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Overview of the Canadian Energy Flow Account

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Overview

- How the Canadian Energy Flow Account is compiled
 - control totals and our account structure
 - data sources used (consumption per industry)
 - compilation method
 - how we fill the gaps when data is missing
 - quality control
 - challenges

Official Canadian consumption

Annual Report on Energy Supply and Demand (RES-D)

2008 revised	Total coal	Crude oil	Natural gas	Gas plant natural gas liquids (NGL's)
Terajoules (TJ)				
Supply and demand characteristics				
Production	1,490,152	5,916,116	6,660,798	627,143
Exports	802,072	4,153,944	3,940,791	205,573
Imports	398,549	1,919,985	596,887	9,073
Inter-regional transfers	..	..	..	..
Stock variation	-2,328	-4,488	-239,355	-8,602
Inter-product transfers	.	264,048	-79,569	..
Other adjustments	120,666	131,361	176,421	86,445
Availability	1,209,351	4,218,523	3,653,099	525,690
Stock change				
Transformed to other fuels				
Electricity by utilities	1,015,342	.	342,599	.
Electricity by industry	21	..	74,358	.
Coke and manufactured gases	124,510	.	.	.
Refined petroleum products	.	4,218,523	26,705	93,500
Steam generation	3	.	19,436	.
Net supply	74,371	..	3,189,985	491,269
Producer consumption	2,920	..	653,940	16,015
Non-energy use	9,954	.	144,925	344,566
Energy use, final demand	61,496	..	2,391,131	130,691
Total industrial	59,189	.	1,037,317	60,691
<u>Total mining and oil and gas extraction</u>	11,174	.	394,797	40,597
<u>Total manufacturing</u>	48,017	.	623,902	17,001
Pulp and paper manufacturing	x	.	55,221	.
Iron and steel manufacturing	x	.	59,192	.
Aluminum and non-ferrous metal manufacturing	x	.	26,671	.
Cement manufacturing	x	.	2,200	.
Refined petroleum products manufacturing	.	.	55,335	.
Chemicals and fertilizers manufacturing	x	.	121,648	.
All other manufacturing	x	.	303,635	x
<u>Forestry and logging and support activities for forestry</u>	.	.	..	.
<u>Construction</u>	.	.	18,602	3,093
<u>Total transportation</u>	.	.	148,843	12,812
Railways	.	.	.	.
Total airlines	.	.	.	.
Canadian airlines	.	.	.	.
Foreign airlines	.	.	.	.
Total marine	.	.	.	.
Domestic marine	.	.	.	.

Energy balance table covers:

- more than 20 fuels
 - refined petroleum products and electricity types are detailed
- more than 40 supply-demand
 - production, trade and inter-regional transfers are listed.
 - energy use consumption by sector is shown.
 - fuel conversion, producer consumption and non-energy use are isolated.

Net availability is our control total

TJ available for consumption =
“Availability – Stock change”

Canadian Energy Flow Account - energy use and non-energy use tables

Fuel types (11) →

Industries (300) +
household (2)



		CC0370	CC0380	CC0390	CC3950	CC3961	CC3962	CC3963	CC3964	CC3990	CC5460	CC5480
		Coal	Crude oil	Natural Gas	Motor Gas	Aviation	Diesel	Light Fuel Oil	Heavy Fuel Oil	Liquid Petroleum Gas	Electricity	Coke
111400	Greenhouse, Nursery and Floriculture Production											
111A00	(except Greenhouse, Nursery and Floriculture Production)											
112500	Animal Aquaculture											
112A00	Animal Production (except Animal Aquaculture)											
113000	Forestry and Logging											
114000	Fishing, Hunting and Trapping											
115100	Support Activities for Crop Production											
115200	Support Activities for Animal Production											
115300	Support Activities for Forestry											
211100	Oil and Gas Extraction											
212100	Coal Mining											
212210	Iron Ore Mining											
212220	Gold and Silver Ore Mining											
212230	Copper, Nickel, Lead and Zinc Ore Mining											
212290	Other Metal Ore Mining											
212310	Stone Mining and Quarrying											
212320	Other Mineral Mining and Quarrying											
212392	Diamond Mining											
212393	Salt Mining											
212394	Asbestos Mining											
212396	Potash Mining											
21239A	Other Non-Metallic Mineral Mining and Quarrying											
213100	Activities for Mining and Oil and Gas Extraction											
221100	Electric Power Generation, Transmission and Distribution											
221200	Natural Gas Distribution											
221300	Water, Sewage and Other Systems											

- share same classifications as IO accounts.
- detail 11 commodities (fuel types).
- compiled at the most detailed industry level.
- focus on energy consumption and not supply.
- allow linkage between energy flow and economic accounts.

