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Energy Briefing Note

Canadian Energy Overview 2011

energy

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Foreword

The National Energy Board (the NEB or the Board) is an independent federal regulator whose purpose is to promote safety and security, environmental protection and efficient energy infrastructure and markets in the Canadian public interest[1] within the mandate set by Parliament for the regulation of pipelines, energy development, and trade.

The Board's main responsibilities include regulating the construction and operation of interprovincial and international hydrocarbon pipelines, international power lines, and designated interprovincial power lines. Furthermore, the Board regulates the tolls and tariffs for the pipelines under its jurisdiction. With respect to the specific energy commodities, the Board regulates the export of natural gas, oil, natural gas liquids (NGLs) and electricity, and the import of natural gas. Additionally, the Board regulates oil and gas exploration and development on frontier lands and offshore areas not covered by provincial or federal management agreements.

The Board also monitors energy markets, and provides its view of the reasonable foreseeable requirements for energy use in Canada having regard to trends in the discovery of oil and gas.[2] The Board periodically publishes assessments of Canadian supply and demand of energy and natural gas markets in support of its ongoing market monitoring. These assessments address various aspects of energy markets in Canada. Annually, the Board conducts a review of the previous year's energy markets in a report, titled *Canadian Energy Overview*. This year's report, *Canadian Energy Overview 2011*, is an abridged form of previous editions. Figures and tables from previous editions remain with less narrative.

If a party wishes to rely on material from this report in any regulatory proceeding before the NEB, it may submit the material, just as it may submit any public document. Under these circumstances, the submitting party in effect adopts the material and that party could be required to answer questions pertaining to the material.

This report does not provide an indication about whether any application will be approved or not. The Board will decide on specific applications based on the material in evidence before it at that time.

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1 The public interest is inclusive of all Canadians and refers to a balance of economic, environmental, and social considerations that change as society's values and preferences evolve over time.

2 This activity is undertaken pursuant to the Board's responsibilities under Part VI of the *National Energy Board Act* and the Board's decision in GHR-1-87.

Overview

- Growth in Canadian energy production increased in 2011, while growth in the economy and energy consumption slowed. Reduced growth in consumption, exports and government spending resulted in Canadian Gross Domestic Product (GDP) increasing by 2.6 per cent in 2011, compared to 3.4 per cent in 2010. Increased crude oil production and crude export prices offset lower natural gas export revenue to allow net energy export revenues to increase by 16 per cent in 2011, compared to 14 per cent in 2010.

- The European sovereign debt crisis, tighter international financial markets and increased risk aversion slowed global growth in 2011. Global real GDP growth slowed to 3.8 per cent compared to 5.2 per cent in 2010. U.S. real GDP grew by 1.7 per cent in 2011 compared to 3.0 per cent in 2010.

- Energy production, led by growth in petroleum and electricity generation sectors, is estimated to have increased by 3.0 per cent in 2011 compared to 1.1 per cent in 2010. Reduced energy use in industry and transportation slowed Canadian secondary energy consumption growth to an estimated increase of 1.8 per cent in 2011, down from 2.2 per cent in 2010.

- Canadian crude oil production increased by six per cent in 2011, compared to five per cent in 2010. The increase is largely attributable to additional oil sands activity. Mined bitumen production, in situ bitumen production and upgrading all reached new highs in 2011.

- Increases in marker crude oil prices led to higher export prices for Canadian heavy and light crude and led to a 10 per cent increase in Canadian energy export revenues in 2011. Higher crude prices also increased oil-targeted drilling.

- Canadian natural gas production in 2011 was about equal to production in 2010, while natural gas consumption increased by eight per cent compared to 2010. Natural gas exports fell 14 per cent in 2011 compared to 2010.

- The impact on natural gas prices of rising U.S. shale gas production was offset for part of the year by additional demand from a cold winter and hot summer. Prices declined later in 2011 as milder weather arrived to moderate demand. The decline in prices made most new dry natural gas drilling uneconomic, pushing producers to target liquid-rich natural gas where the NGL revenue supplemented the reduced revenue from produced gas.

- Renewable electricity generation increased by 7.7 per cent in 2011, and led to an estimated 3.2 per cent increase in total electricity production over 2010. The increase in renewable generation was partially offset by a 9.7 per cent decrease in thermal generation as Ontario retired coal units and reduced the output of several remaining units. Canadian electricity demand is estimated to have increased by 1.3 per cent in 2011 compared to 0.5 per cent in 2010.

Energy and the Canadian Economy

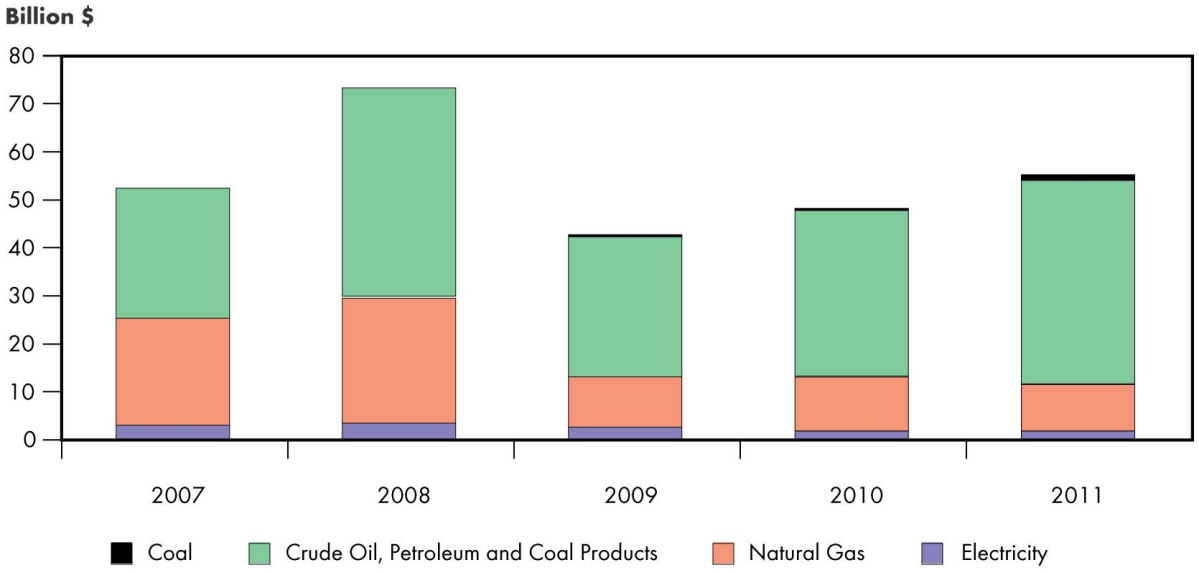
- The energy sector accounted for 6.9 per cent of Canada's GDP in 2011, which was marginally higher than in 2010. Canadian energy exports contributed $113.7 billion to the economy in 2011, an increase of $19.9 billion from 2010. Crude oil prices continued to rise through 2011 averaging almost US$95/bbl.

