SEEA Extensions and applications

Perspectives on environmental input-output modelling

Joe St. Lawrence

October 3rd, 2012

Overview

- Material flows from a demand perspective

- Footprints

- Aggregation effects

- Multi-regional models

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Table 1
Sources of industrial greenhouse gas emissions from the demand perspective, 1990 and 2002

Final demand category	1990	2002[p]	Percentage change 1990 to 2002	Share of total 1990	Share of total 2002[p]
	kilotonnes		percent		
Internal demand	308,276	309,485	0.4	63.6	53.9
Personal expenditure	196,193	209,787	6.9	40.5	36.6
Construction	43,853	42,490	-3.1	9.0	7.4
Machinery and equipment	11,005	10,505	-4.5	2.3	1.8
Government	42,710	41,641	-2.5	8.8	7.3
Inventories	14,515	5,062	-65.1	3.0	0.9
External demand					
Exports	176,363	264,358	49.9	36.4	46.1
Total domestic industrial emissions	**484,640**	**573,843**	**18.4**	**100.0**	**100.0**

Source: Statistics Canada, Environment Accounts and Statistics Division.

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Industrial emissions by final demand category

Legend: Personal Expenditure — Machinery & Equipment — Construction — Inventory — Government — Exports
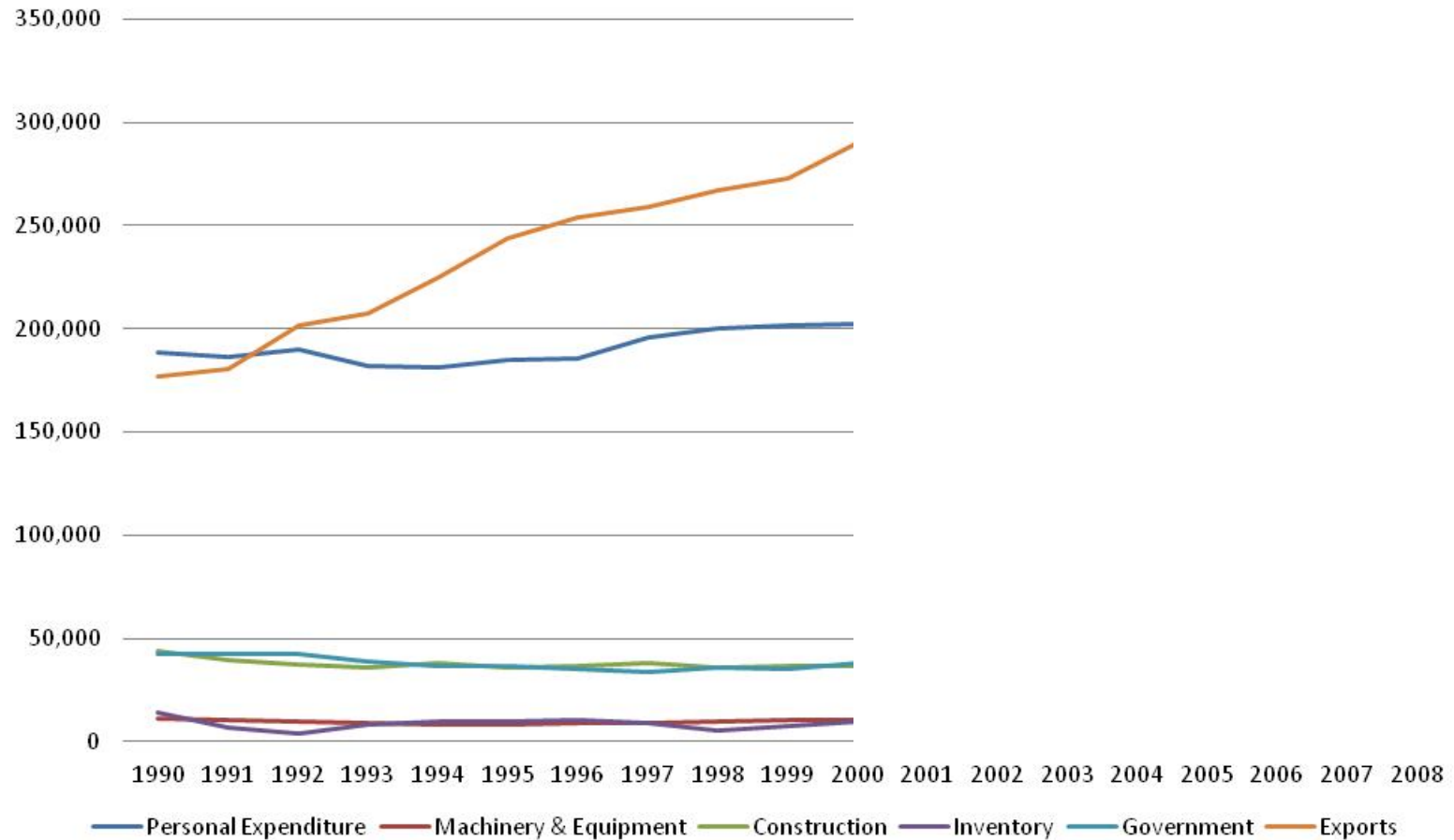
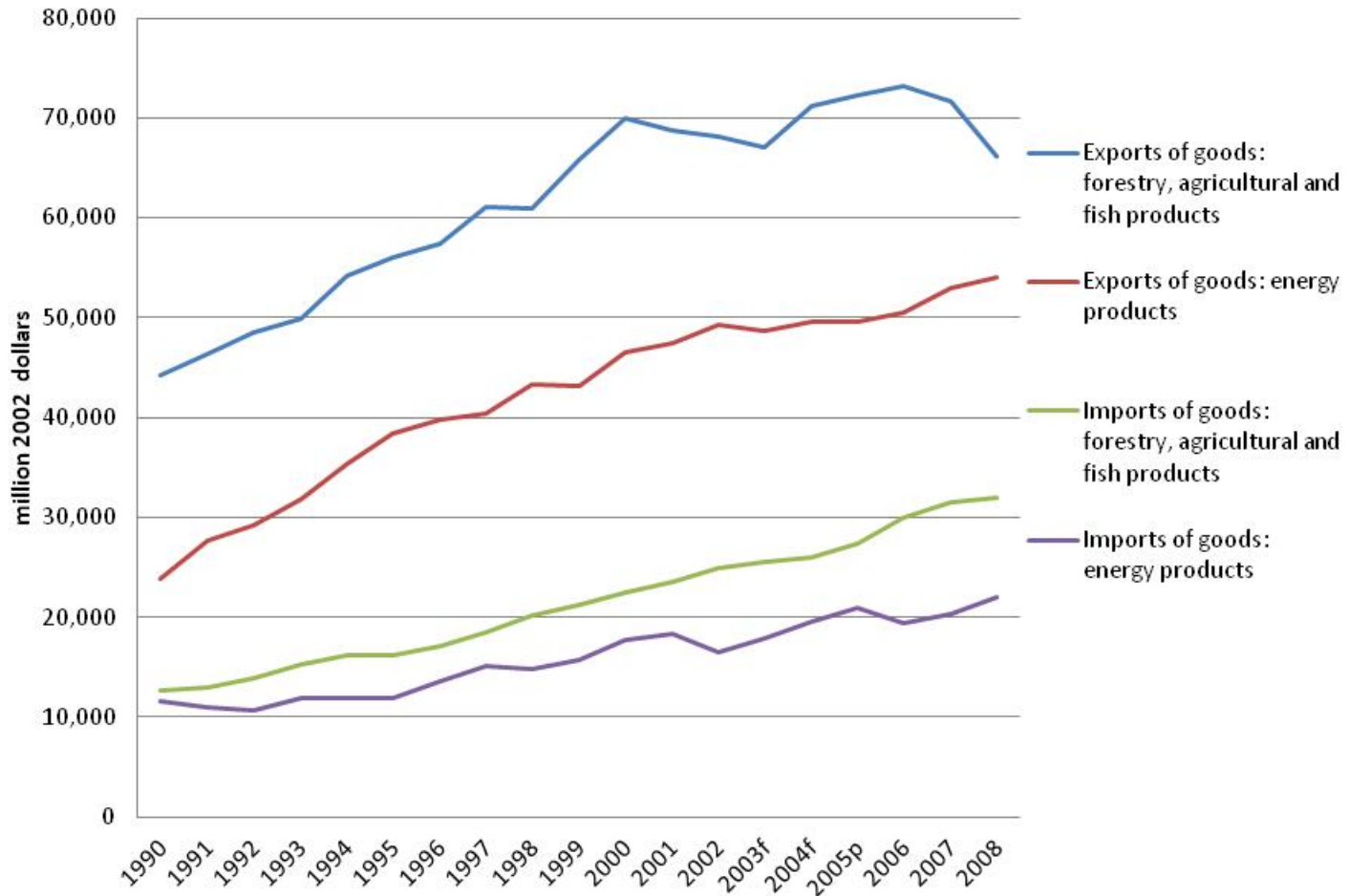Statistics Canada • Statistique Canada

Table 2
Domestic industrial greenhouse gas emissions associated with the production of exports, 1990 and 2002

