Introduction

This article gives Environment Hamilton's views on energy generation and use. It is intended to give our members and supporters some input to help them form their own views.

Conservation should come first, before spending time looking for improved ways of energy generation and consumption. We will develop our conservation ideas and recommendations in another "Viewpoint" article.

Today's energy based society is not sustainable because it depends on depleting resources (coal, oil, gas) which pollute our environment. Unfortunately this pollution, which results in too much atmospheric CO_2 from burning fossil fuels, and the resulting climate change, will most likely seriously affect humanity before resource depletion sufficiently reduces emissions.

We present our viewpoints below to have a discussion. We don't pretend to have answers as to how to maintain a fair standard of living for the world's population while accomplishing the goals suggested by our viewpoints. But we are pretty sure that we cannot meet the needs of the projected 9 billion world population by 2050 using the current energy system.

Energy generation and use is highly politicized. It is important that you make your views known to your political representatives at all levels of government. Only through political pressure will strong environmentally sound energy policies and plans be implemented in Hamilton, in Ontario and in Canada.

Our views are based both on published scientific evidence and on the conclusions of many expert climatologists and physicists. Wherever possible we will give references to support our views.

We have commented on the following sources of energy and energy generation. There are some others which can be discussed in the future (geo-thermal, tidal, etc)

Coal – Oil - Natural gas – Nuclear – Wind –Solar – Biomass

We will start with some basic viewpoints and it will quickly become clear that these viewpoints need to be examined through a number of "filters" related to things like availability, cost and standard of living – in other words through the social and economic elements of the "triple bottom line".

At the end of this document we include some local implications of these energy viewpoints. This is an opportunity for you to take action.

Environment Hamilton viewpoints on energy sources

Here are our viewpoints – they are discussed below

1. **Renewable energy sources are better than non-renewable sources.**
2. **Fossil fuel sources of energy should be avoided.**
3. **Switching from coal to gas for electricity generation is a short term solution at best.**
4. **Greater energy conservation is required in modern economies.**
5. **We need to move away from nuclear power generation.**
6. **Wind energy facilities should be encouraged.**
7. **The resilience provided by decentralized power generation sources is preferred.**
8. **Public transit should be encouraged, especially clean and efficient forms.**
9. **Hydro electricity is a good source of renewable power.**
10. **Not all bio-fuels are equally beneficial; land use problems must be considered.**

Viewpoint # 1: Renewable energy sources are better than non-renewable sources

As a starting point, we think that Economist Herman Daly's three simple rules[A] that define the sustainable limits of human activity provide a foundation to understand energy use.

- For a renewable resource – soil, water, forest, fish, the sustainable rate of use can be no greater than the rate of regeneration.
- For a non-renewable resource – fossil fuels, high grade mineral ores, fossil groundwater, the sustainable rate can be no greater than the rate at which a renewable resource, used sustainably, can be substituted for it.
- For a pollutant - the sustainable rate of use can be no greater than the rate at which any waste products can be recycled, reused, absorbed or rendered harmless.

Clearly, these rules drive us away from fossil fuels and towards renewable energy.

Viewpoint # 2: Fossil fuel sources of energy should be reduced

The International Panel on Climate Change has shown that our burning of fossil fuels is exceeding the absorptive capacity of our atmosphere leading to negative changes in our climate. Fossil fuel demands are also leading to irreparable damage to many places through mountain top coal removal, oil drilling (on shore and offshore) and tar sands development. Hydraulic fracturing has many unknown risks. Political and economic disruption is occurring in many countries where fossil fuel extraction is overriding social justice and economic fairness. There is evidence that depletion of fossil fuel resources ("peak oil") is setting up our society for a big crash. As large populations in China and India increase their consumption of oil, demand will outstrip declining supplies.

Viewpoint #3: Switching from coal to gas as for electricity generation is a short term solution at best. Natural gas from fracking is not really cleaner than coal

There has been significant reduction in North American carbon emissions from electricity generation as power stations have moved from coal to natural gas[B]. Other toxic emissions from coal burning have also been reduced. This is a good thing short term but is in danger of being used to put off long term action on GHG emissions. Worse still, the current excitement over natural gas produced by hydraulic fracturing (fracking) appears to be misplaced as the approach carries environmental risks to water supplies[C]. Recent studies have shown that the amount of methane produced through leaks and flaring off is much higher than previously thought.[D] In a full analysis, natural gas is still a fossil fuel and burning it creates greenhouse gas emissions.

Viewpoint #4: Greater energy conservation is required in modern economies.

It is a natural inclination of civilized societies to look for ways to use energy to improve their standard of living and way of life. If a source of energy other than human muscle power is readily available, it is used as a substitute. Food and shelter (and warmth in cold climates) are the first priorities. Once these are satisfied we move up the socio-economic consumption curve all the way to the peak currently enjoyed in North America. This level of consumption is possible because the price we pay for energy is relatively cheap and does not include externalities such as pollution and habitat destruction. If we are to come close to the sustainable limits described above we must reduce consumption in our society, as it is so dependent on energy. We must avoid the "Jevons paradox[E]" through which increasing energy efficiency reduces unit energy consumption but leads to overall consumption increases.

