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Coal and Shale Gas Obstacles to Climate Justice

By John Dillon

Recent struggles over the building of the Keystone XL pipeline have put the spotlight on an ever-growing dependence on the tar sands as a source of fossil fuel. Less well publicized, but of equal concern, are two other carbon-intensive energy sources: coal and shale gas.

As eminent climate scientist James Hansen warns: "Burning all fossil fuels would have a climate impact that literally produces a different planet than the one on which civilization developed."[1] If we are to have any hope of keeping the rise in global temperatures below two degrees Celsius, and as close as possible to 1.5 degrees, we must phase out the use of coal and avoid further development of unconventional fossil fuels, including those from the tar sands and shale formations.

The reality, however, is that plans are underway for expanded use of coal around the globe accompanied by a boom in shale gas production despite public concern about the ecological impacts of "hydraulic fracturing" (or fracking) of shale rock formations.

This Briefing Paper will first describe the extent of coal and unconventional oil and gas reserves in relation to conventional oil and gas reserves. Secondly, we consider in some depth specific issues that pertain to coal. Thirdly, we examine current developments and controversies concerning shale gas in the North American context. Finally, we recount how opposition to shale gas extraction is growing among Indigenous and other communities in Quebec, New Brunswick and British Columbia.

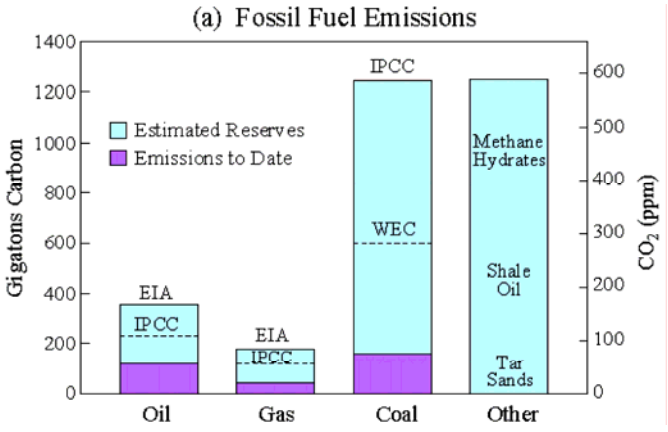
Greenhouse Gas Emissions from Coal and Non-conventional Fossil Fuels

While the tar sands are the fastest growing source of Canadian greenhouse gas (GHG) emissions, coal combustion is actually a larger source of GHGs at the present time. In Alberta alone, coal-fired power plants accounted for 43 megatons (millions of tons or Mt) of carbon emissions in 2009[2] – close to the 45 Mt emitted by tar sands extraction and upgrading that year.[3]

The graph (from James Hansen's web site) shows the relative amounts of carbon contained in four categories of fossil fuels. It illustrates the fact that the amount of carbon still buried underground in coal seams or unconventional types of fossil fuel deposits (shown as "other") far outweighs both the amount of carbon that has been released to date through the burning of oil, gas and coal and the remaining reserves of conventional oil and gas.

The graph does not attempt to resolve the different estimates of the Intergovernmental Panel on Climate Change (IPCC), the U.S. Energy Information Administration (EIA) and the World Energy Council (WEC) as to the extent of resources underground. The point of the graph is to show how coal and non-conventional oil and gas dwarf estimates of conventional oil and gas reserves.

Figure 1: Gigatons of Carbon in Fossil Fuels



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Coal

Canada's coal reserves are large enough to last for several centuries at current rates of use. Canada is also the world's seventh largest coal exporter. Coal currently accounts for 16.9% of electricity generation in Canada.

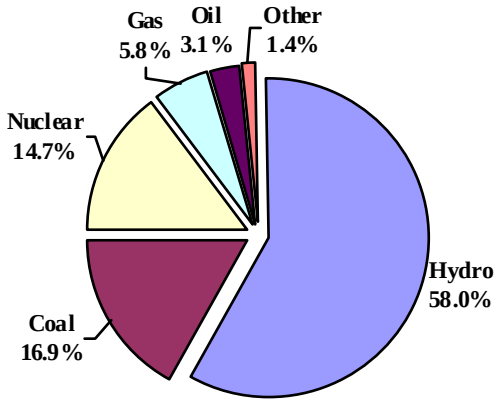


Figure 2: Electrical Generation in Canada by Source

Although Ontario has promised to phase out coal-fired plants by 2014, there are plans to build new generators in other parts of the country. On August 27, 2011, Environment Minister Peter Kent tabled draft regulations that would take effect in 2015 requiring new coal plants, and old plants needing significant refurbishment, to emit 70% fewer GHGs per kilowatt hour (kwh) than the average of current Canadian coal-fired power plants.

