WESTPORT INNOVATIONS Inc.

COMMENTS ON REPORT BY CALIFORNIA AIR RESOURCES BOARD

"EVALUATION OF PORT TRUCKS AND POSSIBLE MITIGATION STRATEGIES"

Stationary Source Division, Project Assessment Branch
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1. Introduction

The California Environmental Protection Agency, Air Resources Board (CARB) has published a report, ***"Evaluation of Port Trucks and Possible Mitigation Strategies"***.

While a detailed study of the environmental and economic claims discussed in the report has not been made by Westport at this time, Westport would like to make the following comments and suggestions regarding the subject of LNG trucks.

2. CARB Comments on LNG Trucks

The subject of LNG fuelled, heavy duty trucks, is referenced in the report in at least two sections, notably:

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"3. Heavy-Duty Pilot Ignition Engines

A heavy-duty pilot ignition engine is a compression-ignition engine that operates on natural gas but uses diesel as a pilot ignition source. The total use of diesel is around six percent of the fuel consumed. ARB has defined this engine in its fleet rule for transit agencies and in the rule for solid waste collection vehicles as an engine that uses diesel fuel at a ratio of no more than one part diesel fuel to ten parts total fuel on an energy equivalent basis. Furthermore, the engine cannot idle or operate solely on diesel fuel at any time. An engine that meets this definition and is certified to the lower optional PM standard (0.01 g/bhp-hr) would be classified as an alternative-fuel engine. This technology is still in the development stages and might not be applicable for the engines power needed in port truck application. Other issues with this technology include limited range, limited power, cost, and the widespread availability of alternate fuels."

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"A second possibility assessed was to replace all existing trucks with LNG powered vehicles. Additional financial and technical hurdles exist for this approach. Chief among these is the lack of fuelling infrastructure, limited operating range, and possible incompatibility of LNG engines with some port truck duty cycles. Staff estimates the cost of an LNG powered heavy duty truck to be ~$150,000. The total cost to replace the existing 12,000 port truck fleet with new LNG powered trucks is ~$1.5 billion (2005 dollars) over a 10 year capital recovery period. The annual fleet-wide PM

emissions benefits of ~ 520 TPY is again roughly equal to the estimated PM benefits from each of the three strategies. Staff expects NOx reductions to be somewhat greater, about 5600 TPY after full implementation in 2010 assuming Natural Gas Engines that fully meet 2010 NOx standards are available in 2007. Again assigning $180million of the costs as attributable to PM reductions and the remaining to NOx reductions, staff estimates the annual PM and NOx cost effectiveness to be approximately $35,000 per ton and $23,000 per ton respectively over the capital recovery period. The annual weighted emission cost effectiveness using Carl Moyer Methodologies is ~$13,900 per ton (using a 10 year capital recovery period for new trucks).

Overall the cost to replace the existing fleet with new 2007 MY or LNG powered trucks is approximately 3 times the cost of strategy 3 with no appreciable differences in the annual NOx and PM reductions after full implementation."

3. Westport Comments

3.1 LNG Engines

LNG engines are available using a variety of combustion technologies, including lean burn spark ignition, stoichiometric-EGR spark ignition and diesel pilot ignition engines.

Today, spark ignition LNG engines are used in large numbers in transit fleets and a growing number of applications in heavy duty refuse collection, cargo handling and urban delivery fleets. Typical engine sizes are up to 9 litres swept volume with power output up to 320hp, used in trucks up to Class 6 and into Class 7, but not in use today for Class 8 truck applications.

Historically, pilot ignition engines have typically been associated with larger engine applications, 10 litres and above, with ratings up to 400 hp.

Westport's High Pressure Direct Injection ("HPDI") technology fits into the category of pilot ignition engines, and broadens the scope of applications with ratings up to 450hp and 1650 ft-lbs for Class 8 trucks.

3.2 Heavy-Duty Pilot Ignition Engines

Westport's HPDI technology applied to the Cummins ISX engine is a heavy-duty pilot ignition engine. It is a compression-ignition engine that operates on natural gas but uses diesel as a pilot ignition source. The total use of diesel is around six percent of the fuel consumed. ARB has defined this engine in its fleet rule for transit agencies and in the rule for solid waste collection vehicles as an engine that uses diesel fuel at a ratio of no more than one part diesel fuel to ten parts

total fuel on an energy equivalent basis. A HPDI engine operates with a majority of natural gas even at idle.

The Westport HPDI ISX engine is currently certified as an optional low NOx engine by CARB and is commercially available to customers for use in Class 8 trucks. The engine is available in two ratings, 400hp or 450hp, with up to 1650 ft-lbs of torque. These ratings are equivalent to the standard diesel engine ratings for the 15 litre ISX diesel engine, and provide for more than adequate power for trucks operating at the port with GVW limits of 80,000 lbs. The 450hp HPDI rating provides sufficient torque for trucks operating in overweight corridors. HPDI trucks with 450hp ratings have been in service with fleets in Canada for a year, in demanding applications hauling up to 140,000 lbs GVW on routes of up to 500 miles.

As demonstrated, HPDI equipped natural gas trucks are fully compatible with the vast majority of Class 8 truck applications serving the port.

An engine that meets this definition and is certified to the lower optional PM standard (0.01 g/bhp-hr) would be classified as an alternative-fuel engine.

3.3 Additional Comments

The report does little to address two areas of growing concern; global climate change and oil supply.

In an era when there is increased concerned over the contribution of industry and transportation in the generation of carbon dioxide and other greenhouse gases, efficient, LNG fuelled vehicles can make significant segment reductions in this area. For LNG fuelled vehicles that match or exceed diesel engine combustion efficiency, up to 25% carbon dioxide reductions and 20% overall greenhouse gas reductions can be realised as an additional benefit to a clean air program.

Global petroleum use continues to increase, and much public commentary has been made about the world's ability to find new reserves of oil, production rates, and regional supply concerns. Alternative fuels have received significant political attention in relation to these concerns, with the promotion of ethanol, bio-diesel and natural gas among the proposed solutions. Westport's view is that each of these alternative fuels could play a role, and that none provide a single solution. The use of natural gas in heavy duty trucks provides between 94% and 100% displacement of crude oil derived diesel fuel in comparison to the 5% to 10% blending of bio-diesel being proposed. With ethanol not an option for heavy duty trucks, the use of natural gas in port trucks would make a significant impact on diesel consumption and demand in the port regions of California, with the potential of 10's of millions of gallons reduction in diesel use annually.