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Readvantaging Community-Scale Systems Through Sustainable Facility, Fuel, Fleet, Feedstocks and Farming

From the ports of California to the Great Central Valley, a network of renewable natural gas (RNG) production facilities and RNG fueling stations for near-zero NOx heavy-duty recycling vehicles that haul organics should be funded to de-carbonize the fuels and the fleets now. Getting the fossil out of the fuel with near-zero NOx emission engines, using carbon negative fuel produced from zero waste at net-zero facilities, should receive priority incentives from cap-and-trade proceeds. The technology is commercially available, proven, and can provide significant GHG and NOx reductions now while mitigating methane at landfills and creating organic compost to help zero out the use of pesticides and petroleum-based fertilizers. With incentive investment of \$100 million per year in these facilities and investment of \$100 million year in these clean fleets, California communities can experience significant benefits by 2020.

These community-scale anaerobic digestion and compost systems have been determined to be among the most cost-effective GHG reduction strategies, with 100% of the CalRecycle grants from cap-and-trade proceeds having benefitted disadvantaged communities (DACs). The California Legislative Analyst's Office determined the cost of organic recycling grants to be at just \$9/ton of GHG reduction while the overall average is \$57/ton. Incentives for electrification and modernization of public fleets in DACs is costing \$414/ton to \$725/ton.

CalEnviroScreen Methodology: CalEnviroScreen is used to help identify California communities that are disproportionately burdened by multiple sources of pollution. Disadvantaged communities in California are specifically targeted for investment of proceeds from the State's cap-and-trade program. Cal EPA designated the top 25 percent of census tracts in CalEnviroScreen 3.0 as disadvantaged communities for the purpose of investing cap-and-trade proceeds in April 2017. The maps depict the relative scoring of California's census tracts using the CalEnviroScreen methodology. Census tracts with darker red colors have the higher CalEnviroScreen scores and therefore have relatively high pollution burdens and population sensitivities. Census tracts with lighter green colors have lower scores, and correspondingly lower pollution burdens and sensitivities. The graphic on the next page

displays the relatively lower pollution burdens that the new Community-Scale, Carbon Negative, near-Zero Emissions, at Net-Zero Facilities system may pose. Direct hauling of garbage to a landfill with diesel vehicles (done dirt cheap!) is an outdated model that the organics recycling industry is not using and the DAC stakeholders have the opportunity to adopt this new model and the benefits that can be realized in their community using their own wasted materials.

The [Short-Lived Climate Pollutant Plan \(SLCP\)](#) was adopted on March 23, 2017 and the [SB 32 Scoping Plan Update with 2030 goals](#) may be considered by CARB on June 29, 2017. The community-scale anaerobic digestion facilities model (see graphic on page 4) is at the intersection of the SLCP, SB 32, and the [Governor's Five Pillars](#) where the RNG produced at these anaerobic digestion facilities has been deemed to be carbon negative and – when utilized in CNG trucks with the near zero emissions – will be a game changer today by reducing heavy duty diesel emissions now while striving for zero waste. Another huge game changer is the Federal EPA Food Recovery Hierarchy striving to feed hungry people first where CalRecycle and the industry have embraced programs coupled with AB 1826 outreach. SB 1383 will require that 20% of edible food be recovered by 2025 resulting in 49,500 tons that year being rescued, or 270,000 pounds resulting in 225,000 meals per day. CalRecycle will be awarding grants of over \$1 million in August as part of the organics infrastructure grants and another \$5 million has just been noticed, which will benefit DACs 100%.

Back to the Future is now as the heavy-duty refuse fleet can be transformed in the short-term to address SLCPs (such as methane) and produce RNG, as heavy-duty electrification is still a generation away. The refuse industry is doing the heavy lifting now on heavy-duty vehicle deployment that will need to be further recognized and funded by CARB as the transformation of the industry to reduce reliance on diesel, landfills, NOx, and pesticides is expensive. Being a Zero Hero is not cheap and incentive funding is needed to benefit the community that fully utilizes their own waste for their own good.



