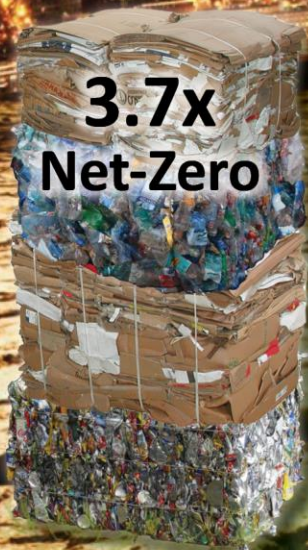


# Achieving Net Zero GHGs in the Solid Waste Industry



**3.7x  
Net-Zero**

**2018**

**Presented By:  
Evan Edgar**



**9.9x  
Net-Zero**

**2030**





The diagram illustrates the RNG cycle with four main stages: **GENERATION** (Healthy Soils), **COLLECTION** (Food Green/Food), **PROCESSING** (RNG & Compost Production), and **HAULING**. A central logo features the text **RNG** inside a green diamond. Images of trucks are shown at each stage: a collection truck at Collection, a processing truck at Processing, and a hauling truck at Hauling. The background shows a farm, a city street with food waste bins, and a processing facility.

LCFS

# BioMAT

## 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

Operational GHG Emissions – 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 MTCO<sub>2</sub>e will be reduced by 2030 due to SB 1383, from 8.70 Million MTCO<sub>2</sub>e in 2018.
- NASA data shows landfills are among the state's "super-emitters" of methane.

8.70  
Million  
MTCO<sub>2</sub>e

2018

3.70  
Million  
MTCO<sub>2</sub>e

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 MTCO<sub>2</sub>e 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 N<sub>2</sub>O from fertilizer use. The protocol was adopted by the Climate Action Reserve Board of Directors in September 2020.

0.40  
Million  
MTCO<sub>2</sub>e

2018

Scope 3

1.83  
Million  
MTCO<sub>2</sub>e

1.06  
Million  
MTCO<sub>2</sub>e

2030

Scope 3

3.94  
Million  
MTCO<sub>2</sub>e

### 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<sub>x</sub> 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 MTCO<sub>2</sub>e.
- 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  
MTCO<sub>2</sub>e

2018

0.45  
Million  
MTCO<sub>2</sub>e

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  
MTCO<sub>2</sub>e

2018

1.80  
Million  
MTCO<sub>2</sub>e

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 built 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  
MTCO<sub>2</sub>e

