

West Coast Diesel Emissions Reduction Collaborative

Heavy-Duty Refuse Trucking Project

This document describes an important potential diesel emissions reduction project in the Trucking Sector, Class 8, Heavy-Duty, Refuse Trucking Project. This multi-year project could be replicated at any and all refuse trucking companies on the West Coast. **After all, converting the 30 refuse trucks contemplated by this proposal to natural gas has the same emission reductions as taking 9,750 light-duty vehicles off the road! We believe that this project will compliment the emission reduction efforts of this Collaborative.**

Project at a Glance -- Introduction

Clean Energy is proposing to partner with the West Coast Diesel Emissions Reduction Collaborative on a multi-year project to help offset the incremental capital costs to launch a fleet of new natural gas refuse trucks and increase natural gas fueling infrastructure throughout the West Coast. Air pollution has been widely linked to heart disease, lung cancer and birth defects. The significance of this project is that it will help reduce emissions from tailpipe exhaust that lead to these negative health effects. In addition, this project will decrease the nation's dependence on foreign oil by approximately 3 million gallons of the diesel over the life of the vehicles. Further, it will provide significant, measurable environmental benefits **especially to historically underserved communities.**



H&C CNG Refuse Truck at Clean Energy
Public Fueling Station at
Los Angeles International Airport

The goal and objective of the project is to reduce the source of emissions of oxides of nitrogen (NOx) as well as diesel particulate matter produced at the tailpipe from diesel engines, thus demonstrating that clean burning natural gas is an effective and efficient fuel for use in refuse truck applications. **By deploying a fleet of 30 natural gas refuse trucks, a total reduction of 172,800 lbs. of harmful pollutants would be achieved over the term of the project's life.**

We envision that this project will serve as a model for other heavy duty fleets to consider using natural gas as a vehicle fuel.



Waste Management LNG Refuse Truck at
Fueling Station in Corona, CA

Environmental Benefits

This project would achieve over a 40 percent emission reduction benefit by converting 30 refuse trucks to liquefied natural gas (LNG) as an alternative to diesel fuel. Total emission reductions resulting from this project is **86.4 tons of NOx** over the project life. To demonstrate the emission reductions that are achievable, we have used information from a fleet of refuse trucks that are currently powered with a Caterpillar C-7 or Cummins M-11 diesel engines and replacing them with clean burning NG Cummins 8.3+ natural gas engines. The environmental benefit per dollar invested is calculated based on proven methodology used by the California Air Resources Board (CARB).

- Estimated emission reductions = (.36 tons/year) (30 trucks) = 10.8 tons/year NOx
- Estimated emission reductions for project life = 86.4 tons or 172,800 lbs. NOx
- Emission reductions begin in year 2005
- Initial emission reductions will be effective over an 2 year period

Baseline NOx Emission Factor = 4.4 g/bhp-hr
 Reduced NOx Emission Factor = 1.8 g/bhp-hr
 Energy Consumption Factor = 18.5 bhp-hr/gal
 Annual Diesel Fuel Consumption = 6,750 gal/year
 Convert grams to tons = ton/907,200 g

Base Line

$$(4.4 \text{ g/bhp-hr}) (18.5 \text{ bhp-hr/gal})(6,750 \text{ gal/yr})(\text{ton}/907,200\text{g}) = .61 \text{ ton/yr}$$

Reduced

$$(1.8 \text{ g/bhp-hr})(18.5 \text{ bhp-hr/gal})(6,750 \text{ gal/yr})(\text{ton}/907,000) = .25 \text{ tons/yr}$$

NOx emission reductions: (.61 tons/yr) – (.25 tons/yr) = **.36 tons/yr/truck**

Project is to replace 15 trucks per year: (15)(.36) = 5.4 tons/year or 10,800 lbs

Project life is 8 years: (8)(5.4 tons/year) = 43.2 tons or 86,400 lbs. NOx reduction

For two-year project: 30 trucks X .36 = 10.8 tons/year or 21,600 lbs.

Two-year Project Life is calculated as follows: 8 years X 10.8 tons/year = 86.4 tons or 172,800 lbs. NOx reductions

Project Visibility

The South Coast Air Basin has a population of 14 million people, and is one of the fastest growing areas of the country. Increase in population means an increase in the number of vehicles on the roads, thus an increase in emissions exhaust. Using natural gas in heavy-duty refuse applications helps offset the emissions generated by increased vehicle miles traveled. This project will demonstrate to other commercial heavy-duty fleets that using natural gas powered engines is technologically feasible and economically beneficial. Further, it will lend the type of experience fleet managers want to see before they choose a non-diesel path.

Refuse trucks are ubiquitous in urban areas and considered a necessary evil; however this project will show that refuse trucks can be clean and quiet. Prominent clean air signage could be placed on the sides of the refuse trucks letting the community know that a clean refuse fleet powered by natural gas is serving them. This project would further help offset the cost to educate the general public about the benefits of using clean, burning natural gas. In fact, the average refuse truck makes over 800 stops per day.

Trash trucks are on the road each day. This project will develop a clean air decal to visibly promote that the trucks use natural gas. Each trash truck, on average, will pass 800 homes a day in addition to traveling on the highways to and from the route.

