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## BIG AND LITTLE FEET PROVINCIAL PROFILES: PRINCE EDWARD ISLAND<sup>†</sup>

Sarah Dobson and G. Kent Fellows

This communiqué provides a summary of the production- and consumption-based greenhouse gas emissions accounts for Prince Edward Island, as well as their associated trade flows. It is part of a series of communiqués profiling the Canadian provinces and territories.<sup>1</sup>

In simplest terms, a production-based emissions account measures the quantity of greenhouse gas emissions produced in Prince Edward Island. In contrast, a consumption-based emissions account measures the quantity of greenhouse gas emissions generated during the production process for final goods and services that are consumed in Prince Edward Island through household purchases, investment by firms and government spending. Trade flows refer to the movement of emissions that are produced in Prince Edward Island but which support consumption in a different province, territory or country (and vice versa). For example, emissions associated with the production of Prince Edward Island crops that are exported to Nova Scotia for processing and sale are recorded as a trade flow from Prince Edward Island to Nova Scotia. Moving in the opposite direction, emissions associated with the generation of electricity in New Brunswick that is exported to Prince Edward Island for sale to a Prince Edward Island homeowner are recorded as a trade flow from New Brunswick to Prince Edward Island.

For further details on these results in a national context, the methodology for generating them and their policy implications, please see the companion papers to this communiqué series: (1) Fellows and Dobson (2017); and (2) Dobson and Fellows (2017). Additionally, the consumption emissions and trade flow data for each of the provinces and territories are available at: <http://www.policyschool.ca/embodied-emissions-inputs-outputs-data-tables-2004-2011/>.

Unless otherwise noted, all emissions data referenced in this communiqué are for 2011.

<sup>†</sup> This communiqué benefited from financial support provided by Alberta Innovates and by donors through The School of Public Policy's Energy for Life program.

<sup>1</sup> Nunavut, the Northwest Territories and the Yukon Territory are grouped into a single profile both for convenience and due to the underlying structure of available data.

