Andrea Copping, PhD (PNNL)  
andrea.copping@pnnl.gov

Jon Weers (NREL)  
jon.weers@nrel.gov

Cesar Castillo, PhD (Sandia)  
cesar.castillo@sandia.gov

July 21, 2022

https://primre.org
The **Portal and Repository for Information on Marine Renewable Energy (PRIMRE)** provides centralized access, standardization, community building, and integration of WPTO-funded marine energy data repositories and knowledge hubs. By bringing key databases together, knowledge will be increased by reducing redundancy, ensuring information and lessons learned in this sector are captured, made publicly available, and the efficiency of data searching and analysis will be enhanced.

### Intended Outcomes

Data and information available and readily extractable from PRIMRE will help the marine energy community to build on past experience, investigate promising lines of research and development, and increase awareness of the value of marine energy. Taken together, these outcomes will help establish robust, sustainable, and responsible marine energy as a significant part of the nation’s renewable energy portfolio.
PRIMRE brings together data and information that supports WPTO marine energy program goals, enabling data accessibility and dissemination, as well as supporting the dissemination strategy for many other aspects of the program.

**Data access, analytics, and workforce development**

- Aggregate, analyze, & disseminate data on performance and technology advances
- Support development of educational resources (e.g., curricula, training), to support an evolving workforce

**Reducing barriers to testing**

- Identify potential improvements to regulatory processes and requirements
- Mitigate environmental risks & reduce costs & complexity of environmental monitoring

**Technology-specific system design and validation**

- Support the development & adoption of international standards for device performance and insurance certification
- Improve methods for safe, cost-efficient installation, grid integration, O&M, and decommissioning
- Evaluate current and potential future needs for IO&M infrastructure
Project Objectives: Approach

- **PRIMRE is the overarching system** that brings together information from 7 Knowledge Hubs.
- Each **Knowledge Hub** houses a different type and format of information related to marine energy.
- Several Knowledge Hubs were developed under other projects, but all have been integrated (made interoperable), expanded, and improved under the PRIMRE project.
- PRIMRE has a **one-stop search** that allows users to find and contribute data in any part of the system.
- Value-added products developed based on access to all data and information types.

**MHKDR** hosts all data collected by WPTO-funded projects

**Tethys** hosts documents on environmental effects

**Tethys Engineering** hosts technical MRE documents

**Marine Energy Software** hosts codes and software

**Telesco** hosts testing and measurement guidance

**Marine Energy Projects Database** hosts deployment info

**Marine Energy Atlas** hosts GIS-based resource maps
Project Objectives: Expected Outputs and Intended Outcomes

**Expected Outputs**

- **PRIMRE and 7 Knowledge Hubs**
- **Launched Tethys Engineering, MRE Software, and Telesto**
- **Public webinars, workshops, publications**
- **International data sharing workshop (OES)**
- **Value Added Products**
- **Lessons Learned**
- **Signature Projects**

**Intended Outcomes**

- **Improve access to US data and information**
- **Strengthen links to international community**
- **Retain lessons learned**
- **Coordinate across labs**
- **Enable forward-looking research**
- **Facilitate marine energy development**
- **Bridging the gap between data and people**
Project Timeline

• Continue collaboration and coordination among 3 labs (weekly meetings)
• Continue curating and maintaining the PRIMRE Knowledge Hubs
• Develop and implement Stakeholder Engagement activities

**FY19**
- Develop and launch Tethys Engineering
- Publish Data Guidelines and Best Practices for contributing and linking to PRIMRE
- Enhance search capabilities on MHKDR
- Develop Signature Project organizational structure for accessing related data and information

**FY20**
- Develop and launch MRE Software and Telesto
- Add 3 Signature Projects
- Establish consistent data standards and metadata across Knowledge Hubs
- Aggregate search across Knowledge Hubs
- Conduct user review of 2 Knowledge Hubs

**FY21**
- Add 5 Signature Projects
- Launch Lessons Learned interviews with developers, researchers, test centers
- Conduct user review of 2 additional Knowledge Hubs
- Further integration of PRIMRE with WPTO-funded projects
# Project Budget

<table>
<thead>
<tr>
<th>Lab</th>
<th>FY19</th>
<th>FY20</th>
<th>FY21</th>
<th>Total Actual Costs FY19–FY21</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNNL</td>
<td>$478K</td>
<td>$315K</td>
<td>$428K</td>
<td>$1,221K</td>
</tr>
<tr>
<td>NREL</td>
<td>$155K</td>
<td>$208K</td>
<td>$216K</td>
<td>$579K</td>
</tr>
<tr>
<td>Sandia</td>
<td>$259K</td>
<td>$210K</td>
<td>$410K</td>
<td>$879K</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$892K</strong></td>
<td><strong>$733K</strong></td>
<td><strong>$1,054K</strong></td>
<td><strong>$2,159K</strong></td>
</tr>
</tbody>
</table>

- No changes in scope, overruns, budget reallocations, or missed milestones.
- Lead lab rotates to ensure strong coordination and shift in administrative load.
- External Steering Committee represents industry, academia, agencies, international reps, to ensure community input in decision making.