Discrepancies between our starting point and our final output

- Energy Supply & Demand table does not give enough industry detail.

Energy supply & demand	Energy flow account
Total mining and oil and gas extraction	14 industries

- Non-energy, producer consumption and energy conversion amounts are not reported in the industries where it happened.
- Fuels are not reported at the same level of detail.

Energy supply & demand		Energy flow account
Petroleum Coke	Coke	Coke

Energy Account data sources

Manufacturing sector

Industrial consumption of energy survey

- terajoules (TJ) unit and NAICS classification
- non-energy and energy consumption
- coal, natural gas, electricity, HFO, LPG and coke

Petroleum report (provincial \$/litre) and provincial IO expenditure

- derive number of litres bought and transform it into TJ
- diesel, motor gasoline and light fuel oil

~ 20% of total energy consumption

Energy Account data sources

Mining sector

Annual Census of mines

- conducted by Natural Resources Canada
- census of all mines for various fuel use (except coal)
- physical units and SIC classification

~ 2% of total energy consumption

Energy Account data sources

Various sectors

Report on Energy Demand and Supply

- TJ units, aggregated demand categories (no NAICS, SIC or IO structure), and energy and non-energy use.
- amounts are moved into their appropriate industries (non-energy, producer consumption and conversion)

Electric Power Thermal Generating Station Fuel Consumption Survey

- Own production of electricity

~ 40% of total energy consumption

Energy Account data sources

Transportation sector

Annual Air Carrier, Trucking, Passenger Bus and Urban Transit, and Rail surveys

- physical units and NAICS classification

~ 13% of total energy consumption

Compilation method

- Obtain a consumption value in TJ, per IO industry, per fuel.
 - Involves conversion of physical units into terajoules
 - Involves preparation of concordance files
 - Some reported data match 1:1 IO industry
 - Some match many:1 (many source data sum into 1 IO industry)
 - Some match 1:many (1 source data is split amongst many IO industries)
 - Expenditure dollars from Input-Output are used in these cases. TJ amount is shared between the industries based on their purchase ratio.

Filling the gaps when there is no survey data - example

- After integrating all source data

		CC0370	CC0380	CC0390
		Coal	Crude oil	Natural gas
111400	Greenhouse, Nursery and Floriculture Production	25		
111A00	Crop Production (except Greenhouse, Nursery and Floriculture Production)	6	35	
112500	Animal Aquaculture	12.3		
112A00	Animal Production (except Animal Aquaculture)			
113000	Forestry and Logging		25	

- Benchmark to our control totals

Net Availability	100	82	132
Residual use (Net_avail - surveyed)	69	10	132
Total \$ IO expenditure of blank industries	1000	150	3000
Total \$ IO expenditure of 112500	178	0	50
ratio of 112500	0.18	0	0.01667
Amount gave to industry 112500	12.3	0	2.2

Release format of the Energy Flow Account

Total energy, 1990 - 2008

Industries (117) +
household (2)