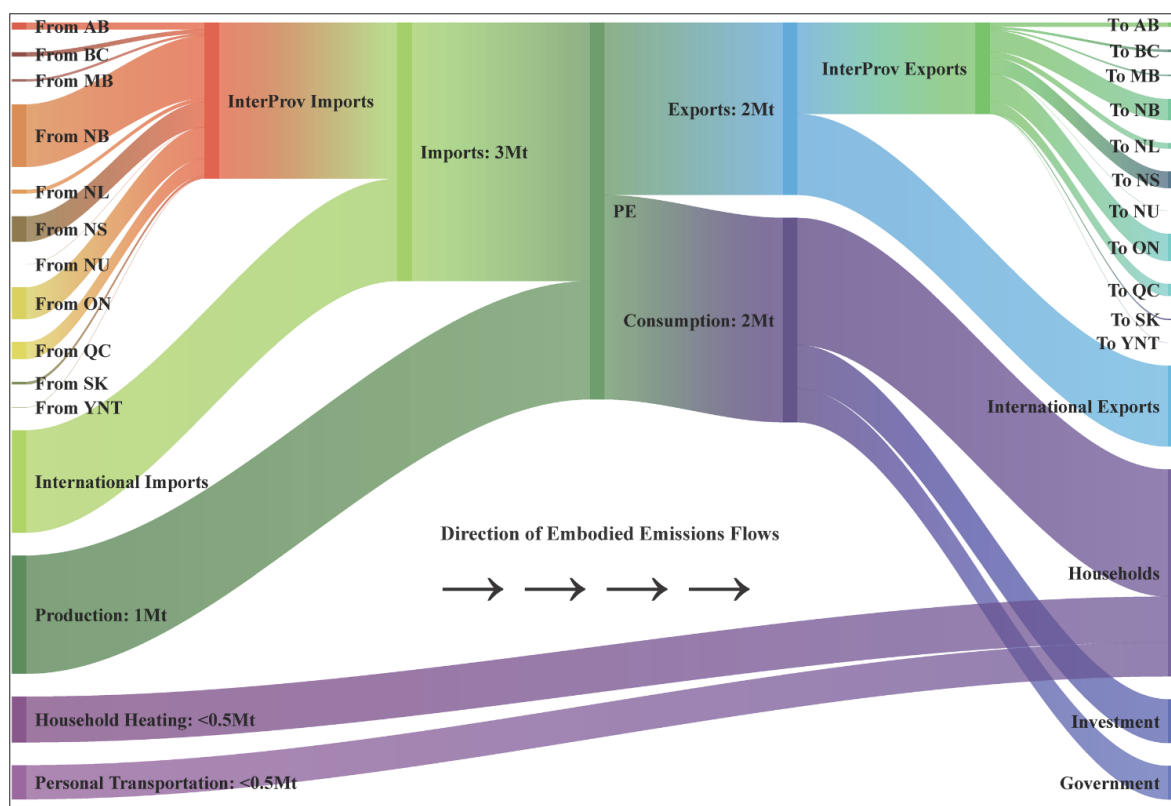
## PRODUCTION- AND CONSUMPTION-BASED EMISSIONS ACCOUNTS

The relationship between production- and consumption-based greenhouse gas emissions is given by the following equation:

$$\text{Consumption Emissions} = \text{Production Emissions} + \text{Interprovincial Imports} + \text{International Imports} - \text{Interprovincial Exports} - \text{International Exports}$$

Prince Edward Island's total production emissions in 2011 were 2.1 megatonnes (Mt) of CO<sub>2</sub>e (Figure 1), corresponding to per capita emissions of 14.5 t. The province is a net importer of greenhouse gas emissions from both international (+0.2 Mt) and interprovincial (+0.7 Mt) sources. Prince Edward Island's emissions therefore increase when moving to a consumption-based accounting approach, rising to 3.0 Mt total CO<sub>2</sub>e emissions or 20.9 t of CO<sub>2</sub>e per capita.<sup>2</sup>

**FIGURE 1 EMISSIONS FLOWS THROUGH THE PRINCE EDWARD ISLAND ECONOMY**



Net exporter of emissions to:	Newfoundland and Labrador
Net importer of emissions from:	International, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, Territories

