FROM OIL DEPENDENCY TO RENEWABLE ENERGY

AN ENERGY TRANSITION GUIDEBOOK FOR THE WOODSTOCK REGION

Assessment *Planning* *Resources*

SUSTAINABLE ENERGY GROUP
(CARLETON CHAPTER)

Prepared By
The Sustainable Energy Group

Transition Town Woodstock
Woodstock, New Brunswick
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New Nouveau Brunswick
Your Environmental Trust Fund at Work.

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From Oil Dependency to Renewable Energy
An Energy Transition Guidebook for the Woodstock Region
Assessment, Planning, and Resources

The Sustainable Energy Group was established in 2004 for the purpose of advancing the awareness and knowledge of renewable and sustainable options in energy production and use in the Woodstock region.
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SEG is a working group of Transition Town Woodstock (TTW). TTW is a citizens' initiative for advancing and coordinating activities in the Woodstock region that will make our community more resilient and secure in dealing with rising energy costs and economic uncertainty.
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Purpose of this Guidebook

In 2010, the Woodstock Sustainable Energy Group (SEG) initiated an analysis of energy usage for the local area with the idea of determining how to comfortably transition to a post peak oil environment.

The study initially identified each form of energy that is used in the Woodstock area today and what each form is used for.

The impact of expensive and scarce petroleum products was evaluated for each energy usage.

Alternative methods and fuels were identified that avoid or mitigate negative impacts for those energy usages that will be severely or moderately impacted.

Equipment and methods were researched to determine best practices for avoiding negative impacts or achieving positive mitigation.

This guidebook was prepared to describe practical recommendations that can be used by local residents and businesses to assist in implementing the best practices.

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References:

Hubbert's Peak: The Impending World Oil Shortage by Kenneth Deffeyes

Beyond Oil: The View from Hubbert's Peak by Kenneth Deffeyes

Power Down: Options and Actions for a Post-Carbon World by Richard Heinberg

The Oil Depletion Protocol: A Plan to Avert Oil Wars, Terrorism, and Economic Collapse by Richard Heinberg

The End of Oil: On the Edge of a Perilous New World by Paul Roberts

Why Your World is About to Get a Whole Lot Smaller by Jeff Rubin

Introduction

Have you ever thought about what would happen to our households or businesses if oil became three or four times more expensive or spot outages of gasoline or fuel oil were to occur? What would happen to transportation? Could we get to work? Could we keep our houses warm? How would food supplies be affected? How much would fresh vegetables from California cost? What if they stop coming?

The worldwide phenomenon of peak oil is now unfolding and will have major effects on the economy and lifestyle of Woodstock and its surrounding region. These effects could be unpleasant and disruptive if we don't think ahead, but they do not *have* to be. With proper foresight, planning and preparation, Woodstock can experience peak oil while actually becoming a healthier, more resilient, and invigorated community.

What is Peak Oil?

Peak oil is about the end of cheap and plentiful oil. The technical definition of peak oil is the time when the worldwide production capacity of crude oil is at an absolute maximum. After that time, worldwide production capacity will begin to diminish.

What Causes Peak Oil?

Oil is a finite commodity. Starting about 1900 significant quantities of easy-to-produce oil were discovered. This spurred massive growth in transportation, manufacturing, large scale centralized food production, medical equipment and drugs, home construction and oil heating.

Some of the early oil wells produced over 100 units of energy for every unit of energy put into development and production. As the easiest access oil was used up, the next easiest was then tapped. Then the next easiest was developed, etc., with oil getting harder and harder to produce as the sources became more difficult to develop.

Today the most efficient oil wells (located in the Middle East) are producing only 20 units of energy for every unit of energy input. Many difficult to access sources are now down to 3 to 1. Below this ratio the economics of oil production becomes nonviable and hard to access oil will eventually become too costly to bring to market. Some sources, like the Canadian tar sands, are producing only one unit of energy for every unit of energy input. Production of oil from this source continues only because the natural gas input energy required for processing is priced significantly lower per unit than the final oil product.

Eventually, the capacity of each petroleum source will be depleted or the costs of production will become economically nonviable and production will cease. At some point, the loss of capacity from current sources will equal the capacity of new sources being developed. When that happens, maximum production capacity is reached. This is "peak oil." Oil industry analysts calculate we are just about at that point. From that point on, total oil production capacity will decline and price will steadily climb.

What Affect Does Peak Oil Have on the Economy and Society?

For more than a century cheap oil has allowed innovation to develop new uses that serve the global economy and drive today's society. This resulted in an ever-increasing demand for oil.

The global economy has allowed production of most goods to be centralized in large manufacturing facilities and shipped to far off markets. Only a small fraction of the total goods produced worldwide is used in the community of origin.

Thus the global economy is totally dependent on cheap and plentiful oil for transporting most goods long distances. So far, oil production capacity has been able to keep ahead of demand.

When peak oil occurs, and production capacity stabilizes and then begins to decline, increased demand will surpass production capacity causing an oil shortage and a price spike. Oil consumption will be forced downward until demand matches production capacity.

…increased demand will surpass production capacity causing an oil shortage and a price spike.

This will drastically affect the cost of shipping goods to distant markets. Much of the downward pressure in oil consumption will result in higher costs for the goods we use. Some markets will become unviable for some goods and scarcities will occur.

Even after demand again matches oil production, there will be further dwindling of production capacity as new sources of oil become harder to develop. This cyclical pattern of decline is unlikely to happen smoothly. As production capacity becomes limited, the consumption changes that correct the imbalance will likely overcompensate, causing a temporary surplus and a lowering of oil prices until a renewed demand for the dwindling supply drives it back up ever higher. Oil prices will trend higher as the supply of oil decreases over the longer term.

When Will Peak Oil Occur?

Many experts believe that "peak oil" has already occurred. Indeed, world oil production has remained fairly steady during the last several years. This pattern is distinctly different from the steady gains experienced in the previous one hundred years, except during the artificial shortages of oil embargoes in the 1970's.

Passing peak oil means that increasing demand cannot be matched by increasing production any longer. It won't be physically possible since the easily produced oil is gone.

What Impacts Will this Have on the Woodstock Area?

Woodstock is part of the global economy. Residents and businesses overwhelmingly depend on products shipped in from distant locations. Also, many of the products produced on our farms and in our factories are shipped to far off markets.

Woodstock, like virtually all other communities, will feel the impact of fluctuations resulting in more expensive and less plentiful oil supplies, leading to uncertainty and instability in both the importing and exporting of goods.

In addition to transporting goods, oil products in our community are used for personal transportation, agriculture, yard maintenance, recreation and heating of some homes. All of these areas will be significantly impacted.

What Can Be Done to Reduce the Impacts?

Woodstock, like any community, can best prepare for the negative impacts associated with diminishing oil availability by taking steps to reduce oil dependency and increase the use of renewable and sustainable energy. This turn away from oil dependency to sustainable energy will create resilience throughout local society and lifestyles. This can best be accomplished by consciously building a sense of "community." The working together, the caring and cooperation that are strong in a well functioning community, can foster innovative solutions that lead to reducing oil dependency. This is the kind of strength that allows a community to survive and often thrive through what otherwise would be severe crises.

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The most important component in dealing with the disruptive effects of scarce and expensive oil is for Woodstock and its surrounding region to become as cohesive a community as possible, and, as a region, anticipate the impacts and begin to prepare for them.

General steps that can be taken include:

- Re-localising our community by producing as many of our essential goods as locally as possible, whether in agriculture, manufacturing, or sustainably managing and harvesting our forests.
- Conserving our resources by changing consumption behaviour to reduce oil based energy use. This means smarter commuting, close to home vacations, recycling waste products, doing more yard work manually, and enjoying less energy intense recreation.
- Using less energy intensive transportation modes such as walking, biking, car-sharing and public transportation.
- Generating energy for household and business uses with non-fossil fuel means such as geothermal, solar, wind and wood products.

Commonly Used Forms of Energy

Electricity

Electricity is used extensively for lighting, heating and running appliances in our homes and commercial buildings. It is also used in many forms of manufacturing and other industrial uses. Farmers, particularly dairy farmers depend on electricity for many of their processes. Some forms of transportation such as golf carts and electric cars also depend on electricity.

Presently, virtually all electricity in the Woodstock area is provided by NB Power from central generators, and transmitted through long distance distribution lines.

Fuel Oil

Fuel oil is used to heat many residences and commercial buildings in our area. It is also used for some industrial purposes.

Fuel oil is derived from petroleum as one of the products made at the refinery.

Gasoline and Diesel

Most gasoline and diesel used in our region fuels our motor vehicles. However, there is a significant use of gasoline to fuel lawn mowers, snow blowers and other yard maintenance equipment. Another important component of gasoline usage goes for recreational vehicles such as power-boats, snowmobiles and all terrain vehicles.

Diesel is primarily used for medium and large truck transportation, construction equipment and farm tractors.

Both gasoline and diesel are derived from petroleum as products made at the refinery.

Liquid Propane (LP Gas)

Liquid propane is used in the Woodstock region primarily for cooking on kitchen ranges and barbeque grills. Propane also fuels clothes dryers and water heaters. A few buildings are heated with LP gas.

Much of the LP Gas usage in our area is in lieu of natural gas, which is not available.

Liquid propane is a petroleum product from the refinery process.

Heat Pumps

Ground source heat-pumps represent a relatively new technology that uses the natural heat of the earth 2 or 3 metres below the surface for heating buildings. The temperature of the ground at the depth of 2 or more metres stays a relatively even 5 to 7 degrees Celsius year around. By exposing a liquid in long pipes to that temperature and warming it through compression, buildings can be warmed to room temperature much more efficiently than through fuel burning or using electrical resistance heaters. During summertime warm spells, the process can be reversed by evaporating the liquid to cool buildings, which is an efficient means of air conditioning. Air to air heat-pumps work on the same principle but utilize air temperature differential to provide heating and cooling. A variety of buildings in the region have heat-pump systems already installed. All heat-pumps require electricity.

Solar Energy

Solar energy serves residences and businesses in the Woodstock area in two forms:

1) **Solar water heating:** Solar thermal panels installed on the roofs of some buildings allow the rays from the sun to directly heat water to supplement the hot water supply; and
2) **Photovoltaic (PV) solar panels** located on roofs and/or in yards generate electricity to offset some of the electricity needs that would otherwise be provided from NB Power.

Wind Generators

Wind generators can be seen at a few locations in the region. They are typical mounted on towers in outlying areas and supply all or part of the electricity requirements for a residence, farm, government building, or larger community. Wind generators can be mounted on the roofs of buildings or even under the eaves, but these types are rare or unknown at the present time in the Woodstock area.

Transitioning from Oil to Renewable Energy: Vulnerability Assessment with Potential Solutions

The following chart assesses the vulnerability of each energy form or fuel type to petroleum becoming increasingly expensive, being rationed, or unavailable. The last column in the chart identifies categories of solutions that offer a reduction or elimination of that vulnerability.

