



# Overview of California's Medium- and Heavy-Duty Natural Gas Vehicle Market—For the Dairy Working Group Digester Committee

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# Overview

1. Relevance of medium- and heavy-duty (MHD) Natural Gas Vehicles (NGVs) to the Dairy RNG industry
2. MHD NGVs on the road – current population, growth scenarios, and incentive programs
3. A “strawman” summary of barriers and needs for NGV growth

# Relevance of NGVs to Dairy RNG

## 1. Demand Market

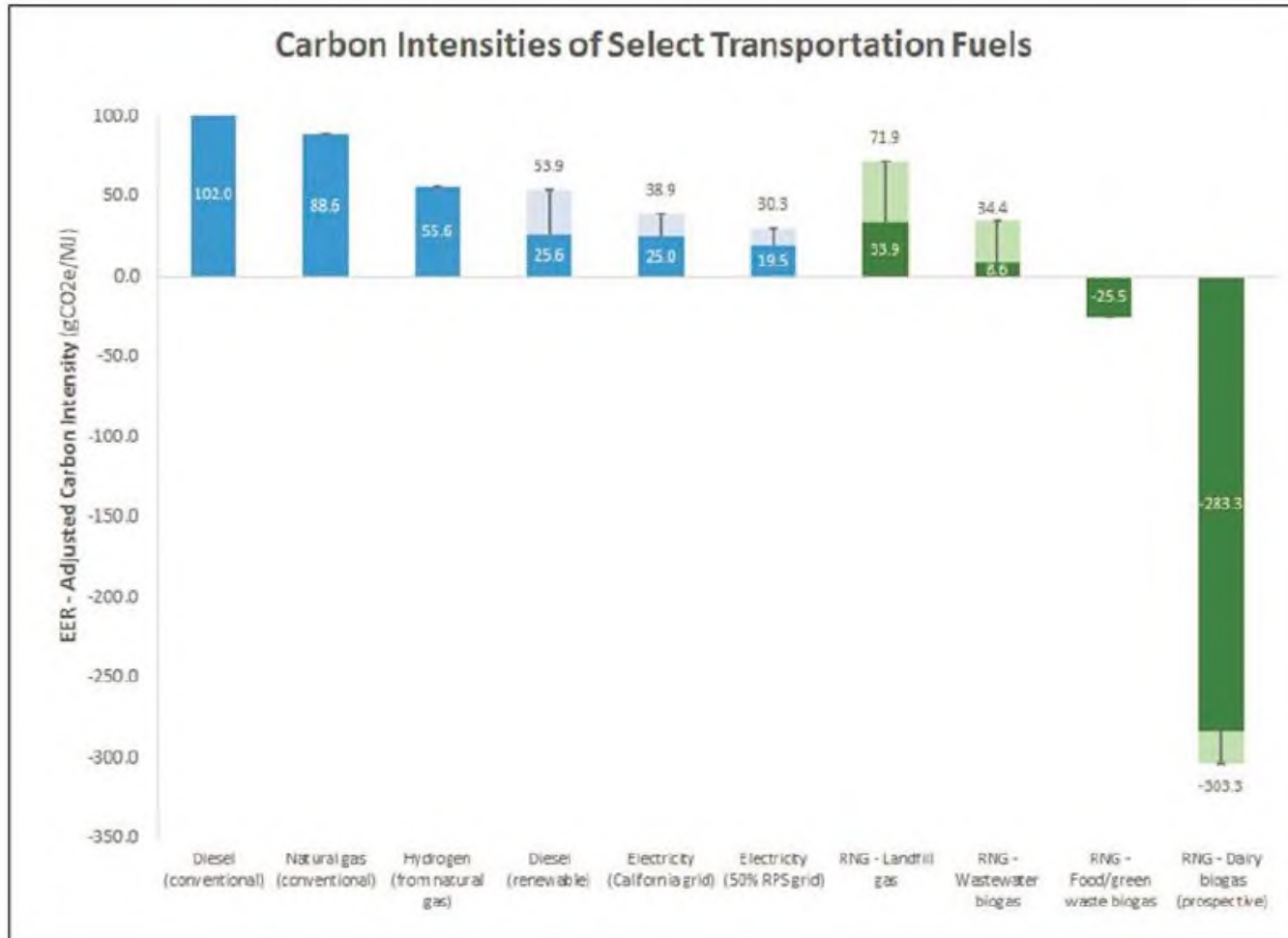
- LCFS credit values are vital to financing (can be 80% of the value)
- LCFS credits require vehicles to use
- NGV demand reaching saturation (60%+ of CA NVGs fueled by RNG)

## 2. GHG Reduction

- RNG has low carbon intensity (CI)
- Dairy RNG has very low CI
- Replacing diesel trucks with RNG trucks displaces significant GHG



# GHG Reduction



1 Source: Southern California Gas Company, using Carbon intensity values from ARB, “Current Lookup Table, Tier 1, Tier 2, and Legacy Fuel Pathway Table” August 28, 2017 update, located at <https://www.arb.ca.gov/fuels/lcfs/fuelpathways/pathwaytable.htm>.