READVANTAGING COMMUNITY-SCALE SYSTEMS THROUGH SUSTAINABLE FACILITY, FUEL, FLEET, FEEDSTOCKS & FARMING



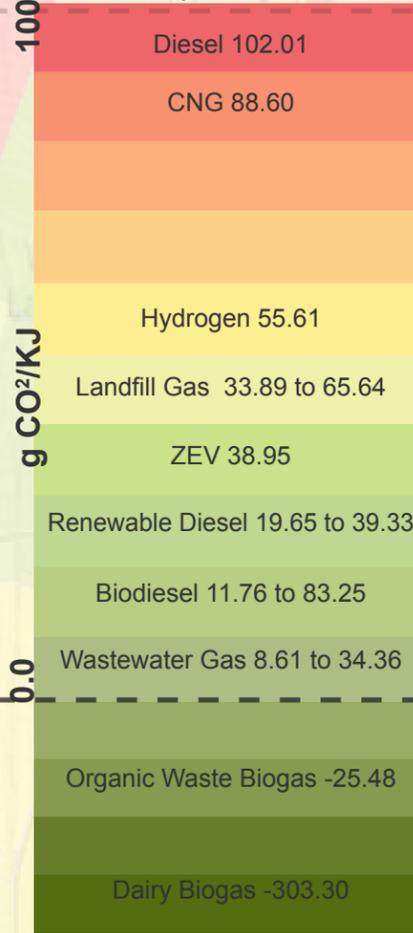
NET-ZERO FACILITIES

Greenhouse Gases

The Net-Zero Facilities in the recycling sector including material recovery facilities processing recyclable materials, compost facilities, anaerobic digestion facilities, and biomass conversion facilities. The new composting facilities are covered aerated static pile systems using the best available control technologies and the anaerobic digestion facilities are enclosed closed-loop system without high temperature incineration. The avoided GHG emissions for these facilities compared to landfilling fully offset the project emissions including collection, hauling, processing activities and the landfilling of residuals. Landfills and garbage transfer stations are in the waste sector and are not Net-Zero Facilities.

