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E-Mailed: June 24, 2015 June 24, 2015
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**Final Program Environmental Impact Report (Final PEIR)
for the Proposed World Logistics Center Project**

The South Coast Air Quality Management District (SCAQMD) staff appreciates the opportunity to submit comments on the Final PEIR for the World Logistics Center Project. SCAQMD staff appreciates the time that city staff and the project applicant have taken to meet with us to discuss this project and the inclusion of some mitigation measures in the Final PEIR, such as the requirement for 100% Tier 4 construction equipment. However, we continue to have significant concerns about this project that were raised in previous comments, including those not adequately addressed in the Final PEIR.[1] Most importantly, given the magnitude of the air quality impacts, the project must provide more substantial mitigation for the significant emissions from the additional on-road truck trips generated by this project.

SCAQMD staff recognizes the critical role that warehousing and goods movement have in our regional and national economy. While there has been tremendous growth in warehousing in our region over the past several years to accommodate the needs of the logistics sector, the scale of the proposed World Logistics Center is unprecedented. The 40.6 million square feet of new warehousing in this single project make up almost ten percent of the total new warehousing space projected to be needed in the region by 2035[2], and also represents an area that is bigger than 32 individual cities in our jurisdiction. As a further indication of the scale of this project, the estimated ~14,000 trucks per day serving this project at project build out will be more than half the total number of trucks that currently visit the entire Port of Long Beach[3]. Below we present the major air quality issues that the lead agency must address before it considers approving this project.

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[1] http://www.aqmd.gov/docs/default-source/ceqa/comment-letters/2012/march/world-logistics-center-specific-plan.pdf
http://www.aqmd.gov/docs/default-source/ceqa/comment-letters/2012/may/world-logistics-center-specific-plan-may-2012.pdf
http://www.aqmd.gov/docs/default-source/ceqa/comment-letters/2013/april/world-logistics-center.pdf
http://www.aqmd.gov/docs/default-source/ceqa/comment-letters/2015/june/fpeirworldlog.pdf

[2] Industrial Space in Southern California: Future Supply and Demand for Warehousing and Intermodal Facilities, Southern California Association of Governments (2010)
http://www.freightworks.org/DocumentLibrary/Comprehensive%20Regional%20Goods%20Movement%20Plan%20and%20Implementation%20Strategy%20-%20Reigonal%20Warehousing%20Needs%20Assessment%20Final%20Report.pdf

[3] Based on the most recent emission inventory: http://www.polb.com/civica/filebank/blobdload.asp?BlobID=12246

Inadequate Mitigation of Trucking Emissions

While the proposed project includes a seemingly stringent requirement to only allow trucks that meet the 2010 emissions standard onsite, in reality this measure will do very little to reduce air quality impacts beyond current regulatory requirements. Due to the state Air Resources Board's existing Truck and Bus Regulation, by the time the first warehouse will become operational (likely no sooner than 2018), approximately 75 percent of all truck miles in our region will already be driven by trucks meeting the 2010 emissions standard. By 2023 (when half of this project is still unbuilt), the proposed mitigation will affect no more than about 1 percent of the project's trucking emissions from then onwards.

As currently proposed, the mitigated emissions from this project will reach between about one half and three quarters of a ton of nitrogen oxide (NOx) emissions each day for the majority of the project's life.[4] To put this in perspective, this level of emissions is comparable to facilities in the top ten largest stationary sources of NOx in the air basin (e.g., power plants or refineries). Despite this substantial air quality impact, the proposed mitigation from this project does not include all feasible measures to reduce impacts, nor does it provide a fair-share reduction in NOx to meet air quality standards, as demonstrated below.

In order to meet federal requirements to achieve air quality standards, our air basin must reduce NOx emissions beyond existing regulations by up to 65% by 2023 and up to 75% by 2032[5]. If these ozone and particulate matter air quality standards are not achieved, the region faces two significant challenges. First, we will continue to experience poor air quality and the resulting health impacts, including lung damage and premature deaths. Second, federally mandated sanctions will be imposed, including higher operating costs for businesses with air permits and more importantly for this project, loss of federal transportation funding. It is for these reasons that we are disappointed that this project does not propose more measures to mitigate its air quality impacts. This project can and must do more.

The unprecedented scale of this project requires all feasible mitigation measures for the large amount of NOx emissions that will be generated by the project. Although the PEIR investigated the truck technologies currently utilized by the ports of Los Angeles and Long Beach to determine what is feasible to implement for this project today, it ignored the more important actions taken by both ports to encourage and implement newer technologies in the future. For example, because vehicle technology is evolving rapidly, both ports have programs in place to demonstrate and deploy newer truck tailpipe and infrastructure technologies as they become available.[6] These actions are implemented both as mitigation measures within individual CEQA projects[7], and as measures separate

[4] NOx is a key ingredient to both ozone and particulate matter formation in the atmosphere, two pollutants for which the air basin and the Inland Empire in particular do not meet air quality standards.
[5] Based on estimates from the 2012 Air Quality Management Plan.
[6] http://www.cleanairactionplan.org/
[7] See the following Mitigation, Monitoring, and Reporting Programs for examples of how projects have incorporated future technology reviews and implementation into project approvals:

from development projects. This approach has proven to be generally successful to ensure continued growth at the ports by bringing stakeholders together to build consensus regarding feasible mitigation measures without excessive litigation and corresponding delays, subsequently resulting in sizable air quality improvements.

The Final PEIR's response to SCAQMD staff and ARB staff comments regarding the implementation of an alternative technology truck phase-in was not sufficient and did not consider the feasible measures that are, or soon will be, available to implement new technologies early and throughout the life of the project. It is inappropriate to simply dismiss as 'speculative' the comments of two public agencies who have considerable expertise in truck engine technologies and who have devoted considerable financial resources to ensure that these technologies will be commercially available in the time frames specified. Establishing a program of enforceable mitigation that actually will reduce emissions for most of the project's life is particularly important at this juncture because the PEIR is being used to approve a Development Agreement, which may not receive any further environmental review.

More specifically, the lead agency and project applicant should consider developing strategies that are consistent with ARB's Draft Sustainable Freight Strategy (SFS) document[8]. For example, the project could include a project-wide cap (e.g., SFS page 45) that declines through time as newer truck engine types become commercially available and/or are required to be manufactured per future regulations. Today there are already many trucks that are commercially available that have certification levels that are below ARB's current NOx standard (Attachment A). Further, trucks that meet ARB's lowest Optional NOx standard (90% lower than the current standard) are expected to be commercially available in the 2018 timeframe, very early in the life of the project (Attachment B). Lastly, engine technologies that may achieve even greater reductions in emissions are being demonstrated widely today for potential commercialization well before project buildout (Attachment C).

