



San Pedro Bay Ports Sustainable Supply Chain Advisory Committee *July Meeting Summary*

Date: July 15th, 2020 | 11:00 am – 3:00 pm

Location: Via phone conference

Attachments: Attachment A - Attendees
Attachment B - Meeting Agenda
Attachment C - Presentation

Meeting Summary

1. POLA / POLB Opening Remarks
 - a. The Ports reported a decrease in cargo volumes from the same time period in 2019 due, in large part, to the coronavirus pandemic, and said that their near-term efforts are focused on rebuilding market share.
 - b. Emphasizing that they do not intend to step back from their environmental commitments, the Ports reminded the Committee that they are presenting an update on their Clean Truck Program (CTP) to their boards at the end of July.
2. Review & Approve May Meeting Summary
 - a. The Committee members approved the May Meeting Summary.
3. Update on Port Demonstration Projects
 - a. The Ports presented a summary update of their current zero and near-zero emission projects (**see Attachment C**), beginning with a notice that the Request for Information under the Technology Advancement Program (TAP) is available online. They also noted that precautions related to the coronavirus have caused delays for some projects, where below-normal cargo volumes and terminal access restrictions limit the pace of technology demonstrations.
 - b. Updates from the Port of Long Beach:
 - i. The electrification of an existing RTG was delayed due to limitations on contractor access under the coronavirus protocols but has now been completed, and the equipment's guidance system is being tested. Full conversion of the second crane under this project is expected to be complete in early August.
 - ii. ITS and LBCT terminals have provided positive preliminary reports on BYD's yard trucks and charging equipment, noting that the vehicles are completing a 7-hour shift with a 30 percent state-of-charge remaining. The terminals have noted that labor's required checks on charging connections are adding time and cost.
 - Committee members observed that these checks are important for ensuring a stable connection for an optimal charge. The Port noted that



more recent project scopes incorporate technology that allows terminals to monitor connections remotely.

- iii. An electric top handler at LBCT has been meeting shift requirements, while the batteries in two such units at SSA have been found to be undersized for that terminal's longer shift requirements (>9 hours). The data from this project at both terminals is still being collected.
 - iv. LBCT continues to provide positive reports from operators of Kalmar's electric yard truck, which has been in operation for almost one year.
 - The Committee suggested that it would benefit their process to ensure that labor reports are regularly communicated through those Committee members with direct labor engagements, as well as the ports. Representatives from PMSA and ILWU 13 agreed to identify ways to improve those feedback channels with their members.
- c. Updates from the Port of Los Angeles:
- i. A microgrid project at the Green Omni (Pasha) terminal is working through coronavirus-related delays, however, the Shore-Kat system's demonstration was completed in April and remains in use as an effective emissions control system. Separately, operation of several electric forklifts and some of the terminal's demonstration yard trucks is currently on hold, while the yard trucks from BYD remain operation.
 - ii. WBCT's AID project demonstration 12 wireless charging stations from WAVE supporting 10 BYD yard trucks is undergoing advanced design and permit review.
 - iii. The multi-partner Shore to Store project's first five hydrogen fuel cell drayage trucks from the Kenworth-Toyota partnership will enter demonstration by the end of 2020, with all 10 entering operation by April 2021.
 - Shell's hydrogen production facility in Ontario is on track to begin operating at the end of 2020, producing 1,000 kg/day for port trucks, while a similar station at the Port of Long Beach is in early construction stages. Station use is expected to produce valuable information on available economies of scale, and the cost-benefits of using hydrogen in port truck operations.
 - iv. Everport Terminal has begun operating five battery electric yard trucks from BYD after a delay this spring and is awaiting delivery of three next-generation models later this year. In May, the terminal began upgrades to electrify two Taylor top handlers. These units are expected to perform for 18 consecutive hours on a 1 MW battery.
- d. The joint ports reported that common delays across their projects include EVSE certification requirements and noted that equipment that is certified at project level instead of the product level adds time and cost to the projects. Representatives from the City of Los Angeles noted that they have raised this issue with manufacturers who consistently require project-level certification, and encouraged them to pursue product-level UL listings.
- i. The Port of Los Angeles added that their next technical feasibility study - anticipated to begin in 2020/2021 - will capture a significant number of results from these demonstration projects, making them publicly available.



