KAIROS Research Paper

Time to Refocus our Approach to Climate Change

by John Dillon
Program Coordinator, Global Economic Justice
March, 2013

In light of the mounting threat posed by climate change, it is imperative that we take urgent action to mitigate greenhouse gas emissions. We can no longer wait for governments to reach agreements at the United Nations climate change negotiations. After countless meetings, the current agreement is to produce a plan by 2015 that would take effect only in 2020. Even if such a plan were a binding accord, the timeline, would be too late to stop catastrophic climate change. We must act now to curb emissions.

The 18th annual conference under the United Nations Framework Convention on Climate Change held in Doha in December 2012 ended in failure. In fact, the climate negotiations have been moving backward ever since the Copenhagen conference of 2009. Given mounting evidence that climate change is already causing massive destruction, action to contain greenhouse gas emissions is more urgent than ever. The lack of progress in the official proceedings obliges us to consider new avenues for action.

In Part One of this paper we shall re-examine our past efforts to influence climate negotiators and describe how our allies in the climate justice movement are re-evaluating their strategies. Then in Part Two we shall describe some of the ways in which we can achieve real progress in combating climate change.

Part One: Re-evaluating Past Approaches

In 2009, KAIROS published Canada's Climate Challenge: What's at stake in the Copenhagen climate change talks[1] and joined other civil society organizations in the KyotoPlus Campaign. We urged Canada to "set a national target to cut greenhouse gas emissions at least 25% from 1990 levels by 2020 … and help developing countries to reduce their emissions and adapt to climate change."

We came away from Copenhagen deeply disappointed with the flawed "Copenhagen Accord" which replaced mandatory greenhouse gas reduction targets under the Kyoto Protocol with lower, voluntary goals. Canada announced a new reduction goal that would result in 2020 emissions being 2.5% higher than they had been in 1990. Canada's Kyoto obligation had been to lower emissions to 6% below 1990 levels by 2012.

Similarly we geared up for the 2010 UN conference with a report entitled Decisive Action Vital at Cancún Climate Talks.[2] Once again we were extremely disappointed as the Cancún conference only mirrored the Copenhagen Accord without making any new greenhouse gas (GHG) reduction commitments.

Nevertheless we once again prepared for the 2011 Durban meeting with a report whose very title reflected our growing concern: Is Durban the world's last, best hope to avoid climate disaster?[3] The government of Canada responded by announcing that it would formally withdraw from the Kyoto Protocol. Despite the urgency to act, the principal outcome at Durban was a promise to negotiate a new protocol by 2015 for emission reductions that would not take effect until 2020. Needless to say each year of delay only increases the danger of irreversible climate change. Moreover, according to a new report in the journal *Nature*, "Waiting until 2020 to curb global emissions will cost twice as much compared with peaking emissions by 2015."[4]

By the time the 2012 Doha conference began, we in KAIROS had turned our attention to how Canadians [are] Resisting Climate Change Despite Inaction at UN Talks.[5] The only new development of significance at Doha was a weak promise to consider how communities suffering losses and damages from climate change might be compensated. Implicit is an admission that the focus of the talks had shifted from commitments to reduce emissions to a recognition that devastating damages are inevitable. The destruction wrought by Hurricane Sandy on the eve of the conference and Typhoon Bopha that left over 700 people dead in the Philippines brought home the reality that further losses and damages are now a certainty.

Our Allies Call for Victories Outside the Negotiations

Pablo Solon, Bolivia's Ambassador to the United Nations and chief negotiator at Copenhagen and Cancún, is very familiar with the inner workings of the UN system. He stood alone during the final plenary in the Danish capital to oppose the adoption of the Copenhagen Accord on the grounds that it had been negotiated by only a handful of countries behind closed doors and outside of the official conference.

In Mexico, Solon attempted to stop the approval of the vacuous Cancún accord before the chairperson unilaterally declared it adopted despite Bolivia's objections. At the time, Solon asserted that an accord that permitted a four-degree rise in temperatures is "disastrous for humanity [as] recent scientific reports show that 300,000 people already die each year from climate change-related disasters. [A four-degree rise] threatens to increase the number of deaths annually to one million."[6]

In an open letter[7] released on the eve of the Doha conference, Pablo Solon, now Executive Director of Focus on the Global South, joined Bill McKibben, founder of 350.org, and Nnimmo Bassey, Coordinator of Oilwatch International, in laying out the stark reality of what must be done to stop runaway climate change:

"If we want a 50-50 chance of staying below two degrees [Celsius increase in global temperatures], we have to leave 2/3 of the known reserves of coal and oil and gas underground; if we want an 80% chance, we have to leave 80% of those reserves untouched. That's not 'environmentalist math' or some radical interpretation – that's from the report of the

International Energy Agency last month. It means that – without dramatic global action to change our path – the end of the climate story is already written. There is no room for doubt – absent remarkable action, these fossil fuels will burn, and the temperature will climb creating a chain reaction of climate related natural disasters."

In the wake of the failure of the Doha talks, Pablo Solon no longer views the UNFCCC as the appropriate locus for action. He has concluded that the real cause of a standstill in the negotiations is not the divergent interests of different groups of countries – developed, developing, emergent or least developed. Rather the stalemate reflects a convergence between the interests of the elites in the two biggest emitters, the U.S. and China, neither of whom is willing to accept curbs on profitable energy megaprojects. This analysis has led Pablo to declare: "It is time to challenge the negotiations by winning concrete victories outside the negotiations."[8]

Bill McKibben's Math Lesson

The open letter cited above draws on Bill McKibben's influential article Global Warming's Terrifying New Math[9] in *Rolling Stone* in August 2012. He begins by recalling that the Copenhagen Accord did recognize an apparent consensus among scientists that temperature increases should be held at less than two degrees Celsius above pre-industrial levels. In fact at Copenhagen delegates from small island states were calling for keeping temperature increases below 1.5 degrees lest their nations disappear beneath rising oceans. African civil society groups called for a one degree limit.

But the reality is that temperatures have already risen by 0.8 degrees and there now are sufficient GHGs in the atmosphere to increase temperatures by close to another full degree.[10]

McKibben reports that to have an 80% chance of keeping the rise in global temperatures below 2^{0}C, the world can only release 565 gigatons (Gt) of CO_2 by 2050. He then shows that at current rates of fossil fuel production and growth this allowance could be used up in just 16 years. He further reports that known global reserves of coal, oil and natural gas contain 2,795 Gt of CO_2. Hence to keep temperatures from rising more than two degrees, we would have to leave 80% of known fossil fuel reserves in the ground.

