H₂ Fuel Cells at Ports: An Overview

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EPA’s Work to Improve Air Quality Around Ports

• **Regulatory Standards** for emissions from new trucks, vessels, and equipment as well as sulfur levels in fuels.

• **Non-Regulatory Efforts** to advance next-generation, clean technologies and practices at ports.
Vision for EPA’s Ports Initiative

People living and working near ports across the country will breathe cleaner air and live better lives as a result of bold steps taken through a collaboration of industry, government, and communities to improve environmental performance and increase economic prosperity.

- Stakeholders asked EPA to do more.

- In 2013, begin to gather specific feedback and recommendations, including through formal federal advisory committee.
Funding
Helping Ports Capitalize on Funding for Clean Technologies

Technical Resources
Providing Tools to Help Identify Smart Infrastructure Investments

Collaboration
Promoting Port-Community Collaboration for Effective Planning

Coordination
Increasing Efficiency in Federal Government and Port Operations

Communications
Creating a Knowledge Clearinghouse
Technical Resources

Providing Tools to Help Identify Smart Infrastructure Investments

**National Port Strategy Assessment: Reducing Air Pollution and Greenhouse Gases at U.S. Ports, 2016**

**Shore Power Technology Assessment at U.S. Ports, 2017**

**EPA, Port Everglades Report Shines Light on New Methods for Analyzing Potential Air Pollution Reductions, 2018**
Upcoming – Fuel Cells at Ports

**Purpose**: To develop a report that characterizes fuel cell technology applications at ports, how they can be best utilized.

Fuel cell technologies have the potential to replace diesel engines across a variety of sectors (i.e. marine, rail, and nonroad) and thus significantly reduce diesel emissions at ports.
Why is EPA Interested?

Seek to use H₂ fuel

Provide users with confidence that technology will perform as expected

EPA does not provide funding for research purposes

Looking for fuel cells commercially available for port application

Offer funding assistance for market-ready fuel cell technologies
Project Overview

Expected Report Contents:
• Detail background information on fuel cells
• Identify current applications of fuel cells across U.S. ports
• Emissions and cost effectiveness analysis of fuel cells
• Economic analysis of fuel cells
• Future projection focused on commercial viability of fuel cells

Expected Outcomes:
• Assist EPA and port stakeholders in evaluating the technology
• Estimate potential emissions impacts for nonroad, marine, and heavy-duty applications
• Guide the use of these technologies in the DERA program

Note: This research is still preliminary and under review.
H₂ Fuel Cells

ADVANTAGES

• Zero tailpipe emissions
• Fuel efficient
• Minimal noise
• Quick & simple refueling
• Modular, scalable
• More efficient than combustion engines

DISADVANTAGES

• Expensive (production, storage, transport)
• Can be sensitive to fuel impurities
• H₂ is highly flammable
• Most H₂ is produced by SMR which emits CO₂
• Not as efficient as batteries

**FCEV Technology Readiness Levels – 2019 Update**

- **Demonstration**
  - Tech D&D, Early Stage Demonstrations
  - TRL 5-6

- **Pilots**
  - Advanced Technology Demonstrations, Pilots
  - TRL 7-8

- **Commercial**
  - Early Market Entry
  - TRL 9

Key:
- Off-road shown in red
- AGV = automated guided vehicle
- GSE = ground support equipment
- CHE = cargo handling equipment
- TRU = transport refrigeration unit

Source: CALSTART (2019).
Recent Fuel Cell Demonstrations & Deployments at U.S. Ports

Identified 22 fuel cell projects at ports

- CA – 17 (77%)
- HI – 2
- CT – 2
- MD – 1

Port LA/Long Beach – 14 (~63%)

11 projects in design phase; 8 in demonstration phase
Type of Recent Fuel Cell Demonstrations & Deployments at U.S. Ports

- Drayage Truck – 7
- Power Generation – 5
- Yard Tractor/Top Loader – 4
- H2 Refueling Station – 4
- Portable Light Tower – 1
- Ferry Boat – 1

Source: Toyota Motor North America, Inc., 2017
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Funding Opportunities

Go to https://www.epa.gov/ports-initiative/funding-ports-and-near-port-communities

Funding for Ports and Near-Port Communities

- Funding Opportunities for Ports and Near-Port Communities
  View a list of funding opportunities to assist port facilities or nearby communities in reducing emissions and improving the environment while increasing efficiency.

- Tips For a Successful Grant Application
  View helpful tips and resources to help you write a successful grant.

- Overview of Clean Diesel Grants Awarded for Ports Projects
  View a summary of funding information and project details for ports-only projects funded through clean diesel grants.
DERA authorizes funding assistance to reduce diesel emissions from legacy engines and provide immediate health & environmental benefits to target areas.

There are 4 components to DERA: national competitive grant, rebate, tribal grant, and state grant programs.
DERA Cost-Share Funding

Fuel cells can be funded as a replacement.

Funding levels vary based on the technology cost share.

- Diesel – up to 25%
- Alternative fuel/ Hybrid – up to 25%
- Engine Certified to meet CARB Optional Low-NOx Standard – up to 35%
- Zero Tailpipe Emission – up to 45%
- Drayage Replacement (MY 2013 or newer) – up to 50%

Note: DERA grant priorities and cost share could change for FY2020
https://www.epa.gov/cleandiesel
Since 2008, fleets at marine & inland water ports have been a priority for DERA grants with ~$148 million spent on 152 clean diesel port projects (2008-2018).
Only one fuel cell project funded w/DERA.

In 2017, awarded four transit buses in Canton, OH

EPA welcomes fuel cell technology applications
What’s Next?

Expected Outcomes:

• Assist EPA and port stakeholders in evaluating the technology
• Estimate potential emissions impacts for nonroad, marine, and heavy-duty applications
• Guide the use of these technologies in the DERA program

Interested in learning about technologies ready for commercial sale/use

Report Expected ~December 2019
Thank You

EPA’s Port Initiative website, including newsletter sign-up: https://www.epa.gov/ports-initiative

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