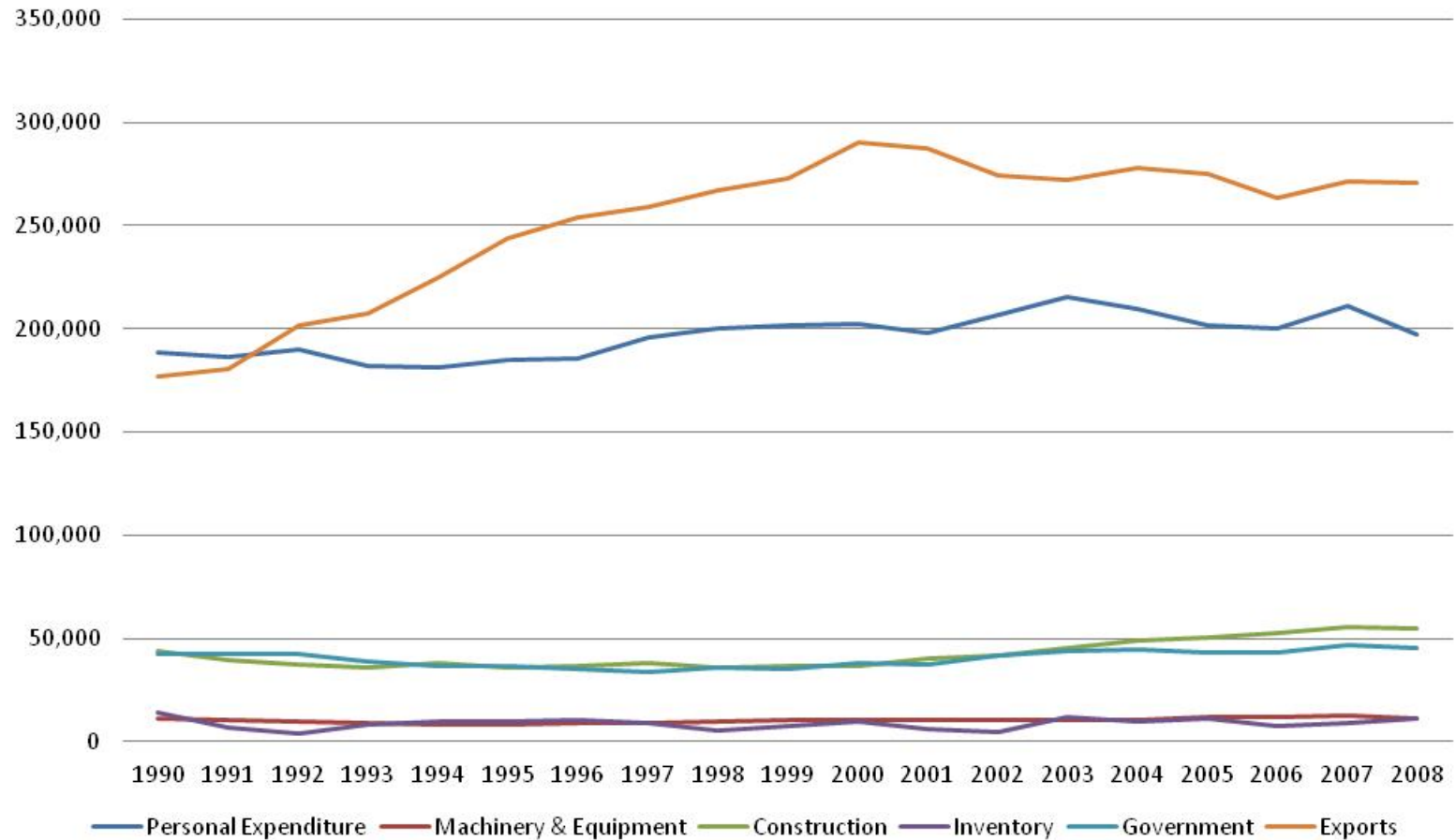|	1990	2002[p]	Share of total 1990	Share of total 2002[p]
	kilotonnes		percent	
Agricultural, forestry, fishing and trapping products	20,357	23,212	11.5	8.8
Mineral fuels	26,419	61,953	15.0	23.4
Non-metallic minerals, metal ores and concentrates	6,799	5,722	3.9	2.2
Services incidental to mining	0	98	0.0	0.0
Food products	7,289	16,038	4.1	6.1
Beverages and tobacco products	787	401	0.4	0.2
Leather, rubber and plastic products	1,382	2,534	0.8	1.0
Textile products, hosiery, clothing and accessories	2,072	2,045	1.2	0.8
Lumber, wood products, furniture and fixtures	4,234	8,253	2.4	3.1
Pulp and paper products	19,603	18,986	11.1	7.2
Printing and publishing	197	571	0.1	0.2
Primary metal and other metal products	16,737	20,992	9.5	7.9
Machinery and equipment	2,278	4,134	1.3	1.6
Motor vehicle, other transport equipment and parts	10,852	15,352	6.2	5.8
Electrical, electronic and communication products	1,665	2,994	0.9	1.1
Non-metallic mineral products	1,870	3,685	1.1	1.4
Petroleum and coal products	10,241	12,836	5.8	4.9
Chemicals, pharmaceuticals and chemical products	12,876	17,159	7.3	6.5
Other manufactured products	1,378	1,561	0.8	0.6
Transportation and storage	10,067	15,901	5.7	6.0
Communications services	303	411	0.2	0.2
Other utilities	2,577	7,150	1.5	2.7
Wholesaling, retailing margins and transportation margins	11,906	15,362	6.8	5.8
Other finance, insurance and real estate services	896	1,808	0.5	0.7
Business and computer services	737	3,549	0.4	1.3
Private education services	83	175	0.0	0.1
Health and social services	12	13	0.0	0.0
Accommodation services and meals	1,933	116	1.1	0.0
Other services	780	1,220	0.4	0.5
Sales of other government services	33	125	0.0	0.0
Total	176,363	264,358	100.0	100.0

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Value of emissions intensive exports and imports

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Industrial emissions by final demand category

Legend: Personal Expenditure · Machinery & Equipment · Construction · Inventory · Government · Exports

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Emissions per household

Chart: tonnes CO2 equivalent per household by income quantile

Legend:
- 1991
- 2002
- 2002 w 91 pattern

Y-axis: tonnes CO_2 equivalent (0 to 60)

X-axis categories: 1st quantile, 2nd quantile, 3rd quantile, 4th quantile, 5th quantile, All

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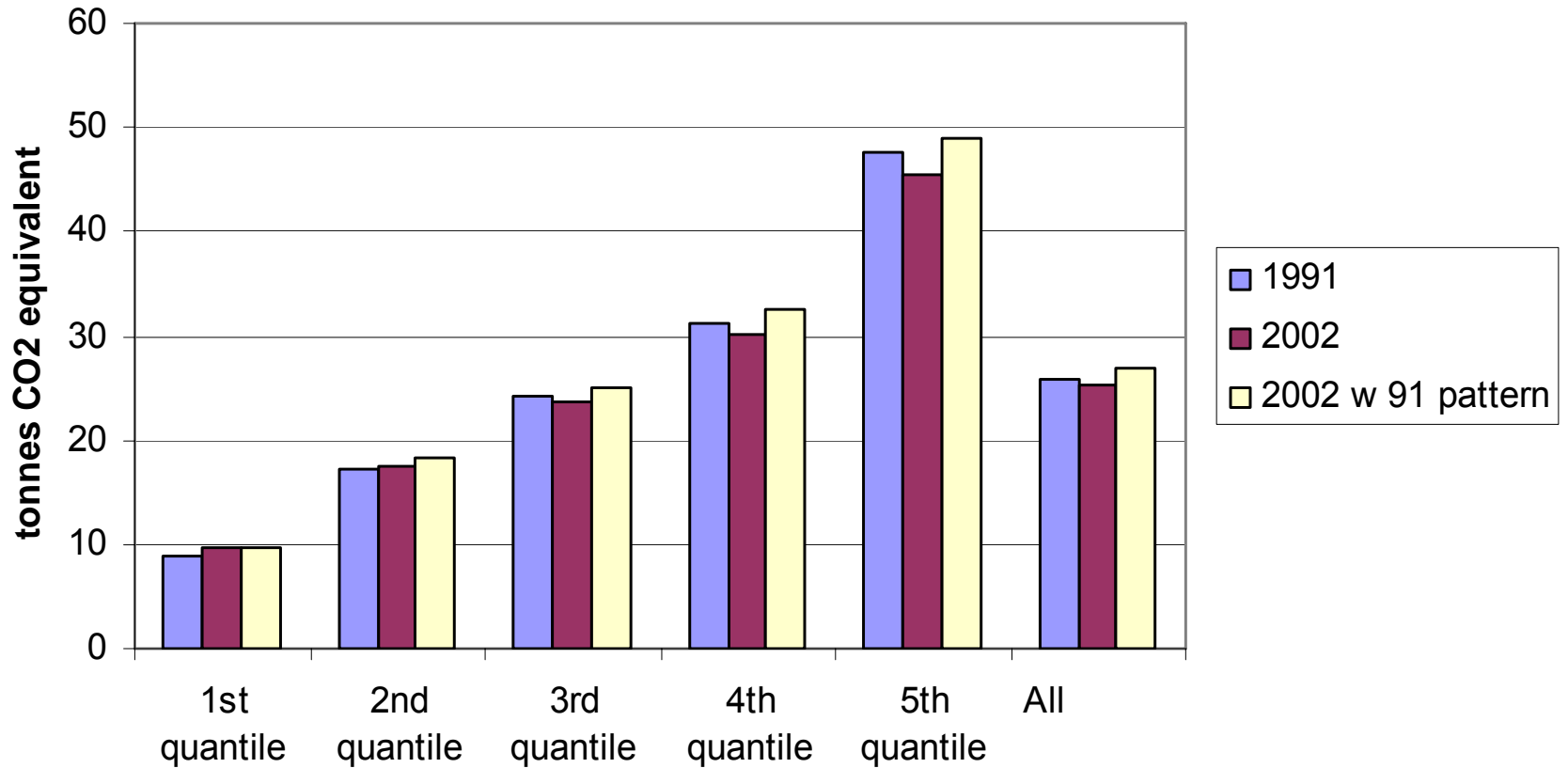
Emissions per million dollars

