

Maritime Decarbonization at DOE

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy



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Mission: Accelerate the research, development, demonstration, and deployment (RDD&D) of technologies and solutions to equitably transition America to net-zero GHG emissions economy-wide by no later than 2050

How we Accomplish the Mission:

Strategic investments in reducing GHG emissions in five programmatic areas:

- Electricity sector
- Transportation across all modes: air, sea, rail, and road
- Industrial sector
- Buildings
- Agriculture, specifically focused on the nexus between energy and water

EERE supports RDD&D through competitive grants, prize competitions, technical assistance, and enabling collaborative partnerships

EERE

Sustainable
Transport

Renewable
Power

Energy
Efficiency

Maritime activities are largely concentrated within the Sustainable Transport portfolio of EERE, but other parts of EERE and DOE also have strong maritime equities.

Bioenergy Technologies Office (BETO)

FY 2021 Budget: \$255 million

Office Mission

Supports bioenergy technologies to produce industrially viable fuels, products, and power using renewable biomass and waste resources.



Maritime Activities

- Supporting a multi-laboratory team of scientists studying the feasibility of using biofuels such as biocrude and bio-oil for marine applications. This team has access to a modeled 1:10 scale, two-stroke research engine at a national laboratory to evaluate lubricants and combustion properties of new fuels.
- Recently announced notice of intent for funding opportunity “Scale-Up” (FOA) (DE-FOA-0002638). This FOA will aim to accelerate the scale-up of biofuel and bioproduct biorefineries, including marine biofuels.

Hydrogen and Fuel Cell Technologies Office (HFTO)

FY 2021 Budget: \$150 million

Office Mission

Focuses on RD&D of H₂ and fuel cell technologies across multiple sectors enabling innovation, a strong domestic economy, and a clean, equitable future.



Maritime Activities

- Supporting the design and construction of first-of-its-kind maritime hydrogen refueling bunker barge, capable of producing more than 500 kg of H₂ daily.
- Funded technoeconomic studies on total cost of ownership for different types of hydrogen vessels, hydrogen demand forecasts at ports, and more
- Supported the development of one of the first hydrogen fuel cell ferries in the world, entering operation in early 2022
- Hydrogen Energy Earthshot - \$1 for 1 kg of H₂ within the next decade

Vehicle Technologies Office (VTO)

FY 2021 Budget: \$400 million

Office Mission

Focused on RD&D of transportation technologies that will improve energy efficiency, fuel economy, and enable America to use less petroleum.



Maritime Activities

- Supporting R&D activities for battery cost reduction – R&D has reduced the cost of EV lithium-ion battery packs to \$133/kWh at 100k packs per year
- New shift in research focus towards hardest-to-electrify sectors (off-road heavy-duty vehicles, inland marine, long-haul locomotive, and aviation)
- Leading development of DOE maritime decarbonization strategy
- Currently evaluating projects in maritime – new emphasis area for VTO this FY

Water Power Technologies Office (WPTO)

FY 2021 Budget: \$150 million

Office Mission

Enables research, development, and testing of emerging technologies to advance marine energy and hydropower.



Maritime Activities

- Leading the Powering the Blue Economy Initiative, investigating non-grid applications for marine renewable energy technologies
- Drafted a 100-page Report to Congress in FY 2021 on R&D for maritime decarbonization
- Supporting the Energy Transitions Initiative Partnership Project (ETIPP) which provides technical assistance in energy and resiliency planning for remote coastal and islanded communities, including maritime stakeholders

Wind Energy Technologies Office (WETO)

FY 2021 Budget: \$110 million

Office Mission

WETO's R&D activities are aimed at improving performance, lowering costs, and reducing market barriers for U.S. wind energy.