Energy Form or Fuel Type	General Usage	Vulnerability to Peak Oil	Potential Solutions
ELECTRICITY FROM GRID	Residential Commercial Industrial	**Low**	Solar Hot Water Solar Photovoltaic Energy Efficiency Improvements Wind Geothermal
	Transportation (Electric Cars & Golf Carts)	**None**	Solar Photovoltaic Wind
	Farming (especially Dairy)	**Low**	Solar Photovoltaic Wind Energy Efficiency Improvements Biogas BioFuels
FUEL OIL	Residential Heating	**Severe**	Geothermal Wood / Wood Pellets Passive Solar Energy Efficiency Improvements
	Commercial Industrial	**Severe**	Wood / Wood Pellets Energy Efficiency Improvements Solar Photovoltaic Wind
WOOD PRODUCTS	Heating	**Moderate**	Passive Solar Energy Efficiency Improvements Geothermal
	Maple Syrup Production	**Low**	None Identified

Energy Form or Fuel Type	General Usage	Vulnerability to Peak Oil	Potential Solutions
GASOLINE / DIESEL	Cars	**Severe**	Electric Vehicles Walking & Biking Relocation to Minimize Trips Public Transportation
	Trucking	**Severe**	Biodiesel Railroads Minimize Need
	Agriculture	**Severe**	Biogas Animal Power Biodiesel Smaller Farms Solar Photovoltaic Wind Energy Efficiency Improvements
	Yard Maintenance	**Severe**	Manual Tools Electric Tools Solar Photovoltaic
	Recreation	**Severe**	Alternative reaction choices to minimize fuel needs; i.e. Skiing or snow-shoeing instead of snow mobiling; canoes or kayaks instead of power boats; or hiking or biking instead of all terrain vehicles
LIQUID PROPANE	Cooking	**Severe**	Minimize need Wood Solar Photovoltaic Wind
	Heating	**Severe**	Geothermal Passive Solar Wood / Wood Pellets Energy Efficiency Improvements Solar Photovoltic Wind
	Hot Water	**Severe**	Solar Hot Water
GEOTHERMAL	Heating	**Low**	Energy Efficiency Improvements Combine with Solar Photovoltaic Combine with Wind Generation
SOLAR	Hot Water Home Energy Generation	**None** **None**	n/a n/a
WIND	Electricity Generation (mostly agricuLture)	**None**	n/a

Practical Solutions for Utilizing Renewable Energy and Energy Conservation Practices

The following sections provide technology descriptions, planning suggestions, tips, and examples, as well as resource information for each of the potential solutions.

Solar Hot Water

In New Brunswick we are fortunate in having a climate that makes solar domestic hot water heating appropriate. Solar panels designed to heat water may be mounted on the roofs of homes and buildings of every description provided that they face south toward the sun and that there is no obstruction. Solar hot water panels can also be mounted at ground level in spaces open to the sun. The rapidity of the heating varies from season to season but on average two or three hours of direct sunshine are usually enough to bring the water up to seventy five degrees Celsius or more.

…two or three hours of direct sunshine are usually enough to bring the water up to seventy five degrees Celsius or more.

The panels on the roof actually contain tubes filled with a solution of propylene glycol (non-toxic antifreeze) and water, which is heated by the sun. A circulation pump brings the heated fluid to a heat exchanger inside the building, where the heat is transferred to the domestic hot water system. The better types of such systems have a dedicated solar hot water storage tank, which is fed cold water to be heated by the sun's energy. This solar pre-heated water then passes through whatever kind of backup water heater you wish to use, for example electric, propane, oil or wood, to be topped up in case it hasn't been a sunny enough day.

On sunny days, and especially in summer, the stored solar hot water may be hot enough that your fueled backup heater doesn't have to work at all. When the weather has been cloudy for a few days and you have used up the solar heat, the backup heater will work to add the amount of energy needed to supply water at the pre-set temperature you have requested. The overall effect is a significant decrease in the amount of fuel purchased to supply your hot water.

During the sunniest months, it is possible that the solar heater will heat the water in the solar tank up to a very high temperature, especially if the occupants are not at home to use hot water. Canadian Standards Association (CSA) certified systems should have a temperature controller that will turn off the solar fluid pump to avoid boiling the water in the tank. In case this fails, the solar storage tank must also have a pressure-temperature relief valve at the top to release steam and pressure. When ordering a solar water heater, check with the manufacturer, distributor and/or installer to make sure the system has these safety features.

Larger solar water heating systems may have a significant surplus of heat energy in summer. Although the safety features of a well-designed system prevent any danger from this surplus energy, repeated overheating can cause loss or degradation of the glycol fluid. A large solar heating system can benefit from having a heat

Sources:

Efficiency New Brunswick: 506-643-7826, 1-866-643-8833 (Toll-Free)
http://www.efficiencynb.ca/residential/reep-existinghomes.html

Community Energy Co-op: www.communityenergynb.ca 506-324-5053

Fundy Solar: http://www.fundysolar.com 1-888-536-2070

RenewablesNB: http://renewablesnb.ca/en/

Solaris Canada: www.solar-hot-water.ca/index.html

Thermo Dynamics Ltd: www.thermo-dynamics.com 902-468-1001

"Why Solar Thermal Energy Still Shines,"
http://telegraphjournal.canadaeast.com/rss/article/724546

dissipater, such as a radiator, to carry off excess heat.

In any case, it is a good idea to know how to check the level and quality of the glycol fluid, and to check it at least once per year. The autumn equinox (late September), is a good time to check – after the summer season is over and before winter comes on. Ask the supplier of your system for information on how to check the glycol fluid, and what to do if it needs to be topped up or exchanged.

Efficiency New Brunswick offers a $2500 rebate for installing a solar water heater, as part of the Residential Energy Efficiency Program. This program includes an energy assessment of your home and opportunities and incentives to save energy in a variety of ways, including solar energy. You can check out your options at Efficiency New Brunswick (see sources on previous page).

Efficiency New Brunswick offers a $2500 rebate for installing a solar water heater…

Solar Electricity

Homemade electricity using the sun as its source is one of the keys to local self-sufficiency in energy. It is part of a whole new outlook on electricity supply and its present acceptance and utilization means we are becoming less and less dependent on large centralized power sources.

In rural and remote areas solar electricity is used for many off-grid applications. In towns and cities and their suburban districts solar electricity often combines with the existing provincial grid, which may gradually be much reduced as more and more local solar generated electricity replaces it.

Net metering is the method of determining how much of a consumer's electricity derives from the sun and how much from the utility. The meter automatically provides this information and the homeowner receives a corresponding credit on her or his electrical bill. At the present time NB Power is paying about ten cents per kilowatt-hour. The huge success of this system in Germany has been an inspiration to other countries.

The meter automatically provides this information and the homeowner receives a corresponding credit on her or his electrical bill.

The silicon solar cell, which produces the electricity in the roof panels, was developed some time ago. However, efficiency in production to make the costs competitive is a fairly recent development. Solar electric panels require to be mounted in a way that receives maximum sunlight as is described above for solar hot water panels.

It has often been suggested that if government installed large solar electric units on the roofs of government buildings, this leadership example and level of investment would greatly spur the industry. Again, Germany has done this and has shown how effective such leadership can be.

The capital costs of installing photovoltaic systems have come down by a factor of four over the last seven years and will become increasingly affordable. As of March 2012 solar panels were available at less than $2.30 per watt. The price dropped 50% in 2011 and continues to fall in 2012. Installation costs are now reported around $4.50 per watt, meaning that a one-kilowatt system will cost approximately $4500. Improvements in design and materials continue to improve the efficiency and lower the cost of solar electricity.

Sources:

Woodside Solar Solutions: Woodstock NB **506-538-7560**
Sharpe Solar Svc Ltd: Fredericton NB, **506-474-0054**
Fundy Solar: Jolicure NB, http://fundysolar.ca **1-888-536-2070**
Energy Unlimited: www.energyunlimited.ca **506-565-2839**

Micro-Hydro Electricity

Does your property have a source of running water; A stream behind your house or spring on the hill? If the water source has a usable head (the vertical distance the water falls) and enough flow (the amount of water), you may benefit from the installation of a micro-hydro electricity generator. In order to determine the answers to these questions, a site assessment may be required. You can contact a micro-hydro provider to assess your site.

Sources:

Energy Systems & Design: Sussex, NB
506-433-3151 www.microhydropower.com

Wind Power Electricity

The technology for wind power electricity technology comes in a range of sizes from small domestic units to large industrial scale generators. For the purposes of this guidebook, we are dealing only with the small to medium scale units suitable for home, farm, business, and institutional locations.

Among the renewable energy choices that are available to provide electricity, domestic scale wind generators are somewhat problematic: They are relatively expensive to purchase and install and require a certain amount of technical maintenance; they require a minimum wind speed of 10 km per hour in order to work; they provide power intermittently; other sources of power and/or battery storage are required to have a reliable system; and they are subject to mechanical wear and breakdown.

Wind generators can be a good choice for off-grid use where there are no power lines nearby and there is a reliable supply of wind.

That said, wind generators certainly should be considered as a viable option where circumstances are favourable for small and medium scale use. They work well in combination with solar electric installations. Wind generators can be a good choice for off-grid use where there are no power lines nearby and there is a reliable supply of wind. They can be effective on farms, camps, residences, businesses, and even on schools, government and municipal buildings when placed where there is an open and unobstructed flow of wind.

Under good conditions a single generator with a battery bank to store energy can produce reliable power. The turbine must be mounted well above the trees and other obstructions in order to work effectively and reliably. Trees and buildings cause turbulence that reduces both the performance and the life of the turbine. A larger swept area with a blade rotor of 2.5 meters that is mounted on a 10-meter or higher high tower should provide optimal performance and last twenty to thirty years.

Under good conditions a single generator with a battery bank to store energy can produce reliable power.

But before researching any given location for the amount of available wind and the appropriate wind generator, it is wise to know what the annual consumption of electricity is in order to calculate which wind generator will best meet that demand. The Annual Energy Output (AEO) is the most accurate measurement to compare and evaluate the specifications of the various sized turbines on the market.

Two wind power experts, Ian Woofenden and Mick Sagrillo advise, "Avoid as much pain as possible by buying the highest-quality system you can afford." They say that for smaller systems, a tower can easily exceed the cost of the turbine. Off-gridders need to include the cost of batteries and the inverter from DC to AC. Other installation costs can include excavation for the foundation; concrete and steel reinforcement bars, possible crane costs, wiring and all electrical components, shipping, taxes, and labour, if the job is contracted. Some turbine packages include tower, wiring, installation materials, and labour costs in the price. Small-scale domestic wind turbines are now available at about $6.00 per watt, installed.

Finding the right product is one challenge, but then finding a qualified installer for wind generators may be a greater challenge at this time.

Hopefully, with increasing demand for renewable energy this situation will improve in the near future.

Sources:

2010 Wind Generator Buyers Guide by Ian Woofenden and Mick Sagrillo. http://www.windustry.org/wind-turbine-guide-2010

Wind Energy Comes of Age by Paul Gipe http://www.wind-works.org/books/wind_energy_age.html

Wind Power: Renewable Energy for Home, Farm and Business by Paul Gipe http://wind-works.org/books/wind_power2004_home.html

Wind Resource Map of New Brunswick (Université de Moncton 2007): http://www.gnb.ca/0085/maps/Wind_Map_NB_80m2007.pdf

Fundy Solar: http://fundysolar.ca 1-888-536-2070

Matrix Energy: http://www.matrixenergy.ca/stand-alone-systems/energy-catalogue-sections.html

World on the Edge by Lester R. Brown. This book is packed with information on this subject and the whole field of renewable energy.

Biomass Electricity

Until recently, generating electricity from burning biomass has not been feasible at a household, farm, or small business scale. Small scale, completely integrated, portable units are now available with 10 or 20 kw outputs. (See Sources) While these small units are fascinating and may have important applications, municipal scale biomass electricity generation is the most promising from a community resilience perspective. If we look toward the future efficiencies and economies of distributed electricity generation, biomass could, at some point, make sense for Woodstock. After hydro, biomass is already the second largest source of renewable energy in North America.

If we look toward the future efficiences and economies of distributed electricity generation, biomass could, at some point, make sense for Woodstock.

The term "biomass" encompasses diverse fuels derived from wood, agriculture and food processing wastes or from fuel crops that are specifically grown or reserved for electricity generation. Biomass fuel can also include sewage sludge and animal manure. Some biomass fuels are derived from trees. Given the capacity of trees to regenerate, these fuels are considered renewable. Burning crop residues, sewage or manure – all wastes that are continually generated – to provide electricity may offer environmental benefits in the form of preserving precious landfill space. However, they may also be grown and harvested in ways that cause environmental harm. For example, harvesting and burning crop residue that should stay on the land and be incorporated in the soil is environmentally damaging.

At present, most biomass power plants burn wood, agricultural waste, or construction/demolition wood wastes. Direct Combustion power plants burn the biomass fuel directly in boilers that supply steam for the same kind of steam-electric generators used to burn fossil fuels. With biomass gasification, biomass is converted into a gas – methane – that can then fuel steam generators, combustion turbines, combined cycle technologies or fuel cells. The primary benefit of biomass gasification, compared to direct

Because biomass technologies use combustion processes to produce electricity, they can generate electricity at any time…

combustion, is that extracted gasses can be used in a variety of power plant configurations. Because biomass technologies use combustion processes to produce electricity, they can generate electricity at any time, unlike wind and most solar technologies, which only produce when the wind is blowing or sun is shining.