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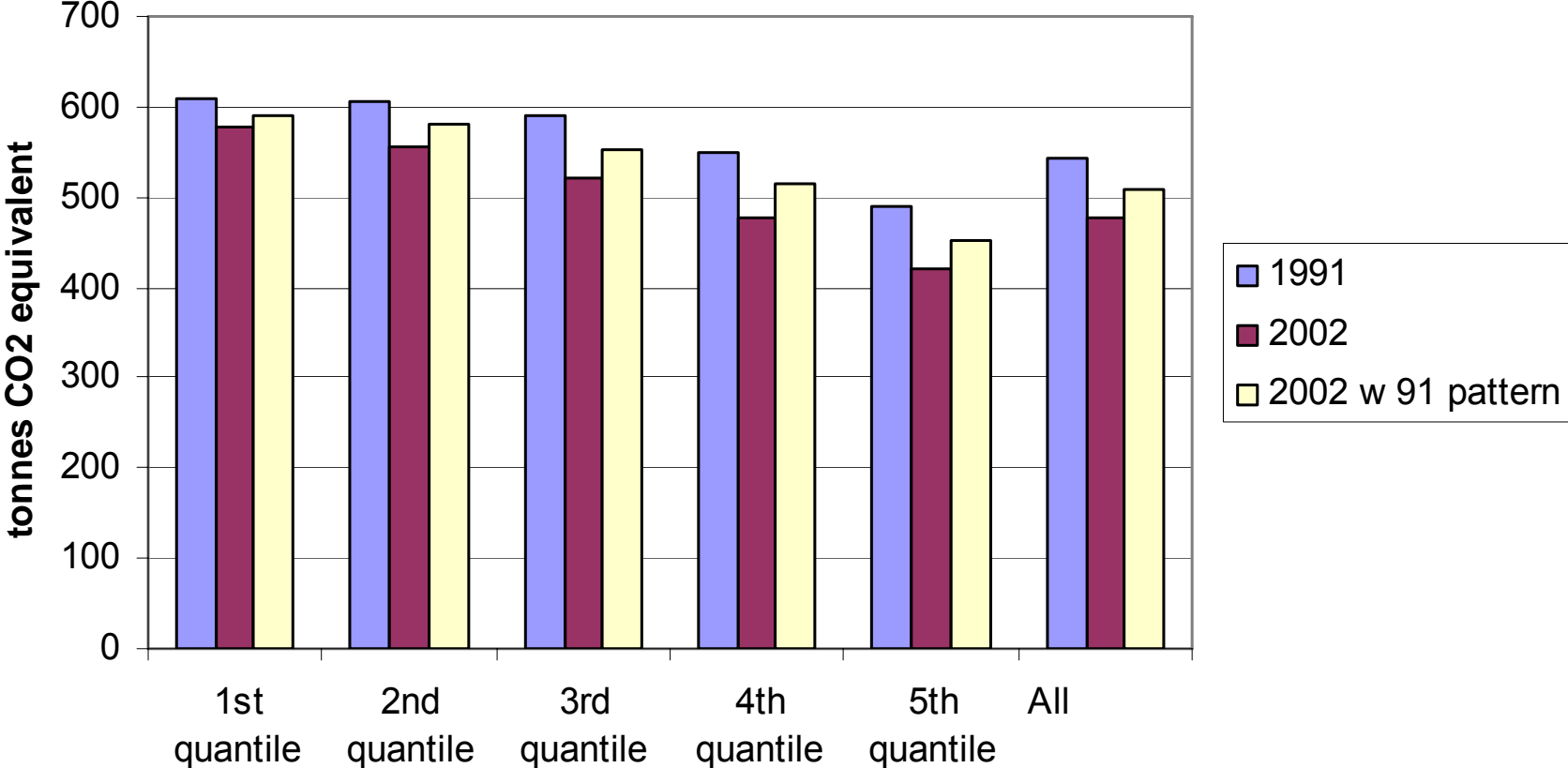
Economic and environmental measures of selected tourism industries, Canada 2002

	Economic measures of tourism		Environmental measures of tourism	
	CTSA tourism GVA[1]	Tourism[2] shares of industries	Energy Use[3]	GHG emissions[4]
	($ millions)	(%)	(terajoules)	(Kt of CO_2-e)
Industry	(1)	(2)	(3)	(4)
Air transportation	3,088	78.7%	151,572	10,595
Food and beverage services	2,898	17.3%	7,019	210

Tourism and non-tourism GHG emissions for air transportation and food and beverage services, CTSA - MEFA 2002 linkage

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A demand perspective on greenhouse gas emissions
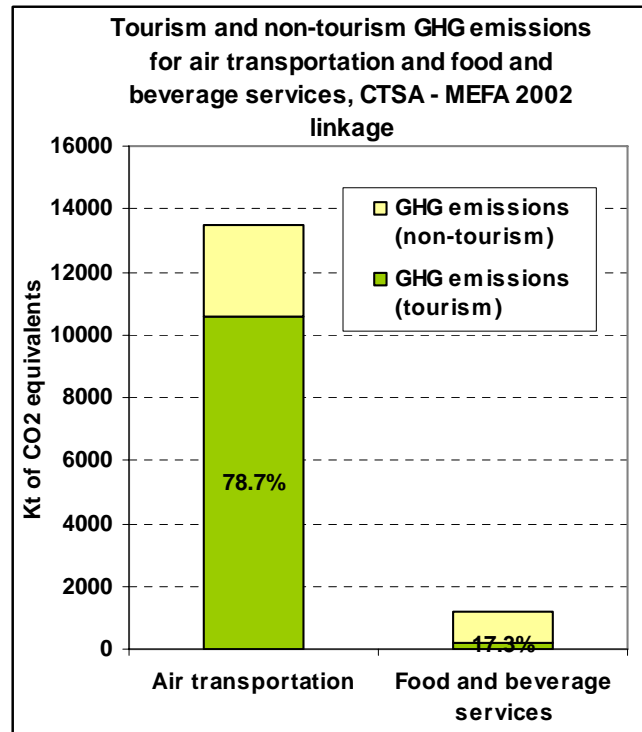
A demand perspective on greenhouse gas emissions

Joe St. Lawrence, Environment Accounts and Statistics Division

It is a well-reported fact that Canadian greenhouse gas emissions have risen substantially over the last fifteen years. To be specific, emissions increased 25% between 1990 and 2005 to 747 Mt,[1] a level 33% higher than the nation's Kyoto target.[2]

Typically, emissions are reported from this "supply" perspective, showing how much pollutant is produced and by whom. While this is the demand for perspective is important, it is the demand for products and services that drives greenhouse gas emissions. The famous economist Adam Smith once wrote that "consumption is the sole end and purpose of all production," meaning that there would be no economic production or associated pollution, without a demand for products and services.

When demand for a good or service is sufficient, industry will meet the need. Greenhouse gas emissions are an unfortunate by-product of the associated production. This article considers the main drivers of greenhouse gas emissions during the period 1990 to 2002 from this demand perspective.

What is behind the increase in greenhouse gases from a demand perspective?

Canada is heavily integrated into the international economy and runs trade surpluses. As a result, we produce more greenhouse gases than we need to satisfy our demand for Canadian-made goods and services.

In fact, the greenhouse gas emissions created to satisfy internal demand for domestic goods and services accounted for 54% of the 574 Mt of greenhouse gases produced by industry in 2002 (Table 1). In other words, exports accounted for 46% of the industrial emissions of greenhouse gases.

Background to the methodology and sources

The results of this study are derived from an output model that combines physical and greenhouse gas emissions by industry with the production and consumption of goods and services estimation of greenhouse gas emissions from the production of each good and service in the economy. It considers both emissions produced directly with the industry as well emissions that are latter emissions can "embedded" emissions.

Canada is a signatory to the Framework Convention on Climate Change and is therefore required to prepare an annual inventory of its greenhouse gas emissions. Environment Canada is responsible to prepare the national inventory. This inventory is part of Canada's ratification of the Kyoto Protocol in December of 2002. Canada's greenhouse gas emissions for 1990 are used as a baseline. The Kyoto Protocol reporting is consistent with the national guidelines set out by the Intergovernmental Panel on Climate Change endorsed by the United Nations.

Statistics Canada
Environment Accounts...

1. All emission figures in this report are expressed in carbon dioxide equivalent emissions. These are calculated by emissions of individual greenhouse gases relative to the warming potential of carbon dioxide (which is assigned a value of 1) and then aggregating over all gases.
2. Environment Canada, 2007, National Inventory Report, Greenhouse Gas Sources and Sinks in Canada, Greenhouse Gas Division, Ottawa.

Statistics Canada
Catalogue no. 16-002-XIE

Greenhouse gas emissions—a focus on Canadian households   3

Greenhouse gas emissions—a focus on Canadian households

Alison Clark Milito and Gabriel Gagnon, Environment Accounts and Statistics Division

Households contribute to greenhouse gas (GHG) emissions in Canada in two ways. Direct emissions from motor fuel use and residential fuel use account for about one-third of household emissions, while indirect emissions from the production of the goods and services that households consume make up the remainder (see textbox for definitions). Consideration of both types of emissions, direct and indirect, gives a more complete picture of the GHG emissions associated with household activities.

