City of Burnaby

Meeting 2006 Jan 11

COMMITTEE REPORT

TO:	CHAIR AND MEMBERS TRANSPORTATION COMMITTEE	**DATE:**	2006 January 4
FROM:	DIRECTOR PLANNING AND BUILDING	**FILE:** *Ref:*	94000 – 20 *Environmental Impacts*

SUBJECT: GLOBAL PEAK IN OIL PRODUCTION: THE MUNICIPAL CONTEXT

PURPOSE: To provide the Committee and Council with a requested overview of the peaking of global oil production

RECOMMENDATION:

1. **THAT** the Committee recommend that Council receive this report for information.

REPORT

1.0 BACKGROUND

Arising out of a general discussion on 2005 June 22, the Transportation Committee requested a staff report on the issue of peak oil, and its general implications for the City of Burnaby.

The term "peak oil" refers to the point in time at which the global production rate of oil reaches a maximum level, and thereafter declines. Since oil is a finite resource, it must eventually reach such a peak. Some analysts believe that that time is very near. Since the consumption of oil is pervasive in our society, the effects of passing that peak are likely to be significant. Events in 2005 have given an indication of the widespread impacts that a reduction in oil supply may have.

2.0 THE ISSUE

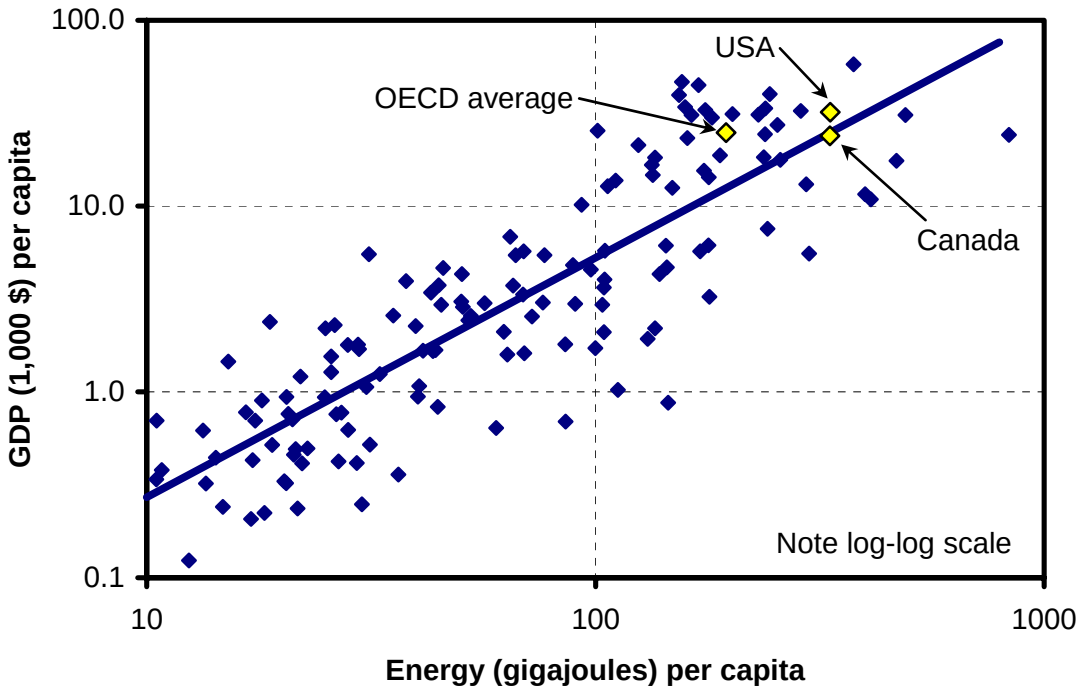
> *"The entire global economy is like a huge machine, steadily turning energy into wealth."* [1]
>
> *"Perhaps the ultimate answer to how high oil prices need to go before demand destruction occurs is derived from knowing when … consumers will stop buying gas guzzling sport utility vehicles and instead seek fuel efficient alternatives."* [2]

The economic wealth of societies is directly related to their consumption of energy. The role of energy in generating wealth is illustrated in ***Figure 1***, which shows energy consumption and

[1] Roberts, Paul; "The End of Oil: On the Edge of a Perilous New World"; 2004.
[2] Goldman Sachs as quoted in Finfacts; "Oil Over $57 as Super Spike to $105 Forecast"; 2005 April 2.

Gross Domestic Product (GDP) per capita for each country in the world. There is clearly a strong correlation between increased energy usage and increased wealth. The countries of the Organization for Economic Cooperation and Development (OECD) have 18% of the world's population, yet consume 52% of the world's energy [3].

Figure 1: Energy Consumption vs. GDP [4]



As Canadians, we live in an energy-intensive society. Energy is used to heat our homes, dry our clothes, transport us, and manufacture the products we purchase and the food we eat. Canadian per-capita energy consumption is well above the OECD average, placing us fourth-highest in the OECD and eighth-highest on the planet.[5]

The world's energy comes from a variety of sources, but the single biggest source (37% of the total) is oil.[6] Oil is a finite resource. It is created and stored in the earth's crust under only the most unusual of circumstances:

- A large number of life-forms must die in one place.

