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**Black Gold:
Developments in the World Oil Market
and the Implications for Canada**

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EXECUTIVE SUMMARY

The oil industry faces major challenges as the end of the century approaches. These challenges include protecting the environment, raising needed capital, allocating efficiently the funds available to the industry, perhaps achieving some degree of price stability, and certainly pursuing security of supply.

The goals of this paper are modest. The paper discusses likely developments in the world oil market, the likely impact of key uncertainties affecting this market, and the implications of these developments for Canadian oil supply-demand balances. Some of the questions that the paper attempts to answer include the following: How rapidly will oil demand grow? Will supplies outside OPEC increase, stabilize, or decline? What are the long-run implications of these supply and demand trends for the world's dependence on oil from OPEC countries and particularly from the Persian Gulf? It does not focus on short-run impacts of disruptions in oil markets.

While there are many experts who have recently published their views on the likely developments in the world oil market, there are only three sets of recent projections on the outlook for the Canadian oil sector. These include Energy, Mines and Resources (EMR), the National Energy Board (NEB), and Data Resources Inc.(DRI). Although a comparison of these alternative sets of projections does indicate some diversity in views and expectations, likely trends are obvious too. We outline the trends in this paper. The results are summarized below.

- Oil prices will continue to be determined primarily by the relationship between world oil supplies and demand, with economic expansion expected to remain the principal influence on demand growth.
- Generally, there is a consensus among analysts that world oil demand will increase at moderate rates of around 1.0 to 1.5% per year in the 1990s and at a slower rate thereafter, reflecting the gradual implementation of policies to accommodate environmental concerns. The oil consumption of LDCs is expected to rise much more rapidly than that of the industrialized countries. As a result, by 2005, the LDC share of world oil demand is expected to increase substantially from the current 24% to over 30%.
- An assessment of the world's oil production prospects indicates that several factors will contribute to ensuring adequate supplies of oil for the next 20 years or so. Non-OPEC supplies are expected to remain essentially flat during the first half of the 1990s, rising marginally by 2000, with most of

the increase coming from developing countries in Asia-Pacific and Latin America. With the prospects of moderately increasing demand and flat non-OPEC supplies, there are likely to be greater demands on OPEC to increase production. This will require OPEC to increase its productive capacity significantly. Several OPEC countries have already announced expansion plans. The problem of raising the capital necessary to undertake capacity expansion projects will be a major challenge facing OPEC in this decade, as well as in the post 2000 period. As the world's dependence upon the Middle East increases, shifts in the availability of oil from this region are expected to have a larger effect on oil prices.

- Most of the forecasters are projecting an environment of stable prices during the 1990s. After achieving an annual average real price of U.S. \$24/bbl (in 1992 dollars) in 1995, the remainder of the decade is expected to see virtually flat real prices. The crude oil price is expected to average \$25-26 in 2000 and to rise to around \$30 by 2010.

The key uncertainties that could affect developments in the world oil market include: oil supplies from the ex-Soviet Union, OPEC's ability to raise its crude oil productive capacity, and the possible widespread use of measures like a carbon tax for environmental purposes. Political developments that could temporarily upset supplies and cloud the economic fundamentals, and unanticipated shifts in OPEC policies (either towards or away from the controls it exercises over total production) are some of the other developments that could significantly influence the world oil market as we enter the 21st century.

- At a real oil price in the range of \$25 in 2000 and \$30 in 2010, the outlook for Canada is for stable domestic light crude oil supply, increasing domestic heavy crude oil availability and moderate growth in domestic demand for petroleum products. With current financing profiles, megaprojects including Hibernia, Suncor and Syncrude enhancements, Lloydminster, and expanded operations for bitumen production are expected to come on stream before the turn of the century.

If, however, crude oil real prices were to remain in the range of \$23/bbl for the next 20 years, some of Canada's mega projects would not be profitable. Under this low price scenario, Canadian oil production could decline by about 25% by the turn of the century, and by as much as 50% by the year 2010.

- As the dual trends of reduction in energy-use intensity and a switch to non-oil energy sources are expected to continue, overall Canadian oil demand is likely to increase at moderate rates, with transportation likely to remain the largest user of oil. Significant increases in the consumption of transportation fuels (motor gasoline, aviation fuels and diesel) are expected to contribute to an increase in Canada's reliance on light oil imports, which will be somewhat masked by exports of heavy crude oil. In the post 2000 period, over 25% of domestic light crude requirements are expected to be met by imports.
- In 1992, Canada was a net exporter of crude oil and equivalents to the extent of 44 thousand cubic meters per day. Net imports of 31 thousand cubic meters per day of light crude oil were more than offset by net exports of heavy crude oil and petroleum products of 75 thousand cubic meters per day. The net export position of total crude is expected to decline during the 1990s. Both NEB and DRI expect Canada to recover to remain a net exporter of crude during the following decade. EMR, on the other hand, expects that Canada will become a net importer of crude by 2010, when net imports on the order of 8 thousand cubic meters per day will be required.
- Developments in the world oil market have implications for the sourcing of Canadian light oil imports and the possible destination for heavy oil exports. In recent years, we have seen a modest increase in the share of oil imports from Latin America. With projected declines in North Sea production, one can expect a continuation of this trend toward more Latin American oil imports into Canada (particularly Venezuelan and perhaps some Colombian oil; Mexican oil is heavy). Venezuela does have great production potential and perhaps could prove to be a more secure source of supply than the Middle East OPEC countries.

Heavy crude oil exports are projected to increase marginally during this decade, but to increase substantially in the post 2000 period. In addition to opportunities for further penetration of Canadian heavy crude into Northern Tier U.S. markets, the other alternative market that has scope for Canadian heavy oil exports would be the Pacific Rim (e.g., Japan, Korea, Thailand).

**Black Gold:
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1.0 INTRODUCTION

The oil industry faces major challenges as the end of the century approaches. These challenges include protecting the environment, raising needed capital, allocating efficiently the funds available to the industry, perhaps achieving some degree of price stability and predictability, and certainly pursuing security of supply.

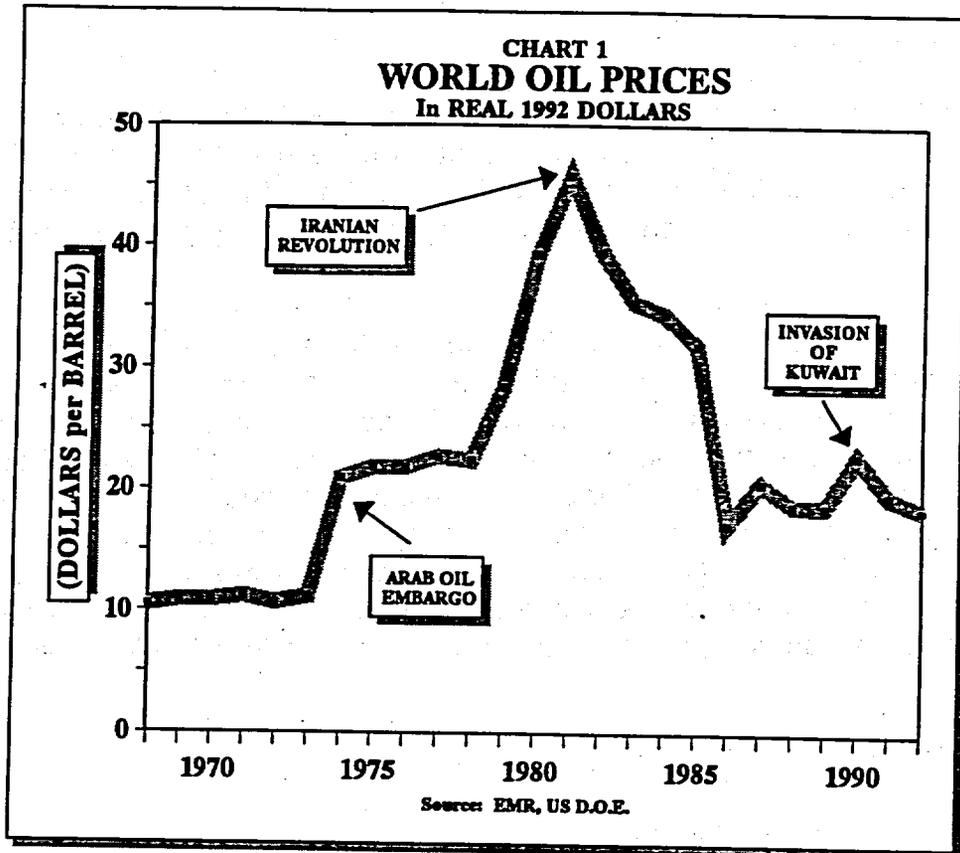
This paper discusses likely developments in the world oil market, the likely impact of key uncertainties affecting this market, and the implications of these developments for Canadian supply-demand balances. Some of the questions that the paper attempts to answer include the following: How rapidly will oil demand grow? Will supplies outside OPEC increase, stabilize, or decline? What are the long-run implications of these supply and demand trends for the world's dependence on oil from OPEC countries and particularly from the Persian Gulf? Do these trends make us more or less concerned about possible future oil disruptions? The paper does not focus on short-run impacts of disruptions in oil markets.

2.0 WORLD OIL MARKET

The sixties were marked by low crude oil and product prices and extraordinary demand growth--around 8% per year. This period of low oil prices created the conditions which engendered the dependencies, shortages, and high oil prices of the 1970s and early 1980s. The extraordinary growth in petroleum demand could not, of course, be sustained indefinitely. During the thirty years between 1960 and 1990, three major events took place that dominated oil pricing. These include the Arab oil embargo, the Iranian revolution, and Iraq's invasion of Kuwait (Chart 1). All three events had the impact of a sudden drop of several millions of barrels per day, with the last event and subsequent Gulf war having a far less serious impact on oil pricing than the revolution in Iran.

Part of the reason for the moderate oil price increase in 1990 was the dramatic price collapse of 1986. In the early eighties, OPEC waited too long to lower prices. When the market finally collapsed, OPEC's members and many others in the industry were financially devastated. It was an experience no-one

wanted to repeat. Thus, despite the Gulf emergency, no-one was anxious to bid oil prices up. Put another way, the oil industry discovered that its commodity was not special: oil prices, like those of gold, silver, and wheat could go down as well as up.¹



Knowledge about oil markets has vastly improved over time, and the institutions that govern the pricing and distribution of crude oil are more competitive and diversified. Multilateral corporations of the sixties have now been replaced by national oil companies from producing and consuming nations, smaller integrated companies and brokers. The crude oil futures market has made pricing more transparent and introduced a new set of buyers and sellers, thus diluting OPEC's market power. OPEC must now cope with a new group of suppliers from third-world countries, with consumers who have shown their readiness to

¹ S. A. V. Victor, "Developments in the World Oil Market", in IEA Proceedings: Energy Disruptions, Lessons, Opportunities, Prospects, Nov. 1991, pp. 298-303.

conserve when necessary, and the oil futures market. In the 1970s, an open land war in the Persian Gulf would likely have provoked a sharp, sustained escalation in crude oil prices. But the price-collapse lessons of the 1980s have been learned and, hopefully, will not be forgotten. The market has become wiser and, consequently, more stable.