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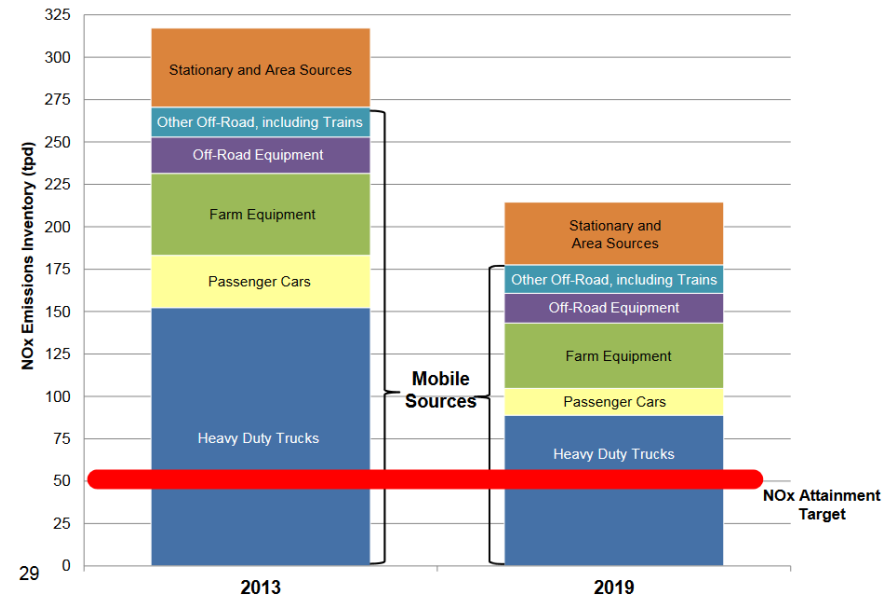
## 3. Air Quality

- NOx reduction is one of SJV's/South Coast's top environmental concerns
- Replacing diesel with Low NOx trucks is primary AQ attainment strategy

# Air Quality Improvement in the San Joaquin Valley



Additional Emissions Reductions Required for Attainment After Direct PM2.5 Reductions (2019 Serious Deadline for 2006 24-hr PM2.5 Std)



The San Joaquin Valley (SJV) is one of only two extreme ozone nonattainment areas in the nation<sup>1</sup>

Mobile sources create 85%+ of the SJV's NOx, and Low NOx trucks are central to any conceivable strategy for attainment<sup>2</sup>

1 California Air Resources Board (2016). Mobile Source Strategy.

2 San Joaquin Air Pollution Control District (2017). Public Advisory Workgroup Meeting – April 12, 2017.

# Air Quality Improvement in the San Joaquin Valley

Effect on NOx emissions from using methane emissions from a typical dairy, according to SJVAPCD:<sup>1</sup>

- » **Standard Electricity Generation:** New emissions of 3,300 lbs-NOx per year
- » **Cleaner Electricity Generation:** New emissions of 500 lbs-NOx per year
- » **Pipeline Injection:** No new NOx emissions
- » **Vehicle Fuel:** No new NOx emissions; or reduction of 20,000 lb/yr NOx if replacing 2007-09 MY trucks and 47,000 lb/yr Nox if replacing older vehicles

Best case for NOx reduction

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## 4. Local Benefits

- Local dairy RNG could be used to fuel local trucking industries
- Opportunity to create closed loop with benefits staying in communities

## 5. Proven Production Methods

- Dairy RNG is well-established in Europe—Dairy RNG is mature in Sweden, Netherlands, and Germany, and a key strategy for Sweden to be fossil free