[3] International Energy Agency; "Key World Energy Statistics 2004"; 2004 March 16.
[4] Data are for 2002, from International Energy Agency; "Key World Energy Statistics 2004"; 2004 March 16. GDP is expressed in 1995 US dollars.
[5] International Energy Agency, "Key World Energy Statistics 2004", 2004 March 16.
[6] BP p.l.c.; "BP Statistical Review of World Energy"; 2005 June. Other major sources are coal (27%), natural gas (24%), nuclear (6%), and hydro-electric (6%).

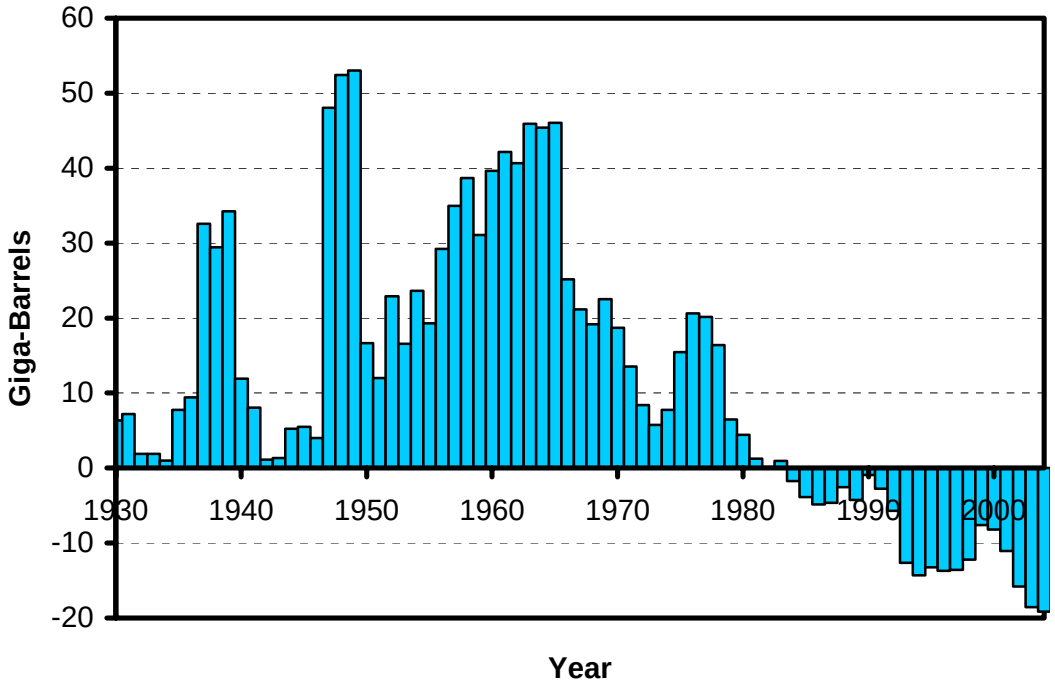
- Their remains must eventually be covered to the right depth (about 2,000 to 5,000 metres) in the earth's crust, where the temperature is just right to "cook" their remains into oil.

- The rock in which the oil is embedded must become cracked, so that it is porous enough for the oil to flow.

- There must be a cap of impermeable rock on top, to keep the oil from evaporating into the atmosphere.

All these conditions are sufficiently rare that most of the world's oil comes from only two periods in history: 90 and 145 million years ago. And that oil is found in only a few isolated locations: 62% of it is in the Persian Gulf, in an area measuring only 0.2% of the Earth's surface.
It is estimated that we have now extracted from the earth's crust about half (the easy half) of all the oil we will ever be able to recover. ***Figure 2*** shows the difference between oil found [7] and oil consumed on an annual basis. The year 1983 was the last in which we found more than we used. For over 20 years now, we have been consuming more than we find, at ever-increasing rates.

Figure 2: Oil Discovery Minus Consumption [8]



[7] All oil discoveries in this reported are "backdated" to when each field was originally discovered. Subsequent increases in the estimated field size (e.g., due to greater site knowledge or new extraction techniques) are therefore logged at the original field discovery date. This report focuses on "conventional" oil (from wells), which represents most of our supply.
[8] Data from Campbell, Colin; "The End of the First Half of the Age of Oil"; 2005 May 19.

Clearly, this is not sustainable. Sometime fairly soon, we will no longer be able to get oil out of the ground fast enough to meet our ever-increasing demands. Starting at that time – the peak – production (and therefore consumption) must decline.

In the last 12 months, peak oil has gone from being a relatively obscure topic to one that is being considered publicly at the highest levels of government. The government of Sweden has created a National Commission on Oil Independence with the objective of making Sweden oil-independent by 2020. In the U.S., the House of Representatives has asked its Subcommittee on Energy and Air Quality to investigate a proposed motion "…that the United States, in collaboration with other international allies, should establish an energy project with the magnitude, creativity, and sense of urgency that was incorporated in the 'Man on the Moon' project to address the inevitable challenges of 'Peak Oil'."

3.0 THE DEBATE

> *"Anyone who believes exponential growth can go on forever in a finite world is either a madman or an economist."* [9]
>
> *"Today no one disagrees that the wolf is out there but differences in analyses and opinions as to when it will attack the sheep still prevail."* [10]

Among geologists and others that have examined the issue, there is general agreement that we are headed for a peak in global oil production. The only serious debate is about *when* this will occur. The uncertainty is due to the complexities involved in making such a prediction.

Numerous agencies and individuals have published their estimates for the timing of peak oil production. Of these, two have achieved particular attention. The Association for the Study of Peak Oil (ASPO) is the strongest voice expressing the view of "peak sooner"; whereas the Energy Information Administration (EIA), a branch of the U.S. Department of Energy, can be considered the leader of the "peak later" viewpoint.