- e. Meeting participants agreed that the upcoming joint CARB / CEC truck funding opportunity presents an important opportunity for the ports to pursue a large scale zero-emission technology demonstration (50-100 drayage trucks), and that the Committee would welcome the opportunity to review and express support for a proposal from the ports.
 - i. The ports agreed to share their project concept with the Committee at the September meeting.
 - f. The group additionally agreed that continued dialogue with external stakeholders as well as terminal operators about the fueling infrastructure needed to support the port truck fleet, and a clear recommendation from the Committee, would empower the ports to develop a clear fueling infrastructure strategy.
 - i. The Committee agreed to dedicate time on a future meeting to discuss this in greater detail with external stakeholders, similar to the roundtable discussions that have been held previously for drayage trucks.
 - ii. A sub-committee was voluntarily appointed to develop a draft recommendation for review.
4. Update on CARB Activities (CARB)
- a. CARB advised the Committee that it is facing staffing restrictions and process as the agency and State continue to respond to the coronavirus pandemic, and that regulations remain a top priority.
 - b. Joint CARB/CEC ZE Drayage Truck RFP (\$40M)
 - i. Agency staff advised that this solicitation will be released in late July or early August, and will be open for between 60 and 90 days.
 - c. ACT Regulation
 - i. This regulation was passed by the agency's board in late June. Agency staff added that they look forward to working with the 15 states and the District of Columbia to achieve a 100% zero emission truck sales standard by 2050.
 - ii. The agency plans to begin drafting the corresponding fleet rule in late 2020.
 - d. Low NOx Omnibus Rule
 - i. The agency will present this rule to its board in August 2020, which recommends moving the NOx emissions standard on vehicle engines from 0.2 g/bhp-hr to 0.05 g/bhp-hr by 2024, and to 0.02 g/bhp-hr by 2027. The agency expects that this approach will achieve a reduction of 27 tons NOx/day by 2031, reducing healthcare costs by \$37Bn while costing the industry \$4.5 Bn. The agency's methodology is still under review.
 - ii. Additional features of the rule include an extended useful life and warranty, and a credit multiplier option.
 - e. At-berth Rule
 - i. The agency released the latest set of changes to this rule for public comment on July 10th, which included returning the original RORO equipment compliance start date of 2025 and aligning report requirements for all vessel operators and terminal operators starting in January 2023. The board vote is scheduled for August 27th.
 - f. eTRU Regulation
 - i. A workshop will be held on July 29th to develop cost assumptions for this rule.



- g. CARB added that the agency is conducting a rail inventory update and will host workshops in the summer and fall of 2020. On an emerging harbor craft rule, it has received comments on a concept paper and is developing draft language to share in a September 2020 workshop.

5. Discussion - Infrastructure Stakeholder Roundtable

a. Key Takeaways

- i. Reinforcing the points made under agenda items 3.e-f, the Committee advised that clarity is needed from the Ports to define the anticipated deployment schedule and routes of zero and near-zero emission trucks resulting from the Clean Truck Program. These were identified as key missing pieces of information by the infrastructure and fuel providers in the prior roundtable discussion. In addition, it was noted that suitable areas near the ports need to be identified for the required infrastructure as this infrastructure cannot be developed on port property.
- ii. The Port of Long Beach noted that some public charging infrastructure is being installed on port property under CARB's ZANZEFF programs, and added that the ports are conducting a survey of adjacent available lands that could provide smaller fueling support for as-needed cases.
 - The Port of Long Beach is also issuing an RFI to develop an area of its north harbor which could support peel-off operations.

b. Opportunity for Committee Action

- i. The Committee agreed to convene a sub-committee to discuss and develop a potential recommendation on a forward plan for clean truck deployments and associated fueling / charging infrastructure.

6. Review of Committee Recommendations

a. Harbor Maintenance Trust (HMT) Fund Letter of Support

i. Update on HMT Proposal

- The Port of Long Beach shared that the Water Resources Development Act (WRDA) was released from the federal House of Representatives on July 13th and is moving quickly to the floor. It is being advanced in the Senate but has not yet advanced to the floor. If the bill is not approved by the end of this Congressional session, it will be treated as dormant until after the November 2020 election.
- The approved draft includes provisions for expanded in-water uses by donor ports, and an increase to donor and energy ports' annual receipts from the HMT.

- ii. The ports reinforced prior statements that the HMT funds are unlikely to be available for non-in-water uses, and, that the ports' deficit for this infrastructure work remains significant. An increase in HMT receipts is not expected to free up currently earmarked funds.

iii. The Ports will provide an update on this legislation in the September meeting.

b. Hybridization of RTGs and Top Handlers Recommendation

- i. The Committee was unable to further develop or approve this recommendation due to a disagreement over use of the term "human-operated".



7. Next SSCAC Meeting:
 - a. September 16, 2020; 11 am – 3 pm PDT
 - b. Location TBD

8. Conclusion & Next Steps
 - a. The Committee will work with its members and the ports to address the identified action items.



Attachment A
List of Meeting Participants

SSCAC Committee Members	
Michele Grubbs	PMSA
Thomas Jelenic	PMSA
Matt Miyasato	South Coast AQMD
Heather Arias	CARB
Marnie Primmer	FuturePorts
Chris Chavez	CCA
Louis Dominguez	San Pedro Neighborhood Council
Ray Familathe	ILWU Local 13
Stella Ursua	Grid Alternatives
Adrian Martinez	EarthJustice
Los Angeles Port & City Staff	
Chris Cannon	Port of Los Angeles
Erick Martell	Port of Los Angeles
Tim DeMoss	Port of Los Angeles
Michael DiBernardo	Port of Los Angeles
Justin Houterman	Port of Los Angeles
Jacob Goldberg	Port of Los Angeles
Michael Samulon	City of LA, Mayor's Office
Lauren Faber O'Connor	City of LA, Mayor's Office
Max Reyes	City of LA, Mayor's Office
Jacob Haik	Councilman Joe Buscaino's Office
Long Beach Port & City Staff	
Heather Tomley	Port of Long Beach
Sam Joumblat	Port of Long Beach
Bianca Villanueva	Port of Long Beach
Morgan Caswell	Port of Long Beach
Rose Szoke	Port of Long Beach
Justin Ramirez	City of Long Beach, Mayor's Office
Meeting Facilitation Staff	
Erik Neandross	GNA
Eleanor Johnstone	GNA
Patrick Couch	GNA
Alexis Wiley	GNA
Other Stakeholders	