The fundamental characteristics operating on the supply and demand side of any market ultimately determine the direction and development of that market. In the remainder of this section, we have attempted to isolate the supply and demand side fundamentals which underlie the evolution of the world oil market as we enter the next century.

Recent trends in oil supply and demand

Table 1 provides a summary of key indicators of world oil supply and demand over the past six years, as a benchmark for comparison with the long term outlook. The table indicates the following:

- Oil consumption of the OECD remained virtually unchanged in 1992 at 1991 levels and some 2.4 mmbd above 1987 levels.
- Demand growth in the non-OECD countries-- excluding the Commonwealth of Independent States (C.I.S), the former Soviet Union -- has been somewhat stronger than in the industrialized nations at 3.1% per year. The CIS consumption of petroleum has decreased during the last five years. The net effect is for a world oil consumption increase of only 1.2 % per year over the last five years.
- Year-over-year production of non-OPEC crude oil is expected to record a fifth consecutive year of decline, falling to 40.7 mmbd in 1992 versus 42.7 mmbd in 1987. Much of this decline can be accounted for by falling production in the C.I.S. In the other non-OPEC regions, volume gains in the emerging oil producing countries - such as Colombia, Yemen and Argentina - are managing to keep ahead of output declines in the older producing basins of Canada and the U.S., yielding a small net gain in output for this group.
- Total OPEC oil production is expected to show a gain of 700,000 bd in 1992, up 6.5 mmbd from the 17.7 mmbd produced in 1987. This leaves OPEC with just under 40% of the world market in 1992, versus 31% in 1987.

Table 1
World Oil Supply and Demand
(1987 - 92 MMBD)

DEMAND

	1987	1988	1989	1990	1991	1992
OECD	36.0	37.2	37.8	37.9	38.0	38.4
USSR	9.0	8.9	8.8	8.4	8.3	7.7
Other Non-OECD	17.9	18.6	19.4	19.8	20.1	20.7
Total WORLD	62.9	64.7	66.0	66.1	66.4	66.8
OECD	16.8	16.6	15.9	15.9	16.3	16.5
USSR	12.6	12.6	12.3	11.5	10.4	9.3
Other Non-OECD	12.0	12.4	12.6	13.1	13.4	13.6
Total Non-OPEC *	42.7	42.9	42.1	41.9	41.1	40.7
OPEC **	19.5	21.7	23.7	25.1	25.4	26.1
Total WORLD	62.2	64.6	66.0	67.0	66.8	66.8

* Includes refinery gain.

** Includes Natural Gas Liquids (NGL) production.

Source: A.E. Reinsch, "Challenging OPEC: World Oil Market Projections, 1992-2007", CERl study #47, July 1992.

Projections

There exists considerable uncertainty about the basic economic forces influencing the oil demand and supply conditions that determine oil prices. Moreover, the market outcome is critically dependent upon how these economic forces interact with a set of highly unpredictable political factors. CERl's recent world oil market study² rightly states that "the one thing which can be said with certainty about the world oil market is that its future will continue to surprise both those involved in the market and those who study its development".

² CERl study # 47, published in July 1992.

In this paper we have attempted to put together the views of various oil companies and world oil market experts including: the Canadian Energy Research Institute (CERI, August 1992), Data Resources Inc. (DRI, 3rd Quarter, 1992), the International Energy Agency (IEA, April 1991), the U.S. Department of Energy (DOE, April 1992), Energy, Mines and Resources (EMR, Winter 1992), and the National Energy Board (NEB, June 1991). As one would expect, there is a diversity of views on subjects such as the outlook for global oil consumption, non-OPEC production and net demand for OPEC crude. As an example of the prevailing diversity, consider the long-term global oil demand projections published by the DOE, the IEA, and CERI (Chart 2). It is immediately clear that the projections differ markedly from each other. The U.S. DOE and CERI share a moderate view of the growth of oil consumption. The IEA, on the other hand, represents the upper end of the range of projections published over the past year or so. A similar wide variety of views prevails in projections of non-OPEC supply, as illustrated in Chart 3.

Oil Demand Outlook

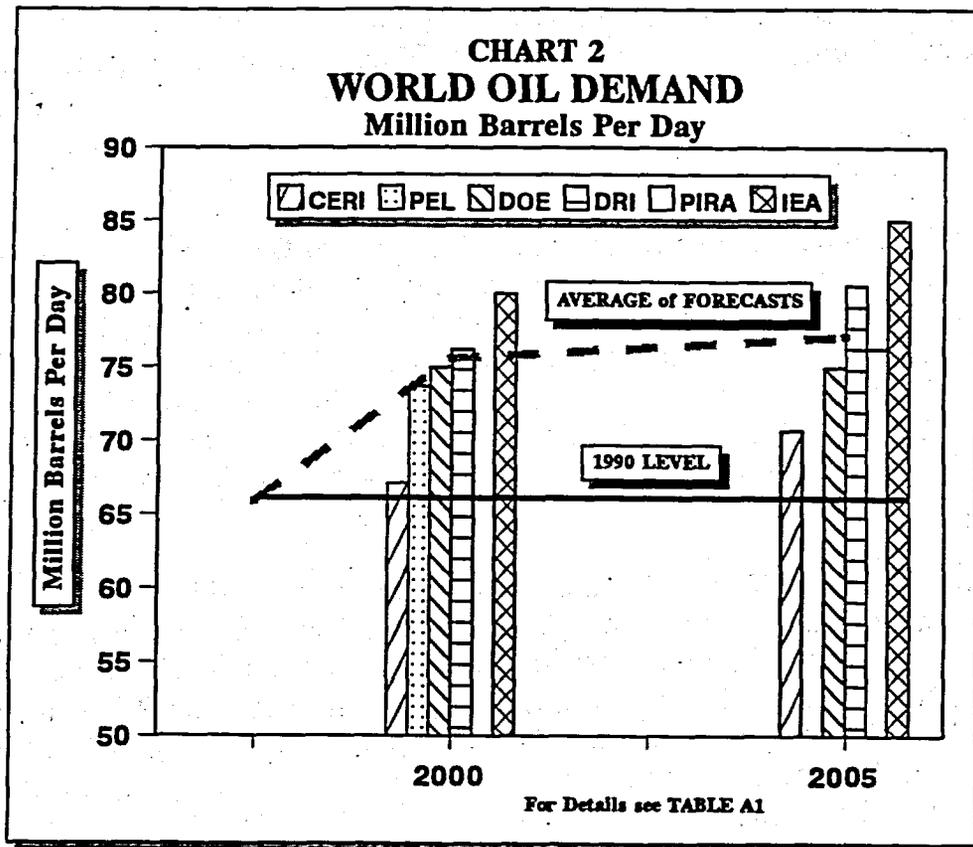
World oil demand plays a key role in influencing OPEC's rising market share, the increasing oil dependence of the U.S. (the largest oil consuming nation in the world) and the future path of market clearing prices. Nowhere else is this role emphasized more than in the Energy Modelling Forum's latest "EMF 11" study.³ Low oil demand results in low calls on OPEC, which when combined with expanded OPEC capacity, results in low oil prices. On the other hand, higher world oil demand (and hence, more calls on OPEC) or lower OPEC production results in higher oil price paths.

Oil price, economic growth, technological progress and interfuel substitution are the key determinants of oil demand. *Oil demand projections considered in this paper are generally based on a decade of steady, positive growth for the global economy.* GDP is expected to grow at an average rate between 2.5 and 3.5% over the period 1990-95, and 2.8 to 3.8% during 1995-2000, up slightly from the previous period. The outlook for the period 2000-2005 is for GDP growth in the range between 3.0 to 3.6%.

Views of the various experts on the outlook for world oil demand are shown in Chart 2. *World oil consumption is projected to increase at an average annual rate of 1.4% to 2000 and at a much slower rate thereafter.* This could be a

³ International Oil Supplies and Demands, Energy Modelling Forum (EMF), Report 11, April 1992.

reflection of gradual implementation of strategies to reduce petroleum consumption in response to environmental concerns. For the year 2000, most of the forecasts place world oil demand between 67.1 MMBD (CERI) and 76.2 MMBD (DRI), averaging 75.6 MMBD. At one end of the spectrum is the forecast by CERI, which shows world oil demand in 2000 at 67.1 MMBD. At the other end of the spectrum, Conoco and the IEA are forecasting considerably higher oil demand of around 80.0 MMBD, reflecting their expectation of strong economic growth in developing countries and the former Soviet Union. By 2005, the IEA's forecast remains considerably above other forecasters' projections, at around 85.0 MMBD.



Oil demand is expected to register the strongest gains in developing countries, largely because of rapid population growth, urbanization, increased transportation fuel requirements, and accelerating industrialization, followed by Eastern Europe and the former Soviet Union. OECD oil demand is projected to increase only slightly (at about 1% per year) over the next fifteen years, whereas the average growth rate for developing countries' oil consumption is forecast at just over 3% per year. Projections for oil demand growth for the latter group over the period to 2000 range from 1.5% (DOE) to 4.6% (IEA). As a result of a relatively faster increase in consumption, the developing countries' share of total world oil demand is expected to increase from 24% in 1990 to 29% in 2000, and 31% by 2005.

All experts, with the exception of CERl and the IEA, expect oil demand in the former Centrally Planned Economies (CPEs) to decrease, or stagnate over the next five years. Political and economic restructuring is likely to restrain oil demand during the short to medium term. However, the forecasters generally agree that oil demand in this region will rebound over the 1995 to 2005 period as these economies begin to recover and grow.

