

Energy: The global picture and its implications for Canada's role in going forward

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**Authors would also like to thank
Bruce Carson and Aaron Cosby for
their helpful comments; they of
course carry no responsibility for
the final product.**

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Published by the International Institute for
Sustainable Development

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This report is an excerpt from the paper “Towards a National Clean Energy Strategy” presented to the Banff Dialogue, April 8–10, 2010 in Banff, Alberta. The event was hosted by the National Round Table on the Environment and the Economy, Public Policy Forum and the Canada School of Energy and Environment.

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Introduction: A rapidly evolving global regime

This paper is intended to scope out the global picture on energy and its future over the next few decades, with a focus on dynamics within North America. An accompanying piece looks at how Canada can act to ensure its energy security is protected and contribute to the global shift towards clean energy development. Both papers serve as a distinct complement to the presentation that will be provided by Erik Haites at the conference in Banff.

The international energy regime is characterized by increasing fluidity in policy, supply and consumption due to a wide range of factors, including the relative health of the global economy; increasing concerns about energy security; increasing demand globally, particularly with evolving economies; constraints on supply; evolving trade relationships; and environmental considerations, covering both local and global issues (climate change). All these factors appear to point to a fundamental transformation of energy systems around the globe over the next few decades.

Energy needs are by and large covered off in two main areas: power and transportation. The power sector has long carried a strong tradition of identifying and using internal resources to meet their energy needs, at the very least at the national level. In North America, this has even been further framed at the sub-national level, with states and/or provinces seeking, as a priority, internal resources to drive power supply. As a result of placing a priority on ownership of power supply, grids have been inefficiently implemented, with negative consequences for consumers ranging from economic to environmental considerations. Energy security, therefore, is not as large a driver for change in this sector as in the oil and gas sectors. Instead, the main drivers for change in the power sector are economic efficiencies and local and global environmental considerations. On the other hand, when we look at the transportation sector, there was not nearly the same sensitivity towards “energy security/sovereignty” issues. Particularly since the end of the Second World War, and the beginning of the love affair with the automobile, there was a marked increase in demand for overseas oil to meet growing demand and decreasing availability in internal “conventional” resources. International Energy Outlook statistics project an increase of oil production from 85 million barrels per day (bpd) to 107 million bpd in 2030, driven by demand in transportation, where oil remains the primary energy source (EIA, 2009). This is now changing: the main driver behind the change is energy security, but another factor is an increasing focus on the social and environmental impacts of fossil fuels. As a result, we see an increase in policies that support energy efficiency, fuel switching and the development of technologies that address the negative environmental “by-products” of using traditional fossil fuels, such as carbon capture and storage.

Most recently, these changing energy patterns have often been framed domestically as actions that support investment and job creation. President Obama remarked in the State of the Union that “jobs must be our number one focus in 2010” (White House Office of the Press Secretary, 2010) and that the construction of clean energy facilities in the United States would be one of the key planks of a “clean energy jobs” agenda, highlighting the way the White House has married the issues of climate change, clean energy and job creation in their policies. Indeed, large investments in both traditional and renewable energies will be necessary if we are to keep up with increasing demand while simultaneously addressing considerations relating to security, trade relationships and environmental considerations, such as the push for the “decarbonization” of energy sources and use. National policy frameworks and investments are not only needed, but a wide-spread systemic approach to the issues at the international level will also be key if we are to move forward in a prosperous and responsible way.

Overall increases in energy demand are expected increase 1.5 per cent per year through 2030 (overall, 40 per cent), driven mainly by developing countries in Asia and the Middle East (IEA, 2009a). Many countries face the issues of reliability and stability. Political challenges, economic factors such as resources ownership and access, and geographic factors like grid development all influence desires in various parts of the world to seek stable and reliable forms of energy. Furthermore, those regions most likely to increase production and supply of fossil fuels (due to availability of supply and relative price of production)— including Africa and the Middle East—are also those most insecure in other respects. The rhetoric of “energy independence” has grown in recent years, with varying terms of reference. For North America, this has mainly been demonstrated through the utilization of existing resources to a larger extent (i.e., further development of the oil sands, “clean coal” investment, expansion of nuclear supply, biofuels and some renewables), while in other regions such as Western Europe, movement towards energy independence and stable supply has meant significant investments in modern renewable energy technologies and shifts in energy portfolios.