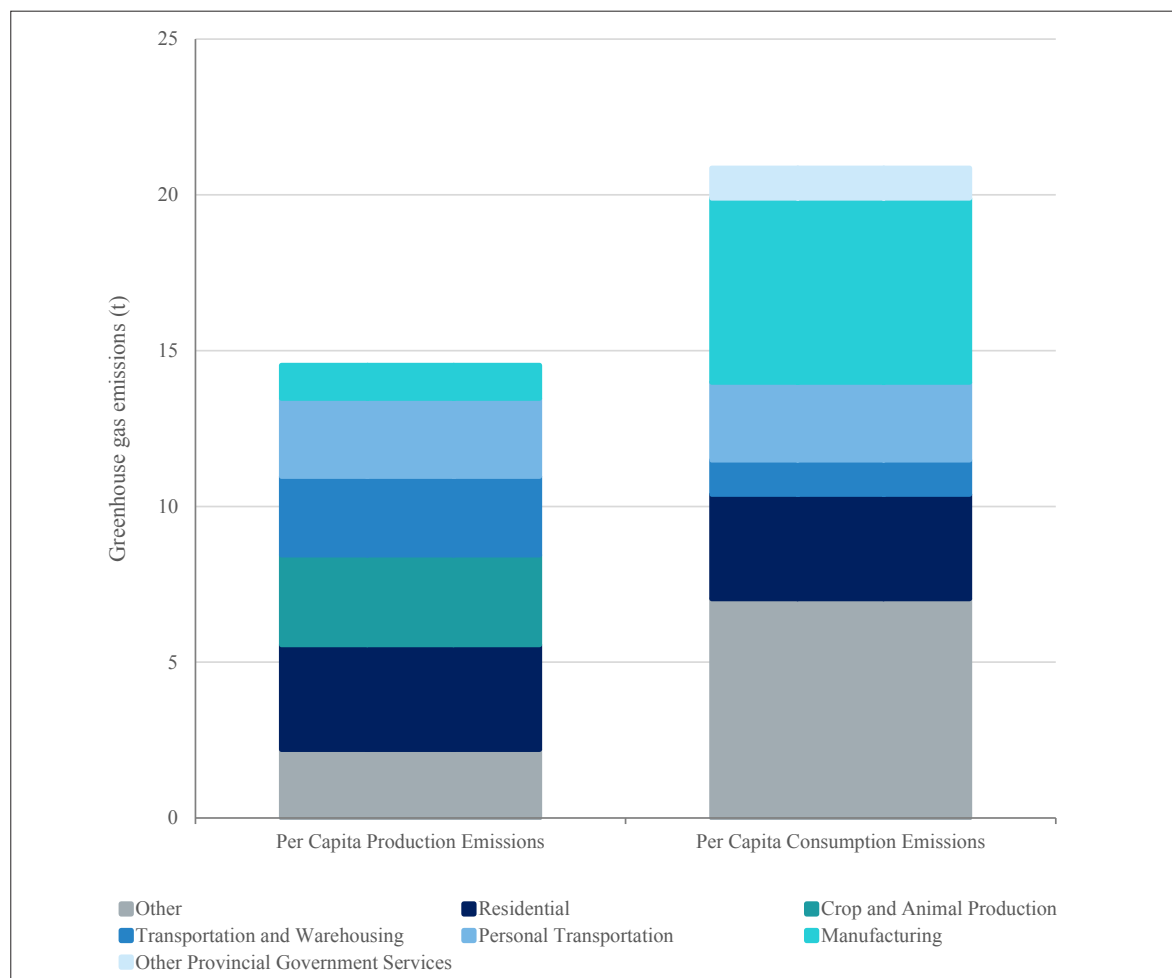
Data Source: Fellows, G. Kent and Sarah Dobson. 2017. "Embodied Emissions in Inputs and Outputs: A Value-Added Approach to National Emissions Accounting." *Canadian Public Policy*, 43(2): 140-164. <https://doi.org/10.3138/cpp.2016-040>.

Data tables are available at: <http://www.policyschool.ca/embodied-emissions-inputs-outputs-data-tables-2004-2011/>.

<sup>2</sup> Production and consumption totals indicated here include residential and personal transportation emissions. However, these emissions are not "embodied" in any traded good within the provincial economies, since they are produced during the act of final consumption by households. As such, these emissions are recorded as separate parallel flows in Figure 1.

The largest sectors responsible for per capita production emissions in Prince Edward Island are residential (3.4 t), crop and animal production (2.9 t), transportation and warehousing (2.5 t), personal transportation (2.5 t) and manufacturing (1.1 t). In comparison, the largest sectors responsible for per capita consumption emissions are manufacturing (5.9 t), residential (3.4 t), personal transportation (2.5 t), transportation and warehousing (1.1 t) and other provincial government services (1.0 t) (Figure 2).

**FIGURE 2 BREAKDOWN BY SECTOR OF PRINCE EDWARD ISLAND PER CAPITA PRODUCTION AND CONSUMPTION EMISSIONS**



Note: See the appendix of Dobson and Fellows (2017) for a full listing of the sectors included in the “Other” category. Note also that the figure displays individually only the top five sectors contributing to per capita production emissions and the top five sectors contributing to per capita consumption emissions. As a result, a sector that is a primary source of production emissions but not consumption emissions will be included in the “Other” category for consumption emissions (and vice versa).

