

Hawaii Greenhouse Gas (GHG) Emission Report for 2016: Summary of Key Results

Statewide carbon dioxide equivalent (CO₂e) emissions and sinks (GHG removals) were compiled for the following four (4) Intergovernmental Panel on Climate Change (IPCC) sectors: (1) Energy - emissions from stationary combustion, transportation, waste incineration, and oil and natural gas systems; (2) Industrial Processes and Product Use (IPPU) - emissions from cement production, electrical transmission and distribution, and substitution of ozone depleting substances; (3) Agriculture, Forestry, and other Land Use (AFOLU) - emissions and sinks from agricultural activities, land use, changes in land use, and land management practices; and (4) Waste - emissions from waste management and treatment activities such as landfills, composting, and wastewater treatment.

Energy sector emissions from aircraft (e.g., domestic aviation, military aviation) were quantified and subtracted from net emissions for comparison to Hawaii's CO₂e emissions limit¹. Biogenic carbon dioxide (CO₂) and international bunker fuel CO₂e emissions were excluded from the statewide GHG totals in accordance with IPCC guidelines.

As of 2016, the statewide GHG emission limit of 10.84 million metric tons (MMT) has been reached, and statewide GHG projections of 8.37 MMT and 6.43 MMT for 2020 and 2025, respectively, indicate Hawaii is on target to meet its statewide GHG emissions limit by 2020. This finding will be reassessed and updated in the forthcoming (e.g., 2017) report.

Hawaii GHG Emissions and Sinks by Sector/Category for 1990, 2007, 2010, 2015, 2016, 2020, and 2025 (MMT CO ₂ e); Reproduced from Tables ES-1 and ES-2 (Projections*) of the Report.							
Sector/Category	1990	2007	2010	2015	2016	<u>2020</u>	<u>2025</u>
Energy	19.09	22.65	17.62	16.97	16.94	<u>16.31</u>	<u>14.58</u>
IPPU	0.17	0.55	0.66	0.77	0.78	<u>0.85</u>	<u>0.99</u>
AFOLU (Sources)	1.31	1.12	1.02	1.03	1.08	<u>1.01</u>	<u>0.96</u>
AFOLU (Sinks)	-6.70	-6.52	-6.55	-6.50	-6.51	<u>-6.57</u>	<u>-6.64</u>
Waste	0.75	1.05	0.92	0.77	0.78	<u>0.84</u>	<u>0.92</u>
Total Emissions (Excluding Sinks)	21.33	25.37	20.22	19.54	19.58	<u>19.02</u>	<u>17.45</u>
Net Emissions (Including Sinks)	14.63	18.85	13.67	13.04	13.07	<u>12.45</u>	<u>10.81</u>
Aviation (domestic & military)	3.79	4.11	3.16	3.99	3.84	<u>4.08</u>	<u>4.38</u>
Net Emissions (State Goal)**	10.84	14.73	10.51	9.04	9.23	<u>8.37</u>	<u>6.43</u>

* Projected Emissions are underlined

** Net Emissions (State Goal) include sinks and exclude aviation. Updated statewide limit is the 1990 GHG emissions level. Emissions beyond 1990 show Hawaii's progress relative to the statewide goal of not exceeding the 1990 GHG level.

Energy: The table above provides results from the 2016 report showing that most of the emissions are from the Energy sector for all emission years. For 2016, the 16.94 MMT of CO₂e from the energy sector are about 87% of the total 19.58 MMT of statewide CO₂e emissions.

IPPU: IPPU sector emissions for 2016 represent about 4% of statewide emissions but are seen to grow from 0.17 MMT of CO₂e in 1990 to 0.78 MMT of CO₂e in 2016. The growth rate in this sector is due to the way IPPC guidance considers ozone depleting substances (ODS) versus their substitutes. While IPPC guidance does not count the significant GHG emission reductions from the decline in use of ODS associated with the Montreal Protocol, it does count the increase in GHG emissions from the associated growth in the use of their substitutes².

AFOLU: AFOLU (Sources) emissions for 2016 represent about 6% of statewide emissions. The AFOLU (Sinks) offset about 33% of statewide emissions.

Waste: Waste sector emissions for 2015 represent about 4% of statewide emissions.

¹ Statewide GHG emission limit excludes aviation and international bunker fuel emissions and includes carbon sinks. International bunker fuel emissions are defined as marine and aviation travel originating in Hawaii and ending in a foreign country.

² Appendix J: ODS Emissions documents the reduction in ODS emissions and growth in ODS substitutes from 1990 to 2016. The ICF estimates for ODS emissions were 11.01 MMT of CO₂e in 1990, 2.17 MMT of CO₂e in 2007, 1.77 MMT of CO₂e in 2010, 1.35 MMT of CO₂e in 2015, and 1.27 MMT of CO₂e in 2016.

