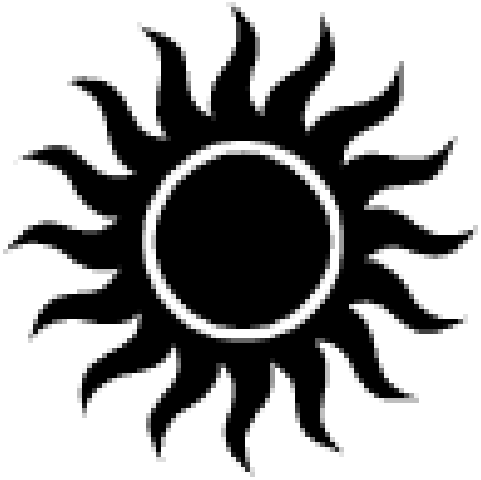
Sustainable energy for the Ottawa Valley

A preliminary investigation by the Ottawa River Institute's Sustainable Energy Committee…



- *working definition of sustainable energy*
- *priority shifts in energy use*
- *possible roles for the Ottawa River Institute*

Ottawa River Institute, April 2006 ***www.ottawariverinstitue.ca***

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The Ottawa River Institute, Pembroke, Ontario
www.ottawariverinstitute.ca
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Introduction

The Ottawa River Institute (ORI) is an incorporated, charitable organization based in the Ottawa Valley. ORI's mission is to foster sustainable communities and ecological integrity in the Ottawa River watershed. Since incorporation in 2001 our main focus has been on sustainable, healthy communities, with a particular emphasis on energy conservation.

Sustainable energy is key to healthy communities. Energy is central to almost everything we do. Current patterns of energy use in the Ottawa Valley and the rest of Canada are not sustainable. We use and waste large quantities of energy. Much of the energy that we use is derived from non-renewable sources such as oil, gas, coal, and uranium. High levels of use and waste are contributing to serious pollution problems and global climate change (1). Annual production of oil and gas is approaching a peak and will begin to decline in the near future, resulting in very high prices (2). Ontario faces an electricity crisis with the possibility of brownouts in the future (3).

In January 2005, the Ottawa River Institute's Sustainable Energy Committee began exploring the questions "What might sustainable energy mean for the Ottawa Valley?", and "How might the Ottawa River Institute help to facilitate a transition to sustainable energy?" In this exploration we focused mainly on Renfrew County as a representative political unit in the Ottawa Valley.

Our exploration was done using committee discussions, interviews and profiles of energy innovators, consultations with energy experts and municipal councils and individuals, networking with the Ontario Sustainable Energy Association, a community forum on wind energy, internet research, and review of resource materials on sustainable energy. Each of these will be described in this report, along with our preliminary conclusions, our views on priority shifts that could make Ottawa Valley communities more sustainable in terms of energy use, and possible ways that the Ottawa River Institute could help facilitate these shifts.

Some background information on Renfrew County and the Ottawa Valley may be helpful as a context for this study.

Background information on the Ottawa Valley / Renfrew County…

- The "Ottawa Valley" is that part of the Ottawa River watershed north and west of the city of Ottawa. The two largest counties in the Ottawa Valley are Renfrew (Ontario) and Pontiac (Quebec). While the two counties have many characteristics in common, our focus has been mainly on Renfrew County.

- Renfrew County is the largest county in Ontario. It covers almost 8,000 square kilometers. The Ottawa River forms the northeastern border of the county and flows toward Ottawa in a south-easterly direction.

- The population of about 100,000 is widely distributed and mostly rural, with small towns and villages. None of the 18 municipalities contains more than 15,000 people. There is almost no public transit. People depend on personal vehicles for traveling to places of work, shopping, recreation, education, medical care, and worship.

- Forty percent of the area in Renfrew County is Crown Land. Logging and agriculture date back over 200 years. Before that the area was inhabited by native Algonquin people for possibly thousands of years.

- Typical for North America, households in Renfrew County use large amounts of energy. Electricity is generated at two large dams on the Ottawa and four dams on the Madawaska. Wood-burning stoves and furnaces are more common for household space heating in Renfrew County than in Ontario and Canada generally; other households are heated with gas, oil or electricity.

- Specific data on energy use by Renfrew County households is not available. However, Natural Resources Canada provides Canada-wide data on this subject (4). Space heating accounts for 60% of total residential energy consumed. About 52 % Canadian households are heated by hot air furnaces, 25% by electric baseboards, 11% by hot water furnaces, 4% by woodstoves, and 4% by heat pumps. Natural gas is the most commonly used heating fuel at 46%, followed by electricity at 33%, and oil at 10%. Usage of wood as a main heating fuel is reported to be 3%, although in rural parts of Renfrew County it is likely quite a bit higher.

Methods of exploration and major findings from each

Committee meetings

The ORI sustainable energy committee met ten times from January 2005 to March 2006. We initially met face-to-face in a central location, and subsequently adopted teleconferencing to save time and fuel.

Our initial discussions focused on renewable sources of energy. But we quickly agreed that using renewable sources is only part of the picture of "sustainable energy". There are also opportunities to use less energy, to use energy more efficiently, and to do things in ways that don't use fuel or electricity (e.g., bicycling and line-drying clothes).

The committee attempted to capture this bigger picture of sustainable energy on a one-page **"sustainable energy schematic"** (Figure 1, below). It identifies sustainable energy options under three main headings: transportation, space heating and electricity use.

Figure 1: Sustainable Energy Schematic

Sustainable Energy for Renfrew County

Moving away from non-renewable sources (fossil fuels, etc.), toward renewable sources and sustainable levels of use

Rev2: Apr29/06

Transportation (50%)	**Heating (30%)**	**Electricity (20%)** for water pumping, water heating (50%), cooking, lighting, refrigeration etc.
Using less ▪ Car pools, ride sharing, fewer trips ▪ Work-at-home arrangements ▪ Teleconferencing and videoconferencing	**Using less** ▪ Energuide for Houses retrofits ▪ Insulated window coverings ▪ Smaller houses ▪ Thicker walls (e.g.,straw bales) ▪ Earth berming ▪ Close off sections in winter ▪ Seasonal house-sharing	**Using less** ▪ Conservation, turning off lights etc. ▪ Smaller houses, fewer devices ▪ Cooking less, going to bed earlier!
Greater efficiency ▪ Public transit ▪ Trains ▪ More efficient vehicles ▪ Lower speed limits	**Greater efficiency** ▪ More efficient stoves, furnaces, boilers ▪ Multi-family dwellings	**Greater efficiency** ▪ Efficient appliances, lighting, motors ▪ Distributed generation ▪ Improved storage (batteries, flywheels)
Alternative fuels ▪ Ethanol ▪ Methanol ▪ Biodiesel ▪ Hydrogen	**Alternative sources** ▪ Wood and wood wastes ▪ Other biomass (corncobs, switchgrass) ▪ Active solar ▪ Cogeneration ▪ Biogas ▪ Geothermal	**Alternative sources** ▪ Community-scale wind ▪ Home-scale wind ▪ Solar (shingles, panels) ▪ Biomass (including water heating with cogeneration of electricity) ▪ Biogas ▪ Small hydro ▪ Solar water heating
Alternative modes (non-motorized) ▪ Bicycles & trailers ▪ Animals & trailers	**Alternative Methods** ▪ Pasive solar design principles ▪ Sunspace air heaters	**Alternative methods** ▪ Solar clothes drying ▪ Solar cooking ▪ Hand pumping of water ▪ Passive solar water heaters ▪ Cold storage rooms, root cellars

Food production was not included on our schematic. We now believe that it should have been. Much of the food on Renfrew County dinner plates travels 2000 kilometers or more from farm to table. Fossil fuel inputs are required for machinery, fertilizers, pesticides, processing and long-distance trucking. Current food production methods may use ten kilocalories of fossil fuel energy to produce one calorie of food energy. This will have to change as fossil fuels become scarcer and more expensive.

Working definition of sustainable energy: The committee developed a working definition of "sustainable energy" for the Ottawa Valley. Our definition has two components: 1) sustainable levels of use and 2) energy from renewable sources: **At sustainable levels of energy use, the primary energy source and the energy inputs for the infrastructure to make it usable can be readily renewed, leaving ample supplies and healthy ecosystems for future generations.**

Energy is used to mine, manufacture and transport component materials for many types of energy systems. These energy inputs must be fully accounted for to determine if a technology is truly sustainable. Such detailed analysis was beyond the scope of this investigation. However, it is still possible to point to energy systems that are more likely to be sustainable. Most of these are lower-technology options.

Sustainable energy use is difficult to define and to attain. We therefore offer this simplified version of our working definition as a guide: **"moving away from non-renewable sources of energy toward renewable sources and sustainable levels of use".**

Committee members reviewed many print and internet resources over the course of this exploration. A list of the major resources we consulted is presented in the References section of this report.

Municipal Council Consultations

Committee members visited six municipal councils and the Pikwakanagan First Nation to get input from elected officials on sustainable energy. The sustainable energy schematic was used as a basis for the discussion.

These consultations were very enjoyable and productive. Time and resource constraints did not allow us to visit all 18 councils in Renfrew County; we hope to continue to consult municipal councils in the future.

A list of the councils visited is presented below followed by a summary of the main messages received. A more detailed summary of these consultations is provided in Appendix A.

McNab-Braeside Township Council
Horton Township Council
Arnprior Town Council
Renfrew Town Council
Bonnechere Valley Township Council
Greater Madawaska Valley Township Council
Pikwakanagan Algonquin Band Council

♦ There is considerable interest, engagement and knowledge about energy issues at the municipal government level. People are talking about energy with their council representatives.

♦ Councils are willing to share information about local developments, and are interested in hearing about what is happening in other municipalities. Most are taking practical steps within their mandate to save energy and cut costs.

♦ Energy price signals are a powerful motivator for everyone. Conservation is only a motivator for some, but this number could grow.

♦ There is a need for a "cultural shift" in public attitudes towards conservation.

♦ Current government programs at federal and provincial levels are seen as confusing, inaccessible, and mired in red tape. People would likely respond to consistent and coordinated home retrofit programs, for example, but none exist at present. Municipal regulations (e.g., zoning) generally do not present barriers to innovative housing designs or projects such as district energy facilities.

♦ People tend to act based on cost-benefit and payback considerations. ORI was urged to make the case for cost savings associated with energy conservation measures. It was noted, however, that uncertain projections of future energy costs make it difficult to provide credible analyses.

♦ There is a general perception that "wastes" (e.g., garbage, wood wastes) are not well integrated within the mix of energy generation options.

♦ Wood provides a major part of the energy needs of Renfrew County. Councils have positive attitudes towards continuing or increased use of wood energy.

♦ Despite considerable potential for new wind and hydro power developments, implementation has been slowed by red tape, artificially-low prices paid to generators, and difficulty finding willing lenders.

♦ Highways and personal vehicles are a "given" in the County. No one is looking to a future without cars. Public transport is not seen as a viable alternative for rural Canada. Programs are needed to facilitate car pooling and ride sharing. More people would work at home if they had access to high speed internet.

Individual Consultations

The committee carried interviews with knowledgeable individuals on key challenges for sustainable energy and possible roles for the Ottawa River Institute. The individuals we consulted are listed below, along with brief summaries of their input.

Doug Fee

Doug is currently President of Ottawa River Power Corporation; he has considerable experience in the electrical utility business, having worked for 25 years with Gloucester Hydro and Ottawa Hydro before coming to Pembroke. He generously shared his expertise and knowledge of the history of electricity generation and distribution in Ontario.

Doug highlighted the fact that we indeed are facing an electricity crisis in Ontario. We are an affluent society with high levels of electricity use; people have very high expectations and generally believe that conservation is for other people. It is hard to get people's attention. More and more electricity using-appliances such as air conditioners are coming on-stream daily. Demand is continuing to increase while infrastructure ages and generating plants need to be repaired and/or replaced. Doug shared a remark made by David Suzuki to the Enercom Conference (of Ontario power producers and distributors) in February 2006: "We are on a collision course with the end of the world".

It is necessary to create a "conservation culture" but this is very difficult. The Conservation Bureau (of the Ontario Power Authority) has been set up to do this, and has major residential campaigns planned for coming years. Smart meters are designed to help shift demand to off-peak hours.

District heating with cogeneration is attractive but the infrastructure is expensive. It is more likely to be of interest where an existing heating system is at the end of its life and in need of replacement. The Parliamentary precinct in Ottawa uses a district heating/cooling system. Cornwall Electric has a combined district heating / electricity generation system.

John Gulland

John Gulland is a director of the Wood Heat Organization. He has written extensively on wood heat and has served as a consultant to various levels of government on training programs and policy matters. He also has experience with electricity generation from renewable energy sources such as sun and wind.

John suggested that more homes in the Ottawa Valley could be heated with wood than is now the case. Towns and villages could install insulated pipes to distribute hot water to heat homes and businesses from district energy facilities. Renfrew County has unused supplies of wood wastes from harvesting operations and processing facilities that could fuel such facilities. Larger district energy facilities could generate electricity as well as heat for community use.

John has installed solar photovoltaic panels and a 1 kw wind turbine at his home. The power from the wind turbine allows him to run a variety of power tools (e.g., welders, grinders) in his shop. John observes that it takes a great deal of energy to run houses as we now run them, and it is challenging and expensive to make a single house energy self-sufficient (independent of the electrical grid). Groups of households, or villages and towns could probably be made energy self-reliant at a lower cost per household.

John suggested that the public would benefit from an inventory of renewable energy contractors and some sort of evaluation or standards for them.

John drew our attention to the 1998 Scientific American article: "The End of Cheap Oil" by Colin Campbell, one of the first recent articles in a reputable scientific journal to explain that a permanent decline in global oil production is likely to begin by 2010, leading to very high prices along with social and economic tensions.

Ralph Torrie

Ralph Torrie is the President of Torrie Smith Associates and an internationally recognized expert in the field of energy and sustainable development. He is the co-inventor of software for strategic planning of air pollution and greenhouse gas reduction that has been translated into several languages and is used in more than 300 cities on all five continents. He works and lectures throughout the world.

Ralph told us that conservation and efficiency should be given top priority. He said that a great deal can be accomplished with deep and extensive retrofits that would not only save energy but offer significant potential for local economic development. Ralph suggested that an energy inventory as outlined in the Rocky Mountain Institute's Community Energy Workbook would be very useful. Once completed it would suggest numerous projects. He suggested doing an inventory of local tradespeople that can do the work, facilitation of training, and working with municipalities.

David Delaney

David was educated as an electrical engineer. He retired in 1999 as Chairman of Plaintree Systems in Ottawa. He has a long-standing interest in energy and a particular interest in low-technology solar applications that can be used by large numbers of people at all income levels. He has researched and written extensively on fossil fuel depletion including a recent article for the Canadian Association of the Club of Rome's September 2005 newsletter "The Age of Oil".