Requested Modification to PEIR[9]*:* SCAQMD staff strongly recommends that the PEIR implement a program that includes elements such as:

- Steps to implement new truck and infrastructure technologies as a part of the project based on periodic and frequent technology/feasibility reviews as individual buildings are leased or sold.
- Project-wide or building-specific emissions caps that decline through time. The lowering of emission caps could be tied to the advancement of engine technologies. For example, in a set period of time after the commercial introduction of trucks meeting ARB's lowest Optional NOx Standard the emission caps could be reduced by a certain percentage. These caps could be implemented as individual buildings are leased or sold.

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http://www.polb.com/civica/filebank/blobdload.asp?BlobID=6261 (e.g., MMAQ-8 & 25)
http://www.portoflosangeles.org/EIR/YTI/FEIR/MMRP_FINAL.pdf (e.g., MMAQ-8 & LMAQ-1 & 2 & 4)

[8] Draft document available here: http://www.arb.ca.gov/gmp/sfti/Sustainable_Freight_Draft_4-3-2015.pdf

[9] SCAQMD staff is available to help craft detailed revisions to the project's mitigation on an expedited basis.

- Similar to the SCAQMD Surplus Off-road Option for NOx (SOON) program for owners of off-road vehicles[10], tenants that occupy buildings in the project site should be required to apply in good faith for incentive funding assistance[11] to replace and retrofit older trucks. Should awards be granted, the applicant must also be required to use them.

Misleading Discussion of Potential Health Risks

The PEIR misinterprets and then relies heavily on a single study published by the Health Effects Institute (HEI) to determine that "*new technology diesel exhaust does not cause cancer.*" (PEIR pg. 4.3-1). The PEIR should not make such sweeping conclusions based on a single study. While the study identifies real reductions in the mass of particulate matter with newer truck technologies, the study size was too small to identify potential cancer effects for exposures similar to what people will experience from this project. This study did not, nor was it designed to, evaluate the question of whether the toxicity per unit mass of diesel exhaust particulate (e.g., the cancer potency factor) was different compared to older engines. At the concentrations studied, one would not expect to find any tumors given the number of animals used, even if the carcinogenic potency of the new technology particulate emissions were the same as that of the particulate from the older technology engines. From the study results, it is not possible to make any conclusions on the relative carcinogenic potency of diesel exhaust particulates.

Further, the state Office of Environmental Health Hazard Assessment (OEHHA) is charged with determining the cancer potency factors of all pollutants for use in Health Risk Assessment (HRAs) throughout the state. The cancer potency factors from OEHHA have been used in the HRA prepared for this EIR, and the emission factors from the state Air Resources Board's EMFAC model already account for the reduced diesel exhaust coming from 2010 trucks. Therefore, the EIR's conclusions regarding diesel exhaust from this single HEI study are wholly unsupported by the volume of studies that OEHHA and ARB rely on to determine the carcinogenicity of diesel particulate matter coming from 2010 trucks.

We note that in response to ARB staff's comments expressing concern about the misuse of the HEI study, the PEIR consultant provided a response using a partial quote taken from the study's Executive Summary.

> RESPONSE TO ARB STAFF'S CONCERNS ABOUT THE HEI STUDY IN JUNE 10, 2015 MEMO FROM LSA ASSOCIATES TO MORENO VALLEY PLANNING DEPARTMENT.
>
> *"The primary conclusion of the HEI ACES is 'that the [New Technology Diesel Exhaust] would not cause an increase in tumor formation or substantial toxic health effects.' (HEI ACES Report p.3)"*

SCAQMD staff is concerned that the lead agency is selecting this quote out of the full context of the report and ignoring an important aspect of the HEI publication process, the

[10] http://www.aqmd.gov/home/programs/business/business-detail?title=off-road-diesel-engines&parent=vehicle-engine-upgrades
[11] For example, Carl Moyer, Proposition 1B, VIP, or other similar funding programs. http://www.aqmd.gov/home/programs/business/business-detail?title=vehicle-engine-upgrades

independent peer review. Importantly, in the Commentary prepared by HEI's own independent review panel, the peer reviewers felt it necessary to modify the quote from above to the statement below.

> HEI PEER REVIEW PANEL CONCLUSION ON STUDY (PAGE 165 OF THE HEI STUDY) (**EMPHASIS ADDED**):
>
> > *"Using appropriate statistical approaches to analyze the data, the investigators in this core study confirmed the a priori hypothesis, namely, that lifetime exposure to [New Technology Diesel Exhaust]* ***at the concentrations studied*** *would not cause an increase in tumor formation or substantial toxic health effects in rats, although some biologic effects might occur."*

The HEI study as designed cannot determine whether diesel exhaust from the World Logistics Center project would pose a potential cancer risk in the surrounding community. The study does not contain sufficient information to determine whether 2010 diesel truck exhaust can cause cancer in humans. The number of animals in the study was too low to detect any cancer risk that would be expected at the concentrations evaluated. Therefore in SCAQMD staff's expert opinion, the whole of the scientific literature leads us to conclude that 2010 diesel truck exhaust be considered carcinogenic.

> *Requested Modification to PEIR:* SCAQMD staff strongly recommends that the lead agency not rely on an approach that cherry picks and misuses a single study to conclude that diesel exhaust emitted from this project would not be carcinogenic. In particular, this study – which contradicts the general consensus of air quality experts that diesel exhaust is a carcinogen – should not be used as substantial evidence to support a Statement of Overriding Considerations. For significance determinations, the PEIR instead should only rely on the HRA that was already prepared following standard procedures to account for reduced emissions from 2010 trucks. If the lead agency chooses to keep references to the HEI study as part of the PEIR, then it should only be as supplementary information and characterized correctly.

Conclusion

As demonstrated in this letter, the project's mitigation is insufficient, but the city still has several options to improve this project and the PEIR prior to approval that would reduce the substantial and significant impacts on air quality. The choice is not about promoting jobs OR promoting clean air. It is about promoting a future that provides both. It has been done before and it should be done for this project.

We appreciate your willingness to consider these comments, and we look forward to continuing to work with you in developing strategies that can be implemented to reduce the air quality impacts of the World Logistics Center project. If you have any questions, don't hesitate to contact me at (909) 396-3244.

Sincerely,

Ian MacMillan
Planning & Rules Manager

ATTACHMENT A1
Trucks That Have Certification Levels That Are Lower Than the Current NOx Standard of 0.2 (g/bhp-hr)