Environmental groups have criticized these draft regulations as weak and inadequate. The David Suzuki Foundation notes that the regulations would not apply to existing coal-fired plants until they have to upgrade their facilities. The Foundation estimates that the regulations would achieve only 10 Mt of emission reductions between 2015 and 2025, not the 15 Mt predicted by Environment Canada. Even if that reduction target were achieved, it would be the equivalent of only 2% of total Canadian GHG emissions. Moreover this official emission reduction forecast includes reductions that will be achieved by the closing of plants in Ontario. New plants that incorporate Carbon Capture and Storage (discussed below) are exempt from the regulations until 2025.

Clean coal – an oxymoron?

The term "clean coal" was initially invented by the industry to describe efforts to reduce soot emissions by putting scrubbers on smokestacks or washing coal to remove surface impurities. It is now also being applied to technologies designed to reduce GHG emissions.

Proponents of clean coal argue that it can be safely used through technologies such as carbon capture and storage (CCS) and *in-situ* coal gasification. CCS involves trapping carbon dioxide (CO_2) emissions and storing them underground before they escape into the atmosphere. *In-situ* coal gasification involves injecting oxygen underground into coal seams and setting off controlled, partial combustion that turns coal into a gasified state. This synthetic gas can be separated from CO_2 and burned to produce electricity. The CO_2 can then be stored underground as occurs with conventional CCS.[4]

The Pembina Institute observes that CCS "is no cheap magic bullet … . Since the technology is not yet proved on economic scales, leaning on it as the primary means to reduce emissions in Alberta (rather than investing in efficiency and renewables) essentially subsidizes coal at the expense of cleaner options."[5]

Our KAIROS Briefing Paper "*The Costs and Risks of Carbon Capture and Storage*" notes that capturing CO_2 at a power plant, compressing it and transporting it to a storage site all consume energy. As a result any new power plant with CCS capacity would have to be 25% to 40% larger than a convention plant to produce the same net amount of electricity. According to one study new coal-fired plants fitted with CCS capability will emit 60 to 110 times more carbon and air pollution than wind turbines.

International Resistance to Coal

New coal combustion is a concern of the climate justice movement internationally. In *Move Beyond Coal, Now! Voices from the Front Lines of the Global Struggle*, the Sierra Club documents how local communities that host coal-fired electrical generators seldom benefit. The following description of the situation in India is typical:

"Many people outside of coal-affected communities accept the myth that coal-fired power is bringing development to India's poor. Ground realities paint a very different picture: Local communities and ecosystems pay the steep price of coal's impacts but rarely receive the power, let alone the profits, that are generated. All across India, people living near the highest concentrations of coal-fired power plants have the least access to electricity. Instead, power lines carry electricity literally over their heads and into industrial and urban areas, doing little to alleviate energy poverty in rural communities."

(*Move Beyond Coal Now!* Washington: Sierra Club and Bank Information Center. September 2011. Page 15. www.sierraclub.org/coal/narratives/downloads/MoveBeyondCoalNow.pdf.)

Phasing out Coal

The evidence presented above argues strongly for going beyond the inadequate regulatory regime proposed by Canada's Environment Minister to phasing out coal-fired electrical generation plants as Ontario is doing.

In *Greening the Grid*, the Pembina Institute describes how Alberta could phase out coal use entirely over the next 20 years. The Pembina study asserts that proven technologies already in use in Alberta can meet the province's electricity needs even if demand doubles over the next two decades. The study describes the potential for increasing efficiency and developing renewable forms of energy such as wind and geothermal power. Pembina's fact sheet on Greening the Grid notes: "The Canadian Hydro Association estimates that there is more untapped hydro potential in Alberta than its total existing coal capacity."[6]

Pembina's director of renewable energy, Tim Weis, also refers to a study from the Geological Survey of Canada that found, "There's enough geothermal potential to meet Canada's electricity needs one million times over."[7]

Are energy alternatives cost competitive with coal?