- Budgets for previous Knowledge Hubs development:
  - MHKDR: FY19=$96K FY20=$183K FY21=$135K Total=$413K
  - Tethys: FY19=$197K FY20=$103K FY21=$151K Total=$451K
PRIMRE is an outward facing data system to ensure awareness and access

- All aspects are geared towards end-users
- Design and content based on stakeholder inputs
- Cloud-based storage provides universal access without a paywall
- Allows engagement with smaller institutions, increased DEI access

Multi-sector Steering Committee guides and reviews progress
Webinars held annually to highlight new features
Workshops held at conferences in US and internationally
Newsletters allow for ongoing, open access engagement
Social media encourages access/involvement for public
International engagement through tech transfer and workshops
## Performance: Accomplishments and Progress

<table>
<thead>
<tr>
<th>Integrated Data System</th>
<th>One-Stop Search</th>
<th>Guidelines/Best Practices</th>
<th>Signature Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brings together all US marine energy outputs from disparate systems</td>
<td>Improves discoverability of US marine energy data, information, and resources</td>
<td>Enables sharing of data across US and international databases</td>
<td>Allows access to all data and information from significant WPTO projects</td>
</tr>
</tbody>
</table>

### Tethys Engineering
- Hosts thousands of technical and engineering marine energy documents

### MRE Software
- Systematically catalogues codes and software relevant to marine energy

### Telesto
- Provides guidance on marine energy testing, measurement, and analysis

### Lessons Learned
- Captures progress and caveats from US marine energy industry
# Performance: Accomplishments and Progress

**Papers & Presentations**
- ICOE 2021
- EWTEC 2021
- PAMEC 2020
- EWTEC 2019
- WPW 2019
- OTC 2019
- EWTEC 2021
- WPW 2019
- OTC 2019
- WPW 2020
- PAMEC 2020
- OTC 2019

**Workshops/Attendees**
- OREC 2021
- ORES 2021
- PAMEC 2020
- OREC 2019
- EWTEC 2019
- PAMEC 2020
- OREC 2019
- EWTEC 2019
- PAMEC 2020
- OREC 2021
- ORES 2021
- PAMEC 2020

**Webinars/Attendees**
- MECC Webinar 2021
- WPTO R&D Deep Dive 2021
- 2 New PRIMRE Developments 2021
- National Lab Demos 2021
- MECC Webinar 2020
- Tethys Engineering 2019

## PRIMRE Tracking Metrics

<table>
<thead>
<tr>
<th></th>
<th>FY19</th>
<th>FY20</th>
<th>FY21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pageviews</td>
<td>0</td>
<td>1000</td>
<td>2000</td>
</tr>
</tbody>
</table>

## Knowledge Hub Tracking Metrics

<table>
<thead>
<tr>
<th></th>
<th>FY19</th>
<th>FY20</th>
<th>FY21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sessions</td>
<td>0</td>
<td>1000</td>
<td>2000</td>
</tr>
<tr>
<td>Pageviews</td>
<td>0</td>
<td>1000</td>
<td>2000</td>
</tr>
</tbody>
</table>

https://tethys-engineering.pnnl.gov/summaries/primre-fact-sheet

### PRIMRE Tracking Metrics

- 0
- 1000
- 2000
- 3000
- 4000
- 5000
- 6000
- 7000

### Knowledge Hub Tracking Metrics

- 0
- 10000
- 20000
- 30000
- 40000
- 50000
- 60000
- 70000

### Tethys Tracking Metrics

- 0
- 10000
- 20000
- 30000
- 40000
- 50000
- 60000

### MHKDR Tracking Metrics

- 0
- 10000
- 20000
- 30000
- 40000
- 50000
- 60000

---

U.S. DEPARTMENT OF ENERGY | OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY | WATER POWER TECHNOLOGIES OFFICE
Future Work – FY22

PRIMRE & Knowledge Hubs
- Added Marine Energy Atlas to PRIMRE
- Enabled aggregate search across the Tethyses & MHKDR
- Reviewed & increased access to MRE Software
- Overhauled Marine Energy Projects Database (new features, updates)

Coordination & Support
- Provided language & technical support for AOPs and FOAs
- Provided technical support for dissemination of WPTO funded projects (webinars, dissemination guide)

Value Added Products
- Supporting TEAMER & UMERC
- Added Signature Projects for TEAMER & UMERC
- Completed interviews for Lessons Learned
- Developed process for Lessons Learned data analysis

Outreach & Engagement
- Hosted 2nd International OES Workshop on Data Sharing
- Hosted webinars & workshops (PAMEC)
- Contributed to STEM page on PRIMRE
- Developed a PRIMRE Fact Sheet and video
- Conducted user review of Tethys Engineering & MHKDR
Future Work – FY23 & FY24

**PRIMRE & Knowledge Hubs**
- Enable aggregate search across all remaining Knowledge Hubs
- Update PRIMRE Events Calendar
- Continue updating Marine Energy Projects Database
- Update/reorganize Telesto
- Revamp OES GIS

**Coordination & Support**
- Provide ongoing technical support for AOP & FOA language
- Provide ongoing assistance with data & information dissemination
- Improve access to and awareness of data for underserved institutions

**Value Added Products**
- Assist WPTO with Lessons Learned integration into project close outs
- Enable data pipelines for all marine energy data
- Continue to expand Signature Projects for accessibility
- Analyze gaps & opportunities

**Outreach & Engagement**
- Host webinars and workshops, focus on underserved individuals and institutions
- Host annual international workshops on data sharing
- Establish linkages with international databases
Thank You

PRIMRE PIs:
- Andrea Copping (andrea.copping@pnnl.gov)
- Jon Weers (jon.weers@nrel.gov)
- Cesar Castillo (cesar.castillo@sandia.gov)

PRIMRE Team:
- PNNL: Jonathan Whiting, Lysel Garavelli, Hayley Farr, Dorian Overhus, Deborah Rose, Levy Tugade, and Chitra Sivaraman
- NREL: Jon Weers, Jay Huggins, Tom King, Hanna Fields, and Katie Peterson
- Sandia: Kelley Ruehl, Thushara Gunda, Will Peplinski, Alec Carruthers, and Rachel Homan

https://primre.org