Brian Choe	South Coast AQMD
Regina Hsu	EarthJustice
Sydney Vergis	CARB



Attachment B

Meeting Agenda

1. POLA / POLB Opening Remarks
2. Review & Approve May Meeting Summary
3. Update on Port Demonstration Projects
4. Update on CARB Activities (CARB)
 - a. Joint CARB/CEC ZE Drayage Truck RFP (\$40M)
 - b. ACT Regulation
 - c. Low NOx Omnibus Rule
 - d. At-berth Rule
 - e. eTRU Regulation
5. Discussion - Infrastructure Stakeholder Roundtable
 - c. Key Takeaways
 - d. Opportunity for Committee Action
6. Review of Committee Recommendations
 - a. Harbor Maintenance Trust Fund Letter of Support
 - i. Update on HMT Proposal
 - b. Hybridization of RTGs and Top Handlers Recommendation
7. Next SSCAC Meeting:
 - a. September 16, 2020; 11 am – 3 pm PDT
 - b. Location TBD
8. Conclusion & Next Steps



Attachment C
Presentation

Sustainable Supply Chain Advisory Committee Meeting

July 15th, 2020



Agenda

1. POLA / POLB Opening Remarks
2. Review & Approve May Meeting Summary
3. Updates on Port Demonstration Projects
4. Updates on CARB Activities
 1. Joint CARB/CEC ZE Drayage Truck RFP (\$40MM)
 2. ACT Regulation
 3. Low NOx Omnibus Rule
 4. At-berth Rule
 5. eTRU Regulation
5. Discussion – Infrastructure Stakeholder Roundtable
 1. Key Takeaways
 2. Opportunity for Committee Action
6. Review of Committee Recommendations
 1. Harbor Maintenance Trust Fund Letter of Support
 1. Update on HMT Policy and Congressional Review
 2. Hybridization of RTGs and Top Handlers Recommendation
7. Next SSCAC Meeting:
 6. September 16, 2020; 11 am – 3 pm PDT
 7. Location TBD
8. Conclusion and Next Steps



1. Ports' Opening Remarks



2. Review & Approve May Meeting Summary



3. Updates on Port Demonstration Projects

Rose Szoke, Port of Long Beach
Jacob Goldberg, Port of Los Angeles





SAN PEDRO BAY PORTS
CLEAN AIR ACTION PLAN

Ports Zero-Emissions Projects Update
Sustainable Supply Chain Advisory Committee
July 15, 2020

Questions or comments? Chat us or
submit via caap@cleanairactionplan.org

Rose Szoke, Port of Long Beach
Jacob Goldberg, Port of Los Angeles





- Update on the Ports' Technology Advancement Program, or TAP
- Port of Long Beach Grant-Funded Technology Demonstrations
- Port of Los Angeles Grant-Funded Technology Demonstrations
- COVID-19 Impacts



Ports' Technology Advancement Program Update

- Updated TAP Program Guidelines is available online.
- Includes the new Request for Information and Concept Paper process.
- This is how the Ports will accept and review technology advancement proposals moving forward.

San Pedro Bay Ports
Technology Advancement Program

Program Guidelines





Updated: December 2019



Ports' Technology Advancement Program Update

- TAP Request for Information (RFI) is available online.
- Concept papers (along with the RFI form) may be submitted at any time online.
- Project concepts that conform to the TAP Program Guidelines will be considered for the next step, which is an invitation to submit a full proposal.

Request for Information
San Pedro Bay Ports Technology Advancement Program
CONCEPT PAPER

Instructions: Read the "San Pedro Bay Ports Technology Advancement Program Guidelines" in its entirety. These guidelines contain information about applicant eligibility, project eligibility, match funding requirements, and the evaluation process. **Concepts that do not conform to the guidelines will be rejected.** and proposers will be unable to resubmit this same concept for a full calendar year. Fill in all fields in the form below. If you cannot answer a question, write "N/A". **Note:** Proposers should be aware that documents submitted to the Ports are considered public records.

Company Information			
Company Name:		Year Established:	
Address:			
City:	State:	ZIP Code:	
Primary Point of Contact:		Title/Position:	
Phone Number:		Email:	
Technical/Engineering Contact:		Title/Position:	
Phone Number:		Email:	
Technology Description (300 characters max)			
Target Source Category			
<input type="checkbox"/> Heavy Duty Trucks (Class B)	<input type="checkbox"/> Locomotives		
<input type="checkbox"/> Cargo-handling Equipment	<input type="checkbox"/> Infrastructure		
<input type="checkbox"/> Ocean-going Vessels	<input type="checkbox"/> Other, please describe:		
<input type="checkbox"/> Harbor Craft			
Funding			
Total Project Cost:		TAP Funding Requested:	
Total Federal Match Funding (\$):		Amount:	
Match Funding Source:		Amount:	
Match Funding Source:		Amount:	
<small>Are additional match funding sources and amounts stated below an attachment?</small>			
Partners			
Do you have a demonstration partner?			
<input type="checkbox"/> Yes, describe: _____			
<input type="checkbox"/> No			
Have you approached other agencies to fund or support this technology demonstration?			
<input type="checkbox"/> Yes			
<input type="checkbox"/> No			
If yes, please describe: _____			



