

Achieving Net Zero GHGs in the Solid Waste Industry



2018

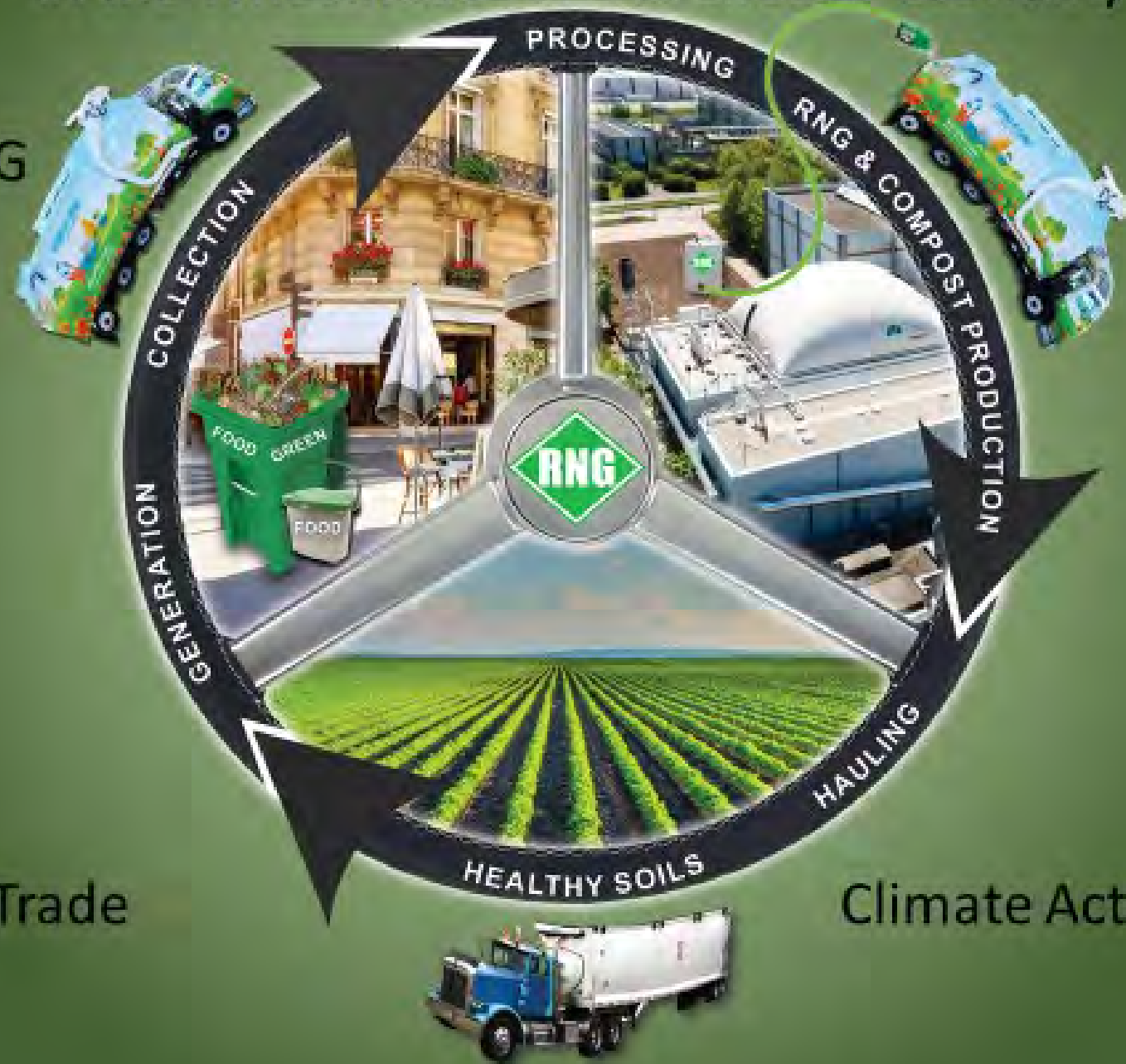
Presented By:
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2030



In the Wheelhouse of the Circular Economy



Net-Zero GHG

LCFS

SB 1383

BioMAT

Cap-and-Trade

Climate Action Reserve

GHG EMISSIONS IDENTIFICATION

SCOPES 1,2 AND 3

Industry standards and best practices were followed in the preparation of this greenhouse gas emissions inventory. Emissions in the following categories were analyzed:

Scope 1 – Direct GHG Emissions

Direct Emissions from Landfill Methane

Direct Emissions from Composting

Direct Emissions from Mobile Combustion – Transportation Sector – Fleets

Direct Emissions from Marine Fuel Combustion – Transportation Sector – Shipping

Scope 2 – in-Direct GHG Emissions

Indirect Emissions from Imported Electricity – Electricity Sector

Scope 3 – Avoided GHG Emissions

Recycling, Composting, and Biomass Combustion

NET-ZERO GHG ANALYSIS

Net-Zero GHG for the Waste Sector has been defined by CARB in the 2014 Scoping Plan First Update, as highlighted below. To meet Net-Zero GHG, one's avoided GHG emissions must be greater than or equal to one's operational GHG emissions. By analyzing the operational versus avoided emissions, it will be possible to demonstrate that the Waste Sector is Net-Zero GHG now.

