

## Hawai'i Greenhouse Gas Emissions Report for 2020 and 2021: Summary of Key Results

Statewide carbon dioxide equivalent (CO<sub>2</sub> Eq) emissions and sinks (Greenhouse Gas (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 (ODS);
- (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.

Per Act 234 (2007)<sup>1</sup> energy sector emissions from aircraft (domestic aviation and military aviation) were quantified and subtracted from net emissions for comparison to Hawaii's CO<sub>2</sub> Eq emissions limit that is equal to, or below, 1990 statewide GHG emissions. Per Act 15 (2018)<sup>2</sup> and Act 238 (2022)<sup>3</sup> aircraft emissions were added in net emissions total for comparison to Hawaii's CO<sub>2</sub> Eq emissions limits. Biogenic carbon dioxide (CO<sub>2</sub>) and international bunker fuel CO<sub>2</sub> Eq emissions were excluded from the statewide GHG totals in accordance with IPCC guidelines.

The statewide GHG emission limit of 15.48 million metric tons (MMT) CO<sub>2</sub> Eq based upon 1990 emissions levels as specified in Act 234 (2007)<sup>1</sup> has been attained (2020 GHG emissions = 11.54 MMT CO<sub>2</sub> Eq). Statewide GHG projections of 12.01 MMT, 7.23 MMT, and 4.61 MMT CO<sub>2</sub> Eq for 2025, 2035, and 2045, respectively, indicate Hawaii is on target to continue to meet its statewide GHG emissions limit after 2020. Act 15 (2018)<sup>2</sup> and Act 238 (2022)<sup>3</sup> emissions limits are not projected to be met in goal years 2030 and 2045, respectively. These findings will be reassessed and updated in the forthcoming emissions report for 2022.

**Energy:** The table below provides results from the Hawai'i Greenhouse Gas Emissions Report for 2020 and 2021 (the report) showing that most of the emissions are from the Energy sector for all emission years. For 2021, the Energy sector's 17.50 MMT CO<sub>2</sub> Eq emissions represents approximately 87% of the total statewide emissions which are equal to 20.18 MMT CO<sub>2</sub> Eq.

**IPPU:** IPPU sector emissions for 2021 represent about 4% of statewide emissions but are seen to grow from 0.18 MMT CO<sub>2</sub> Eq emissions in 1990 to 0.82 MMT CO<sub>2</sub> Eq emissions in 2021. The growth rate in this sector is due to the way IPCC guidance considers Ozone-Depleting Substances (ODS) versus their substitutes. While IPCC 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 substitutes.

**AFOLU:** AFOLU (Sources) emissions for 2021 represent about 7% of the statewide GHG emissions. The AFOLU (Sinks) for 2021 offset about 12% of the statewide GHG emissions.

**Waste:** Waste sector emissions for 2021 represent about 2% of statewide emissions.

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<sup>1</sup> Act 234 (2007): achieve at or below Hawaii's 1990 GHG emissions by January 1, 2020 (excluding emissions from airplanes). 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.

<sup>2</sup> Act 15 (2018): Established a statewide carbon net-negative goal by 2045.

<sup>3</sup> Act 238 (2022): Established a goal for the level of statewide GHG emissions to be at least 50 percent below 2005 levels by the year 2030 (including emissions from aviation).

