

ABS Maritime Transportation Decarbonization Update



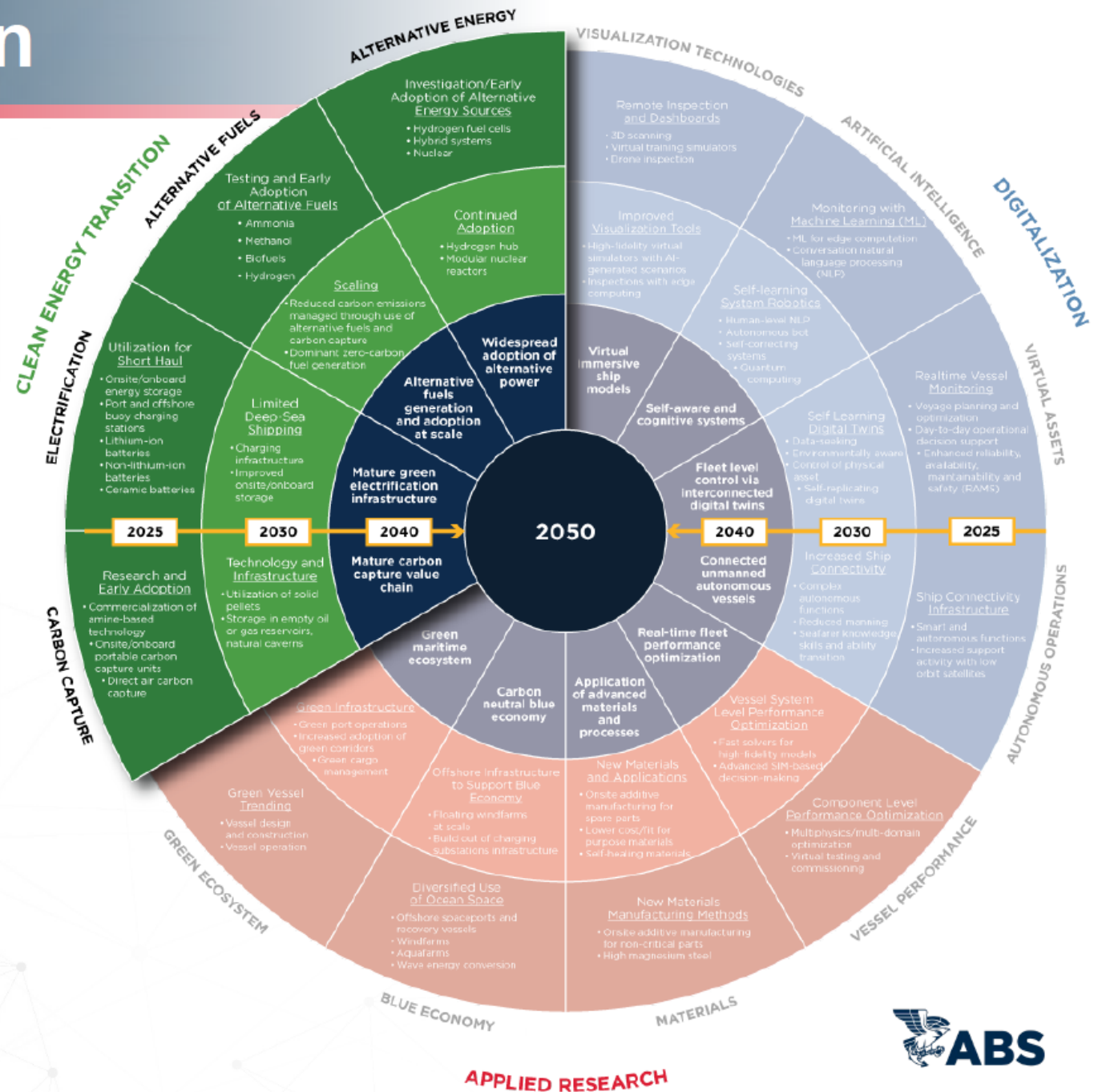
Clean Energy Transition

TECHNOLOGY ENABLERS

- Alternative Energy - Nuclear
- Alternative Fuels
- Electrification Developments
- Carbon Capture Technology

