Hamilton: Towards a paradigm of energy-first planning

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Introduction

Over the next decade, energy concerns may well displace climate change as a major societal preoccupation, as climate change has recently displaced sustainability. This could be a welcome development, not only because of its relevance but also because, more than many other issues, energy may be able to engage a wide spectrum of interests in serious consideration of society's possible futures. Such engagement could restore what used to be a central feature of human endeavor: concern for the well-being of generations to come. This feature was reflected in the title of the 1997 report of Canada's Royal Commission on Aboriginal Peoples, *For Seven Generations*, based on words in the Kaianerekowa—Great Law of Peace—of the Haudenosaunee (Iroquois) Confederacy: "The lawmakers, in weighing any decision, must cast their minds seven generations ahead, to consider its effects on the coming faces." [26, Vol. 2, Ch. 3, Sec. 1.2]

Hamilton, with just over 500,000 residents, is Canada's ninth most populous municipality. It lies at the western end of Lake Ontario, about 70 kilometers southwest of Toronto. Hamilton is Canada's 'steeltown', home to two of North America's largest steel mills that supply the Toronto region's automotive industry, whose output now exceeds that of the Detroit region.

Hamilton's pressing economic imperative is job creation. There are only three jobs in Hamilton for every four resident members of the work force. This imbalance presents economic and social challenges to the City of Hamilton, which has unusually low tax revenues from business, more than to residents, who readily find work in neighboring communities.

Since 2003, the City has been developing its Growth Related Integrated Development Strategy (GRIDS), which integrates several specific plans, e.g., the Transportation Master Plan and the Social Development Strategy. One input into GRIDS is the Economic Development Strategy, which recommends concentration on the development of eight industry clusters, the most important of which would be the aerotropolis, a proposed airport-related business park.

In June 2005, at public meetings on the aerotropolis concept, several residents raised concerns about how potential energy constraints might affect the concept's viability. City Council directed staff to "prepare an analysis to establish a strategy to deal with the potential fossil fuel crisis (e.g., Oil peak) and the potential impact on our aerotropolis, goods movement future initiatives, fleet, and HSR." (HSR is Hamilton Street Railway, the

City's public transport system, now comprising buses only.) Staff contracted this author to prepare the analysis, known hereafter as the Hamilton report. [12] It was to assess the likelihood of future energy constraints, consider a broad range of land use, transport, and economic development issues, and pay special attention to the matters identified by City Council.

The prospect of severe energy constraints had already been noted in documentation supporting development of Hamilton's Transportation Master Plan, which suggested that "a dramatic increase in fuel costs beginning before 2015 is very likely." [16, p. 13] The GRIDS process had also benefited from a brief discussion of energy in its background paper on climate change, which noted the potential for energy-related economic development: "Renewable energy also presents a tremendous manufacturing and employment opportunity for Hamilton: steel for wind towers, installation expertise, and incorporation into new construction or upgrades." [23, p. 22]

Those reports attest to the topicality of energy concerns at the time the Hamilton report was commissioned and the receptivity of City officials and councilors to them. However, the crucial factor in the commissioning of the report was the persistence of several Hamilton residents in raising concerns about energy supply, particularly in relation to the aerotropolis concept, and the residents' skill in persuading City councilors to seek answers. Nominal oil prices were at their highest ever in the summer of 2005, offering support for the view—elaborated below—that a peak in world oil production could be imminent. If consequent even higher oil prices were considered likely, Council could be unwise to put a business park dependent on aviation—the most oil-intensive transport mode—at the forefront of its economic development strategy.

The main challenge in preparing the Hamilton report was that of contributing to a paradigm shift concerning energy availability while remaining credible to officials and councilors. The shift would be from a planning perspective that takes availability of sufficient energy as a premise to one that anticipates scarcity and puts energy concerns at the forefront of most municipal decision-making. The chosen strategy focused on the economic development aspects of energy scarcity in ways that responded to officials' and councilors' preoccupations with job creation.