ARB Executive Order	OEM/Engine MFR	Engine Family	Heavy-Duty Engine Model	Fuel Type	Liters	Max BHP	Low BHP	NOx Cert. Level (g/bhp-hr)
A-364-0051	BAF	FBAFE06.83NN	V-10	**CNG**	6.8	285	285	**0.100**
A-364-0052	BAF	FBAFE06.89NN	V-10	**CNG**	6.8	242	242	**0.050**
A-338-0012	Capstone Turbine	FCSTH0.31NGL	Turbine	**CNG**		30kW	30kW	**0.050**
A-338-0013	Capstone Turbine	FCSTH0.51NGB	Turbine	**CNG**		65kW	65kW	**0.050**
A-338-0014	Capstone Turbine	FCSTH0.51NGH	Turbine	**CNG**		65kW	65kW	**0.050**
A-290-0148	Detroit Diesel Corp.	FDDXH14.8EAD	DD15	**Diesel/SCR**	14.8	505	455	**0.090**
A-290-0149	Detroit Diesel Corp.	FDDXH14.8EED	DD15	**Diesel/SCR**	14.8	560	455	**0.090**
A-290-0154	Detroit Diesel Corp.	FDDXH15.6GED	DD16	**Diesel/SCR**	15.6	600	475	**0.070**
A-010-1814-2	Ford Motor Company	FFMXE06.8BW5	F450/550 Chassis Cab; F650 Chassis Cab; Step Van; Motor Home	**Gasoline**	6.8	362	362	**0.030**
A-398-0012-1	Greenkraft, Inc.	FGKTE06.8FM1	V10	**CNG**	6.8	362	362	**0.010**
A-328-0068	IMPCO Technologies	FZ9XE06.0DCA	6.0L CNG	**CNG**	6.0	265	265	**0.080**
A-328-0069	IMPCO Technologies	FZ9XE06.8DC3	F- Series	**CNG**	6.8	308	308	**0.080**
A-328-0070	IMPCO Technologies	FZ9XE06.8DC2	E- Series	**CNG**	6.8	251	251	**0.060**
A-328-0074	IMPCO Technologies	FZ9XE06.8DC4	E- Series	**CNG**	6.8	251	251	**0.060**
A-400-0014	Landi Renzo USA	FLDRE06.8C10	F450/550 Chassis Cab; Step Van; Motor Home; F650 Chassis Cab	**CNG**	6.8	362	362	**0.100**
A-400-0018	Landi Renzo USA	FLDRE06.8B10	E450	**CNG**	6.8	362	362	**0.080**
A-415-0003-1	Power Solutions International	FPSIE08.8CNG	PSI CNG 235-180	**CNG**	8.8	235	180	**0.100**
A-415-0001-1	Power Solutions Intl	FPSIE08.8LPG	PSI LPG 270	**LPG**	8.8	270	270	**0.100**
A-344-0052-4	Roush Industries	FRIIE06.8BW5	Bluebird Vision School Bus: F450, 550, 650, Motor Home, Step Van	**LPG**	6.8	362	362	**0.080**
A-344-0056	Roush Industries	FRIIE06.8BWX	E450	**LPG**	6.8	305	305	**0.090**
A-242-0076	Volvo Powertrain Corp.	FVPTH10.8G01	MP7: 325E, 355E, 405E, 345A, 345C, 365C, 395C, 325M, 365M, 405M; D11H: 325, 355, 365, 385, 405	**Diesel/SCR**	10.8	405	325	**0.060**
A-242-0077	Volvo Powertrain Corp.	FVPTH12.8G01	D13H: 375, 405, 425, 435, 435P, 475, 500, 500P; MP8: 415 E, 415C, 425M, 445C, 445E, 455M, 505C, 505E	**Diesel/SCR**	12.8	505	375	**0.060**
A-242-0078	Volvo Powertrain Corp.	FVPTH16.1G01	D16H: 500, 550; MP10: 515M, 525C, 555M, 565C, 605C	**Diesel/SCR**	16.1	605	515	**0.060**

ATTACHMENT A2

Heavy Duty Vehicles that Have Emissions Benefits Beyond NOx Standard of 0.2 g/bhp-hr That are Funded Through the State HVIP Program

https://www.californiahvip.org/docs/HVIP_Year4_EligibleVehicles.pdf

Manufacturer: **Altec**

Type: **Utility**

Aerial Boom Vehicle with JEMS: 16-20 kWh Lithium-Ion battery and 3000 PSI maximum hydraulic pressure

Chassis Model	TA50, AM55	TA50, TA60, AM55, AM55E
Gross Vehicle Weight	> 26,000	> 26,000
Vehicle Year/Engine Model Year	All	All
Exportable Power	N/A	> 3.0 kW
Year 4 ARB Preliminary Voucher Amount	$20,000	$22,000

PDF Spec Sheet

Manufacturer: **AMP Electric Vehicles**

Type: **Delivery**

E-100 Workhorse Zero-Emissions Walk-In Van

Gross Vehicle Weight	19,501-26,000
Vehicle Year/Engine Model Year	2013/2013
Year 4 ARB Preliminary Voucher Amount	$90,000

PDF Spec Sheet

Manufacturer: **Autocar**

Type: **Refuse**

Xpeditor E3 Refuse Vehicle with Cummins ISL9 Engine and Parker RunWise Advanced Series Hydraulic Hybrid Drive

Gross Vehicle Weight	38,001-66,000	38,001-66,000
Vehicle Year/Engine Model Year	2013/2012	2015/2012
Year 4 ARB Preliminary Voucher Amount	$40,000	$40,000

PDF Spec Sheet

Manufacturer: **BYD Motors**

Type: **Bus**

40-Ft All Electric Zero-Emission Transit Bus

Gross Vehicle Weight	33,001-55,000	33,001-55,000
Li-Ion Battery Specification	324 kWh	324kWh
Vehicle Year/Engine Model Year	2014/2014	2015/2015
Year 4 ARB Preliminary Voucher Amount	$95,000	$95,000

PDF Spec Sheet

60-Ft Articulated All Electric Zero-Emission Transit Bus

Gross Vehicle Weight	33,001-55,000
Li-Ion Battery Specification	547.5 kWh
Vehicle Year/Engine Model Year	2015/2015
Year 4 ARB Preliminary Voucher Amount	$95,000

PDF Spec Sheet

30-Ft All Electric Zero-Emission Transit Bus

Gross Vehicle Weight	>26,000
Li-Ion Battery Specification	182.5 kWh
Vehicle Year/Engine Model Year	2015/2015
Year 4 ARB Preliminary Voucher Amount	$95,000

PDF Spec Sheet

Manufacturer: **EVI**

Type: **Delivery**

EVI WI (Walk In)

Gross Vehicle Weight	14,001-19,500	19,501-26,000
Vehicle Year/Engine Model Year	2013/2013	2013/2013
Year 4 ARB Preliminary Voucher Amount	$80,000	$90,000

PDF Spec Sheet

EVI MD (Medium Duty)

Gross Vehicle Weight	14,001-19,500	19,501-26,000	19,501-26,000
Vehicle Year/Engine Model Year	2013/2013	2013/2013	2014/2014
Year 4 ARB Preliminary Voucher Amount	$80,000	$90,000	$90,000

PDF Spec Sheet

Manufacturer: **Hino Motors**

Type: **Delivery**

195h Delivery Truck with Parallel Hybrid System

Delivery Type	Beverage Delivery	Package Delivery	Food Distribution	Liquid Propane Pick-Up & Delivery	Uniform & Linen Delivery	Other Delivery
Gross Vehicle Weight	14,001-19,500	14,001-19,500	14,001-19,500	14,001-19,500	14,001-19,500	14,001-19,500
Vehicle Year/Engine Model Year	2016/2015	2016/2015	2016/2015	2016/2015	2016/2015	2016/2015
	2015/2014	2015/2014	2015/2014	2015/2014	2015/2014	2015/2014
	2014/2013	2014/2013	2014/2013	2014/2013	2014/2013	2014/2013
Year 4 ARB Preliminary Voucher Amount	$18,000	$18,000	$18,000	$18,000	$18,000	$18,000