Four sectors – residential, transportation and warehousing, personal transportation and manufacturing – overlap as main sources of both production and consumption emissions in Prince Edward Island. Emissions from the transportation and warehousing sector decrease by 57 per cent (-1.4 t) when moving from a production- to a consumption-based accounting approach while emissions from the manufacturing sector increase by over five times (+4.8 t) and emissions from the personal transportation and residential sectors remain unchanged. The decrease in emissions from the transportation and warehousing sector is due to the fact that a significant share of emissions in the sector are generated from the movement and storage of goods. As this is an intermediate step in bringing a final good to market, a consumption-based accounting approach

reallocates these emissions to the sector and region in which consumption of the final good occurs. Transportation and warehousing emissions that remain in the sector under a consumption-based accounting approach are primarily those generated by household use of public transportation options including air, rail, ferry, taxi and bus. In contrast, the increase in manufacturing sector emissions is attributable to three factors. First, the sector uses substantial intermediate inputs with associated emissions produced by upstream suppliers. Second, the sector is a key supplier of final consumption goods for households and firm investment. Third, the sector engages in significant trade with a large share of intermediate inputs and final consumption goods being produced by suppliers in other provinces and internationally. Combined, these factors result in a large number of production emissions from Prince Edward Island, elsewhere in Canada and internationally being reallocated to Prince Edward Island's manufacturing sector – and specifically household consumption and firm investment – under a consumption-based accounting approach. Last, emissions from the personal transportation and residential sectors are unchanged when moving from a production- to a consumption-based accounting approach as all of the production emissions in these sectors are generated by household consumption of fossil fuels in personal vehicles and in homes. Production and consumption emissions are therefore the same.

The crop and animal production sector is the only sector that is a primary source of production emissions in Prince Edward Island but not consumption emissions. Emissions in the sector fall by nearly 90 per cent (-2.6 t) when moving from a production- to a consumption-based accounting approach. This is the result of a large share of output from the sector being sold to intermediate suppliers – food manufacturers, distributors, restaurants and grocery stores – in Prince Edward Island, elsewhere in Canada and internationally. Production emissions associated with this output are subsequently reallocated to the sector and region that supply the final consumption good for which Prince Edward Island's farm output is an input.

Last, the other provincial government services sector is the only sector that is a primary source of consumption emissions in Prince Edward Island but not production emissions. Emissions increase from only 0.1 t under a production-based accounting approach to 1.0 t under a consumption-based accounting approach. This increase is attributable to the sector absorbing all of the emissions associated with production of its inputs. For example, when the provincial government purchases electricity for use in its ministry offices, emissions associated with the electricity's production are reallocated from the utilities sector to the other provincial government services sector. Notably, output from the sector reflects primarily expenditures by government and the large majority of consumption emissions are therefore allocated to government spending.

As shown on the right-hand side of Figure 1, Prince Edward Island's consumption emissions can additionally be broken down by household, firm investment and government spending. Per capita consumption emissions for each of these groups, as well as the breakdown of emissions in each of these groups by economic sector, are summarized in Table 1.

**TABLE 1 PRINCE EDWARD ISLAND PER CAPITA CONSUMPTION EMISSIONS BY CONSUMPTION GROUP AND SECTOR**

Household Consumption Emissions		Firm Investment Consumption Emissions		Government Consumption Emissions	
<b>Per Capita Consumption Emissions (Share of Total Per Capita Consumption Emissions)</b>					
15.2 t (73%)		3.2 t (15%)		2.5 t (12%)	
<b>Top Sectors Contributing to Consumption Emissions</b>					
Manufacturing:	4.5 t	Manufacturing:	1.4 t	Other provincial government services	0.9 t
Residential:	3.4 t	Residential construction:	0.7 t	Other federal government services:	0.6 t
Personal transportation:	2.5 t	Engineering construction:	0.6 t	Government education services:	0.4 t
Transportation and warehousing:	1.1 t	Non-residential building construction:	0.3 t	Government health services:	0.3 t
Utilities:	0.6 t	Finance, insurance, real estate and rental and leasing	0.04 t	Other municipal government services:	0.2 t
Other:	3.2 t	Other:	0.2 t	Other Aboriginal government services:	0.03 t

Note: See the appendix of Dobson and Fellows (2017) for a full listing of the sectors included in the "Other" category for household and firm investment emissions. The appendix additionally lists household and firm investment consumption emissions for each of these sectors. Government consumption emissions by sector are fully accounted for as they are limited to the six government-specific sectors listed in the table.