Possibly important too was an appeal for restoration of Hamilton's former status as a major industrial center. The report's title *Hamilton: The Electric City* reflected a key conclusion about Hamilton's future: that electricity's share of energy consumption should rise to more than 50 percent from its current level of about 20 percent. It also pointed back to the 1890s, when Hamilton was Canada's third largest city after Toronto and Montreal and was among the first cities anywhere to have widespread electric light: for streets, offices, and homes. The report argued that Hamilton could again be 'The Electric City', now in the forefront of a transition to electric transport, new electricity generation, and greatly reduced reliance on fossil fuels.

Oil and natural gas prospects

A key element of the Hamilton report was assessment of the likelihood that retail prices of oil products and natural gas would rise steeply within the City's planning horizon, i.e., before 2031.

More than 95 percent of transport in North America and elsewhere is fuelled by products of petroleum—mostly gasoline and diesel fuel—laid down by geological and other processes acting over many hundreds of millions of years. Transport fuels, including for international shipping, comprise 60 percent of end uses of oil products worldwide, 71 percent in North America. [17] The remainder is used for lubrication, electricity generation, heating, and lighting, and as feedstock for a wide range of chemicals: notably plastics, fertilizers, pesticides, and pharmaceuticals.

World consumption of oil increased enormously between 1945 and 1975, from less than 10 million to more than 60 million barrels a day (mb/d). There have been more modest increases during the last 30 years, to about 80 mb/d, but recent rates of growth have been higher as China has moved rapidly into second place among consuming nations. [5]

There appears to be a growing mismatch between consumption of oil and the discoveries of it that make the consumption possible. Worldwide, discoveries reached a peak in the 1960s, even though exploration activity has increased. Now, two to three times more oil is consumed than is discovered. [2, 19] If discovery and consumption trends continue, discoveries could be less than a tenth of consumption in 2030, which is expected to be near 115 mb/d. [17]

Discoveries eventually translate into extraction of crude oil and then production of petrol, diesel fuel, and other oil products. Considerable evidence suggests that for one or several sources of oil, extraction reaches a peak when about half of the extractable oil has been removed. [11] The main evidence is the peaking of oil extraction in the continental United States in 1970 and in 54 of the other 63 countries in which significant amounts of oil have been extracted. [7] Worldwide, the peak in production of petroleum liquids appears to be set for 2012. These liquids include so-called conventional oil, non-conventional oil (e.g., oil from Alberta's oil sands), and liquid products of natural gas extraction (e.g., butane).

By 2020, the mismatch between what may be the most authoritative projections of *potential* consumption [17] and likely production [1] could be substantial (105 vs. 70 mb/d). But, actual consumption cannot exceed production. Either production has to rise, which may be impossible or difficult, or consumption has to be restrained, by price increases or rationing.

How large could the price increases be? According to the U.S. National Commission on Energy Policy, "a roughly four-per-cent global shortfall in daily supply results in a 177 percent increase in the price of oil." [20 p. 2] Another analysis suggested that a 15 percent shortfall could result in a 550 percent increase. [25] The shortfall noted in the previous paragraph substantially exceeds 15 percent. However, higher prices could raise production by opening up previously uneconomic extraction, perhaps reducing the shortfall to 15-20

percent and limiting the increase in the price of crude oil to about a factor of six. At 2006 price and tax levels, a sixfold increase in crude oil price would translate into a fourfold increase in retail prices in North America, less elsewhere.

This estimate of the extent of price increases must be regarded as tentative. There is no solid base of analysis that allows estimation of where such large differences between projected supply and projected demand will be balanced. Moreover, making specific predictions as to the date of the peak or as to particular price increases could be unwise. One expert suggested that gasoline prices in the U.S. could reach $10/gallon during the winter of 2005-2006, [18] but prices stayed below $3/gallon (about $1/litre).