PDF Spec Sheet

195h-DC Delivery Truck with Parallel Hybrid System

Delivery Type	Package Delivery	Other Delivery
Gross Vehicle Weight	14,001-19,500	14,001-19,500
Vehicle Year/Engine Model Year	2016/2015	2016/2015
Year 4 ARB Preliminary Voucher Amount	$18,000	$18,000

PDF Spec Sheet

Manufacturer: **Motiv Power**

Zero-Emission FE4 Vehicle with Ford Chassis

Chassis Model	School Bus, Shuttle Bus, Delivery, Utility	School Bus, Shuttle Bus, Delivery, Utility
Gross Vehicle Weight	14,500	22,000
Li-Ion Battery Specification	80 kWh, 100 kWh, 120 kWh	4, 5, and 6-Battery Variations
Vehicle Year/Engine Model Year	2015/2015	2015/2015
Year 4 ARB Preliminary Voucher Amount	$80,000	$90,000

PDF Spec Sheet

Manufacturer: **Phoenix**

Type: **Bus**

ZEUS 300 Bus with Lithium-Ion 102-120kWh Battery Pack

Chassis Model	Shuttle Bus
Gross Vehicle Weight	10,001-14,000
Vehicle Year/Engine Model Year	2015/2015
Year 4 ARB Preliminary Voucher Amount	$50,000

PDF Spec Sheet

Type: **Utility**

Zero-Emission Flat Bed Truck with Lithium-Ion 102kWh Battery Pack

Chassis Model	Shuttle Bus
Gross Vehicle Weight	10,001-14,000
Vehicle Year/Engine Model Year	2015/2015
Year 4 ARB Preliminary Voucher Amount	$50,000

No Photo Available.

PDF Spec Sheet

Manufacturer: **New Flyer**

Type: **Bus**

Xcelsior Bus with Lithium-Ion Battery Pack

Chassis Model	XE35	XE40
Gross Vehicle Weight	42,540-44,312	42,540-44,312
Li-Ion Battery Specification	100 kWh, 150 kWh, 200 kWh	100 kWh, 150 kWh, 200 kWh, 300 kWh
Vehicle Year/Engine Model Year	2015/2015	2015/2015
Year 4 ARB Preliminary Voucher Amount	$117,000	$117,000

PDF Spec Sheet

Manufacturer: **Proterra**

Type: **Bus**

Catalyst 40-foot Urban Transit Bus

Chassis Model	BE40	BE35-74T
Gross Vehicle Weight	>38,000	>26,000
Vehicle Year/Engine Model Year	2015/2015	2013/2013
Year 4 ARB Preliminary Voucher Amount	$115,000	$115,000

PDF Spec Sheet

Manufacturer: **Smith Electric**

Type: **Delivery**

Newton Box Truck

Gross Vehicle Weight	14,001-19,500	19,501-26,000	26,001-33,000
Chassis Length (ft.)	18.8, 21.3, 23.8	18.8, 21.3, 23.8	18.8, 21.3, 23.8
Vehicle Year/Engine Model Year	2013/2013	2013/2013	2013/2013
Year 4 ARB Preliminary Voucher Amount	$80,000	$90,000	$95,000

PDF Spec Sheet

Newton Step Van			
Gross Vehicle Weight	14,001-19,500	19,501-26,000	26,001-33,000
Chassis Length (ft.)	18.8, 21.3, 23.8	18.8, 21.3, 23.8	18.8, 21.3, 23.8
Vehicle Year/Engine Model Year	2013/2013	2013/2013	2013/2013
Year 4 ARB Preliminary Voucher Amount	$80,000	$90,000	$95,000

PDF Spec Sheet

Manufacturer: **Zenith Motors**

Type: **Bus**

Electric Shuttle Van		
Gross Vehicle Weight	8,500-10,000	10,001-14,000
Li-Ion Battery Specification	51.84kWh	62.1kWh
Vehicle Year/Engine Model Year	2014/2014	2014/2014
Year 4 ARB Preliminary Voucher Amount	$25,000	$50,000

PDF Spec Sheet

Type: **Delivery**

Electric Cargo Van		
Gross Vehicle Weight	10,001-14,000	10,001-14,000
Wheelbase	159”	136”
Li-Ion Battery Specification	62.1kWh	51.8kWh
Vehicle Year/Engine Model Year	2014/2014	2014/2014
Year 4 ARB Preliminary Voucher Amount	$50,000	$50,000

ATTACHMENT B

Trucks Engines That Will Be Available Very Early in The Life of the Project That Will Meet ARB's Optional NOx Standard

http://www.cumminswestport.com/press-releases/2015/near-zero-nox-emissions-isl-g-natural-gas-engine-proprietary-technology-capable-of-reducing-nox-emissions-by-90

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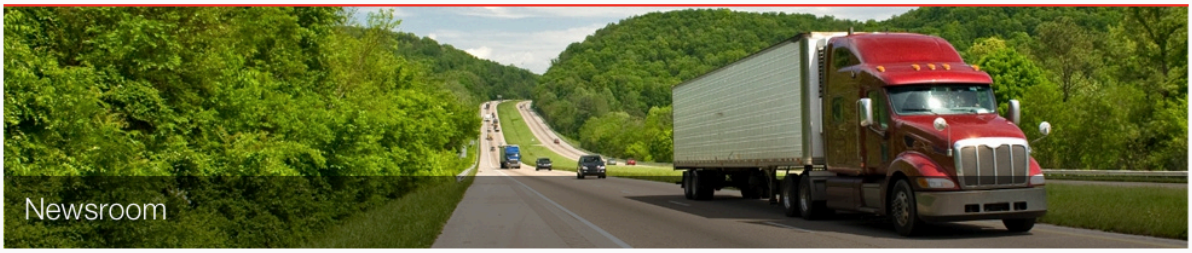

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Near Zero NOx Emissions ISL G Natural Gas Engine ~Proprietary technology capable of reducing NOx emissions by 90%~

May 6, 2015

VANCOUVER, May 6, 2015 - Cummins Westport (CWI) announced it will begin field tests this year in California in transit buses with a spark ignited natural gas engine capable of producing Near Zero NOx emissions well before the 2023 California Near Zero NOx schedule for Low NOx vehicles.

CWI believes its proprietary Stoichiometric EGR Spark Ignited (SESI) natural gas engine technology as released on its ISL G and ISX12 G engines is ideally suited to continue to provide an economic and efficient solution to California air quality improvement initiatives.

