Maryland's GHG Inventory

Maryland Commission on Climate Change

Scientific and Technical Working Group

June 20, 2017

Why an Emissions Inventory?

- Required by the GGRA
  - 3 Year Increments for Full Inventories
  - Data collected annually
- Track emissions relative to the GGRA
- Trends - Going up? Going down?
- Advises regulations
- Most importantly … **identifies large and small source categories to provide focus for reduction opportunities**

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Maryland's GHG Inventory

Overview

- The Greenhouse Gas Reduction Act (GGRA) requires MDE to report on the statewide greenhouse gas inventory every three years
  - Most recent update released based on 2014 data
  - Next update will be based on 2017 data
- 2014 Inventory covers six types of GHGs, including methane
- Emissions were estimated bottom-up using generally accepted principles and guidelines
  - Maryland specific data to the extent possible

Greenhouse Gas	GWP
Carbon Dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Oxide (N_2O)	310

- Equivalent CO_2 (CO_2e) was calculated using global warming potentials (GWP) from the IPCC 2nd Assessment Report

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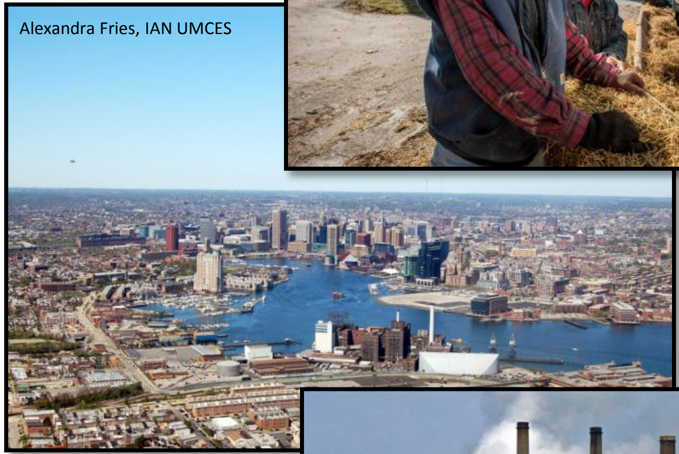
Maryland’s GHG Inventory

Source Categories

- Electricity Use (Consumption)
- Residential, Commercial, and Industrial Fuel Use
- On-road Mobile Sources
- Non-road Mobile Sources
- Fossil Fuel Industry
- Industrial Processes
- Agriculture
- Waste Management
- Sinks


UMCP dairy farm


Alexandra Fries, IAN UMCES


Adrian Jones, IAN UMCES


Husqvarna

Maryland’s GHG Inventory
Methods and Data Sources

- Based upon the very best available data
  - Calculated bottom-up using widely accepted principles and guidelines
  - *Maryland-specific* whenever possible
- Estimation/calculation process varies for each source category
  - Mobile source emissions (both on-road and non-road) are generated using a well-accepted EPA model with inputs from data sets maintained by SHA, MDE, MVA and EIA
  - Emissions from the majority of point sources are directly measured
  - Non-point source calculations utilize state-specific consumption data, fuel-specific carbon content coefficients and EPA established emissions factors and methodology

Alexandra Fries, IAN UMCES (ian.umces.edu/imagelibrary/)