Similar but more complex and uncertain arguments could be made in respect of natural gas. Except for trivial amounts moved across oceans as liquefied natural gas (LNG), this fuel is subject to a continental market. Production appears to have peaked already in North America. [5] Prices are highly erratic, but the general tendency has been for increases. Growth in consumption of natural gas is being offset by warmer winters and relocation of chemical plants relying on natural gas as a feedstock to places where it is more plentiful. In the absence of a firm basis for prediction, and in consideration of a historical positive association between oil and natural gas prices, the trajectory of retail natural gas prices was assumed to be similar to that for oil products: i.e., they could rise by a factor of four or more by 2020.

The Hamilton report noted that movement to a new price equilibrium at four or more times present levels could seem a dismal prospect, but also a positive outcome of large convulsions in oil and gas markets. A new equilibrium would mean that market forces were still working, that our industrialized society was still functioning, and that economic and social activities were continuing, albeit with much higher energy prices than prevail today.

The Hamilton report considered only the positive outcome of a new equilibrium of high and relatively stable fuel prices. Several other outcomes of energy constraints are possible, including negative outcomes involving economic or societal collapse that are difficult to plan for. Negative outcomes could involve major paradigm changes, but have greater intellectual than practical interest.

Analytical basis for the Hamilton report

The Hamilton report concerned the extent to which it would be reasonable to reorient the City's various planning processes to put energy concerns front and centre. Three scenarios were considered; they differed according to the likelihood that very high retail fuel prices would arrive during the planning period. If the chance of a quadrupling of prices were estimated to be less than one in four, there would not be strong reason to give undue weight to energy considerations. If it were to be between one in four and one in two, the City could be wise to continue with its present planning arrangements but develop a 'Plan B' for implementation if prices were to rise steeply. If the chance were estimated to be greater

than one in two—i.e., high prices were considered likely—the prudent strategy for the City could be to put energy concerns foremost in its planning.

After considering the results of an elaboration of the analysis in the previous section, the third scenario became the basis for the Hamilton report. That analysis suggested that fourfold price increases could occur by 2020 or earlier, well before the 2031 planning horizon. Notable additional factors in the consideration were possible major shortfalls from Saudi Arabia's expected oil production, [28] and inability to replace declining production of North American natural gas with sufficient imports or new production.

A further factor was the apparent lack of substitutes for oil and natural gas, or prospects for them. The substitute most talked about for oil as a transport fuel is hydrogen, to be used with fuel cells. Today, almost all hydrogen is produced from natural gas, North American production of which has already peaked. Hydrogen can also be produced by electrolysis, but in an energy-constrained world a wiser course would be to use electricity directly rather than make hydrogen that is then used in a fuel cell to make electricity. In the first case, the energy loss is about 10 percent, chiefly line losses during distribution. In the second case, the energy loss is can be as high as 80 percent. [4]

Prospects for alternative liquid fuels were also considered, including ethanol and biodiesel from organic material [24] and fuels produced from coal. [3] Some use of such fuels can be expected but not to any significant extent without severe environmental degradation. Coal can substitute for many uses of natural gas, but only at substantial cost to the environment.

Fourfold retail prices over a period of about 15 years could be such as to produce substantial changes in transport and in the use of energy in buildings. The Hamilton report noted that in places where transport fuels are twice North American levels, notably Europe, transport activity is substantially similar to activity in North America. Most journeys are made by automobile, even though there are somewhat higher rates of walking, cycling, and travel by public transport. Moreover, European cities are sprawling much as North American cities have sprawled, although less dramatically. [6] A doubling of prices would not appear to be sufficient to induce a shift to a new energy-use paradigm. Fourfold increases could well produce this effect, although evidence is limited.

With fourfold increases, continuation of 'business as usual' could become unaffordable. A household or business might be able to live with a doubling of expenditure on gasoline and natural gas. Much beyond that point, perhaps too many sacrifices would have to be made. Radical changes in many aspects of society could be expected. People would travel differently because everyday use of present kinds of automobile will become unaffordable, live differently because the heating and cooling of present types of building will become unaffordable, and eat differently because importing food from afar will become unaffordable (and because artificial fertilizers, made from and with oil and natural gas, will be much more expensive).