According to David's understanding of the likely impact of fossil fuel depletion, global economic difficulties and widespread unemployment are likely to occur as fossil fuels become scarcer and more expensive, since much current economic activity depends on a growing supply of cheap oil. Therefore we must find ways to make our communities less dependent on a global economy that will struggle and contract with the shrinking oil supply.

David told us that our sustainable energy schematic was fine as far as it went, but that it should include food. Present methods of producing and distributing food are energy-intensive and unsustainable. He suggested that we focus on re-localizing the food system through food cooperatives, farmers markets and other models.

David emphasized the value of local economic development and increased community self-reliance. He told us "Anything you do to replace imports will create jobs in your community and reduce your exposure to contractions of the national and global economies. The most important kinds of jobs to create are not, as most economists will tell you, to make exports, but to replace imported products and services. The world won't buy your exports in a depression, but you'll still need the imports you may be able to replace by local production. If you do create exports, you should do your best to make them products that your community and neighbouring communities can consume now and continue to consume in a future global or national depression." He said that local currencies are a useful tool to facilitate local economic development. He recommends Richard Douthwaite's book, "Short circuit: strengthening local economies for security in an unstable world". The whole text of the book is available on line at www.feasta.org/documents/shortcircuit/.

Keeping warm in Ontario winters will be a significant challenge as oil, gasoline, and natural gas become scarcer and more expensive. David suggests that new houses should have twice the insulation recommended by the building code, and that older houses should be retrofitted with extra insulation where possible.

To meet future challenges of space and water heating, David favours low-technology solar applications such as low thermal mass sunspace air heaters, and solar batch water heaters.

A sunspace air heater can be made cheaply or expensively, depending on resources and desired durability. It is essentially a greenhouse attached to the south side of a house. It gets hot when the sun is shining (even in January), and cold at night. It should contain almost no thermal mass that would keep it warm after the sun goes down, thereby heating the out of doors. When the sun is shining, hot air flows by natural convection from the sunspace through vents or windows into the house. When the air in the sunspace is cooler than the air in the house, passive dampers made of light plastic film close the vents automatically (or the home owner closes the windows). Sunspace air heaters can provide a lot of free heat any time the sun is shining. They can be designed with appropriate overhangs to keep out the sun in summer.

Batch water heaters consist of a black water tank in a large insulated box with a reflective interior and a glass cover (a glazing unit from an old patio door makes an ideal cover). The water in the black tank heats up whenever the sun shines through the glass of the batch heater, pre-warming the water for a heater that uses purchased energy, or providing almost all hot water needed during the height of the summer.

David suggested that a useful role for ORI might be in establishing a community library

on low-tech solar thermal technology and community economic development. He recommends www.builditsolar.com as a good source of information on designs for sunspace air heaters and solar batch water heaters.

Profiles of Energy Innovators

Fourteen energy innovators were interviewed and photographed. The innovators are listed below, along with brief notes about the main findings from each interview. Profiles, with photographs, were prepared and posted on the ORI website (www.ottawariverinstitute.ca). Watershed Ways articles were written on each of the innovators and distributed to eight Ottawa Valley newspapers; these articles are reproduced in Appendix B.

This is merely a sampling of energy innovators in the Ottawa Valley. The profiles demonstrate many ways to use energy from renewable sources, and to use energy far more efficiently than is generally the case at present.

Energy efficiency and Solar heating

Renfrew County District School Board

Behavior changes initiated through the ORI-sponsored Destination Conservation program (such as turning off lights and computers when not in use and turning down the heat) resulted in $175,000 worth of energy savings the first year. Additional savings are possible using retrofits of efficient lighting, boilers and air exchangers. Active solar heating technology is in use at McNab Public School near Arnprior. (Article, page 29)

Micro Hydro

Andreas and Petra Vornweg, Killaloe

The Vornwegs generate 20 to 25 kilowatts of electricity (year round average) in their home on Brennan's Creek in Killaloe, Ontario. This is enough for 3-4 Canadian households (or more if usage were cut to European levels). There is significant unused potential for generation of electricity from micro hydro installations. The artificially-low price of electricity keeps this potential from being developed. (Article, page 30)

Solar water pumping

Bob Dobson, Snake River near Cobden

Solar photovoltaic technology can be used very effectively for water pumping in a cow-calf operation with a very short pay-back period, in a location where the cost of accessing the electrical grid would be prohibitive. (Article, page 32)

EnerGuide for Houses

John Bateson and Peggy Patterson, Pembroke

Significant improvements can be made to a home's energy efficiency, by having an EnerGuide blower door test, and plugging the cracks and crannies where air infiltration is occurring. (Article, page 31)

Insulated window covers

Dorothy Allemang, Arnprior

Attractive insulated Roman shades can greatly increase the R-value of windows. Other window insulation methods such as fabric-covered Styrofoam are possible. (Article, page 33)

Solar water heaters

EcoPerth, Perth

In most communities, a large number of homes will be appropriately situated to capture solar energy through a roof-mounted flat plate water heater. These units can be installed for about $2000. At current electricity rates these have a payback period of about seven years. (Article, page 35)

Energy efficient lighting for households

John Yakabuski, MPP for Renfrew Nipissing Pembroke, Barry's Bay

Replacing incandescent light bulbs with compact fluorescents can result in a significant reduction in monthly electricity bills. Compact fluorescents use roughly one-fourth of the electricity to produce the same amount of light. If each household in Ontario were to install one CF bulb per family member in one of their most-used fixtures, the energy saved would be equivalent to that produced by a 500-megawatt nuclear reactor. This would power 250,000 households in Ontario at current levels of electricity consumption. (Article, page 38)

"Small hydro" turbine manufacture

Canadian Hydro Components, Almonte

Highly-efficient, state-of-the-art small hydro turbines are manufactured in Almonte at Canadian Hydro Components. Ontario's low electricity rates and heavy subsidies for other technologies have left considerable potential for small hydro electricity generation untapped. Most of the small turbines manufactured in the Ottawa Valley are installed in the United States or overseas. (Article, page 42)

High efficiency solar heating, electricity and hot water

Dave Gerwing, Kanata

Embedding solar absorbers in a concave reflective surface greatly increases the efficiency of the capture of solar energy. The units are called Power-spars and can be used for space heating, water heating or electricity generation. (Article, page 41)

Off-grid living and passive solar water heating

Audrey and Richard Copeland, Matawatchan

A spacious, modern home can be energy self-sufficient, or off-grid, through a combination of wood heating for space and hot water, energy-conserving appliances and lights, and generation of electricity from solar panels and wind turbines. Passive solar water heating can provide an enjoyable, low-cost, three-season, outdoor shower. (Article, page 40)

Low-technology solar applications for space and water heating

David Delaney, Ottawa

Low-technology solar devices provide low-cost energy for domestic space and water heating. Low thermal-mass, passive-solar sunspaces can provide significant amounts of heat whenever the sun is shining. Batch or "breadbox" water heaters can provide significant quantities of warm to hot water most days. Low technology applications can be used by large numbers of people at all income levels; they will become increasingly important as fossil fuel supplies decline in coming years. (Article, page 36)

Energy-efficient building construction

Living Sol Building and Design, Killaloe

Super-insulation and passive solar design principles used in new construction can reduce heating costs by as much as two-thirds of the average cost for homes in Ontario. Several efficient, alternative water heating systems are available. (Article, page 39)

Household geothermal heating

Peter Saffrey, Micksburg

Geothermal heating and cooling systems are highly efficient and suitable for the Ottawa Valley climate. They currently provide space heating, cooling and hot water for 30,000 buildings across Canada at one-third of the cost of providing the same with electricity. (Article, page 43)

Biodiesel fuel from waste

Steve Anderson, Arnprior

Waste oil from restaurant deep fryers can be turned into fuel for diesel engines through a simple chemical process. The fuel is cleaner than regular diesel, cheaper, and uses a waste product. (Article, page 34)

Watershed Ways Articles

In addition to the fourteen Watershed Ways articles on energy innovators (described above), the following six articles on energy-related topics were researched, written and distributed to eight Ottawa Valley newspapers and posted on the ORI website. These articles are also included in Appendix B.

The bigger story behind Katrina
This article provides an overview of fossil fuel depletion. It outlines the special characteristics and myriad uses of oil. Problems likely to result from oil and natural gas depletion are identified. (Appendix B, page 44)

How to be a woodburning wizard
Tips for efficient household wood burning are provided in this article, along with information on wood as a sustainable source of heating fuel. (Appendix B, page 46)

Why not wood?
This article discusses district heating plants and cogeneration of electricity from wood biomass. Examples are provided of significant recent progress on district heating in Finland. (Appendix B, page 47)

A refreshing vision for Ontario's electricity future
Decentralized energy, a model that is coming increasingly popular in the European Union, is described and promoted in this article as an alternative to the inefficient and centralized model of power generation in Ontario. (Appendix B, page 48)

Ten easy ways to conserve electricity
The focus in this article is on things that homeowners can do to save significant amounts of electricity in their homes. Most of the suggestions don't cost anything. (Appendix B, page 50)

Burning issues: the changing forestry landscape
This article describes new uses for forest biomass and the need for long range planning to make optimal use of forests as a renewable resource. (Appendix B, page 51)

Wind Energy Forum

The sustainable energy committee held a forum on community wind power at the Municipal Hall in Cobden on April 7, 2005. It was attended by about 70 people from all over Renfrew County including representatives from five municipalities and M.P.P. John Yakabuski. The speakers were James Murphy from the Ontario Sustainable Energy Association (OSEA) and Don McIver, a wind expert from Environment Canada with experience in municipal politics and beef farming.

We learned from this forum that there is a lot of interest in the subject of wind energy in our communities. We learned of the great benefits of community-owned power projects and resources at OSEA and elsewhere for assisting communities interested in moving in this direction. We also learned of pitfalls to avoid, considerations for choosing a site, and the on-line Canadian Wind Atlas project of Environment Canada.

The Ottawa Valley meets the minimum wind speeds for generation of electricity. High-wind areas are found in areas of higher elevation. Even in less than ideal locations,

household wind installations can make a significant contribution of electricity for household needs. Community-owned projects can help strengthen local economies. While wind development is limited at present, there are good prospects for future wind energy projects here. A more detailed summary of the Wind Energy Forum is attached to this report as Appendix C.

Networking with the Ontario Sustainable Energy Association

The Ottawa River Institute became an associate member of the OSEA at the beginning of our exploration of sustainable energy.

James Murphy of OSEA gave an excellent talk on community wind energy at our April 2005 forum in Cobden. We networked with OSEA throughout the year. ORI President and sustainable energy committee member Ken Birkett attended the OSEA retreat in September 2005. From this meeting he brought back a good understanding of the importance of Standard Offer Contracts (SOC's) for a decentralized, sustainable energy future for Ontario. As a result, ORI chose to use its limited advocacy time (as required to maintain charitable status) to lobby the Ontario government in support of Standard Offer Contracts. ORI's letter to Energy Minister Donna Cansfield is attached to this report as Appendix D. Three members of the sustainable energy committee met with M.P.P. and Conservative Party energy critic John Yakabuski in January to brief him on SOC's and ask for his support.

In March 2006, the Ontario government announced the SOC plan, and although details are yet to be released, it appears that the SOC's will indeed be extended to all power producers, no matter how small, across the province. It is our understanding that this has the potential to be of significant benefit to Ontario's electricity generation picture in years to come, and that rural economies such as ours in the Ottawa Valley could greatly benefit from the increased economic activity related to power generation. The price offered per kilowatt hour will be a critical determinant of the success of the SOC initiative in stimulating significant development of generating capacity by small producers. Attracting potential small power producers and finding lenders who understand and are willing to support this type of investment is essential.

Conclusions

1. Sustainable energy has two components: sustainable levels of energy use and sustainable or renewable sources. "Sustainable energy means a level of consumption that does not use up resources faster than they can be replaced."

2. Truly sustainable levels of energy use are difficult to define. They are likely much lower than current average levels of use among residents of the Ottawa Valley (and the rest of North America).

3. There are many ways to move toward sustainable energy for transportation, heating and electricity (summarized on the sustainable energy schematic). Transportation may be the most difficult area in which to make a transition to sustainable levels of energy use.

4. Space heating and water heating require urgent attention since so many households are now using oil, gas and electricity.

5. District energy systems have considerable potential to heat towns and villages with a renewable resource that is plentiful in the Ottawa Valley, although the necessary infrastructure is expensive. They also have potential for cogeneration of electricity.

6. Low technology passive solar thermal applications may provide heat for space and hot water, at relatively low cost, for large numbers of people.

7. There is considerable potential for expansion of electricity generation from wind, solar, and small hydro at both household and community scales.

8. Food is inextricably linked to energy and needs more attention. A more sustainable diet of foods produced closer to where they are consumed using low-input agriculture is also an important priority.

9. Re-localization could greatly reduce energy consumption, stimulate and strengthen the local economy and reduce vulnerability to contractions of the national and global economies that are likely to occur when supplies of fossil fuels begin to decline.

Priority Shifts

Based on our research and conclusions, the committee feels the following shifts are key to making a transition to sustainable energy in the Ottawa Valley.

- Switching from space heating using fossil fuels and electricity to wood, passive solar and geothermal systems.

- Reducing heat requirements through smaller buildings, improved insulation and reduced air infiltration.

- Replacing fossil fuels and electricity as ways to heat water for residential consumption with wood, passive solar and active solar technologies.

- Moving from centralized generation of electricity to smaller-scale, local electricity generation from renewable sources (solar, wind, small hydro, biomass and biogas).

- Shifting to a more locally-based diet comprised mainly of organically-produced, whole foods in-season.

- Reducing reliance on personal automobiles through ride sharing or use of public transit for commuting and long distance travel, and walking and cycling where possible.

Possible Roles for the Ottawa River Institute

1. Plan and carry out (possibly in conjunction with municipalities or other partners) a program of "deep" retrofits for keeping the heat in and reducing electricity consumption (this could include education and training and advocacy). Alternatively undertake a smaller program of "homey" retrofits.

2. Carry out a community energy inventory as outlined in the Rocky Mountain Institute handbook.

3. Undertake a community-owned renewable energy project as per the OSEA model.

4. Sponsor workshops and / or tours on household wind and solar electricity generation and solar hot water heating.

5. Promote passive solar heating of space and hot water through education, training, demonstration projects, awareness-raising and advocacy.

6. Promote re-localization of the food supply through local food coops, community supported agriculture, expanded farmers markets, and demonstration gardens.

7. Promote and advocate for district heating, decentralized electricity generation (e.g., small hydro, wind, solar photovoltaic, biomass, biogas), public transit, and ride-sharing networks.

8. Continue consultations and information-sharing with municipal councils.

9. Work with municipal councils on local economic development/energy conservation retrofit work.

10. Sponsor community roundtables on healthy energy choices, local agriculture and transportation.

11. Make available resources on low-tech solar thermal applications and community economic development, through existing libraries or a new resource collection.

12. Continue education initiatives in the schools with a focus on sustainable energy.

13. Help people access government funding assistance for sustainable energy initiatives.

Vision of sustainable energy in the Ottawa Valley

Developing a vision of sustainable energy in the Ottawa Valley could be a project in itself. We have come closer to an understanding of what it might look like and offer the following preliminary glimpse as food for thought and further elaboration….

