Stratford in Action

Sharing Best Practices to Reduce Our Carbon Footprint

This resource book has been compiled by the Environmental Coalition of Prince Edward Island in partnership with the Town of Stratford and with funding provided by Environment Canada's EcoAction Community Funding Program

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Foreword

The Town of Stratford's goal is to decrease our impact on the environment as much as we possibly can. Stratford is striving to become a sustainable community. In other words, the Town is committed to treading more lightly on the earth by reducing our ecological footprint. As a town, Stratford operates buildings, runs recreation and other programs, and has staff and vehicles, all of which are necessary for the town's infrastructure. These activities require energy and other resources and they also produce waste.

"Imagine Stratford" is our vision as to what the Town will be like in twenty years. Citizens have assisted in developing this vision as well as a set of principles and a strategy for moving Stratford forward. It includes not only what the Town itself can do to operate in a more environmentally friendly way, but also encourages citizens to make a difference in their everyday activities.

While some actions may be large, most are small however; but what really makes an impact is the sum of all our individual efforts. Whatever each person does to reduce, re-use, and recycle will decrease the amount of energy and other resources we use. This Stratford in Action resource book contains excellent examples of actions that are being taken by individual citizens and which are easy to do. It is important to pick things which are easy and which cause us no hardship, so that we are indeed more likely to work that activity into our everyday lifestyle. Everyone one of us is part of the solution to moving Stratford toward the "Imagine Stratford" vision for the year 2020.

Diane Griffin
Town Councillor, Stratford

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A Message from the Coordinator

It has been an absolute pleasure to have been involved in the compilation of this resource book which profiles many of the carbon reduction actions of the residents of Town of Stratford. What a wonderful experience it has been to meet so many people who are concerned about the environment and are taking actions that are right for them as they progress on their carbon reduction journeys.

The phrase "carbon reduction journey" is one that I expect many of the people in this resource book would be hesitant to use. That's because the motivation behind their actions often includes not only environmental reasons but also those that pertain to practicality, economics, health, and enjoyment. There is nothing wrong with this and, in fact, it draws attention to the many connections that exist between of our actions and the environment.

And "drawing attention" is one of the main purposes of this project - to draw attention to the many things that are being done and can be done to reduce our carbon footprints. It is my hope that readers will learn from the information within this resource book, draw some inspiration from the stories, and feel motivated to proceed further on their own carbon reduction journeys.

It is likely that many readers (particularly if they live in Stratford) will recognize some of the people profiled in the following stories. This isn't surprising because they're your friends, neighbours, and people you may encounter while going about your daily business. Just like you, they're regular people who, to one extent or another, care about the environment.

For most of these people, being interviewed about a personal environmental action was a new experience. Some people were uncomfortable about going public with their actions; others were only too willing to share their experiences. Everyone, though, understood the value of their contribution and participated enthusiastically even if it meant having to venture outside of their comfort zone.

And, for me as Coordinator, that is perhaps what I have found most encouraging and heartening about the project - that so many people would be willing to share their experience and knowledge for the benefit of others and the environment. It is my belief that this is something that must continue. When it comes to carbon-reduction (and environmentally-friendly) actions, we should not have any secrets. Whatever we can share, by way of experience and knowledge should and must be shared. Because we all live in the same biosphere and rely on the same natural systems, the benefit from any knowledge or experience you pass on to others is also your benefit.

In closing, I want to express my appreciation to the Town of Stratford and to the project's Advisory Committee: Kirk Brown, Doug Deacon, Don Mazer, Kate McDonald, Matt McCarville, and Brenda Penak. Your efforts have been greatly appreciated, and I have absolutely no regrets about deliberately stacking the Advisory Committee with very nice and knowledgeable people!

And, of course, to the residents of Stratford whose stories are contained in this resource book - Thank you! The project would not have been possible without you.

Rod Dempsey
Coordinator, Stratford in Action Project
Environmental Coalition of Prince Edward Island

And, a Challenge

Imagine waking up tomorrow morning to find a large clear plastic dome placed over your community - a dome that permits sunlight to pass through but seals in everything else. If we continued on with business as usual (e.g., driving our cars, heating our homes, consuming resources), would it be difficult to believe that the quality of the air and water in our domed community would soon decline and that resources would run low while waste accumulated? At what point would we take corrective action?

In many ways, our planet is similar to a domed community, albeit vastly larger. Other than for the input of the sun's energy, it is essentially a closed system in which almost 6.8 billion of us are entirely reliant on natural systems (e.g., oxygen production, soil formation, water regulation and supply, and resource provision.)

On March 30, 2005, an article was published in The Guardian titled "Planetary life-support systems declining: report." It referred to some of the conclusions of the newly released Millennium Ecosystem Assessment report, a four-year long United Nations study involving 1,360 scientists from 95 countries. The article concluded with the following quote made by the 49 members of the Millennium Ecosystem Assessment Board.

"Human activity is putting such a strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted."[1]

This is a worrisome statement, not just for its literal meaning, but also for two other reasons. First, the statement was made by a large group of credible people (such as Co-chair Robert T. Watson, the Chief Scientist at the World Bank) representing an even larger group of credible people (the 1,360 scientists) from around the world. Second, it is a statement of such immense gravity that it is, arguably, much too difficult and unpleasant for most people to contemplate. It's more probable that people will ignore it and remain focused on the "here and now" - which for most of us is a considerably more attractive proposition.

Unfortunately, even though focusing on our own realities can be rewarding, as anyone engaged in work, family, and community responsibilities knows, it is not necessarily going to help change the environmental future that many scientists fear will come to pass. And, since the quality of our reality is ultimately derived from the health of our environment, it would seem, especially from the perspective of self-interest, that we would want to ensure our environment remains healthy.

Despite the environmental issues we're already facing, most of us do, however, continue to enjoy a high quality of life because the consequences of a deteriorating environment haven't yet penetrated the cushion that our adequately resourced middle class lifestyles afford us. And this is perhaps one of the biggest impediments to our heeding the call to action that is being issued by the mainstream scientific community. However, even thick cushions don't necessarily last forever, so now may be a good time to proceed a bit further on your own carbon reduction journey. Here are a few suggestions.

- Adopt several new actions from this resource book.
- Educate yourself about environmental issues.
- Talk to other people about the environment and be willing to share your knowledge and experience.
- Appreciate the environment. Go for a walk in the woods and think about the ecosystem services we enjoy. Or just stand on your back doorstep and enjoy the freshness of the air you breathe.

The Importance of Reducing our Carbon Footprint

When the industrial revolution began in the late 1700's, humans started using fossil fuels in earnest, and we have never looked back. Worldwide, we're now emitting almost 30 billion tonnes of greenhouse gasses into the atmosphere each year.

The reason why reducing our carbon footprint is so important is that the mainstream scientific community is now virtually certain that our consumption of fossil fuels is causing our climate to change at a rate far in excess of the naturally occurring rate.

In Canada, climate change is already being cited in relation to melting permafrost and loss of sea ice in the Arctic and pine beetle infestations in British Columbia and Alberta.[2] In Prince Edward Island, there is strong concern pertaining to the effect of rising sea levels on our erosion-susceptible coastline and of rising temperature on crop productivity.[3]

In addition to changing our climate, our carbon emissions are beginning to affect the chemistry and biology of our oceans. Oceans absorb "approximately one-fourth of the CO_2 added to the atmosphere from human activities each year."[4] This absorption is acidifying our sea water which, in turn, is affecting marine organisms and, potentially, entire marine ecosystems.

Our carbon footprint, which is a measure of the carbon dioxide and other greenhouse gasses we create, can be expressed in two ways, either as a per capita footprint or a personal footprint.

The per capita footprint is measured in tonnes of "carbon dioxide equivalent" per person per year which means that not only is carbon dioxide included but also other greenhouse gasses such as methane and nitrous oxide. It is calculated by adding Canada's total emissions from all sources (industrial, transportation, electricity generation, etc.) and dividing by our population. Expressed this way, the average Canadian has a per capita carbon footprint of 18.8 tonnes per year.[5]

On its own, this number may not seem meaningful, but to put it in perspective, consider some of the per capita carbon footprints from other countries as shown in Table 1, below.

Table 1: Per Capita Carbon Footprint of Countries (tonnes of carbon dioxide equivalent)[5]

Country	Per Capita Footprint
United States	19.8
Canada	18.8
Germany	10.4
Japan	9.8
France	6.6
Brazil	2.0

The personal carbon footprint is calculated in a similar way to the per capita footprint but considers only emissions directly linked to lifestyle. According to one source, the average Canadian personal footprint is 9.1 tonnes per year.[6]

In general, the size of our personal carbon footprint increases as our personal income increases; but, this does not have to be the case. By making lifestyle decisions with a view toward reducing carbon emissions, we can easily begin reducing our personal carbon footprint. Reading this resource book will help you. So too will accessing some of the many carbon footprint calculators available on the internet (type "carbon calculator" into Google).

About This Resource Book

This resource book is a compilation of forty-seven stories about residents of Stratford who are taking action to reduce their carbon footprint. The stories are divided into six sections based on subject and each section concludes with related statistics from a survey that was completed by many of the people who are profiled in the stories and their friends or neighbours within the community.

The actions upon which the stories are based range from being very simple and inexpensive (and often have no cost) to being more complex and sometimes quite expensive (although with a payback over time). Some of the actions are labour intensive and have to be performed on a recurring basis. Other actions have only to be completed once and will provide benefits well into the future.

It is not the intent of this resource book to unreservedly endorse any or all of the actions described. Rather, the intent is to provide basic information on the action and to motivate readers to consider if the action would work well in their own households and lifestyles. For some of the simpler actions, this is easily done. For other actions, especially those involving products or equipment, it is recommended that readers obtain additional information and seek out qualified personnel to help them in their decision-making process.

At the end of each story is an estimate of the annual savings related to the action(s) about which the story is written. In most cases, the savings are expressed in terms of quantities such as kilograms of carbon dioxide saved, litres of oil saved, and dollars saved (see Appendix A for calculations). Often, actual data was not available so the calculations were based on assumptions. And because there can be considerable variation in the assumptions pertaining to specific households, there can also be considerable variation in the estimated annual savings.

Another aspect of savings is that they are relative. For example, replacing a full-size car with a compact car will result in greater savings than would replacing a mid-size car with a compact car. So it's important to know the reference upon which the savings are based before assuming you will realize similar savings.

In some stories, savings are not expressed quantitatively because it is beyond the scope of this project to go through the analytical process necessary to arrive at a savings estimate. In these stories, a statement is provided to indicate instead the types of savings that would be likely.

Although the stories in this resource book provide a diverse collection of carbon-reduction actions, it is important to understand that there are literally dozens and dozens of other ways to reduce carbon emissions. Readers interested in learning more about reducing the size of their carbon footprint should begin by looking on the internet and visiting their local library.

As previously mentioned, each section of this resource book concludes with a page of related statistics. Because the forty-two people who submitted surveys were not chosen randomly, the statistics should not be portrayed as being representative of the residents of Stratford. However, it should be recognized that the people who submitted surveys are regular people with regular behaviors (although some do have a positive bias toward the environment) and, therefore, the statistics also reflect regular behavior.

Section A: Conserving Electricity

Electricity is one of the most useful forms of energy available to us. It improves our standard of living and our quality of life, something of which we become acutely aware on occasions when there is a power outage. Unfortunately, from an environmental perspective, electricity can also be one of the most insidious forms of energy.

As householders, our experience with electricity occurs mostly where we use it, that is, within our homes where it is convenient, abundant, and emissions-free. But if we follow the electricity back through the transformers, distribution lines, substations, and transmission lines to the generating plants, our understanding of electricity may change.

Currently, most of our electricity comes from New Brunswick where NB Power maintains sixteen generating stations powered by hydro, coal, oil, nuclear and diesel.[7] To various degrees, each of these sources has associated environmental issues (including direct and/or indirect carbon emissions).

As electricity consumers on Prince Edward Island, it is easy for us to become disconnected from these issues because we receive the benefits these generating stations provide without having to directly contend with any detrimental consequences. Not surprisingly, this allows us the privilege of becoming complacent in our use of electricity.

There is no indication that our future will be any less electrified than has been our immediate past. What is beginning to change, though, is the way in which electricity is being generated. Already, on Prince Edward Island, a portion of our electricity is being generated by wind turbines (and consideration is being given to other methods of generation from renewable sources, for example, tidal generation).

However, there are issues associated with both installed and planned wind generating capacity on the Island; issues concerning turbine locations and operations, transmission corridors, and community impact. And this is not necessarily a bad thing because it focuses attention on the reality that even the generation of electricity from renewable sources has costs, whether they are environmental, financial, or social.

In view of this reality, we should realize that, no matter how it is generated, electricity is never free; therefore, we should always act responsibly in how we choose to consume it. This is especially important now because of the high proportion of our electricity that is still generated from non-renewable fossil fuels but it will continue to be important in the future as the transition toward electricity generation from renewable sources continues.

There are many actions we can adopt to conserve electricity. Some actions, such as ensuring lights are turned off when leaving a room, are recurrent in that they have to be repeated continually. Other actions, such as purchasing an Energy Star qualified appliance, are non-recurrent in that they only have to be performed once.

There is also wide variation in how much electricity any specific action can save; switching to more efficient appliances will result in major savings while using power bars to eliminate standby power consumption will result in less. However, it should never be forgotten that every conservation action reduces carbon emissions and, over time, the cumulative savings of many small actions can easily match the savings of a single large action.

A1: Saving Electricity in the Kitchen

Ann Wootton cites two reasons for saving electricity – it saves money and it helps the environment.

About two years ago, Ann purchased a toaster oven which, as she observes, is "just super for baking, warming things up, and even thawing things out." It is also more efficient for preparing smaller amounts of food than a full-size oven.

Under full load, a toaster oven, with its smaller heating elements, can draw between 1,000 and 1,500 watts of electric power while a full-size oven can draw in excess of 4,500 watts. This is the basis for the toaster oven's efficiency; because its elements have been sized for a smaller oven cavity, it provides the same range of temperatures for cooking as a full-size oven but uses much less electricity.

Toaster ovens are available with a convection option in which a small fan helps circulate the hot air for faster and more even cooking; others are shaped so they can accept a small casserole dish or even a 12-inch round pizza pan.

Ann feels that a toaster oven would be a useful addition to most kitchens.

"I think it would be very good for most families even if you don't use it all the time; as a supplementary appliance, it would save a lot of electricity."

In addition to using a toaster oven, Ann also saves electricity in the kitchen by keeping the lids on boiling pots. This improves

the efficiency of stovetop cooking because the heat in the pot does not escape as readily and the food cooks at a slightly higher temperature due to a small increase in vapor pressure in the pot.

One of the well known hazards of keeping the lid securely on the pot, of course, is that the contents of the pot may boil over onto the stove. Using a deeper pot will help prevent this and so too will this advice from Ann.

"I think a lot of people do tilt the lids so the pots won't boil over but if you turn the heat down instead, it doesn't boil over. That's what we're all aiming at doing!"

Ann's Estimated Annual Savings (toaster oven)
193 kg of CO_2, 385 kilowatt-hours of electricity, $58

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A2: Energy Star Means Energy Savings

Billy Amon has a ready answer for anyone who asks him why he has purchased Energy Star qualified products.

"I have always been concerned about trying to live as eco-friendly as possible. So I do pay special attention to the resources I'm using. That's why I've opted to purchase Energy Star appliances."

The Energy Star is a symbol of energy efficiency that is recognized internationally. In Canada, the Energy Star program is administered by Natural Resources Canada and allows consumers to identify the most energy-efficient products in the marketplace.[14]

Care must be taken, however, not to confuse the Energy Star label with the EnerGuide label. As explained by Natural Resources Canada, the "EnerGuide [label] provides information on the energy performance of products, allowing the buyer to compare energy performance ratings for different models. Energy Star identifies the most energy-efficient models that meet or exceed premium levels of energy."[8]

This is a distinction that Billy understands and that has guided the purchase of several products in the last year and a half including a dishwasher, a clothes washer, a television, and a DVD player. It is also his intention that when his existing refrigerator needs replacing, it will be with an Energy Star qualified refrigerator.

Among the Energy Star qualified products in his home, Billy is particularly pleased with the front-loading clothes washer.

"A front-loading clothes washer is more convenient. It's much more efficient with the water consumption, and you use less detergent too. It works extremely well."

Another of its major advantages is that, not only does it use less electricity, but it is also more efficient than a conventional clothes washer in removing water from the clothes during the spin cycle. This means the clothes will dry more quickly when placed in a clothes dryer (saving even more energy) or hung out on a clothes line. As Billy recalls, this is a nice change.

"Before, with our top-loading clothes washer, the clothes were soaked when they were done. Now, it's a lot better!"

Billy's Estimated Annual Savings (Clothes Washer)
118 kg of CO_2, 236 kilowatt-hours of electricity, $35

A3: Washing Dishes Efficiently

The debate over whether it is more energy-efficient to wash dishes manually or with a dishwasher seems to be pretty much over. Most sources indicate that dishwashers are generally more efficient, providing, as Will and Gail MacDonald know, that certain conditions are met.

Will and Gail have an Energy Star qualified dishwasher. This means it is among the most energy-efficient dishwashers available, using less electricity and hot water than non-qualified models. And, as Gail explains, they try to use it as efficiently as possible.

"One thing we do is to not let the dishwasher go through the whole cycle. We open the door and let the dishes air dry instead of letting them continue through the dry cycle. Another thing we do is scrape the plates to make sure that there is not a build up of food on them so that the dishes will come cleaner."

They also try to ensure that the dishwasher is full before being started. (Running a dishwasher at full capacity rather than at 80 percent capacity means 20 percent less use.) The only time the dishwasher might not be full is when it contains dishes soiled with fish or cheese that would, otherwise, sit for a day or two.

In a typical week, they use their dishwasher about three times, and they hand wash most pots and pans in the evenings after supper. Here is Will's reasoning.

"We never do our pots in the dishwasher. [The dishwasher] just takes too much time and energy and I don't think they really come clean anyway."

Washing some items by hand allows Will and Gail flexibility as to when they run their dishwasher. For example, if they run out of clean cutlery before the dishwasher is full, they will wash some cutlery in the sink rather than running the dishwasher with only a partial load.

Will helps to maintain the dishwasher's performance by periodically cleaning a little filter located in the door of the dishwasher to ensure it is free from food particles. And, every two or three months, he checks the nozzles on the dishwasher's spray arm to ensure they aren't blocked. If they are, he uses a toothpick to clear them.

Will and Gail's Estimated Annual Savings by Running Full Dishwasher Loads

30 kg of CO_2, 61 kilowatt-hours of electricity, $9

A4: Keeping Seals and Filters Clean

If you were to ask Judy MacDonald whether she keeps the seals on her refrigerator doors clean for reasons pertaining to sanitation or to efficiency, here is what she would say.

"Both. It would have always been initiated through cleanliness but it would also be that I was trying to keep the fridge in good working order for as long as I possibly could."

The seals on a refrigerator's doors keep the cold air where you want it - in the refrigerator compartment and the freezer compartment. When a seal allows cold air to leak out of the refrigerator, it results in the compressor having to work longer to maintain the set temperature. (You can check your seals for tightness by placing a piece of paper between the door and the refrigerator. If the paper won't stay in place or pulls out easily, the seal is either dirty or needs replacement.)

About once a month, Judy cleans the flat surface of her seals with a damp cloth and then makes a second pass with a dry cloth. As she explains below, she also cleans the grooves on the side of the seals.

"I use a toothbrush for the seals at the top of the doors because I find that, if you get crumbs [or any debris] in the grooves, it can push the seal out."

Two other ways to improve your refrigerator's efficiency are to keep the temperature of the refrigerator compartment at 3^0 C (37^0 F) and the temperature of the freezer compartment at -18^0 C (0^0 F)[9] and to regularly clean the coils at the back of the refrigerator.

In addition to cleaning the seals on her refrigerator doors, Judy also cleans the lint filter of her clothes dryer after every load.

"I clean it with my hand. The odd time, if I'm going by with the vacuum, I may take the hose to the top part of it."

Because a clogged lint filter reduces air flow, it makes the dryer less effective and reduces its efficiency. However, cleaning the lint filter has another benefit – it helps prevent the dryer from overheating which can lead to a fire. For many people, including Judy, this safety consideration is sufficient reason in itself to always keep the lint filter clean and the hot air flowing freely.

Judy's Estimated Annual Savings (Refrigerator and Clothes Washer)
108 kg of CO_2, 216 kilowatt-hours of electricity, $32

A5: Installing Efficient Light Bulbs

"I think if everyone does something it's going to make an impact on how much longer this Earth is going to last."