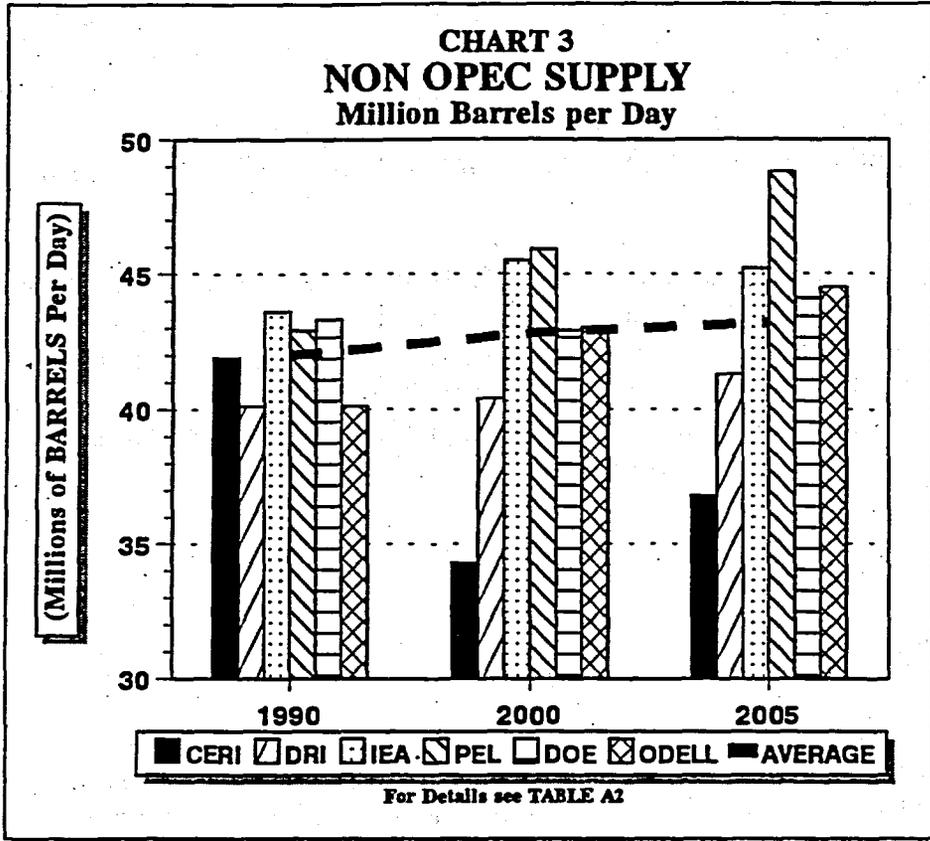
Oil Supply Outlook

Non-OPEC oil supply

Chart 3 presents the projections for non-OPEC supply for selected years. The general expectation is that non-OPEC oil supply will remain essentially flat during the first half of the 90s, rising marginally by 2000. Experts generally agree that any increases in non-OPEC oil supplies during this period will come mainly from developing countries in Asia Pacific and Latin America and that the gains will be from new discoveries, rather than from existing mature fields. These gains should offset the projected declines in oil output from the U.S., the North Sea and the former Centrally Planned Economies (CPEs).

A major part of non-OPEC supply comes from former-CPE production, the bulk of which is located in Russia, the largest crude producer in the world. Oil production from the former USSR has declined from 12.6 MMBD in 1987 to about 10.4 MMBD in 1991, and is estimated to decline to 9.3 MMBD in 1992. This lower production is due to the general deterioration of infrastructure; inefficient production practices and antiquated technology resulting in low well productivity and higher operating costs; a lack of capital investment; irrational pricing; and political and social uncertainties. Most of the experts expect that, over the

medium term, Russian oil production will face continued difficulties.⁴ However, in the long term, this decline in production could be stopped, as the existing wells are reactivated and new fields are brought on line with the help of foreign investment (Table A3).



Forecasters with more optimistic views on non-OPEC supply believe that, at \$20/bbl, there is a great deal of oil potential in various parts of the world in which investment is worthwhile - both for countries and for oil companies. A continuation of the increasingly significant post-1973 efforts to enhance oil production from non-OPEC sources remains relevant and appropriate- unless and until OPEC policy changes, or the organization falls apart. According to one of these forecasters⁵, the pre-2000 possibilities of increased oil output from Western Europe and the

⁴ CERI Study # 48, "Oil in the Former Soviet Union", October 1992.

⁵ Peter Odell, "Prospects for Non-OPEC Supply", *Energy Policy*, October 1992.

non-OPEC developing countries seem likely to be enough to offset some short-term declines in other non-OPEC oil availability- notably from the U.S., China and the former U.S.S.R. Therefore, the additional call on OPEC will be small and of no consequence as far as price determination is concerned.

For the longer term (post 2000), assuming no major changes in OPEC policies, exports from Russia and other former Soviet Republics, and the continuing expansion of production in the non-OPEC developing countries will play a major role in meeting world oil demand. By the end of this century, as efficiencies in energy consumption and production improve, the oil and gas exports of the former USSR should be on a strong rising trend. It is generally agreed that relative to the rest of the world's potentially prospective hydrocarbons basins, those in the developing countries remain under explored and/or developed. Some economists⁶ estimate a 75% increase in oil supplies from the developing countries outside OPEC by 2020 from the current level of about 10 MMBD.

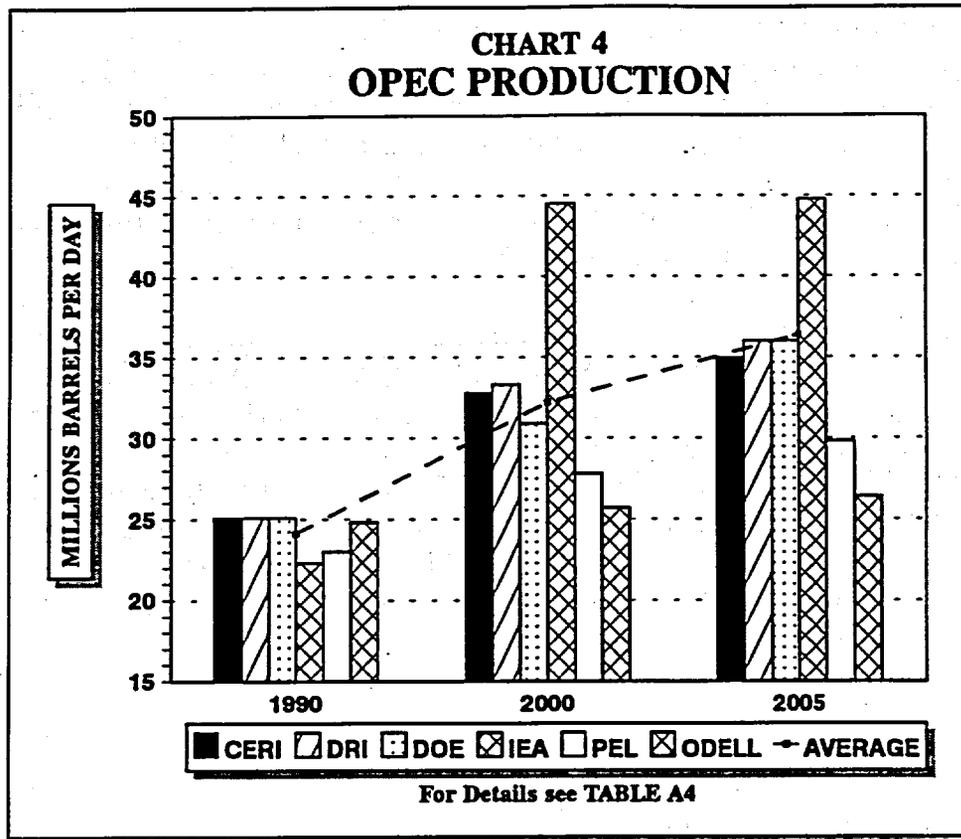
From a global perspective, developments in the C.I.S. are a key ingredient to future price determination and to OPEC price/production strategy development. A delayed recovery in the C.I.S. production and/or a stronger recovery in domestic demand in that region would tend to tighten the world oil market relative to the projections, requiring further increases in OPEC production and placing upward pressure on prices. Alternatively, more aggressive foreign investment in the C.I.S. and/or delayed domestic demand growth would tend to weaken prices, thereby forcing OPEC to accept a lower price or further restrict output to achieve even the weak price trajectory.

Outlook for OPEC production

The critical assumption in any long-term projection of crude oil prices is the likely path of OPEC crude oil production. Indeed, the only surplus capacity in the world oil market is held by the OPEC members, centred largely in the Middle East countries. Therefore, the strategy assumed for OPEC regarding prices and volumes determines, in large part, the likely direction of future price movements. OPEC restricts production of oil to achieve, among other things, a market price which is higher than that which would exist in a deregulated market environment. In doing so, the organization also creates an incentive for its members to individually violate these output restrictions, achieving higher revenues at little cost.

⁶ Odell, "Prospects for Non-OPEC Supply".

The production profile for OPEC that underlies various oil market projections is provided in Chart 4. Peter Odell represents the low end, whereas PEL and the IEA represents the high end of the projections. *With prospects of non-OPEC supply remaining flat over the next 10 years, there will be greater demands on OPEC to increase production from 24.0 MMBD in 1992 to over 30 MMBD by 2000.*



OPEC Capacity

As discussed in previous sections, over the nineties, experts project world oil demand to rise at 1.4% annually and non-OPEC oil supply to remain flat, or at best increase marginally. To meet this extra growth in demand, the requirement for OPEC crude oil will rise steadily throughout the period. This would require significant increases in OPEC capacity. Many analysts agree that the existence of

surplus productive capacity⁷ is necessary to help maintain crude oil price stability. Presumably, the cartel is in a strong strategic position to influence prices, whenever the call for OPEC crude is at or in excess of its productive capacity. ***Currently OPEC is operating at 82% of its capacity. According to the forecasts presented in this paper, OPEC will be producing at this rate of capacity utilization until 1995, after which the utilization rate is expected to increase to around 90%.***

The CERI study argues that the low price, high volume market strategy long favoured by the Saudis will be the dominant OPEC strategy over the decade of the nineties. Several leading OPEC members including Saudi Arabia, Iraq, Kuwait and Venezuela plan to increase their crude oil capacity. Table A16 shows the estimates of productive capacity expansions derived from the individual OPEC member country plans. These capacity additions will certainly require significant capital investment. According to some estimates⁸, an investment of up to \$70 billion would be required to increase productive capacity in the Middle East by 5 MMBD over the next 5 years. Of this amount \$20 billion would be needed to develop new capacity and \$50 billion would be required to maintain current capacity levels. Additional funds required for restoring Kuwaiti wells are estimated to be around \$20-30 billion, while the cost of restoration in Iraq is unclear.

