SAN PEDRO BAY PORTS

CLEAN AIR ACTION PLAN

Ocean Going Vessel Update

August 5, 2025

Laura Hunter – Port of Los Angeles
Air Quality Environmental Specialist

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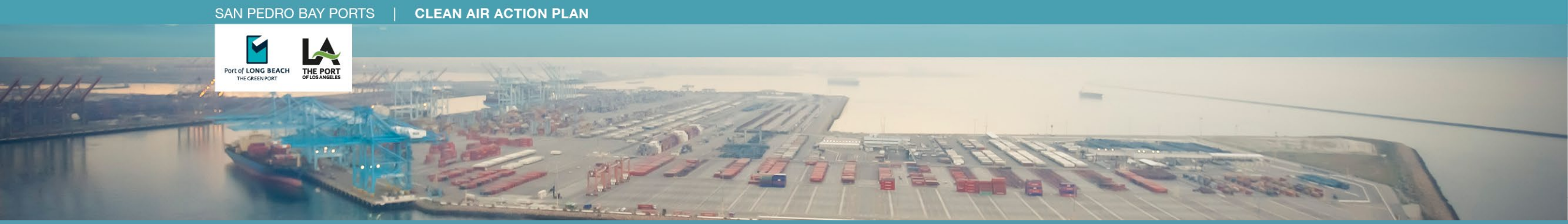
Manager of Clean Energy and Resiliency



Ocean Going Vessel Efforts Overview

- Each Port maintains Ocean Going Vessel incentive programs:
  - Speed Reduction Incentives
    - POLB Green Flag Program
    - POLA Vessel Speed Reduction Program
  - **Clean Ship Incentives:**
    - **POLB: Green Ship Incentive**
    - **POLA: Environmental Ship Index**
- **Green Shipping Corridors**
- Technology Advancement Program (TAP)

Environmental Ship Index Program

- ESI is a voluntary international ship indexing program to reward vessels that demonstrate improvement in emissions performance.
- Each participating port develops its own incentive structure based on ESI points.
- Ships earn points by using cleaner technology and practices that reduce emissions beyond the regulatory requirements set by the International Maritime Organization (IMO).
- The aim is to achieve reductions in NOx, SOx and particulates, as well as CO2, by encouraging changes in behavior among ship owners/operators and ports.
- Developed through the International Association of Ports and Harbors' (IAPH) World Ports Climate Initiative (2011).

ESI Incentives - POLB

- POLB: Original Green Ship Incentive (GSI) program (2012) offered $2,500 per call for ships with Tier II engines and $6,000 for Tier III engines.
- GSI adopted ESI's scoring system July 2021.
- Current POLB Incentive Levels (Total 2024 - $2,060,400):
  - Base: $600
  - Intermediate: $3,000
  - Premier: $6,000
- Additional Tier III Vessel Incentive +$3,000

ESI Incentives - POLA

- POLA was the first seaport in North America and the Pacific Rim to implement the ESI incentive program (2012).
- POLA 2012 Incentive Levels (per call):
  - ESI Incentive: $250 - $1,250
  - IMO Tiers: $750 - $3,250
- POLA Current Incentive Levels (per call):
  - ESI Incentive: $750 - $2,500
  - IMO Tier III Standards: $5,000
  - TAP Demonstration: $750
- POLA FY 24/25 ESI Incentives: $751,500

ESI Core (2.0)

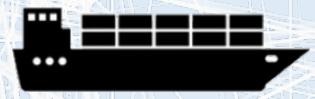
- ESI 2.0 will update the baseline for scores to meet increasing levels of regulation and environmental improvement.
- ESI 2.0 expected to begin **January 1, 2027.**
- In addition to calculating NO_x and SO_x emissions, ESI 2.0 will now include updated modules for **Greenhouse Gases**, **Underwater Noise,** and **Innovation**.
- Participating ports will update their Incentive Program scales/payments.
- Soft Launch: Through 2026, participating Ports and Vessels will see both original and 2.0 scores for vessels.

Green Ship Index and Interim ESI

- Once finalized and adopted, the Ports' programs will incorporate ESI 2.0 scoring.
- Considering additional incentive plus-ups:
  - Categories:
    - Different fuel types? Clean technologies?
  - Amounts?

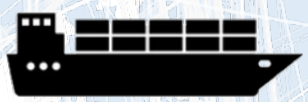
GREEN SHIPPING CORRIDORS (GSC)

Shanghai



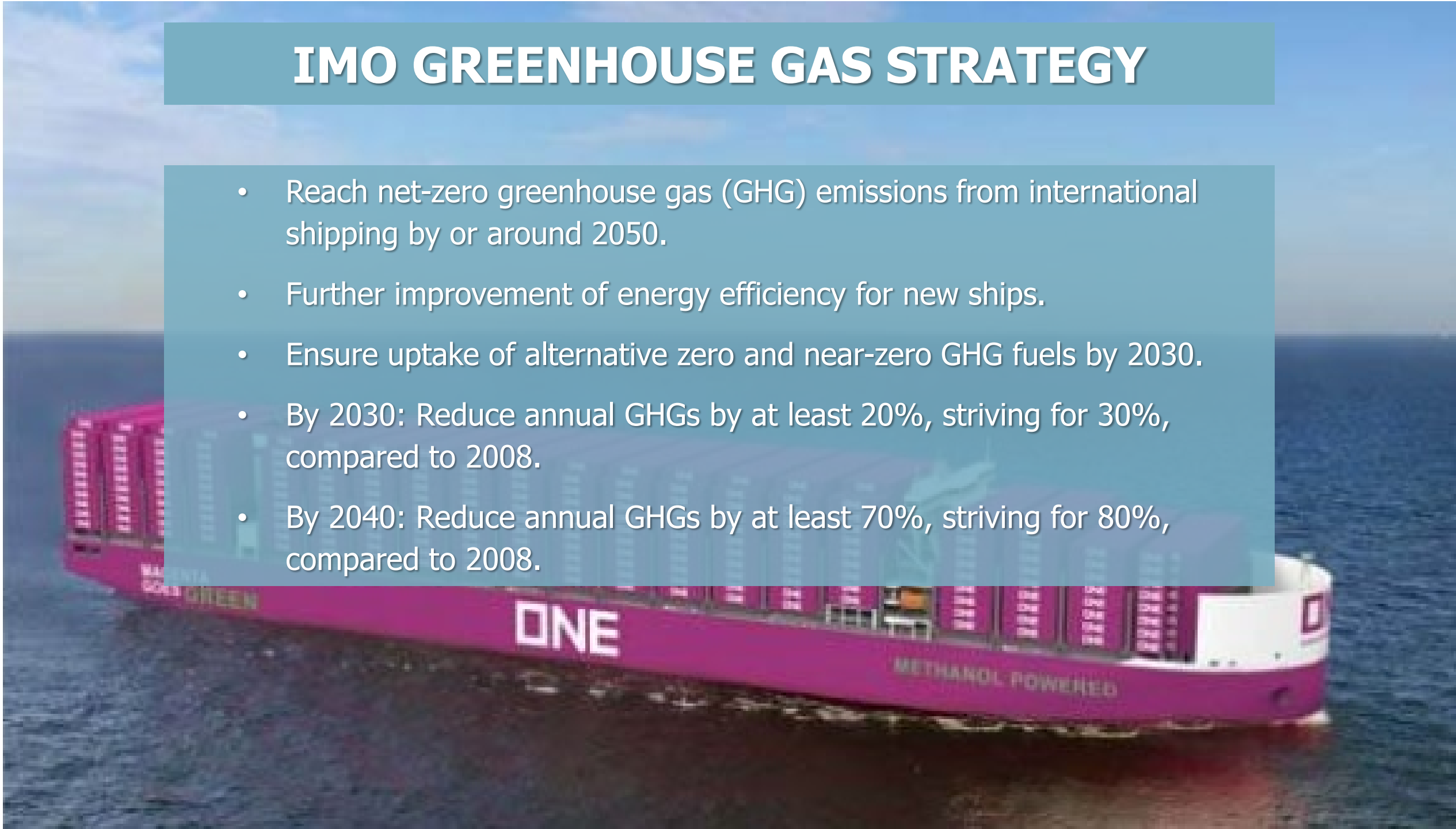
Long Beach/Los Angeles

Singapore



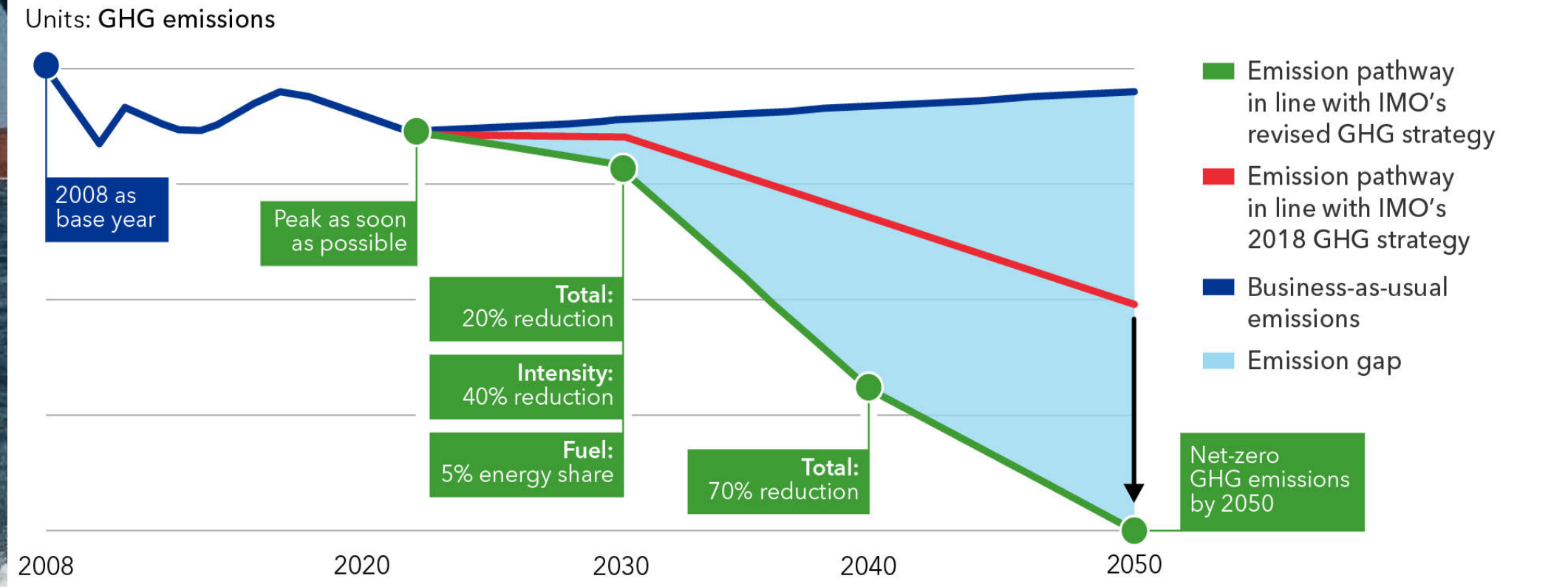
IMO GREENHOUSE GAS STRATEGY

- Reach net-zero greenhouse gas (GHG) emissions from international shipping by or around 2050.
- Further improvement of energy efficiency for new ships.
- Ensure uptake of alternative zero and near-zero GHG fuels by 2030.
- By 2030: Reduce annual GHGs by at least 20%, striving for 30%, compared to 2008.
- By 2040: Reduce annual GHGs by at least 70%, striving for 80%, compared to 2008.