Whether combusting directly or engaged in gasification, biomass resources do generate emissions. These emissions (SO2 and NOx) vary depending upon the precise fuel and technology used. Carbon monoxide (CO) is also emitted – sometimes at levels higher than those for coal plants. Biomass plants also release carbon dioxide (CO2), the primary greenhouse gas. However, the cycle of growing, processing and burning biomass recycles CO2 from the atmosphere. If this cycle is sustained, there is little or no net gain in atmospheric CO2. Another air quality concern associated with biomass combustion is particulates. These emissions can be readily controlled through conventional technologies.

The collection of biomass fuels can have significant environmental impacts. Harvesting timber and growing agricultural products for fuel requires large volumes to be collected, transported, processed and stored. Biomass fuels may be obtained from supplies of clean, uncontaminated wood that otherwise would be landfilled or from sustainable harvesting. In both of these fuel collection examples, the net environmental plusses of biomass are significant when compared to fossil fuel collection alternatives. On the other hand, the collection, processing and combustion of biomass fuels may cause environmental problems if, for example, the fuel source contains toxic contaminants, or if the handling of agricultural waste pollutes local water resources, or if burning biomass deprives local ecosystems of nutrients that forest or agricultural waste may otherwise provide.

With these factors and cautions in mind, the Woodstock region may, at some point, be well served by community-based biomass electricity generation. We are well situated with both forest and cropland fuel potential. Producing electricity for local use in this way could be a solid backup for other forms of renewable energy that are intermittent in nature. Tied into a smart regional grid of distributed generation, strategically placed biomass plants could help anchor the reliability of renewable electrical energy sources in general.

Sources:

The following websites offer information on biomass generation at a variety of levels. A Google search will bring up many more.

General information:
http://www.wbdg.org/resources/biomasselectric.php

Small-scale bio-mass generators:
http://gekgasifier.com/gasification-store/gasifier-genset-skids/

New construction:
http://www.calgaryherald.com/business/Calgary+company+building+biomass+plant+northern+Alberta/7226576/story.html

Products:
http://solageninc.com/

Heat Pumps

Any material (solid, liquid, or gas) contains heat energy down to absolute zero (00 Kelvin). This heat can be extracted and transferred to another medium with varying degrees of efficiency using a reverse refrigeration method called a heat pump. Systems available achieve this transfer of heat from earth, water, or outside air to inside air. These systems are referred to as earth-to-air, liquid-to-air, and air-to-air respectively.

Ground source heat pumps are often referred to as providing geothermal energy. Technically, geothermal energy refers to making use of the earth's molten core heat in places where it reaches the surface in predictable and non-destructive ways, such as hot springs. Ground source heat pumps can tap the constant heat energy of earth's subsurface depths anywhere.

Choice of systems will depend on installation costs, heating requirements, availability or need for supplementary heat, land surface area, geology, access to water, including flow volume and depth, and whether the system will be part of a new or existing structure. Air-to-air is the least expensive to install, but may require supplementary heat on the coldest weather days (below minus 200 C). All these systems require electricity to operate pumps and compressors, but otherwise do not require any other fuel to produce heat energy. These systems may be reversed and act as cooling devices (air conditioners) in hot weather.

Heat pump systems have many advantages. Once installed, they operate automatically with virtually no maintenance. They are long lived and will payback the investment costs. When incorporated in new construction, they can be the main source of winter heating (and summer air conditioning) and take the place, for example, of an oil or wood furnace and its cost. With no operating costs beyond the small amount of electricity they use, heat pumps are becoming increasingly sought after in New Brunswick. It is very important that the system be designed for its specific application and installed correctly.

Peter Steeves of Eastern Ventures has been especially keen on recording statistics from the installation and use of heat-pumps his company supplies. Since establishing their business in 2010 they have realized heat pump sales of one per day. They credit their success to the financial savings heat pumps provide for homeowners. Because he is passionate about his work, Steeves has recorded the performance of many of the pumps he supplies and calculates a savings of at least $1000 a year for a typical two story house which has installed a ductless heat-pump. With a set up cost of roughly $3500, payback time is usually 2- 3 years depending on how energy efficient the house was prior to installation.

With a warranty of six years on the typical pump, Steeves states that this provides a significant savings without much risk. Even if the heat pump needs to be replaced at some point after the warranty period, the accumulated savings makes installing a heat pump a wise choice. Steeves acknowledges that although heat pumps are continuously becoming more efficient, they still have a limitation. They are unable to provide adequate heating at temperatures below –200C and, therefore, they cannot yet be considered an exclusive heat source for older homes in a cold

Sources:

Peter Steeves:
Eastern Ventures: Fredericton 506-470-6541
peter.steeves@easternventures.ca
http://www.easternventures.ca

Installers of heat-pump systems in the Woodstock area include:

Luke Dukeshire:
River Valley Ventilation: 506-324-0103;
rivervalleyvent@gmail.com

Valley Refrigeration and Air Conditioning: 506-325-2204

Sunshine Refrigeration and Air Conditioning: 506-325-9225

Monteith Heating: 506-328-2795

Woodchuck Heating: 506-375-6779
http://woodchuckheating.com/

climate. But, as Steeves points out, this is not much of a concern for residents in most of New Brunswick. He has diligently recorded the frequency of when the local temperature in Fredericton has dipped below -200C since the establishment of his business. Since 2010, Fredericton has averaged only 5 days a year where this would be a concern to heat pump owners. A small amount of supplementary heating will suffice. With this in mind, one can seriously consider using this technology with the reassurance that the financial savings the system provides will quickly offset the initial cost of installation.

Passive Solar Heating

Passive solar energy is one of the best, most affordable, and most widely adaptable sustainable energy sources. Passive solar design is a set of principles for designing and constructing a house so that it is naturally heated by the sun in winter and does not overheat in the summer. The basic principles of passive solar design are:

- **Window Orientation:** Design the building with the maximum number of windows facing south and the minimum number of windows facing north. The south-facing windows will act as solar heat collectors for the building in winter. These windows are positioned vertically, and preferably be shaded in summer by long eaves of the building or by awnings to prevent summer overheating.
- **Insulation:** Insulate the building thoroughly and effectively to keep the heat energy inside in winter.
- **Thermal Mass:** Incorporate heavy materials, called thermal mass, into the building. Floors, walls and interior features of stone, tile and concrete, or even simply thicker gypsum wallboard, have the capacity to absorb heat in the day and release heat at night, keeping the building temperature naturally more stable.
- **Heat Circulation:** Use a fan and ducts or other systems to move heat from where it accumulates as hot air at the top of the house down to where it can be stored in the thermal mass.

By being well designed to capture the incoming solar energy of the low-angle winter sun, a building constructed according to passive solar design principles will have much lower heating fuel consumption than one that isn't. In summer, when the sun is higher in the sky, shade from the extended eaves or awnings and reflection from the vertical position of the glass minimize the amount of solar heat entering the house. Solar Nova Scotia has long experience and expertise in passive solar home design and offers courses on the topic in Nova Scotia and periodically in New Brunswick.

Another approach to the same goals, the Passive House Standard (originally Passivhaus, from Germany), is among the most advanced energy efficient and passive solar house methods in the world. Houses built according to the Passive House Standard use very little purchased energy of any kind. These houses are becoming available in our region. A local designer recently created one near Fredericton that is so efficient it will only need supplementary heat the equivalent of an electric toaster (see profile).

Houses built according to the Passive House Standard use very little purchased energy of any kind.

You can take advantage of passive solar heating in an existing building by adding a new window, sunroom or greenhouse in the south-facing wall. Passive solar energy works in gardening too, when you place a cold frame (a miniature greenhouse) over a garden bed to warm the soil and advance seed germination.

Additional applications of passive solar heat include solar cookers and solar food dryers. And if you are inclined to go really "high-tech," a "linear passive solar clothes dryer" costs almost nothing to install and will perform without cost for many years. Our grandmothers called them "a clothes line."

Sources:

A wealth of information on passive solar home heating is available online. Here are several comprehensive sites;

Build Green Canada: www.buildgreen.ca/2008/08/passive-solar-design/

Build It Solar: The Renewable Energy Site for Do-It-Yourselfers
www.builditsolar.com/Projects/SolarHomes/plansps.htm

Sun Plans: www.sunplans.com

Solar Nova Scotia: www.solarns.ca

Passive House Canada: www.passivehouse.ca

Three good books on passive solar design are:

The Canadian Solar Home Design Manual, published by Solar Nova Scotia, available through their website at www.solarns.ca

The Passive Solar House: Using Solar Design to Cool and Heat Your Home by James Kachadorian.

The Solar House: Passive Heating and Cooling by Dan Chiras.

Local contractors and carpenters can easily build passive solar design buildings if they have the plans. For design and planning assistance contact;

Garth Hood at **Thoughtful Dwellings**: Fredericton, 506-476-5611,
garth@thoughtfuldwellings.ca
www.thoughtfuldwellings.com

EnerGreen Builders Cooperative: Sackville, www.ener-green.ca

For solar heating in garden applications see online references for cold frames, row covers and greenhouses. Wikipedia is a good place to start: http://en.wikipedia.org/wiki/Cold_frame

Many other sites have plans for building cold frames. Go to this site for a Maritime source of good ready to assemble cold frames.
www.veseys.com/ca/en/store/tools/greenhouses/ultimatecold

For solar food drying go to the website for the book The Solar Food Dryer by Eben Fordor.
www.solarfooddryer.com Many other information and product sources can also be found online. Same thing applies to information on solar cookers. For an especially good website see www.solarcooking.org/plans

Wood Heating

Wood heating in this section means burning plain firewood or wood bricks as distinct from wood pellets. Firewood requires harvesting, transportation, sawing to length, splitting, and seasoning (drying). Firewood is a good local resource in the Woodstock region, but it is critical to conserve forestland and, therefore, to minimize the consumption of firewood by using it efficiently. This can be achieved, in part, with small houses or the partial heating of large houses. All houses that are heated with wood should be properly insulated and winterized. This strategy may also include extra inside clothing and extra warm bedding.

In recent years wood burning appliances, whether they be stoves, furnaces, or fireplace inserts have seen vast improvements in efficiency. Sometimes the term "airtight" is used although all combustion requires oxygen. A hot fire initially keeps stovepipes and chimneys clear. A smoldering fire produces an accumulation of soot and creosote, which can lead to dangerous chimney fires. Wood burning furnaces are now available that are housed in a small outbuildings, and provide hot water heat for houses and other applications.

The wood supply may be softwood, hardwood, or a combination depending on requirement for heat or cooking. The kitchen stove is a good example of co-generation where one energy source can be used for space heating, cooking, and heating water. Wood burning furnaces have become popular because they can replace oil furnaces in a forced air central heating system.

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To minimize transportation of firewood it is important to protect and nurture nearby forests and woodlots. Selective cutting and the use of horses for yarding is a sustainable method for supplying firewood. An array of hand tools including axes, splitting mauls, saws (buck and crosscut), wedges, and sharpeners will be essential. Wood heat has always been a primary energy source in our region and, with careful management of woodlands and the maintenance of wood handling skills, can be central to a sustainable way of life long past the end of oil and natural gas. Manufactured wood bricks are a new alternative to firewood for use in wood burning stoves.

Sources:

Our region has three businesses specializing in sales and installation of wood burning stoves and furnaces:

Woodchuck Heating: Waterville, 506-375-6779

Dingee's Energy Systems: Centreville, 506-276-4519

Sunpoke Energy Systems: Woodstock, 506-324-8190

In addition, local hardware stores sell woodstoves:

Stewart's Home Hardware: Woodstock, 506-328-6655

Currie's Ace Hardware: Woodstock, 506-328-8788

Brennan Home Hardware Building Centre: Florenceville-Bristol, 506-392-5511

Best Home Building Supplies: Florenceville-Bristol, 506-392-6043

Wiebe's Home Building Centre: Centreville, 506-276-4516

The tools needed for working with firewood can be found at hardware stores. **Valley Chainsaw (328-6536)** in Jacksonville sells tools, clothing and supplies for cutting and working with fire wood.