Ports' Technology Advancement Program Update

- 2019 TAP Annual Report is available online.
- The TAP Annual Reports highlight technology advancement and progress via TAP, grant-funded demonstrations as well as cost-sharing partnerships
- Project Priorities
 - ZE for trucks and cargo handling equipment





POLB Grant-Funded Demonstrations - Overview



START PROJECT
CARB \$50 MILLION
SSA, Pier C and Shippers Transport

- 33 Electric Yard Tractors
- 1 Electric Top Handler
- 1 NZE Tugboat
- 2 Tier 3 Ships
- 5 Electric Trucks

ZE EQUIPMENT
TRANSITION PROJECT
CEC \$9.75 MILLION
LBCT, Pier E and SSA, Pier J and ITS, Pier G

- 12 Electric Yard Tractors
- 9 Electric RTG
- 4 LNG Hybrid Electric Trucks

PAVE PROJECT
CEC \$8 MILLION
TTI, Pier T

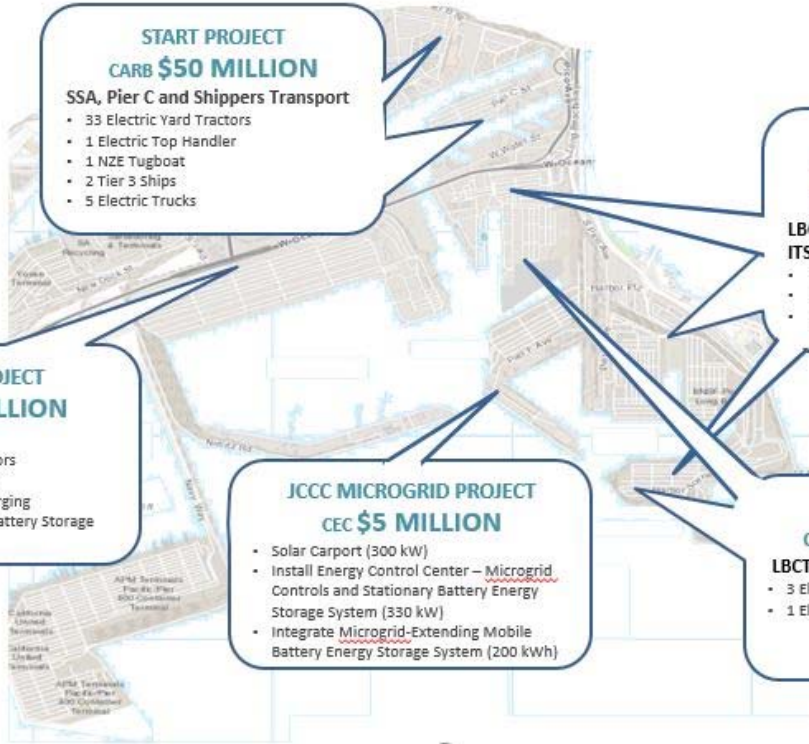
- 6 Electric Yard Tractors
- 10 Electric Fork Lifts
- Install Electrical Charging Infrastructure and Battery Storage

JCCC MICROGRID PROJECT
CEC \$5 MILLION

- Solar Carport (300 kW)
- Install Energy Control Center – Microgrid Controls and Stationary Battery Energy Storage System (330 kW)
- Integrate Microgrid-Extending Mobile Battery Energy Storage System (200 kWh)

C-PORT PROJECT
CARB \$5.3 MILLION
LBCT, Pier E and SSA, Pier J

- 3 Electric Top Picks
- 1 Electric Yard Tractor





eRTG Crane Demonstration (SSA Pier J)





Electric Yard Tractor and EVSE Demonstration (ITS, LBCT)





Electric Top Handler Demonstration (SSA, LBCT)





Kalmar Battery Electric Yard Tractor (LBCT)





POLB Technology Demonstrations – COVID Impacts

- Technology manufacturers temporarily shutting down their businesses or facilities to comply with the Governor’s stay-at-home order.
- Shifting priorities and redeployment of personnel to COVID-related activities.
- Limited access to terminals for equipment testing and data collection.
- Paused demonstrations until freight volume increases and business operations return to normal.

POLA Grant-Funded Technology Demos - Update

Green Omni-Terminal Project

CARB \$10.3 Million

STATUS UPDATE:

- 4 electric yard tractors
- 2 electric Class 8 trucks
- ShoreKat land-based at-berth emissions control system
- Solar rooftop array with microgrid controls and battery storage
- 3 electric forklifts

Shore to Store Project

CARB \$41 Million

Various Partners off-Port Property

- 10 H₂-electric Class 8 trucks
- 2 heavy duty H₂ fueling stations
- 2 electric yard tractors with charging infrastructure (Port of Hueneme)
- 2 Zero-emission forklifts

AID Project

CEC \$7.8 Million

WBCT (China Shipping)

- 10 battery-electric yard tractors
- 12 Wireless charging stations
- Peak-shaving storage system

Advanced CHE Demonstrations

CEC \$10.3 Million

Everport

- 20 RNG yard tractors
- 5 electric yard tractors, standard chargers
- 3 electric yard tractors, advanced charging system
- 2 electric top handlers



Kenworth Toyota Zero Emissions Trucks





Shell Hydrogen Station – Ontario





Shell Hydrogen Station – Long Beach





Battery Electric Yard Tractors





Taylor Battery Electric Top Handler





Thank you!