According to the U.S. Energy Information Agency (EIA), the cost of building a new wind turbine is 9.7 cents per kilowatt hour (kwh) while a conventional coal plant costs 9.5 cents.[8] An advanced coal plant would produce electricity for 10.9 ¢/kwh and a coal plant with carbon capture and storage would cost 13.6 ¢/kwh. The EIA says geothermal generation would cost 10.2 ¢/kwh. All these alternatives are competitive with coal. The exception, according to the EIA, is solar photovoltaic electricity which currently is more expensive at 21.1 ¢/kwh. However a new study by three Queen's University Professors finds that solar photovoltaic electricity "has already obtained grid parity in specific locations and as installed costs continue to decline, grid electricity prices continue to escalate, and industry experience increases, PV will become an increasingly economically advantageous source of electricity over expanding geographical regions."[9]

Another consideration is the cost to health care systems from burning coal. In Ontario, the health-related damages from coal are estimated at $3 billion a year. A Harvard University study suggests that the cost of burning coal doubles when health related damages are taken into account.[10]

Is Natural Gas Needed as a Transition Fuel for Electrical Generation?

It is frequently argued that natural gas-fueled power plants should be used as stand-by units to fill in the gaps when there is insufficient wind or sunlight to operate wind turbines or solar photovoltaic displays. Natural gas fired boilers can start up quickly and the heat they produce can be put to further uses such as space heating. Natural gas plants emit about half as much GHG as today's coal plants.[11]

However a Pembina Institute briefing note "Is Natural Gas a climate change solution for Canada?" argues that, "There are several reasons why increased consumption of natural gas-fired electricity is not required to support a major expansion of intermittent wind or solar power. These include: the capacity of existing electricity systems to integrate new variable-output sources; the fact that backup natural gas-fired generating capacity may only need to be used sparingly; the use of 'smart' grids to integrate a higher proportion of intermittent sources; the possibility of expanding interconnections to regions with hydropower; and emerging energy storage technologies that smooth the output of energy from the wind and the sun."[12]

The Rush to Develop Shale Gas

According to the petroleum industry, Canada has some 4,000 trillion cubic feet of natural gas resources waiting to be developed. In a paid information feature in *The Globe and Mail* the industry says its problem is that, "Canada's traditional (and only) export market for natural gas, the U.S., has ramped up its own production [of shale gas] and cut back on Canadian imports. [Therefore the industry proposes] to develop the export gateway to Asia as quickly as possible."[13]

This rosy scenario ignores controversial issues that have arisen in both the U.S. and Canada around the dangers associated with the recovery of natural gas from shale formations through "hydraulic fracturing" (or "fracking") where water, sand and a variety of chemicals are forced underground under pressure to break apart fissures in the rock to allow the gas to flow.

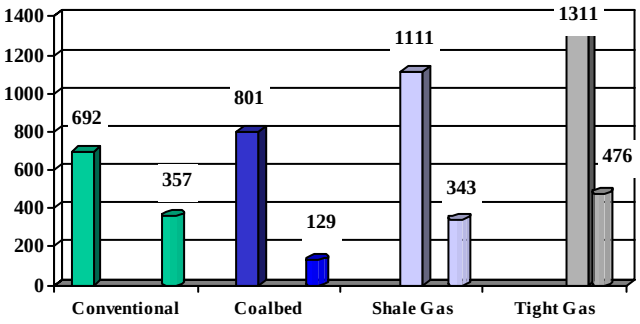
Figure 3 illustrates the industry-sponsored Canadian Society for Unconventional Gas estimates of the amount of natural gas that can be found in coal beds, in tight gas formations (gas found in rocks that have a very low permeability) and shale gas (found in fine grained sedimentary rocks defined as shale or mudstone.) What is notable is the substantial scope for future sales of both shale gas and tight gas. Their estimate for the marketable portion of the shale gas resources (343 Tcf) is almost as large as the marketable reserves of conventional gas (357 Tcf) while the marketable portion of tight gas is even larger at 476 Tcf.