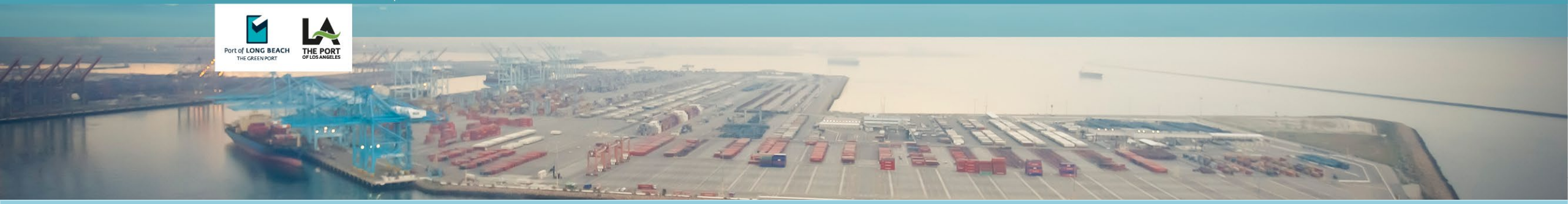


IMO GHG STRATEGY

Outline of ambitions and minimum indicative checkpoints in the revised IMO GHG strategy



Total: Well-to-wake GHG emissions; **Intensity:** CO_2 emitted per transport work; **Fuel:** Uptake of zero or near-zero GHG technologies, fuels and/or energy sources



MONITORING CLEAN MARINE FUEL TRENDS

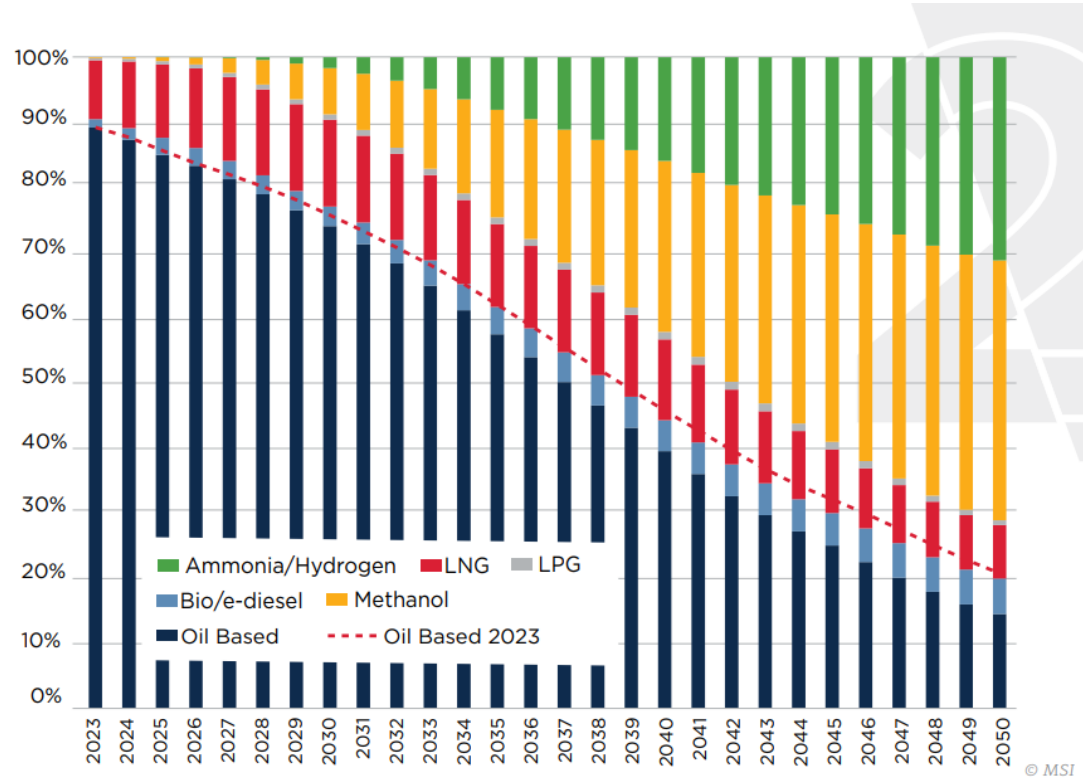


Figure 2.34: Fuel mix (HFO equivalent).

Ship types included: oil and chemical tankers, dry bulk carriers, containerships, LPG, LNG, car carriers, general cargo, ro/ro, ro/pax and cruise.

Source: American Bureau of Shipping, *Beyond the Horizon*, 2024

GSC CONCEPT

- Establish a framework and process to provide real emissions reductions from shipping and goods movement between designated ports that can be tracked and reported to the world.
- Showcase cutting edge goods movement technologies, fuels, and best management practices, including digitization.
- Incentivize demonstration of technology/strategies to reduce GHGs.
- Serve as a model to other ports for decarbonizing supply chains along various routes.

GSC RECENT ACCOMPLISHMENTS

- Shanghai/Los Angeles/Long Beach GSC met the 2025 goal to begin deploying reduced or zero lifecycle carbon emission capable ships in the corridor.
  - Established a Metrics and Evaluation Working Group to develop measurement processes to track and report progress towards the voluntary ambitions.
- Singapore/Los Angeles/Long Beach completed Baseline Study.
  - Estimated the energy needs and future fuel mix for vessels operating along the corridor to support decarbonization in alignment with IMO.
  - Conducted by American Bureau of Shipping

CLEAN MARINE FUEL

- POLA/POLB are preparing for the clean marine fuel future in San Pedro Bay with the support of a technical advisory forum including regulatory agencies.
  - Development of Clean Marine Fueling Guidelines and Standard Operating Practices
  - Safety Protocols and Training
  - Regulatory Requirements

TECHNOLOGY ASSESSMENT

- Clean Fuels Infrastructure Assessment 2.0
  - Meeting with potential fuel and bunkering service providers regarding their plans to meet the demands of clean marine fueling for the GSC.
- A Clean Marine Fuel Bunkering Pilot Project is under development.
  - The Ports are working with C40 Cities to release a Request for Information (RFI).
  - The RFI will inform the direction of the Pilot Project Request for Projects (RFP).


Thank You!

