The U.S.-Canada Energy Relationship: Joined at the Well

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Summary

The United States and Canada, while independent countries, effectively comprise a single integrated market for petroleum and natural gas. Canada is the single largest foreign supplier of petroleum products and natural gas to the United States—and the United States is the dominant consumer of Canada's energy exports. The value of the petroleum and natural gas trade between the two countries totaled nearly $100 billion in 2010, helping to promote general economic growth and directly support thousands of energy industry and related jobs on both sides of the border. Increased energy trade between the United States and Canada—a stable, friendly neighbor—is viewed by many as a major contributor to U.S. energy security. The U.S.-Canada energy relationship is increasingly complex, however, and is undergoing fundamental change, particularly in the petroleum and natural gas sectors.

Congress has been facing important policy questions in the U.S.-Canada energy context on several fronts, including the siting of major cross-border pipelines, increasing petroleum supplies from Canadian oil sands, increasing natural gas production from North American shales, and the construction of new facilities for liquefied natural gas (LNG) exports. Legislative proposals in the 112th Congress could directly influence these developments. These proposals include H.R. 1938, which would expedite consideration of the Keystone XL pipeline proposal, H.R. 909, which would encourage petroleum and natural gas production on the outer continental shelf and in the Arctic National Wildlife Refuge, and S. 304, which would support a program to train workers involved with oil and gas infrastructure in Alaska. Other proposals in Congress affecting hydraulic fracturing operations for natural gas production, offshore drilling, or U.S. oil shale development could also affect the U.S.-Canada energy relationship.

Traditionally, the energy trade between the United States and Canada, while intertwined, has been uncomplicated—taking the form of a steadily growing southward flow of crude oil and natural gas to markets in the U.S. Midwest and Northeast. But recent developments have greatly complicated that energy relationship creating new competition and interconnections. Consequently, while energy policies in one country have always inevitably affected the other, their cross-cutting effects in the future may not be widely understood and, in some cases, may be largely unanticipated. For example, policies affecting U.S. shale gas production could affect North American natural gas prices overall, and thus, the costs of producing petroleum from oil sands (which requires large volumes of natural gas for heating). Changing oil sands costs could, in turn, affect Canadian petroleum supplies to the United States, affecting north-south pipeline use and changing U.S. petroleum import requirements from overseas. Changing natural gas prices would also change the economics of Arctic natural gas, however, and influence the development of the Arctic natural gas pipelines, which could provide an alternative source of economic natural gas for oil sands production in Alberta. How such scenarios could play out in reality is open to debate, but they illustrate the tangled web policymakers in both countries must navigate as they consider future energy, environmental, and transportation decisions.

As Congress debates legislative proposals affecting the petroleum and natural gas industries, it may be helpful to consider these proposals in the broadest possible North American context, recognizing that the energy sector in Canada may be moved in one direction or another based on policies in Washington, DC. To date, the judgment of Congress has favored a growing U.S.-Canada energy partnership—but ensuring that this relationship continues to be as mutually beneficial as possible will likely remain a key oversight challenge for the next decades.

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Introduction

Canada has long been the United States' most important energy partner. Canada is the single largest foreign supplier of petroleum products, natural gas, and electric power to the United States—and the United States is the dominant consumer of Canada's energy exports. Canada is also the primary recipient of U.S. energy exports. The value of the energy trade between the two countries totaled nearly $100 billion in 2010, helping to promote general economic growth and directly support thousands of energy industry and related jobs on both sides of the border. Increased energy trade between the United States and Canada—a stable, friendly neighbor—is viewed by many as a major contributor to U.S. energy security. The U.S.-Canada energy relationship is increasingly complex, however, and is undergoing fundamental change, particularly in the petroleum and natural gas sectors.

Congress has been facing important policy questions in the U.S.-Canada energy context on several fronts, including the siting of major cross-border pipelines, increasing petroleum supplies from Canadian oil sands, increasing natural gas production from North American shales, and the construction of new facilities for liquefied natural gas (LNG) exports. Legislative proposals in the 112th Congress could directly influence these developments. For example, H.R. 1938 would direct the President to expedite the consideration and approval of the Keystone XL pipeline linking Canadian oil sands production to refineries in the Gulf of Mexico. H.R. 909 would encourage petroleum and natural gas production on the outer continental shelf, would prescribe requirements for coordination with adjacent states regarding associated pipeline construction, and would allow production of petroleum and natural gas from the Arctic National Wildlife Refuge, among other provisions. S. 304 would support a program to train workers in the construction, operation, maintenance, and performance of all related environmental processes involving oil and gas infrastructure in Alaska. Other proposals in Congress affecting hydraulic fracturing operations for natural gas production, offshore drilling, or U.S. oil shale development could also affect the U.S.-Canada energy trade.

While specific energy policy issues arising in the United States and Canada may appear to be independent of one another, many have important physical, economic, and environmental links. Thus, U.S.-Canada energy policies established in one context may have important implications in others. This report provides an overview of the U.S.-Canada energy trade, with a focus on petroleum and natural gas.[1] It summarizes important trends in both of these sectors and identifies key connections among these trends. Finally, the report discusses possible implications for the U.S.-Canada energy relationship going forward, highlighting considerations for Congress as it continues its oversight of the energy industry and considers new energy legislation.[2] Although the report raises environmental issues in specific contexts, a broad discussion of environmental impacts from North American energy production and consumption is beyond its scope.