Table 1
Key Canadian Energy and Economy Statistics

	2010	2011	% Change
The energy industry's direct contribution to GDP (per cent)	6.8	6.9	1.5
Annual energy export revenues (Billion $)	$93.8	$113.7	21.2
The energy industry's contribution to export revenues (per cent)	23.5	25.4	12.1
Average WTI Crude Oil Price (US$/bbl)	$79.40	$94.90	19.5

Sources: Statistics Canada, U.S. Energy Information Administration

Figure 1
Net Energy Export Revenues



Sources: Statistics Canada, NEB

Table 2
Domestic Energy Production by Energy Source (petajoules)

	2007	2008	2009	2010	2011 [a]	% Change (2010-2011)
Petroleum [b]	6 939	6 839	6 785	7 090	7 506	5.9
Natural Gas [c]	6 657	6 385	5 984	5 772	5 765	-0.1
Hydroelectricity	1 311	1 346	1 314	1 253	1 350	7.7
Nuclear Electricity	318	326	306	308	324	5.3
Coal	1 539	1 512	1 379	1 524	1 500	-1.6
Wind, Tidal and Solar Electricity	11	14	24	35	37	7.3
Other [d]	581	575 (a)	534 (a)	523 (a)	516	-1.4
Total	17 356	16 996	16 327	16 505	16 998	3.0
Annual % Change		-2.1	-3.9	1.1	3.0	

(a) Estimates
(b) Petroleum includes crude oil and gas plant NGLs, upgraded and non-upgraded bitumen and condensate
(c) Marketable natural gas
(d) Includes solid wood waste, spent pulping liquor, wood and other fuels for electricity generation
Sources: NEB, Statistics Canada, Natural Resources Canada

- In 2011, net energy export revenue increased to about $56 billion from $48 billion in 2010, a 16 per cent increase (Figure 1). Crude oil, petroleum and coal products contributed 77 per cent of net energy export revenue in 2011, compared to 72 per cent in 2010, and 50 per cent in 2007. Overall Canadian energy production (Table 2) and secondary energy[3] consumption (Table 3) increased by 3.0 per cent and 1.8 per cent respectively.

Table 3
Domestic Secondary Energy Consumption (petajoules)

	2007	2008	2009	2010 [a]	2011[a]	% Change (2010-2011)
Residential [b]	1 439	1 461	1 419	1 424	1 446	1.5
Commercial	1 475	1 489	1 466	1 474	1 481	0.5
Industrial [b][c]	5 292	5 061	4 803	4 973	5 107	2.7
Transportation	2 630	2 630	2 611	2 653	2 684	1.2
Total	**10 836**	**10 641**	**10 298**	**10 525**	**10 718**	1.8
Annual % Change		-1.8	-3.2	2.2	1.8	

(a) Estimates
(b) Includes biomass (wood and pulping liquor)
(c) Includes producer-consumption energy use and non-energy use
Sources: NEB, Statistics Canada

3 As defined by Natural Resources Canada, energy used by final consumers for residential, agricultural, commercial, industrial and transportation purposes.

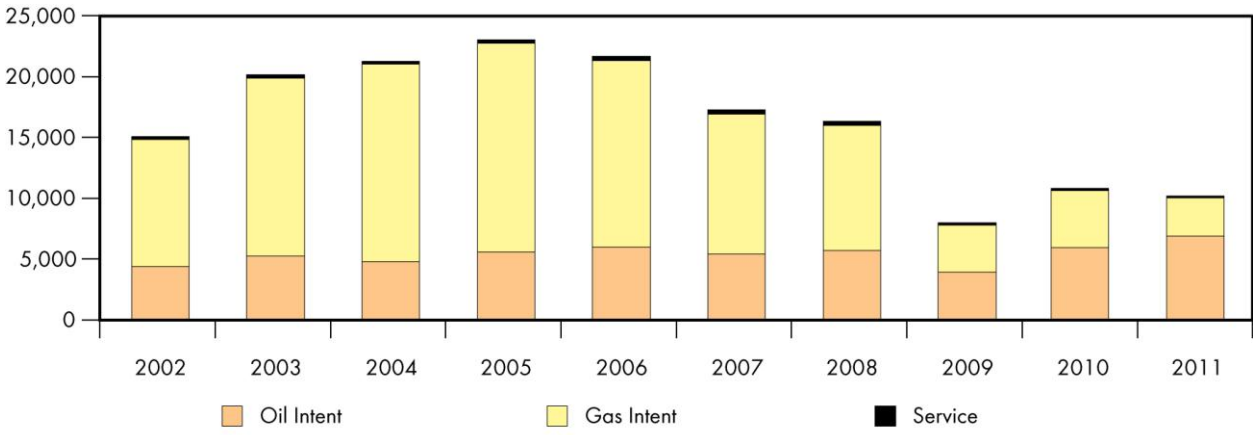
Crude Oil and Petroleum Products

- Canadian crude oil demand in 2011 fell to an estimated 266 672 m^3/d (1.68 MMb/d) from 282 005 m^3/d (1.77 MMb/d) or 5.4 per cent from 2010. The decrease in demand is largely due to the closure of Shell's Montreal refinery.

- The number of wells drilled in Western Canada, excluding bitumen wells, declined about six per cent in 2011 compared to 2010. However, the increasing focus on horizontal drilling and fracturing in both shale gas and shale oil plays has resulted in:
    - average well length increasing by about 10 per cent[4]
    - total metres drilled increasing by about 17 per cent[5], and
    - higher average initial production rates for both oil and gas wells.

- The number of rigs targeting oil increased by 23 per cent in 2011 as companies moved away from natural gas plays to develop oil plays because of relatively high oil prices and low natural gas prices (Figure 2).

Figure 2
Number of Wells Drilled – Western Canada



Source: NEB analysis of Divestco data

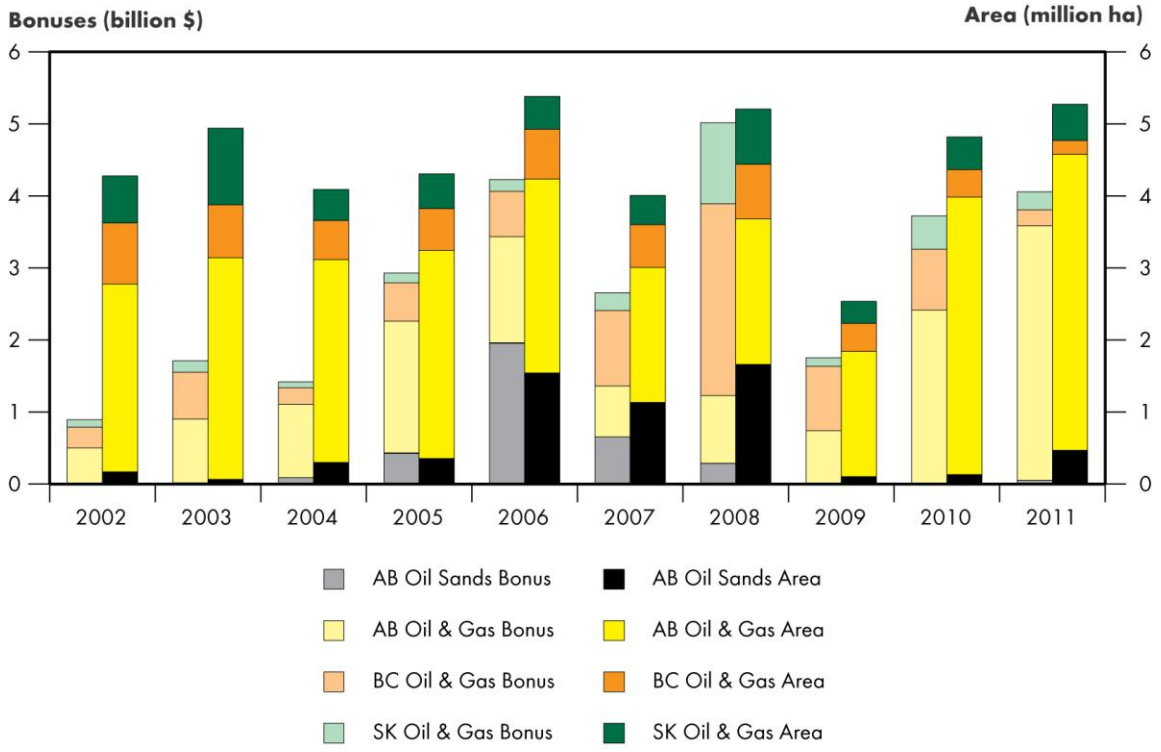
Note: Number of wells drilled excludes bitumen wells.