## Hawai'i Greenhouse Gas Emissions Report for 2020 and 2021: Summary of Key Results

<b>Hawaii GHG Emissions and Sinks (MMT CO<sub>2</sub> Eq) by Sector for 1990, 2005, 2007, 2017, 2018, 2019, 2020, 2021, 2025, 2030, 2035, 2040, and 2045; Reproduced from Tables ES-1 and ES-2 (Projections <sup>a</sup>) of the Report.</b>													
<b>Sector/Category</b>	<b>1990</b>	<b>2005</b>	<b>2007</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b><u>2025</u></b>	<b><u>2030</u></b>	<b><u>2035</u></b>	<b><u>2040</u></b>	<b><u>2045</u></b>
<b>Energy <sup>b</sup></b>	20.26	22.72	24.35	18.97	19.23	19.45	14.65	17.50	<u>17.53</u>	<u>16.12</u>	<u>13.54</u>	<u>12.67</u>	<u>11.45</u>
<b>IPPU</b>	0.18	0.50	0.55	0.80	0.81	0.83	0.77	0.82	<u>0.75</u>	<u>0.62</u>	<u>0.41</u>	<u>0.27</u>	<u>0.26</u>
<b>AFOLU (Sources)</b>	1.58	1.25	1.31	1.28	1.48	1.30	1.28	1.45	<u>1.22</u>	<u>1.15</u>	<u>1.08</u>	<u>1.02</u>	<u>0.97</u>
<b>AFOLU (Sinks)</b>	-2.43	-2.57	-2.59	-2.61	-2.51	-2.50	-2.38	-2.39	<u>-2.38</u>	<u>-2.37</u>	<u>-2.42</u>	<u>-2.48</u>	<u>-2.55</u>
<b>Waste</b>	1.01	0.98	0.88	0.42	0.41	0.44	0.41	0.41	<u>0.43</u>	<u>0.43</u>	<u>0.43</u>	<u>0.43</u>	<u>0.44</u>
<b>Total Emissions (Excluding Sinks)</b>	<b>23.02</b>	<b>25.45</b>	<b>27.09</b>	<b>21.48</b>	<b>21.92</b>	<b>22.02</b>	<b>17.10</b>	<b>20.18</b>	<b><u>19.93</u></b>	<b><u>18.32</u></b>	<b><u>15.46</u></b>	<b><u>14.40</u></b>	<b><u>13.12</u></b>
<b>Net Emissions (Including Sinks) <sup>c</sup></b>	<b>20.59</b>	<b>22.87<sup>d</sup></b>	<b>24.50</b>	<b>18.86</b>	<b>19.41</b>	<b>19.52</b>	<b>14.72</b>	<b>17.79</b>	<b><u>17.55</u></b>	<b><u>15.95</u></b>	<b><u>13.04</u></b>	<b><u>11.92</u></b>	<b><u>10.57</u></b>
Aviation (domestic & military)	5.11	7.16	5.67	5.46	5.64	5.84	3.18	5.25	<u>5.54</u>	<u>5.70</u>	<u>5.81</u>	<u>5.88</u>	<u>5.96</u>
<b>Net Emissions (Incl. Sinks, Excluding Aviation) <sup>e</sup></b>	<b>15.48<sup>f</sup></b>	<b>15.71</b>	<b>18.83</b>	<b>13.40</b>	<b>13.77</b>	<b>13.68</b>	<b>11.54</b>	<b>12.53</b>	<b><u>12.01</u></b>	<b><u>10.25</u></b>	<b><u>7.23</u></b>	<b><u>6.04</u></b>	<b><u>4.61</u></b>

<sup>a</sup> Projected Emissions are underlined.

<sup>b</sup> Emissions from International Bunker Fuels are not included in the totals, as per IPCC (2006) guidelines.

<sup>c</sup> Net Emissions (Including Sinks) includes sinks and aviation per Act 15 (2018).

Per Act 238 (2022), a statewide goal is set at 50% below 2005 GHG emissions level by 2030, so the 2030 goal =  $22.87 \div 2 = 11.44$  MMT CO<sub>2</sub> Eq versus projected 2030 emissions of 15.95 MMT CO<sub>2</sub> Eq (including sinks and aviation).

Per Act 15 (2018), a statewide carbon net-negative goal by 2045 was established and can be compared to the projected 2045 emissions value of 10.57 MMT CO<sub>2</sub> Eq (including sinks and aviation).

<sup>d</sup> 2005 baseline emissions for Act 238 (2022).

<sup>e</sup> Net Emissions (Incl. Sinks, Excluding Aviation) includes sinks and excludes aviation per Act 237 (2007). Act 237 (2007) aims to achieve emission levels at or below Hawaii's 1990 GHG emissions by January 1, 2020 (excluding aviation emissions). Domestic aviation and military emissions, which are reported under the Energy Sector, are excluded from Hawaii's GHG emission reduction goal established in Act 234 (2007).

<sup>f</sup> 1990 baseline emissions for Act 237 (2007).