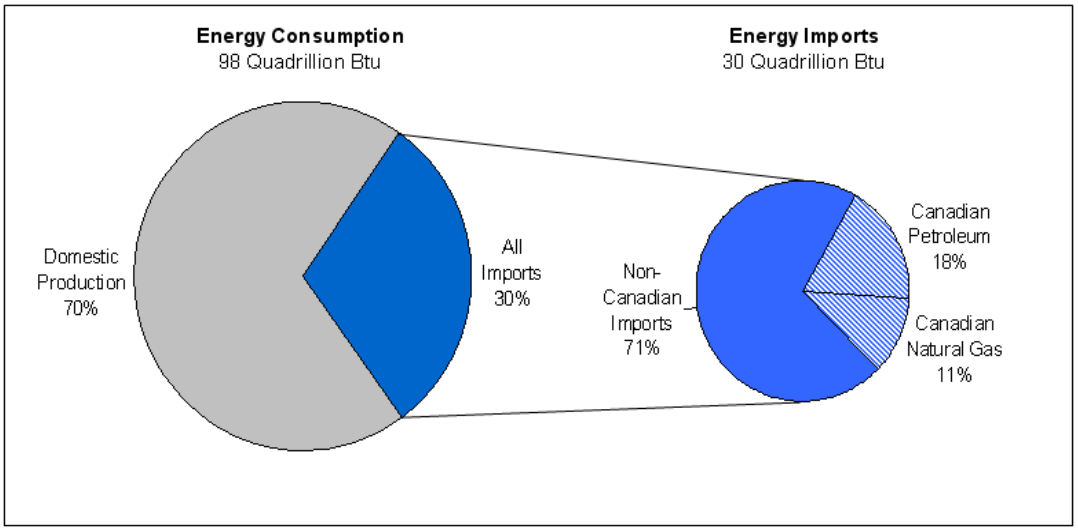
[1] Although regionally significant, Canadian electricity exports to the United States are small on a national basis. In 2009, Canadian imports comprised approximately 4,000 terrawatt-hours, or about 1% of U.S. electricity consumption. Canada also supplies approximately one-third of the uranium used in U.S. nuclear power plants. Issues related to the U.S.-Canada electric grid and nuclear power sectors are important, but beyond the scope of this report.

[2] For broader analyses of the U.S. relationship with Canada, see CRS Report 96-397, *Canada-U.S. Relations*, coordinated by Carl Ek and Ian F. Fergusson, or CRS Report RL33087, *United States-Canada Trade and Economic Relationship: Prospects and Challenges*, by Ian F. Fergusson.

U.S.-Canada Energy Trade and Infrastructure[3]

In 2010, 30% of primary energy consumed in the United States was imported (**Figure 1**).[4] Approximately 29% of these energy imports were Canadian petroleum (18%) and Canadian natural gas (11%).[5] Taken together, Canadian petroleum and natural gas accounted for 9% of total U.S. primary energy consumption in 2010, the largest contribution from any one foreign supplier.

Figure 1. 2010 U.S. Primary Energy Consumption and Sources



Source: U.S. Energy Information Administration, *Monthly Energy Review*, April 2011, pp. 3, 41, 45, and 70.

Notes: Btu = British thermal unit. One quadrillion Btu equals about 172 million barrels of oil or 974 billion cubic feet of natural gas.

The value of energy imports from Canada in 2010 was $83.6 billion, accounting for about 3.5% of all U.S. imports of goods and services that year.[6] These payments were primarily for petroleum and natural gas (**Figure 2**). In addition to these imports, the United States exported $13.5 billion worth of energy commodities to Canada, including $5.3 billion of refined petroleum products. The North America Free Trade Agreement's (NAFTA) extensive energy provisions have facilitated energy trade between the United States and Canada, underscoring the importance of this trade for both countries. NAFTA states, in part, "it is desirable to strengthen the important role that trade in energy and basic petrochemical goods plays in the free trade area...."[7]

[3] The data used in this report are for gross imports not net imports (imports less exports) unless otherwise specified.

[4] "Primary energy" includes all forms of energy when they are initially consumed. For example, natural gas can be converted to a liquid and consumed in a car. Natural gas, in this case, is the primary energy, while the liquid fuel is the secondary energy. Renewable forms of electricity generation, such as wind or solar, are considered primary energy, while electricity produced by natural gas or coal is not. Nuclear fuel is not included as energy in this report. Imports of electricity from nuclear and other fuel sources is included, but not broken out.

[5] "Petroleum" includes crude oil, fuel oil, natural gas liquids, and refined petroleum products (e.g., gasoline).

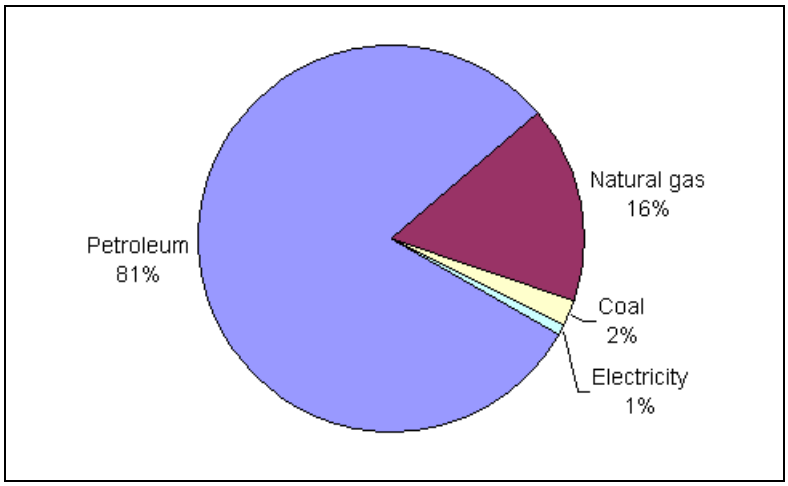
[6] U.S. Census Bureau, "U.S. Exports to Canada by 5-digit End-Use Code 2002-2010," March 15, 2011, http://www.census.gov/foreign-trade/statistics/product/enduse/exports/c1220.html.