ASPO consists primarily of geologists and other industry experts. Their position is that global oil production will peak in about 2008. In contrast, the EIA does not have a specific prediction for the peak. They have developed a range of scenarios for possible peaking, based on a range of values for selected input parameters. Their dates thus range from 2021 to 2112. However, their mid-range scenario, while not explicitly endorsed by them, is the one that is generally taken to be EIA's "best guess". It shows a peak in 2037, followed by a steep decline.

To understand how these predictions were developed, and why they differ, it is worthwhile to briefly review the most important input parameters:

1. **How much oil has been found (but not yet used)?** Countries and oil companies report on the amount of "proven" oil reserves that they have in the ground. The term "proven"

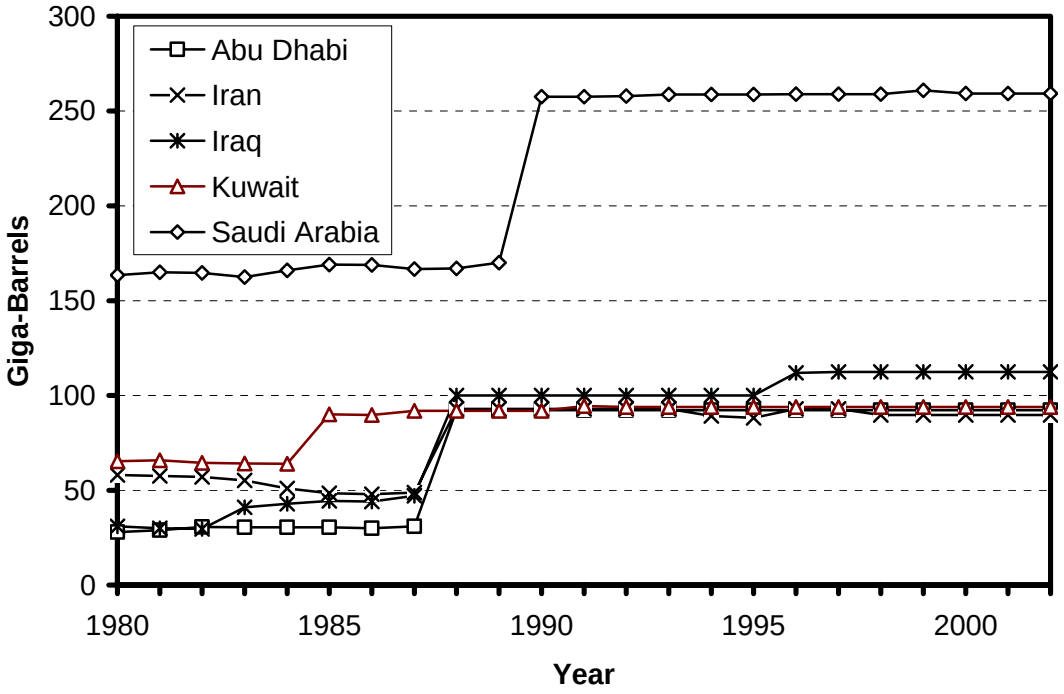
[9] Boulding, Kenneth (economist, past-president American Economic Association); ca. 1980.
[10] Illum, Klaus; "Oil-Based Technology and Economy – Prospects for the Future"; 2004 March.

reserves means that they are 90% certain that there is at least that much recoverable oil in the ground, in a particular oil field. They also report on their "proven + probable" reserves, a larger number, of which they are 50% certain that there is at least that much recoverable oil. In principle, determining how much recoverable oil has been found (but not yet extracted) in the world should be just a matter of adding up the reports from the various countries.

In practice, some have suggested that companies and countries are rewarded for erring on the side of optimism when reporting their reserves. For example, larger reserves make it easier to attract investment, and enhance a company's share prices. In addition, the Organization for Petroleum Exporting Countries (OPEC) brought in new rules for their members in 1985, in which the amount of oil that each country could export in a year would be proportional to that country's reported reserves. The higher a country's reported reserves, the more oil it could export, and the more income it would receive each year.

This led to the situation depicted in ***Figure 3***, in which reported reserves in various OPEC countries jumped by as much as 200% without any major new oil finds being reported. It is also worth noting in ***Figure 3*** that the size of most countries' reserves have not declined from one year to the next, in spite of large volumes of oil being extracted.

Figure 3: Reported Oil Reserves (selected OPEC countries) [11]