Communities in the Ottawa Valley produce much of their own energy. Small rural villages and towns are revitalized economically by controlling and providing for their own energy needs. Many small producers feed into the electrical grid and most of the power they produce is used locally. The availability of locally-produced power attracts other businesses to small communities, enabling economic diversification and self-reliance.

Electricity is generated from renewable sources such as small hydro, household wind turbines and wind farms, solar panels, solar roof shingles, biomass such as wood, wood waste and switch grass, and biogas from landfills and manure.

Electricity generation takes place close to the point of use. Heat produced is captured and distributed to nearby buildings through district energy systems.

Because electricity generation is a local affair, people are much more tuned in to using energy wisely, and have readily adopted sustainable levels of use.

Communities in the Ottawa Valley produce most of their own food and many other basic necessities. Communities are less affected by global and national economic recessions as a result of their increased self-reliance.

Many people live within walking or cycling distance of their jobs and the other places they need to go on a daily or weekly basis. A well-developed rural transportation network uses the internet to coordinate rides for people who need to travel outside their community. Vehicles are energy-efficient. Small amounts of biodiesel fuel are produced for farm operations and other essential services.

Passive solar design principles are used in all new construction of buildings. Where possible existing buildings have been super-insulated. In many cases, sunspace heaters have been added to provide solar heating in winter. Active space heating is in most cases provided by wood, wood waste and biomass such as switchgrass.

Quality of life has increased as energy waste has declined. People are more connected to their friends and neighbours. The Ottawa Valley is a mosaic of vibrant, diverse, healthy communities living in harmony with local ecosystems.

References

(1) **Earth is at the tipping point:** Why the crisis hit so soon -- and what we can do about it. Jeffrey Kluger, **Time Magazine**, April 3, 2006 (Full text available on-line at Energy Bulletin www.energybulletin.net)

(2) **The End of Oil**. Robert B. Semple Jr. **New York Times**. March 1, 2006. (Full text available on-line at Energy Bulletin www.energybulletin.net)

(3) **Ontario warned of power crisis**: TransAlta chief says brouwnouts loom unless province finds way to fill demand. Omar el Akkad. **Globe and Mail**, April 6, 2006

(4) **Survey of Household Energy Use - Summary Report**, Natural Resources Canada / Statistics Canada, www.statcan.ca, April 4 , 2006

(5) **Supply Mix Advice Report and Recommendations**. Ontario Power Authority. Toronto, December, 2005.

(6) **Designing a Clean Energy Future: A Resource Manual**. The Minnesota Project, University of Minnesota's Regional Sustainable Development Partnerships, July 2003

(7) **A New Electricity Strategy for Ontario: Increasing Productivity and Moving towards a Renewable Future**. Ontario Clean Air Alliance. Toronto, 2006.

(8) **Power for the Future: Towards a Sustainable Electricity System for Ontario: Update on Status of Recommendations**. Pembina Institute and Canadian Environmental Law Association. Toronto, November 2005.

(9) **The Age of Oil**. Proceedings of the Canadian Association for the Club of Rome. Ottawa, September 2005.

(10) **Smart Generation: Powering Ontario with Renewable Energy. David Suzuki Foundation**. Vancouver, 2004.

(11) **Primer on the Technologies of Renewable Energy**. Pollution Probe. Toronto, 2003.

(12) **The End of Cheap Oil**. Colin J. Campbell and Jean H. Laherrère, **Scientific American**, March 1998

(13) Short Circuit. Strengthening local economies for security in an unstable world. Richard Douthwaite. London, 1996. (Text available on-line at www.feasta.org)

(14) **Decentralising Power: An Energy Revolution for the 21st Century**. Greenpeace U.K. London, 2005.

(15) **The theory of energy return on investment: a case study of whole tree chipping for biomass in Prince Edward Island**. Jon Gingerich and Ole Hendrickson. Forestry Chronicle, June 1993.

(16) **Residential Wood Heating: The Forest, the Atmosphere and the Public Consciousness**. John Gulland and Ole Hendrickson. Air & Waste Management Association 86th Annual Meeting, June 1993.

(17) **Community Energy Workbook**. Rocky Mountain Institute. www.rmi.org. 1995.

(18) **Meeting Ontario's Electricity Needs**: A critical review of the Ontario Power Authority's supply mix advice report. Jack Gibbons. Ontario Clean Air Alliance. January 27, 2006.

(19) **Canadian Renewable Energy Network website www.canren.gc.ca**

Appendix A

Report on consultations with municipal councils

Seven municipal councils (Table 1) generously gave roughly 30 minutes each to assist the ORI's sustainable energy project. The consultations took place between November 1, 2005 and February 6, 2006.

To help guide discussions, councillors were provided with the sustainable energy schematic (Figure 1, page 6) addressing transportation, heating, and electricity. Sometimes councillors raised points not directly covered on the diagram, such as the need to provide the public with access to information on government programs, and the importance of working with schools.

Discussions mainly occurred among council members. Local residents attending council meetings sometimes offered comments as well.

Table 1. Municipal consultations for the ORI Sustainable Energy Project

Municipality	Date
Horton Township	November 1, 2005
Township of McNab/Braeside	November 8, 2005
Greater Madawaska Township	November 10, 2005
Town of Arnprior	December 19, 2005
Township of Bonnechere Valley	January 23, 2006
Golden Lake Pikwakanagan Council	January 24, 2006
Town of Renfrew	February 6, 2006

Horton Township, November 1, 2005

Horton Township councilors agreed that there is considerable potential for car pooling. Many township residents commute to Ottawa or Arnprior. People seeking rides may post notes in public places such as the post office, but there is no formal means to connect people seeking rides to people offering rides. Public bus service from Haley Station to Renfrew has been terminated. With the price of fuel going up, people will be looking for ways to reduce commuting costs.

The absence of high speed internet represents a huge impediment to teleworking. Bell Canada does not provide broadband service, and wireless internet is also lacking.

Councilors were familiar with Steve Anderson's work in producing biodiesel from vegetable oil wastes.

With regard to alternative modes of transport, "It's pretty much motorized out here."

Councilors discussed reducing energy and costs for home heating through retrofits, and specifically mentioned the Energuide for Houses program. They noted the potential to upgrade windows or door frames, and pointed out that there are lots of older farmhouses in the township. One council member had heard a recent announcement of new federal funding in this area that would cover 50% of the costs of inspection.

Councilors suggested purchase of efficient furnaces and other heating appliances could include partial subsidies or refund of sales tax.

Almost all homes in township are single family, with a few duplexes and in-law suites. Duplexes are permitted under current zoning regulations, and larger multi-family dwellings are possible with zoning amendments.

Councilors noted that cogeneration of heat and electric power from either wood residues or garbage is worth considering, but added that this is impeded by "layers of red tape." They

questioned why waste incineration for energy is not receiving more attention as would provide the additional benefit of diverting garbage from the landfill.

District energy systems would apply more in towns such as Renfrew, with its hospital and other public buildings.

Councilors suggested an emphasis on urging people to conserve electricity. It is important to let them know how much they can save in dollars and cents, and to provide realistic scenarios.

Councilors noted that a Douglas gentleman has wind and solar installations and may want to sell the technology to others. He is also interested in selling power to the grid and is looking into net metering. We discussed the possibility that Standard Offer Contracts could encourage this by allowing power to be sold at a higher rate, instead of just offsetting what is taken out.

A micro hydro site in the township has potential. Again, there is a need to have information on return on investment, and a perception is that red tape is a difficulty.

Engaging the general public and the community must be given priority. People want to know what they can do at what cost. For all the alternative energy sources and opportunities for conservation, people need to know the payback.

The discussion concluded on the topic of solar hot water heating, and the possibility that ORI would host a demonstration event. Information would be provided to the public on how much we spend each day on average for electric hot water heating, what a solar system would cost, and what the payback period might be. It was noted that estimating payback depends on future electricity prices, and forecasting future prices is difficult.

Township of McNab/Braeside, November 8, 2005

The Ministry of Transportation – Ontario (MTO) is preparing plans for the extension of highway 417 past Arnprior to Renfrew. The Township suggested, and MTO agreed, to construct a "Park & Ride" at the Calabogie Road (Highway 508) intersection.

Car pools are an obvious option. The MTO agreed to put the Park & Ride at Calabogie Road because there is already considerable interest. Some large companies in Kanata have run employee buses in the past. There are commuter buses from Arnprior to Ottawa. Their use needs to be encouraged

With regard to work-at-home arrangements, lack of high-speed internet is an obstacle. One councilor has a family member in the publications business. They could download and work on large documents at home if high-speed internet were available. Under this arrangement they would probably only go into work an average of one day per week.

With regard to ethanol, Cornwall has been trying to get a new plant for many years. When regulations present obstacles, investors take their money elsewhere.

The township has invested in a 17-km recreational trail that extends from Arnprior to Horton Township. This is not really aimed at regular transportation needs, but it may work for certain individuals.

An ORI speaker introduced the notion of straw-bale homes, and asked if any of the councilors were familiar with them, or knew of issues related to building codes, bylaws, or insurance. He mentioned the proposed "Eco-Village" in southern Ontario, which will use both straw-bale construction and off-grid electricity supplies.

One of the councilors was aware of the "tire house" that had been built locally and suggested this as another alternative. The need for local building inspectors to be familiar with these alternative building types was noted. It was noted that these can be quite attractive and aesthetics should not be an issue.

Some people who heat with wood are reporting problems with their insurance companies, who feel that fire risks are increased.

Heating fuel price increases will force an examination of fuel-efficient stoves and furnaces. Outdoor wood furnaces were noted as an option but "they're hard on wood, not efficient."

Councilors noted that a new solar heating system has been installed at McNab Public School. The system will run on a series of units called Power Spars, an innovative device for capturing solar energy. In the initial phase, the devices will be used to generate hot water to heat the school; future phases may involve generation of electricity.

District energy and cogeneration are difficult options given the low population densities in the Township.

In discussing on hot water heating, councilors notes that most homes lack access to natural gas. Options are electric or propane for hot water heating. Given these choices, which is better? One of the councilors suggested providing additional information on passive solar hot water heating.

A councilor asked about small hydro installations that do not require a dam. There has been interest in Bonnechere First Chute, near Castleford, close to where the river empties into the Ottawa. There was once a mill at this location, but it no longer exists.

There are three small hydro producers on Waba Creek – David Fraser, George Barrie, and Morris Stewart.

Greater Madawaska Township, November 10, 2005

Car pooling and ride sharing are difficult given the dispersed population. There are opportunities to link people who live in localized areas, such as some of the smaller hamlets or communities, from which cars go out daily.

Work at home arrangements would be a real asset. High speed internet would greatly facilitate this. A small wireless internet unit that the Township could purchase would be of interest. Nortel is promoting wireless internet and could be contacted to develop a partnership.

There is no public transit in the township. Buses, trains, etc. are very difficult for a rural area.

With regard to more efficient vehicles, the population drives what it can afford. People need to be convinced that they would save money by driving at a lower speed. Information on fuel savings associated with lower driving speeds or lower speed limits would be helpful.

There should be support for the folks in Winchester who are trying to get an ethanol plant in place.

To save winter heating costs, one councilor is closing off the back half of their house for winter. It was noted that many people are building larger houses, but there are also trends towards downsizing, particularly as people age. An education effort is needed to get people thinking about the downsizing option.

The local building code is not a barrier to straw bale construction. Multi-family homes are a possibility but would require special zoning.

Electric baseboard heating is recognized as being inefficient, but information is needed about the alternatives. One councilor who heats with wood asks, "What do you do when you go away? Is it better to use propane than baseboard heaters?" It would be helpful for people to have some general information on this.

With regard to Energuide for Houses retrofits, councilors noted that there was a time when Ontario Hydro would come and do an audit of your home. Why is this no longer available? A councilor had heard a suggestion from Hydro One that they might have an announcement of support for home audits, perhaps linked to funding for retrofits. ORI should check on the status of this.

Retrofits are also an option for commercial buildings. Another possibility is to cluster new commercial buildings at a single location.

With regard to alternatives like active and passive solar, biogas, and geothermal heat, people won't understand these unless they have more information, and simple explanations.

One councilor suggested that wood is an "excellent" option for heating homes, especially with high-efficiency, low-emission wood stoves. It was suggested that ORI explain to the public that wood is carbon neutral.

Outside wood furnaces, on the other hand, have created air quality problems in some hamlets, leading to restrictions on their use.

Councilors noted that certain terms will not be familiar to people – the concept of "distributed generation", for example. An ORI spokesperson explained that this means more sources such as home- or community-scale wind or solar electricity, and greater efficiency owing to lower transmission losses.

Councilors noted that a wind turbine farm has been proposed for Evergreen Mountain on the far side of Centennial Lake, but this proposal is currently in abeyance.

The Reeve and the CEO of the Township had both heard a series of presentations on "energy from waste" at a meeting of the Association of Municipalities of Ontario. John Baird could provide contact information.

A member of the public suggested a student works program to change from incandescent to fluorescent lighting, including in commercial buildings. It would be helpful if there was a standard audit procedure that could examine the costs and benefits of prompt versus staggered change for lighting.

Town of Arnprior, December 19, 2005

Many Arnprior residents commute to Ottawa. Car pools, ride shares, fewer trips are all options. Consideration could be given to "car pool only" lanes on the 417. Making the highway four lanes all the way to Arnprior has increased average speed, so limiting fuel consumption through lower speed is unrealistic.

With regard to teleworking, "those who can work at home are doing it."

With regard to public transit, there have been several meetings on train service to Arnprior, but the $800M estimated cost was deemed to be prohibitive. When there was a threat that bus service to Ottawa would be canceled, many people contacted councilors to voice their opposition.

Ethanol – gasoline blends are available. One councilor noted that his family regularly uses ethanol blends. They feel it is cleaner, no more expensive, and better for the environment.

There are lots of bicyclists in Arnprior. Some have suggested adding bike lanes on streets in town, but the width of streets makes this difficult. There is a bike lane on the bridge across the Madawaska River.

Councilors receive many calls about Energuide and retrofit programs. They suggest making information available on ORI's web site. Most people find it difficult to locate relevant information on government web sites.

The size of house lots in Arnprior is getting smaller, and development more intensive.

Local building codes might make it difficult to build a straw bale house.

Wood is an important energy source. A district heating facility would be worth consideration.

The landfill site might be a source of "energy from waste". Arnprior is also looking at becoming a test site for an enhanced recycling program. There is interest in re-use, as opposing to crushing, of glass.

It was noted that McNab School has a new solar heating system.

ORI should consider strengthening its information/education function. People need information on Energuide and retrofits. Destination Conservation has been a successful program in the schools. It should be considered as a means of "getting the word out" to parents. Getting involved with school children is generally an excellent idea.

In general, the concept of using less – energy conservation - is the way to go. A cultural shift of the type that has occurred with smoking is needed. Again, schools should be involved, as children are good at influencing their parents.