Viewpoint #5: We need to move away from nuclear power generation

Nuclear Power leads to many very conflicted opinions. It produces electricity with a low level of greenhouse gas emissions – which come mainly from the construction and mining processes rather than actual generation (Some analyses show nuclear not to be so carbon free as touted by its supporters[F]). But it carries with it risks from accidents, difficulties in storing waste products and very high capital and research and development costs.

Premier Climate Change scientist James Hansen has published a study that concludes "*Because nuclear power is an abundant, low-carbon source of base-load power, it could make a large contribution to mitigation of global climate change and air pollution. Using historical production data, we calculate that global nuclear power has prevented about 1.84 million air pollution-related deaths and 64 gigatonnes (Gt) CO2-equivalent greenhouse gas (GHG) emissions that would have resulted from fossil fuel burning.*[G]"

But the drawbacks are great– massive capital investments, very long lead times to construct, potential for massive damage in case of accident (viz Fukashima) and a waste product that is dangerous and very difficult to store. Using sustainable limits rule # 3 – absorbing waste – nuclear power is highly problematic[H]. It leaves us with dangerous waste products that cannot be absorbed. It is so problematic that Ontario is currently studying a Deep Nuclear Waste Repository – and this is just for low and intermediate level waste. It has also been pointed out that, given limited investment dollars for our energy infrastructure, money spent on new nuclear power diverts investment from renewable energy. On balance, Environment Hamilton opposes further nuclear developments.

Viewpoint #6: Wind Energy generation should be increased, with care on its location

Wind energy meets Daly's Rule #2 of sustainability – it uses non renewable resources such as steel and cement to build a renewable source of energy from wind turbines. After hydro power, wind has become the largest renewable energy source in the world today. In terms of growth, wind power is annually adding more installed capacity than any other electricity generation method worldwide. Wikipedia's current entry[I] summarizes the impact of wind turbines as follows: *"Compared to the environmental impact of traditional energy sources, the environmental impact of wind power is relatively minor in terms of pollution. Wind power consumes no fuel, and emits no air pollution, unlike fossil fuel power sources. The energy consumed to manufacture and transport the materials used to build a wind power plant is equal to the new energy produced by the plant within a few months. While a wind farm may cover a large area of land, many land uses such as agriculture are compatible, with only small areas of turbine foundations and infrastructure made unavailable for use"*

There has been a lot of opposition to wind power development in Ontario – both offshore in Lake Ontario and in various rural communities.[J] Similar opposition has been seen in other jurisdictions where governments and large business take the lead. However in places where the community has taken the lead – through community power cooperatives – there has been less opposition.[K] We support the work of the Community Energy Partnerships Program, a grant program to support community power in Ontario.

The contentious elements of wind power are its visual impact and the possible health impacts on nearby residents. Health Canada is currently studying the possible impacts, with results expected in 2014.[L] Our view is that growing use of wind energy will be essential to provide renewable energy in the future and efforts must be made to locate it away from residential housing. The visual impact is not significantly greater than many other elements of our modern society but efforts should be made to site wind turbines away from significant areas of natural beauty such National and Provincial Parks.

Viewpoint#7: Hydro electricity is a good source of renewable power. Large scale hydro-electric schemes need to properly consider land use impacts, particularly on First Nations communities.

Ontario currently generates just over 20% of its electricity though hydro-electric means. Hydro represents a source of large scale renewable energy generation which does not present the risks of nuclear power. However they do have environmental impacts in the lands that are submerged and in the changes to river systems. In areas used by First Nations for traditional hunting and fishing, these impacts have been ignored in the past and need proper consideration for new projects. An interesting fact for Ontario; both our neighbouring Provinces of Manitoba and Quebec have large hydro-electric capacities and surpluses which are mainly sold to the United States. Some improvements may be needed in the distribution network, but purchases from these provinces could be very beneficial to Ontario.

Viewpoint #8: The resilience provided by decentralized power generation sources is preferred.

North American power systems tend to be large scale, relying on centralized power generation connected to a wide area distribution network. We have seen examples where an equipment failure or an extreme natural event (storm, flood, tsunami) has caused wide scale loss of power to large populations. To withstand such shocks and be able to continue to function is to be resilient. Decentralized power generation, rather than the reliance on large centralized generation sources, is preferable in the face of more expected extreme climate events. This is why solar and wind generation sources are so valuable; they create sources of local distributed power in small units that are not vulnerable to large scale outages.

Viewpoint #9: Public transit should be encouraged; electrification of land transit should be increased

Our current economic and social systems place a great reliance and value on mobility of people and things. This mobility consumes massive amounts of energy that is usually provided by petroleum based fossil fuel products - gasoline, diesel fuel, jet fuel and bunker oil.

The value placed on personal mobility has lead to massive use of the motor car which is still mostly fossil fuel based. Use of mass transit dramatically reduces the energy required to move people. Land-based public transit can use electricity generated from renewable sources. Better rail systems will also promote more goods transport and get trucks off the road.