[7] North American Free Trade Agreement, Chapter Six: Energy and Basic Petrochemicals, Article 601.2, 1994.

By virtue of NAFTA and the private sector orientation of the energy sectors in both countries, U.S. and Canadian companies have become integrated in the development, production, transportation, and marketing of petroleum and natural gas. Joint ventures between U.S. and Canadian companies on petroleum and natural gas projects are common. These close connections, and geographic proximity, have led the U.S. and Canadian energy markets to be viewed as one.

Figure 2. Value of U.S. Energy Imports from Canada 2010

Total = $83.6 billion



Source: U.S. Census Bureau, "U.S. Imports from Canada by 5-digit End-Use Code 2002 – 2010," March 15, 2011, http://www.census.gov/foreign-trade/statistics/product/enduse/imports/c1220.html.

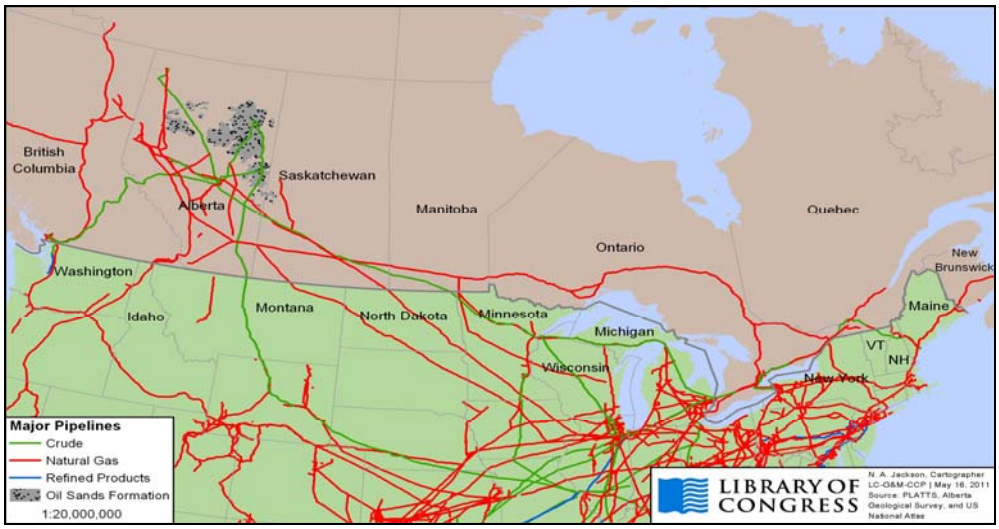
Energy Pipeline Infrastructure

The United States and Canada are connected by high capacity pipelines carrying crude oil, other petroleum products, and natural gas. As **Figure 3** shows, pipelines originating in Canadian supply basins are linked to major markets across the United States, comprising a large part of the North American pipeline system. There are five major Canadian petroleum export pipelines, discussed later in this report. Canadian natural gas exports cross into the United States at 25 entry points across the length of the border through major and minor pipelines. The primary receiving states are Idaho (21%), New York (20%), Montana (15%), North Dakota (15%), and Minnesota (15%).[8] While pipelines carry most Canadian energy exports to the United States, significant volumes are also transported by truck, train, and marine vessel.[9]

[8] U.S. Energy Information Administration, "U.S. Natural Gas Imports by Point of Entry," Internet table, May 31, 2011, http://www.eia.gov/dnav/ng/ng_move_poe1_a_EPG0_IRP_Mmcf_a.htm.

[9] Transport Canada, "Table RO18: International Trade Volume Shipped by Trucks, by Commodity Groups, 2008 and 2009," July 29, 2010, http://www.tc.gc.ca/eng/policy/report-aca-anre2009-2478.htm; "Table RA12: Value of Rail Exports and Imports by Commodity, 2000 – 2009," August 6, 2010, http://www.tc.gc.ca/eng/policy/report-aca-anre2009-2433.htm; "Table M29: Total Marine Imports/Exports by Commodities, 2008," July 29, 1010, http://www.tc.gc.ca/eng/policy/report-aca-anre2009-2520.htm.

Figure 3. Major U.S.-Canada Energy Commodity Pipelines



Source: Compiled by the Library of Congress's cartography division.

Key Developments in U.S.-Canada Energy

Although the United States and Canada have a long-established trade relationship in petroleum and natural gas—both have been shipped across the border since the late 1800s—several aspects of that relationship have been undergoing a transformation in recent years. These changes include the rapid growth in petroleum supplies from Canadian oil sands, the siting of major cross-border petroleum pipelines, renewed attempts to commercialize Arctic natural gas, a sharp rise in natural gas production from U.S. shales, and the development of new liquefied natural gas (LNG) facilities. In each of these areas new technology and infrastructure investments may have a significant effect on the balance of energy supply, demand, and trade between the United States and Canada. In some cases, they may also create new competition between the two countries in developing specific mineral resources and infrastructure projects.