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The report updates emission estimates³ for 1990, 2007, 2010, 2015, and projections for 2020 and 2025 from those estimated by ICF⁴ in January 2019 for DOH as shown in the table below. The change to the 1990 net statewide GHG emissions (including sinks and excluding aviation) also updates the 1990 statewide GHG emissions limit. Key reasons for the difference in prior and updated GHG inventories are the use of Hawaii-specific net carbon sequestration rates from the USGS to calculate sinks from forest carbon⁵, the use of SEDS⁶ data as the primary source of fuel consumption data to calculate emissions from the Energy sector⁷, the use of Hawaii-specific forest fire emission factors to calculate emissions from forest fires, the use of Hawaii's annual percent of acres burned by forest type obtained from the USGS (Ref.5), and the use of annual percent urban tree cover in Honolulu and statewide. The report also identifies *Areas for Improvement* in report subsections (e.g., 3.1. *Stationary Combustion*) and presents prioritized lists by Sector in *Appendix I. Areas for Improvement*. For the 2017 Report, these areas will be investigated further and implemented as appropriate considering available resources and data.

Change in Hawaii GHG Emissions and Sinks by Sector/Category for 1990, 2007, 2010, and 2015 (MMT CO ₂ e); Reproduced from Table B-1 of the Report.						
Sector	1990			2007		
	2015 Report	2016 Report	Percent Change	2015 Report	2016 Report	Percent Change
Energy	19.61	19.09	-2.6%	21.84	22.65	3.7%
IPPU	0.17	0.17	+	0.54	0.55	1.7%
AFOLU (Sources)	1.61	1.31	-18.4%	1.56	1.12	-28.6%
AFOLU (Sinks)	-3.06	-6.7	118.7%	-3.28	-6.52	98.6%
Waste	0.75	0.75	+	1.05	1.05	+
Total Emissions (Excluding Sinks)	22.15	21.33	-3.7%	25	25.37	1.5%
Net Emissions (Including Sinks)	19.08	14.63	-23.3%	21.71	18.85	-13.2%
Aviation (domestic & military)*	4.66	3.79	-18.6%	4.42	4.11	-6.9%
Net Emissions (State Goal)**	14.43	10.84	-24.8%	17.29	14.73	-14.8%
Sector	2010			2015		
	2015 Report	2016 Report	Percent Change	2015 Report	2016 Report	Percent Change
Energy	20.46	17.62	-13.9%	18.57	16.97	-8.6%
IPPU	0.67	0.66	-1.2%	0.83	0.77	-7.8%
AFOLU (Sources)	1.18	1.02	-14.0%	1.1	1.03	-6.5%
AFOLU (Sinks)	-3.44	-6.55	90.5%	-3.54	-6.5	83.9%
Waste	0.89	0.92	2.8%	0.78	0.77	-1.2%
Total Emissions (Excluding Sinks)	23.21	20.22	-12.9%	21.28	19.54	-8.2%
Net Emissions (Including Sinks)	19.77	13.67	-30.8%	17.75	13.04	-26.5%
Aviation (domestic & military)*	2.87	3.16	10.2%	3.23	3.99	23.8%
Net Emissions (State Goal)**	16.9	10.51	-37.8%	14.52	9.04	-37.7%

* Identified as Energy (Aviation) in Table B-1. Note that Table B-1 has only includes domestic aviation in the 2015 report since Military Aviation & Military Non-Aviation were combined; see Table B-2 for additional details.

** Emissions include sinks and exclude aviation. GHG emissions from international bunker fuel and biogenic CO₂ are excluded from statewide GHG totals in accordance with IPCC guidance.

³ See discussions in the *Changes in Estimates since the previous Inventory Report* subsections within the body of the report, and *Appendix B: Updates to the Historical Emission Estimates Presented in the 2015 Inventory Report*.

⁴ Prepared by ICF and the University of Hawaii Economic Research Organization (UHRO) for the Hawaii Department of Health, "Hawaii Greenhouse Gas Emissions Report for 2015", January 2019; https://health.hawaii.gov/cab/files/2019/02/2015-Inventory_Final-Report_January-2019-004-1.pdf

⁵ U.S. Geological Survey (USGS), Selmants, P.C., Giardina, C.P., Jacobi, J.D., and Zhu, Zhiliang, eds. (2017). Baseline and projected future carbon storage and carbon fluxes in ecosystems of Hawai'i: U.S. Geological Survey Professional Paper 1834. Available: <https://doi.org/10.3133/pp1834>.

⁶ U.S. Energy Information Administration, State Energy Data System (SEDS); <https://www.eia.gov/state/seds/>

⁷ In the 2016 Report, ICF examined fuel consumption data from EIA SEDS and data collected by DBEDT (which was primarily used in the prior report) and "found higher confidence in the SEDS data"; see Appendix C and text boxes in Sections 1.2 (page 3) and 1.4 (page 5) for additional information on the comparative analysis that ICF performed.