SAN PEDRO BAY PORTS

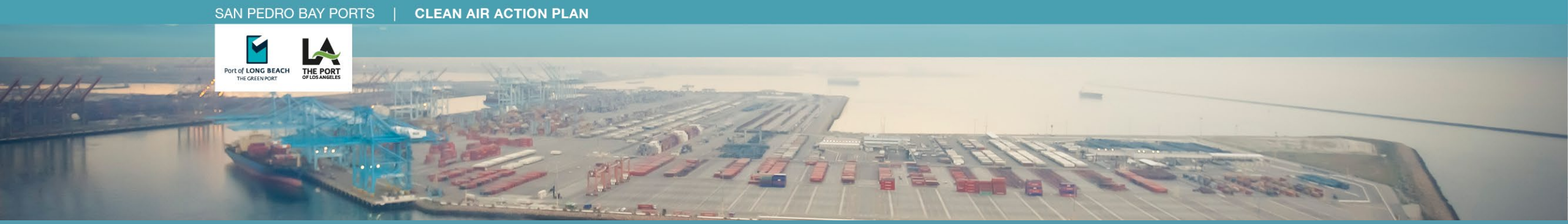
CLEAN AIR ACTION PLAN

Update on Clean Truck Program and Clean Truck Fund

August 5, 2025

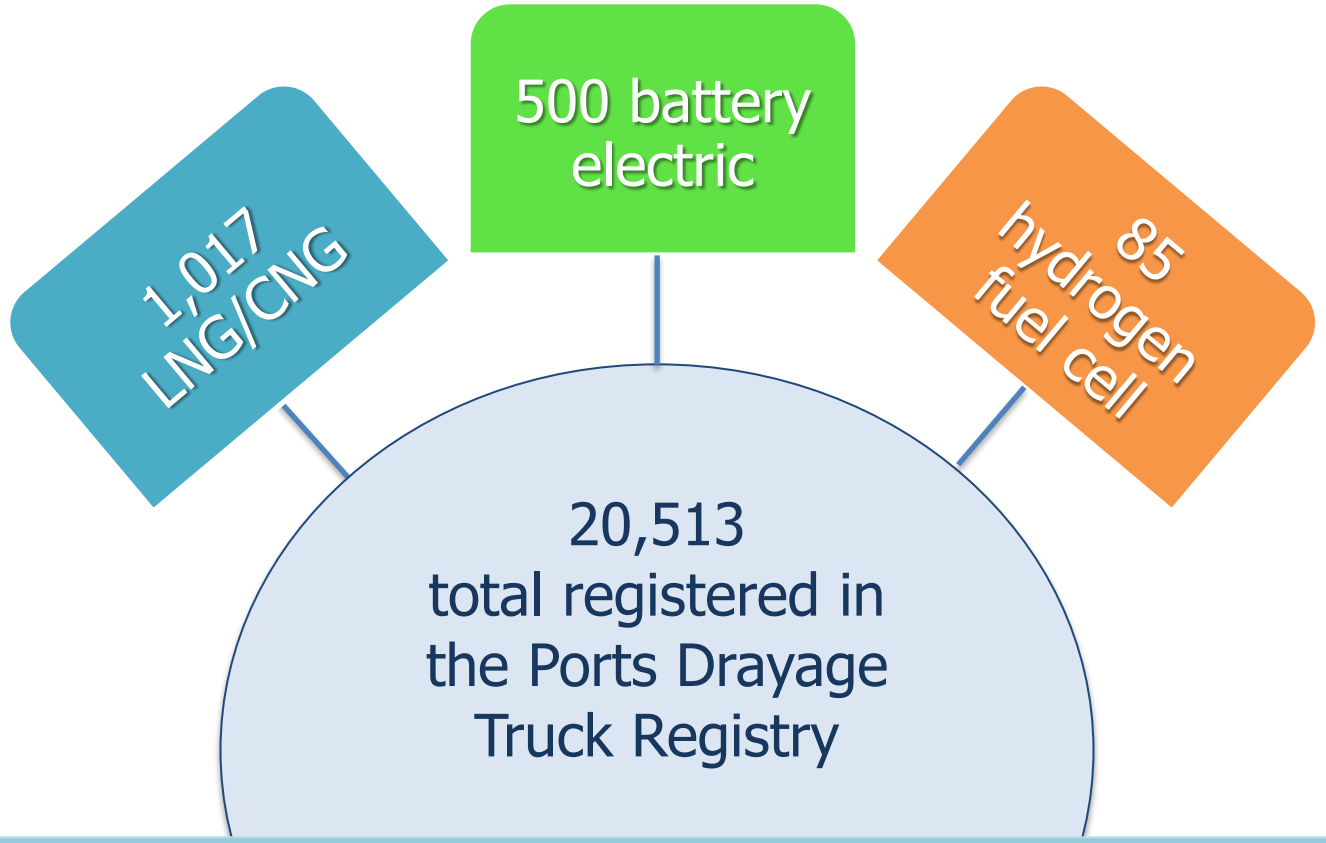
Amber Coluso – Port of Los Angeles
Air Quality Environmental Specialist

Diana Thai – Port of Long Beach
Environmental Specialist



Ports Trucks Today*

*As of June 2025



Model Year and Moves	
2014 and newer	• 14,341 trucks • 94.16% of moves
Meet 2010 EPA standards	• 99.95% of trucks • 99.95% of moves
2007-2009 engine year	• 0.05% of trucks • 0.05% of moves

LNG/CNG = Liquefied Natural Gas/Compressed Natural Gas; EPA = Environmental Protection Agency

Clean Truck Fund (CTF) Rate Status

- Collection began at both Ports on April 1, 2022
- ~$2-4 million collected by each port monthly
- As of May 2025, ~$252 million has been collected by Ports
- $141 million allocated to zero-emission (ZE) trucks and infrastructure

CTF Rate Revenue Spending Priorities

- Each Port develops CTF Rate Spending Plans for approval by our respective Board of Harbor Commissioners
  - Both Ports have prioritized truck and infrastructure incentives
  - Both Ports have also allocated funds for innovative concepts and ZE pilot project deployment and demonstration

POLA Early ZE Truck Deployment

- POLA released a Request for Proposal (RFP) (in 2021) for ZE trucks and associated infrastructure
- POLA Board approved two proposals for a total of $6 million
  - One project has deployed all 10 trucks
  - Second project has received 12 trucks and waiting for infrastructure installation (estimated completion Quarter 4 2025)
    - Truck operator is looking for alternative charging site until construction completion

U.S. EPA Clean Ports Program

POLA awarded
~$412 million

- Electric cargo handling equipment and drayage trucks
- Charging Infrastructure, solar generation, and battery energy storage system
- Vessel shore power

U.S. EPA Clean Ports Program (continued)

- Includes funding a community-led $50 million ZE grant program and workforce development
- ZE Truck Incentive RFP
  - $50 million of EPA grant funding
  - $25 million of POLA CTF revenue
  - Expected release = Quarter 3 2025

Ports' Plus-Up Program

Ports' Plus-Up Program

- Using CTF Rate funds, Ports provided additional funding (plus-ups) to CARB's HVIP vouchers

Program Details

- Opened November 2023 with $60 million, closed in October 2024
- $150,000 CARB HVIP Voucher + $75,000 plus-up OR $100,000 for fleets with less than 20 trucks

Reopening Late 2025

- Due to voucher cancellations and Nikola bankruptcy, CARB expected to reopen HVIP with returned funds and for Port plus-ups as well

CARB's HVIP = California Air Resources Board Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project

ZE Truck Voucher Incentive Program

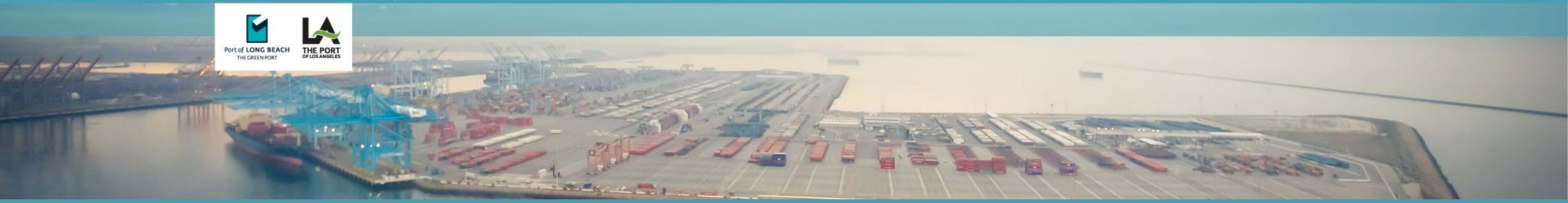
Port Voucher Program

- Based on public feedback, Ports developing a stand-alone voucher program
- Ports are developing guidelines and aiming to request Board approval later this year

Proposed Program Elements

- Voucher amounts: $100,000 - $200,000 per truck
- No fleet size limit
- Cap on number of vouchers/fleet/year
- Stacking with SCE, SCAQMD, and HVIP allowed

SCE = Southern California Edison; SCAQMD = South Coast Air Quality Management District



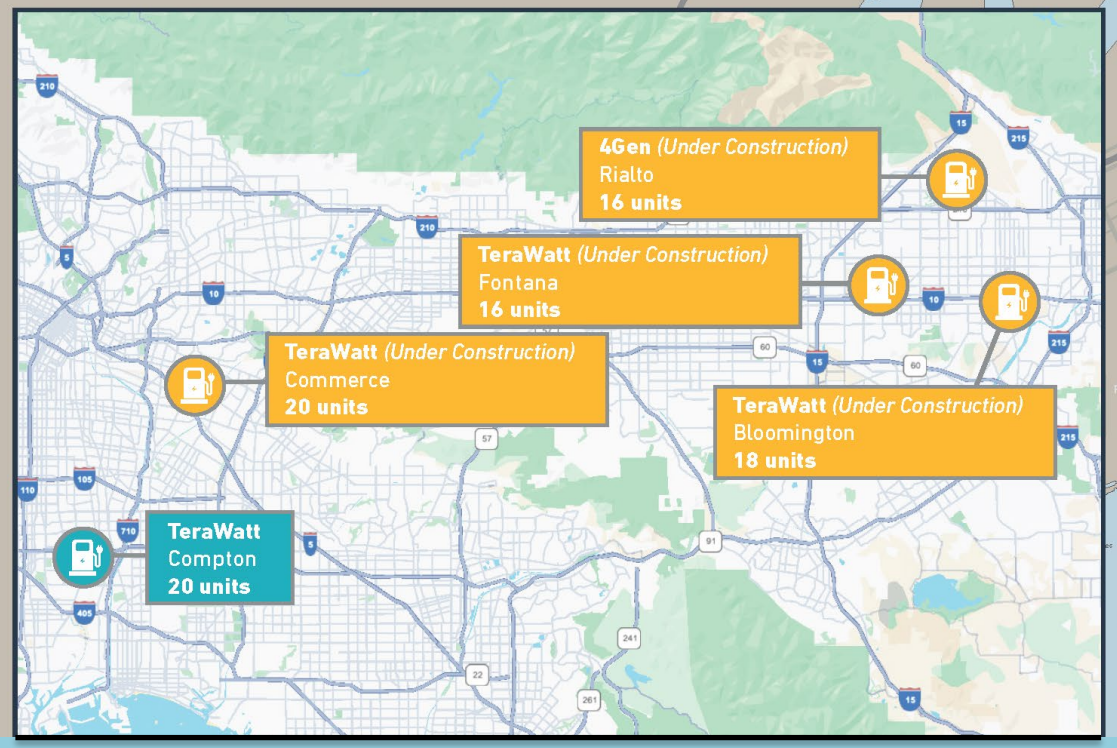
Public Charging Infrastructure

- POLB accepted solicitations for public charging stations at two sites
  - Both sites, 1) Terminal Access Center and 2) Pier B/Carrack Ave, are under real estate negotiations
- POLA released an RFP for a site in Wilmington in January 2024
  - Selection and CEQA analysis has been completed
  - Expected to go to POLA Board Fall 2025

Public Charging Infrastructure (continued)

TOTAL: 313+ Charging Units

- Operating
- Under Construction
- Proposed



Clean Energy *(Under Construction)*
3 units

Pier B Street/Carrack Avenue
(In Negotiation)

I Street Charging Depot
(In Negotiation)

Clean Truck Terminal Access Center
2 units
(In Negotiation)

WattEV
30 units

Forum Mobility
44 units

Zeem *(Under Construction)*
84 units

4Gen Logistics
Up to 60 units

Port of LONG BEACH THE GREEN PORT

LA THE PORT OF LOS ANGELES

Regulatory Landscape

- CARB withdrew its request for a waiver for the Advanced Clean Fleets (ACF) Regulation
  - Ports are still committed to CAAP goal of 100% ZE trucks by 2035
- Port staff continuing to meet with partners (i.e., CARB, utilities) to identify strategies to continue ZE truck adoption and maximize funding

Next Steps

Continue to monitor CTF Rate implementation and spending plan roll-out

Continue plus-up voucher program

Develop additional strategies to advance ZE truck deployment

Complete ongoing public charging depot infrastructure projects

Next Steps


Thank you!