Growth in Petroleum Supplies from Canadian Oil Sands

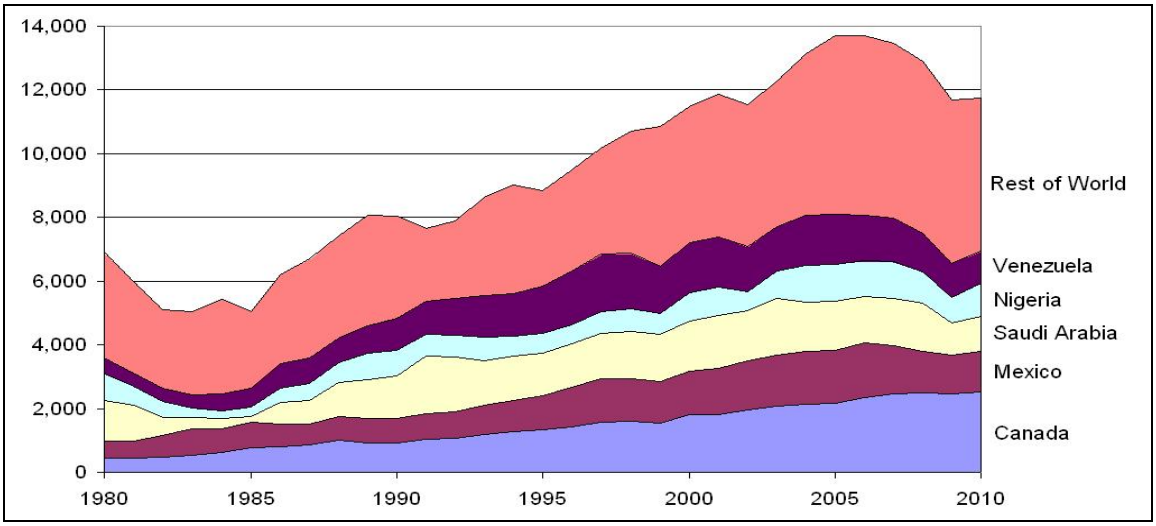
In 2010, Canada was the largest supplier of imported petroleum to the United States.[10] Of the 11.8 million barrels per day (Mbpd) the United States imported last year, Canada supplied 2.5 Mbpd (22%), more than the imports from the next two largest suppliers combined—Mexico and Saudi Arabia (**Figure 4**). Canadian imports have grown fairly steadily since the early 1980s and are expected to continue growing as new U.S.-Canada pipeline capacity is added and Canadian petroleum resource development expands. The Canadian Association of Petroleum Producers (CAPP) projects crude oil output to increase more than 50% from 2010 to 2025, with most of this production destined for the United States.[11] As noted earlier, the United States also exports a limited amount of petroleum to Canada, mostly as refined products.

[10] For additional analysis of U.S. petroleum imports, see CRS Report R41765, *U.S. Oil Imports: Context and Considerations*, by Neelesh Nerurkar.

[11] Canadian Association of Petroleum Producers (CAPP), "Crude Oil: Forecast, Markets & Pipelines," Calgary, AB, (continued...)

Figure 4. Gross U.S. Oil Imports 1980-2010

(Thousand barrels per day)



Source: U.S. Energy Information Administration, Petroleum & Other Liquids, U.S. Imports by Country of Origin," Online tables, July 29, 2010, http://www.eia.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mbblpd_a.htm.

Notes: In 2010, total U.S. gross imports were about 11.8 Mbpd, down from a peak of 13.7 Mbpd in 2005. During that period, U.S. oil exports increased from 1.2 Mbpd to 2.3 Mbpd, nearly all in the form of refined petroleum products.

Petroleum production from oil sands is the key driver behind the growth in Canadian petroleum exports. Oil sands are mixtures of sand, water, and bitumen.[12] When oil sands, also known as tar sands, are included, Canada's petroleum reserves rank second in the world behind Saudi Arabia's.[13] Canada has an estimated 143.1 billion barrels of petroleum reserves, of which 81% are from oil sands. According to CAPP projections, by 2025, oil sands will account for about 80% of total Canadian oil production, up from 50% currently.[14]

Notwithstanding its rapid growth, petroleum production from Canadian oil sands is controversial because it has significant environmental impacts, including emissions of greenhouse gases during extraction and processing (that exceed emissions from conventional oil production), disturbance of mined land, and impacts on wildlife and water quality.[15] Since bitumen in oil sands cannot be pumped from a conventional well, it must be mined, usually using strip mining or open pit techniques, or the oil can be extracted using underground heating methods, which require large amounts of water and natural gas (for heating).[16] The magnitude of the environmental impacts of

(...continued)

June 2010, p. 27, http://www.capp.ca/GetDoc.aspx?DocId=173003.

[12] Bitumen is a black, sticky, and viscous substance that naturally occurs as a byproduct of decomposed organic materials. In the United States, bitumen is also known as asphalt, a binder mixed with aggregate in road surfaces.

[13] BP, *BP Statistical Review of World Energy*, June 2011, p. 6.

[14] CAPP, June 2010, p. 28.

[15] For more analysis of oil sands and their environmental impacts, see CRS Report RL34258, *North American Oil Sands: History of Development, Prospects for the Future*, by Marc Humphries.