Environmental considerations, particularly climate change, have been another piece of the evolving energy puzzle. But this has been a difficult variable to get a firm grasp on, mainly due to the “fits and starts” that have characterized climate change policy development globally and, of particular significance to Canada, in North America. As a result, how large an impact climate change policies will have on future energy development and deployment remains one of the large “elephants in the room” when discussing the future global picture on energy.

Moving Forward: The international energy outlook

If no changes or significant shifts occur to the global energy market and policies in place at present, it is estimated that primary demand will increase by 40 per cent between 2007–2030, at a rate of 1.5 per cent per year. In a business as usual scenario, fossil fuels will remain the dominant sources of energy, with the use of non-hydro renewable energies seeing an increase, though significantly smaller than that of coal, gas and oil (IEA, 2009a). With respect to coal, the incredible construction schedule in China (one new facility per month), driven by ever-increasing consumption and coupled with high domestic resources, mean that China is now responsible for 47 per cent of global hard coal production (IEA, 2009b). This scenario is characterized by continuous increases in CO₂ emissions and concentrations, potentially resulting in a global average temperature increase of up to 6° Celsius.

With respect to the macro trends of international energy trade, it is important to consider some shifting and developing energy trends amongst international players. In March 2009, the *Economist* published a tongue-in-cheek cover map of “How China Sees the World” with Africa covered in pyramids and oil derricks. While the map was satire of an original 1976 New Yorker cover of the world seen from New York’s 9th Avenue, the depiction of Africa as a home for oil resources for China was not that far off. Chinese oil demand is the fastest growing in the world and is expected to increase its demand by 6 per cent this year, a third of the global growth total (Sorkin, 2010). To meet this demand, China relies on Africa for roughly 30 per cent of its imports (Tattersall, 2010).

At the same time as Africa is taking up an ever increasing amount of Chinese oil imports, the U.S. is actually seeing a slight drop in imports from OPEC Countries (EIA, 2010a). While this can partially be explained by the drop in the world economy, it is also important to note that oil imports from Canada have slightly increased, showing that while imports are down, it is the OPEC markets that are shipping less to the U.S. while Canadian imports have remained steady or slightly increased (EIA, 2010a).

Finally, the increasing presence of Russia on the oil and gas export market has been a major shift. Russian natural gas production is expected to climb from 20,500 billion cubic feet in 2001 to a forecasted 23,064 billion cubic feet in 2011 (EIA, 2010b). Meanwhile, while OPEC is cutting back, Russian oil exports have shot up from just over 4,145,000 bpd in 2000 to just over 6,873,000 bpd in 2008 (EIA, 2010b).

Among these fossil fuel energy trends, we also have to address the vision of limiting the concentration of greenhouse gasses (GHGs) in the atmosphere to 450 parts per million of CO₂ equivalent, maintaining a 2° Celcius warming threshold, which all major economies (including

Canada) committed to under the Copenhagen Accord. Reducing energy-related CO₂ emissions to limit warming to 2° would mean substantial derivations from any business as usual scenario. The entire global energy system, from production to end use, would need to be transformed. Energy usage would need to become more efficient and carbon content of energy significantly reduced. The rate of demand would need to be halved—8 per cent annually compared to the projected 1.5 per cent rate (IEA, 2009a). Estimates vary, but it is clear that low carbon growth (the 450ppm scenario) will require additional investments in the range of US\$10.5 trillion by 2030, plus additional investments in energy development, capital and infrastructure. Indeed, models used in the Intergovernmental Panel on Climate Change's *Fourth Assessment Report* estimate that establishing a carbon price signal of US\$20-80/tCO₂-eq is what would be required just to ensure stabilization in a 550 ppm scenario in 2100 (IPCC, 2007). How quickly and deeply countries commit to implementing such actions will be the key consideration in determining how radical (i.e., to the root) the transformation in the global energy system will be. It may be supported through different international institutions and agreements, but at the end of the day, the primary determinant in making the transformation will be on the domestic side, first driven by the actions and policies of the two major global economies—the U.S. and China.

