

# British Columbia Greenhouse Gas Inventory Report 2007 – SUMMARY

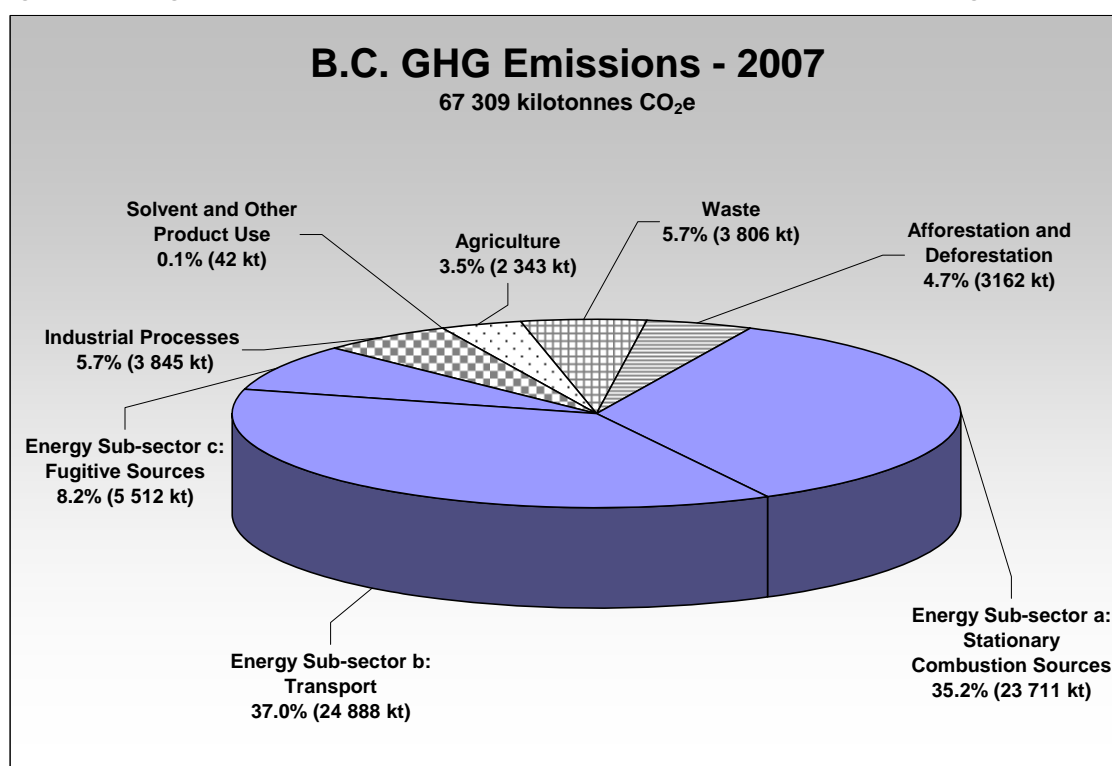
The B.C. GHG inventory report has been prepared by the Ministry of Environment, working with staff in other provincial ministries and with federal counterparts, to determine and report the 2007 GHG emissions level for B.C. The year 2007 was established under the provincial *Greenhouse Gas Reductions Target Act*<sup>1</sup> as the base year for calculation of GHG emissions targets.<sup>2</sup>

The full report, as well as additional information, is available at the ministry's GHG inventory home-page: [www.env.gov.bc.ca/epd/climate/ghg-inventory/index.htm](http://www.env.gov.bc.ca/epd/climate/ghg-inventory/index.htm)

Comments or questions regarding the report can be sent to: [GHGInventory@gov.bc.ca](mailto:GHGInventory@gov.bc.ca)

## 1. B.C. Greenhouse Gas Emissions 2007

Total greenhouse gas (GHG)<sup>3</sup> emissions in British Columbia in 2007 were 67.3 megatonnes CO<sub>2</sub>e.<sup>4</sup>



<sup>1</sup> The Act puts into law British Columbia's target of reducing greenhouse gas emissions (GHGs) by at least 33 per cent below 2007 levels by 2020 and includes the long-term target of an 80 per cent reduction below 2007 levels by 2050.