[16] U.S. Bureau of Land Management, "About Tar Sands," web page, January 11, 2011, http://ostseis.anl.gov/guide/tarsands/index.cfm; Cecilia Jamasmie, "The Challenges and Potential of Canada's Oil Sands," *Mining*, September-

(continued...)

oil sands production, in absolute terms and compared to conventional oil production, has been the subject of numerous, and sometimes conflicting, studies and policy papers.[17]

Development of New Cross-Border Petroleum Pipelines

Cross-border pipeline infrastructure for Canadian petroleum exports to the United States has been growing rapidly. Five major pipelines with a combined capacity of 3.3 Mbpd currently link Canadian petroleum producing regions to markets in the United States (**Table 1**). Two of these pipelines, Alberta Clipper and Keystone, with a combined capacity of just under 0.9 Mbpd (26% of the total) began service last year. A permit application for a sixth pipeline, Keystone XL, which would add an additional 0.8 Mbpd of capacity, is in the final stages of review by the U.S. State Department.[18] If approved and constructed, Keystone XL would bring Canada's total U.S. petroleum export capacity to over 4.1Mbpd, enough capacity to carry over 34% of U.S. petroleum imports in 2010.[19] Given that Canada actually supplied the United States 2.5 Mbpd in 2010, large increases in Canadian supply will ultimately be possible, although the industry anticipates significant excess pipeline capacity for the next decade.[20] In addition, several large pipeline projects are proposed within the United States to increase movements of Canadian petroleum to key U.S. market hubs, including refineries in the Midwest and on the Gulf Coast that employ complex technology in order to process "heavy" crude oils like those from Canada, Mexico, and Venezuela. Note that whether a pipeline is located in one country or the other has little bearing on its ownership; Kinder Morgan is a U.S. company while Enbridge and TransCanada are Canadian companies (**Table 1**).

(...continued)

October 2010, pp. 7-8.

[17] For an example of contrasting views, see IHS CERA Inc., *Oil Sands, Greenhouse Gases, and US Oil Supply, Getting the Numbers Right*, 2010; and Natural Resources Defense Council, "Setting the Record Straight: Lifecycle Emissions of Tar Sands," November 2010.

[18] U.S. Department of State, Supplemental Draft Environmental Impact Statement for the Keystone XL Oil Pipeline Project, April 15, 2011. p. 1-4. An initial capacity of 700,000 bpd may be raised to 830,000 bpd by increasing the pumping capacity. The Keystone XL project had applied to the U.S. Pipeline Hazardous Materials Safety Administration to operate at slightly higher pressure than permitted in standard regulations, which would have enabled a 900,000 bpd capacity, but it withdrew its applications for such a Special Permit in August 2010.

[19] TransCanada has proposed a pipeline spur from the Keystone XL pipeline to the Bakken oil shale field in Montana, North Dakota, and South Dakota, known as the Bakken Marketlink Project. Although this project would be exclusively in the United States, it would be owned by TransCanada, again emphasizing the role companies play in the development each country's oil and natural gas projects.

[20] CAPP, June 2010, p.23.

Table 1. Major U.S.-Canadian Petroleum Import Pipelines

Pipeline	Operator	Status	Capacity (bpd)
Enbridge Mainline	Enbridge	Operating	1,868,000
Express	Kinder Morgan	Operating	280,000
Trans Mountain	Kinder Morgan	Operating	300,000
Alberta Clipper	Enbridge	Began operating in 2010	450,000
Keystone	TransCanada	Began operating in 2010	435,000
Keystone XL	TransCanada	Proposed	830,000
TOTAL			**4,163,000**

Source: CAPP, June 2010, p. 19; U.S. Department of State, April 15, 2011, p. 1-4.

The recent expansion of petroleum pipelines from Canada has generated considerable controversy in the United States. Proponents of these pipelines, including Canadian government agencies, petroleum industry stakeholders, and pipeline construction workers, have based their public interest justifications primarily on increasing the diversity of the U.S. petroleum supply and on expected economic benefits to the United States, including near-term job creation associated with pipeline construction and operation. Opponents, primarily environmental groups and affected communities along pipeline routes, have objected to these projects principally on the grounds that Canadian oil sands development has negative environmental impacts and that it promotes continued U.S. dependency on fossil fuels. Some opponents also argue that, given the excess capacity anticipated in the existing Canadian petroleum pipelines noted above, additional pipelines are not needed. These issues have come into particular focus in the context of the Keystone XL pipeline proposal, which applied for a Presidential Permit from the U.S. Department of State in 2008.[21] The State Department expects to make a decision regarding this permit by the end of 2011. [22] H.R. 1938 (Sec. 3) would require this decision by November 1, 2011.

Arctic Natural Gas Pipeline Proposals

The Arctic region has substantial natural gas resources. For example, the U.S. Geological Survey (USGS) estimates that conventional natural gas reserves just on Alaska's North Slope potentially exceed 100 trillion cubic feet (Tcf), over four times the total annual gas consumption of the United States.[23] The Mackenzie River Delta region in the Canadian Arctic contains an estimated 40 Tcf of natural gas.[24] The USGS's assessment of undiscovered conventional natural gas resources across the entire Arctic region concluded that over 1,600 Tcf of additional natural gas

[21] The construction, connection, operation, and maintenance of a pipeline connecting the United States with a foreign country requires executive permission through a Presidential Permit under Executive Orders 11423 and 13337.

[22] For additional analysis of the Keystone XL pipeline, see CRS Report R41668, *Keystone XL Pipeline Project: Key Issues*, by Paul W. Parfomak et al.

[23] David W. Houseknecht, U.S. Geological Survey, *Conventional Natural Gas Resource Potential, Alaska North Slope*, Open File Report 2004-1440, December 13, 2004; U.S. Energy Information Administration, *Annual Energy Outlook 2009*, DOE/EIA-0383(2009), March 2009, p. 109.