The problem of raising the capital necessary to undertake these projects is now a major hurdle facing OPEC members. Over a third of the national oil companies' capital requirements is expected to be met from bank borrowings, a small portion from state reserves and the remainder from foreign contractors offering financing packages. The speculation is that a gradual transformation and commercialization will eventually lead to privatization and the opening up of the hydrocarbon sector to foreign participation in the Gulf region⁹.

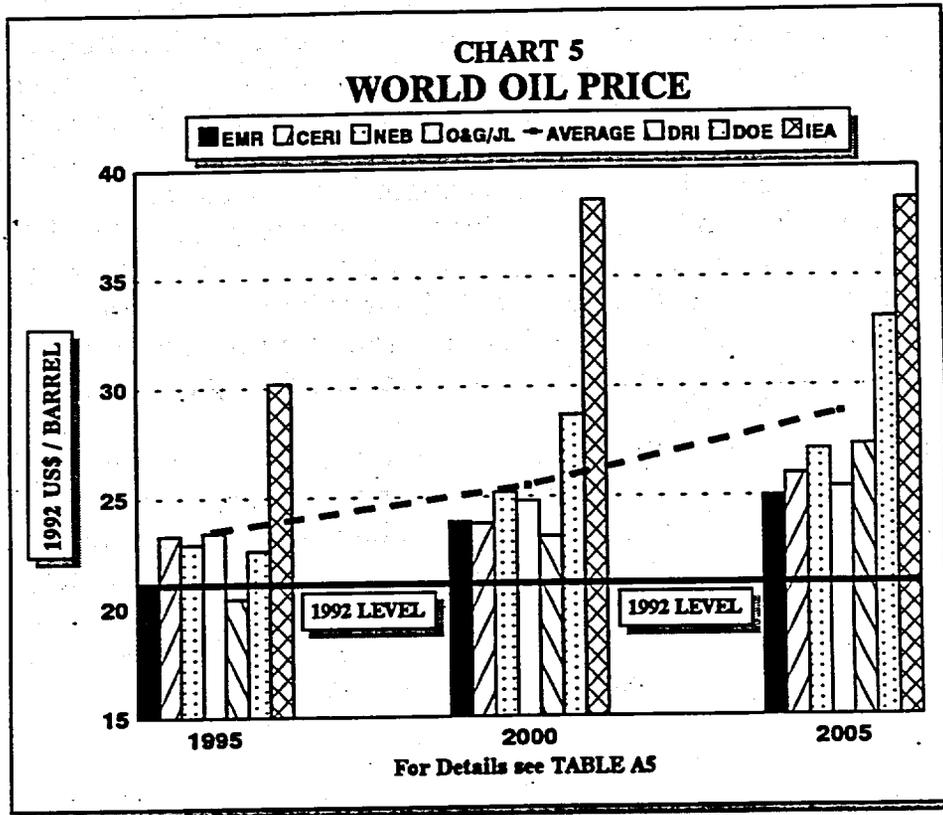
⁷ Production capacity is related to proven reserves through the engineering principles of an optimal field depletion rate given the number of wells and the physical output limits. It normally means the rated optimal production capacity of a field that is sustainable over a period of months or years without causing permanent reservoir damage. (Energy Policy, Oct. 1992)

⁸ EMR, "Experts' Views on World Oil Markets", Winter 1992.

⁹ W.A. Mazedi, "Privatizing National Oil Companies in the Gulf", Energy Policy, October 1992, pp 983-994.

Recent oil price projections

Most of the forecasters expect the oil prices to remain weak over this decade. After achieving an annual average price of \$24/bbl in 1995, the remainder of the decade sees virtually flat real prices, as OPEC follows the policy of revenue growth through output gains, rather than price increases. The crude oil price (in 1992 dollars) is expected to average \$ 25-26 in 2000 and rise to around \$29 by 2005.



On the high side of the projections are the DOE, various oil companies which project prices in the range of \$28-29 in 2000 and \$38-39 in 2005, and the IEA (high price scenario) which projects about a \$38 per barrel price in 2000 and after.

Most of the forecasters including DRI, EMR, CERI, NEB, IEA (low scenario) and CONOCO, are projecting low real oil prices in the range of \$23-24 by 2000 and \$25-27 by 2005. These low oil price projections are generally based on the following assumptions:

- Low world oil demand growth of 1.0% to 1.5% per year.

- Fairly stable non-OPEC supply.
- Expected increases in OPEC capacity. OPEC's preference will be to have a stable increase in revenues through a moderate price increase policy.
- While measures will be taken to reduce greenhouse gases, extreme carbon/energy taxes will not be widespread by the turn of the century.

3.0 MAJOR ISSUES AND UNCERTAINTIES

As noted in the previous sections, there is general consensus among forecasters that world oil demand will increase at moderate rates and non-OPEC supplies will remain flat over the next 10 to 15 years, resulting in somewhat higher demand for OPEC crude oil and moderately rising oil prices. In the post 2000 period, assuming no major changes in OPEC policies, the slow increase in demand will be met by the combination of two main supply side developments: first, the renewed expansion of the oil industry of Russia and other former Soviet Republics - and thus of their oil exports to the rest of the world; and second, the continuing expansion of production in the non-OPEC developing countries.

However, this outlook is subject to some uncertainties. The key uncertainties include the oil supplies from the ex-Soviet Union, OPEC's ability to raise its crude oil productive capacity, and the current energy-economy-environment debate. Several other developments that could significantly influence world oil markets as we enter the 21st century include: the reintegration of the oil industry, political developments that could temporarily upset supplies and overshadow economics, and shifts in OPEC policies, either towards or away from the controls it exercises over total production.

1) Heavy Capital Requirements For the Former Soviet Union and C.I.S. Republics

The long term oil production outlook for the former Soviet Union is quite uncertain. Part of this uncertainty stems from questions about the size of Soviet oil reserves. There are suggestions that Soviet oil reserves (estimated at 57 billion barrels, equivalent to 15 years of production at 1991 production rates) may be significantly underestimated. Uncertainty also exists regarding the pace of reforms in the oil industry and the economy in general.

Some of the recent literature on the subject paints a very pessimistic picture of the Russian oil industry's plight in the 1990s. According to a recent article

published in The Oil and Gas Journal, "only an enormous cut in Russian consumption can prevent the Republic from becoming a net oil importer by the mid 1990s and a big importer by 2000. The effect on world oil markets could be significant. Moscow may be forced to return to its cold war policy of trading arms for Iranian and Libyan crude".¹⁰

It is unlikely that the decline in Soviet oil output can be reversed without a massive infusion of financial and technological resources into oil industry. Until the former Soviet economy emerges from its current crisis, these resources will have to come from elsewhere. This leaves the outlook for this region's production clouded with uncertainty. The former Soviet Union has already sought assistance from various countries. The degree to which such assistance will be forthcoming and the form it will take are quite uncertain. The estimates for financial requirements of the Russian oil industry in the period to the end of this century are in the range of \$30 billion. Currently, foreign investment in the former Soviet Union is influenced by a variety of issues, including a battle among the former republics over property rights, the lack of appropriate and relevant laws, and the lack of a convertible currency.

If Russia and the other CIS republics are successful in: 1) attracting much needed foreign capital and technology that could reverse the decline in oil production, and 2) improving energy efficiency and conservation, one may see a dramatic increase in net crude exports from this region. This may force OPEC to constrain output and face declining prices.

2) OPEC's Capability to Influence Oil Markets

Over the past 30 years of its existence, OPEC has enjoyed neither unconditional success nor inglorious failure. It is likely that OPEC will maintain some market power for quite a few more years. The strongest empowering factors for OPEC appear to be the huge monetary cost to members if it were to collapse, the ability of Saudi Arabia to enforce discipline through credible production-related threats, and the external support OPEC enjoys from producers who like high petroleum prices. The strongest enfeebling factors for OPEC arise from the differing production costs and economic goals of OPEC members and the high long-run elasticities of world demand and supply external to OPEC.

Oil and Gas Journal, December 7, 1992.

It is rightly stated by many that oil price trends are set by economics, while the actual movements are determined by politics. This is because of the fact that oil supplies in a highly imperfect market are strongly affected by domestic issues in key oil producing countries and by the political relations among them.

Some analysts¹¹ not only foresee increased potential for conflict among the Gulf producers that enhances the uncertainties for the oil markets, but they also emphasize the possibility that the former Soviet Union may once again play a more active role in the Middle East, keeping fairly close political links with Iraq, and improving relations with Iran and Saudi Arabia. A triangle of Iran, Iraq and the former Soviet Union would be a potential force to take into account in Middle East politics because all these countries have a common interest in high oil prices.

The political circumstances in the Middle East will influence various countries', particularly Saudi Arabia's, decisions to invest in raising productive capacity. Moreover, the world's growing dependence upon oil from the Gulf area does imply that, as in the past, oil prices will continue to be subject to Middle East politics. Doubts and uncertainties concerning oil supplies from the Middle East are likely to persist.

3) Capacity Expansion and Financial Constraints

Although there are plenty of identified reserves around the world, low prices do create strong disincentives for reinvestment in production capacity growth. OPEC recognizes that, even with moderate demand growth forecasts, and without substantial current investment, there are likely to be severe capacity constraints by mid decade.

Therefore, most of the leading producers have announced ambitious production capacity expansion programmes (see Table A16). The total of these announced programmes for OPEC alone will require around \$160 billion by the end of 1995. If the programmes for Mexico and the republics of the CIS are added, the capital needs for capacity expansion come to more than \$250 billion over the next five years, as shown in Table A17 in the Appendix.

¹¹ O. Noreng and J.M.Bourdair, "Beyond the crisis - Middle East oil supplies after the Gulf conflict - the strategic and economic issues". Energy Watchers III, ed by D.H.El Mallakh (1992).

The question is - can this kind of money be found? Some analysts¹² believe that these programmes will run into difficulties because of financial, policy and structural as well as technological constraints on efforts to expand capacity. Funds for the oil industry in these nations compete within tight budgets with other priorities such as education, food, health and infrastructure. Political conditions often are not conducive to large-scale foreign investment in the oil industry. If the producer states do fall short of their targets, the prospects for oil supply will be gloomy, and there will be a tightening of the market and increased pressure on oil prices as demand grows through the mid 1990s.