<sup>2</sup> In keeping with national and international GHG inventory procedures, it is expected that GHG estimates, including the 2007 baseline, will be updated annually or periodically to reflect improved quantification methods and input data, as well as resolution of data anomalies.

<sup>3</sup> GHGs trap heat and reflect it back to the Earth's surface, altering the chemical composition of the atmosphere and changing climate. There are four major gases or groups of gases that make up GHGs: carbon dioxide (CO<sub>2</sub>); methane (CH<sub>4</sub>); nitrous oxide (N<sub>2</sub>O); and synthetic (not naturally occurring) fluorinated gases – sulphur hexafluoride (SF<sub>6</sub>), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). Each GHG has a different potential to contribute to global warming (GWP), measured in terms of "CO<sub>2</sub>e" – with carbon dioxide set as the baseline of one. Methane, for example, has a GWP of 21 CO<sub>2</sub>e. GHG emissions are reported in common units (CO<sub>2</sub>e) by weight – 1 megatonne (1 Mt) is one million tonnes and one kilotonne (1 kt) is one thousand tonnes.

<sup>4</sup> This figure includes B.C.-specific emissions currently not reported at the provincial level in the National Inventory Report (NIR). As a result, reported emissions are 4.2 Mt (6.7%) higher than the emissions of 63.1 Mt reported for B.C. in the NIR.

GHG emissions are attributed to six defined sectors – energy (with three sub-sectors), industrial processes, solvents and other product use, agriculture, waste, and afforestation and deforestation – following national and international reporting protocols. These sectors, and energy sub-sectors, are described in the table below.

| Sector                                    | Description   |
|---|---|
| <b>ENERGY</b>                             | Emissions from stationary and transport fuel combustion and fugitive emissions from the fossil fuel industry.   |
| Sub-sector a:<br>Stationary<br>Combustion | Emissions from stationary devices that combust solid, liquid or gaseous fuel in order to generate useful heat or electricity (excluding devices used in pipeline transport). Emissions are broken down by the following industrial sectors: electricity and heat generation; fossil fuel industries; mining and oil and gas extraction; manufacturing; construction; commercial and institutional; and residential. |
| Sub-sector b:<br>Transport                | Emissions from mobile devices that combust liquid or gaseous fuels for the purpose of generating useful energy (including stationary devices used in pipeline transport). Emissions are broken down by the following vehicle categories: domestic aviation; road transportation; railways; domestic marine; off-road transportation; and pipelines.   |
| Sub-sector c:<br>Fugitive Emissions       | Intentional or unintentional emissions from: the production, processing, transmission, storage and delivery of fossil fuels; and the combustion of fossil fuels not used to generate useful heat or electricity.  |
| <b>INDUSTRIAL PROCESSES</b>               | Emissions from chemical reactions used in industry that physically or chemically transform materials (occurring during the production of cement, lime, aluminium, other base metals and hydrogen) and fugitive emissions from the use of halocarbons and sulphur hexafluoride in various applications.  |
| <b>SOLVENT &amp; OTHER PRODUCT USE</b>    | Fugitive emissions of nitrous oxide when the gas is used as an anaesthetic or propellant.   |
| <b>AGRICULTURE</b>                        | Emissions from enteric fermentation (digestive processes of ruminant animals such as cattle), manure management and agricultural soils.   |
| <b>WASTE</b>                              | Emissions from solid waste decomposition at landfills, wastewater treatment and waste incineration.   |
| <b>AFFORESTATION &amp; DEFORESTATION</b>  | Emissions from deforestation (i.e., releases at the time of deforestation <sup>5</sup> and the residual decay of dead organic matter) and removals from afforestation (i.e., new trees absorbing and storing CO <sub>2</sub> from the atmosphere).  |

## **2. B.C. GHG Emissions by Sector – 1990 to 2007**

The table on the following pages provides a summary of GHG emissions for B.C. by category for key years between 1990 and 2007.<sup>6</sup> Note that the table includes “Other Land Use” emissions categories. These “memo items” are reported for transparency and GHG accounting purposes but do not contribute to British Columbia total GHG emissions.<sup>7</sup>

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<sup>5</sup> Under current international accounting protocols, all carbon stored in removed biomass is considered to be converted to CO<sub>2</sub> and emitted to the atmosphere immediately.