[24] U.S. Geological Survey, "Assessment of Undiscovered Oil and Gas Resources of the Mackenzie Delta Province, North America, 2004," Fact Sheet 2006-3002, March, 2006.

resources remain to be found, much of it under Canadian and U.S. territory.[25] Both the United States and Canada have long recognized the potential of these natural gas resources and have pursued policies to develop them. Principal among these policies has been promoting the construction of natural gas pipelines from the Arctic to markets in the lower-48 United States.

While Arctic natural gas pipeline projects have been on and off the drawing board for decades, serious interest in Arctic natural gas pipeline revived around 2000 because of accelerated growth in U.S. natural gas demand, rising natural gas prices, and increased importation of liquefied natural gas (LNG) from overseas. Moreover, many industry analysts expected a U.S. policy of carbon dioxide control could further increase natural gas demand for electric power generation and, possibly, transportation fuel. These factors led both U.S. and Canadian officials to restart the process of Arctic natural gas pipeline development.[26]

Important milestones in Arctic pipeline activity were Alaska's 2008 award to TransCanada of a license to build an Alaska natural gas transportation system from Prudhoe Bay, AK, through Canada to the lower-48 states, the concurrent announcement of a competing pipeline proposal (Denali) along a similar route, and revival of a third proposal for an all-Canada pipeline originating in the Mackenzie Delta (**Figure 5**). Since large sections of either of the proposed Alaska natural gas pipelines would pass through Canadian territory, Canada has cooperated with the United States on their development. However, because the Mackenzie pipeline would commercialize a major new source of North American natural gas, and would draw on a limited pool of construction resources and materials available for such a project, it has been viewed by some as a direct competitor to an Alaska gas pipeline.[27]

[25] U.S. Geological Survey, *USGS Arctic Oil and Gas Report*, Fact Sheet, July 2008.

[26] U.S. Energy Information Administration, *Natural Gas Monthly*, August 2009, Table 2. Full initial pipeline capacity is 4.5 billion cubic feet per day.

[27] See, for example: James Irwin, "Alaska Pipeline Advance Could Threaten Mackenzie Valley Pipeline," *Natural Gas Week*, March, 7, 2005.

Figure 5. Arctic Natural Gas Pipelines Proposals

Source: Adapted from CRS Report RL31278, *Arctic National Wildlife Refuge: Background and Issues*, Figure 6, based on Energy Department maps.

Notwithstanding recent development progress, there have been many obstacles to Arctic natural gas pipelines—most notably natural gas prices in the lower-48 states, the primary market for Arctic natural gas. As discussed below, a rapid and largely unanticipated increase in natural gas production from U.S. shales has lowered natural gas price forecasts for the foreseeable future. Given this drop in prices, Arctic natural gas projects may not be economically viable at present. In March 2011, Canadian authorities provisionally approved the Mackenzie pipeline project, although some analysts believe it may not be constructed without new government subsidies.[28] In May 2011 the developers of the Denali pipeline proposal discontinued the project, citing a lack of commitment to contract for pipeline capacity among potential Arctic gas producers (two of which—BP and ConocoPhillips—were Denali sponsors).[29] TransCanada officials have stated that they remain committed to developing their Alaska pipeline project, although some industry analysts are skeptical.[30] If either the TransCanada or Mackenzie pipeline is ultimately constructed and begins transporting natural gas to lower-48 markets, it could have a significant impact on U.S. energy prices, energy security, and emissions of carbon dioxide.

[28] National Energy Board (Canada), "National Energy Board Issues Certificate of Public Convenience and Necessity for Mackenzie Valley Pipeline," Press release, Calgary, AB, March 10, 2011; "Mackenzie Pipeline Needs Federal Cash: Insiders," CBC News, January 12, 2011.

[29] Denali-the Alaska Gas Pipeline, "Denali Discontinues Gas Pipeline Project," Press release, Anchorage, AK, May 17, 2011.

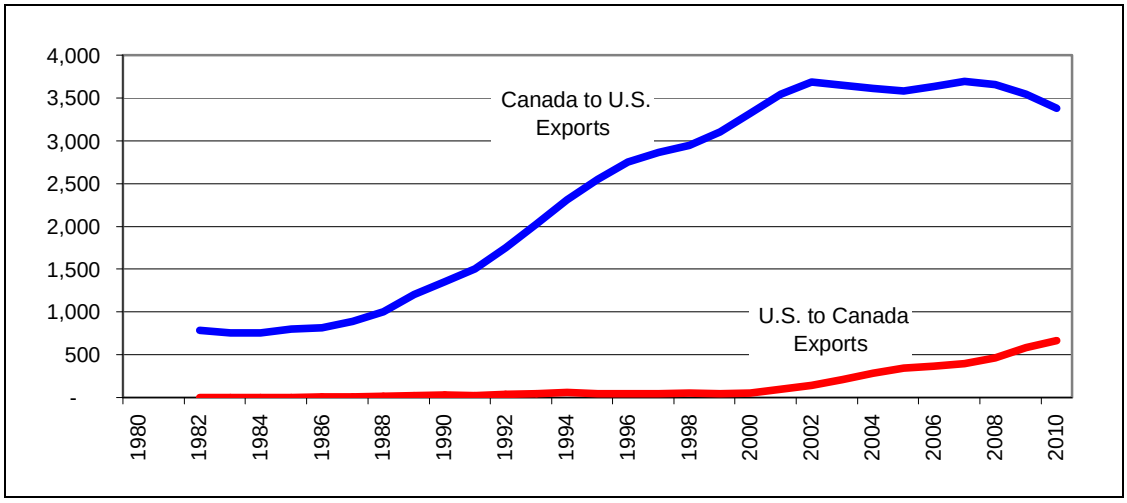
[30] Cassandra Sweet, "TransCanada Sticks to Alaska Gas Pipeline Project Even as Rival Bows Out," *Wall Street Journal*, May 17, 2011.