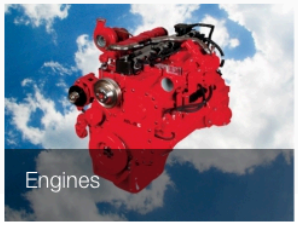
With funding support from South Coast Air Quality Management District (SCAQMD), SoCal Gas and California Energy Commission (CEC), CWI has recently invested significantly on leveraging the SESI platform to develop a new Near Zero NOx technology pathway to 0.02 grams per brake-horsepower hour NOx. CWI has demonstrated this technology and will now field test a transit bus with the new Cummins Westport Near Zero NOx ISL G that will reduce NOx emissions by 90% from the current EPA limit of 0.2 g/bhp-hr to 0.02 g/bhp-hr NOx while also meeting the 2017 EPA greenhouse gas emission requirements.

The new Near Zero NOx ISL G will continue to offer customers the benefit of performance with the lowest emissions utilizing maintenance-free Three Way Catalyst (TWC) aftertreatment. TWCs are effective, simple, passive devices, packaged as part of the muffler.

Cummins Westport natural gas engines do not require active aftertreatment such as a Diesel Particulate Filter (DPF) or Selective Catalytic Reduction (SCR).

Since it was first introduced in 2007, the ISL G 8.9 liter engine has become the leading natural gas engine for transit buses and refuse trucks which represents a significant portion of on-highway and urban power in California.

While commercial availability will be announced at a later date, the Near Zero NOx technology in the ISLG engine will be made available as a first fit engine with transit and refuse OEMs and as an engine replacement for existing ISL G vehicles resulting in an immediate NOx emission reduction well before the 2023 Near Zero NOx goals set in California.



ATTACHMENT B
Trucks Engines That Will Be Available Very Early in The Life of the Project That Will Meet ARB's Optional NOx Standard

Southern California Gas Company Briefing for A Business Case for Clean Air White Paper Working Group: Natural Gas Near Zero Emission Technologies Near-Zero Emission Natural Gas Opportunities, October 31, 2014
http://www.aqmd.gov/docs/default-source/Agendas/aqmp/white-paper-working-groups/business-case-socalgas-pres-final.pdf

Southern California Gas Company Briefing for A Business Case for Clean Air White Paper Working Group

Natural Gas Near Zero Emission Technologies
Near-Zero Emission Natural Gas Opportunities

October 31, 2014

Natural Gas Near Zero Emission Technologies

To meet NOx and GHG Emissions Reductions

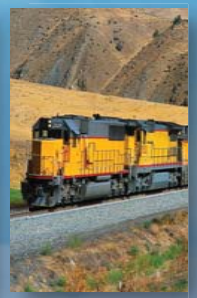
Offering Cleaner Solutions for The Mobile Sectors

Current Focus → ← Expanding Focus


Fleet Vehicles


Heavy Duty Trucks

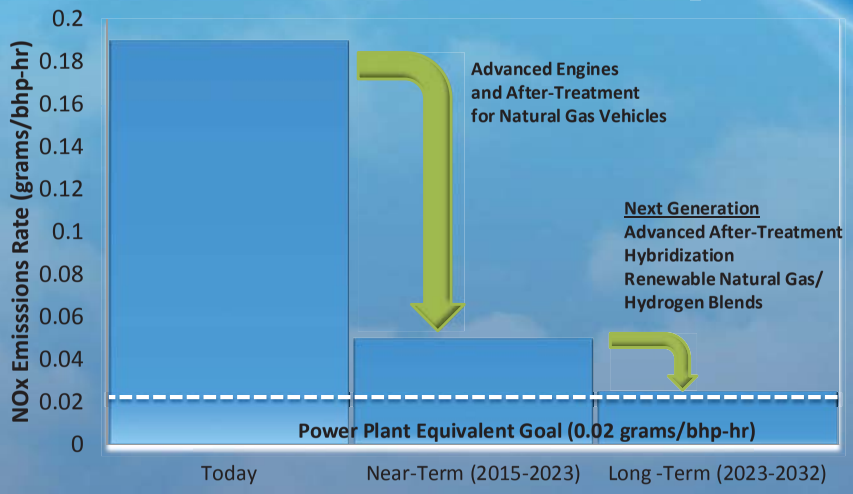

Cargo Handling Equipment


Locomotives


Marine Vessels

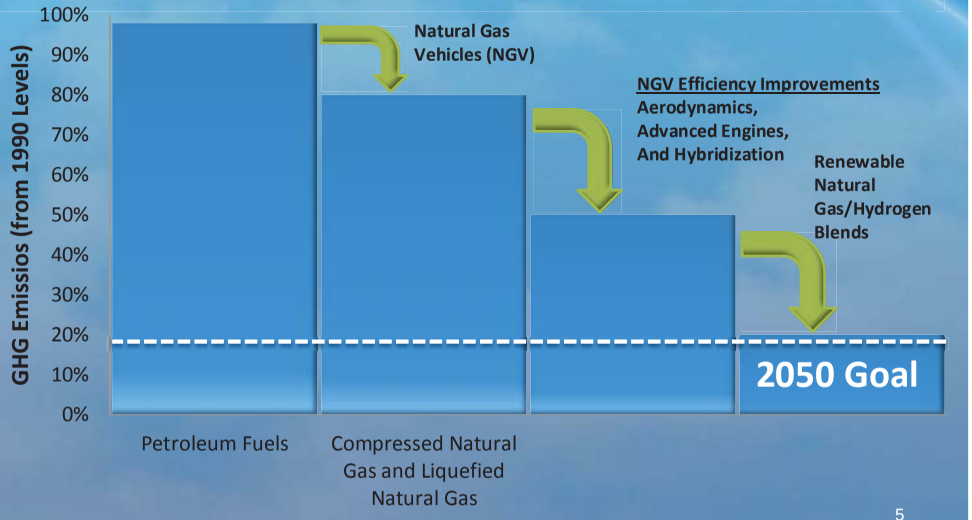
CNG ↔ LNG

"Near Zero" NOx Emissions for Heavy Duty Truck Achievable through Technology Development



Technologies Also Address Greenhouse Gas (GHG) Goals

Efficiency Improvements & Renewables Availability Increase Over Time



SCG-Supported CNG RD&D Programs for HHD Trucks

	Project	NOx Goal (g/bhp-hr)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
CNG Engines	CWI ISL-G 8.9L	0.20	Commercial									
	CWI ISX 12G	0.20			Commercial							
	CWI 6.7L	0.20			RD&D	Commercial						
	Doosan 11G	0.05			RD&D			Pre-commercial	Commercial			
	Brayton Gas Turbine	0.05				RD&D		Pre-commercial			Commercial	
	CW 8.9L, PSI 8.9L & Cummins 15L	0.02					RD&D		Pre-commercial		Commercial	
CNG HEVs	BAE/GTI ZEV-Catenary with CNG Genset	TBD					RD&D			Pre-commercial		
	Three HEV Trucks (CI 8 & 4)	TBD					RD&D			Pre-commercial		

