiency.
- Have a heat pump installed. There are three types of heat pumps, air source heat pumps, water, and ground source heat pumps. They all utilize pre-existing heat to warm air inside the building in the winter, and remove heat from the building in the summer.

3.2.3 Behavioural Change

- Keep doors closed to rooms when not in use. This will help to lower the volume of the building which requires heating.
- During times of the year in which you would normally be heating the building, keep curtains closed at night to keep the cold air out and open during the day to let the sun naturally warm the room.

If you find that your building has high humidity or condensation problems, there are a number of things that can be done in addition to any technological changes that were made:

- Do not store wood in the building.
- Try not to hang laundry to dry inside.
- Turn on ventilation systems in the kitchen and the bathroom, but only when there is moisture in the room.
• Open a few windows while the building is occupied and for a few minutes after. If you are using the air conditioning system frequently, try and use other ways to cool off.
• Wear lightweight and lightly coloured clothing and drink plenty of liquids.
• Try not to use appliances that produce a lot of heat, such as the oven or the clothes dryer. Instead, use a microwave or cook outside on the barbeque and hang your clothes to dry outside.
• Close the drapes to keep out the heat.
• Turn off any unnecessary lights.
• By opening a window early in the morning, you can cool the building off, and by keeping the building sealed for the remainder of the day, you can retain much of this cool air.
• Use ceiling fans.

3.3 Electricity Use

3.3.1 Basic Definition and Concept
• Electrical energy is typically supplied to a building from a central utility via power lines. Electricity provides power for lighting, appliances, and heating & cooling in buildings. A meter records the amount of electricity used for billing by a central utility.
• Almost all buildings use a large amount of electricity, much of it unnecessarily. This is an area with a lot of room for easily-achieved energy efficiency improvements.

3.3.2 Technology and Action
Simple Do-It-Yourself Steps
a) Lighting
• Replace light bulbs with energy efficient bulbs, such as compact fluorescent light (CFL) bulbs. CFL bulbs use up to 75% less energy than incandescent bulbs, and they last around 10 times longer.
• Install dimmer switches in areas where there may only be a small requirement for lighting. Note that CFL bulbs cannot at present be used with dimmer switches.
• Replace exit sign lights with LED exit signs.

b) Equipment and Appliances
• Remove excess ice from freezers
• If the refrigerator door is not sealing properly, make sure the fridge is level, as this may fix the problem. If it still will not seal properly, it is time to replace the gaskets which can be bought from the appliance dealer or a hardware store.
• If a major appliance is replaced, look for the EnerGuide label when purchasing the replacement in order to compare energy efficiency levels.
• Install refrigerators out of direct sunlight and away from heat sources such as the oven.
• Clean the coils on the back of the fridge at least twice a year with a vacuum. Dust collecting on the coils will increase the energy required by the refrigerator to keep cool.

c) Heating and Cooling
• If not already present, install automated thermostat controls. These controls can be preset to lower the temperature during the night time, so that you don’t need to remember to do it.

Professional Work
a) Lighting
• Occupancy sensors should be installed in bathrooms, as they are used infrequently, and people can forget to turn out the light.
• Rewire switches so that one switch does not control all fixtures in multiple work spaces.
3.3.3 Behavioural Change

There are many tips to keep in mind throughout the day for electricity use. Posting posters throughout the building will present a helpful reminder. The youth groups could get involved by creating posters such as “Turn out the Light” reminders near the door or switch.

a) Lighting

- Ensure that lights are turned off whenever a room is not in use.
- Make use of any available natural lighting.
- Use specific lighting for specific purposes, i.e. do not use the general room lighting when a reading lamp will provide the required light on its own.
- Keep lights clean, as dusty bulbs will diminish the light being provided.

b) Equipment and Appliances

- Remove water coolers and keep water in the refrigerator instead. Water coolers are an inefficient use of electricity and are generally infrequently used.
- Ensure that the back of the refrigerator remains 3 inches away from the wall.
- Try not to run a refrigerator which is only partially full. A full refrigerator runs more efficiently. If you have more then one refrigerator, consider how often each is used. If they are each only partially filled, then the contents should be transferred to a single unit and the now-empty appliance should be unplugged until needed.
- When shopping for new appliances or electronics, look for the EnerGuide energy rating label.
- Turn off any equipment when not in use, such as computers.

c) Heating and Cooling

- Turn down the thermostat in rooms that are not being occupied, at night or when you leave the building.

3.4 Water

3.4.1 Basic Definition and Concept: Water Use in Buildings

Energy is needed to heat, treat, and circulate water. In a building, energy and water use is most directly tied to hot water, with the treatment and circulation happening off-site. However, in the true spirit of energy efficiency and environmental stewardship, it is good to consider water conservation in addition to ways to cut down on your water heating costs.

When examining water use in your place of worship, there are three areas in particular that should be looked at: water use and conservation, water-efficient technology, and the heating of hot water.

a) Water Use and Conservation

- It is useful to make a list of all the different ways that water is used in your building. For example, how many bathrooms are there? Is there a kitchen, and if so, is there a dishwasher? Is water from the building used to water the church grounds? Also, WHO uses the water and WHEN is the water used?
- To conserve water, it is also essential to ensure your current systems, such as toilets, sinks, and hot water tank are functioning well. For example, a leak from a hot water tap at one drop per second can waste as much as 700 L (155 gallons) of water a month, not to mention the increased cost of your energy bill. Saving on wasted hot water can therefore help reduce your building’s energy costs.

Did you know? Computer Myth Busted!

Many people think that turning off computers and monitors can harm the equipment, but this is far from the truth. Turning off computers will actually prolong their life and will save money. Leaving one computer and monitor turned on during the weekend and at night time will cost upwards of $60 per year.

(Source: Lower Costs, Greener Profits)

b) Water Efficient Technology

- Apart from ensuring that your toilet, taps and water heater are working efficiently, there may be additional retrofitting steps. For instance, low-flow faucet aerators can reduce water flow by as much as 50%.
In older toilet models, which can use as much as 15 litres of water per flush, the installation of toilet dams (or a similar device such as a plastic pop bottle filled with water) can reduce the amount of water used.

- If the toilets in your building are to be replaced altogether, consider low-flow toilet models which can use as little as 6 L or less when flushed.

c) Heating Hot Water

- Heating hot water can be a big factor in the energy use in your building. It is essential that your hot water tank is in good functioning order (annual tune-ups are important, especially for oil or gas-fired water heaters) and that it runs as efficiently as possible.

- Adding insulating blankets to hot water heaters and insulation to hot water pipes is simple and can conserve energy. The hot water heater can also be turned off in your building if it will not be used for extended periods.

- To save energy costs, your hot water tank can be turned down to 50ºC or 125º F. Any lower than this may pose health risks, such as Legionnaire’s Disease. Most hot water heaters are set as high as 140ºF, or 60ºC, so there may be an opportunity to lower the temperature. Reducing the hot water temperature from 60ºC to 50ºC can save on heating costs by as much as 12 to 14%.

- If your church does not use a lot of hot water, consider getting rid of the hot water storage tank altogether, and replacing the system with a “heating on demand” model.

- Solar hot water heaters are becoming a more and more popular option for consumers. Solar hot water heating can reduce water heating costs as much as 65%. For more information about solar hot water systems, contact Natural Resources Canada for their guide to Solar Hot Water Heating Systems at [www.canren.gc.ca/prod_serv/index](http://www.canren.gc.ca/prod_serv/index).

3.4.2 Technology and Action

**Do-it-Yourself**

There are some easy technological changes that can be done to help conserve water. The installation of faucet aerators, toilet dams or insulation blankets for hot water tanks are all easy, inexpensive steps that members of your congregation can do to improve water efficiency.

**When to Hire a Professional Contractor**

A professional contractor for water efficiency issues should be called in for any maintenance or adjustments made to your hot water tank, or if you are planning the installation of new technology (such as new toilets or sinks).

---

**Toilet Leak Detector**

Toilets can sometimes have a leak from the tank to the toilet bowl. This is often the result of a malfunctioning flapper, the rubber plug that regulates the amount of water going from tank to toilet bowl.

