Energy Supply and Pricing for a Sustainable Future

by

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Canadians enjoy one of the most energy-intensive economies on Earth.[1] Much of the country depends, directly or indirectly, on fossil fuel for heat in winter and for air conditioning in summer. The Canadian way of life feeds on mainly fossil-fuelled transportation that moves everything people need over vast distances within the country and connects the nation materially to the rest of the world. Thanks to production agriculture and industrial food processing, our daily bread now 'embodies' more fossil energy than solar energy. The reality is, that for all the paper wealth being generated by the so-called knowledge-based economy, the country's entire post-industrial economy still floats on an 'old economy' pool of oil and gas. No wonder that in recent years Canadians have been taken aback by wild swings in the market supply and pricing of gasoline, diesel fuel, heating oil, and natural gas.

The Canadian – and US – governments have generally responded to this instability with interventions designed to restore stable low prices for conventional fossil fuels. Even while ratifying the Kyoto accord (which is designed to *reduce* CO_2 emissions), Ottawa is doing everything it can, including ruling out a carbon tax, and exempting the auto industry, to ensure that the oil and gas and automotive industries are minimally affected. While this may be good short-term politics it is bad economics and lousy environmental policy. And it won't prevent even steeper price increases in the near future. To avoid a serious energy crisis in coming decades, citizens in the industrial countries should actually be urging their governments to come to international agreement on a persistent, orderly, predictable, and steepening series of oil and natural gas price hikes over the next two decades. The present world energy market obscures the true price of hydrocarbon fuels and inhibits the development of alternatives.

This argument comes in two parts. The first is neatly summarized in a 1998 report by the Washington-based International Centre for Technology Assessment on "The Real Price of Gas". The purpose of this report was to quantify the numerous external costs associated with the use of fossil-fuelled motor vehicles that are not reflected in US consumer prices. Such hidden costs range from various tax and direct subsidies to the oil industry from governments, through publicly funded infrastructure costs, to the health and environmental costs associated with burning fossil fuels (e.g., breathing 'second-hand exhaust'). These direct and indirect subsidies seriously distort energy markets, burden the economy with rampant inefficiencies, and in the process, are helping to destabilize the world's climate.

Depending on the range of subsidies included and the quality of available data, the total unaccounted cost of fossil fuel use in the US was found to lie between $559 billion and $1.7 trillion dollars annually. A fuller social cost accounting for the use of fossil fuel would therefore

[1] This makes life very pleasant indeed in what would otherwise be a cold dark country for half the year.

result in a gasoline price per gallon of between US$ 5.60 and US$ 15.14. In Canadian terms, this would be roughly equivalent to a price per litre of between C$2.20 and C$5.95, or three to eight or nine times recent Vancouver prices (i.e., before the current price surge related to reduced exports from Venezuela and the threat of war in Iraq). In other words, even with the burden of existing taxes, prevailing energy prices do not 'tell the truth' about the costs of using fossil energy – North Americans pay a fraction of the price they would pay for gas in a perfectly functioning market.

In fact, US consumers enjoy the most under-priced fuel available in any major industrialized country and Canadians are really not that far behind—with predictable results. As every economist knows, the invariable consequence of under-pricing is overuse. Wealthy and middle-class North Americans live in ever-larger energy-inefficient houses, drive ever-bigger and less fuel-efficient vehicles and are therefore squandering in a few decades a non-renewable resource that took tens of millions of years to accumulate. Even if there were no other issues at hand, it would be economically rational and ecologically beneficial—e.g., price-induced lower consumption would help Canada meet its Kyoto commitment—for our federal governments to intervene in today's energy market to correct at least the best-documented and non-controversial market imperfections. We should be paying significantly greater taxes and prices at the pump.

But there *is* another issue at hand. The world is running out of cheap oil and North America is looking at dwindling reserves of gas. Recent price hikes may be mere tremors heralding the real price shock to come. Surely this is not the time to be discouraging the development of alternative energy sources and deepening our dependence on fossil fuel.