What McKibben's analysis means for us in Canada is that we cannot go on expanding production from the tar sands. If we were to limit extraction to the 170 billion barrels of tar sands crude that are deemed recoverable, given current technology and prices, their combustion would release 81.4 Gt of CO_2, equivalent to 14.4% of world's allowable total. If all the oil in place in the tar sands were burned, their CO_2 emissions would eventually amount to 881 Gt, far in excess of allowable emissions.[i]

[i] McKibben's initial analysis showing a 565 Gt limit on how much CO_2 could be emitted correctly reports data from the United Kingdom-based Carbon Tracker Initiative. *Unburnable Carbon – Are the world's financial markets carrying a carbon bubble?* at http://www.carbontracker.org/wp-content/uploads/downloads/2012/08/Unburnable-Carbon-Full1.pdf However, unfortunately later in his essay McKibben confuses data for tonnes of carbon with tonnes of carbon dioxide when he discusses emission from the tar sands. This confusion underestimates the threat posed by the tar sands by a factor of 3.7, that is the amount of CO_2 contained in each tonne of carbon.The calculations used here correct that error.

What adds weight to McKibbon's conclusions is a similar assessment by the International Energy Agency (IEA), established in the 1970s to represent the interests of industrial countries. The IEA calculates that two-thirds of known fossil fuels reserves have to remain in the ground if we are to have a 50% chance of keeping the temperature rise under two degrees.[11]

McKibben asserts that global concentrations of carbon dioxide (CO_2) must be capped at 350 parts per million (ppm), down from their current 392 ppm. The IEA uses a different measure, namely total GHG concentrations in terms of carbon dioxide equivalent, i.e., including both carbon dioxide and other GHGs, calibrated according to their warming potential in terms of carbon dioxide. The IEA projects that atmospheric concentrations of carbon dioxide equivalent (CO_2 e) as high as 450 ppm are compatible with keeping the increase in global temperature at around two degrees Celsius.

Two Degrees "a prescription for long-term disaster"

McKibben acknowledges that a two degree rise is extremely dangerous. Among others, he cites NASA climatologist James Hansen who declares: "The target ... for two degrees of warming is actually a prescription for long-term disaster." What particularly alarms Hansen is the potential consequences from the climate change that is already occurring in the Arctic and Antarctic regions to push us past irreversible tipping points.

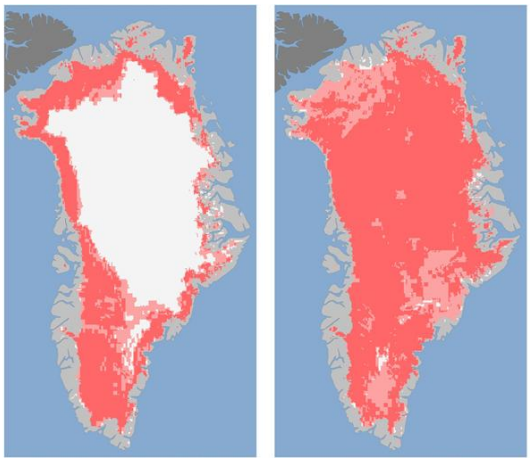
KAIROS' 2011 Briefing Paper Arctic Melting Sounds the Alarm for Life on Earth[12] examined several scientific studies on the danger posed by temperature increases in the far North. As Arctic ice melts exposing the darker sea, less sunlight is reflected back into space, contributing to temperature increases in the region that are two or more times higher than the global average.

During the last year new, alarming evidence has emerged concerning accelerating climate change in polar regions. In 2012, the European Space Agency discovered that sea ice loss in the Arctic is 50% greater than previously estimated. Moreover researchers have discovered that "temperatures in central west Antarctica have increased 2.4^{0}C between 1958 and 2010, three times faster than the rest of the world."[13] The combination of warmer water eroding the West Antarctic Ice Sheet from below and higher surface temperatures could cause 2.2 million cubic kilometres of ice to melt into the sea.

Unprecedented Melting of Greenland Ice Sheet

In July 2012, NASA satellite observations revealed that an unprecedented 97% of the surface of the Greenland ice sheet was melting, although the underlying ice remained intact. The Greenland ice sheet is already losing mass at the rate of 100 cubic kilometres a year.

Scientists calculate that a two-degree temperature increase would melt enough polar ice to raise ocean levels by between 7.5 and 9 metres. Higher temperatures would mean even higher sea levels. The eastern Antarctica ice sheet contains enough water to raise sea levels over time by an extraordinary 54 metres.[14]



NASA images show the extent of surface melt over Greenland's ice sheet between July 8, 2012 (left) and July 12, 2012.[15]

Another tipping point that Hansen warns about is what would happen if carbon contained in frozen permafrost in Arctic regions were released. Charles Tarnocai, a Canadian scientist, estimates that there are about 1.5 trillion metric tons of carbon locked in frozen soil in Northern regions, equivalent to two and a half times as much as all the carbon in the atmosphere.[16] When permafrost is exposed to sunlight, bacteria convert soil carbon into carbon dioxide 40% faster than from permafrost that remains in the dark, according to Rose Cory, a researcher at the University of North Carolina.

Carbon emissions from permafrost are not included in the projections from the IEA cited above. Nor are they included in climate change models. Hence scientists who study Arctic climate change warn that permafrost melting could release enough carbon "to raise global temperatures three degrees Celsius on top of what will result from human emissions from [burning] oil, gas and coal."[17]

In addition, offshore in the Arctic Ocean there are millions of tons of methane gas trapped in methane hydrates (frozen water molecules that trap methane gas molecules in a crystalline structure). Methane is a GHG that is 72 times more potent than CO_2, measured over a 20-year period. If only a small part of the GHGs stored in permafrost and methane hydrates are released into the atmosphere, the consequence, according to Hansen, would be, "practically irreversible on time scales of relevance to humanity."[18]

More Evidence of Climate Disasters

Extreme weather events are confirming warnings from climate scientists that rising temperatures would inevitably bring not just heat waves but also more intense storms and droughts. In 2012 severe droughts devastated crops in the Southern and Midwestern United States which endured their warmest year since 1895. More than 70 people perished from torrential rains in Beijing, while half of Manila was inundated by floods. A million people in Bangladesh had to flee floods and landslides. As 2013 began, Australia faced a wave of wildfires fanned by high winds and record high temperatures.[19]

A report entitled *Turn Down the Heat* issued by the World Bank late in 2012 confirmed that the world is on track for a four degree Celsius temperature increase by the end of the century. Most alarming is the report's finding that the effects would be more severe for tropical, sub-tropical and polar regions. Although worldwide average temperatures might rise by four degrees, "The largest warming would ... range from 4^0C to 10^0C [in tropical, subtropical and polar regions.] Increases of 6^0C or more in average monthly summer temperatures would be expected in the Mediterranean, North Africa, Middle East and parts of the United States."[20]

