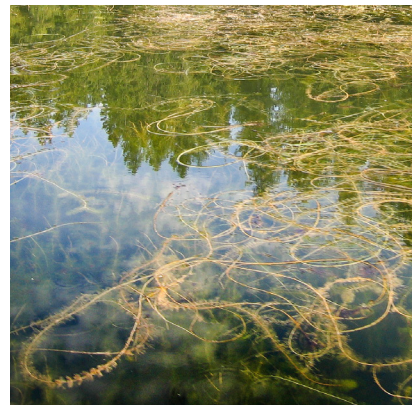
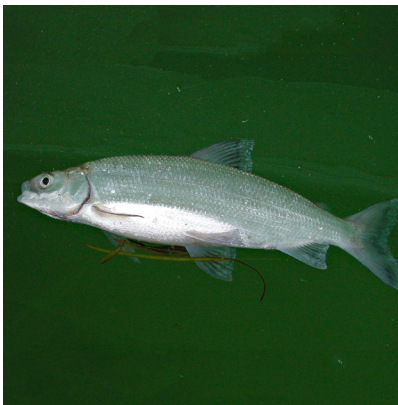
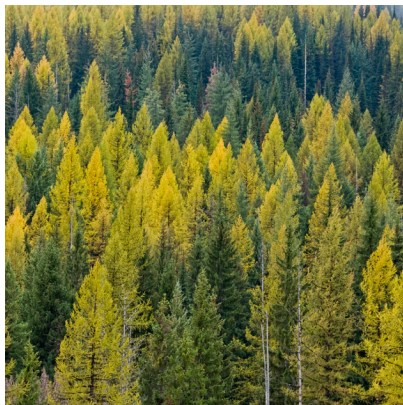


Greenhouse Gas Emissions Reduction

Biennial Report to the Minnesota Legislature
January 2013



Legislative Charge

Minn. Statutes § 216H.07 Emissions-Reduction Attainment; Subd. 3. Biennial report.

(a) By January 15 of each odd-numbered year, the commissioners of Commerce and the Pollution Control Agency shall jointly report to the chairs and ranking minority members of the legislative committees with primary policy jurisdiction over energy and environmental issues the most recent and best available evidence identifying the level of reductions already achieved and the level necessary to achieve the reductions timetable in section 216H.02.

HIST: 2008 c 296 art 1 s 20; 2009 c 86 art 1 s 33; 2012 c 272 s 80

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Introduction

The State of Minnesota continues to be a leader in renewable energy, renewable fuels, energy efficiency and other efforts that reduce emissions associated with energy production and use. The Next Generation Energy Act of 2007 set targets for energy conservation, renewable energy use and greenhouse gas (GHG) emission reductions. Minnesota legislative action helped spearhead other GHG emission reduction actions by state and local government agencies, educational institutions, businesses, communities and non-profit organizations throughout the state.

This report, coauthored by the Minnesota Department of Commerce Division of Energy Resources (DER) and the Minnesota Pollution Control Agency (MPCA), discusses the trend of Minnesota's GHG emissions in relation to the Next Generation Energy Act goal of reducing emissions to a level in 2015 that is 15% below 2005 emissions.

Between 2005 and 2010, statewide GHG emissions declined by about 3%, with the most significant reductions coming from electric power utilities and transportation energy use.

A significant reduction in GHG emissions is seen in 2009. The financial crisis led to a contraction of economic production, which had the effect of reducing energy use and greenhouse gas emissions. With economic recovery, emissions rose in 2010.

This report fulfills the requirements of Minnesota Statute §216H.07. In the past, this report included both a greenhouse gas emissions reduction progress report per subdivision 3 and a discussion of legislative proposals to achieve greenhouse gas emission reductions per subdivision 4. Minnesota Statute §216H.07 subdivision 4 was repealed in 2012.