## INTERPROVINCIAL TRADE FLOWS

Prince Edward Island's primary source of net interprovincial imports of greenhouse gas emissions is the manufacturing sectors in New Brunswick, Quebec, Nova Scotia and British Columbia. Imports from New Brunswick are by far the largest and are most likely driven by the emissions embedded in refined petroleum products produced at the Irving Oil Refinery in Saint John, New Brunswick and sold in Prince Edward Island. The province additionally has large net imports of emissions from the utilities sector in New Brunswick and from the transportation and warehousing sector in Nova Scotia. The flow of emissions in the utilities sector is consistent with New Brunswick being the only interconnection for electricity imports to Prince Edward Island (CBC News, 2011). Accordingly, in 2011 just over 80 per cent of Prince Edward Island's electricity was imported through New Brunswick (Statistics Canada, 2017a).

Prince Edward Island's largest source of interprovincial net exports of emissions is the crop and animal production sector. Prince Edward Island is a net exporter of emissions in the crop and animal production sector to all but two of the other provinces (Alberta and Saskatchewan), with the largest flows going to Nova Scotia, New Brunswick, Ontario and Quebec. The province also has smaller net exports in the manufacturing sector to Newfoundland and Labrador and in the administrative and support, waste management and remediation services sector to Nova Scotia.

## INTERNATIONAL TRADE FLOWS

Prince Edward Island's largest source of net international imports of greenhouse gas emissions is the manufacturing sector. The province also has small net international imports in the accommodation and food services sector. The two sectors with the largest net exports of emissions internationally are the transportation and warehousing sector, and the crop and animal production sector. This is consistent with the province's well-known potato industry being the largest contributor to exports in 2011, accounting for one third of the total value of exports from Prince Edward Island (Industry Canada, 2017).

## TIME TREND OF PER CAPITA PRODUCTION AND CONSUMPTION EMISSIONS

Total production emissions in Prince Edward Island declined over the period of 2004 to 2011 (-3 per cent) (Figure 3). Prince Edward Island's population grew over this period (+5 per cent), leading to an even larger percentage drop in the province's per capita production emissions (-8 per cent) (Figure 4). The decrease in total emissions is largely a result of steadily declining emissions from the province's crop and animal production sector from 2004 to 2010 and from the fishing, hunting and trapping sector from 2005 to 2009. Output from the crop and animal production sector declined over this period, although by a smaller percentage than the decline in emissions, while output from the fishing, hunting and trapping sector increased (Statistics Canada, 2017b). This suggests a transition to less carbon-intensive farming and fishing practices played a role in lowering emissions.

On net, Prince Edward Island also saw a small decline in its consumption emissions over the period of 2004 to 2011. Specifically, total consumption emissions in the province decreased by 0.2 per cent while per capita emissions fell by almost five per cent. Consumption emissions did not follow any obvious trend, however, and although Prince Edward Island remained a net importer of emissions over the entire period, its level of per capita imports varied considerably – from a low of 4.1 t in 2005 to a high of 9.8 t in 2010.

The lack of an obvious trend in consumption emissions was most evident for households. On net, total household consumption emissions increased by one per cent from 2004 to 2011 while per capita emissions declined by three per cent. Within this period, however, there was no consistent pattern with household consumption emissions generally hovering around 13.5 t per capita but regularly spiking up to levels in excess of 15.0 t per capita. Large but temporary increases in emissions from the manufacturing sector drive the spikes, while the net decline in per capita emissions over the entire period is largely a result of more steadily declining emissions from the utilities and finance, insurance, real estate and rental and leasing sectors. As Prince Edward Island imports a significant share of its electricity from New Brunswick, this trend is consistent with decreasing production emissions from New Brunswick's utilities sector over this same period.