DRIVERS

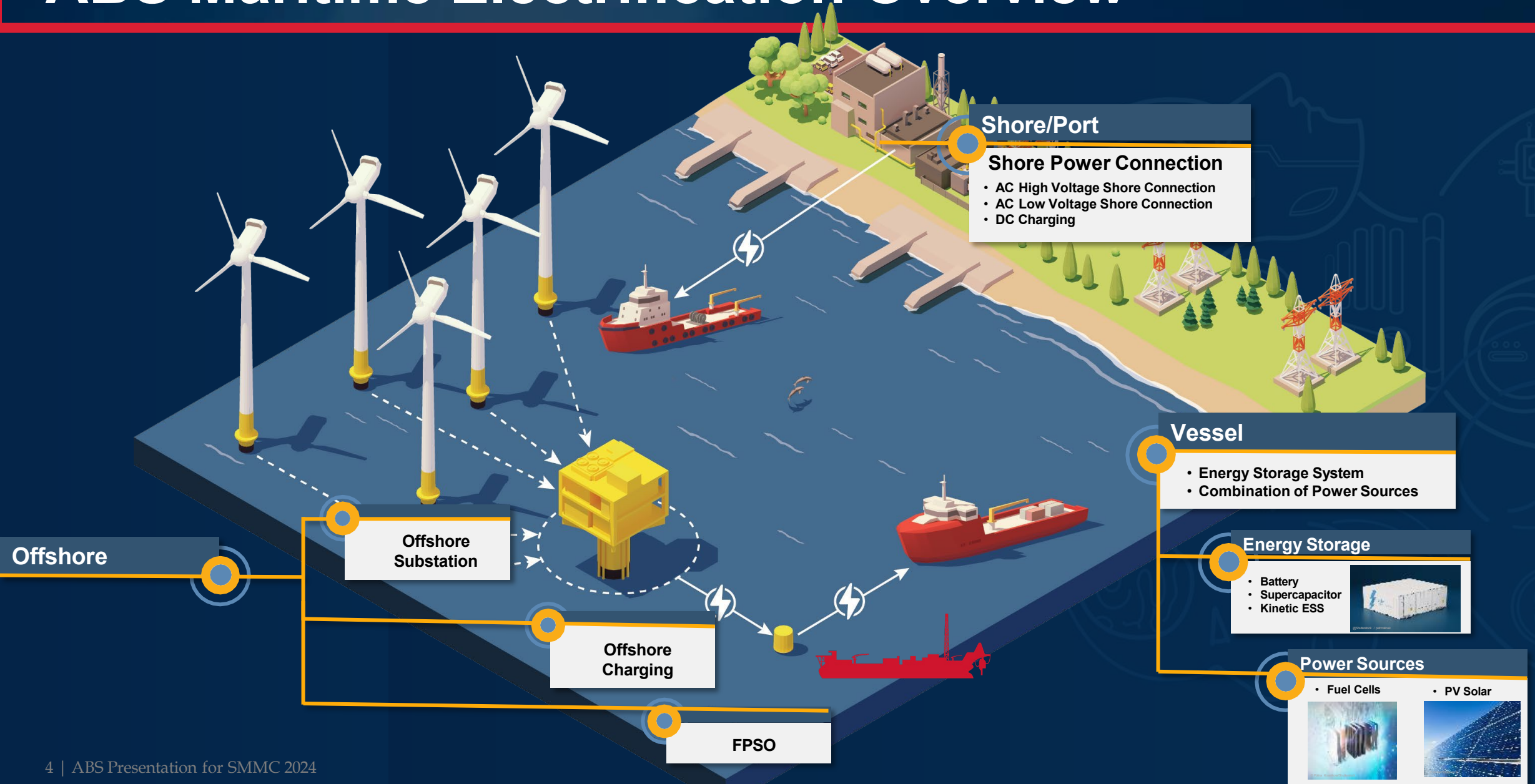
- Regulatory Targets
- Societal Pressures
- Finance Requirements
- Corporate Governance