Viewpoint#10: Not all bio-fuels are equally beneficial

There are several types of bio-fuels – namely bio-ethanol made from plants and bio-diesel made from vegetable oils and animal fats. Methane from animal waste is also usable as a fuel though not normal included in bio-fuel discussions.

The use of ethanol as a gasoline supplement has resulted in large areas of crop production being used for corn and sugar cane based ethanol production. Production of the ethanol raw materials uses significant fossil fuels in fertilizer, pesticides and machinery – more than the energy produced. We do not think this is a good use of scarce agricultural land; it diverts agricultural capacity away from much needed food production. In some places the crop production is using large quantities of scarce water supplies, exacerbating shortages.

Cellulosic ethanol produced from trees and grasses is considered to have greater advantages – using poor land to produce trees and grasses. However, consideration must be given to potential biodiversity loss if these sources are used.

Wood is also used as a fuel in some large scale generating plants; it is a reasonable source if the wood used is a waste product (such as pine beetle devastated forests). While this is better than burning coal, it will still result in CO2 emissions. Although the long term the burning of wood just returns carbon to the atmosphere that was captured by the growing tree, in the next few critical decades it will result in more emissions than captured by newly planted replacements. And care must be taken that we do not encourage large scale deforestation to source wood for fuel if demand grows.

Local implications of Environment Hamilton's energy viewpoints

1. **Conserve energy use in your home** through improving your home weather stripping, insulation, lighting and appliance energy efficiency. Make proper use of set-back thermostats. In winter, wear warmer clothes indoors and reduce your thermostat level. Consider heating rooms rather than the whole house. In summer, draw curtains or blinds in the day time and turn off or minimize AC use. Minimize or eliminate use of a clothes dryer; use a washing line. Turn off unused computers, disconnect "instant-on" TV's and other equipment when not in use.
2. **Explore your renewable energy options** – install solar panels on your home or buy power from renewable sources such a Bullfrog Power (www.bullfrogpower.com/)
3. **Join a renewable energy Co-operative** such as The Green Energy Co-operative of Ontario (http://geco.coop/) or the TREC Renewable Energy Co-operative (http://www.trec.on.ca/)
4. **Use active transportation** (biking and walking) as much as possible. Support City-wide initiatives to increase public transportation. Reduce your car usage through biking, taking transit and doing careful trip planning.
5. **Reduce water usage**. The City of Hamilton's largest use of electricity is for water and wastewater treatment. Install rain barrels around your home. Disconnect downspouts from City drains. Stop watering lawns and washing driveways.

References

[A] Quoted in Limits to Growth – The 30 Year update Meadows/Randers/Meadows P54

[B] Centre for Climate and Energy Solutions - Leveraging Natural Gas to reduce GHG emissions http://www.c2es.org/initiatives/natural-gas

[C] Vidic, R. D., S. L. Brantley, J. M. Vandenbossche, D. Yoxtheimer, and J. D. Abad. "Impact of shale gas development on regional water quality." *Science* 340, no. 6134 (2013).

[D] Measures of methane emissions at natural gas production sites in US. http://news.harvard.edu/gazette/story/2013/11/u-s-methane-emissions-far-exceed-government-estimates/ and The Glaring Threat from Shale http://www.theglobeandmail.com/report-on-business/rob-magazine/the-glaring-threat-from-shale/article16606986/

[E] In economics, the **Jevons paradox** (sometimes **Jevons effect**) is the proposition that as technology progresses, the increase in efficiency with which a resource is used tends to increase (rather than decrease) the rate of consumption of that resource. In 1865, the English economist William Stanley Jevons observed that technological improvements that increased the efficiency of coal use led to increased consumption of coal in a wide range of industries. He argued that, contrary to common intuition, technological improvements could not be relied upon to reduce fuel consumption. http://en.wikipedia.org/wiki/Jevons_paradox

[F] Greenhouse-gas Emissions from Solar Electric- and Nuclear Power: A Life-cycle Study Vasilis M. Fthenakis and Hyung Chul Kim http://www.researchgate.net/publication/222396555_Greenhouse-gas_emissions_from_solar_electric-_and_nuclear_power_A_life-cycle_study

[G] Prevented Mortality and Greenhouse Gas Emissions from Historical and Projected Nuclear Power Pushker A. Kharecha* and James E. Hansen http://pubs.acs.org/doi/pdf/10.1021/es3051197

H Once a fuel bundle has been used to generate electricity, it is highly radioactive and must be carefully managed for a very long period of time, essentially indefinitely. http://www.nwmo.ca/sitingprocess_faqs#a6

[I] http://en.wikipedia.org/wiki/Wind_power

[J] Offshore wind moratorium http://www.thestar.com/business/economy/2013/02/15/ontarios_offshore_wind_turbine_moratorium_unresolved_two_years_later.html

[K] See articles referred to by the Community Energy Partnerships Program http://www.communityenergyprogram.ca/Resources/ResourcesCommunityPower.aspx

[L] Health Canada Wind Turbines FAQ http://www.hc-sc.gc.ca/ewh-semt/consult/_2013/wind_turbine-eoliennes/question-eng.php