Global Questions:

looking at new oil and gas developments

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IN THIS ISSUE

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Energy and The Global Village

It is relatively easy, in the great scheme of things, to identify the likely local effects of a development, whether it's a subdivision of new homes, a farm, a factory, or an offshore oil and gas well. You look at the environment at the site, you look at what's going to happen there, and you figure out what pathways link the two, and what will happen as a result – good or bad.

But to do the same thing and extrapolate to a global scale, is a far different kettle of fish. To think globally and assess locally – or vice versa – means balancing what may seem to be an impossible list of considerations.

How people look at the consequences of development depends greatly on their own way of seeing the world. For some people, economic growth, job creation, and other human needs are global priorities; others see the planet as a fragile ecological sphere, in crisis because of our species' selfishness. Somewhere in the middle are those with a conservation and stewardship outlook toward the natural environment. Clearly, different perspectives will lead to different conclusions about the effects of the same new development.

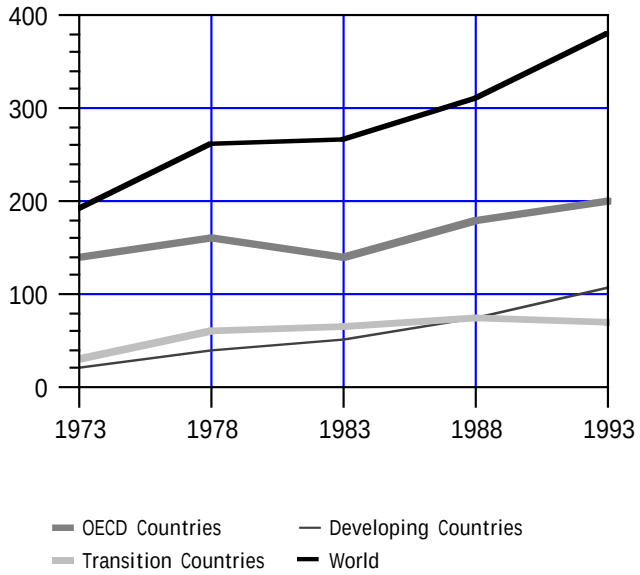
When we look for, produce, and use gas and oil there are inevitable environmental costs, both direct local impacts and broader, more diffuse effects. Direct impacts of hydrocarbon exploration and production are reviewed in companion papers to this one: *Exploring for Offshore Oil and Gas; Offshore Production, Storage and Transportation*; and *Communities and Change*.

Marine pollution is one example of a global impact; hydrocarbons have been found in all parts of the world's oceans. It appears, however, that most of the background hydrocarbon pollution in the oceans derives from shipping, rather than offshore oil and gas production.

Many other global issues are energy related – different uses of energy have different effects on the environment. Whether one energy option is chosen

continued on page 2

Total Energy Consumption (exajoules)
1973 - 1993



GREENHOUSE GASES: A PRIMER

Worldwide, greenhouse gases occur naturally. Water vapour, for example, is the biggest greenhouse gas by volume and can be produced by evaporation. Carbon dioxide (CO_2) is the second largest greenhouse gas by volume; methane (CH_4) and nitrous oxide (N_2O) are two other common greenhouse gases, and all can be emitted naturally, by volcanoes or the decay of plants.

Man-made emissions of greenhouse gases have been rising steeply and exponentially since the beginning of the Industrial Revolution. There is a close correlation between the economic growth of the past 200 years and the emission of greenhouse gases. With the steep rise in the earth's population has also come a rise in greenhouse gas production from cutting and burning forests, raising livestock, tilling land, and flooding rice paddies.

Greenhouse gas emissions are usually measured in units that are equivalent to the potential of the same number of tonnes of CO_2 to contribute to global warming. The relative amounts of CO_2 that would need to be released to equal one tonne of the following gases are:

methane ..... 21 tonnes of CO_2

nitrous oxide 310 tonnes of CO_2

over another depends on how we view the world and how we think the future will look. This paper looks at the possible impacts of new developments, reviews the forecasts for global energy demand and production, and suggests some ways to start putting the effects of a particular project into a global context. It focuses primarily on climate change, as this is currently the best known and potentially most serious result of our reliance on hydrocarbons.

ENERGY AND ENVIRONMENT: THE GLOBAL OUTLOOK

Global problems are more complex than local ones, more difficult to explain, and 'expert' opinions vary more widely. Many are linked to our desire for the energy that makes modern life possible – like issues such as climate change, large scale cutting of forests, and ground level ozone and acid rain caused by industrial pollution from hundreds or thousands of miles away. All of these have ties to energy production and use, especially the burning of hydrocarbons and other fossil fuels.

