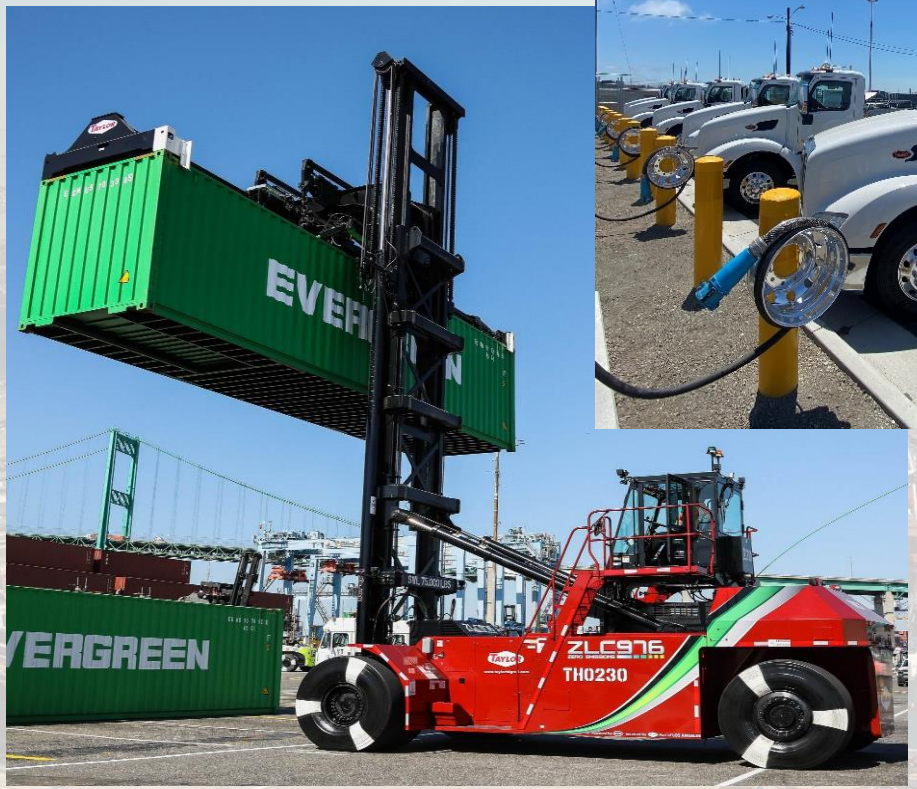
Status Update on Technology Demonstrations



Christopher Cannon
Environmental Management Division
August 10, 2023

Technology Development Efforts

1. Technology Advancement Program (TAP)
2. Grant Funded Demonstration Projects
3. Supporting Other Demonstration Projects (Regulatory Agencies, Other Ports)

POLA Technology Advancement Strategy

Goals

- Encourage technology innovation
- Support manufacturer and operator evaluations of new technologies under real Port operation duty cycles
- Accelerate commercial availability of new technologies
- Deploy technology that can lead to emissions reductions
- Facilitate steps needed to meet the goals of the Clean Air Action Plan (CAAP)
  - e.g. 2030 goal for zero-emission (ZE) cargo handling equipment

Projects Over Years

- Hybrid rubber-tire gantry crane
- Low NOx trucks
- ZE Trucks (battery electric & hydrogen)
- ZE cargo handling equipment
- Natural gas switcher locomotive
- ZE switcher locomotive