What is Going On in the World of Clean Energy Development?

How the energy issue is framed in the U.S. and China—representing 50 per cent of global emissions, 37 per cent of global energy consumption (EIA, n.d.) and 31 per cent of global GDP (World Bank, 2010)—will play a critical role in determining how the global regime evolves over the century. Will it be in the form of emissions constraints, with concerns that any such agreement to such limitations will potentially work to compromise economic growth potential (particularly for energy intensive sectors/regions)? If one country or region goes “too far ahead” of another, it will likely suffer significant competitiveness impacts. Or will it be in the form of “getting ahead of the curve” in the new energy future—a move that will drive countries out of their economic doldrums and enhance energy security, while also addressing global and local environmental considerations? Internationally, the emphasis is on the need to drive down emissions for environmental reasons; with a lack of a coherent international regime on energy, the international negotiations on climate change have become the effective proxy for developing a coordinated, sustainable energy response. That development is framed in the context of a global environmental threat that focuses on emission limitation targets and policies as a way of responding to the direct climate threat of emissions associated with human industrial and land-use activity.

The national dynamic in both China and the U.S. focuses on clean energy development as an investment decision that stimulates jobs and competitiveness and enhances security, while also addressing clean air/climate change issues. In the U.S., reducing “dependence on oil” (White House Office of the Press Secretary, 2009) (particularly from OPEC sources) has become a familiar refrain of the energy security and clean energy debate. While this has meant a push for development of domestic energy reserves such as coal and offshore oil development, it has also meant investment in biofuels, nuclear power development, wind energy, solar and the greening of traditional fuels (the push for “clean coal” [White House Blog, 2010]). All of these initiatives are seen as a way to help make the U.S. energy independent, and not subject to the ups and downs of international oil prices. Similarly, China is busy diversifying its reliance on oil imports, particularly focusing on Africa,¹ and its aggressive energy efficiency targets of 20 per cent by 2011 is regarded as critical in enhancing China’s self-reliance on energy sources and making a significant contribution to reducing GHG emissions (Zhou, Levine & Price, 2010).

The other major non-environmental factor driving the clean energy debate is that it is seen as a way to address unemployment and the economic downturn, while achieving energy security and environmental goals. As previously mentioned, “clean energy jobs” are seen as a key part of the

¹ See: D. Large & C. Alden (2008), *China returns to Africa: A rising power and a continent embrace* (with Daniel Large and Christopher Alden, Hurst/Columbia UP 2008); and S. Hanson, (2008, June), *China, Africa and oil: Background for Council for Foreign Relations*. Retrieved March 8, 2010 from: http://www.cfr.org/publication/9557/china_africa_and_oil.html.

President's economic agenda (White House Office of the Press Secretary, 2010). Focusing on jobs and economic opportunity in a time of high unemployment and economic downturn can also be a way to seek support for the clean energy shift in general. The president has expressed his view that clean energy development is an avenue to "millions of new jobs" (White House Office of the Press Secretary, 2009). The link between pricing carbon, clean energy and economic development have also been made by GOP Sen. Lindsay Graham, revealing that there is at least some bipartisan support for a clean energy agenda and that a focus on economic development arguments can help make the shift to clean energy politically palatable (Bennhold, 2010).