Together, direct and indirect household emissions accounted for 46% of Canada's total GHG emissions in 2004.[1] Overall, these emissions increased 13% between 1990 and 2004, from 285,884 kilotonnes (kt) to 321,727 kt.

Between 1990 and 2004, household GHG emissions intensity decreased by 22% (Chart 1). This was partly due to efficiency gains in the production of goods and services by industry and partly to energy efficiency improvements within Canadian homes. However, spending per capita increased by 25% over the same period. The increase in spending resulted in a 10% increase in indirect GHG emissions from households. This, coupled with the 16% increase in household direct emissions offset most of the gains in efficiency. The end result of these combined effects was an insignificant change in emissions per capita between 1990 and 2004.

How much do Canadian households emit directly via household activities?

Approximately one-third of total household emissions are a result of motor fuel use and fuel use within the home.

Household emissions from motor fuel use increased by 29% between 1990 and 2004, from 55,770 kt to 71,873 kt, while emissions from fuel use in the home remained relatively stable.

1. The remaining 54% of total emissions were the result of industrial production to meet the demand for goods and services from other consumers (for example, exports to foreign countries) and the emissions associated with government activities.

Statistics Canada
Catalogue no. 16-002-X

What you should know about this study

The data used to produce this article are derived from Statistics Canada's Material and Energy Flow Accounts (MEFA), which integrates environmental data with the economic data from Canada's System of National Accounts (CSNA). The CSNA is the source of a number of Statistics Canada's most important indicators of economic activity. Including gross domestic product (GDP). One of the main components of the CSNA are the input-output (I/O) accounts which produce highly detailed production and consumption statistics for 303 industries, 719 goods and services and 170 categories of final demand.

The MEFA follow the I/O accounting framework to track the use of energy and the generation of emission by each industry and final demand sector. The flows are linked through the common industrial and commodity classification of the I/O tables. This linkage allows analysis of the interplay between economic activity and greenhouse gas emissions. This article analyses the portion of GHG emissions that are included in the MEFA. Total GHG emissions in the account increased 24% from 571,076 kilotonnes (kt) to 706,660 kt, between 1990 and 2004.

Readers may notice that the emissions estimates in this document differ from the totals that appear in the official Environment Canada submission to the United Nations Framework Convention on Climate Change. This is due to adjustments that have to be made to National Inventory Report sectoring and definitions in order to ensure consistency with the requirements of the CSNA.

The accounts used for this analysis also include only the three main greenhouse gases, namely carbon dioxide, methane, and nitrous oxide, and do not include emissions from the decomposition or incineration of waste. Total GHG emissions reported in Environment Canada's National Inventory Report increased 25.4% from 592,000 kt to 743,000 kt, between 1990 and 2004.

Emissions factors from Environment Canada are applied to Statistics Canada's energy use account data, which are also based on the CSNA industry and commodity frameworks. The energy use data come mainly from Statistics Canada's Industrial Consumption of Energy Survey, transportation surveys, the Report on Energy Supply-Demand in Canada and Natural Resources Canada's Census of Mines. Additional estimates of emissions that are not linked to fossil fuel consumption are taken directly from the Environment Canada greenhouse gas inventory and are applied to the appropriate industries in the CSNA. Chapter 4 of the publication, Concepts, Sources and Methods of the Canadian System of Environmental and Resource Accounts (16-505-G, free) describes in detail the conceptual framework, data sources and empirical methods used in this study.

Definitions:
Direct household emissions are the greenhouse gases that are emitted when people drive their vehicles for personal use and use fossil fuels to heat their homes.
Indirect household emissions are the greenhouse gases that are emitted when industries produce the goods and services that people purchase for household use.
Household emissions intensity is total direct plus indirect household emissions divided by total household spending (personal expenditure) in dollars.

EnviroStats
Winter 2008

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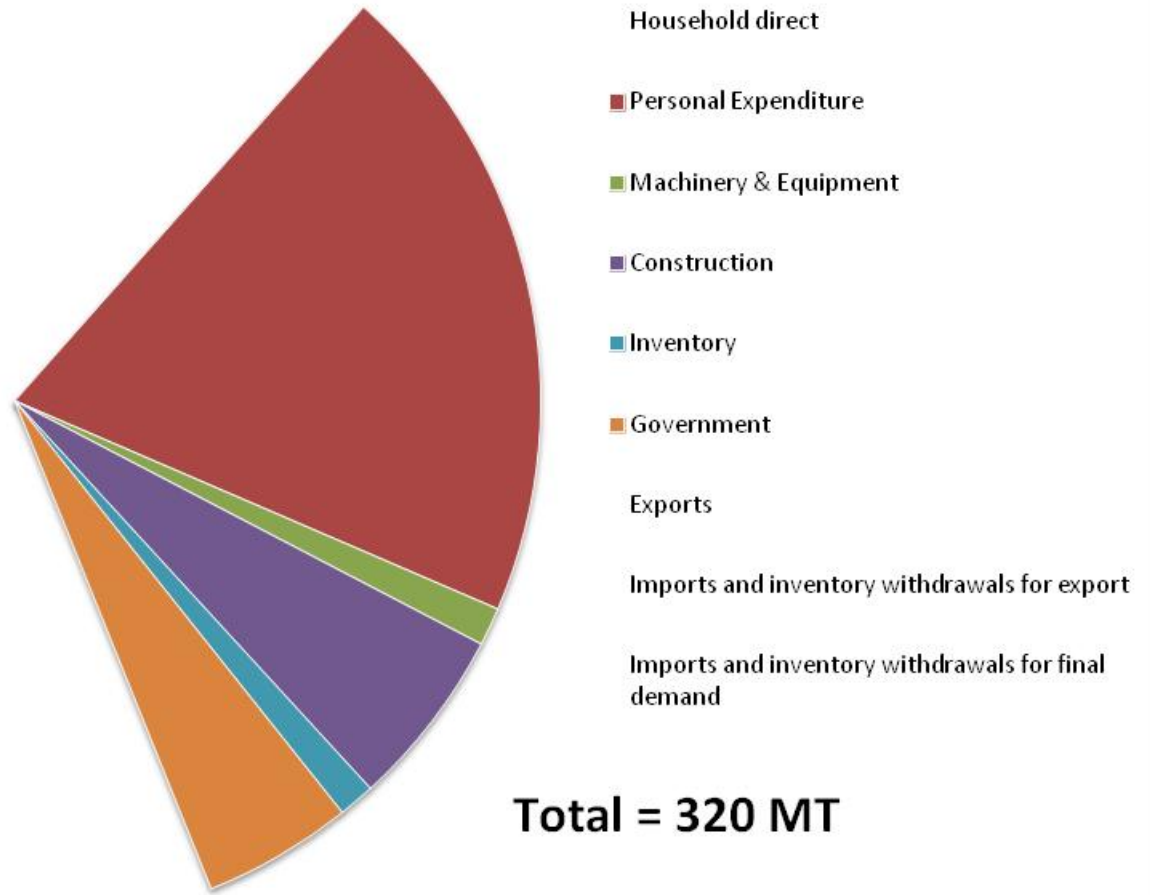
Canada's Emissions Footprint, 2008

Domestic industrial emissions required for final demand

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Canada's Emissions Footprint, 2008

- Household direct
- Personal Expenditure
- Machinery & Equipment
- Construction
- Inventory
- Government
- Exports
- Imports and inventory withdrawals for export
- Imports and inventory withdrawals for final demand

Total = 434 MT
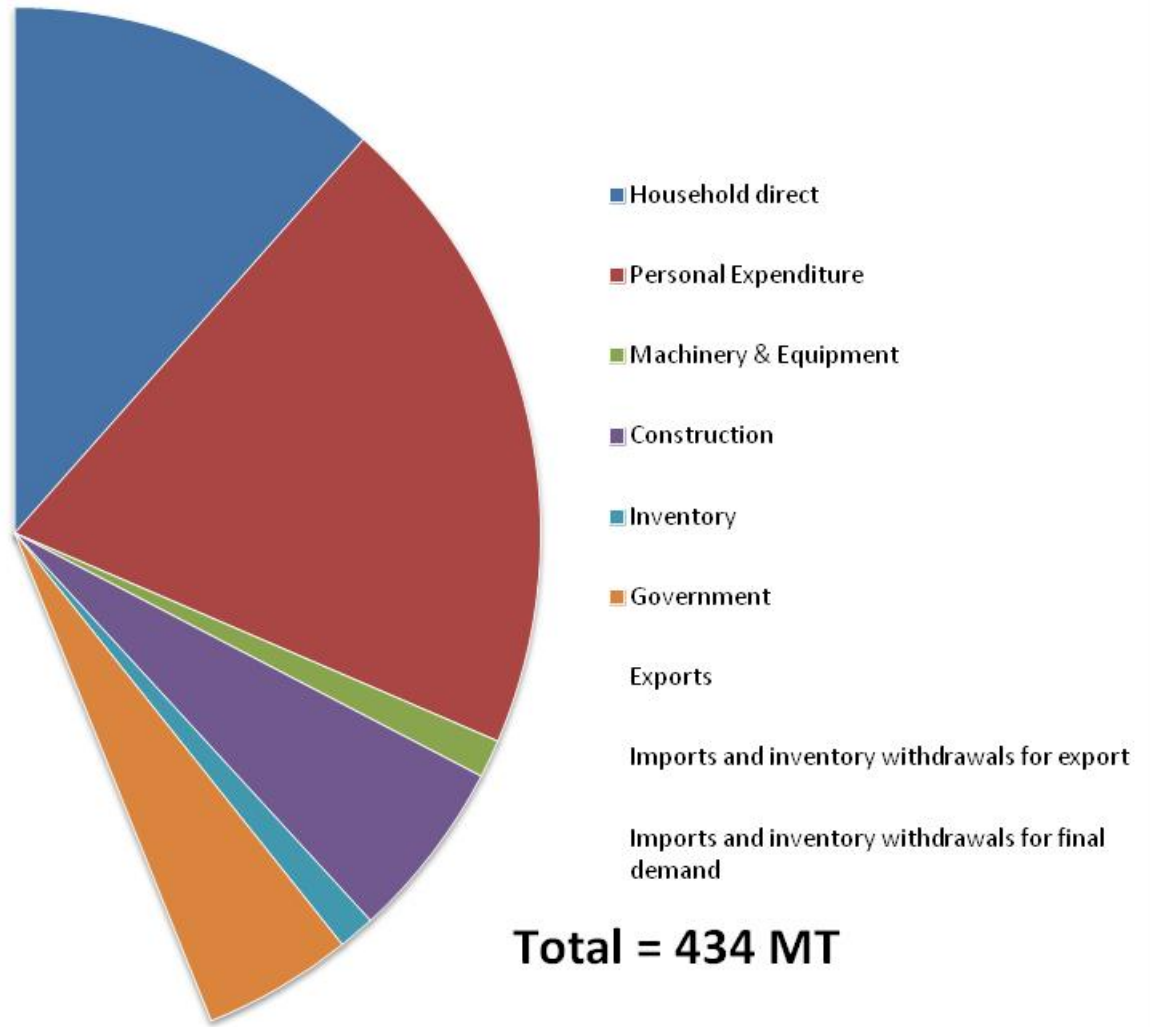
Domestic industrial emissions required for final demand and direct household emissions