Dangers Associated with Hydraulic Fracturing to Extract Shale Gas

Shale gas has been produced for years in small quantities from shale rock formations containing natural fissures. What is new is the rush to increase production through

Figure 3: Conventional and Non-Conventional Natural Gas

Canadian resources (rectangular columns) and marketable portion (circular columns) in trillions of cubic feet



Source: Canadian Society for Unconventional Gas

hydraulic fracturing or "fracking." Companies are also using fracking techniques to develop "tight gas" and "tight oil" reservoirs.[14]

According to the *Calgary Herald*, shale gas is expected to supply half of North America's gas demand by 2020.[15] Shale gas production in the U.S. has not only led to a reduction in Canadian gas exports, it has also contributed to a 70% reduction in the volume of gas shipped from Western Canada through TransCanada Pipelines main line to Eastern Canada where shale gas is now being imported from the United States.[16]

Hydraulic fracturing to extract shale gas is controversial for many reasons. Three principal concerns involve water contamination, GHG emissions and earthquakes.

a) Water Contamination

There is substantial evidence that fracking chemicals are fouling water supplies with contaminants that are hazardous to human, plant and animal health. The Pembina Institute reports: "Democratic members of three U.S. House of Representatives Committees recently published a list of 750 substances used in hydraulic fracturing of oil and gas wells in the U.S. between 2005 and 2009 based on information voluntarily provided by producers. Of these substances, 29 are known to be possible human carcinogens and/or regulated toxic chemicals."[17]

The U.S. Environmental Protection Agency (EPA) says that 20 to 40% of the fluids injected can remain trapped in rock formations for decades. Other studies indicate that from 50% to 90% of injected fluids can remain underground.[18] Engineering Professor Tony Ingraffea of Cornell University notes: "The effects of fracking are cumulative. … [Although] communities may not be seeing some of the consequences today, communities will see the effects of fracking in 10 or more years."[19]

A *New York Times* investigation revealed that "fracturing wastewater containing worrying levels of naturally occurring radioactivity was being released into Pennsylvania rivers."[20] Fracking leeches highly carcinogenic radon from shale rock. One study found that 85% of water wells close to shale gas sites in Pennsylvania and New York are contaminated with methane levels that are up to 17 times higher than normal.[21] A dramatic illustration of how methane can contaminate water wells in the vicinity of fracking operations can be seen in the trailer to the documentary film *Gasland* showing a person setting his tap water on fire.[22]

b) GHG Intensive

There is evidence that shale gas production is more greenhouse gas intensive than conventional natural gas and may even release more GHGs than coal. A GHG emissions model funded by Natural Resources Canada predicts that shale gas production will release 27% more CO_2 than conventional gas. Professor Robert Howarth of Cornell University investigated how much methane was escaping into the atmosphere from fracking sites. His preliminary study estimates that since methane is 25 times more powerful than CO_2, a 2% leakage rate of methane could put more GHG into the atmosphere than burning the other 98% over a period of 20 years. [23]

In a subsequent study published in the peer-reviewed journal *Climactic Change Letters*, Howarth and colleagues found that between 3.6% and 7.9% of a shale gas well's total production escapes into the atmosphere as methane. They concluded that over a 20-year period, "The GHG footprint for shale gas is at least 20% greater than and perhaps more than twice as great as that for coal when expressed per quantity of energy available during combustion."[24]

A study released by the National Energy Board found that shale gas from British Columbia's Horn River Basin contained approximately 12% CO_2 as compared with a 2% CO_2 average for all gas pools in the province. Simon Fraser University professor of environmental economics Mark Jaccard concluded that this high level of CO_2 intensity would make it "extremely difficult for B.C. to achieve its CO_2 reduction target" unless the excessive CO_2 were captured and stored underground instead of vented into the atmosphere as the industry typically does at other gas extraction sites.[25]

c) Earthquakes

Fracking has also been linked to earthquakes in Arkansas and Great Britain. In Arkansas, geologists say they have found a correlation between earthquakes previously unheard of in the region and "the disposal of wastewater in injection wells."[26] In Britain, a company had to halt drilling pending an investigation into a 1.5 magnitude tremor.[27]

Opposition to Shale Gas Extraction

Maryland, New York and South Africa have all placed temporary or indefinite moratoriums on hydraulic fracturing pending investigation into the risks involved. In June 2011, France became the first nation to issue an outright ban on fracking.[28]

The *Réseau oecuménique Justice et Paix* (ROJeP), a Quebec group working on issues of justice, peace and the integrity of creation and closely associated with KAIROS, has expressed profound concerns about the hazards associated with shale gas extraction including: "its use and pollution of millions of liters of water injected into the earth; toxic chemicals of which only 40 to 60% are recovered; contaminants leaking into the water table; hazardous gases such as radon and methane; industrial intrusions into the best agricultural land; and delays in the development of non-fossil alternative energies."[29]