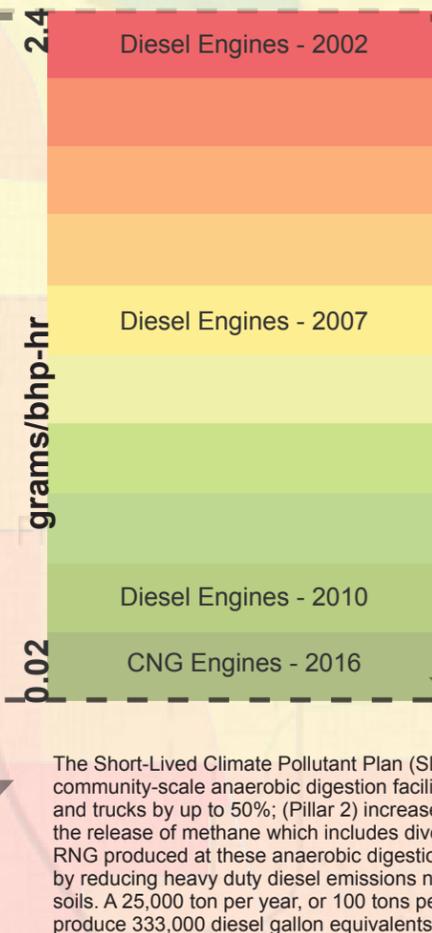
CARBON NEGATIVE FUEL

Carbon Intensity Transportation Fuel



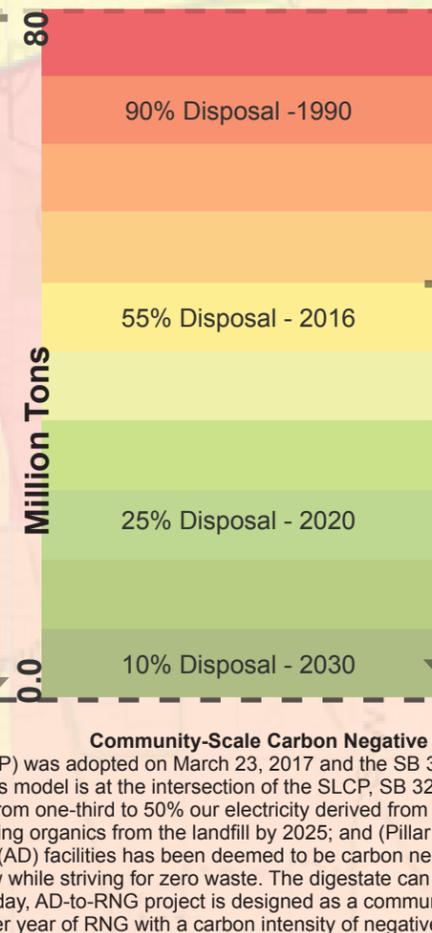
NEAR ZERO FLEET

Heavy-Duty Vehicle NOx Emissions



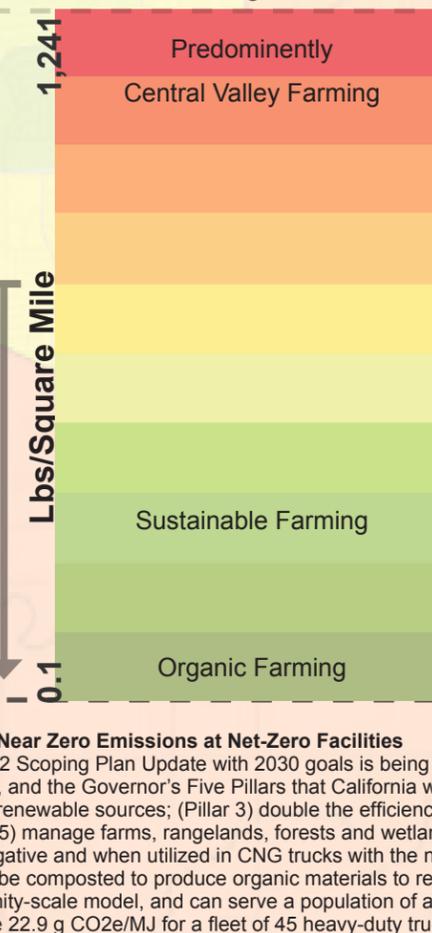
ZERO WASTE

Disposal Solid Waste Tons



ZERO PESTICIDE USE

Pounds of selected active ingredients



DISADVANTAGED COMMUNITIES

CalEnviro Screen 3.0 results



Community-Scale Carbon Negative Near Zero Emissions at Net-Zero Facilities
 The Short-Lived Climate Pollutant Plan (SLCP) was adopted on March 23, 2017 and the SB 32 Scoping Plan Update with 2030 goals is being considered by CARB on June 23, 2017. The community-scale anaerobic digestion facilities model is at the intersection of the SLCP, SB 32, and the Governor's Five Pillars that California will: (Pillar 1) reduce today's petroleum use in cars and trucks by up to 50%; (Pillar 2) increase from one-third to 50% our electricity derived from renewable sources; (Pillar 3) double the efficiency savings from existing buildings; (Pillar 4) reduce the release of methane which includes diverting organics from the landfill by 2025; and (Pillar 5) manage farms, rangelands, forests and wetlands so that they can use compost and store carbon. RNG produced at these anaerobic digestion (AD) facilities has been deemed to be carbon negative and when utilized in CNG trucks with the near zero emissions will be a game changer today by reducing heavy duty diesel emissions now while striving for zero waste. The digestate can be composted to produce organic materials to reduce pesticide and fertilizer use to produce healthy soils. A 25,000 ton per year, or 100 tons per day, AD-to-RNG project is designed as a community-scale model, and can serve a population of approximately 100,000 people. This model can produce 333,000 diesel gallon equivalents per year of RNG with a carbon intensity of negative 22.9 g CO₂e/MJ for a fleet of 45 heavy-duty trucks with near-zero NOx emissions.