Over time, financing for oil development is expected to prove a lot harder to identify than it has been at any time in the last 30 or so years because the main providers of international capital in the 1970s and 1980s, the commercial banks, are expected to be less influential in the 1990s, while the oil companies' ability to finance exploration and production out of internal cashflow is likely to be lower in the 1990s.¹³ The multilateral agencies may be able to pick up some slack. However, energy does not seem to be their first priority. Some other possibilities for easing the capital availability for oil projects are bilateral and multilateral arrangements like NAFTA (by generally encouraging the investment climate in Mexico), the EC-sponsored European Energy Charter, and Japan's involvement in rehabilitating and expanding the Russian oil industry in return for the Kurile Islands (which were seized by the USSR in 1945).

On balance, the likelihood is that the 1990s will be a period in which the availability of oil will be constrained by the availability of capital.

4) Energy/Economy/Environment Debate

Environmental pressures have become an important factor influencing the future development of the energy sector in general, and the oil industry in particular. During the 1990s, the scope of the environmental pressures will expand as global issues, such as climate change, begin to define the agenda. The oil industry could find itself challenged by these pressures.

¹² D.T. Gouchenour, "The Coming Capacity Shortfall", Energy Policy, October 1992.

¹³ A. E. Hilton, Energy Policy, (October 1992), p.963.

The European Community (EC) is set to introduce a tax to reduce carbon dioxide emissions independently of any wider international agreements. If the proposed tax is agreed, the effect on oil markets could be considerable. The analysis conducted by CERI indicates that the price and revenue implications of such a move for OPEC would be significant. OPEC could well find itself caught in the middle of rising product prices and weak or declining crude prices. To the extent that these initiatives are successful, they would restrain crude oil demand worldwide and put downward pressure on oil prices.

Tax measures are not the only response to climate change that could affect oil markets. Transport policy initiatives such as steps to improve auto efficiencies and other similar regulatory measures could also contribute to a slowing in the growth in demand for oil and oil products. Thus, the world outlook for oil supply demand could prove to be markedly different from the outlook presented in this paper.

4.0 IMPLICATIONS FOR CANADIAN OIL SUPPLY/DEMAND BALANCES¹⁴

Oil is an important energy source for Canada. Despite impressive gains in off-oil energy consumption, certain regions and sectors in Canada are still critically affected by changes in crude oil prices. Similarly, although a small player in the world oil market (accounting for under 3% of world production), the jobs, revenues, and economic growth generated by this sector are important to the national economy, and critical to the producing provinces of Western Canada. The development of mega projects associated with non-conventional crude oil development is very sensitive to the forecast of oil prices. Therefore, the likely developments in the world oil market are of great importance to Canadian consumers and producers.

Supply Implications

How Canada's resources, through production from established reserves and reserve additions, contribute to the supply of crude oil and equivalents, in both the

¹⁴ This section draws heavily on the Energy, Mines and Resources (EMR) publication "2020 Vision" (1990), the National Energy Board's "Canadian Energy" (1991), EMR's preliminary "Canadian Energy Outlook" (1992), and DRI's Energy Review, "Canadian Market Focus", Second Quarter, 1992.

domestic and export markets, does depend a lot on crude oil prices that are set by competitive forces in the world.

Canada's crude oil resource base is diverse and its components have particular characteristics which along with cost and price considerations will influence their future contribution to supply. Conventional light and heavy crude oil resources of Western Canada are fairly well-defined, with somewhat limited scope for significant future exploratory discoveries. However, these resources are readily accessible and provide opportunity for the application of advanced improved recovery technologies.

On the other hand, Canada's frontier regions provide the potential for the development of discovered resources and for substantial future exploratory discoveries. Nonetheless, these resources are not readily accessible and their contribution to future supply will depend, to a large extent, on technological improvements to reduce capital and operating costs in the harsh environments of the frontier regions and on the relationship between costs and prices.

Canada's bitumen resource is very large, and readily accessible. Issues with regard to its development are also primarily related to the relationship between costs and prices and whether technological advances can reduce production and processing costs.

Resources that can be expected to be added to the reserves that can contribute to crude oil supply depend largely upon the perceived profitability of these activities. Industry evaluates the profitability of a resource exploration and development by considering the capital costs required for exploration and development, the capital and operating costs associated with its production, the wellhead price to be received for this production, the taxes and royalties to be levied by the various levels of government and, finally, an appropriate rate of return on investment in the project. NEB estimates supply costs for the various sources of oil supply at the wellhead to be in the range of \$14-27 in 1990 US dollars.¹⁵

The analysis in the previous sections concluded that, on average, world oil prices can be expected to increase gradually from the current \$21/bbl (in \$U.S.1992) to around \$25 by 2000, and \$30 by 2010. In this section, we will look at the outlook for Canadian oil supply, demand, and balances at oil prices in the range of \$21 to \$29 by the year 2000 and \$25 to \$31 in 2010. Only three

¹⁵ For details see table A18 of the Appendix.

organizations - EMR, NEB and DRI - provide the long term outlook for Canadian oil supply and demand. World oil price assumptions used for preparing the Canadian oil supply-demand outlook by these organisations are summarized in Table 2.

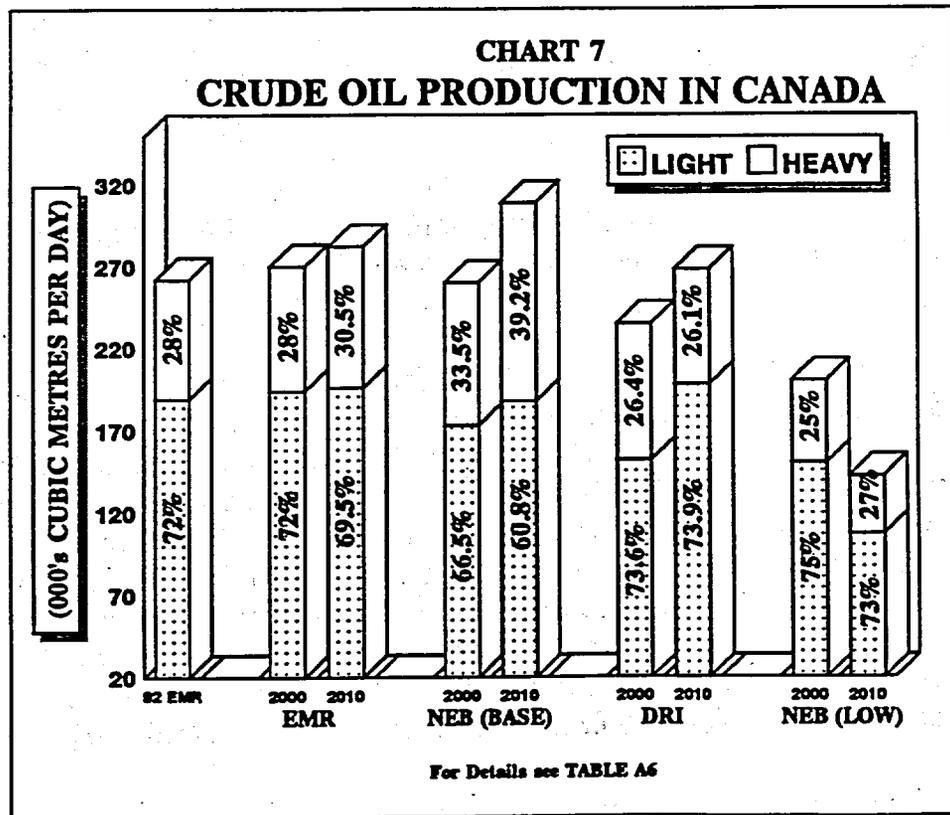
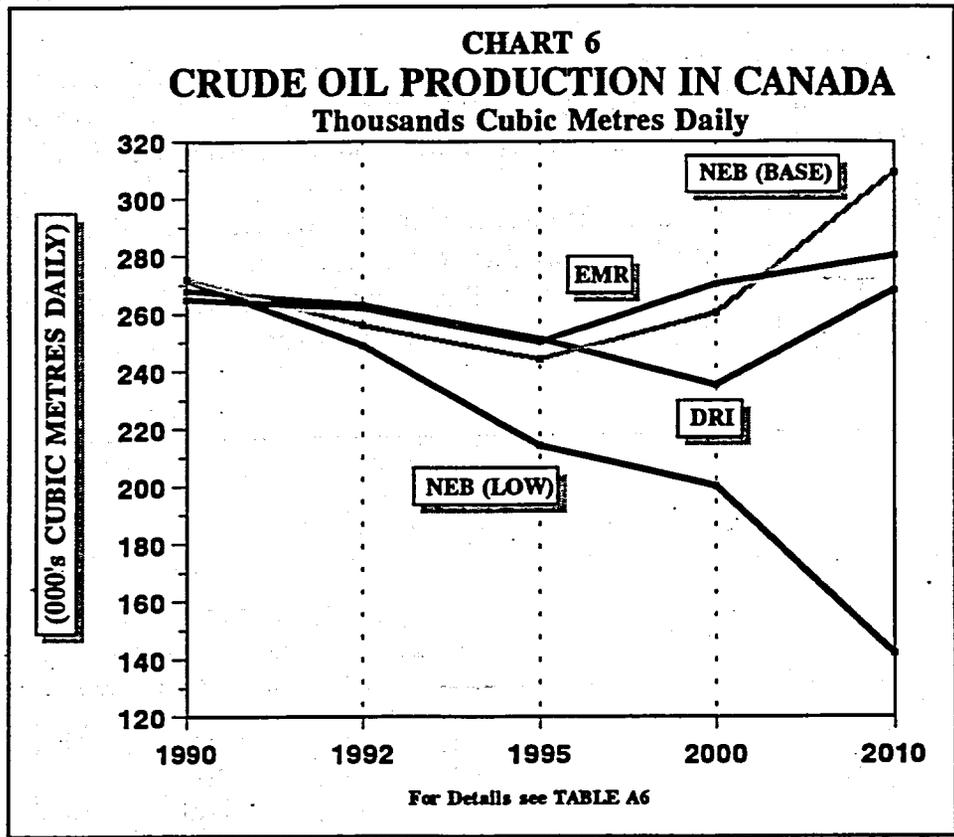
The NEB's low price case is included to reflect the potential downside price risk associated with competitive world oil markets. The other three cases, on the other hand, are able to identify the possible price supplies that the Canadian oil industry could bring into production, if world oil prices rise more steadily.

Table 2
World Oil Prices
 (1992 \$US / Barrel)

	1992	2000	2010
EMR	20.8	24.0	25.0
NEB Base	20.9	25.0	28.0
DRI	18.6	23.0	31.0
NEB Low	18.8	20.0	23.0

The projections of Canadian oil supply of light and heavy crude are presented on Charts 6 and 7 (the assumptions of DRI and NEB regarding the development of non-conventional oil supplies are listed on Table A7 of the Appendix).

