Short-Lived Climate Pollutants

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Overview – Short-Lived Climate Pollutants

- SLCPs are potent, climate forcing gases with relatively short atmospheric lifetimes

  o Methane

    ▪ Dairy & Livestock

    ▪ Landfill Organic Waste
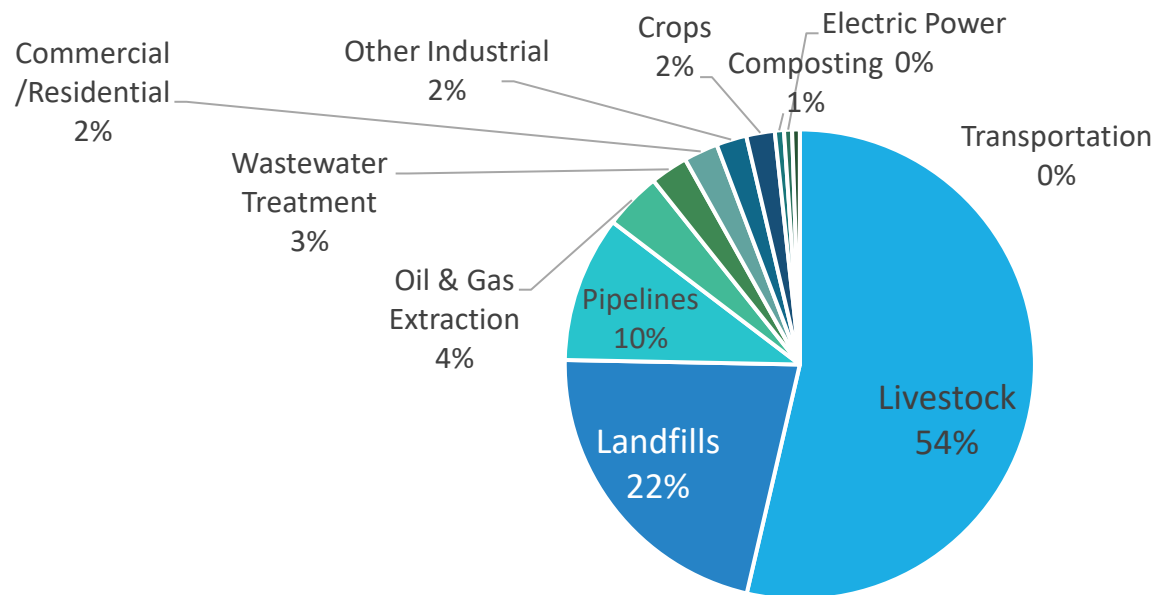
    ▪ Oil & Gas

  o HFCs

  o Black carbon

Short-Lived Climate Pollutants Policy Framework

- Senate Bill 1383 (Lara, 2016) requires CARB to adopt and begin implementing the Short-Lived Climate Pollutant (SLCP) Reduction Strategy

- In 2017, CARB approved and began implementing the comprehensive SLCP Reduction Strategy to reduce statewide emissions to below 2013 levels by 2030 for:
  - methane by 40 percent
  - hydrofluorocarbon gases by 40 percent, and
  - anthropogenic black carbon by 50 percent.

Methane Emissions

Statewide Total Methane Emissions in 2018: 39.8 MMTCO$_2$e

- Leading **emission sources:**
  - Dairy and Livestock Sector (54%)
  - Landfilled Organic Waste (22%)
  - Oil & Gas (14%)

