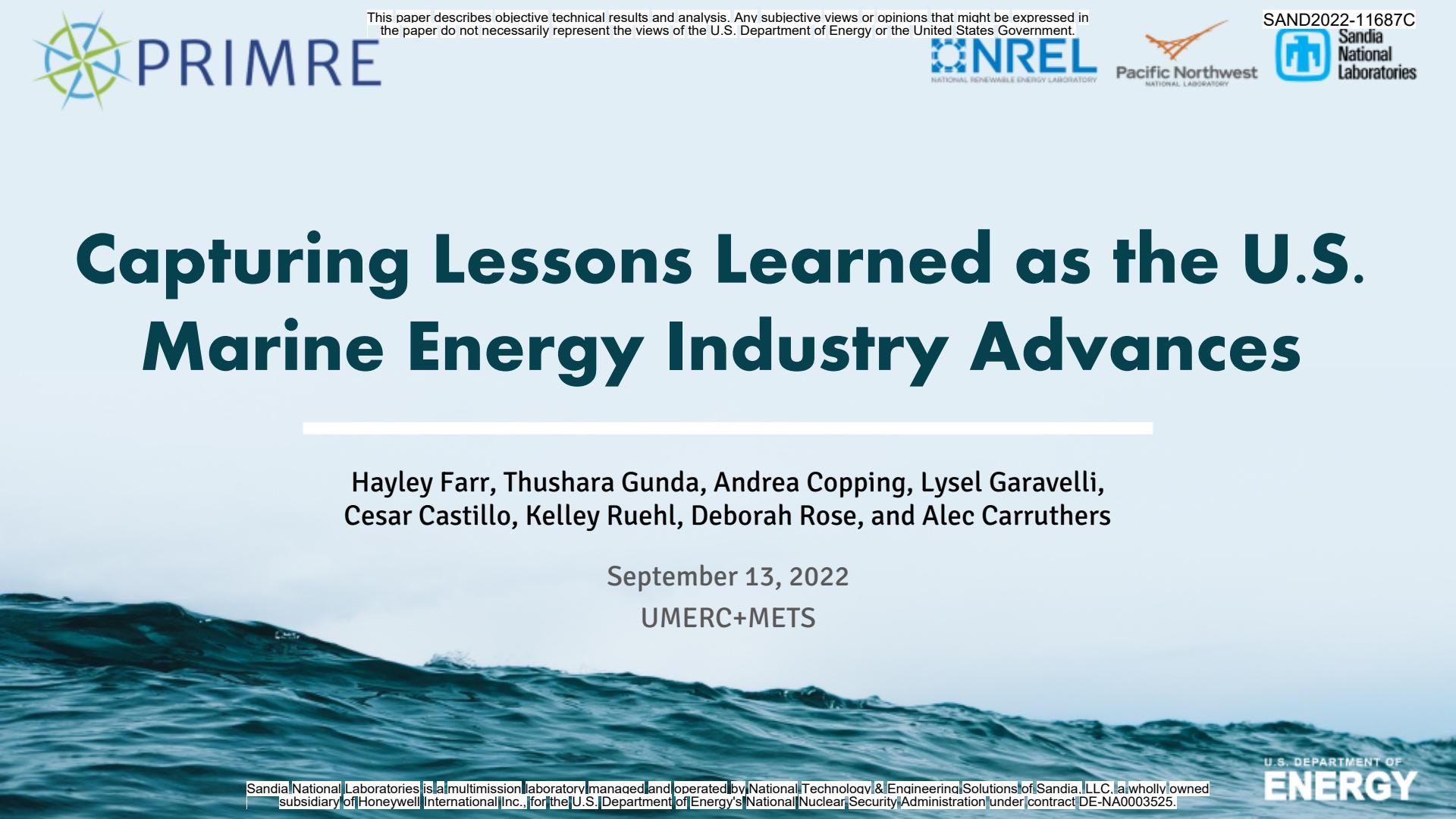


# Capturing Lessons Learned as the U.S. Marine Energy Industry Advances



Hayley Farr, Thushara Gunda, Andrea Copping, Lysel Garavelli,  
Cesar Castillo, Kelley Ruehl, Deborah Rose, and Alec Carruthers