Sheri Chislett has definitely captured a sentiment shared by many people. And doing something can be as simple as changing a light bulb which she and her husband Phil did a lot of about five years ago when they replaced most of the incandescent bulbs in their home with compact fluorescent bulbs.

Compact fluorescent bulbs are more efficient at producing light than incandescent bulbs. They produce the same amount of light with only one quarter of the electricity and, because less electricity is required, they also help to reduce the amount of greenhouse gas being released into the atmosphere.

Some people may be deterred from purchasing compact fluorescent bulbs because they cost more than incandescent bulbs. However, as Phil explains, "Your savings accumulate over the long run; it's just that you don't see it right away."

Compact fluorescent bulbs also last longer than incandescent bulbs. Some manufacturers claim their compact fluorescent bulbs have life spans of 6,000 to 10,000 hours which is far in excess of the 1,000 hour life span typical of incandescent bulbs. Sheri has been pleased with how their bulbs have lasted.

"We haven't had to replace a whole lot of them. There may have been four or five over the course of the last four or five years."

Recently, as Phil notes, a greater range of compact fluorescent bulbs have become available.

"You can buy them now with a plastic or glass cover on them to make them look like chandelier bulbs, or even regular incandescent bulbs."

Despite technological advancements, compact fluorescent bulbs are not without their faults. They contain small amounts of mercury - old bulbs are considered as hazardous waste and must be disposed of properly. They also emit low levels of electromagnetic radiation that may be bothersome to some people. However, manufacturers are working to correct these problems, and compact fluorescent bulbs remain a good lighting choice for most people.

Sheri and Phil's Estimated Annual Savings
481 kg of CO_2, 960 kilowatt-hours of electricity, $144

A6: Automatic Electricity Savings

"I frequently came home to darkness because I would have forgotten to turn the outside lights on before I left, or I would not have wanted to leave the lights on for hours at a time if I was gone all day."

When Beth Toombs comes home at night, her house is still in darkness but only until she gets out of her car and is detected by the new motion sensor light installed on the front corner of her house. It serves as a perfect, energy-efficient complement to the motion sensor light that had previously been installed at her back door.

Motion sensor lights have been around for decades and are available in a variety of styles. Their advantages are that they only turn on when motion is detected; they can be set to turn off after a predetermined time; and they normally don't come on during the day.

Because motion sensor lights have to remain sensitive to motion and ambient light levels at all times, they do consume a small amount of standby electricity (3 watts) even when the bulbs are off. However, this consumption is more than offset by the savings of not having bulbs (with much higher wattages) on for extended periods of time.

Beth is very satisfied with the operation of her two outside motion sensor lights.

"If you come in the driveway and want to go to the back door, the new motion sensor light will light up that whole part of the driveway and then the other motion sensor light will kick in when

you're on the back deck. Or, if you want to use the front door, the new light will light up the whole front sidewalk. It comes on for ten minutes so you have more than enough time to get things from your car before it shuts off."

In addition to appreciating the convenience of motion sensor lights, Beth also understands the economics.

"I wanted the convenience of only having the lights on when I needed them, and I definitely wanted to cut back on energy usage. I'm hoping that, in combination with all of the other things I do in the house, [the motion sensor lights] will make my power bill lower overall."

Beth's Estimated Annual Savings
53 kg of CO_2, 105 kilowatt-hours of electricity, $16

A7: Lights Off, Fan On

If you were to drive by Jane Hogan's house at night, you might notice that very few lights were on and conclude that no one was home. That's because Jane is, and always has been, very mindful about her consumption of electricity.

"Sometimes, if I'm watching television, the only light I have on in the house is the lamp beside me. That's it!"

While growing up on the family farm, Jane became aware of self-sufficiency, energy-efficiency, and our connection to the environment. This has influenced her development of what some people would term a "conserver" attitude, especially when it concerns the use of electricity.

The benefits of conserving electricity are quite apparent to Jane.

"Well, obviously there is an economic advantage to me and, hopefully, a long term advantage to the environment.

Her appreciation for these advantages motivates her to keep turning off lights, appliances, and any devices that are on but are not being used when she is at home or even at work. It has also influenced her to use a lot of task lights in her home; that is, lamps that provide light only where it is needed as opposed to using higher wattage ceiling lights.

"I don't tend to use any ceiling lights at all. I have them, everywhere, but I never turn them on unless there are people here.

Jane is also in the process of replacing many of her incandescent

light bulbs with compact fluorescent bulbs - a process that continues as each old incandescent bulb burns out.

In addition to saving electricity by turning things off, Jane sometimes saves electricity by turning things on, like her ceiling mounted kitchen fan that allows her to get through summer's hot, humid days without using an air conditioner. The fan doesn't actually cool the air but, rather, creates a wind chill effect that makes her feel cooler as its breeze blows by.

Even on high speed, the fan likely uses no more than about 75 watts of electricity[10] which is far less than the 800 to 1,400 watts of electricity that could be consumed by a small air conditioner.

Jane's Estimated Annual Savings
Lights off: 210 kg of CO_2, 420 kilowatt-hours of electricity, $63
Fan on: 203 kg of CO_2, 405 kilowatt-hours of electricity, $61

A8: Ending Standby Power Consumption

"When I asked the cable guy about it, he thought it was really wild that I would want to turn it off at the power bar!"

Rosemary Curley still chuckles when she recalls the conversation she had with her cable installation technician about eliminating standby power consumption which is the electricity used by many appliances and electronic devices when they are supposedly off.

About a year and a half ago, Rosemary had listened to a radio program on the topic of reducing standby power and decided to take action to reduce standby power consumption in her home. So, when she switched to digital cable television, she wanted to ensure that it operated efficiently – that is, without standby power consumption.

Together, Rosemary's television, cable converter box, and dvd/vcr combination unit consume 23 watts of electricity when plugged in but turned off. Rosemary has eliminated this standby power consumption by plugging everything into a power bar which she turns off when she finishes watching television.

She has discovered, however, that her electricity conservation action has come with a minor tradeoff.

"It teaches me patience because, when I turn the television on, I have to wait about 15 minutes for the program listings to show up. [However,] it's more important to me to have a lower electricity bill than it is to have the program listings. I'm motivated by the end result."

Rosemary also has most of her computer equipment plugged into

a power bar. She turns each component off using its own switch and then turns the power bar off, thereby eliminating another 25 watts of standby power consumption.

When using a power bar to eliminate standby power consumption, it's important to locate it where it can be easily operated either by hand or foot. And then, of course, you must remember to use it, which, in Rosemary's case, is aided by her underlying concern for the environment.

"The fact that we're using finite resources is definitely something that perhaps we don't think about often enough. We have to leave something for others that are to come."

Rosemary's Estimated Annual Savings
184 kg of CO_2, 368 kilowatt-hours of electricity, $55

A9: Pulling the Plug on Standby Power

Keeping electric and electronic devices plugged into a power bar and then turning the power bar off is certainly an effective way to eliminate standby power consumption. However, for devices that are used infrequently or even seasonally, it can be just as easy to unplug them at the electrical outlet.

For the non-winter months, when she doesn't keep her car in the garage, Judy Haldemann unplugs her automatic garage door opener. Even when it's sitting idle, the opener consumes 5 watts of electricity (it remains in a ready state to receive a signal whenever the remote control is pushed). Having the opener unplugged isn't an inconvenience for Judy because, if she chooses to, she can still open the door manually although she rarely does.

Judy had also started unplugging her microwave which consumes 3 watts of standby electricity but soon realized something important about human nature.

"For about a week, I unplugged my microwave after I used it. Then I thought, well, this is annoying. I'm not going to keep doing this [eliminating standby power consumption] unless I can make it easier. So now, I have it plugged into a power bar."

With a view toward convenience and eliminating standby power consumption, Judy now has a variety of devices throughout her home that are either unplugged or on power bars. The net effect is that her monthly electricity bill has decreased to where it is much lower than would be typical for a comparable household. Although she conserves electricity for environmental reasons, she also does so for financial reasons.

"If you save money on electricity and you don't need it, you can give it to a charity. If you save money on electricity and you do need it, then you're that much farther ahead with your disposable income."

So, does Judy view her electricity conservation actions as being special? Not really!

"If I can reduce my rate of electricity consumption, then, in my view, anyone can. If I can do it in some way that's easy, then anyone else can say, 'Oh, that's easy. I'm going to try that'."

Judy's Estimated Annual Savings (Garage Door Opener and Microwave)
28 kg of CO_2, 55 kilowatt-hours of electricity, $8

A10: Reducing Unnecessary Ventilation

If your home was built in the last fifteen or twenty years, it likely has some form of mechanical ventilation system such as an air exchanger or, preferably, a heat recovery ventilator (HRV). Modern homes are generally tighter homes, and ventilation systems have become necessary to distribute fresh outside air within the home while exhausting stale inside air.

When it was built in 1991, Charlene Duffy's house had an air exchanger. Recently, however, she replaced it with an HRV.

"When we had an energy audit done, that was one of the things listed as a recommendation. It was the heat recovery aspect of it that just made more sense in terms of it being more efficient and saving on heat."

Air exchangers draw in outside air and exhaust inside air. During the heating season, this means cold air is supplied to your home while warm air is exhausted. This exchange of air is desirable from a health and often a humidity perspective but is not very energy efficient. An HRV also exchanges air but does so in a way that recovers between 60 to 90 percent of the heat from the outgoing exhaust air which preheats the incoming fresh air. Because the supply air is now warmer, it has less of a cooling effect in the house and less demand is placed on the house's heating system.

One way to reduce the cost of operating an HRV (or air exchanger), providing you don't notice any unfavorable effects from doing this (e.g., stale air, condensation), is to put it on a timer so it turns itself off when the house is unoccupied during the day and for a few hours overnight.

Another way to reduce the cost is to leave it unplugged during the summer (and during late spring and early fall) when most people keep their windows open. Here are Charlene's thoughts on the matter.

"I don't think I ever thought about not unplugging it. To me, it was just something automatic - getting the windows open and letting the warm air in here earlier in the summer and then later letting in the cool air for a breeze. It would be a waste of electricity to have the HRV or air exchanger on. It makes sense to open your windows, turn the air exchanger off, and save electricity."

Charlene's Estimated Annual Savings (Unplugging the HRV in Summer)
306 kg of CO_2, 612 kilowatt-hours of electricity, $92

A11: Drying Laundry the Natural Way

Barbara Cairns enjoys the simplicity and benefits of using a clothes line to dry laundry. Starting in April and continuing into October, she uses her clothes line to dry about five loads of laundry per week.

"I like the smell of the clothing when it comes off the line. There's nothing like having your pillow cases smelling fresh. You put your clothing on and you smell that fresh smell that the fabric softener sheets try to give you. And, the sun is a natural brightener so you don't have to use bleach."

Perhaps the greatest benefit of using a clothes line to dry laundry, however, is that it displaces electricity that would otherwise by used by a clothes dryer. Unfortunately, in our climate, it is difficult to get by without a clothes dryer entirely.

"Depending on the weather, in the summer, I combine the clothes line with the dryer, and in the winter, I use an indoor line combined with the dryer. So, I do use the dryer, I want to make that clear."

Like most of us, Barbara has long recognized the enticing convenience of using a clothes dryer, particularly when trying to balance the demands on her time as a central figure in a busy household. She does, however, have a solution to the problem.

"If I wash my laundry at night and it's ready in the morning to put out on the line, it's actually a twenty minute break from all the rushing. And, it's quiet and I can hear the birds, feel the wind, and smell the air. It can be very relaxing. It makes you take a break from your busyness."

In addition to the personal enjoyment Barbara takes in using her clothes line, she also recognizes its importance as a way in which she can express her long-held concern for the environment. This is why it makes her feel good when she travels around her neighbourhood and sees other people also using their clothes lines.

Despite her commitment to drying laundry the natural way, Barbara doesn't try to directly influence other people to use clothes lines, but she is very willing to attest to their many benefits - you need only ask her.

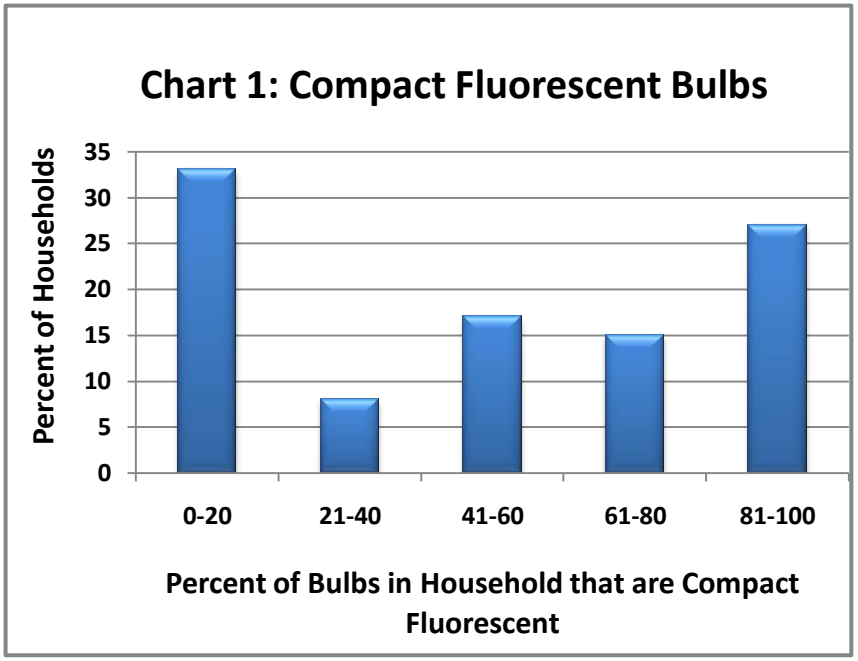
Barbara's Estimated Annual Savings (Use of Clothes Line Only)
152 kg of CO_2, 304 kilowatt-hours of electricity, $46

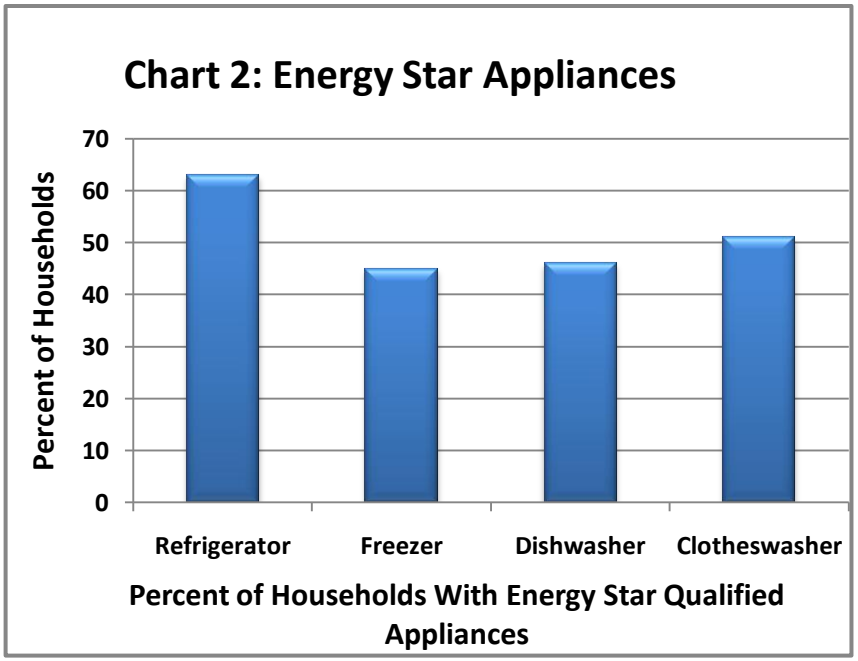
Electricity Related Statistics

- Chart 1 indicates the wide variation in the percentage of bulbs in the households or respondents that are compact fluorescent.
- Slightly less than one third of respondents who plug their desk top computer into a power bar turn the power bar off at night.
- Most respondents (90 percent) try to ensure that lights, appliances, electronics and other electricity consuming devices are turned off when not in use.
- A clothes line or drying rack is used by 78 percent of respondents to dry laundry - on average for 3 loads of laundry per week and for 8 months of the year.
- Energy Star qualified appliances are very common in the the households surveyed (see Chart 2).
- Table 2, below, summarizes monthly electricity consumption in kilowatt-hours (kWh) based on the number of people living in the household. (Households with electric water heaters or heat pumps are not included.)

Table 2: Monthly Electricity Consumption (kWh)

No. of People in Household	1	2	3	4	5
Highest Consumption	379	817	962	827	734
Average Consumption	**298**	**556**	**793**	**682**	**694**
Lowest Consumption	245	353	589	579	654





Section B: Conserving Water

Upon first consideration, the connection between water consumption and carbon emissions may not be obvious. However, since electricity is required to pump and treat water, the carbon emitted when the necessary electricity is produced is attributal to water consumption.

Each year in Stratford, about 437 million litres of water are pumped from the ground, treated, and then pumped to homes and businesses for consumption. Considerably more water, about 986 million litres, enters the sewer system and has to be treated. (This greater volume of water in the sewer system occurs because there are more customers connected to the sewer system and because of unwanted water infiltration.)

In total, almost 58,000 kilowatt-hours of electricity are used by the Town to supply and treat drinking water and 552,000 kilowatt-hours are consumed for sewage treatment. From a carbon emissions perspective, this translates into 0.07 kilograms of carbon dioxide being released for every 1,000 litres of drinking water and 0.28 kilograms for every 1,000 litres of wastewater. Although the carbon dioxide emissions per unit of water on the supply side are less than those for wastewater treatment, it should be remembered that, as Canadians, we consume a lot of water. Estimates of per person consumption rates range from 238 to 329 liters per day.[11, 12]

While the carbon emissions associated with unheated water are modest, it's a very different story when considering heated water. Depending on the method of heating, the use of every 1,000 litres of water can easily result in as much as 10 to 12 kilograms of carbon dioxide being released into the atmosphere. From a consumer's perspective, hot water is also expensive water because, in most cases, the consumer foots the bill for the added heat. And unlike some municipal water pricing structures in which a fixed fee is charged to residential consumers regardless of consumption, with hot water the more you use, the more you pay.

In view of the preceding information, reasons for conserving water can easily be framed in terms of reducing carbon emissions and saving money. However, there are ethical reasons as well. While we have generally been fortunate in our region with regard to water supply and quality, large portions of the world's population, residing in both developed and developing countries, no longer have the luxury of taking water for granted. According to the United Nations, "two-thirds of the world's population will face a lack of water in less than 20 years if current trends in climate change, population growth, rural to urban migration and consumption continue."[12]

An ample supply of clean, fresh water should never be taken for granted. And, in fact, demand for municipal water in Stratford is now poised to overwhelm supply - mostly for reasons relating to population growth and development. The traditional response to this type of situation has been to increase supply by boring more wells either in the same watershed or in an adjacent watershed. But this is a response that can have environmental implications for watersheds as the removal of ground water can affect stream flow and fish and wildlife habitat.

Simply supplying more water also disregards the opportunities and benefits that can result from engaging commercial and residential water users to help reduce demand and seek a more sustainable water future.

B1: Not Much Water Down This Drain

For more than five years, Ann Dutton has been taking various actions to reduce her use of municipal water. She finds meaning in these actions because she appreciates how the quality of her life is dependent on having an ample supply of clean, affordable, drinking water - something that not all of the world's citizens can take for granted.

Here is how Ann describes her method for conserving water when preparing vegetables.

"When I'm peeling vegetables, I usually have a bowl of water in the sink. (After washing, peeling and rinsing) I'll then put the water into a pail (which I keep in the kitchen). I'll take the pail outside when it's about half full and use it to water flowers or plants."

In addition to the water savings, Ann remembers that there was another reason she started preparing her vegetables this way. "I didn't like the dirt going down the drain!"

Keeping the bowl in the kitchen sink allows Ann to also collect the water she uses when washing lettuce and tomatoes. "And, sometimes, if I'm washing my hands, I'll wash my hands over the bowl. Even if it's a little soapy, that doesn't matter for the plants."

Ann also saves the water she uses when cooking vegetables on the stove. Because it contains the water-soluble nutrients leached from the vegetables during cooking process, she finds this water useful for preparing soup, stews, or gravies, or, she may freeze to use later as soup stock. When she finds herself

with an excess of this "vegetable water," she will add it to the pail in her kitchen containing the other rinse water.

Although these water conservation actions are a matter of habit for her, Ann does admit that they may not be for everyone. They are simple, but they do take time.

Despite this, Ann remains resolute in her conviction to be efficient in her use of municipal water, which, she notes, has been treated to a high standard for human consumption. It is her hope that, someday, we'll find ways of not having to use treated water for washing our cars or flushing our toilets.