## Hawai'i Greenhouse Gas Emissions Report for 2020 and 2021: Summary of Key Results

The report provides new 2020 and 2021 GHG estimates, updates emission estimates for 1990, 2005, 2007, 2010, 2015, 2016, 2017, 2018, and 2019 from those provided by ICF in the Hawai'i GHG Emissions Report for 2005, 2018, and 2019 as shown in the following table, and updates prior 2025, 2030, 2035, 2040, and 2045 projections. The change to the 1990 net statewide GHG emissions (including sinks and excluding aviation) also updates the 1990 statewide GHG emissions limit. As found in ICF's Hawai'i Greenhouse Gas Emissions Report for 2020 and 2021, Appendix B, "Updates to the Historical Emission Estimates Presented in the previous inventory report," changes can be attributed due to:

- (1) Conversion of GWPs to reflect the recent UNFCCC decision that Parties should use GWPs from the IPCC *Fifth Assessment Report (AR5)* (IPCC 2013);
- (2) Updates to the Hawai'i specific data for wastewater treatment plants (e.g., flow rates and biochemical oxygen demand - BOD5 and national pollutant discharge elimination system - NPDES); and
- (3) Updates to Hawai'i specific data (e.g., historical population numbers).

## Hawai'i Greenhouse Gas Emissions Report for 2020 and 2021: Summary of Key Results

From Table B-1 of the report<sup>a</sup>: Change in Emissions Relative to the 2019 Inventory Report<sup>b</sup> (MMT CO<sub>2</sub> Eq.)

Report Year	Sector									
	Energy	Energy (Excluding Aviation)	Energy (Aviation)	IPPU	AFOLU (Sources)	AFOLU (Sinks) <sup>c</sup>	Waste	Total Emissions (Excluding Sinks)	Net Emissions (Including Sinks)	Net Emissions (Including Sinks, Excluding Aviation)
<b>1990</b>										
2019 Report <sup>d</sup>	20.26	15.16	5.10	0.17	1.55	(2.43)	0.93	22.91	20.48	15.38
2021 Report <sup>e</sup>	19.40	15.14	4.26	0.18	1.58	(2.43)	1.01	22.16	19.73	15.48
Difference	(0.86)	(0.02)	(0.84)	0.00	0.03	0.00	0.07	(0.75)	(0.75)	0.09
Percent Change	-4.2%	-0.1%	-16.4%	2.8%	2.1%	0.0%	7.8%	-3.3%	-3.6%	0.6%
<b>2005</b>										
2019 Report <sup>d</sup>	22.71	15.56	7.14	0.53	1.22	(2.56)	0.91	25.37	22.81	15.66
2021 Report <sup>e</sup>	22.72	15.56	7.16	0.50	1.25	(2.57)	0.98	25.45	22.87	15.71
Difference	0.01	(0.01)	0.02	(0.03)	0.02	(0.01)	0.07	0.08	0.07	0.05
Percent Change	0.1%	-0.1%	0.3%	-5.6%	1.9%	0.3%	7.8%	0.3%	0.3%	0.3%
<b>2007</b>										
2019 Report <sup>d</sup>	24.35	18.70	5.65	0.58	1.29	(2.57)	0.82	27.04	24.47	18.81
2021 Report <sup>e</sup>	24.35	18.68	5.67	0.55	1.31	(2.59)	0.88	27.09	24.50	18.83
Difference	(0.00)	(0.01)	0.01	(0.03)	0.02	(0.02)	0.06	0.05	0.03	0.02
Percent Change	0.0%	-0.1%	0.2%	-5.7%	1.6%	0.6%	7.6%	0.2%	0.1%	0.1%
<b>2010</b>										
2019 Report <sup>d</sup>	19.38	14.74	4.64	0.71	1.24	(2.58)	0.55	21.88	19.29	14.65
2021 Report <sup>e</sup>	19.38	14.73	4.65	0.67	1.25	(2.60)	0.59	21.90	19.30	14.65
Difference	(0.00)	(0.01)	0.01	(0.04)	0.02	(0.02)	0.05	0.02	0.00	(0.00)
Percent Change	0.0%	0.0%	0.1%	-6.1%	1.3%	0.7%	8.8%	0.1%	0.0%	0.0%
<b>2015</b>										
2019 Report <sup>d</sup>	18.50	13.40	5.10	0.83	1.28	(2.72)	0.47	21.08	18.37	13.27
2021 Report <sup>e</sup>	18.50	13.41	5.10	0.79	1.29	(2.69)	0.51	21.09	18.40	13.30
Difference	0.00	0.00	0.00	(0.04)	0.00	0.03	0.04	0.00	0.03	0.03
Percent Change	0.0%	0.0%	0.0%	-5.0%	0.4%	-1.1%	7.8%	0.0%	0.2%	0.2%

+ Does not exceed 0.005 MMT CO<sub>2</sub> Eq. or 0.05 percent.