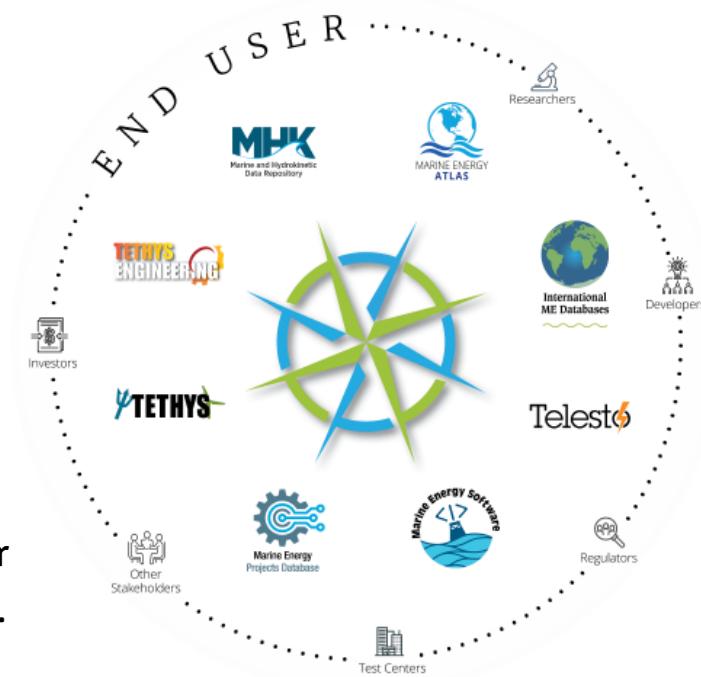
September 13, 2022  
UMERC+METS

# PRIMRE

**The Portal and Repository for Information on Marine Renewable Energy (PRIMRE) provides access to:**

- Datasets
- Documents
- Software
- Guidance
- Project info.
- STEM resources
- Events calendar
- Archived webinars
- Photo library

PRIMRE is funded by the Department of Energy's Water Power Technologies Office and led by a multi-lab team.



# Project Goals

Capture lessons learned by the marine energy industry to ensure that:

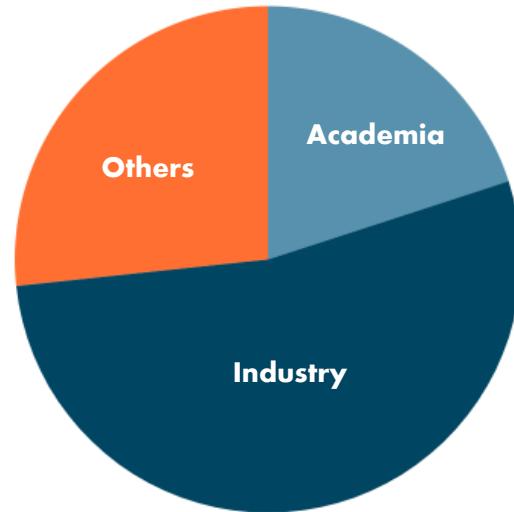
- Hard-won achievements are recognized and available
- Missteps and unfortunate outcomes are prevented in future
- Efficiencies and useful resources are publicized and used as the industry advances



# Data Collection

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- 15 semi-structured interviews with marine energy subject matter experts (SMEs) held between November 2020 and December 2021
- Interviews and data analysis conducted in accordance with the Department of Energy Institutional Review Board's requirements for human subjects research