Commercial /Residential 2%

Other Industrial 2%

Crops 2%

Electric Power 0%

Composting 1%

Wastewater Treatment 3%

Transportation 0%

Oil & Gas Extraction 4%

Pipelines 10%
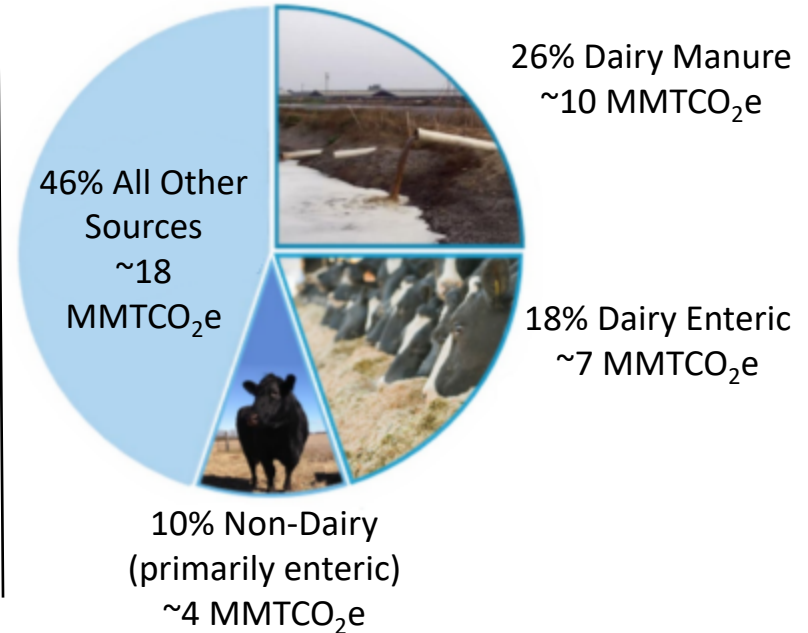
Livestock 54%

Landfills 22%

* California Methane Inventory for 2000-2018; using 100-year AR4 Global Warming Potential

Dairy and Livestock Methane Sources

- Dairy and livestock methane comprises 55% of the 40 MMTCO$_2$e methane emissions annually
  - 10 MMTCO$_2$e from manure management
  - 11 MMTCO$_2$e from enteric fermentation
  - 18 MMTCO$_2$e from other sources

2018 Methane Emissions

26% Dairy Manure ~10 MMTCO$_2$e

46% All Other Sources ~18 MMTCO$_2$e

18% Dairy Enteric ~7 MMTCO$_2$e

10% Non-Dairy (primarily enteric) ~4 MMTCO$_2$e

Actions to Reduce Dairy and Livestock Methane Emissions

Manure Management

- Install an anaerobic digester
- Implement an alternative manure management practice

Enteric Fermentation

- Developing strategies including the use of methane inhibiting feed additives

Research

- Conduct methane emissions reduction research into new and emerging methane reduction strategies for manure management and enteric fermentation

Dairy and Livestock Methane Emissions Reduction Programs

CARB
Cap-and-Trade
Low Carbon Fuel Standard

cdfa
Dairy Digester Research and Development Program
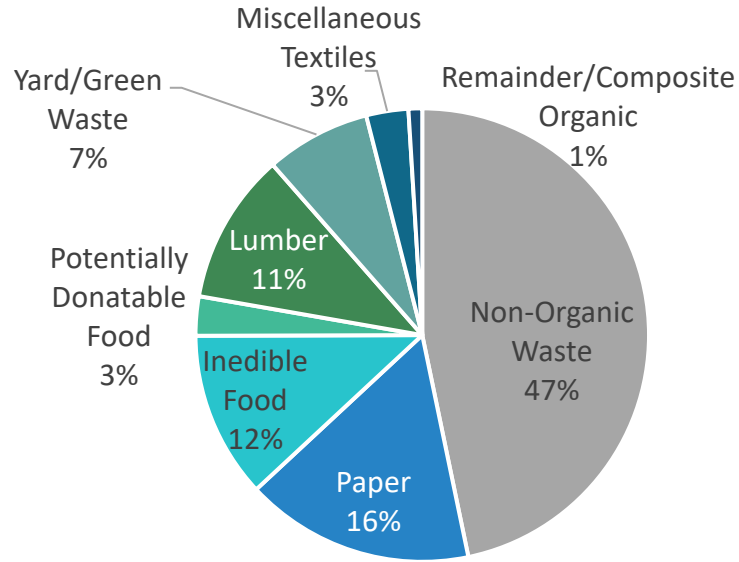Alternative Manure Management Program

Bioenergy Market Adjusting Tariff (BioMAT)
SB 1383 Dairy Biomethane Pipeline Injection Pilot Projects
AB 2313

Renewable Fuel Standard (RFS)

Landfill Methane

Pie chart: Landfill Methane waste characterization
- Non-Organic Waste 47%
- Paper 16%
- Inedible Food 12%
- Lumber 11%
- Yard/Green Waste 7%
- Miscellaneous Textiles 3%
- Potentially Donatable Food 3%
- Remainder/Composite Organic 1%

- Californians disposed of approximately 22 million tons of organic waste in 2018, making up over half of all landfilled waste
  - Landfill gas capture systems (required under CARB's Landfill Methane Regulation) avoid the release of up to 80% of methane generated
  - Landfill fugitive methane makes up over 8 $MMTCO_2e$ statewide, the second largest source of methane emissions (22%)

CalRecycle (May 2020) 2018 Characterization of Solid Waste in California

Actions to Reduce Methane Emissions from Organic Waste

Prevention
- Food waste prevention and rescue programs to recover 20% of edible food

Recycling
- Expand Organics Recycling and Recovery Infrastructure
- Ensure best management practices are instituted at compost and AD facilities; promote use of compost to restore soil health and reduce fertilizer use.