Declining U.S. Natural Gas Imports[31]

Canada is the dominant foreign supplier of natural gas to the United States. Of the 3,683 billion cubic feet (bcf) of natural gas the United States imported in 2010, Canada supplied 3,222 bcf (88%), almost 20 times the next largest supplier. This level of Canadian natural gas exports to the United States comprised approximately 13% of total U.S. natural gas consumption last year. Canadian natural gas exports to the United States saw rapid growth beginning in the mid-1980s, rising more than 400% between 1984 and 2002. These imports have begun to decline, however, due to increases in U.S. imports of LNG from overseas and, more recently and importantly, due to increases in domestic natural gas production. At the same time, the United States has begun to export significant volumes of U.S.-produced natural gas to markets in eastern Canada, displacing Canadian supplies (**Figure 6**). In 2010, the United States exported 738 billion cubic feet of natural gas to Canada, mostly via Michigan. In May, the U.S. Federal Energy Regulatory Commission approved a new pipeline from Marcellus shale gas fields in the United States to Canada, potentially increasing northward natural gas exports.[32]

Figure 6. Canada-U.S. Natural Gas Exports (bcf)

Three-Year Moving Average 1982-2010



Source: U.S. Energy Information Administration, "Annual U.S. Natural Gas Pipeline Imports From Canada," and "Annual U.S. Natural Gas Pipeline Exports to Canada," Internet tables, April 29, 2011, http://www.eia.gov/dnav/ng/hist/n9102cn2a.htm and http://www.eia.doe.gov/dnav/ng/hist/n9132cn2A.htm.

The rise in U.S. domestic natural gas supplies has been driven by an unanticipated growth in natural gas production from shale, a widespread type of geologic formation that often holds large quantities of natural gas but poses technical challenges for extraction. In recent years, energy companies have overcome these challenges, making large natural gas resources in U.S. shales commercially available. For example, in its 2011 *Annual Energy Outlook*, the Energy Information Administration more than doubled its estimate of shale gas resources to 827 Tcf from its 2010 *Annual Energy Outlook* estimate of 347 Tcf—due primarily to a re-evaluation of shale gas

[31] For additional analysis of natural gas markets, see CRS Report R41543, *Global Natural Gas: A Growing Resource*, by Michael Ratner.

[32] U.S. Federal Energy Regulatory Commission, *Order Issuing Certificate And Approving Abandonment*, Empire Pipeline, Inc., Docket No. CP10-493-000, issued May 19, 2011.

supplies.[33] Because U.S. shale gas reserves are located close to major natural gas markets, U.S. shale gas has an advantage over traditional supply basins in Western Canada and the U.S. Gulf Coast. Large shale gas reserves are also found in Canada, although they are several years behind the development of U.S. reserves because of limited pipeline infrastructure and because transportation costs make them less competitive than other North American supplies.[34]

The reversal of Canada-U.S. natural gas export trends is driving fundamental changes in the North American natural gas industry. For example, due to sharply declining long-haul contract volumes on its Canadian natural gas pipelines to the United States, TransCanada has had to drastically restructure its pipeline tariffs to maintain the economic viability of certain lines.[35] Likewise, as discussed earlier, shale gas plays have hurt prospects for Arctic natural gas development in both Alaska and Arctic Canada. On the other hand, low natural gas prices benefit the production of petroleum from oil sands, which requires large volumes of natural gas for extraction and processing. It remains to be seen how the development of additional North American natural gas reserves and associated pipeline infrastructure will turn out over time as Canada seeks to develop its own resources (with the help of U.S. companies) in response to U.S. shale gas developments. At least in the near-term, however, it appears that recent trends of reduced U.S. imports of Canadian natural gas will continue.

Liquefied Natural Gas Import-Export Terminals

Liquefied natural gas (LNG) shipments from overseas historically have played a minor role in North American energy markets. However, in reaction to rising natural gas prices in the early 2000s and a fear of impending shortages of pipeline natural gas, demand for LNG imports to the United States was expected to increase.[36] To meet this anticipated growth in LNG demand, developers expanded existing LNG terminals and constructed or proposed numerous new LNG import terminals in both the United States and Canada. In the United States, between 2001 and 2011, three existing LNG import terminals were expanded, seven new LNG terminals were constructed, and sixteen were approved but not constructed. In Canada during this period, one new LNG import terminal was constructed and two more were approved. Because Canada's new LNG terminals would serve the same Northeast markets as several of the proposed U.S. terminals, there was considerable competition among the developers of these projects. In one instance, this competition even reportedly created diplomatic tension between the two countries.[37] But the building boom in LNG terminals was premature. As North American natural gas supplies

[33] EIA's 2011 and 2010 Annual Energy Outlook.

[34] National Energy Board of Canada, "Understanding Canadian Shale Gas," November 2009; Advanced Resources International, Inc., *World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States*, Arlington, VA, prepared for the U.S. Energy Information Administration, April 2011, Chapter I, http://www.adv-res.com/pdf/ARI%20EIA%20Intl%20Gas%20Shale%20APR%202011.pdf

[35] This restructuring has been somewhat complicated across TransCanada's system. For an initial perspective, see Samantha Santa Maria, "TransCanada Files Final 2011 Mainline Tolls; Raises Rates Again," Platts, April 29, 2011.