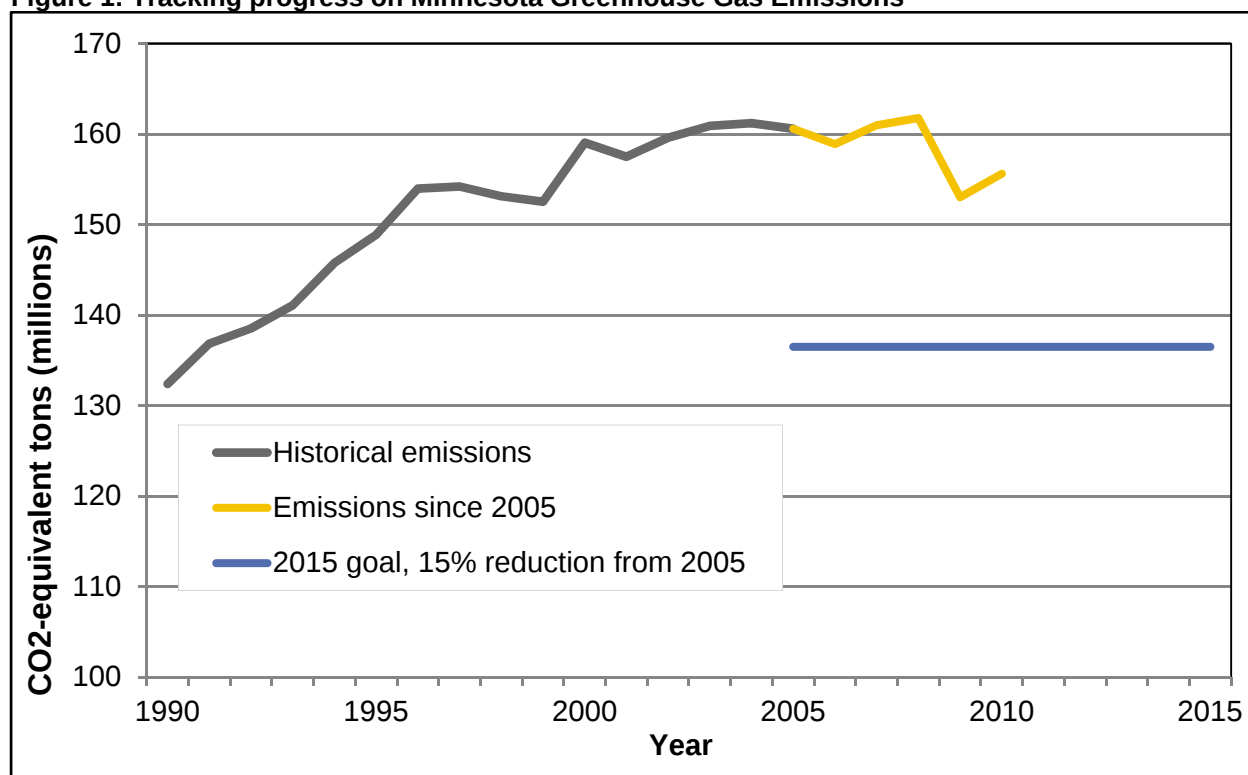
Progress Toward Next Generation Energy Act Greenhouse Gas Emission Reduction Goals

The Minnesota Pollution Control Agency (MPCA) is required to report on statewide progress toward the greenhouse gas (GHG) reduction goals established in the Next Generation Energy Act (Minn. Stat. § 216H.02). This act established a 2015 reduction goal 15 percent below 2005 emissions. The longer term goals of the Next Generation Energy Act are to reduce emissions 30% below 2005 emissions by 2025, and 80% below 2005 emissions by 2050.

Greenhouse gases are gases that, upon release to the atmosphere, warm the atmosphere and surface of the planet, leading to alterations in the earth's climate. To track progress with the Next Generation Energy Act reduction goals, the MPCA calculates and reports emissions of carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄), sulfur hexafluoride (SF₆), and two classes of compounds known collectively as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).