- Operators spent $4.1 billion to lease natural gas, oil and oil sands rights in Western Canada in 2011. In this year, Alberta set a new record for total revenue received from oil, natural gas and oil sands rights, while B.C.'s take in 2011 from oil and natural gas rights was the lowest in the last 10 years (Figure 3).

4 Daily Oil Bulletin 26 January 2012.

5 ibid.

Figure 3
WCSB Oil, Natural Gas and Oil Sands Land Activity and Rights Expenditures



Sources: Provincial regulatory agencies

- Canadian crude oil production in 2011 increased by six per cent compared to 2010, averaging an estimated 479 021 m^3/d (3.01 MMb/d). The growth was largely attributable to increased oil sands production. In 2011, estimated synthetic crude oil and non-upgraded bitumen production increased nine and 12 per cent respectively over 2010. Meanwhile, the estimated production of light crude oil increased by three per cent, largely because of gains in tight oil production in Western Canada[6]. Heavy crude oil production remained virtually unchanged in 2011. Oil production for Newfoundland and Labrador declined to 42 370 m^3/d (266 520 b/d) in 2011, reflecting the natural decline as fields age. Refer to Appendix 1 for estimates of Canadian Crude Oil and Bitumen Reserves.

- Interest in oil and gas exploration in the East Coast Offshore regions was renewed in 2011. The Nova Scotia government released a report[7] which supported a tripling of the province's estimate of offshore resource potential. Subsequently, Royal Dutch Shell plc bid $970 million to win rights for four leases offshore Nova Scotia. Also, a consortium led by Statoil Canada Ltd., successfully bid $348 million for rights in the Flemish Pass/North Central Ridge region of offshore Newfoundland and Labrador.

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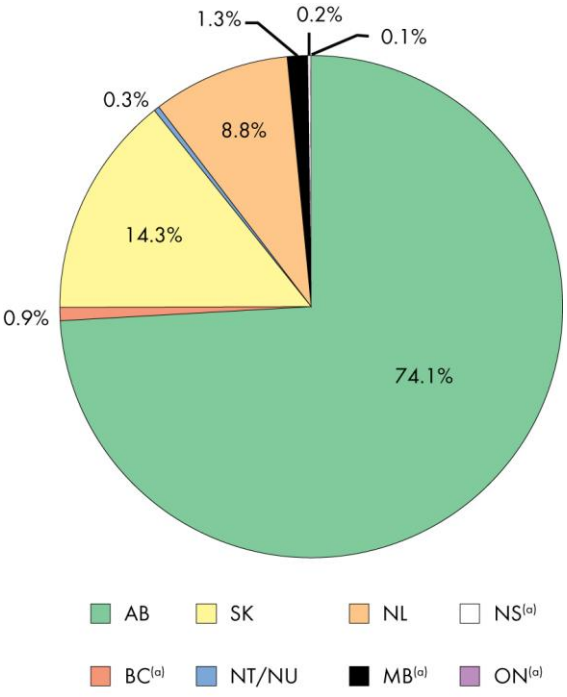
6 More detail on tight oil production in Western Canada can be found in the Board's Tight Oil Developments in the Western Canada Sedimentary Basin Energy Briefing Note.

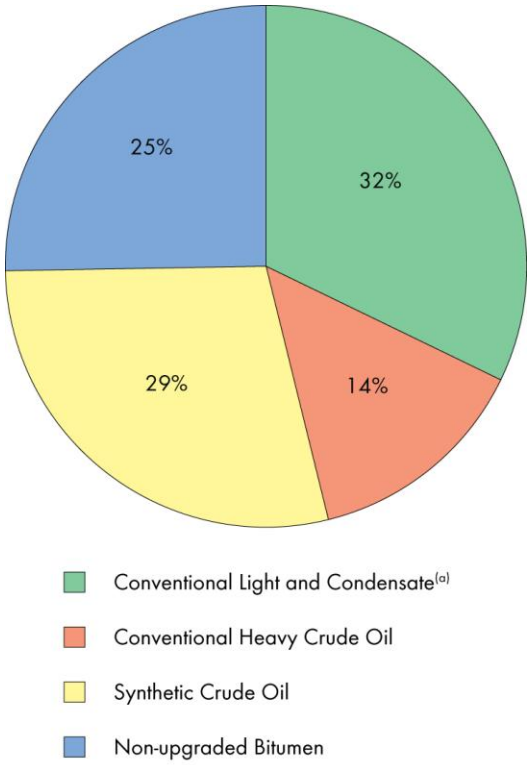
7 The Play Fairway Analysis project is available on the Nova Scotia Offshore website.

Figure 4
Crude Oil and Equivalent Production by Province, 2011



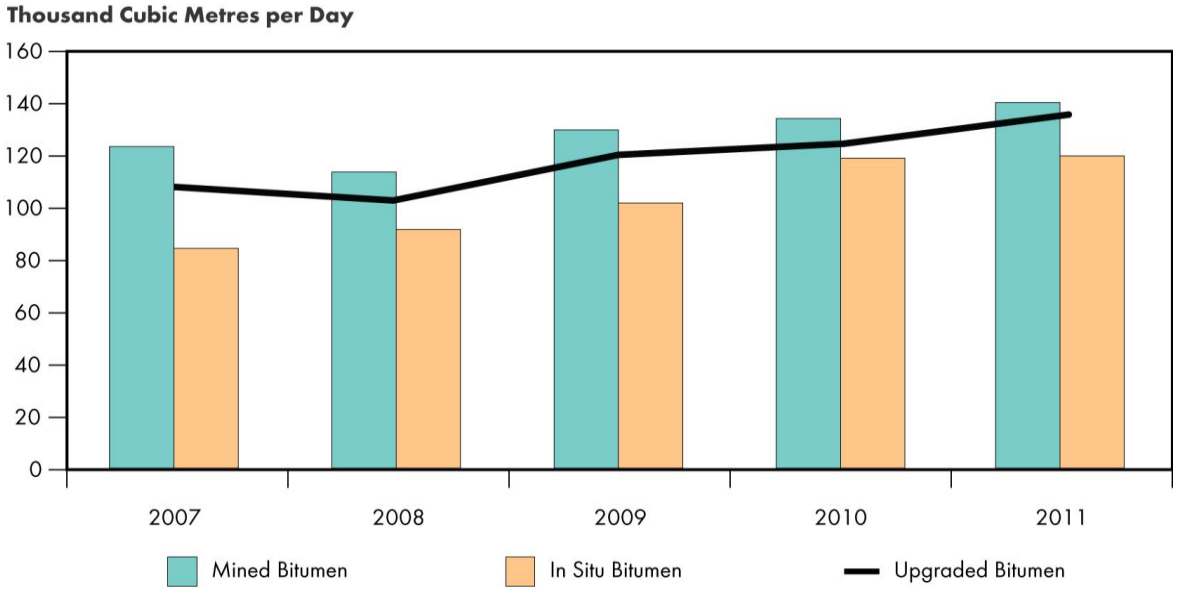
(a) Estimates
Sources: Governments of energy producing provinces, NEB

