



## Overview

- Hawaii's Greenhouse Gas (GHG) Inventory Project
  - Context and Purpose
  - Inventory Methodology and Assumptions
- Preliminary Update of 1990 and 2005 GHG Estimates – By Sector
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## Hawaii's GHG Inventory Project: 1994-1998

- Phase I – Statewide Inventory GHG Emissions Estimates a start point for Greenhouse Reduction Strategy for State of Hawaii.
- Phase II -- Hawaii Climate Change Action Plan.
- Joint project -- DBEDT Strategic Industries Division, and Department of Health Clean Air Branch (DOH contractor non-energy sectors: UH Environmental Center).
- U.S. Environmental Protection Agency grant and assistance:
  - Identifying state's greenhouse gas emissions sources and estimating overall contribution to global warming;
  - Assessing areas of state most vulnerable to climate change; and
  - Developing state-specific greenhouse gas mitigation strategies.

## Hawaii's GHG Inventory Project (1994-1998) Context and Purpose

- Context
  - Part of national effort under U.S. Climate Change Action Plan to meet U.S. goals under the United Nations Framework Convention on Climate Change.
- Purpose
  - Inventory and understand Hawaii's GHG.
  - Foundation of second-phase Hawaii Climate Change Action Plan.
  - First step to developing mitigation measures.

## Inventory Methodology and Assumptions

### Methodology

- Used data for energy use, industrial processes, agriculture, municipal waste management, crop waste burning, fertilizer use, and land use changes.
- Formulae provided by USEPA to calculate estimated emissions of CO<sub>2</sub>, methane (CH<sub>4</sub>) and nitrous oxides N<sub>2</sub>O, the three principal GHG.\*
- Reported global warming potential of CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O emissions in short tons of carbon dioxide-equivalent (CO<sub>2</sub>E).\*

### Assumptions

- GWP factors provided by EPA at time:
  - CO<sub>2</sub> = 1.
  - CH<sub>4</sub> = 22 (now 21).
  - N<sub>2</sub>O = 270 (now 310).
- CO<sub>2</sub> emissions from burning of bagasse, macadamia nut shells, and wood chips for electricity and process heat not included in total as fuels sequester CO<sub>2</sub> in growing stage and were assumed replanted.
- Hawaii estimate did not include exported fuels or overseas uses
- Excluded military aviation fuel emissions.

\*Note: Calculated precursor gases emissions estimates: nitrogen oxides (NOx), carbon monoxide (CO), and non-methane volatile organic compounds (NMVOC), but not part of GWP due to USEPA tools' then lack of conversion factors.



## Preliminary Estimate of Hawaii's Greenhouse Gas Emissions in 1990 and 2005 Expressed as Global Warming Potential

Tons Carbon Dioxide Equivalent (Tons CO<sub>2</sub>E)

ENERGY SECTOR	1990	2005	Percentage Change 1990-2005
Residential Commercial Industrial	1,038,657	2,271,802	118.7%
Electric Utilities (and IPPs)	7,884,515	9,039,871	14.7%
<b>Stationary Subtotal</b>	<b>8,923,172</b>	<b>11,311,672</b>	<b>26.8%</b>
Ground Transportation	3,895,698	4,992,807	28.2%
Domestic Aviation and Marine	3,880,691	3,717,036	-4.2%
International Aviation and Marine	6,432,255	4,722,044	-26.6%
<b>Transportation Subtotal</b>	<b>14,208,644</b>	<b>13,431,887</b>	<b>-5.5%</b>
<b>ENERGY TOTAL</b>	<b>23,131,816</b>	<b>24,743,560</b>	<b>7.0%</b>
NON-ENERGY SECTOR	1990	2005	
Industrial Processes: Oil/Gas Transportation, Refining, Storage	4,977	5,157	3.6%
Industrial Processes: Cement Manufacturing	109,274	Ended 1995	
<b>Industrial Processes Subtotal</b>	<b>114,251</b>	<b>5,157</b>	<b>-95.5%</b>
MSW Management	1,161,291	1,701,100	46.5%
Wastewater Treatment	21,563	23,923	10.9%
Domestic Animals	273,879	192,119	-29.9%
Manure Management	129,768	56,774	-56.2%
Sugarcane Burning	31,958	10,797	-66.2%
Fertilizer Use	60,850	62,310	2.4%
<b>NON-ENERGY TOTAL</b>	<b>1,793,559</b>	<b>2,052,180</b>	<b>14.4%</b>
<b>TOTAL</b>	<b>24,925,375</b>	<b>26,795,740</b>	<b>7.5%</b>

U.S. Nationwide  
Change  
1990-2005  
**16.3%**  
*USEPA Estimate*

Preliminary Estimates -- January 2007 (Revision May 2007)

### Notes:

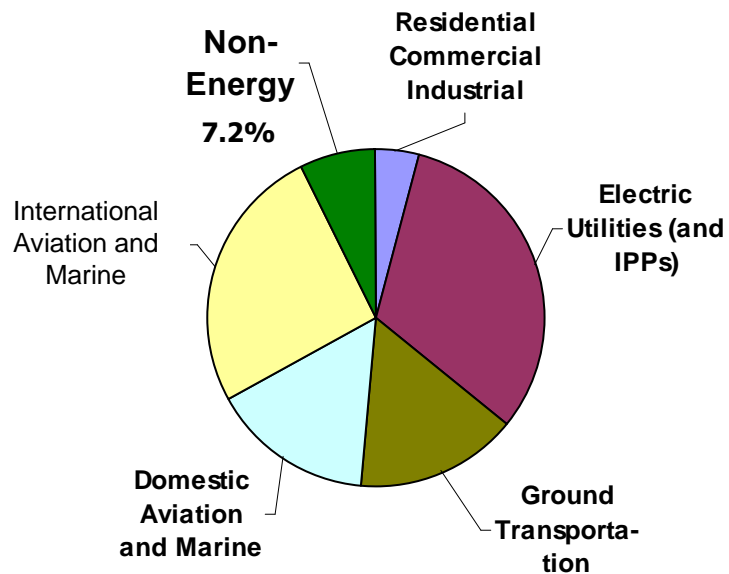
1. All estimates were calculated using the formulas and procedures from the State Workbook: Methodologies for Estimating Greenhouse Gas Emissions, Second Edition, U.S. Environmental Protection Agency (USEPA) Office of Policy, Planning, and Evaluation, 1995, except as discussed below.