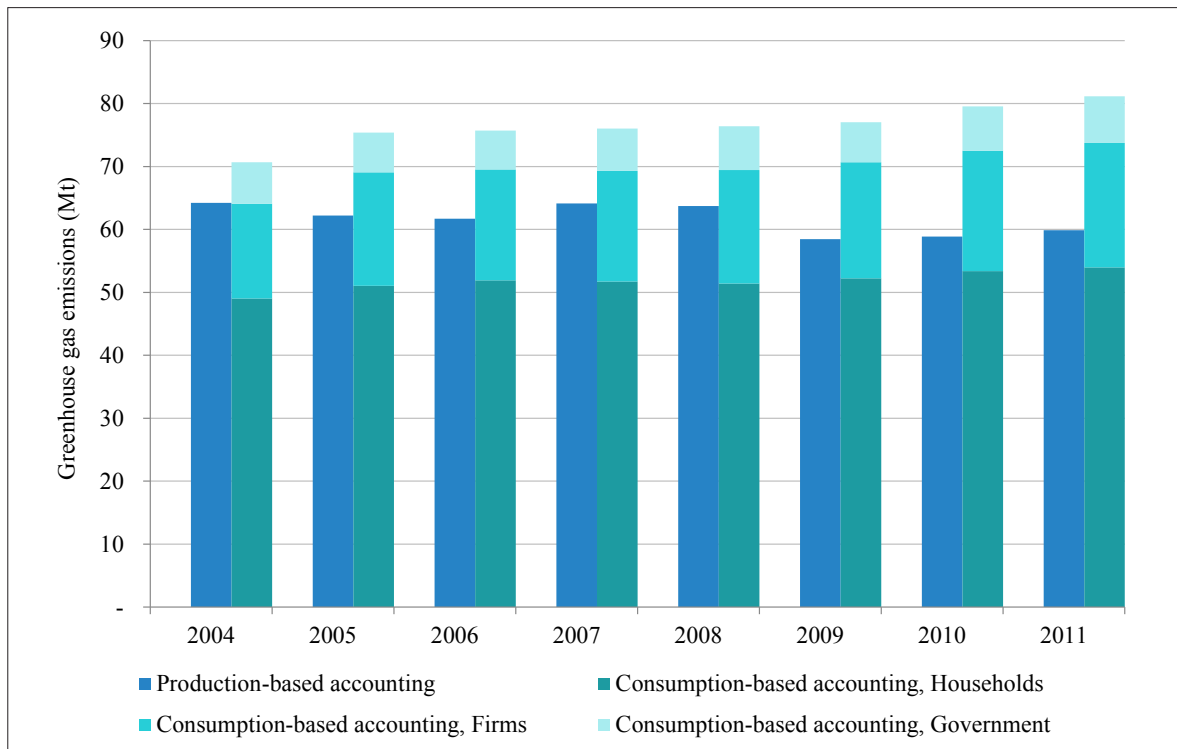
Total and per capita firm investment consumption emissions in Prince Edward Island saw the largest net decrease over the period of 2004 to 2011, falling by six and 10 per cent respectively. Their lowest levels, however, were reached in 2009, before spiking up in 2010 and declining again in 2011. The decrease in emissions was driven primarily by the manufacturing sector, which saw firm investment consumption emissions decline steadily from 2004 to 2009 and never fully recover. Emissions in the aggregate construction sector similarly declined from 2004 to 2008 but had recovered to just above 2004 levels by 2011, driven up by rising emissions in both the residential and engineering construction sectors post-2009.<sup>3</sup>

Last, total and per capita government consumption emissions decreased by two and six per cent respectively from 2004 to 2011. Similar to firm investment emissions, government consumption emissions reached a low in 2009 and sharply increased in 2010, but otherwise did not follow a consistent pattern. Since 2009 government consumption emissions have increased in all government subsectors except government education services, with the largest increases coming in the other (non-health care and education) federal and provincial government services sectors.<sup>4</sup>