Electrification



ABS Maritime Electrification Overview



ABS Electrification Rules/Requirements/Guides

Overview

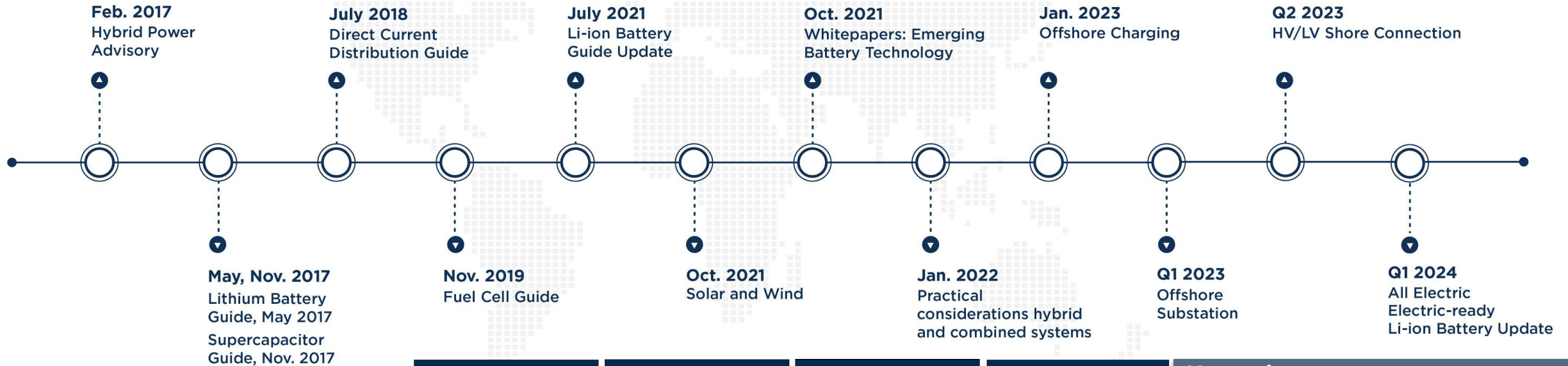
Energy Storage

Energy Distribution

Energy Generation

Electrical Charging

- Port (High Voltage/Low Voltage)
- Offshore
- Charging Station (MegaWatt Charging)



Recently Released

- All-Electric
- Electric-Ready
- Li-ion Battery Guide updates

Overview

- Hybrid Power Advisory
- Practice Consideration of Hybrid Systems

Energy Generation

- Fuel Cells
- Solar
- Wind

Energy Storage

- Lithium-ion Batteries
- Supercapacitors

Energy Distribution

- DC Distribution
- Offshore Charging
- Offshore Substation

Upcoming

- High Voltage Requirements
- Fuel Cell Update
- DP Guide Update
- Offshore High Voltage Cable Tech Standard
- Offshore Floating Solar PV Tech Standard



Hybrid and All Electric Power Systems



Load Optimization



Peak Shaving



Immediate Power



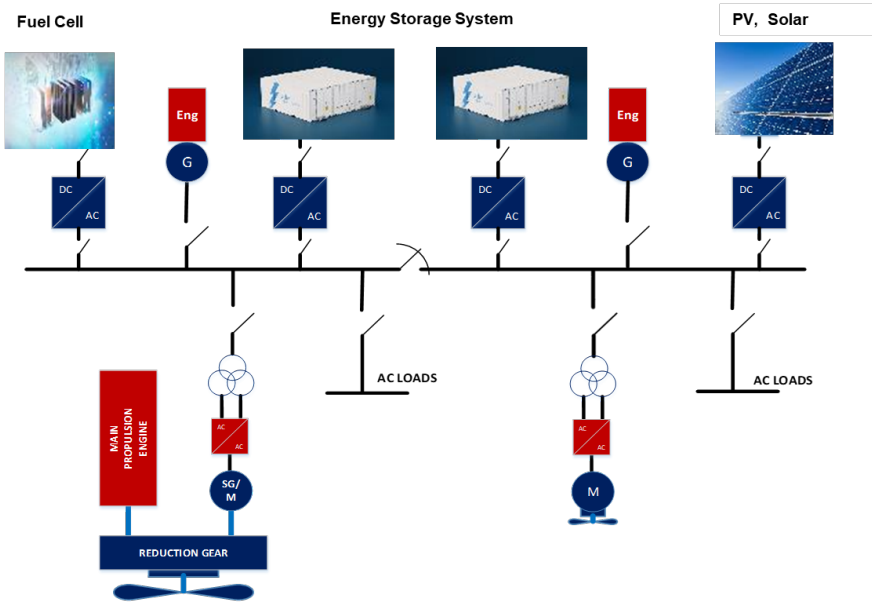
Harvest Energy

Combination of Power Sources

- Conventional Generator
- Fuel Cells
- Solar PV
- Wind

Energy Storage Systems

- Batteries
- Supercapacitors
- Kinetic energy storage



Vessel Type	Fleet Status		
	Existing Fleet	Orderbook	Grand Total
Container Carrier		3	3
High Speed Craft		2	2
Offshore Supply Vessel	2		2
Offshore Support Vessel	20	10	30
Oil Carrier		1	1
Special Purpose Vessel		3	3
Towboat		2	2
Tug	7	33	40
Grand Total	29	54	83

ABS Classed Hybrid Electric Vessels

ABS Activities

ABS Classes First Offshore Vessel in GOM to Use Hybrid Power

By Heather Suttle Senior Manager, Marketing - Mar 12, 2018



Wartsila-Hudong-ABS LNGC Hybrid JDP



- **New Technology Qualification**
 - Energy Storage System
 - Fuel Cell
- **Texas A&M University**
 - Current and Emerging Battery Technology Safety
- **Global Electrification Center**
- **Joint Development Projects**

ABS Launches Pioneering Global Electrification Center to Support Maritime's Net-Zero Transition



MON, SEP 11, 2023 08:00 CET

Report this content

ABS to Class First 'Tri-fueled' Vessel for Harvey Gulf

Posted by Michelle Howard June 20, 2019



First Battery Electric Tug from Sanmar Shipyards Delivered to ABS Class



MON, JUN 05, 2023 07:01 CET

Report this content



(ISTANBUL) Sanmar Shipyards delivered its first battery electric tug to ABS class for Canada-based HaiSea Marine, a joint venture partnership between the Haisla First Nation and Seaspan ULC.