GHG emissions in 2010 totaled 155.6 million CO₂-equivalent tons¹ (CO₂-e). Between 2005 and 2010², GHG emissions from Minnesota declined by 5 million CO₂-e, or about 3 percent. Figure 1 shows the trend in CO₂-e emissions since 1990, relative to the 2015 emission reduction goal.

Figure 1: Tracking progress on Minnesota Greenhouse Gas Emissions



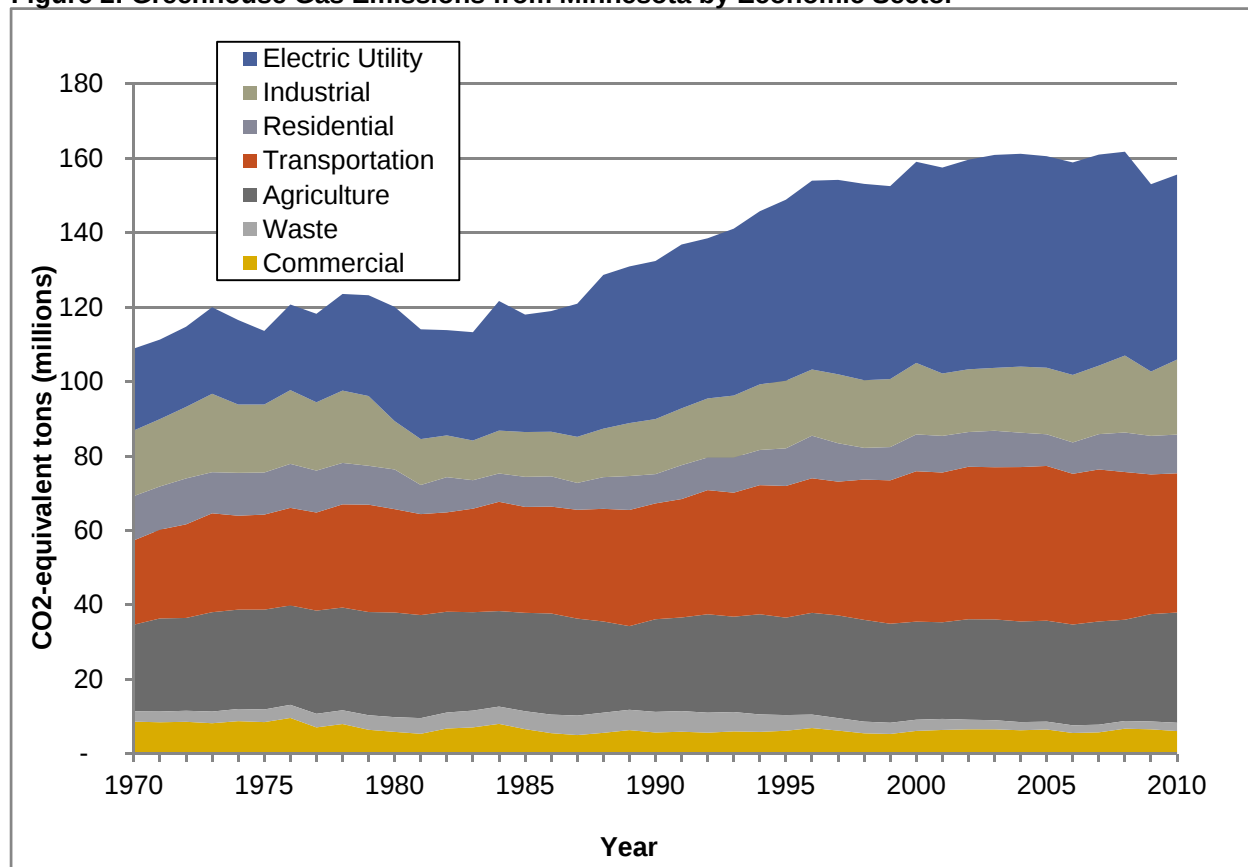
¹ A CO₂-equivalent ton is a standardized metric used to compare emissions of different greenhouse gases.