# Low NOx Trucks and Buses are Here



- » Low NOx (a.k.a. near zero): Certified to 50% or lower NOx than the “2010 standard” of 0.2 g/bhp-hr
- » Low NOx NGVs are available for transit, refuse, yard, and goods movement applications, including:
  - » 8.9L ISL G – 0.02 g/bhp-hr – Cummins Westport MY 2016-17 (HVIP-eligible)
  - » 6.7L ISB6.7 G – 0.10 g/bhp-hr – Cummins Westport MY 2017 (HVIP-eligible)
  - » 6.8L CNG – 0.10 g/bhp-hr – Roush Cleantech MY 2016
  - » 6.8L LPG – 0.05 g/bhp-hr – Roush Cleantech MY 2017
- » Over 340 orders have been placed using HVIP / Low NOx Incentives since January 2017
- » A 12L engine with 0.02 g/bhp-hr from Cummins Westport is scheduled for launch in early 2018

# Current NGVs in California by Key Segment

Approximate Number of On-Road Medium- and Heavy-Duty NGVs Currently Operating in California – by Key Segment<sup>1</sup>

Segment	Number of NGVs	Notes
HD Transit	6,500	Flattening recent growth
HD Refuse	2,500 – 4,000	Increasing recent growth
HD Drayage	1,200 – 1,500	Most located in the South Coast
HD OTR + Delivery	200 – 500	Overall OTR pop is 175,000+
MD Delivery	200 – 500	Most in a few large fleets
Subtotal	10,600 – 13,000 <sup>2</sup>	<1% of CA's 1.5M MHDV pop

<sup>1</sup> Estimate based on [CALHEAT Research and Market Transformation Roadmap for Medium- and Heavy-Duty Trucks](#), [Heavy-Duty Truck and Bus Natural Gas Vehicle Technology Roadmap](#), [ARB Transit report](#), and discussion with analysts.

<sup>2</sup> Subtotal represents select segments; total vehicle registrations for all MHDVs (class 4-8) is around 16,900.

# Scenario for MHD NGV Expansion: South Coast

Potential Market Growth Scenario for SoCalGas Territory<sup>1</sup>

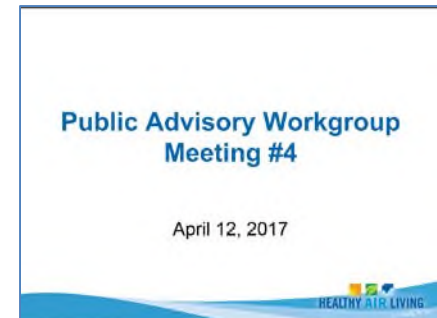
	2013	2020	2025	2030
Refuse	<b>1,886</b> (28%)	<b>4,594</b> (55.5%)	<b>4,704</b> (53.2%)	<b>6,411</b> (62.4%)
Transit	<b>4,399</b> (68%)	<b>4,620</b> (68.8%)	<b>4,760</b> (68.8%)	<b>5,050</b> (68.8%)
Drayage	<b>905</b> (6.9%)	<b>1,075</b> (6.9%)	<b>3,525</b> (21.5%)	<b>4,077</b> (22.1%)
Regional Delivery	<b>100</b> (0.2%)	<b>3,265</b> (5.5%)	<b>6,087</b> (10.5%)	<b>15,518</b> (24.5%)
Line Haul	<b>245</b> (0.2%)	<b>1,4313</b> (8.7%)	<b>19,133</b> (11.1%)	<b>41,798</b> (21.3%)
Subtotal	<b>7,535</b> (4.0%)	<b>27,868</b> (10.9%)	<b>38,210</b> (14.5%)	<b>72,853</b> (24.6%)

Units: First figure is number of vehicles, second figure (in parentheses) is market share

<sup>1</sup> CALSTART (2013) [CALHEAT Research and Market Transformation Roadmap for Medium- and Heavy-Duty Trucks](#)