In anticipation of fourfold increases in fuel prices, the Hamilton report proposed four strategic objectives:

- reduce per-capita energy use by two thirds, for transport and in residential, commercial, and institutional buildings

- generate the total amount of Hamilton's electricity consumption locally, while continuing to trade with the Ontario grid

- generate half of Hamilton's non-electrical energy use locally

- keep the cost to households and businesses of implementing the above objectives to within twice current expenditures on energy.

These four objectives would define a civic mission for Hamilton and act as a prism through which to guide and assess all municipal policies and activities.

Proposed changes in energy use

How the Hamilton report proposed that energy uses change to meet the objectives is set out in four detailed energy-use tables for 2003 and 2018 that appear in Boxes 11, 12, 22, and 17 of the Hamilton report. [12] The tables provide: (1) An overview of energy use for transport and in buildings other than industrial and agricultural uses. (2) and (3) Details of energy use for the motorized movement of people and freight, respectively. (4) Details of energy use in buildings. Key features of the overview table are:

- energy used in buildings (residential and commercial) remains at about 25 percent more than the energy used for transport

- similarly, the balances between energy for moving people and freight, and energy use in residential and non-residential buildings are also maintained

- with expected population growth, the per-capita reduction in energy use by 67 percent by 2018 becomes an absolute reduction by 62 percent

- fossil fuel use falls by 80 percent; consumption of electricity remains essentially unchanged although consumption for present purposes declines by 63 percent

- electricity's share of the end-use fuel mix rises from 20 to 52 percent.

Motorized travel would remain overall near the current level: specifically, a 3 percent fall in total person-kilometers, or 18 percent per capita. The fall would arise chiefly from two factors that are as much to do with land-use planning, discussed below, as with transport arrangements:

- a shift to travel using non-motorized rather than motorized means.
- a reduction in the amount of travel because trip origins and destinations would be closer together.

Of Hamilton residents' motorized travel in 2003, 90 percent was by personal automobile. This share would fall to just over a third of travel, and only half of this automobile travel would be fuelled by gasoline or diesel fuel. The remainder would be fuelled electrically, in all-battery vehicles or 'plug-in hybrids'. [27]

Part of the balance of the travel would be taken up by conventional public transit—mostly local but some intercity—all of which would be electrified. Transit ridership would almost triple between 2003 and 2018, although accounting then for only a quarter of total travel.

The remaining third of motorized travel, all in and near Hamilton, would be by an entirely new form of public transport known as Personal Rapid Transport (PRT). [9]

There are greater challenges in developing proposals for the movement of freight. Here's why:

- we know less generally about the movement of freight than about the movement of people, particularly the movement of freight in cities
- estimates for Ontario, from which estimates for Hamilton must be derived, are affected by the considerable amount of through traffic between Quebec and the U.S., which bypasses Hamilton
- the movement of freight has been changing much more than the movement of people; in Ontario, energy use for freight transport grew by 43 percent between 1990 and 2003; energy use for moving people grew by 16 percent (less than the population growth of close to 20 percent). [21]

The Hamilton report's targets for freight movement in 2018 assume an overall *increase* in the amount of freight transport. This is because more local production of food is assumed and because of the proposal that Hamilton become a centre for the conversion of waste into energy, noted below. However, per-capita freight movement would decline slightly.

A reduction in the amount of trucking is assumed, replace by rail and marine transport. Almost half of trucking would be electrically powered, because the trucks are plug-in hybrids, battery only, or grid-connected.

A key feature of the proposed transport arrangements is use of electric motors for propulsion rather than internal combustion engines (ICEs). Using an electric motor is a more efficient way of achieving traction, especially under stop-and-start conditions. This is why hybrids—which provide for some substitution of a vehicle's ICE by an electric motor—use less fuel than regular ICE-only vehicles.