AB 32 Scoping Plan 2014 Update Waste Sector
 Net-Zero GHG Emissions from the Waste Sector by 2030. Reduce Scope 1 emissions with alternative fuels. Reduce Scope 2 emissions with roof-top solar and on-site bioenergy. Avoid Scope 3 GHG emissions with recycling and composting. 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. Most material recovery facilities are 15 to 25 times offset over their GHG emissions.

LCFS Pathway CARB Certified Carbon Intensities
 The wide range of carbon intensities is due to the lifecycle emissions methodology of the Low Carbon Fuel standard (LCFS); variation of feedstock types, origin, raw material production, processing efficiencies, and transportation all contribute to the producers' fuel pathway carbon intensity. The certification of carbon negative fuel for the production of renewable natural gas (RNG) from organic waste anaerobic digestion is based on the biogenic feedstocks of food waste and green waste, and the avoided methane emissions from the landfilling of the material. The same CNG truck collects food waste to make RNG.

CARB and EPA certified ISL G NZ (8.9) L CNG engines
 In 2015, Cummins Westport certified the world's first heavy-duty engine at near-zero-emission levels (90 percent below the existing federal standard) for Class 7 refuse trucks and will be available for Class 8 transfer trucks in 2018. To complement the NOx reductions provided by this landmark engine, conventional (fossil) natural gas provides significant GHG reduction benefits. However, renewable natural gas with carbon negative fuel completes the game-changing proposition by providing the lowest carbon intensity of any heavy duty transportation fuel available in the market today.

90% or more Waste Reduction from Landfills and Incineration
 Zero Waste is a goal that is ethical, economical, efficient and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use. Communities that have a Zero Waste goal and are working towards or have reduced their waste to landfill, incineration and the environment by 90% or more. Dozens of large cities from San Francisco to Fresno have adopted zero waste goal by 2025. California is at a 45% recycling rate as compost facilities are curtailed by NIMBYism.

Healthy Soils Initiative with Compost Use
 Communities near agricultural fields, primarily farm worker communities, may be at risk for exposure to pesticides. Drift or volatilization of pesticides from agricultural fields can be a significant source of pesticide exposure. The use of most synthetic pesticides and fertilizers is prohibited from organic production. Organic farming with certified organic compost use and a zero pesticide goal makes healthy soils. The multiple co-benefits of enhanced soil organic matter on our agricultural lands, include improved water retention, soil stability and nutrient use efficiency to reduce fertilizer use.

CalEnviroScreen 3.0 Cap-and-Trade Investments
 The California Communities Environmental Health Screening Tool (CalEnviroScreen) helps us to address environmental threat challenges. The objective in developing this tool is to use it to assist California communities by directing state and potentially local government resources toward a common purpose: the revitalization of disadvantaged communities and the pursuit of environmental justice. Cap-and-trade proceeds have funded projects where over \$3.3 billion has been appropriated with 50% of the funding benefiting DACs and 34% located in DACs.