Production of both conventional light and heavy crude is expected to decline. However, heavy crude production is expected to decline more gradually due mainly to increased production from Alberta. Declining production in the medium term reflects the decline in conventional established reserves and reserve additions. In the long term, as prices increase, the projected commencement of East Coast offshore and other frontier production, and anticipated increases in synthetic crude oil supply from the upgrading of heavy crude oil and bitumen largely offset this decline. *Thus, the long term outlook presented in this section suggests stable domestic light crude oil supply, increasing domestic heavy crude oil availability and moderate growth in domestic demand for petroleum products.*



Both NEB and DRI are projecting declining oil supplies until 2000, whereas EMR's views are more optimistic. According to EMR's latest outlook, oil production, after declining to around 250 thousand cubic metres daily in 1995, will rebound to 270 thousand cubic metres daily in 2000, a level marginally lower than the peak level attained in 1988. In the post 2000 period, both NEB and DRI foresee a reversal of the trend of declining oil production, and EMR projects a slightly larger increase in production as compared to the 1990s. In DRI's projections, the decline in oil production in the 1990s, is offset by the increases in the post-2000 period. As a result, oil production in 2010 just reaches the 1990 level of 268 thousand cubic meters.

In total, both EMR and NEB expect the supply of crude oil and equivalent to increase by 8% and 13 % respectively during the next 20 years, whereas DRI projects no increases. The views of these forecasters also differ significantly on the mix between light and heavy. By the year 2010, both EMR and DRI expect the bulk of the total crude oil supply (about 70% to 75%) to be that of light crude. NEB, on the other hand, is very optimistic on heavy crude oil supply and expects its share to increase from the current 28% to 39 % by the year 2010.

A word of caution is appropriate at this point. If the NEB's low price scenario turns out to be correct (see Table 2), the result on Canadian supply could be dramatic. According to NEB's forecast, if crude oil prices were to remain at \$23/bbl for the next 20 years¹⁶, Canadian oil production would drop from the current 268 thousand cubic meters daily to around 200 thousand cubic meters by the turn of the century, and 142 thousand cubic meters daily by 2010. In the low price scenario, no new integrated oil sands plants or upgraders are constructed and further frontier development is restricted to the projects that are underway (Hibernia and Cohasset/Panuke), and the Terra Nova project which is viable under the low case price projection also. The development of new bitumen projects is also not profitable under low prices.

¹⁶ NEB "Canadian Energy Supply and Demand 1990-2010", June, 1991, p. 230.

Demand

The energy price increases of the 1970s and early 1980s led to two major changes in the pattern of energy use in Canada: a marked decrease in energy-use intensity¹⁷ and a switch to non-oil energy sources. The combination of higher energy prices and government off-oil programs led to a pronounced decline in the energy-use intensity at an average annual rate of 1.5% per year between 1972 and 1988. At the same time, the share of oil in total energy consumption declined from 49% in 1978 to about 40% in 1988. Despite the fact that prices have not increased much during the past four years, these dual trends of reduction in energy-use intensity and a switch to non-oil energy sources have continued. EMR, DRI and NEB do expect these trends to continue in all sectors of the economy during this decade as well as in the post 2000 period.

Charts 8 shows the outlook for Canadian demand for crude oil during the next 18 years. NEB's projection of oil demand growth in the 1990s is relatively subdued, with average annual growth rate of 0.4%, whereas DRI and EMR are more optimistic and expect oil demand to increase at around 1.0% annually. In the post 2000 period, each of the forecasters is projecting relatively higher increases in oil consumption. However, during this period, EMR is somewhat more optimistic (with 2.0% annual growth rate) than DRI or NEB, which expect oil demand to increase at an average annual rate of almost 1.0%. Of all the end-use sectors, transportation is expected to remain the largest user of oil, with small increases in its share in primary oil demand. As a result, motor gasoline, aviation fuels and diesel are expected to show the most growth. According to DRI, an increase in trade with Asia should increase transportation fuel demands in western Canada.

Supply/demand Balances

In 1992, total crude oil and product imports were about 88 thousand cubic metres daily and exports were approximately 132 thousand cubic meters daily, thus making Canada a net exporter of crude oil and equivalents to the extent of 44 thousand cubic meters per day. Net imports of 31 thousand cubic meters per day of light crude oil were more than offset by net exports of heavy crude oil and petroleum products of 60 and 15 thousand cubic meters per day respectively.

¹⁷ Energy consumption divided by total real domestic product (RDP).

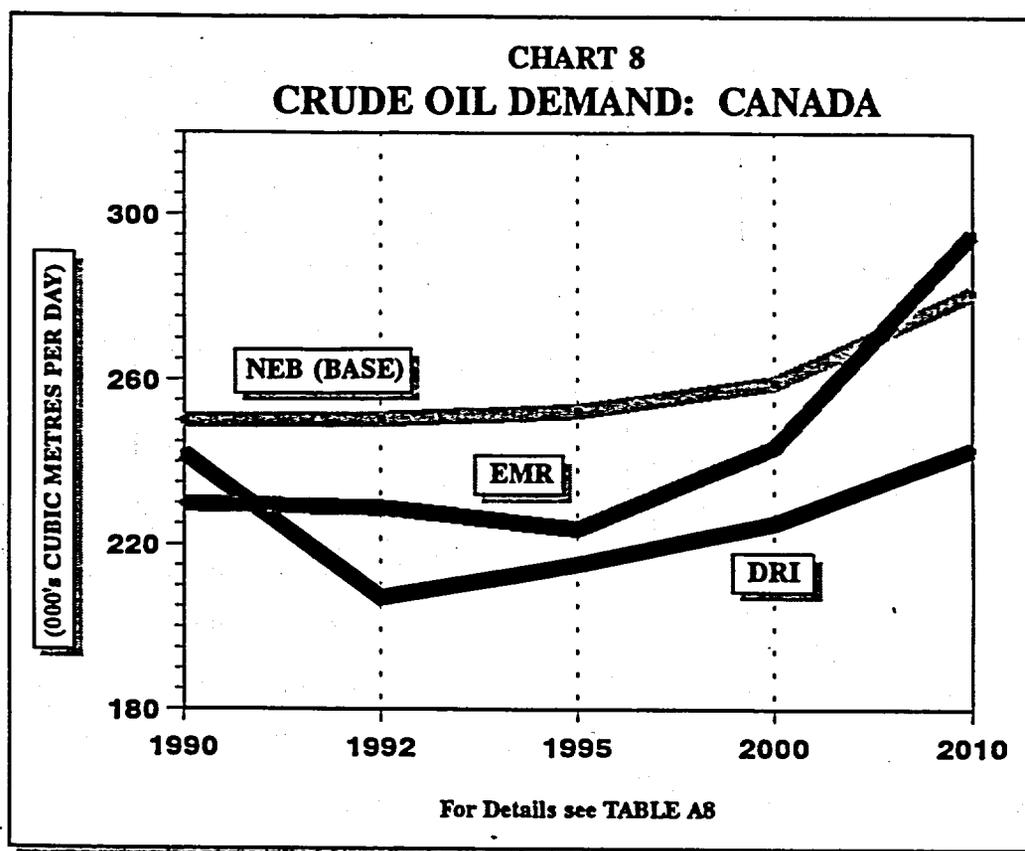
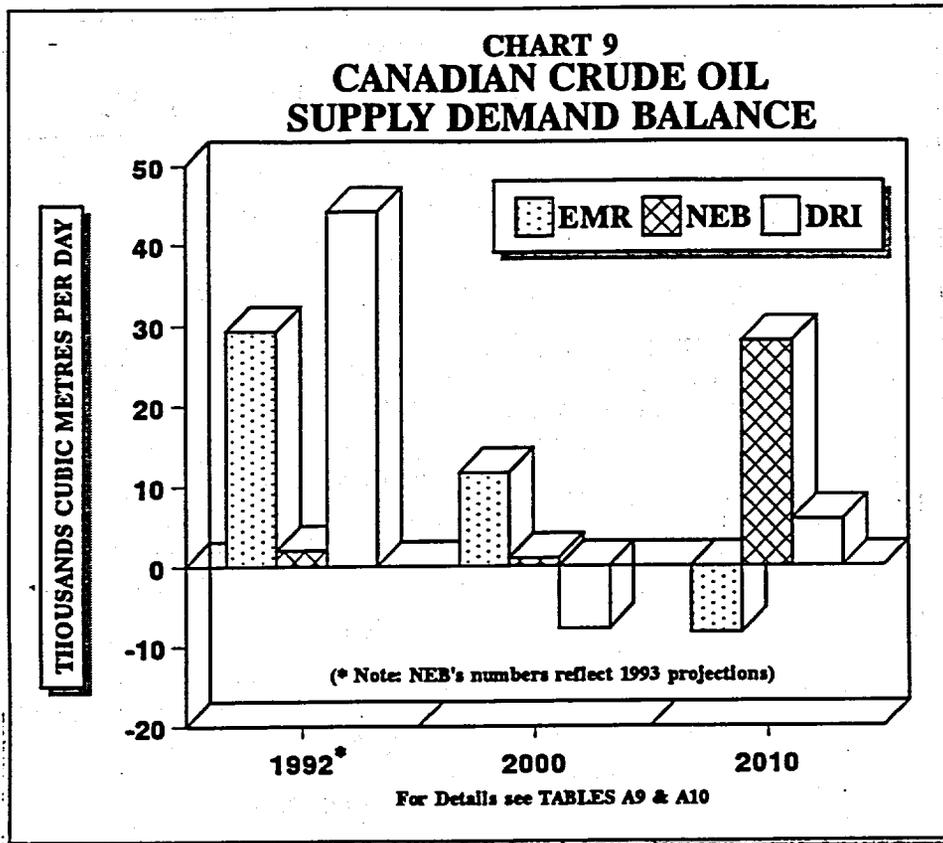


Chart 9 summarizes the projections of Canadian supply-demand balances for crude oil as well as petroleum products. The outlook presented by EMR suggests that the net export position of total crude will decline gradually during the next 18 years. EMR expects that, by 2010, Canada will become a net importer of crude when imports on the order of 8 thousand cubic meters per day are required.¹⁸ However, the NEB and DRI expect that this decline will begin to reverse after 2000 and that Canada will remain a net exporter of oil in the first decade of the 21st century (see Tables A9 and A10).