A leaking toilet can be a large waste of water. To test if your toilet is leaking, add a few drops of food colouring or dye tablets from your hardware store to the toilet tank. If after 15 minutes or so you see coloured water in your toilet bowl (without having flushed), it means that you have a toilet leak! A simple adjustment to the flapper may be the solution. If the problem persists, contact a professional.
3.4.3 Behavioural Change

There are all sorts of interesting ways that your congregation can be engaged in water conservation. The first step is to make the congregation aware of the efforts of the building committee in conserving water. Encourage congregation members to take simple steps, such as not running the tap excessively when washing their hands, or only plugging in the dishwasher in the kitchen when full. Posting signs or posters reminding the congregation about water conservation could be a project for the youth group, including designing a presentation or pamphlet to educate the congregation.

3.5 Green Space

Green space around a building, such as provided by trees, shrubs, grass and gardens, can provide a cool, lush and attractive area. In addition to being beautiful, such green space can also help to keep a building cool in the summer (by providing shade) and warm in the winter (by providing a wind block). Please read below for some tips on how to have a green space around your building.

**What to plant:** a variety of trees and shrubs. Small garden plots full of flowers add beauty to the landscape. A nice lawn is always attractive, though a church may wish to consider keeping lawn space minimal to reduce the cost and energy needed for maintenance. Native species should be planted as much as possible due to their hardiness. For a list of native tree and shrub species in Nova Scotia, please visit an excellent website at [www.evergreen.ca/nativeplants/search/guided.php](http://www.evergreen.ca/nativeplants/search/guided.php) or consult a field book.

**Where to plant:** to shade the building, deciduous trees and shrubs can be planted in the south and south-west area of the building. To provide a winter wind block, coniferous trees and shrubs can be planted in the north and north-west region on the building.

**The joys of gardening:** Flower or vegetable gardens can be a beautiful addition to a church’s green space. Members of the congregation, youth, and the surrounding community may wish to get involved.
The garden may be viewed alongside the church or chapel as a place to meet God and also to appreciate the beauty of the earth. The gospels record that Jesus valued finding moments of quiet to approach his Father in prayer. He did so during his busy lakeside ministry around Galilee and most poignantly in the Garden of Gethsemane as he prepared for the hour that was coming. The garden was also the place where Mary of Magdala became the first person to meet the risen Christ. Could a quiet corner be set aside around your church as a place of prayer for the church and local community?

Inviting people into the awareness of the presence of God in creation has lead the Sisters to build on the property a Contemplative Trail, an outdoor labyrinth and two hermitages. The Contemplative Trail invites people into stillness and to touch the sacred within and around them. The labyrinth is a walking prayer and a symbol for the sacred journey of life which leads us to our center and then back out into the world. The hermitage immerses an individual in nature and allows for a discovery of connection with a bigger reality. Contact us at www.themarthas.com Look under Bethany Center.

Environmental Stewardship:
Going Further

There is not room enough in this workbook to deal with the myriad of environmental issues your worship place may encounter. Some churches and faith groups are establishing committees of environmental stewards. Pursuing this energy efficiency process may have helped you identify some champions that your congregation can look up to.

To help you get started, here are some basic waste management tips:

- Remember the 4Rs: Reduce, Reuse, Recycle and...Rethink!
- Setting up a compost bin, bin for refundable beverage containers, paper and newspaper recycling, etc; is not difficult.
- Most people already recycle and compost at home, so doing so at the church should not be difficult.
A clear benefit of retrofitting a building is the cost savings on the energy bill. Religious buildings can accrue yearly energy costs ranging from $6,000 to $60,000 annually—money that could be used for things other than energy bills.

Yet what about the hidden costs that lie behind the monetary value of electricity, propane, or coal burned to power a building? What about the environmental, social, and other economic costs that are connected to the use of such fuels?

The consideration of these economic, social, and environmental costs of our actions relates to “sustainable development” which means: “Meeting the needs of the present without compromising the ability of future generations to meet their own needs.” (Our Common Future: The World Commission on Environment and Development Brundtland Report, 1987).

If we stop and think about it, there are many extended costs to fuel which consumers can chose to ignore. For example, how often do we consider the environmental costs of the production of this fuel? Were forests destroyed, or mass amounts of greenhouse gases emitted in the production of the fuel? What about the social costs, such as how communities that live near the power plants may be affected by this fuel refinement and generation? How might one begin to assign a cost to the loss of a forest, the contamination of water, or the pollution of air?

Given the high importance that a place of worship plays in a community and the leadership it provides, it is important that a strong code of environmental, social and economic ethics are represented by this institution. Such good policies easily will extend from the church, to the home, to the province, and to the globe.

The following section describes how, with just a few simple steps, your place of worship can begin to consider the “hidden costs” of your heating and power bills. Though it is important to consider the economic, social and environmental issues when looking at these hidden costs, these steps will focus on the environmental cost of greenhouse gas emissions or GHGs. This is because the greenhouse gases emitted when we burn coal, oil, and gas contribute to climate change which is considered to be the most pressing environmental issue of this century. This subject also ties in easily with the calculation of your energy costs.
4.2 Genuine Progress Index (GPI) Atlantic

GPI Atlantic is a non-profit research organization, founded in 1997, committed to the development of the Genuine Progress Index (GPI)—a new measure of sustainability, wellbeing and quality of life consisting of social, economic and environmental components. GPI Atlantic is a pioneer and leader in quality of life research and is not affiliated with any political party or interest group. For more information about GPI Atlantic, please visit www.gpiatlantic.org

The Genuine Progress Index (GPI) is designed as an alternative and complement to the current tendency to equate “progress” with economic growth alone in such indicators as the Gross Domestic Product (GDP). That approach fails to properly account for environmental degradation, natural resource health and depletion, unpaid work, equity, and a wide range of social assets such as health, education and security. For example, society would categorize increased crime, environmental catastrophes, and poorer health as negatives. However, associated spending to address these issues, such as spending on more police officers, the cost of cleaning up an oil spill, or increased spending on health care, are all counted as positives in the calculation of the GDP. Economic growth as measured by the GDP includes this kind of spending.

The GPI therefore tries to use a full-cost accounting approach to give an accurate representation of true costs and benefits to a society. Full-cost accounting means that all costs associated with a process or product are identified and quantified where possible. This includes not only typical economic impacts and costs, but also environmental and social impacts that do not typically have an economic value associated with them; for example, the effect of a project on air quality, or the benefit of a new policy in creating a more educated population. Including economic, environmental and social impacts results in a better and more complete picture that helps society better assess situations and available choices and make more responsible decisions.

The natural environment plays a pivotal role in the GPI Atlantic approach. This is because: The human economy is not a closed system. It exists as a sub-system within, and is completely dependent upon, an encompassing ecosystem that provides vital life-support services to the human economy, including climate regulation, pollination, nutrient and hydrological cycling, waste filtration and assimilation, and the range of products provided by natural resources (The GPI Greenhouse Gas Account Summary; 1997, pg.1).

So, what are the hidden costs, the damages that burning fossil fuels such as coal, oil, and gas to heat and power our religious buildings are having on the environment?

What are the implications of a practice that, aside from its environmental costs, may have detrimental effects on our life-supporting ecosystems? To understand this, the issue of fossil fuels and greenhouse gases needs to be understood.

What is a fossil fuel?

A fossil fuel is a hydrocarbon deposit, such as petroleum, coal, or natural gas, derived from living matter of a previous geologic time and used for fuel.

Fossil fuels belong in a category of energy called non-renewable energy, so called because once it is used up, it cannot be replaced. Our society uses these non-renewable fossil fuels for practically everything—to generate electricity and to heat our homes, to power our cars, machines, and to make material such as plastic (which is a petrochemical product) that we use for countless purposes.

4.3 What are the greenhouse gases (GHGs)?

Greenhouse gases are various gases that exist naturally in our atmosphere to create the greenhouse effect. The principal greenhouse gases found in the earth’s atmosphere are: water vapour (H2O), carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O). These gases are released naturally into the atmosphere from earth (see table, page 21). These greenhouse gases together in the atmosphere create a “blanket” of gases that helps to trap the
Climate Change: A Definition

Climate change can be defined as “any change in climate over time, whether due to natural variability or as a result of human activity” (The Intergovernmental Panel on Climate Change-IPCC). The Earth’s climate has changed constantly since the beginning of its existence. In fact, over a period of thousands of years, the Earth has gone through cycles of ice ages and warming periods. The big issue now (and the reason that climate change is in the news these days) is that HUMANS are currently contributing to climate change.