Ann's Estimated Annual Savings (both actions)
0.4 kg of CO_2; 1,000 litres of water

B2: Making Use of Every Drop

Nine year-old Nathan and twelve year-old Jerika Ramsay are definitely on the right track when it comes to water conservation. They are both very aware of the importance of conserving water and are quite conscientious of how they use it.

Nathan brushes his teeth using what some people call the intercept method; that is, his toothbrush must be positioned beneath the tap to intercept the flow of water or he won't turn on the tap. Here's how he describes his technique.

"Well, I just turn the cold water on halfway, and I put my brush under it before I turn it off. [After I brush, I turn the water back on and] rinse the brush and I turn the water off. And then, I put the brush back in the drawer."

Nathan never allows water to flow down the drain without being used, and he thinks the way he brushes his teeth is a pretty easy habit to adopt.

Jerika has been working on having shorter showers and sometimes uses a shower timer that the Town of Stratford distributed to everyone in her school grade last year. The timer has a sand filled vial mounted on a plastic disc with a suction cup on the back so that it can be attached to the wall.

It takes five minutes for the sand to flow from the upper part of the vial to the lower part which Nathan feels is enough time to have a good shower but, as Jerika admits, isn't long enough for her.

"It's a good idea, but I'm not quite at five minutes yet."

Part of the reason Jerika requires additional time is that it takes longer to shampoo and rinse long hair - a reality sometimes overlooked by people with short hair.

Still, the timers have been well received by Jerika and her friends and have helped to increase their consciousness about water consumption. The timers have even prompted some friendly competition.

"They would tell me that they took shorter showers to try to beat the timer!"

Nathan's Estimated Annual Savings
4 kg of CO_2; 11,497 litres of water
Jerika's Estimated Savings:
76 kg of CO_2; 5,460 litres of hot water; 28 litres of oil; $24

B3: Saving Water Every Morning

A great way to start each day is by saving water and energy; something which is easy to do with an efficient showerhead. Selecting the right showerhead, however, may not be quite as easy.

Most showerheads on the market are defined as low-flow which means they should deliver no more than 9.5 litres of water per minute. But, it's possible to do much better than that.

Marie Ewing's showerhead delivers about 6 litres of water per minute. She knows this because she measured the flow rate using a bucket (which she held under the showerhead for one minute) and a graduated one-litre measuring cup.

What does she think about the 6-litre per minute flow rate?

"It's quite adequate. It's more than enough. It's got enough pressure and does the job well."

Efficient showerheads come in a variety of configurations and price ranges, beginning at about $12. What they all have in common is a flow rate that is much less than 9.5 litres per minute and, in some cases, as low as 4 or 5 litres per minute.

Marie is quick to appreciate the significance of an efficient showerhead.

"It uses less energy. Less hot water has to be heated. Less energy is needed to get it upstairs to our shower. Less water is used."

Some efficient showerheads even come with a pause valve that allows you to have a "navy" shower by turning off the water when lathering your hair or body. To rinse off, you turn the water back on and because you have not touched the shower's main controls, the water temperature is unaffected.

In addition to having a showerhead with an efficient flow rate, Marie also ensures she doesn't spend too much time in the shower, but she doesn't have to rely on a clock.

"If the news is on the radio, I can usually get out before the sports. I can be out of there in five to eight minutes!"

Marie's Estimated Annual Savings
124 kg of CO_2; 8,943 litres of hot water; 46 litres of oil; $39

B4: Saving Water with Every Flush

Because toilets are one of the most water consumptive fixtures in a home, replacing a conventional 13-litre per flush toilet with a 6-litre per flush toilet or a dual flush toilet (6 litres per flush for solids and 3 liters per flush for liquids) can result in massive water savings and is a major step toward having a water-efficient home.

As Derek Smith explains, this is something he and his wife, Holly, considered when they built their new home in 2008.

"We did a lot of research when we built our house. We wanted to be as environmentally friendly as possible. We looked at 6-litre toilets, did some research, and found out they worked well. So, we went with them."

6-litre toilets have been available since the early 1990's. Unfortunately, not all models have worked well and users would sometimes have to flush twice to completely clear the bowl. Over the years, design and performance have improved and now ratings are even available to indicate how many grams of solids will be removed from the bowl with each flush. (To access ratings, type "maximum performance testing of popular toilet models" into Google.)

A year and a half after having installed the toilets, Holly remains very pleased with them and is quick to respond when asked if she would like to switch back to 13-litre conventional toilets.

"Why? These are better. They don't use as much water and they flush quicker."

Derek and Holly recognize that an ideal time to install efficient toilets is during new construction or when renovating. In their case, they don't recall there being any significant difference in cost compared with conventional toilets.

When not building or renovating, it may be more difficult to justify replacing an existing 13-litre toilet with a new 6-litre toilet, at least from a financial perspective. However, something Derek said may help to reframe such a decision.

"You're doing something for the next generation. Maybe they're going to have a little bit more water, maybe we're doing our part."

Derek & Holly's Estimated Annual Savings
9 kg of CO_2; 25,550 litres of water

B5: Saving Rain for a Sunny Day

For Kevin Jenkins, every cloud has a silver lining, particularly if it's a rain cloud. That's because when it rains, he knows that the runoff from his roof is being stored in a rain barrel at the back of his house where it will be used later for watering plants and shrubs. And this knowledge pleases him.

"We're certainly sensitive to water consumption. My wife is quite a gardener so she's concerned about chlorine and the treatment of the water. Rain water is supposed to be oxygenated and healthier for plants."

As of mid-July, the water from the rain barrel has pretty much eliminated the need to use municipal water which has to be pumped from the ground, treated and then conveyed to his home through a series of buried pipes. Kevin has been amazed at the volume of water that has been collected in his 180 litre rain barrel – even if the rain barrel filled only a dozen times during the watering season, it would save 2,160 litres of municipal water.

Kevin notes that the rain barrel was easy to set up. He just leveled off a place in the flowerbed, installed a concrete patio block to serve as a solid foundation, positioned the rain barrel, and then made the connection to the down spout.

He has also been quite pleased with its performance.

"It has functioned very well. It has an automatic overflow on it so when the rain barrel reaches capacity, the water goes down the spout as usual. And, the rain barrel has a solid sealed top to prevent insects from getting in or out."

Although some people may think it would be inconvenient to use a rain barrel, Kevin considers it differently.

"I think it's a very minor adjustment. The negatives in terms of a little slower filling time for the watering can are more than made up for in terms of the temperature of the water, the quality of the water, and the water savings, so it's a very minor tradeoff."

And, Kevin also considers this simple act of water conservation in a much larger context as he ponders, "What will the future hold for our children in terms of the resources that we leave for them?"

A good question indeed!

Kevin's Estimated Annual Savings
0.2 kg of CO_2, 2,160 litres of municipal water

Water Related Statistics

- About 30 percent of respondents report having at least one 6-litre per flush toilet in their household (see Chart 3). As older conventional 13-litre per flush toilets are replaced and as new homes are built, it is expected that 6-litre per flush toilets will become more popular (as will dual-flush toilets which are even more efficient).

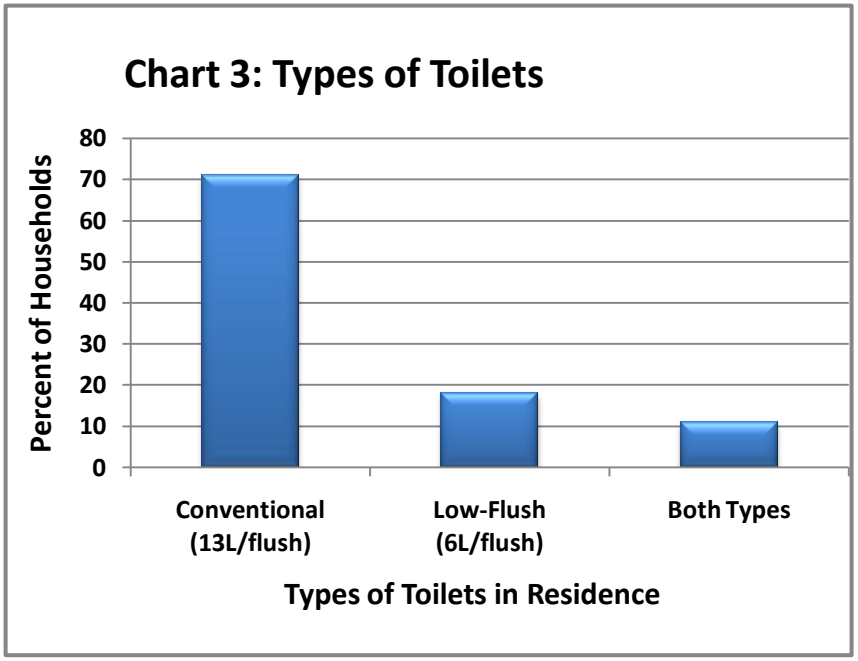
- Almost 71 percent of respondents drink water directly from the tap. Of the remaining respondents, 24 percent also drink water from the tap but only after it has been filtered (usually to remove any taste of chlorine) and 5 percent consume bottled water.

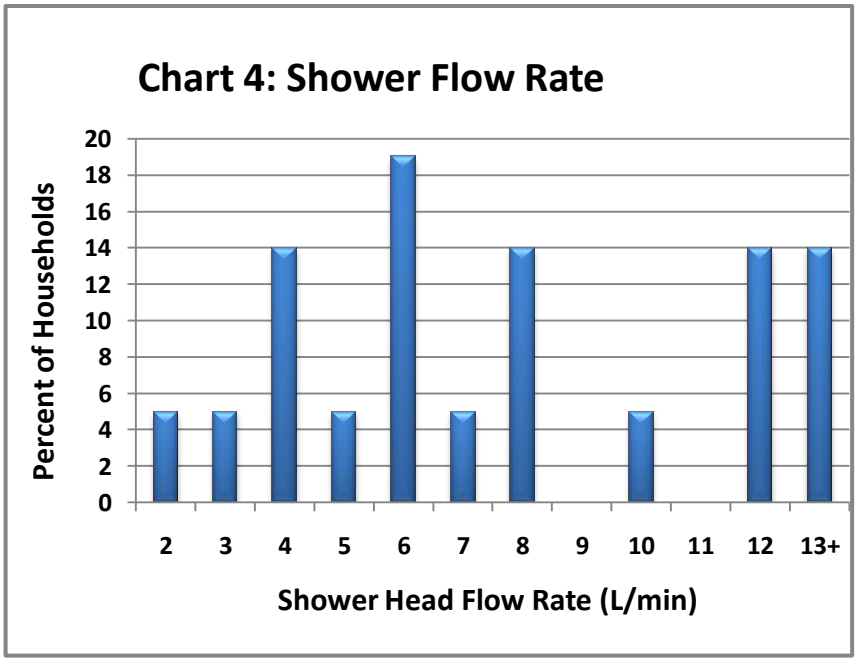
- As Chart 4 indicates, most shower head flow rates (67 percent) fell within the definition of low-flow (no more than 9.5 litres per minute. It is important to note, however, that most people can have an acceptable shower using only 5 or 6 litres of water per minute.

- An effective but (unfortunately) unpopular way to save hot water is to take navy showers; that is, showers during which the water is turned off while you lather your hair and/or body. No respondents reported taking this action.

- The average shower length was about 7 minutes.

- Most people take showers rather than baths. In 48 percent of households, showers are taken exclusively and only 15 percent of households report more than 5 baths being taken per week.





Section C: Reducing Heating Requirements

Space and domestic water heating are major sources of carbon emissions in most households. Fortunately, there are many actions that can be taken to reduce emissions that often also reduce costs and improve occupant comfort.

Perhaps the best way to reduce heating requirements is by improving the efficiency of the building envelope (those parts of the house that separate the inside from the outside). The rationale in beginning with the building envelope is that any efficiencies you may gain by having, for example, a very efficient furnace, will be lost if you're trying to heat a drafty, poorly insulated house. It's almost always best to concentrate first on keeping the heat in the house.

Once the efficiency of the building envelope has been improved, it is time to look at the efficiency of the various mechanical systems in the house. If some of these systems are very inefficient, it may make financial sense to replace them immediately with more efficient systems. If they are still working well, however, it may be a better financial decision to wait until they have to be replaced and then choosing from among the most efficient replacement systems available.

Even if personal finances prevent a home owner from taking major actions, there are still many things that can be done to save money and reduce carbon emissions. Using caulking and weather stripping to seal air leaks is a low cost way to improve the building envelope and can provide significant savings. Actions such as being mindful to set the thermostat back at night (and when the home is unoccupied) or closing window blinds or curtains on winter nights don't cost anything and can also result in significant savings

Many people find that a convenient way to begin the process of reducing their home's heating requirements is to have an ecoEnergy Home Energy Evaluation performed on their home. Information on the evaluation (and other energy saving related programs and services) is available by contacting the Government of Prince Edward Island's Office of Energy Efficiency (www.gov.pe.ca/oee).

Another consideration in home heating is the role of renewable energy technologies (biomass, solar energy, geothermal). Some of these technologies have been around for decades, and others are more recent. Generally, though, all are becoming more efficient as technological advances in equipment are made.

For many people, a perceived deterrent to acquiring renewable energy technology equipment is the initial capital cost. However, because operating costs can be so low (or even non-existent in some cases), the equipment pays for itself over time and then provides further savings for the duration of its operational life. This is in direct contrast to conventional equipment which will always have substantial monthly and yearly operational costs.

Perhaps the most important advice regarding reducing your home heating requirements is to simply begin: do some research, talk to sales and service people, and talk to homeowners who have already reduced their heating costs. Most homeowners are pleased to share their knowledge and experience and it's always valuable to obtain first hand information.

C1: Letting the Sun Shine In

The fact that sunlight is free is not wasted on Hung-Min Chiang. This, coupled with his memory of the 1973 oil embargo when the supply of foreign oil decreased and the price escalated, was all the rationale he needed for incorporating passive solar characteristics into the home he built in 1978.

"After the oil shock, I was very conscious of the fact that we should conserve energy. So I decided, from the very beginning, this was the route I would take."

Passive solar design takes advantage of the sun's energy for home heating and lighting. One of the primary design elements is to minimize the size and number of north facing windows while increasing the size and number of south facing windows, up to a point. That point depends on the ratio between window and floor area, and on the capacity of available thermal mass (e.g., drywall, brick or concrete) to absorb the sun's heat.

Min recognizes that, ideally, there would be no north facing windows; however, the north side of his home faces the street.

"So, I made some concessions, having some windows in the north but most of the big windows are facing south, which was easy because we also enjoy the view."

Min has increased the efficiency of his windows by installing heavy drapes that are closed on winter nights. The draperies on the largest windows continue down to the floor to help reduce thermal drafts.

In addition to paying attention to the solar orientation of his

home, Min also took measures to shelter it from the prevailing winter winds out of the west. He did this, in part, by positioning his garage at the northwest corner of the house and by strategically planting trees.

"One of the first things I did when I purchased our lot was to plant a row of white spruce on the western side of the house to serve as a wind barrier. Today, it's forty feet high."

Perhaps one of the nicest aspects of letting the sun shine in is the bright and cheery atmosphere it creates. Min observes, "I never have to go south for the winter months. I am perfectly happy here!"

Benefits of Passive Solar Heating
Up to 30% of a conventional home's heating needs can be obtained through passive solar heating.[14]

C2: Solar Gain without a Window

Not quite three years ago, Alana Gallant made a decision to take advantage of the free solar energy that bathed the south facing end wall of her house. She installed a forced convection solar heating system and is as pleased with its performance now as she was then.

When the sun shines, a 31-watt circulating fan in Alana's system draws room air (at the rate of 100 cubic feet per minute) through a wall vent above the floor and forces it through 240 aluminum pop cans painted black and arranged in columns behind a curved polycarbonate lens. The heated air then returns to the room through a wall vent near the ceiling providing a heat output of between 1,200 and 2,400 watts.[15]

The operation of Alana's system is totally automated. When the temperature inside the unit rises above 110^0 Fahrenheit, the circulating fan starts and the temperature of the discharge air can increase from between 50 to 100^0 Fahrenheit.[15] When the temperature drops below 90^0 Fahrenheit, the circulating fan stops.

Alana cites two main reasons for installing the system.

"Trying to save money was certainly part of it. And, I was trying to find another source of heat instead of using oil all the time. I had good southern exposure on that end of the house and the solar heating system seemed to be a good choice."

She also cites an unexpected consequence of having a forced convection solar heating system - it attracts people! Neighbours and even people driving by her home notice it and are curious

about its function and performance. With a smile, Alana explains that she is okay with this, and she remains quite gracious about providing them with information.

"I've had a lot of people phone or drop by wanting to come in and take a look at it - just to get some information."

And Alana feels that information is just what the public needs if forced convection heating systems are to become more common.

"People don't know the benefits of them. Initial cost is probably a big part of it for most people but, if you look at the long term benefits and the programs the government is offering, the cost balances itself out."

Alana's Estimated Annual Savings
1,612 kg of CO_2, 597 litres of oil, $507

C3: Heating Water with the Sun

In time, it's likely that young Wyatt Clarke will be just as enthusiastic about his home's solar domestic hot water system as his parents, Craig and Amy. Craig had the system installed in the fall of 2007 and has been very pleased with its performance, especially during the summer.

"We often have all the hot water we could ever want. It's piping hot and is absolutely more than we need. Even when it hasn't been sunny for a day or two, we still get some hot water out of the system."

Craig's system has a photovoltaic module that produces electricity when the sun is shining. The electricity powers a pump that circulates a mixture of glycol and water through two glazed flat plate collectors on the roof. The mixture then passes through a heat exchanger in the basement and is pumped back to the roof. The heat exchanger draws cool domestic water from the bottom of a storage tank, heats it up, and returns it to the top of the storage tank where it is ready for use.

When all variables are considered, solar domestic hot water systems can provide 70 to 100 percent of a household's water heating needs during the summer and 10 to 25 percent in the winter.[16]

Because his home is heated by an oil-fired boiler (which also provides domestic hot water) Craig has an opportunity for further efficiency. As he explains, "The [solar domestic hot water] system allows us to shut our boiler off in the spring and turn it back on in the fall." This is significant because residential boilers are quite inefficient when used only for heating domestic hot water as is the case during the summer.

People considering solar domestic hot water systems often perceive the initial cost as a deterrent; Craig viewed it as an investment. He realized that, because sunlight will always be free, his system will pay for itself in time and then continue to provide hot domestic water at no cost. And, because he was looking for ways to reduce his carbon emissions, he knew it was an ideal type of renewable energy technology for his household.

When he's older, Wyatt will undoubtedly approve of his parents' decision!

Craig & Amy's Estimated Annual Savings
1,922 kg of CO_2; 718 litres of oil, $606

C4: Heating Water Indirectly

In homes with hydronic heating systems (e.g., hot water base board heating), it is very common for domestic hot water to be produced through the use of a heating coil inserted in the boiler. Tankless coils, as they are known, can be reasonably efficient during the winter when the boiler is firing frequently to heat the home, but their efficiency can drop to as little as 25 percent during the summer when the boiler fires only to supply domestic hot water.[17]

After Carol Anne Duffy had an energy audit performed on her house in 2008, she decided to follow up on the recommendation to replace her tankless coil with a more efficient means of heating water.

"I was concerned about the amount of oil that we were using and our domestic water is heated by oil. Last year, especially when the price of oil had gone up in the spring, we felt that it was worthwhile to invest in something that was going to be more efficient from a cost and conservation perspective."

So Carol Anne replaced her old boiler with a more efficient model, and she installed an indirect-fired water heater to provide domestic hot water. An indirect-fired water heater is essentially an insulated storage tank with a heating coil (heat exchanger). Hot water from the boiler passes through the heating coil which transfers the heat to the domestic water within the tank. Since the tank holds a large volume of water, the boiler doesn't cycle on and off as frequently as would be the case with a tankless coil. (Because boilers are less efficient at the beginning of their heating cycle, reducing the number of firing cycles means improved efficiency and energy savings.)

"What we have noticed with the new boiler and the tank is that the boiler ran very little during the summer. Obviously, it would run occasionally because the water still has to be heated but not the frequent heating of water that was always taking place with the old boiler."

Another aspect of the indirect-fired water heater is that the temperature of the domestic water can be kept at a lower temperature than the water in the boiler. Maintaining the domestic water at a temperature of 120^0 F, rather than at the temperature of the boiler water (often in range of 140 to 160^0 F or higher), further increases efficiency by reducing standby heat losses.

Carol Anne's Estimated Annual Savings
1,102 kg of CO_2, 408 litres of oil, $347

C5: Getting Efficient about Oil Heat

"There was actually nothing wrong with our old boiler. It worked well, and we never had any trouble with it. However, it was not efficient, so we had no misgivings about replacing it because we realized a new efficient boiler was the way to go. It certainly was going to save on oil and be better for the environment."