<sup>6</sup> Emissions data for all years between 1990 and 2007 can be downloaded in Microsoft Excel spreadsheet format from the ministry’s GHG inventory homepage: [www.env.gov.bc.ca/epd/climate/ghg-inventory/index.htm](http://www.env.gov.bc.ca/epd/climate/ghg-inventory/index.htm)

<sup>7</sup> Refer to Chapter 1 of the BC Provincial GHG Inventory Report 2007 for additional information regarding GHG emissions accounting and reporting protocols and procedures.

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| GHG Source Category                     | Year                                 | 1990   | 1995   | 1997   | 2000   | 2004   | 2005   | 2006   | 2007   |
|---|--------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
|   | GHG Emissions (kt CO <sub>2</sub> e) |        |        |        |        |        |        |        |        |
| <b>TOTAL EMISSIONS</b>                  |                                      | 55 678 | 62 671 | 62 557 | 66 241 | 68 157 | 65 682 | 64 835 | 67 309 |
| <b>ENERGY</b>                           |                                      | 40 517 | 47 971 | 47 671 | 51 365 | 54 247 | 51 833 | 51 280 | 54 111 |
| <b>a. Stationary Combustion Sources</b> |                                      | 18 812 | 20 989 | 19 149 | 22 387 | 23 186 | 21 639 | 21 643 | 23 711 |
| Electricity and Heat Generation         |                                      | 1 183  | 2 734  | 1 200  | 2 513  | 1 871  | 1 485  | 1 539  | 1 565  |
| Fossil Fuel Industries                  |                                      | 3 502  | 3 516  | 2 790  | 3 767  | 6 521  | 5 768  | 5 780  | 6 289  |
| Mining and Oil & Gas Extraction         |                                      | 255    | 164    | 347    | 318    | 494    | 299    | 1 000  | 1 039  |
| Manufacturing Industries                |                                      | 6 078  | 6 387  | 6 531  | 7 336  | 6 614  | 6 189  | 5 362  | 6 939  |
| Construction                            |                                      | 306    | 200    | 127    | 76     | 101    | 107    | 111    | 117    |
| Commercial & Institutional              |                                      | 2 838  | 3 398  | 3 319  | 3 423  | 3 522  | 3 399  | 3 362  | 3 326  |
| Residential                             |                                      | 4 329  | 4 439  | 4 566  | 4 638  | 3 995  | 4 325  | 4 424  | 4 372  |
| Agriculture & Forestry                  |                                      | 321    | 152    | 268    | 315    | 68     | 66     | 66     | 64     |
| <b>b. Transport</b>                     |                                      | 18 385 | 22 006 | 23 192 | 23 705 | 25 934 | 24 953 | 24 314 | 24 888 |
| Domestic Aviation                       |                                      | 1 067  | 1 228  | 1 313  | 1 414  | 1 505  | 1 489  | 1 479  | 1 397  |
| Road Transportation                     |                                      | 11 444 | 13 183 | 13 912 | 14 677 | 15 733 | 15 334 | 15 284 | 15 574 |
| Light-Duty Gasoline Vehicles            |                                      | 3 850  | 4 428  | 4 580  | 4 453  | 4 439  | 4 169  | 4 096  | 4 131  |
| Light-Duty Gasoline Trucks              |                                      | 2 200  | 3 387  | 3 948  | 4 473  | 4 999  | 4 774  | 4 709  | 4 752  |
| Heavy-Duty Gasoline Vehicles            |                                      | 2 042  | 1 828  | 1 818  | 1 672  | 1 719  | 1 641  | 1 629  | 1 648  |
| Motorcycles                             |                                      | 18     | 13     | 12     | 16     | 26     | 27     | 27     | 27     |
| Light-Duty Diesel Vehicles              |                                      | 26     | 29     | 32     | 38     | 44     | 46     | 45     | 46     |