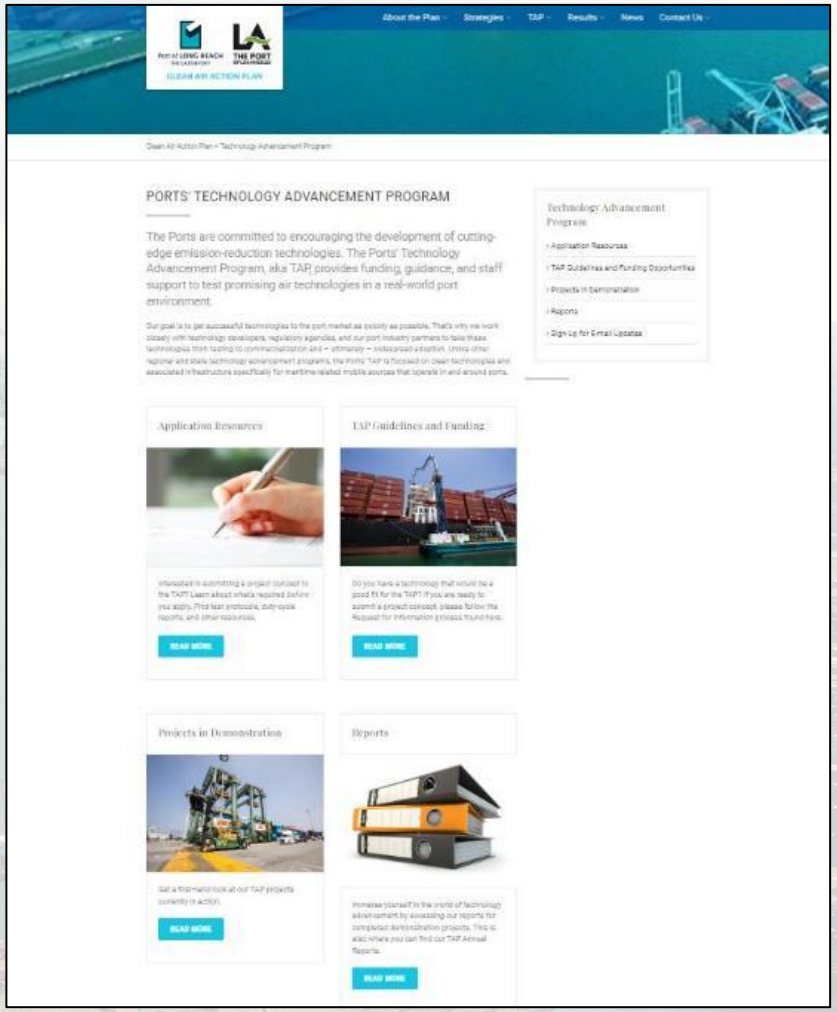
Projects Over Years (Cont.)

- Capture & control vessel emission technologies
- Ship efficiency retrofit
- Ship scrubber project
- Ship water-in-fuel emulsion
- Hybrid tugboat

TAP Website & Annual Reports

- Ports post annual reports on technology projects on the CAAP website
- Project concepts may be submitted via the TAP Request For Information Form

https://cleanairactionplan.org/technology-advancement-program/



Evolution of TAP

THE PORT OF LOS ANGELES

Past

- Previously supporting CAAP programs for the two Ports
- Focus was Port-area specific
- Smaller companies (“Mom & Pop”)

Present

- Leverage other grants to support larger projects
- Original Equipment Manufacturers
- Collaborative effort and sharing of information with regulatory agencies on advanced technology throughout the region
- International collaboration of technology advancement through the Green Shipping Corridor

Example Technology Development Timeline

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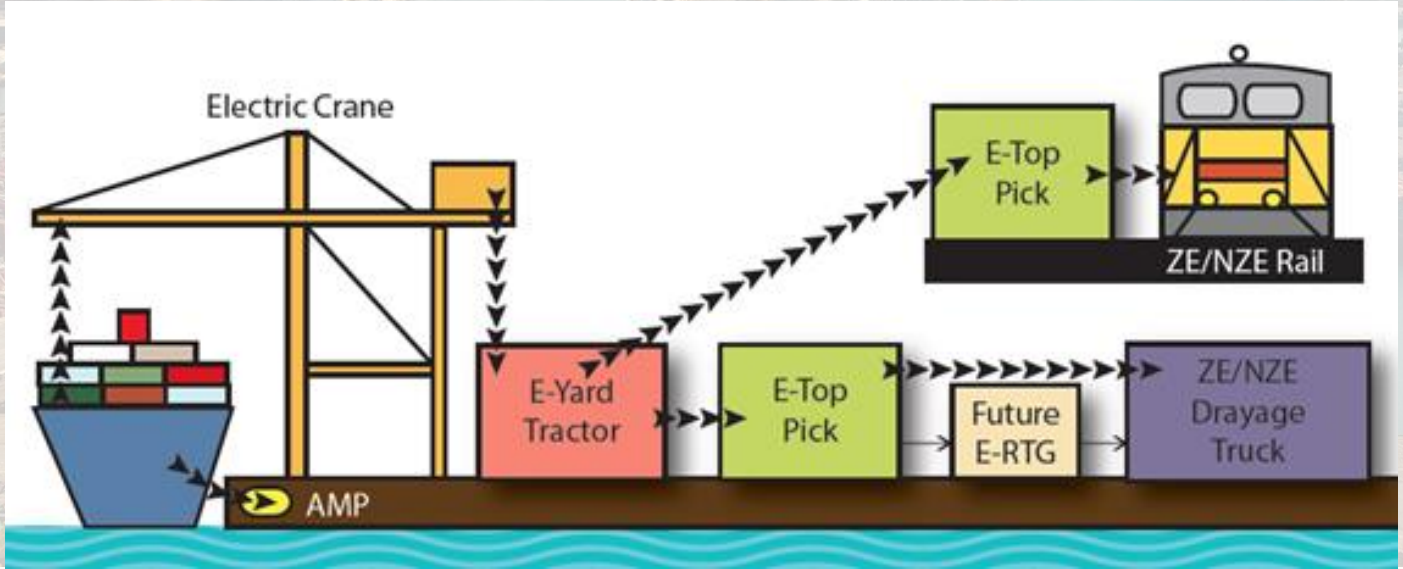
Truck Technologies Timeline