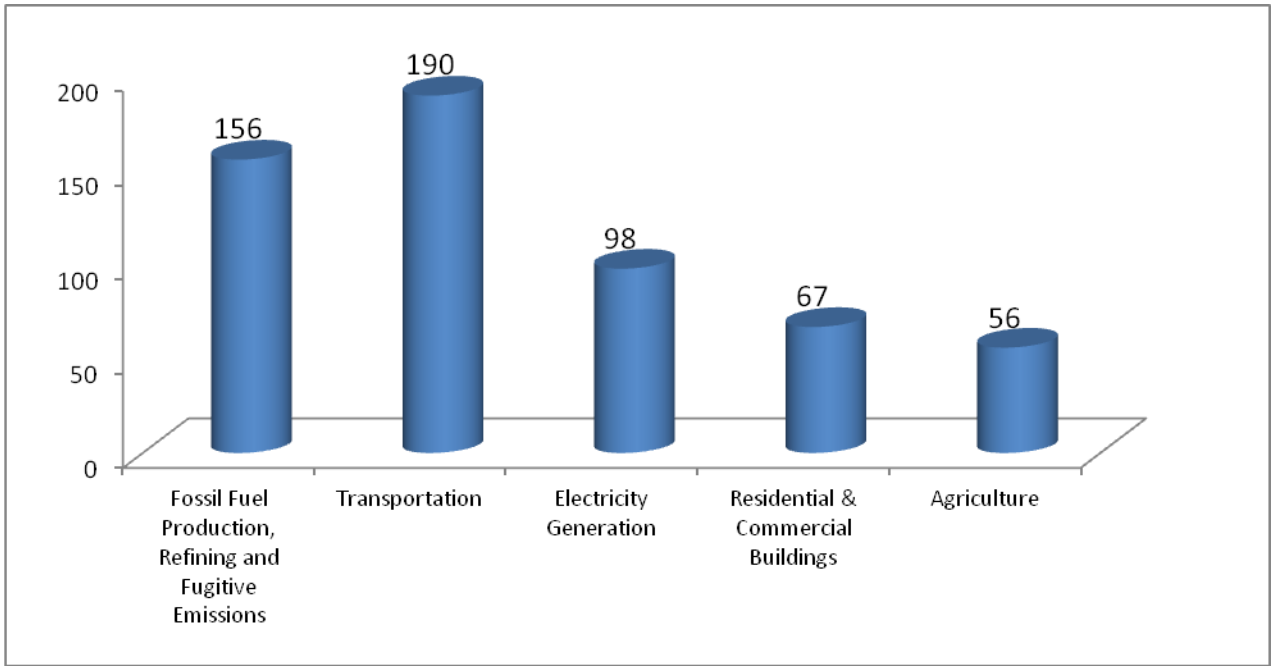
Robert Watson, former chair of the Intergovernmental Panel on Climate Change and now science director at the Tyndall Centre for Climate Change research in Britain, says that the world has already missed its chance to hold climate change below two degrees Celsius and we should now prepare to face from three to five degrees of warming.[21]

PART TWO Actions to Combat Climate Change

In light of the evidence presented above of the threat posed by climate change, it is **imperative** that we take **urgent** measures to mitigate GHG emissions without waiting for negotiators to (possibly) come up with a plan by 2015 that would take effect only in 2020. **We must act now on curbing emissions.**

In this section, without attempting to present a comprehensive plan, we shall highlight some areas where action is both urgently needed and feasible. Figure 1 shows the major components of Canadian GHG emissions as of 2009.

Figure 1: Major Components of Canada's Greenhouse Gas Emissions 2009 (Megatonnes of CO_2 equivalent)



Source: Environment Canada National Inventory Report 1990-2009 at http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=72E6D4E2-1#cn-tphp

Curbing Emissions from Fossil Fuel Production

As Figure 1 shows, the production and refining of fossil fuels within Canada accounted for 156 megatonnes (millions of metric tonnes or Mt) of GHG emissions in 2009. This includes 60.7 Mt of what are called "fugitive" emissions, largely from the venting or escape of natural gas into the atmosphere from production wells.

This may well be an underestimation as recent studies in the U.S. indicate that leakage rates from natural gas wells are nearly double the losses reported by the industry.[22] They show that from 4% to 9% of the methane contained in natural gas wells leaks into the air. Of particular concern is the high rate of leakage from shale gas extracted through hydraulic fracturing. As reported in our Briefing Paper on Coal and Shale Gas Obstacles to Climate Change,[23] scientists at Cornell University found that "between 3.6% and 7.9% of a shale gas well's total production escapes into the atmosphere as methane, making the GHG footprint of shale gas greater than that of coal.

According to Environment Canada, the production and consumption of fossil fuels accounted for 82% of Canadian greenhouse gas emissions in 2009. But this is only part of the story as it measures only GHGs released within Canada.

A study by the Canadian Centre for Policy Alternatives shows that the carbon footprint from the combustion of fossil fuel products exported from Canada is even larger than the emissions from oil, gas and coal products consumed within the country. In 2009, emissions from Canadian fossil fuel exports were 115% as large as emissions from their combustion in Canada.[24] Hence any plan to reduce global emissions must take into account emissions from fossil fuels exported from Canada.

Resist Tar Sands Expansion and Exports

Figure 2 breaks down the sources of GHG emissions within Alberta. Emissions from the tar sands far outpace those from conventional oil and gas extraction (but are still smaller than those from coal-fired power plants). On a per barrel basis, extraction of synthetic fuel from the tar sands releases from 3.2 to 4.5 times more GHGs than conventional oil extraction.