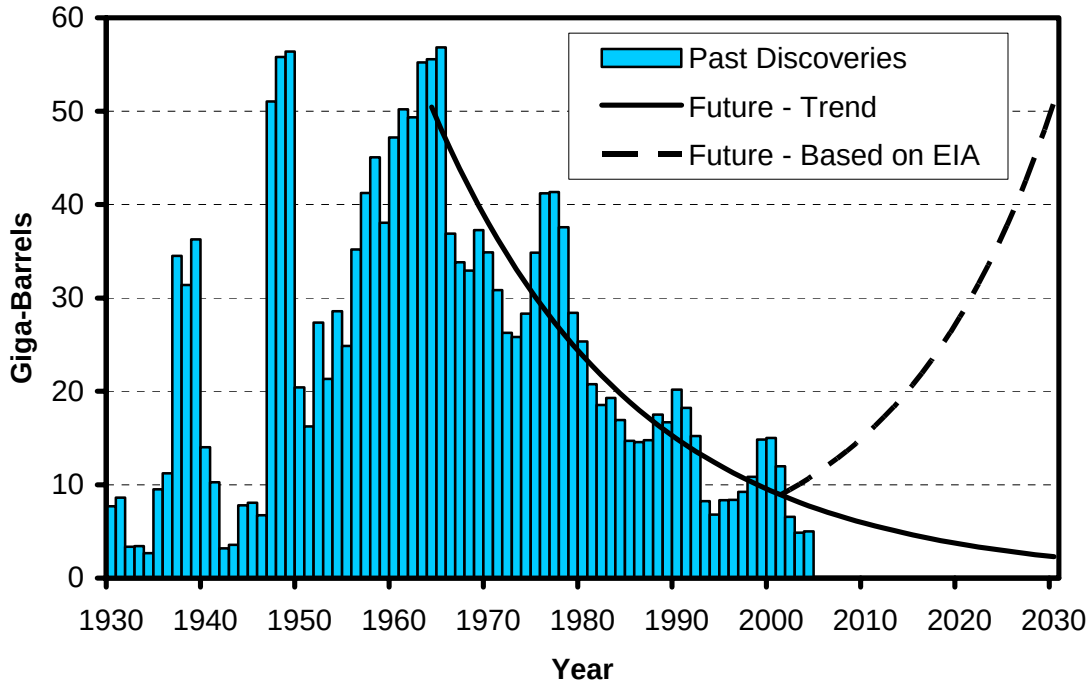


[11] Data from Aleklett, Kjell; "International Energy Agency Accepts Peak Oil"; 2004 November.

This is not to say that all reported reserves are exaggerated; it merely demonstrates that the temptation is there. Rather than "proven + probable", a more accurate term might be "claimed" reserves. A recent source has estimated that only 5% of claimed reserves world-wide have been audited by independent agencies[12]. A certain amount of scepticism is therefore in order. "Peak sooner" advocates tend to have more scepticism in this regard than those with a "peak later" perspective. Similarly, there are different views on the extent to which new technology may allow us to extract oil in the future that is presently inaccessible.

2. **How much oil is yet to be found?** In addition to the known reserves, as described above, it is reasonable to expect that some new oil fields will be found in the coming years. ASPO points out that, in spite of computer technology and 3-D underground imaging, the volume of new oil being found each year has been in general decline for 40 years. Large fields tend to be found first, because they are easiest to spot. Subsequent finds will tend to be harder to find, and will probably yield less oil. The EIA mid-range scenario, in contrast, assumes that the trend of declining discovery will be dramatically reversed in the immediate future, and that new oil discoveries will rise significantly. The two viewpoints are illustrated in ***Figure 4***. (In the five years since the EIA scenarios were released, their predicted upsurge in discovery has failed to materialize.)

Figure 4: Past Discoveries and Future Expectations [13]

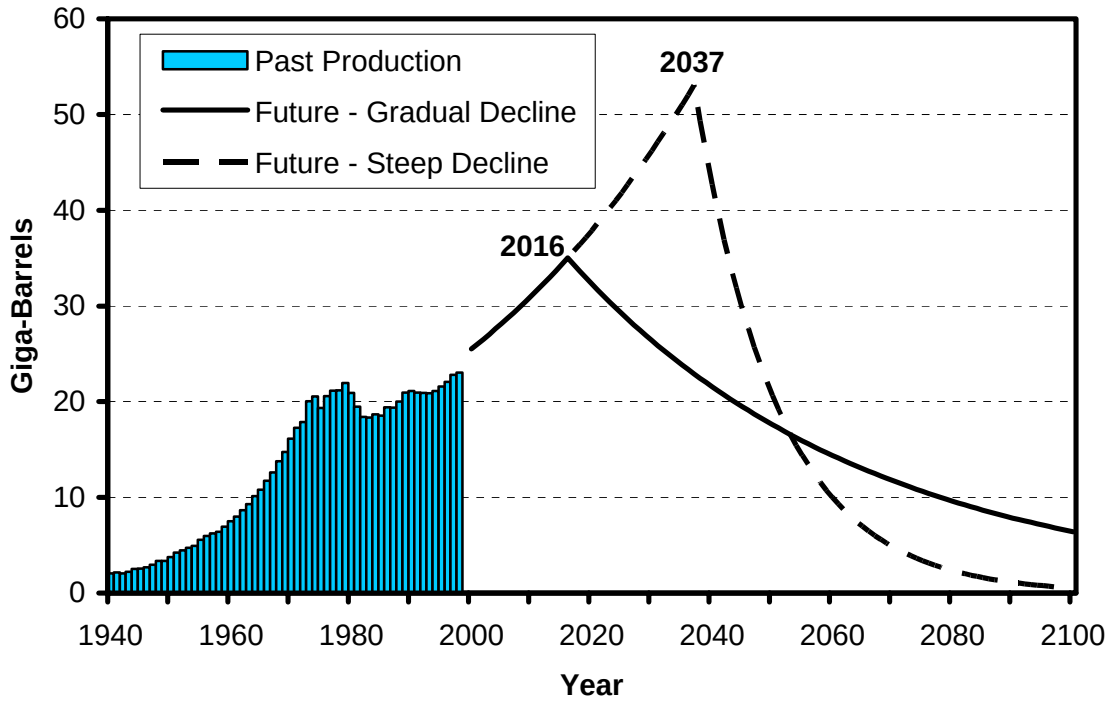


[12] Simmons, Matthew; speaking at "Peak Oil UK" conference; 2005 April 25.
[13] Historical data from Campbell, Colin; "The End of the First Half of the Age of Oil"; 2005 May 19.

