H_2 Fuel Cells at Ports: An Overview

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OFFICE OF TRANSPORTATION AND AIR QUALITY
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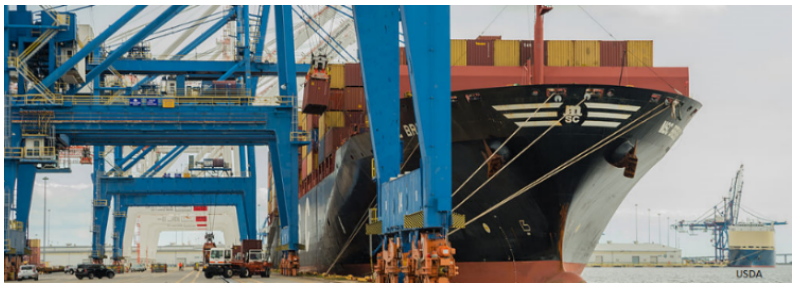
EPA's Work to Improve Air Quality Around Ports

- **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.

EPA PORTS INITIATIVE

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

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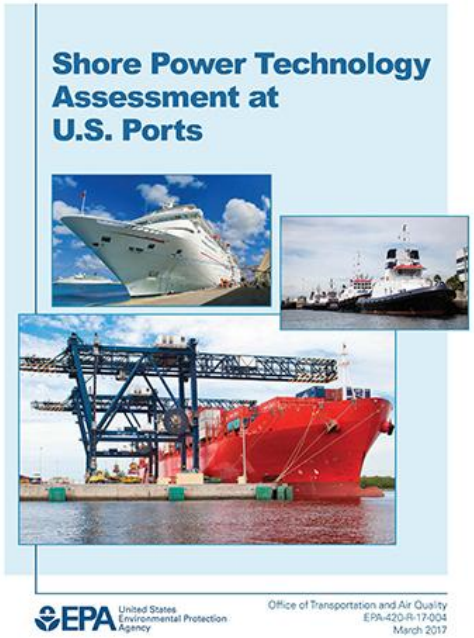
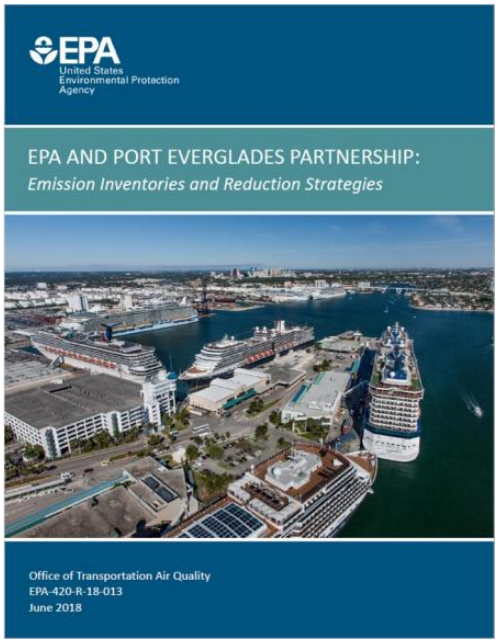
[National Port Strategy Assessment: Reducing Air Pollution and Greenhouse Gases at U.S. Ports, 2016]



[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 u
H_2 fue

Looking for fuel cells commercially available for port application

Provide users with confidence that technology will perform as expected

EPA does not provide funding for research purposes

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.