Since space heating accounts for about 60 percent of the energy consumed in the average home[18], Brian Greenan had no regrets about replacing his 18 year-old conventional boiler with a new Energy Star qualified cast iron high efficiency boiler. In fact, it was one of the recommendations from his 2008 home energy audit.

After the audit, Brian took the partial step of installing a more efficient burner on the old boiler. While this resulted in some savings, it didn't quite solve the inefficiency problem.

"We were told that over half the heat generated by the old boiler was actually going out the stack which is a waste of money."

So he recently installed a new boiler (and kept the new burner purchased the previous year). The new boiler has an AFUE rating of almost 87 percent. The AFUE rating, which stands for "annual fuel utilization efficiency" provides a measure of the boiler's annual efficiency in consideration of on/off cycles and energy losses.

Unlike the old boiler which was a single-pass design, Brian's new boiler is a three-pass design which means that the hot gases produced by the burner has to travel further (and, therefore, is better able to transfer more of its heat to the boiler water) before being exhausted up the stack.

Another efficiency aspect of the new boiler is its insulation (3 ½ inches). Most boilers maintain a specified volume of boiler water at a preset minimum temperature; higher insulation levels keep this water warmer so the boiler does not have to fire as frequently.

Lastly, Brian's boiler is also available with optional controls that modulate the boiler water temperature with respect to outside temperature. This allows the rate of heat supplied through the baseboard radiators to more closely match the rate of heat loss from the house (based on outside temperature) and can result in further efficiencies of 10 to 15 percent.[19]

Brian's Estimated Annual Savings (space heating only)
1,639 kg of CO_2, 607 litres of oil, $516

C6: Extracting Heat from Groundwater

When it comes to home heating, there is one thing about which Cyril Armstrong is absolutely certain - a heating oil truck will never pull up in front of his home to make a delivery. Because Cyril heats his home with a groundwater heat pump (and has a small woodstove for backup), he has no need for heating oil.

His rationale for installing the system ten years ago includes not only financial and environmental reasons but also practical reasons.

"I live on a road that is not plowed in the winter so there would be no easy way to obtain heating oil in the wintertime."

Residential heat pumps come in a variety of sizes and configurations. Cyril's system uses groundwater as a heat source; groundwater from one well passes through a heat pump where the heat is extracted before the water is returned to the ground via a second well. The extracted heat is used to warm air that is circulated throughout his home by way of a typical forced air distribution system. His system also preheats his domestic hot water before it enters his electric water heater.

The advantage of using a heat pump is that it does not create heat by burning fuel like a furnace or boiler. Rather, it collects and concentrates existing heat from a source such as water, the ground, or even the air. This is the reason why for every unit of input energy, heat pumps can deliver between 2.5 and 4.5 units of output energy.

When he installed his system, Cyril expected it to pay for itself in about seven or eight years when compared to heating with oil.

"So did I actually do better? Yes, I think I did much better than my seven or eight year estimate."

It should be recognized that operating a heat pump will increase electricity consumption (as will operating an electric water heater). However, the increased cost of electricity will be more than offset by not having to purchase heating oil. In addition, overall carbon dioxide emissions will be significantly reduced; although, this will vary depending on how the electricity is generated.

Cyril's Estimated Net Annual Savings (compared to oil heat)
2,402 kg of CO_2, 1,355 litres of oil, $775

C7: Extracting Heat from Air

"People think it's an air conditioner. And I was very reluctant at the time to put in an outdoor system because I was worried the sound would disturb my neighbours but it's no louder than the fridge."

As it turns out, Dennis Munroe's neighbours no longer think his air to air heat pump system is an air conditioner (although, when it runs in reverse, it can cool his house during the summer) nor are they concerned about its ambient noise.

In the fall of 2008, Dennis had his system installed to further reduce his carbon footprint and his heating costs. He had previously heated his house, which was one of the first custom built R-2000 certified houses on the Island, exclusively by means of a propane furnace.

His new system is a dual fuel system controlled by a single indoor thermostat. At outdoor temperatures down to minus 5^0 Celsius, the electric heat pump provides heat for his house while at temperatures below minus 5^0 Celsius, the heat pump shuts off and an integrated high efficiency propane furnace automatically takes over.

The process by which an air to air heat pump extracts heat from cold outside air and uses it to heat a house may seem like magic, but it is simply an application of the basic refrigeration cycle used in many appliances. The secret to the efficiency of an air to air heat pump, which can provide up to 3.3 units of energy output for every unit of energy input[20], is that it is only moving existing heat, not generating it such as a furnace would do.

However, efficiency is affected by outside temperature. Lower outside temperatures mean lower efficiencies and, when energy output no longer exceeds energy input, the systems turn themselves off and the secondary heating source starts.

After having now gone through one heating season, Dennis is pleased with the performance of the system. As expected, his electricity bill has gone up but by less than the amount his propane bill has gone down. It's not surprising, then, that Dennis is willing to share his experience.

"I've given out all the brochures that we have plus a copy of our records. I know four people right now who are interested in the system."

Dennis's Estimated Annual Savings
511 kg of CO_2; 1,872 litres of propane; $350

C8: Displacing Oil with Biomass

Six week old Sadie may not yet understand the benefits of a biomass stove but her mother, Colette Gallant, certainly does. Colette and her husband installed a biomass stove in their home in the fall of 2008 after the price of heating oil climbed to almost $1.30 per liter earlier in the year.

"We started thinking about our space heating options and decided we wanted to reduce our reliance on fossil fuel. What we liked about the biomass stove was that it burns various fuels so we would not get locked into one fuel type."

Another aspect of burning biomass is that from a carbon perspective it is considered to be almost carbon neutral. As biomass grows, it absorbs carbon dioxide. During burning, this carbon is released. So, overall, little new carbon is introduced into the atmosphere other than what may be necessary for the growing, processing, and transportation of the biomass.

Biomass stoves share many characteristics with pellet stoves such as a hopper for fuel storage and an electrically-powered auger that moves the fuel into the combustion chamber. The biomass stove distinguishes itself, however, in that it can burn not only wood pellets but also corn, wheat, barley, and even cherry pits.

After some experimenting for performance, Colette ended up using a fuel mixture of one-third wood pellets and two-thirds wheat - the wheat was destined for composting if they hadn't purchased it from a local farmer. Both fuels came in bags which were stored on a pallet in the garage.

Colette has also tracked the savings associated with the biomass

stove. The 3,320 litres of heating oil consumed by their boiler during the 2007/08 heating season dropped to 1,900 litres for the 2008/09 heating season when they were also using the biomass stove – a savings of 1,420 litres. Fuel for the biomass stove cost a total of $618 ($285 for wood pellets and $333 for wheat).

A biomass stove (like a pellet or wood stove) does come with an additional requirement in the form of some time that has to be spent for fueling and cleaning. But, it's not a major task for Colette and her husband.

"Even with the time commitment," says Colette, "we have had such a good experience that we wanted to share it with other people."

Colette's Annual Savings
3,384 kg of CO_2, 1,420 litres of oil, $589

C9:Insulating to Save Money and Carbon

"Fuel prices were huge for us. That's what really spurred us to start improving the efficiency of our house about a year and a half ago when fuel prices were going crazy."

Like most homeowners, Aaron Hansen wasn't immune to the impact of rising prices for heating oil in 2008 before the global economic downturn. Since he couldn't control the price of oil, he decided to use less of it by improving the performance of his home's building envelope – the part of the house that provides a barrier against winter's cold temperatures and blustery winds.

Aaron began the process by having a Natural Resources Canada certified energy advisor perform an energy audit of his home. Among the audit's recommendations was the need to add insulation to the bare concrete walls in part of the basement.

As he recounts, "The basement is partially finished except for the furnace room area which is a pretty big section. When they gave us the energy audit, I was surprised to learn that the exposed concrete wall was one of our biggest areas of heat loss."

Aaron obtained all the necessary materials from a local building supply dealer and, with help from family members, set about constructing a framed wall that he positioned almost against the inside of the concrete basement wall. He then insulated the wall with R-20 fiberglass insulation, covered it with a polyethylene vapor barrier, and then drywall.

The energy audit also recommended upgrading the existing single layer of fiberglass batt insulation in the attic which Aaron did by adding 14 inches of blown-in cellulose insulation. This

increased the overall R-value from 12 to 60.

Aaron took his time and did the job right. After sealing air leaks around the chimney, he installed soffit baffles to allow for the free movement of air between the soffits and the attic, built a crib around the attic hatch to hold the extra depth of insulation in place and then blew in the cellulose insulation.

Was it difficult to insulate his basement and attic? Not according to Aaron.

"It was as easy as pie, even for novices. I had a little experience but nothing major. It wasn't a chore really - it was fun."

Aaron's Estimated Annual Savings (attic only)
1,744 kg of CO_2, 646 litres of oil, $549

C10: Saving Energy by Sealing Air Leaks

Sealing air leaks in your home is an easy way to increase your comfort and save on heating bills. And as Brenda Goodine can attest, it's not hard to develop the necessary skills and enjoy the resulting benefits.

"I'm not the best weather stripper or caulking person in the world but I've learned how to do these things to windows and doors. It makes a difference in preserving them and keeping them for as long as possible. It's a cost savings for me in not having to purchase new ones, and it keeps them from ending up in the landfill site."

All houses have a certain amount of air leakage. It's most noticeable on cold, windy winter days when the house may seem drafty (as warm inside air is being replaced with cold outside air). Energy technicians often estimate the total area of all the little individual cracks and gaps in a house that leak air (known as the equivalent leakage area) by conducting a blower door test. In poorly sealed houses, the equivalent leakage area can be the same as having a two or three square foot hole in the outside wall which greatly increases the energy required to heat the home.

In Brenda's home, she knew that many of her existing windows leaked air, so she had new windows installed on the ground floor and caulked around the existing basement windows. On several of the basement windows (ones not required to be operable to provide a means of fire escape), she even applied caulking between the window sash and frame to esentially convert them into fixed pane windows for even greater air tightness.

Brenda also had weatherstripping installed to improve the seal of two outside doors, and she has used low-expansion foam to insulate a hole where the line from the oil tank comes into her house. She tends to view the work she has done in a very practial manner.

"It's about having a warm home in the winter time and not heating the great outdoors. And, in some regards, it's just part of typical maintenance."

Because of the work she has done, Brenda has definitely noticed an improvement in the comfort of her home and a reduction in her home heating costs.

Benefits of Sealing Air Leaks

Sealing air leaks can result in up to a 20 percent reduction in heating costs.[21]

C11: Saving Heat, Automatically

"They're not that expensive to buy, and they're easy to install. They reduce our costs and our consumption of oil and, therefore, they reduce our greenhouse gas emissions."

Robert Hughes is talking about the programmable thermostats he installed in his home three years ago – one upstairs and one downstairs.

Programmable thermostats have been on the market for decades and are available with a wide variety of features. A convenient type of programmable thermostat for many households, and the type that Robert installed, is one that allows for separate weekday and weekend programs. For example, on weekdays, Robert wakes up to a temperature of 19^0 Celsius which drops to 15^0 by the time he leaves for work. Later in the afternoon, the thermostat raises the temperature back to 19^0 and lowers it to 15^0 at bedtime, all automatically.

Although there is no technical basis for it, some people feel that it takes more heat to bring a cooler house back up to temperature than was saved by setting the temperature back in the first place. In reality, anything you can do to reduce the difference in temperature between the inside of your house and the outside (such as lowering the thermostat for even a few hours) will reduce the rate of heat loss and save fuel. In fact, for every 1^0 Fahrenheit reduction in temperature over an eight-hour period, you'll reduce your energy consumption by 1 percent.[22]

This is something that Robert's father must have understood; although, he managed quite nicely with a manual thermostat, as Robert recalls.

"I grew up in a house where my father always turned the thermostat down at night and always turned it up first thing in the morning. So, I had that philosophy growing up. [However, having a manual thermostat] is not as convenient. You have to remember to do it."

Robert remains convinced about the benefits of programmable thermostats and shares two final reasons for using them.

"I've come to recognize, as a lot of people have, that we can't continue to consume resources at the level that we are and be able to sustain ourselves. And, there's something nice about automatic savings!"

Robert's Estimated Annual Savings
354 kg of CO_2, 131 litres of oil, $111

C12: Casement Windows Keep Heat In

Some five to ten years ago, Cynthia Dunsford installed casement windows in her house, replacing the horizontal slider windows that had originally been installed when the house was built. There was no doubt in Cynthia's mind that the old windows had to go.

"We had very inefficient windows. We could light a match [beside the window] and it would blow out. So, we did our homework and looked at what window was going to be most efficient."

Cynthia's choice of casement windows was a good one because casement windows have low air leakage rates and are among the most efficient window types available. Unlike sliding type windows where the fit between the sash and the seal must remain loose enough to allow the sash to slide against the window frame, the sash of a casement window presses tightly against a compression seal on the window frame as it closes, making for a snug fit.

Casement windows have another advantage in that they can help improve a room's ventilation, something about which Cynthia is quite aware.

"I like having good windows that open properly and catch the wind and bounce it inside so, even on a warm day, you're getting a little bit of cooling."

In addition to choosing an efficient type of window, Cynthia also selected double glazed sashes, a low-emissivity coating, and argon gas between the panes. The low-emissivity coating helps

prevent heat from escaping back through the window during the winter and argon gas, which is denser than air and a poorer heat conductor, provides additional insulating value.[23]

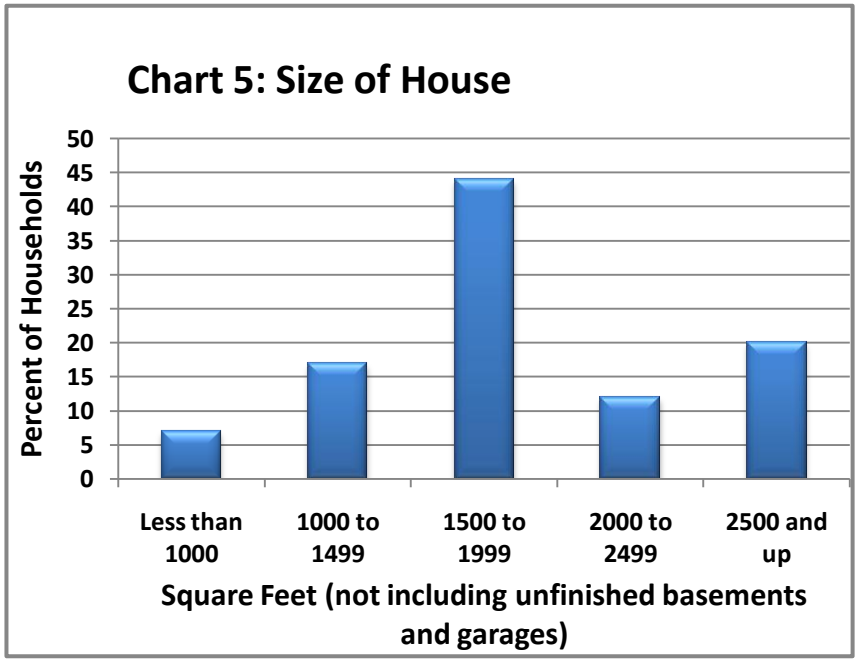
At the time, Cynthia paid a premium for her windows, not only because they were casements but also because of the low-emissivity coating and argon gas filling. However, she is quite pragmatic about the extra cost.

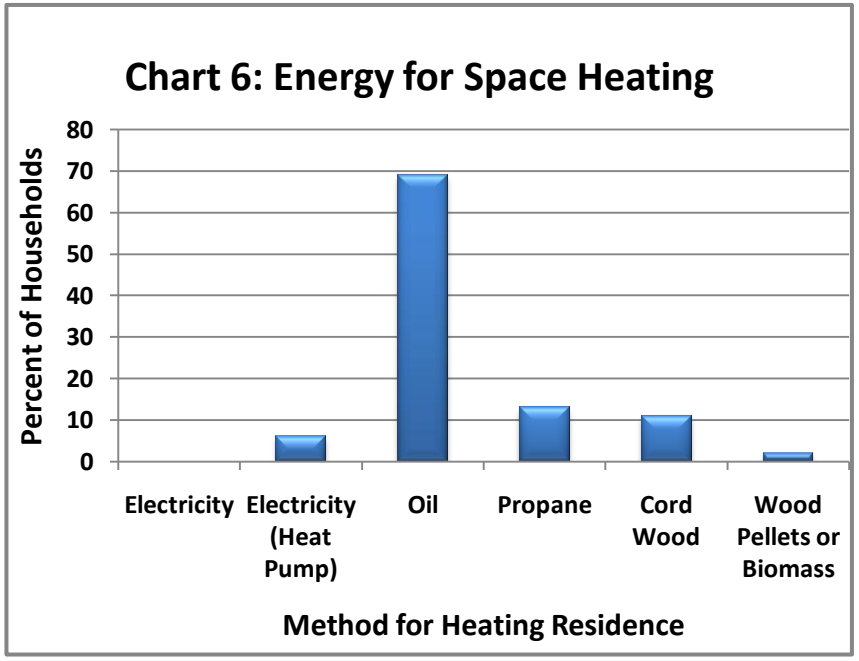
"It is an initial cost just like a lot of conversions or investments into trying to be a little bit more environmental about how you live. This has paid for itself over time, and it's more efficient. And, of course, my heating bills are more bearable."

Cynthia's Estimated Annual Savings
740 kg of CO_2, 274 litres of oil, $233

Heating Related Statistics

- As per Chart 5, there was considerable variation in house size. The advantage of a smaller house is that (with all other variables held constant) less energy is required for heating.
- Most people (63 percent) are content with the size of their house. Of the remaining people, about half wanted to increase the size while half wanted to decrease the size.
- Slightly more than one third of respondents have had an EcoEnergy audit performed on their house.
- As indicated in Chart 6, oil is the predominant home heating fuel and is used in 69 percent of homes.
- Domestic hot water is most often produced with an oil-fired boiler (40 percent of homes) and next with a stand-alone oil-fired water heater (38 percent of homes).
- The average household consumes 3,239 litres of oil per year. Individual household consumption rates ranged from 1,600 to 6,500 litres per year.
- In the winter, the average daytime thermostat setting is 20^0 C (68^0 F) while at night it is 17^0 C (63^0 F).
- There has been very little uptake of renewable energy technologies among the respondents: one household has a solar water heater, no households have a solar electric (PV) system, two households have groundwater heat pumps, one household has an air to air heat pump, and one household has a forced convection solar heating system.





Section D: Outside Practices

The way in which we use the land around our homes can help to reduce our carbon footprint. In fact, anyone who maintains a green space has an opportunity not just to reduce carbon emissions but also to increase carbon storage.

Abstaining from the use of synthetic fertilizers and transitioning to organic methods will certainly help lower emissions. This is because synthetic fertilizers contain nitrous oxide, a greenhouse gas more than three hundred times as powerful as carbon dioxide.[24, 25] Online, there is an abundance of information available about switching to organic lawn care methods such as this advice from the Manitoba Eco-Network: "The guiding principle of organic lawn care is to nourish the soil. In this way, it differs fundamentally from chemical lawn care, which focuses on feeding the grass. Nourish your soil with natural and organic products such as finished compost (from your own backyard compost heap), well-aged manure, grass clippings and/or slow-release organic fertilizers."[26]

At present, however, it is likely that the largest source of direct carbon emissions associated with our green spaces is gasoline-powered lawn care equipment. The Clean Air Foundation reports that "according to Statistics Canada, gas-powered lawn equipment releases about 80,000 tonnes of emissions in Canada every year, using 151 million litres of gas."[27] Also, according to the Foundation, "a standard gas mower can emit the same amount of common air pollutants in one hour as driving a new car for almost 500 km."[27]

Emissions-free lawn care equipment, such as reel mowers and shears are readily available, but are only practical on smaller lawns (typically ¼ acre in area or less). If you maintain a large lawn, then your challenge will be to reduce its area to a size that is manageable with emissions-free equipment.

There are many ways this can be done such as by creating vegetable gardens or flower beds, planting trees or shrubs, or simply ceasing to mow parts of the lawn. From a carbon reduction perspective, the most beneficial way to shrink your lawn is probably to plant shrubs and trees because, as they grow, they will store carbon in their roots, trunks and branches, and in the soil. Planting trees also has an additional benefit in that if the site allows, softwood trees (e.g., spruce or fir) can serve as a windbreak for your house thereby helping to reduce heating costs.