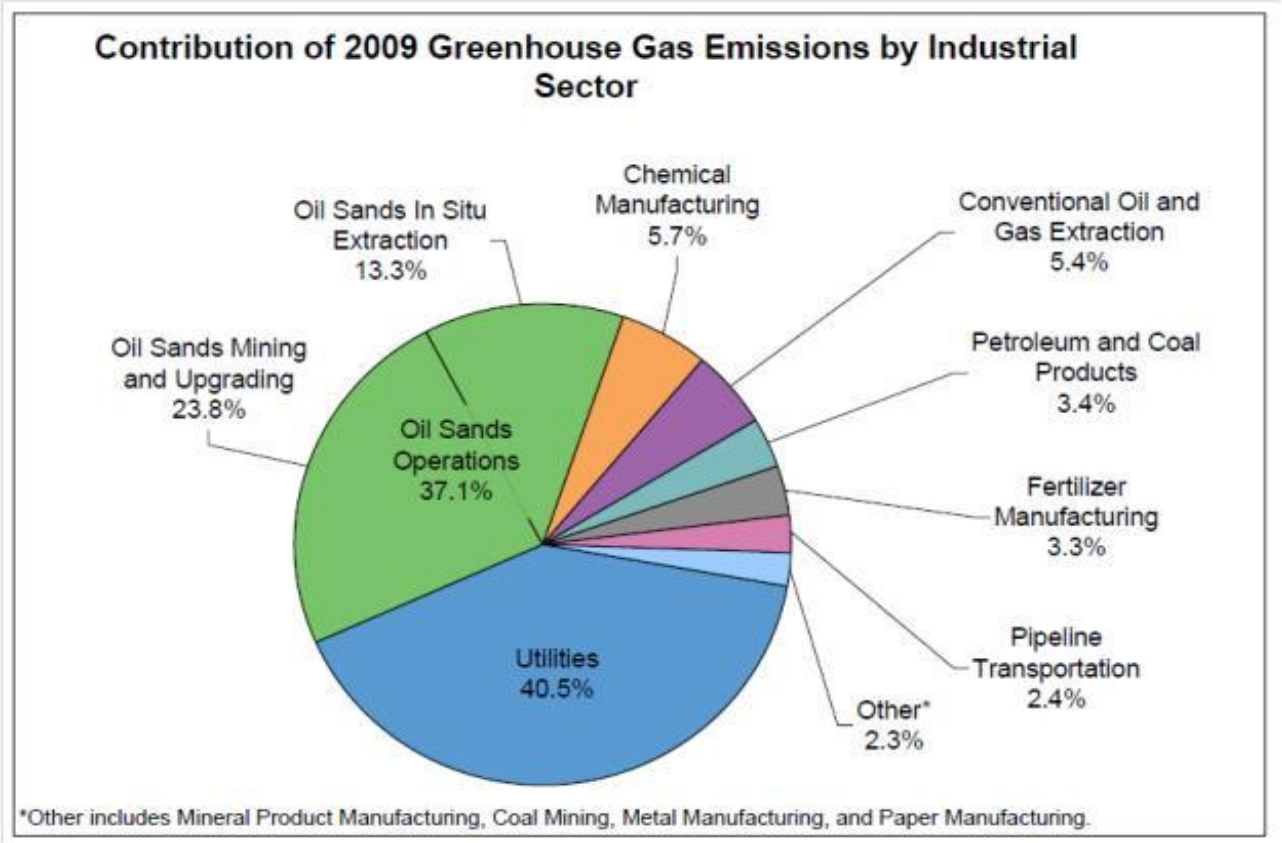
Despite heavy lobbying by the government of Canada to modify its findings, the European Commission's Fuel Quality Directive has stood by its conclusion that petroleum derived from the tar sands is more polluting than other oil on a "wells-to-wheels" basis, that is over the total life cycle of a fuel from extraction to final combustion. The EU found that tar sands crude emits 107 grams of GHGs per megajoule of energy output or 22% more than the average 87.5 grams of emissions for other types of crude oil.[25]

Moreover there is yet another source of GHG emissions from the tar sands that has hitherto been largely overlooked. When tar sands crude is refined it leaves behind a by-product called petroleum coke or petcoke. A new study from Oil Change International explains: "Petcoke is like coal, but dirtier. Petcoke looks and acts like coal, but it has even higher carbon emissions than already carbon-intensive coal. On a per-unit of energy basis petcoke emits 5 to 10% more carbon dioxide than coal."[26]

Since petcoke is a refinery by-product, emissions from its combustion are not considered in most assessments of the impact of the tar sands on the climate. Moreover, petcoke is "'priced to move,' selling at roughly a 25% discount to conventional coal."[27] Hence the ultimate climate impact of using fuels from the tar sands is frequently underestimated. The Oil Change International study estimates that if all the proven reserves of tar sands bitumen were extracted, they would yield roughly five billion tons of petcoke, enough to fuel 111 coal-fired electricity plants until 2050.

According to Environment Canada, in 2010 GHG emissions from tar sands extraction and upgrading amounted to 48 Mt and are expected to grow to 104 Mt by 2020 unless current federal and provincial policies change.[28] Combustion of the synthetic oil produced in 2010, most of which occurred in the United States, released another 235 Mt of carbon dioxide equivalent (CO_2e) into the atmosphere.

Figure 2: Sources of GHG Emissions in Alberta



Source: http://www.energy.alberta.ca/oilsands/791.asp

As noted in Part One, the International Energy Agency has calculated the probable consequences for global temperatures from exploiting known fossil fuel reserves. The IEA breaks down its forecasts into three different scenarios depending on how much of the world's fossil fuel reserves are exploited. Under its "current policies" scenario, the IEA forecasts high demand for fossil fuels leading to long-term temperature increases in excess of six degrees Celsius. Its "new policies" scenario assumes that countries will cautiously implement the pledges made in the Copenhagen Accord, leading to likely temperature increases of more than 3.5°C in the long term. Under its "450 scenario," global demand for energy from fossil fuels declines and petroleum output peaks before 2020 giving us a 50% chance of limiting temperature increases to around two degrees.

The IEA also projects how production from the Canadian tar sands would fare under each of its scenarios (see Figure 3). If current policies prevail, the IEA projects that by 2035 tar sands output will rise to 4.5 million barrels a day (mb/d), contributing to an unacceptable six degree rise in temperatures. Under its new policies scenario, tar sands production would rise to 4.2 mb/d. For its 450 scenario, the IEA calculates that, if we are to keep global temperatures from rising above two degrees Celsius, production from the tar sands must be capped at 3.3 mb/d by 2035 and just 2.5 mb/d by 2020.