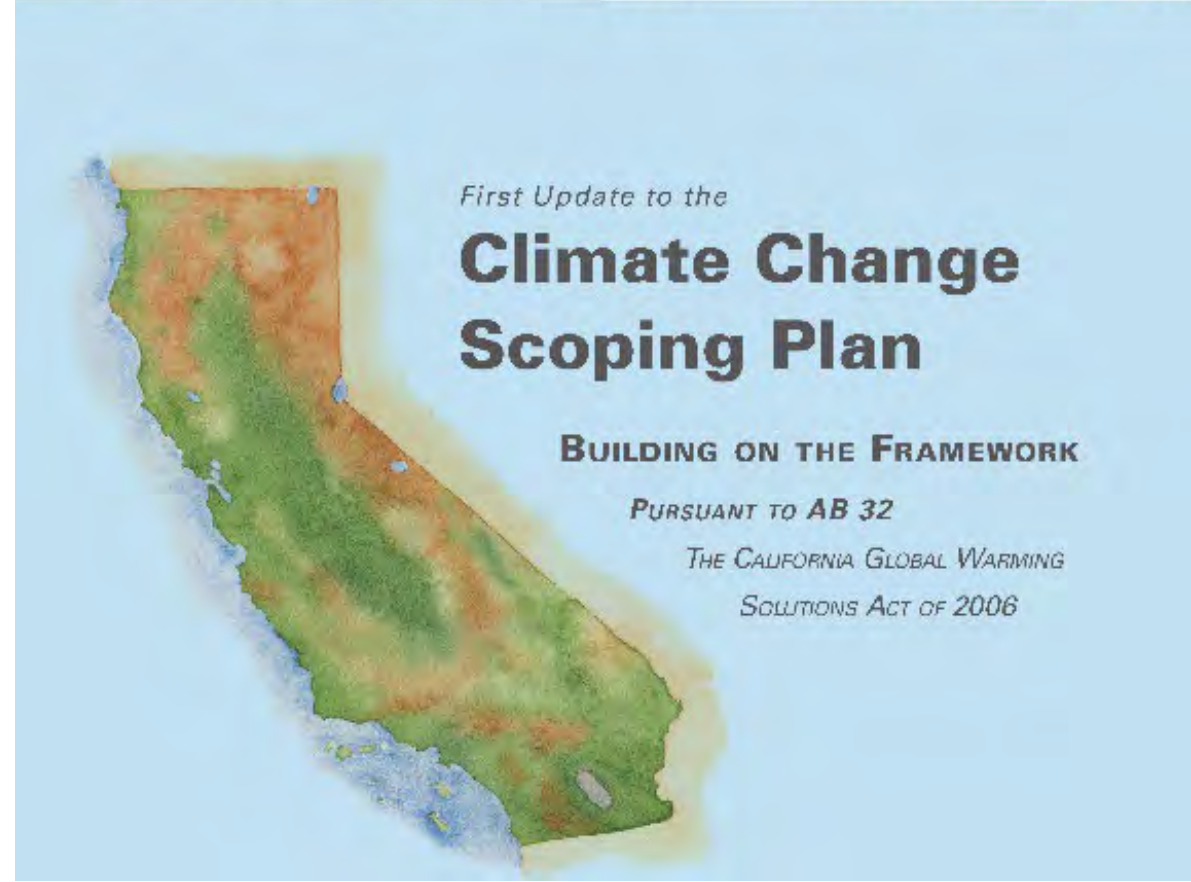


Net-Zero GHG Equation

$$\text{Operational GHG Emissions} - \text{Avoided GHG Emissions} \leq 0$$

Achieving Net-Zero GHG Emissions from the Waste Sector

Beyond 2020, additional reductions in GHG emissions from the Waste Sector will be needed to achieve a Net-Zero GHG emissions goal. To achieve these reductions, even greater diversion of organics and other recyclable commodities from landfills must be realized and further expansion and enhancement of the alternative non-disposal pathways must be developed. In addition, greater emphasis will need to be placed on reducing the volume of waste generated, recycling/reusing products at the end-of-life and remanufacturing these materials into beneficial products. To achieve Net-Zero, the direct GHG emissions from the Waste Sector would have to be fully offset by avoided GHG emissions. Avoided GHG emissions are reductions in life cycle GHG emissions that would occur because waste is shifted from landfilling to alternative non-disposal pathways.