Maritime Dimension Hardwoods at 105 Moffat Street, Woodstock Industrial Park **(325-9209)** produces hardwood "bricks" for burning in woodstoves.

Wood Pellet Heating

Wood pellets are an ideal fuel for heating New Brunswick homes. That is partly because the waste wood from which they are made is abundantly available almost everywhere in New Brunswick and they can be manufactured locally. So, unlike oil, we don't have to import this home grown fuel. And, unlike fossil fuels, there is very little carbon emitted when you burn wood pellets.

The carbon emitted from the combustion of wood products would be, by itself, within the natural carbon cycle and could be absorbed by the atmosphere without overloading. But with coal, petroleum, and natural gas now being burned in vast quantities, the capacity of the atmosphere to harmlessly absorb all the carbon emitted is being overwhelmed. Burning anything that emits carbon, including wood, adds to this problem. Because pellet stoves and pellet furnaces burn their fuel at over 90% efficiency, emitting very little carbon, they are the cleanest burning technology for heating with wood.

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Waste wood from forestry and mill operations is the raw material for manufacturing pellets. Because this fuel source is available in every region of the Province, the increased use of wood pellets becomes a factor in the revival of local and regional economies. There are now two industries manufacturing wood pellets in central New Brunswick, one being in Bristol. The raw material is first made into chips and these in turn are reduced to sawdust. The sawdust is compacted to form the pellets that come out of the process covered with a thin coating of natural resin. Pellets are sold in 18.5 kilo bags (40 pounds).

Pellet heaters have been in use in New Brunswick homes for some time, often supplementing heating from oil. In some smaller homes they are capable of heating the whole building, depending on its floor plan. In larger homes they should be located as strategically as possible so that they can heat as much space as possible.

Pellet burning heaters are controlled manually; adjustments to the controls can be made at any time. They are forced air systems dependent on an electric fan that is an integral part of the heater. If there is a stairwell near the heater then part or all of the upstairs level might be heated or at least preheated, simply on the principle that heat rises.

However the rapidly rising costs of fuel oil means that the time has come to consider installing pellet-burning furnaces as the sole heat source for a home in winter. These furnaces, and their pellet storage and delivery systems, have been perfected in northern European countries. These furnaces are highly efficient and can replace oil-burning furnaces. Pellet furnaces are now available in the North American market.

These furnaces are thermostatically controlled like existing oil furnaces. At present most models require periodic manual loading when the fuel in the large hopper gets low. (There is usually a warning light on the control.) The ash receptacles are also very large and do not require as frequent emptying as the smaller heaters.

Automatic pellet feeding systems driven by augers from an outdoor hopper have been developed in Europe and are now becoming available in North America. With these systems, the pellet fuel container is periodically filled from the street like the delivery of fuel oil.

Sources:

Pellet stove fuel is sold by stove dealers and is also widely available from many hardware, farm, and home supply stores.

Dingee's Energy Systems: Centreville, 506-276-4519

Woodchuck Heating: Waterville, 506-375-6779
http://woodchuckheating.com/

Sunpoke Energy Systems: Woodstock, 506-324-8109

Pellet stove reviews: www.wiseheat.com

Upgrading Energy Efficiency

Upgrading the energy efficiency of our homes and commercial buildings is the best investment in the future we can make. This has now been proven over and over again. New Brunswick is fortunate to have a government agency devoted entirely to helping homeowners and business people make their buildings as energy efficient as possible. Efficiency New Brunswick is a wonderful example of what government can do to create a better quality of life for the residents of the province, while reducing home heating costs and lowering our collective carbon footprint. Here is a statement from Efficiency NB prepared for inclusion in this Guidebook:

Looking to save energy and money? Efficiency NB offers financial incentives to help you make your home more energy efficient. As of August 2012, almost 130 Woodstock homeowners have already upgraded their homes of energy efficiency and are saving money each year on their energy bills. Plus, they've decreased the Town's greenhouse gas emissions by an estimated 641 tonnes. That's the equivalent of taking 126 cars off the road each year! Contact Efficiency NB at 1-866-643-8833 or visit www.efficiencynb.ca to schedule a Pre-Upgrade Assessment or receive information on financial incentives available for energy efficiency upgrades to your home.

The upgrading that is supported by this program includes general weather-proofing of houses to make them tighter, insulating basement walls, adding more insulation to walls and attic, and installing new energy efficient windows and doors. Incentives are also offered for installing various high-efficiency and renewable heating systems.

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We know heating oil prices will rise along with all petroleum products, and we are being told that electricity prices will be steadily increasing. Firewood suppliers will have to up their prices as fuel and equipment expense go higher and higher. Wood pellets are likely to go up as well. Upgrading the energy efficiency of your home will not only pay back immediately, but an energy efficient house will command a premium price on the market if and when you choose to sell.

Sources:

Efficiency New Brunswick: www.efficencynb.ca
506-643-7826

Local home building and retrofitting contractors

Biofuels

Humans have burned fats and oils of animals and plants for ages, mostly for light, but also to some degree for heat. Oil lamps are mentioned in the Bible. Arctic inhabitants burned whale and seal blubber. Europeans burned candles and torches containing animal fats. Most animal lipids are solid at room and body temperature and are called fats. Most plant lipids are liquid at room temperatures and are called oils. The plant oils lend themselves most readily to combustion in diesel engines. Plants such as flax, canola, sunflowers, peanuts, and soybeans are rich in oils. Some fish are also a source of oil.

Biofuels include; 1) methane (biogas), 2) alcohols – especially ethanol, 3) lipids – oils and fats from plants and animals.

1. **Methane.** One of the primary products of anaerobic decomposition of organic material is biogas (mostly methane). "Anaerobic" means in the absence of oxygen. An example of this in nature is swamp gas from the decay of plant material. Anaerobic decay differs from composting where the organic material is regularly turned to allow the entrance of oxygen and may become quite warm. It must be remembered that methane is heavier than air, displaces it and excludes oxygen, thus making it lethal. It is highly combustible, and several times more potent as a greenhouse gas than carbon dioxide.

   In controlled systems methane gas may be produced, collected, and burned on differing scales for various purposes. Small-scale digesters using mostly cattle dung have been used in eastern Asia for many years for cooking. Large-scale pilot projects using animals manures stored in dairy farm lagoons, municipal and regional solid waste landfills, and sewage treatment facilities are ongoing here in the Maritimes for the production of electricity. The organic material may be household, yard, and commercial waste that would otherwise go to the landfill. It may also be animal manures, crop residues, or woods waste. The resulting gas is unlikely to be pure methane but rather a mixture including other short chain carbon compounds, carbon dioxide and some foul-smelling sulphur compounds. The solid residue remaining after the anaerobic digestion process is useful for soil improvement.

   The organic material may be household, yard, and commercial waste that would otherwise go to the landfill.

   Anaerobic digestion is a process that creates methane gas from organic (mostly animal) wastes. The process is particularly applicable to animal farms, meat processors and domestic wastewater treatment facilities.

   Anaerobic digesters are usually custom designed and built to fit a particular operation, such as a dairy farm, cattle fattening operation or sludge from a domestic wastewater treatment plant. The digester tanks are sealed to minimize the availability of oxygen and to capture the gas that is produced. Anaerobic microbes that thrive in a low or no oxygen environment absorb the waste and produce the gas, as well as a high nutrient by-product that can be used for fertilization of crops.

   The captured gas is piped to some form energy generator such as a heat exchanger, combustion engine or electric generator. The energy (heat, mechanical, or electric) is typically used onsite to offset purchased energy.

2. **Ethanol.** Ethanol is a combustible and controversial fuel produced by the fermentation of sugars and starches such as those found in traditional food crops. Recent public discussions about the addition of ethanol to gasoline have highlighted the negatives. For example, the net energy conversion is unfavourable for many crops including corn, the most heavily used. The calories required for ethanol production from corn and the calories available for use in the ethanol fuel have a ratio of around 1:1 – in other words, no net gain.

   The diversion of food crops and crop land to help power luxury vehicles and wastefully

transport superfluous goods, while the world teeters on the brink of food shortages and rising food prices, is unacceptable to many people. E10 gasoline (10% ethanol) is contra indicated in small engines moderately or infrequently used. Ethanol will separate and mix with water. Some engines parts are damaged by ethanol.

E10 gasoline should be used within one week of being put in the fuel tank.

3. **Biodiesel.** Diesel engine fuel is now being made from plant oils on a commercial scale. The same issue of diverting food and food producing land to fuel is a concern in the production and use of biodiesel. Plant oils used in cooking are basic culinary items in many cultures, supplying a much need calorie intake. It would be tragic if demand for biodiesel began to affect the price and/or availability of cooking oil, especially where people live in poverty. As an after-product of deep fat frying, the use of these oils for diesel fuel is less objectionable. Rather than discarding this used oil, it can be collected from restaurants and bakeries, and, after cleaning by filtration and processing, can be used as diesel fuel.

   On-farm biodiesel production has now been developed making it possible for farm operations to produce their own diesel fuel from their own land base, and thus eliminate their dependence on diesel fuel derived from petroleum.

Sources:

Biogas digesters can be built at any scale from backyard and homestead units to midsize farm based systems to large industrial complexes. To access information on design and construction, as well as sources for whole systems, put keywords "biogas digester" into Google and many sources at all scales will come up. The Wikipedia site is a good place to begin for further general information.

A complete description of anaerobic digestion can be found at the Government of Alberta, Agriculture and Rural Development website:
http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex10945

For information specifically on farm production of biodiesel go to:
http://www.omafra.gov.on.ca/english/engineer/facts/biodiesel.htm

For information on making biodiesel from waste vegetable oil go these websites:
http://www.utahbiodieselsupply.com/biodieseldvd.php?gclid=CPmb1PzT3bECFeYRNAodA20AYg

http://www.wikihow.com/Prepare-Used-Cooking-Oil-for-Biodiesel

Transportation

Public Transportation

Taking the Train. People now in their twenties, who may live to see the end of affordable gasoline as a viable fuel for personal transportation, should be starting thinking about alternatives. We are already in a transition and we must urgently work to prevent a crisis. If we do not have transportation alternatives in place to provide both infrastructure and reasonable costs then this alone could be enough to spark an economic depression.

The railway immediately comes to mind as an alternative that could be put back in place. Cost should not be the only criterion in a decision to expand and improve the railways. Long term public interest planning for sustainable transportation by making train travel and freight shipping convenient and appealing should be the main considerations.

In New Brunswick there are certain lines that are now used for freight but not for passengers. The line from Saint John to Moncton could become part of the passenger train network once again for connections to Halifax and Montreal. The same could be said of the freight line from Moncton to Edmundston and on to Quebec and Montreal to the west, and Halifax to the east. This line did carry passenger trains in the recent past. Bus connections could be made from Fredericton (at McGivney) and from Woodstock (at Grand Falls).

The use of rail-liners should not be delayed any longer. The important thing is to make passenger service available over all the existing lines so that the habit of taking the train will come back. Attractive scheduling will of course be most important and the system can draw on past studies and the experience of such companies as Via Rail.

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Shipping by rail should also be encouraged. Could it be reasonable to suppose that in twenty years most freight will be carried on the railway system? Depending on how high and how fast oil prices spike, freight transport may shift rapidly from road to rail. With their much greater freight capacity, trains can transport goods at much lower energy cost than trucks. Personal transportation may follow if passenger rail options can be brought back. Sound judgment now depends on long term thinking for long-term gain. That should lead, again, to railroads.

