

Environment Fact Sheets

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Household food consumption and Canadian greenhouse gas emissions, 2015

by Jennie Wang and Abdoul-Razak Mamane

People generally think about transportation and industrial activities when they think about sources of greenhouse gas (GHG) emissions. They don't necessarily think about emissions that were released during the production of the foods we eat. However, the emissions associated with restaurant meals, bread or the milk in the fridge can be attributed to household consumption and are termed indirect emissions.

Canadian households were directly responsible for 142,936 kilotonnes of CO₂ equivalent GHG emissions in 2015¹—19% of total emissions in Canada—through use of fuels for transportation (55%) and home heating, lighting and appliance use (45%).² However, when including the indirect emissions associated with their purchases of goods and services, households were responsible for 42% of total Canadian GHG emissions in 2015 (Table 1).³ Indirect emissions associated with household spending on food and beverages accounted for a quarter of indirect emissions and were a top source after indirect emissions associated with household energy consumption.

GHG emissions associated with different types of food can vary depending on the resources needed during production (e.g., fuel and fertilizer use), emissions from animals (e.g., enteric fermentation) and manure management, as well as the amount and type of energy used in manufacturing, storage, distribution and consumption (FAO, 2013).⁴

In a full accounting of food-related emissions, households would also be indirectly responsible for emissions related to food they purchase that is imported into Canada; however, emissions related to foreign production are not included in the GHG account.⁵ Overall, 64% of Canada's food supply was produced domestically in 2015, down from 71% in 2010, although there were large variations by type of food product (Statistics Canada, 2018).⁶

In addition to these emissions associated with spending on food and beverages, Natural Resources Canada estimates that 11% of the emissions associated with residential electricity use in 2015 relate to the use of kitchen appliances including refrigerators, electric ranges, freezers and dishwashers⁷ used in food storage, preparation and cleanup (Natural Resources Canada, n.d.).

Focusing on direct emissions from Canadian food-related industries,⁸ one sees that crop and animal production industries dominated because of the higher emissions from this stage of the food supply chain. The largest shares of GHG emissions were associated with crop production (45%) and animal production industries (42%), with a further 7% attributed to food and beverage manufacturing, 3% to farm product and food and beverage wholesale and retail trade, 1% to food services and drinking places and 1% to fishing, hunting and trapping (Chart 1).

Exported products account for 50% of emissions associated with these industries in 2015. The crop production industry had the highest share of emissions associated with exported products (70%), while in comparison 35% of emissions from animal production were related to exports.

1. Includes emissions of carbon dioxide, methane and nitrous oxide.

2. Statistics Canada, [Table 38-10-00097-01](https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810009701), Physical flow account for greenhouse gas emissions, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810009701> (accessed September 11, 2019). Includes all direct use of motor fuels and lubricants and fuel use (e.g., natural gas, oil, propane, fuelwood) for residential purposes including home and water heating, gas appliance use and others.

3. Statistics Canada, [Table 38-10-00010-01](https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810001001), Physical flows by final demand category, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810001001> (accessed September 11, 2019). Note that this includes Canadian greenhouse gas emissions only. It excludes emissions associated with purchases of imported goods and services from non-Canadian enterprises. For more information, please see: <http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5115>

4. GHG emissions related to margins from wholesale and retail trade and transportation of food products are not included in this analysis of household indirect emissions. This analysis does not account for carbon sequestration services provided by agricultural land.

5. Note that GHG estimates include emissions associated with the production of goods that are manufactured in Canada using imported inputs.

6. The percentage of the food supply that was produced domestically is calculated based on the total value of output supplied domestically (excluding exports) and imports (excluding international re-exports and international travel) of the food and beverage products included in Table 1. It includes food consumed by final consumers and food used for intermediate consumption by businesses, including manufacturers, restaurants and others.

7. Excludes electricity for hot water and for microwaves and other small appliances.

8. Includes crop production (including greenhouse, nursery and floriculture production), animal production (including aquaculture), food and beverage manufacturing, farm product, food, beverage and tobacco wholesale and retail trade, food and beverage services and hunting, fishing and trapping. Direct emissions by industry exclude electricity consumption. This analysis does not account for carbon sequestration services provided by agricultural land.