The HAISEA WAMIS harbor tug, the first in its ElectRA 2800SX series, will be part of a fleet of harbor and escort providing services to LNG Canada's future terminal in British Columbia and is equipped with two steerable, fixed.



ABS and Sea Forrest Sign Pioneering MOU to Advance Maritime Electrification Technology



TUE, OCT 31, 2023 02:00 CET

Report this content

Energy Storage Systems PDA

- Corvus ESS: Li-Ion
- Siemens ESS: Li-Ion
- Spear power systems
- Kongsberg ESS : Li Ion

Fuel Cells PDA

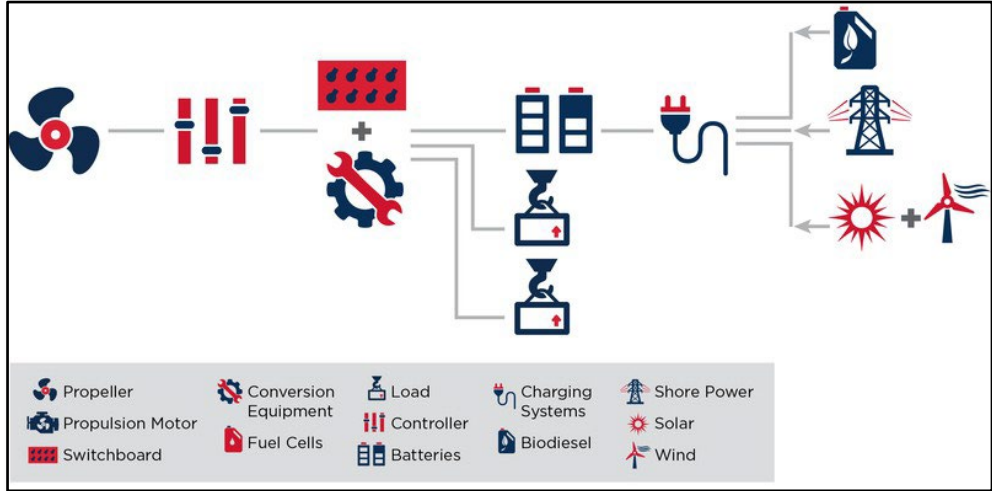
- Bloom Energy SOFC

ABS Activities

- Next Generation of Lakers Seminars in Montreal and Cleveland
 - Infrastructure needs
 - Challenges for maritime electrification
 - Efforts to standardize shore power
- MARAD Awarded project with Crowley, CharIN
 - Standardize Megawatt Charging
- Port Charging
 - On-shore power supply
 - Low or high-voltage shore connection
 - Connections
 - Conductor cables Induction (wireless charging)