2. Due to differences compared to the Mainland in Hawaii's oil transportation, refining, and storage systems, and in its utility gas production, storage, transmission, and distribution system, industry-calculated emissions estimates were used for 1990. This value was extrapolated forward using data on total oil imports and utility gas sales, the key variables upon which the estimates were based.

3. The values reported for 1990 in DBEDT's initial Inventory of Hawaii Greenhouse Gas Emissions, Estimates for 1990, published in 1997, were recalculated using updated data and new conversion factors to calculate global warming potential. In late 1997, the factor used to convert tons of methane (CH<sub>4</sub>) to tons of Carbon Dioxide-Equivalent (CO<sub>2</sub>E) was changed from 22 to 21 and the conversion factor for Nitrous Oxide (N<sub>2</sub>O) to tons of CO<sub>2</sub>E was increased from 270 to 310 on the basis of findings of the Intergovernmental Panel on Climate Change and the use of the new factors was accepted by the USEPA.

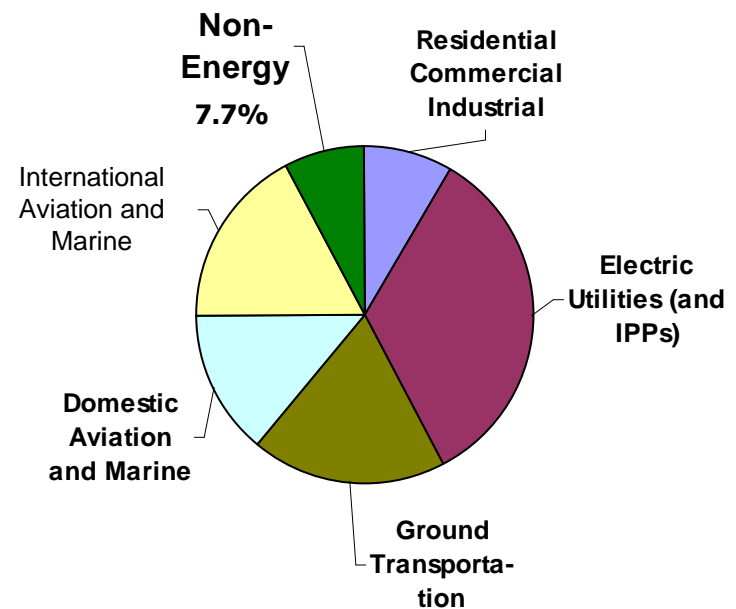
# Energy Sector Remains Largest GHG Emission Source – Slight Improvement

**1990**



**Energy – 92.8%**

**2005**



**Energy – 92.3%**

## Preliminary Update of 1990 Inventory and 2005 Estimate: Other Limitations & Improvement Needs

- Acquisition of new data needed to enhance accuracy.
- Data improvement needs:
  - Diesel fuel use.
  - Marine fuel use.
  - Military fuel use in Hawaii
  - Fertilizer use.
  - Land use changes.
- Data transparency.

## Meeting Regulatory Challenges: EPA-Hawaii Partnership

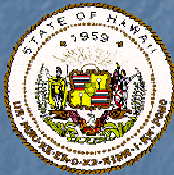
- On February 12, 2007, Hawaii joined EPA's Clean Energy-Environment State Partnership:
  - Includes 14 other states.
  - EPA provides partner states with comprehensive technical assistance in planning, policy, technical, analytical and information resources.
  - Also works to establish linkages to other federal programs that support clean energy-environment strategies.
- Reduction of GHG emissions is one of Hawaii's key areas:
  - In late May 2007, EPA experts advised that EPA's state emissions inventory estimation models not intended for regulatory purposes – emissions baseline target-setting.
  - DBEDT and DOH working with EPA experts to develop improvements to Hawaii's models, as resources permit.

## Additional Information Sources

- Hawaii Greenhouse Gas Inventory, Estimates for 1990 (1997)\*
  - <http://www.hawaii.gov/dbedt/info/energy/publications/>
- Hawaii Climate Change Action Plan (1998)
  - <http://www.hawaii.gov/dbedt/info/energy/publications/>
- Hawaii Energy Strategy 2000 (2000)
  - <http://www.hawaii.gov/dbedt/info/energy/publications/hes2000.pdf>
- Intergovernmental Panel for Climate Change
  - <http://www.ipcc.ch/>
- U.S. Environmental Protection Agency Climate Change Web Site
  - <http://epa.gov/climatechange/index.html>

\*Note: Electronic file to be re-posted on DBEDT website – expected download availability date: June 15, 2007)

## Hawaii's Greenhouse Gas Emissions Inventory



Presentation by Invitation of:

Hawaiian Electric Company (HECO)  
Integrated Resource Planning (IRP)  
Advisory Group Technical Session  
Climate Change/Global Warming  
State Capitol Auditorium  
June 8, 2007

# MAHALO!