NET-ZERO NOW

OFF DIESEL

KNOCK OFF NOx

OFF LANDFILLS

OFF PESTICIDES

GREENING YOUR COMMUNITY

ANAEROBIC DIGESTION FACILITY



**BLUELINE AD
SOUTH SAN FRANCISCO
SCAVENGER**

FARM



COMPOST

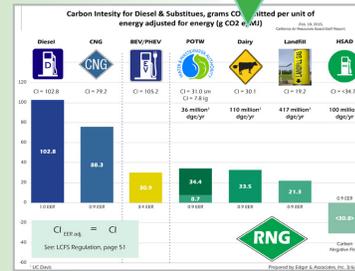
BIOGAS

FOOD WASTE/
GREEN WASTE



COMMUNITY SCALE CARBON NEGATIVE FLEET

BIOGAS CONDITIONING AND COMPRESSION



CNG GARBAGE TRUCK



FRANCHISE



RESTAURANT

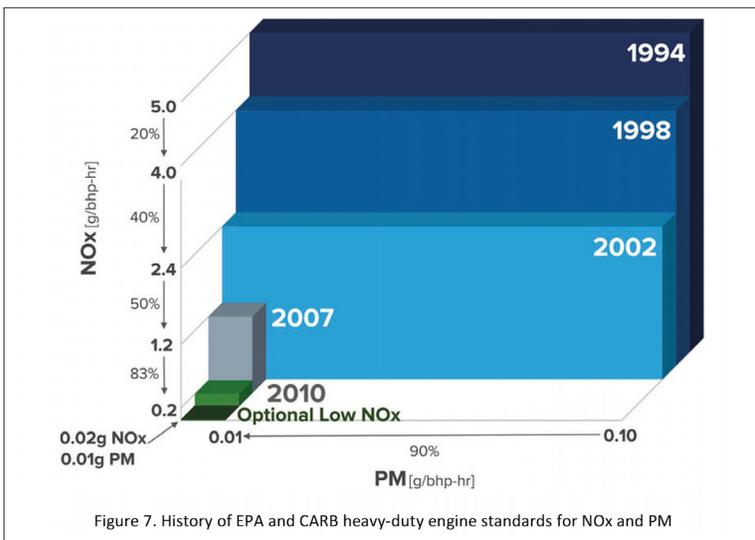
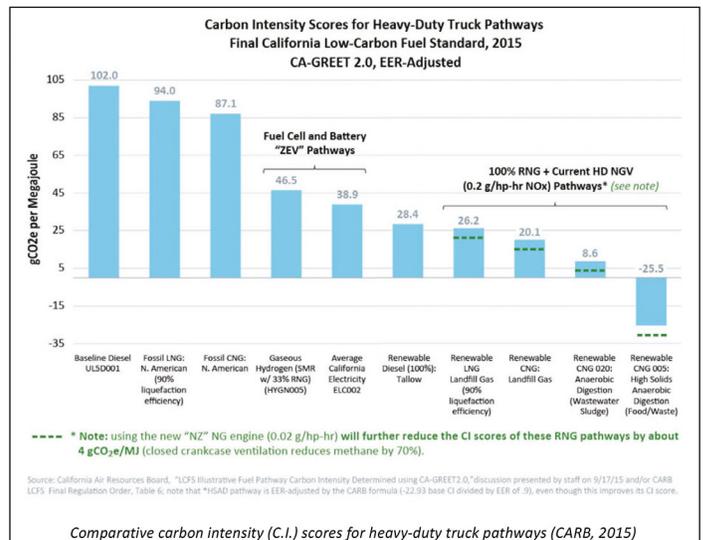


Figure 7. History of EPA and CARB heavy-duty engine standards for NOx and PM



* Note: using the new "NZ" NG engine (0.02 g/hp-hr) will further reduce the CI scores of these RNG pathways by about 4 gCO₂e/MJ (closed crankcase ventilation reduces methane by 70%).
Source: California Air Resources Board, "LCFS Illustrative Fuel Pathway Carbon Intensity Determined using CA-GREET 2.0," discussion presented by staff on 9/17/15 and for CARB LCFS Final Regulation Order, Table 6; note that "HGAD pathway is EER-adjusted by the CARB formula (-22.53 base CI divided by EER of .9), even though this improves its CI score.

Comparative carbon intensity (C.I.) scores for heavy-duty truck pathways (CARB, 2015)

Source: [Game Changer Technical White Paper. Full Report](#), prepared by the clean transportation and energy consulting firm of Gladstein, Neandross & Associates (GNA).