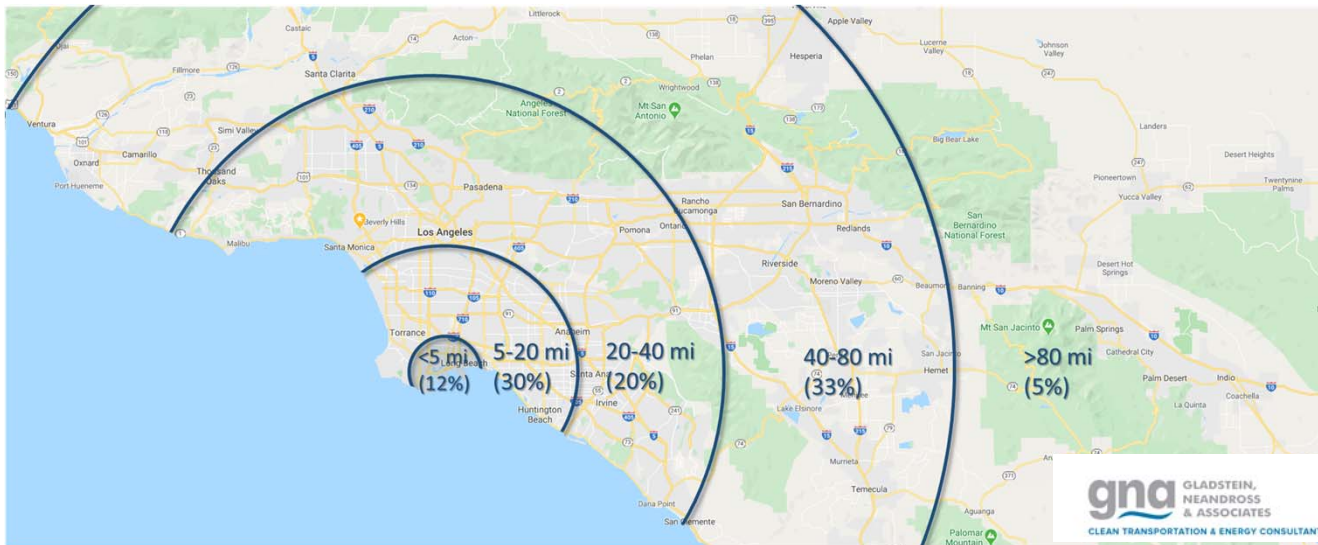
4. Updates on CARB Activities

1. Joint CARB/CEC ZE Drayage Truck RFP (\$40MM)
2. ACT Regulation
3. Low NOx Omnibus Rule
4. At-berth Rule
5. eTRU Regulation



5. Infrastructure Roundtable Key Takeaways

What does the ports' goal of "transitioning the current drayage truck fleet to a near-zero and ultimately zero emissions drayage trucking fleet by 2035" mean for building out the fueling infrastructure in the harbor and throughout the region to support the transition of this 11,000 to 18,000 truck fleet?



Fuel	11,000 Truck Fleet Daily Throughput
Natural Gas	513,000 DGE
Electricity	6.55 GWh
Hydrogen	272,400 kg



Natural Gas Key Takeaways

- Existing natural gas fueling infrastructure in the port fleets' region of travel can accommodate several years of aggressive natural gas truck deployments at +/- 2,000 new trucks per year.
- Subsidies are needed but they must be used to deploy new trucks. Private capital can be used to build infrastructure, if there is confidence that infrastructure will be utilized by new truck deployments.
- The ports' and city's heavy focus on the long-term goal of zero emission technology devalues the business case for near-term emission reduction technology (i.e. natural gas trucks and infrastructure). This challenges the region's ability to meet its near-term air quality attainment deadlines.
- RNG is a decarbonizing solution which can be scaled up in a short period of time, as there is a growing number of sources low carbon RNG to meet the port fleets' needs. RNG can have a lower carbon footprint than zero emission technology, both in the immediate and long term.

Speakers	
CleanEnergy	Greg Roche
GAIN	Scott Hanstedt
Shell	Shawn Murphy
SoCal Gas	Kevin Maggay
Trillium	Ryan Forrest



Hydrogen Key Takeaways

- Hydrogen complements battery electric technology as a solution to a zero emission future in trucking; the two are not exclusive. Long-term planning is challenged by the fact that today’s trucks and stations are first generation, which creates uncertainty around the final form and scale.
- SMR production facilities (Air Products) are less space- and capital- intensive than electrolysis stations (Nikola), although build times for either tend to be 2-3 years and permitting is both time- and cost- intensive.
 - Air Products currently serves the transit market with stations producing 4-10 tons/day. Large stations can take up to 3 years to build.
 - Nikola’s first stations are expected to come online in the I-10 corridor in 2023. These will provide 8 tons/day using electrolysis, for a price tag of \$16MM per site. The station requires approx. 6 acres of land and a 24-month build time (the first 6 months are dedicated to permitting).
- Some portions of the SPBP drayage market may be satisfied with smaller (<8 ton) stations – a detailed heat map of the fleet’s travel would enable infrastructure stakeholders respond to future needs.
- If the initial deployments and scaling processes for hydrogen infrastructure are well-managed with clear milestones, then 2035 is a realistic timeline to transition to zero emission technology from an infrastructure perspective.
 - If the target is modified to require zero carbon fueling, then the transition will require additional time.