| Light-Duty Diesel Trucks                |                                      | 35     | 63     | 66     | 65     | 57     | 56     | 57     | 58     |
| Heavy-Duty Diesel Vehicles              |                                      | 2 490  | 2 864  | 3 054  | 3 631  | 4 188  | 4 428  | 4 530  | 4 686  |
| Propane & Natural Gas Vehicles          |                                      | 782    | 570    | 400    | 329    | 260    | 194    | 191    | 226    |
| Railways                                |                                      | 1 441  | 1 650  | 1 439  | 1 268  | 388    | 414    | 400    | 402    |
| Domestic Marine                         |                                      | 1 025  | 1 232  | 1 033  | 1 235  | 2 656  | 2 544  | 2 461  | 2 566  |
| Other Transportation                    |                                      | 3 409  | 4 713  | 5 496  | 5 111  | 5 652  | 5 173  | 4 690  | 4 948  |
| Off Road                                |                                      | 2 553  | 3 328  | 4 049  | 3 457  | 4 520  | 4 183  | 3 916  | 4 014  |
| Off-Road Gasoline                       |                                      | 350    | 421    | 461    | 493    | 505    | 451    | 447    | 449    |
| Off-Road Diesel                         |                                      | 2 203  | 2 907  | 3 588  | 2 964  | 4 015  | 3 732  | 3 469  | 3 565  |
| Pipelines                               |                                      | 856    | 1 385  | 1 446  | 1 655  | 1 131  | 989    | 774    | 933    |
| <b>c. Fugitive Sources</b>              |                                      | 3 320  | 4 976  | 5 330  | 5 273  | 5 127  | 5 241  | 5 323  | 5 512  |
| Coal Mining                             |                                      | 487    | 569    | 657    | 478    | X      | X      | X      | X      |
| Oil and Natural Gas                     |                                      | 2 833  | 4 407  | 4 673  | 4 794  | X      | X      | X      | X      |
| <b>INDUSTRIAL PROCESSES</b>             |                                      | 3 582  | 3 883  | 4 283  | 4 779  | 4 087  | 4 137  | 3 952  | 3 845  |
| <b>a. Mineral Products</b>              |                                      | 871    | 1 023  | 1 138  | 1 348  | 1 407  | 1 376  | 1 397  | 1 418  |
| Cement Production                       |                                      | 613    | 758    | 861    | 1 054  | 1 175  | 1 149  | 1 171  | 1 194  |
| Lime Production                         |                                      | 162    | 192    | 195    | 218    | 191    | 181    | 166    | 162    |
| Limestone and Dolomite Use              |                                      | 75     | 52     | 56     | 49     | 21     | 21     | 35     | 35     |
| Soda Ash Production and Use             |                                      | 22     | 21     | 25     | 27     | 20     | 24     | 25     | 28     |
| <b>b. Chemical Industry</b>             |                                      | -      | -      | -      | -      | -      | -      | -      | -      |
| Nitric Acid Production                  |                                      | -      | -      | -      | -      | -      | -      | -      | -      |
| Adipic Acid Production                  |                                      | -      | -      | -      | -      | -      | -      | -      | -      |
| <b>c. Metal Production</b>              |                                      | 1 507  | 1 687  | 1 795  | 1 820  | 1 357  | 1 131  | 1 015  | 1 101  |
| Iron and Steel Production               |                                      | -      | -      | -      | -      | -      | -      | -      | -      |
| Aluminium Production                    |                                      | 1 507  | 1 687  | 1 795  | 1 820  | 1 357  | 1 131  | 1 015  | 1 101  |