Scope 1:

Direct Emissions from Landfill Methane

- SB 1383 organic waste reduction from landfills (with a 75% mandate by 2025) will reduce methane generation.
- The 2017 Scoping Plan Second Update estimates 4 Million MTCO₂e will be reduced by 2030 due to SB 1383, from 8.70 Million MTCO₂e in 2018.
- NASA data shows landfills are among the state's "super-emitters" of methane.

8.70 Million MTCO₂e

2018

3.70 Million MTCO₂e

2030

Scope 1:

Direct Emissions from Composting

- 75% diversion of food waste and green waste by 2030 will increase direct emissions from composting.
- The avoided emissions from composting, as Scope 3 emissions, may also increase from 1.83 Million MTCO₂e to 3.94 Million metric tons by 2030.
- The Soil Enrichment Protocol provides guidance on how to quantify, monitor, report, and verify agricultural practices that enhance carbon storage in soils from the use of compost. The primary GHG benefit targeted is the accrual of additional carbon in soils, with hopes to incentivize GHG emission reductions from other sources, such as N₂O from fertilizer use. The protocol was adopted by the Climate Action Reserve Board of Directors in September 2020.

0.40 Million MTCO₂e

2018

1.83 Million MTCO₂e

1.06 Million MTCO₂e

2030

3.94 Million MTCO₂e

Scope 3

Scope 3

Scope 1:

Direct Emissions from Mobile Combustion

- The Low Carbon Fuel Standard is designed to reduce the carbon intensity of transportation fuels by 20% by 2030.
- By 2030, the Waste Sector could have been negative or at least carbon neutral should CARB support a CNG fleet, fueled by in-state RNG with near-zero NO_x engines. But the Advanced Clean Truck Rule is forcing the Waste Sector to retain a longer-term diesel pathway with the possible use of renewable diesel. There is a conservative estimate that the Waste Sector can reduce their fleet GHG emissions by at least 45% to 0.45 Million MTCO₂e.
- CARB verified a negative Carbon Intensity (CI) under the LCFS, for two ZWE anaerobic digesters: with Napa Recycling, using food scraps with a

0.825 Million MTCO₂e

2018

0.45 Million MTCO₂e

2030

Scope 1:

Direct Emissions from Marine Fuel Combustion

- In April 2018, the International Maritime Organization adopted a strategy which aims to reduce the carbon intensity of marine fuel combustion from international shipping by at least 40% by 2030.
- In 2018, 15.4 Million tons of recyclables were exported. In order to meet a 75% statewide recycling rate in 2030, another 8.9 Million tons of the materials (paper, plastic, and metals) may need to be exported.
- AB 617 was designed to directly address ongoing issues with local air pollution in disadvantaged communities, especially around ports and the Central Valley, recognizing that AB 32 and the Clean Air Act are insufficient. AB 617 is not a climate change policy but is an important companion bill

1.93 Million MTCO₂e

2018

1.80 Million MTCO₂e

2030

Scope 2:

Indirect Emissions from Imported Electricity

- On-site solar, combined heat and power from renewable natural gas, and/or bioenergy from on-site biomass power plants are solutions for renewable energy being build today.
- By 2030, it would be conservative to assume that the GHG emission would be cut in half, surpassing State targets.
- The BioMAT program was extended another five years to give biomass gasification a chance, where up to 250 MW needs to be purchased by investor-owned utilities, which may be expanded to community choice aggregation and could handle up to 2.1 Million tons of wood chips transformed into bioenergy with SB 1383 procurement mandates.
- [AB 1086 \(Aguiar-Curry\)](#) is moving forward this year to develop an Organic

1.24 Million MTCO₂e

2018

0.62 Million MTCO₂e

2030

Scope 3:

Avoided GHG Emissions Recycling, Composting, Biomass

- The amount of recycling will double from the current documented 27.2 Million tons diverted in 2018, by adding an estimated 28.3 Million new tons, to total 55.6 Million tons, to achieve a statewide recycling rate of 75% by 2030.
- Based on CalRecycle tonnage data, and the best practice in modeling GHG using WARM, California's Waste Sector was 3.7 times avoided GHG in 2018.