Sources:

Transport Action Atlantic: Dartmouth NS, www.atlantic.transport2000.ca 902-416-0301. National website http://www.transport-action.ca

Local representative: Harold Nicholson: Hartland, hnichol@nbnet.nb.ca 506-375-6929

Taking the Bus. Acadian Bus Lines will cease providing intercity bus service in the Maritime Provinces on November 30, 2012. Trius Bus Company has proposed to pick up the service, but likely with reduced access. At this time (September 2012) the future provision of intercity bus service in our region remains uncertain. Another proposal has come from VIA Rail Canada that would link bus service to passenger train service. This would be an important move in line with the discussion above on taking the train. Even if intercity bus service is rescued, there will remain the question of public transport feeder lines from rural areas, which will be much needed. As the era of low-cost petroleum comes to an end, the need for a more fully developed public transportation system will become critical. Hopefully, the current crisis in public transportation in New Brunswick will be resolved with long-term public/private planning for significantly improved service. To advance this essential public service, the Conservation Council of New Brunswick is preparing a Transportation Action Plan. It will be based on the need for a convenient and seamless public transportation system that enables one to travel from town to town and within our cities on the same ticket, linking with our ferries, airports, and remaining train stations.

Sources:

Conservation Council of New Brunswick: Fredericton, 506-458-8747 info@ccnbaction.ca www.ccnbaction.ca

Reducing Car Travel

Driving long distances each day to and from work will become increasingly expensive as oil prices increase in the future. People who commute may want to evaluate if their residence is reasonably close to their work and consider whether relocating closer would be an attractive option for reducing both expenses and environmental impact.

Making such a move, however, must be evaluated against anticipated personal changes in the next few years, the value of your present residence, and the attachment you and your family may have to your home and neighbourhood. Making a list of pros and cons will help in making such a big decision wisely and objectively. Weighing both tangible and intangible criteria is not easy, but the process involved can be both interesting and informative.

Living in or near the downtown core of towns and villages often makes it possible to shop and access services without using a car. Varieties of sturdy carts are available for hauling groceries and parcels. Those who live within a few miles of commercial and service centers can use bicycle or motor scooter transportation. Car-pooling with neighbours to make town trips can significantly reduce transportation costs.

Planning and taking holiday trips within New Brunswick instead of traveling to far away places will reduce car use and expense. Spending vacation money in New Brunswick has the added benefit of helping the provincial economy. Reducing car use will make your vehicle last longer, reducing the frequency of replacement and this large expenditure. Many cars being built now can easily travel several hundred thousand kilometers before needing to be replaced. If annual travel can be reduced to around 16,000 km or less, a new car may easily last 15 to 20 years. We will probably keep using our cars as long as we can afford to, but we will be able to use them longer if we use them a lot less.

Sources:
Local real estate agents.

Electric Vehicles

There are four categories of electric vehicles that show promise for practical use in the Woodstock area. These are;

- pedestrian enhancing – such as electric wheelchairs.
- electric golf carts and similar type passenger and utility vehicles,
- electric scooters and electric assist bicycles (for electric bikes see Cycling section),
- passenger cars and trucks.

Electric wheel chairs are highly versatile and widely used by mobility-restricted people in urban environments. They can be readily used in the downtown and residential areas of Woodstock.

Electric golf carts are commonly used on golf courses, but rarely seen elsewhere in our community. They are a regular way of getting around in many retirement communities. They are often used in various campus settings, in parks, and in large municipal and private gardens for transportation and maintenance work. Small trucks based on the same design and technology are also available. Electric scooters are becoming increasingly popular in many urban areas. There is no reason why they couldn't be widely used in Woodstock. The electric vehicles described above all plug into electrical outlets for recharging.

Hybrid-electric passenger cars have been in production for a decade and are now widely available. Hybrid vehicles operate on electric motors energized by batteries that are charged from small gasoline or diesel engines. Hybrids also have a number of high-tech features that capture unused and wasted energy during operation and deliver it back to the battery. They have proven dependable and feature much improved fuel efficiency compared to traditional combustion engine driven cars. But

Hybrids also have a number of high-tech features that capture unused and wasted energy during operation and deliver it back to the battery.

they are still dependent on gasoline or diesel to operate.

Fully electric cars are also available. They operate on electric motors energized by batteries that are charged by connecting to the domestic electric grid. Their major shortcoming is that their range of operation is limited to approximately100 kilometres or less before they need recharging. Recharging times are in the range of 8 to 12 hours. They are, therefore, limited to local trips generally within an urban area. Longer range electric cars for highway travel are being developed.

In the last few of years, major automobile manufacturers have been making available several combinations of hybrid and electric cars. One combination offers plug-in charging and a range comparable to traditional combustion engine cars. It is essentially an electric car with on-board electrical generation provided by a gas engine for extra range, and with domestic grid connection to eliminate the need for petroleum fuel on short trips. Electric cars will undoubtedly become the increasingly sought after replacement for petroleum fuelled vehicles as oil prices continue to rise.

Sources:

Electric wheelchairs: Electric wheelchairs are often available through health equipment stores and pharmacies. In our area a primary dealer is **MediChair**: Fredericton, fredericton@medichair.ca 506-4590-4449

Golf carts: **Allied Golf Carts**: Woodstock, 506-325-5433
For a full range of electric transport and utility vehicles go twww.clubcar.com/Pages/default.aspx

Electric scooters: A telephone survey of all motorcycle/motor scooter dealers in Woodstock and Fredericton turned up no electric scooters for sale. Canadian Tire in Woodstock is now carrying an electric scooter. For full information on electric scooters and electric motorcycles and go to www.electric-bikes.com/motor/index.html and www.e-ride.ca

Electric cars: The development of electric cars and hybrids is evolving rapidly. Practically all manufactures now have hybrids in production and full electrics in development. The best way to learn about the options available is to check manufacture's websites and then talk to local dealers. Existing cars and trucks can be converted to electric power. If you are interested in converting a car or truck to electric, here is the place to start: www.electric-car-conversions.com

Cycling

Bicycle use can replace motor vehicle use in many applications. In the last 25 years, bicycle design has developed in ways that provide many different kinds of bicycles for all kinds of users.

There are now bikes designed for whatever kind of riding you want to do and for many different transportation needs, including light hauling of goods and materials. Many versatile bike trailers are available for transport of everything from children to bulky packages, to building materials, furniture and canoes. Electric assisted bicycles are also available. For people who would like to get out on a bike but find the local hills a bit too much, the electric assisted bike is a great solution.

Many versatile bike trailers are available for transport of everything from children to bulky packages, to building materials, furniture and canoes.

Choosing a bike that will be comfortable and serve your needs requires a bit of research. It pays to seek experienced advice and become educated about bike design, sizing, use, safety, and maintenance. Professional staff at full service bike shops can provide good help, or seek out an experienced cyclist for advice.

Cycling can work well for regular transportation – commuting to work or school, for shopping, and for visiting friends and family. Local day trip touring is a good way to better acquainted with our home region. Independent, long distance touring or package tours offered in many regions of the world are challenging and rewarding vacation activities.

Local, recreational cycling with friends and family along the river roads below Woodstock is easily accomplished. Backcountry roads and trails for mountain bike riding are widely available in our region. The old railroad beds, snowmobile trails, and woods roads make almost endless exploration possible. See the new publication, Atlantic Canada Back Road Atlas, available where maps and road atlas are sold. Always wear a helmet and carry plenty of water.

Sources:

Steeves Bike Shop Ltd: Woodstock, 506-328-3150

Stewart's Home Hardware: Woodstock, 506-328-6655

Savages Bicycle Center: Fredericton. *Established 1897. Canada's oldest bike shop and the second oldest in North America.* www.savages.ca 506-457-7452

SkiWolf: Fredericton, www.skiwolf.ca 506-458-1059

The Radical Edge: Fredericton, www.radicaledge.ca 506-459-3478

For information on electric bikes go to www.electric-bikes.com/motor/index.html and www.e-ride.ca

Walking

The human body is designed for walking, jogging, and sprinting. In the absence of other means of travel this is the default method. In the modern era this mode of travel needs to be viewed as more than exercise. It is a low impact means of getting from point A to point B. The health benefits, both mental and physical, are a bonus. The only fuel required is food and water.

Successful walking starts with good quality footgear. Modern sportswear that is both breathable and wickable to disperse perspiration increases the comfort of regular walking. With proper apparel, walking can be a year round activity regardless of the weather. "There is no such thing as bad weather, there's only bad clothing." Dressing in layers that can be added or removed is the smart way. Protective clothing may include insulation, waterproofing, and windproofing. Facemasks, scarves, toques in winter, and wide brimmed hats, and sunglasses in summer can provide head, neck, face, and eye protection. Winter alternatives are cross-country skiing and snowshoeing.

Distances for walking may be anything up to 50 km or more per day depending on conditions and ability. Routes may vary from roads to trails to cross-country. Backpacking, being mindful of load, offers hands-free travel and the use of a walking stick. Our ancestors thought nothing of regular travel by walking. Walking trails crisscross Europe. Charles Dickens reportedly made a habit of walking 20 miles a day. Martin Luther walked from Germany to Rome. Robert Louis Stevenson wrote one of his best books about a walking journey across France. We have good walking trails up and down the St. John Valley. The old Trans-Canada below Woodstock is a good road for walking now that most of the traffic is on the new Trans-Canada highway. Practical walking from place to place in towns and villages is still quite common. Walking will likely increase as car ownership and operation gets more and more expensive. Most of our walking these days is recreational, but walking for travel is always possible. It's just a matter of time and personal energy.

We have good walking trails up and down the St. John Valley.

Sources:

Footgear is the most important equipment for walking. **Curries Boot Shop** on the Houlton Road in Woodstock (506-328-8788) has good selection of shoes and boots for serious walking and hiking. You can find especially appropriate and useful clothing at outdoor recreation shops like The **Radical Edge** in Fredericton (506-459-3478). Outdoor recreation shops also sell other gear for successful walking like water bottles, packs of various sizes, and walking sticks. With a small saw and a good knife you can also easily make a rugged walking stick.

Food and Agriculture

Small Scale Farming, Household and Community Gardening

Food requires energy to produce. As oil prices rise, it will become more and more expensive to produce food on a large centralized scale and transport long distances to market. Food produced locally on a small scale by farmers and gardeners, using a minimum of fossil fuel, will be less affected by this escalating cost. Small scale farming and market gardening that can minimize the use of fossil fuel will be able to supply the local market with food at afforable prices. As household gardening and small farming increases, dependence on fossil fuels decreases. Food security grows accordingly.

The development of neighbourhood and community gardens is also central to building up a sustainable local food system. As food prices go up, the business case for market gardens and small farms will also steadily improve. Backyard chicken and rabbit keeping can be expanded in city, town, and country. During the Second World War many households in France were able to survive because they always had a few rabbit hutches in the back yard. Raising chickens and rabbits has been a common rural practice in our region as well. A revival of this practice could add a significant level of high quality protein to our local food security.

Sources:

The best source for gardening and local food production information is from local gardeners and farmers. Gardeners generally love to talk about what they are doing so a good way to get started is to talk to gardeners. The **Woodstock Farm Market** and the **Florenceville-Bristol Outdoor Market** are good places to find people who talk gardens.

In addition, there are many books and videos that can provide good advice for start-up gardening. Check out local libraries or go online with key words relating to gardening. Gardening magazines abound, many devoted to ornamentals and flowers; Key in *"vegetable gardening magazines"* for food production literature.

Transition Town Woodstock has started a **Community Garden Project** to provide space for those who want to garden but don't have access to a suitable site. (Contact Deborah Helle 506-324-9115, or Keith Helmuth 506-325-3546) The Community Garden Project is ready to help people get started in gardening.

If you are getting started in gardening many good books and online sources of information are available. A good book on serious food production gardening in our geographic zone is *Four Season Harvest* by Elliot Coleman. www.fourseasonfarm.com

For intensive gardening in a small space one of the best resources is the classic book, *All New Square Foot Gardening* by Mel Bartholomew. This author also has an excellent website. www.squarefootgardening.com

If you have garden ground that needs tilling, contact Dana Smith of Smith's Landscaping, Woodstock, 506-328-2010. You can also rent a tiller from **Curries Hardware**, Woodstock, 328-8788.

For going into the market garden business the following website is a good introduction: www.new-terra-natural-food.com/market-gardening-book.html

Two Maritime seed companies specialize in vegetable seeds especially suited to our region – **Veseys Seeds** and **Hope Seeds**. **Hayward's Potato House** on the old TransCanada at Jacksonville is the local agent for Veseys Seeds. Hope Seeds are available at the **Woodstock Farm and Craft Market**, 220 King Street.