The council is looking into increasing the energy efficiency of city hall. The new "Town of Arnprior" sign is powered by a solar panel. Electric heaters in the recreation center are being replaced with more efficient gas heaters.

Better tracking of energy use is a priority.

A study was done of the potential to build a wind turbine at the airport, but the cost-benefit analysis did not prove favorable. A private landowner looked into wind energy and also decided not to invest in it.

At the end of the discussion, Arnprior councilors again emphasized that ORI should continue its information sharing and public awareness efforts, and suggested that this may be more effective than trying to implement on-the-ground projects.

Bonnechere Valley Municipal Council, January 23, 2006

The Bonnechere Valley council has just authorized an audit of energy consumption in all of their buildings. They will be looking at more cost effective heating, lighting, insulation etc.

Some things the council would like to see available in the area include:

- high-speed internet (they may be interested in supporting a community of councils to pursue this);
- government incentives to re-insulate older homes;
- increased use of geo-thermal heating; and
- increased use of ethanol.

There is some limited interest in bio-diesel fuel.

A company is currently looking at installing wind generators along the Opeongo ridge from Foymount to Dacre.

Councilors noted that with wind generation now being permitted in rural areas there is a need to create a more inclusive zoning category for wind generators. Wind generators are now permitted on land zoned rural. Adding extractive lands to this is being considered. Planners tend to restrict first and later to make allowances.

A councilor noted that economic advantages are the best motivator toward conservation.

Golden Lake Pikwakanagan Council, January 24, 2006

Local residents are already giving attention to carpooling for travel to work locations outside Golden Lake, although only a small percentage of their population has to commute to work. There are also efforts to plan around medical appointments, home care appointments, etc. so that one trip serves more than one need. Home Care service provides transportation to seniors for appointments.

With respect to heating there is one example of shared heating with an outdoor furnace. Most people have more than one alternative for home heating (e.g., oil and wood).

With the high cost of electric heating the council chose to convert a large number of rental units from electric to oil furnaces.

A good deal of new construction is moving toward in-floor heating.

The council observed that economical heating is always a concern.

Approximately four years ago the council requested to be a pilot project for smart metering. They did not hear back about this request. They are still interested in having smart meters as a means of raising awareness about their energy usage.

The council voiced interest in receiving information on the following areas:

- Are there any government initiatives for installing solar hot water heating?
- Is there a schematic for comparing various types of energy?

- Where is corn and wood pellet heating at these days?

They would be interested in becoming more educated about energy-saving tips.

This council is interested in being informed about what other councils in the valley are doing about energy conservation and alternatives.

Town of Renfrew, February 6, 2006

The council described the community of Renfrew as being innovative. There are many initiatives that are undertaken without council involvement (e.g. a park and ride program for people traveling to and from Ottawa by bus). The parking for this program is on municipal property.

High speed internet is in use in Renfrew.

The council makes use of teleconferencing and video conferencing.

Ethanol is available as a fuel choice in Renfrew.

New houses are generally being built more efficiently. In response to market demand one builder is building smaller homes. More efficient appliances are also available.

The municipality has been investigating various ways of creating energy. Some industries are already making use of sawdust and wood pellets.

With respect to electricity conservation, smart meters are being used at the water treatment facility.

Energy audits were done in the past and numerous changes were made as a result. In municipal buildings lights and computers are turned off when not in use. Light fixtures are on timers.

At the arena, all water is heated from the compressor.

Water meters have just been installed in the town and are used by schools as well.

Public transit was recently researched and cost proved prohibitive to implementing this.

There was concern with bus transportation not being convenient in and out of Renfrew due to the poor location for the bus depot.

There are no trains available now in the area. The consensus is that their use would not be great even if they were available.

Appendix B

Watershed Ways articles on energy innovators and sustainable energy

Leading the list of energy innovators in the valley
By Lynn Jones
September 4, 2005

With this article the Ottawa River Institute begins a series on energy innovators in the Ottawa Valley. As everyone knows, oil and gas are finite resources. The supply of both is expected to begin to decline soon and prices to rise sharply as a result. Burning of fossil fuels also contributes to climate change. Therefore it behooves us all to learn more about conservation and alternatives. Fortunately here in the Ottawa Valley there are many pioneers that are leading the way.

It may surprise some readers to learn that one of the most inspiring energy innovators in the Ottawa Valley is a large institution that is central to the lives of many Valley families. In the past couple of years, the Renfrew County District School Board (RCDSB) has made a series of breath-taking innovations that have saved large amounts of energy and placed it on the leading edge of energy innovation, not just in the Ottawa Valley, but in the province and country as well.

Two years ago, in the fall of 2003, the RCDSB embarked upon a program called "Destination Conservation" in most of its 26 elementary schools. The DC program, which began in Alberta, involves students, teachers, custodians, parents and principals in conserving energy in their schools. Grade five teachers and students receive extensive training and then take a leadership role in their schools, conducting energy audits and behaviour change programs. DC was sponsored initially by the Ottawa River Institute through a grant from the Ontario Trillium Foundation.

The RCDSB's success with the DC program has far surpassed results obtained elsewhere in the province. The trainers have been very impressed by the attendance and enthusiasm of the participants. And the results speak for themselves. James Brose, energy management coordinator for the Board so far estimates that annual utility savings on the order of 175 thousand dollars have been achieved from behaviour changes such as turning off lights and computers when not in use, turning down the heat, keeping radiators clear and making sure that exhaust fans don't run unnecessarily. The Board is set to begin the third and final year of DC in its elementary schools and would like to extend the program to include high schools this year.

Last summer, with funding from Natural Resources Canada, the RCDSB conducted energy efficiency retrofits on five of its elementary schools. Changes included upgrading of insulation, installation of new windows, new lighting and installation of new heating systems including new modular boilers that are much more efficient and adjustable to varying demands for heat throughout the building and the school-year. A particularly innovative addition at three of the schools was a heat wheel ventilation unit, a big wheel covered by a fine synthetic membrane that mixes incoming and outgoing air resulting in considerable energy savings and a great improvement to comfort.

To keep track of its energy savings (a requirement of its NRCan grant) the RCDSB has developed an energy monitoring and tracking system that is very impressive in its sophistication and simplicity of use. All energy-using devices in every school down to the last light-bulb are tracked and data are accessible to staff and students through a web interface. The system is called Energy Investigator and provides staff and students with immediate feedback on the impact of their programs to reduce energy consumption. The system was fully operational for the start of the current school year.

Also new for the current school year is a solar heating system at McNab Public School. The system is based on a series of 33 units called Power Spars, an innovative device for capturing solar energy and using it to heat water or generate electricity. These devices are designed and manufactured in Kanata by a company named Minova. The system is expected to provide 66%

of total heating for the school, with the balance coming from propane boilers. NRCan staff are very interested in this project and will be using data from McNab school to verify some of their projections about solar heating systems. There is also a high level of interest from other school boards and municipalities.

Congratulations to RCDSB Director of Education Eleanor Newman, Energy Management Coordinator James Brose, Curriculum Coordinator Sherri Wylie, Board members, staff and students, for outstanding examples of energy innovation. We applaud your leadership!

Water power pioneers in Killaloe
By Lynn Jones
September 4, 2005

This article is the second in a series by the Ottawa River Institute on energy innovators in the Ottawa Valley. As everyone knows, oil and gas are finite resources. The supply of both is expected to begin to decline soon and prices to rise sharply as a result. Burning of fossil fuels also contributes to climate change. Therefore it behooves us all to learn more about conservation and alternatives. Fortunately here in the Ottawa Valley there are many pioneers that are leading the way.

Andreas and Petra Vornweg and their two daughters live in a very unusual house. A creek runs through their home in Killaloe, Ontario and a small turbine captures enough energy from the gently flowing water to power 3 or 4 nearby homes besides their own.

This scale of power generation from falling water is called “micro hydro” and it is underutilized in Canada at present. According to Andreas, in his home country of Germany, there are over 30,000 microhydro installations, whereas here in Ontario, there are only 60-some.

The Vornweg home used to be a grist mill. It was built in 1876 and when they bought it in 1991, it still had two very nice, but very inefficient old turbines. They put in a new turbine, manufactured by Canadian Hydro Components in Almonte, a leading hydro component company that installs turbines all over the world.

The Vornweg living quarters are beautifully renovated, modern, comfortable and energy-efficient. Although they share the big red mill building with white water and a hydro turbine, you wouldn’t know it if they didn’t take you downstairs and show you the installation. As you get closer to the water, descending old stone steps past ancient wooden beams, the noise becomes considerable and you can actually see the frothing water. Inside their living space though, you can’t hear the turbine at all.

Water power available from creeks and rivers is more abundant at some times in the year than at others so the Vornwegs do use some power from the electrical grid. To keep track of the coming and going of energy in their house, they have two electrical meters – one spins when they are producing and the other when they are using (if the turbine shut down for some reason). They get paid by Ontario Power Generation for everything they produce and get a bill for what they use.

The net result is that they make a few thousand dollars per year. Their system was paid for within 10 years. Andreas points out that the system would have paid for itself much sooner if Ontario had a realistic price for electricity. The price currently paid to small generators like the Vornwegs and charged to consumers is kept artificially low at around 5 cents per kilowatt-hour. A more realistic price according to Andreas would be 10 to 15 cents per kilowatt-hour. (A kilowatt-hour (kWh) is the amount of energy consumed by ten 100-watt light-bulbs burning for one hour.)

The Vornwegs’ year-round average production level is 20 to 25 kilowatts. To get a sense of how much energy this is, imagine 20 or 25 houses each with ten 100-watt lightbulbs burning 24 hours a day, seven days per week for the whole year. This is enough to power 3-4 houses in Canada

or 10-15 houses in a more energy-conscious and efficient country like Germany.

There is a lot of potential for increased use of microhydro in Ontario. As we move toward paying the real price of electricity in coming years, and start to experience the end of cheap fossil fuels, this ancient method of power generation will likely make a comeback.

Putting a "blower door" to good use
by Janet McNeill
October 17, 2005

This article is third in a series by the Ottawa River Institute on energy innovators in the Ottawa Valley. As we all know, oil and gas are finite resources. The supply of both is expected to begin to decline soon, and prices to rise sharply as a result. Since the burning of fossil fuels also contributes to climate change, it behooves us all to learn more about conservation and alternatives. Fortunately, here in the Ottawa Valley there are many pioneers leading the way!

Did you know that it is possible to get an EnerGuide rating for your house? And that it will tell you how energy-efficient your house is compared to others the same size and age in your climate zone? Well it is and it does, and it's all part of a program from Natural Resources Canada called EnerGuide for Houses. Even better, the program provides funding to partly reimburse participants for any improvements they make to their home's "energy performance".

The EnerGuide program uses sophisticated tools and software to determine the "energy performance" of a house and find sources of heat loss and energy wastage. One of the tools is a bright red "blower door" that the technician installs in the front door opening. Then, with all of the doors, windows, flues and other openings tightly closed, air is sucked out of the house by a big fan that is built into the blower door. This enables the technician to walk through the house and find air leaks, as the suction creates quite a draft. The cracks and crannies discovered this way can add up to a hole that is one square foot or more in size resulting in heat loss worth about $500 each year on average.

For John Bateson and Peggy Patterson of Pembroke, taking advantage of the EnerGuide for Houses program has been a win-win-win scenario resulting in reduced energy consumption, lower fuel bills, a warmer, more comfortable house, and reduced greenhouse gas emissions.

Peggy and John got an EnerGuide home energy assessment done in 2002 because their house was drafty and felt cold in the winter, even when the thermostat was turned up. One of the bedrooms in their house was particularly cold, and they couldn't figure out why.

The assessment of the Bateson-Patterson wood and stucco 1910-era house, which had some insulation in the attic, but none in the walls, took a couple of hours. Their rating came in at 57 out of a possible 100, and the report stated that, if they made the recommended improvements, their rating could go up to 75. It also estimated percentage savings for each recommendation, and the approximate payback period.

There were some surprising findings. For one thing, there was an air leak in the attic that was sending cool air down a plumbing chase into the basement. There were other unexpected leak locations, particularly in the cold bedroom, that John and Peggy would not have been able to track down without professional assistance.

One of the easy recommendations was to reduce air leakage by 30%, which they achieved by doing some caulking. The big job they needed to do involved having insulation blown into the home's walls – work they had performed by a contractor that cost them around $2,500.

After the work was done in the summer of 2004, the house was re-evaluated and their rating

increased to 75. So far this year, their gas consumption has been 25% less than last year. As well as making their home more energy-efficient and thus saving them money, they now find their house much more comfortable in both summer and winter, and also quieter.

After spending about $2500, their reimbursement from the government was $614, and they also received a $150 credit on their gas bill from Enbridge. Along with lower heating bills, they feel good about reducing their contribution to climate change.

John is an enthusiastic supporter of the EnerGuide program. His advice? “Do it!” He also suggests making sure one has a qualified contractor by asking for references, and using cellulose insulation rather than fibreglass which is carcinogenic.

In order to receive the federal rebate you must have a home energy assessment done. The Bateson-Pattersons booked their assessment through the EnviroCentre in Ottawa (613- 580-2852).

A great source of information on the EnerGuide for Houses program is the Green Communities EnerGuide for Houses website (www.egh.gca.ca) or call them at 1-888-661-0000. Exciting recent changes to the EnerGuide for Houses program include an extension to rental units and a program especially for low-income households.

Ontario's Hydro One recently announced that qualified low-income customers heating their homes electrically are eligible to receive a free EnerGuide assessment and a grant up to $3,000 for energy efficiency retrofits. Call 1-877-506-7584 for more info.

Using energy from the sun to pump water
by Lynn Jones
November 4, 2005

This article is fourth in a series by the Ottawa River Institute on energy innovators in the Ottawa Valley. As we all know, oil, gas and coal are finite resources. The supply of both is expected to begin to decline soon, and prices to rise sharply as a result. Since the burning of fossil fuels also contributes to climate change, it behooves us all to learn more about conservation and alternatives. Fortunately, here in the Ottawa Valley there are many pioneers leading the way!

One of the most important and least considered uses of electricity is for pumping water. This is especially true in rural areas where homeowners rely on wells and farmers pump large quantities of water for their livestock.

Fossil fuel depletion affects price and availability of electricity in two ways. First, natural gas and coal are used to generate much of our electricity. Second, oil is needed to fuel the equipment used to produce and transport fossil fuels, to maintain pipeline and power grids, and so forth; thus impacting on many steps in the production and use of electricity.

It’s somewhat reassuring therefore to know that we all have access to a readily available, inexhaustible source of energy for pumping water – the sun.

Bob Dobson, of Snake River near Cobden, has been using solar energy to pump water for his cow-calf farm for the past ten years. The system is powered by two 75-watt solar panels which capture the energy from the sun and store it in two 12-volt deep cell marine batteries; these in turn send power to the 24-volt floating pump.

The water for the system comes from a man-made, spring-fed pond. Three well tiles are buried in the ground ten feet away from the pond. They are connected to the pond, and are thus about

half full of water year-round. The pump floats inside the well tiles.