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Canada's Emissions Footprint, 2008

- Household direct
- Personal Expenditure
- Machinery & Equipment
- Construction
- Inventory
- Government
- Exports
- Imports and inventory withdrawals for export
- Imports and inventory withdrawals for final demand

Total = 619 MT
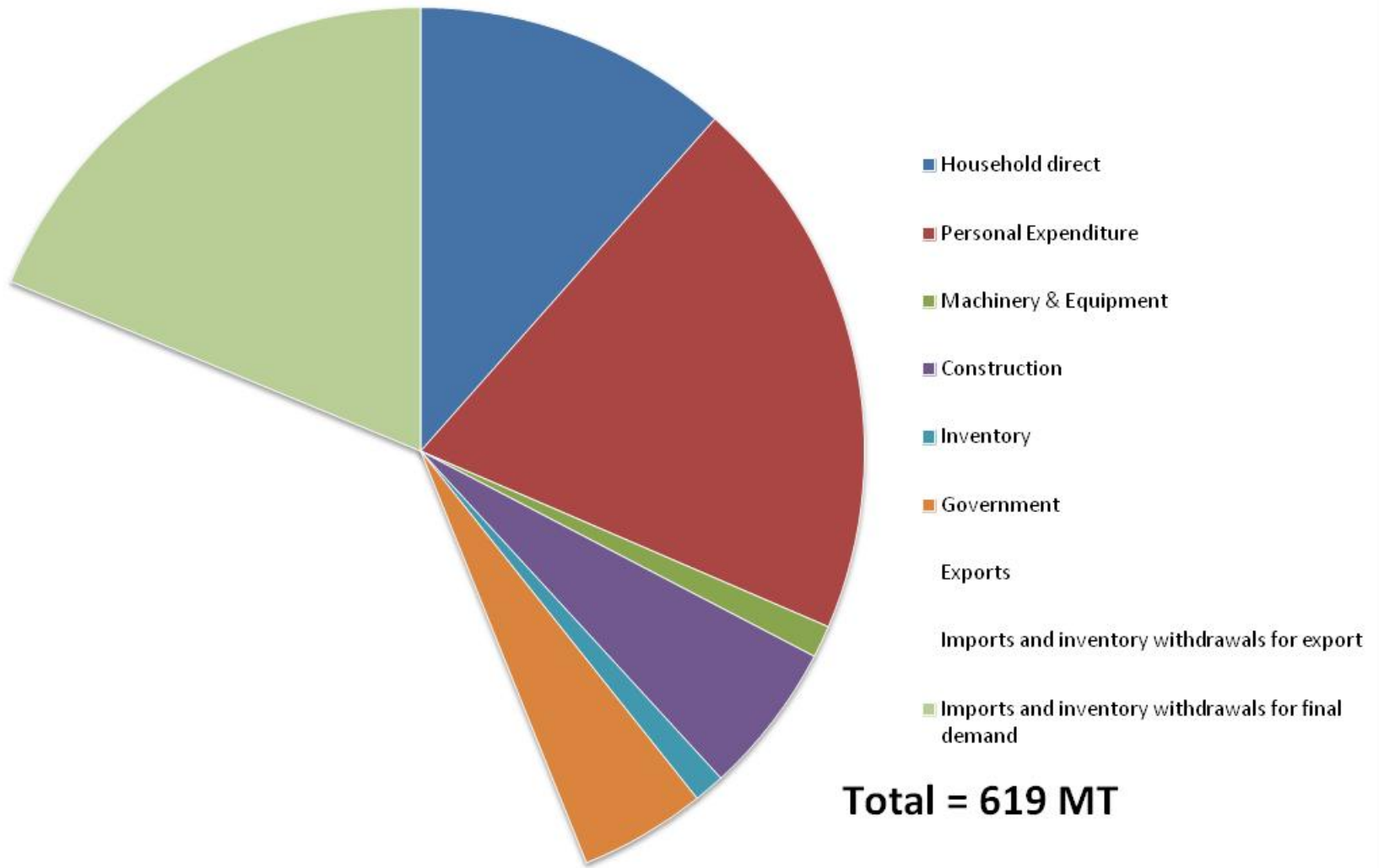
National footprint from domestic consumption in the current accounting period including emissions abroad and from previous production

Canada's Emissions Footprint, 2008

- Household direct
- Personal Expenditure
- Machinery & Equipment
- Construction
- Inventory
- Government
- Exports
- Imports and inventory withdrawals for export
- Imports and inventory withdrawals for final demand

Total = 988 MT
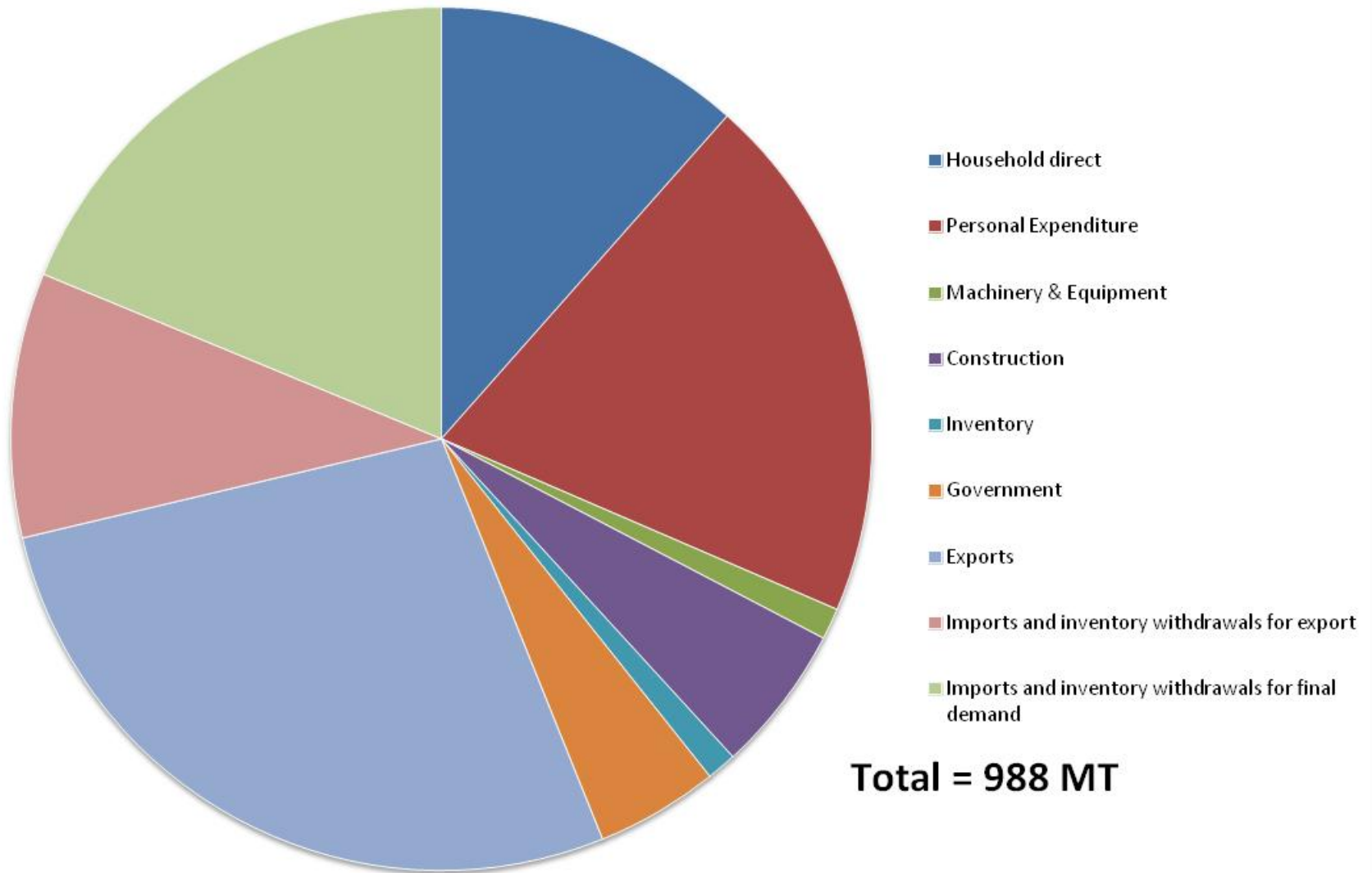
National footprint from the whole economy in the current accounting period including emissions from previous production

