

WHITE PAPER ON BEST AVAILABLE CONTROL TECHNOLOGY AND LIQUEFIED NATURAL GAS FUELED TRUCKS

SUMMARY

The Clean Air Action Plan (CAAP) is clear that the Port of Long Beach and the Port of Los Angeles (Ports) are committed to the use of the cleanest available technologies to achieve the clean air goals and standards established in the CAAP. These technologies must be certified or verified by the regulatory agencies to ensure that they meet the claimed emissions levels. It is not necessary, however, to establish a Best Available Control Technology (BACT) requirement to meet these goals. The Ports can achieve the emission reductions goals in the CAAP by relying on established regulatory standards, and by the use of the cleanest available technologies that meet those standards. Establishing a BACT standard will unnecessarily limit the Ports' flexibility in administering the program and will impact the practical considerations (e.g. maintenance) that a truck owner must address. In addition, a BACT requirement would remove Board and end user discretion and flexibility in terms of cost and equipment options. However, the CAAP was developed as a "living document". Accordingly, as new regulatory standards are promulgated, and cleaner technologies become available, the Ports can update their CAAP requirements to be consistent with those new cleaner standards.

Cost is currently the most significant difference between the "clean" diesel trucks and liquefied natural gas (LNG) trucks. While emission reductions are comparable (when compared to the average 1995 model year drayage truck serving the Ports, a clean diesel truck will achieve approximately an 82% reduction in nitrogen oxides while an LNG truck will achieve an 86% reduction in nitrogen oxides – particulate matter emissions are equivalent), there is a much greater cost associated with the purchase of LNG trucks versus new clean diesel trucks. Currently, LNG trucks can cost up to twice as much as diesel-powered trucks. Therefore, diesel-powered trucks are significantly more cost effective. Staff believe that a mixed fleet of conventional diesel and alternative fueled vehicles like LNG is consistent with the CAAP goals. Staff recommends continuing to support the use of LNG trucks by moving forward with the current funding commitment outlined in the CAAP of \$8 million per year from each Port. However, the Board should be aware of the substantial cost differential between clean diesel and LNG trucks and that cost differential must ultimately be considered given the estimated 16,800 drayage trucks that must be replaced. Since greenhouse gases are now a significant challenge (i.e. LNG trucks may provide greenhouse gas benefits), and LNG technologies continue to evolve, possibly lowering costs, staff should continue to evaluate LNG truck replacement requirements in the upcoming months.

Additionally, analysis shows LNG trucks meet or exceed the 2007 on-road emissions standards. However, while PM emissions are comparable between clean diesel and LNG trucks, the health risks associated with diesel particulate matter (DPM) emissions may be more dangerous than PM emissions associated with LNG (i.e. DPM is considered a carcinogen in California). Accordingly, a potential benefit of LNG vehicles is the lower health risk of PM from their exhaust.

INTRODUCTION

Under the CAAP, the Ports of Long Beach and Los Angeles are assessing several strategies to mitigate the air quality impacts associated with Port trucking operations. Emissions from diesel-fueled engines are of particular concern to the local, regional, and state air quality regulators. The purpose of this paper is to discuss the BACT approach and to clarify the issues associated with LNG trucks, which are specifically identified as a control strategy in the CAAP. This paper primarily focuses on emissions reductions on a truck-per-truck basis, and the costs associated with replacement.

The Clean Trucks Program (CTP) recently adopted by both Ports' Board of Harbor Commissioners, requires that drayage trucks servicing the Ports meet EPA 2007 or newer model year on-road truck standards. The truck control measure (HDV1) detailed in the CAAP (now referred to as the CTP), considered several implementation scenarios that included varying percentages of retrofit technologies and replacement with LNG or clean diesel-fueled trucks. For discussion purposes, the CAAP highlighted Budget Scenario 7, which examined retrofits, and a 50:50 split between LNG replacements and diesel replacements. To arrive at budget estimates, funding was assumed to be 100% of the cost of a retrofit device or the purchase price of a replacement truck regardless of fuel type. However, as was stated in the CAAP, the actual percentage of funding to be used for alternative fuels, clean diesel, or retrofit trucks would ultimately be decided by each Port's Board of Harbor Commissioners. As outlined in the CAAP, HDV1 was developed to provide the Boards with the necessary flexibility to implement the program, while still achieving the Port's emissions reduction goals. As the Boards move forward with implementation of the Clean Trucks Program, consideration of issues related to the mix of clean diesel trucks and LNG may be necessary. This white paper is intended to be used to assist decision makers in determining the final mix of retrofits, LNG, and diesel replacements. In addition, the concept of BACT has been introduced in many forums, accordingly it is also the intent of this paper to describe the role of BACT as it relates to CTP.