Gas Capture
- Improve landfill operations and cover practices to control fugitive emissions
- Explore automated monitoring and control systems to improve capture efficiency

Monitor and Respond
- Develop remote sensing capabilities to monitor and respond to methane leaks
- Methane Source Finder and Carbon Mapper Projects

Organic Waste Methane Emissions Reduction Programs

Organic Waste Grants and Loans

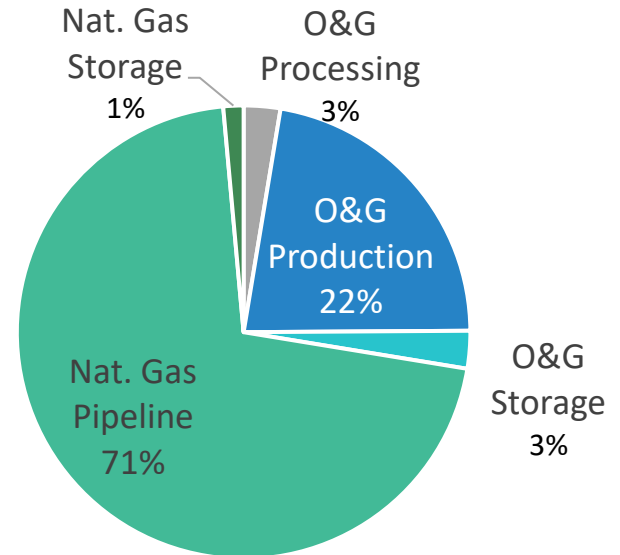Organic Waste Methane Emissions Reductions Regulation (2020)

Landfill Methane Regulation

Low Carbon Fuel Standard

Fugitive Methane from Oil & Gas Systems

- In 2018, California's oil and gas systems were responsible for ~6 MMTCO2e

- CA has an extensive oil and gas industry that contributes to fugitive methane emissions, including:

  - *Oil and gas production*

  - *Oil and gas storage*

  - *Natural gas transmission and distribution*

Nat. Gas Storage 1%

O&G Processing 3%

O&G Production 22%

O&G Storage 3%

Nat. Gas Pipeline 71%

Oil & Gas Methane Emissions Reduction Programs

GHG Emission Standards for Crude Oil and Natural Gas Facilities (Oil and Gas Methane Regulation, 2017)
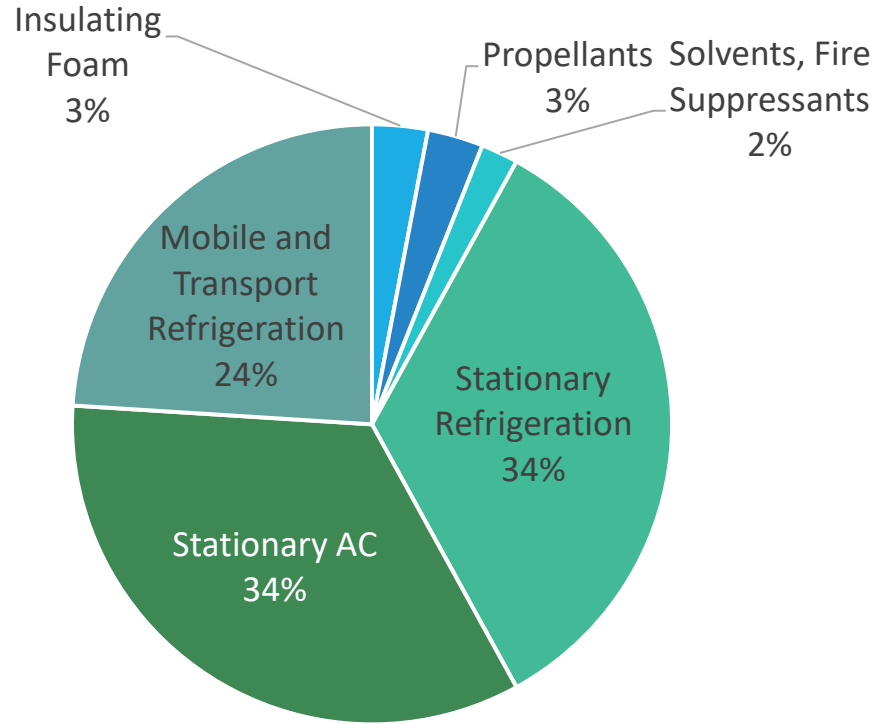
Decision (D.17-06-015, June 2017)