Problem Statement

The South Coast Air Basin is a non-attainment area, and, must find both NO_x and VOC emission reductions from both mobile and station sources to reach attainment compliance. Since the region's NO_x problem results primarily from mobile sources, reducing these emissions is paramount to the region's efforts. However, beyond meeting Federal air quality standards there is a more pressing and localized need for this project. Multiple epidemiological studies have linked diesel particulate matter and ground level ozone with negative health impacts such as reduced lung function and increases episodes of asthma among children and the elderly. Moreover, studies such as the MATES II study commissioned by the South Coast Air Quality Management District (SCAQMD) have shown that economically disadvantaged neighborhoods and neighborhoods near freeways bore the brunt of increased air quality pollution and the associated negative health impacts. Therefore, reducing NO_x and particulate matter emissions from heavy-duty diesel engines that serve communities throughout the South Coast Air Basin will provide an Environmental justice benefit as well. The fact is we commonly accept diesel refuse trucks as a necessary evil to have our trash picked up from homes. We accept that they are loud, noisy, and smelling, but it doesn't have to be that way. Dedicated natural gas refuse collections vehicles, such as the ones envisioned by this project, are 37% cleaner than even today's cleanest diesel engines and are up to 50% quieter as well. While economically disadvantaged communities might not be able to do anything about the freeways that they find themselves living near, we can do something to clean up the dirty diesel refuse trucks that pass by their homes every week.

Proposed Actions

We propose to reduce emissions throughout the West Coast by launching a fleet or fleets of clean burning natural gas refuse trucks and building infrastructure to fuel the trucks. It is possible to include in the clean fuel infrastructure multiple choices of clean fuel in addition to natural gas. We propose that the first year would encompass deploying a fleet of 15 natural gas refuse trucks and construction of the infrastructure. Year 2 would concentrate on adding an additional 15 trucks to the fleet.

Progress would be monitored through personal contact with the natural gas customer running the fleet of refuse trucks. Clean Energy has a developed and proven system for monitoring projects funded by various partners. Quarterly and annual reports are provided to the funding agency(s).

Anticipated Benefits

Benefits provided by this project include ones for the public good, i.e., environmental, assisting with mitigating natural resource depletion, supporting national security through decreasing the volume of imported oil used by our country, community health benefits, economic benefit such as training and education programs related to natural gas vehicles and health benefits associated with decreasing toxic air emissions which have been directly linked to asthma and other respiratory diseases.

Estimated Costs

The purpose of this project is to (1) fund the incremental cost between 30 new natural gas refuse trucks and 30 new diesel refuse trucks, (2) offset the capital costs of designing, building, owning and operating a new, state-of-the-art liquefied natural gas (LNG) fueling station, and (3) partner in the marketing and media costs to showcase the benefits of this choice to use clean natural gas refuse fleet.

Based on our experience working with refuse fleets that are running natural gas trucks, the incremental cost of a natural gas refuse truck is approximately \$40,000 per truck. The total budget for the necessary fueling infrastructure to fuel the fleet of trucks is \$942,050 assuming that the station includes one fuel at the site. Marketing and other educational materials for this project are estimated to be \$75,000 (or \$2,500 per truck). The total cost of this project is \$1,650,000, of which \$1,050,000 would be incurred in the first year's budget with the balance of \$600,000 in the second budget year.

Collaborative Partners

Numerous cities located within the South Coast Air Basin attract millions of visitors each year. These trucks will provide excellent public exposure and education for demonstrating the positive environmental effects of using an alternative fuel in refuse applications. The project will also offer cities within the South Coast Air Basin to join as a project partner. As respects potential project partners, Clean Energy is an active participant in various Clean Cities Coalitions (Coalitions), a well-recognized organization supported by the Department of Energy. As an active participant, Clean Energy participates in the Coalition's outreach and education efforts to teach the public and new members of the Coalition about the advantages of natural gas vehicles. The Coalition and Clean Energy actively promote the natural gas vehicles in the region and have prioritized California as a key element in expanding the use of natural gas powered vehicles throughout the State. As partners with the Coalition, Clean Energy and the Coalition have expanded resources for their marketing efforts demonstrated by the number of vehicles that fuel at Clean Energy's current fueling stations. Clean Energy's outreach initiative includes one-on-

one meetings with fleet operators focusing on how natural gas vehicles (NGVs) can assist companies in meeting operational, environmental and financial goals. Clean Energy also facilitates purchases of NGVs by its customers, ensuring that they have all the information necessary to make a purchase decision, including information on discounts and incentives.

In terms of media awareness, Clean Energy hosts formal grand openings of its new fueling stations and includes its funding partners in such events. As an example of its wide-spread media campaign, Clean Energy recently built a new fueling station in Seattle, Washington at the Seattle Tacoma (Sea-Tac) International Airport. To increase the number of natural gas vehicles fueling at this new station, Clean Energy hosted an event known in the industry as a "Ride and Drive" at Sea-Tac in June 2002. Media was well represented with two local television stations and two local radio stations attending and covering the event. Just a few months ago, in Dallas, Clean Energy hosted a ground breaking event with the City of Dallas for a new compressed natural gas (CNG) fueling station at Love Field. Clean Energy's founder, Boone Pickens, and Dallas Mayor Laura Miller along with other City officials held a press conference to commemorate the event. All of the major local TV stations and radio stations covered the event.

In partnership and with the support of funding from this project, Clean Energy would be able to replicate its very effective marketing tool, its decal programs. Decal programs educate the general public about the availability of NGVs, and Clean Energy has an excellent track record of working with the vehicle manufacturers to put decal programs into place on vehicles that have chosen the clean fuel path.

Respectfully submitted,

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