<sup>a</sup> Hawai'i Greenhouse Gas Emissions Report for 2020 and 2021.

<sup>b</sup> Hawai'i Greenhouse Gas Emissions Report for 2005, 2018, and 2019.

<sup>c</sup> Positive percent change in this column indicates an increase in carbon sinks.

<sup>d</sup> 2019 Report means: Hawai'i Greenhouse Gas Emissions Report for 2005, 2018, and 2019.

<sup>e</sup> 2021 Report means: Hawai'i Greenhouse Gas Emissions Report for 2020 and 2021.

Notes: Totals may not sum due to independent rounding. Parentheses indicate negative values or sequestration.

## Hawai'i Greenhouse Gas Emissions Report for 2020 and 2021: Summary of Key Results

From Table B-1 of the report<sup>a</sup>, continued: Change in Emissions Relative to the 2019 Inventory Report<sup>b</sup> (MMT CO<sub>2</sub> Eq.)

Report Year	Energy	Energy (Excluding Aviation)	Energy (Aviation)	IPPU	AFOLU (Sources)	AFOLU (Sinks) <sup>c</sup>	Waste	Total Emissions (Excluding Sinks)	Net Emissions (Including Sinks)	Net Emissions (Including Sinks, Excluding Aviation)
<b>2016</b>										
2019 Report <sup>d</sup>	18.52	13.34	5.18	0.83	1.29	(2.69)	0.43	21.07	18.38	13.20
2021 Report <sup>e</sup>	18.53	13.35	5.18	0.80	1.29	(2.65)	0.46	21.08	18.43	13.25
Difference	0.00	0.00	(0.00)	(0.03)	0.01	0.04	0.03	0.01	0.05	0.05
Percent Change	0.0%	0.0%	0.0%	-4.0%	0.5%	-1.6%	7.3%	0.0%	0.3%	0.4%
<b>2017</b>										
2019 Report <sup>d</sup>	18.97	13.51	5.47	0.83	1.28	(2.68)	0.40	21.48	18.80	13.33
2021 Report <sup>e</sup>	18.97	13.51	5.46	0.80	1.28	(2.62)	0.42	21.48	18.86	13.39
Difference	0.00	0.00	(0.00)	(0.03)	(0.00)	0.06	0.03	(0.00)	0.06	0.06
Percent Change	0.0%	0.0%	0.0%	-3.4%	-0.3%	-2.3%	6.9%	0.0%	0.3%	0.4%
<b>2018</b>										
2019 Report <sup>d</sup>	19.23	13.59	5.64	0.83	1.48	(2.59)	0.38	21.92	19.33	13.69
2021 Report <sup>e</sup>	19.23	13.59	5.64	0.81	1.47	(2.51)	0.41	21.92	19.41	13.76
Difference	(0.00)	(0.00)	(0.00)	(0.02)	(0.01)	0.08	0.03	(0.00)	0.07	0.07
Percent Change	0.0%	0.0%	0.0%	-2.7%	-0.5%	-2.9%	7.6%	0.0%	0.4%	0.5%
<b>2019</b>										
2019 Report <sup>d</sup>	19.44	18.62	0.83	0.84	1.31	(2.59)	0.41	22.01	19.42	13.59
2021 Report <sup>e</sup>	19.45	18.66	0.80	0.83	1.30	(2.50)	0.44	22.03	19.53	13.68
Difference	0.01	0.04	(0.03)	(0.02)	(0.01)	0.09	0.03	0.02	0.11	0.09
Percent Change	0.1%	0.2%	-3.4%	-1.9%	-0.4%	-3.5%	7.0%	0.1%	0.6%	0.7%

<sup>+</sup> Does not exceed 0.005 MMT CO<sub>2</sub> Eq. or 0.05 percent.

<sup>a</sup> Hawai'i Greenhouse Gas Emissions Report for 2020 and 2021.

<sup>b</sup> Hawai'i Greenhouse Gas Emissions Report for 2005, 2018, and 2019.

<sup>c</sup> Positive percent change in this column indicates an increase in carbon sinks.

<sup>d</sup> 2019 Report means: Hawai'i Greenhouse Gas Emissions Report for 2005, 2018, and 2019.

<sup>e</sup> 2021 Report means: Hawai'i Greenhouse Gas Emissions Report for 2020 and 2021.

Notes: Totals may not sum due to independent rounding. Parentheses indicate negative values or sequestration.