² Current data reporting and analysis procedures result in about a two year lag in tabulation of calendar year emissions.

Greenhouse Gas Emissions by Economic Sector

The MPCA's GHG Emission Inventory groups GHG emissions in the agricultural, commercial, electric generation, industrial, residential, transportation, and waste sectors. Figure 2 shows the 40-year trend in emissions by economic sector

Figure 2: Greenhouse Gas Emissions from Minnesota by Economic Sector



The electric power sector and transportation sector together account for 56 percent of 2010 emissions from Minnesota sources (Table 1).

Most of the reductions in state-level GHG emissions occurred in the electric power and transportation sectors. The emission reductions observed between 2005 and 2010 are described by economic sector in Table 2.

Between 2005 and 2010, emissions of GHGs from electricity generation declined by 7 million CO₂-equivalent tons, while those from transportation declined by 4 million CO₂-equivalent tons. This was countered by a 2.5 million CO₂-equivalent ton increase in agricultural emissions and a 1.9 million CO₂-equivalent ton increase in residential sector emissions. The industrial and commercial sectors experienced slight decreases in emissions and the waste sector emissions increased slightly over this time period.

Table 1: Sector Percentages of Total 2010 GHG Emissions

Electric Utility	32%
Transportation	24%
Agriculture	19%
Industrial	13%
Residential	7%
Commercial	4%
Waste	1%

Table 2: Emission Change by Sector (million CO₂-e tons)

	2005	2010	Net Change	Percent Change	Principal source of the change in emissions
Electric Utility	56.8	49.7	-7.2	-13%	Decrease in energy consumption and in coal use, increase in renewable energy sources
Transportation	41.6	37.4	-4.2	-10%	Increase in fuel efficiency and use of biofuels, decrease in energy consumption and in fossil fuel energy
Agriculture	27.1	29.6	2.5	9%	Increase in livestock, increase in energy use
Industrial	17.9	20.2	2.3	13%	Sector volatility
Residential	8.5	10.4	1.9	22%	Decreased fossil fuel use, but no net carbon sequestration due to housing construction downturn
Commercial	6.6	6.1	-0.5	-7%	Decrease in energy use
Waste	2.1	2.3	0.2	8%	Decrease in sequestration in demolition and construction landfills
Total	160.6	155.6	-5.0	-3%	Energy use, economic factors

Overall, energy consumption declined between 2005 and 2010. The economic recession influenced the sharp drop in emissions in 2009. The initial economic recovery is seen in the increase in emissions in 2010. Between 2005 and 2010, electric power sector emissions declined, principally as a result of decreased reliance on coal as a power generation source. As less energy was consumed to produce electricity, coal use declined and the use of renewable fuel sources and wind energy increased. Transportation emissions also decreased because of improved fuel efficiency, decreased fuel consumption, and air travel.

GHG emissions from electricity consumed by the residential, industrial, commercial, transportation, agricultural, and waste sectors are categorized as emissions from electric utilities. Emissions from other energy sources used in these sectors, such as natural gas for heating and cooking, are counted within each sector.

The effects of the economic recession are seen in the residential and waste sectors. While emissions from energy use and other activities declined between 2005 and 2010, the amount of carbon stored in new residential structures and in demolition and construction landfills decreased, so there was less of an offset for other GHG emissions.