Surveyed 27 ports and 2 terminal operators in USA

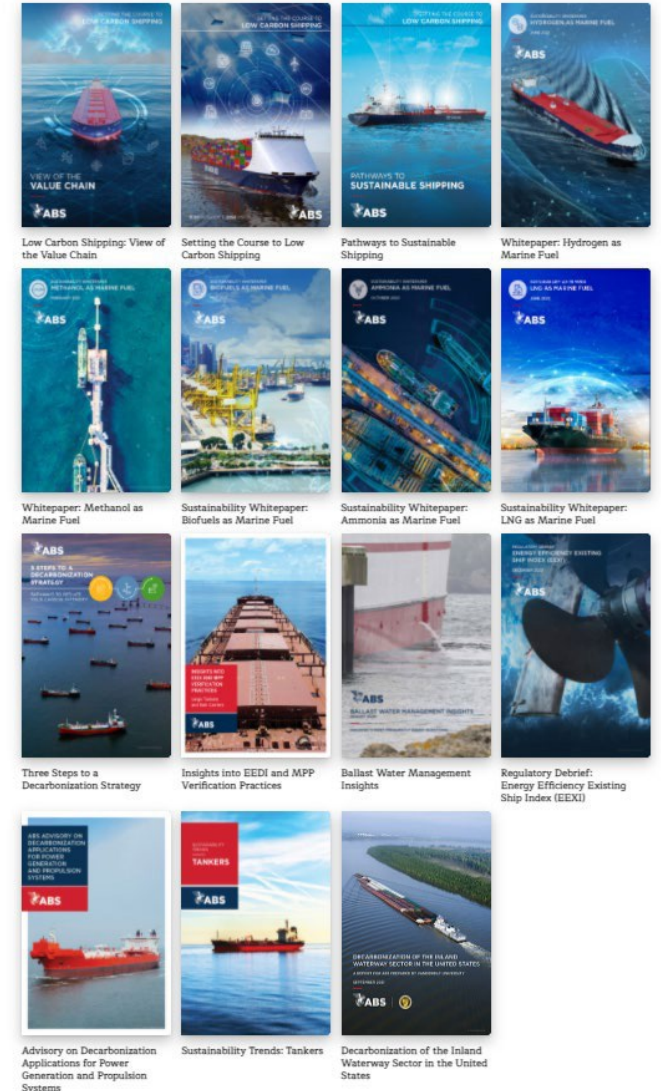


Alternative Fuels



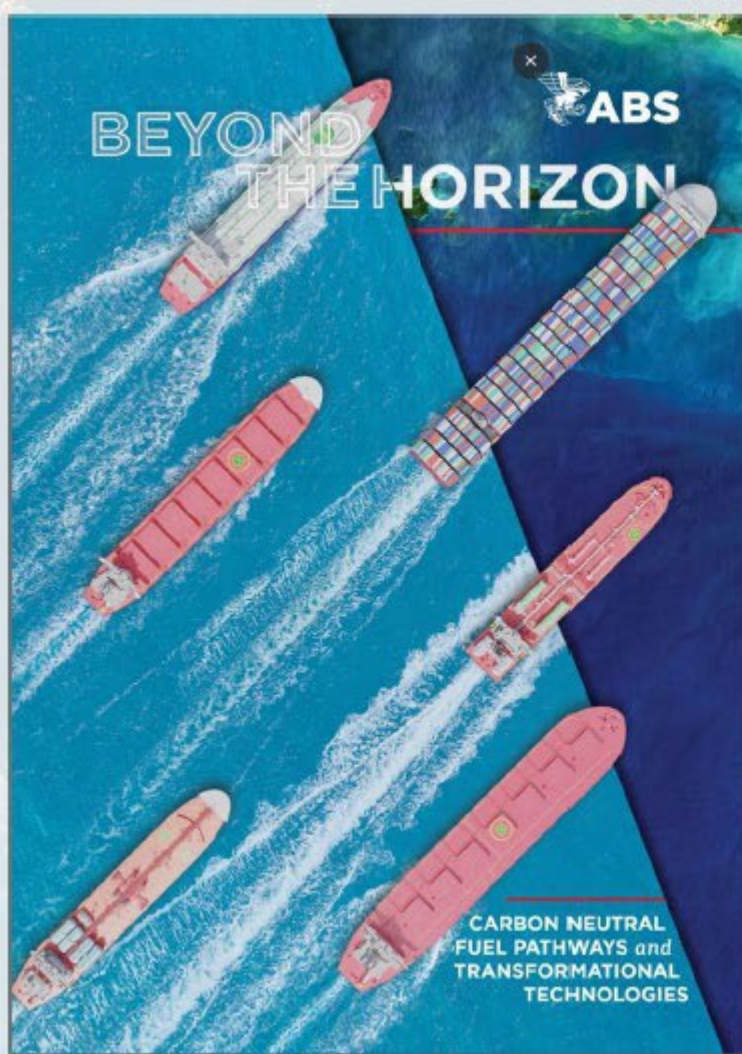
Maritime Decarbonization Guides

-  Low Carbon Shipping Guides, Pathways, and Outlook
-  Sustainability Whitepapers on Alternative Fuels (LNG, Biofuels, Methanol, Hydrogen, Ammonia, etc.)
-  Advisory on Decarbonization Applications for Power Generation and Propulsion Systems
-  Guides on Energy Efficiency Index Calculations for Ships (EEDI/EEXI)
-  ABS Guides on Clean Energy Systems (Electrification, Batteries, Electrolyzers, Fuel Cells, etc.)



Rules and Guides are available to download anytime on www.eagle.org

New 2024 Outlook



Outlook 2024

Beyond the Horizon: Carbon Neutral Fuel Pathways and Transformational Technologies

The sixth annual edition of the ABS Sustainability Outlook series.

Explores various aspects of the maritime industry's journey toward carbon neutrality by 2050, including:

- ✓ *Updated fuel mix forecasts*
- ✓ *Potential net-zero scenarios*
- ✓ *Analysis of the maritime ecosystem's capacity to support decarbonization.*

A crucial resource for understanding the transformative technologies and pathways that will shape the future of shipping.