Garden vegetable transplants are available from **Hayward's Potato House**, from **Smith's Landscaping and Nursery** at 312 Connell Road, Woodstock and at the **Woodstock Farm and Craft Market**.

General gardening supplies are available at **Curries Hardware**, **Stewart's Home Hardware** and a variety of other seasonal garden centre locations in the area.

Chicken keeping for both eggs and meat, and rabbit raising can both be done on a backyard scale. Again, the best way to get started is to contact people who are experienced in the chicken or rabbit business and get their advice. Alternatively, there are websites and books that are very helpful. Here is one for chickens: www.poultry.allotment.org.uk/Chicken_a/keeping_chickens/index.php
Here is one on backyard rabbit keeping. www.extopian.com/?p=215

Animal Power in Agriculture

Animal power can best be thought of as metabolic energy. The metabolic process that takes place in every cell of an animal body is a combustion process. The energy produced by this combustion process gives animals strength and movement and the ability to do work. The fuel for this combustion process is food and oxygen.

For most of our history the human species relied on its own metabolic energy to get needed work done and secure survival. This is the kind of human adaptation known as hunter/gatherer culture and accounts for most of human history – literally, millions of years. The cultivating of food crops and the domestication of certain animals built up a new kind of culture – agriculture.

Agriculture began about 10,000 years ago. When our ancestors began to supplement their own metabolic energy with the energy of draft animals, the scale of agriculture greatly increased. Along with the energy of controlled fire, and a few simple machines for capturing the energy of water and wind, our ancestors survived and flourished for the last 6000 to 7000 years.

Animal metabolism, along with wind and water, was the primary energy that powered the human world up until a couple hundred years ago. Then came coal, the steam engine, electrical generators, petroleum, gasoline and diesel engines, and nuclear reactors. Agriculture was powered almost entirely by metabolic energy until the early part of the 20th Century, and horsepower was still prominent in many places until the middle of the Century.

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With the coming decline in oil production, and the inevitably climbing prices of petroleum products, animal power in small to medium scale agriculture can again be a smart energy option and smart economic move. As the long distance transportation of food becomes less and less economic, the movement for local food security will grow. Although it may seem strange now, utilizing both kinds of animal energy – human energy and draft animal energy – will make good sense in the development of local food systems and greater food security as we pass beyond the petroleum era.

Animal energy is not "out of date." It is simply an energy resource that has been temporarily sidelined by oil. It still makes economic sense in certain applications. Animal energy will again make sense in agriculture and in certain kinds of transport as our communities re-adapt to declining oil and the need to develop greater security in our local economies – especially food security.

Animal energy will again make sense in agriculture and in certain kinds of transport as our communities re-adapt to declining oil…

The energy economy of metabolically based agriculture has a positive net balance. More energy is available from the food produced than is required to produce it. For example, the fuel (food) for horses is produced on the farm and the horses reproduce themselves. All the energy that works the farm is produced on the farm, and a farm worked in this way will produce more energy in its crops than it takes to grow them – a net energy balance.

With the mechanization of food production based on the burning of fossil fuels, we have the emergence and domination of specialization, monoculture, and the economics of scale measured by simplified cash accounting. This kind of agriculture ignores the larger energy economy and full cost accounting. Measured in calories, modern industrial agriculture uses far more energy to produce crops than the crops return to the energy economy – a negative energy balance. Most calculations place the energy deficit of industrial agriculture at 1:10, i.e. for every unit of energy produced, ten units of energy are expended. This kind of agriculture is not sustainable. It is a blip in the history of the human food economy made possible by the energy blip of petroleum.

With the decline in availability and affordability of petroleum products, we will need to bring animal power back into the energy economy to assist in the daily tasks of food production, travel, and transport of goods.

Not so long ago (80 to 100 years) this was the norm. The most popular draft animal was the horse. Other options were mules, donkeys, oxen, and goats. Bringing back animal power would foster a local economy. Animals would be bred and raised locally along with their food supply. Their waste, properly managed, would be returned to the soil as fertilizer, adding nutrients and organic matter. Chemical fertilizer is entirely dependent on the petroleum industry. It lacks micro-nutrients and trace minerals. Heavy farm equipment also creates another problem – soil compaction. This adversely affects drainage and root penetration to deeper levels. This problem is corrected and eliminated when draft animals are used in tillage and cultivation. Bringing back animal power would be a boon to soil improvement.

The use of draft animals in food production requires a higher component of human energy as well. In North America prior to 1914 approximately 25% of the working population was employed in agriculture. By 1945 it was 14%. By 1980 it was down to around 2% and dropping. Food system analysts calculate that well balanced, sustainable food system will likely require around 20 to 25% of the working population to be engaged in some kind of food production. This takes into account everything from home gardening to community gardening to market gardening to all levels of farming.

With sustainable animal energy input and sustainable soil management, a pragmatic view of positive change can be described. Employment opportunities would be increased. Food quality and diet would improve. Better health would result. A whole range of useful skills would be rescued and redeveloped. Food security would be advanced. The local and regional economy would be rebalanced toward greater self-provisioning and resilience.

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Sources:

Horse powered farming is still very much alive in the US and Canada. In the last few decades, it has been a growing segment of agriculture. A primary resource for learning about horse farming in North America is the *"Small Farmer's Journal"* published by Lyn Miller in Oregon. Go to www.smallfarnersjournal.com Street address: 192 West Barclay Drive, Sisters, Oregon 97759. Mailing address: PO Box 1627, Sisters, Oregon 97759. Phone numbers: 800-876-2893, 541-549-2064, 541-549-4403 fax. Email: agrarian@smallfarmersjournal.com

A similar publication is the magazine *Rural Heritage*.
Go to www.ruralheritage.com **The American Suffolk Horse Association** includes many Canadian members in its directory.
Go to www.suffolkpunch.com For a specific Canadian source go to www.drafthorseconnection.ca/dhc
These periodicals, associations and websites provide extensive information about the practice of animal powered farming, access to breeders, and sources of equipment.

Closer to home, seeking out people who work with horses is the best way to investigate and to become familiar with the local and regional sources for animals and equipment. Amish farmers near Woodstock and in northern Maine are also a primary source for horse farming information and advice.

Diet and Food Preparation

A good diet can be designed around foods that require little or no cooking. This is not only an alternative to energy consumption in the kitchen, but reduces energy consumption in transportation, packaging, and processing. There is also plenty of evidence that a diet consisting mainly of fresh and raw foods is a health promoting way to eat. Meals made of raw or lightly cooked foods generally require less time to prepare and clean up. Meats products that are dried, smoked, or canned may be added to a diet that minimizes cooking. A shift toward eating more raw foods is a step toward energy conservation and better health.

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Many garden vegetables, in addition to salad greens, can be eaten without cooking: carrots, cabbage, turnip, various greens, onions, peas, string beans, broccoli, cauliflower, etc. Be sure to wash thoroughly before eating. Fruit, nuts, cheese, dried, smoked, and pickled foods help make up a well balanced, energy conserving, no-cooking, or minimal cooking diet.

Sources:

The freshest raw foods come from local gardens and Farm Markets. Most all the foods in the minimal cooking diet are regularly available in most grocery stores or sometimes in specialty food shops. In the Maritimes we can easily include dulse (dried seaweed) in this diet. It is the most mineral rich food in the world and is as easy to eat as potato chips. Comprehensive guidance for using more raw foods can be found at www.thebestofrawfood.com

Manual Tools

Manual tools are powered by metabolic energy – muscle power – that comes from food, which comes from solar energy – sunlight. Manual tools are relatively inexpensive, easy to use, require little maintenance, and are long lasting. With a good set of manual tools, an able-bodied person can accomplish most of the gardening and yard work of a small lot. A number of tool manufacturers are again producing reel-type push mowers. They are generally lightweight and east to operate.

Sources:

Many good hand tools can be found in local hardware stores and garden centres. Big box stores have hand tools but they are often poor quality. **Canadian Tire** is an exception. They carry good quality tools. For the best quality tools available go to **Lee Valley Tools** at www.leevalley.com They carry both gardening and woodworking tools, as well as hardware needed for many applications.

For those who prepare firewood for winter it is hard to imagine doing it without a chainsaw, but our ancestors did this work season after season on muscle power. If our houses were super insulated and built or retrofitted for maximum solar heating, we might need only two or three cords of wood for the winter. Working up that amount of wood with hand tools would not be so difficult. It is just a matter of time. Relying on hand tools generally requires more time for any given task. Shifting to manual tools gradually may be easier than doing it all at once. But when petrol hits $5.00 a litre, or becomes a rationed commodity, the use of manual tools will be a smart move.

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The following tasks can all be accomplished with hand tools:

- garden preparation and maintenance,
- lawn mowing and trimming,
- leaf removal,
- snow removal,
- pruning and tree maintenance,
- hedge trimming,
- firewood cutting and splitting (within reason).

Electric Alternatives for Gas Powered Tools

With good planning and smart technology, access to reliable electrical power will be sustainable long after petroleum has become a very expensive and rationed commodity. A range of electricity-powered tools can already replace gas-powered tools: tillers, mowers, chainsaws, shredders, trimmers, and firewood splitters.

Sources:

For electric tillers go to http://mantis.com/mantis-electric-tiller.asp

Electric lawn mowers are now widely available from regular lawn mower dealers in both corded and battery powered models.

Electric chainsaws are available from chainsaw dealers and **Canadian Tire**.

For electric leaf shredders go to www.leafmulcher.com/index.html

Recreational Activities

There are many ways in which physical fitness and recreational activities can be done without the use of vehicles that burn fossil fuels. Recreational activities that do not rely on vehicle use will shield our budgets from increasing gasoline prices, lower carbon energy use, and increase physical activity. In choosing this kind of recreation, we help both ourselves and the environment to better health. Traveling to recreation sites close to home will decrease the cost and reduce our carbon footprints.

Summer Activities:

- Running
- Walking
- Canoeing kayaking, and sailing
- Cycling
- Gardening (exercise that also produces food and enjoyment)
- Tennis
- Golf (without petrol fuelled carts)
- Swimming
- Working out in the gym
- Team sports (summer)
- Skateboarding
- Rollerblading
- Hiking
- Fishing and hunting

Winter Activities:

- Cross-county skiing
- Snowshoeing
- Walking
- Swimming (indoors)
- Working out in the gym
- Hockey
- Ice-skating
- Ice fishing and hunting

Sources:

The equipment, shoes and clothing needed for much of the above are commonly found in outdoor recreation and sports stores. Canoes, kayaks, snowshoes, fishing and hunting equipment, as well as boots, shoes, and clothing are available at **Currie's Hardware** (506-328-8788) in Woodstock. See also bike shops in the Cycling section. For ski equipment the nearest shops are in Fredericton. See **SkiWolf**, www.skiwolf.ca

Purchasing Products

Manufactured products will become increasingly expensive as energy prices increase. Both manufacturing costs and transport costs will go up. By consciously evaluating all purchases from the standpoint of quality, durability, reparability, packaging, and, in general, the amount of energy required to manufacture and transport the product, we can then choose to purchase items that, in the long run, will save money and reduce environmental impact.

Consumer choice is a powerful factor in what manufacturers decide to produce. We can both save money in the long run and influence what goods are produced by choosing to purchase high quality, durable, and repairable products, and avoiding low quality products that will end up in the trash and require making repeated purchases.

We can both save money in the long run and influence what goods are produced by choosing to purchase high quality, durable and repairable products…

A good example of how this works is with the Energy Star rating of appliances. As more and more consumers decide to purchase appliances that use a low level of electricity and have a high Energy Star rating, the manufacturing of appliances that use a lot of electricity will cease even though they are initially cheaper.

There is now also a movement to have labels that show a rating for how much "embodied energy" is in each product. "Embodied energy" is the amount of energy required to produce and market each item. Companies that are able to reduce the embodied energy in their products will attract customers who are making conscious decisions based on reducing energy use, saving money, and benefiting the environment.