Environmental Stewardship:
Going Further—Benefits

The Eco-Congregation of Scotland has found that many of the churches participating in their program have benefited from greening their church in ways they had not anticipated. Churches have reported that it has:

- Brought the church family closer together
- Helped the church to deepen their understanding of God and their Christian calling
- Brought a renewed sense of wonder and joy to worship
- Helped young people to feel that the church is relevant to their lives and concerns and given them a part to play
- Drawn in adult members who previously felt they didn’t have an opportunity to use their gifts and interests in the church
- Brought old and young together over a shared interest and concern
- Been a positive witness to the wider community and sparked off renewed interest in the church in many non-church-goers
- Helped the church engage more with other groups in the community (e.g. local authority, community council, local natural history groups)
- Attracted people who have never set foot in the church building to take part in church-led activities (e.g. community litter-picks, wildlife walks or outdoor services)
- Saved the church money

(source: www.ecocongregation.org/scotland/involve/impacts.shtml)
### 4.4 Human and Natural Sources of Greenhouse Gases (GHGs)

<table>
<thead>
<tr>
<th>Greenhouse Gas (GHG)</th>
<th>Human &amp; Natural Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water Vapour (H₂O)</strong></td>
<td>When water in rivers, lakes and oceans warms and evaporates, more water vapour rises into the atmosphere. The same happens with the water from plant transpiration. Water vapour helps to keep the sun's energy that is absorbed by land and water from escaping back into space. When water vapour in the atmosphere cools, it condenses into rain and snow and then falls back to earth. That is how water cycles back into rivers, lakes and oceans.</td>
</tr>
<tr>
<td><strong>Carbon Dioxide (CO₂)</strong></td>
<td>Plants need it to survive and animals and people breathe it out. Over the past 10,000 years the amount of carbon dioxide in the atmosphere has been about the same: the amount made has been balanced by the amount used. But this balance is changing due to human activities. Human sources of CO₂ include: the burning of fossil fuels such as coal, oil and natural gas to create energy. Deforestation, poor agricultural practices, poor soil management and cement production can all lead to CO₂ emissions.</td>
</tr>
<tr>
<td><strong>Nitrous Oxide (N₂O)</strong></td>
<td>When farmers use chemical fertilizers that are nitrogen-based, nitrous oxide can be released as the fertilizer breaks down. Nitrous oxide is also stored in soil, and when farmers turn the soil to prepare the land for crops, nitrous oxide is often released. It is also created when ammonia is being made by catalytic converters in automobiles. And it's even found in horse manure! Another source is forest fires, and if the global temperatures increase the risk of forest fires is higher. Human sources of nitrous oxide include: poor soil management, transportation and industrial processes.</td>
</tr>
<tr>
<td><strong>Methane (CH₄)</strong></td>
<td>Methane is created when organic matter decomposes without oxygen present (&quot;anaerobic” decomposition). Animals like cows, bison, musk ox, sheep, goats and camels are called “ruminants.” In the large fore-stomach of these animals little microbes help food digestion. This creates gas (methane) which is released the way most of us release stomach gas. Humans also produce methane, but not nearly as much as ruminants. Another source of methane is natural gas, a fossil fuel we often use to heat homes and run some types of vehicles. In tropical countries the growing of rice includes flooding, which also produces methane. Human sources of methane: by-product when fossil fuels are extracted from the Earth, released by animals such as cattle during their digestive processes, rice paddies, produced when garbage begins to decompose in landfills, and a by-product from animal manure/slurry.</td>
</tr>
</tbody>
</table>
4.5 Predicted Climate Change Impacts: NS

Source: The Government of Canada: Climate Change in Nova Scotia fact sheet

<table>
<thead>
<tr>
<th>Climate Change Impact</th>
<th>Potential Impact on Nova Scotia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warming of ocean temperatures</td>
<td>The distribution and population of fish species could be affected. The arrival of invasive species, as well as toxic algae blooms could occur as a result of the warmer water temperatures.</td>
</tr>
<tr>
<td>Sea level rise</td>
<td>Coastal areas will be vulnerable to increased erosion and flooding. Beaches and wetlands could be threatened as a result. Coastal infrastructure, such as boardwalks and bridges, could also be negatively affected.</td>
</tr>
<tr>
<td>Storm surges</td>
<td>Storm surges are caused when low pressure and strong winds combine to suddenly raise the water level a metre or more above normal. With sea level rise, storm surges could become even more serious.</td>
</tr>
<tr>
<td>Forests</td>
<td>A changing climate may mean a change in forest species. For example, as temperatures get warmer, the boreal forest could gradually be replaced by temperate forests. Warmer temperatures may also increase the risk of invasive insects such as the gypsy moth as well as the risk of forest fires.</td>
</tr>
<tr>
<td>Freshwater</td>
<td>An increase in sea level can increase the risk of salt water intrusion of ground water. Warmer temperatures may also lead to less surface water.</td>
</tr>
<tr>
<td>The air</td>
<td>Warmer temperatures may lead to an increase in smog which is an air pollutant. This will increase negative health impacts such as asthma and chronic lung diseases.</td>
</tr>
</tbody>
</table>

4.6 How to Conduct a Greenhouse Gas Inventory for Your Religious Building

You have now read about reasons to consider the hidden costs of your energy bill in relation to greenhouse gases. You have also learned why it is important to consider the amount of GHG emissions that we emit. The final step is learning how to calculate the GHG emissions released from the electricity and heating that you use for your building.

Similar to the concept of hidden costs, there are indirect and direct emissions in a building.

- Direct emissions are generated and physically released on-site. Examples include the emissions given off from burning wood in a wood stove, or emissions from on-site oil or propane combustion to heat a building.
- Indirect emissions are those that are produced off-site. A good example is electricity that is generated here in Nova Scotia. Coal is burned at a NS Power plant to generate electricity for consumer use. When we flick on a light or turn on a radio, there are no emissions generated on site. However, pollution is given off at the actual plant where the coal is burned to generate the electricity. These indirect emissions can be considered when calculating your GHG emissions.

4.6.1 Steps for Calculating your Building’s GHG Emissions

With only a few extra calculations when calculating your building’s energy use and costs, you can find out the amount of greenhouse gas emissions coming from your building. The process is simple: you take the amount of energy your building uses, such as the amount of megawatts you use for electricity (such as per billing period or year), or the amount of propane or oil that you burn (per billing period or year) and multiply it by its emission factor. These emission factors are published in The Canadian GHG Challenge Registry Guide to Entity & Facility-Based Reporting (www.ghgregistries.ca/challenge/index_e.cfm). The table for emissions factors is reproduced at the end of this chapter. To view the full Registry,
4.6.2 Calculating GHG Emissions for Electricity Use

If your building uses 1000 kilowatts (kW) of electricity every two months, you can multiple this amount by the emission factor calculated for electricity in Nova Scotia which is 0.957 kg of carbon dioxide (CO₂) per kWh. This means that your building was responsible for 957 kg of CO₂ emitted as an indirect emission from your building.

Sample Equation:

\[1000 \text{ kW} \times 0.957 \text{ kg of CO}_2/\text{kWh} = 957 \text{ kg of CO}_2\text{ emitted as an indirect emission from your building.}\]

Example calculation for 900 litres of propane burned:

\[900 \text{ litres of propane} \times 1.500 \text{ kg/l CO}_2 \text{ equivalent} = 1350 \text{ kg of CO}_2\]

Please note that for heating fuel, the emission factors for methane (CH₄) and nitrous oxide (N₂O) are also available. So it is possible to also calculate the amount of these GHGs produced by the heating of your building.

4.7 From Simple Calculations to Bigger Steps!

When doing these calculations for your place of worship, you may simply want to do these calculations to get an idea of the amount of greenhouse gases produced by your building. However, for the more ambitious, you may wish to consider registering your building with the Canadian Standards Association (CSA) Canadian GHG Challenge Registry. Please visit www.ghgregistries.ca/challenge if you are interested in registering.

According to the CSA, the following are some reasons to consider registering your building:

- Developing a champion-level GHG Action Plan requires tracking and monitoring energy consumption, which provides opportunities to focus corporate efforts on savings.
- This publicly accessible forum allows for the comparison and publishing of best practices.
- As leading experts in managing, reporting, and measuring GHG emissions [the CSA] ensures that all submissions undergo a thorough and accurate review.
- Registered entities receive positive market recognition and exposure

1 The figure of 0.957 kg of CO₂ equivalent per kilowatt hour (kWh) is from the Environmental Policy and Program Division of Nova Scotia Power (June 2006). Please note also that the emission factors in the CSAs registry and the HRM report may be different depending on how these respective organizations did their calculations.
Please use the below table taken from the CSA’s Canadian GHG Challenge Registry Guide to find the correct emission factors for your greenhouse gas emission calculations.