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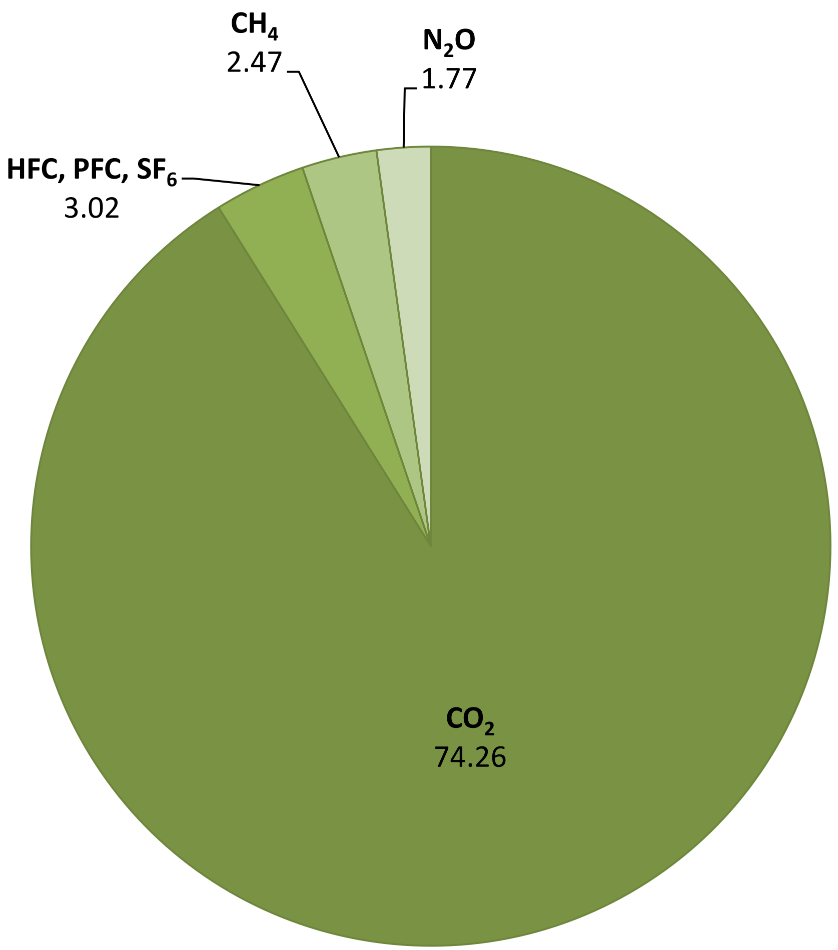
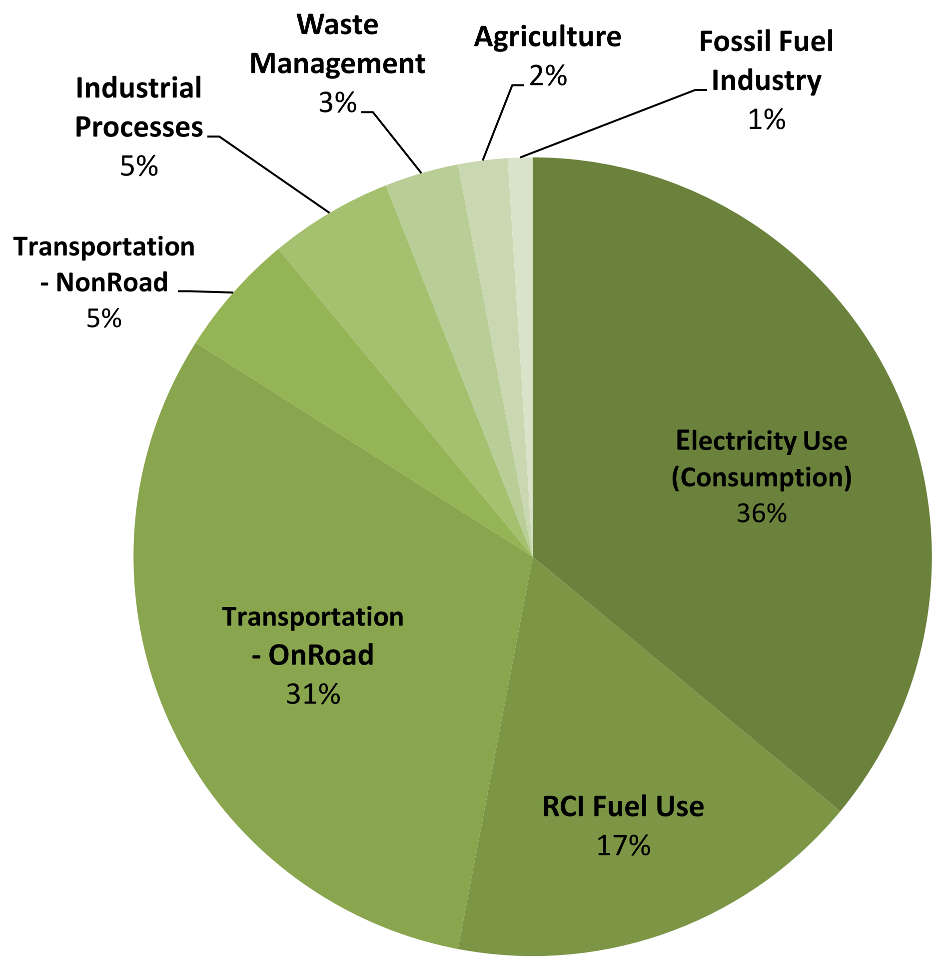
2014 Results