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Canada's Emissions Footprint, 2008

Legend:
- Household direct
- Personal Expenditure
- Machinery & Equipment
- Construction
- Inventory
- Government
- Exports
- Imports and inventory withdrawals for export
- Imports and inventory withdrawals for final demand

Total = 704 MT

Emissions following IPCC guidelines (adjusted to SEEA requirements)

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Integrated SEEA/IPCC accounts

draft example

Greenhouse Gas Emissions (carbon dioxide equivalents) by Sector, 2008	
	kt
Crop and Animal Production	67,617
Forestry and Logging	3,104
Fishing, Hunting and Trapping	818
Support Activities for Agriculture and Forestry	1,164
Mining and Oil and Gas Extraction	120,656
Utilities	118,582
Construction	12,404
Manufacturing	110,548
Wholesale Trade	11,763
Retail Trade	7,953
Transportation and Warehousing	76,073
Information and Cultural Industries	1,130
Finance, Insurance, Real Estate and Renting and Leasing	19,029
Professional, Scientific and Technical Services	1,920
Administrative and Support, Waste Management and Remediation Services	3,162
Education Services	311
Health Care and Social Assistance	2,352
Arts, Entertainment and Recreation	338
Accommodation and Food Services	1,914
Other Services (Except Public Administration)	2,387
Operating, Office, Cafeteria and Laboratory Supplies	10
Travel, Entertainment, Advertising and Promotion	5,989
Transportation Margins	-
Non-Profit Institutions Serving Households	2,897
Government Sector	18,332
Household Heating, lighting and appliances	39,963
Household Motor fuels and lubricants	74,010
Total	**704,426**
IPCC/SEEA balancing items	
Waste	*21,386*
Prescribed burns	*- 875*
Household firewood use	*2,000*
Gasoline difference in MOBILE model	*- 2,818*
International aviation fuel purchases	*- 7,583*
HFC	*5,500*
PFC	*2,200*
SF6	*670*
Solvent use	*340*
Statistical difference	*- 6,753*
NIR total from Environment Canada	**732,000**

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Agricultural emissions intensities, 2007

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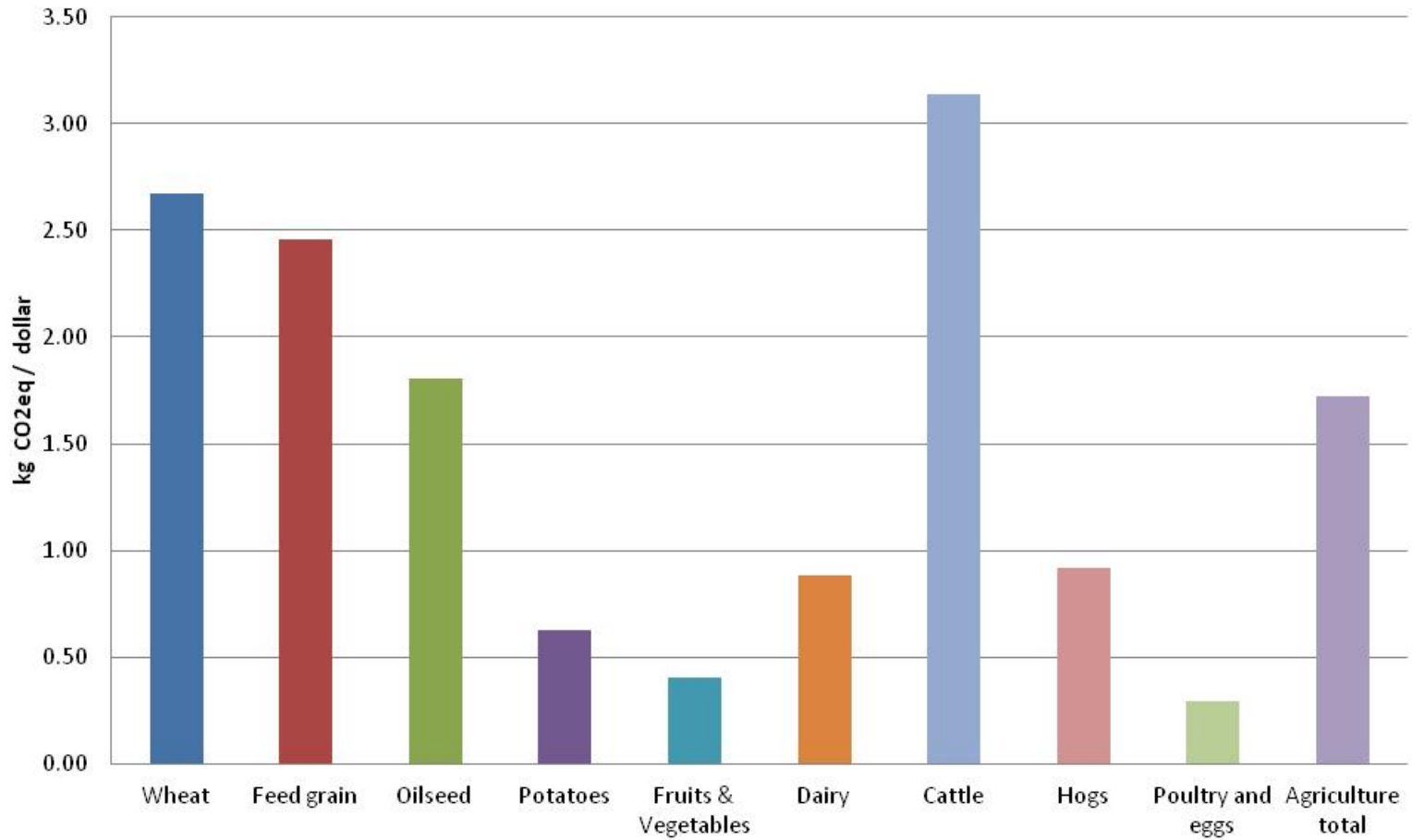
Gross output and export shares of agricultural commodities, 2007

α_g = **1.54** , α_x = **1.76** , α_{fd} = **1.44** α_x / α_g = **1.14** α_{fd} / α_g = **0.94**

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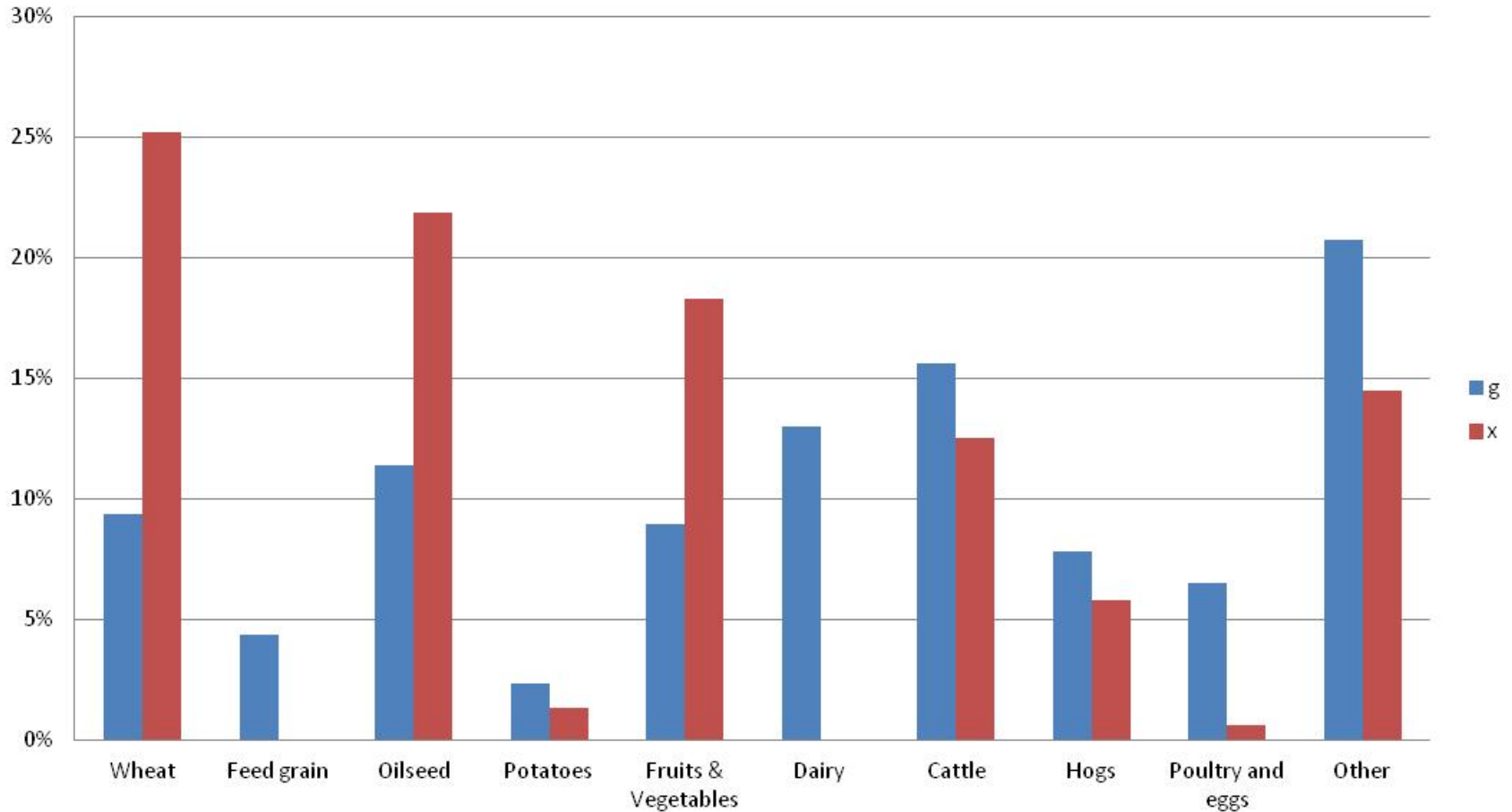
Emissions embodied in exports, 2007 (Mt CO2eq)