Refineries in Canada generally use light crude oil to manufacture petroleum products, while the bulk of Canadian heavy crude oil production is exported, primarily to the U.S. Canada's reliance on light imports, which is somewhat masked by the exports of heavy crude oil, is expected to increase over the forecast period. *Currently, light crude imports are around 31 thousand cubic metres representing about 15% of Canadian demand. By 2010, they are projected to increase substantially representing over 25% of domestic light crude requirements.*

¹⁸ A deficit of 13,000 cubic meters is anticipated for combined crude and petroleum products.



The developments in the world oil market have implications for the sourcing of Canadian oil imports. Canada currently imports about 62% of its oil from Western Europe, 14% from the Middle East, 13% from Latin America (Venezuela and Mexico), about 9% Africa, and the rest from the U.S. and some other countries (see Table A11 of the Appendix). During the past three years, the share of oil from Latin America has increased from 10% to 13% at the expense of the U.S. and "other" countries, whereas the share of Western Europe, the Middle East and Africa stayed constant. *With expected declines in North Sea production, more Latin American oil (in particular Venezuelan and perhaps new Colombian production; Mexican oil is heavy) can be expected in Canada.* Venezuela does have great production potential and perhaps could prove to be a more secure source of supply than the Middle East OPEC countries.

Canadian exports of heavy crude to the U.S. quadrupled during the 1980s, from 15 thousand cubic metres per day in 1980 to 60 thousand cubic metres per day in 1990. Heavy crude oil exports are projected to remain stable at the 1990 level during this decade. Although Canada is expected to be a large exporter of heavy crude in the post 2000 period, the growth in exports will be well below the growth in the 1980s.

The major U.S. market for heavy crude exports is the Northern Tier (the midwest states and Montana), where there is potential for refinery capacity expansion. While analysts see opportunities for further penetration of Canadian heavy crude into Northern Tier U.S. markets, they recognize that there will continue to be strong competitive pressures in these markets. The other alternative destination where there would appear to be scope for Canadian exports to increase would be Pacific Rim markets (e.g., Japan, Korea, Thailand). These markets have the potential for additional penetration by Canadian heavy crudes, but are expected to remain highly competitive because of the availability of crude oils from the Middle East, South-East Asia and Australia.

5.0 CONCLUSIONS

- World oil demand plays a key role in influencing various aspects of the world oil market, including: OPEC's market share, the increasing oil dependence of the U.S. (the largest oil consuming nation in the world), and the future path of market clearing prices. Low oil demand results in low calls on OPEC, which combined with expanded OPEC capacity results in low oil prices. On the other hand, higher world oil demand (hence, higher calls on OPEC) or lower OPEC production results in higher oil price paths.

The world's oil consumption is projected to increase at average annual rate of 1.4% to 2000 and at a slower rate thereafter. This rate of growth is substantially lower than the rate (almost half) projected for the global economy, implying a significant improvement in oil-use intensity. This moderate increase in demand could be a reflection of gradual implementation of strategies to reduce petroleum consumption in response to environmental concerns.

Oil demand is expected to register the strongest gains in developing countries (largely because of rapid population growth, urbanization, increased transportation fuel requirements, and accelerating industrialization), followed by Eastern Europe and the former Soviet Union. As a result, the developing countries' share of total world oil demand is expected to increase from 24% in 1990 to 29% in 2000, and 31% by 2005.

- The general expectation is that *non-OPEC oil supply will remain essentially flat during the first half of the 1990s, rising marginally by 2000. Any increases in non-OPEC oil supplies will come mainly from developing countries in the Asia-Pacific region and Latin America, and the gains will be*

from new discoveries, rather than from existing mature fields. These gains should offset the projected declines in oil output from the U.S., the North Sea and the former Centrally Planned Economies.

- From a global perspective, developments in the C.I.S. are a key ingredient to future price determination and to OPEC price/production strategy development. A delayed recovery in C.I.S. production and/or a stronger recovery in domestic demand would tend to tighten the world oil market relative to the projections, requiring further increases in OPEC production and placing upward pressure on prices. Alternatively, more aggressive foreign investment in the region and/or delayed domestic demand growth would tend to weaken prices, thereby forcing OPEC to accept a lower price or further restrict output to achieve even a weak price trajectory. Most of the experts expect that, over the medium term, former Soviet oil production will face continued difficulties.

- *With oil demand likely rising at 1.4% annually and non-OPEC supply remaining flat over the next 18 years, there will be greater demands on OPEC to increase production from 24.0 MMBD in 1992 to over 30 MMBD by 2000.* This would require significant increases in OPEC capacity. Presumably, the cartel is in a strong strategic position to influence prices, whenever the call for OPEC crude is at or in excess of its productive capacity. Currently, OPEC is operating at 82% of its capacity. According to the forecasts presented in this paper, OPEC will be producing at this rate of capacity utilization until 1995, after which the utilization rate is expected to increase to around 90%.

Several leading OPEC members including Saudi Arabia, Iraq, Kuwait and Venezuela plan to increase their crude oil capacity. The problem of raising the capital necessary to undertake these projects is now a major hurdle facing OPEC members.

- *Most of the forecasters project an environment of stable prices during the 1990s.* After achieving an annual average real price of \$24/bbl in 1995, the remainder of the decade is expected to see virtually flat real prices, as OPEC follows the policy of revenue growth through output gains, rather than price increases. The crude oil real price is expected to average \$25-26 in 2000 and rise to around \$30 by 2010.
- The key uncertainties that could affect developments in the world oil market include: oil supplies from the ex-Soviet Union, OPEC's ability to raise its

crude oil productive capacity, and a widespread use of measures like a carbon tax for environmental purposes. Political developments that could temporarily upset supplies and dominate economics, and unanticipated shifts in OPEC policies (either towards or away from the controls it exercises over total production) are some of the other developments that could significantly influence the world oil market as we enter the 21st century.

- Oil is an important energy source for Canada. Therefore, the likely developments in the world oil market are of great importance to Canadian consumers and producers.

At prices in the range of \$25 in 2000 and \$30 (in 1992 U.S. dollars) in 2010, the outlook is for stable domestic light crude oil supply, increasing domestic heavy crude oil availability and moderate growth in domestic demand for petroleum products. Megaprojects including Hibernia, Suncor and Syncrude enhancements, Lloydminster plus another upgrader, and expanded operations for bitumen production are expected to come on stream before the turn of the century. The likelihood of production from Amauligac in the Beaufort sea is uncertain.

Although production of both existing conventional light and heavy crude is expected to decline, in the long term, with a gradual increase in prices, supplies from non-conventional sources including East coast offshore and other frontier production, and synthetic crude oil supply from the upgrading of heavy crude oil and bitumen, should largely offset this decline.

The projections differ significantly on the production of Canadian light and heavy crudes. In total, both EMR and NEB expect the supply of crude oil and equivalent to increase by 8% and 13% respectively during the next 20 years, whereas DRI projects no increases. By the year 2010, although the bulk of the total crude oil supply is expected to be that of light crude, the share of heavy crude oil supply is expected to go up.

If, however, crude oil real prices were to remain in the range of \$23/bbl for the next 20 years, some of Canada's mega projects would not be profitable. This includes oil sands plants, upgraders, further frontier development (which may be restricted to the projects that are underway: Hibernia and Cohasset/Panuke, and the Terra Nova project which is viable under the low case price projection) and the development of new bitumen projects. Under this low price scenario, Canadian oil production could decline by about 25% by the turn of the century, and by as much as 50% by the year 2010.

- Despite the fact that prices have not increased much during the past four years, the dual trends of reduction in energy-use intensity and a switch to non-oil energy sources have continued. These trends are expected to continue, in all the sectors of the economy, in this decade as well as in the post 2000 period. Overall, Canadian oil demand is projected to increase at moderate average annual rates between 0.7% and 1.4% between 1992 and 2010. Of all the end-use sectors, transportation is expected to remain the largest user of oil, with small increases in its share of primary oil demand. As a result, motor gasoline, aviation fuels and diesel are expected to show the most growth.
- In 1992, total crude oil and product imports were about 88 thousand cubic metres daily and exports were approximately 132 thousand cubic meters daily, thus making Canada a net exporter of crude oil and equivalents to the extent of 44 thousand cubic meters per day. Net imports of 16 thousand cubic meters per day of light crude oil and petroleum products were more than offset by net exports of heavy crude oil of 60 thousand cubic meters per day.

The net export position of total crude is expected to decline during the 1990s. Both NEB and DRI expect Canada to recover to remain a net exporter of crude during the following decade. EMR, on the other hand, expects that Canada will become a net importer of crude by 2010, when net imports in the order of 8 thousand cubic meters per day will be required.

- ***Canada's reliance on light imports, which is somewhat masked by the exports of heavy crude oil, is expected to increase.*** As a result, over 25% of domestic light crude requirements in the post 2000 period will be met by imports.

Developments in the world oil market also have implications for the sourcing of Canadian oil imports. In recent years, we have seen a modest increase in the share of oil imports from Latin America. With projected declines in North Sea production, one can expect a continuation of this trend toward more Latin American oil imports into Canada (particularly Venezuelan and perhaps some Colombian oil because Mexican oil is heavy). Venezuela does have great production potential and perhaps could prove to be a more secure source of supply than the Middle East OPEC countries.

- ***Heavy crude oil exports are projected to increase marginally during this decade, but to increase substantially in the post 2000 period. However, the growth in exports is expected to be well below that registered in the 1980s.*** In addition to the opportunities for further penetration of Canadian heavy crude into Northern Tier U.S. markets, the other alternative market that has scope for Canadian heavy oil exports would be the Pacific Rim (e.g., Japan, Korea, Thailand). This market has the potential for additional penetration by Canadian heavy crudes, but is expected to remain highly competitive because of the availability of crude oils from the Middle East, South-East Asia and Australia.

STATISTICAL APPENDIX

Table A1
World Oil Demand Projections
 Millions of barrels per day (MMBD)

	1990	1995	2000	2005	2010	
CERI	66.2	64.0	67.1	70.7	72.2	(2007)
DRI	66.2	70.6	76.2	80.6	85.1	
PIRA *	66.8	70.3	—	76.3	—	
PEL *	65.9	70.4	73.7	—	—	
IEA (High)	65.9	75.0	80.0	85.0	—	
DOE	65.9	69.6	75.0	75.0	84.3	
CONOCO	68.0	—	80.0	—	—	
OIL & GAS J.L. SURVEY	65.4	69.5	73.1	69.5	74.9	(AV.)
AVERAGE	65.9	71.2	75.6	76.2	80.5	

*Source: EMR, "Experts View on World Oil Markets", Winter 1992.