### Table 3 — Emissions Factors for Common Combustion Energy Sources for Commercial and Industrial Boilers (Not Steel Production)

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Carbon Dioxide CO₂</th>
<th>Methane CH₄</th>
<th>Nitrous Oxide N₂O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>1.891 kg/m³</td>
<td>0.000037 kg/m³</td>
<td>0.000033 kg/m³</td>
</tr>
<tr>
<td>(m³) (all sectors except natural gas producers)</td>
<td>(industrial, commercial, agricultural and residential)</td>
<td>(industrial, commercial, agricultural, residential)</td>
<td>(producer consumption)</td>
</tr>
<tr>
<td>2.389 kg/m³</td>
<td>0.00049 kg/m³</td>
<td>0.0019 kg/m³</td>
<td>0.00049 kg/m³</td>
</tr>
<tr>
<td>(producer consumption only)</td>
<td>(electric utilities)</td>
<td>(pipelines)</td>
<td>(electric utilities)</td>
</tr>
<tr>
<td>0.0065 kg/m³</td>
<td></td>
<td>0.00005 kg/m³</td>
<td></td>
</tr>
<tr>
<td>(producer consumption)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Natural Gas (GJ) For virtually all applications, multiply factors above by 26.25 to get kg/GJ. (This factor does not apply to natural gas producers.)

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Carbon Dioxide CO₂</th>
<th>Methane CH₄</th>
<th>Nitrous Oxide N₂O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Still Gas</td>
<td>2.000 kg/m³</td>
<td>0.000037 kg/m³</td>
<td>0.000002 kg/m³</td>
</tr>
<tr>
<td>Light (‘Distillate’) Oil (Oil #2)</td>
<td>2.830 kg/l</td>
<td>0.000006 kg/l (industrial)</td>
<td>0.000031 kg/l (electric utilities, industrial, commercial)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.000026 kg/l (commercial, residential)</td>
<td>0.00006 kg/l (residential)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.00018 kg/l (electric utilities)</td>
<td></td>
</tr>
<tr>
<td>Heavy (‘Residual’) Oil (Oil #6)</td>
<td>3.090 kg/l</td>
<td>0.000012 kg/l (industrial)</td>
<td>0.000034 kg/l (electric utilities)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.000057 kg/l (commercial, residential)</td>
<td>0.000064 kg/l</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.000034 kg/l (electric utilities)</td>
<td>0.00006 kg/l (electric utilities, industrial, commercial)</td>
</tr>
<tr>
<td>Kerosene</td>
<td>2.550 kg/l</td>
<td>0.000006 kg/l (electric utilities, industrial)</td>
<td>0.000031 kg/l (electric utilities, industrial, commercial)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.000026 kg/l (commercial, residential)</td>
<td>0.00006 kg/l (residential)</td>
</tr>
<tr>
<td>Diesel</td>
<td>2.730 kg/l</td>
<td>0.00013 kg/l</td>
<td>0.0004 kg/l</td>
</tr>
<tr>
<td>Propane</td>
<td>1.500 kg/l</td>
<td>0.000024 kg/l</td>
<td>0.000108 kg/l</td>
</tr>
<tr>
<td>Butane</td>
<td>1.730 kg/l</td>
<td>0.000024 kg/l</td>
<td>0.000108 kg/l</td>
</tr>
<tr>
<td>Ethane</td>
<td>0.976 kg/l</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

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2. Raw natural gas is often used as fuel by the upstream oil and gas industry. This fuel contains ethane, propane, butane and other non-methane hydrocarbons, which are stripped out of natural gas at gas plants.

Canadian GHG Challenge Registry Guide to Entity & Facility-Based Reporting — Emission Factors
5.0 Youth Group Engagement

5.1 Introduction

The world around us daily reflects creation in all of its beauty and in doing so presents the need for care and protection. As stated at the UN climate change conference in Montreal (2005):

"Ultimately, climate change affects the whole of creation. It constitutes a threat for animals and plants, and disturbs the subtle equilibrium on which the present civilization is built in nature."

It is important to get youth involved in energy projects within faith communities, as the youth will help inspire the rest of the congregation and carry their education into the wider community. There are a number of different ideas presented that can be chosen from and adapted to engaging youth in energy and environmental issues. These suggestions are arranged into categories and a suggested order.

5.2 Getting Involved in the Environment

5.3 Footprints

Footprints are a measure of our impact on the environment, and this section will provide ways in which the youth can calculate their ecological and greenhouse gas footprints.

5.4 Spiritual Study

By educating youth on the spiritual aspect of helping the environment, they will be presented with the opportunity to serve.

5.5 The Audit

The audit section will discuss how to involve youth in the energy audit so that they will be interested in the retrofitting practices. This can complement section 4.0 in this workbook.

5.6 Bringing it Home

A major goal in the energy efficient church project should also be to educate others and to encourage youth to apply energy efficient techniques at home.

5.7 Other Environmental Ideas

This will present a number of fun activities and events for youth to plan and carry out. These activities can keep the youth involved and excited about the environment.

5.8 Further Study

Hopefully many of the youth will by now have a keen interest in the environment, and this section discusses a couple of possibilities for further research.
Please note that in many cases the ideas presented in this section should be passed along to youth leaders. Youth leaders can also be involved on the actual committee(s) where possible.

5.2 Getting Involved in the Environment

For youth to become engaged in the issues surrounding the environment, they must first have an interest in the world around them. This interest could stem from curiosity about, or appreciation of the sheer beauty of nature and creation. In order to help them to see this beauty, there are several possible activities.

- Community walks: these could be a quick outing to a local park or beach or a planned community event where the congregation and community are also invited.
- Plant a church or community garden: try to make the garden an activity that everyone can be excited about, by posting flyers and letting the community know that the youth will be planting a garden. There may be members of the community interested in donating plants or supplies towards the garden, especially if they see the youth excited.
- Tree planting: an excellent activity that would be beneficial to the community.
- Consult youth themselves to see what they would be interested in doing in the community.

5.3 Footprints

A very interesting way of allowing youth to realize the impact they have on the environment is to have them calculate their footprints. An ecological footprint is defined by the Public Broadcasting Service (PBS) website as an estimate of "the area of Earth's productive land and water required to supply the resources that an individual or group demands, as well as to absorb the wastes that the individual or group produces" (www.pbs.org/strangedays/glossary). There are many online footprint calculators which are very simple to use and will provide youth groups with a concept of how their choices can have an impact on our earth.

The Earthday Network, in conjunction with Redefining Progress, has the definitive footprint calculator at www.myfootprint.org/. It covers three topics—food, transport and housing. This particular calculator provides your personal ecological footprint as well as a comparison with the average North American footprint (10.2 hectares).

5.4 Spiritual Study

Aside from the ideas to engage youth in the environment already listed, it would also be beneficial to devote a night of study to the spiritual side of why they should be concerned for the environment.

For each specific religion there will be ways to tie faith and the environment together. It can be left to the youth leader to decide which approach to take based on their faith. The youth will hopefully realize that they are being provided the opportunity to serve by doing things for the environment. By being involved in the world around them, they can strengthen their faith, build leadership skills, and gain hope for the future. The topic of justice to the world and creation can open their eyes to the needs of others.
5.5 The Audit

Please see the master checklist at the end of this workbook for tips on how the youth could be involved in the energy audit of your church. Aside from helping to collect information or monitor energy use, youth can also help by:

- Looking for areas that may benefit from signs prompting energy efficiency actions, such as near light switches or doorways. These signs can display reminders such as “don’t forget to turn out the light!” or “please close door tightly!” that the youth could make and post themselves.

- Also, youth could be the ‘energy ambassadors’ for a church where they are responsible for helping to promote energy efficiency to the congregation and to educate the congregation. The youth could be given some of the main responsibilities to educate the congregation members about energy efficiency and the behavioural changes that must be done to complement retrofitting projects.

- During this energy audit, it may be a good idea to make the church energy utility bills available to the youth group. They could also be posted in a public location for the whole of the congregation to see. Keeping track of how much energy is used each month from the utility bills is one of the best ways to educate members of the congregation about the problem and motivate them to do something about it. It will also enable them to see how the efficiency projects have a financial impact as well as the environmentally related benefits.