Table 1
Household direct and indirect greenhouse gas emissions, including emissions related to spending on food and beverages, 2010 and 2015

	2010	2015
	kilotonnes	
Total emissions, industries and households	732,759	767,289
Total household direct and indirect emissions	329,243	321,851
Total household direct emissions	140,001	142,936
Motor fuel and lubricant use	76,313	78,653
In-home fuel use	63,688	64,283
Total household indirect emissions	189,242	178,915
Energy products ¹	54,952	52,750
Food and beverage products ²	34,928	31,368
Food and beverage services ³	11,818	12,577
Other goods and services	87,543	82,221

1. Includes the following products from the supply-use table: electricity, gasoline, natural gas, light fuel oils, natural gas liquids and related products and fuelwood.

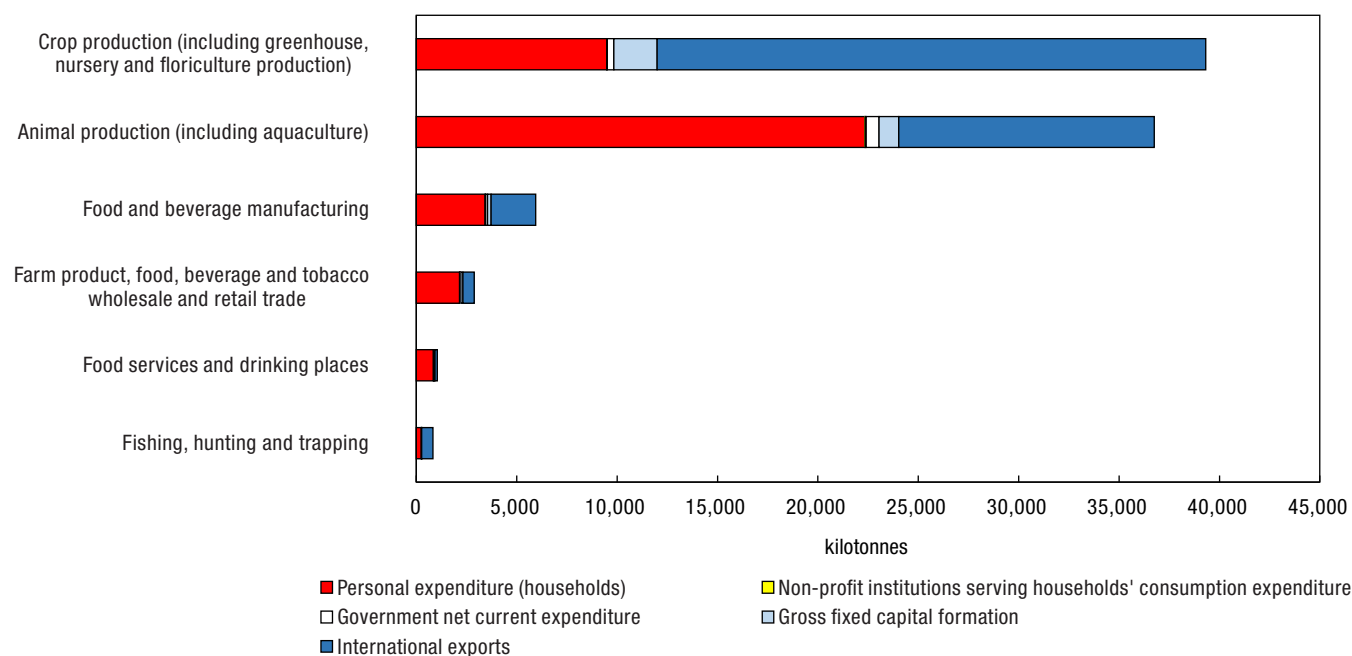
2. Includes the following products from the supply-use table: fresh and frozen poultry of all types, cheese and cheese products, processed fluid milk and milk products, processed meat products, other miscellaneous meats and animal by-products, fresh and frozen beef and veal, fresh and frozen pork, preserved fruit and vegetables and frozen foods, eggs in shell, beer, bread, rolls and flatbreads, butter and dry and canned dairy products, snack food products, fresh potatoes, fresh fruits and nuts, bottled water, soft drinks and ice, ice cream, sherbet and similar frozen desserts, margarine and cooking oils, cookies, crackers and baked sweet goods, fresh vegetables (except potatoes), other food products, n.e.c., fish, crustaceans, shellfish and other fishery products, confectionery products, breakfast cereal and other cereal products, grain and oilseed products, n.e.c., fresh, frozen and canned fruit and vegetable juices, flavouring syrups, seasonings and dressings, flour mixes, dough and dry pasta, coffee and tea, wine and brandy, other miscellaneous crop products, flour and other grain mill products, distilled liquor, prepared and packaged seafood products, sugar and sugar mill by-products and chocolate (except confectionary).