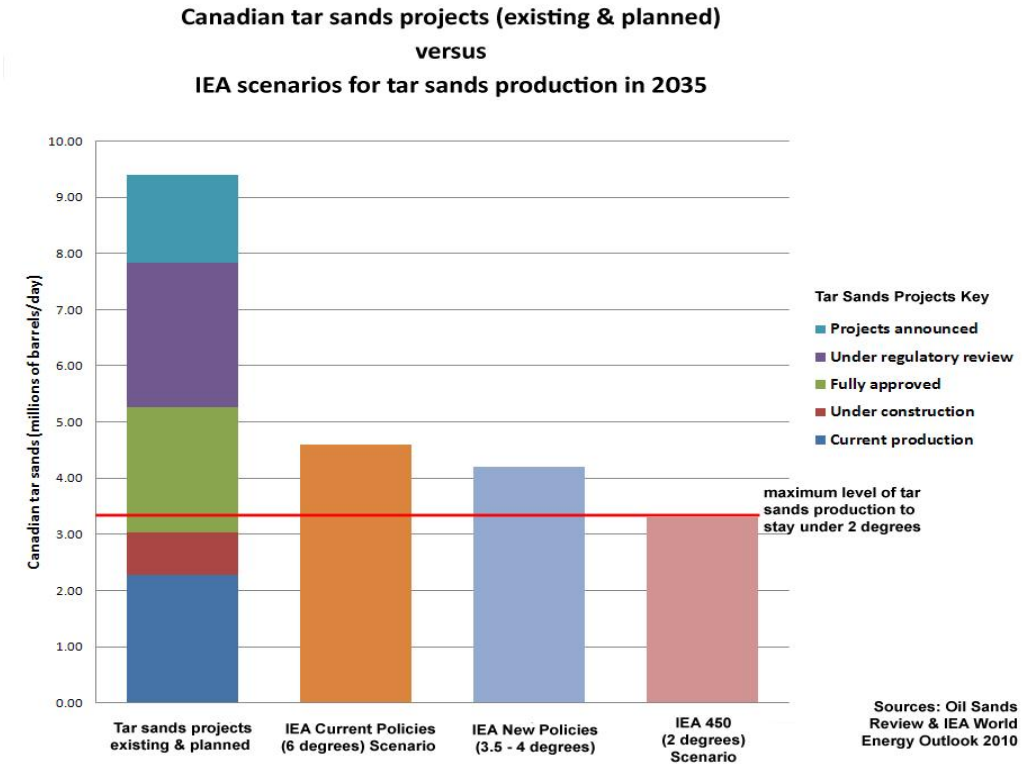
These projections of tar sands production caps are only rough estimates since the IEA's global scenarios assume comparable actions to reduce emissions by other jurisdictions. Nevertheless the

IEA calculations are useful as an indicator of the challenge we face when the 3.3 mb/d limit is compared in Figure 3 with existing tar sands operations and those that are under construction, approved, under regulatory review or just announced.

In 2012, when KAIROS issued its policy paper Drawing a Line in the Sand: Why Canada needs to limit tar sands expansion and invest in a green economy,[29] we called for "no further approvals for tar sands projects." At the time, the capacity of tar sands projects in production was 1.7 mb/d, with another 267,000 barrels a day of capacity under construction and approvals already granted for an additional 1.3 mb/d of future capacity. Hence the upper limit for tar sands production deemed acceptable amounted to 3.3 mb/d, the same as the upper limit suggested by the IEA for 2035 under its 450 scenario.

As Figure 3 shows, since 2010 several new projects have been approved. If all these are built, daily production would exceed the 4.6 mb/d level that the IEA says could lead to six degrees of warming. Hence the challenge now is not just to deny new approvals but also to roll back projects approved after 2010.

Figure 3: Tar Sands Projects and International Energy Agency Scenarios



Source: Greenpeace Canada

Export Pipelines are Key

Decisions on whether crude production from the tar sands will continue to expand depend very much on whether or not new export pipelines are built. Current pipeline capacity for transporting oil from the tar sands is 3.8 mb/d or more than enough to allow for 3.3 mb/d of production, the level deemed compatible with a two degree increase in temperatures.[30]

Currently five major tar sands export pipeline projects are vying for approval:

- TransCanada's Keystone XL that would connect Alberta to the U.S. Gulf coast with an initial capacity of 830,000 barrels a day (b/d) is awaiting a permit from President Obama.
- Enbridge's Northern Gateway pipeline from northern Alberta to Kitimat, B.C. is designed to carry 525,000 b/d, potentially expandable to 850,000 b/d.
- An expansion of Kinder Morgan's existing Trans Mountain line to 890,000 b/d to an export terminal at Burnaby, B.C. near Vancouver.
- The reversal of Enbridge Line 9 to carry up to 300,000 b/d of tar sands crude east from Sarnia, Ontario, to Montreal for possible eventual export through Portland, Maine, or Saint John, New Brunswick.
- Plans by Enbridge to expand its existing pipeline network into the U.S. markets by 800,000 to one million b/d. Although Enbridge would not need a new presidential permit to expand parts of its network already built within the United States, it would need a permit, similar to the one sought by TransCanada for Keystone XL, to expand its Alberta Clipper pipeline by 350,000 b/d.[31]

In addition to these projects, there is talk of converting TransCanada's main natural gas pipeline from Western Canada into an oil pipeline to carry between 500,000 and one million b/d of light oil and upgraded synthetic tar sands oil into Ontario and Quebec and on to Saint John, New Brunswick.[32] Other possible export outlets include building a new line to Churchill, Manitoba, on Hudson's Bay or a railway tanker corridor to ports in Alaska.[33]

The construction of any one of these pipelines would necessarily go hand in hand with expansion of tar sands production. If just three of these export pipelines were built, one to each coast – the Pacific, the Atlantic and the Gulf of Mexico – and operated at near their capacities, the combustion of the fuel they carry would add another 200 Mt of CO^2e to the atmosphere each year. A U.S. Environmental Protection Agency analysis estimates that crude shipped through the Keystone XL pipeline would increase GHG emissions by an additional 27.6 Mt, compared with existing sources of crude oil.[34]

In addition to the consequences for climate change, bitumen pipeline projects face resistance from Indigenous peoples who are defending their rights to free, prior and informed consent before any project can traverse their lands or waters. The Indigenous nations[35] of the Fraser River watershed and British Columbia's coast are strongly resisting the Northern Gateway pipeline. Similarly, an international coalition of civil society organizations[36] has mounted a campaign against approval of the Keystone XL line.

These campaigns to halt tar sands export pipelines coincide with KAIROS' advocacy for Indigenous peoples' right to free, prior and informed consent under the UN Declaration on the Rights of Indigenous Peoples and our call for no new approvals for tar sands projects.

Cutting GHGs from Transportation

As Figure 1 shows, the transportation sector was responsible for 190 Mt of Canada's GHG emissions in 2009 – more than any other sector – and 30% more than in 1990. Passenger transportation accounts for over half of the emissions, and moving freight close to one-third.

Driving private automobiles and trucks is responsible for most transportation emissions since the average Canadian household drives about 26,460 kilometres each year. Public transit produces only 5% to 10% as much GHG as private automobiles.[37] If Canadians took transit to work