Figure 5
Crude Oil and Equivalent Production by Type, 2011



(a) Estimates
Sources: Governments of energy producing provinces, NEB

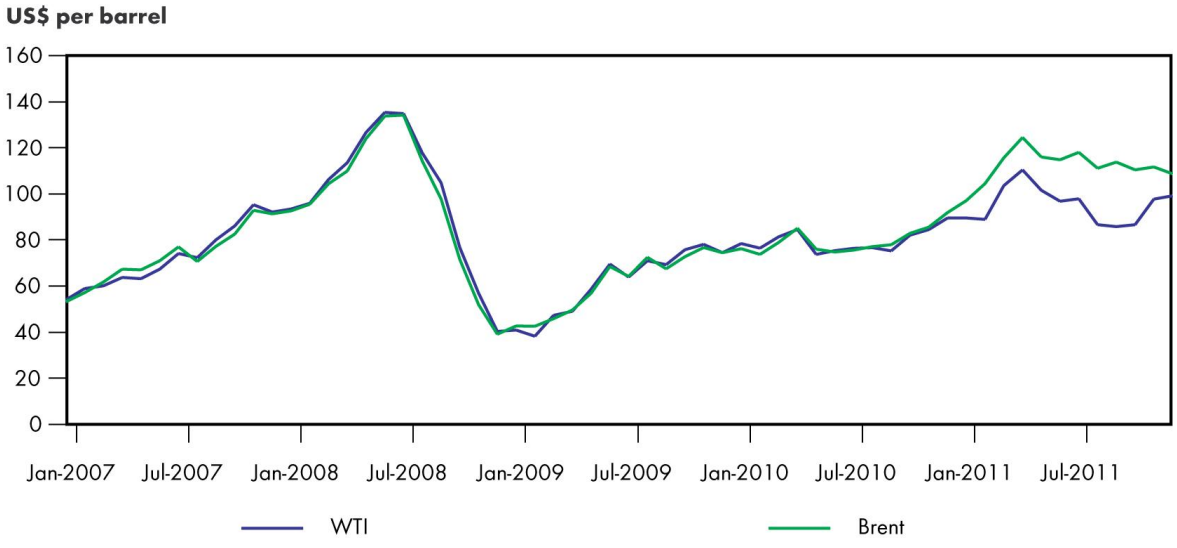
Figure 6
Crude Bitumen Production



Source: Energy Resources Conservation Board (ERCB)

- WTI oil prices continued to increase in 2011, averaging approximately US$95/bbl, a 20 per cent increase from 2010 (Figure 7). In Canada, light crude oil prices averaged $96/bbl (Edmonton Par) and heavy crude oil averaged $77/bbl (Western Canadian Select) in 2011. Throughout 2011 a lack of transportation capacity out of the U.S. Midwest depressed WTI prices relative to the average US$111/bbl Brent price.

Figure 7
WTI and North Sea Brent Oil Prices



Source: U.S. Energy Information Administration

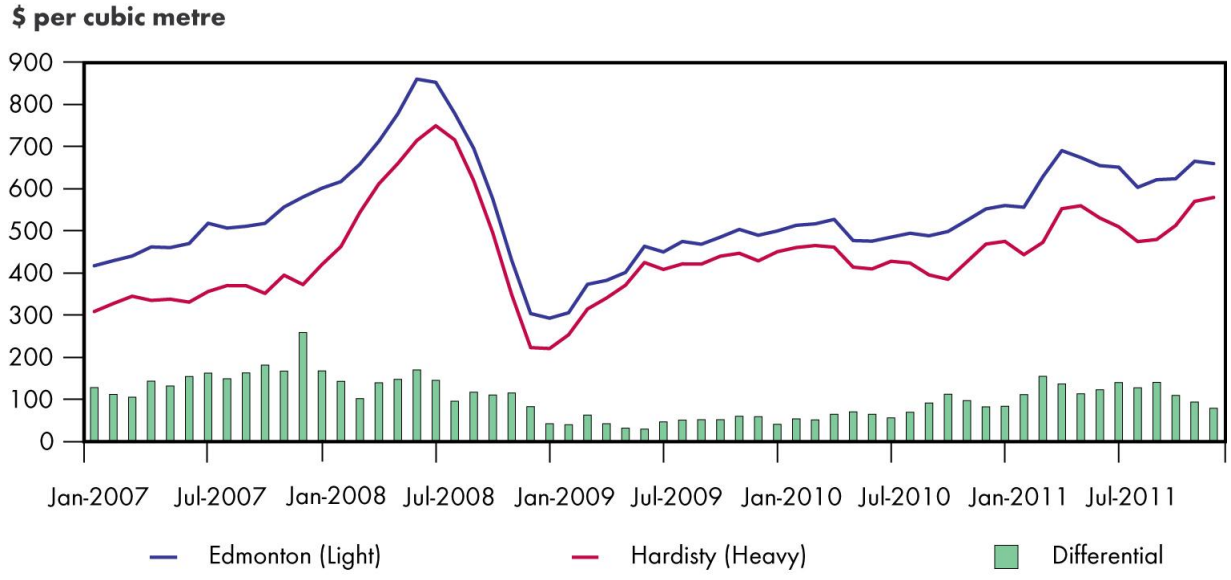
Table 4
World Oil and Canadian Product Prices

	2010	2011	Change	% Change
Gasoline (cents/litre)	103.6	124.0	20.4	20
Diesel (cents/litre)	100.8	124.7	23.9	24
Furnace oil (cents/litre)	90.3	113.0	22.8	25
WTI (US$/bbl, Cushing, OK)	$79.40	$94.90	$15.50	20
Edmonton Par ($/bbl)	$77.80	$95.60	$17.70	23

Sources: Natural Resources Canada, U.S. Energy Information Administration, NEB

- In 2011, export prices for light and heavy crude oil increased by about $20/bbl and $13/bbl from 2010 to average $99/bbl and $80/bbl, respectively. This is slightly higher than the average prices quoted above. The North American light/heavy differential widened in 2011 (Figure 8), in part due to pipeline bottlenecks upstream of the major U.S. refining markets.