Maritime Activities

- Working towards the U.S. goal of 30 gigawatts of offshore wind deployed by 2030 - evaluating supply chain bottlenecks, costs, and risks which include ports and vessels.
- Investigating wind turbine installation vessel design and construction opportunities

- International Affairs
 - Mission Innovation
 - Clean Hydrogen Mission
 - Work streams place emphasis on ports as energy hubs
 - Zero-Emission Shipping Mission
 - Emphasis on zero-emission fuels for ocean-going vessels
- Office of Fossil Energy
 - Supports work on Natural Gas and Carbon Capture
- Office of Electricity
 - Supports research on the electric grid and power generation, including microgrids at ports
- Loan Program Office
 - Advanced Vehicle Technology Manufacturing program in IIJA amended to include maritime vessels within their loan authority

- **The Goal:** To increase the cost-competitiveness of clean hydrogen by reducing end-to-end costs to USD 2 per kilogram by 2030.
- **The Mission:** We will catalyze cost reductions by increasing research and development in hydrogen technologies and industrial processes and delivering at least 100 hydrogen valleys covering production, storage and end-use worldwide by 2030, to unleash a global clean hydrogen economy.



Mission Co-Leads:

- Australia, Department of Industry, Science, Energy and Resources
- Chile, Ministry of Energy
- European Commission, DG Research and Innovation
- United Kingdom, Department for Business, Energy and Industrial Strategy
- United States of America, Department of Energy

Mission Innovation: Zero Emission Shipping Mission

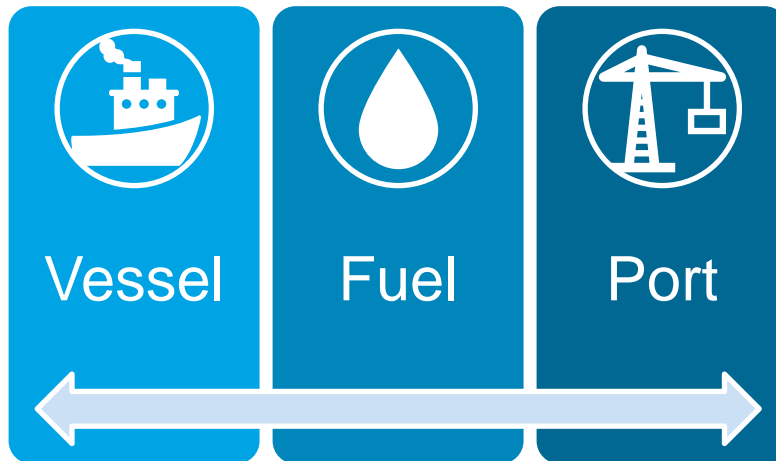
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The Goal: By 2030 ships capable of running on well-to-wake zero-emission fuels make up at least 5% of the global deep-sea fleet measured by fuel consumption and that at least 200 of these ships primarily use these fuels across the main deep sea shipping routes.

Three Mission Pillars

Ocean-going
commercial
vessels



- Advanced Biofuels
- Green Ammonia
- Green Hydrogen
- Green Methanol

Government Co-Leads



United States



Denmark



Norway

Industry Co-Leads

Mærsk Mc-Kinney Møller Center
for Zero Carbon Shipping

GLOBAL
MARITIME
FORUM

- The Loan Program Office (LPO) has **\$17.7 billion** in loan authority to support the manufacture of eligible vehicles and qualifying components under the **Advanced Technology Vehicles Manufacturing (ATVM)** Loan Program, authorized by the Energy Independence and Security Act of 2007.
- LPO can provide debt capital at U.S. Treasury rates, or other flexible financing options
- Pending legislation for the Infrastructure Bill may broaden the scope of the AVTM to include vessel construction
- To date, the program has loaned \$8 billion for projects that have supported the production of more than 4 million advanced technology vehicles. Read more about LPO's [ATVM portfolio](#).

- DOE is collaborating with other Federal and State Agencies, as well as industry partners in our maritime efforts. As examples:
- Senior Executive Service personnel from DOE, EPA, MARAD, NOAA, and USCG have been meeting regularly for the past year to coordinate on maritime decarbonization
- DOE, DOT, and EPA are coordinating on transportation decarbonization strategies
- A DOE-funded National Laboratory consortium researching marine biofuels has established an industry advisory group which includes fuel producers, shipping companies, NGOs, and other stakeholders
- DOE is co-leading the Zero-emission Shipping Mission along with the governments of Denmark and Norway, as well as the private organizations Global Maritime Forum and the Maersk Mc-Kinney Moller for Zero Carbon Shipping

For more information on maritime decarbonization activities at the US Department of Energy, please contact:

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