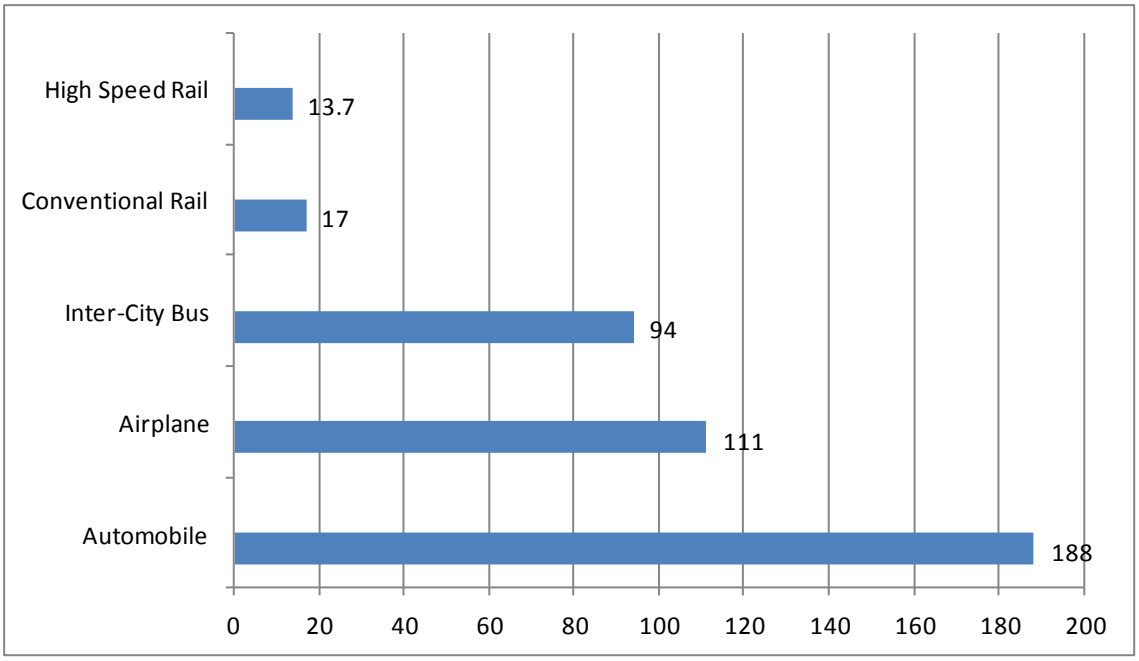
instead of driving private automobiles, up to three-fifths of GHG emissions from commuting could be eliminated.[38]

Fortunately there are a number of feasible and cost-effective policy measures available for reducing automobile use. These will require co-ordinated efforts by all levels of government – municipal, provincial, territorial and federal. One place to start would be to redirect a portion of the subsidies the federal government now gives to fossil fuels – worth about $1.3 billion a year – to public transit and renewable energy projects.

A report from Blue Green Canada, an alliance of labour unions, environmental and civil society organizations, shows that from six to eight times more jobs could be created if the $1.3 billion were invested in energy efficiency, renewable energy or public transit compared to a similar amount invested in the oil and gas industry.[39] The Green Economy Network, in which KAIROS collaborates with several other civil society organizations, advocates an investment of $10.7 billion a year over 10 years in urban public transit that would create 211,599 jobs each year.[40] Public transit could also be financed through gasoline taxes, carbon taxes, road tolls, congestion charges or parking fees.

In addition, governments and employers could offer more incentives for telecommuting and transit use. Municipal governments can play an important role through urban planning to reduce suburban sprawl, build transit lines and provide designated bicycle lanes and bike racks. The Green Economy Network advocates investing $5.14 billion a year over five years to build high speed rail connections between major Canadian cities that would create over 100,000 jobs each year. Canada is the only G8 country without a plan to provide federal funding for urban transit and without any funding for high-speed rail lines. As Figure 4 shows, high speed rail passenger transportation emits eight times fewer GHGs than airplane travel and over 13 times fewer than automobiles.

Figure 4: Relative Efficiency of Transportation Modes
Grams of CO_2 per Seat per Kilometre



Source: www.albertahighspeedrail.com

Reducing Emissions from Electricity Generation
Emissions from coal-fired power plants accounted for 77% of emissions from the electricity sector and 11% of Canada's total GHG emissions in 2009. Most of these installations are located in Alberta, Saskatchewan and Nova Scotia.

In September 2012, Environment Minister Peter Kent announced new regulations for coal-fired power plants. These rules were much weaker than the draft regulations tabled a year earlier which themselves were far from adequate as they were expected to decrease emissions by just 5.3 Mt by 2020. The final regulations increased the time span in which plants are allowed to operate from 45 to 50 years and increased the carbon dioxide emission allotment to 420 tonnes of CO_2 from an already inadequate 375 tonnes.

The effect of these loosened regulations is that plants that would have been forced to close may be allowed to remain in operation, especially if they are fitted with carbon capture and storage (CCS) technology. As explained in our Briefing Paper The Costs and Risks of Carbon Capture and Storage,[41] capturing CO_2 also consumes energy. At a new coal-fired power plant, from 25% to 40% more energy must be produced to allow for the same amount of electricity output after allowing for CO_2 capture. Retrofitting an existing plant requires an even larger amount of new power, estimated at an additional 43% to 77%. Moreover a new CCS capable coal-fired plant will emit from 60 to 110 times as much CO_2 as wind turbines.

Since the federal regulations are so weak, it will be up to provincial governments to take the lead on phasing out coal-fired electricity generation. Ontario is leading the way by phasing out 17 of 19 coal-fired power plants between 2003 and 2013. The last plant, a small back-up generator, is scheduled to close in 2014. As a result, emissions from Ontario's electricity sector have fallen from 40 Mt a decade ago to 10 Mt.[42] Manitoba's single small installation will be closed by 2015.

A study by the Pembina Institute shows how Alberta, the province most dependent on coal power, could completely phase it out over 20 years by a combination of measures emphasizing efficiency gains and renewable power from wind, hydro, biomass and geothermal sources.[43]

Substituting Renewable Energy for Fossil Fuels
A key factor in Ontario's decision to phase-out coal-fired electricity generation was a simultaneous decision to encourage the development of renewable sources of power, particularly from wind and solar installations. Ontario's feed-in-tariff program guarantees producers of wind and solar power remunerative prices for the electricity they sell into the provincial grid.

One out of every seven Ontario farmers has taken advantage of the program which has led to the installation of 2,500 megawatts of green power. It has attracted over $27 billion in private sector investment and fostered 30 clean energy companies. So far the program has "created more than 20,000 jobs and is on track to create 50,000 jobs."[44]

In our study, A Sustainable Energy Economy is Possible,[45] we examine the prospects for renewable energy production within Canada. While the National Energy Board does forecast some growth in electricity production from wind, solar and geothermal sources, its projections are far below the potential cited by the industry associations representing renewable power producers. For example, the NEB says wind-based generation is likely to triple from less than 2% of total power generation currently to 6% by 2035, reaching 23 GW (one gigawatt is equal to

one billion watts).[46] But the Canadian Wind Energy Association says that we have the potential to produce more than twice as much 10 years earlier, 55 GW by 2025.

Similarly the NEB projects that Canada's hydro-based generation capacity will increase by 12 GW from 75 GW in 2010 to 87 GW in 2035, while the Canadian Hydro Power Association asserts that its members could increase hydro capacity by 20 GW by 2030. However, as we point out in our study paper, this does not necessarily mean that every potential hydro project should be pursued. For example, First Nations in the Peace River region of B.C. oppose the Site C dam as it would destroy forests and flood farmland.