Biofuel Emissions

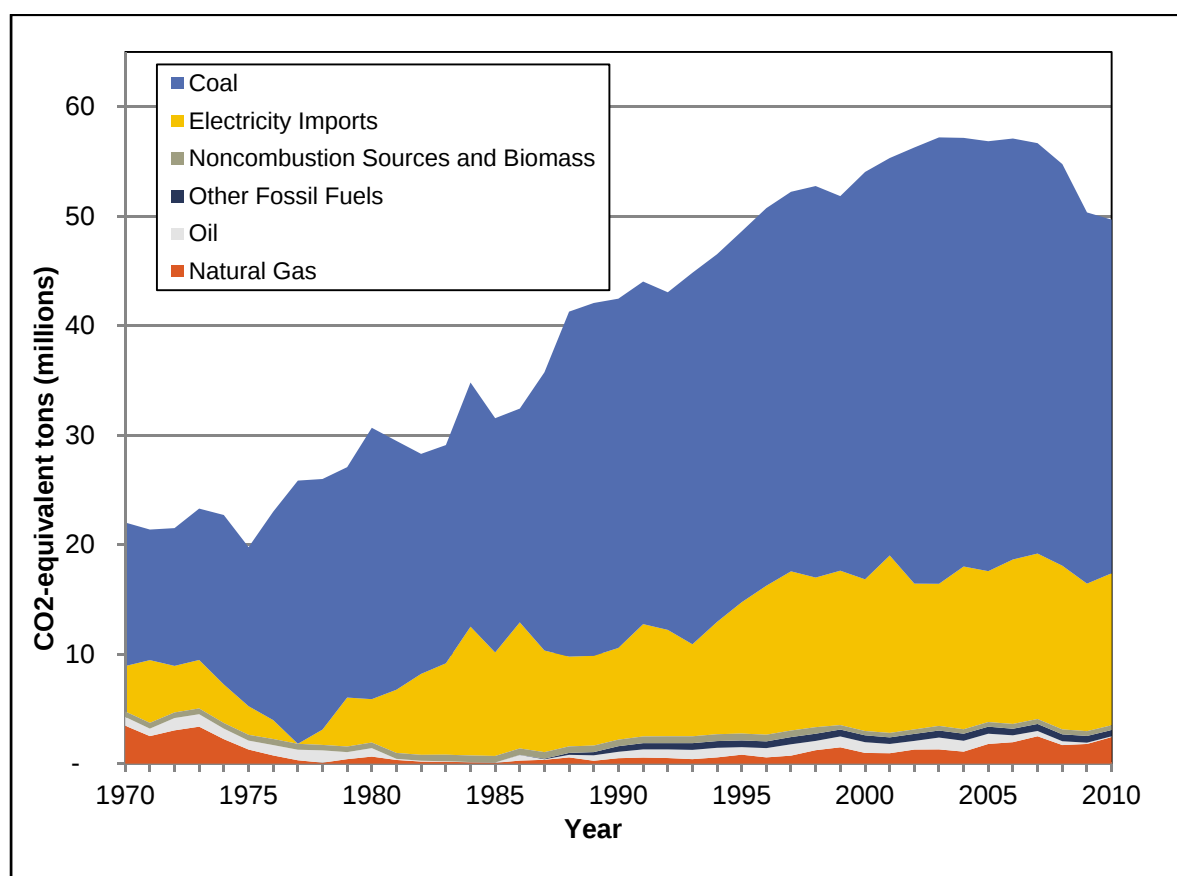
Biofuel GHG emissions are accounted for differently than fossil fuel GHG emissions per Minn. Stat. §216H.01. Because biofuels are considered renewable resources, CO₂ emissions are excluded from the total GHG emissions and tracked separately. CO₂ will be used by plants during photosynthesis and incorporated into the next crop of biofuels. Biofuel CO₂ emissions are not included with fossil fuel GHG emissions, because fossil fuels contain carbon from millions of years ago which have long been removed from the carbon cycle. Biofuel sources of N₂O and CH₄ are included in the total because these gases are not part of the carbon cycle to be used by growing biofuel crops.

Further Discussion of GHG Emissions from Electricity Generation

While most of the electricity consumed in Minnesota is generated within the state, some electricity is purchased from utilities outside the state borders. The Next Generation Energy Act (Minn. Stat. § 216H.01) specifies that statewide GHG emission estimates must include emissions from “...generation of electricity imported from outside the state and consumed in Minnesota.” In 2010, imported electricity supplied 26% of the electricity consumed in the state. GHG emissions from imported electricity are estimated based on a regional average of GHG emissions from electricity generation.

