



Our Constrained Energy Future: Part One

The near future will see two global issues affect the sustainability of urban and suburban living in Southern Ontario and beyond.

The first is environmental damage from the toxins and greenhouse gases that are being increasingly emitted around the world. The second is energy price and supply pressures resulting from increasing global demand. The International Energy Agency (IEA) has projected that, in a business-as-usual scenario, global primary energy demand will increase by 53% between 2006 and 2030¹. The great majority of the increase will be supplied by fossil fuels, which emit toxins and the majority of greenhouse gases.

The struggle for Canada and other countries will be to balance energy conservation and investments in fossil fuels and alternative energy sources, not only to support economies but to reduce some of the greenhouse gas emissions that cause rapid climate change. A review of the implications of global climate change by economist Sir Nicholas Stern, commissioned by the UK's Chancellor of the Exchequer and issued in October 2006, concluded that the costs of doing nothing to fight rapid global climate change will be far in excess of investments required to reduce greenhouse gas emissions².

Maintaining current trends in the use of fossil fuels will mean increases in health costs related to pollution, higher insurance premiums as a result of severe weather events, higher food prices due to increases in transportation costs and weather effects, mass displacement of coastal residents over the longer term due to rising sea levels, higher public expenditures for remediation of environmental damage, destabilized regional ecosystems, worsening conditions and a declining quality of life for future generations. Given that the global economy may theoretically grow to 3 to 4 times today's level by 2050², greenhouse gas emission reductions needed to reduce the pace of global warming will be very substantial. For Canada, the needed reductions will far exceed the Kyoto Protocol target of 6% below 1990 levels that this country is obligated to meet under international law. Canada's emissions are more than 35% above our Kyoto target³ and current government policy is to not achieve the Kyoto target.

Environmental considerations aside, the world is now facing a very constrained energy future – particularly a shortage of relatively inexpensive petroleum and natural gas. In the past, excess global production and delivery capacity has kept oil prices in check. Those excesses in capacity no longer exist, or are marginal at best.

There is now a growing recognition that the world is fast approaching what is known as a 'peak oil' situation – where petroleum production will not be able to keep pace with demand. This situation is due to the lagging rate of new discoveries⁴ and the gradual depletion of fields in production, including the giant fields in Saudi Arabia, which supply about 12% of the world's demand⁵. Energy investment analyst Matthew Simmons has analyzed these fields and concluded that they will soon be in decline⁵. In addition, newer oil finds around the globe generally require extraordinary effort and energy inputs to bring production to market, as do declining existing wells. Several peak oil forecast models project that the global production peak will come between 2010 and 2015, and that production will fall at an accelerating rate soon thereafter⁶. Indeed, the Chief Economist at the IEA said in 2009 that production from existing oil fields is now declining at a 6.7% annual rate. The situation is somewhat less specific for natural gas; until the 2008-2009 recession, production in North America had fallen short of demand and imports of LNG (liquid natural gas) were rising⁷.

The overall impact of these developments will be much higher prices for fossil fuels and the endless number of petroleum-based products we depend on. Given the importance of oil to industrial processes, food production, transportation and electricity production, and given traditional price volatility, there is a significant risk that even modest shortfalls in crude oil supplies will send the price per barrel of crude oil to well over \$200 per barrel. A report by the Brookings Institute in the United States suggests that a 10% shortfall in oil supplies would theoretically result in a tripling of crude prices, while a 15% shortfall would cause a six-fold increase⁸. Pressures such as these will entail dramatic economic and social adjustments, marked by cycles of growth and contraction as energy prices gyrate.

One of the economic outcomes of higher oil and gas prices will be the search for alternative energy sources, all of which will have a mix of problems and potentials associated with them.