When done in the right way, displacing part or all of a lawn can result in the creation of wildlife habitat, which is important as existing natural wildlife habitat continues to be lost to residential development and other land use practices. Through its Backyard Habitat Certification Program, the Canadian Wildlife Federation provides information on the requirements (food, water, shelter, and space) necessary to create appropriate wildlife habitat.[28]

In addition to lawn care practices, using manual methods to maintain flower beds and gardens will also help reduce carbon emissions. Backyard composting is always a good idea as is using a conveniently located clothes line for at least part of the year instead of an electric clothes dryer.

Taken together, it is entirely possible to modify our existing outside practices to create an inviting, interesting and environmentally low-impact green space around our home.

D1: Emissions-Free Lawn Care

Often, carbon reduction actions not only help people address environmental concerns but also fit nicely into their lifestyles. Joe Carroll, for example, was concerned about the amount of pollutants being released into the air and was also interested in becoming more physically active. This developed into a win-win situation for him two years ago when he started using a reel mower to maintain his lawn.

"I was looking into having an environmentally-friendly yard and [at the same time] decided I was going to cut my grass for better exercise so I got out looking at reel mowers. I saw this one here and said, 'Well, I might as well give it a try.'"

Since then, Joe hasn't looked back and is quick to point out that there are few disadvantages to using a reel mower.

"It does everything a regular lawn mower can do and it does it more cheaply. And, it's better for the environment."

Reel mowers provide a practical way to maintain lawns up to about a quarter of an acre in size. Since they don't have an engine, they don't require gasoline and are emissions-free. They're also quiet, as Joe points out.

"There's no noise pollution. I can get up at the crack of dawn and cut the grass, and I won't wake up the neighbours or be a nuisance to anyone."

It should be as easy, or almost as easy, to push a reel mower as a regular mower. However, you must ensure that the grass doesn't grow too high between cuttings; otherwise, the reel

mower will be difficult to push and will likely not do a satisfactory job.

It is also important that the reel mower be well maintained. This involves keeping the blades sharp using a process called backlapping in which a grinding compound is applied to the blade tips as they are rotated backwards. As well, the gap between the blades and the bed knife should be adjusted periodically.

So, two years later, how does Joe feel about his reel mower?

"I'm doing something for the environment plus I'm a healthier person for doing it!"

Joe's Annual Savings
86 kg of CO_2, 36 litres of gasoline, $38

D2: Composting in the Backyard

Diane Griffin has been composting kitchen and garden waste for seventeen or eighteen years, after initially being influenced by a friend in Edmonton.

"My friend composted to create a soil amendment for her garden and flower beds. So I thought to myself, what am I doing throwing away my potato peelings when I could be reusing them in my garden as compost?"

Even though our provincial Waste Watch Program accepts all compostable materials, Diane prefers to separate vegetable peelings and scraps by placing them in a small container she keeps under her kitchen sink. When the container is full, she empties it into her backyard composter where she also deposits certain types of garden waste (e.g., bean leaves and stems).

Diane composts year round and acknowledges that not much happens in the composter in the winter; it's just too cold for decomposition to take place. In the spring, Diane gets to enjoy the fruit of her efforts when she removes the newly formed nutrient-rich soil from her composter.

"I just tip the composter over and the soil that's on the bottom and ready to go into the garden goes into the garden. Everything else gets stirred up and put back in the composter before the top gets put back on."

Diane operates her composter on a two-year cycle so the material that she returns to the composter will have a chance to decompose for another year. Her composter is large enough

that capacity is never an issue; it easily handles all the waste generated in her two-person household.

For a while, Diane used a compost accelerator to speed up the decomposition process. She no longer does that; instead, she chooses to simply allow more time for decomposition to occur. This is part of her philosophy of making the whole composting exercise as work free as possible.

Overall, Diane is very pleased with her home composting experience and recommends it to anyone who wants to generate a modest amount of high quality soil.

Benefits of Composting
Reduces emissions of carbon dioxide as less waste has to be trucked to a central composting site

D3: Planting Trees for Climate Protection

It has been said that "the best time to plant a tree is twenty years ago. The second best time is now."[29] This is advice which Della Wood has followed most of her life.

Since she was a child, she has enjoyed trees and shrubs and, from the diversity of vegetation around her house, it is obvious that this enjoyment has continued into her adult life.

Della can offer many reasons why it is important to plant trees. Among them is the fact that planting a tree helps absorb carbon dioxide which is important as we attempt to lessen the impacts of climate change. And her observations lead her to believe that the climate on Prince Edward Island is indeed changing.

"I know that zone 6 plants [which are intended for milder locations] can now grow on P.E.I. as long as they're handy to a house or protected from the wind. They couldn't grow here 20 years ago. So, we are warming up."

In addition to improving the aesthetics of a property by making it more inviting and attractive than a broad expanse of lawn, trees also have a very practical application in terms of household energy savings. Deciduous (hardwood) shade trees to the south and west of a house can help keep it cool in the summer and coniferous (softwood) trees to the north can provide an effective windbreak in the winter.

According to Della, it's never too late to begin planting trees.

"First, plant trees in the front of your house because that's what everyone sees first. Planting a tree today is always better than waiting five years - you're better off doing it now and getting it started no matter what size it is."

Also, Della isn't too troubled by the distinction between native and non-native tree species (some of which have been present on P.E.I. for a few hundred years).

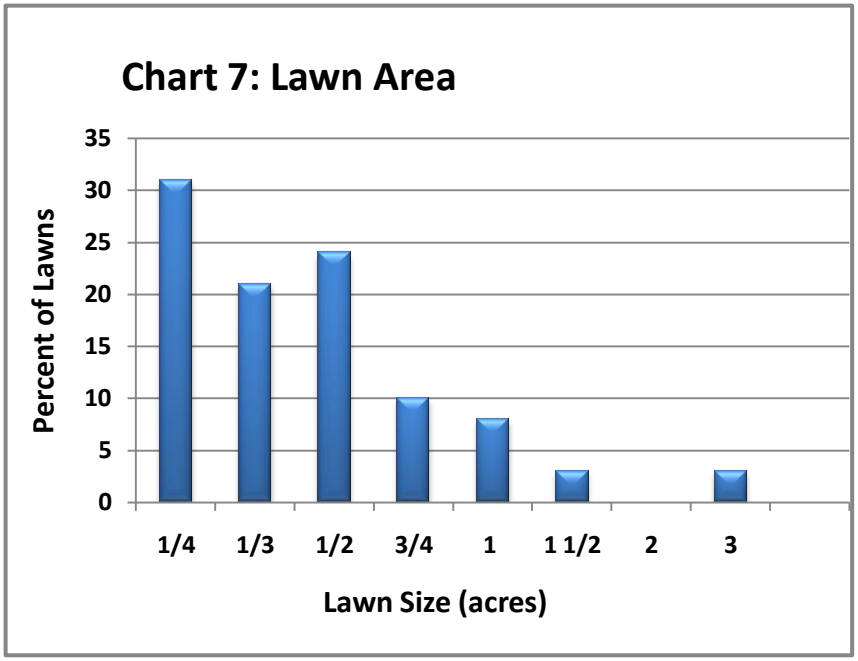
"I like native trees but I also like non-native trees as long as they are healthy and grow well. I think that's the thing."

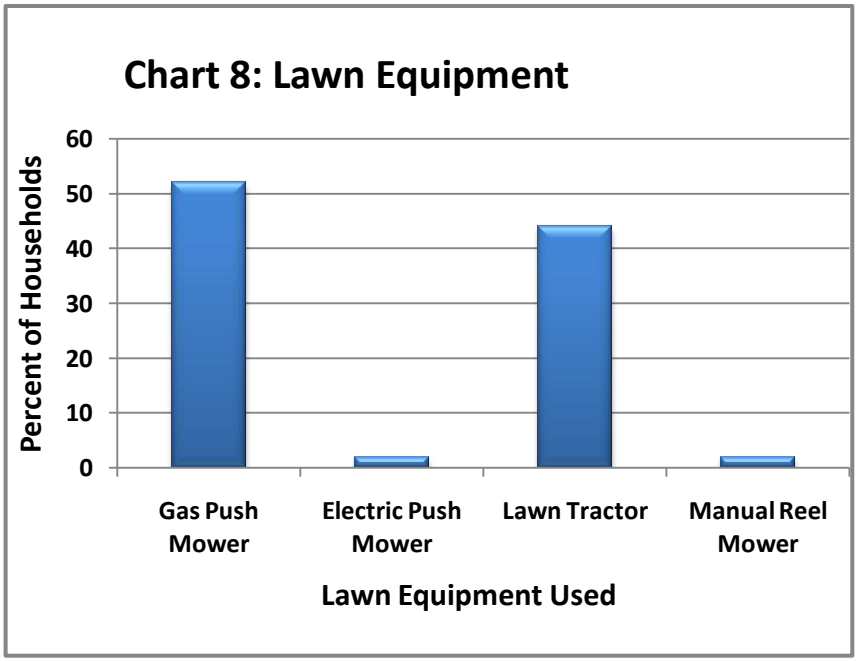
Della also recommends buying trees that have been grown locally. They're already acclimatized to local conditions and it's a good way to eliminate emissions relating to transportation.

Benefits of Planting Trees
Absorbs carbon dioxide, reduces heating and cooling costs

Outside Related Statistics

- Lawn areas of ¼ to ½ acre are most common (see Chart 7).
- Gas powered trimmers are used by 56 percent of respondents, 25 percent use manual shears and 19 percent use electric trimmers.
- On average, respondents spend about 2 hours per week mowing and trimming their lawns.
- Just more than half of respondents do not water vegetable or flower gardens or shrubs.
- The survey data (see Chart 8) indicates that slightly more lawns are cut with gasoline powered push mowers than with lawn tractors. Electric mowers and reel mowers are far less common.
- Rain barrels are used by 26 percent of respondents, 67 percent compost in the backyard, 8% use an electric leaf blower, no one uses a gas powered leaf blower, and 10 percent of respondents use or own a tiller.
- Only 20 percent of respondents are bothered by the noise of neighbourhood lawn care.
- Most respondents (87 percent) do not use pesticides on their lawn.
- Most respondents (68 percent) do not use synthetic fertilizers on their lawn.





Section E: Food Choices

When you consider it, the diversity of food available to us is absolutely remarkable. At your local grocery store, you can easily find fruit cocktail from South Africa, kiwis from New Zealand, baby clams from China, and even potatoes from Idaho, all attractively displayed and waiting to be purchased. It's no wonder, then, that our attention often remains focused on the culinary delights that await us rather than on some of the far less palatable issues associated with the food itself.

Two of these issues are the distance food is transported from where it is produced to where it is consumed (food miles or kilometers) and the amount of energy/material inputs necessary to produce the food.

All things being equal, it is considered better to purchase food produced locally rather than similar food produced from further away. Less transportation means less carbon emitted into the atmosphere. This choice works well for people as long as what they want is available locally. When it isn't, they have to decide whether to do without the product, find a substitute, or purchase it knowing it has travelled a great distance.

The issue of food's energy/material inputs pertains mostly to the efficiency of the use of resources associated with the production of a particular food item. From this perspective, some foods provide a much greater caloric and nutritional return on investment of energy and materials than other foods. The same holds true for environmental consequences.

In terms of greenhouse gas emissions, "the start-to-finish process of raising and distributing red meat causes more greenhouse gas emissions than any other food group, with dairy products coming in second. Animal products create the greatest amounts of nitrous oxide, emitted as a result of soil fertilization and management, because animals are inefficient at using plant energy. Lower on the greenhouse gas emission scale are non-red meat protein sources such as chicken, fish, eggs and nuts, as well as fruit and vegetables."[30]

In view of the above, it appears as if Albert Einstein may have been ahead of his time when he remarked, "Nothing will benefit human health and increase the chances for survival of life on Earth as much as the evolution to a vegetarian diet."[31]

And then, there are other issues around food choices such as organic versus non-organic methods of production, nutrition, health, packaging, social implications, economics, and even ethics. All of this can leave a person feeling quite bewildered when trying to make appropriate food choices.

Another major consideration greatly influencing our food choice decision-making process is that of taste. Quite naturally, most of us are predisposed toward purchasing foods that provide us with a pleasant taste experience.

So, with all of this in mind, how can you begin making better food choices? In all likelihood, you already are - such as when you purchase locally produced foods and foods with little or no processing. However, why not think about why you purchase these foods and then apply the same rationale to some of your other food choices? At the same time, become curious about your food; find out where and how it is produced - even talk to local farmers. And lastly, begin experimenting with new recipes and different ingredients. There are lots of delicious, eco-friendly meal choices just waiting to be discovered.

E1: Eliminating Food Miles, Organically

Although estimates vary, the average meal travels almost 1,500 miles to reach your plate.[32] And, individual food items can travel even greater distances. This concept of "food miles," as it is commonly known, is quite familiar to Lana Beth Barkhouse.

"You don't have to buy vegetables and fruits out of season from far away. It would probably be a lot better if they were grown on P.E.I. There is just something inherently better about this than food that is shipped here from halfway around the world."

Lana Beth has an organic solution for actually eliminating food miles for at least part of the diet she enjoys with her family - her backyard garden, which contains a mix of vegetables and flowers planted in proximity to each other in a way that is known as companion planting.

As Lana Beth explains it, companion planting allows for the control of garden pests without the need to use pesticides. "If you're growing tomatoes, you would have marigolds growing around them because that protects the tomatoes from the pests that like to feed on the tomatoes."

It may also help that she keeps her soil in good condition by using mushroom compost as a fertilizer. She also gathers eel grass from a nearby beach to use as mulch between the garden rows.

The variety of food Lana Beth grows is extensive, including carrots, peas, beets, parsnips, red onions, beans, herbs, broccoli, cucumbers, peppers, garlic, rhubarb, asparagus, Swiss chard, and lettuce. And, every year, she likes to grow something that she has never grown before.

In addition to enjoying a convenient source of fresh vegetables just metres from her backdoor and the environmental and financial benefits, Lana Beth enjoys other benefits that are less tangible but just as important.

"I like to dig in the soil. It's good for my soul. It's a meditation in a funny sort of way. And I think that's good."

Not surprisingly, Lana Beth feels that if everyone had a garden, the world would be a better place. And, perhaps, this would be a good reason to consider taking full advantage of our backyards, community gardens, and balcony planters.

Benefits on Maintaining a Home Garden
Reduces food miles (CO_2 emissions), saves money, improves health

E2: Buying Locally Produced Food

"I have literally held food in my hand at the grocery store and thought, okay, this has travelled all the way from South America. And then I put it back down. And it's hard because it's good food, like fruit in the middle of the winter that is hard to get."

Nancy Russell is no stranger to the challenge of trying to balance food choices with food miles. However, having given the matter a lot of thought, she is comfortable with the choices she now makes in her own busy household.

A significant proportion of the food Nancy purchases includes locally produced products such as eggs, milk, butter, cheese, meat, vegetables, and fruit. And her motivation for buying these products is based not only on reducing food miles, but also on considerations such as food quality, supporting the local economy, and, as she explains, establishing relationships with producers.

"I like knowing where the food is coming from and having conversations with the people who produce it."

For Nancy, these social and educational encounters are an important part of the experience that keeps her buying locally produced food. In fact, one of the markets where she shops has gone a step further in advancing customer relations by helping people obtain even more enjoyment from their locally produced food.

"They have chefs come in on Saturdays to make different recipes with the products that are there. So I've got some really good ideas from them. You make something and the next time you

come in, the person at the counter asks how it turned out. There is a real sense that they're interested in how their products are working in your life."

Nancy admits that using basic local products to prepare meals from scratch can take extra time, but she feels it is worth it. And she is pleased that local markets are expanding their product lines - something which will help her avoid the temptation to purchase that previously-mentioned fruit from South America.

"Fortunately, my local market has a lot of frozen fruit now. They have raspberries, blueberries, and strawberries that are frozen so I can get them all winter."

Benefits of Buying Locally Produced Food
Reduces food miles (CO_2 emissions), improves health

E3: Eating Lower on the Food Chain

There can be many reasons why a person chooses to follow a vegetarian diet. For Anne Gallé, it was simply a matter of taste.

"I think I always preferred vegetables to meat. When I grew up and had the opportunity to make my own meals, I decided I didn't want meat."

Vegetarian diets vary and may be classified according to what is and is not allowed for consumption. The pure vegetarian diet, which is the strictest, excludes meat, poultry, fish, seafood, milk, dairy products, and eggs.[33] Less strict variations, among which is the type Anne follows, allow for the consumption of milk, dairy products and eggs.

An underlying environmental benefit of following a vegetarian diet is that it requires fewer inputs than a meat-based diet. For example, it "takes an average of 2,500 gallons of water and 7 pounds of vegetable protein (grain, soy, etc.) to produce one pound of beef."[34] It is a far more efficient use of resources to consume the vegetable protein (grains) directly.

Although Anne appreciates how her choice of diet is better for the environment and the welfare of animals, she sometimes finds herself in situations where she is faced with meals that she would normally not eat. However, she handles these situations in a gracious manner.

"At a social occasion, if somebody has gone to the trouble of preparing a meal and I'm a guest, I will eat what they have put in front of me. Although, if it's a buffet [with non-meat alternatives], I will always be able to solve that problem."

Generally, though, Anne has little difficulty in adhering to her preferred diet.

"[Being a vegetarian] is much easier these days because there are more vegetables around. Every year I find something new that I never even thought about eating. So, it's great."

In part, this is because the public is demanding fresh, locally produced fruits and vegetables, and markets and stores are responding with improved choice and higher quality items. And as more people follow the latest edition of Canada's Food Guide, with its emphasis on vegetables, fruits, and grains, this trend will likely continue well into the future.

Benefits of Following a Vegetarian Diet
Requires less production-related inputs (less CO_2 emissions), improves health

E4: Preparing Meals from Scratch

For Louise Daigle, maintaining a healthy lifestyle includes not only cycling and gardening but also preparing meals from scratch - something that is important to her and comes quite naturally.

"Coming from a big family, a lot of celebrations and get-togethers were around the table. The home-made meal was a big part of this and where the conversation was. We could stay around the table for hours."

Louise uses basic ingredients as the basis for most meals which she feels makes sense economically and health-wise. She also prepares homemade favorites such as pickled beets, grape jelly, and even wild strawberry jam – all from vegetables and fruits grown in her backyard.

When she does shop for groceries, Louise tries to limit the amount of processed food she buys. She also insures food purchases are put to good use; leftovers are never wasted and usually find their way into lunches for work or are used to supplement other meals. When food does require disposal, most of it ends up in the backyard composter while what remains is placed in the green Waste Watch bin.

Louise is appreciative of other environmental benefits in that, by selecting her own ingredients, she can control the types of food that are brought into her home. This allows her the opportunity to learn where her food has been produced. She checks food labels and, although she doesn't always purchase locally produced food, she does prefer to purchase food produced in Canada.

When asked about the extra time required to prepare meals

from scratch, Louise admits there may be times or stages in a person's life when it can be difficult, particularly when children are young or schedules are full. However, she feels that, with planning, time issues can be managed, and it helps to have a partner who is responsible for a portion of the food preparation responsibility.

At this point in her life, Louise takes great pleasure in preparing meals and is quick to summarize some of the benefits.

"You know what you're putting in your body by preparing it yourself. It's very economical. You're in your own home. It's relaxing!"

Benefits of Preparing Meals from Scratch
Reduces food miles (CO_2 emissions), saves money, improves health

E5: Enjoying Low Impact Lunches

Ross Horrelt makes his own lunch and takes it to work (or university) about four out of every five weekdays. After having grown up taking home-made lunches to school, he has certainly become accustomed to "brown-bagging" it, but there are other reasons he has continued the practice as an adult.

"I definitely notice that I save money. And I like the food. A sandwich is just as good as anything else."

For the most part, Ross's lunches are simple and easy to prepare. He makes good use of the leftovers he finds in the refrigerator and will occasionally include a salad with his lunch.

"I'll usually have an apple or banana and a sandwich and some crackers or something like that. And perhaps a yogurt or granola bar."

Ross has a strong concern for the environment and recognizes that taking his lunch to work has environmental benefits.

"Well, there's definitely less trash left over from a packed lunch. You can take the sandwich bags home and reuse them. The only real garbage is the yogurt container and the wrapper from the granola bar."

In his current summer job, Ross finds that having a packed lunch is practical and convenient particularly on days when he is outside of the office working in local rivers and estuaries. At noon, he doesn't have to spend time or gasoline seeking out the nearest restaurant.

The people with whom Ross often works have followed his lead and usually bring their lunches to work as well.

In general, Ross feels there aren't many disadvantages to taking his lunch to work other than, perhaps, having to get up a little earlier in the morning to prepare it and ensuring that there are adequate groceries in the house.