The evidence? Oil 'production' (i.e., *extraction*) peaked in the US around 1970 and in North America as a whole in 1984. Extraction from North Sea fields peaked in 2000 (only 25 years after peak discovery) and is now also in decline. More than 50 other oil-'producing' countries have already gone through this cycle of discovery, peak extraction and decline so that non-OPEC production is approaching its aggregate peak even as this is being written. Indeed, several recent studies project *global* conventional oil production to peak as early as 2010 . Harry J. Longwell, Executive Vice President of Exxon Mobil, made an unprecedented admission recently when he wrote: "To put a number on it, we expect that by 2010 about half the daily volume needed to meet projected demand is not on production today—and that's the challenge facing producers" (Longwell 2002). Even the necessarily conservative International Energy Agency (IEA) in its *World Energy Outlook, 1998* concurred for the first time that global output could top out between 2009 and 2012 and decline rapidly thereafter. Indeed, the IEA projected a nearly 20% shortfall of supply relative to demand by 2020 that will have to be made up of from "unidentified unconventional" sources (i.e., known oil-sands deposits such as those being developed in Alberta have already been taken into account). Other studies show that by 2040 total oil and natural gas liquid output from all sources may fall to 60% of today's 25 billion barrels of oil equivalents per year.

And running out of oil is not running out of just oil. Oil is the means by which industrial society obtains (and over-exploits) all other resources. The world's fishing fleets, its forest sector, its mines, and its agriculture all are powered by liquid portable fossil fuels. Seventeen percent of the US energy budget, most of it oil, is used just to grow, process, and transport food alone. (Physicist Albert Bartlett of the University of Colorado has called modern agriculture "the use of land to convert oil into food.") Keep in mind, too, that petroleum is not just a fuel. Oil and

natural gas are the raw material for thousands of products from medicines, paints, and plastics to agricultural fertilizers and pesticides. Since oil is directly or indirectly a part of everything else *the coming scarcity of oil and the attendant price shock may mean higher prices for everything else as well*.

But wait a minute. Many analysts will agree with energy economist M.A. Adelman that rising prices will stimulate "..a stream of investment [creating] additions to proved reserves, a very large in-ground inventory, constantly renewed as it is extracted". Unfortunately, this argument is dangerously misleading. The physical stock of exploitable oil is not being "renewed" and while higher prices have stimulated more drilling, they have not "added to proved reserves" in net terms since the early 1980s. To complicate matters, improved technology does make dwindling finite reserves more accessible thus increasing short-term market supply. Unfortunately, this effectively short-circuits the price increases that would otherwise signal impending real scarcity, even as finite stocks are depleted.

Adelman's argument also ignores the fact that oil exploration is subject to diminishing material returns. Despite increasing effort, we typically discover only six to eight billion barrels of new oil per year, or between a quarter and a third of present consumption. A few decades ago, oil extractors in the US would discover 50 barrels of oil for every barrel consumed in drilling and pumping. In the mid-1990s the ratio fell as low as five to one. While the ratio fluctuates, the trend in older oil producing regions is downward. At some point, there will no point in extracting oil with oil *at any price* even though there will still be plenty left in the ground.

What about substitutes? Concerns over climate change have already stimulated a growing interest in alternative energy sources. However, there are problems on the supply side. A recent summary article on energy engineering in *Science* cautioned that most renewable alternative sources of energy suffer from low areal power densities—biomass, wind power, and solar, for example, produce relatively few watts of power per unit area compared to the chemical energy concentrated in fossil fuel—intermittent supply and other severe deficiencies that limit their ability to replace fossil fuels. For these and other reasons, a recent issue of *The Energy Advocate* argued rather bleakly that: "The renewable sources of energy – direct sunlight, wind, hydropower, biomass – are all solar in origin and are *in toto* inadequate for running anything that passes for civilization. [They have] no chance whatsoever of sustaining the present world's population."

While not all analysts agree with *that* grim prognosis, it has yet to be confidently refuted and there are still other problems. We sometimes forget that qualitative differences among energy types make them imperfectly substitutable. Wind-generated and photovoltaic electricity may be able to substitute for most of the electricity currently generated by fossil fuels (nuclear fission is still in disrepute and commercial fusion reactors are decades in the future). However, electricity cannot replace the direct use of petroleum derivatives as fuel nor overcome their clear advantages in energy storage. While there may be promise in fuel-cells (if we can discover a way to produce hydrogen efficiently), the fact is that no suitable substitutes are yet in sight for the fossil fuels used in heavy farm machinery, construction and mining equipment, diesel trains and trucks, and ocean-going freighters. Jet aircraft cannot be powered by electricity, whatever its source. Nothing can replace hydrocarbons as feedstocks in the manufacture of myriad industrial and agricultural products. Finally, it is no small irony that we need high-intensity fossil fuel to produce the machinery and infrastructure required for most alternative forms of energy. Sunlight

is simply too “dilute” (remember, “low energy density per unit area”) to use in manufacturing the high-tech devices and equipment required for its own conversion to heat and electricity. Industrial civilization faces a paradox: we need oil to move beyond the age of oil.