BACT

The CAAP included multiple levels of requirements, based upon adopted regulatory standards and available clean technologies, to ultimately achieve the emissions reduction targets. The "Project Specific Standards" are applied to all new projects, and include application of the maximum available controls and feasible mitigations for any emissions increases that occur as a result of new projects. The "Source Specific Performance Standards" lay out in-use strategies for individual source categories (e.g. trucks, terminal equipment, etc.). Where applicable, the Source Specific Performance Standards require the use of equipment that meets the cleanest regulatory emissions standards. The Ports are relying on these regulatory standards and applying them to Port operations, rather than concepts like BACT.

Generally, BACT establishes a framework that once the most effective emission reduction strategy has been identified and implemented in an application, all future applications must meet that same level of emissions control. While the Ports support the use of the cleanest available technologies, the Ports specifically did not use the term "BACT" when developing the CAAP. As defined above, BACT calls for a rigid regulatory

compliance process that does not allow for the flexibility that staff feels is necessary to implement the CAAP, and that operators need to comply.

A BACT-based program would eliminate the Board's discretion with regard to controlling total program costs. While the currently available technologies achieve comparable emission reductions, the cost differential is significant. More significantly, BACT requirements can be subject to regular change. This causes significant difficulty in financial planning for the five-year program, since forecasting future costs relies on knowledge of future BACT requirements that do not currently exist. As a result, the establishment of funding levels, cargo fees to support such funding, and grant parameters (e.g., percentage funded of a replacement truck) could only be based on gross estimates that could fluctuate significantly year-to-year.

In addition, drayage trucks must be able to travel throughout Southern California and beyond, delivering goods without limitation of the fueling infrastructure. As a result, drayage firms must be able to select vehicles that can operate in locations without specialized fueling infrastructure. From a practical consideration, those purchasing equipment from year to year would also not be able to plan for cost effective maintenance of fleets. That is because different vehicle types that may be required to be purchased in different years could be significantly different, thus resulting in potential problems with regard to maintaining a complex system of parts, inventories, and mechanics that work on the vehicles.

Finally, it is important to note that as the Ports implement the standards of the Clean Truck Program, the program draws strength from the fact that the program standards rely on existing EPA on-road truck emissions standards. The implementation of BACT would move the Ports away from a reliance on such existing standards and put the Ports in the tenuous position of determining its own BACT standards. Such an approach raises additional legal concerns, particularly that of preemption.

As a result, Staff believes that the industry should be provided with a standard they must achieve and then be given the flexibility to choose from a range of technologies to meet that requirement. Currently the CTP requires a truck to meet the 2007 emissions rate, whether it is diesel-fueled, LNG-fueled, or some other clean technology.

LNG TRUCKS

Staff believe that it is in the Port's best interest to promote and support alternatives to conventional diesel. However, we believe that the Board must have all pertinent information so that they can make informed decisions with regard to alternatives. One alternative that is currently included in the CAAP is LNG trucks. In order to assist with the evaluation of future procurement allocations, as well as funding for LNG trucks, an analysis of the emission reductions and cost of LNG trucks as compared to clean diesel trucks was conducted.

The nitrogen oxide (NOx) and particulate matter (PM) emission reductions that can be achieved with LNG-fueled trucks and clean diesel trucks are similar. It has been argued however, that the health risks associated with diesel PM (DPM) emissions are greater than from PM emissions produced by LNG-fueled engines. DPM emissions are

collectively listed as a toxic air contaminant in California. While PM emissions from LNG engines have not been collectively identified as a toxic air contaminant, specific components of the PM emissions are listed, and therefore do pose a health risk.

LNG fuel provides an alternative to diesel fuel, and therefore supports energy diversity. On average, however, a new LNG truck costs approximately \$100,000 more than a new diesel truck. An LNG truck cost is \$211k; therefore, providing grant funding up to 80% of the purchase price for an LNG truck would result in a grant of \$168k. It should be noted that the cost of a clean diesel truck that achieves comparable air emission reductions is \$110k. The financial impact of a 50:50 LNG-diesel split would increase total CTP program costs by \$672 million (based on 80% grants for 16,800 trucks).

It is also important to note that substantial financial incentives for the purchase of alternatively fueled vehicles and equipment have been included in the federal Energy Policy Act. Tax credits of up to 40% of the differential cost of alternatively fueled equipment are available to the purchaser or vendor of the vehicle or equipment.