GTAP producing industry	ENV	STD	GTAP based on ENV	GTAP based on STD
Total oil and gas	84.3	82.6	83.8	80.4
Electricity	29.4	33.0	33.3	32.1
Transport nec	30.1	30.6	24.7	24.9
Total crops	22.5	21.3	22.3	20.4
Chemical,rubber,plastic prods	18.6	18.7	16.3	16.2
Total livestock	13.6	10.9	14.4	11.6
Petroleum, coal products	10.5	10.6	10.0	10.6
Ferrous metals	10.1	10.1	9.8	9.8
All other	52.7	52.3	52.0	51.6
Total	**271.9**	**270.0**	**266.5**	**257.6**

ENV = special environmental IO aggregation (extra detail for agriculture and oil and gas)
STD = standard detailed IO aggregation
GTAP = Global Trade Analysis Project database aggregation

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Emissions embodied in exports, 2001 and 2004 (Mt CO2eq)

GTAP producing industry	2001			2004	
	Perdue GTAP	StatCan IO		Perdue GTAP	StatCan IO
Total oil and gas	78.5	81.2		79.2	83.3
Total livestock	13.2	12.6		10.0	10.3
Total crops	25.3	20.2		25.7	19.3
Electricity	50.8	47.3		45.5	35.7
Chemical,rubber,plastic prods	16.7	17.9		18.6	20.5
Transport nec	8.9	29.4		12.5	28.1
Petroleum, coal products	8.2	8.8		12.0	12.0
Ferrous metals	10.2	10.2		10.2	10.3
Minerals nec	6.7	5.6		7.3	5.7
Air transport	4.0	2.8		6.1	2.5
All other industries	51.3	52.0		47.1	50.3
All industries	**273.8**	**287.9**		**274.3**	**277.8**

+ 0.5 Mt

- 10.1 Mt

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Final destination of domestic emissions

Source of footprint

GHG emission related to domestic final expenditures by region, 2002					
	Canada	**US**	**China**	**Rest of world**	**Total**
			$mt\ CO_2\ eq$		
Canada	401	217	3	68	689
US	58	6,232	19	448	6,757
China	14	178	4,120	665	4,977
Rest of world	57	731	198	21,922	22,908
Total	**530**	**7,359**	**4,340**	**23,103**	**35,331**

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Consumption-related greenhouse gas emissions in Canada, the United States and China

Craig Gaston, Environment Accounts and Statistics Division

Although the location of greenhouse gas (GHG) emissions is not important as far as their contribution to global warming is concerned, it can be useful to know how final domestic expenditures on products and services in Canada cause emissions in other countries and conversely, how final expenditures elsewhere cause emissions in Canada. This is a "consumption perspective" on GHG emissions as opposed to the production perspective by which countries normally present their GHG emissions.

GHG emissions statistics are generally compiled according to the various sources of emissions within the geographical boundaries of a country. Emissions in other countries related to Canadian expenditures are not directly observable but can be approximated using input-output models that describe the flows of goods between industries and countries.[11] Input-output models have a long tradition at Statistics Canada and have been used with environmental extensions to estimate the energy and GHG effects of expenditures by Canadian households.[12]

This article uses a novel multi-regional input-output (MRIO) model to trace the connections between domestic final expenditures on goods and services in one country and the resulting GHG emissions in another. The model represents the economies of Canada, the United States and China. The rest of the world is not specified explicitly; only the trade flows with the rest of the world are articulated.

The model was built for the year 2002 because that is the most recent year for which detailed input-output tables are available for all three countries. There has been rapid growth of China's economy since then and additional analysis has been done here to provide some insight into the effect of increased Canadian expenditures on Chinese goods since 2002. A more recent MRIO model would be necessary to capture the fine-grained changes in the world economy over the last decade.

When using a single-country input-output model (unlike the MRIO model that has been used here), the simplifying assumption that imports have the same embodied emissions as similar goods produced in Canada is required. The Canada-U.S.-China MRIO model addresses this shortcoming. While a substantial improvement on single-country models for this reason, constructing the MRIO model requires a number of assumptions and considerable manipulation of the individual countries' input-output tables. The results presented here should, therefore, be considered experimental and taken as illustrative rather than final (see the textbox below for further details).[13]

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11. Statistics Canada, 2008, *Guide to the Income and Expenditure Accounts*, Catalogue no. 13-017-X.
12. A. Clark Milito and G. Gagnon, 2008, "Greenhouse gas emissions—a focus on Canadian households," *EnviroStats*, Vol. 2, no. 4, Statistics Canada Catalogue no. 16-002-X200800410749.
13. Documentation on the MRIO model used in this study can be obtained by contacting the Information Officer, Environment Accounts and Statistics Division (613-951-0297; environ@statcan.gc.ca).

http://www.statcan.gc.ca/pub/16-002-x/16-002-x2011004-eng.pdf

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Summary

- Linking of environmental and economic data can provide valuable alternative perspectives

- Defining analytical and data boundaries is very important

- Aggregation of heterogeneous industries must be done with care

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Statistics Canada's approach to environmental IO modelling: Our IO tables

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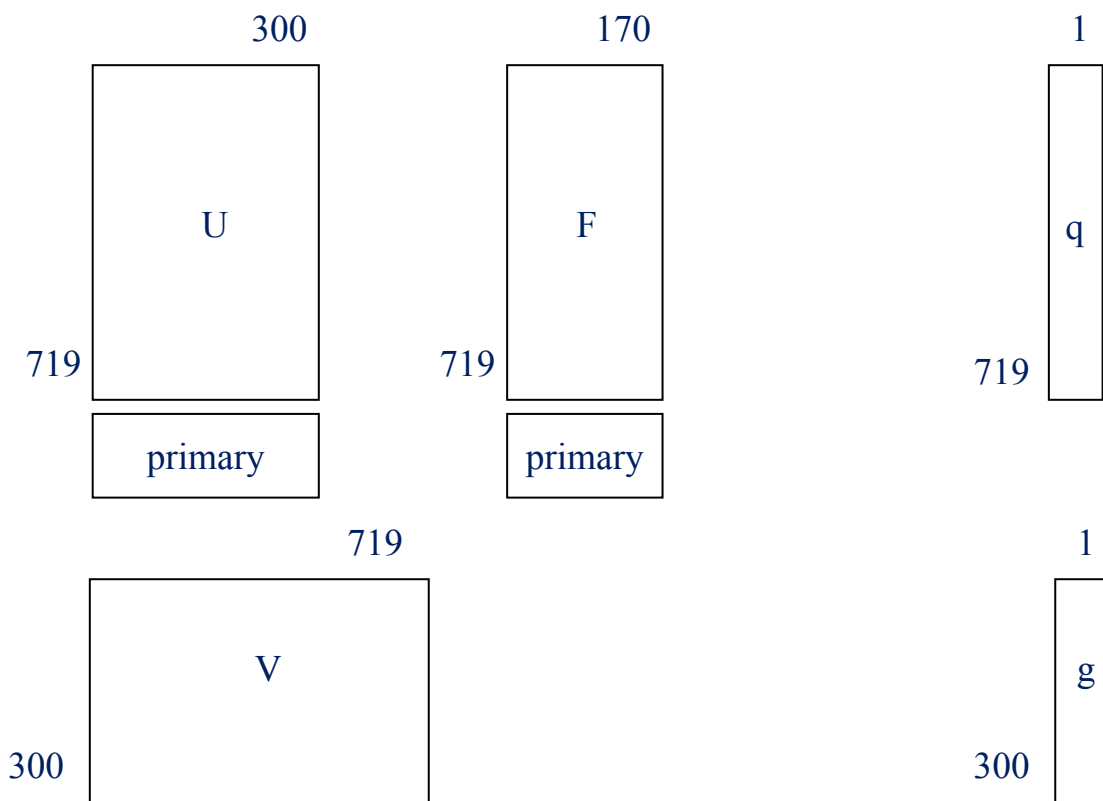
Statistics Canada's approach to environmental IO modelling: model derivation

- *Basic identity: supply = demand*

$$q + inv_- + m = u + fd + x + inv_+$$

By substituting for market share ($D=V/q$) and technology ($B=U/g$), we get:

$$g = (I - DB)^{-1}Df$$

- *Allows an estimate of the gross production (g) required from each industry to satisfy a given final demand (f) based on pre-defined relationships of market-share (D) and technology (B)*