3. Includes the following products from the supply-use table: prepared meals and alcoholic beverages for immediate consumption.

Note: Includes Canadian greenhouse gas emissions only. Excludes emissions associated with purchases of imported goods and services from non-Canadian enterprises.

Source: Statistics Canada, Environment, Energy and Transportation Statistics Division, 2019, special tabulation from the Physical Flow Accounts and [Table 38-10-0010-01](https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810001001), Physical flows by final demand category, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810001001> (accessed September 11, 2019) and [38-10-0097-01](https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=3810009701), Physical flow account for greenhouse gas emissions, <https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=3810009701> (accessed September 11, 2019).

Chart 1
Selected food-related industries' greenhouse gas emissions by final demand category, 2015



Note: This chart displays the direct emissions of selected food-related industries by final demand category including personal expenditure. These emissions are not equivalent to the indirect emission from households consumption expenditure on food and beverages services or products in Table 1. Direct emissions by industry exclude electricity consumption.

Source: Statistics Canada, Environment, Environment Energy and Transportation Statistics Division, 2019, special tabulation from the Physical Flow Accounts.

Note to readers:

The emissions estimates related to spending on food and beverage products and services presented in this article are based on an [input-output model](#) that combines physical flow data on greenhouse gas emissions (GHG) by industry with economic data on production and consumption of goods and services. A strength of this type of analysis is its ability to provide estimates of the embedded GHG emissions related with downstream economic consumption. However, a limitation includes the assumption of homogeneity—that each sector of the economy produces a single good or service, with the same or similar environmental impact. For example, it assumes that the emissions embedded in tomatoes are similar to those embedded in apples.

GHG emission data are taken from the [Canadian System of Environmental-Economic Accounts - Physical Flow Accounts \(PFA\)](#). The GHG account covers annual emissions of carbon dioxide, methane and nitrous oxide by industry, governments, institutions and households. Note that GHG emissions from solid waste are not included in the account. Data are also available according to the final demand perspective, where emissions are attributed to the end-user of goods and services rather than the producer, and are referred to as indirect emissions. Final demand categories include personal expenditure (household consumer spending), non-profit institutions serving households' consumption expenditure, government net current expenditure, gross fixed capital formation and international exports.

These emissions data can also be associated with spending on goods and services by final demand category. Indirect emissions related to food are categorized according to the Supply and Use Product Classification (SUPC). These indirect emissions do not include emissions associated with the production of food by non-Canadian enterprises that was subsequently imported and consumed in Canada. However, they include emissions associated with the production of goods that are manufactured in Canada using imported inputs. While the model can be used to derive emissions estimates for imports, it assumes that foreign food-related emissions are similar to Canadian emissions, which may not always be the case. For many commodities there is also no Canadian equivalent—for example we do not grow avocado or cacao trees. A more rigorous analysis of total household food-related emissions would employ a multi-regional input-output model and would include emissions released during transportation.

GHG emission estimates in the Physical Flow Accounts differ from those reported in the *National Inventory Report on Greenhouse Gas Sources and Sinks* (NIR) produced by Environment and Climate Change Canada ([Infographic 1](#)). The NIR fulfills Canada's reporting obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and is the official benchmark for GHG emissions in Canada.

The reporting requirements of the UNFCCC differ from the methodological guidelines of the United Nations System of Environmental-Economic Accounting used to create the GHG account described here. These differences result from conceptual differences, as well as different data sources and allocation of emissions. In addition, four gases covered in Canada's official GHG inventory are not covered in the GHG account: hydrofluorocarbons (HFCs), perfluorinated compounds (PFCs), sulphur hexafluoride (SF6) and nitrogen trifluoride (NF3).

For more information see <http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5115>

References

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Natural Resources Canada, n.d., "Table 2: Secondary energy use and GHG emissions by end-use" and "Table 18: Appliance secondary energy use and GHG emissions by appliance type," *National Energy Use Database, Comprehensive Energy Use Database, Residential Sector*, Canada, http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/menus/trends/comprehensive/trends_res_ca.cfm (accessed May 30, 2019).

Statistics Canada, 2018, [Table 36-10-0478-01 Supply and use tables, detail level, provincial and territorial \(x 1,000\)](#), <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610047801> (accessed June 7, 2019).