The NEB forecasts for future solar and geothermal power are also far below their actual potential. The Canadian Solar Industries Association says that from 9 to 15 GW of solar power could be online by 2025. And the Canadian Geothermal Energy Association puts the potential of power generated from heat deep in the earth at 5 GW with current technology and 10 GW or more from Enhanced Geothermal Systems that generate power by pumping water through hot, dry rock formations underground.

One of the conclusions of our study on a sustainable energy future for Canada is that the huge potential for geothermal heating and power generation has yet to be explored. Similarly the potential for generating power from ocean waves and tides deserves more attention. For example, the Canadian Hydraulics Centre estimates the potential for wave power off Canada's Pacific coast at 37 GW and that from the Atlantic at 146.5 GW.

Building Retrofits

Emissions from residential and commercial buildings account for about 11% of Canadian GHG emissions. The Green Economy Network proposes retrofitting 40% of Canadian homes by 2020 to an average level of 30% increased energy efficiency. In addition, efficiency upgrades for 150,000 new low income homes could reduce their energy bills by 30% by 2015. The GEN advocates new standards for housing construction that would increase energy efficiency of new homes by 2% per year until 2020. All homes built after that date would be "zero net energy," i.e., they would produce as much energy as they consume.

For industrial, commercial, business and public buildings, GEN calls for improving energy efficiency by 50% over 10 years and requiring all buildings to be zero net energy by 2020. If these goals were achieved Canada's GHG emissions would be reduced by 10 million tonnes a year by 2020.[47]

Reducing Emissions from Agriculture

Industrial agriculture is estimated to be responsible for between 11% to 15% of global GHG emissions. The 56 Mt of emissions from agriculture in Canada in 2009 accounted for 8% of our total emissions.

Large-scale, industrial agriculture is responsible for releasing GHGs into the air at the same time that it depletes organic matter from the soil. Small-scale, sustainable farming could restore soil fertility and reduce emissions by recycling organic matter.

According to studies compiled by GRAIN, an international civil society organization supporting small farmers, total GHG emissions can be reduced:

- by 20-35% using agroecological practices to rebuild the organic matter in soils lost from industrial agriculture;
- by 5-9% by decentralising livestock farming and integrating it with crop production;
- by 10-12% by distributing food mainly through local markets instead of transnational food chains;
- by 15-18% by stopping land clearing and deforestation for plantations.[48]

There are a number of practical steps that North American farmers can take to reduce emissions, including changing tillage practices by ploughing less, adding a grass or legume to crop rotation so there are more roots holding more soil intact, and planting trees and hedgerows. As agrologist Janet Kaufmann writes: "Farm policy should promote ... perennial crops, biodiversity, grass-based livestock, reforestation of stream banks, hedgerows and woodlots."[49]

Methane emitted by cattle and other livestock account for a large portion of agricultural GHG emissions. Improved feed can reduce methane emissions from cattle. When livestock are concentrated on large factory farms and feedlots, methane and nitrous oxide are released from manure heaps. Better manure management, such as reducing the surface area of a manure pile and covering manure tanks, can decrease emissions. Composted cattle manure has lower methane emissions than stockpiled manure.[50]

Instead of using nitrogen fertilizers derived from natural gas, farmers can employ organic alternatives such as biological nitrogen found in manure, legumes and green manures (crops grown for ploughing back into the soil).

Organic farms can be carbon neutral or net carbon sinks when they capture more CO_2 than they produce. Biodiverse organic and local food systems contribute both to mitigation of, and adaptation to, climate change. Biodiverse systems are more resilient to droughts and floods because they have higher water holding capacity and hence contribute to adaption to climate change. Physicist and environmental activist Vandana Shiva asserts: "Organic farming can bring down emissions by almost 40%."[51]

Conclusion

This brief survey of potential actions for reducing GHG emissions is not exhaustive. Rather its intent is to show that there are a number of immediately feasible steps that can be taken by municipal, provincial, territorial and federal governments.

As emphasized from the beginning, the core message of this research paper is that we cannot wait for negotiators at United Nations climate conferences to come up with a plan to mitigate climate change. A plan that takes effect only in 2020 will be too late to prevent drastic changes to the Earth's biosphere. We must act now on feasible steps to reduce our emissions even as we work for a deeper transformation of the dominant system to a new ecologically sustainable paradigm.

[1] KAIROS Briefing Paper, Number 22. 2009. http://www.kairoscanada.org/wp-content/uploads/2011/09/PBP22-Copenhagen_WhatsatStake1.pdf.

[2] KAIROS Briefing Paper, Number 26. 2010. http://www.kairoscanada.org/wp-content/uploads/2011/09/PBP26-Cancun.pdf.

[3] KAIROS Briefing Paper, Number 28. 2011. http://www.kairoscanada.org/wp-content/uploads/2011/10/PBP28-Durban.pdf.

[4] Cited in Stephen Leahy. "Climate Inaction Is a Clear Failure of Democracy." Uxbridge: Inter Press Service January 4, 2013. http://www.ipsnews.net/2013/01/op-ed-climate-inaction-is-a-clear-failure-of-democracy/.

[5] See www.kairoscanada.org/wp-content/uploads/2012/12/SUS-CJ-CdnsResistClimateChange.pdf.

[6] Cited in John Dillon's final blog from Cancun. December 12, 2010. www.kairoscanada.org/sustainability/climate-justice/un-climate-negotiations/cancun-climate-conference/cancun-accord-mirrors-copenhagen-accord-while-keeping-kyoto-protocol-alive/.

[7] Bill McKibben, Nnimmo Bassey and Pablo Solo. See http://focusweb.org/content/really-address-climate-change-unfccc-cop18-should-decide-leave-under-soil-more-23-fossil.

[8] See Pablo Solon. "Time to Rethink Analysis and Strategies in Climate crisis." www.t.grupoapoyo.org/node/168.

[9] Bill McGibben. "Global Warming's Terrifying New Math." *Rolling Stone Magazine*. July 2012. http://www.rollingstone.com/politics/news/global-warmings-terrifying-new-math-20120719.

[10] Scientist John Stone, a member of the Intergovernmental Panel on Climate Change, asserts that there is almost one degree of temperature increase in the pipeline due to past emissions. Briefing note submitted to Canadian Environment Minister Peter Kent at a meeting held with the Climate Action Network in Doha on Dec. 6, 2012.

[11] International Energy Agency. World Energy Outlook 2012. Paris: International Energy Agency. Executive Summary. Page 3.

[12] KAIROS Briefing Paper, Number 29. 2011. www.kairoscanada.org/wp-content/uploads/2011/12/PBP29-ArcticIce.pdf.