The main problem with all-electric vehicles is that they run from a battery, which means carrying a heavy weight and frequently recharging, or directly from the grid, which means that the vehicle must remain connected to a live rail or wire.

Where vehicles can run alongside a wire, they are much more efficient. Trolley buses use less than half the energy used by comparable diesel buses. Streetcars use even less, and

electric trains use even less than streetcars. [13] Of special interest in Canada is Calgary's light-rail system because it is powered entirely by renewable energy, hence its slogan 'Ride the Wind.'

Proposals for changes in energy use in buildings parallel those for transport, with similar reductions in absolute and per-capita consumption and a marked increase in electricity's share. Most of the reduction in in-building energy use will come from changes in the buildings themselves, through construction of new buildings and, more importantly, retrofit of existing buildings. Energy-use savings of more than 75 percent can be achieved for new buildings, compared with current practice, and more than 50 percent for existing buildings. [14]

Energy-first land-use planning

In considering the contribution of land-use planning to the achievement of aggressive reductions in transport and in-building energy use, the Hamilton report proposed application of seven principles, set out with rationales in Chapter 9 of the Hamilton report. [12]

The first principle is: Make energy use and production the principal factor in land-use decisions. This is the most fundamental principle—the application of the proposed paradigm shift to land-use planning—from which the others follow. Presently, this function serves numerous purposes that rarely include energy-related objectives.

The principle addresses energy use and production equally. These can be in conflict. Energy use decreases with increasing settlement density, more absolutely for building-related use but more relatively for transport-related use. [22] Energy production—e.g., from solar or wind energy—increases with the amount of space available, other things being equal. Reconciling this conflict could be a fundamental task within a land-use planning approach derived from a new urban energy-use paradigm.

Energy production opportunities

A substantial part of the Hamilton report concerned proposed production within Hamilton of all the required electrical energy and a substantial portion of other energy. In brief, there were proposals in respect of the following: solar energy; wind energy; Deep Lake Water Cooling (cooling buildings with cold water piped in from the depths of Lake Ontario, as is done in Toronto); hydroelectric generation; biogas production (using the vast amount of waste animal and plant residue from farming operations in southern Ontario); energy from waste (positioning Hamilton as a recipient of much of southern Ontario's solid waste, combusted to generate electricity and provide hot water for heating); and district energy (massive expansion of Hamilton's existing system, allowing productive use of numerous sources of waste heat).

The Hamilton report noted that the city is well positioned to move advantageously on energy production through its ownership of three companies in energy-related businesses. One produces electricity and hot and chilled water. One distributes electricity and one distributed hot and chilled water through its district energy system.

The imperative for more local food production in an energy-constrained world was noted but not elaborated in the Hamilton report. It was flagged as requiring special attention in subsequent work to make best use of nearby prime agricultural land and obviate long-distance transport.

Economic and social development through energy-first planning

If the City were to follow the strategy proposed in the Hamilton report, there could be substantial advantages from an economic development perspective. To the extent that the report's projections concerning future energy constraints and prices are correct, communities could seek to transform the ways in which they produce and consume energy. Hamilton would be a pioneer in distributed energy production and in radically reducing energy use and could benefit from the development in Hamilton of energy-related businesses.

Hamilton could thrive not only because of the additional economic activity but also because it would be saving and producing energy, benefiting from more secure supply and lower energy costs than communities that had not acted with respect to energy. Moreover, Hamilton as a community would be purchasing little energy, and would be able to use its productive surplus for other purposes.

A municipal focus on energy use and production would be contributing but not a sufficient condition for moving Hamilton towards becoming energy's 'Silicon Valley': a seedbed of research, innovation, development, and marketing. Silicon Valley, the southern part of the San Francisco region, has for many years attracted one third of the venture capital invested in the U.S. This happens, according to one analyst, because of proximity to venture funds' offices and technical expertise, and a milieu sympathetic to entrepreneurs. [29] A significant factor in the evolution of Silicon Valley may have been the development of Stanford Industrial Park in 1951—possibly the world's first technology incubator—and the co-location of venture capital funds.