Update on 2024 Feasibility Assessment for Class 8 Drayage Trucks

August 5, 2025

Class 8 Drayage Truck Feasibility Assessment

Required as part of the 2017 San Pedro Bay Ports Clean Air Action Plan (CAAP)

3 Updated every three years

Assess feasibility of battery-electric or hydrogen-powered drayage trucks.

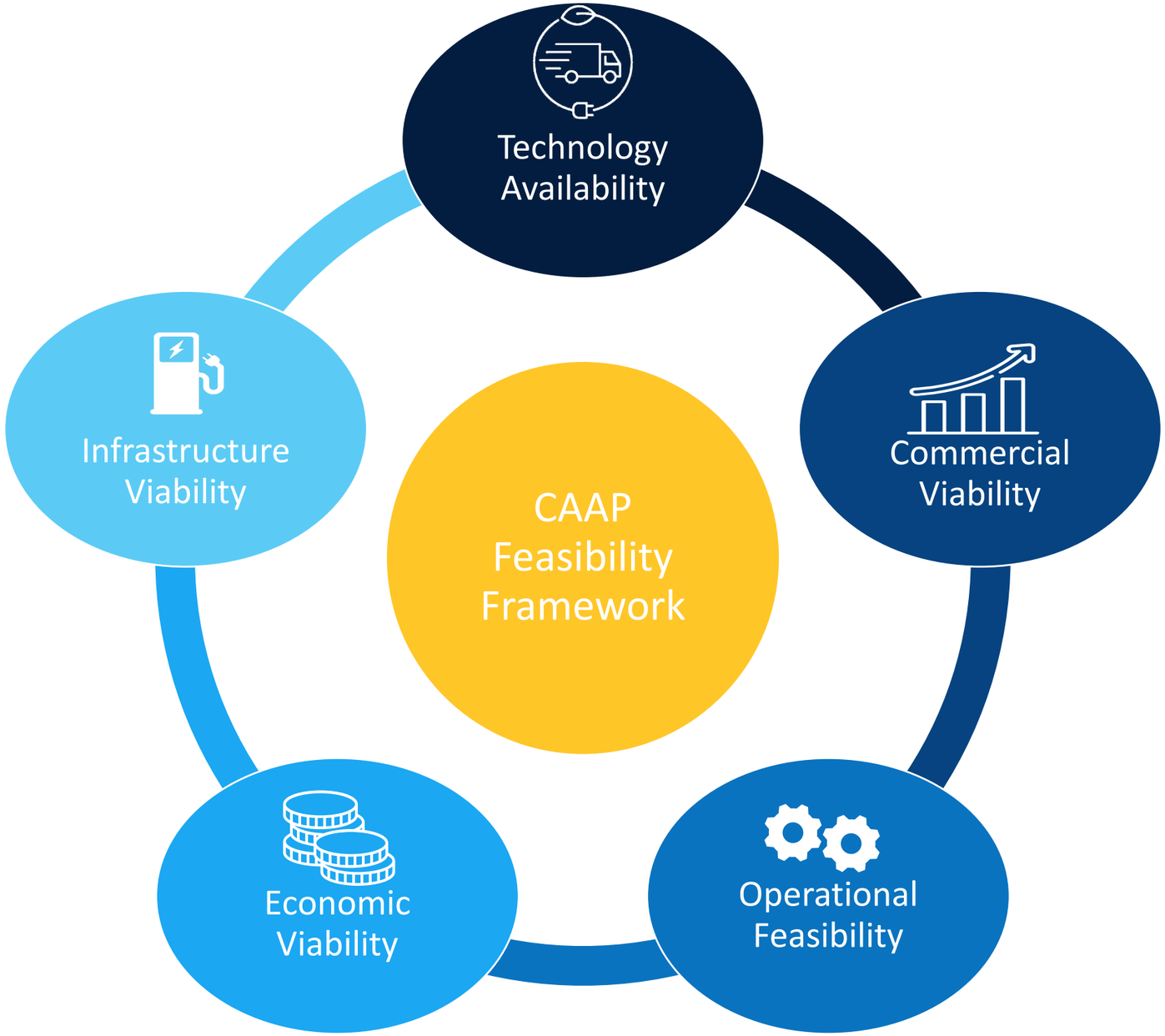
Analyze the operational feasibility and requirements for implementing zero emission (ZE) technology in port operations

Examine the readiness of supporting infrastructure and evaluate economic considerations

Public engagement through CAAP stakeholder meetings

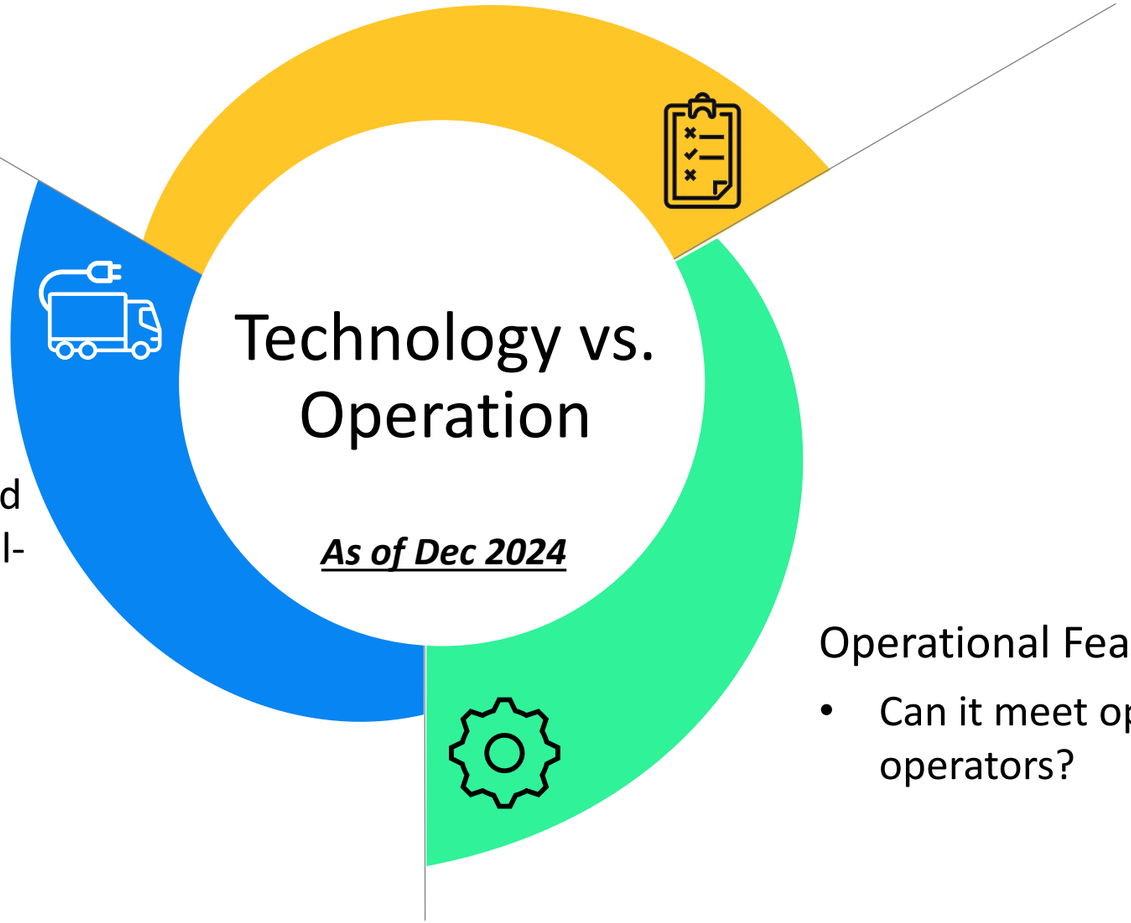
Ports' Clean Air Action Plan – Feasibility Assessments

Clean Air Action Plan (CAAP) Feasibility Assessment Criteria



Commercial Viability

- Manufacturing Capability
- Production Timelines
- Support Services



Technology Availability

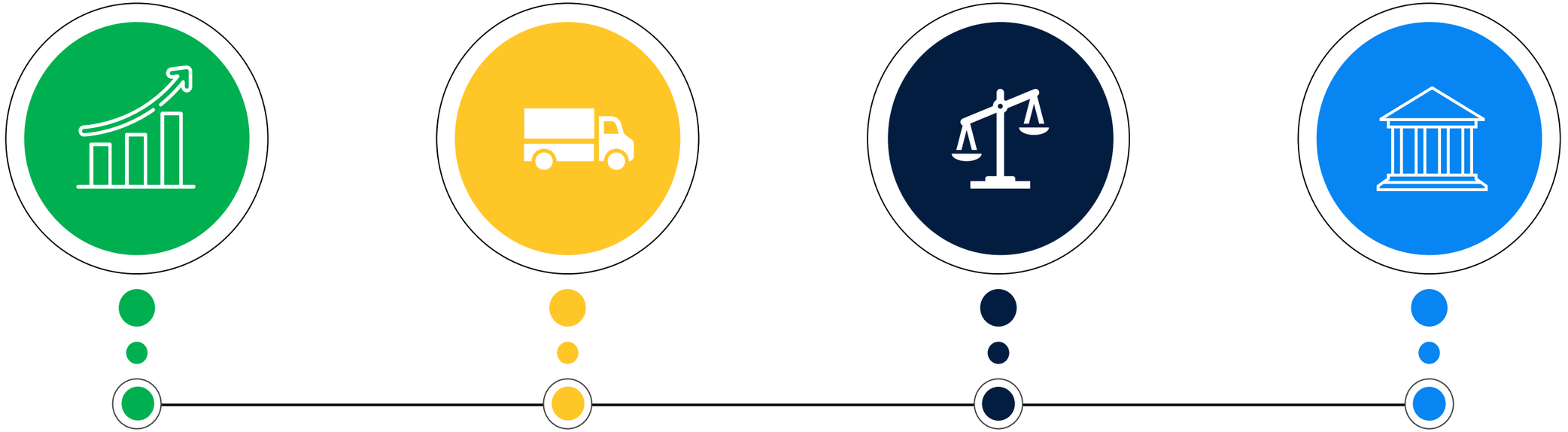
- Is the technology proven and ready for deployment in real-world conditions?
- Does it meet the necessary performance standards?