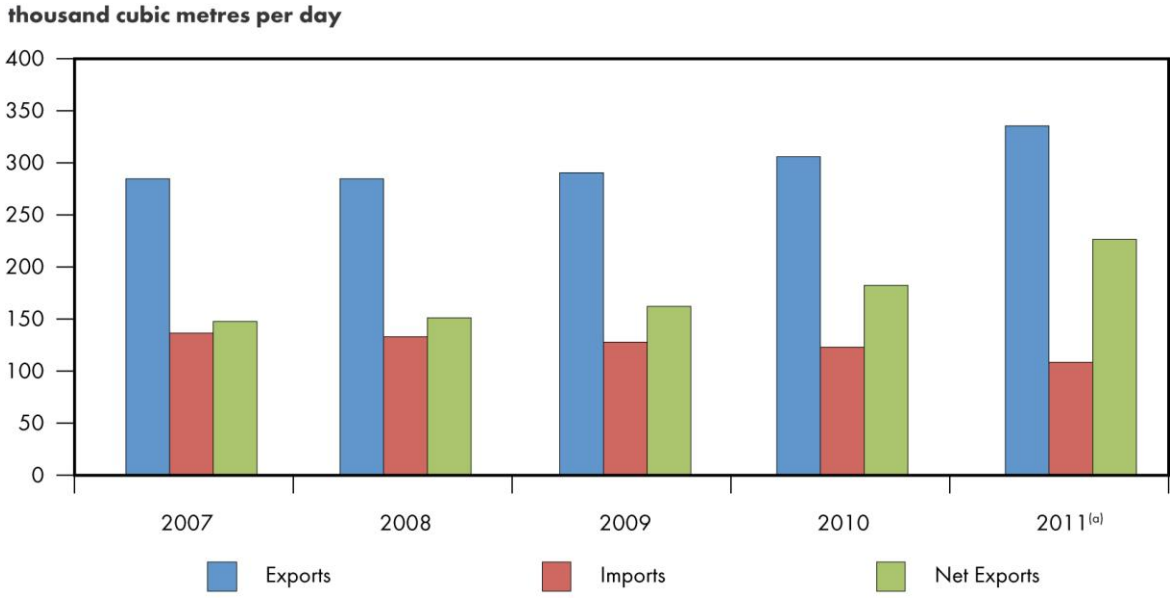
Figure 8
Light and Heavy Crude Oil Export Prices



Sources: NEB

- Crude oil exports averaged 340 301 m^3/d (2.14 MMb/d), an increase of 10 per cent compared to 2010. The estimated value of crude oil exports for 2011 was $66.8 billion compared to $50.4 billion in 2010. In 2011, crude oil imports were estimated to be 109 000 m^3/d (0.69 Mb/d), a decline of 12 per cent from 2010 (Figure 9).

Figure 9
Annual Crude Oil Exports and Imports



(a) Estimates
Sources: NEB, Statistics Canada

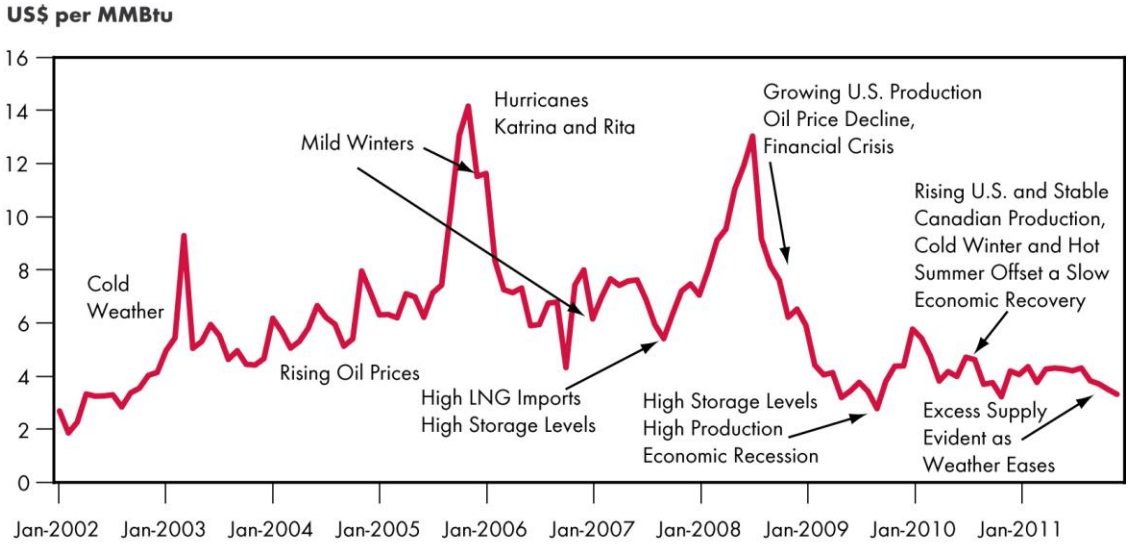
Natural Gas

- Throughout 2011, monthly spot natural gas prices at NIT[8] fluctuated between $3.80/GJ in January and a low of $2.81/GJ in December and averaged $3.43/GJ over the year. The monthly spot price at Henry Hub[9] in the U.S. ranged from US$3.17/MMBtu to US$4.54/MMBtu and averaged US$4.00/MMBtu in 2011, nine per cent lower than the 2010 average (Figure 10).

8 The Nova Inventory Transfer System (NIT) is the primary pricing point for gas in Western Canada.

9 Henry Hub is the biggest natural gas hub in North America, where the continent's benchmark natural gas price is established. It is the pricing point for natural gas futures contracts traded on the New York Mercantile Exchange (NYMEX). Henry Hub is located in the state of Louisiana at the interconnection of numerous intra and interstate natural gas pipelines.

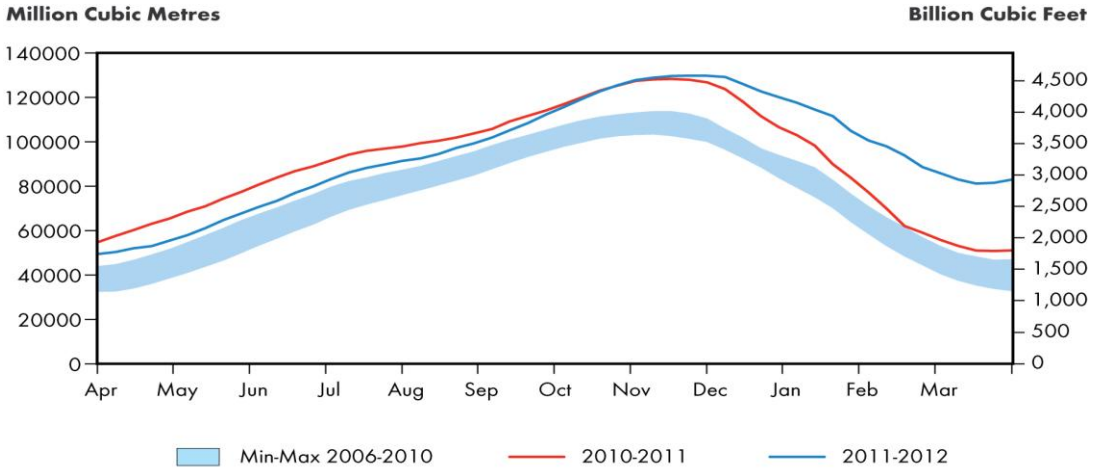
Figure 10
North American Natural Gas Prices – Henry Hub (3-day average price)



Source: GLJ Publications Inc.

- The price impact of rising U.S. supply was offset through mid-2011 by higher demand from a cold 2010-2011 winter and a hot summer. Milder weather in the remainder of the year lessened demand and the excess supply caused prices to decline. This excess supply also contributed to a 50 per cent increase in natural gas storage at the end of the 2011/2012 winter compared to the previous year (Figure 11).