2018

0.62  
Million  
MTCO<sub>2</sub>e

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  
MTCO<sub>2</sub>e

2030



69.78  
Million  
MTCO<sub>2</sub>e



# SCOPE 1: DIRECT EMISSIONS FROM LANDFILL METHANE



**8.70**  
Million  
MTCO<sub>2</sub>e

**2018**



**3.70**  
Million  
MTCO<sub>2</sub>e

**2030**





# SCOPE 1: DIRECT EMISSIONS FROM COMPOSTING

0.40  
Million  
MTCO<sub>2</sub>e

1.06  
Million  
MTCO<sub>2</sub>e

2018

2030

Scope 3

Scope 3

1.83  
Million  
MTCO<sub>2</sub>e

3.94  
Million  
MTCO<sub>2</sub>e



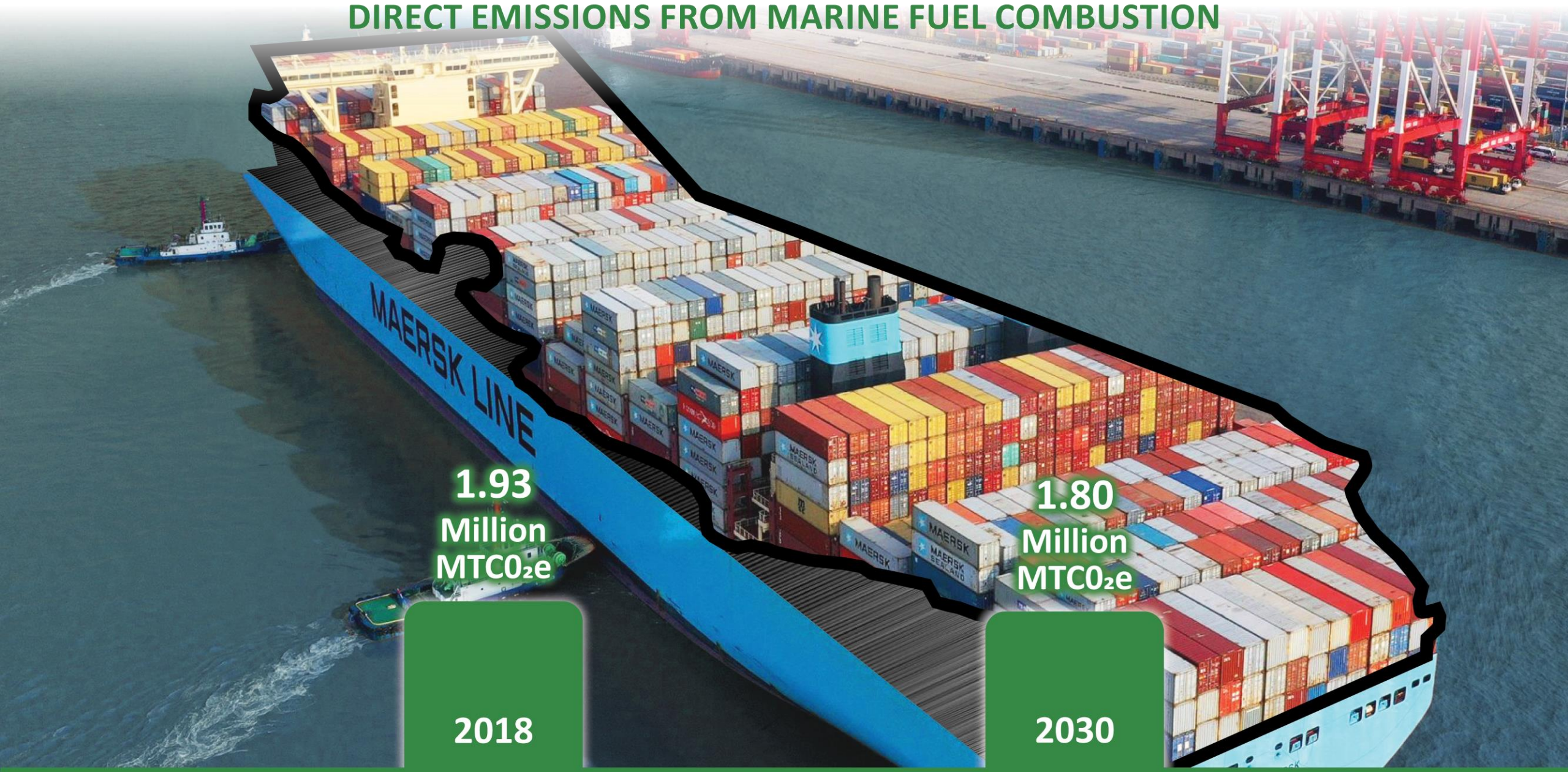


# SCOPE 1: DIRECT EMISSIONS FROM MOBILE COMBUSTION





# SCOPE 1: DIRECT EMISSIONS FROM MARINE FUEL COMBUSTION



1.93  
Million  
MTCO<sub>2</sub>e

2018

1.80  
Million  
MTCO<sub>2</sub>e

2030



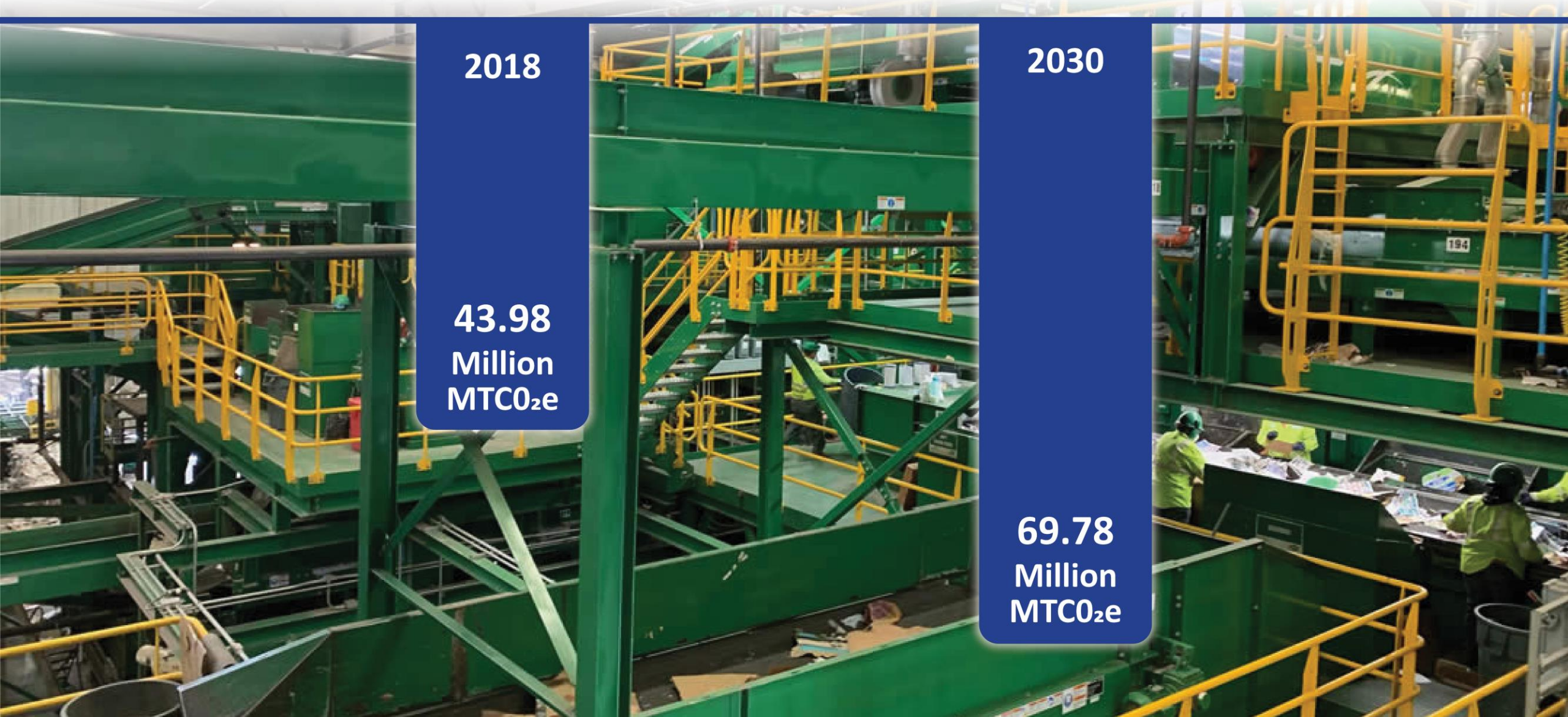