Hydro-fluorocarbon (HFC) Emissions

Statewide Total HFC Emissions in 2018:

21 MMTCO$_2$e

Insulating Foam 3%

Propellants 3%

Solvents, Fire Suppressants 2%

Mobile and Transport Refrigeration 24%

Stationary Refrigeration 34%

Stationary AC 34%

HFC Emissions Reduction Programs

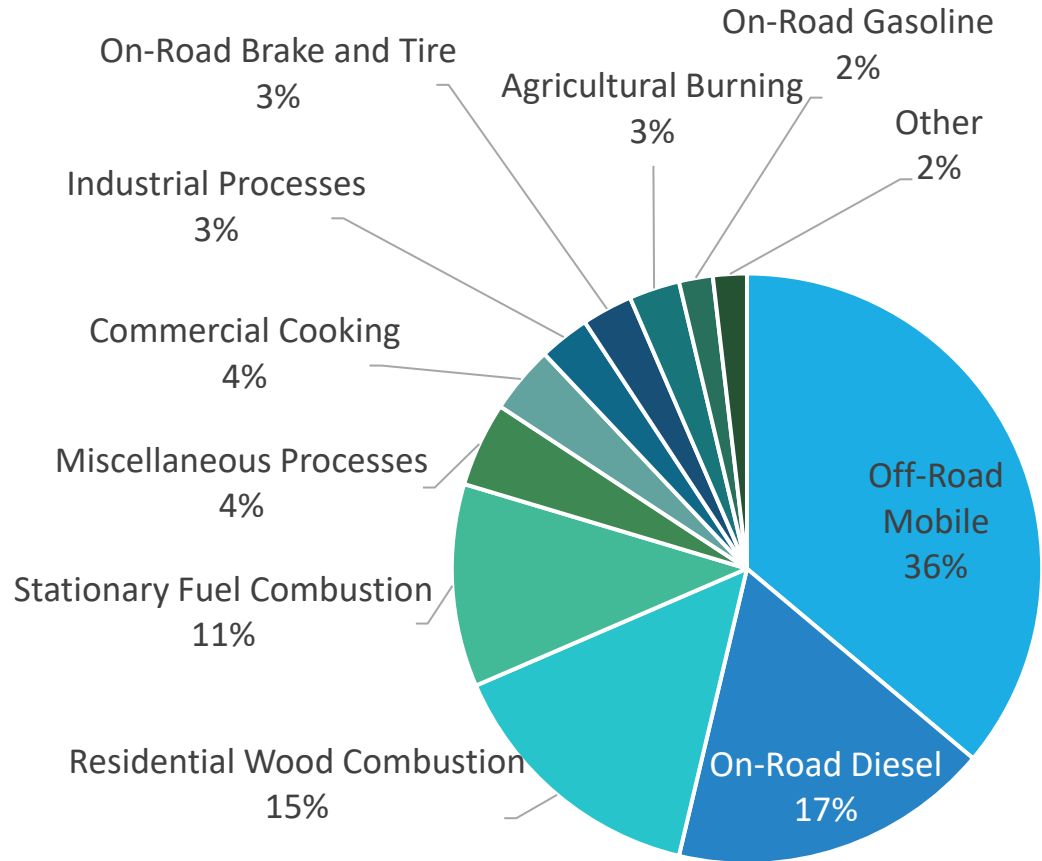|	
Regulations Adopted Under AB32	• The Refrigerant Management Program (RMP) • Motor Vehicle AC: Advanced Clean Cars Low-GWP AC, and Small Can Recycling for DIYers • Consumer Product Aerosol Propellants • Semiconductor Manufacturing F-gas Reductions
Cap-and-Trade ODS Offset Protocol	• Provides methods to quantify and report GHG emission reductions from destruction of high GWP ozone depleting substances
California SNAP	• CARB Regulation • SB 1013 (Lara, 2018)
F-gas Reduction Incentive Program (FRIP)	• Increase adoption of low-GWP refrigerant technologies in the supermarket and industrial sector. • SB 1013 is the first State law to authorize incentive funding for this purpose