Table A2
Non-OPEC Supply Projections
MMBD

	1990	1995	2000	2005
CERI	41.9	35.6	34.3	35.8
DRI	40.1	39.2	40.4	41.3
IEA	43.6	44.8	45.5	45.2
PEL	42.9	44.0	45.9	48.8
PIRA	42.1	41.0	46.3	-
DOE	43.3	42.9	44.1	* 43.3
Odell	40.1	* 41.5	43.0	* 44.5
AVERAGE	42.0	41.3	42.8	43.2

NOTE: Starred numbers are interpolated from the 1990, 2000, and 2010 projections.

Table A3
Former Soviet Oil Production projections
MMBD

	1990	1995	2000	2005	2007
DRI	12.6	12.7	14.0	15.2	-
CERI	11.4	7.6	7.5	10.0	11.5
DOE	11.4	8.5	9.5	-	11.0
IEA	11.7	11.1	11.4	11.7	-
PEL	11.4	10.0	10.5	10.6	-
PIRA	11.3	8.6	10.0	12.0	-

Table A4
CALL ON OPEC (1990 – 2010)
MMBD

	1990	1995	2000	2005	2010	
CERI (REF. CASE)	25.1	28.4	32.8	35.0	35.8	(2007)
DRI	25.1	29.0	33.3	36.0	38.8	
DOE	25.1	27.1	30.9	–	41.9	
IEA	22.3	30.2	44.5	44.8	–	
PEL	23.0	26.4	27.8	29.8	–	
PIRA	23.2	25.3	30.1	–	–	
Odell	24.8	25.7	–	26.7	–	
AVERAGE	24.1	27.7	32.2	36.4	36.5	

1) Some of the numbers are derived by subtracting non-OPEC supply from projected world oil demand

Table A5
Recent oil price projections
in \$U.S. 1992/barrel

	1992	1995	2000	2005	2010
DRI	18.6	20.4	23.2	27.3	30.9
DOE	20.3	22.6	28.7	33.1	36.3
PIRA	—	22.0	23.0	—	—
EMR	20.8	—	23.9	25.0	25.0
CONOCO	21.0	23.0	24.0	—	—
CERI (REF.)	20.8	23.3	23.8	26.0	* 27.6
NEB	—	22.9	25.0	27.1	—
IEA: LOW	21.0	22.9	22.9	22.9	—
HIGH	22.9	30.2	38.5	38.5	—
SHELL	\$21 to 26	(1990–2005)			
CHEVERON	\$18 to 29	(1990–2005)			
Oil & Gas JL. SURVEY:					
LOW	20.7	20.1	19.5	19.5	19.5
HIGH	26.0	26.5	29.8	33.3	38.0
AVERAGE	22.6	23.4	24.8	25.4	27.1
AVERAGE	21.0	23.5	25.5	28.8	30.5

* This number is for the year 2007

Table A6

Crude Oil Production : CANADA
 (Thousands of Cubic Metres Per day)

Total Crude

	1990	1992	1995	2000	2010	1990-2000 %AAI	2000-2010 %AAI
EMR	265.0	262.0	250.0	270.0	282.0	0.2	0.4
NEB Base	272.0	256.0	244.0	260.0	309.0	-0.5	1.7
DRI	268.0	263.0	251.0	235.0	268.0	-1.4	1.3
NEB Low	272.0	249.0	214.0	200.0	142.0	-3.0	-3.4
Light and Medium Crude							
EMR	189.0	189.0	188.0	194.0	196.0	0.0	0.1
NEB Base	195.0	181.0	168.0	173.0	188.0	-1.8	0.8
DRI	193.0	187.0	173.0	152.0	198.0	-2.4	2.7
NEB Low	195.0	177.0	157.0	150.0	107.0	-2.6	-3.4
Heavy Crude							
EMR	75.0	73.0	62.0	76.0	86.0	0.1	1.2
NEB Base	77.0	78.0	76.0	87.0	121.0	1.2	3.4
DRI	75.0	76.0	78.0	83.0	70.0	1.0	-1.7
NEB Low	77.0	68.0	57.0	50.0	35.0	-4.2	-3.5

* Average Annual Increase

Table A7
Megaprojects : CANADA

DRI	NEB
East Coast	
	Cohasset/Panuke : Start-up date 1992, with average production of 164 mb/d.
Hibernia to be completed before 2000	1996, with production at 110 mb/d.
	Terra Nova : 1988 at 88 mb/d
Beaufort	
Production After 2000	Production in 2004
Mining Plants	
Two oil sand mining plants	Suncor and Syncrude enhancements. OSLO to commence production in 2005 and one more project in 2009
Upgraders	
Husky upgrader	Husky upgrader 1993. One upgrader at Edmonton refinery in 2004.
Bitumen	
Additional phases at Cold Lake will increase bitumen production	Expansion of existing operations and some new projects. Bitumen production reaches 460 mb/d by 2010.

Table A8**Crude Oil Demand : CANADA**
(Thousands of Cubic Metres Per day)

	1992-2000		2000-2010		1992-2010			
	1990	1992	1995	2000	2010	%AAI *	%AAI	%AAI
EMR	229.9	228.7	223.5	243.3	295.4	0.8	2.0	1.4
NEB								
Base Scenario	250.0	250.0	252.0	259.0	281.0	0.4	0.8	0.7
DRI	242.0	206.7	215.1	224.6	242.9	1.0	0.8	0.9

* Average Annual Increase

Table A9
Canadian Oil Supply-Demand Balances
Net Exports

(Thousands of Cubic Metres Per day)

1992 /

	1993 *	1995	2000	2005	2010
Light Crude					
EMR	-30.7	-34.8	-47.6	-50.6	-73.6
NEB (Base)	* -54.0	-59.0	-59.0	-84.0	-61.0
Heavy Crude					
EMR	60.0	46.2	59.2	57.2	65.3
NEB (Base)	* 53.0	51.0	60.0	69.0	89.0
Total Crude Balance					
EMR	29.3	11.4	11.6	6.6	-8.3
NEB (Base)	* 2.0	-8.0	1.0	15.0	28.0
DRI	44.2	19.4	-7.8	7.5	5.8
Products					
EMR	15.0	15.0	15.0	5.0	-5.0
NEB (Base)	* 7.0	7.0	4.0	-3.0	-12.0

* All the starred numbers in the first column are for the year 1993 and the remainder for 1992

Table A10
Canadian Oil Supply-Demand Balances
Net Exports

(Thousands of Cubic Metres Per day)

	1990	1992	1995	2000	2005	2010	
			Light Crude *				
Demand	211.9	204.2	207.9	226.2	250.0	274.9	
Supply	189.4	188.6	188.1	193.6	204.5	196.3	
Net Exports	-22.6	-15.7	-19.8	-32.6	-45.6	-78.6	
			Heavy Crude				
Demand	18.0	13.6	15.5	17.1	18.6	20.5	
Supply	74.7	73.6	61.7	76.3	75.8	85.8	
Net Exports	56.7	60.0	46.2	59.2	57.2	65.3	
			Total Balance				
Demand	229.9	217.8	223.5	243.3	268.7	295.4	
Supply	264.1	262.2	249.8	269.9	280.1	282.1	
Net Exports	34.1	44.4	26.4	26.6	11.6	-13.3	

Source: EMR, 'Preliminary Long Term Energy Outlook', 1992

* Includes petroleum products.

Table A11
Canadian Imports of Crude Oil by Region
 % Share

	Middle East	W. Europe	Latin America *	Africa **	U.S. & Other	Total
1981	34.7	-	37.8	6.3	21.2	100.0
1985	3.8	35.6	33.6	17.0	10.0	100.0
1990	14.1	61.5	10.0	9.1	5.3	100.0
1991	14.0	62.7	9.5	10.5	3.3	100.0
1992	13.8	62.0	12.6	9.3	2.3	100.0

* Includes Venezuela and Mexico.

** Includes Algeria, Libya, and Nigeria.

Table A12

Economic Growth Assumptions
Average annual growth rate
(%)

1990 - 1995	2.6 - 3.6
1995 - 2000	2.8 - 3.7
2000 - 2005	3.0 - 3.6

Table A13

LCD share of total world oil demand

	% Share
1990	24.3
1995	26.7
2000	28.8
2005	30.8

Table A14

Average annual increase in world oil demand
1990 - 2005

Region	Percentage
LDCs	2.90 %
OECD	0.50 %
Former CPEs	1.06 %
World	1.22 %

Source: This table is based on the average
of various forecasts.

Table A15
OPEC Productive Capacity
MMBD

	1990	1995	2000	2005	2007
CERI	* 32.8	34.7	36.4	38.9	39.9
DOE (Low)	28.1	29.9	33.3	42.2	—
(High)	28.1	31.5	36.9	49.4	—
PIRA	29.3	32.8	36.3	—	—

* Estimated productive capacity for 1993.

Table A16
World Sustainable Productive Capacity
MMBD

	1991	1995 *
TOTAL OPEC	25.8	36.2
EX-USSR	10.8	8.9
CHINA	2.9	3.1
USA	8.5	8
NORTH SEA	4.8	4.6
CANADA	2.2	2
MEXICO	2.9	3.3
REST of WORLD	13.5	14.9
TOTAL CAPACITY	71.3	80.9

Source: D.T. Gochenour, "The Coming Capacity Shortfall",
 Energy Policy, October, 1992

* planned or announced

Table A17
Announced Capacity Investment Plan
 (Billions US dollars)

Investment plans by	1995	2000
TOTAL OPEC *	156.0	198.0
MEXICO	20.0	
CIS REPUBLICS	80.0	
TOTAL PROJECTED	256.0	

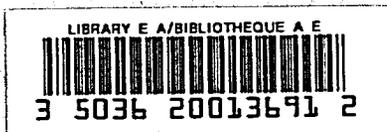
* About 47% in 1995 and 54% in 2000 of the intended investment cost is in the Middle East.

Source: D.T. Gochenour, "The Coming Capacity Shortfall", Energy Policy, October, 1992

Table A18
Supply Costs
 US\$ 1990/bbl at Cushing

	\$/barrel
Conventional Crude Oil	
Discovered Reserves	14-27
Undiscovered Reserves	19-27
Frontiers	
East Coast Offshore	15-27
Mackenzie / Beaufort	24-27
Unconventional Crude Oil	
Bitumen	
Upgraded Bitumen	23-25
Integrated Mining Plants	27

Source: NEB, "Canadian Energy Supply and Demand 1990 - 2010", June 1991



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