3. **How fast will global demand increase?** Global demand for oil has been increasing at about 2% per annum. Both ASPO and the EIA mid-range scenario use similar values for this parameter.

4. **How steep will the decline be?** ***Figure 5*** shows two possible shapes for the oil production curve. In each case, the total amount of oil produced over all time is the same. However, one curve assumes that an early peak will be followed by a gradual decline, whereas the other assumes that we will be able to keep increasing the volume pumped for a few more decades, followed by a much steeper decline. This one assumption can account for about 20 years of the 30-year spread between the "peak sooner" and "peak later" predictions. If true, the assumption of a steeper decline is the worst possible scenario, as it means we will spend two more decades becoming even more dependent on oil, and will then need to kick the habit in a much shorter time frame. (In fact, the production curve is not expected to peak as sharply as shown in this figure. The actual peak will probably be spread over several years, but the significance of the post-peak decline rate still applies.)

Figure 5: Two Oil Production Scenarios [14]



These are the key aspects of the debate. The EIA has been regularly criticized in the technical literature about the realism of their assumptions, as a result of which they published a defence of their projections. They continue to defend the 2037 date of their mid-range scenario but observe that, in view of the long lead-times needed to implement change, this later date "in no way justi-

[14] Based on Energy Information Administration; "Long Term World Oil Supply"; 2000 July 28.

fies complacency" in preparing for the peak[15]. Interestingly, recent work for a separate branch of the U.S. Department of Energy (EIA's parent organization) has called the EIA's projections into question, suggesting that the EIA's steep post-peak decline (as illustrated in ***Figure 5***) is unrealistic, and that a more gradual decline with a peak date of 2016 is "much more credible"[16]. That report further observes that a date even prior to 2016 is possible, if the EIA's projections of total world reserves are unrealistically high (as many people claim). This is now entering into the range of ASPO's 2008 prediction.

The major oil companies obviously have views on peak oil, though some of their statements on the subject can be a bit vague. Perhaps the clearest statement has come from Chevron Corporation. In 2005 July, they created a stand-alone web site, www.WillYouJoinUs.com, that invites the world to participate in a dialogue (hosted on the web site) about energy. The site is linked prominently from their main corporate web site, as well as being promoted via television, billboards, and print media. One of the print ads includes an open letter from David J. O'Reilly, Chairman and CEO, which begins:

> *"Energy will be one of the defining issues of this century. One thing is clear: the era of easy oil is over. What we all do next will determine how well we meet the energy needs of the entire world in this century and beyond."*

It should also be noted that the dates of 2008 and 2037 do not fully capture the range of the debate. At one extreme, there is the view that we have already passed the peak; that we will eventually look back and say that we never produced more oil than we did in 2004. At the other end of the spectrum are firm adherents of economic and market theories, stating that rising prices will lead to technological and other breakthroughs that will allow oil production to continue to rise for the foreseeable future. According to this perspective, those predicting a peak have put "an unjustifiable faith in geology"[17]. However, both of these extreme views are relatively uncommon. The vast majority of predictions fall into the range bracketed by ASPO and EIA, and generally closer to ASPO's "peak sooner" perspective.

4.0 ACCOMMODATING THE PEAK

> *"We lean toward [the] view that our survival depends not only on engaging in long-term planning but also on the extent to which we are able to replace certain core values. One such core value is that moving people and goods farther and faster in ever-increasing amounts is inherently desirable, a value manifested in the 'predict and provide' paradigm that has inspired transport policy for at least three generations."*[18]

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[15] Wood, John H.; Long, Gary R.; Morehouse, David F.; "Long-Term World Oil Supply Scenarios"; 2004 August 18.

[16] Hirsch, Robert L.; Bezdek, Roger; Wendling, Robert; "Peaking of World Oil Production: Impacts, Mitigation and Risk Management"; 2005 February.

[17] Maugeri, Leonardo; "Oil: Never Cry Wolf – Why the Petroleum Age is Far From Over", in Science; 2004 May 21.

[18] Gilbert, Richard; Perl, Anthony; "Energy and Transport Futures"; 2005 June 5.

> *"It will cost less to displace all the oil the United States now uses than it will cost to buy that oil"* [19]

Once oil production starts to decline and prices escalate, there are three activities that society will need to engage in:

1. Switch to other energy sources;

2. Improve efficiency (i.e., the benefit received from a given amount of energy); and

3. Reduce activities that consume energy.

After the peak, these will be essential. Prior to it, they just make sense. Each of these is explored below.

4.1 Other Energy Sources

Other energy sources are available, but there are challenges. Firstly, oil consumption is so massive (37% of total world energy consumption, as noted above, and much higher in the transportation sector). Secondly, we have developed an infrastructure for the distribution and consumption of oil that is not readily adaptable to other energy sources. Any conversion to other fuels will take a long time and be very expensive. Furthermore, many of these alternative fuel sources have issues of their own:

1. **Oil sands** are an example of "unconventional" oil. It is considerably more expensive to produce, though this is not an impediment at current oil prices. However, production of this oil is also more energy-intensive, in that the oil must be separated from the "sand" that it is imbedded in. As a result, the net energy derived from each barrel of oil is lower, and the emission of greenhouse gases is higher. The process itself consumes 25% to 30% of the energy it produces, along with large amounts of water. In addition, "there is a significant environmental footprint associated with the development of the resource, and that could become a potential constraint to growth"[20].