Sector	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total, all sectors	10,242,348	10,091,416	10,266,979	10,557,868	10,498,742	10,470,903	10,226,701	10,840,945	10,612,484
Business sector	7,638,001	7,513,910	7,552,989	7,764,124	7,658,424	7,632,322	7,442,237	7,851,631	7,649,385
Crop and animal production	189,336	196,453	185,421	185,335	177,363	169,023	162,585	177,368	174,849
Forestry and logging	62,207	32,609	37,162	42,756	41,144	44,839	38,362	31,051	30,369
Fishing, hunting and trapping	19,911	16,181	15,765	16,652	16,950	13,492	11,351	11,196	11,118
Support activities for agriculture and forestry	11,804	10,766	11,748	13,211	13,468	15,955	14,049	15,295	15,837
Oil and gas extraction	1,001,287	960,445	1,058,644	1,137,990	1,074,476	1,112,942	1,052,099	1,104,403	1,096,012
Coal mining	16,733	20,257	17,077	18,165	17,916	14,919	12,498	14,162	17,921
Metal ore mining	76,393	76,296	76,469	77,997	70,269	74,533	74,584	70,172	82,056
Non-metallic mineral mining and quarrying	54,006	51,055	48,888	55,860	55,270	53,045	58,387	58,604	58,858
Support activities for mining and oil and gas extraction	41,867	47,940	44,423	52,426	54,195	61,830	68,896	63,791	61,170
Electric power generation, transmission and distribution	1,729,000	1,745,122	1,665,133	1,733,336	1,611,069	1,623,420	1,515,911	1,666,580	1,657,178
Natural gas distribution, water and other systems	21,013	17,197	19,624	18,778	18,404	18,413	16,983	21,048	21,446
Residential building construction	17,829	19,120	21,853	23,899	28,015	29,672	27,935	30,567	30,256

Quality control

- % changes in energy use, per industry, per fuel.
- Implicit price (\$ paid/TJ) and intensity (TJ/\$ output), per industry, per fuel.
- GHG account output
 - Small changes in energy consumption may reflect in high changes in GHG emissions.
- Bridge tables
 - to explain visually how we go from the total energy consumed to the energy flow account.

Quality control – bridge table

MEFA fuel #11 - Coke, 2006p (TJ)	RESD fuel types		MEFA fuel type	Impact of other data sources							Re-allocation of activities			Accounting adjustments				Benchmark	Final MEFA Energy Use Account
	Coke	Petroleum coke	Coke	ICE (fuel use)	ICE (non-fuel use)	Pet Report and I/O Prov	Thermal Plants Survey	Census of Mines	Transportation Surveys	Input-Output expenditure allocation	Net adjustment due to other data sources	Energy transformation	Producer consumption	Transportation	Foreign use of fuels	Stock change	Other adjustments			Total final adjustment
Production	92,239	115,215	207,454																
Exports	2,836	3,925	6,761																
Imports	2,879	89,172	92,051																
Inter-regional transfers	.	0	0																
Stock variation	0	-60	-60																
Inter-product transfers	.	-646	-646																
Other adjustments	10,737	9,277	20,014																
Availability	103,018	209,153	312,172		-62,241					-13					26,925			-35,329	276,843
Stock change	-1,317	-25,608	-26,925																
Transformed to electricity by utilities	.	36,648	36,648																36,648
Transformed to electricity by industry	0	2,180	2,180							-2,180	-2,180							-2,180	
Transformed to coke and manufactured gases	.	.	0																
Transformed to refined petroleum products	.	.	0																
Transformed to steam generation	.	.	0																
Net supply	104,335	195,933	300,268																
Producer consumption	.	103,526	103,526	-57,154							-57,154	-46,372						-103,526	
Non-energy use	464	61,777	62,241		-62,241						-62,241							-62,241	
Energy use, final demand	103,871	30,628	134,498																
Total industrial	103,871	30,628	134,498																
Total mining and oil and gas extraction	3,591	854	4,445									46,372						46,372	50,817
Total manufacturing	100,280	29,774	130,053	57,138						2,123	59,261							59,261	189,314
Pulp and paper manufacturing	x	.	0																
..... (hidden - no data)																			
Chemicals and fertilizers manufacturing	x	x	0																
All other manufacturing	x	4,922	0																
Forestry and logging and support activities	.	.	0																
Construction	.	.	0																
..... (hidden - no data)																			
Residential	.	.	0																
Public administration	.	.	0																
Commercial and other institutional	.	0	0																
Statistical difference	.	3	3	17						43	60							63	63
Balanced totals																		276,842	276,842

Notes:

1 - Because of confidentiality, the **Non-energy use** detail (62,241 TJ) was removed from the **Availability** as too many cells would have been suppressed.

Challenges

- Integration of data from many sources/providers
 - Concepts and definitions may be different: be careful of double counting.
 - Some data includes foreign purchases of domestic fuel.
 - Some data includes producer consumption, some does not.
 - Source data are not all collected using the same classification systems.
 - Input data are not always in a dataset format.
- Need to find new data sources
 - Improve household and services sectors (less surveyed).
 - Help for decision making when two sources give us different pictures.

Questions?

Thank you

For further information:

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