The current state of the international economy presents both challenges and opportunities to clean energy development. The global recessionary state has brought about decreased energy use over the past year. While this lower level of usage equates to fewer GHG emissions in the short term, it also means lower levels of investment overall. Falling energy investment has the potential to have long-term and serious consequences for energy security and broader development concerns, depending on how governments and private investors choose to respond.

While the global recession has tightened budgets in many ways, there are also countless opportunities and examples where policy actions have been taken to address energy and climate issues in the face of an economic downturn. Numerous countries have taken advantage of utilizing stimulus injections to propel clean energy investment into the future and look seriously at low carbon development opportunities. China invested US\$221 billion in "green" initiatives through its stimulus program (and an overall total of US\$440 billion was invested in clean energy last year [Bennhold, 2010]), while the U.S. committed over US\$100 billion. South Korea, despite having a much smaller stimulus investment, committed a world-best 81 per cent of the total (US\$30.7 billion) towards green initiatives (Robins, Clover & Singh, 2009). Post stimulus, investments in climate change and clean energy have continued, but China has far outpaced the rest of the world. This has not been lost on American politicians and led to a remark from leading climate change/clean energy legislation proponent Lindsey Graham stated that "every day that we delay trying to find a price for carbon is a day that China uses to dominate the green economy" (Bennhold, 2010). The Obama Administration's 2011 budget includes significant investment in climate change and energy. The tightened economic times also present an innovative opportunity to tackle and eliminate subsidies to inefficient fossil fuel production and re-route support to clean energy development (White House Office of Management and Budget, 2010). Tackling inefficient subsidies, along with clean energy development, are integral parts of the solution, as these subsidies lower production costs and therefore inadvertently increase the consumption of fossil fuels. This increased consumption, in effect, increases GHG emissions and contributes to climate change. By removing subsidies in the 20 largest subsidizing developing countries, it is estimated that the result would be a decrease of 10 per cent in global emissions by 2050 (Ellis, 2010).

Despite increased investment, China remains a dominant power given its national reserves and capital to publicly finance a clean energy transformation. The United States and others simply cannot compete on the public funding front and rely on private sector investments to stay competitive. These investments can and will not happen without a commensurate price signal on carbon.

With major developing economies (MDEs) such as China, India, Brazil and South Africa accounting for an ever-growing share of world emissions, the issue of low carbon development pathways will gain increasing importance. Having them develop in the same carbon intensive manner that drove the industrial revolution is simply not an option if there is to be any hope of meeting the 450 ppm/2° goal. However, these MDEs have shown the ability to leapfrog technology² in the past and leapfrogging the emissions-intensive development path of the Western world will be essential to keeping emissions in check. But they are almost certainly not willing to consider such a course without a viable demonstration that delinking emissions growth from economic growth is in fact possible: something which, with the exception of Denmark, France, Germany, the U.K. and Sweden, no other OECD countries have been singularly successful in demonstrating (UNFCCC, 2009). That said, achieving the balance between economic growth and environmental progress remains a priority for the developed world, despite the fact that few have been able to achieve it thus far.

In conclusion, moving forward will require a thoughtful integration of security, investment and environmental approaches: clean and sustainable energy development can only go so far without a clear and rising carbon price as a strong support for such investments, and a commensurate development and penetration of carbon free technologies—covering the full suite of options—is necessary for economies to be able to rationally adjust to a rising carbon price for energy consumption. Though the onus is on many actors in reaching low-carbon development goals, it is governments that truly hold the key through policy options and regulatory frameworks to provide incentives and steer energy development trends that meet growing needs while also addressing sensitivities around energy security and sustainable development.

² China's proliferation of cellular telephone technology in areas where there was no hardwired telephone infrastructure is a perfect example.

List of References

Bennhold, K. (2010, January 29). Race is on to develop green, clean technology. *New York Times/International Herald Tribune*. Retrieved March 8, 2010 from: <http://www.nytimes.com/2010/01/30/business/global/30davos.html>.

Economist. (2009, March 21). How China sees the world. (cover graphic). *Economist*.