After the fierce debates of the past decade, most scientists now agree that humans are changing global climate because of the 'greenhouse gas' effect (see sidebar). 'Climate change' used to be called global warming, but that term is misleading. The overall temperature of the planet *is* forecast to increase by between 1.5 and 4.5º C over the next century. However, any one part of the globe may become warmer and dryer or cooler and wetter, depending on how weather patterns change as a result of the temperature increase.

Climate change also relates to deforestation because forests, along with the ocean, provide important pools for storing carbon. These pools of carbon, frequently called "sinks", continuously store some of the carbon dioxide in the atmosphere as organic matter in the form of trees or plankton.

This linkage explains why some tropical countries such as Costa Rica can offer to sell credits for carbon emissions – you can provide storage for carbon dioxide by not cutting down trees.

However, forests are being cut at a tremendous rate throughout the world, for fuel, to clear land for agriculture or towns, and for consumption as timber and pulpwood. Wood burning has created a particulate haze around the tropics that is visible from space, and adds its own emissions burden.

Sulphur dioxide (SO_2) is produced by burning coal and oil, can travel thousands of kilometres, and is a primary cause of acid rain. Tighter restrictions in the US and Canada have reduced the amount of SO_2 emissions, but sulphates continue to rain from the sky, at a rate of 10 kg/ha in Nova Scotia in 1996, 25% in excess of the 'critical load' for protection of our surface waters. The burning of hydrocarbons is also a source of mercury contamination in lakes and rivers.

Smog is usually thought of as a problem of individual large urban areas, but it turns out that the ground level ozone and fine particulates which make it up can also be transported long distances. They are mostly generated by burning gasoline and diesel fuel in cars and trucks, as well as by industry.

Permanent hazes hundreds of kilometres long now hang over many parts of the planet, like the industrial areas of the Ural Mountains and the Great Smokies and central Appalachians.

Are Greenhouse Gases Released By Producing Oil and Gas?

Canada's 1995 Energy-related Carbon Dioxide Emissions

In Canada, 90% of CO_2 emissions come from the energy sector, as does 35% of total CH_4. The graph to the right breaks down CO

AGREEING TO COMBAT CLIMATE CHANGE: A SWAMP OF INTERNATIONAL POLITICS

The Intergovernmental Panel on Climate Change (IPCC) was set up in 1988 by the World Meteorological Organization and the United Nations Environmental Programme. It helped get the world's scientific community to voice its concerns about climate change.

In 1992, the UN Conference on Environment and Development in Rio de Janeiro endorsed the Framework Convention on Climate Change (FCCC) that urged nations to take actions to limit carbon emissions. The Convention had an objective of holding emissions to 1990 levels but this was not met by any nation – in fact, emissions climbed sharply through the 90s.

Currently, the United Nation's Intergovernmental Panel on Climate Change projects that an immediate 60 percent reduction in fossil-fuel use is necessary just to stabilize climate at the current level of disruption.

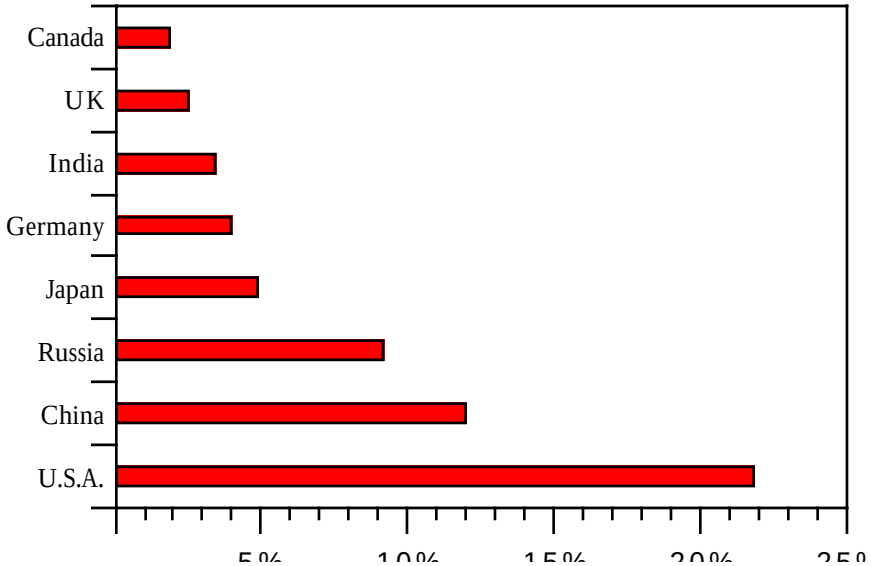
World nations met in Kyoto, Japan, in December of 1997. In 10 days of often frantic negotiation they agreed on a number of issues, but many more were left unresolved. Increasing energy use in the third world means more pollution and more carbon emissions. At the same time, consumption of energy from fossil fuels is much higher in developed nations – 33 times higher in the United States than in India, for example.