# Example Questions

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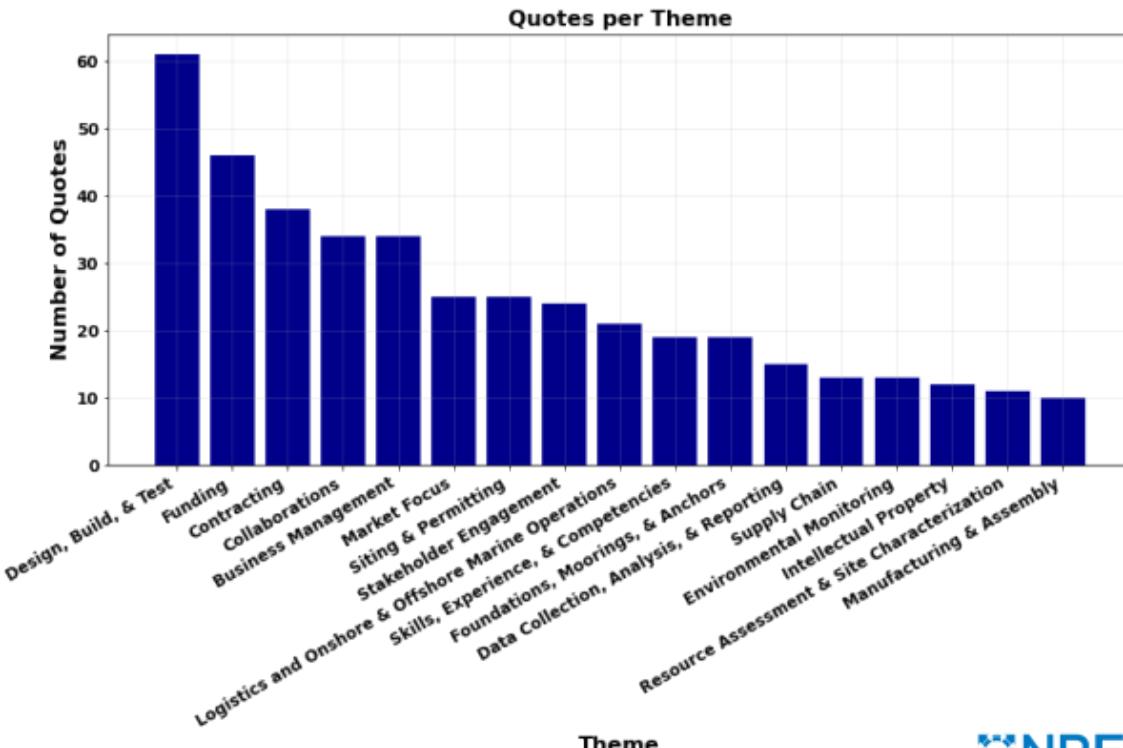
- Who was involved in the project? What were the project goals?
- What worked well/did not work well for the project or project team?
- Were there any issues or project circumstances that were not anticipated?
- Were there any impacts to the project's timeline?
- Were there financial or legal impacts? Impacts to safety?
- Were changes in system or subsystem design necessary? Were any data lost?
- What lessons did you learn that might/might not be applicable to other projects?
- What recommendations would you make to other MRE developers and researchers?