2014 GHG Emissions
MMtCO2e



2014 GHG Emissions by Sector

2014 Results

High level of confidence on over 90% of the inventory

CO_2 emissions from MD EGUs were compiled from CEMS/Emissions Certification Reports and cross-checked against two other reporting programs	21.5%
PJM provides both the fuel mix information and CO_2 emission rates for each fuel type to determine emissions from imported electricity	17.1%
EPA's well-accepted MOVES model was used to estimate on-road mobile emissions as well as most off-road mobile emissions	34.6%
R/C/I Fuel Use emissions estimates were calculated using MD specific fuel consumption data and carbon content coefficients specific to each fuel	17.1%

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Sinks

Organic Biomass

Forest Carbon Flux

- Sequestration in above- and below-ground biomass, dead wood, litter, and soil organic carbon
- Removal in wood products (in use and in landfills)

- Data:
  - State forest-carbon stock (1990-2009) (USDA Forest Service, Carbon Calculation Tool)
  - State harvested wood stock (1987, 1992, and 1997) (USDA Forest Service)
- Calculations:
  - Stock-difference method to assess change over time in forest-carbon stock
  - Average annual change in harvested wood stock

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Emissions or Sequestration (MMTCO$_2$e)	=	Aboveground Biomass Carbon Flux	+	Belowground Biomass Carbon Flux	+	Dead Wood Carbon Flux	+	Litter Carbon Flux	+	Soil Organic Carbon Flux	+	Wood Products Carbon Flux	+	Landfills Carbon Flux

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Organic Biomass

Urban Trees

- Sequestration in urban tree cover

- Data:
  - Maryland's urban area, and percent urban area with tree cover (Maryland Forest Services)
- Calculations:

Sequestration ($MMTCO_2e$)	=	Total Urban Area	X	Urban Area with Tree Cover (%)	X	Carbon Sequestration Factor

Landfilled Biomass

- Yard trimmings and food scraps which store carbon in biomass

- Data and Calculations:
  - Amount of landfilled yard trimmings and food scraps (MDE Solid Waste Program), apportioned to grass, leaves and branches (default data)
  - Carbon content of each waste category (default data)
  - Change in landfill carbon stocks between inventory years (IPCC methodology) from added stock and decomposition

Anne Arundel County, Waste Management Dept.

Sinks

What Don't We Include?

Wetlands and Waterways

- Vegetated coastal wetlands can sequester soil carbon, which tends to accumulate under anaerobic conditions
- Wetlands also generate CH_4 emissions due to anaerobic decomposition

Why Isn't it Included?

- There is no EPA-approved methodology to calculate carbon flux in vegetated coastal wetlands at the state level
  - Data (NOAA) is available only at the continental level
- Not included in EPA SIT software LULUCF module for calculating net CO_2 flux

Ben Fertig, IAN UMCES

Agricultural Soils Management

- CO_2 emissions from liming and urea fertilizer applications; CH_4 and N_2O emissions from manure management; and N_2O emissions from fertilizer application, N-fixation by legumes, and crop residues are all included in the inventory
- Management can also result in net fluxes of soil carbon content, which are not included

Why Isn't it Included?

- There is no EPA-approved methodology for calculating changes in soil carbon content from management practices
- Not included in EPA SIT software LULUCF module for calculating net carbon dioxide flux

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2014 Results

Total Emissions ($MMtCO_2e$)	**92.67**
Total Sequestered ($MMtCO_2e$)	(11.78)
Forest Carbon Flux	**(10.50)**
Above-ground Biomass	(7.48)
Below-ground Biomass	(1.42)
Wood Products and Landfills	(0.72)
Dead Wood	(0.58)
Litter	(0.23)
Soil Organic Carbon	(0.05)
Urban Trees	**(1.09)**
Landfilled Yard Trimmings and Food Scraps	**(0.19)**
Landfilled Food Scraps	(0.07)
Leaves	(0.06)
Branches	(0.05)
Grass	(0.01)

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Questions ?

Southern Living Magazine