One way to slow climate change is to limit development in poorer parts of the world. Another way would be for us to drive less, air condition less, *use* less. As well, while we in developed nations consume roughly 10 times as much energy as poor nations, it's the poorest that will be hardest hit by climate change – tenuous semi-desert states in Africa, tiny island nations in the Pacific, coastal Bangladesh.

The Kyoto convention calls for only industrialised countries to reduce car-

CANADA'S KYOTO COMMITMENT

Canada, with one-half of one per cent of the world's population, accounts for



Agreeing to Combat Climate Change

bon emissions. Emission targets for industrialized nations were set to differ from 1990 levels by specific percentage by 2008 - 2012. European Union (EU) countries must reduce emission levels by 8%, the USA by 7%, and Canada and Japan by 6%, but Australia could exceed 1990 emission levels by 8%.

Many developed countries, like the USA, resist making emissions cuts, unless developing countries make commitments and help the developed world to meet theirs through emissions trading mechanisms.

Developing countries, however, have refused to establish targets for cuts as they blame the industrialized world for the greenhouse gas problem, and do not wish to cripple their emerging economies.

The trading of emission rights was approved in principle at Kyoto, with details to be finalized at the next meetings. In return for technology which will reduce emissions in developing countries, the industrialised nations will be able to continue along their current energy path. The treaty also approves in principle "credits" to nations planting or protecting woodlands at home or abroad.

The next international meeting, the Conference of the Parties (COP), was held in Buenos Aires, Argentina in November of 1998. Few decisions were taken in Buenos Aires, due to the sharp division between the developed and developing countries. However, three trading mechanisms are currently under discussion: joint implementation (countries joining up to control emissions), emissions trading, and the Clean Development Mechanism (companies in the developed world can enter into cooperative projects to reduce emissions).

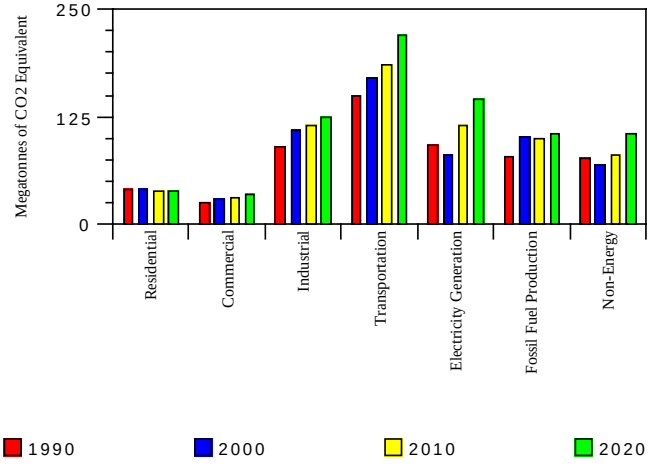
The "Kyoto Protocol" will take effect when a minimum of 55 nations representing 55% of CO_2 emissions ratify the treaty. Terms of the treaty will become binding to individual nations only when ratified by their governments. Any nation can withdraw from the agreement for three years after it comes into effect. Canada signed the Kyoto Protocol on April 29, 1998.

Canada's Kyoto Commitment

- the process for developing a national implementation strategy on climate change;
- establishing credit for early action to reduce greenhouse gas emissions; and
- strengthening voluntary action.

The Prime Minister established a Climate Change Secretariat and a $150 million Climate Change Action Fund in February, 1998. As well, 15 Issue Tables were struck to identify options for achieving reductions in greenhouse gas in a number of specialized areas. They include such topics as modelling & analysis, transportation, electricity, international emission trading & flexibility mechanisms, joint implementation & domestic trading issues, technology, sinks, credit for early action, public education & outreach, & building technology.

Canadian GHG Emissions by Sector, 1990 - 2020



CLIMATE CHANGE AND NOVA SCOTIA

We are probably already seeing early effects of climate change in Nova Scotia. The decline of groundfish stocks, particularly cod, was in part due to changes in oceanographic conditions that may be linked to climate change. So too may be the recent disappearance of Atlantic salmon from ocean feeding areas. We can also expect more variable weather with more storms and high intensity rainfall. Increases in average temperatures will also lead to rises in sea level, with flooding of low-lying coastal areas, particularly when wind and tide conditions bring extreme high tides. Estimates of damage to agriculture have ranged from $20 to $88 million a year.