## SCOPE 2: INDIRECT EMISSIONS FROM IMPORTED ELECTRICITY





## SCOPE 3:

### AVOIDED GHG EMISSIONS RECYCLING, COMPOSTING AND BIOMASS COMBUSTION



2018

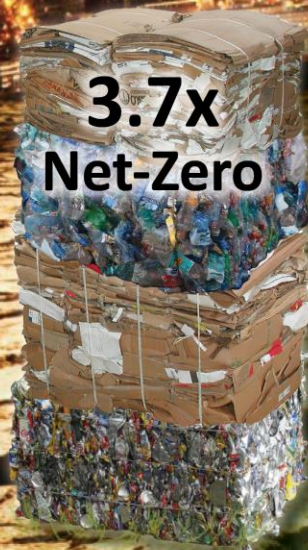
43.98  
Million  
MTCO<sub>2</sub>e

2030

69.78  
Million  
MTCO<sub>2</sub>e



# California's Waste Sector Net-Zero Greenhouse Gas Report



**3.7x  
Net-Zero**

**2018**



**9.9x  
Net-Zero**

**2030**





## ZERO HERO PROGRAMS OF THE RECYCLING INDUSTRY



# READVANTAGING COMMUNITY-SCALE SYSTEMS

THROUGH SUSTAINABLE FACILITY, FUEL, FLEET, FEEDSTOCKS & FARMING

### FACILITY GREENHOUSE GASES

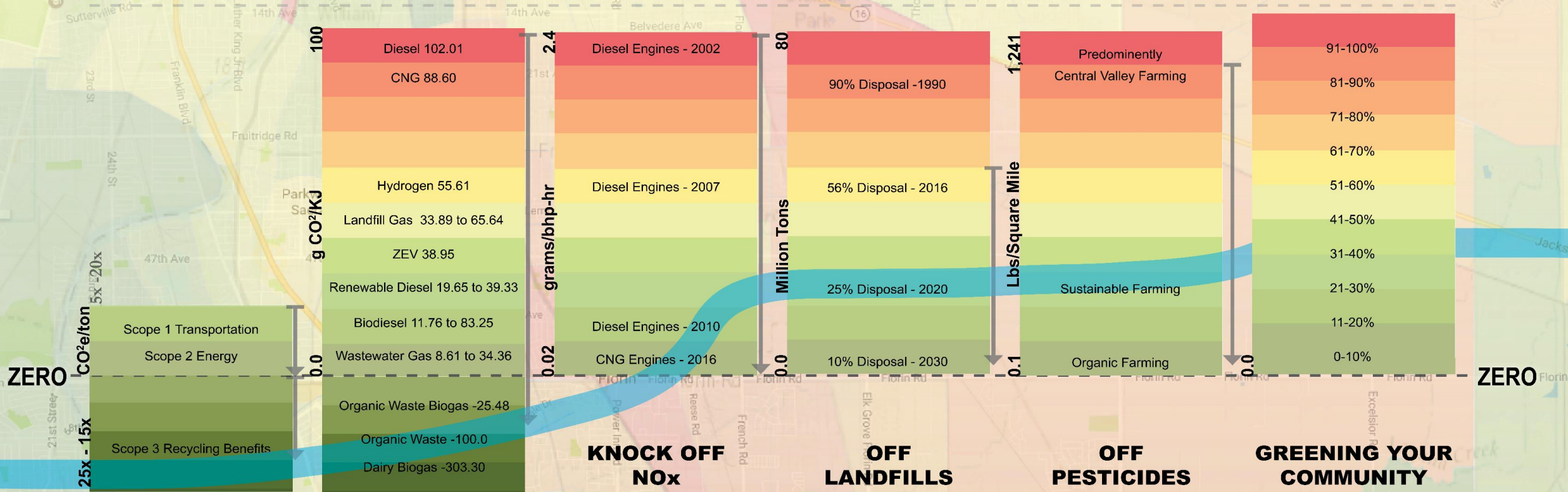
### CARBON INTENSITY FUEL

### HEAVY-DUTY VEHICLE NOX EMISSIONS

### DISPOSAL SOLID WASTE TONS

### POUNDS OF PESTICIDES

### CALENVIRO SCREEN 3.0 RESULTS



# ZERO HEROES