# Data Analysis

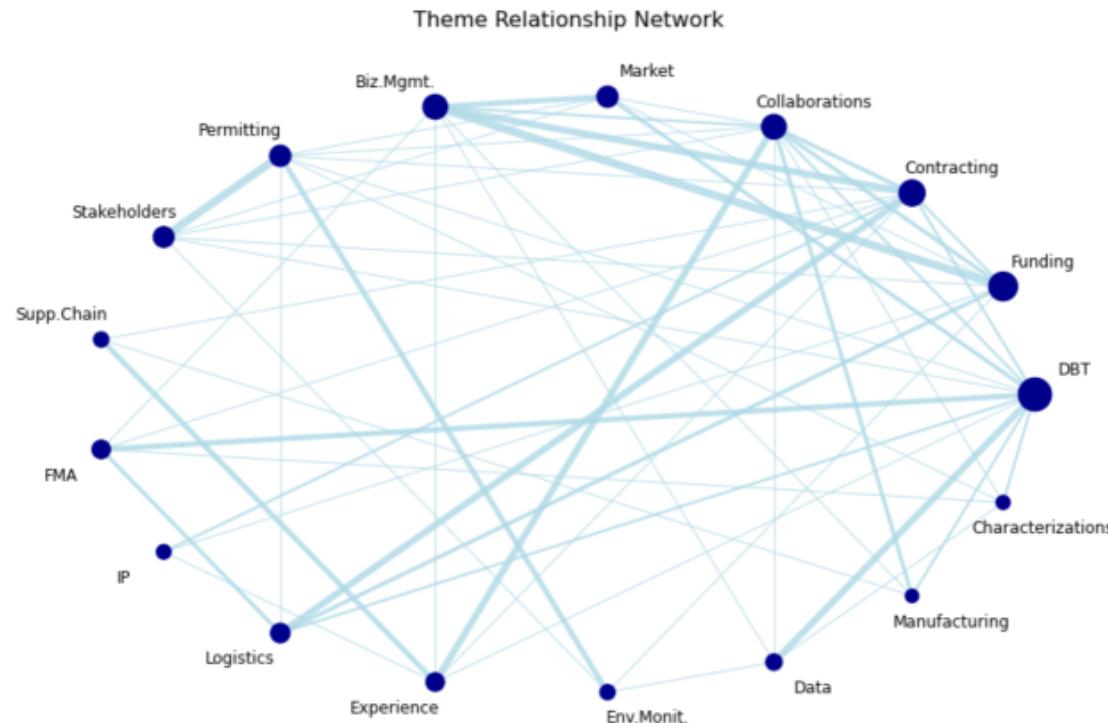
- Broke all transcribed content into discrete quotes and tagged each with 1-2 corresponding themes
- Synthesized and summarized content within individual themes
- Developed recommendations for WPTO, the industry, and future work

A	B	C	D	E	F	G	H
1	This <b>Lessons Learned Categorization Spreadsheet</b> contains all transcribed content from SME interviews, excluding the <b>ReadMe</b> .						
2	This <b>ReadMe</b> describes the content within the following worksheets and provides a list of ideas/questions that were used to develop the recommendations.						
3							
4	<b>Sheet Name</b>	<b>Description</b>					
5	Demographics	Contains interview metadata, including interview date, participant ID, and participant background.					
6	Categorization	Contains all transcribed content from SME interviews, broken up into discrete quotes and tagged.					
7	Miscellaneous	Contains quotations that did not seem directly related to lessons learned objectives.					
8	Themes	Contains list of themes used in the drop down menu to tag entries in the Categorization sheet.					
9							
10	<b>Sheet Name</b>	<b>Column Name</b>	<b>Description</b>				
11	Demographics	ID	Anonymized ID associated with each interview participant.				
12	Demographics	Interview Date	Date interview was conducted.				
13	Demographics	Company	Affiliation of the interview participant(s).				
14	Demographics	WorldView	Categories developed by project team to reflect general perspective.				
15	Demographics	Description of Expertise	Description of interview participant's background and experience.				
16	Demographics	Project Name(s)	Name of project(s) the participant discussed in detail.				
17	Demographics	Project Location	Location of project(s) the participant discussed in detail.				
18	Demographics	Project Background	Background of marine energy project and/or technology discussed.				
19	Demographics	Team Commentary	Notes taken by project team within the summary documents.				
20	Categorization	ID	Anonymized ID associated with each interview participant.				
21	Categorization	Quotation	Transcribed content from interview notes.				
22	Categorization	Theme #1	Associated theme identified by project team members.				
23	Categorization	Theme #2	If applicable, team members may select an additional associated theme.				
24	Categorization	Positive Things	Indicates whether the quotation describes a positive outcome or problem.				

# Overall Theme Breakdown



# Connections between Themes



# Environmental Monitoring

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- Discussions highlighted that developers often underestimate the level of effort (time and cost)
- SMEs noted challenges servicing instrumentation
- Several SMEs highlighted successes associated with:
  - Frequent and early communication directly with small groups of regulators
  - Applying an adaptive monitoring approach
  - Considering proportionality (applying proportional effort to the level of risk)



# Funding

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- Discussions highlighted the pros and cons of different funding sources and mechanisms
- General recognition that managing a DOE grant is a lot of work, so having a dedicated staff was key to project success (for proposals, contracting, reporting, etc.)
- Challenges associated with cost share were frequently highlighted, especially for smaller companies and at later stages of development