Hamilton's economic development strategy proposes eight industry clusters, with the aerotropolis concept as the first priority. The Hamilton report argued for establishment of an energy cluster as the first priority. To make an effective contribution to a paradigm shift, the cluster should have all the conditions required for technology incubation and development.

Implementing energy-first planning

The Hamilton report touched only briefly on implementation issues, including the City's legal and financial competences. Indeed, the report's chief recommendation was that further

action should begin with preparation of a more in-depth and robust analysis of relevant matters, together with an implementation strategy. The Hamilton report aimed "to give no more than a taste of what could be to come. It was written in a relatively short period with limited resources." Using the new report, the City should decide whether and how it would wish to proceed. If the decision were to do nothing, the matter should be revisited in two or three years.

The Hamilton report nevertheless noted that a particular challenge would be securing the funds needed to engage in energy-first planning. These could flow from offering Hamilton as a testbed for advanced energy conservation and production. As such, Hamilton could well be the recipient of an extraordinary amount of private-sector investment as well as research and development funds from public agencies. Three examples were given:

- If the City were to call for expressions of interest for the construction of a city-wide Personal Rapid Transport (PRT) system, at no cost to the City, a range of appealing responses could be received giving confidence to move towards a call for proposals.
- If the city were to issue a call for proposals for an energy-from-waste plant and associated district energy system, using the waste from a large part of southern Ontario, at no cost to the City except a modest cost for disposing of its own waste, a range of appealing responses could be received.
- If the City or its electrical utility were to issue a call for expressions of interest for massive installation of photovoltaic collectors on Hamilton buildings, indicating what order of subsidy would be required, a range of appealing responses could be received that could form the basis for an approach to senior governments for appropriate contributions.

Such initiatives by the City of Hamilton would complement and reinforce the proposed establishment of an energy cluster as the first priority for the City's economic development strategy.

The City's disposition of the report, and aftermath

The first draft of the Hamilton report was completed as agreed in October 2005, as agreed, but it was April 2006 before a final version became available. Much of the intervening time was taken up with review by City officials. The delays had one probable and one known effect. The probable effect was that City officials became much more familiar with the report than they would have if the final report had been issued in early December, as first intended. The known effect was that the delay in issuance led to media and other speculation that the report was being suppressed, ensuring unusual attention when it was released.

Hamilton City Council took the unusual step of holding a special meeting of Council members to consider the report. After a 30-minute presentation and two hours of questioning and debate, a long resolution was adopted that eventually included the following:

- develop an energy management policy for city facilities with targets, timelines, and full consideration of use of renewable energy and an expanded district energy system.
- investigate (i) restoring trolley buses to the City's transit fleet; (ii) requiring especially stringent energy use standards for new construction in Hamilton; (iii) the feasibility of refocusing the Economic Development Strategy to include a strong energy component and nurturing of an energy cluster; and (iv) development of a community energy plan. [9, p. 7]

By October 2006, the City had done the following pursuant to this resolution:

- created a new element of the City's administration, the Energy Office, and hired a Manager of Energy Initiatives to run it
- included the above investigations in departmental work plans for 2007
- conducted a study tour of business parks with an environmental/energy focus.

In addition, a neighboring municipality (the Region of Halton) has moved towards considering construction of a large-scale energy-from-waste facility serving a large part of southern Ontario. Possibly inspired by the Hamilton report, it has issued a contract to prepare a business case for such a facility.