Speakers	
Air Liquide	Charles Sanders Jordan Truitt
Air Products	Christine Kretz
FuelCell Energy	Paul Fukumoto
Nikola	Elizabeth Fretheim Dale Prows
Shell	Wayne Leighty
Trillium	Ryan Forrest



Battery Electric Key Takeaways

- Large corporate fleets (e.g. not port drayage fleets) are expected to be the first to transition due to high vehicle prices. This is prompting utilities to invest in large-scale charging facilities (10-20 MW) in the near term, with an estimated lead time of 7-10 years. In-route solutions may be developed once large fleets have begun to transition.
 - Initial investments require an anchor fleet; speculative demand (such as the ports') is not sufficient for a vendor to begin station development today.
- Incentives for both vehicles and infrastructure are critical for infrastructure development and must be sustained over the long term to sustain customer interest as the technology moves through the commercialization process.
 - Reserving, aligning vehicle incentives with OEM's forecasted sales timeline may smooth the adoption curve.
 - Over-regulation on the use of funds, and sale of electricity, limit the fuel station owners' business case.
- Fleet- and region- specific data would enable infrastructure providers to respond to need forecasts in greater detail. This includes:
 - Fleet heat map based on trip origin/destination data
 - Details of current fuel station populations and new investments
 - Details of current fleet parking areas, vehicle use, duty cycles

Speakers	
AMPLY	Rob Kelly
ChargePoint	David Peterson
Greenlots	Lin-Zhuang Khoo Ashley Horvat
LADWP	Louis Ting
SCE	Eric Seilo Damon Hannaman
Tesla	Noelani Derrickson
Trillium	Ryan Forrest



6. Review of Committee Recommendations

1. Harbor Maintenance Trust Fund Letter of Support
 - a. Update on HMT Policy and Congressional Review
2. Hybridization of RTGs and Top Handlers Recommendation



7/8. Closing Remarks

1. Next SSCAC Meeting

- September 16th, 11 am – 3 pm
- Location TBD

2. Conclusion & Next Steps

Appendix

Infrastructure Roundtable Primer



N/ZE Truck Manufacturer and Fleet Perspectives on Infrastructure (2017-2019)

Between 2017 and 2019, the SSCAC convened truck manufacturers and fleets to discuss the development and deployment of N/ZE drayage trucks for the San Pedro Bay Ports. Their perspectives on the role of infrastructure in this work is generally summarized below and supported on the following two slides.

NGV production volumes are strong and infrastructure is moderately developed; both can be scaled to meet demand in the near term.

Meanwhile,

BEV production volumes are low and will remain limited until infrastructure solutions become more clearly defined for the customer. FCEV demonstrations have not yet begun for the port drayage segment.



NZE Truck Manufacturer and Fleet Perspectives on Infrastructure Availability

Manufacturers of NGVs are prepared to scale production to 8,000/yr over a 6-month period, and expect infrastructure will scale accordingly

- No limitation on natural gas production volumes is anticipated

Manufacturers of BEVs and FCEVs may have the capacity to scale production, but do not see clear customer demand because customers do not see clear fueling solutions. Progress in this area is hindered by:

- Lack of supply – the HD BEV and FCEV network is nascent, and both fueling industries' abilities to supply enough fuel and fueling equipment to support large-scale deployments is unclear.
- Lack of standardization - no standard has been defined, and, some interfaces are being sold without Nationally Recognized Testing Laboratory (e.g. UL) listing, creating a higher perceived risk of disruption during construction/commissioning.
- Lack of clear process and timeline – infrastructure development requires multiple parties whose actions are limited by a lack of standardized and clearly accepted market practices.

Appropriate applications of BEV and FCEV are undefined

- How will these two fuel-technology architectures be used in the larger trucking market?
- What balance of public/private, fast/slow fueling infrastructure will best meet needs in these applications?



ZE Truck Manufacturer and Fleet Perspectives on Infrastructure Cost

Cost of fueling is unpredictable, mitigating customer appetite for BEV technologies

- Electricity rate structures are inconsistent across large territories
- Electricity rates vary by time of day, and season
- Fast-fueling can have unpredictably high costs

Funding is available but often poorly aligned and from diverse sources

- Funding for infrastructure and funding for vehicles are often not available from the same sources
- Customers often have to cobble together funds from disparate sources to cover project costs

Funding terms are restrictive

- The relationship between funding, charging standards, and NRTL listing restricts what infrastructure a fleet can purchase, in turn restricting what vehicles it can purchase
- These terms can limit the project scope and scale



Port Drayage Fleet Population and Behavior

Population: 17,471 Class 8 Drayage trucks total

- 12,845 active (73% of total population)
 - MY'07-'09: 5,187
 - MY'10-'13: 3,765
 - MY'14+: 3,983
- 95% Diesel – 4% Natural Gas – 1% Other
- ~67% LMCs have small (<20 unit) fleets
- Majority of trucks driven by IOOs