A watering trough for the cattle is 600 feet away and slightly elevated from the location of the pump. Water is pumped 15 feet vertically and 600 feet horizontally. The pump, activated by an electronic float, fills the 1000-gallon trough in about 20 minutes. It comes on when the trough is half empty and turns off when the trough is full.

The system operates without any human intervention at temperatures as low as 10 degrees C. Below minus 10, it requires minimal management, for example breaking ice on the surface of the water in the trough.

The full water requirement for100 cows and their offspring, can be provided by this system, even on the hottest days in the summer. In fact, it is ideally suited for this purpose since, on the hottest days, when the cattle are drinking a lot more water, the system is absorbing a lot more solar energy!

The system cost about $5500 to install. Half of the cost was recovered by a federal-provincial funding program for environmental protection on farms. The batteries cost about $250 (total) and need to be replaced every 6-7 years, but savings in not having to purchase electricity from the grid easily pay for these batteries.

There are many advantages to this system beyond saving money on electricity. In fact, the system was specifically designed for the landscape, the environment, and a carefully-considered, rotational grazing system for the Dobsons' grass-fed cattle, to maximize benefits to the environment, the cattle and the farm ecosystem. Keeping cattle out of the stream prevents pink eye and foot rot, and keeps the water clean. The improved health of the cattle and extra gain (gain increases proportionally with the quality of drinking water), have paid for the system many times over.

Bob suggests that similar projects can be partly funded by the recently-announced Canada Ontario Environmental Farm Plan program. Details are available on the Ontario Soil and Crop Association website at www.ontariosoilcrop.org. He also questions why there are not yet any programs to support home-owners who wish to install renewable energy generating systems?

Warmth through window covers
by Janet McNeill
November 20, 2005

This article is fifth in a series by the Ottawa River Institute on energy innovators in the Ottawa Valley. As we all know, oil, gas and coal are finite resources. The supply of both is expected to begin to decline soon, and prices to rise sharply as a result. Since the burning of fossil fuels also contributes to climate change, it behooves us all to learn more about conservation and alternatives. Fortunately, here in the Ottawa Valley there are many pioneers leading the way!

With winter on its way, and fuel costs rising, it’s a perfect time to hear about innovations in the area of window coverings – especially since, according to the Ministry of Municipal Affairs, heat loss through windows can account for as much as 25% of the average fuel bill.

Window quilts are one very effective type of insulated window covering. They usually consist of layers of fabric, insulation, mylar, and lining quilted together and made into attractive Roman shades. When made to cover a window opening and fitted with magnetic tape or wooden strips on hinges to seal them shut when they are lowered, they can increase the insulating value of a window from four to five times over that of a double-pane glass window!

Arnprior resident Dorothy Allemang has been making and using window quilts since the early 1980's when she learned about them from a provincial government publication. During the 80's

and early 90's, she made many attractive and practical creations for customers all over the Ottawa Valley.

According to Dorothy, window quilts greatly increase the comfort level of a room in both summer and winter. In summer they keep the radiant heat out and in winter they keep the radiant heat in. They also block air currents. They are an ideal do-it-yourself project for someone who sews, as they are not overly complicated to make. A complete guide to making them, called "Shades for Comfort" can be downloaded free from the internet at www.warmcompany.com.

There are many other ways warm up your windows. One ingenious soul from the Killaloe area recently told me about two kinds of window coverings she has experimented with. The first was for three, large south-facing windows in her former apartment. She took two-inch white Styrofoam boards, cut to fit the window opening and covered them with bed coverings not then in use. Each day in the winter, as the day wore on and the temperature grew cooler, she would place the covered boards into the windows, saving a great deal of heat from escaping through the windows in the process. She also used them in the summer, to keep the apartment cool.

Now she is in a different home and continuing her window-covering experiments for her two sets south-facing windows and a patio door, around which heat loss is generally considerable. For the summer months, she put together a layer of cotton broadcloth with a silver emergency blanket, using duct tape to hold them together and grommets for hanging purposes. For winter, still experimenting, she is adding a layer of reused drapery fabric, reinforced with more grommets. It delights her to think that, in doing this, she is both saving energy and reducing waste by creating new purpose for drapery fabrics and bedding not otherwise in use.

If you are interested in learning more about making window quilts or window coverings, or if you have tips of your own to share, please contact the Ottawa River Institute at 613-735-6444. Workshops on making insulated window quilts and/or boards can be organized if sufficient numbers of people are interested in attending.

Waste cooking oil powers cars, trucks and buses
By Lynn Jones
November 12, 2005

This article is sixth in a series by the Ottawa River Institute on energy innovators in the Ottawa Valley. As everyone knows, oil and gas are finite resources. The supply of both is expected to begin to decline soon and prices to rise sharply as a result. Burning of fossil fuels also contributes to climate change. For both reasons, we need to get better at energy conservation and using energy from renewable sources. Fortunately here in the Ottawa Valley there are many pioneers that are leading the way.

On a beautiful sunny day recently, out in the country near Wilno, Steve Anderson of Arnprior shared his knowledge of how to convert waste cooking oil from restaurant deep fryers into fuel for his diesel engine pick-up truck. More than 40 interested folks from around Renfrew County and as far away as Burk's Falls attended.

Fuel from waste cooking oil is called "biodiesel" and it can be made from vegetable oils and animal fats according to a pamphlet from Natural Resources Canada. Steve prefers canola oil. It makes very good biodiesel, and by collecting it from restaurants he is helping to re-use a waste product.

The process for turning waste cooking oil into biodiesel involves several steps. The oil is filtered, warmed, stirred, and then mixed with lye dissolved in wood alcohol. The lye causes a chemical change to take place in the cooking oil, turning it into a mixture of biodiesel fuel and glycerine. Some equipment is required but it is fairly simple, and Steve has put his system together from previously-used materials, such as a heating element from a discarded hot water heater, plastic

pails, and an electric drill.

Steve estimates that his fuel costs him 75 cents per litre compared with about $1 per litre for petroleum diesel fuel or “dino” diesel as he likes to call it. For the last two years he has fueled his truck and another family vehicle with straight biodiesel, except in the coldest months of the year when he mixes in 50% regular diesel, due to the fact that biodiesel gels at a higher temperature than its fossil fuel relation.

No modifications to the engine are needed in order to burn biodiesel. As Steve points out, the original diesel engine, demonstrated by Rudolf Diesel in 1893, ran on vegetable oil.

Steve has recently given six demonstrations on making biodiesel to interested groups around the valley, and has sold some biodiesel to interested individuals. He advises folks to start gradually with 10% biodiesel and work their way up to 100%. He also advises purchase of a spare fuel filter since biodiesel cleans the fuel tank, engine and other components due to its higher solvent action.

Many people all over the world are making and using biodiesel. In Canada, several municipalities have experimented with mixing biodiesel and regular diesel- with biodiesel constituting up to 20% of the mix- and using the resulting fuel in bus and truck fleets with excellent results.

According to Natural Resources Canada, there are many advantages to biodiesel. It is versatile, readily biodegradable in water, and it produces fewer emissions than petroleum fuel when burned. There are also engine benefits associated with biodiesel use since it is a very good lubricant.

With the world facing fossil fuel depletion in the near future, biodiesel can play an increasingly important role as liquid fuel for motorized vehicles. While it is clear that there is not enough arable land in the world to replace petroleum with biodiesel, it can play a role in a sustainable energy future where we carefully use liquid fuels for essential activities.

A wealth of information on making biodiesel from waste cooking oil is available on the Journey to Forever website at: www.journeytoforever.org. Natural Resources Canada’s Office of Energy Efficiency offers information on biodiesel for municipalities and members of the general public.

Let the sun heat your water
By Janet McNeill
December 4, 2005

This article is seventh in a series by the Ottawa River Institute on energy innovators in the Ottawa Valley. As everyone knows, oil and gas are finite resources. The supply of both is expected to begin to decline soon and prices to rise sharply as a result. Burning of fossil fuels also contributes to climate change. For both reasons, we need to get better at energy conservation and using energy from renewable sources. Fortunately here in the Ottawa Valley there are many pioneers that are leading the way.

The small town of Perth, in the south-west corner of the Ottawa River watershed, is home to an organization that has set out to show how a small town in central Canada can respond to the issues of climate change. The organization is called EcoPerth and one of its most innovative projects is aimed at increasing the use of solar energy for hot water heating.

A solar water heater can provide enough solar energy to meet about one half of the water heating energy needs for a family of four. Solar water heaters are thus a good way to reduce direct and indirect fossil fuel use.

Beginning a few years ago, EcoPerth mapped their town to determine how many houses could properly accommodate solar water heaters. An impressive 74% were found to be suitable, meaning their roofs are oriented between southwest and southeast, slope between 20 and 60 degrees, are un-shaded for most of the mid-afternoon, and have enough space for one or two solar panels (other factors include the shape of the roof and the presence of any possible obstructions).

EcoPerth partnered with a company called EnerWorks to supply the solar water heating units and arranged for bulk purchasing so that the cost of unit installation could be brought down by an average of $700 per system.

The units, which cost between $2000 and $3000 to install, enable householders to save about 50% on their hot water needs. Typical annual savings are between $250 and $350.

So far, five systems have been installed; 20 more are to be installed after Christmas, and another 30 during the next fiscal year.

EcoPerth is looking into developing a lease program, which would help out the householders who find the initial $2000 3000 cost a bit too steep.

There are different types of solar hot water heating systems. The ones being installed in Perth use south-facing solar collectors on the roof, ground, fence or wall of the house that gather the suns energy during the day. These collectors are set at the same angle as the homes latitude north of the equator (in Ottawa, an angle of 45).

A system controller monitors the temperature of the collectors and the indoor reservoir that holds the water. When it senses there is sufficient warmth to heat the indoor water, it sets off a pump that circulates a heat transfer fluid to the collectors. The water heated by the sun goes through a heat exchanger and is sent to the insulated water tank indoors. From there, it is fed into the houses hot water system, as required.

According to Natural Resources Canada, Canadian manufacturers have developed some of the most cost-effective solar domestic hot-water heating systems in the world. Consumers can now buy off-the-shelf solar water heaters that meet industry-wide standards, providing a clean alternative to gas, electric, oil or propane water heaters. Freeze-protected solar water heaters manufactured in Canada have been specifically designed to operate reliably through the entire year, even when the outside temperature is either well below freezing or extremely hot.

Solar energy is free, renewable, and non-polluting. Add to that a 50% saving on hot water expenses and there are a lot of incentives for home-owners to invest in this technology.

A few Web sites you can visit for more information about solar water heaters are NRCan's at http://www.canren.gc.ca ; EnerWorks at http://www.enerworks.com and the Canadian Solar Industries Association, at www.CanSIA.ca

Solar heating for everyone
by Lynn Jones
April 23, 2006

Retired electrical engineer David Delaney of Ottawa is a big believer in low-technology applications of solar energy that everyone can build and use.

Upon retiring in 1999 as Chairman of Plaintree Systems, a software firm in Ottawa, David decided to turn his attention and energy to appropriate technology for developing countries. A particular interest of his at the time was solar cookers that would enable people to cook their food entirely

using free energy from the sun. Rapidly-diminishing supplies of firewood for cooking and air pollution from cooking fires were two problems that David felt could be addressed by widespread adoption of solar cookers.

Early in his research, David came across a comment about how unfortunate it was that rural poor in developing countries were just switching to kerosene in time for it to become a scarce and expensive commodity. That statement prompted further research and the astonishing realization that the worlds supplies of oil and gas are likely to begin to decline soon causing fossil fuels themselves and all products made from them or using them (basically everything!) to become increasingly scarce and expensive. In turn, this change is likely to lead to a major transition in the developed world as we know it, to a situation in which everyone will have a lot less money and resources at their disposal.

Since that realization David has been actively researching and writing about oil depletion and sharing his knowledge with internet discussion groups and the Canadian Association of the Club of Rome, of which he is a member and which recently devoted an entire issue of its newsletter to oil depletion (Proceedings of the Canadian Association of the Club of Rome, Series 3, Number 6, September 2005). The issue is entitled The age of oil and contains articles by David and other leading energy analysts including former Chief Science Advisor to the Government of Canada Dr. Rennie Whitehead. It is available online at www.cacor.ca/Proceed-Sep%2005.pdf.

David believes that keeping warm in Ontario winters will be a significant challenge as oil and gas become scarcer and more expensive, affecting the prices of electricity, chainsaw oil, transportation fuel etc. Because of this, David suggests new houses should have twice the insulation recommended by the building code, and older houses should be retrofitted with extra insulation where possible. Incorporating passive solar design principles is also recommended.

David has identified some simple, low-technology solar applications as useful solutions to the coming challenges of space and water heating. Two applications that he recommends are low thermal mass passive solar sunspaces (sunspace air heaters), and passive solar, batch hot water heaters (batch water heaters).

A sunspace air heater can be made cheaply or expensively, depending on resources and desired durability. It is essentially a greenhouse attached to the south side of the house. It gets hot when the sun is shining (even in January), and cold at night. It should contain almost no thermal mass that would keep it warm after the sun goes down, thereby heating the out of doors. When the sun is shining, hot air flows by natural convection from the sunspace through vents or windows into the house. When the air in the sunspace is cooler than the air in the house, passive dampers made of light plastic film close the vents automatically (or the home owner closes the windows). Sunspace air heaters can provide a lot of free heat any time the sun is shining. They can be designed with appropriate overhangs to keep out the sun in summer.

Batch water heaters consist of a black water tank in a large insulated box with a reflective interior and a glass cover (a glazing unit from an old patio door makes an ideal cover). The water in the black tank heats up whenever the sun is shines through the glass of the batch heater, pre-warming the water for a heater that uses purchased energy, or providing almost all hot water needed during the height of the summer.

David maintains a personal website (www.geocities.com/davidmdelaney/) where he has posted lots of information about passive solar applications. He recommends www.builditsolar.com as a good source of information on designs for sunspace heaters and batch water heaters. This site includes a page called Ten projects with one year paybacks !

MPP shows leadership on energy conservation
by Lynn Jones
April 28, 2006

Since becoming energy critic for the provincial Conservative party, John Yakabuski has been on a steep but enjoyable learning curve, hearing from many different experts and interest groups in Ontario about all aspects of energy use in the province.

John's role is an important one, not only because Ontario faces an electricity crunch, but also because our heavy reliance on fossil fuels will be increasingly problematic in coming years as supplies decline and prices escalate.

Even before he became energy critic, John was interested in energy conservation. Back in 2003, he and his wife Vicky began replacing all of the incandescent light bulbs in their home with compact fluorescent (CF) lights, beginning with the ones that were most used. This was a smart move on their part and shows leadership on this issue from an elected official, something that alas, is not as common as we would like it to be.

Compact fluorescent lights are much more efficient than standard incandescent light bulbs. CF lights use about 25% as much energy to produce the same light as an incandescent bulb. You can replace a 100-watt incandescent bulb with a 25-watt CF light and get the same light for one-quarter of the electricity!