Noting a lack of transparency and adequate public debate, ROJeP calls for "the immediate cessation of exploration activities and … demands a moratorium: a step back to consider the evidence, the more urgent when shale gas impacts elsewhere suggest that thorough analysis could lead to a complete ban." ROJeP asserts: "Quebec has the potential to be a world leader in renewable energy, but needs the political will to do so. The economy should serve humanity and the earth our home. Decisions should be made with communities' free, prior and informed consent."[30]

First Nations in Maine and New Brunswick have jointly led protests against fracking on their ancestral lands. Alma Brooks from the Maliseet Grand Council told the KAIROS Atlantic Regional meeting on September 25, 2011, "The people of New Brunswick came to our people for leadership." She described how they obtained media attention by peacefully taking over five trucks that were being used to locate shale gas deposits. The Maliseet Grand Council, a member of the Wabanaki Confederacy, aims is to build an alliance with non-Indigenous groups to protect the Earth and water for the sake of future generations.

On November 19, 2011, members of the St. Mary's First Nation erected a teepee on the lawn of the New Brunswick legislature during a rally attended by some 600 people demanding a ban on fracking in the province.[31] The First Nations welcomed the public to nightly ceremonies, inviting them sleep over in the teepee until the legislature opened for its fall session on November 23.

Industry Proposes Voluntary Guidelines in Response to Criticism

The shale gas industry is seeking to head off opposition by proposing its own voluntary guidelines for disclosure of chemicals used in fracking and promising to comply with any mandatory disclosure requirements from provincial governments.[32] The Parliamentary Secretary to the federal Minister of the Environment has welcomed the industry's adoption of voluntary guidelines. The Minister has asked the Council of Canadian Academies to study fracking and its potential impacts. Echoing industry wishes, the federal government proposes that regulation occur at the provincial level despite the impacts on areas of federal jurisdiction including the Fisheries Act governing water quality and the rights of First Nations.

In British Columbia, plans to ship shale gas by pipeline to a port near Kitimat for export to Asian countries as Liquefied Natural Gas (LNG) have not received the same degree of resistance as has the proposed Northern Gateway pipeline that would convey crude oil from the Alberta tar sands to a marine terminal at Kitimat. Industry proponents of a natural gas pipeline appear to have pre-empted opposition. According to one report: "First Nations have taken a pragmatic position [concerning a gas pipeline]. Fifteen First Nations, using $35-million provided by the province, will take an equity stake and are set to receive roughly $550-million over 25 years from the pipeline profits."[33]

University of British Columbia resource policy professor George Hoberg notes that the issue is not money but the difference between the harmful effects of an oil spill versus the rupture of a gas pipeline. The rupture of an oil pipeline can cause extensive damage to watercourses, whereas gas from a ruptured pipeline escapes into the atmosphere.[34]

Nevertheless a report by the Canadian Centre for Policy Alternatives and the Wilderness Committee notes that Indigenous peoples' water rights are threatened by the rapid expansion of shale gas fracking: "There is no formalized process for members of the public or First Nations to raise questions about … permit applications or water licence applications, and only narrow rights of appeal pertaining to water tenures."[35]

Moreover the dangers of an explosion once gas has been liquefied must be taken into account. LNG tankers would follow the same route as oil tankers through narrow channels from Kitimat to the Pacific Ocean. As far back as 1983, in a dissertation on the dangers of shipping liquefied gas out of Vancouver, a University of British Columbia graduate student warned: "If a mishap occurred, the gas could explode, and the resulting fire with a temperature of 1,650 degrees or higher could ignite fires on both sides of the harbour, resulting in the possible devastation of a 10-kilometre area around the port."[36]

Conclusion

Coal and shale gas are not intermediate or long-term solutions for our energy needs. They are potentially more harmful than conventional oil and gas in terms of their ecological and human health effects. We need to focus on energy conservation and the development of renewable forms of energy as proposed in our KAIROS policy paper "Re-Energizing the Future: Faith and Justice in a Post-petroleum World".

For more information, please contact John Dillon, Program Coordinator for Economic Justice, jdillon@kairoscanada.org

KAIROS: Canadian Ecumenical Justice Initiatives unites eleven churches and religious institutions in work for social justice in Canada and around the globe.

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