Mitigation Actions to Achieve the 2030 Target for HFC Emissions

Business-as-Usual = 27 MMTCO$_2$e
Emissions Goal = 10 MMTCO$_2$e

HFC Emissions in California
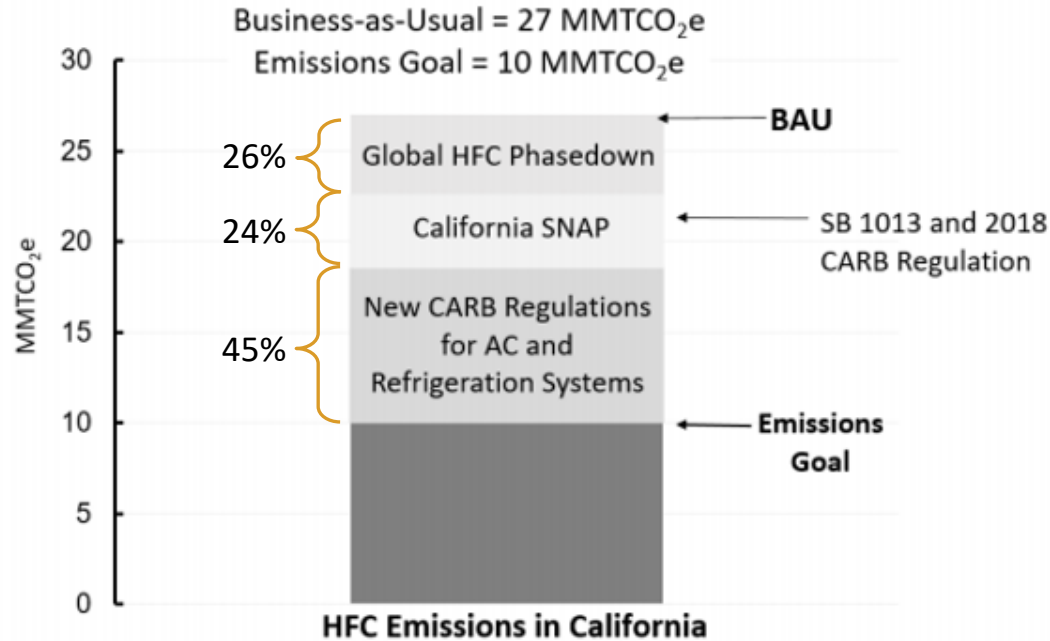
Anthropogenic Black Carbon

Statewide Total Anthropogenic Black Carbon Emissions in 2013:

10.7 MMTCO$_2$e

Pie chart: Anthropogenic Black Carbon

- On-Road Brake and Tire 3%
- On-Road Gasoline 2%
- Agricultural Burning 3%
- Other 2%
- Industrial Processes 3%
- Commercial Cooking 4%
- Miscellaneous Processes 4%
- Stationary Fuel Combustion 11%
- Residential Wood Combustion 15%
- Off-Road Mobile 36%
- On-Road Diesel 17%

* 2013 emissions from 2017 SLCP Inventory; using 100-year Global Warming Potential

Anthropogenic Black Carbon Emissions Reduction Programs

Fuel Combustion at On-road, Off-Road, and Stationary Sources

- Engine certification standards and in-use rules for on-road and off-road fleets
- Clean fuel requirements and incentives including California Climate Investments and Low Carbon Fuel Standard credits
- Investments in Research and Technology

Residential Wood Smoke

- SB 563 established the Woodsmoke Reduction Program: $7 million (2018-2020) through California Climate Investments
- USEPA Targeted Air Shed Grants: $11 million (2018-2020)
- Additional funding through Local Air District grant programs

What's Next for SLCPs?

- Implementation continues, including for incentive programs that support methane reductions from livestock and waste, for deploying low-GWP refrigerants, and for black carbon reductions;

- Deployment of new monitoring technologies to identify, quantify, track, and respond to methane leaks;

- And in support of carbon neutrality and for the upcoming Scoping Plan:

  - Evaluation of progress towards the 2030 targets for SLCPs

  - Identification of post-2030 SLCP emissions and mitigation opportunities