- Getting the youth involved from this initial audit step through to the implementation of the ‘green’ ideas will ensure that the youth will stay interested and excited about what is happening to the church.

5.6 Bringing it Home

Educating family members is a predicted part of the “Ripple Effect” shown in section 4.0. Ideally, youth will be able to enforce energy efficient measures in their own homes and to educate family and friends; therefore applying the information they have learned.

School Presentations (or Guest Speakers): the youth may be interested in giving presentations to the congregation or their class and conversely, they may be interested in inviting guest speakers to talk about a relevant subject.

Global Justice: one possible topic could be justice for the poor who are unfairly impacted by the actions of the wealthy nations. This topic was widely discussed at the UN climate change conference in Montreal on December 9, 2005; “…we owe a debt to poor and marginalised communities who, by emitting low levels of CO₂, limit the climate impact that would occur if all people were to live the lives of the wealthy communities…”
5.7 Additional Ideas

Once the energy project is underway, it may be a good idea to keep the youth involved in other environmental projects.

- A **special recognition program** could be initiated honouring youth who raise awareness and participate in developing an eco-community. The youth group could be in charge of nomination and the honouree could receive a certificate to be displayed in the church.

- A **commitment list of goals** for reduced energy use made by the youth group (and the wider congregation) could be posted.

- A **swap day or yard sale** can help emphasize the importance of diverting material from landfills and appreciating how many consumer goods already exist. A swap is where everyone brings in items they no longer want or use, such as clothing, books or toys, to be traded. Those involved can swap items with each other, with no need for money to be involved. Alternately, the congregation may choose to collect the items for a yard sale. The money raised could be donated towards the church or a charity of the youth group's choice.

- A **community clean-up day** reduces litter and waste in public areas. Youth and congregation could help collect garbage near the faith centre or along roads, in parks, or on beaches. Be sure that before and after pictures are taken to remind the youth of the impact they can visibly have on the environment around them.

Solar Cookers: many websites are available with instructions on how to build your own solar cooker, such as www.solarcooking.org. This particular website has a number of different styles of cookers to choose from and the youth can decide which one they feel would be most efficient. These are relatively inexpensive to construct and will allow the youth to see first-hand the power of the sun through cooking.

Solar cars: you can order kits that can be used to create small cars that run via solar power, see www.sunwind.ca. There are also websites which give instructions on how to build a solar car from scratch, such as www.xof1.com/educationmini.html. The materials needed are generally things you may already have, other than solar cells and a small motor, which can be found at a hobby or craft store, or at an electronics store.

5.9 Conclusion

Youth involved at an early age will carry with them the importance of the environment, and its relation to their faith. They will know that they have made a lasting contribution to their community both by being involved in their church energy efficiency project and by creating awareness among friends and family. Cleaning up the areas around which they live will provide them with the fulfilment of knowing they can have a direct input through relatively simple actions.

“… the gift of life – ever so precious and ever so delicate – which for us and other people of faith is a gracious and sacred gift.”

- World Council of church’s statement to the high level segment of the UN climate change conference. Montreal, December 9, 2005.

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5.8 Further Research

Some members of the group may want to conduct further research into other future possibilities in terms of renewable energy, such as solar panels on the roof.

Did you know? Trees clean!

In one year an acre of trees can absorb as much carbon as is produced by a car driven up to 14,000 kilometres.

Source: International Society of Arboriculture

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28 | GUIDE TO ENERGY EFFICIENCY FOR RELIGIOUS BUILDINGS IN NOVA SCOTIA |
6.0 Energy Efficiency Improvements

Tools, Costs and Paybacks

By: Brian MacNeish, Atlantic Home Inspections

6.1 Energy Audits

Different types of commercial energy audits can be performed on a church.

6.1.1 Class A: The “full meal deal”

Done by experienced engineering or energy professionals

- all wall/ceiling/basement/window surfaces are measured and construction type determined
- existing insulation types and R values are noted
- a building air leakage test is conducted using a blower door
- building orientation determined
- heating system type and heat delivery mode recorded
- heating system efficiency test conducted
- light types/locations/wattages recorded
- water use and fuel type noted
- all data entered in recognized energy audit program
- fuel and electrical records used to reconcile with audit numbers
- recommendations made for retrofits with anticipated years of payback

Cost: $1,500 - $5,000 +

6.1.2 Class B

- done by experienced engineering or energy professionals
- a “walk through” that records the existing insulation types and R values, notes windows with regards to number of layers of glass
- heating system efficiency test conducted
- light types/locations/wattages recorded.

Brian MacNeish, in a still captured from the Clean Nova Scotia DVD production, “Feeling the Loss: Air Leakage and Your Home”
• water use and fuel type noted
• Calculations done and retrofit recommendations made with estimated years to payback included

Cost: $700 - $2,000

6.1.3 Class C
Least accurate of all due to limited knowledge of building owner. A questionnaire is filled out by owner and sent to utility. They make recommendations based on information on form.

Cost: Free

Note: In any audit, be looking for potential moisture problems, from leaking roofs and foundations to crawl spaces with uncovered dirt floors

6.2 Retrofitting Measures

6.2.1 Air Sealing
During first energy crunch of 1978-85, air sealing was poorly or not understood by most insulation companies and hence little was done.

Uncontrolled air leakage (infiltration and exfiltration) can be responsible for up to 40% of a heating bill. Older buildings have much more air leakage than newer ones.

Air leakage occurs at:
• baseboards and window trim
• electrical fixtures such as switches, receptacles and lights in outer walls and ceilings
• chimney, plumbing and wiring penetrations of the ceiling and walls
• the sills or sill plates at the foundation
• windows and doors
• attic hatch
• various odd architectural features such as walls behind stepped/raised pews not having any lath and plaster finish........wide open to the studs and board sheathing.

Note: Look for and work on large holes first!!

Cost: Determined on an individual basis since the architectural details can vary substantially from church to church. Can be $1000 for a small church to $5,000 - 10,000 for a large church with special problems such open frame lights in the ceiling of the sanctuary and altar

Payback Period: From under 1 year to 3 years depending on complexity of building and cost. This is a great congregation volunteer job since 80-90% of the cost of commercial airsealing is simple labour!! Materials used are caulking, expanding foam, weatherstripping, rigid insulation and possibly some wood to re-build a poor attic hatch.

6.2.2 Insulation
If there is no insulation in any of the main walls or attic, further big savings are available.

If the church buildings are used 10% or less of the time and thermostat set-back is used, the heating system is experiencing a reduced number of heating degree days (DD). For example, in Halifax, the number of degree days is roughly 7500. For the following examples, I use 5500 and 6500 DD.

Law of Diminishing Returns
An economic concept which simply put says, “As you increase the financial input into an activity, the proportional profit from each new input unit decreases. At some point, it is not economical to invest more money, therefore, invest the money somewhere else.”

In insulation, each R-value of insulation added to a surface saves less heat than the previous R-value. At some point an increased R Value becomes uneconomic (e.g. the payback time becomes greater than 10 years or so). The money that might’ve been invested in more of the same insulation in the attic may be better used in the walls or for a new furnace/boiler.
Note the following table begins with R-values of single pane glass to demonstrate the lowest R-value. Changing the R-value by doubling the glass produces a 50% heat loss reduction from the baseline.

Example:

<table>
<thead>
<tr>
<th>R Value</th>
<th>Heat flow- btu /sq.ft./degree Temperature difference</th>
<th>% heat loss reduction from base case</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (single pane glass)</td>
<td>1.0</td>
<td>Base case</td>
</tr>
<tr>
<td>2 (double pane glass)</td>
<td>0.50</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>0.333</td>
<td>another 16.7</td>
</tr>
<tr>
<td>4</td>
<td>0.25</td>
<td>another 8.33</td>
</tr>
<tr>
<td>5</td>
<td>0.20</td>
<td>another 5.0</td>
</tr>
<tr>
<td>6</td>
<td>0.167</td>
<td>another 3.33</td>
</tr>
<tr>
<td>20</td>
<td>0.05</td>
<td>another 0.26</td>
</tr>
<tr>
<td>40</td>
<td>0.025</td>
<td>another 0.06</td>
</tr>
</tbody>
</table>

NOTE: As the cost of the fuel rises, some of the paybacks may become more economical if the cost of the retrofit measures remain static or rise more slowly than the fuel prices.

6.2.3 Attics

- On flat or low slope ceilings (up to 1-in-6), always use blown insulation: loose cellulose or fibreglass. Above 1-in-6, spray adhesive cellulose is available; or you may want to use batts, depending on accessibility of the area.