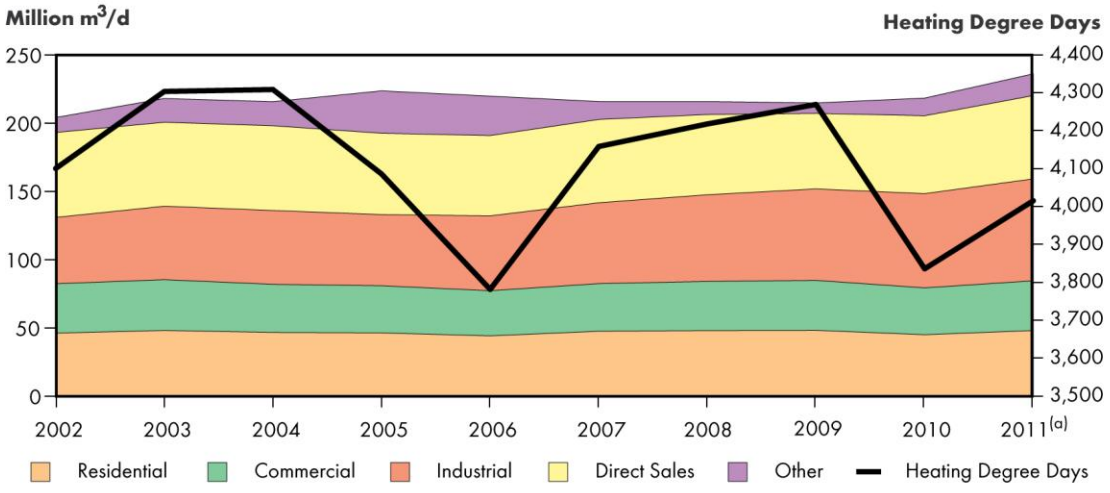
Figure 11
North American Natural Gas Storage Levels



Sources: Canadian Enerdata Ltd., NEB estimates, U.S. Energy Information Administration

- In 2011, Canadian natural gas consumption was estimated at 235 million m^3/d (8.3 Bcf/d), eight per cent higher than in 2010 (Figure 12).

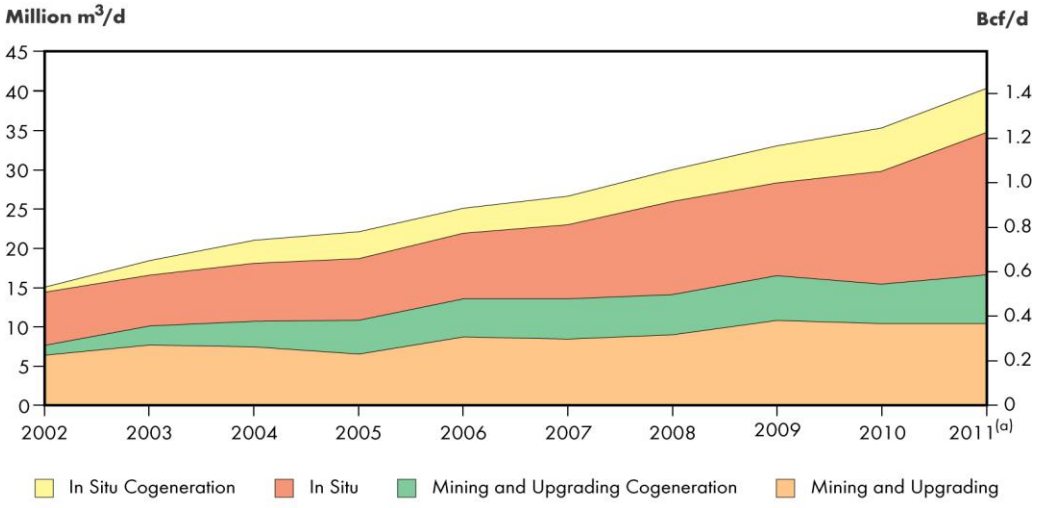
Figure 12
Canadian Natural Gas Consumption and Heating Degree Days



(a) Heating degree days (HDD) is an index calculated to reflect the demand for energy needed for heating homes, businesses, etc. HDD is the cumulative number of degrees in a year for which the mean temperature falls below 18.3 degrees C.
Sources: Statistics Canada, NEB estimates, Canadian Gas Association

- In oil sands operations in Alberta, natural gas is used to generate electricity and steam. Steam is used for in situ oil production and in the production of hydrogen to upgrade bitumen into synthetic crude oil blends. Gas consumption by the oil sands in 2011 was estimated to be 40.9 million m^3/d (1.4 Bcf/d), 14 per cent higher than in 2010, and approximately 10 per cent of total Canadian natural gas production (Figure 13).

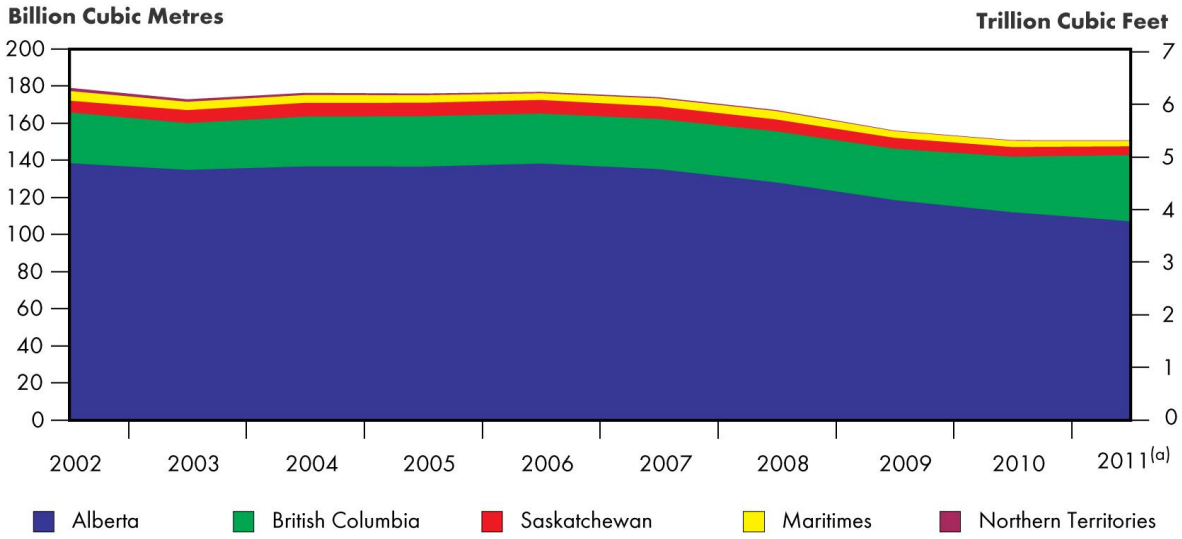
Figure 13
Average Annual Purchased Natural Gas Requirements for Oil Sands Operations



(a) Estimate
Sources: NEB and ERCB

- In 2011, natural gas production in Canada was estimated to be 151 billion m^3 (5.3 Tcf), down only a tenth of one per cent from 2010 (Figure 14). This is despite the relatively low number of gas wells drilled for the year (Figure 2), indicating the average new gas well has a higher initial production rate than in recent years, consistent with other analyses by the Board[10]. The estimated natural gas reserves of the wells drilled prior to 2011 are in Appendix 2.