Near-zero Emission Development – CWI8.9L and Cummins 15L Engines

Project Overview

- Reduce emissions through stoichiometric combustion with high rates of EGR and a three way catalyst to achieve near zero emission (i.e., 90% reduction from current CARB standards) focusing on:
  - dedicated NG engine
  - Power cylinder and cylinder head
  - Air handling (i.e. turbocharger)
  - Ignition system
  - Control system and fuel supply module
- ***Cummins-Westport*** 8.9 liter
- ***Cummins Inc.*** 15 liter

Goals / Targets

- NOx: 0.02 g/hp-hr vs. 2010 0.2 g/hp-hr / PM: near zero
- Performance/Efficiency: 2010 diesel equivalent
- CO2: 15% reduction from current diesel options
- Secondary goal: NH3< 10 ppm

Funding Partners

- CEC ($4M), SCAQMD ($2M), Cummins, SCG ($0.5M)

ICR-350 Multi-fuel Vehicular Engine

Technology Description

- Develop a near zero emissions dual natural gas and diesel combustor for the existing 350 kW microturbine designed for a hybrid Class-8 trucks
- Use natural gas as a priority, but when the truck is required to travel outside its normal territory or when CNG fueling is not readily available, the engine will seamlessly transition to operate on liquid fuel
- Plan to demonstrate a Kenworth & FedEx Class 8 dual fuel truck in 2015

Goals / Targets

- **Price** : Same as emission compliant diesel engine system
- **Fuel Efficiency** : 10-20% savings
- **Maintenance** : 16x longer interval
- **Life** : +1,000,000 miles with only routine maintenance
- **Fuel Flexibility** : any liquid or gas
- **Emissions** : 5x-10x better CARB & no treatment
- **Size** : half size/half weight (+ aerodynamics)
- **Any drivetrain** : mechanical/electric/hybrid

Funding Partners

- Brayton, CEC

8

US Hybrid: Plug-in Hybrid Drayage and Hybrid Natural Gas Trucks

Technology Description

PHEV

- Demo of 80,000 GVWR Nat Gas Plug-in Hybrid Drayage Truck
- Utilizes CWI ISL-G (8.9 L) CARB certified engine, 100 kWh Li-Ion Battery-Pack, 500 HP Electric Drive Motor, 300 amp converter
- Eliminates frequent periods of idling typical at Port facilities where drayage trucks often queue for long periods. Hybrid truck will operate in electric mode (EV mode) around 25% of time (30 miles) in charge depletion mode, then in hybrid mode with sustaining charge.

Hybrid

- 8.9L CWI ISL-G engine integration with 200kW motor, battery storage and engine controllers

Goals & TargetS

- Low NOx plus target of 30% fuel reduction due to HEV operation
- Overcomes perceived issue of lack of power from CWI 8.9 liter engine currently in use.
- No limitation of the range and usage and will have higher number of operating hours than a diesel truck.
- CNG / LNG / biomethane capable

Funding Partners

- PHEV - CEC ($1.6M), GTI, US Hybrid, CWI, Calko Transport, Freightliner, UC-Riverside, SCG (two trucks)
- Hybrid – CEC($900K) US Hybrid, SCG ($100K)

GTI Class 8 CNG- Hybrid

Technology Description

- Develop a Class 8 CNG-hybrid truck with an advanced systems approach to NOx reduction.
- Utilize a 9 Liter CWI ISL-G Engine integrated with a 200 kW electric motor, battery storage and engines controls optimized for hybrid operations
- Reduce the NOx emissions beyond current CARB limits
- Showcase the economic attractiveness of CNG vehicles for fleet operators

Goals / Targets

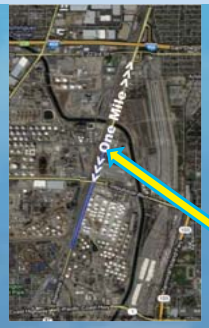
- Demonstrate improved fuel economy
- Demonstrate ability to meet and exceed CARB emissions limits
- Test the vehicle in a typical duty cycle
- Prepare a Chassis Dynamometer Demon Report with recommendations for extended field testing by a fleet operator as well as summaries of the emissions and fuel economy profiles

Funding Partners

- CEC ($900K), US Hybrid (In-Kind), SCG ($100K)

Recent Project Funding by SCAQMD and SoCalGas

Gas Technology Institute Team – Electric Drayage Truck with CNG 6.7L Genset Range Extender



Based on Kenworth Model T-370 (Cummins 6.7L CNG engine)

Approx. one mile each way along Alameda St in Carson (current north bound route for trucks to warehouses and I-405)

Scope	Develop HEV truck with CNG 6.7L engine and Siemens pantograph hardware enabling catenary connection capability. ZEV operation in port, catenary power outside of port, onboard CNG engine genset providing extended range when off of catenary.
Schedule	1/1/15 (Project Start) thru 7/31/18 (Commercialization Roadmap)
Budget	Total of about $10M (DOE & SCAQMD 50/50 cost share) – SoCalGas contributing $0.5M in total to SCAQMD share of $5M
Benefit	Demonstrates zero-emissions capability of heavy duty truck with extended range provided by CNG and hybrid-electric technology; breaking new "ground"

Infrastructure - Central

- Standardized station designs
- Increased dispensing efficiencies
- Better controls, including for time-fil
- Smaller footprint
- Lower cost
- Co-Locating with Hydrogen Station
- On-site Hydrogen Production (SMR)

Fuel Storage

Need:
- Lower Cost
- Lower Pressure
- Less/Conforming Space

Rail & Marine Opportunities for Natural Gas

Extending the Pathways to Off Road Locomotives

Today	2013-2015	2015-2023	2023-2032	2032+
Existing Tier 2 Locomotive •5.5 g NOx	• New engine options (HPDI, dynamic gas blending) • LNG Tender Car	• **Tier 2 LNG Retrofits** (<3 g NOx) • **Tier 4 LNG Newbuilds** (<1.3 g NOx)	**Solid Oxide Fuel Cell Technology** **Near Zero Emissions Target** **Renewable NG blending**	**NZ-Emission Natural Gas Fuel Cell Locomotive** •<0.02 g NOx •>60% efficiency

Ongoing RD&D for LNG fuel systems and engine conversions

Benefits
- Tier 2: 45% NOx reductions
- Tier 2 and 4: 20% GHG reductions vs Tier 2 diesel

Benefits*
- 98% + NOx reductions vs Tier 2 diesel
- 55%+ GHG reductions vs Tier 2 diesel w/o RNG

GE Dual Fuel – Development Timeline

SCE Testing

Feasibility Study
Optimize In-cylinder combustion
Maximize gas substitution rate
Initial knock detection investigation

Multi-cylinder testing

Detailed performance mapping (HPDI)
Knock detection / mitigation strategy
Maximize gas usage and thermal efficiency

Engine hardware test
DOC development
Control optimization

Two Locomotives Entering Actual Revenue Service (BNSF in Barstow, Ca.)