- Electricity from hydro power is clean and very efficient, and Ontario has the theoretical potential to expand generation by a factor of four over time, but expansion would require large initial infrastructure investments. Availability of excess off-peak electrical capacity would support a shift to the use of electric automobiles, but globally, expansion of this energy source will be much more limited, providing only a minor offset to declines in oil and gas.
- Coal is currently one of the most polluting energy sources. Reserves are relatively plentiful, but much of what remains is in harder-to-get deposits, and is of declining quality. Over the longer term, extraction will be more costly per unit of energy delivered, as will newer 'clean coal' technologies. Out of necessity, coal may soon replace many oil and gas-fired electric power plants. Coal now constitutes the greatest potential source of global energy production increases.
- Petroleum production from tar sands – mostly in Canada, with even larger reserves waiting in Venezuela – is very energy-intensive, and is currently a disproportionate contributor of greenhouse gases. Ramping up production is environmentally very destructive.
- The efficiency of hydrogen as a fuel is marginal at best, since hydrogen is not a readily available resource, and requires energy to produce, compress and transport. For transportation, it is more efficient for vehicles to be directly powered by electricity than by hydrogen-powered fuel cells.
- The potential for using crops to produce transportation fuels – particularly ethanol – is limited. Hardy, fast-growing switchgrass is becoming an alternative candidate for ethanol production, but a minor positive energy balance overall and limited land on which to grow it undermine its potential. This energy source in the USA is seen as mostly a political solution to dependency on petroleum imports from Asia. Using cropland for energy production affects food production, and is already creating significant increases in agricultural commodity prices.
- Solar energy systems for electric power and heating are environmentally clean, once installed. Production of photovoltaics has been hampered by high cost and recent shortages of refined silicon, but prospects for solar energy systems are good. Variable weather and lower solar radiation in Canada are limiting factors, but arid regions in the USA and elsewhere offer good potential.
- Wind power systems are energy-intensive to establish, and subject to the variability of weather. It is not expected to meet more than a small fraction of global energy demand.
- Nuclear power is fraught with problems related to high startup costs and construction time, community opposition, and radioactive wastes that need to be stored safely for thousands of years. Nuclear energy currently provides 17% of global electricity production⁹, but is unlikely to be able to keep pace with demand

growth. The availability of global uranium reserves to support significant nuclear power expansion is uncertain.

- Geothermal energy is clean and in abundant supply based on the natural heat of the earth, and although it is currently expensive to install, holds significant potential as natural gas prices for heating increase.

Other sources of energy, such as methane hydrates, oil from shale, and biomass energy have a mix of limitations and problems related to environmental protection, returns on investment, and the adequacy and timing of supply. The degree to which a combination of energy alternatives and conservation can reduce greenhouse gas emissions and offset traditional sources of supply is unclear.

Based on this evidence, the bottom line is that we are facing a tumultuous future characterized by a high risk of supply problems, prices rising much faster than the overall rate of inflation, and a shift to 'dirtier' and less efficient fuels as the global scramble for economic survival intensifies. The cost to households and commerce everywhere will undermine the affordability of today's energy-intensive communities and their lifestyle. Adopting alternative approaches to the current 'business as usual' must begin now.

Next: Part Two: Rebalancing at the Local Level

Notes:

- ¹ World Energy Outlook 2006; International Energy Agency press release November 7, 2006. www.iea.org.
- ² Sir Nicholas Stern, Stern Review Report on the Economics of Climate Change; commissioned by UK Finance. Link: http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm
- ³ Federal Environment Minister Rona Ambrose, "Canada's Greenhouse Gas Emissions Far Above Target", Reuters, May 11, 2006.
- ⁴ A highly and informative and disturbing crash course on oil discoveries, production and consumption, and their implications, is available at <http://www.chrismartenson.com/crashcourse/chapter-17a-peak-oil>.
- ⁵ Simmons, Matthew R.; *Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy*; John Wiley & Sons Inc., 2005.
- ⁶ Aleklett K, *IEA accepts peak oil: An analysis of Chapter 3 of the World Energy Outlook 2004*, Figure 20; available <http://www.peakoil.net/uhdsg/weo2004/TheUppsalaCode.html>. Also http://www.peakoil.ie/downloads/newsletters/newsletter64_200604.pdf.
- ⁷ Foss, Michelle Michot, Ph.D., "The Role of LNG in North American Natural Gas Supply and Demand"; Centre for Energy Economics, September 2004; www.beg.utexas.edu/energyecon/lng.
- ⁸ Perry GL, *The War on Terrorism, the World Oil Market and the U.S. Economy*. Analysis Paper #7. Washington DC: The Brookings Institution, October 24, 2001, available at <http://www.brookings.edu/views/papers/perry/20011024.htm>.
- ⁹ Nicholet, J-P and Underhill, Douglas, "Balancing Needs: Global Trends in Uranium Production and Demand, IAEA; www.iaea.org/Publications/Magazines/Bulletin/Bull401/art4_graphs.html

Prepared by SUDA staff

For further information, please e-mail SUDA at contact@suda.ca, or call 416-400-0553.

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