Operational Feasibility

- Can it meet operational needs of drayage operators?

Previous presentation can be found at:
https://cleanairactionplan.org/about-the-plan/stakeholder-advisory-group/

Technical and Commercial Viability



Commercial Readiness

ZE trucks reached commercial maturity by end of 2024

Model Availability

- 7 Battery Electric Truck (BET) models available (150–330 mile range)
- 6 Fuel Cell Electric Truck (FCET) models available (249–500 mile range)

Weight & Charging

- Heavier curb weights (8,000 lbs. more than diesel)
- BETs have slow charging rates, requiring megawatt-level charging

Build America Buy America Act (BABA) Compliance

Limited domestic compliance raises production costs and causes delays

Operational Viability

BETs suit **short-haul**, single-shift routes (<150 miles), with approximately 75% of operators able to use them for these trips.

FCETs offer longer range and rapid refueling (12–20 mins), making them ideal for **longer routes (150-250 miles)** and two-shift operations.

FCET infrastructure is limited, constraining broader deployment.

Payload limits due to heavier curb weight reduce profitability. Only approximately 67% of operators can manage these constraints.

Economic Viability

- Evaluate costs associated with adopting ZE technologies compared to traditional diesel baselines

ZE Infrastructure Accessibility

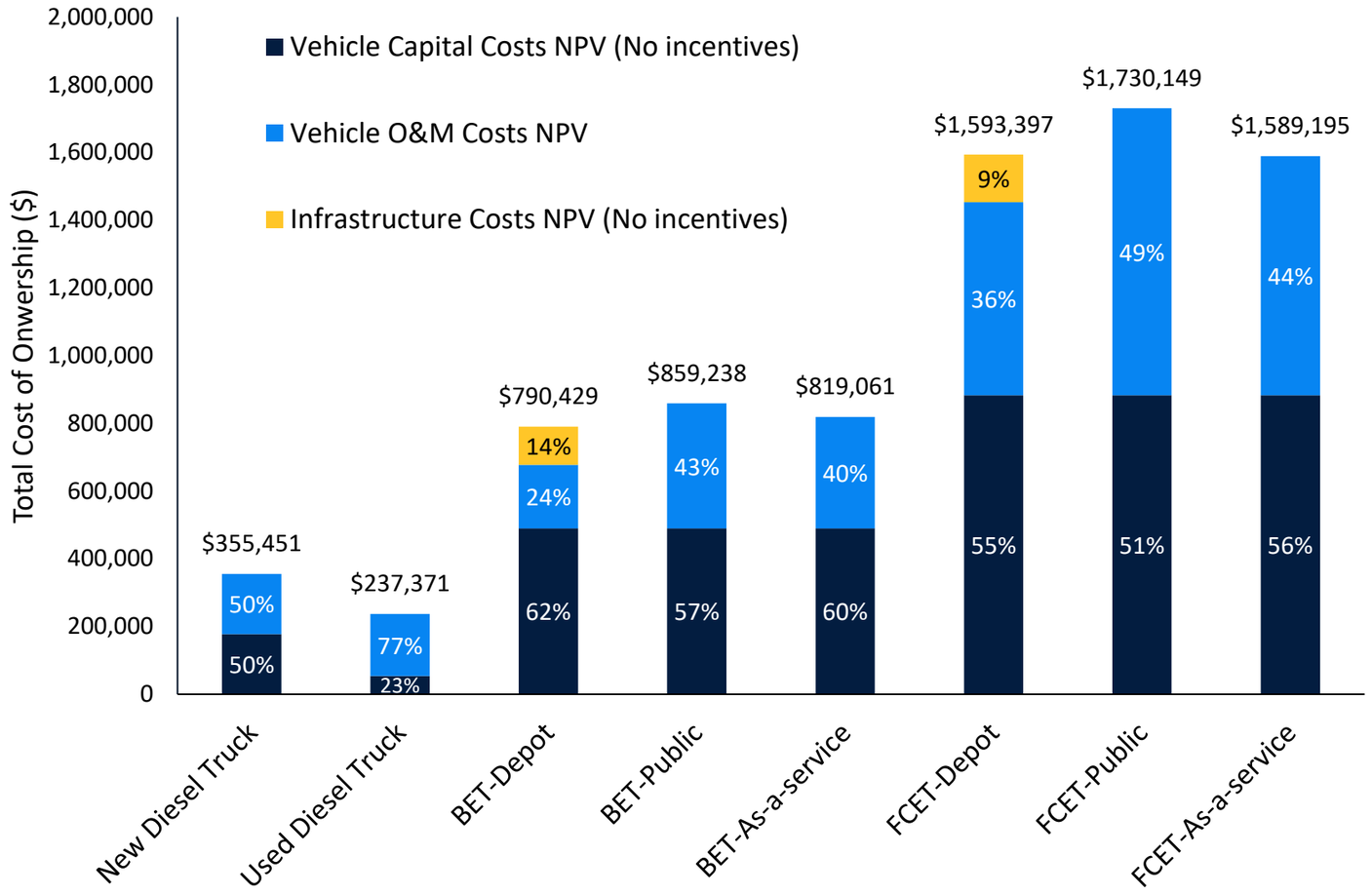
- Identify infrastructure gaps and estimate necessary charging and refueling needs

Previous presentation can be found at:
https://cleanairactionplan.org/about-the-plan/stakeholder-advisory-group/

Economic Viability

Total Cost of Ownership (TCO) Results

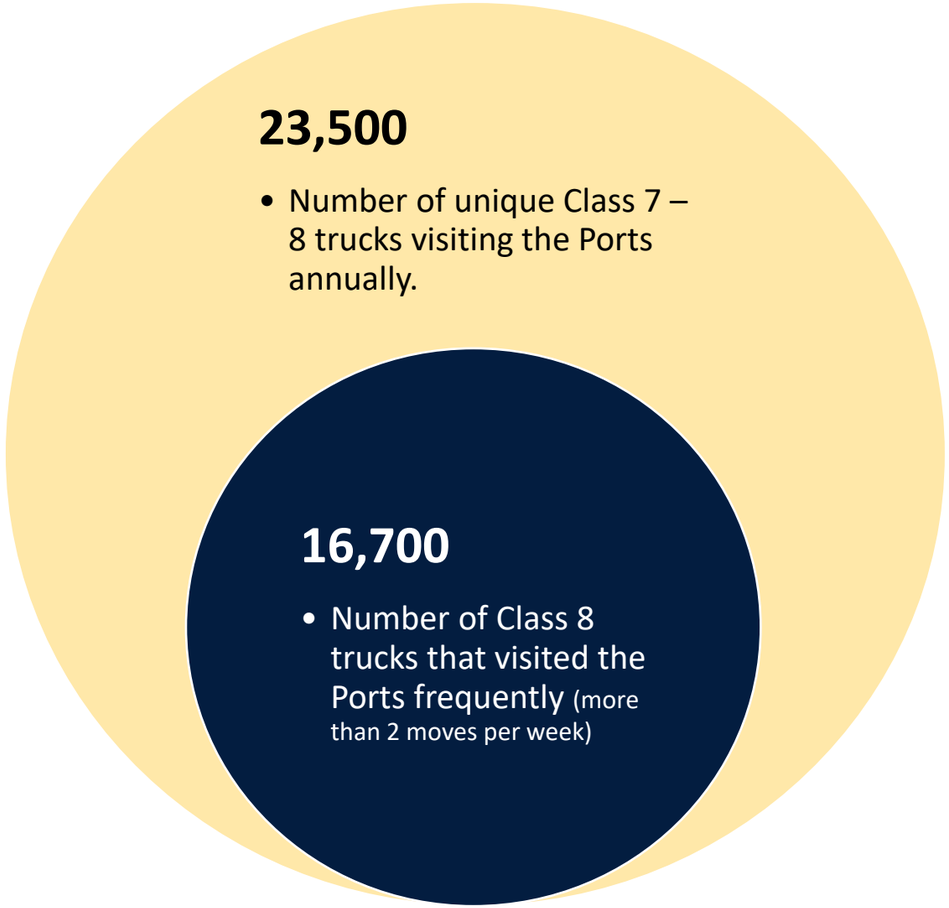
- BET TCO is 2–2.4x higher than new diesel trucks; FCET TCO is 4.5–5x higher.
- Used diesel trucks have the lowest TCO.
- Depot charging offers lower energy costs than diesel; public charging and hydrogen are more expensive.
- Incentives reduce BET TCO by up to 34% and FCETs by 16–21%, but diesel trucks remain most affordable.