2018

43.98 Million MTCO₂e

2030

69.78 Million MTCO₂e

SCOPE 1: DIRECT EMISSIONS FROM LANDFILL METHANE



8.70
Million
MTCO₂e

2018



3.70
Million
MTCO₂e

2030

SCOPE 1: DIRECT EMISSIONS FROM COMPOSTING

0.40
Million
MTCO₂e

1.06
Million
MTCO₂e

2018

2030

Scope 3

Scope 3

1.83
Million
MTCO₂e

3.94
Million
MTCO₂e



SCOPE 1: DIRECT EMISSIONS FROM MOBILE COMBUSTION



0.825
Million
MTCO_{2e}

2018

0.45
Million
MTCO_{2e}

2030

SCOPE 1:

DIRECT EMISSIONS FROM MARINE FUEL COMBUSTION



1.93
Million
MTCO₂e

2018

1.80
Million
MTCO₂e

2030

SCOPE 2: INDIRECT EMISSIONS FROM IMPORTED ELECTRICITY

1.24
Million
MTCO₂e

2018

0.62
Million
MTCO₂e

2030



SCOPE 3:

AVOIDED GHG EMISSIONS RECYCLING, COMPOSTING AND BIOMASS COMBUSTION



2018

43.98
Million
MTCO_{2e}



2030

69.78
Million
MTCO_{2e}



California's Waste Sector Net-Zero Greenhouse Gas Report



2018



2030



ZERO HERO PROGRAMS OF THE RECYCLING INDUSTRY



READVANTAGING COMMUNITY-SCALE SYSTEMS

THROUGH SUSTAINABLE FACILITY, FUEL, FLEET, FEEDSTOCKS & FARMING

FACILITY GREENHOUSE GASES

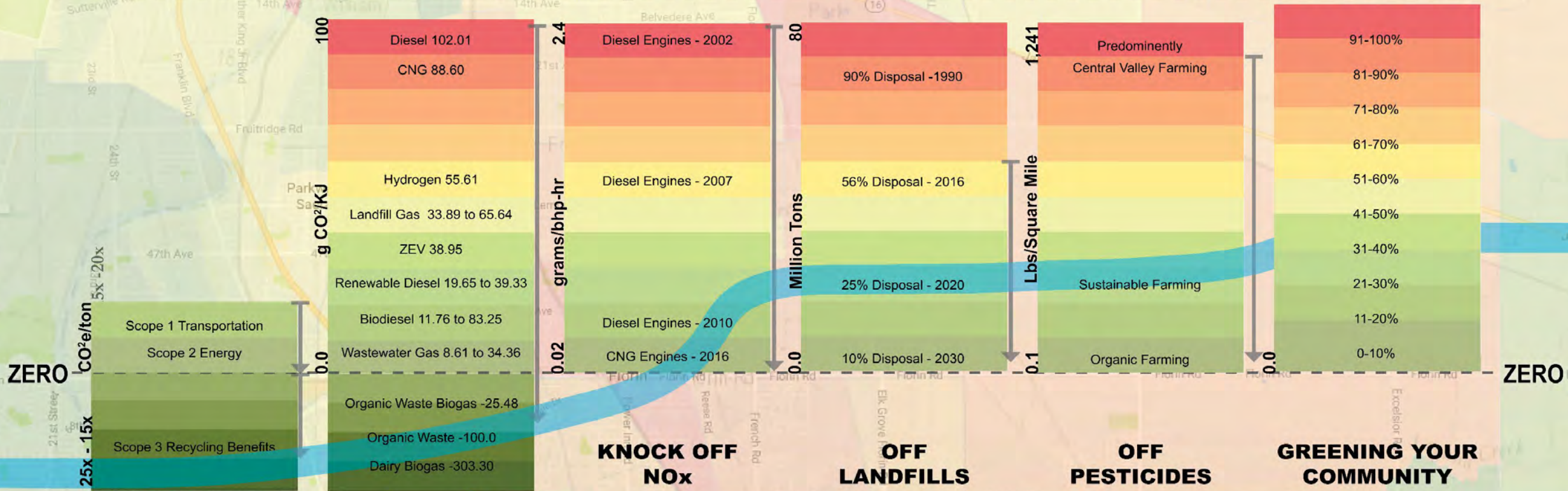
CARBON INTENSITY FUEL

HEAVY-DUTY VEHICLE NOX EMISSIONS

DISPOSAL SOLID WASTE TONS

POUNDS OF PESTICIDES

CALENVIRO SCREEN 3.0 RESULTS



ZERO

ZERO

5X - 20x CO₂e/ton

25x - 15x

Scope 1 Transportation

Scope 2 Energy

Scope 3 Recycling Benefits

KNOCK OFF NOx

OFF LANDFILLS

OFF PESTICIDES

GREENING YOUR COMMUNITY

NET ZERO NOW

OFF DIESEL

ZERO HEROES