Dual Fuel Early LNG	2008 CNG only	2018 Low NOx LNG 2022 Low NOx Diesel	2021 Battery EV	2022 Hydrogen Fuel Cell

Notable Success Stories

- Majority of diesel rubber-tire gantry cranes have converted to the hybrid version
- Capture & control vessel emission technologies are part of the California Air Resources Board At Berth Regulation requirements
- ZE truck commercialization
  - Battery electric trucks getting greater range
  - Shore to Store hydrogen fuel cell trucks and hydrogen fueling infrastructure
- Battery electric top handler near commercialization



Current Project Status

- Hydrogen Fuel Cell Top Handlers Demonstration
- South Coast AQMD Low-Pressure Exhaust Gas Recirculation Retrofit and Multi-Fuel Injection System for OGVs
- PHL Battery Charging System Demonstration
- Joint Electric Truck Scaling Initiative (JETSI) for 100 ZE trucks
- Advanced Infrastructure Demonstration (AID)

Major Terminal Equipment Projects

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Green Omni-Terminal Project

CARB $14.5 Million

Pasha

STATUS UPDATE:

- 5 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

ARCHES Hydrogen Hub Application (Pending)

US DOE $300 Million

Various Terminals TBD – Pending Award

- Deployment of Hydrogen Fuel Cell Terminal Equipment
- Fueling equipment will be deployed at each participating terminal
- All details pending award from US DOE

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

Port Infrastructure Development Program (Pending)

MARAD $64 Million

APMT, YTI, TraPac, Pasha – Pending Award

- 41 electric yard tractors
- 34 electric top handlers
- 22 electric support vehicles
- 4 battery storage units
- 99 charging outlets and supporting gear
- All details pending award from MARAD

Pending Applications/Looking Forward

Pending Applications:

- US DOE Regional Clean Hydrogen Hubs - ARCHES Proposal
  - POLA/POLB Joint Project Component $300M
- Port Infrastructure Development Program (PIDP) FY 2023
  - ~$64M for various ZE equipment at 4 terminals

Upcoming Grant Opportunities

- US EPA
  - DERA
  - Clean Ports Program
- California Energy Commission – M/HD Innovative Charging Solutions

Green Shipping Corridors

Green Shipping Corridor (GSC)- Shipping route(s) between two major port hubs on which to deploy new technologies, and measure and support the reduction of carbon emissions of shipping and port activities through public and private actions and policies.

LA-Shanghai Green Corridor Alliance Members

- C40 Cities
- Shanghai Municipal Transportation Commission
- Port of Los Angeles
- City of Shanghai
- City of Los Angeles
- Shanghai International Port Group
- Port of Long Beach
- Maritime Technology Cooperation Center – Asia
- China Classification Society
- AP Moller-Maersk
- CMA CGM
- COSCO Shipping
- Ocean Network Express Alliance (Nippon Yusen, K Line, Mitsui O S K Lines
- Aspen institute - Cargo Owners for Zero Emissions Vessels program