Emissions associated with electricity generation within the state are shown by fuel in Figure 3, with imported electricity emissions included as a separate category. Emissions from coal continue to dominate, but a sharp decline is seen in recent years. As noted above, biofuel CO₂ emissions are excluded, although N₂O and CH₄ from biofuels are included. Many sources of electricity are not shown in this figure because they do not generate GHG emissions. Nuclear power is a significant portion of electricity generated in Minnesota, and electricity from wind turbines is an expanding source of energy.

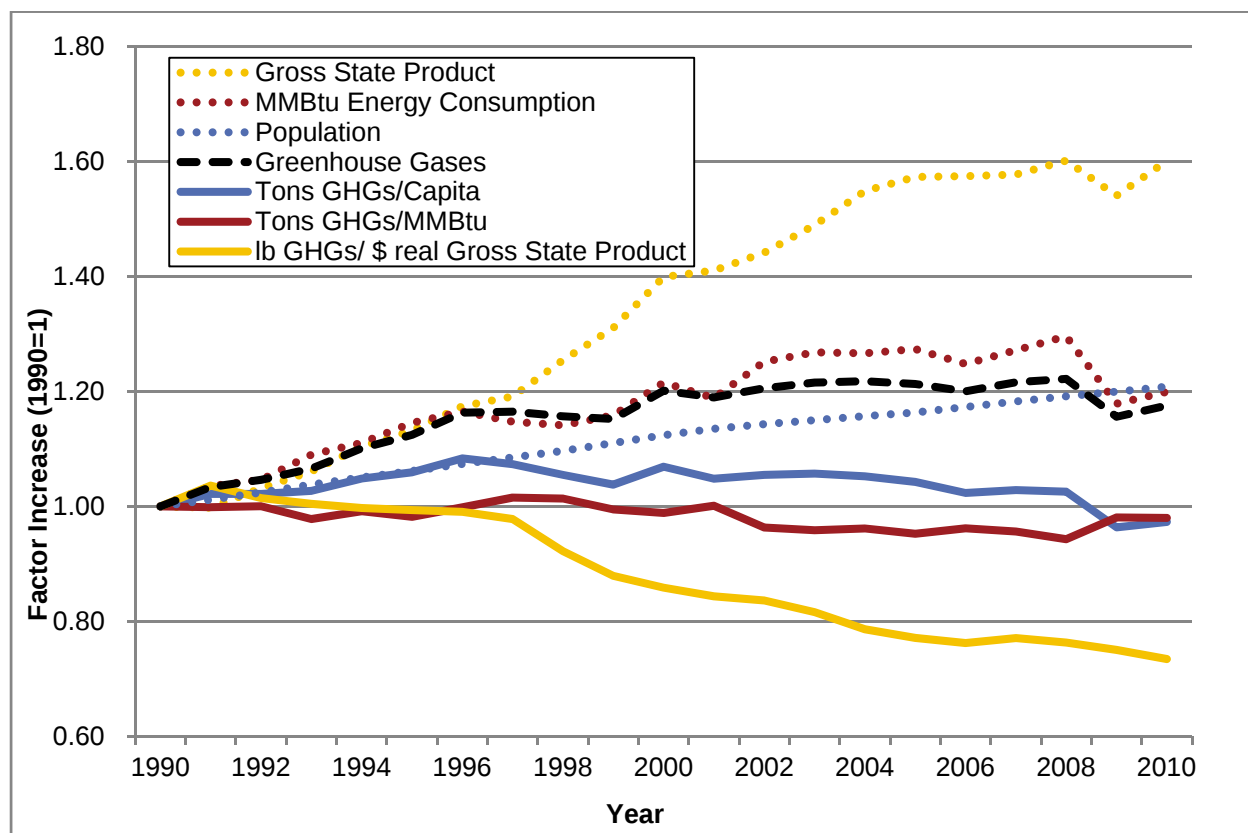
Figure 3: GHG Emissions from Electric Generation



Indicators of Greenhouse Gas Emission Intensity

Measures of GHG emission intensity are useful in understanding how GHG emissions change in relation to other Minnesota trends. Indicators related to GHG emissions include population, economic outputs and energy consumption. The changes in these indicators, relative to 1990, are shown in Figure 4.