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| Year  | 1990   | 1995    | 1997    | 2000    | 2004   | 2005   | 2006   | 2007              |
|---|--|---------|---------|---------|--------|--------|--------|-------------------|
| GHG Source Category   | GHG Emissions (kt CO <sub>2</sub> e)   |         |         |         |        |        |        |                   |
| <b>TOTAL EMISSIONS</b>  | 55 678   | 62 671  | 62 557  | 66 241  | 68 157 | 65 682 | 64 835 | 67 309            |
| SF <sub>6</sub> Used in Magnesium Smelters and Casters <sup>2</sup> | –  | –       | X       | X       | X      | X      | X      | X                 |
| d. Consumption of Halocarbons and SF <sub>6</sub>                   | 427  | 492     | 545     | 822     | 892    | 1 073  | 1 133  | 1 023             |
| e. Other & Undifferentiated Production                              | 777  | 681     | 805     | 789     | 431    | 557    | 407    | 303               |
| <b>SOLVENT &amp; OTHER PRODUCT USE</b>                              | 21   | 27      | 30      | 32      | 27     | 23     | 42     | 42                |
| <b>AGRICULTURE</b>  | 2 171  | 2 392   | 2 455   | 2 432   | 2 686  | 2 639  | 2 397  | 2 343             |
| a. Enteric Fermentation   | 996  | 1 160   | 1 166   | 1 187   | 1 333  | 1 298  | 1 199  | 1 149             |
| b. Manure Management  | 315  | 356     | 362     | 377     | 404    | 396    | 377    | 368               |
| c. Agriculture Soils  | 860  | 876     | 928     | 867     | 949    | 945    | 821    | 826               |
| Direct Sources  | 375  | 342     | 376     | 316     | 339    | 346    | 286    | 300               |
| Pasture Range and Paddock Manure                                    | 198  | 240     | 239     | 260     | 292    | 285    | 261    | 251               |
| Indirect Sources  | 288  | 293     | 313     | 291     | 317    | 315    | 273    | 275               |
| <b>WASTE</b>  | 3 420  | 3 761   | 3 998   | 3 863   | 3 788  | 3 714  | 3 790  | 3 806             |
| a. Solid Waste Disposal on Land                                     | 3 269  | 3 590   | 3 823   | 3 688   | 3 612  | 3 540  | 3 615  | 3 629             |
| b. Wastewater Handling  | 85   | 98      | 102     | 105     | 107    | 106    | 107    | 109               |
| c. Waste Incineration   | 66   | 73      | 73      | 70      | 69     | 69     | 68     | 68                |
| <b>AFFORESTATION &amp; DEFORESTATION</b>                            | 5 967  | 4 637   | 4 120   | 3 770   | 3 322  | 3 335  | 3 374  | 3 162             |
| a. Afforestation <sup>1</sup>                                       | -14  | -14     | -14     | -14     | -15    | -16    | -15    | -16               |
| b. Deforestation  | 5 980  | 4 651   | 4 014   | 3 784   | 3 337  | 3 351  | 3 390  | 3 178             |
| <b>MEMO ITEMS</b>   | (categories presented for information purposes but not included in B.C. total GHG emissions) |         |         |         |        |        |        | <b>MEMO ITEMS</b> |
| <b>OTHER LAND USE</b>   | -27 464  | -41 331 | -46 481 | -36 116 | 43 380 | 28 268 | 50 021 | 52 453            |
| a. Forest Land Remaining Forest Land                                | -27 692  | -41 623 | -46 800 | -36 463 | 43 025 | 27 904 | 49 655 | 52 095            |
| b. Cropland Remaining Cropland                                      | 98   | 171     | 216     | 263     | 291    | 303    | 309    | 305               |
| c. Wetlands Remaining Wetlands                                      | 117  | 120     | 103     | 83      | 64     | 60     | 57     | 53                |