2. **Natural gas** production in North America has already peaked. Gas production in the Lower 48 U.S. states has held constant since 1982. Since then, almost all the increase in North American production has been in Canada. But Canadian production levelled off in 2000. In Canada, we drill 17,000 gas wells a year just to hold steady, and further increases are unlikely[21]. While the peak may be soon for

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[19] Lovins, Amory *et al* in "Winning the Oil Endgame: Innovation, for Profits, Jobs and Security" as quoted by Jeremy Leggett in "Half Gone: The Coming Global Energy Crisis, Its Conflation With Global Warming, and the Implications"; 2005 April 25

[20] Lambert, Gordon; VP for Sustainable Development, Suncor Energy Inc.; quoted in New York Times; 2005 October 9.

[21] Kvisle, Harold; President & CEO, TransCanada PipeLines Ltd.; speaking to the Standing Senate Committee on Energy, the Environment and Natural Resources; 2005 March 8.

oil, it appears to be here already for North American natural gas. The only way to increase consumption will be to import natural gas by ship, in the form of refrigerated Liquefied Natural Gas. There are few ports that can accommodate this at present, and environmental and terrorism concerns have stalled the construction of such terminals. If built, they may provide only short-term relief, as global natural gas production is likely to peak about a decade after oil.

3. **Coal** is highly polluting in terms of particulate matter and greenhouse gases. These factors have led to, for example, Ontario's decision to phase out all coal power generation over the next few years. There are technologies that can help with these issues, but none has yet been implemented on a commercial scale.

4. **Nuclear** energy requires a long-term solution for the disposal of nuclear waste. It is also an expensive energy source that has relied on government subsidies to be viable. In addition, there are concerns from a terrorism perspective.

5. **Hydro-electric** is our only existing major energy source that is sustainable. That is to say, setting aside changes in precipitation patterns brought on by global warming, the current level of hydro-electric production can be maintained indefinitely. However, like oil, the easiest and best sources for hydro-electric power were the first to be developed. Expansion will therefore be increasingly difficult.

6. **Other sustainable energy sources** include solar, wind, tidal, wave, heat exchange, biofuels, and others. Each of these has some potential, and some issues. Current deployment is very small. Expansion is possible, but will require time.

A key consideration is that oil and natural gas are highly portable, making them very desirable for transportation. Most of the above-listed energy sources are less portable. We do not have another source of portable energy that can be scaled up fast enough to meet the expected decline in oil and natural gas production. This has particular significance in the field of transportation.

A brief mention should be made of hydrogen. Hydrogen is not something that we extract from nature (like oil or natural gas); it is something we manufacture. We need some other fuel in order to make hydrogen. If issues of cost and efficiency can be addressed, hydrogen may eventually provide a new way of storing or transporting energy, but it is not an energy source.

Finally, it is important that we solve our energy issues in a way that does not dig ourselves a deeper hole somewhere else, such as in global warming, habitat destruction, water pollution, or other significant global issues.

4.2 Increased Efficiency

Increased efficiency is something we already know how to do, that can generate immediate economic benefits. This approach is typified by BC Hydro's "Power Smart" pro-

gram, and by California's response to their 2001 electricity crisis. It is cheaper (and faster) to improve efficiency than to increase energy supply [22].

This illustrates the concept of "least-cost planning", in which solutions are not limited to the creation of new supply. For example, one analyst has estimated that average fuel efficiency could be doubled by driving small cars rather than SUVs. Since auto transportation makes up about half of global oil demand, he concludes that 25% of total global oil consumption today serves no purpose other than "… to satisfy a certain vanity attached to the car as a status symbol" [23].

4.3 Consumption Patterns

It is very unlikely, particularly in the short- to medium-term, that we will be able to find and/or save enough energy to offset declining oil and gas production. With finite resources, we will thus have no choice but to change our consumption patterns to match the available energy. How we do that, and whether the establishment of priorities is conducted primarily in the financial or political arena, remains to be seen.

Many possibilities exist, such as changes to: building forms, densities, mode choices, combining of trips, use of oil in manufacturing processes, etc.