There are two LNG truck engine families certified to meet 2007 or newer standards. However, the maximum engine displacement for one of these trucks is 8.9 liters, and all are rated for use in either Urban/Transit Bus or Medium Heavy Duty trucks. Trucks that conduct drayage in the Ports generally require a larger displacement engine for the heavy loads. Accordingly, some currently certified LNG trucks have limited applicability in Port drayage.

Currently only one alternatively fueled Heavy-Heavy Duty Truck (14.1 liter engine) is suitable for Port truck operations. It is Cummins Westport's 2007 MY diesel pilot HPDI ISX engine. The average cost of this truck is approximately \$211,500.

Current LNG Projects

In order to advance technology options, the Ports and their tenants have developed several projects that help promote the use of LNG in Port operations. The Ports and SCAQMD see these programs as opportunities to bring a viable alternative fuel to the market and reduce the dependence on standard petroleum-based diesel fuel.

The Ports recently approved funding for their LNG Truck Program to replace older diesel fueled trucks with 2006 Model Year LNG trucks. This project was implemented in coordination with the South Coast Air Quality Management District (SCAQMD). Each Port originally contributed \$8 million and SCAQMD contributed an additional \$6 million. Funding for a total of 41 trucks has been approved by SCAQMD at a total cost of \$5,904,000. The Ports have approved funding for 117 trucks at a total cost of \$21,528,000. In addition to the LNG Truck Program, the Ports have also awarded a contract to Clean Energy Fuels to construct and operate a public fueling station in the Port area, which would provide fuel to the growing LNG fleet. The facility will open in summer 2008, at the intersection of Anaheim and I Street, in the City of Los Angeles. The station will also include a maintenance facility.

Southern Counties Express, a locally-based trucking company, was awarded a grant by the Ports to purchase LNG trucks and has also agreed to construct an LNG fueling and

maintenance facility on their property. That fueling and maintenance facility recently became operational.

Port of Los Angeles' tenant, Yusen Terminals, and Port of Long Beach tenants, Long Beach Container Terminal and SSA, have also conducted LNG yard tractor demonstration projects. Pacific Harbor Lines, the switching locomotive operator serving both Ports, has agreed to conduct an LNG switching locomotive demonstration project. That project is scheduled to begin in 2008.

DIESEL TRUCKS

Model year 2007 to 2009 diesel truck emission standards require that engines meet a 1.2 grams/hp-hr non-methane hydrocarbon (NMHC) + NOx standard and a 0.01 grams/hp-hr PM standard. Starting with model years 2010, NMHC + NOx standards are further tightened to 0.2 grams/hp-hr. Based on the California Air Resources Board's Engine Certification data, there are seventeen diesel engine families currently certified to meet 2007 standards. All of the engines have displacements equal to or greater than 10.8 liters, making them suitable for Port truck operations. The average cost of new diesel truck is approximately \$109,700. Accordingly, there are several choices available to those who would purchase clean diesel trucks meeting the CAAP standards. The large number of choices is also good for the purchaser since it affords opportunity for market competition to positively influence pricing. As a result, diesel trucks offer a more favorable cost-effectiveness for reducing emissions than LNG with cost-effectiveness of approximately \$14,300/ton and \$27,000/ton, respectively.

Regulatory agencies use cost effectiveness as a measure of how much it would cost to reduce a ton of emissions from equivalent vehicles. It is calculated by dividing the cost of a vehicle by the tons of emissions reduced by that vehicle. A lower dollar cost per ton of emissions reduced is the desired value. Staff evaluated the cost effectiveness for LNG and clean diesel trucks. That analysis showed that it costs roughly half the amount to reduce a ton of emissions by replacing an existing truck with a clean diesel truck compared with an LNG replacement. However, there are considerations that go beyond cost alone for the selection of cleaner vehicles. As previously mentioned, diversification of the fleet and encouraging new technologies are just two. In addition, greenhouse gases (GHG), which are not a target pollutant of the current CAAP, are of emerging importance. Greater, greenhouse gas reductions may be achieved by employing LNG powered trucks. Accordingly, this factor should be considered as we move forward with the CTP.

RECOMMENDATION

In consideration of all these issues, Staff recommends that the Boards not adopt a prescriptive BACT-based approach, but rather retain the current CTP standard based on the nationwide 2007 EPA emissions standard and retain their discretion with regard to annual funding allocations for diesel and LNG-powered trucks in order to maintain program flexibility for both the Ports and industry.