CF bulbs are more expensive than incandescent bulbs but last much longer. They pay for themselves quickly and save many times their cost over the life of the bulb.

John and Vicky estimate that their monthly electricity bills decreased by about 20% as a result of the switch to CF bulbs. In an average sized-home with a monthly electricity bill of $100-$120 this is roughly $20, or $240 per year.

John is quick to point out that it is not necessary to replace all of your existing bulbs with CF lights to get the benefit. Replacing 6-8 of your most frequently used bulbs will noticeably reduce your electricity consumption.

Since they use so much less energy, CF lights reduce demand on the electrical grid. This is important because new generating stations and infrastructure for transporting electricity are very expensive. It makes eminent sense to save all we can before we install new equipment!

A 2003 Statistics Canada survey found that only a third of Ontario households had installed CF lights - about 6 million bulbs in total. This compares to roughly 75 million ordinary light bulbs installed. If a quarter of these bulbs are turned on at once, and they average 60 watts, they consume over 1000 megawatts. Household lighting is a big portion of the evening peak load on the grid in winter and a significant opportunity for savings.

Peter Bursztyn of Citizens for Renewable Energy has calculated that if each household in Ontario were to install **one CF bulb per family member** in one of their most-used fixtures, the energy saved would be equivalent to that produced by a 500-megawatt nuclear reactor. This would power 250,000 households in Ontario at current levels of electricity consumption!

CF bulbs have two other important advantages. Because they use so much less energy, far fewer greenhouse gases and other pollutants are released into the atmosphere for the same amount of light. In addition, CF lamps generate less heat. If you have air conditioning, it will work less hard in the summer, saving you even more.

John and Vicky Yakabuski also conserve energy in other ways in their home. They have made sure their weather-stripping and insulation are up to par, they operate a very efficient washing

machine, and they drive a fuel-efficient vehicle.

Super-insulate for super savings!
by Lynn Jones
April 23, 2006

Here in the Ottawa River watershed, we live in a pretty cold climate. Ottawa is the second-coldest national capital in the world after Ulan Bator, Mongolia.

Freezing temperatures can arrive as early as late October and last until mid-April. This presents us with the significant challenge of heating our living spaces for up to six months of the year. Home heating is quite a costly proposition here, and is likely to become even more so in coming years.

The average owner of a 1200-square-foot home in Ontario spends between $1500 and $2300 on heating each year. Amazingly, it is possible to reduce this to as little as $500 by making a homes walls and ceilings extra thick and super-insulated and designing homes to capture free heat from the sun.

Frank Tettemer and Cheryl Keetch of Killaloe have perfected the art of building beautiful homes that require smaller than average amounts of heating fuel in winter. They operate a business called Living Sol Building and Design through which they design and build energy-efficient homes that incorporate such features as super-insulation and passive solar design principles and energy efficient heating systems.

In 2002 Living Sol build the first straw bale house in Renfrew County for a client in Killaloe, Haggarty-Richards. This 1,100 square-foot home is very fuel-efficient, requiring only $260 per year worth of firewood to heat. The same fuel is also used for water heating in winter and some cooking. The walls are made out of square bales of straw, and are thus one and a half feet thick with an R-value of between 40 and 50. They are beautifully finished on the interior and exterior with hand-troweled cement stucco. South facing windows and patio doors allow considerable solar heat gain in winter.

Living Sol also builds energy-efficient conventional frame homes, cottages and additions. They are currently working on a two-bedroom, passive-solar, highly energy-efficient home in Barry's Bay. The anticipated fuel requirement for this home is around $500 a year, for both the heating and domestic hot water.

If you are building a new home, Frank says don't hesitate to ask your builder to put twice as much insulation as required by the building code. Careful attention to vapour barriers, weather-stripping and caulking will also add significantly to energy savings. It is also possible to retrofit existing houses with added insulation either on the outside or the inside. Each has its advantages and disadvantages, and both can be fairly costly, but with rising fuel prices insulation retrofits are definitely worth considering.

Frank believes that all houses in our climate should incorporate passive solar design principles. In essence these principles suggest placing larger amounts of window area on the south-facing walls, and building roof or awning overhangs out to just the right distance so that free heat from the sun can pour into the windows all winter when the sun takes a low arc through the sky, and be excluded in summer when it would be very unwelcome!

Other services that Frank and Cheryl offer through Living Sol Building and Design include design and installation of alternative water heating systems, solar and alternative energy systems, water catchment systems, home and cottage design and consultation services.

Cheryl maintains the Living Sol website at www.livingsol.com where you can view inspiring photos of a number of beautiful, energy-efficient homes that have been thoughtfully-designed with the Ottawa Valley's six month heating season in mind.

Shower outdoors and save money!
by Lynn Jones
April 23, 2006

Audrey and Richard Copeland escaped from the rat-race in Southern Ontario a few years back and built themselves a beautiful home in the Madawaska Highlands, near Matawatchan. The prohibitive cost of bringing hydro to their property tipped the economics in favour of off-grid generation of household electricity from renewables, and they have done an inspiring job of it.

Their 4,000 square foot home is powered by four 400-watt wind turbines and three 5-panel solar arrays. A backup gas generator is used very infrequently. They use energy-efficient lighting (mostly compact fluorescent bulbs), and an energy-efficient refrigerator and washing machine. They don't use a dishwasher and only infrequently use a gas-fired clothes dryer because both use energy at high rates, and acceptable methods that require no electricity are readily available!

The Copelands heat their home with wood and use a wood cookstove and a propane cooktop for cooking. Their hot water is heated by a combination of a roof-mounted solar pre-heater and the woodstove.

Richard has a background in the solar photovoltaic business, and has really enjoyed designing his system. He believes that solar technology is underutilized at present. In particular, it would make a great deal of sense for solar applications for water heating to be more widely employed in cases where people are currently heating their domestic hot water with electricity. Heating anything with electricity is an extremely inefficient and wasteful process.

Off-grid living is not for everyone, partly because of the expense and complexity involved. But one of Richard's inventions is something we could all have fun experimenting with while saving energy and money into the bargain. It requires only a small investment in materials, some time, some recycled parts and some basic handyman (or handywoman) skills. This great invention is a three-season, outdoor solar shower that is enjoyed by family and visitors alike. Here it is described in Richard's words:

The design is simple, as passive solar heating should be. A tank, lying on its side, holds water above the shower stall in an insulated enclosure made out of local cedar. Reflecting material covers the insulation and transparent glazing covers the box that is angled around 45 degrees and facing south. The solar box is supported by posts and the enclosure is made to provide total privacy.

The tank, an antique 30-gallon expansion tank, was supplied by the best reuse center in the Matawatchan dump. We cleaned up the outside and painted it with a flat black heat-resistant paint. Then we found a piece of acrylic the right size to cover the solar panel and an old sprinkler head. With purchased pipes and fittings and valves, the shower was plumbed to allow filling of the tank with a garden hose from below.

The shower will provide 4-6 showers per day (except when used by teenaged girls with long hair). Sometimes it can be cool (no sun) but most of the time it is right on. We do run into too hot conditions frequently but you can simply add more cold in this case. It is used in late April through Thanksgiving, when the hardier among us will bear the cold air and enjoy a hot shower.

We love it! Visitors line up to use it, and there is exhilaration in looking at mountains and sky, or talking with your friends while enjoying a refreshing shower in the great outdoors. There is appreciation for what nature can supply readily from the environment, without the costly addition of non-renewable energy. There is further satisfaction in finding materials that can be re-used instead of dumped.

Solar innovation that produces heat, hot water and electricity
by Lynn Jones
April 16, 2006

Here in the Ottawa Valley, we have the Great Ice Storm of 1998 to thank for an exciting new technology for converting energy from the sun into space heat, hot water and electricity.

During the ice storm, Ottawa engineer Dave Gerwing, his wife and infant son spent 12 days without heat or electricity after up to ten centimeters of freezing rain downed power lines all over Eastern Ontario and Western Quebec. Dave was motivated by this experience to develop a method of providing heat and electricity, independent of the electrical grid.

Dave's creative process was informed by his knowledge that the solar energy striking the average building in Canada is sufficient to provide it with all its heat and power! The trick of course is how to capture and harness that energy.

Traditional flat solar panels capture only about 10-15 percent of the energy available. Their efficiency has been steadily increasing in recent years but even the most efficient ones available today capture only 30 percent of the energy that shines on them.

Dave's innovation, the Power- Spar, incorporates an absorptive surface in a concave, reflector that focuses the sun on a small area; thus it becomes possible to capture up to 80 percent of the sun's power, of which four parts are thermal and one part electrical! This means that for a given investment, it is possible to get a much larger quantity of energy from the sun in the form of both heat and electricity. This, in turn, greatly reduces the length of time it takes to pay off the initial investment with savings on one's energy bills.

The PS-2 Power- Spars, are units about 39 feet long comprised of a concave reflective surface with an absorber running from end to end. The mirror gathers and concentrates the sun's energy and focuses it on the absorbers which absorb heat. The absorbers can be supplemented or replaced by solar cells that produce electricity depending on whether the system is for heating or electricity or both.

Two 39' Spars can produce heat and electricity for an average 2000 square foot home.

The Power- Spar system can be connected to forced air, radiant baseboard, and in-floor heating systems. If the units are being used for heat, the system will also include a heat exchanger, a storage tank, and hot water radiant baseboards or another heat exchanger for heating air.

If the system is for generating electricity, the complete system will also include a grid tie inverter and optional batteries.

A little grey box on the side of the system is connected to a sophisticated internet-based tracking system. Date, time of day, latitude and longitude are noted by the program to ensure that spars point in the right direction to capture the most solar energy. The program also tracks usage and provides data to the system owner, if desired.

Parts for these systems are now manufactured in Toronto, but the assembly is done locally using local tradespeople. Dave believes it is important to keep money and jobs in the local economy. Dave's company, Menova Energy Inc., is based in Kanata. More information on Power Spars is

available at www.power-spar.com

Small hydro – Ancient technology for modern times
by Lynn Jones
April 29, 2006

"Hydropower is one of the oldest forms of alchemy, a way to convert falling water into wealth. Historically, that wealth has been measured in milled flour, sawed wood, and pumped water. Today, the currency of choice is the kilowatt-hour". (www.globalwebsol.com/WaterAlchemy/)

Perhaps it is this "alchemy" that provides some of the fascination with water power for people like Mike Dupuis. Mike has been interested in hydro power for his whole life. He was born and raised on the Waba Creek near Arnprior, Ontario, where his family owned an old mill.

When Mike was a young lad he learned what he could about water power from his dad. He then went on to study the engineering behind the technology.

In 1987 Mike founded Canadian Hydro Components (CHC) in Almonte, near Ottawa, to promote renewable energy, especially low-impact hydro. The company designs and manufactures state-of-the-art hydroelectric turbines for customers all over the world. CHC turbines are especially designed for what is called "small hydro", projects that generate anywhere from 50 kW (sufficient to provide for peak demand for about eight Canadian homes) to 15 MW (enough for about 2,400 homes).

Across the road from the CHC facility is the Almonte Upper Dam project. On display outside the old mill is a turbine from years gone by. In 1996, the old equipment was replaced with two new highly-efficient turbines manufactured by CHC that feed about 350 kW into the electrical grid with little environmental damage and no pollution.

According to the Canadian Renewable Energy Network website, (sponsored by Natural Resources Canada at www.canren.gc.ca) Canada has abundant water resources. Water power is the main source of electricity in Canada, representing nearly two-thirds of all electricity produced. Furthermore, Canada is the world leader in hydroelectricity production.

Many would argue that water power is the world's best renewable energy resource. It is relatively inexpensive and clean and gives a better return on investment than photovoltaic or wind systems. It is more reliable than wind and works at night, unlike the sun.

Perhaps that is why humans have been using it for thousands of years.

Water power installations require no fuel and release no heat or noxious gases. They tend to have long life-spans (over 100 years in some cases) with low costs for maintenance and operation. They can be over 90% efficient in converting the water power to electricity (as is the case with CHC turbines) and they can respond in seconds to changes in load demand.

There is significant potential for additional hydroelectricity production in Canada. Unfortunately, the practice of heavily subsidizing power from other sources in Ontario has made the economics of water power development unattractive here. Hopefully this will change in the future. One step in the right direction was the recent announcement by the Ontario government that small power producers will be offered contracts to feed electricity into the provincial grid for a premium price.

Water power fits well with the decentralized model of electricity generation that was described in this column a few weeks ago. Decentralized energy has many advantages over the outdated, centralized model which is highly inefficient and concentrates power and economic activity in a few central locations. Hopefully in coming years, with water power playing an important role, we

will see electricity generation spread widely over the province leading to a resurgence of healthy and vibrant local economies.

Heating and cooling with earth energy
by Lynn Jones
April 29, 2006

"Over two thirds of the energy needed to heat and cool your home is available right beneath your feet." *Natural Resources Canada's Canadian Renewable Energy Network (CANREN www.canren.gc.ca)*

Even more surprising is the fact that the technology to heat and cool buildings with earth energy is well-developed and already in use in over 30,000 houses and commercial buildings across Canada! The technology is referred to by several names including "geothermal heating", "earth energy systems", and "ground-source heat pumps".

Geothermal heating systems consist of open or closed loops of circulating water or glycol that picks up heat from the ground. The heat is then "stepped up" by a heat pump inside the building. Electricity is used to operate the circulation pump and the heat pump. This electrical energy is the extra third (not covered in the opening statement) that must be supplied, to move heat from the ground into the home.

One of the early adopters of geothermal heating in the Ottawa Valley, Peter Saffery has always been interested in energy efficiency. Using his professional expertise in the plumbing and heating business, he installed a geothermal system at his home in Micksbug back in 1988. He believes that ground source heating is an optimal technology for this region. Not only does it save money, but it greatly reduces greenhouse gas emissions associated with heating and cooling.

According to Peter, geothermal systems are highly efficient. They provide heating, cooling and domestic hot water for about one-third of the cost of heating a home with electricity. The cost to install a geothermal heating system can vary a great deal depending on the type of system, size of house, and other factors. The average cost for a 1200 square-foot home is in the neighbourhood of $8,000.

The CANREN website offers considerable information of how geothermal systems work. The earth around our homes holds a lot of energy. A meter or two below the surface, the ground is about the same temperature as the average air temperature. In the prairies, that's about 5-6° C. In southern Ontario it's about 10° C, and on the East or West coast, about 11-12° C.

The sun provides this heat to the earth. Its energy warms the earth directly, but also indirectly. Its heat evaporates water from the lakes and streams, which eventually falls back to earth and filters into the ground. A few metres of surface soil insulate the earth and ground water below. The warm earth and ground water below the surface thus provide a free, renewable source of energy.

A simple flick of a switch is all that is needed for the heat pump to operate in reverse to cool a home by transferring the heat out of the house, where the cooler ground absorbs the excess heat.

Heating and cooling can also be provided by a lake or pond. The City of Toronto has a deep water cooling project which takes cold water from deep in Lake Ontario and uses it to cool office buildings in the summer.