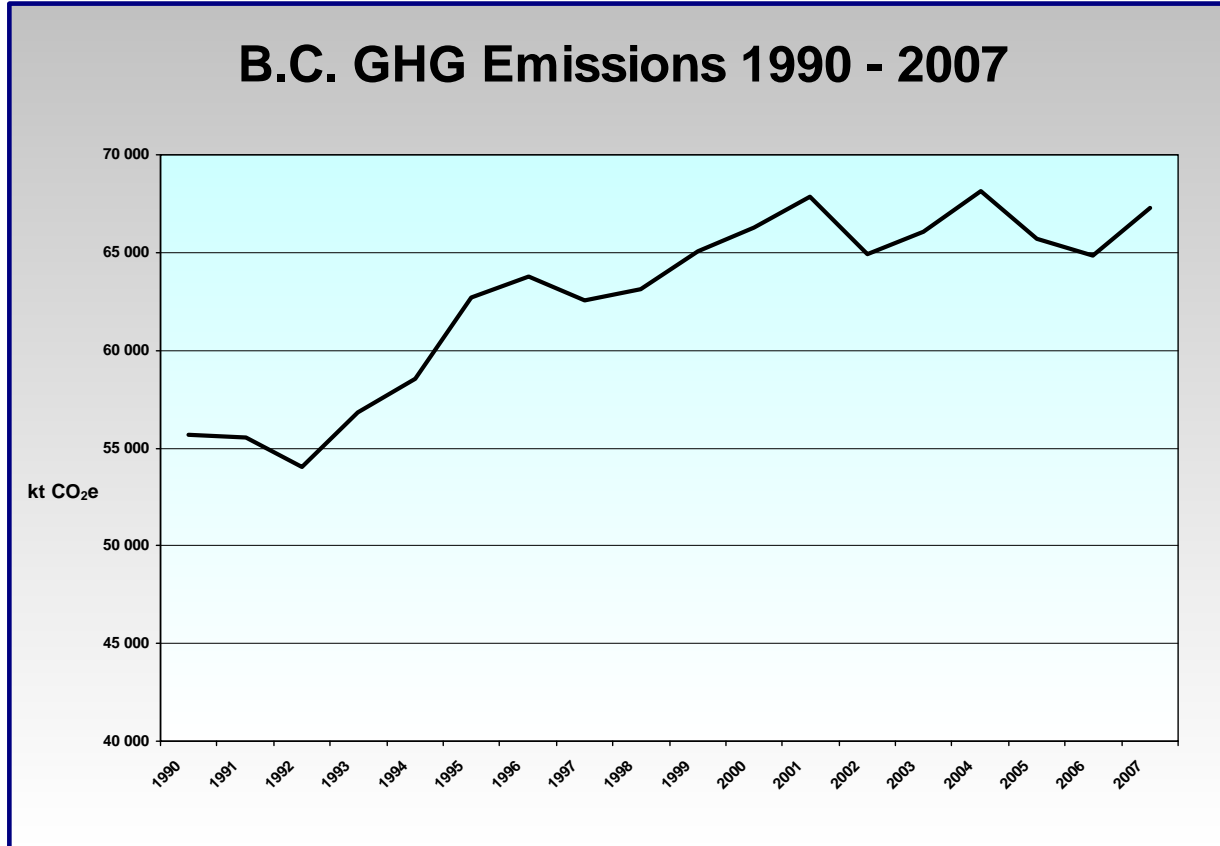
Note: "X" indicates confidential data, "-" indicates no emissions

<sup>1</sup> A negative number indicates that the estimate is a sink (i.e., the activity removes carbon from the atmosphere)

<sup>2</sup> Information on SF<sub>6</sub> use in casters is confidential – hence, SF<sub>6</sub> emissions for this category are reported (with HFC emissions) under "Consumption of Halocarbons and SF<sub>6</sub>"

### 3. Trends in Emissions

British Columbia's reported GHG emissions increased by 3.8% from 2006 to 2007 – from 64.8 Mt to 67.3 Mt CO<sub>2</sub>e.<sup>8</sup> Total annual GHG emissions in B.C. have decreased by 1.2% between 2004 and 2007 (from 68.2 Mt in 2004) and increased by 7.6% (from 62.6 Mt) over the ten year period from 1997 to 2007.



#### Trends in Emissions by Sector

| Sector                        | 2007 GHG Emissions (kt CO <sub>2</sub> e) | 3-Year Change (2004-2007) | 10-Year Change (1997-2007) |
|-------------------------------|---|---------------------------|----------------------------|
| ENERGY                        | 54 111                                    | -0.3%                     | +13.5%                     |
| INDUSTRIAL PROCESSES          | 3 845                                     | -5.9%                     | -10.2%                     |
| SOLVENT & OTHER PRODUCT USE   | 42  | +55.6%                    | +40.0%                     |
| AGRICULTURE                   | 2 343                                     | -12.8%                    | -4.6%                      |
| WASTE                         | 3 806                                     | +0.5%                     | -4.8%                      |
| AFFORESTATION & DEFORESTATION | 3 162                                     | -4.8%                     | -23.3%                     |

<sup>8</sup> Interpretation of short-term (i.e., year-to-year) changes in emissions should be undertaken with caution due to the influence and variability of annual weather conditions (such as snow pack and heating/cooling degree days), methodological changes and data anomalies on reported emission levels. Longer term comparisons (i.e., three and ten year periods) provide more useful trend information.