Notes: Net Present Value (NPV) at 5% discount rate; Costs adjusted to 2024 dollars.
NPV is a financial metric that calculates the profitability of an investment by subtracting the present value of cash outflows from the present value of cash inflows, accounting for the time value of money

Charging and Refueling Infrastructure Needed for Full Transition to ZE

Class 8 drayage truck inventory

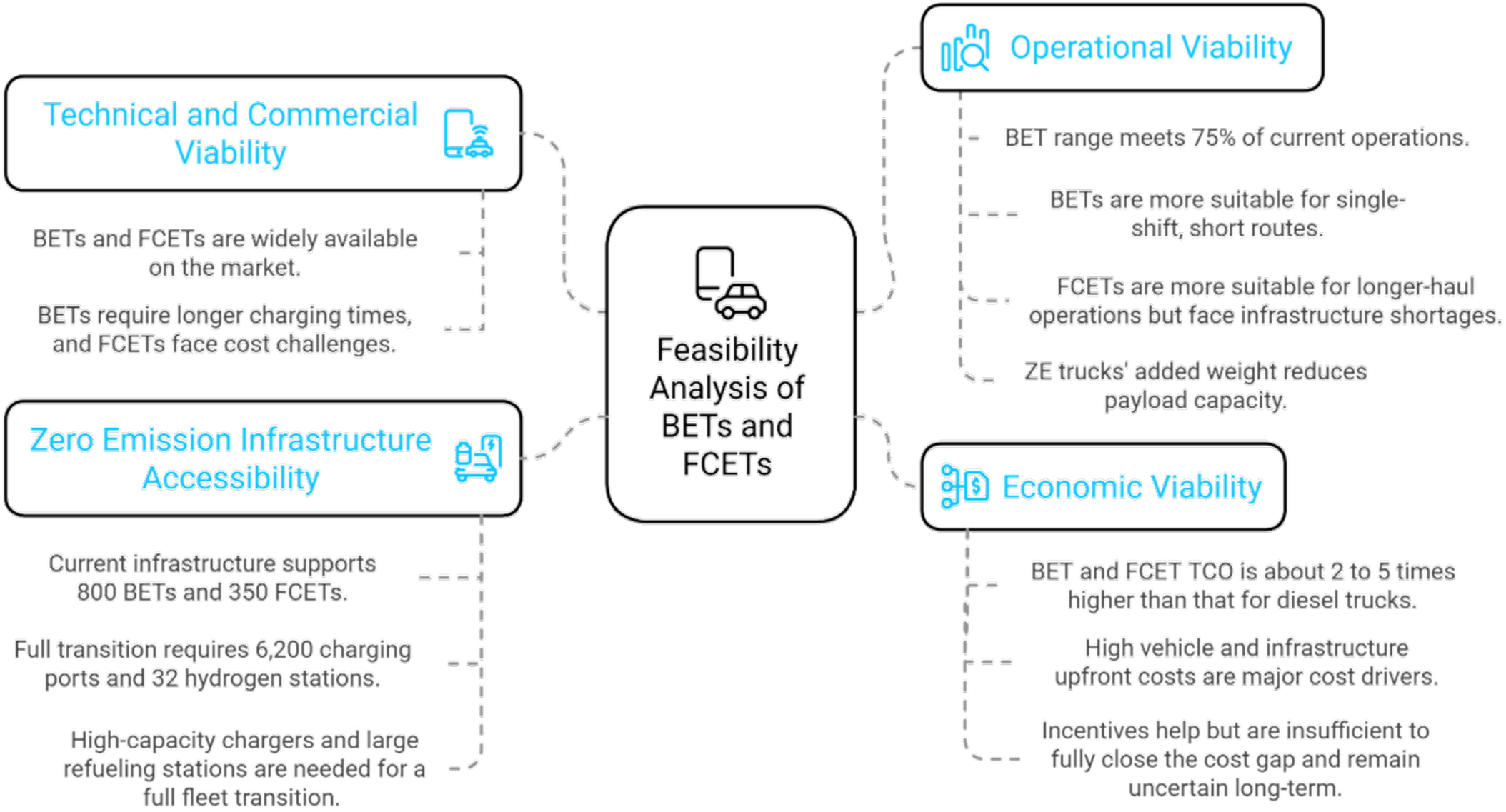


There is a need for a total of **6,200 charging ports** and **32 hydrogen refueling stations** in the region for a full transition to ZE trucks

Fuel type	Number of Class 8 ZE trucks	**Existing** operational or in development infrastructure	Number of charging ports / hydrogen refueling stations **Needed** in the region*
Battery electric trucks (BETs)	15,000	462 charging ports *(can support up to 800 BETs)*	6,200 charging ports
Hydrogen fuel cell electric trucks (FCETs)	1,700	6 hydrogen refueling stations *(with a total of 25,200 kg/day refueling capacity can support up to 350 FCETs)*	32 hydrogen refueling stations *(with a total of 123,200 kg/day refueling capacity)*

** This includes the existing infrastrcture*

Overall Feasibility



Comparison with Previous Assessments

Commercial Maturity

In 2018, only 1 BET model existed (pre-commercial); By 2024, 7 BET and 6 FCET models are commercially available.

Infrastructure

Charging and hydrogen refueling options remain limited but have expanded significantly since 2018.

Technology

BET range increased from 100–150 miles (2018) to up to 330 miles (2024);
By 2024, FCETs entered market for first time.

Previous Feasibility Assessments: 2018, 2021

Cost

Despite progress in narrowing the gap, ZE trucks still have much higher TCO than diesel.

There is still a long way to achieve full market maturity and widespread adoption. Continued investments, policy support, and infrastructure expansion will be critical to closing cost gaps and enabling broader ZE truck adoption.

Summary of Public Input

- ✓ Review public input
- ✓ Update feasibility assessment report
- ✓ Publish final feasibility assessment report

- **TCO analysis lacks nuance** – Uses uniform assumptions that don't reflect differences between owner-operators and large fleets.
- **Assumptions skewed against BETs** – Depreciation, interest rates, and labor costs overstate BET costs and understate diesel costs.
- **Survey sample too small and biased** – Only 42 out of 2,156 companies responded; results may reflect anti-regulatory bias and are not statistically valid.
- **Truck ownership time underestimated** – TCO assumes 5-year truck life, while real-world data and CARB's ACF analysis use 12 years, inflating ZE truck costs.
- **Fuel economy for diesel trucks too high** – Assessment uses 7.7 mpg (long-haul average); drayage trucks are closer to 5.1 mpg, which underestimates diesel costs.
- **Missing TCO components** – Excludes tax depreciation benefits for ZE trucks and omits the $10/TEU Clean Truck Fund fee for diesel trucks.
- **Incentives not properly factored** – Fails to account for Clean Truck Fund and HVIP, which significantly reduce BET costs.
- **Charging needs overestimated** – Most drayage trips are under 100 miles; midday charging rarely needed.
- **Hydrogen analysis misleading** – Ignores safety, cost, and environmental concerns; groups hydrogen with BETs inaccurately.

12

Questions?

Thank you!

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SAN PEDRO BAY PORTS

2024 CARGO HANDLING EQUIPMENT FEASIBLITY ASSESSMENT

CAAP Stakeholder Meeting
August 5, 2025

AGENDA

CAAP Stakeholder Meeting

August 5, 2025

1. Approach Review
2. Feasibility Assessment Results
3. Schedule / Next Steps

BURNS McDONNELL

ZE CHE Feasibility Assessment Approach

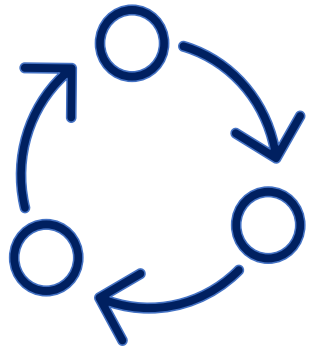
In-Scope Equipment

- Assessment of the following zero emission (ZE) cargo handling equipment (CHE) technologies: battery-electric (BE) and hydrogen fuel cell (HFC) for:
  - Yard Tractor
  - Top Handler
  - Large-Capacity Forklift (36,000+ lbs)
  - Rubber-tired gantry crane (RTG), including grid electric

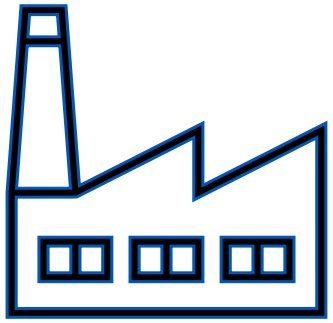
Feasibility Assessment Approach

2017 CAAP Update Framework for Developing Feasibility Assessments - Parameters

Technical Viability



Infrastructure Availability



Commercial Availability

Operational Feasibility

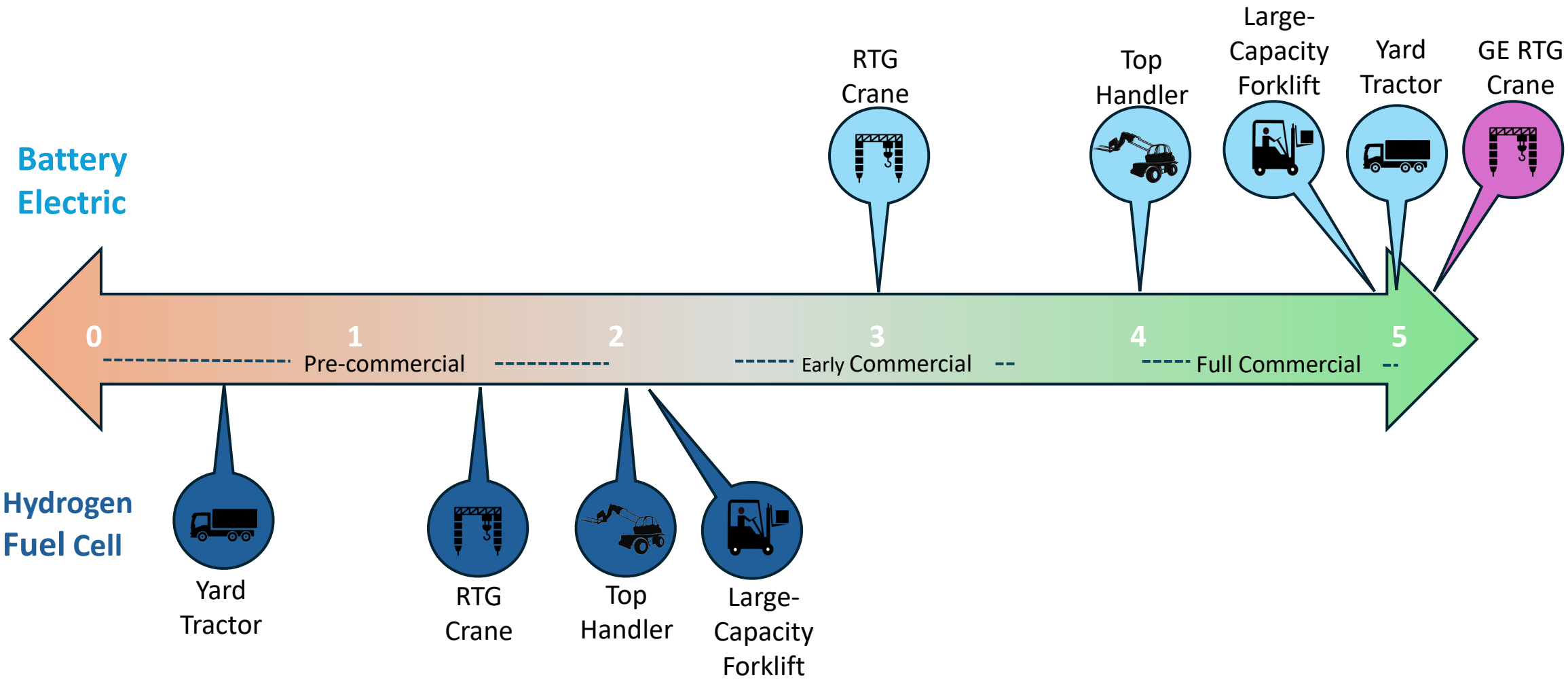
Economic Workability

Commercial Availability

Assessment Parameters

- Production and Certification by Major OEMs
- Network of Dealerships to Sell and Service CHE
- ZE CHE Include Warranties and Long-Term Support
- Ability to Manufacture CHE to Meet Current/Forecasted Demand
- Backlog of CHE Orders or Credible Expression of Interest

