California State Legislature

JOINT LEGISLATIVE COMMITTEE ON CLIMATE CHANGE POLICIES

ASSEMBLYMEMBER CRISTINA GARCIA, CHAIR
SENATOR HENRY STERN, VICE CHAIR

INFORMATIONAL HEARING

Negative GHG Emission Impacts and Annual Update on Statewide Trends of Greenhouse Gas Emissions and Indicators

Hearing Goal

Assembly Bill 197(Garcia, Chapter 250, Statutes of 2016) requires the chair of the California Air Resources Board (ARB) to appear annually before the Joint Legislative Committee on Climate Change Policies (JLCCCP) to present an informational report on the reported greenhouse gases, criteria pollutants and toxic contaminants from all sectors covered by the ARB's scoping plan.

Increased and more severe wildfires pose significant risks to the states natural and working lands and their potential to sequester carbon and reduce greenhouse gas (GHG) emissions. The goal of this hearing is to provide members with an evaluation of emission trends, including understanding how wildfire emissions are assessed and impact our statewide GHG emission reduction goals, including the state's goals on short-lived climate pollutants.

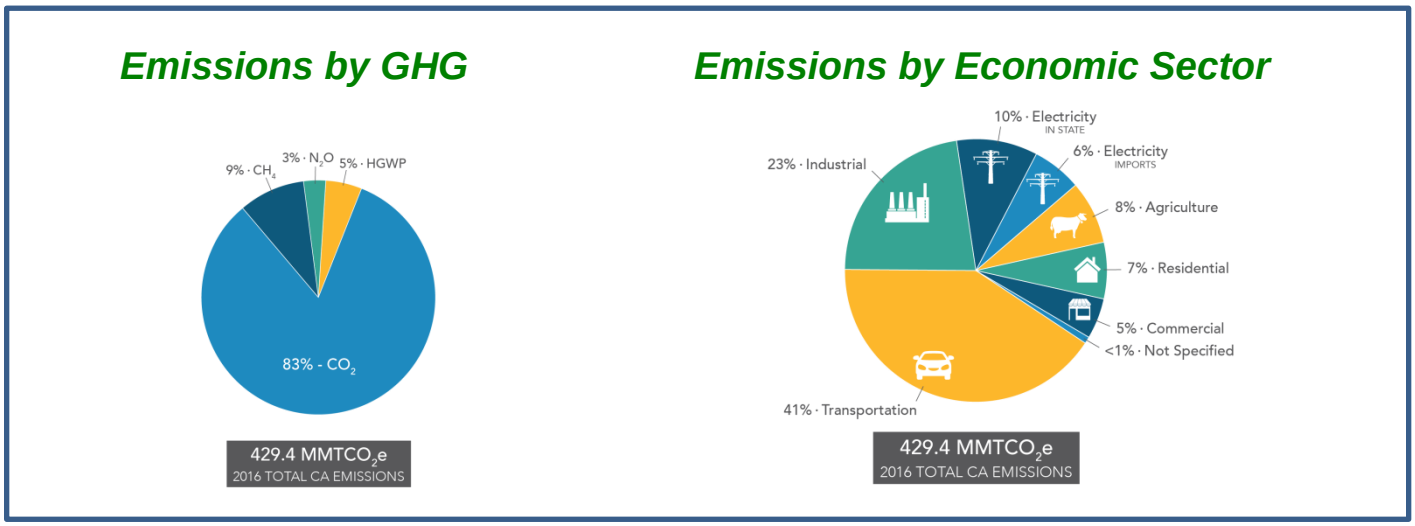
The hearing will also provide information on opportunities to increase negative emissions, based on research, experience and outcomes provided by Lawrence Livermore National Laboratories, Lawrence Berkeley National Laboratories and California's Strategic Growth Council. This information may better inform additional policy and program efforts toward increasing appropriate negative emissions strategies to help the state meet its goal to be carbon neutral by 2045, as established by Governor Jerry Brown's Executive Order B-55-18, signed in September 2018.]

Background on Reported Statewide Greenhouse Gas Emissions

A. General

California's annual statewide GHG emission inventory is an important tool for establishing historical emission trends and tracking California's progress in reducing GHGs. In concert with data collected through various California Global Warming Solutions Act (AB 32) programs, the GHG inventory is a critical piece in demonstrating the state's progress in achieving the statewide GHG target. The annual statewide inventory provides estimates of anthropogenic GHG emissions within California, as well as emissions associated with imported electricity. ARB is responsible for maintaining and updating California's GHG Inventory per Health and Safety Code section 39607.4. Natural sources are not included in this inventory, but many natural sources are included in ARB's seperate Natural and Working Land Inventory. Additionally, ARB has been developing estimates from wildfire emissions since 2000.