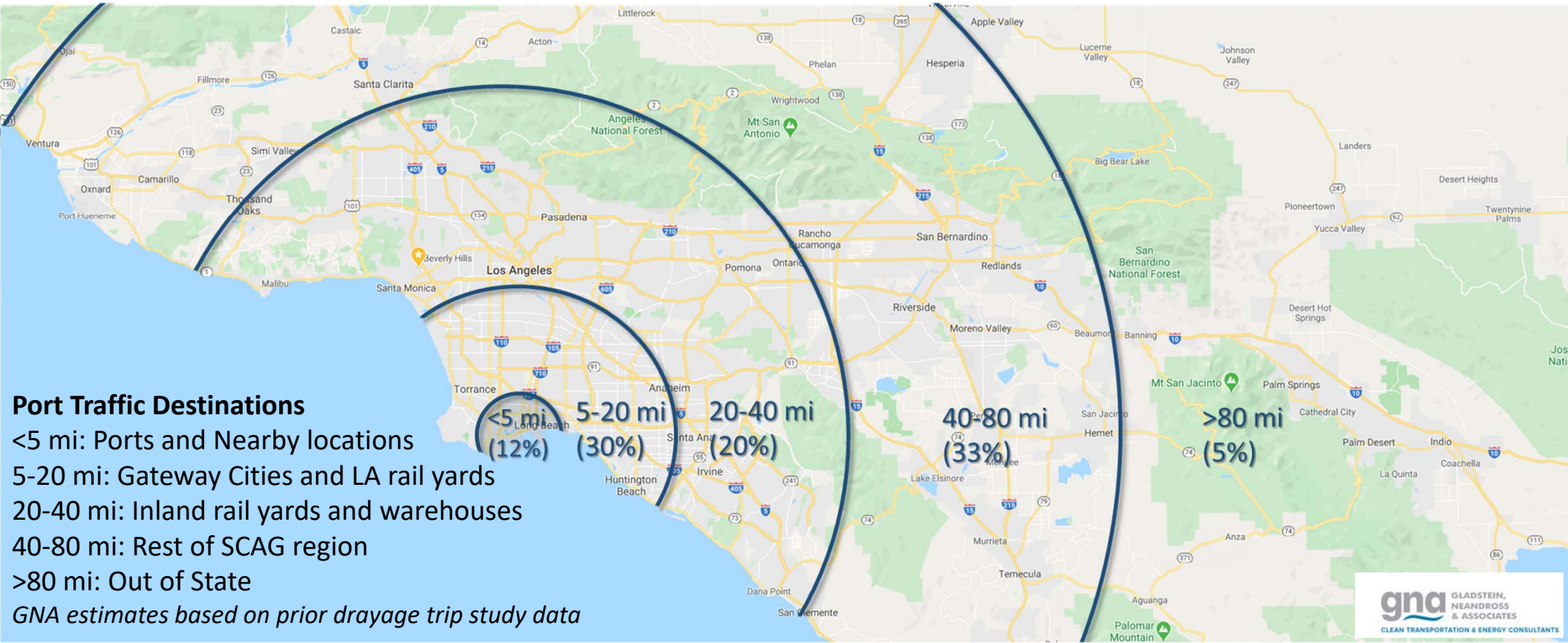
San Pedro Bay Port Clean Truck Incentive Program

- A \$10/TEU rate may be assessed on non-ZE trucks beginning in Q3 2020, pending confirmation from the respective Harbor Commissions.
- Revenue (est. \$90MM/year) to support the adoption of clean trucks by port drayage operators
- Terms of using the revenue for a program incentive to buy clean trucks are currently under consideration

Port Truck Critical Compliance Targets

- 2020: MY2014 required for new port truck registrations; ZE are rate-exempt
- 2023: MY2010 or newer required to remain in truck registry; NZE or better required for new truck registration
- 2035: 100% ZE drayage truck goal





Port Drayage Fleet's Estimated Infrastructure Needs

2018 Feasibility Assessment

- Considered fleet size of 11,000 and 18,000 trucks
- Estimated 42% of fleet has space for on-site fueling/charging infrastructure
- 58% of fleet would require public access fueling/charging infrastructure
- Public access infrastructure is critical to current drayage fleet
 - NGV: 9-14 large stations
 - EV: 1,200-2,000 charging stalls for multi-hour charge sessions
 - FCV: 100-175 stations at 1,500 kg/day capacity per station

Estimated AFV Fuel Demands (Source: 2018 SPBP Drayage Truck Technical Feasibility Study)

Fueling Station Type / Location	11,000 Truck Fleet	18,000 Truck Fleet
On-site Stations – Daily Energy Throughput		
Trucks Served	4,620	7,560
Natural Gas	215,600 DGE	352,800 DGE
Electricity	2.75 GWh	4.50 GWh
Hydrogen	114,400 kg	187,300 kg
Public Stations – Daily Energy Throughput		
Trucks Served	6,380	10,440
Natural Gas	297,700 DGE	487,200 DGE
Electricity	3.80 GWh	6.21 GWh
Hydrogen	158,000 kg	258,600 kg
Total Daily Energy Throughput		
Natural Gas	513,000 DGE	840,000 DGE
Electricity	6.55 GWh	10.71 GWh
Hydrogen*	272,400 kg	445,900 kg