Project Announcement

Office of Nuclear Energy

DOE Awards \$8.5 Million to Advance Promising Nuclear Technologies

NOVEMBER 18, 2021

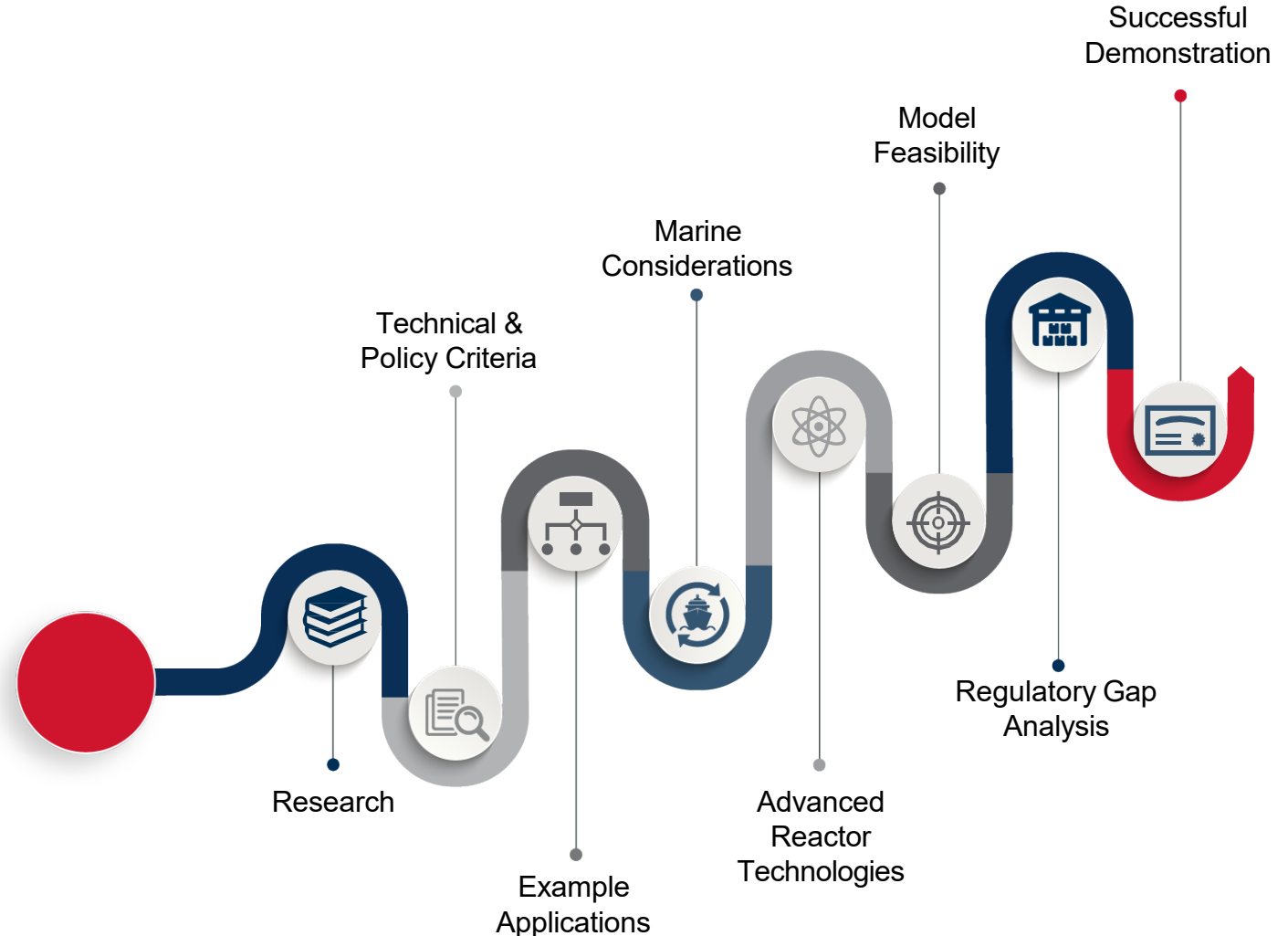
Accelerating Commercial Maritime Demonstration Projects for Advanced Nuclear Reactor Technologies ~

American Bureau of Shipping (Spring, TX) will focus on addressing hurdles in the maritime domain so that new reactor technology can be rapidly deployed for commercial applications. Advanced nuclear technology is well-positioned to be one of the strongest tools available to help the industry achieve its aggressive decarbonization goals.