- There may soon be a local dealer for Icynene, a low-density polyurethane foam that also air seals. It has similar R-values to fibreglass or cellulose, but a much higher cost (4 – 5 times more). Weigh air sealing and other insulation costs against the foam costs.

Sample recommendations
(from an actual audit):

Install R28 adhesive-based blown cellulose fibre (Pro-Cell by Weathershield) on all main church sloped and flat ceilings including the bell tower (at the finished/painted ceiling). The sidewalls of the tower stairwell to the attic should be blown, the back of the door insulated and the door be weatherstripped. Some ceiling areas may have to have an attic hatch installed (left stairwell to balcony).

Cost would be approximately $2.00-$2.50 per square foot with a payback period of 3-4 years or 25-33% simple return on investment.

Projected costs (approx. 7,000 sq. ft.) $14,000-$17,500 +HST

Savings per year $4,000-$6,000

NOTE: For simple flat ceilings, the cost per sq. ft. for R28 blown insulation will be $0.70 to $1.00.
6.2.4 Walls
Standard open wall cavity has an R Value of about 4 due to the plaster/lath, air and wood sheathing/siding.

Empty walls should have blown cellulose or fibre-glass installed.

- There is no need to rip out walls to install a vapour barrier!!
- Installed properly, there will be no settling.
- The company should be checking horizontally for vertical studding and vertically for bracing, firestopping and old framing such as windows and doors that have been closed in. Any good company should be able to find 99% of the wall cavities.

6.2.5 Storm Windows
If the building has large expanses of clear or stained glass windows in good condition, install low “E” hard coat glass storm windows.

Sample recommendations from an actual audit:

Single pane storm windows should be added to all single pane windows. Cost would be $12-15 per square foot. Payback would be 6-9 years for a return of 11-17%. Consider having “hard Low E” coating installed on the inner surface of the storm window glass for even better savings. This would be on special request to a contractor.

Projected costs: Gym only (approx. 1,000 sq. ft.)
- Retrofit cost for blown insulation - $1.50 to $2.00 / sq. ft.
- Installs R15 cellulose:
  - 33,000 Btus / yr (5500 DD); 39,000 Btus/year (6500 DD)
  - 7,765 Btus/yr (new, reduced heat loss through 1 sq. ft.)
- Savings (5500 DD) 25,235 Btus/yr = $0.76
  - (6500 DD) 31,235 = $0.94
- Payback period: 2-3 years

For the extra $1.50 per square foot for the Low E coating, the payback period approaches the lower 6 year estimate.
6.2.6 Oil Burner Upgrade or Furnace/Boiler Replacement


Example:

Note: 1 Imp. Gallon (4.54 litres) contains 166,000 Btus potential heat

75% Steady State Efficiency—70% Annual Fuel Utilization Efficiency (AFUE)

116,200 Btus useful heat into building

— IMPROVED TO —

83% Steady State Efficiency—80% AFUE

132,600 Btus useful heat into building

Improvement of 16,400 Btus or 14.3% more heat out of each gallon (please note that this figure is not the percentage that bills will be reduced).

If your facility now uses 15,000 litres (3304 gal) per year on average, the savings are calculated as follows:

1. For the present yearly heat load (need) of the building, multiply gallons used by the useful heat per gallon:
   
   3304 gal x 116,200 Btus /gal = 383,924,800 Btus yearly heat load

2. To get future reduced number of gallons used, divide the heat load by the new higher efficiency Btus useful heat per gallon:
   
   383,924,800 Btus heat load / 132,600 useful Btus /gal = 2,895 gal

3. For number of gallons saved, subtract #2 from original 3304 gal:
   
   3304 gal - 2895 gal = 409 gal  (NOTE: @ $0.70/liter +HST = $1397.00 saved)

4. For savings percentage divide (3) by 3304 gallons: 409 / 3304 = 12.4% savings

Note: The higher the fuel usage, the more it may be financially beneficial to have an efficiency check of the furnace/boiler about halfway through the heating season. This may cost $30-50 but if it picks up a 3-4% efficiency decline that can be adjusted upwards, then the savings will easily pay back the test cost plus more! Each 1% gain will save 0.5 (for half the year) x 409 gallons x 0.1 (1/10 of 10%) = 20.45 gallons (92.8 litres)

   X 3 3% gain

   278.4 litres

   0.70 per litre

   Savings including ½ HST 209.50
So many of our churches’ resources are going into our buildings that congregations are often struggling with financial survival when we ought to be struggling with how to be more faithful in carrying out the mission and ministry to which we’re called. Even though making changes in our church buildings and in our practices to conserve energy are not what we usually think of when we think of getting involved in God’s healing mission, considering the deteriorating state of the environment, one of the most urgent callings we have as people of God today, is to care for the earth and to inspire and encourage others to do likewise. It is a way to care for our neighbours’ well-being as well as for the well-being of our congregations.

The following is a timeline describing the steps that the KAIROS Ecumenical Energy Project (Cape Breton) took to form as a group and begin various projects.

April 2005: The Initial Workshop—Nudging Churches

Most of us have good intentions, but need a nudge—something to get us started on what we need to do. For us in Cape Breton, the nudge came in the form of a workshop entitled Your Church’s Ecological Footprint and Heating Costs. It was organized by the Climate Change Centre at Clean Nova Scotia, and co-sponsored by the Nova Scotia Department of Energy, the Maritime Conference of the United Church of Canada, and KAIROS (a national ecumenical coalition of churches and religious organizations working for justice).

The workshop speakers began by educating participants regarding issues of climate change and the ecological impacts of operating a building, and then presented faith groups with ways to save money on their energy costs through basic retrofitting.

The workshop was hosted at Bethel Presbyterian Church on April 15, 2005. Over 50 people came from various church denominations; and the discussion and questions were very animated. A few had come out of concern for the depletion of oil and interest in sustainable sources of energy, but most were clearly very anxious to find ways to save their church’s money on the cost of energy.
May 2005: Exploring Interest in a KAIROS Ecumenical Energy Project

KAIROS Sydney evaluated the workshop and its enthusiastic response. There was so much interest expressed by churches at the workshop about the need to reduce their energy costs, that KAIROS felt churches needed more help. We had the impression that churches could apply as a group to Natural Resources Canada’s program EnerGuide for Existing Buildings (EEB) to get financial assistance for energy audits of their buildings and to be reimbursed for energy saved as a result of retrofitting work. With that possibility in mind, we contacted churches in the area to see if there was enough interest to explore such a group effort. Every church contacted expressed interest in working together for mutual benefit.

Summer 2005: Researching Funding Sources

Through our research, we learned that it was not possible to apply as a group of churches for NRCAN’s EEB program, if churches from several different religions joined on one proposal, due to all the different legal entities involved. We also learned about Environment Canada’s community funding program Eco-Action. In particular, we learned about the Enviro Church Conservation Program of PEI that received Eco-Action funding in 2002. That program was begun by the Catholic Diocese of PEI, then expanded with an Eco-Action funding grant to include the Protestant churches of PEI in conserving energy and reducing pollutants on church properties. That example gave us an idea of what churches are able to do together and gave us hope that maybe we could do something like that. We contacted the organization’s facilitator, David MacKay, and became convinced that he would be an excellent resource person to share his experience at a fall 2005 meeting of interested church representatives in Cape Breton. But we had no money to bring him to Sydney.

September 2005: The Fall Workshop: An Example Leading to Action

The Climate Change Centre agreed to assist KAIROS with the costs of bringing David to Sydney. The workshop took place at St. Anthony Daniel Catholic Church, Sydney, on September 22, 2005.

KAIROS widely promoted the event, specifically encouraging churches / parishes to send someone from their Parish Council, Board of Stewards, finance committee and/or clergy. Forty-five people came from 22 different congregations of 7 denominations. David MacKay was a living example of what churches can do together as he shared his passion for the environment, his experiences and ideas, and the unique role churches can play in protecting the environment. Daisy Kidston of the Climate Change Centre and representatives from ACAP Cape Breton were also there. (ACAPs, or Atlantic Coastal Action Programs, are environmental non-profit organizations in Atlantic Canada set up by the federal government. ACAP-Cape Breton has an office in Sydney).