Commercial Availability

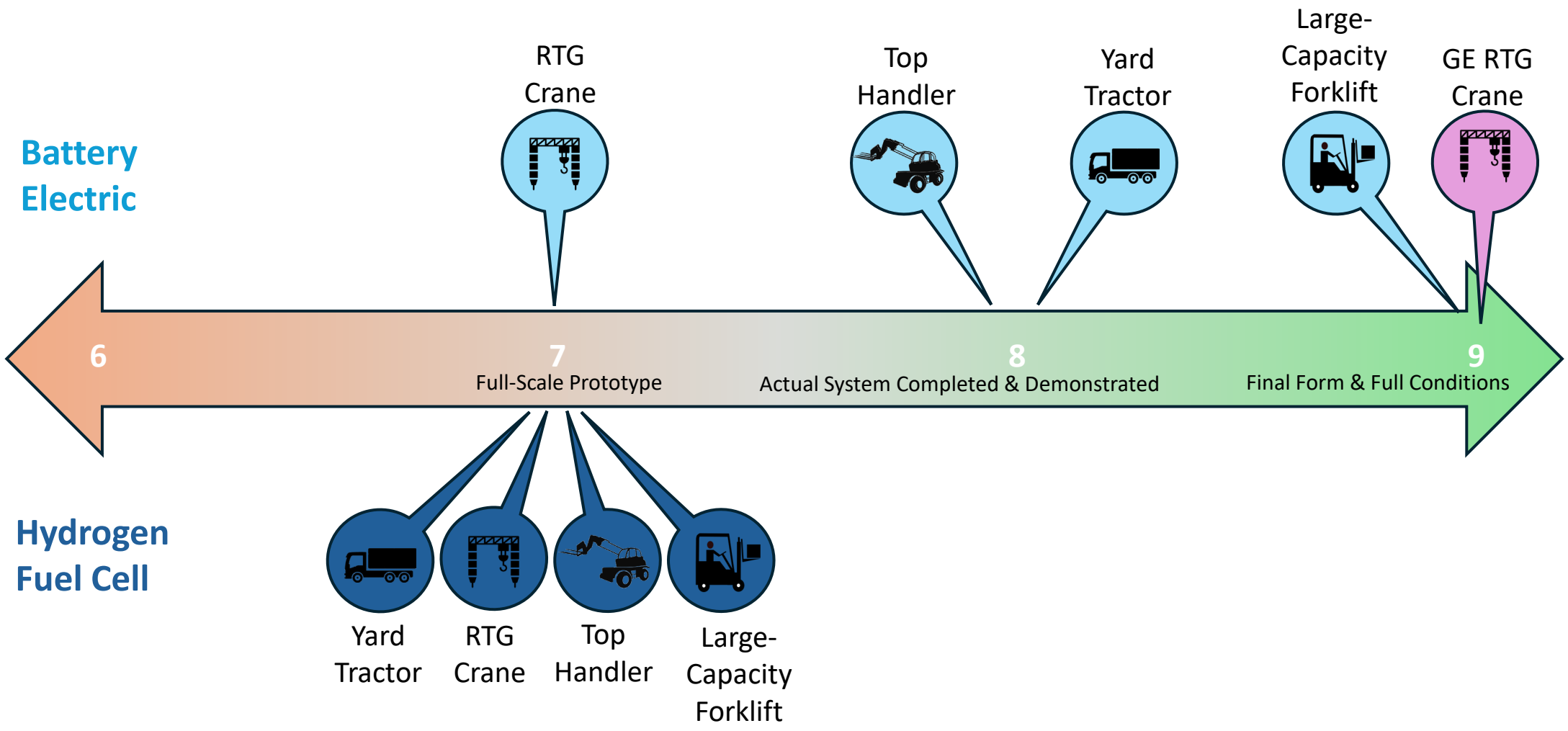


ZE CHE Assessment

Technical Viability

Relative Stage of Development	Technology Readiness Level (TRL)	Department of Energy TRL Definition
Systems Operations	TRL 9	Actual system in its final form and operated under full range of operating conditions.
Systems Conditioning	TRL 8	Actual system completed and qualified through test and demonstration. The technology has been proven to work in its final form and under expected conditions.
Systems Conditioning	TRL 7	Full-scale similar prototype system demonstrated in relevant environment.
Technology Demonstration	TRL 6	Engineering/pilot-scale system validation in relevant environment.

Technical Viability

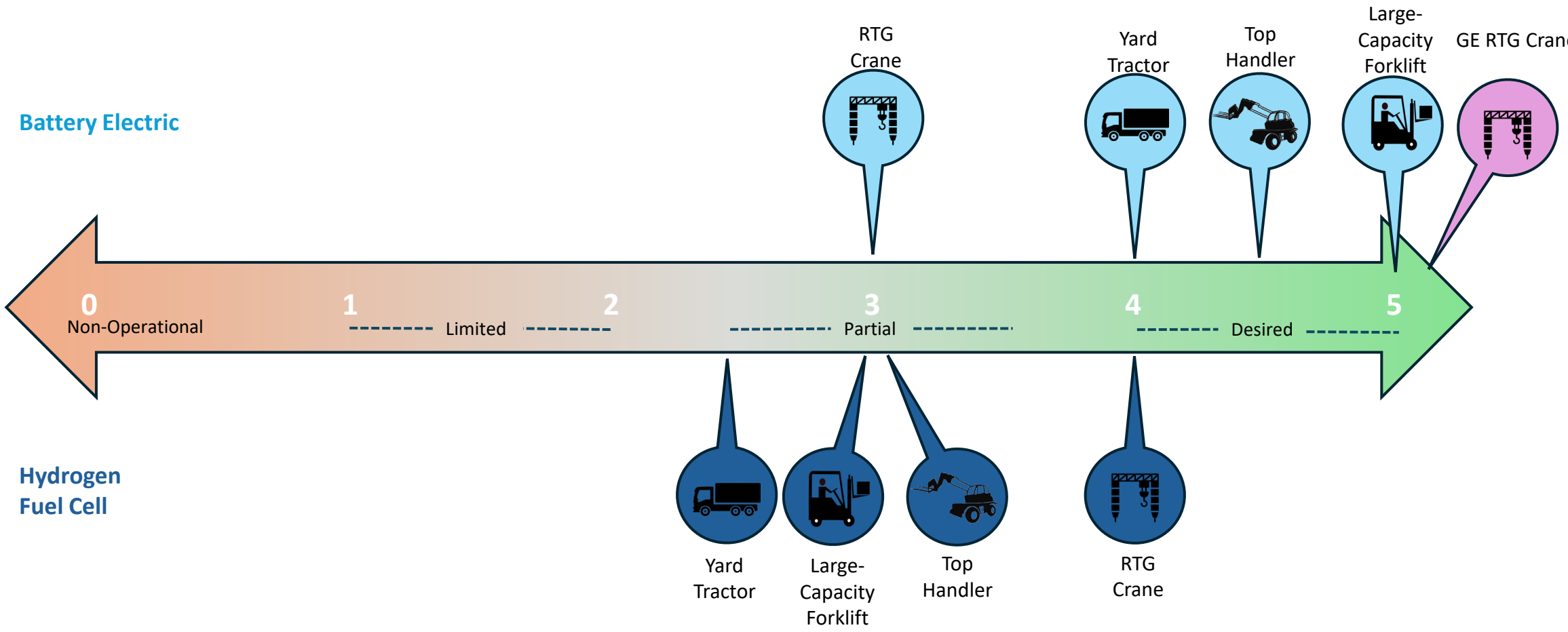


Operational Feasibility

Assessment Parameters

- Capability to Meet MTO Performance Parameters
- Ability to Meet Per-Shift and Daily Operating Time Requirements
- Fueling / Charging Speed Meets Revenue Operation Requirements
- Operator Comfort, Safety, and Fueling Procedures
- Available Parts, Maintenance, Training, and Manuals