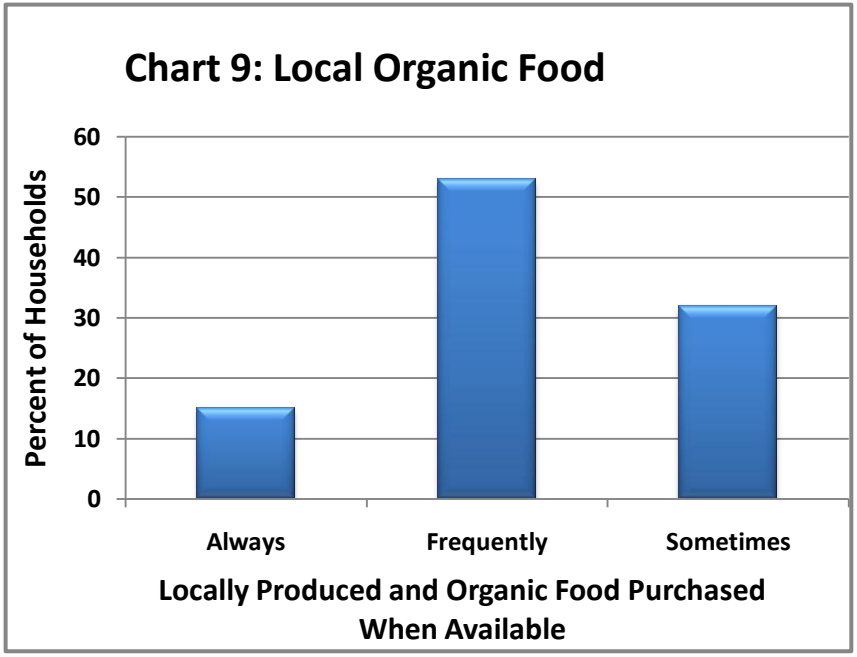
He does, however, have some advice on how he maintains his motivation.

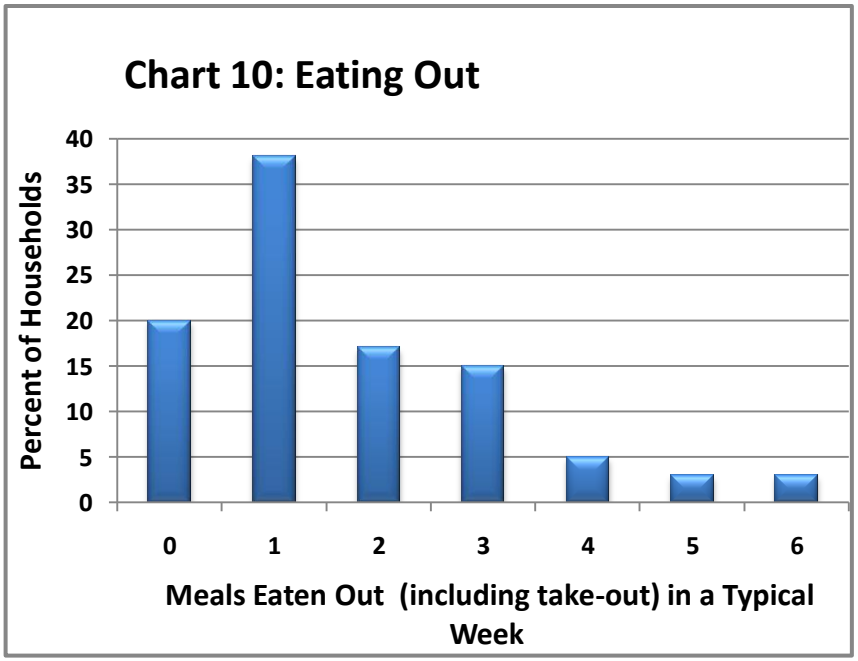
"You really need to really appreciate the planet and the beauty of nature. That kind of helps you."

Ross's Benefits
Reduces packaging, opportunity to buy local ingredients, Reduces food miles (CO_2 emissions), saves money

Food Choice Related Statistics

- All respondents reported purchasing local organic food, albeit, to varying degrees (see Chart 9).
- Most respondents (80 percent) would be willing to pay a premium for locally produced organic food: 47 percent of respondents would pay an extra 10 percent, 28 percent of respondents would pay an extra 20 percent, and 5 percent of respondents would pay an extra 30 percent.
- Most respondents (61 percent) grow some of their own food.
- If any meal tends toward being meat-free, it's breakfast. Just slightly more than half of the respondents (51 percent) indicated they have meat-free breakfasts. Of the remaining respondents, 43 percent of respondents indicated they have 5 or 6 meat free breakfasts per week and 6 percent never have meat free breakfasts.
- About 53 percent of respondents report having 4 to 7 meat free lunches per week.
- Only 26 percent of respondents report having 4 to 7 meat free suppers per week.
- Only one household reported having a member who follows a vegetarian diet.
- Almost 90 percent of respondents eat out 3 or fewer times per week (see Chart 10)





Section F: Transportation Choices

According to the Government of Prince Edward Island's Annual Statistical Review, the average Island household spent just over $8,000 on transportation in 2007.[35] For most households, this amount includes a considerable capital investment in personal vehicles.

When it comes to transportation, it is interesting to think about what we really want. Is it a vehicle, or is it the provision of convenient transportation? The two are not the same nor are their financial and environmental consequences.

It is generally best to think first about your transportation needs and how those needs can be met. Do you have access to public transit near your home and can it take you to your destination? Does the public transit schedule fit well with your schedule? If your answer to these questions is "yes", then you have a financially and environmentally desirable option that may fulfill your transportation needs.

If public transit is not an option, do you have other modes of transportation available? Is cycling or walking an option? Or, would a neighbour or co-worker be interested in entering into a pay-as-you-go arrangement with you (he or she drives and you pay as you go!). If this investigation doesn't produce any positive results, then you may have no choice but to consider a personal vehicle but, even so, you still may have some options to prevent you from ending up with a SOV (single occupancy vehicle). Is it convenient to carpool? Or do you know of someone who would be interested into entering into a pay-as-you-go arrangement with you and your vehicle?

When selecting a vehicle, select one that is fuel efficient. The Fuel Consumption Guide maintained by Natural Resources Canada is an excellent resource to help you in the selection process. It provides information on city and highway fuel consumption rates, estimates of annual fuel consumption, and estimates of annual carbon dioxide emissions. The on-line version of the Guide (to access the Guide, type "fuel consumption guide" into Google) allows for an easy comparison of the fuel efficiency of vehicles within any class (e.g., compact car, pickup truck) and even allows for the comparison of vehicles back to the 1995 model year.

Before making your final selection, it may be informative to see how your vehicle ranks for fuel efficiency compared to all of the vehicles available (regardless of class) for that model year. The on-line version of the Guide can generate a list of all vehicles available in Canada in order of descending fuel efficiency. You may be surprised at the variety of vehicles that rank within the top 100.

When selecting a vehicle, try to distinguish between wants and needs - they are often confused. Focusing on needs, instead of wants, may allow you to move into a more fuel efficient vehicle within a particular class or even to move from a less efficient vehicle class to one that is more efficient.

No matter what type of vehicle you drive, it is always possible to improve your fuel efficiency by keeping your vehicle well maintained and by operating it efficiently. For example, avoiding quick starts and excessive speeds, removing any unnecessary weight from your vehicle, and refraining from idling will all help to improve fuel economy, save money, and reduce carbon emissions.

F1: Commuting by Pedal Power

Cycling is Andy Trivett's preferred choice of transportation for making the 19 kilometre round trip between his home and office.

"It's such a great way to start the day. Most days, if the weather is decent, it's really nice to get out there and get some fresh air before work."

About two years ago, Andy decided that the advantages of using a bicycle as a means to commute greatly outweighed any disadvantages, and he now takes his bike to work about four days a week throughout much of the year.

"For me, the season starts around the first of March. I don't like to bike when it's below zero, but you can have many days in March when it's not below zero. I keep biking right through to early December. You get some days that are fabulous."

It also turns out that, for Andy, his cycling commuting time isn't significantly longer than the time required using a vehicle. He can cycle to the front door of his office building, doesn't have to spend time searching for a parking space, and, doesn't have to spend four or five minutes walking from the parking space back to his building.

Andy wears proper biking clothes and, when he arrives at his office, he cools down and uses a towel to freshen up before changing into the work clothes he carries in his bike bag. Even this time is productive as he also uses it to prepare for his work day.

It's not just his enjoyment of cycling that keeps Andy going. He

is also well aware of the environmental and health benefits.

"When you're out riding, you're doing no harm to the environment. You're not emitting any pollution, and you're doing good for yourself."

Does Andy have any advice for beginner commuters? You bet he does!

"Just give it a try. Some morning, give yourself some extra time and see how it goes. Also, with the right attitude and with a bit of practice, the Hillsborough Bridge is not as scary as you think. It's actually quite doable!"

Andy's Estimated Annual Savings
840 kg of CO_2, 350 litres of gasoline, $368

F2: Displacing Four Wheels with Two

When it comes to personal transportation, most people enjoy having a certain amount of independence. However, if you're environmentally conscious and almost twelve years of age, like Dalton Killorn, then it's likely you'll be exercising that independence by riding a bicycle.

For about two years, Dalton has been, more or less, travelling independently around the community.

"I go biking to volunteer activities, sleepovers, the movie store, soccer, and baseball."

Travelling on his own during the summer (and late spring and early fall) means that Dalton's parents don't have to drive him, so, in a very real way, Dalton's emissions-free bike miles are displacing motor vehicle miles.

Dalton has been riding tricycles and bicycles since he was a toddler and his parents have always been there to ensure his safety and enjoyment. So, as he got older, it was quite natural for him to want to use his bicycle as a means to get around.

He always wears a helmet and is very mindful of the traffic around him. Although he mostly drives on the sidewalk, he is quick to give the right of way to pedestrians. And when it comes to crossing a few of the busier streets in Stratford, he actually crosses as a pedestrian - dismounting from his bicycle and walking it across the street but not forgetting to wave thanks to the drivers who have stopped.

Fortunately, Stratford's most heavily travelled road (the Trans

Canada Highway) has a pedestrian underpass which always provides Dalton safe passage.

Dalton's nine year-old sister, Madeline, is aware of the advantages and convenience that Dalton enjoys but she will have to wait just a while longer to have similar privileges. For now, she has contented herself with parent accompanied trips to school, the library, and the movie store.

Meanwhile, Dalton continues to enjoy the freedom of two wheels.

"You get to go more places that you could go in the car. And even if Mom and Dad are doing something, I can still just go."

Dalton's Estimated Annual Savings
110 kg of CO_2; 46 litres of gasoline; $48

F3: Taking the Bus Instead of the Car

"The route is very convenient and fits my schedule quite well. I can get the bus at about 7:30, and it gets me to the office at 8:00. At the end of the day, the bus leaves at 4:00 and gets me home at 4:30."

Because it fits his schedule so well, it's not surprising that Stewart Macintosh uses public transit on a regular basis. In fact, he has been using it since it first became available in September of 2008.

Other than during the summer, he usually purchases a monthly pass that allows him unlimited ridership; although, he normally uses it just to commute to and from work in Charlottetown, a 17 kilometre round trip.

Overall, Stewart estimates that the difference in commuting time between using public transit and his own vehicle is minimal. In the summer, it's a little faster to take his own vehicle (when he has to); although, he usually parks several blocks away from his office building which adds to the walking time. In the winter, the time can be even.

"[When I use public transit] in the winter, I don't have to shovel. I don't have to defrost the car or anything like that. I just go out the door and go to the bus stop."

Stewart would like to see more people using public transit but recognizes that, because the system is still new and developing, it is not yet at the point where it can meet everyone's needs. Stewarts's wife, Leona, for example, has a work schedule that has not allowed her to become a regular user of the system;

although, she is able to use it on occasion. Nevertheless, public transit works well for Stewart, and he is quick to point out its advantages.

"It's good environmentally. It's good personally. We don't have extra insurance costs. We don't have extra maintenance costs. So it's a win-win situation."

Even though using public transit is already saving him money, Stewart is looking forward to even greater savings when he and his wife eventually dispose of their second vehicle and become a one vehicle household - an option they could not consider if he didn't have access to public transit.

Stewart's Estimated Annual Savings
898 kg of CO_2; 374 litres of gasoline; $393

F4: Making Lists and Planning Trips

"I have a grocery list on our fridge. If we run out of an item, we'll write it on our list. We'll take our list and do all of our stops the one time we're out. It helps us become more efficient and reduces the amount of travel."

Like most people, Jillian Westcott values her time and likes to use it wisely. Since she is also concerned about carbon emissions, it's not surprising that she tries to reduce her vehicle usage by using lists so as not to have to return to stores for forgotten items.

What is interesting about Jillian's situation is that many of the basic services she utilizes are only a few kilometers away from her home so even if she occasionally has to repeat a trip, she doesn't have to travel very far. Even so, this is a situation she prefers to avoid.

"It comes down to having busy lifestyles too. It's a time management thing. It's making sure you are not taking all those trips in the car if you don't have to."

In addition to maintaining a shopping list, Jillian also recognizes other opportunities to reduce her vehicle miles.

"When I leave work in Charlottetown and I want to pick up things, I'll do whatever I can close to work on the way home. I won't backtrack and go in the opposite direction. It's always in the way I'm heading."

Jillian recognizes that her decisions relating to vehicle usage are guided by an underlying appreciation for efficiency, part of which

she developed through her technical training. She also recognizes that growing up in the presence of a good role model, her father, and observing some of his environmental practices have influenced her attitude toward the environment.

With this in mind, it is no wonder that Jillian remains vigilant in seeking opportunities to reduce unnecessary vehicle travel such as on this recent trip she describes below.

"We picked up our movies, walked across the parking lot to another store, and then drove two minutes up the road to the grocery store. In one trip, we accomplished three tasks. We did it all in span of 15 minutes and within 5 kilometers of our house."

Jillian's Estimated Annual Savings
132 kg of CO_2; 55 litres of gasoline; $58

F5: From Two Vehicles to One

Prior to March of 2008, when both Steve and Evelyn McQuaid worked outside of their home, having one vehicle would not have been a convenient option. But since then, Steve has been telecommuting; that is, working from an office set up in a spare bedroom in their house and completing his work assignments and staying in touch with his main office by using a computer, the internet, a printer, and the telephone.

To some extent, his change in work venue was based on what he terms "age and stage." As a senior partner in his company, he had been considering reducing his work hours and when the opportunity came, rather than continuing to rent office space on a full-time basis for only half-time occupancy, he decided instead to work from home.

So now, Steve and Evelyn have transitioned to being a single-vehicle household. In addition to the environmental benefits, there are also financial benefits, as Steve indicates.

"We certainly have seen benefits money-wise in going to one car. You're paying less for maintenance, insurance, and gas.

Managing the transportation needs of two people with one vehicle can be challenging but is, according to Evelyn, quite doable.

"We make sure, when we're taking a trip to Charlottetown, that we both go and do everything that we have to do. So there's a lot more planning and organizing."

Despite this, there are times when Steve does require a vehicle for his work. On these occasions, he sometimes takes public transit, drops Evelyn off at her workplace, uses a bicycle, or takes a taxi.

While some of this may sound inconvenient, Steve appreciates that having only one vehicle has allowed them to come out far ahead financially, and it relates to their environmental concerns.

"We're conscious of the fact that globally we're consuming resources, and it's just getting more difficult for the world to sustain this level of consumption. We are at the point where we are all going to have to start shifting our behaviors."

Steve and Evelyn's Estimated Annual Fuel Savings
989 kg of CO_2, 412 litres of gasoline, $433
(See Appendix A for total savings)

F6: Running on Gas and Electricity

Ray and Judy MacInnis are aware that transportation accounts for a major portion of their personal greenhouse gas emissions. It wasn't surprising, then, that this factor influenced them more than any other to purchase a hybrid when they were looking for a new vehicle in 2008.

Because their hybrid vehicle contains an electric motor in addition to a gasoline engine (plus a number of other energy efficient features like regenerative braking), the purchase price was higher than for a similar sized conventional vehicle. However, Ray looks at the price this way.

"You pay more to buy a car that is more fuel efficient and that affects your pocketbook at the time of purchase, but it also affects your pocketbook [the other way] every time you go to the gas pumps!"

And, as it turns out, Ray and Judy don't have to spend that much time at the gas pumps. Even though they have determined that their hybrid's actual fuel economy is less than the rated fuel economy, it still averages up to 55 miles per gallon (5.1 litres per 100 kilometers).

The efficiency of Ray and Judy's hybrid is rooted in its ability to switch seamlessly between its two fuel sources. At low speeds, the electric motor operates very efficiently, unlike the gasoline engine. At high speeds, the efficiency of the gasoline engine is much improved and often predominates; although, assistance will be provided by the electric motor as needed.

Judy has found there is some getting used to driving a

hybrid because, when you stop, the gasoline engine shuts off leaving you in total silence. As she recalls, this can be confusing.

"We had someone in the car who wasn't used to it, and when we got to the lights, the engine stopped. Our passenger said, "Oh, your car stalled!" And I said, "No, it didn't stall; it's okay!"

Incidents like this keep Ray and Judy smiling which is likely easy to do anyway when you consider the operational efficiencies of a hybrid vehicle.

Ray & Judy's Estimated Annual Savings (Compared to Average Vehicle in Size Class)
2,880 kg of CO_2, 1,200 litres of gasoline, $1,260

F7: Small Vehicle, Less Fuel

"The price of gas drove me to buy it. I was looking for something smaller. And when I filled it up, I realized I could get about 600 kilometers to a tank. So, that made me happy."

Two years ago, Mark Butler traded in his 3,800 pound SUV for a 2,400 pound two-door hatchback. At that time, the price of gasoline was higher than it is at present, and he was fed up with his fuel bills. Looking back, he recognizes that he made a good decision.

"The last time I filled up the SUV was for the guy who bought it, and it cost me $96. And that was [what I used to pay] every two weeks. In the new car, I can now go much longer on a tank of gas, and it costs me much less to fill it."

Unfortunately, operating almost any personal vehicle is one of the most expensive and inefficient ways of meeting your transportation needs. In fact, the U.S. Department of Energy estimates that, after accounting for engine and driveline inefficiencies and idling, "only about 15% of the energy from the fuel you put in your tank gets used to move your car down the road or run useful accessories, such as air conditioning.[36]

However, since many of us have no choice but to operate a personal vehicle, it makes economic and environmental sense to choose as efficient a vehicle as possible which is a good reason to consult the Fuel Consumption Guide prepared by Natural Resources Canada when selecting a vehicle. (To access the Guide, type "fuel consumption guide" into Google.)

In the year it was manufactured, Mark's vehicle ranked among

the top ten percent of vehicles with regard to fuel economy. In addition to being pleased with its fuel-efficiency, he is also pleased with its ability to meet his transportation needs.

"If I have to pick up lumber or anything, I can put the seats down and leave the tailgate open. If not, I take my small utility trailer and use it to haul whatever I need."

With three other people and a dog in his household, however, Mark knows that his hatchback is too compact to be used as the "family" vehicle. That role is filled by the station wagon his wife drives which, fortunately, like the hatchback is also ranked among the top ten percent of vehicles for fuel economy.

Mark's Estimated Annual Savings
1,270 kg of CO_2; 529 litres of gasoline; $546

F8: Driving Lightly and Efficiently

No matter what type of vehicle you drive, there are many ways to improve your fuel economy. Sandra Gallant has two ways that work well: keeping her vehicle free of excess weight and following the four-second rule.

Sandra is vigilant in not allowing her vehicle to become a mobile storage container. "We never use the trunk for storage. Items might get in there and stay there for a week before I drop them off, but I do drop them off."

This is important because your fuel economy will improve as much as two percent for every one hundred pounds of unnecessary weight you remove from your vehicle.[37]

Sandra admits that some items remain in her vehicle during different seasons and that other items (such as cloth shopping bags and a set of booster cables) remain year round. However, all of the the items in her vehicle have been placed there for good reason.

Sandra also follows the four-second rule for vehicle spacing. When the vehicle ahead passes some recognizable feature (e.g., a telephone pole, driveway, or highway sign), she counts the number of seconds until she passes the same feature, with the intent to be at least four seconds behind.

Following the four-second rule allows drivers adequate time to perceive situations ahead and then to react accordingly. It also improves your fuel economy. Whenever you apply the brake, you're wasting the fuel it took to get you up to speed. If the vehicle ahead brakes and you have a sufficient gap, you may

be able to remove your foot from the accelerator and save some fuel by letting your vehicle coast a little on its own.

Sometimes, however, it's difficult to maintain the gap, especially in heavier traffic. Here's how Sandra sums it up.

"I'm going the same speed but I'm not packed in like the rest of them and people do get annoyed with that. They think they're going to be that much faster if they go by."