It was clear at this meeting that churches were still concerned about the high costs of fuel oil. Some of the participants could see dire consequences for their church if fuel costs continued to rise radically as predicted. Some had begun to do energy audits and to make changes in their facilities. When asked how and in what ways we could work together as a group of churches, people’s responses were:

1. to purchase fuel as a group to get a better price;
2. to write proposals together, sharing our people skills / resources;
3. to connect with a wider vision than our own particular church/parish needs;
4. to combine worship services and find ways for several congregations to use one building.

The “next steps” people suggested were:

1. start to “tighten up” our respective churches;
2. sell the idea of working together to our church council;
3. begin discussions at the church council and in the congregation re the importance of energy conservation and of working together;
4. explore the possibility of each church starting an energy committee; and
5. have representatives of each of these committees meet.

November 17, 2005: The Next Meeting—Agreeing to Organize

At the next meeting of congregational representatives working on energy efficiency, people’s reports were encouraging. Churches shared some of the progress that they made since the meeting in September such as: the organization of energy committees; some retrofitting work; a One-Tonne Challenge workshop**; and a representative from the Catholic Diocese sending a letter to every parish encouraging them to work towards energy efficiency.

After sharing these positive reports, people heard representatives of an energy company discuss complexities of oil pricing and share heating efficiency tips. ACAP staff invited parishes to get an EnerGuide audit of manses / glebes. Other resources for churches concerned about energy efficiency and options for action were also shared and considered.

Church representatives attending the meeting agreed that they wanted to follow the example of churches in PEI—to work together and to apply for an Eco-Action grant to assist churches to become more energy efficient. Six volunteers (3 Catholic and 3 United Church) agreed to be a “working group” to develop specific plans and a proposal for funding to go to Environment Canada’s community funding program, Eco-Action.

December 2005-March 2006: Developing a Plan / Applying for Funding

The working group met numerous times as members worked on the short and long term goals set by the church representatives. They continued to explore lowering the price of heating oil for churches by purchasing as a group. They contacted and began negotiations with several oil companies. They sent a survey to parishes about their oil use. Many surveys were returned and indicated wide variance of oil consumption including a high at one parish of approximately 73,000 L per year.

Most of the group’s time and efforts were focused on specific plans to help churches become more energy efficient in their buildings and practices, and to become leaders of congregations and communities to do likewise—through example, education and inspiration. The plan was basically to offer, coordinate, and provide:

- energy audits of church buildings including specific recommendations of actions that would help those churches to be more energy efficient; and
- educational events and resources re energy conservation for church committees, groups and organizations including some oriented for use in newsletters, worship and liturgy, and community and age-specific outreach.

At a minimum, funds would be needed for a project coordinator / energy advisor, transportation, communication and continuing supportive assistance for local church energy committees. Additional funds were requested to enable a few large churches with unique, complex architecture to have professional energy audits and recommendations. An energy advisor trained and capable of auditing small scale buildings would not be able to provide that specialized service, nor would the churches in our area be able to afford the cost of such a professional audit.

We decided to apply for funding to Environment Canada’s Eco-Action program. We named our project proposal: KAIROS Ecumenical Energy Project, Cape Breton. Our hope and plan was to coordinate with and complement the existing work of ACAP Cape Breton and to include and benefit as many churches / parishes in Cape Breton as we could interest in participating. The “working group” called a general meeting of church representatives in January to inform them of progress and to get feedback from them. The proposal was submitted to Eco-Action on March 1, 2006

** The One-Tonne Challenge is a now defunct federal program which had the goal of encouraging individual Canadians to reduce their own greenhouse gas emissions by one tonne each.
May and June 2006: Assessing Progress and Taking Next Steps

Upon reflection, we recognized that the circumstances of many churches in the area were going through changes. Some of those who had been eager or even desperate for information and help a year ago, had, in some way, moved on. For many reasons—declining and aging membership, declining financial resources, and old buildings too costly to heat and to maintain—some have been making plans to close, some to amalgamate, some to reorganize the use of their buildings, some combining and constructing new buildings.

We realized how important it is for the KAIROS Ecumenical Energy Project to stay in communication with the regional church bodies (Anglican and Catholic Deaneries and Presbyterian and United Church Presbyteries) as well as individual churches. We need them as partners. We also need their help to know how and with whom to work. We want to begin with and concentrate our efforts and resources on those churches where we have the greatest opportunity to make a difference. We need to identify the churches who feel that they can be helped to be sustained in the future by saving energy costs and becoming better stewards of their resources. We probably would not want to begin with those whose buildings are relatively new and energy efficient, nor would we put resources into a congregation that is considering moving, closing or not using its building in the relatively near future.

If a proposed amalgamation or cooperating ministry may involve closing existing buildings and constructing a new facility to be shared, then we want to encourage those leaders and planners to put priority on ways they can include the most energy efficient and “green construction” aspects possible in their plans.

The first week of June, we sent letters to each of the denominations’ regional bodies asking for time on their September meeting’s agenda. We plan to give an update on the project and its goals, to get feedback from churches and to ask churches to get involved.

Again we will encourage them to organize Energy Stewardship Committees (that may include members of the building, finance, social ministry and religious education committees as well as a pastor, custodian and other volunteers) to lead their congregation in making a commitment to good energy stewardship; to begin assessing, confronting and addressing their energy efficiency issues; and to connect and work together with the network of other churches seeking to address similar issues.

Unfortunately, it was also the first week of June that we received our letter of rejection re our application for funding from Environment Canada. So we still don’t have funding to help our plans become reality. We’re disappointed about that, but we are not discouraged.

At Present – Committed to Continuing to Move Forward

We will proceed to communicate, work with and encourage our churches to do what they can that doesn’t require additional money or expertise. When we have done all that we can with the people, connections and resources that we have, we will look again for financial and other resources to help us go further toward our goals.

The more we do, the more we are learning. We are learning more about exactly what our churches’ needs and resources are re energy efficiency / stewardship; what other resources exist that we don’t have to create ourselves; what other sources of funding may exist; and how to make the most effective use of the resources and partners we have.

Churches and people of faith have unique and special gifts, challenges and responsibilities—to communicate and to live our faith values in the care and healing of the environment. It’s our vocation to practice what we preach, sing, pray and affirm in our places of worship so that our neighbours, our grandchildren and all our fellow creatures can hope to share and enjoy God’s life-giving gifts. We hope to continue working together to be faithful in fulfilling our calling to be good stewards.
8.0 Master Checklist

The Walk-Through Audit

The following checklist can be used during the Walk-Through Audit of your church. It includes components from the various checklists found in chapter four of this workbook.

### 1.0 General Information for Walk-Through Audit

| Date of audit: ____________________________ |
| Name(s) of people participating in the audit process: __________________________________________ |
| Will any youth from the church be participating in the walk through audit? Please list their name(s): |

Has baseline energy data for your church (such as the previous years total energy and electricity costs, recent bills, etc.) been collected?  Yes  No

**Safety Checklist:** Please ensure that the following safety measures are taken into account before you start the walk-through audit:

- Is a first aid kit available?
- Is a fire extinguisher located in the building?
- Has extra precaution been taken for any ladder work (such as a hard hat) or for any contact with insulation (such as long sleeve clothing, safety goggles, etc.)?
2.0 The Building Envelope

**Insulation**

1. What type of insulation is found in your building?
   __________________________________________

2. Where is the insulation in your building located?
   __________________________________________

3. What is the rating of this insulation?
   __________________________________________

4. What is the quality of this insulation—i.e. age, condition, etc; 
   __________________________________________

**Caulking and Weatherstripping**

When looking for areas of air leakage in your building, the following are good areas to check:

- Around doors & windows
- Electrical outlets (on exterior walls)
- Where floor and exterior walls meet
- Cracks in walls & floors
- Attic hatches
- Plumbing stack
- Electrical wires
- Exhaust fans and ducts
- Where ceiling and walls meet
- Chimneys
- Floor Drain
- Gaps around pipes & ducts
- Recessed light fixtures
- Ceiling light fixtures

1. Check for air leaks using incense method described in section 3.1.2.

2. Where is weatherstripping or caulking currently located in your building?
   ________________________________

3. What sort of condition is the current weatherstripping and/or caulking in your building?
   Is it old and in need of replacement or in good condition?
   ________________________________
**Windows and Doors**

1. What is the condition of the windows and doors in your building? Are they old and in disrepair, or relatively new?  

2. Are there drafts around the windows and doors?  

3. Are storm windows currently in place anywhere in the building?  

4. Is there the potential to have any windows permanently sealed?  

NOTE: Does your church contain special stained glass windows or decorative doors that may need special consideration? If yes, it may be wise to contact a professional for advice on ways to retrofit such structures.