Ellis, J. (2010, March). *Economic, social and environmental effects*. Retrieved March 8, 2010 from Global Subsidies Initiative: <http://www.globalsubsidies.org/en/research/economic-social-and-environmental-effects>.

Energy Information Administration (EIA). (n.d.). *International energy statistics*. Retrieved March 8, 2010 from: <http://tonto.eia.doe.gov/cfapps/ipdbproject/iedindex3.cfm?tid=44&pid=44&aid=2&cid=CH,US,ww,&syid=2003&eyid=2007&unit=QBTU>.

Energy Information Administration (EIA). (2009). *International energy outlook 2009*. Retrieved March 8, 2010 from: <http://www.eia.doe.gov/oiaf/ieo/highlights.html>.

Energy Information Administration (EIA). (2010a, August 30). *Monthly U.S. net imports from OPEC countries of crude oil and petroleum products*. Retrieved March 16, 2010 from U.S. Department of Energy: <http://tonto.eia.doe.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MTTNTUSCA2&f=M>.

Energy Information Administration (EIA). (2010b, July 30). *Russia energy profile*. Retrieved March 16, 2010 from U.S. Department of Energy: http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=RS.

International Energy Agency (IEA). (2009a). *World energy outlook 2009: Executive summary*. Paris: OECD/IEA.

International Energy Agency (IEA). (2009b). *Key world energy statistics 2009*. Paris: IEA.

Intergovernmental Panel on Climate Change (IPCC). (2007). *Climate change 2007: Synthesis report*. Valencia, Spain: IPCC.

Robins, N., Clover, R. & Singh, C. (2009, February 25). *A climate for recovery: The colour of stimulus goes green*. London: HSBC Global Research.

Sorkin, A. R. (2010, March 15). Deal for oil fields extends china's quest for energy. *New York Times DealBook Blog*. Retrieved March 16, 2010 from:

<http://dealbook.blogs.nytimes.com/2010/03/15/deal-for-oil-fields-extends-chinas-quest-for-energy/>.

Tattersall, N. (2010, March 15). *Q+A: The implications of bomb attacks in Nigeria's oil delta*. Retrieved March 16, 2010 from Reuters UK:

<http://www.reuters.com/article/idUSLDE62E1A520100315?type=marketsNews>.

United Nations Framework Convention on Climate Change (UNFCCC), "National greenhouse gas inventory data for the period 1990-2007", UNFCCC, December 2009, Accessed 8 March 2010, <http://unfccc.int/resource/docs/2008/sbi/eng/12.pdf>

White House Blog. (2010, February 3). Moving America's clean energy economy forward: Boost for biofuels, clean coal. Retrieved March 18, 2010 from The White House:

<http://www.whitehouse.gov/blog/2010/02/03/moving-america-s-clean-energy-economy-forward-boostbiofuels-clean-coal>.

White House Office of Management and Budget. (n.d.). Creating the clean energy economy of tomorrow. Retrieved March 4 2010 from The White House:

http://www.whitehouse.gov/omb/factsheet_key_clean_energy/.

White House Office of the Press Secretary. (2010, January 27). Remarks by the President in the State of the Union Address. Retrieved March 8, 2010 from The White House:

<http://www.whitehouse.gov/the-press-office/remarks-president-state-union-address>.

White House Office of the Press Secretary. (2009, October 23). Remarks by the President challenging Americans to lead the global economy in clean energy. Retrieved March 18, 2009 from The White House: <http://www.whitehouse.gov/the-press-office/remarks-president-challenging-americans-lead-global-economy-clean-energy>.

World Bank. (2010, July 1). *Gross domestic product 2008*. Retrieved March 8, 2010 from The World Bank: <http://siteresources.worldbank.org/DATASTATISTICS/Resources/GDP.pdf>.

Zhou, N., Levine, M. & Price, L. (2010, August). Overview of current energy efficiency policies in China. *Energy Policy*, 38(8). China Energy Group, Lawrence Berkley National Laboratory.