Total Award Value: \$793,999

Project Objectives

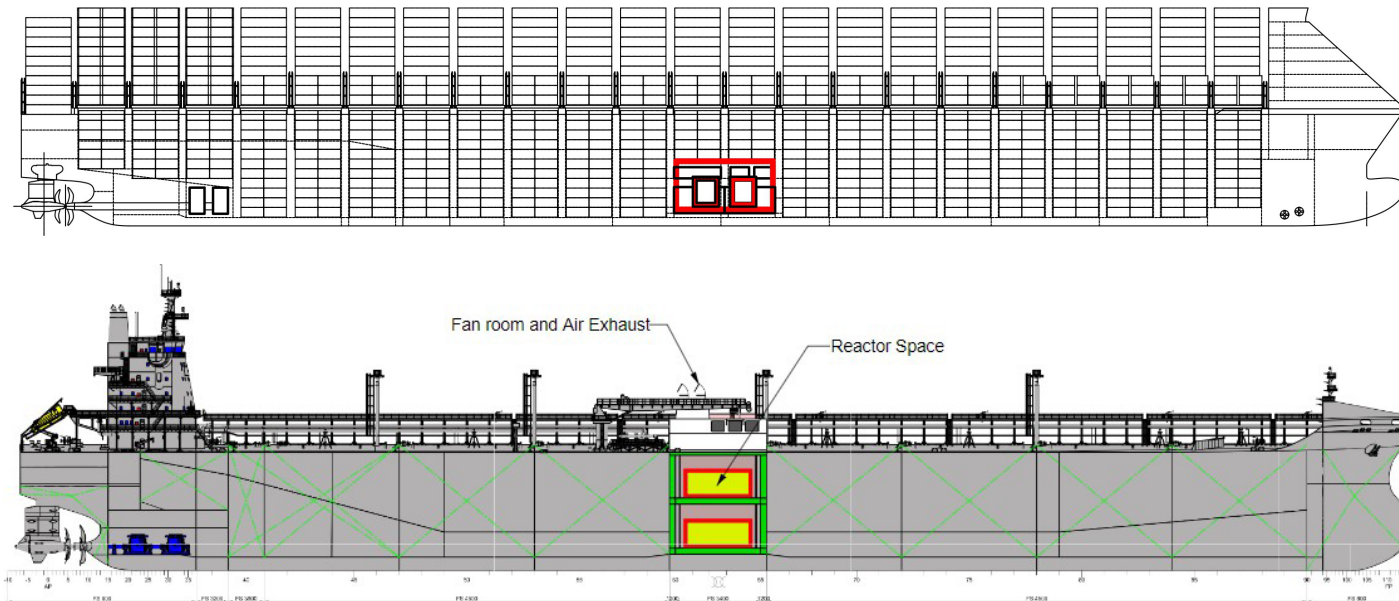
1. Build demonstration project pathways and business cases
2. Develop models of various advanced reactor technologies integrated with maritime applications
3. Assess the readiness of the United States Department of Energy for supporting demonstration projects
4. Publish guidance for addressing key technical, regulatory and policy issues for maritime demonstration projects



Nuclear Vessels Concept Study Findings

Study Highlights

1. **Nuclear-electric plant** is the preferred arrangement
2. Supplemented with **batteries** for load following and peak shaving
3. The position of the nuclear reactor(s) at **mid-ship**
4. Nuclear systems are **shielded** and completely **separated** from the non-nuclear systems
5. **Increased cargo capacity and faster speed potential** for the containership



Industry Engagement

Marine Nuclear Applications Group (MNAG)

- <https://nric.inl.gov/maritime/>
- “Research hub and resource center that brings together experts from the maritime and nuclear energy sectors to demonstrate advanced nuclear technologies for a range of marine applications”

World Nuclear Transport Institute (WNTI)

- <https://www.wnti.co.uk/>
- Global non-governmental membership organization headquartered in London
- “Collaborate with members to influence regulatory change affecting the transport of nuclear materials “

Advanced Nuclear & Production Experts Group (ANPEG)

- <https://anpeg.mit.edu/>
- “A global consortium dedicated to developing low-carbon energy systems based on a “plug-and-play” nuclear microreactor – or Nuclear Battery”



Overview of the US Center for Maritime Innovation



Mission Scope of the Center

- National resource for research, development, and demonstration projects supporting maritime innovation in a range of potential subject areas
- Includes interest in all types of vessel, port/port facility, and other marine transportation issues
- Primarily focused on US maritime issues as well as associated international maritime interconnections
- Coverage of the diverse issues of interest in different geographical regions of the country
- Accessible for funding from MARAD, other agencies, and even private funding of projects
- Near Term Priorities
 - Energy transition in the maritime domain
 - Decarbonization of maritime operations
 - Underwater radiated noise
 - Aquatic nuisance species
 - Other environmental issues