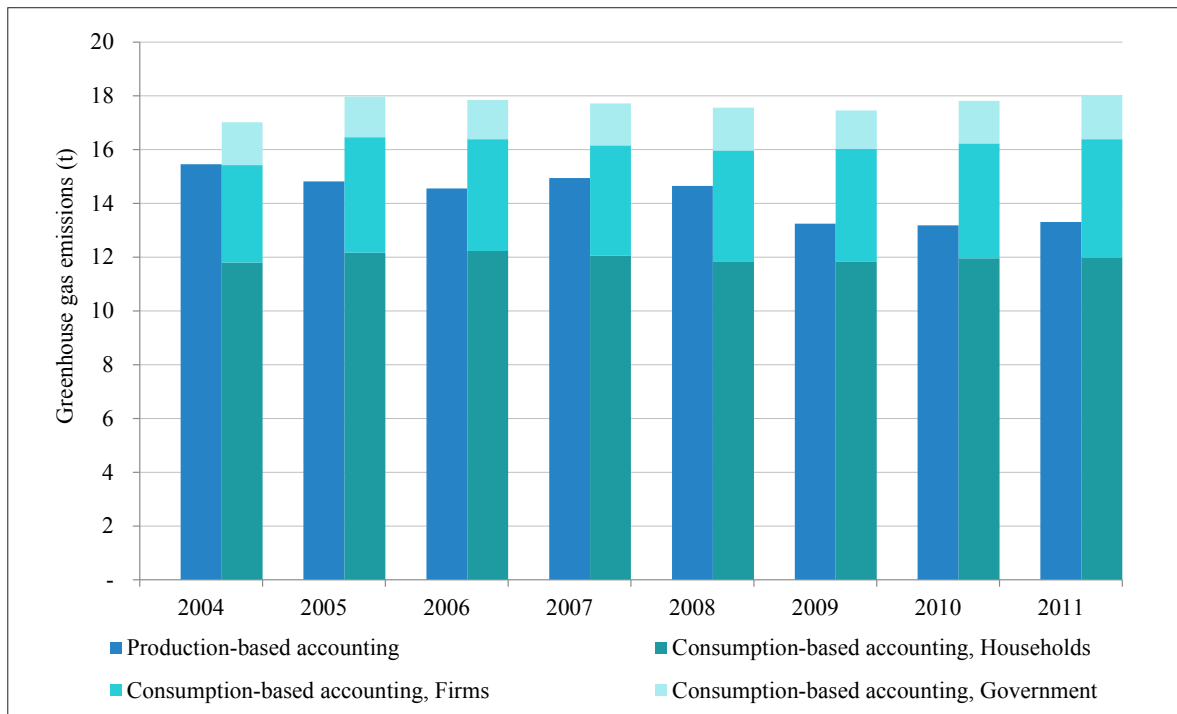
<sup>3</sup> Prior to 2009 emissions data are only available for the aggregate construction sector.

<sup>4</sup> Prior to 2009 emissions data are only available for the aggregate government services sector.

**FIGURE 3 TOTAL PRODUCTION AND CONSUMPTION EMISSIONS, PRINCE EDWARD ISLAND: 2004 TO 2011**



**FIGURE 4 PER CAPITA PRODUCTION AND CONSUMPTION EMISSIONS, PRINCE EDWARD ISLAND: 2004 TO 2011**





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**G. Kent Fellows** (PhD, Calgary) is a research associate at The School of Public Policy, University of Calgary. Kent has previously worked as a researcher for the University of Alberta's School of Public Health and as an intern at the National Energy Board. He has published articles on the effects of price regulation and bargaining power on the Canadian pipeline and pharmaceutical industries as well as the integration of renewable generation capacity in the Alberta electricity market. His current research agenda focuses on the area of computational economics as applied to the construction and use of large-scale quantitative models of inter-sector and interprovincial trade within Canada. Kent is also involved in forwarding The School of Public Policy's Canadian Northern Corridor research program, which is aimed at studying the concept of a multi-modal linear infrastructure right of way through Canada's North and near North.

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