Operational Feasibility

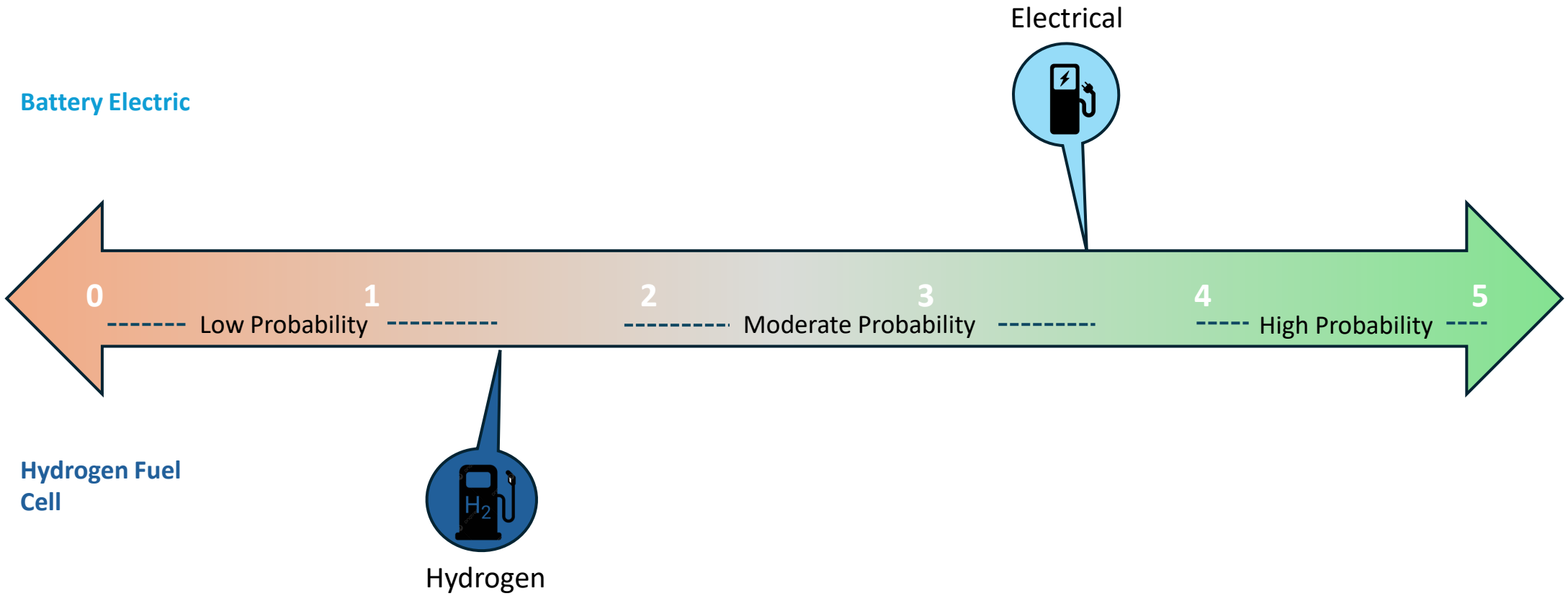


Fuel and Infrastructure Readiness

Assessment Parameters

- Charging / Fueling Technology Readiness
- Terminal Infrastructure Deployed for Full ZE Transition
- Sufficient Utility Capacity or Fuel Supply for Full ZE Transition
- Infrastructure Buildout Stage (Planning, Design, Procurement-Construction)
- Existing Codes and Standards / Successful Installation at Terminals

Fuel and Infrastructure Readiness

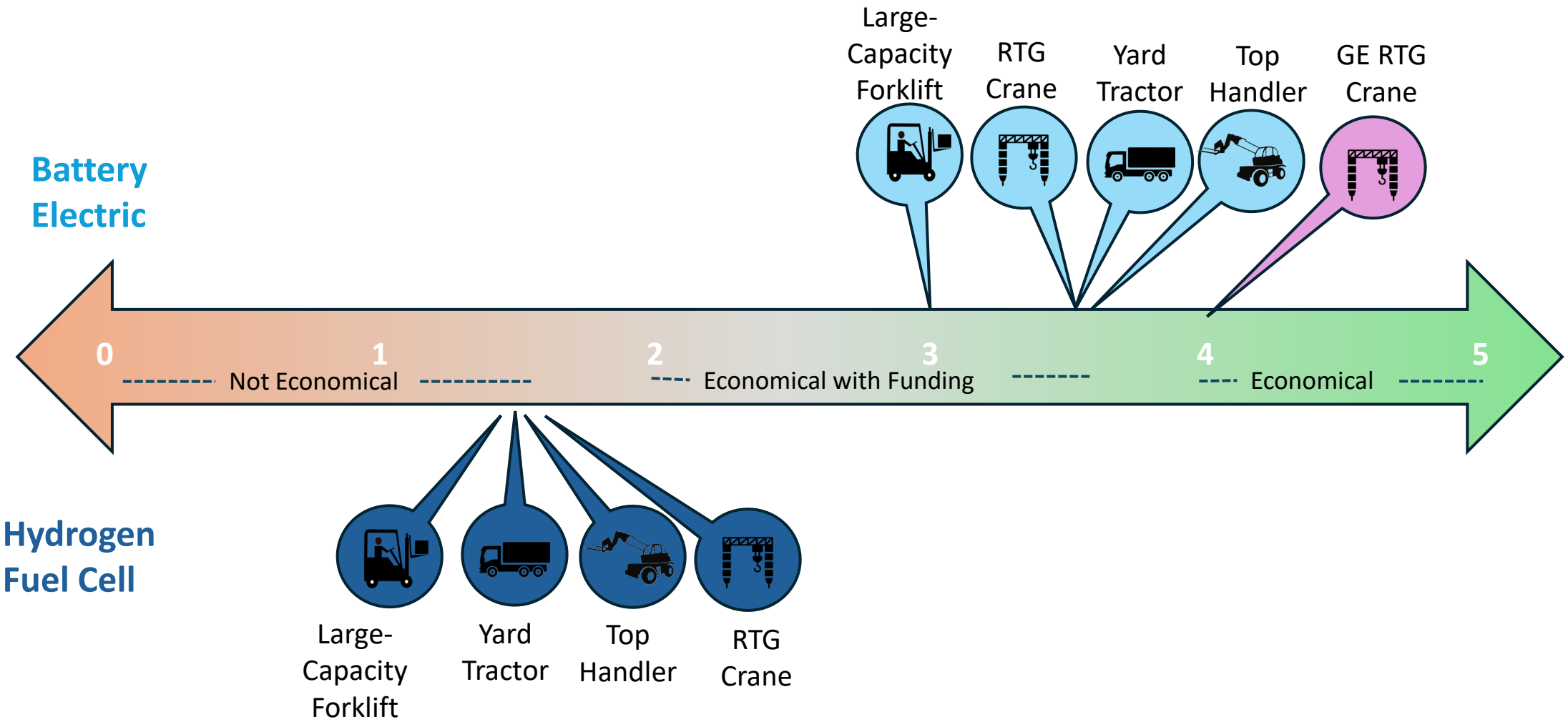


Economic Workability

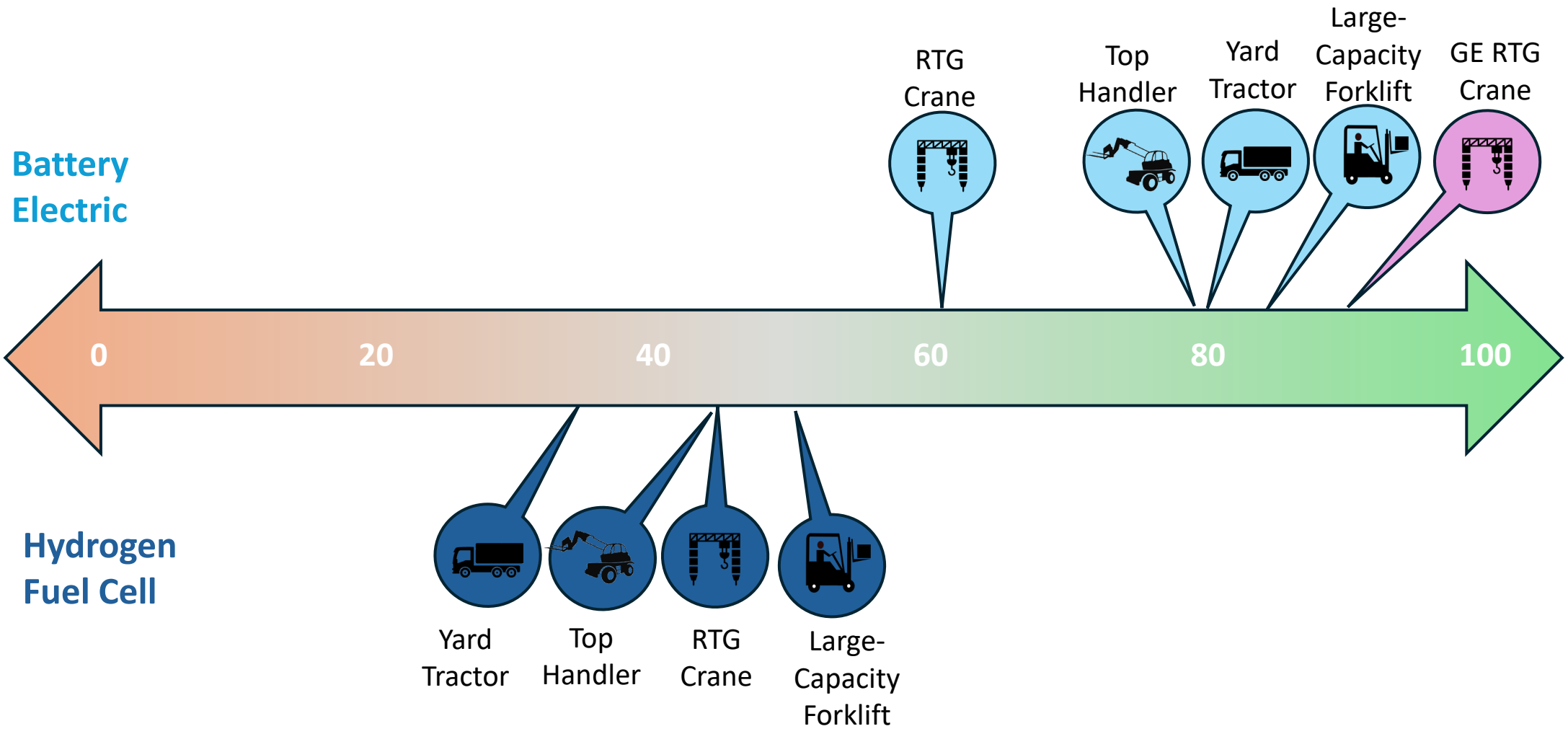
Assessment Parameters

- ZE CHE Purchase Price is Affordable to MTOs / Comparable to Diesel CHE
- ZE CHE O&M Cost is Comparable to Diesel CHE
- Infrastructure Capital and Operational Costs are Affordable to MTOs
- No Major Economic / Workforce Impacts
- ZE CHE Total Cost of Ownership is Affordable to MTOs / Comparable to Diesel with Available Incentives through 2030

Economic Workability



Overall Feasibility



Schedule / Next Steps

Milestones

- ✓ Research/Data Reviews: **July - September 2024**
- ✓ OEM/Operator Interviews: **September - November 2024**
- ✓ Develop Assessment: **December 2024 - June 2025**
- > Peer Review Period: **July - August 2025**
- > Drafts for Public Comment: **September 2025**
- > Public Review Period: **September-October 2025**
- > Final Assessment: **October 2025**