The inventory includes estimates for carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and fluorinated gases with high global warming potentials (High-GWP) which includes hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF6), and nitrogen trifluoride (NF3). It uses an inventory scope and framework consistent with international and national GHG inventory practices. An updated emission inventory is published annually to include additional years and improved estimation methods. Archives of all previous inventory data and documentation are available at: https://ww3.arb.ca.gov/cc/inventory/pubs/pubs.htm



Source: https://ww3.arb.ca.gov/cc/inventory/data/data.htm

B. Data Overview

Statewide emission estimates rely on state, regional or federal data sources, and on aggregated facility-specific emission reports from ARB's Mandatory GHG Reporting Program (MRR). Calculation methodologies are consistent with the 2006 IPCC guidelines. The current inventory uses 100-year global warming potential (GWP) values from the IPCC Fourth Assessment Report, consistent with current international and national GHG inventory practices. Full documentation of data sources and methods is available below or by using the detailed documentation index.

In preparation for each new edition of the inventory, recalculations are made to correct errors, incorporate new methodologies or, most commonly, to reflect changes in statistical data supplied by other agencies. Emission estimates are recalculated for all years to maintain a consistent time-series following IPCC recommendations for developing GHG inventories. Thus, the new inventory may report a different emission level for an earlier year than previous inventory editions.

The California GHG inventory is categorized in three ways:

1. Scoping Plan; follows the categories identified in the AB 32 Scoping Plan.
2. Economic sectors; allows for comparison with other ARB emission inventories, which are similarly categorized.
3. IPCC process-oriented categories; follows the IPCC categorization to ensure comparability with international inventories.

Negative GHG Emissions Impacts, Opportunities, and Equity

Our natural and working lands are often the first to experience the impacts of climate change. Historically, they have helped regulate our climate by removing carbon dioxide from the atmosphere and storing it as carbon in soil and wood. However, with more frequent and severe wildfires, this critical ecosystem and its ability to sequester carbon, are at risk. Reducing GHG emissions from and increasing sequestration on natural and working lands is crucial in the state's longterm climate change strategy. This strategy includes a concerted and ambitious effort to protect carbon stocks, increase carbon sequestration, and reduce GHG emissions on our lands to ensure the trajectory of GHG emissions declines and California lands remain a resilient carbon sink. The national laboratories have engaged in extensive study and modeling on climate impacts. The Lawrence Livermore National Lab's newly released study on negative carbon emissions found that California can achieve carbon neutrality by mid-century with existing negative emissions technologies and implementing the following strategies[1]:

1. **Carbon capture and storage using natural solutions**
   Natural solutions encompass activities such as changes to forest management to increase forest health and carbon uptake, restoration of woodlands, grasslands and wetlands, and other practices that increase the amount of carbon stored in trees and soils. These approaches are among the least expensive and have important co-benefits to air and water quality, ecosystem and soil health, overall resilience, and protection of life and property through fire risk reduction.

2. **Biomass conversion to energy**
   Waste biomass is widely available across California from trash, agricultural waste, sewage and manure, logging, and fire prevention activities. Currently, this biomass returns its carbon to the atmosphere when it decays or burns in prescribed fires or wildfires, or is used to produce energy at a power plant that vents its carbon emissions. Converting this biomass into fuels with simultaneous capture of the process CO2 emissions holds great potential for negative emissions in the state. This would include collecting biogas from landfills, dairies, and wastewater treatment plants for upgrading to pipeline renewable natural gas; conversion of woody biomass to liquid fuels and biochar through pyrolysis; and conversion of woody biomass to gaseous fuels through gasification.

3. **Direct air capture of carbon**
   Direct air capture involves removing CO2 directly from the air using purpose-built machines and then permanently storing the CO2 underground. This is more expensive than other negative emissions options but considered a viable necessary option nonetheless. The first step of the direct air capture process is to absorb CO2 into a solvent or adsorb CO2 onto a solid sorbent material. The second step is to release the CO2 from the capture agent to produce a high-purity stream of CO2 for geologic storage. The process is energy intensive, requiring 180 to 310 megawatts of power for a CO2 capture rate of 1 million tons per year, which leads to extensive land use requirements when powered by solar or wind energy.

Additional strategies could also include leveraging our bioresources from the forest, agricultural, and urban sectors. Carbon negative strategies may be able to help the state adapt to and mitigate climate change, improve air quality, create jobs, and achieve other significant co-

[1] Lawrence Livermore National Laboratory, "Getting to Neutral: Options for Negative Carbon Emissions in California" available at https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf

benefits. For example, biochar technologies remove biomass waste and assist with both restoring carbon in natural and working lands as a soil amendment.

However, these strategies must be durable, equitable and community centric. More simply, these strategies must improve, or at the very least not worsen, emissions of criteria and toxic pollutants and other state priorities to protect public health and community well-being. This may require a comprehensive analysis of the environmental impact of conversion facilities and consulting and engaging communities in planning, developing and implementation of negative emission.