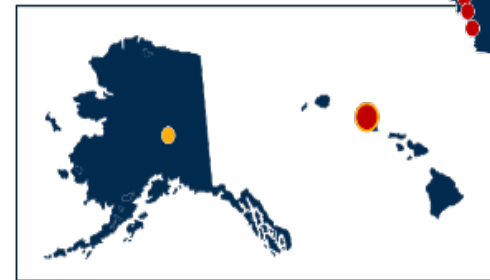
Examples of Basic and Applied Research Topics in Domain

Domain Scope				
Environmental				Other Domains (Operations, Safety/Security, Cross-Cutting)
Decarbonization	Underwater Noise	Invasive Species	Pollution	
<i>Basic Research</i>				
<p>Increase efforts for development of marine drop-in fuels</p> <p>Increase energy density and cost of marine batteries</p> <p>Increase fast-charging and non-contact charging technology for vessels and port equipment</p> <p>New vessel designs and technology for energy efficiency</p> <p>Emission measurement and mitigation technology</p>	<p>Shipboard technology development to mitigate noise and vibration</p> <p>Active noise cancellation technology</p> <p>Interdisciplinary research on effects of noise on species</p>	<p>Species detection and diagnostic technology</p> <p>Quantifying patterns and processes</p> <p>More effective treatments and controls for high priority species</p>	<p>Criteria pollutants of sustainable maritime fuels, marinized batteries, and marinized fuel cells</p> <p>Fate studies of commercial marine pollution on the environment</p>	<p>Safety/risk issues with electrification and alternative fuels, including technology for providing additional safeguards to prevent loss</p> <p>Technology for mitigating cybersecurity threats to vessels, ports, terminals, and MTS infrastructure</p> <p>Augmented and virtual reality training technology for workforce</p> <p>Digital technologies for improving operations</p>
<i>Applied Research</i>				
<p>Accelerate demonstration projects of alternative marine energy and fuels in partnership with industry</p> <p>Engagement with cargo owners and shippers in driving decarbonization initiatives</p> <p>Support US Sustainable Maritime Grand Challenge initiative for alternative fuels</p> <p>Leverage key connections to H2 Hubs, Green Shipping Corridors, Clean Energy Marine Hubs, and MARAD Marine Highways</p>	<p>Regional underwater noise studies and mitigation planning efforts</p> <p>Joint work on international standards on underwater noise</p> <p>Integrated underwater noise management plans</p>	<p>Demonstration of new technologies (e.g., UVC) control practices on ships</p> <p>Modeling and simulation of aquatic invasive species spread and interactions between multiple species</p>	<p>Port area pollution (air, noise, water, etc.) mitigation studies for specific ports/regions, especially DEIA communities</p> <p>Commercial marine pollution/discharges (liquid and solid waste streams)</p>	<p>Policy and initiatives for revitalizing US shipbuilding and ship operating interests, including impacts of MARAD grant/loan programs</p> <p>Enhancing maritime workforce training for the new generation of clean energy technologies and associated operations*</p> <p>Safety and vulnerability assessments for maritime risk issues (accidents, security threats, etc.)</p>

Stakeholder Engagement is Key to Success

- Successful maritime innovation will be a team sport
- Building from our initial Coalition for the Center for Maritime Innovation
 - Regional/national non-profit organizations already working marine environmental/decarbonization initiatives
 - Maritime schools and training organizations
 - Major research colleges and universities
 - Minority serving institutions
 - National laboratories and FFRDCs
 - Industry associations
 - Specialist organizations and NGOs
 - Maritime Operators
 - Ports
- Engaging other key participants and stakeholders for a growing community supporting US maritime innovation

- ABS Office Locations
- ABS Coalition Partners
- Location with ABS Office and Coalition Partner
- ABS Principal Support Center Location



Stakeholder Engagement Opportunities

- Volunteer to help lead or participate in technical and regional committees on maritime research priorities
- Identify/Refer other organizations to engage as research coalition partners or interested stakeholders
- Invite MARAD and/or ABS to participate in upcoming conferences, events, workshops, etc. to discuss the Center and engage your audiences in providing input to the Center on research priorities
- Provide direct input on research priorities
 - Specific suggestions directly to ABS
 - Participate in upcoming engagement sessions and workshops to help shape the research agenda
- Watch for updates on registering for research opportunities in the coming months
- Be a voice advocating for greater investment in U.S. maritime research and innovation

• **Initial Technical Committees**

- Vessel and Port Emission Reductions
- Ship Mediated Aquatic Nuisance Species
- Vessel-generated Underwater Noise
- Emergency Environmental Marine Issues
- Others TBD

• **Regional Stakeholder Committees**

- Northeast Coast
- Mid-Atlantic Coast
- Southeast Coast/Caribbean
- Gulf/Gulf Coast
- Inland Waterways
- Great Lakes/Seaway
- Pacific Northwest
- California Coast
- Alaska
- Pacific Islands

Thank You

www.eagle.org