# Scenario for MHD NGV Expansion: San Joaquin Valley

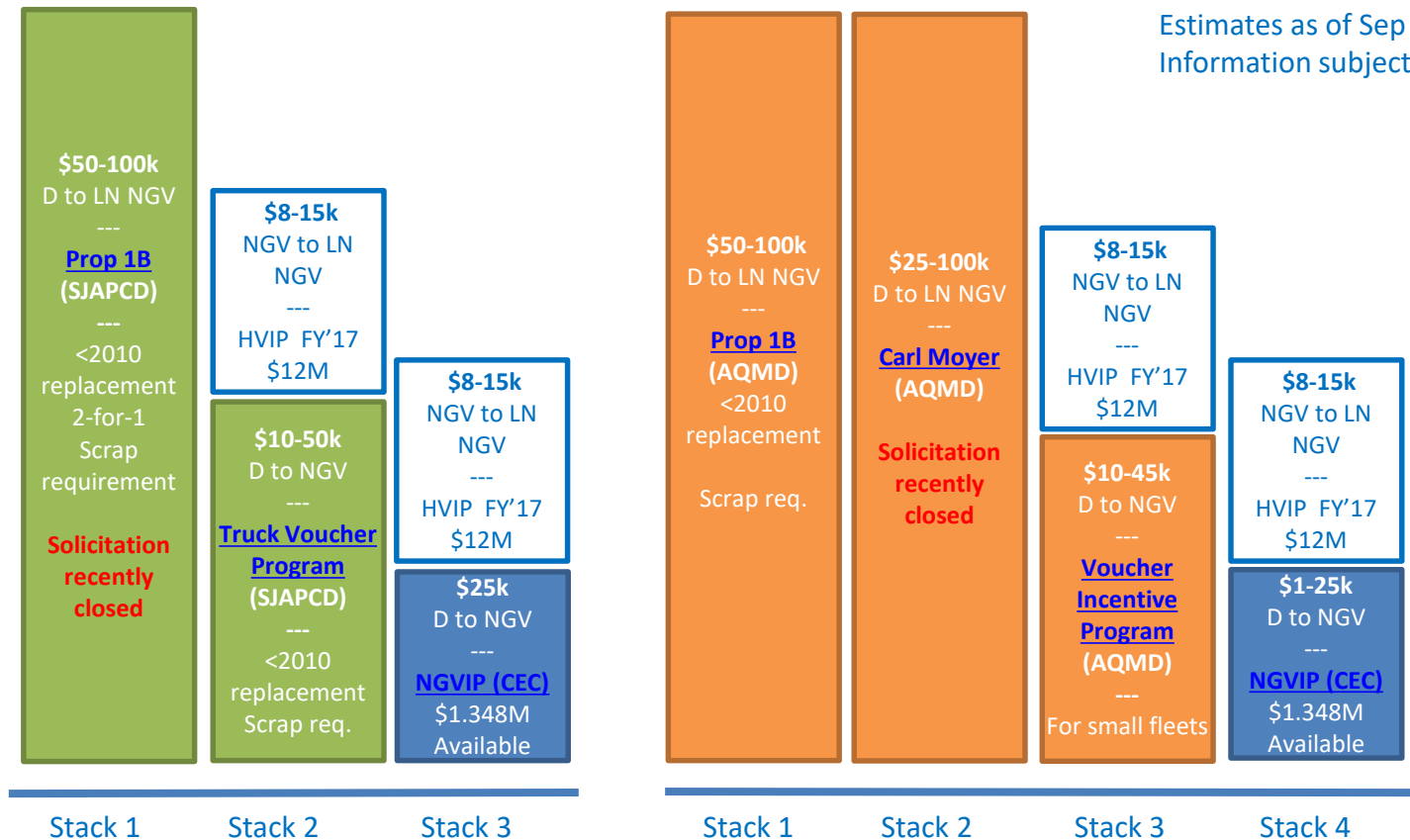
- » San Joaquin Valley APCD: Reducing emissions from trucks is major priority in any conceivable strategy for attainment
- » Ambitious measures (with enough funding and time) to achieve AQ attainment includes deploying the following Low NOX NGVs:
  - » 74,912 H-HD trucks
  - » 110,000 M-HD trucks
  - » 102,936 L-HD trucks



# Existing Incentives for Low NOx NGVs<sup>1</sup>

## Select Incentives – with Stackable Configurations

Estimates as of Sep 7, 2017  
Information subject to change



### San Joaquin Valley (SJV)<sup>2</sup>

### South Coast (SC)

- Statewide
- SJV-Specific
- SC-specific
- D: Diesel
- NGV: Natural Gas Vehicle
- LN NGV: Low NOx NGV (0.02 g/bhp-hr)