Real world application
Emissions validation
Tender interface development
Train handling
Engine control interaction
Infrastructure/Fueling logistics

2012 2013 2014 2015…

Extending the Pathways to The Ports LNG for Marine Vessels

Today	2013-2015	2015-2018	2018-2023	2032+
Existing Tier 1 & 2 Vessels	• 1,000 ppm fuel sulfur limit for marine vessels in ECAs • IMO Tier 3 NOx standards	• Tier 1& 2 LNG retrofits • Tier 3 LNG new builds • First LNG work boats, ferries, short sea shipping vessels deployed	Tankers Container Ships Tug boats (new builds) Expanded LNG bunkering Vessel hydrodynamics Vessel size increases	High penetration of LNG into marine vessel fleet – estimated at 10,000+ vessels
•Ongoing RD&D for LNG fuel systems and vessel retrofits. •Development of LNG bunkering standards and infrastructure		Benefits • Up to 90% NOx reductions • 98%+ PM and SOx reductions • 20%+ GHG reductions		Benefits • NOx, PM, and SOx reductions beyond IMO Tier 3 • GHG reductions of up to 70%

Summary

- Engine technology advancements can achieve power-plant equivalent / near-zero emission NOx levels and diesel equivalent GHG emissions reductions
- Pure economics of transportation fuel will drive natural gas technology adoption by the heavy-duty trucking sector
- Near term and consistent financial and other incentives can accelerate and increase the adoption of conventional natural gas technologies
- New storage technologies will have tremendous impact on CNG for both heavy and light duty vehicles
- In-use mobile emissions need further evaluation
- Significant opportunities exist for natural gas trucks and buses, but also for both locomotive and large marine engine emissions reductions

Near-Zero Emission Natural Gas Opportunities in the South Coast Air Basin

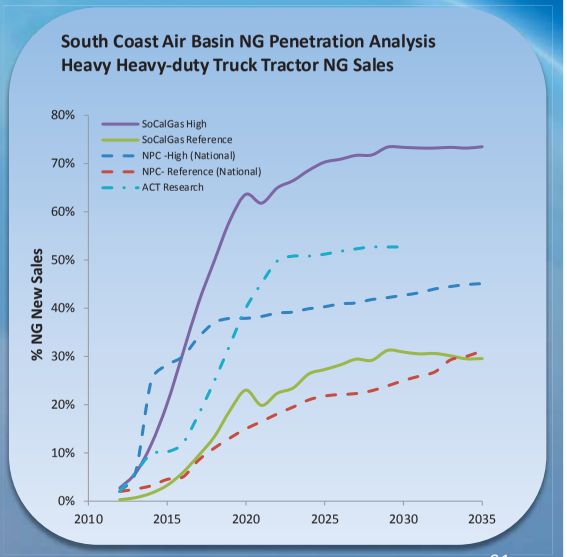
Lee Wallace
Southern California Gas

Project Goals

1. Evaluate NOx benefits of near-zero natural gas engines in heavy-duty vehicles.
2. Explore the effect of incentives on natural gas vehicle penetration rates.

Economic Analysis via the "NPC Model"

- **Economically Derived Analyses** are required to project NGV new sales (penetration rate) based on competition with diesel technology
- **National Petroleum Council Future of Transportation Fuels Economic Decision Model ("NPC Model")** was used to determine rates of NGV adoption by the open market
- **NPC Model Projections** are consistent with projections published by independent research organizations
- **SoCalGas Adjustments** are made to the NPC Model settings specific to the South Coast Air Basin marketplace
- **SoCalGas "Reference" and "High"** NGV adoption curves via the NPC model are derived to bound the analysis



Economic Analysis via the "NPC Model" (cont'd)

- **Fuel Price Projections** are based on 150% of EIA 2010 projections
- **Model variables** adjusted for SoCalGas scenarios include *natural gas vehicle cost* and the *natural gas adoption curve* (3 settings, aggressive, moderate, conservative)
- **SoCalGas Reference Penetration Rate** case ("SoCalGas Reference") assumes: (1) a high price differential between NGV and Diesel Trucks; and (2) uses the conservative NGV adoption curve
- **SoCalGas High Penetration Rate** case ("SoCalGas High") assumes: (1) a low price differential between NGV and Diesel Trucks; and (2) uses aggressive NGV adoption curve
- **NG Financial Incentives** are applied to increase NGV new sales projections

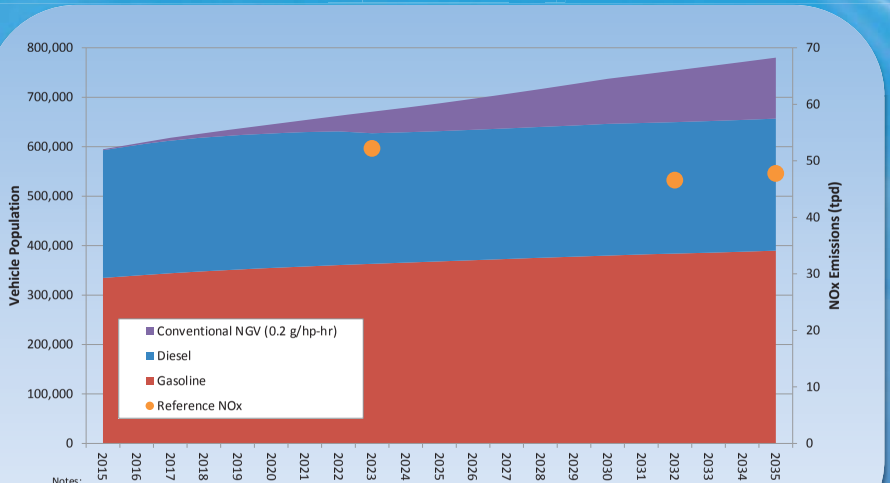
SoCalGas NPC modeled cases, NG truck pricing assumptions.

Truck Group	2023 Base Diesel Vehicle Cost	NG Incremental Price in 2023	
		SoCalGas Reference	SoCalGas High
Class 7/8 Combination	$144,953	$47,355	$30,028
Class 7/8 Single	$ 190,399	$18,906	$7,463
Drayage	$144,953	$34,604	$18,399
Refuse	$190,399	$18,906	$7,463
Class 3-6	$61,529	$21,165	$15,682

SoCalGas High- BASE CASE

In-state Heavy-duty Truck Fleet Composition [1]