[36] For example, in 2003 testimony before Congress, the Federal Reserve Chairman stated "... high gas prices projected in the American distant futures market have made us a potential very large importer.... Access to world natural gas supplies will require a major expansion of LNG terminal import capacity." The Honorable Alan Greenspan, Chairman, U.S. Federal Reserve Board, "Natural Gas Supply and Demand Issues," Testimony before the House Energy and Commerce Committee, June 10, 2003.

[37] Peter Morton, "Canada, U.S. on Course for LNG Collision," *National Post*, February 16, 2007.

from shale plays rapidly increased, the anticipated rise in demand for LNG imports did not materialize, leaving most of the new LNG import capacity unutilized.

In a somewhat ironic turn of events given the origins of the aforementioned LNG terminal building boom, some terminal owners and developers are now proposing to *export* North American natural gas to China, Japan, and other foreign buyers. At least two groups have proposed Canadian LNG export terminals in British Columbia, anticipating significant natural gas supplies from shales in Western Canada. Many analysts view such exports as the only way to economically develop gas reserves from these western shales, which might otherwise not be competitive with U.S. natural gas supplies. Likewise at least three U.S. developers have filed applications for LNG export facilities (modifying existing import terminals), and more such filings are anticipated. On May 20, 2011, the U.S. Department of Energy issued its first conditional authorization for LNG exports from the Sabine Pass LNG Terminal in Louisiana to non-NAFTA countries.[38] If U.S. and Canadian LNG export projects are developed, LNG developers in the two countries could again find themselves in competition, only this time in seeking to supply overseas LNG buyers. The potential effects on North American natural gas prices are difficult to predict, but exports to foreign markets would create upward price pressures.[39] Furthermore, a large LNG export trade might limit U.S. natural gas exports to Canada in the future.

Considerations for Congress

The United States and Canada, while independent countries, effectively comprise a single integrated market for petroleum and natural gas. These markets are physically linked by billions of dollars of transportation and refining infrastructure, and are economically linked by direct participation in the same regional and global energy markets. Canada is the largest foreign supplier of energy to the United States and will continue to be for the foreseeable future. The United States depends on Canada for oil and natural gas supplies that it cannot currently produce itself. As the primary supplier of U.S. imports of petroleum and natural gas, Canada is viewed as a stabilizing factor for U.S. energy supplies; although petroleum prices are set in a global market, the likelihood that Canada would cut off oil and natural gas supplies is remote. But Canada is equally dependent upon the United States to buy energy exports that might not easily find a market elsewhere due to geographical constraints. The United States is also a critical supplier to Canada of refined petroleum products. U.S.-based companies invest heavily in assets and energy resources in Canada and vice versa. Although individual companies in both countries may compete for specific energy opportunities (e.g., LNG terminals), the overall energy relationship between the United State and Canada is mutually beneficial.

Traditionally, the energy trade between the United States and Canada, while intertwined, has been uncomplicated—taking the form of a steadily growing southward flow of crude oil and natural gas to markets in the U.S. Midwest and Northeast. But recent increases in oil sands and shale gas production, expansion of cross-border pipeline capacity, prospects for LNG exports, and renewed interest in Arctic natural gas have greatly complicated that energy relationship creating new

[38] U.S. Dept. of Energy, "Energy Department Approves Gulf Coast Exports of Liquefied Natural Gas," Press release, May 20, 2011.

[39] Some in industry argue that an increase in demand and higher prices in foreign markets for natural gas would increase production and not increase U.S. natural gas prices.

competition and interconnections. Consequently, while energy policies in one country have always inevitably effected the other, their cross-cutting effects in the future may not be widely understood and, in some cases, may be largely unanticipated. For example, policies affecting U.S. shale gas production could affect North American natural gas prices overall, and thus, the costs of producing petroleum from oil sands (which requires large volumes of natural gas for heating). Changing oil sands costs could, in turn, affect Canadian petroleum supplies to the United States, affecting north-south pipeline use and changing U.S. petroleum import requirements from overseas. Changing natural gas prices would also change the economics of Arctic natural gas, however, and influence the development of the Arctic natural gas pipelines, which could provide an alternative source of economic natural gas for oil sands production in Alberta. How such scenarios could play out in reality is open to debate, but they illustrate the tangled web policymakers in both countries must navigate as they consider future energy, environmental, and transportation decisions.

As Congress debates legislative proposals affecting the petroleum and natural gas industries, it may be helpful to consider these proposals in the broadest possible North American context, recognizing that the energy sector in Canada may be moved in one direction or another based on policies in Washington, DC. For example, developers are already pursuing western Canadian routes for petroleum exports to Asia as an alternative to U.S. exports, especially if the latter should fail to grow as expected.[40] Ultimately, the energy market effects of specific energy policies and projects must be weighed against their broader economic value, energy security implications, and environmental impacts. To date, the judgment of Congress has favored a growing U.S.-Canada energy partnership—but ensuring that this relationship continues to be as mutually beneficial as possible will likely remain a key oversight challenge for the next decades. If the balance tips the other way—either in the eyes of developers or the federal government—Congress may need to reconsider its position on key energy and related initiatives to meet the United States' long-term policy objectives.

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[40] Kinder Morgan is considering more than doubling its Trans Mountain Pipeline capacity and expanding west coast shipping facilities. Enbridge has proposed the new Northern Gateway project. Both projects would send oil from Alberta to the British Columbia coast. Enbridge, "Northern Gateway at a Glance," press release, 2011, http://www.northerngateway.ca/project-info/northern-gateway-at-a-glance.