So, the next time you see the vehicle ahead maintaining a safe gap, why not follow its example and create a safe gap of your own?

Sandra's Estimated Total Annual Savings
91 kg of CO_2, 38 litres of gasoline, $40

F9: Accelerating His Fuel Savings

You likely won't find any tire marks on the pavement in front of Doug Kelly's house and, even if you did, you can be assured they wouldn't be his. That's because Doug understands the relationship between quick starts, fuel economy, and the environment.

"Intuitively, I like to go as far as I can on a tank of gas, and I don't like spending money unnecessarily. If I can stretch my dollar with slower acceleration and help the environment at the same time, so much the better."

Doug's intuition serves him well because Natural Resources Canada estimates that, along with speeding and hard stops, quick acceleration "can increase fuel consumption by twenty-five percent."[38]

It's never been difficult to accelerate a vehicle quickly. No effort is required on the part of the driver - just push down on the gas pedal and away you go! But with the increase in vehicle horsepower over the last two decades, it's now even easier to propel your vehicle (all 2,000 to 5,500 pounds of it) up to speed in even less time.

However, quick acceleration has its costs - not only with respect to increased fuel consumption and carbon emissions, as Doug had recognized, but also with respect to highway safety, and, over the longer term, energy security. With the world now consuming approximately 85 million barrels of oil per day[39] and with the era of peak oil either here or quickly approaching (type "peak oil" into Google), now is likely an appropriate time to begin thinking about easing up on our gas pedals.

In addition to accelerating efficiently, Doug also gets more value from his gasoline dollar by avoiding quick stops at traffic signals. He understands that the energy lost while stopping is the energy that had been consumed earlier to get his vehicle up to speed and keep it there. Here's how he likes to approach signals.

"When I anticipate a red light, I coast. Timed lights are really nice because you can see how many seconds are left before they change. The timers are mainly for the pedestrians to know when to cross but it's useful for drivers as well. You can tell from a distance if you're not going to catch the light and, if you're not, then you can coast up to it instead of braking at the last minute."

Doug's Estimated Annual Savings (slow acceleration, easy stops)
514 kg of CO_2; 214 litres of gasoline; $225

F10: Idling Gets You Nowhere

"When I think of the environment, I think of my kids and their future. The future is what we're going to leave for our kids someday and that becomes our legacy."

When it comes to the environment, Carlos Lourenso is thoughtful about a lot of things, including unnecessary idling.

"I think the main reason I try not to idle is that I can't find many good reasons to idle. I know it wastes fuel, money; and what's coming out of my tailpipe is noxious."

Carlos isn't a big fan of zero kilometers per litre which is exactly what you get when you idle your vehicle. In fact, Natural Resources Canada has estimated that "if every driver of a light duty vehicle avoided idling by three minutes a day, collectively over the year, we would save 630 million litres of fuel and over 1.4 million tonnes of greenhouse gas emissions." [40]

From a mechanical perspective, there is no reason to leave a vehicle idling for extended periods of time. The best way to warm up your vehicle is simply by driving it. Even on the coldest winter mornings, there is no advantage to leaving your vehicle idling for more than two or three minutes.[40]

From a fuel and cost savings perspective, "any more than ten seconds of idling uses more fuel than is required to restart the engine. However, the break-even time to offset any potential incremental maintenance costs to the starter or battery is under 60 seconds. So, as a guideline, if you're stopped for more than 60 seconds – except in traffic – turn off the engine."[40]

This advice also applies to drive-thru line ups which Carlos tries to avoid.

"I don't go through drive-thrus if the lines are long or if I know that a particular drive-thru is not very efficient and the line moves slowly. I prefer to just go in."

Carlos remains optimistic that the amount of unnecessary idling will decline.

"Although I think some people do idle needlessly, I believe more and more don't, and the vast majority of people want to make the right choices affecting our environment."

Carlos's Estimated Annual Savings
218 kg of CO_2; 91 litres of gasoline; $96

F11: Keeping Tires Properly Inflated

According to Natural Resources Canada and the Rubber Association of Canada, "twenty-three per cent of vehicles have at least one tire under-inflated by more than twenty percent.[41]

An under-inflated tire is undesirable from a safety perspective because it adversely affects the vehicle's handling. And it is undesirable from a financial perspective because "operating a vehicle with just one tire under-inflated by 20 percent (8 psi) can reduce the life of the tire by 15,000 km and increase the vehicle's fuel consumption by 4 percent."[41]

Patrick Ross understands this which likely explains why he is vigilant in regularly checking the air pressure of his own tires, usually about every six weeks. He uses a manual tire gauge with an angled head that permits easy use. And, when one of his tires does need air, he is even able to fill it without driving to the nearest garage or service station.

"I use my $9 air pump that I bought on sale at the hardware store. It plugs into the cigarette lighter and has a pressure gauge on it. It's very convenient."

In addition to checking his tire pressure himself, he also asks to have it checked whenever his vehicle is at the garage for servicing. As he explains, it's important to have the right tire pressure - not too low and not too high.

"If you're driving on a low tire, you're wearing down the structure of the tire - the walls of the tire, and they're not going to last as long as they should. If you have your tires too full, you then run the risk of them being so hard and rigid that the tread is just rubbing off onto the pavement, so you're wearing them out much more quickly."

When inflating your tires, never go by the maximum pressure printed on the tire sidewall. Instead, look for the information sticker on the edge of the driver's door or on the inside of the glove compartment door that identifies the proper tire pressure for your vehicle.

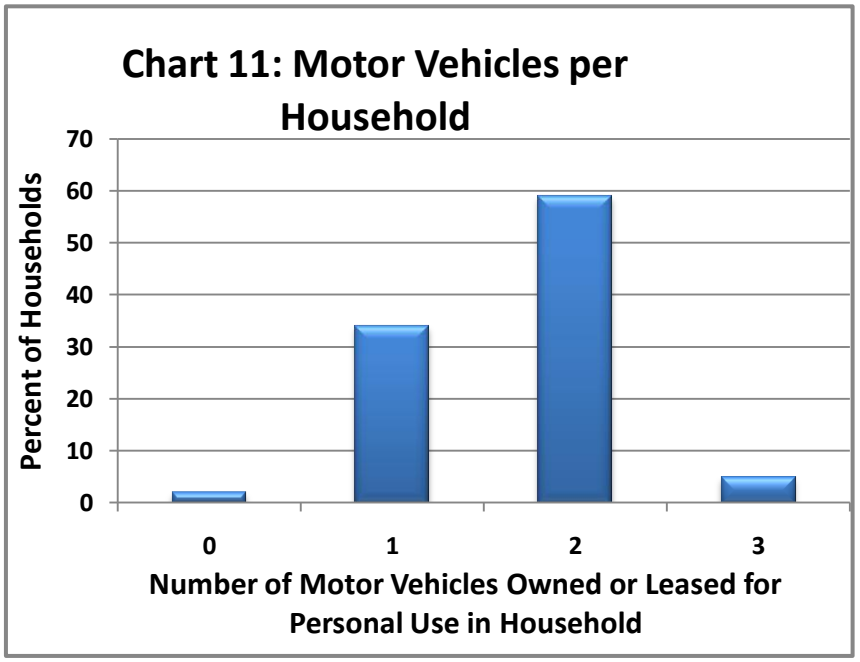
Checking your tire pressure may be a simple action but, as Patrick reflects, it does make a difference.

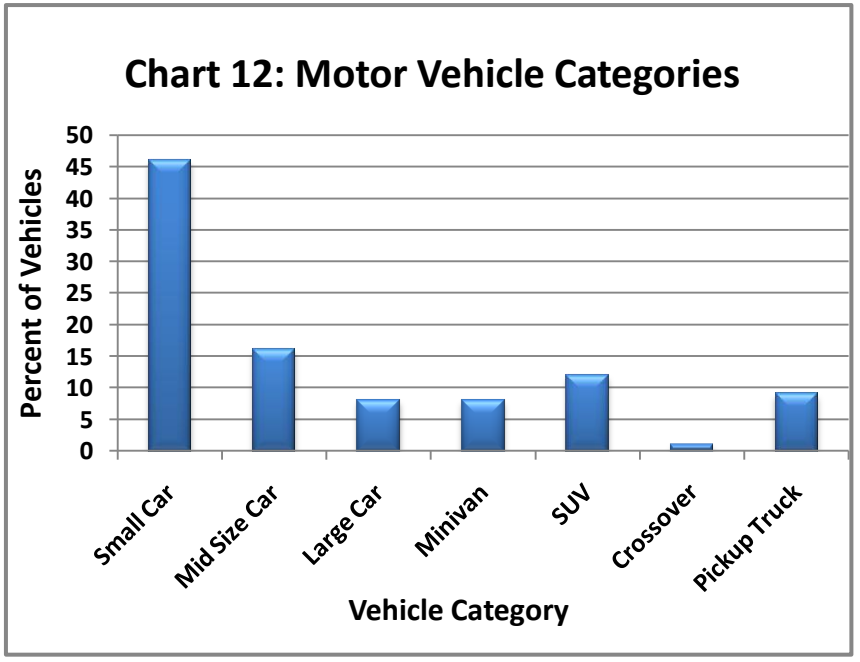
"I think if we can all choose a task, whatever it may be, and just do it, then it is obviously going to have a positive effect."

Patrick's Estimated Annual Savings
202 kg of CO_2; 84 litres of gasoline; $88

Transportation Related Statistics

- More households (59 percent) have two motor vehicles than have one (34 percent). And, it is almost as uncommon to have three vehicles as it is to have no personal vehicle (see Chart 11).
- Nearly 50 percent of vehicles reported fall within the small car category (see Chart 12). The next most common category is mid-sized cars (16 percent) and SUVs (12 percent).
- The majority of respondents (93 percent) make an effort not to idle their vehicles.
- For 73 percent of respondents, public transit is available within 5 minutes of walking distance of their home.
- Public transit can take 79 percent of the respondents who work outside of the home to within 10 minutes of walking distance from their place of work.
- Public transit is not used by 76 percent of respondents while 20 percent use it one to three times per week and 4 percent of respondents use it four or more times per week.
- Daily commuting distances (to and from work) range from 4 to 80 kilometers with 62 percent of respondents indicating a commuting distance of 10 kilometers or less.
- The majority of respondents (68 percent) never use a bicycle to go to work or shopping. A bicycle is used occasionally for this purpose by 20 percent of respondents and is used regularly by 12 percent of respondents.





Appendix A: Estimated Annual Savings

This Appendix contains the calculations upon which the savings estimates for actions are based.

Table 3, below, contains the carbon dioxide emission rates and costs of the fuels referred to in the estimates.

Table 3: Fuel Data

Fuel	Unit	Kg of CO_2	Cost ($)
Oil	Litre	2.7	0.85
Gasoline	Litre	2.4	1.05
Propane	Litre	1.55	0.57
Electricity	Kilowatt-hour	0.5	0.15

The carbon dioxide emissions rate used for municipal water pumping is 0.07 kg per m^3 (1000 litres). The rate for sewage effluent pumping is 0.28 kg per m^3 (1000 litres).

If the water saved would otherwise have been pumped and then disposed of in the sewer, then the rate used is 0.35 kg per m^3 (1000 litres).

All vehicle fuel consumption data was obtained from Natural Resources Canada's Fuel Consumption Guide. Although the calculations do not refer to it, specific vehicle characteristics (e.g., manufacturer, model, year, engine size) were used to obtain fuel consumption data.

A1: Saving Electricity in the Kitchen
(Using a toaster oven instead of range oven)

Electricity consumption of range oven: 4,500 watts
Electricity consumption of toaster oven: 1,300 watts
Savings: 4,500 watts – 1,300 watts = 3,200 watts

Assume toaster oven is used for 20 minutes (0.33 hours) per day.

Ann's Estimated Annual Savings
Electricity: (3,200 watts x 0.33 hrs/day x 365 days/yr) / 1000 = 385 kWh
CO_2: 385 kWh x 0.5 kg CO_2/kWh = 193 kg
Cost: 385 kWh x $0.15/kWh = $58

A2: Energy Star Means Energy Savings
(Using an Energy Star clothes washer)

Annual electricity consumption of Energy Star clothes washer: 189 kWh

Estimated annual energy consumption of non-Energy Star clothes washer: 425 kWh

Billy's Estimated Annual Savings
Electricity: 425 kWh – 189 kWh = 236 kWh
CO_2: 236 kWh x 0.5 kg CO_2/kWh = 118 kg
Cost: 236 kWh x $0.15/kWh = $35

A3: Washing Dishes Efficiently

Annual Electricity Consumption of Dishwasher: 325 kWh
Reduce this consumption by 25 percent to account for a smaller household which means less use of the dishwasher.

325 kWh x 0.75 = 244 kWh

Consumption if Dishwasher Only 80 Percent Full
244 kWh/0.8 = 305 kWh

Will & Gail's Estimated Annual Savings
Electricity: 305 kWh – 244 kWh = 61 kWh
CO_2: 61 kWh x 0.5 kg CO_2/kWh = 30 kg
Cost: 61 kWh x $0.15/kWh = $9

A4: Keeping Seals and Filters Clean

(Keeping seals of refrigerator doors clean, keeping lint filter of clothes dryer clean)

Judy's Estimated Annual Savings by Keeping the Seals of Her Refrigerator Door Clean
This is a "B" action in the "Your Guide to the One-Tonne Challenge (P. 14).[42] "B" actions result in reductions in greenhouse gas emissions of between 100 and 499 kg. Allow a reduction of 100 kg of carbon dioxide per year.

If CO_2 reduction is 100 kg, then kWh saved are:
100 kg / (0.5 kg/kWh) = 200 kWh
Cost: 200 kWh x $0.15/kWh = $30

Judy's Estimated Annual Savings by Keeping the Lint Filter of Her Clothes Dryer Door Clean
Assume a 3 percent loss of efficiency if lint filter is not clean
Electricity: 6 loads/wk x 52 wks/yr x 2 kWh/load x 0.03 = 16 kWh
CO_2: 16 kWh x 0.5 kg CO_2/kWh = 8 kg
Cost: 16 kWh x $0.15/kWh = $2

A5: Installing Efficient Light Bulbs

Assumption: Replaced 16 incandescent bulbs (60 watts each) with compact fluorescent bulbs (13 watts each) thereby saving 47 watts per bulb. Let each bulb be on for 3.5 hours per day.

Sheri & Phil's Estimated Annual Savings
Electricity: (16 bulbs x 47 watts x 3.5 hrs/day x 365 days/yr)/1000 = 961 kWh
CO_2: 961 kWh x 0.5 kg CO_2/kWh = 481 kg
Cost: 961 kWh x $0.15/kWh = $144

A6: Automatic Electricity Savings

(Using two motion sensor lights instead of conventional lights)

Electricity Consumption for Two Conventional Outside Lights
Assume lights left on for four hours per day.
(2 bulbs x 60 watts/bulb x 4 hours/day x 365 days/yr)/1000 = 175 kWh per year

Electricity Consumption for Two Motion Sensor Outside Lights
Assume lights on for ten minutes (0.2 hours) per day.
Consumption when lights on:
(4 bulbs x 75 watts/bulb x 0.2 hours/day x 365 days/yr)/1000 = 18 kWh/year

Standby Consumption of Two Motion Sensor Outside Lights
(2 fixtures x 3 watts x 23.8 hours/day x 365 days/yr)/1000 = 52 kWh/year

Beth's Estimated Annual Savings
Electricity: 175 kWh – (18 kWh + 52 kWh) = 105 kWh
CO_2: 105 kWh x 0.5 kg CO_2/kWh = 53 kg
Cost: 105 kWh x $0.15/kWh = $16

A7: Lights Off, Fan On
(Keeping lights turned of and not using an air conditioner in the summer)

Jane's Estimated Annual Savings by Keeping Lights Off
Average monthly consumption for similar household: 300 kWh
Jane's monthly consumption: 265 kWh

Electricity: (300 kWh – 265 kWh) x 12 = 420 kWh
CO_2: 420 kWh x 0.5 kg CO_2/kWh = 210 kg
Cost: 420 kWh x $0.15/kWh = $63

Jane's Estimated Annual Savings By Not Using an Air Conditioner
Electricity Consumption for Ceiling Fan
(75 watts x 6 hrs/day x 60 days/yr) / 1000 = 27 kWh

Electricity Consumption for Air Conditioner
(1200 watts x 6 hrs/day x 60 days/yr) / 1000 = 432 kWh

Electricity: 432 kWh – 27 kWh = 405 kWh
CO_2: 405 kWh x 0.5 kg CO_2/kWh = 203 kg
Cost: 405 kWh x $0.15/kWh = $61

A8: Ending Standby Power Consumption
(Plugging television/peripherals and computer/peripherals into power bars)

Standby power consumption of television/peripherals: 23 watts
Standby power consumption of computer/peripherals: 25 watts
Total standby power consumption: 48 watts
On average, equipment sits idle for 21 hours/day

Rosemary's Estimated Annual Savings
Electricity: (48 watts x 21 hrs/day x 365 days/yr) / 1000 = 368 kWh
CO_2: 368 kWh x 0.5 kg CO_2/kWh = 184 kg
Cost: 368 kWh x $0.15/kWh = $55

A9: Pulling the Plug on Standby Power
(Unplugging garage door opener and plugging microwave into power bar)

Judy's Estimated Annual Savings by Unplugging Garage Door Opener
Standby power consumption: 5 watts
Time opener is unplugged: 8 mths/yr

Electricity: (5 watts x 24 hrs/day x 30 days/mth x 8 mths/yr) /1000 = 29 kWh
CO_2: 29 kWh x 0.5 kg CO_2/kWh = 15 kg
Cost: 29 kWh x $0.15/kWh = $4

Judy's Estimated Savings from Having Microwave on Power Bar
Standby power consumption: 3 watts
Hours microwave used per week: 1
Hours microwave not used per week: 167

Electricity: (3 watts x 167 hrs/wk x 52 wks/yr) /1000 = 26 kWh
CO_2: 26 kWh x 0.5 kg CO_2/kWh = 13 kg
Cost: 26 kWh x $0.15/kWh = $4

A10: Reducing Unnecessary Ventilation
(Unplugging heat recovery ventilator in the summer)

Normal power consumption: 170 watts
Months HRV is unplugged: Mid-May to Mid October = 5 mths

Charlene's Estimated Annual Savings
Electricity: (170 watts x 24 hrs/day x 30 days/mth x 5 mths/yr) /1000 = 612 kWh
CO_2: 612 kWh x 0.5 kg CO_2/kWh = 306 kg
Cost: 612 kWh x $0.15/kWh = $92

Note: These calculations are based on an HRV with a HEPA filter

A11: Drying Laundry the Natural Way
(Using a clothesline)

Clothesline used for 5 loads of laundry per week for 7 months of the year.