A large amount of embodied energy in products is the result of long distance transport. Locally and regionally produced items have much less embodied oil energy than products that are transported great distances. Purchasing locally and

Purchasing locally and regionally produced goods as much as possible will help establish more local and regional production.

regionally produced goods as much as possible will help establish more local and regional production. This will reduce energy use, save money in the long run, and prepare for the transition away from fossil fuel energy to renewable energy.

Two other factors with regard to the energy component and cost of consumer products are also significant: 1) packaging and 2) advertising. Consumer choice can have an important impact on both.

1. Over-packaging is a huge factor in product cost and in its associated use of energy. Consumers can do two things: we can avoid purchasing over-packaged product as much as possible. And we can ask for regulations that require all packaging to be returned to the manufacturer or distributor for disposal or recycling. When this happens, manufacturers quickly find ways to eliminate over-packaging. This greatly reduces the trash burden of local communities, and the level of embodied energy in each product. Packaging is a significant component of retail costs. A manufacturer that can greatly reduce or eliminate packaging can gain a price advantage in the market and attract more customers.

   This kind of regulation is already working well in Germany and other European countries. In addition, the requirement for manufacturers to take back and recycle durable goods at the end of their useful life is also working well in Europe. Low quality products tend to disappear. The remaining products are made more efficiently and with much great durability. When products last longer and can be easily repaired, it means fewer products need to be made and transported. This means reduced petroleum consumption and less spent on energy. The overall result of these trends is the development of more sustainable economy and society.

2. Advertising and marketing are employed to convince us we need to buy more and more. This kind of advertising has now gone so far that the consumption it creates is damaging the earth's ecosystems that sustain us and is a threat to public safety and security. If advertising were legally limited to basic product description information, we would make purchasing decisions based on quality, durability, and serviceability. Again, the volume of goods produced and sold would adjust to a lower level, less transport would be needed and the amount of oil required to service the economy would decrease.

Consumer preference in purchasing products could be a significant boost in creating a more sustainable economy. It could help reverse the growing consumption of oil. As these trends continue, our households, our communities, and our economy in general will become better equipped to accommodate the full effects of diminishing oil at ever higher prices.

Sources:

No Logo by Naomi Klein
www.naomiklein.org/no-logo

Cradle to Cradle: Remaking the Way We Make Things by William McDonough and Michael Braungart
www.mcdonough.com/cradle_to_cradle.htm

Living Frugally with Purpose and Style: The New Conserver
www.newconserver.com/living-the-good-life
www.weconserve.ca/solutions

Renewable Energy and Conservation Practices: Local People and Their Stories

Solar Hot Water at the Carwash

Softsuds Carwash on Connell Street in Woodstock uses a large volume of hot water to serve its customers. This prompted owner, Brian Fox, to look into ways of reducing the costs of heating all this water. Fox was heating hot water with an oil furnace and furnace oil was steadily rising in price. By installing a solar water heating system in 2008, Fox has been able to greatly reduce his operational costs.

While Brian Fox is very positive about the system, there was an initial problem. It was not working to its full capacity for the first year. He warns about the importance of hiring experienced contractors. In addition, a panel was damaged by a tractor-trailer. But because of the incident he was able to see that the unit is very well designed, and, although it was cracked, its design prevented leakage and costly clean-up and repair. He credits the system for being both serviceable and durable. Despite these problems and extra costs Fox is pleased to say that the system had a payback period of just three years. He recommends a similar system to anyone who is interested in lowering their energy costs for heating water.

In addition to solar hot water heating, Fox says Softsuds Carwash has reduced its overall water use by collecting and recycling much of the water the operation needs.

A Solar Electric House

Miller's most expensive energy gill int he past five years since installation has been $30, which is typically in the month of February.

Dana Miller, a local resident in Houlton Maine, is the proud owner of a 3000 square foot house, which he heats electrically for $3.96 a month, ten months out of the year. How is this possible? In October of 2007 he installed 21 (3x2 feet) solar panels. These panels have saved him thousands of dollars in electricity costs over the years. Miller recommends solar panels for a number of reasons.

First, he credits their efficiency stating that the panels are able to produce on average 28 kw hours/day which is enough electricity to allow the house to be energy self-sufficient for 10 months of the year. Miller's most expensive energy bill in the past five years since installation has been $30, which is typically in the month of February. Secondly, Miller credits the system for its low maintenance. He has experienced only one problem since the time of installation when the inverter needed to be changed. It was a simple process and since then he has seen an even greater output of electricity.

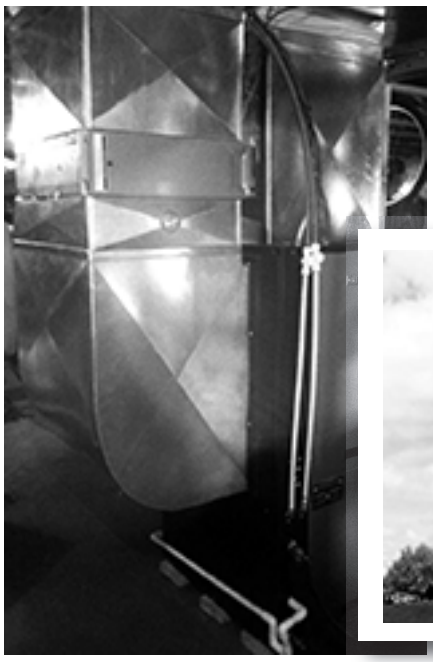
Miller says that although the cost of his panels and installation at the time was over $32,000 this cost has been drastically reduced since then. By his estimates a similar installation today would cost under $10,000. Although a much larger investment was required at the time he made the installation, he is happy with his decision. He places a high value on being able to live more sustainably, and on cutting down on his greenhouse gas emissions as well as enabling him to rely on a renewable source of energy rather than fossil fuels. He values the opportunity to live with renewable energy even though it may not be the least expensive at the moment.

A Pioneer in Geothermal Heating

Dr. Donald Woods of Houlton Maine has been interested in alternative heating options for over 35 years. His interest began when he worked as a carpenter to pay his way through dentistry school and became experienced in building construction. When he was ready to start his dental practice and build his clinic, he would accept no other heating source than geothermal. In 1986, geo-thermal technology was not as readily available as it is today and so he and his wife travelled throughout the entire state of Maine searching for someone to sell them the necessary equipment. Despite their determination they were told repeatedly that Northern Maine was too cold for geo-thermal to be a primary heat source and they ought to heat their office using conventional methods. Instead of compromising, they headed into Canada to continue their search. It was at this time that Dr. Woods found a like-minded individual who agreed that heating Woods' office by geothermal was indeed possible. This man was Woodstock's own, Robert Larsen of Larsen's Electric, who at the time was also in the business of selling heat pumps.

Since then, the system installed in Dr. Woods office has worked so well that he has installed similar systems in his house as well as his daughter's. Dr. Woods has become an advocate for geo-thermal heating and it is not uncommon for him to walk onto construction sites and ask to talk to the construction crew manager. To date, he has influenced over a dozen people to use geothermal and is convinced that everyone can benefit from installing this form of heating technology.

First of all, he recommends this system because of its affordability and dependability. Aside from the initial start up costs, he has yet to pay anything but minimal repair costs to maintain his system. He has also been able to heat and cool his home and office without the use of any supplementary sources. Secondly, he recommends the system because it is easy to use. He says having this heating system at his age gives him peace of mind. Dr. Woods is eighty-two and is thankful to have the system because he lives with peace of mind knowing his wife would be able to live comfortably if he were to pass away prior to her. It has eliminated the worries associated with increasing costs of energy and the hassle of wood heat. Lastly, he likes the idea that it is a clean form of energy. Because there is no combustion of fuel there is no smoke or gasses emitted which maintains a healthy environment in which to live and work.



In addition to his geothermal system, Dr. Woods installed a wind generator in 2006 to help offset his electric bill. He says that living sustainably not only saves him money, but has also made his life easier by not having the stress of increasing energy costs. He recommends geothermal to anyone and especially those planning to build a new home or business.

Passive Solar in Action

Garth Hood has brought the best in passive solar house design to New Brunswick with the completion of the Naugler House at Douglas, near Fredericton. Garth's business – Thoughtful Dwellings – has taken the Passive House Standard, developed in Germany, and is adapting it to our region.

What makes the Naugler house different? It has been built to "Passive House" standards, which focuses on absorbing the sun's heat, internal heat storage, maximum insulation, and a heat recovering ventilation system. The house holds the heat it has absorbed for an extended period. The construction features floor and walls designed for heat retention, the best in R factor windows and doors, and a ceiling insulated to the R90 level. All this allows the house to remain warm in winter without the use of conventional heating systems. A small electric heater fitted in the air exchange system, will come on if the temperature in the house drops below the owner's comfort level.

Passive House Standard design strives to create a high quality indoor environment with an easily maintained comfort level, along with construction materials and methods of superior longevity.

Passive House Standard construction also emphasizes a high quality indoor environment. Because the house is heavily insulated and completely sealed against heat loss or cold penetration, it uses an air exchange system. This system brings in a constant stream of fresh air that is heated by the outgoing air. Strategic shading and ventilation moderates summer heat. Passive House Standard design strives to create a high quality indoor environment with an easily maintained comfort level, along with construction materials and methods of superior longevity.

Garth Hood had developed his approach to Passive House design and construction in a way that supports local employment by using local materials to as great an extent as possible. This includes roofing shingles which are made in Minto from recycled tires and plastics (Modern Slate Roofing Systems http://www.moderneslate.com/). The contractors on the Naugler house also worked in a way that reduced waste during the entire construction process to just a few garbage bags that they were able to dispose of through the weekly roadside garbage pickup.

As the Naugler house approaches its first winter, Garth Hood has estimated its annual cost for supplementary electric heating will be less than $100. This is less electricity than would be needed if the house where constructed by conventional means and heated by a geo thermal system. Hood also points out that not only do Passive Houses cost much less to operate, but are surprisingly affordable to begin with. By the elimination of expensive heating and cooling systems, the homeowner is able to offset the increased cost of investing in higher quality building components required by the Passive House Standard. Garth Hood is firmly convinced this is the future of house building and of building construction of all kinds. With the Naugler house as a prime example, it's hard to see why any other kind of house makes sense. Thoughtful Dwellings, indeed!

Garth Hood can be contacted at garth@thoughtfuldwellings.ca
506-476-5611 www.thoughtfuldwellings.com
For information on the Naugler house go to
www.nauglerhouse.com and www.seconstruction.ca

Low Cost Home Heating with Wood and Hot Water

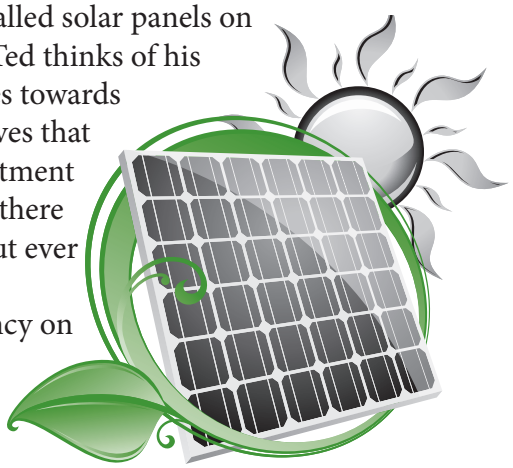
To many people of the Woodstock area, Ted Mouris is known for two things, his veterinarian clinic and his passion for cycling. Ted's average bike ride is 50-60 km/ day six days a week.

A lesser-known fact about Ted is that he is an "energy use reductionist" and is committed to living his life as sustainably as possible. Ted is a firm believer that we should do what we can to lessen our impact on our environment and finds joy in minimizing his ecological footprint.

Ten years ago he installed a wood gasifier to provide hot water heat for his home. The gasifier burns wood in a way that collects the gas emissions for additional combustion. Wood gasifiers are over 90% efficient. The wood gasifier heats the water storage tank which then transfers the heat throughout the floors of his house as well as heating his hot water. Not only has this lessened Ted's electric bill substantially, but maintaining a properly heated home and water is easier than he had anticipated. He says that due to the efficiency of system, he needs to only build a fire approximately every three days throughout the winter to maintain a comfortable temperature throughout the house. Not only has this system lessened his dependency on oil for heating, but Ted is able to use scrap wood from a local business to further lessen the cost of heating his home.