4.4 The Crystal Ball

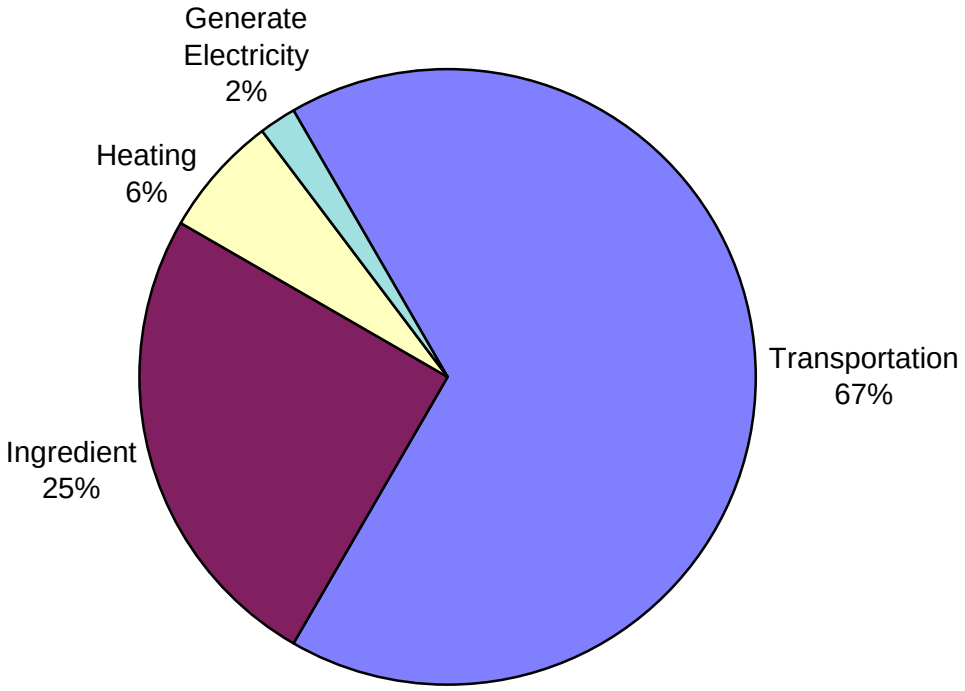
We are heading for a peak in global oil production. The timing is uncertain, but it appears to be relatively soon. Estimates of the impact of peak oil on global society range from the moderate to the catastrophic. While the scale is difficult to judge, the sectors are easier to identify. ***Figure 6*** illustrates the uses that oil is put to in the U.S., which dominates the North American market. Two-thirds of oil is used for transportation, and much of the remainder is used as ingredients in manufactured products ranging from food to fabrics. In general, some of the trends we may see in society include:

- Changes to urban housing and transportation choices.
- Greater demand for locally-produced products, including food.
- Increased average prices and price volatility for all forms of energy.
- Pressure to ease environmental or labour regulations to facilitate development of new energy resources.
- Efforts to reduce the amount of oil that goes into an astonishing number of things we take for granted, from the food we eat to synthetic fabrics, compact discs, pharmaceuticals, and asphalt.

[22] Roberts, Paul; "The End of Oil: On the Edge of a Perilous New World"; 2004
[23] Illum, Klaus; "Oil-Based Technology and Economy – Prospects for the Future"; 2004 March.

- Some writers predict considerable social and political disruption.

Figure 6: U.S. Uses of Oil [24]



In a Canadian context, we presently produce more oil than we need for internal consumption. This might suggest that we will not feel a supply crunch here. However, we have commitments to other nations that limit our ability to use this oil for ourselves. Firstly, the North American Free Trade Agreement prohibits us from implementing any restriction on the percentage of our oil that we ship to the U.S. If we want to use "our" energy, we have to compete with U.S. users on the open market. Secondly, our membership in the International Energy Agency requires us to help out member nations of the OECD by shipping oil to them in the event of a significant shortage (much as was done for the U.S. after the 2005 hurricanes in the Gulf of Mexico).

Europe has a similar quality of life to ours, yet consumes less than half the energy per capita. We have developed an energy-intensive society because, aside from a few discreet incidents, the price of energy has been remarkably low. Canada has the eighth-highest energy consumption per capita of any country on Earth. We thus have ample room for improvement.

The sooner we start changing, the better it will be. A study for the U.S. Department of Energy concluded that it was possible to compensate for declining oil if a "crash" pro-

[24] Data are for 2003, from Hirsch, Robert L.; Bezdek, Roger; Wendling, Robert; "Peaking of World Oil Production: Impacts, Mitigation and Risk Management"; 2005 February.

gram was implemented 20 years before the peak. The difficulty, of course, lies in implementing a "crash" program on the strength of a projection. It is very difficult, politically, to implement such a massive change in policy without public perception of a crisis. However, the authors view the problem as one of risk management: there may be uncertainties about the timing of the peak, but the potential consequences are so enormous as to justify immediate action. [25]

5.0 ROLE OF GOVERNMENT

"It is too late to panic. It is time to plan." [26]

The nature and magnitude of this issue will involve every level of government. Possible interests include:

- **Federal:** national-level policies and international action and commitments. Develop policies and strategies that allow us to "decouple" economic growth from energy consumption. Create national awareness program. Conduct and disseminate research. Influence corporate and consumer decision-making through tax policies.

- **Provincial:** primary responsibility for energy. Constructor of new highway capacity that may no longer be needed, potentially funded by toll revenues that may not live up to expectations. Responsible for protecting agricultural land.

- **Regional:** TransLink may find that demand for its services escalates, at the same time that revenues from the gasoline tax decline and operating (fuel) costs rise. The Greater Vancouver Regional District has a role in air quality, as well as owning the Waste-to-Energy Facility in the Big Bend.

- **Municipal:** defining the shape and character of our cities, and the resultant energy that is expended on transportation and heating.

There is much that municipalities can and should be doing in advance of a peak in global oil production. Some ideas are presented in Appendix A. These ideas also have non-energy benefits such as reduced environmental impacts, improved health, enhanced liveability, and a greater sense of community. These ideas give a sense of the range of actions that is possible at the municipal level. They are not specific recommendations at this time. Fortunately, there is much that Burnaby is already doing that is positive.