The buried circulation loops of a geothermal heating system can be horizontal or vertical. They are generally made out of high density polyethylene and are expected to last 50 years or more. It is worth noting that when they do need replacing, polyethylene is likely to be extremely expensive

as it made from oil. Fifty years from now there will be much less oil available and what is available will be extremely expensive. So while this technology is very efficient and attractive at present, it probably is not sustainable in the long term.

The bigger story behind Katrina
by Lynn Jones
September 4, 2005

In addition to causing enormous suffering, Hurricane Katrina has touched off an energy shock that may have severe repercussions in coming months. While it may be tempting to find fault right now with oil companies for price gouging, there is a much bigger picture unfolding behind the headlines of the human tragedy in the Southern U.S. and gas price spikes here at home.

According to the Globe and Mail, The hurricane has knocked out more than 10 per cent of U.S. refining capacity and virtually all oil and gas produced in the Gulf of Mexico perhaps for months. The hurricane also caused substantial damage to the distribution network, including pipelines and port facilities, used to get crude to and from refineries with supply and demand already tight across North America, Katrina's impact has been magnified. (August 31, 2005, *Disaster Scenario for Refining*). So there are clearly real reasons for the price spikes. But if we step a little farther back and look at the bigger picture, the spikes may be seen as only a preview of more to come.

Long before Katrina hit, independent scientists who study the depletion of oil and gas, were warning of an imminent peak in world oil production. One such scientist, Dr. Kenneth S. Deffeyes, professor emeritus of geology at Princeton University, suggested that the peak would come this fall. Dr. Colin Campbell, founder of the independent scientific organization, the Association of the Study of Peak Oil, believes that the peak has arrived. Many experts agree that the peak, which will only be clearly identifiable several years after it happens, will occur some time between 2000 and 2008. Others argue for a somewhat later arrival and a bumpy plateau rather than a peak, but most seem to agree that the peak of world oil production is likely to mark the beginning of radical changes in the way we live.

Oil is a very special substance. It is a very concentrated form of solar energy that took millions of years and unique geological circumstances to develop. By way of illustrating how concentrated the energy in oil is, it has been suggested that "the flare given off by igniting an ounce of charcoal starter lasts a few seconds, but the energy was derived from, say, a prehistoric tree fern absorbing sunshine for nine years." For another illustration, consider that it is possible to drive a compact car 6 km on the oil that would fill a pop can.

Oil is also highly portable and extremely versatile. It is used to fuel all manner of engines from chain saws and lawn mowers to cars, trucks, heavy machinery and jumbo jets. It gets made into a vast array of everyday items such as asphalt, plastics, fabrics, clothing, elastic, velcro, inks, paints, solvents, lubricants, fertilizers, pesticides, and paraffin wax.

Canadians annually consume more than 6 tonnes of oil equivalent per person. We are highly dependent on oil (and natural gas which is also facing an imminent production peak) for our food, heat, transportation and consumer goods. Our current diet for instance, is based on large inputs of fossil fuels during farming, manufacturing, and transport. It has been estimated that at least 10 calories of fossil fuel energy are used up in the production of every calorie that we eat. Most of the food we eat travels thousands of kilometers before arriving at our dinner table.

Demand for oil has been steadily increasing in Canada for some time. Global consumption has also been steadily increasing. Demand is increasing especially quickly in several rapidly-industrializing countries such as China and India.

World oil production follows a classic bell-curve pattern with a gradual increase early on, followed

by a steep increase to the peak, a steep decline and gradual tapering off at the end. At the peak the world is awash in oil. There is more being produced and consumed than has ever been before or ever will be again. Past the peak, production declines sharply since much of the remaining oil is harder to get at (under oceans and Arctic tundra for instance), more difficult to extract and refine (from tar sands and oil shale for example) and therefore subject to diminishing returns in terms of the energy yield per unit of energy used for extraction.

Thus we are reaching the peak of world oil production at a time when our oil dependence is at a very high level, demand is increasing worldwide, and supplies are about to be sharply reduced. We can therefore expect the price of a barrel of oil to rise to several times its present level in the years ahead. So, while price spikes from Katrina are temporary, and prices may go up and down for several years, at some point in the not-to-distant future they are likely to begin an inexorable rise.

Unfortunately, alternative energy sources are not capable of replacing oil and gas at anywhere near the scale of our current consumption. Most alternatives are much less concentrated forms of energy, are less portable, less versatile, more expensive, and rely on oil at some stage of their production. Many alternatives will be used and will become increasingly important in the future, but no combination of known alternatives will allow energy consumption to continue at its present level.

Detailed analyses of the limitations of alternatives to fossil fuels are available on the internet. See page two of Life After the Oil Crash (www.lifeaftertheoilcrash.net); this site was the source of inspiration for Republican Congressman, beef farmer and scientist, Roscoe Bartlett of Maryland, who has recently made three hour-long speeches on Peak Oil in the American Congress; the speeches are on-line at www.bartlett.house.gov. Also see Energy Bulletin (www.energybulletin.net) and the Association for the Study of Peak Oil and Gas (www.peakoil.net).

Some names that people have coined for the difficult period we are now entering include the Post-Carbon Era"", the "Long Emergency" and "Energy Descent". As oil becomes much more expensive, and rapidly becomes a scarce commodity, we will have to learn to use a lot less energy than we currently do. We will also have to endure a period of economic and social turmoil, since our economy depends to a great degree on abundant cheap oil for its functioning. On the positive side, our lives are likely to become a lot less hectic and more centered in our local communities where we will be more intimately involved with our friends and neighbours and more often engaged in meaningful pursuits than is now the case.

Some have seen this coming for a long time. M. King Hubbert, the Shell Oil geologist whose models are used today to understand the peaking phenomenon, stated in an article in the journal Science in 1949, that "the consumption of energy from fossil fuels is thus seen to be but a "pip", rising sharply from zero to a maximum, and almost as sharply declining, and thus representing but a moment in human history. He then speculated on the impact of this "pip" on industrialized human civilization. He asked if we will make a transition to renewable energy, or "retreat to an agrarian civilization at a much lower population than present."

Saudi Arabians have also apparently seen the writing on the proverbial wall as indicated by a saying they have that goes "My father rode a camel. I drive a motor car. My son flies a jet airplane. His son will ride a camel."

Many positive responses to this challenge are possible. Around the world people in small communities like ours are beginning to develop action plans for energy descent; important initiatives include re-localizing the food supply and developing rural transportation networks. There are also many innovative ways of using both fossil fuels and renewable energy; the Ottawa Valley has many pioneers in the energy field, some of whom we will be profiling in coming articles.

As we begin to face and prepare for oil depletion here in the Ottawa Valley, we can also take some comfort from the fact that there is great tradition of helping your neighbour here and there is still a lot of traditional knowledge about getting along with less energy. Both of these bode well for how we will navigate the energy descent.

Additional references and recommended reading:

The Long Emergency by James Howard Kunstler, Atlantic Monthly Press. 2005
Power Down by Richard Heinberg, New Society Publishers, 2004

How to be a wood burning wizard

By Ole Hendrickson
November 11, 2005

A friend of mine passed on an article with a great title: Confessions of a wood-burning fool. The author, Michell Sherrin of BC, tells how a Burn it Smart workshop changed the way he uses his wood stove.

Sherrin admits “I've been polluting my neighbourhood, playing Russian roulette with my house and burning cords like they're out of style.” He adds, ”Those clouds of cheerful smoke coming from my chimney were actually signs of wasted energy, unhealthy emissions and a higher risk for a chimney fire or carbon monoxide poisoning.”

Sherrin owns an energy-efficient, low-emitting wood stove. His firewood was well seasoned and kept dry. But he was overloading his stove and shutting down the damper too soon. He says that the main message from the workshop was, “Build small hot fires with dry wood.”

With fuel costs going up, you may be tempted to burn fuels other than dry firewood.

Don’t. Not everything that can be burned should be burned

Plastic gives off toxic fumes when burned, and won’t provide any significant amount of heat. Pressed wood products like chipboard and fibreboard have glues that also give toxic fumes when burned. Pressure-treated wood contains copper, chromium and arsenic to kill wood-rotting fungi.

Take these products to the landfill: you don’t want to breathe the smoke, or spread poisonous ashes on your property.

Also remember that not all wood-burning appliances are equal when it comes to reduced smoke. If you’ve got neighbours within hollering distance, use an energy efficient appliance that is designed to burn gases before they go up the chimney. Outdoor furnaces may be acceptable for rural landowners with ample wood supplies, but increasing numbers of municipalities are placing restrictions on their use in more densely settled areas.

Now for the good news: wood burning is a key component of a regional sustainable energy strategy. Wood biomass is a renewable fuel.

Fossil fuels were made mostly during the Carboniferous Era, hundreds of millions of years ago. The Earth is not making more of them, not in any appreciable amounts. We’re having a big party. Solid or liquid carbon comes out of the ground, and makes a 1-way trip to the atmosphere as the greenhouse gas carbon dioxide.

Trees, on the other hand, grow all around us. While burning wood releases carbon dioxide, growing trees take the carbon dioxide back out of the atmosphere and turn it back into wood. The same cycle occurs in nature when trees burn in a forest fire, or when they die and are decomposed by microorganisms.

As long as sustainable forest management practices are being followed, wood energy is renewable.

Many people I've talked to think there is some special virtue in harvesting only dead trees for firewood. While I respect their desire not to harm living creatures, I point out to them that harvesting dead trees takes away extremely important habitat for cavity-nesting birds and other wildlife species. Fallen trees on the ground are habitats for salamanders, and can provide "nurse logs" for new tree seedlings.

In Europe, logging methods that did not recognize the value of snags and decaying logs have pushed woodpeckers, insects, and fungi that rely on these habitats to the edge of extinction. From an ecosystem perspective of doing least harm to living creatures, selective logging of live trees is arguably preferable to cutting only dead trees for firewood.

Wood is definitely part of a sustainable energy future in this part of the world. Given proper respect and consideration, it can put us closer to nature than nearly any other energy source.

Why not wood?
By Ole Hendrickson
April 3, 2006

The Ontario government recently announced that it will issue standard offer contracts for small electrical generating facilities (< 10 MW) powered by renewable energy sources. This puts wood energy in the forefront of ways to reduce dependence on decreasing fossil fuel reserves. Wood energy is one of the most economically and environmentally responsible means to heat buildings and generate power without using fossil fuels.

Finland's progress in this area is noteworthy. Wood energy plays an increasingly important role in that country's decentralized and diversified energy system. About 20% of Finland's primary energy comes from wood (compared to 3% in Canada). Further increasing the use of wood and other renewable energy sources is an explicit goal of the Finnish energy strategy.

Wood is used in older homes throughout rural Canada, but few new Canadian homes are designed to be heated by wood stoves. Finland is similar in this regard. Where Finland differs from Canada is in the development of wood-fired district energy systems.

District heating is now used in over 200 municipalities in Finland. It provides half the energy used to heat residential, commercial and public buildings. A network of insulated underground pipes connects buildings in a local area: a heat grid, as opposed to a power grid.

About 50 Finnish municipalities co-generate heat and electricity in their district energy facilities. Most have cooperative arrangements with power companies or local industries. Nearly all large district energy facilities - 75% of total capacity - are designed for co-generation. The electricity output of co-generation plants using wood fuels is 2000 MW - the equivalent of more than three Pickering-sized nuclear reactors. Most co-generation
plants have multi-fuel boilers that use both peat and wood, so only a portion of electricity is generated from wood.

In the bigger centralized district energy plants, use of wood chips is increasing and displacing the use of peat. Wood chips come from harvesting trees or parts of trees that are not suitable for saw logs and veneers. The price of wood chips has decreased due to technology development and government financial incentives like investment aid and energy taxes on fossil fuels.

The number of small-scale (< 1 MW) district heating systems is also growing in Finland. These systems, run by "biomass heating entrepreneurs", are typically locally owned and use wood

chips. The fuel comes from the entrepreneur's own forest, from the forest owners in the area, or from small-scale portable sawmills in the form of sawing residues. The heating entrepreneur operates the heating plant and earns an income based on the volume of produced heat.

The success of wood energy in Finland has many root causes, but chief among these is that it is well integrated with the existing forest industry. Sweden tried a wood energy strategy based on high-yield biomass production in willow plantations with far less success. The Canadian Forest Service only last week announced that it will devote 10% of its science programs to enhanced wood fibre production. Use of wood as an energy source will be part of the mixture of objectives for the new Fibre Centre.

While relatively little attention is being given at present to use of wood chips in district energy facilities, Canada has some positive experience in this regard. The PEI Government built three small wood chip-fired facilities in Charlottetown in the early 1980s, serving the university, the hospital, and some government buildings. Today, an integrated district energy plant delivers hot water to a 15-km distribution system that runs throughout the core area of the city. The plant serves over 60 customers and heats 84 buildings, including all the provincial buildings, the university, the technical college, two shopping malls and many other apartment and commercial buildings.

The PEI Government sold off this profitable facility in 1995 (when oil prices were low) to a private company, Trigen Energy Canada Inc. Wood chips have been replaced as the fuel source by a combination of sawmill residues and municipal wastes (burning municipal wastes is controversial, owing to potential toxic emissions). According to Natural Resources Canada, there now about 60 district energy systems in Canada, but only three use wood. Most of the other district energy systems are fired with natural gas or oil.

Finland's positive experience with wood-fired district energy systems could be replicated in Canada, starting with First Nations communities and communities with active forest industries. As with other forms of renewable energy (e.g., wind or hydropower), initial investment costs are higher, but long-term operating and maintenance costs are lower than fossil-fuel facilities. This indicates a need for government incentives such as the recent Ontario government announcement. With looming world-wide shortages of fossil fuels, it is encouraging that some government energy policy analysts are now thinking about wood.

A refreshing vision for Ontario's electricity future
by Lynn Jones
March 27, 2006

Citizens have been asked for input on the future of electricity generation in Ontario. A booklet called "Our Energy Our Future" was delivered recently to most households in Ontario. It explains that we face a major supply crisis in coming years if demand for electricity continues to increase as forecast and coal-fired generating plants are shut down, as promised to improve air quality and reduce greenhouse gas emissions.

Large centralized generating stations costing billions of dollars figure prominently in the government's vision of the future. But do we really need them?

Large centralized power stations are inefficient: up to two-thirds of the energy in the source fuel is wasted in the conversion to electricity and its transportation over long distances to end users. Large centralized plants are also expensive, slow to come on line, and vulnerable to system disruptions.