Nova Scotia's current annual emissions are slightly below 1990 gains, at about 18.8 million tonnes. If a moderate level of growth is sustained, with no new efficiency levels, we will probably hit 6% above 1990 levels in 2010 –

continued on page 8

SO HOW CAN YOU ASSESS THE IMPLICATIONS OF A NEW OFFSHORE DEVELOPMENT?

We know that increased emission of greenhouse gases may spell the end of the world as we know it, so should there be a stop to further development of oil and gas? The answer is definitely not a simple yes, nor is it a simple no.

The factors that affect how the world will look in the future include: the cost of energy, the demand for products, changes in technology, and changes in lifestyle.

Experience from the mid 1970s and early 1980s has taught us that relatively major changes in energy use can occur when energy shortages and economic recession occur together.

SUBSTITUTING SOURCES AND CUTTING CONSUMPTION: AN ENVIRONMENTAL JUGGLING ACT

New sources of natural gas can be used to reduce greenhouse gas emissions providing they displace other worse fuels. Switching burning from oil to gas to produce electricity can reduce greenhouse gas emissions; switching from coal to gas can reduce them even more. Natural gas is the best “bridging” fuel we have today. That is, using natural gas is the best alternative while waiting for technological advances to provide increased efficiency, reduced emissions, and create new, better sources of energy - like hydrogen. This, of course, assumes that we do not have the public nor political will to actually cut back on our use of energy in the developed world.

other less desirable fuels. We also know that people will tend to resist change, particularly when it comes to lifestyle choices.

That being said, environmental choices always involve risk and uncertainty. It is always difficult to be sure where technology is going to lead us and even more difficult to predict how people will react.

we need to know what is being produced, how it will be used, what it will replace, and what it will cost in emissions

For example, problems of air-tightness and the "sick-building syndrome" resulted from early improvements in insulating buildings. When car fuel efficiency increased many people drove more rather than saving money. Lifestyle choices and the reluctance to change are an important aspect affecting the future we will have.

Although any one development may seem trivial in global consumption and production terms – right now, The Cohasset Project and Hibernia together supply about .125% of world oil production, for example – effects are cumulative. Individual projects **can** be measured, and their effects estimated.

If there is to be any consensus on the broader impacts of a particular oil and gas development, the need to identify these effects must be identified before the regulatory process begins. Environment impact reviews have generally been limited to the local effects, whether immediate or cumulative. In the case of the Sable Offshore Energy Project, for example, questions of end-use were explicitly ruled outside of the panel mandate.

In order to assess an individual project on a global scale, such questions of end use, the desirability of new hydrocarbon production, the destination of the product, and the consideration of how this fits into the best overall data available, must be made part of the assessment process. To do otherwise is to turn our backs on the commitments we have made to the planet.

PUTTING IT TOGETHER: ASSESSING GLOBAL IMPACTS

The following checklist sets out suggested yardsticks for beginning to assess the global effects of an offshore energy development. As the practice of integrating broader environmental questions into decisions about development becomes more common, these methods will doubtlessly become more sophisticated. We present this as a useful initial framework.

- What kind(s) of fuel will be produced?
- In what quantities?

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FORECASTING WORLD ENERGY USE

A number of forecasts for the next decade are available from highly qualified sources, including institutions in Canada and the United States, as well as the United Nations. Usually forecasts come in sets, with a "Reference Case" representing moderate rates of economic growth, technological change, and policy shifts. These reference cases are then changed by imagining what would happen if, e.g., there were high rates of economic growth, or an ecologically-driven focus on energy savings and efficiency.

Most forecasts agree that highest growth rates will be in developing countries, which are projected to at least double, and possibly even triple their energy use, but developed countries will continue to consume the most in absolute terms.

Price factors are obviously a major influence in predicting developments in the energy sector. Oil prices have fallen dramatically in the past year. Currently, Canadian crude oil prices dropped 7.8% in November of 1998, and were down 30.1% compared with a year ago. The oversupply of crude combined with weak Asian demand has kept prices down.

Forecasts generally assume world oil and electricity prices will remain relatively steady over the next couple of decades, but North American natural gas prices will modestly increase. There is general agreement among the forecasts that oil use will grow by about 2% annually, with generally stronger growth rates for natural gas and renewable resources, and lower for nuclear energy.

The largest difference among the forecasts involve coal consumption. The International Energy Agency's World Energy Outlook 1996 and the International Energy Agency predict slow annual growth for coal. The Petroleum Industry Research Associates, on the other hand, believe that coal will compete successfully with natural gas for existing electric power plants, although natural gas will fuel most of the new plants. They believe that over the next 10 years coal will fuel about one-half of the growth in electricity generation, compared with less than one-third in other projections for the same period.

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