H_2 Fuel Cells

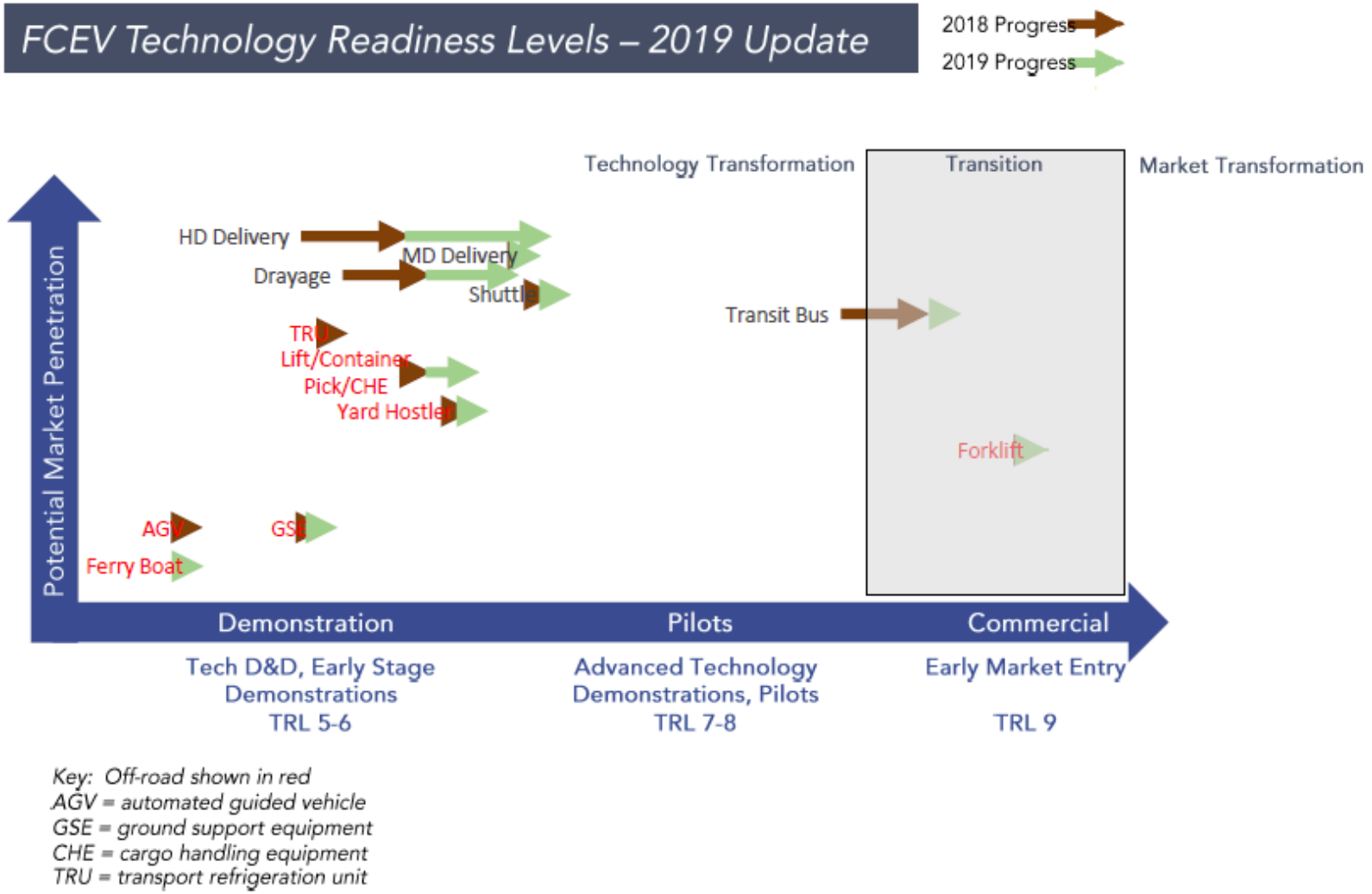
ADVANTAGES

- 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
- H_2 is highly flammable
- Most H_2 is produced by SMR which emits CO_2
- Not as efficient as batteries

Source: Assessment of Fuel Cell Technologies to Address Power Requirements at the Port of Long Beach, Full Report, M. MacKinnon, et al, University of California-Irvine, Submitted to Port of Long Beach, June 28, 2016



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.