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Statistics Canada's approach to environmental IO modelling: environmental vectors

$$\alpha = E/g$$

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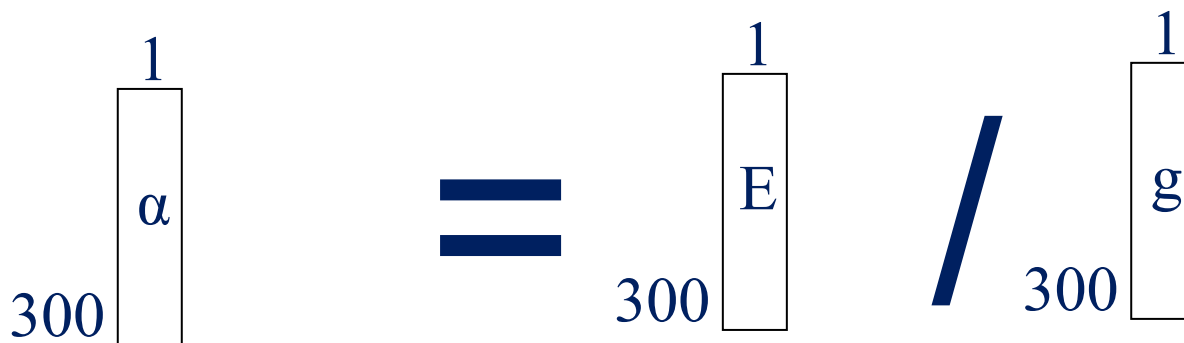
Statistics Canada's approach to environmental IO modelling: combining the two

$$g^* = (I - DB)^{-1}Df_{pe}$$

$$\underset{300}{1}\begin{bmatrix}\alpha\end{bmatrix} \; \ast \; \underset{300}{1}\begin{bmatrix}g^*\end{bmatrix} \; =$$

Greenhouse Gas Emissions (carbon dioxide equivalents) attributable to household purchases and consumption, 2002
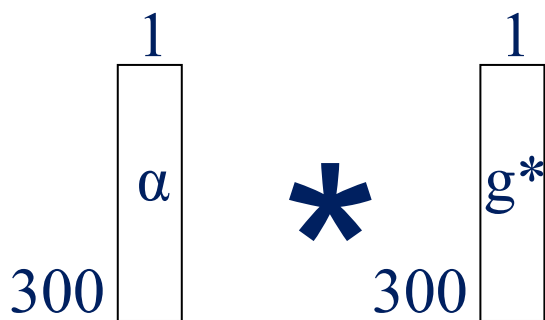
		kilotonnes	%
Indirect emissions	Motor vehicles, parts & repairs	5,023	1.6%
	Furniture and household appliances	3,066	1.0%
	Other durable goods	3,741	1.2%
	Clothing and footwear	4,750	1.5%
	Other semi-durable goods	5,521	1.7%
	Food and non-alcoholic beverage	38,874	12.1%
	Motor fuels and lubricants	15,554	4.8%
	Electricity	43,343	13.5%
	Natural Gas	7,315	2.3%
	Other fuels	2,281	0.7%
	Other non-durable goods	10,781	3.4%
	Gross rent (imputed and paid)	14,555	4.5%
	Restaurants & hotels	15,972	5.0%
	Other services	39,011	12.2%
	Sub total, indirect emissions	**209,787**	**65.3%**
Direct emissions	Heating, lighting and appliances	41,719	13.0%
	Motor fuels and lubricants	69,557	21.7%
	Sub total, direct emissions	**111,276**	**34.7%**
Total GHG emissions attributable to households		**321,064**	**100.0%**

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Statistics Canada's approach to environmental IO modelling

$$\alpha \quad * \quad (I - DB)^{-1} \quad =$$

(with dimensions: α is 300×1; $(I - DB)^{-1}$ is 300×300)
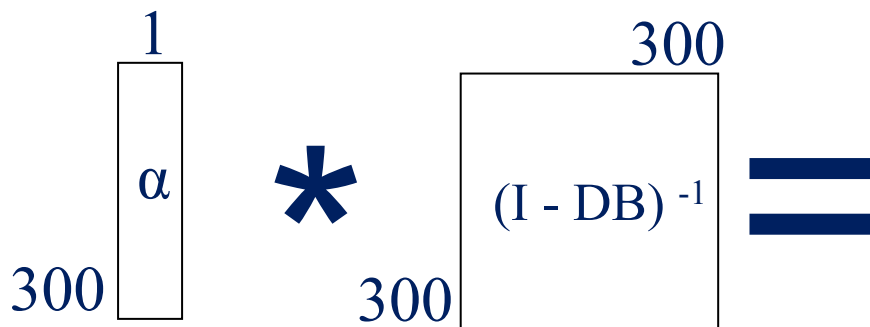
Direct plus indirect energy intensity by industry, 1990-2007						
Industry[1]		1990	1991	1992	1993	1994
1	Crop and animal production	18.70	20.57	21.63	19.70	18.68
2	Forestry and logging	11.80	11.96	12.24	10.73	10.48
3	Fishing, hunting and trapping	11.81	12.56	11.41	9.60	13.57
4	Support activities for agriculture and forestry	11.78	10.91	11.30	10.83	10.53
5	Oil and gas extraction	32.49	37.12	36.93	33.72	31.93
6	Coal mining	18.18	19.21	18.80	16.99	17.24
7	Metal ore mining	17.78	19.49	18.76	20.00	17.93
8	Non-metallic mineral mining and quarrying	22.87	23.82	22.70	22.37	21.75
9	Support activities for mining and oil and gas extraction	14.87	14.42	17.02	16.09	13.54
10	Electric power generation, transmission and distribution	62.63	57.47	57.87	51.07	49.54
11	Natural gas distribution, water and other systems	12.34	10.67	12.06	13.52	11.65
12	Residential building construction	8.94	9.37	9.69	9.41	9.12
13	Non-residential building construction	7.87	8.37	8.57	8.65	8.26
14	Transportation engineering construction	18.63	19.36	18.94	18.08	17.64
15	Oil and gas engineering construction	11.59	12.26	12.87	11.95	11.17
16	Electric power engineering construction	6.97	7.12	7.27	7.14	6.70
17	Communication engineering construction	7.58	8.66	8.57	8.48	8.21
18	Other engineering construction	8.17	8.69	9.14	8.80	8.11
19	Repair construction	8.06	8.33	8.56	8.19	7.92
20	Other activities of the construction industry	9.53	10.40	10.42	10.41	10.02
21	Animal food manufacturing	15.57	16.16	16.44	15.73	15.32
22	Sugar and confectionery product manufacturing	9.74	11.03	10.23	9.58	9.54
23	Fruit and vegetable preserving and specialty food manufactu	13.12	12.54	12.71	12.50	12.57
24	Dairy product manufacturing	15.46	16.25	16.98	15.88	15.43
25	Meat product manufacturing	15.87	16.67	17.11	16.34	15.67
26	Seafood product preparation and packaging	10.45	11.13	11.42	10.25	11.21
27	Miscellaneous food manufacturing	12.04	10.82	11.24	11.31	11.45
28	Soft-drink and ice manufacturing	10.73	11.12	10.26	10.97	11.45
29	Breweries	8.95	8.09	8.46	8.08	7.55

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Statistics Canada's approach to environmental IO modelling

Direct and Indirect Household Greenhouse Gas Emissions, 1990-2007

Year	Direct	Indirect	Total	Emissions per unit of expenditure
	megatonnes			1990=100
1990	95	280	375	100.0
1991	92	278	371	100.3
1992	95	297	392	104.5
1993	99	287	386	101.2
1994	102	287	389	98.9
1995	101	286	387	96.4
1996	106	288	394	95.6
1997	104	299	403	93.6
1998	100	310	410	92.7
1999	103	309	412	89.6
2000	105	306	411	86.0
2001	103	307	410	83.9
2002	108	316	424	83.7
2003	111	322	432	82.9
2004	110	313	424	78.6
2005	111	305	415	74.4
2006	109	303	412	70.7
2007	115	317	432	71.0

Direct emissions include all greenhouse gas emissions due to energy use in the home and for private motor vehicles.
Indirect emissions are those business-sector emissions due to the production of the goods and services purchased
by households. An estimate of the emissions from foreign companies due to the production of the imported
goods purchased by Canadian households is included.
Total emissions are the sum of direct plus indirect emissions.
Source:
Statistics Canada, Environment Accounts and Statistics Division.
CANSIM Table 153-0046

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Statistics Canada's approach to environmental IO modelling

Water use by demand category, 2005

Final Demand		Water Intake		Including precipitation for forestry and agriculture	
		Mm3	%	Mm3	%
Personal Expenditure		18,003	47.0	98,727	15.8
Machinery and Equipment		731	1.9	6,890	1.1
Inventories		1,732	4.5	71,107	11.4
Construction		483	1.3	19,417	3.1
Government		3,169	8.3	14,927	2.4
Exports		14,169	37.0	414,857	66.3
Total		**38,287**	**100.0**	**625,925**	**100.0**

Virtual water content of exports, 2005

Exports		Water Intake		Including precipitation for forestry and agriculture	
		Mm3	%	Mm3	%
Food (incl. accommodation and meal services)		1,525	10.8	52,796	12.7
Other manufactured goods		9,304	65.7	349,203	84.2
Utilities		2,496	17.6	2,682	0.6
Other services		844	6.0	10,176	2.5
Total		**14,169**	**100.0**	**414,857**	**100.0**

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Use | Availability

1996

Prompt scrap
Road vehicles
Aircraft, ships, locomotives
Appliances, furniture, computers
Construction machinery
Repair construction
Packaging
Miscellaneous durables

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