HVIP: Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project

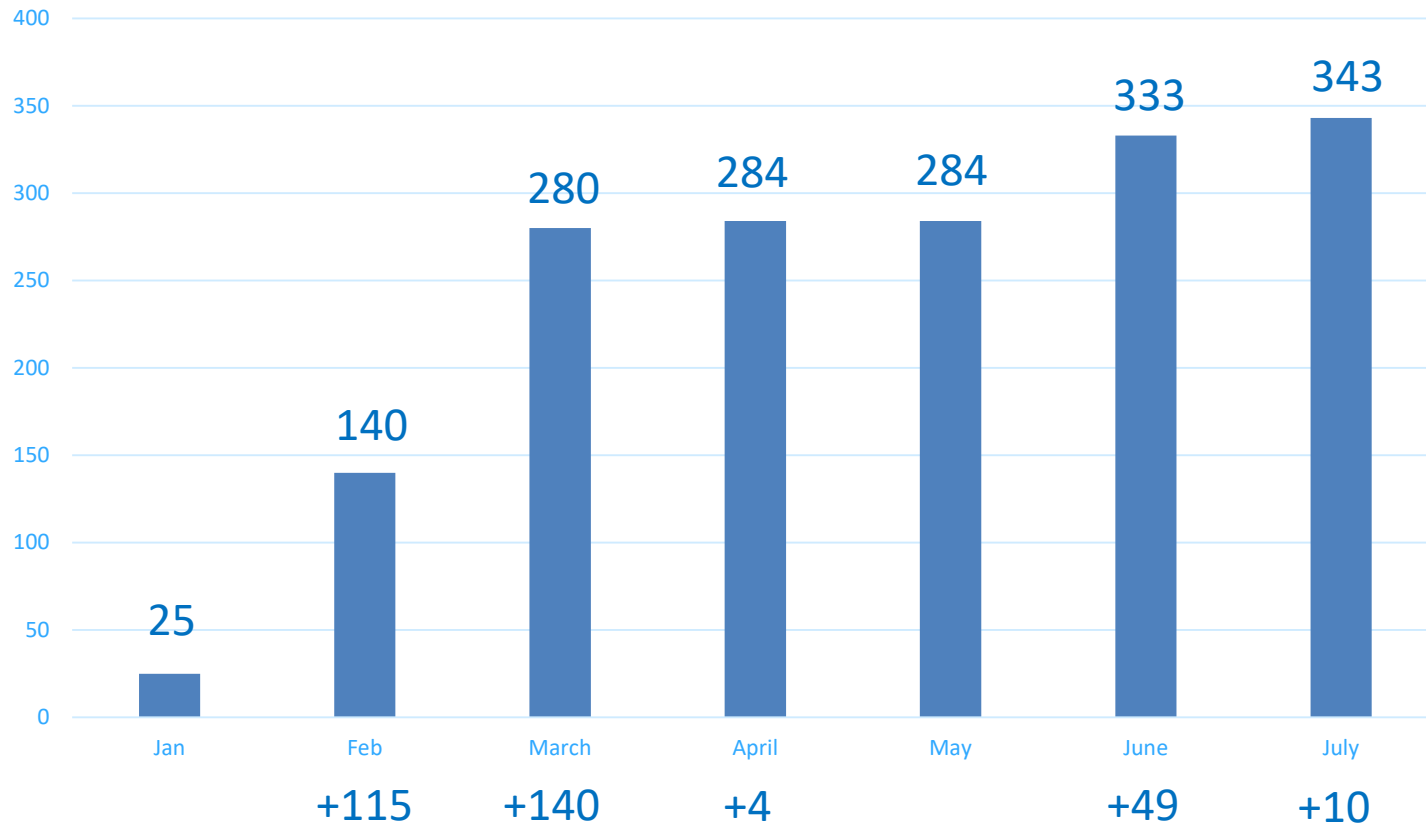
NGVIP: Natural Gas Vehicle Incentive Project

Notes: (1) Currently includes only CWI 8.9 Liter, (2) Currently SJAPCD is not using Carl Moyer for on-road NGVs

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# Low NOx Vehicle Voucher Awards Cumulative Transactions in 2017



Note: All vehicles are 8.9L engine refuse trucks except for one order of nine 8.9 L engine transit buses

# Summary of Barriers and Needs for NGV Expansion: Strawman

Vehicle Cost Premium	Inadequate Fuel Price Savings	Weight Penalty	12L+ Low NOx Launch Pending	Unfamiliar RNG Value Proposition
				
Premium from Diesel to Low NOx NGVs may be \$60-100k+	Retail NG fuel can be higher than diesel	NG trucks 2,000 lbs heavier, which displaces cargo	Low NOx 12L needed for OTR not out til Q1 2018	Some fleets are unfamiliar with RNG contract
Incentives are needed to allow fleets a <18 mo payback on the total incremental vehicle cost		Weight variance is needed	Education needed on business case and emerging investment opportunities	

# Contact

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