Diesel Emissions Reduction Act: A Pathway for Funding

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

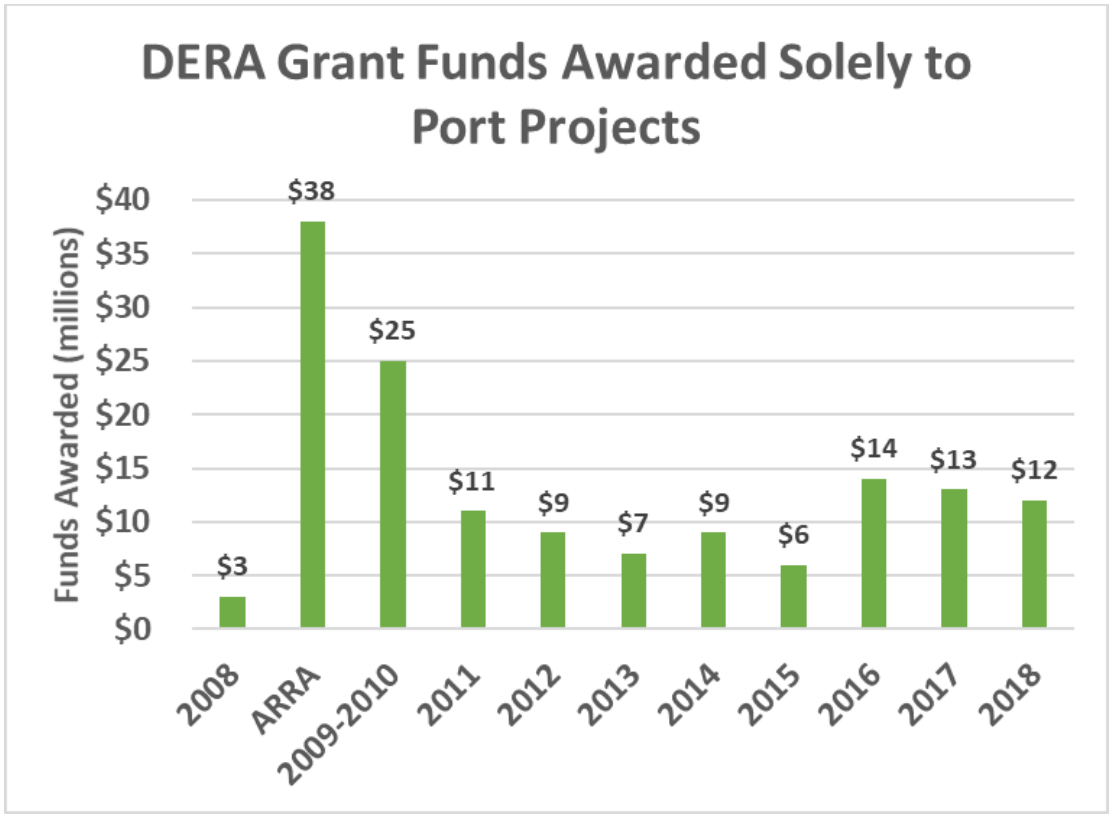
Fuel cells can be funded as a replacement.

Funding levels vary based on the technology cost share.

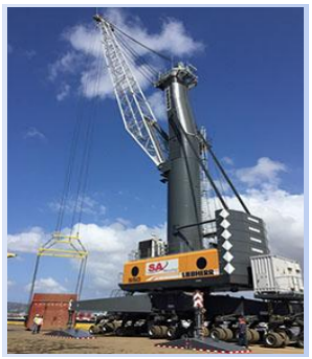
- Diesel – up to 25 %
- Alternative fuel/Hybrid – up to 25%
- Engine Certified to meet CARB Optional Low-NOx Standard – up to 35%
- Zero Tailpipe Emission – up to 45%
- Drayage Replacement (MY 2013 or newer) – up to 50%

Note: DERA grant priorities and cost share could change for FY2020
https://www.epa.gov/cleandiesel

Port Funding



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).



DERA Awarded Replacement Grants (2008-2018)		
Vehicle Type	Electric	Hybrid
Agricultural Equipment and Pumps	174	
Airport GSE	385	10
Cranes	7	
Ferry/Tug Boat	1	6
Long Haul		2
Nonroad Port	9	7
Refuse Hauler		26
School Bus	36	10
Short Haul		53
Stationary Grid Power	82	
Terminal Tractor	41	1
Transit Bus	26	17
TRUs	58	16

Only one fuel cell project funded w/DERA.

In 2017, awarded four transit buses in Canton, OH

EPA welcomes fuel cell technology applications

Photo Credit: SARTA

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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