[13] Lesley Ciarula Taylor. "Antarctica's critical ice is warming." *Toronto Star*. December 29, 2012. Page A19.

[14] Justin Gillis. "Prehistoric Clues to How High the Tide Might Go." *New York Times* reprinted in the *Toronto Star*, February 3, 2013. Page 13.

[15] See http://www.nasa.gov/topics/earth/features/greenland-melt.html

[16] Justin Gillis. "Perils Lurking in Permafrost." *New York Times*, reprinted in the *Toronto Star*. December 26, 2011.

[17] See Stephen Leahy. "Thawing Permafrost may be 'Huge Factor' in Global Warming." *Inter Press Service*. February 14, 2013. Also Fiona Harvey. "UN: methane released from melting ice could push climate past tipping point." *The Guardian*. November 27, 2012.

[18] Cited in Alex Morales. "Arctic Sea Ice heads for record Low as Melt Exceeds Forecasts." Bloomberg. August 17, 2012. www.bloomberg.com/news/2012-08-17/arctic-sea-ice-heads-for-record-low-as-melt-exceeds-forecasts.html.

[19] Raveena Aulakh. "Australian wildfires point to climate change risks." *Toronto Star*. January 8, 2013.

[20] World Bank Press Release. *New Report Examines Risks of 4 Degree Hotter World by End of Century*. Washington: World Bank. November 18, 2012.

[21] Cited in Stephen Leahy. "Thawing Permafrost May Be 'Huge Factor' in Global Warming." *Inter Press Service*. February 14, 2013.

[22] Jeff Tollefson. "Methane leaks erode green credentials of natural gas." *Nature*. January 2, 2013. http://www.nature.com/news/methane-leaks-erode-green-credentials-of-natural-gas-1.12123.

[23] KAIROS Briefing Paper, Number 30. 2011. www.kairoscanada.org/wp-content/uploads/2011/12/PBP30-ShaleCoal.pdf.

[24] Marc Lee and Amanda Card. *Peddling GHGs: What is the Carbon Footprint of Canada's Fossil Fuel Exports?* Ottawa: Canadian Centre for Policy Alternatives. November 2011.

[25] Barbara Lewis and Jeffrey Jones. "EU executive thwarts Canada lobby in tar sand oil." *Reuters*. January 30, 2013. http://uk.reuters.com/assets/print?aid=UKL5N0AYFFA20130130.

[26] Lome Stockman. *Petroleum Coke: The Coal Hiding in the Tar Sands*. Washington: Oil Change International. January 2013. Page 4.

[27] Ibid. Page 5.

[28] Marc Huot and Jennifer Grant. *Clearing the air on oilsands emissions*. Drayton Valley, Alberta: Pembina Institute Backgrounder. November 2012. Page 4.

[29] KAIROS position paper. July 2010 www.kairoscanada.org/wp-content/uploads/2010/12/Sust-Tar-DrawingLine.pdf.

[30] See Michelle Mech. *A Comprehensive Guide to the Alberta Oil Sands*. May 2011. Page 47. http://greenparty.ca/files/attachments/a_comprehensive_guide_to_the_alberta_oil_sands_-_may_20111.pdf.

[31] Matt Pearce and Neela Banerjee. "Keystone XL rival Enbridge avoids scrutiny of oil pipeline plans." *Chicago Tribune*. August 18, 2012. Also Shawn McCarthy and Nathan Vanderklippe. "Pipe Dreams." *The Globe and Mail.* February 18, 2013. A6.

[32] Shawn McCarthy and Nathan Vanderklippe. "Producers back TransCanada's plan to pipe oil east." *The Globe and Mail.* January 29, 2013. B4.

[33] Nathan Vanderklippe. "Alberta scans the horizon for crude oil export options." *The Globe and Mail*. January 19, 2013. B.1.

[34] Cited in Nathan Lemphers. *The climate implications of the proposed Keystone XL oilsands pipeline*. Drayton Valley, Alberta: Pembina Institute backgrounder. January 2013. Page 4.

[35] KAIROS position paper. January 2012. http://www.kairoscanada.org/wp-content/uploads/2012/01/SUS_RE_KAIROSGatewayAnalysis.pdf.

[36] See http://www.350.org/en/stop-keystone-xl.

[37] Stefan Kipfer. "Free Transit and Beyond." The Bullet, No. 738. December 3, 2012. Page 6. http://www.socialistproject.ca/bullet/738.php.

[38] Cherise Burda et al. *Behind the Wheel: Opportunities to drive less, reduce pollution and save money*. Drayton Valley, Alberta: Pembina Institute. October 2012. Page 8.

[39] Blue Green Canada. *More Bang for Our Buck: How Canada Can Create More Energy Jobs and Less Pollution*. Toronto: Blue Green Canada. November 2012. Page 1.

[40] Green Economy Network. *Making the Shift to a Green Economy.* Ottawa: Green Economy Network. http://polarisinstitute.org/files/GEN-Common-Platform-EN_web.pdf.

[41] KAIROS Briefing Paper, Number 21. 2009. http://www.kairoscanada.org/wp-content/uploads/2011/09/PBP21-CarbonCaptureandStorage1.pdf.

[42] Christa Marshall. *Ontario Phases Out Coal Fired Power*. Climate Wire. January 11. 2013.

[43] Jeff Bell and Tim Weis. *Greening the Grid: Powering Alberta's Future with Renewable Energy*. Drayton Valley, Alberta: Pembina Institute. April 2009. http://www.pembina.org/re/greening-the-grid-in-alberta.

[44] Blue Green Canada. Op cit. Page 11.

[45] KAIROS Research Paper. May 2012. http://www.kairoscanada.org/wp-content/uploads/2012/06/SUS-Research-SustainableEnergyEconomyPossible.pdf.

[46] National Energy Board. *Canada's Energy Future: Energy Supply and Demand Projections to 2035*. Ottawa: National Energy Board. 2011.

[47] Green Energy Network. Op cit. Page 10.

[48] GRAIN. December 10, 2009. http://www.grain.org/article/entries/4160-climate-crisis-copenhagen-putting-agriculture-front-and-centre-in-the-discussions-over-climate-change.

[49] Janet Kaufmann. *Bare earth is scorched earth*. The Land Institute. Salina, Kansas. February 1, 2013.

[50] Rod MacRae et al. "Improving Energy Efficiency and GHG Mitigation Potentials in Canadian Organic Farming Systems." *Journal of Sustainable Agriculture.* Vol. 34, Issue 5. June 2010. Pages 549-580.

[51] Cited in Ashwin Aghor. "Organic farming is the way forward, says Vandana Shiva." DNA Agency. Mumbai. December 18, 2009. http://www.dnaindia.com/mumbai/report_organic-farming-is-the-way-forward-says-vandana-shiva_1324774.