### **Factors Influencing Emissions**

**Energy Sector**– Energy sector emissions increased 5.5% from 2006 to 2007, decreased 0.3% between 2004 and 2007 and increased 13.5% between 1997 and 2007. Emissions are influenced primarily by production levels from the fossil fuel and manufacturing industries, space heating requirements in buildings, use of natural gas for electricity generation and kilometres traveled by on- road vehicles, marine vessels and airplanes. The large increase in emissions between 2006 and 2007 can be attributed largely to emissions from the “manufacturing” sub-sector of the stationary combustion sources category – which increased by 29.3% between 2006 and 2007.<sup>9</sup>

**Industrial Processes Sector**– Industrial process sector emissions decreased by 2.7% between 2006 and 2007, 5.9% between 2004 and 2007 and 10.2% between 1997 and 2007. Emissions are influenced primarily by production levels of cement, lime, aluminium and other base metals. Reductions in emissions have been influenced by decreases in process emissions from the production of aluminium and the closure of ammonia and methanol plants, mitigated in part by increases in process emissions from cement production.

**Solvent and Other Product Use Sector**– Solvent and other produce use sector emissions did not change between 2006 and 2007, increased 55.6% between 2004 and 2007 and increased 40.0% between 1997 and 2007. Emissions in this sector are directly related to the quantity of nitrous oxide used as an anaesthetic or propellant.

**Agriculture Sector**– Agriculture sector emissions decreased by 2.3% between 2006 and 2007, 12.8% between 2004 and 2007 and 4.6% between 1997 and 2007. Emissions are influenced by animal populations (e.g., cattle and hogs), as well as soil management practices. Decreases in agricultural emissions can be attributed for the most part to reductions in cattle and hog populations.

**Waste Sector**– Waste sector emissions increased 0.4% between 2006 and 2007 and 0.5% between 2004 and 2007. Between 1997 and 2007 emissions decreased by 4.8%. Emissions are influenced primarily by the amount of waste generated and sent to landfills, rates of waste diversion (i.e., recycling and composting) and the capturing and flaring of methane (CH<sub>4</sub>) emissions from landfills. Emissions reductions associated with waste diversion and methane capture have been overshadowed by increases in the quantities of waste generated and sent to landfills, resulting in the overall trend of increasing emissions from year to year.

**Afforestation and Deforestation** – Net afforestation and deforestation sector emissions decreased 4.8% between 2004 and 2007 and 23.3% between 1997 and 2007. Emissions are influenced primarily by the size of deforested area and forest characteristics (i.e., geographic location, growing conditions, tree species, density and age). Decreases in emissions can be attributed to decreases in the area of deforestation from year to year, particularly in the agricultural sector.

**Other Land Use (Memo items not included in total B.C. GHG emissions)** – Emissions associated with “other land use” categories increased 4.8% between 2006 and 2007 and 20.9% between 2004 and 2007. From 1990 to 2007, “other land use” categories collectively changed from a net sink of GHGs (46.5 megatonnes CO<sub>2</sub>e removed from the atmosphere in 1997) to a net source in 2007 (52.5 megatonnes CO<sub>2</sub>e emitted to the atmosphere). This transition can be attributed in large part to the impacts of the mountain pine beetle (MPB) outbreak – which attacked living forests that act as a sink for GHGs and resulted in large areas of dead and decomposing trees. Net emissions associated with these categories are also influenced by wildfires, slash burning and wood harvesting.

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<sup>9</sup> The reported data that has led to this increase is currently under review and may be subject to change.