Figure 14
Canadian Marketable Natural Gas Production

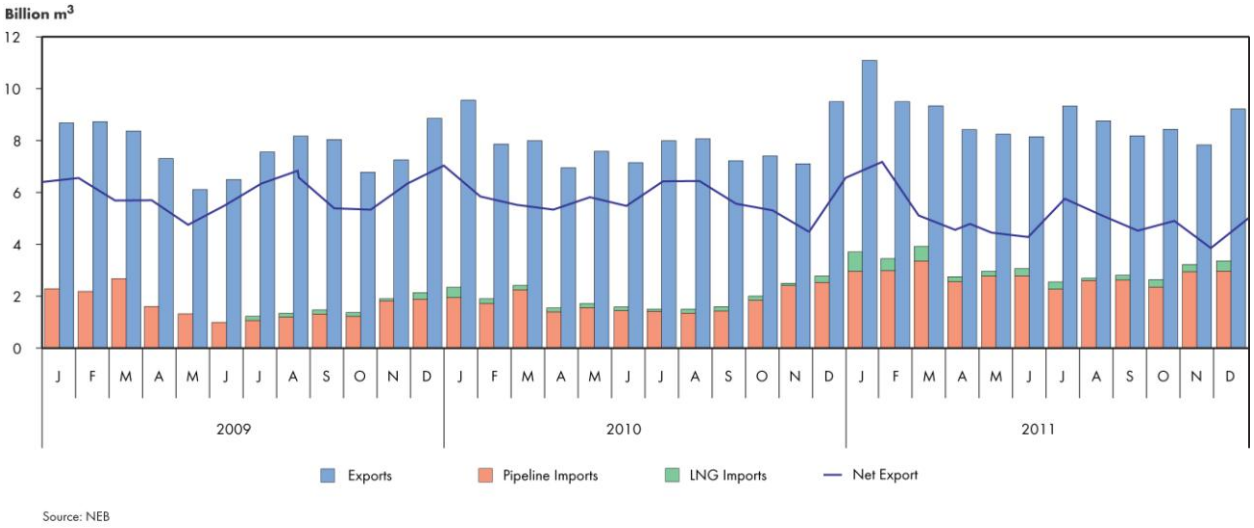


(a) Estimates
Sources: Governments of energy producing provinces and territories

- In 2011, natural gas exports were 248 million m^3/d (8.7 Bcf/d), about 1.6 per cent lower than in 2010. In combination with higher natural gas imports from the U.S., net natural gas exports in 2011 were 59.8 billion m^3 (2.11 Tcf) which was about 14 per cent lower than in 2010 (Figure 15). In 2011 export revenues were $13.1 billion, a decrease of about 13 per cent from 2010.

10 For further detail, refer to Figure A.2.1 in the appendix of the Board's Short-term Canadian Natural Gas Deliverability 2012-2014 Energy Market Assessment.

Figure 15
Monthly Canadian Natural Gas Exports and Imports



Source: NEB

Electricity

- Total electricity demand in Canada is estimated to have been marginally higher in 2011 compared to 2010 (Table 5). Electricity demand increased by about three per cent in the western provinces, while demand in some eastern provinces such as Ontario and New Brunswick declined.

Table 5
Electricity Supply and Disposition (TW.h)

Supply	2007	2008	2009	2010	2011 [(a)]	% Change (2010-2011)
Total Generation	616.8	618.7	595.5	589.0	608.0	3.2
Imports	19.8	23.8	18.6	20.2	16.0	-20.8
Total Supply	636.6	642.5	614.1	609.2	624.0	2.4
Disposition						
Demand	587.2	586.0	560.8	563.6	571.2	1.3
Exports	49.4	56.5	53.3	45.6	52.8	15.8
Total Disposition	636.6	642.5	614.1	609.2	624.0	2.4

(a) Estimates
Sources: 2007: Statistics Canada 57-202, NEB
2008 to 2011: CanWEA, Statistics Canada 127-0003, NEB

- In 2011, total Canadian electricity generation increased by 3.2 per cent from 2010 (Table 6). Thermal generation fell in 2011 because of Ontario's coal generation declining by two-thirds of its 2010 output. This was due to coal unit retirements and reduced need for output from the remaining coal units.

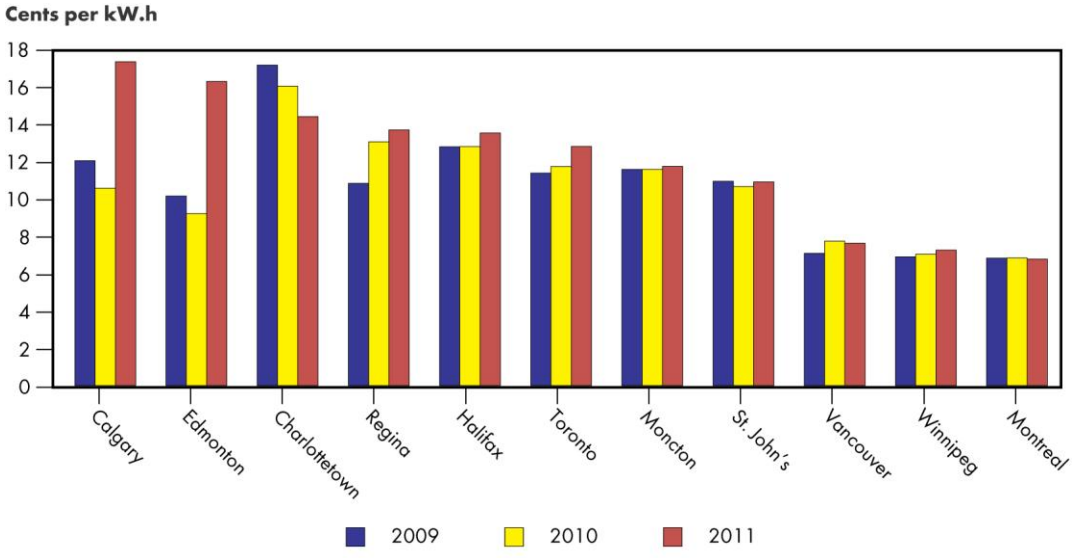
Table 6
Electricity Generation (TW.h)

	2007	2008	2009	2010	2011 (a)	% Change (2010-2011)
Hydroelectric	364.1	373.8	365.1	348.1	375.0	7.7
Nuclear	88.2	90.6	85.0	85.5	90.0	5.3
Thermal	161.5	150.5	136.9	142.8	129.0	-9.7
Wind, Tidal & Solar	3.0	3.8	6.6	9.6	10.3	7.3
Other	(b)	(b)	1.9	3.0	3.7	23.3
Total	616.8	618.7	595.5	589.0	608.0	3.2

(a) Estimates
(b) Suppressed to meet confidentiality requirements of the Statistics Act
Sources: 2007: Statistics Canada 57-202
2008 to 2011: CanWEA, Statistics Canada 127-0002