The human population has grown six-fold in less than 200 years. The global economy has quintupled in less than 50. No factor has played a greater role in this recent explosive growth of the human enterprise than abundant cheap fossil fuel. No other resource has changed the structure of economies, the nature of technologies, the balance of geopolitics, and the quality of human life as much as petroleum. Little wonder that some scientists believe that passing the peak of world oil production will be a shock to the human enterprise like no other event in history. Population and consumption are still on a steep trajectory but the rocket is running out of fuel.

The problem is solvable, but not without positive action and wide-ranging policy innovation. Certainly universities should be leading the way in performing the research required to make alternative energy work and in on-campus energy-conservation demonstration projects. Meanwhile informed ordinary citizens and public service organizations in Canada and the United States should be urging governments to get real about energy policy, including pricing. As a first step, all direct and indirect subsidies to conventional oil and gas producers must be eliminated. Subsidies keep fossil fuel prices artificially low, encouraging excess consumption and inhibiting the development of alternatives. Second, we should be moving closer to full social cost pricing of fossil energy through carbon taxes or resource depletion taxes—as noted, significant price increases for conventional fuels are long overdue. Eventually, particularly if alternative energy development continues to lag, it may be necessary to implement a quota system for remaining fossil reserves. This would slow the pace of fossil energy consumption to ensure there is sufficient conventional energy supply to bridge the transition to the post-petroleum era. Government agencies would determine the annual allowable quota for crude oil and raw gas based on the best available science and analyses; competitive bidding among resource companies would then set a fair and efficient market price for the available supply.

The main point is that more realistic prices for traditional fuels are needed to induce conservation of our remaining fossil fuel reserves, to encourage the private sector to develop more energy-efficient technologies (particularly in the auto and transportation sector generally, building technologies and appliances), and to make inherently more expensive but necessary alternatives more competitive. Keep in mind too that more realistic pricing would help make the entire economy more efficient and competitive as the world energy market tightens up.

It could be argued that higher energy costs would impose an unfair burden on low-income families. Certainly any such inequity must be avoided but without abandoning the overall energy policy objective. (Failure to act now might mean an even greater future burden on the poor.) On the positive side, note that this potential problem might be relatively short-lived if the policy changes are phased in properly, according to a predictable schedule. Both producers and consumers respond to higher costs and prices. People would not object too much about gasoline costing twice as much if their cars were twice as fuel-efficient (and they’d have to become more fuel efficient if their manufacturers hope to retain market share). In any event, changes to energy pricing policy would be part of a broader program of ecological fiscal reform. Even income taxes rates could be adjusted to compensate for any residual inequity resulting from rising energy and material costs (dare we discuss a negative income tax?). Finally, keep in mind that many advanced European countries already have much higher energy costs than we do in Canada.

They have already made many efficiency adjustments with no appreciable negative distributional impacts.

The data and trends in the energy sector are no secret. Governments have known about the deteriorating conventional supply situation for years yet tend to sacrifice the public interest to the interests of the oil and gas and automotive industries who lobby for the *status quo*. Or they remain in the thrall of conventional economists who still argue—against the evidence of recent decades—that rising prices will automatically lead to adequate new discoveries. All this creates a political climate in which the looming crisis remains invisible and corrective action (with the possible exception of an oil-related war in Iraq) is impossible. The point is that higher energy prices are needed now to signal the real scarcity to come. Without higher prices we will not invest in the technologies needed for a smooth transition to the post-petroleum age. Without higher prices we will not conserve the fossil energy needed to manufacture those alternative technologies. Without higher prices, the remaining life expectancy of industrial society (as energy analyst Richard Duncan has frequently argued) may well be less than 40 years!

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