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MHK Manufacturing and Supply Chain Needs Assessment

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NREL 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

Title: Marine and Hydrokinetic Manufacturing and Supply Chain Needs Assessment

The Challenge: A robust marine and hydrokinetic (MHK) manufacturing and domestic supply chain:

1. Reduces the cost of manufacturing and assembling components
2. Improves component reliability
3. Enables design innovations
4. Provides high-quality U.S. manufacturing and supply chain jobs.

Project Objective: Identify U.S. manufacturing and assembly needs, opportunities, and possible actions that support the U.S. MHK supply chain as well as reduce the levelized cost of energy (LCOE) for MHK devices.

Partners: No additional formal partners other than stakeholder involvement.

Technology Maturity

- Test and demonstrate prototypes
- Develop cost effective approaches for installation, grid integration, operations and maintenance
- **Conduct R&D for innovative MHK systems & components**
- Develop tools to optimize device and array performance and reliability
- Develop and apply quantitative metrics to advance MHK technologies

Deployment Barriers

- Identify potential improvements to regulatory processes and requirements
- Support research focused on retiring or mitigating environmental risks and reducing costs
- Build awareness of MHK technologies
- Ensure MHK interests are considered in coastal and marine planning processes
- Evaluate deployment infrastructure needs and possible approaches to bridge gaps

Market Development

- Support project demonstrations to reduce risk and build investor confidence
- Assess and communicate potential MHK market opportunities, including off-grid and non-electric
- Inform incentives and policy measures
- Develop, maintain and communicate our national strategy
- Support development of standards
- Expand MHK technical and research community

Crosscutting Approaches

- Enable access to testing facilities that help accelerate the pace of technology development
- Improve resource characterization to optimize technologies, reduce deployment risks and identify promising markets
- Exchange of data information and expertise

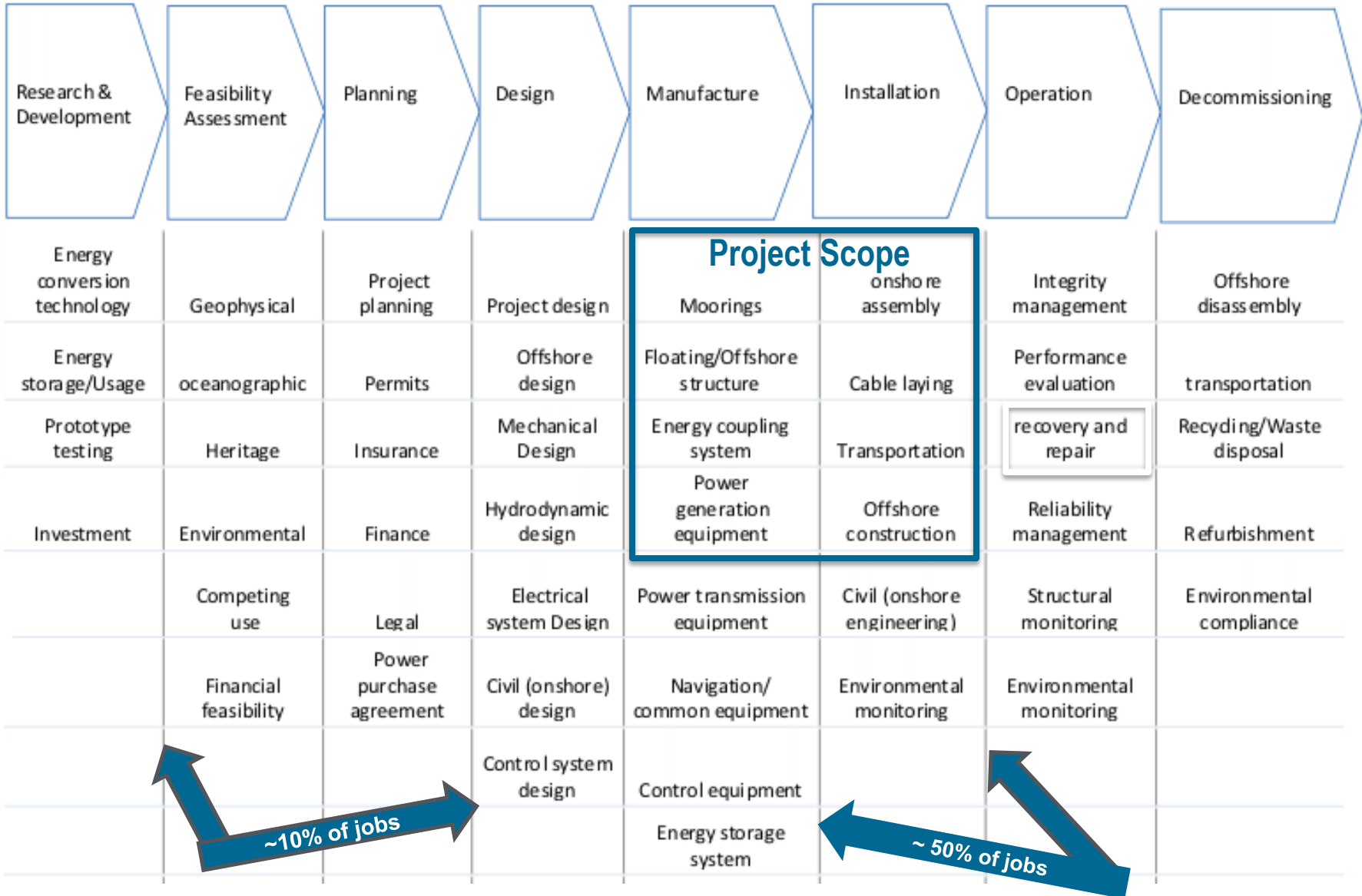
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The Impact