**"There's a real problem relying on prizes to generate innovation. Prizes are a great way to come up with ideas and not a good way to push technology forth."**

**"DOE SBIR is a great tool that allows companies to be able to take a product towards market and there's more funding available for it."**

# Business Management

- SMEs noted key aspects of their general business strategies, including:
  - Growth rate
  - Market clarity
  - Core competencies
  - Creating flexibility
- Discussions highlighted the importance of managing long-term relationships and understanding collaborators' timelines
- Many marine energy companies have had to act as technology and project developers



Orbital Marine Power



CalWave Power Technologies

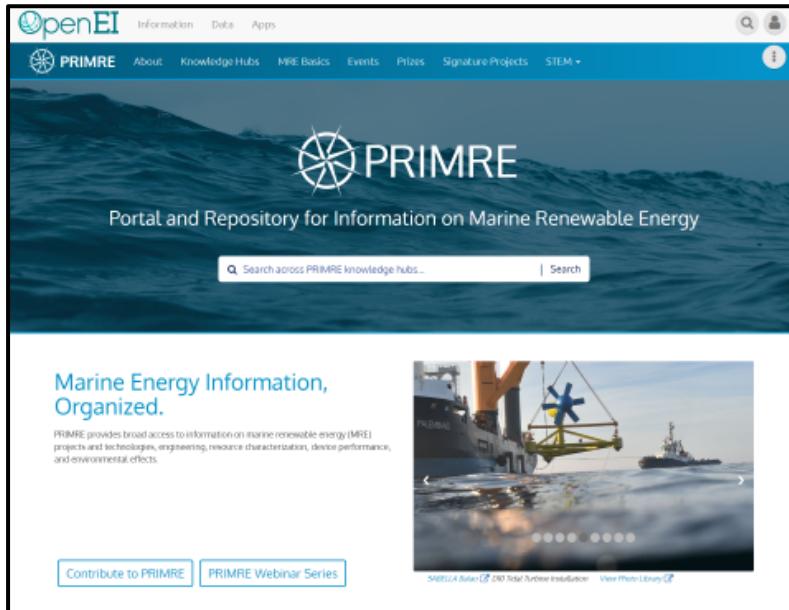


Wave Swell Energy



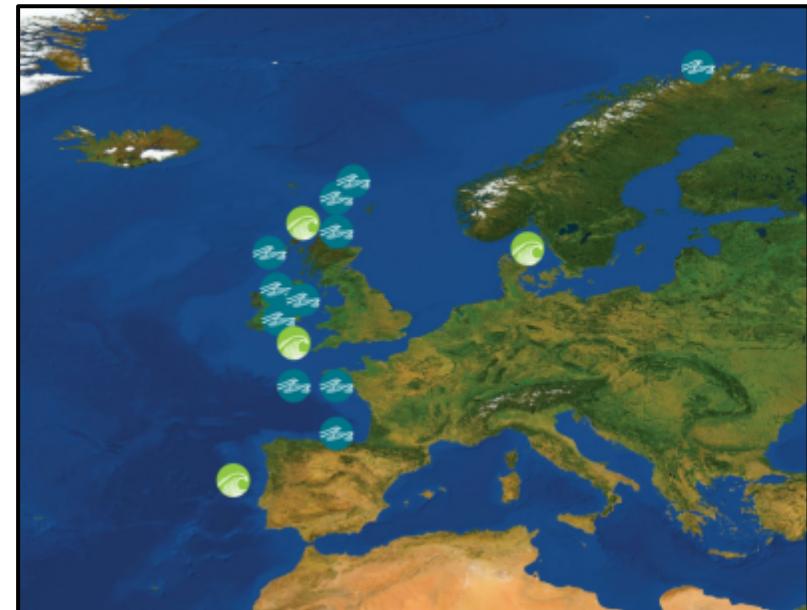
Verdant Power

# Future Work



The screenshot shows the PRIMRE website homepage. At the top, there is a navigation bar with links for 'Information', 'Data', 'Apps', 'About', 'Knowledge Hubs', 'MRE Basics', 'Events', 'Prizes', 'Signature Projects', and 'STEM+'. The main header features the PRIMRE logo, which is a stylized sunburst or gear design, followed by the text 'PRIMRE' in a bold, sans-serif font. Below the header is a sub-header: 'Portal and Repository for Information on Marine Renewable Energy'. A search bar with the placeholder 'Search across PRIMRE Knowledge Hubs...' and a 'Search' button