Residents whose actions had led to the commissioning of the report have been positive about the report, except in one respect. They disliked the suggestion in the report that the site of the proposed aerotropolis could instead serve as a location for industrial and other activity oriented towards energy efficiency, conservation, and production. The City appears to have used this suggestion to support establishment of a business park at that location. The aerotropolis proposal had been the focus of the opposition to GRIDS that had led to the commissioning of the Hamilton report. Otherwise, these residents believe the report has had a negligible effect on the City's actions. They note in particular that the one potentially relevant major planning input commissioned after the Hamilton report made no reference to it and almost none of any kind to energy issues. [15]

Discussion

Hamilton is among the first municipalities to consider the challenges posed by the imminent possibility that world oil production will fall permanently short of potential consumption of oil, and the reality that this is already happening for natural gas in North America. In the 1980s, its predecessor municipality, the Region of Hamilton-Wentworth, was among the first to address the need for sustainable development, which led to a Dubai Best Practices Award in 2000. Thus, despite its reputation as a down-to-earth, 'lunch-bucket' city, there appears in Hamilton to be an unusual disposition to address important long-range issues. Such a disposition, evident in citizen action and the responses of elected representatives, led to the production of the Hamilton report and provided the key context for its consideration. Hamilton's unusual concern for the longer term deserves further examination.

Notwithstanding this disposition, the Hamilton report was framed as much to address the City's preoccupation with job creation as the particular challenges posed by high fuel prices. Selection and use of such a strategy may have been facilitated by the author's earlier experience as a long-time elected representative in a nearby municipality (Toronto). This experience highlighted the persuasive benefits of reaching out to recipients of messages in ways that are relevant to their predicaments.

Another, fortuitous element of the appeal involved Hamilton's history as a pioneer in an earlier energy revolution. It ran the risk of drawing attention to Hamilton's loss of status within Canada over the last century. However, as expected, this was offset by the opportunity for pride in past accomplishments and the indications of community substance that historical references provide. Another useful examination could be the role—or not—of Hamilton's illustrious past in shaping present attitudes and actions.

These framing strategies may have helped with the acceptance of the Hamilton report, but they could not have done so without the plausible argument, presented in the report, that major energy challenges lie ahead. In this, the report was buttressed throughout its gestation by rising fuel prices and growing acceptance in the media of the prospect of an early peak in world oil production.

Although the City took the unusual step of commissioning such a report, and the City Council eventually gave the report serious attention, the outcome was modest in relation to expectations that could have been stimulated by the report. The thrust of the report—that the City should move towards putting energy concerns front and centre in its planning—was not accepted; nor was it explicitly rejected. City Council took several steps towards developing a greater sensitivity to energy issues. If strongly reinforced during the next few years by citizen pressure or world events, these steps could move Hamilton towards becoming 'The Electric City' contemplated in the report.

Hamilton faces the risk that one or more other municipalities in Canada and elsewhere will commandeer the pioneering role proposed for Hamilton. The action of the neighboring Region of Halton with respect to energy from waste has already been noted. The nearby, much larger City of Toronto has maintained a focus on energy issues at least since 1980, when it hosted a major Cities Energy Conference. Again possibly stimulated in part by what Hamilton has done, it is stepping up its concern about energy through development of an Energy Plan for Toronto, and the recent allocation of Can$585,000 (US$515,000) for this work. Burnaby, British Columbia, began work on a 'peak oil' report after Hamilton, quite independently, but produced it first and received substantial credit for its initiative. [8]

The changes ahead for local government are potentially so large and far-reaching as to allow room for many pioneers, with continuing opportunities for benefit from early action. However, even when the need for longer-term action becomes evident during the day-to-day maelstrom of municipal activity, there can be good reasons for holding back. One is that early adopters often experience product failure, which few local governments are in a position to absorb. Local governments have none of the certainties of business and science as to what might be good courses of action, and little of the resilience that comes with the

powers and resources of senior governments. Local governments' particular vulnerabilities and messy, multifaceted natures make attention to long-term trends a challenge. A focus on energy issues at this time, however halting, deserves every encouragement. Hamilton's success in considering energy-first planning could well be part of the encouragement required for other municipalities to take substantive precautionary action in anticipation of the very different energy paradigms that will prevail for most of the 21st century.

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