– No Incentives -

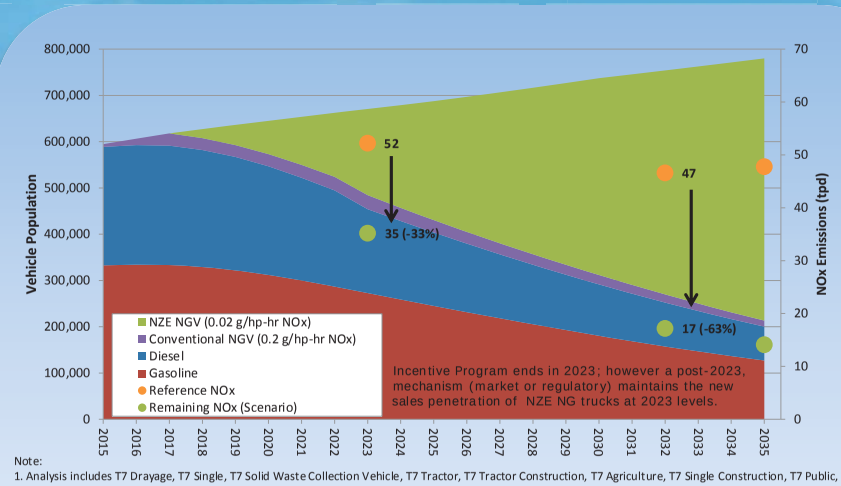


Notes:
1. Analysis includes T7 Drayage, T7 Single, T7 Solid Waste Collection Vehicle, T7 Tractor, T7 Tractor Construction, T7 Agriculture, T7 Single Construction, T7 Public, T7 Utility, T7 IS, T6 Instate Heavy, T6 Instate Small, T6 Utility, T6 Public, T6 TS, T6 Agriculture, T6 Instate Construction Heavy, T6 Instate Construction Small, LHDDT, and LHDGT.
2. Vehicle population is based on the EMFAC2011 data for the South Coast Air Basin.
3. Reference NOx emissions were obtained from the 2012 Air Quality Management Plan (AQMP) from the SCAQMD.

SoCalGas High Incentive Scenario

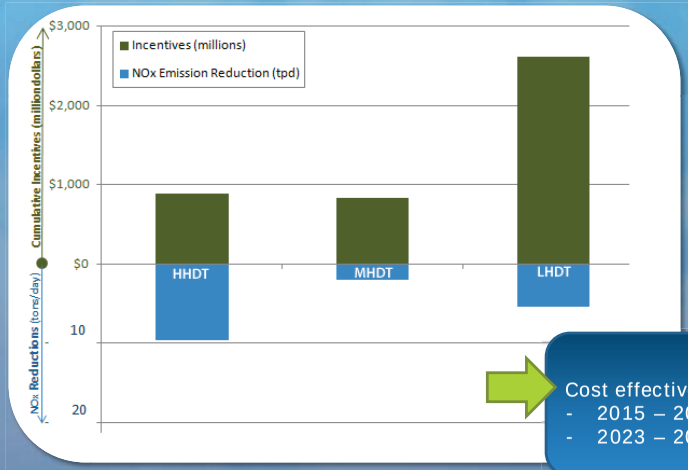
In-State Heavy-duty Truck Fleet Composition [1]

- MODIFIED Maximum Incentivized[2] NG Truck Purchases -



Note:
1. Analysis includes T7 Drayage, T7 Single, T7 Solid Waste Collection Vehicle, T7 Tractor, T7 Tractor Construction, T7 Agriculture, T7 Single Construction, T7 Public, T7 Ut T7 IS, T6 Instate Heavy, T6 Instate Small, T6 Utility, T6 Public, T6 TS, T6 Agriculture, T6 Instate Construction Heavy, T6 Instate Construction Small, LHDDT, and LHDGT.
2. Maximum incentives range from $15,500 - $35,000/Truck depending on the vehicle type and engine size
3. Assumed penetration rates after the incentive period ends remain at the 2023 level due to some mechanism.

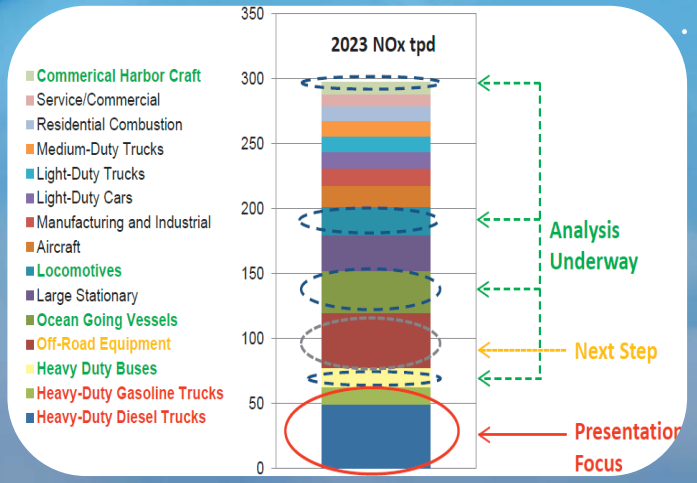
SoCalGas High Incentive Program
2023 Cumulative Cost vs. NOx Reductions



Next Step

Cost effectiveness/ranking for sources
- 2015 – 2023 (incentive program)
- 2023 – 2035 (regulatory program)

Technical Analyses: Next Steps



- Expand analyses to other on- and off-road mobile sources

Conduct full cost-effectiveness analyses (beyond cost vs. year-specific emission reductions) by source categories

Step-wise incentives (0.1 g/bhp-hr from 2015-2018 and 0.02 g/bhp-hr from 2018+)

Summary

- Pure economics of transportation fuel will drive natural gas technology adoption by the heavy-duty trucking sector.
- Financial incentives can accelerate and increase the adoption of conventional natural gas technologies.
- Additional financial incentives (<$10K/vehicle) can shift conventional natural gas technology purchases to “NZE” (90% NOx reductions) natural gas purchases.
- Maximized NOx reductions can be achieved through post-incentive period mechanisms (TBD) to maintain NZE natural gas vehicle penetration rates.

ATTACHMENT C

Advanced Technology Demonstration Projects for Truck Engines That Will Meet or Surpass ARB's Optional NOx Standard Before Full Project Buildout

Project	Truck Manufacturer	Number of Vehicles in Project	Truck Class	Technology Type	Project Completion Year	Total Project Cost
Zero Emission Cargo Transport (ZECT) I - 2012	TransPower	4	8	Battery Electric	2016	$2.8M
ZECT I - 2012	US Hybrid	2	8	Battery Electric	2017	$2.0M
ZECT I - 2012	TransPower	2	8	CNG plug in hybrid	2017	$2.1M
ZECT I - 2012	US Hybrid	3	8	LNG plug in hybrid	2017	$2.1M
ZECT II -2014	BAE Systems	1	8	Battery Electric - Hydrogen Fuel Extender	2018	$7.1M
ZECT II -2014	TransPower	2	8	Battery Electric - Hydrogen Fuel Extender	2017	$2.4M
ZECT II -2014	US Hybrid	2	8	Battery Electric - Hydrogen Fuel Generator	2017	$3.2M
ZECT II -2014	BAE Systems & Kenworth	1	8	Battery Electric - CNG Range Extender	2018	$5.6M
ZECT II -2014	International Rectifier	1	8	Plug in Hybrid	2017	$1.7M
Volvo PHEV Project	Volvo	1	8	Plug in Hybrid	2014	$2.4M
SCAQMD Project	Transpower	2	8	Catenary	2016	$3.2M
Siemens Project	Siemens + Volvo	1	8	Infrastructure + 1 Volvo PHEV catenary truck	2016	$13.5M
UPS	EVI	40	6	Electric	2013	$7.45M