Loads per year = 5 loads per week x 52 weeks per year x (7 months/12 months per year) = 152 loads

Barbara's Estimated Annual Savings
Electricity: 152 loads x 2 kWh/load = 304 kWh
CO_2: 304 kWh x 0.5 kg CO_2/kWh = 152 kg
Cost: 304 kWh x $0.15/kWh = $46

B1: Not Much Water Down this Drain
(Saving water when rinsing vegetables in sink and after boiling vegetables on stove)

Ann's Estimated Annual Savings
Water: 1,000 litres
CO_2: 1,000 litres x 0.35 kg of CO_2/1000 litres = 0.35 kg

B2: Making Use of Every Drop
(Turning water off while brushing teeth and taking shorter showers)

Brush teeth 3 times per day for two minutes each time
Let flow rate = 6 litres/ minute

Water Consumed if Tap Left Running
3 brushings/day x 2 minutes/brushing x 6 litres/minute x 365 days/yr = 13,140 litres/yr

Water Consumed if Tap Turned Off While Brushing
3 brushings/day x 0.25 minutes/brushing x 6 litres/minute x 365 days/yr = 1,643 litres/year

Nathan's Estimated Annual Savings
Water: 13,140 – 1,643 = 11,497 litres
CO_2: 11,497 litres x 0.35 kg of CO_2/1000 litres = 4 kg

Jerika's Savings: Reducing shower length by 5 minutes
Three showers per week
Showerhead flow rate = 7 litres/minute
Water savings:
3 showers/wk x 5 minutes/shower x 7 litres/minute x 52 wks = 5,460 litres of hot water

Heating Capacity of 1 Litre of Oil
Efficiency of boiler/heater: 70 percent
Energy in 1 litre of oil: 38.2 MJ
Output for 1 litre of oil: 38.2 MJ x 0.70 = 26.7 MJ/litre
Rise in water temperature: from 4 to 37^0 C.
$\Delta T = 37 - 4 = 33^0$ C
Energy required to heat 1 litre (1,000 grams) of water:
1000 g x ΔT of 33^0 C = 33,000 calories
Since 1 calorie = 4.186 joules, then 33,000 calories = 138,138 joules = 0.138 MJ (the amount of energy required to heat 1 litre of water)
Heating capacity of 1 litre of oil = 26.7 MJ/0.138 MJ = 193 litres of water

Jerika's Estimated Annual Savings
Oil: 5,460 litres of water/193 litres of water heated per litre of oil = 28 litres of oil
CO_2: 28 litres x 2.7 kg CO_2/litre = 76 kg
Cost: 28 litres x $0.85/litre = $24

B3: Saving Water Every Morning
(Using an efficient showerhead)

Annual savings based on one person showering for 7 minutes each day using a 6 litre/minute showerhead instead of a 9.5 litre/minute showerhead

Water Savings
9.5 litres/minute – 6 litres/minute = 3.5 litres/minute
3.5 litres/minute x 7 minutes/day x 365 days/year = 8,943 litres of hot water saved annually

Heating Capacity of 1 Litre of Oil
Efficiency of boiler/heater: 70 percent
Energy in 1 litre of oil: 38.2 MJ
Output for 1 litre of oil: 38.2 MJ x 0.70 = 26.7 MJ/litre
Rise in water temperature: from 4 to 37^0 C.
$\Delta T = 37 - 4 = 33^0$ C
Energy required to heat 1 litre (1,000 grams) of water:
1000 g x ΔT of 33^0 C = 33,000 calories
Since 1 calorie = 4.186 joules, then 33,000 calories = 138,138 joules = 0.138 MJ (the amount of energy required to heat 1 litre of water)
Heating capacity of 1 litre of oil = 26.7 MJ/0.138 MJ = 193 litres of water

Marie's Estimated Annual Savings
Oil: 8,943 litres of water/193 litres of water heated per litre of oil = 46 litres of oil
CO_2: 46 litres x 2.7 kg CO_2/litre = 124 kg
Cost: 46 litres x $0.85/litre = $39

B4: Saving Water with Every Flush
(Using a 6-litre toilet instead of a 13-litre toilet)

Savings based on 2 people each flushing 5 times per day
Annual Volume of water required by a 13 litre/flush toilet:
10 flushes/day x 13 litres/flush x 365 days/yr = 47,450 litres

Annual volume of water required by a 6 litre/flush toilet:
10 flushes/day x 6 litres/flush x 365 days/yr = 21,900 litres

Derek & Holly's Estimated Annual Savings
Water: 47,450 – 21,900 = 25, 550 litres
CO_2: 25,550 litres x 0.35 kg of CO_2/1000 litres = 8.9 kg

B5: Saving Rain for a Sunny Day
(Using a rain barrel to collect water)

If the 180 litre rain barrel fills 12 times per season, then 2,160 litres of water will be collected.

Kevin's Estimated Annual Savings
Water: 2,160 litres
CO_2: 2,160 litres x 0.07 kg of CO_2/1000 litres = 0.15 kg

C2: Solar Gain without a Window
(Using a forced convection solar heating system)

Heat output of system ranges between 1,200 and 2,400 watts
Let average production be 2,200 watts of heat energy

Annual Heat Energy Production
(2,200 watts x 7 hours/day x 180 days)/1000 = 2,772 kWh
2,772 kWh = 2,772 kWh x 3,600,000 j/kWh = 9.979×10^9 joules

Oil Equivalency
(9.979×10^9 joules)/(38,200,000 joules/litre of oil x 0.70 efficiency) = 373 litres of oil

Adjustment to Savings Based on De-Stratification of Air in Room:
The local distributor of this system has indicated that actual savings (based on customer experience) should exceed calculated savings by a considerable margin because calculated savings do not account for the de-stratification (mixing) of room air that occurs through the use of the circulating fan.

Alana's Estimated Annual Savings
Therefore, increase the savings by 60 percent.
Oil: 373 litres x 1.6 = 597 litres
CO_2 : 597 litres x 2.7 kg of CO_2/litre = 1,612 kg of CO_2
Cost: 597 litres x $0.85/litre = $507

C3: Heating Water with the Sun
(Using a solar domestic hot water system)

Estimate based on actual data from a similar household with an oil-fired boiler and an identical solar domestic hot water system. Oil fired boiler was turned off for 127 days during the late spring, summer, and early fall. Boiler oil consumption to provide domestic hot water only = 4.6 litres of oil/day

Oil not consumed = 127 days x 4.6 litres/day = 584 litres
Estimated of oil savings for remainder of year = 150 litres
Total oil not consumed: 734 litres

Estimated Gross Annual Savings
Oil: 734 litres
CO_2: 734 litres x 2.7 kg of CO_2/litre = 1,982 kg of CO_2
Cost: 734 litres x $0.85/litre = $624

Supplemental electricity required during the 127 days (when the boiler was off) to provide hot water on cloudy days = 119 kWh
Electricity: 119 kWh
CO_2: 119 kWh x 0.5 kg CO_2/kWh = 60 kg
Cost: 119 kWh x $0.15/kWh = $18

Oil Equivalency of 119 kWh of Electricity
119 kWh x 3.6 MJ per kWh = 428.4 MJ
428.4 MJ / (38.2 MJ per litre of oil x 0.70 efficiency) = 16 litres

Craig & Amy's Estimated Net Annual Savings
Oil: 734 – 16 = 718 litres
CO_2: 1,982 kg – 60 kg = 1,922 kg of CO_2
Cost: $624 - $18 = $606

C4: Heating Water Indirectly
(Heating domestic water with an indirect water heater)

According to the Government of Nova Scotia, the typical annual household hot water cost for a family of four with using a tankless coil is $873 while the cost is $526 when an indirect water heater is used in conjunction with a high efficiency boiler.[43] Costs are based on oil at $0.851 per litre (taxes included).

Consumption (tankless coil) = $873 / $0.851/litre = 1,026 litres
Consumption (indirect water heater) = $526 / $0.851/litre = 618 litres

Carol Anne's Estimated Annual Savings
Oil Savings = 1,026 – 618 = 408 litres
CO_2: 408 litres x 2.7 kg CO_2/litre = 1,102 kg
Cost: 408 litres x $0.85/litre = $347

C5: Getting Efficient About Oil Heat
(Using an Energy Star qualified cast iron high efficiency boiler)

Old Boiler
Estimated annual consumption of old boiler (assume AFUE = 65%): 3,200 litres

Reduce annual oil consumption by 25 percent to account for oil used to provide domestic hot water: 3,200 litres x 0.75 = 2,400 litres

New Boiler
AFUE = 87%
Estimated annual consumption = 2,400 x (0.65/0.87) = 1,793 litres

Brian's Estimated Annual Savings (space heating only)
Oil Savings = 2,400 – 1,793 = 607 litres
CO_2: 607 litres x 2.7 kg CO_2/litre = 1,639 kg
Cost: 607 litres x $0.85/litre = $516

C6: Extracting Heat from Groundwater
(Using a groundwater heat pump)

Estimate of monthly electrical consumption directly attributed to operation of heat pump (from owner's records): 359 kWh

Annual electricity consumption: 359 kWh/mth x 7 mths = 2,513 kWh

Given: 1 kWh of electricity = 3.6 Megajoules (MJ)
Given: 1 litre of oil = 38.2 MJ

At 70 percent efficiency, energy output for 1 litre of oil:
38.2 MJ x 0.70 = 26.7 MJ

If coefficient of performance of groundwater heat pump = 4, then 2,513 kWh of electrical input energy results in 4 x 2,513 = 10,052 kWh of output energy.

10,052 kWh of electricity = 10,052 kWh x 3.6 MJ/kWh = 36,187 MJ

Cyril's Estimated Annual Savings
Oil: 36,187 MJ/26.7 MJ per litre of oil = 1,355 litres

CO_2: CO_2 from oil displaced – CO_2 from electricity consumed = (1,355 litres x 2.7 kg of CO_2/litre) – (2,513 kWh x 0.5 kg of CO_2/kWh) = 3,659 kg – 1,257 kg = 2,402 kg

Cost: (1,355 litres x $0.85/litre) – (2,513 kWh x $0.15) = $1,152 - $377 = $775

C7: Extracting Heat from Air
(Using an air to air heat pump)

The following data and calculations are based on the space heating provided by the air to air heat pump only. They do not include the operations of the propane furnace that serves as a backup heat source to the heat pump.

From January to May of 2009, the heat pump consumed 3,107 kilowatt-hours of electricity.

Based on heating degree day data from Environment Canada, these five months represented about 65 percent of the 2008/2009 heating season.

Therefore, the estimated electricity consumption for a full heating season would be 3,107/0.65 = 4,780 kilowatt-hours.

Cost of electricity to operate the heat pump for a full heating season:
4,780 kWh x $0.15 per kWh = $717

CO_2 emissions due to electricity consumed
4,780 kWh x 0.5 kg of CO_2 per kWh = 2,390 kg of CO_2

Average coefficient of performance
(3.3 + 1)/2 = 2.15

Equivalent energy
4,780 kWh x 2.15 = 10,277 kWh of energy produced.
Or, 10,277 kWh x 3.6 x 10^6 Joules per kWh = 3.699 x 10^{10} Joules

Dennis's Estimated Cost/Savings in Terms of Heating Oil
3.699 x 10^{10} Joules / (38.2 x 10^6 Joules per liter of propane x 0.8 efficiency) = 1,210 litres of oil not consumed

CO_2 emissions due to equivalent amount of oil
1,210 litres x 2.7 kg of CO_2 per litre = 3,267 kg of CO_2

Net CO_2 savings
Oil emissions – electricity emissions = savings
3,267 kg CO_2 – 2,390 kg CO_2 = 877 kg CO_2

Cost of equivalent amount of oil
1,210 litres x $0.85 per litre = $1,029

Net financial savings
$1,029 - $717 = $312

Dennis's Estimated Cost/Savings in Terms of Propane
$3.699 \times 10^{10}/(24.7 \times 10^{6}$ Joules per liter of oil x 0.8 efficiency) = 1,872 litres of propane not consumed

CO_2 emissions due to equivalent amount of propane
1,872 litres x 1.55 kg of CO_2 per litre = 2,901 kg of CO_2

Net CO_2 savings
Propane emissions – electricity emissions= savings
2,901 kg CO_2 – 2,390 kg CO_2 = 511 kg CO_2

Cost of the equivalent amount of propane
1,872 litres x $0.57 per litre = $1,067

Net financial savings
$1,067 - $717 = $350

1 kg propane equals 1.55 kg of CO_2 per litre[44]

C8: Displacing Oil with Biomass
(Using a biomass stove)

Actual Data:
3,320 litres consumed by boiler during 2007/08 heating season
1,900 litres consumed by boiler during 2008/09 heating season
1,420 litres of oil saved

Fuel for the biomass stove cost a total of $618 ($285 for wood pellets and $333 for wheat).

Colette's Estimated Annual Savings
Oil: 1,420 litres
CO_2: 1,420 litres x 2.7 kg of CO_2/litre = 3,384 kg of CO_2
Cost: 1,420 litres x $0.85/litre = $1,207
Net Cost: $1,207 - $618 = $589

C9: Insulating to Save Money and Carbon
(Insulating the attic)

Attic Area: 28 ft x 46 ft = 1,288 ft^2
Heating Degree Days (Charlottetown) = 8,519 ^0F
1 litre of oil = 36,200 BTU
1 litre of oil at 75% efficiency = 36,200 x 0.75 = 27,150 BTU

With R-12 Insulation
Heat loss per degree day: (1,288 x 1 x 24) / 12 = 2,576 BTU/DD
Heat loss for season: 2,576 x 8,519 = 21,944,944 BTU
Litres of oil consumed: 21,944,944 / 27,150 = 808 litres

With R-60 Insulation
Heat loss per degree day: (1,288 x 1 x 24) / 60 = 515 BTU/DD
Heat loss for season: 515 x 8,519 = 4,387,285 BTU
Litres of oil consumed: 4,387,285 / 27,150 = 162 litres

Aaron's Estimated Annual Savings
Oil: 808 litres – 162 litres = 646 litres
CO_2: 646 litres x 2.7 kg of CO_2/litre = 1,744 kg of CO_2
Cost: 646 litres x $0.85/litre = $549

C11: Saving Heat, Automatically
(Using a programmable thermostat)

Estimated annual oil consumption: 2,500 litres
Reduce annual oil consumption by 25 percent to account for oil used to provide domestic hot water: 2,500 litres x 0.75 = 1,875 litres

For every 1^0 Fahrenheit reduction in temperature over an eight-hour period, energy consumption is reduced by 1 percent.[22]

Given temperature drop: 66^0 F to 59^0 F (19^0 C to 15^0 C)
$\Delta T = 66 - 59 = 7^0$ F therefore savings will be 7 percent

Robert's Estimated Annual Savings
Oil: 1,875 litres x 0.07 = 131 litres
CO_2: 131 litres x 2.7 kg of CO_2/litre = 354 kg of CO_2
Cost: 131 litres x $0.85/litre = $111

C12: Casement Windows Keep Heat In
(Replacing old windows with new casement windows)

Total Window Area Replaced: 120 ft^2
Heating Degree Days (Charlottetown) = 8,519 ^{0}F
1 litre of oil = 36,200 BTU
1 litre of oil at 75% efficiency = 36,200 x 0.75 = 27,150 BTU

With Old Windows (R-1.7)
Heat loss per degree day: (120 x 1 x 24) / 1.7 = 1,694 BTU/DD
Heat loss for season: 1,694 x 8,519 = 14,431,186 BTU
Litres of oil consumed: 14,431,186 / 27,150 = 532 litres

With New Windows (R-3.5)
Heat loss per degree day: (120 x 1 x 24) / 3.5 = 823 BTU/DD
Heat loss for season: 823 x 8,519 = 7,011,137 BTU
Litres of oil consumed: 7,011,137 / 27,150 = 258 litres

Cynthia's Estimated Annual Savings
Oil: 532 litres – 258 litres = 274 litres
CO_2: 274 litres x 2.7 kg of CO_2/litre = 740 kg of CO_2
Cost: 274 litres x $0.85/litre = $233

D1: Emissions-Free Lawn Care
(Using a reel mower)

If grass is cut every 6 days for 26 weeks per year, then the number of cuttings per season = (26 weeks x 7 days/week) / 6 days = 30

If the gas powered push mower uses 1.2 litres/hour and the lawn takes one hour to mow, then annual fuel consumption = 1.2 litres per cutting x 30 cuttings = 36 litres

Joe's Estimated Annual Savings
Gas: 36 litres
CO_2: 36 litres x 2.4 kg of CO_2/litre = 86 kg
Cost: 36 litres x $1.05/litre = $38

F1: Commuting by Pedal Power
(Commuting by bicycle)

Annual Kilometers Displaced
19 km/trip x 4 trips/wk x 32 wks/yr = 2,432 km/yr

Andy's Estimated Annual Savings (based on city driving)
Gas: 14.4 liters/100 km x 2,432 km = 350 litres
CO_2: 350 litres x 2.4 kg of CO_2/litre = 840 kg
Cost: 350 litres x $1.05/litre = $368

F2: Displacing Four Wheels with Two
(Using a bicycle to travel around Town)

Annual Kilometers Displaced
5 km/trip x 5 trips/wk x 20 wks/yr = 500 km/yr

Dalton's Estimated Annual Savings (based on city driving)
Gas: 9.1 liters/100 km x 500 km = 46 litres
CO_2: 46 litres x 2.4 kg of CO_2/litre = 110 kg
Cost: 46 litres x $1.05/litre = $48

F3: Taking the Bus Instead of the Car
(Using public transit)

Annual Kilometers Displaced
17 km/day x 5 days/wk x 4 wks/mth x 10 mths/yr = 3,400 km/yr

Stewart's Estimated Annual Savings (based on city driving)
Gas: 11.0 liters/100 km x 3,400 km = 374 litres
CO_2: 374 litres x 2.4 kg of CO_2/litre = 898 kg
Cost: 374 litres x $1.05/litre = $393

F4: Making Lists and Planning Trips
Annual Kilometers Displaced
2 trips saved per week x 6 km/trip x 52 weeks/yr = 624 km/yr

Jillian's Estimated Annual Savings (based on city driving)
Gas: 8.8 liters/100 km x 624 km = 55 litres
CO_2: 55 litres x 2.4 kg of CO_2/litre = 132
Cost: 55 litres x $1.05/litre = $58

F5: From Two Vehicles to One
(Going from two to one vehicle)

Annual Kilometers Displaced
24 km/day x 3 days/week x 52 weeks/yr = 3,744 km/yr

Steve & Evelyn's Estimated Annual Savings (based on city driving)
Gas: 11.0 liters/100 km x 3,744 km = 412 litres
CO_2: 412 litres x 2.4 kg of CO_2/litre = 989 kg
Cost: 412 litres x $1.05/litre = $433

Steve & Evelyn's Actual Savings: (Aug 2007/Aug 2008) compared to (Aug 2008/Aug 2009)
Gas: $3,097 - $2,448 = $649
Vehicle Insurance: $1,282 – $857 = $425
Vehicle Registration: $210 - $130 = $80
Maintenance: $1,690 - $986 = $704

Note: The actual savings data contains more driving than was considered in the estimated annual savings.

F6: Running on Gas and Electricity
(Driving a hybrid vehicle)

Annual fuel consumption for hybrid: 820 litres
Annual fuel consumption for median vehicle in class: 2,020 litres

Ray & Judy's Estimated Annual Savings
Gas: 2,020 – 820 = 1,200 litres
CO_2: 1,200 litres x 2.4 kg of CO_2/litre = 2,880 kg
Cost: 1,200 litres x $1.05/litre = $1,260

F7: Small Vehicle, Less Fuel
(Switching to a smaller vehicle)

Vehicle driven drives 10,000 kilometers per year

Annual Fuel Consumption of SUV
2,677 litres (from NRCan Fuel Consumption Guide, based on driving 20,000 km/yr)

Annual Fuel Consumption of Hatchback
1,619 litres (from NRCan Fuel Consumption Guide, based on driving 20,000 km/yr)

Mark's Estimated Annual Savings
2,677 – 1,619 = 1,058 litres (for 20,000 kilometers of driving)

Gas: Since only 10,000 traveled: savings = 1,058/2 = 529 litres
CO_2: 529 litres/yr x 2.4 kg of CO_2 per litre = 1,270 kg
Cost: 520 litres/yr x $1.05/litre = $546

F8: Driving Lightly and Efficiently
(Keeping vehicle free from excess weight and not following too closely behind the vehicle ahead)

Given: Your fuel economy will improve as much as two percent for every one hundred pounds of unnecessary weight you remove from your vehicle.[2]

Assume a one percent improvement in fuel economy from not following too closely behind the vehicle ahead (thus helping to avoid unnecessary braking)

Therefore, total improvement in fuel economy: 3 percent

Annual fuel consumption of subcompact vehicle: 1,280 litres/year

Sandra's Estimated Annual Savings
Gas: 1,280 litres x 0.03 = 38 litres
CO_2: 38 litres x 2.4 kg of CO_2/litre = 91 kg
Cost: 38 litres x $1.05/litre = $40

F9: Accelerating His Fuel Savings
(Slow acceleration, easy stops)

Assumption
Natural Resources Canada estimates that, along with speeding and hard stops, quick acceleration "can increase fuel consumption by twenty-five percent."[76] Therefore, use a 15 percent savings.

Annual Fuel Consumption
1,424 litres (from NRCan Fuel Consumption Guide)

Doug's Estimated Annual Savings
Gas: 1,424 litres x 15 percent savings = 214 litres
CO_2: 214 litres x 2.4 kg of CO_2 per litre = 514 kg
Cost: 214 litres x $1.05/litre = $225

F10: Idling Gets You Nowhere
(Not idling your vehicle)

Given: "For the average vehicle with a 3-litre engine, every 10 minutes of idling costs 300 millilitres in wasted fuel."[45]

Carlos's Estimated Annual Savings
Gas: 0.3 litres/day x 365 days/yr = 91 litres
CO_2: 91 litres x 2.4 kg of CO_2/litre = 218 kg of CO_2
Cost: 91 litres x $1.05/litre = $96

F10: Keeping Tires Properly Inflated
Assumption
"With proper tire maintenance, the average Canadian driver could save the equivalent of two weeks worth of free gas every (http://www.betiresmart.ca/inflation/benefits.html)

Annual Fuel Consumption
2,200 litres (from NRCan Fuel Consumption Guide)

Patrick's Estimated Annual Savings
Gas: (2,184 litres/52 weeks) x 2 weeks = 84 litres
CO_2: 84 litres x 2.4 kg of CO_2 per litre = 202 kg
Cost: 84 litres x $1.05/litre = $88

Appendix B: References

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