are located below the sub-header. The main content area has a background image of ocean waves. It features a section titled 'Marine Energy Information, Organized.' with a sub-description: 'PRIMRE provides broad access to information on marine renewable energy (MRE) projects and technologies, engineering, resource characterization, device performance, and environmental effects.' Below this text is a photograph of a large ship, the 'SARAFELLA 2', being towed by a tugboat, with the text 'SARAFELLA 2 being 2D Total Turbine Installed' and 'View Photo Library'. At the bottom of the page are two buttons: 'Contribute to PRIMRE' and 'PRIMRE Webinar Series'.

Interactive Webpage



International Interviews

# Thank You!

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**Thushara Gunda, Andrea Copping, Lysel Garavelli, Cesar Castillo, Kelley Ruehl, Deborah Rose, and Alec Carruthers**

Visit PRIMRE:

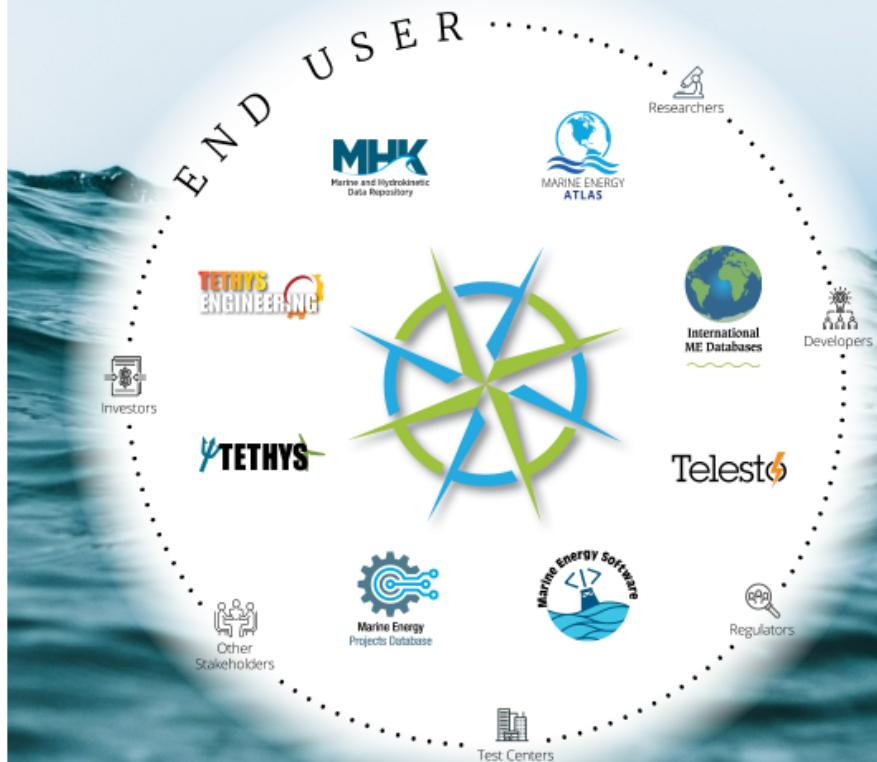
<https://primre.org>

U.S. DEPARTMENT OF  
**ENERGY**

**ONREL**  
NATIONAL RENEWABLE ENERGY LABORATORY

Pacific Northwest  
National Laboratory

Sandia  
National  
Laboratories



The National Renewable Energy Laboratory is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC, under contract No. DE-AC36-08GO28308. Pacific Northwest National Laboratory is operated by Battelle for the U.S. Department of Energy under contract DE-AC05-76RL01830. Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.