Context for 11,000 Truck Fuel and Infrastructure Needs Estimates:

513,000 DGE natural gas = 3% SCG average daily delivery; 16 large (10-lane) fueling stations

6.55 GWh = 2% LADWP+SCE average daily sales; 2.7x Tesla global Supercharger network

272,400 kg H2 = 1% of US average daily production; 22x CA fueling station network

*Hydrogen values not included in Feasibility Study, but are estimated here using LCFS Program EER values



Ports' Drayage Truck Technical Feasibility Study (2018) – Overall Findings

Basis for determining
"Technical Feasibility"

Feasibility Parameter / Criteria	Overall Achievement* of Criteria in 2018 (Commercially Available / Technically Viable Truck Platforms)	
	ZE Battery-Electric	NZE NG ICE
Commercial Availability		
Technical Viability	TRL 6 to 7 (moving to 7 or 8)	TRL 9
Operational Feasibility		
Infrastructure Availability		
Economic Workability		

Legend: Achievement of Each Noted Parameter / Criteria (2018)

Little/No Achievement

 Fully Achieved

*These ratings for overall achievement of each five feasibility parameters are based on the analysis of several criteria within that parameter. Because each criterion is important for the success of a given fuel-technology platform in drayage, the overall achievement ratings are based on the lowest criterion score for each feasibility parameter.

Infrastructure Availability is one of/the area needing the most improvement for NGVs and BEVs.

TRL Rankings Explained:

BEV Trucks

- Currently "Fully integrated prototypes tested in a relevant environment" and "System prototype in an operational environment"
- Moving towards "Commercial demonstration, full scale deployment in final form"

NGV Trucks

- Currently in "Commercial demonstration, full scale deployment in final form"
- Moving towards "Commercial operation in a relevant environment"

Ports' Drayage Truck Technical Feasibility Study (2018) – Drayage Truck Infrastructure Findings

Infrastructure Criteria / Parameter	Base Considerations for Assessing Infrastructure Availability	Achievement of Criteria for Remaining Drayage Truck Platforms	
		ZE Battery-Electric	NZE NG ICE
Dwell Time at Station	Refueling/recharging can be accommodated within typical work breaks, lunches, other downtime compatible with trucking company schedules and operational needs.		
Station Location and Footprint	Fleets have existing onsite access to fueling infrastructure, or can be fueled/charged conveniently and affordably off site, at public or private stations. New infrastructure can be installed without extensive redesign, reconfiguration or operational disruptions and there is sufficient electrical or natural gas capacity at the site.		
Infrastructure Buildout	Infrastructure can be constructed at a pace consistent with fleet adoption and able to meet fleet fueling/charging requirements by the end of the assessment period.		
Existence of / Compatibility with Standards	A sufficient body of codes and standards exist from appropriate organizations that enables safe and effective refueling/recharging. The refueling/recharging station technology has already been installed at other trucking companies in the U.S., with sufficient time to assess performance and safety.		

Infrastructure Buildout is one of/the area needing the most improvement for NGVs and BEVs.

Today, the majority of port drayage truck drivers rely on public fueling infrastructure located off of port property. The ports are not anticipating this to shift with the transition to N/ZE technologies.

Additionally, most truck depots have limited available space.

Legend: **Infrastructure Availability (2018)**



Little/No Achievement

Fully Achieved

Source: based on preliminary OEM survey responses, OEM product information, various government sources, and Tetra Tech team's industry knowledge.

Discussion Questions

1. What is your vision for the development of the fueling infrastructure – for your fuel – to meet the needs of 12,000 to 18,000 drayage trucks operating within the harbor and throughout Southern California, and considering that approximately 60% of these trucks require public fueling? How does this vision unfold? When and how does it happen? And what is required to make it a reality?
2. What does a centralized public fueling station look like in terms of space and dwell time accommodations? How long can you refuel a truck? Is the technology now market ready? If not, when will it be ready to deploy this kind of infrastructure?
3. How many public sites do you think are required to meet the needs of the port drayage truck market, and do you have a sense of where within the region they would be located? What is your opinion about the real estate needed to site these stations?
4. Where does the capital come from to pay for this infrastructure? Does this have to be paid for with public incentives? How much private capital can be used here? How does private vs public capital ultimately impact the price of fuel to the end user?
5. How realistic is this vision?
6. What signals from the vehicle market are most important to your decision to begin building out to the level required to meet port drayage demand?
7. What is involved to ramp up infrastructure to the level expected to meet Port fleet needs?
 1. What is the estimated time frame for this ramping effort? When do you need to get started, and when do you really see the critical period of time for a ramp in infrastructure development?
 2. What are likely to be the greatest constraints to deploying this scale of infrastructure?
 3. What economies of scale are achievable, both in terms of cost and time?
8. How much fuel can be supplied on a daily basis under current conditions?
 1. Where is it/will it be produced?
 2. What transmission/distribution infrastructure is available today, and what additional infrastructure will be needed to meet demand in the San Pedro Bay Ports?
9. What is your industry's target fuel price range, inclusive of the infrastructure, in 2025? 2030? And, what variations on this price range may exist for fleets?
10. What percent of your fuel will be renewable by 2030? 2035? How does integrating renewables affect your forecasted supply and infrastructure build-out schedule and costs?