Happily there is an appealing alternative – "**decentralized energy"** (DE) which is energy

generated at or near the point of use. Here's a vision of what it could look like in Ontario:

> *Existing large power plants are supplemented each year by a rapidly-increasing number of small and medium-sized producers who feed electricity into the grid. These producers generate electricity from a wide variety of renewable sources of energy and some non-renewable ones like natural gas.*
>
> *Some examples of the renewables are small hydro, household wind turbines and wind farms, solar panels, solar roof shingles, biomass such as wood and biogas from landfills and manure.*
>
> *Electricity generation takes place close to where it is used, therefore any excess heat produced in the process is captured and distributed to nearby buildings, a technology called "cogeneration".*
>
> *Rather than being passive users of energy, many buildings are mini power stations! They have solar panels, solar water heaters, micro wind turbines and heat pumps for extracting energy from the earth. Solar water heaters, heat pumps and cogeneration help to greatly reduce the demand for electricity for space and water heating. Wider use of biomass heating fuels such as pelletized wood waste and switch grass also reduces demand for electricity.*
>
> *Different energy sources predominate at different times. For example, during heat waves when the wind turbines stop generating, solar panels really kick in, so much so that at times, there is power to spare which is stored in reservoirs for later use.*
>
> *Because electricity generation is a local affair, people are much more "tuned in" to using energy wisely and voluntarily reduce their electricity use.*

Decentralized electricity generation is quite popular in Europe. Thanks to supportive government policies, countries such as Finland, Sweden, the Netherlands and Denmark are already meeting a significant portion of their national electricity demand from DE. Many other European countries are following suit. Japan and California are making great strides in decentralized solar electricity generation.

According to the International Energy Agency, the decentralized approach to energy, if applied around the world could save **three trillion** dollars, in the next 25 years over the approach of large, central power plants remote from users.

Other advantages of DE include: considerable up-front private financing thus smaller public debt, rapid deployment, and a grid less vulnerable to widespread blackouts. DE also reduces transmission and distribution losses, greenhouse gas emissions and health care costs due to the emphasis on clean energy sources.

Perhaps the most exciting advantage of DE is that economic activity associated with electricity generation (eg. building, installing, and maintaining equipment) would be spread all over the province. More money would circulate in local economies and they would be stronger as result.

The recent announcement by the Ontario government that small producers will be invited to sell electricity to the grid for a premium price, is a great first step to making this vision a reality. Kudos to the government for this decision, and to many tireless and visionary folks in the sustainable energy sector who have helped move us toward a better vision for electricity generation in Ontario!

If you like the DE vision, please share it with your family, friends and the Our Energy Our Future folks. Write to them at 900 Bay Street Hearst Block 4th Floor, Toronto, or submit your views

through the Ministry of Energy website. If you want to know more about DE check out the World Alliance for Decentralized Energy at www.localpower.org

Ten easy ways to conserve electricity
By Lynn Jones
August 14, 2005

Today is the anniversary of the great blackout of 2003. According to Energy Probe director, Tom Adams, Ontario has done virtually nothing to conserve energy since then. In fact Ontarians are consuming power at record levels. This is bad news given that we are facing an electricity supply crunch in coming years.

The main reason that consumers have done nothing to conserve is that we are totally in the dark as to the true cost of the electricity we are using.

We are only charged 5 cents per kWh for the first 750 kWh we consume in a month, and 5.8 cents per kWh for anything beyond that while the true price, is considerably higher than that. (A kilowatt-hour (kWh) is the amount of energy consumed by ten 100-watt light-bulbs burning for one hour.)

This summer has been very hot in Ontario and we have imported large quantities of power from the United States to keep air conditioners humming. On many occasions this summer our utility companies have been buying power for 10 or 20 times the price per kWh shown on our bill.

At the end of each month utility companies invoice the Ontario government for the difference between what they are allowed to charge us, and what they actually paid for the energy we used. And we Ontario electricity consumers blithely go our merry way, making extravagant use of artificially cheap power.

The government will not be able subsidize our electricity indefinitely. Eventually we will pay the true cost, and this will provide a much greater incentive to conserve.

In the meantime, here are ten ways to save on electricity at home. These simple strategies can save the average household two hundred or more dollars each year at current prices. Why not get into the habit of using them now, before the price goes up?

1. Replace incandescent light-bulbs with compact fluorescents.

2. Wash your laundry in cold water. This can save you $35 per year, and is easier on your clothes.

3. Use indoor or outdoor clotheslines to dry your clothes. Not using an electric clothes dryer can save $50 per year.

4. Lower the thermostat on your hot water heater from 70 to 55 degrees Celsius . .. Install a low-flow showerhead. These two changes can save you over $100 per year. (For some of us, these changes require the help of a handyman or handywoman friend or neighbour).

5. Turn off computers, especially desktops when they are not in use.

6. Pull the plug - Even when turned off, many appliances like televisions and VCRs continue to use small amounts of electricity for things like their clocks and remote controls.

7. Turn out lights whenever you are not using them. A light in an unoccupied place is 100% inefficient!

8. If you use air conditioning, higher temperature settings save considerable energy.

9. If you heat your home or apartment with electricity, lower settings can save 3 - 5% on heating costs per degree.

10. Weatherstrip and caulk - Most houses and apartments have small gaps around doors and windows that can be quickly sealed. Several hours of caulking can yield considerable energy savings.

Average monthly household electricity consumption varies widely in Ontario. One person in a small apartment might use 500 kWh or less ($25 worth at the artificial price). A family in a large house can use 4,000 kWh or more, depending on the size of the house, how many people live in it, and whether electricity is used for heating and hot water.

It is difficult to say how much you can save by making these ten simple changes, but here is an example: Two people in a 1000 square foot home with a gas furnace and water heater could drop their consumption by 50% from the average of 700 kWh per month, to 350 or lower.

There are many reasons to lower your electricity consumption: saving money now, preparing for future rate hikes, helping to improve air quality and limit global warming, or just reducing waste. Most utility companies offer extra incentives to cut power use as part of mandatory conservation initiatives recently undertaken province-wide in Ontario.

So… let's get saving!

Burning issues: the changing forestry landscape (in the Ottawa Valley)
By Ole Hendrickson
April 10, 2006

With the Ontario government's offer of 11 cents per kilowatt hour price for small (< 10 MW) facilities that generate electricity from biomass, forestry will become more prominent on the renewable energy scene.

Wood biomass is an underutilized resource. In the Ottawa Valley, high-grading of pines has left forests dominated by lower-value species such as poplars, white birch, and balsam fir. Could new markets for these species provide incentives to improve forest management and restore our once-majestic pine forests? Maybe - with foresight.

In some respects, the Ottawa Valley is poised for biomass energy growth: ample wood supplies, an intact forestry infrastructure, skilled operators and contractors, and local training facilities for forestry professionals.

Every Valley resident with a wood stove is already a biomass energy consumer. However, the traditional firewood sector has limited room for expansion. Prime hardwood species such as red oak, sugar maple, and yellow birch grow more slowly than pines and poplars, and supplies are limited. Growth in wood bioenergy will likely come from larger commercial-scale facilities that use lower-value species to produce heat, electrical power, and biofuels.

A sustainable forest energy sector requires a long-term vision for rural landscapes that considers the full range of forest species and habitats, fiber demands of existing mills, new infrastructure such as district energy facilities that generate combined heat and power, and prospects for advanced processing and combustion technologies.

This will not be easy. Canada's biomass energy industry is less organized than other renewable sectors. Bioenergy does not accommodate a "cookie cutter" approach. Unplanned expansion can threaten rare species. Some members of the public and environment ministry employees perceive biomass as "dirty". Lack of credible, long-term yield data for different forest types creates biomass supply risk in the eyes of large investors.

After a major forest disturbance such as fire, insect outbreak, or logging, young trees typically crowd together and compete for available light, water, and soil nutrients. Individuals that are less genetically fit or in less desirable locations fall behind and die.

Stems that would otherwise decay on site can be harvested, increasing overall biomass yield. But, unlike some European forests where every last stick of wood is measured and cut with military precision, Canadian forests typically contain large amounts of unused, decaying wood. This has greatly benefited the many species that nest in cavities in decaying snags, or that use fallen logs for shelter. Compared to Europe, Canada has relatively few endangered woodpeckers, lichens, fungi, wood-boring insects, etc.

Fire must also be taken into account. Historically, in the Ottawa Valley, periodic ground fires cleared understory vegetation but merely scorched the base of the tall pines. In some parts of Canada, a combination of active fire suppression and lack of harvesting has created over-dense forests, with unacceptable risks of catastrophic fire and attendant loss of life, property, and valuable timber. In western Canada, reducing these risks can be the primary motive for thinning operations. Bioenergy production represents a secondary side benefit.

Optimal forest management falls somewhere between the European model (which is being reformed to accommodate biodiversity concerns) and current Canadian practice. Unfortunately, few long-term Canadian studies have documented biomass yields for a sequence of harvests on the same site. Species conservation data are also scarce. The prospect of new bioenergy markets makes improved forest knowledge an urgent priority.

The economic feasibility of wood bioenergy projects depends heavily on fuel costs for transportation and processing. Wood weighs more than oil per unit energy. "Fuel densification" is required for transport over longer distances. Making denser fuels such as wood pellets, biogas, or bio-oils requires chipping and grinding wood, and additional energy inputs. Networks of smaller electrical generating facilities, close to wood supply sources, can save transport and infrastructure maintenance costs compared to large, centralized facilities. They also make it easier for wood ash to be returned to the forest, helping maintain soil fertility.

Natural Resources Canada is studying mobile "bio-oil" facilities for processing wood near the harvest site, and other advanced techniques such as "fast pyrolysis", which may improve the overall efficiency of the wood energy life cycle. Wood biomass could even be used for transport fuels, as in World War II, when Germany turned to methanol after the Allies cut fossil fuel supply lines.

Global fossil fuel shortages have major implications for Canada's forest sector, and rural communities in general. Planning for change now will provide a better future for our children.

Appendix C

An Introduction to Community Wind Power

April 14, 2005 at Cobden Memorial Hall
Cobden, Ontario, Canada

While Canada seriously lags behind the world leaders in developing electricity generation from renewable sources, the message was clear from the two speakers at **An Introduction to Community Wind Power**, that the time for wind energy has arrived. The federal and provincial governments both have targets and programs to build capacity from renewable sources up to 10% of our total electricity supply by 2010.

James Murphy, Manager of New Project Development with the Ontario Sustainable Energy Association, made several key points regarding wind energy and wind turbine farms:

- Wind power is good for communities. It creates up to 20 jobs per megawatt year, and a much higher portion of the revenue from wind-generated electricity stays in the community than the 75% of centrally generated hydro revenue that leaves the area where the money is spent.
- The Ontario government will help solve the tricky process of selling locally generated electricity by offering Standard Offer Contracts later this year to guarantee connection to the grid and a selling price for the energy generated.
- The federal government has its $5 billion Climate Fund and a program of Wind Power Production Incentives.

James stressed that conservation in our use of electricity is far more efficient that building more generation capacity. When exploring the development of wind power, communities and their partners mush be very clear on their goals and expectations.

Don MacIver is a Meteorologist, Wind Measurement Expert, beef farmer, and Deputy Mayor of Amaranth Township where a wind development project is taking place. Don stressed that energy usage efficiency is the top priority in meeting our energy needs from renewable sources. He explained that air conditioning is a huge consumer of hydro and that solar water heating offers a large potential for saving electricity. Some of his points were:

- Investors like large sites for wind farms that are close to the existing hydro grid.
- There is a potential income for a municipality or farmer of up to $2,500 per turbine per year.
- Ice buildup, severe cold and lightning can damage wind turbines.
- There are ice history maps and wind maps to help with site location.
- One-year anemometer studies are necessary to confirm wind potential.
- Landowners and municipalities must be rigorous in their legal contracts with wind energy development companies and take into account all related issues

such as zoning, building transmission lines, rights of way and concerns around environmental impact.

The Canadian Wind Atlas was described in detail during the presentation by Don MacIver. This valuable resource is available to the pubic at **www.windatlas.ca.**

Newspaper coverage:

ORI introduces second major project through Trillium funding Renfrew Mercury April 26, 2005

Wind generated electricity is cost-effective
Cobden Sun, April 20, 2005

The Ottawa River Institute felt that the two speakers honestly and thoroughly highlighted many key areas around the establishment of large wind power projects. ORI also remains committed to the principle that small wind, solar and other renewable electricity generation projects offer an important way of meeting energy needs while offering benefits to local entrepreneurs, home owners and communities.

Appendix D

Letter to Energy Minister Donna Cansfield

Hon. Donna Cansfield *January 5, 2006*
Minister of Energy
900 Bay Street, 4th floor
Hearst Block
Toronto, Ontario
M7A 2E1

Dear Ms Cansfield:

I strongly support your plan to make electricity generation from renewable sources a large part of Ontario's energy supply. I feel that we are at a very important time in the decision making process regarding the huge issue of energy supply and demand and also the direct connections between energy supply and our healthy economy and environment. The pending decisions on Standard Offer Contracts can make the difference between continuing with the current highly centralized generation model with its huge costs for development and transmission and moving toward a decentralized model which results in people and smaller companies and cooperatives all over the province producing electricity from renewable sources.

The renewable generation path coupled with a vigorous programme of electricity conservation will, I believe, solve our supply crunch without the need for building new nuclear or gas fired plants and the huge expense of transmission line building that must accompany any new centralized generation plant. Here are some of thee points in favour of the renewable, community based power generation model:

1) *Small 1kw to 10MW plants would be built by individuals and cooperatives all over the province. There are a great many sites suitable for smaller developments.*
2) *These installations would spread economic activity over every part of the province fostering a whole new business opportunity for rural and urban residents.*
3) *Many smaller generation sites would mean that existing power lines could carry new generation capacity with little improvement. Remember that virtually every home or farm in Ontario is connected to a line right now with capacity to carry 20 to 60 kw of new generation capacity.*
4) *Decentralized generation would mean more switching options to deal with massive power outages.*
5) *Smaller community based generation facilities can come on line very quickly. In fact, many cooperatives are set up and ready right now to start installing renewable based generation plants. The financial role of provincial and federal governments would be to promote these new energy sources by eliminating taxes on renewable generation equipment and encouraging development of these new sources by paying a premium price for electricity generated. These expenditures will result in jobs and energy without incurring dept.*
6) *Emphasis on renewable generation can be a powerful tool toward promoting conservation.*
7) *Renewably generated electricity would be a very important contributor to meeting our Kyoto commitments and to cleaning up the air in Southern Ontario.*

8) *The province could vigorously promote new manufacturing businesses to produce the turbines, solar panels, smaller water power generators and all the necessary switching and controlling apparatus that will always be in demand once a decentralized supply starts to grow.*
9) *The province could also promote business and conservation by helping manufacturers produce appliances that are much more energy efficient like many of those in Europe.*

Minister, I believe that this is a time for a whole new way of looking at how we produce and consume energy. I have no doubt that by opening up the electricity market to every person or cooperative who can meet the standards, we Ontarians have a golden opportunity to build a vibrant modern economy and a safe, diverse and dependable way of generating electricity. Conservation and renewables are the way to solve the energy crunch without crippling debt and more pollution. Please support the implementation of the Standard Contract Model that paves the way to spread the generation of clean electricity all over this province. It will be a boon to us all. Thank you for your attention to this letter.

Yours Truly

Ken Birkett, President
Ottawa River Institute

cc. Hon John Yakabuski, MPP