6.0 CONCLUSION

"The world has never faced a problem like this. Without massive mitigation more than a decade before the fact, the problem will be pervasive and will not be tem-

[25] Hirsch, Robert L.; Bezdek, Roger; Wendling, Robert; "Peaking of World Oil Production: Impacts, Mitigation and Risk Management"; 2005 February.
[26] Darley, Julian; author of "High Noon for Natural Gas"; quoted in Canadian Business magazine; 2005 January 17.

porary. Previous energy transitions (wood to coal and coal to oil) were gradual and evolutionary; oil peaking will be abrupt and revolutionary." [27]

This report has explored the issue of global peak oil supply. Major findings are:

- The consumption of energy is essential to economic vitality.

- Oil is a finite resource. It will run out. Long before it runs out, production will peak and decline. Prices will rise, and consumption will be forced to decline. This will have a profound affect on our society.

- The date of the peak is a matter of considerable debate. Most projections fall in the range of 2008 to 2037, generally closer to the earlier date. However, in view of the time needed for mitigation, even 2037 is very soon.

- We are an energy-intensive society. There is much that we can do to reduce consumption. Actions fall into three categories: develop other energy sources, increase efficiency, and change consumption patterns.

- To minimize the impact on our economy and society, all levels of government and the corporate sector should begin preparations well before the peak. This is because our current consumption patterns are imbedded in our infrastructure (for energy production, transmission, and consumption) which can only be amended through a substantial investment of time and money.

It is recommended that Council receive this report for information.

J.S. Belhouse, Director
PLANNING AND BUILDING

SR:jc

Copied to: City Manager
Director Engineering
Director Finance
Director Parks, Recreation and Cultural Services

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[27] Hirsch, Robert L.; Bezdek, Roger; Wendling, Robert; "Peaking of World Oil Production: Impacts, Mitigation and Risk Management"; 2005 February.

APPENDIX A: POSSIBLE MUNICIPAL ACTIONS TO ADDRESS PEAK OIL

This appendix illustrates the range of ideas that municipalities could consider in the context of addressing peak oil. They are not specific recommendations at this time.

A.1 As A Government

Table A.1 presents a sample of the ideas that municipalities could consider, as a level of government.

Table A.1: Possible Municipal Ideas as a Government

Strategy	Transportation	Heating	Other
New Energy Sources		Incentives to use sustainable energy sources in new buildings	
Efficiency	Preferred parking for hybrid vehicles and/or hybrid access to High Occupancy Vehicle lanes	Explicit discussion of energy in re-zoning reports	Greater role (in partnership with energy suppliers) in promoting energy efficiency programs
		Incentives (e.g., density bonuses, fast-track approvals) for buildings certified by Leadership in Energy and Environmental Design (LEED)	Use municipal publications for messages on consumption patterns and fuel-efficient habits
Consumption Patterns	Allow higher development densities in transit-oriented locations	Promote more temporal and spatial variation of interior temperatures in buildings	Engage other levels of government in a dialogue on coordinated responses to peak oil
	Improve quality and extent of pedestrian networks		Protect existing agricultural lands and encourage urban agriculture (e.g., in residential or commercial areas)
	Improve quality and extent of cycling networks		Support appropriate actions by outside agencies (e.g., protection of agricultural lands, more transit passes, implementation of pay-as-you-drive insurance)

Table A.1 (continued): Possible Municipal Ideas as a Government

Strategy	Transportation	Heating	Other
Consumption Patterns	Enhance quality of bus stops (amenities)		Develop a plan for additional measures that may be needed post-peak
	Reduce investment in road capacity increases		
	Increase implementation of priority measures for select modes (transit, High-Occupancy Vehicles, trucks)		
	Consider Trip Reduction Plans for larger new developments		
	Work to bring amenities closer to where people live		
	Consider revising parking standards for commercial and multi-family residential developments		
	Evaluate energy impacts of various strategies (e.g., reducing the speed limit on Local Residential roads to 40 km/hr, converting traffic signals to roundabouts where feasible)		
	Increased use of parking meters		

A.2 As A Corporate Citizen

Municipalities are also major employers, land owners, developers, and oil consumers. In these capacities, municipalities can lead by example, exhibiting best practices for other corporations. In the process, the market for more sustainable products is stimulated. Municipalities can also expect a direct financial benefit from operating more efficiently.

The City of Burnaby has done this in the past, for example through the building retrofits of the EnergyFit program, or by installing end-of-trip facilities for cyclists. ***Table A.2*** presents a sample of the possibilities that are available to municipalities as corporate citizens.

Table A.2: Possible Municipal Ideas as a Corporate Citizen

Strategy	Transportation	Heating	Other
New Energy Sources		New municipal buildings to consider on-site energy sources	Purchase renewable energy from BC Hydro or other sources
Efficiency	Purchase vehicles with exemplary fuel efficiency whenever possible (e.g., light-weight, hybrid, electric)	New municipal buildings to incorporate LEED principles	
	Research energy-saving retrofits to existing vehicles		
Consumption Patterns	Consider pay parking at municipal facilities and/or provide free transit passes to employees and reclaim the freed-up parking space	Explore conversion of existing building to alternative energy sources	Identify those major product purchases (e.g., asphalt) that are most strongly linked to oil prices
	Identify any positions for which telecommuting may be possible at certain times	Allow more temporal and spatial variation of interior temperatures in municipal buildings	Include energy considerations in purchasing decisions (e.g., buying more locally-produced items)
	Retrofit bicycle end-of-trip facilities into more municipal buildings		Review fiscal policies and financial projections (revenues and major expenses) to assess the possible impact of peak oil