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**3.0 Heating, Ventilation and Air Conditioning (HVAC)**

**Heating**

1. What is the temperature set to during occupied hours?  

2. What is the temperature set to during unoccupied hours?  

3. Is there a difference? (ie, is temperature lowered during unoccupied hours?) □ Yes □ No  

4. What type of heating system does the building use?  

5. Are heating areas zoned off in the building?  

6. How many heat pumps does the building have, if any?  

7. Are unoccupied or little-used areas heated or cooled unnecessarily?  

8. Is the furnace filter clean?  

9. When was the heating system last serviced?  

10. Do community groups who use the church for activities have the ability to change the heat of the building?
## Ventilation

1. When was the ventilation system last cleaned or inspected? ________________________________
2. If present, does the kitchen range hood fan and the bathroom exhaust fan vent directly outside? _________________________________________________________________
3. Are there fireplaces in the building? ___________________________________________________
4. Are dehumidifiers used in the building? ________________________________________________
5. If so, how many? ___________________________________________________________________

## Air-Conditioning

1. What type of air conditioning system does the building have? (ie, central or window units?) ______
2. How often is the air-conditioner used? ___________________________________________________
3. How old is the air conditioner? (if more than 10 yrs old, it should be replaced) _______________
4. How many air conditioning units are there in the building? _________________________________
5. Are there fans installed in the building? _________________________________________________
6. Are there any trees near the building to provide shade (and lower cooling costs)? __________
### 4.0 Electricity Use

#### Lighting
1. How many light bulbs are there in the building? _______________________________________
2. How many of these bulbs are energy efficient? (for example, compact fluorescent lights) __________
3. Are the lights turned off whenever the room is not in use? _____________________________________
4. Is daylight utilized when available? (i.e., lights off when there is sufficient daylight) __________
5. Are lamps and fixtures free of dust? _______________________________________________________
6. Do switches turn on a large circuit of lights in which some are not needed? _______________________
7. If so, in how many locations does this occur? ______________________________________________
8. Is there security or outdoor lighting? ______________________________________________________
9. If so, are these lights on motion detectors, or are they left on all night? _________________________
10. Are there any exit signs in the building? ___________________________________________________
11. If so, are they LED exit signs? ___________________________________________________________

#### Equipment and Appliances
1. Is equipment, such as computers, turned off when not in use? ________________________________
2. Does the refrigerator door seal well when shut? (Close the door on a $5 bill: if it can easily be slipped out, refrigerator door is not sealing properly). _________________________________
3. Is the back of the refrigerator at least 3 inches away from the wall? ___________________________
4. Does the building have more than one refrigerator? ________________________________________
5. Is there a water cooler in the building? ____________________________________________________
6. How old are appliances? Refrigerators ________, freezers__________, washing machines______, other: ____________________________________________________
7. Does the building have a dishwasher or clothes washing machine? ____________________________
8. If so, are they ever used without a full load (dishes or clothes)? ______________________________
9. Does the building have a clothes dryer? ____________________________________________________
10. Is there a clothesline? __________________________________________________________________
11. Is the dryer ever used when clothes could otherwise be hung out to dry? ____________________
### Heating and Cooling

1. Is electric heat used in the building? ________________________________
2. If so, are there programmable thermostats? ________________________________
3. Who has access to the thermostat? (i.e. the custodian only, the entire congregation, etc.) ________
   ________________________________________________________________

### 5.0 Water Use

1. Consider all the different ways that water (hot and cold) is used in your place of worship. For instance, water use in the bathroom, kitchen, outdoors for watering plants, the lawn, and so forth.
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
2. Examine how toilets and faucets are functioning in your building. Any leaky taps or running toilets? ________________________________________________________________
3. Are the urinals in good working order? ________________________________
4. If there is a water fountain in your building, is it running properly? Constantly running? ________
5. Hot water heating system: what sort of system do you use, and is it in good functioning order?
   ________________________________________________________________
6. When was the last time your hot water heating system was serviced? ________________________________
7. Could an insulation blanket for your hot water heater or pipe insulation be installed? ________
8. Could a “heating on demand” system be installed? ________________________________
6.0 Green Space

1. What green space currently exists around your building (i.e. lawn, gardens, trees and shrubs, etc.)
   ________________________________________________________________

2. If your church currently has trees and/or shrubs planted near it, where are these plantings located?
   (Remember: planting on the north side can provide a winter wind break, and planting on the south
   side can provide summer shade). ______________________________________
   ________________________________________________________________

3. Are native tree and shrub species used as much as possible? ______________________________

4. Who currently takes care of the landscape around your building? __________________________

5. Are there opportunities to get other members of the congregation and/or surrounding community
   involved in green space projects at your church (i.e. such as for planting a garden, a tree planting
   project, etc.) _______________________________________________________

7.0 Greenhouse Gas Calculations

To calculate your greenhouse gas emissions, you will need to find out the amount of energy your church
consumes, as well as the amount of electricity. You may wish to calculate your consumption of these re-
sources per billing period, or per year.

**Energy Use:** Multiply the amount of energy used (in joules) by the emission factor (see Section 4.6.2). You
   can enter your calculations on the line below:

   Energy Used: ______ x Emission Factor: _________ = ________  the amount (i.e. kg) of CO2 emitted.

**Electricity Use:** Multiply the amount of electricity used (in watts) by the emission factor (which for Nova
   Scotia is 0.957 kg of CO2). You can enter your calculations on the line below:

   Electricity Used: ______ x Emission Factor: _________ = ________  the amount (i.e. kg) of CO2 emitted.
8.0 Youth Group Engagement

A member(s) of the church’s youth group may be interested in participating in the audit process. If so, they may be invited to go with the team on the walk-through audit and assist with the data collection process. Please ensure that proper safety precautions are taken, especially if youth are involved!

If youth are not involved in the actual audit process, they may be able to help with aspects that come after the walk-through portion, such as:

- **Self-education**: a great first step for youth groups interested in energy issues at their church is educating themselves about the issues. Such activities as outlined in chapter 6.0 can be a good start.

- **Education of the Congregation**: youth can design posters, stickers, pamphlets, do presentations, and so on, that can help educate the congregation members about behavioural changes that can complement the retrofitting process. (The youth can become the “Energy Ambassadors” of the church).

- **Projects with the church**: youth could organize a community gardening and/or tree planting project on the church grounds.

- **Monitoring of energy use**: the youth group can assist in tracking the church’s progress in cutting down on energy use and costs.

- **Global Justice/Social Justice**: the youth may also be interested in taking what they have learned about energy consumption and relate it to the broader global issues related to energy consumption.
9.0 Resources for Churches

To complement the information presented in this *Guide to Energy Efficiency for Religious Buildings in Nova Scotia* manual, you may wish to also consult publications by other organizations also seeking to assist churches with energy efficiency. Below is a list of four such useful resources

   
   This fourteen page workbook provides a series of checklists and worksheets to assist churches in conducting an energy use audit of their church. It can be downloaded from the KAIROS website: [www.kairoscanada.org](http://www.kairoscanada.org) in the Ecology section under Energy Efficiency.

   
   This publication provides a series of modules on spirituality, action and ideas that can be taken to help your church become greener in its practices (including energy efficiency). Contact Wood Lake Books or the Anglican Diocese of British Columbia on how to order this resource.

3. **MacKay, David. The Enviro Church Conservation Project of P.E.I’s Green Sanctuary Manual.**
   
   Similar to the *Footprint Files*, this manual provides both spiritual and practical suggestions with a focus on consensus building and group dynamics when moving forward on environmental and energy projects within your church. Contact David MacKay at the Enviro Church Conservation Project to order a copy (david@ecopei.ca)

   
   This very comprehensive, 86-page technical guide offers suggestions to congregations on how to move forward with retrofitting projects in their church. This publication can be downloaded for free at: [http://www.energystar.gov/ia/business/small_business/congregations.pdf](http://www.energystar.gov/ia/business/small_business/congregations.pdf)
10.0 References

**Chapter Two: Getting Started**


**Chapter Three: The Walk-Through Audit**


**Chapter Four: How to do a Greenhouse Gas Inventory**
Levin, Clare. (GPI-Atlantic). Personal E-mail, July 2006.


Chapter Five: Youth Group Engagement


Foy, Linda. Personal E-mail, May 2006.


Morris, Matthew. Personal E-mail, May 2006.


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