Figure 4: Indicators of Minnesota GHG intensity



The effect of the economic recession is apparent in the gross state product (GSP) (2005 dollars)³, and is echoed in energy consumption and emissions showing a clear relationship between these indicators.

The decline in Minnesota's economic output and resulting decrease in energy were the primary drivers in the decrease in GHG emissions in 2009. Because GHGs are closely related to energy use, while both decreased in absolute terms, the ratios of GHG emissions to energy use were fairly constant despite the economic recession. Notably, while economic recovery is visible in 2010, with relative 2010 GSP similar to 2008 GSP, energy use and GHG emissions did not show a similar return to pre-recession levels.

The GHG intensity of Minnesota's economy has steadily declined. The GHGs/gross state product indicator shows that Minnesota's economy is increasingly efficient in terms of GHG emissions per economic output.

The GHG intensity of Minnesota's energy has remained fairly constant because our energy sources are still predominantly fossil fuels. The slight decrease in GHGs/MMBtu indicator shows the effect of energy efficiency and renewable energy.

³ The US Department of Commerce, Bureau of Economic Analysis (BEA) changed methodologies in 1997, creating a discontinuity in data streams. Real GSP (chained 2005 dollars) was calculated using the US quantity index values for 1997 and prior years, and an optimized quantity index for all years post-1997, calculated from BEA reported state real and nominal GSP values.

Greenhouse Gas Emission Inventory Methodology

The methods used to develop these emissions estimates were discussed in the first Biennial Progress Report to the Legislature, published in January 2009. A technical support document published in 2012 provides a more detailed discussion on the calculation methodology and is available at <http://www.pca.state.mn.us/tchy611>. With few exceptions, the methods used to develop the emission estimates are unchanged from previous reports. The methodological changes made since the last report were made to improve estimation of total emissions. To assure consistency, these changes were applied to all prior inventory years, including the baseline year of 2005.

Only emissions that occur within the geographical borders of the state are estimated, with two exceptions – net imports of electricity into the state and emissions from the combustion of aviation fuel purchased in Minnesota, but not necessarily combusted within Minnesota air space.

The Next Generation Energy Act requires that evaluation of state-level GHG emissions take into account photosynthetically-removed CO₂ sequestered in biomass in forests, soils, landfills and structures. However, it has proven difficult or impossible to express some observed removals of CO₂ from the atmosphere in standard CO₂-equivalent terms. These removals, mostly involving forestry carbon, are tracked but are reported separately. Removals of CO₂ from the atmosphere and long-term storage in residential structures and demolition and construction landfills are included in statewide GHG emission totals.

Emissions are estimated for all years from 1970 to 2010. With a few exceptions, the methods used to develop these estimates are derived from the following sources:

- **US Environmental Protection Agency.** (2012). *Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2010*.
- **California Air Resources Board, California Climate Action Registry, ICLEI, Local Governments for Sustainability, and The Climate Registry.** (2010). *Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventories, Version 1.1*.
- **Intergovernmental Panel on Climate Change.** (2006). *IPCC Guidelines for National Greenhouse Gas Inventories*. Vol. 1-4.
- **Radian Corporation.** (1996) *Methane Emissions from the Natural Gas Industry*. Volumes 1-15. Prepared for the US Environmental Protection Agency and The Gas Research Institute.
- **The Climate Registry.** (2008). *General Reporting Protocol, Version 1.1*.
- **Greenhouse Gas Emissions in Minnesota: 1970 – 2008.** January, 2012 Minnesota Pollution Control Agency