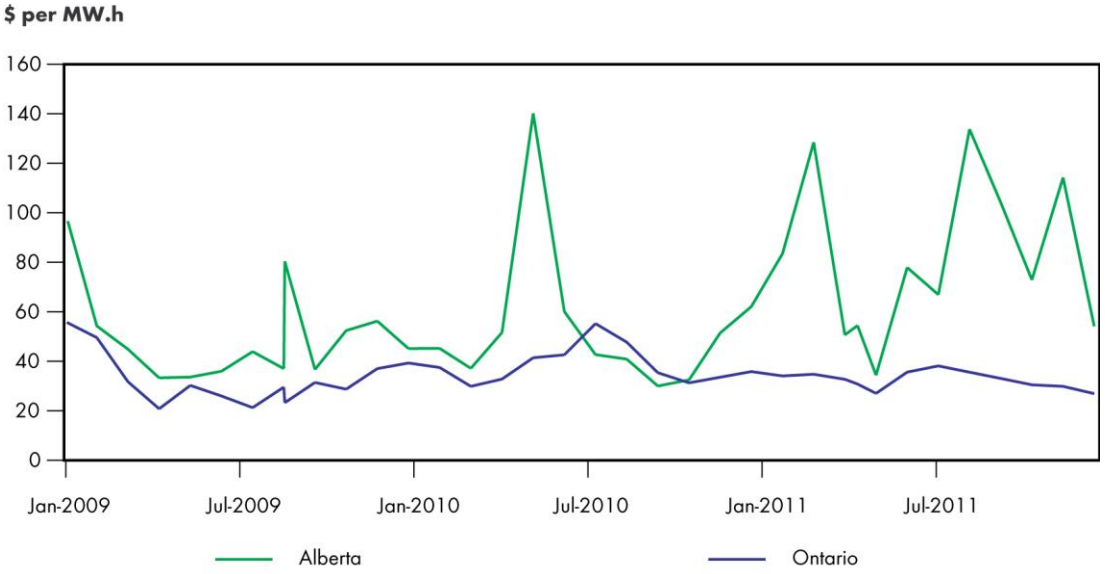
- Canadian provinces, with the exception of Alberta, had relatively stable end-use electricity prices in 2011 compared to recent years (Figure 16). Due to multiple generator outages and growing demand in 2011, Alberta's wholesale power market averaged $112/MW.h during the on-peak hours (or $80.54/MW.h as a weighted average of all hours) (Figure 17).

Figure 16
Canadian Residential Electricity Prices



Sources: Hydro-Québec, based on 1 April rates in 2009, 2010 and 2011 and a monthly consumption of 1000 kW.h

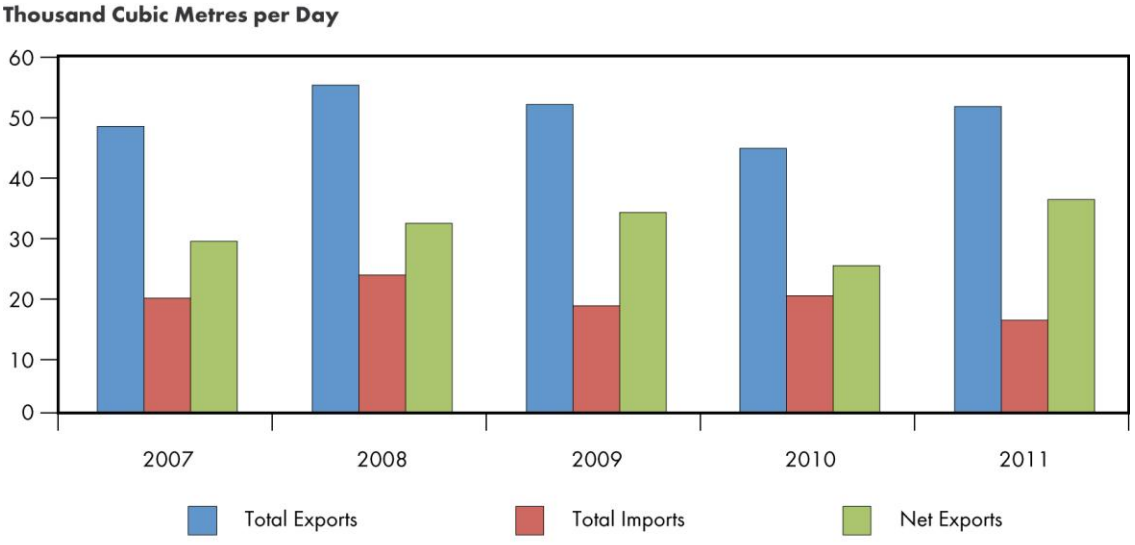
Figure 17
Weighted Average Wholesale Electricity Prices



Note: The Ontario weighted average wholesale electricity price does not include the "global adjustment" which balances the rates paid to the regulated and contracted generators with their portions of the rates determined in the wholesale market.
Sources: Alberta Electric System Operator, Independent Electric System Operator of Ontario

- Net exports in 2011 reached 36.8 TW.h, an increase of 45 per cent from 2010 (Figure 18). Due to high reservoir levels, jurisdictions such as Quebec and B.C. had significant increases in net exports compared to 2010.

Figure 18
Annual Electricity Exports and Imports



Sources: NEB

Appendices

Appendix 1
Estimates of Canadian Crude Oil and Bitumen Reserves at 31 December 2010
(million cubic metres)

	Crude Oil Reserves		
	Initial Reserves	**Cumulative Production**	**Remaining Established Reserves**
Conventional Crude Oil			
Light			
British Columbia	132	113	19
Alberta	2 450	2 278	172
Saskatchewan	275	254	21
Manitoba	53	45	8
Subtotal - WCSB	2 909	2 690	220
Ontario	15	13	2
Nova Scotia Offshore	7	7	0
Newfoundland Grand Banks	336	189	146
Mainland NWT & Yukon	53	42	11
Arctic Islands	1	1	0
Subtotal - Frontier	396	239	157
Subtotal - Light	3 320	2 942	378
Heavy			
Alberta	379	315	65
Saskatchewan	661	566	95
Subtotal - Heavy	1 041	881	160
Total - Conventional	4 361	3 822	538
Oil Sands			
Mining Projects	6 157	768	5 389
In Situ Projects	21 935	426	21 509
Total - Oil Sands	28 092	1 194	26 898

Sources:
1. Offshore Petroleum Board estimates of reserves for the East Coast offshore
2. NEB for estimates of reserves in the Mainland Territories and Arctic Islands
3. Alberta EUB Reserves Report and Supply & Demand Report 2011
4. Saskatchewan Reservoir Annual 2008
5. British Columbia Hydrocarbon and ByProducts Reserves 2010
6. Manitoba Designated Oil Pools
7. CAPP for Ontario

Appendix 2

Estimates of Canadian Natural Gas Reserves at 31 December 2010

(billion cubic metres)

	Natural Gas Reserves		
	Initial Reserves	**Cumulative Production**	**Remaining Established Reserves**
Western Canadian Sedimentary Basin			
British Columbia	1 199	634	565
Alberta	5 214	4 188	1 025
Saskatchewan	266	202	64
Total - WCSB	**6 678**	**5 024**	**1 654**
Ontario	54	35	19
Frontier			
New Brunswick	4	0	4
Nova Scotia Offshore	55	50	5
Mainland NWT & Yukon	32	19	13
Mackenzie Delta	0	0	0
Total - Frontier	**92**	**70**	**22**
Total Canada	**6 824**	**5 129**	**1 695**

Source: NEB

Note: Natural gas reserves are defined as the total amount of marketable gas in discovered pools that can be extracted in current economic conditions.