- Informed actions and investments that best support the U.S. MHK industry.
- Potential impacts:
 1. Support identification of new market opportunities
 2. Reduce LCOE
 3. Increase U.S. manufacturing of MHK equipment
 4. Increase number of U.S. jobs
- Final product: Summary project presentation and report that can be used by industry and DOE

Technical Approach



1. Surveyed available information

- Extensive literature review
- Site visits and stakeholder interviews

2. Down-selected MHK technology focus

- Availability of reference model information
- Larger number of U.S. companies
- Larger U.S. resource potential than tidal or current devices

3. Performed MHK manufacturing SWOT analysis

- Literature review results
- Stakeholder interview and site visits
- Internal brainstorming session

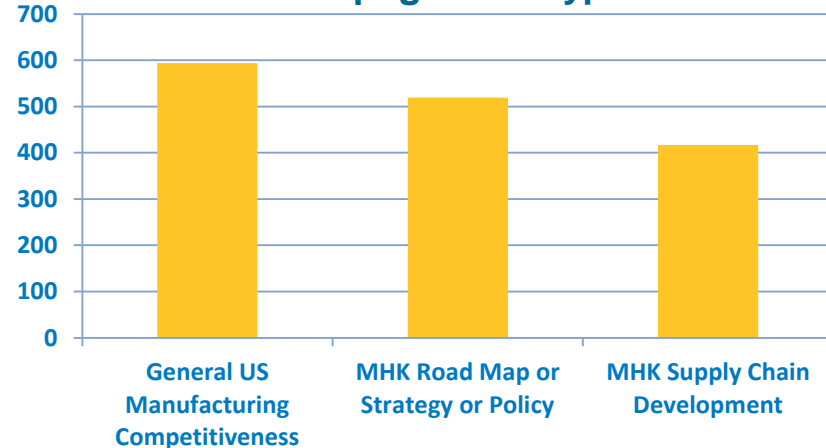
4. Analyzed supply chain capabilities and opportunities

- Fabrication
- Wave energy converter (WEC) assembly
- Transportation and logistics
- Installation and maintenance

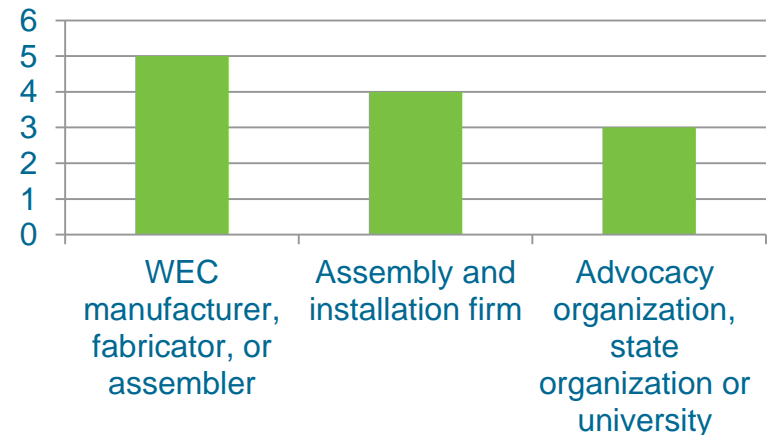
5. Documented results

- Comprehensive presentation
- Executive presentation
- Summary technical report

Number of pages and type reviewed



Stakeholders Interviewed



Comprehensive presentation and technical report were completed in 2014, providing:

Information needed to make strategic decisions about potential U.S. manufacturing investments by:

1. Identifying U.S. WEC manufacturing and assembly gaps, challenges, and opportunities
2. Creating a framework and recommendations for strengthening U.S. WEC manufacturing competitiveness

Recommendations for addressing U.S. WEC manufacturing gaps and challenges

Key opportunities to improve U.S. MHK manufacturing competitiveness

Recommendations for addressing U.S. WEC manufacturing gaps and challenges include:

1. Ten recommendations are identified for increasing domestic demand for WECs to increase economy of scale, supplier interest, investment, and innovation
2. Supporting design for manufacture activities, increasing lot size, facilitating exchange of ideas, and tracking manufacturing and logistics costs will help reduce the moderate costs of U.S. volume manufacturing, including labor costs, finance, capital equipment/plant, and port-side labor for assembly

Key opportunities to improve U.S. MHK manufacturing competitiveness include:

1. Increasing supplier and WEC workforce interest in WECs through the characterization of opportunities in international markets and continued support of technology development, component, and system testing
2. Using component reliability (the key U.S. competitive advantage), LCOE reduction potential, and market value as metrics, the following technology areas have the most potential for achieving Clean Energy Manufacturing Initiative objectives:
 - i. Power-take-off (PTO) components
 - ii. Structure and prime mover
 - iii. Mooring and foundation

- Project started in October 1, 2013.
- A comprehensive internal report was delivered December 24, 2014, with a three-month delay due to a competing MHK priority.

Budget History

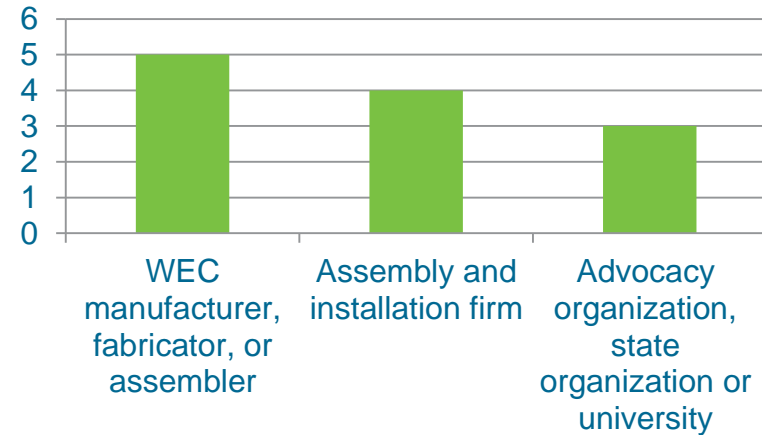
| FY2014 | | FY2015 | | FY2016 | |
|--------|------------|--------|------------|--------|------------|
| DOE | Cost-share | DOE | Cost-share | DOE | Cost-share |
| \$0 | \$0 | \$0 | \$0 | \$0 | \$0 |
| | | | | | |

- Project was funded in late FY13 with \$260k and all funds have been costed.

Partners, Subcontractors, and Collaborators:

This was primarily a National Renewable Energy Laboratory project; however, the project was made possible by the 12 stakeholders who participated.

Stakeholders Interviewed



Communications and Technology Transfer:

- An internal technical report was delivered in 2014 that can be used by decision makers to inform future investments
- There would be value in vetting the report with stakeholders and publishing it externally.

FY17/Current Research: No follow-on work is planned for FY17.

Proposed Future Research:

- Update, vet, and publish the comprehensive internal report and presentation
- Support the development of key opportunities to improve U.S. MHK manufacturing competitiveness, including
 1. Increase supplier and WEC workforce Interest in WECs by quantifying export market potential
 2. Perform Clean Energy Manufacturing Analysis Center cost-sensitivity analyses for the most promising supply chain opportunities in PTO components, structure, prime mover, mooring, and foundation