Not only has this system lessened his dependency on oil for heating, but Ted is able to use scrap wood from a local business to further lessen the cost of heating his home.

Ted enjoys the challenge of seeing just how energy and cost efficient he can make his daily life. He has recently installed solar panels on his house in order to further lessen his dependency on firewood. Ted thinks of his energy reduction strategy as a kind of game with each step he takes towards living carbon free as an inducement to take another step. He believes that everyone is able to live more sustainably and that each small adjustment can create a large impact if adapted on a global scale. He says that there are many people who complain about the rising price of oil without ever taking steps to lessen their dependency on it. With the steadily increasing price of oil each year, an investment to lessen dependency on it only makes good financial sense, and, as Ted has shown, it can even be enjoyable.



Energy Efficiency Upgrading in a 60 Year Old House

In 2009 Sam and Karen Arnold took the plunge and did an Efficiency New Brunswick audit and upgrade on their 60 plus year old home. This has resulted in the house now having more insulation in the attic, topping up the insulation in all the walls, adding Tyvec as an air movement barrier, insulating the basement walls, and stopping all air leaks that were found. Three of the original windows were replaced with new Energy Star rated windows as well. The result has been a dramatic increase in the comfort level of the house while reducing the cost of heating and fuel required. Their wood furnace now burns 3 cords of hardwood per winter, compared to over 4 cords previously, and the oil furnace is burning less than 200 gallons of oil in the spring and fall compared to around 250 plus previously. They urge all owners of older homes or businesses to contact Efficiency NB to arrange for an energy audit and to apply for a grant or interest-free loan to make their buildings more energy-efficient. The Arnolds are pleased that not only will their investment be returned in savings, but they will be using less energy thereby increasing the sustainability of the environment. Sam says, "It's win-win any way you look at it." Sam advises that it is important to make sure the contractors and workers hired to do this kind of work are reputable and reliable. He reports they were very satisfied with the Woodstock area contractors they hired.

The result has been a dramatic increase in the comfort level of the house while reducing the cost of heating and fuel required.

Farming for the Local Food System: Two Examples

Tim and Kirston Livingston are developing Strawberry Hill Farm at Pembrook near Woodstock into a major source for locally grown food. Tim grew up on a farm in New Hampshire. In 2001 he started working with the production of organic soils, compost, and compost teas. Kirsten grew up in New Hampshire and worked in the greenhouse industry for many years. She took laboratory training and water purification courses. Kirsten has always been one to take on a challenge. In the early 1990s she was told it was impossible to grow sweet potatoes in New Hampshire, so she set out to grow them and was successful in doing so. She is now growing them in New Brunswick. In 2003 Tim and Kirsten took training in soil biology and biological farming. They love the challenge of growing good crops using scientifically based organic methods. Tim and Kirsten work together at the many tasks of operating a farm and enjoy the interaction with people in selling their crops directly to local customers.

The focus of Strawberry Hill Farm is two-fold: First of all, they produce vegetables, fruits, and berries for weekly, boxed delivery to customers who have signed up for their service. They also maintain a roadside outlet at the farm throughout the summer and fall months. Secondarily, they have laying hens for egg production, meat birds and other livestock. Strawberry Hill Farm is a good example of what can be done to produce food locally that is less dependent on petroleum than food imported from large industrial scale operations. By using scientifically based organic methods the Livingstons can grow good crops without petroleum based fertilizers and chemical pesticides. They made a conscientious decision to use organic methods because they know that organic farming promotes better health for everyone involved: themselves, their workers, their many loyal customers, and the environment as well. The Livingstons strive to make their farm a place where all are welcome and a place of peace and happiness. Judging by the stream of customers who frequent their roadside market, it looks as though they are well on their way to success.

They made a conscientious decision to use organic methods because they know that organic farming promotes better health for everyone involved: themselves, their workers, their many loyal customers, and the environment as well.

Visit: www.strawberryhillfarm.ca

Mathew Culberson was born in Woodstock and, until recently, lived his life as most residents do throughout the region. He graduated high school, owned a house and a car, married and started a family. From 1998-2007 he owned a prominent business, Eastern Auto Sounds, which specialized in car stereos. But despite this he says that even in his most profitable year of business he found he was dissatisfied with this way of life. In 2008 he sold his business and moved to Temperance Vale and began farming. There he and his family built a log house and began to live off the land with a selection of livestock and a garden. It was at this time he was attracted to the teachings and way of life of the Amish. Mathew and his family have since joined the Amish community near Woodstock.

The Amish way of life is based on horse farming. While this may seem a strange way to farm in the petroleum age, it was the way everyone farmed until quite recently, historically speaking. And there are still woodlot owners who work with horses in harvesting and managing their forestland. Mathew's adoption of horse farming may seem a step backwards in time, but there's a good possibility that horses may again be selectively used for food production when the era of cheap oil comes to an end. We will then need "new" sustainable ways of producing food at reasonable costs. The re-emergence of horse farming may be a welcome "innovation." In which case, Mathew Culberson and his family may be taking a step "back to the future." When asked why he chooses to farm with horses, he says simply, "Tractors don't give birth to tractors."

Today, Mathew and his family live without many of the petroleum based technologies that are taken for granted by the high-tech economy, but his way of farming with the Amish provides him with the kind of knowledge that is the foundation of a sustainable food system. For example, the practice of saving seed insures next year's crop without any dependence on the commercial production of seed, which, of course, depends on petroleum energy. This allows him to maintain a great diversity of crops and contribute to the kind of food security that our energy transition will require. Mathew points out that the urbanization of the Canadian population has not only caused a loss of

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knowledge about producing food, but has increased the distance our food has to travel in order to reach our plates. This system is far from sustainable and Mathew stresses the importance in maintaining the knowledge of our ancestors. He says that if something happens to the global system, we need to be in a position to feed ourselves. The kind of farming Mathew and his family are doing can continue no matter what happens to petroleum dependent agriculture. Mathew's farm products are available every Friday at the Woodstock Farm Market.

Matthew says that a solution to lessening our dependency on foreign oil is easier than we may think. He asks what if every Canadian grew just 3 lbs of beans and 3 lbs of tomatoes every year? The multiplier effect of this small change in people's lives would create a large savings in the fuel needed to otherwise transport that food to the supermarkets. He explains that people have been living off the land for hundreds of years while the petroleum based modern way of life is very new by comparison, and is now under severe stress. He believes that living sustainably is not only natural, but also necessary in order to protect the environment and ensure that future generations have a quality of life that can be carried on beyond the oil-based economy.

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Using Energy (Your Own) and Getting Healthy

Jill Dunnett, a native of Woodstock, has worked for the Carleton Civic Centre as recreational program coordinator since 2007 and has implemented many low cost, low energy activities. Her success in developing the Woodstock Running Club is worthy of special notice. Because Jill has been an active runner most of her adult life, one of her goals on taking up her position at the civic centre was to start a running club. The Woodstock Running Club adds a social aspect to what is typically seen as an individual sport. The Club is for runners of all abilities and meets three times a week. The club is a good way to meet other Woodstock residents who share a similar interest. Group runs add the companionship element to an otherwise lonely sport. Jill adds that by committing to a group, motivation is often increased. She stresses that running is very accessible not only because of the low start up cost but also because of the flexibility of the sport. You can run wherever you are, at any time. She recommends joining a group, not only as a way to stay motivated, but because people often don't take enough time for themselves and an activity they enjoy. Jill emphasizes that group runs are a great way to stay connected with friends while also doing something that is good for your health. She says that the Woodstock Running Group has allowed people to develop very strong personal bonds with one another through a shared love of the sport.

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Each year Jill Dunnett coaches a running group called "Couch To 5k" which starts typically at the end of May. This is a group designed to take inexperienced runners from being "couch potatoes" to running 5 kilometers by the end of July in order to participate in the annual Joe McGuire Road Race. This race takes place each year in connection with Old Home Week and draws runners from around the province. Jill stresses that the Woodstock Running Club is always looking for new members, even if you are new to the sport. Contrary to many other sports, running is a sport that is often picked up later in life. She says that the average beginner in the Woodstock running group is in their late 30s or older.

WRC Woodstock Running Club

Other recreational activities offered through the Carleton Civic Centre include the River Valley Rush Triathlon team, a hiking team that climbs Mt Katahdin and Mt Carleton annually. Tennis and golf lessons are given, as well. Jill has also organized trips for kayaking, treego and paintball.

If there is a sport you are interested in but is not mentioned, please contact Jill Dunnett in order to find an existing group, or she will gladly work with you to establish a group to match your interest. She stresses that the schedule is adapted frequently and they are always looking for feedback and new ideas. Contact: Jill Dunnett, Carleton Civic Centre, Jill.dunnett@town.woodstock.nb.ca

For additional information on running and schedules of road races throughout the province
www.runningroom.ca www.runnb.ca

Great Hiking in the Woodstock Region

Barb Brown has always enjoyed being close to the life of nature. She remembers fondly how she collected insects and butterflies for museums as a child. She and her husband enjoyed ten years of off the grid homestead living when they often worked cooperatively with others and made close relationships, while learning from and relying on each other. They now live near Ayers Lake, east of Woodstock. She fell in love with the area around Ayers Lake at first sight for many reasons, but especially the biodiversity found within its extensive old-growth forest. She says she started hiking because it was the only way to get to the places she wanted to visit and since then has spent much of her time on hiking trails.

She believes that because Ayers Lake is home to such a wide variety of species, the protection of the forest from any disturbance is critical.

Since moving to the Ayers Lake area, she has been making and maintaining trails and frequently takes hikers of all abilities to many of her favorite spots around the lake. With her extensive knowledge of the area and the species within the forest, a hike with her is not only enjoyable, but also informative and educational. She believes that because Ayers Lake is home to such a wide variety of species, the protection of the forest from any disturbance is critical. She encourages anyone who is interested in hiking to visit the area. Due to the extent of the hiking trails, Ayers Lake is now more accessible to visitors than it has been in the past, making it a wonderful spot to enjoy the forest and lake.

A lovely short film about the area was created by Mark Brennan, of Nova Scotia. The video can be viewed at: https://vimeo.com/43003921

There is also a page on Facebook: "Ayers Lake and Surrounding Forest". The website www.hikingnb.ca is in the process of describing the Ayers Lake trails, but to date the list is still incomplete.

For information on another set of hiking trails just to the west of Woodstock go to the website of the **Meduxnekeag River Association** at http://www.meduxnekeag.org/trailguide.htm South of Woodstock off the old Trans-Canada, you can hike the Maliseet Trail up to Hays Falls, one of the highest waterfalls in New Brunswick. Hiking is great recreation that uses no oil and the Woodstock region has great hiking in abundance.

Conclusion

Many residents of the Woodstock region are steeped in the traditions of community cooperation, improvised problem solving, and self-reliance. These skills will be especially important for dealing with the changes that the descent from peak oil will bring. No one can be quite sure what will happen, but we know that oil will be getting scarcer and more expensive, and the whole economic system that has been built up depending on it is likely to become weakened and unstable.

It is the intention of this Guidebook to provide information and direction to assist the Woodstock region to become as resilient a community as possible in the face of a changing and uncertain energy future.

Toward this end, owners of residences and business facilities, as well as the municipal government, can take the following steps:

- Analyze existing energy patterns and usage,
- Determine energy use efficiency,
- Determine vulnerability to impending expensive and scarce petroleum,
- Develop a plan to mitigate and/or avoid the vulnerabilities, and
- Implement that plan.

Life after peak oil is likely to be different in ways we cannot fully imagine. But it need not be a pinched struggle for survival if we plan and act now to create renewable energy alternatives to petroleum dependency. We can wait until we are forced to change and then react, or we can begin now to make the changes in energy technologies and conservation practices that will support a good way of life in the years ahead. We hope this Energy Transition Guidebook will contribute to a flourishing and sustainable future in the Woodstock region of Western New Brunswick.

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