ELECTRIC POWER RESEARCH INSTITUTE

Marine Hydrokinetic Technology: Prioritized RDD&D Needs

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Summary

- October 2008 EPRI facilitated workshop Included a broad set of participants

- Eighteen (18) RDD&D topical areas encompassed
  - Wave Energy
  - Tidal In-stream or Current Energy
  - Ocean In-stream or Current Energy
  - River In-stream or Current
  - Ocean Thermal Energy Conversion

- The three highest prioritized topical areas were
  - Testing
  - Environmental
  - Standards

- Identified a need for technology road mapping

The Starting Point

- Twelve (12) topics identified in the UK Roadmap
  - Resource Modeling - Device modeling
  - Testing - Moorings & Sea bed Attach'ts
  - Electrical - Power Take Off and Control
  - Engineering Design - Lifecycle & Manufacturing
  - Installation, O&M - Environmental
  - Standards - System Simulation
- Six (6) other topics were subsequently added
  - Materials – low cost - Storage
  - System Evaluations - Vision and Roadmap
  - Master Gen/Trans Planning - Education

MHK Technology Needs Briefings

EPRI Overview and Roadmapping	Roger Bedard, EPRI
Resource Assessments: Wave Energy	Roger Bedard, EPRI on behalf of George Hagerman, Virginia Tech
Resource Assessments: Tidal Current	Brian Polagye, University of Washington
Resource Assessments: River Current	Mirko Previsic, Re-Vision
Resource Assessments: Ocean Current	Sue Skemp, Florida Atlantic University
Resource Assessments: Ocean Thermal	Richard Meyers, Ocean Energy Council
Hawaii Specific R&D Needs	Rick Rocheleau, University of Hawaii
Device Modeling and System Simulation	Bob Thresher, NREL
Experimental and System Testing	Bob Paasch, Oregon State University (OSU)
Moorings and Sea Bed Attachments	Tom Hudon, PCCI Inc.
Electrical Infrastructure	Tom Key, EPRI
Power Take Off and Control	Bob Paasch, OSU
Engineering Design*	Mirko Previsic, Re-Vision
Life Cycle and Manufacturing	Chris Retzler, Pelamis Wavepower
Installation and O&M	Chris Retzler, Pelamis Wavepower
Standards	Walt Musial, NREL
Ocean Renewable Energy Coalition Perspectives	Sean O'Neill, Ocean Renewable Energy Coalition
National Hydropower Association Perspectives	Mike Murphy, NHA
Alaska Specific R&D Needs	Roger Bedard on behalf of David Lockard, Alaska Energy Authority
Environmental	Glenn Cada, ORNL
Storage	Patrick Sullivan, NREL
System Configuration	Mirko Previsic, Re-Vision

Briefings and OREC and NHA Member Participation

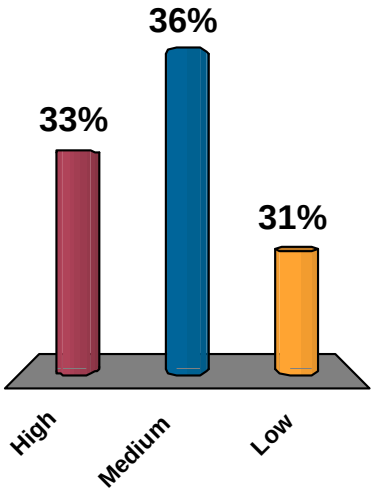
- MHK Technology Needs Briefings were presented by experts at the workshop
- The Ocean Renewable Energy Coalition surveyed their MHK members prior to the workshop. Fourteen (14) members responded.
- The National Hydropower Association (NHA) surveyed their MHK members prior to the workshop. Thirteen (13) members responded.
- Results of these surveys were input into the workshop

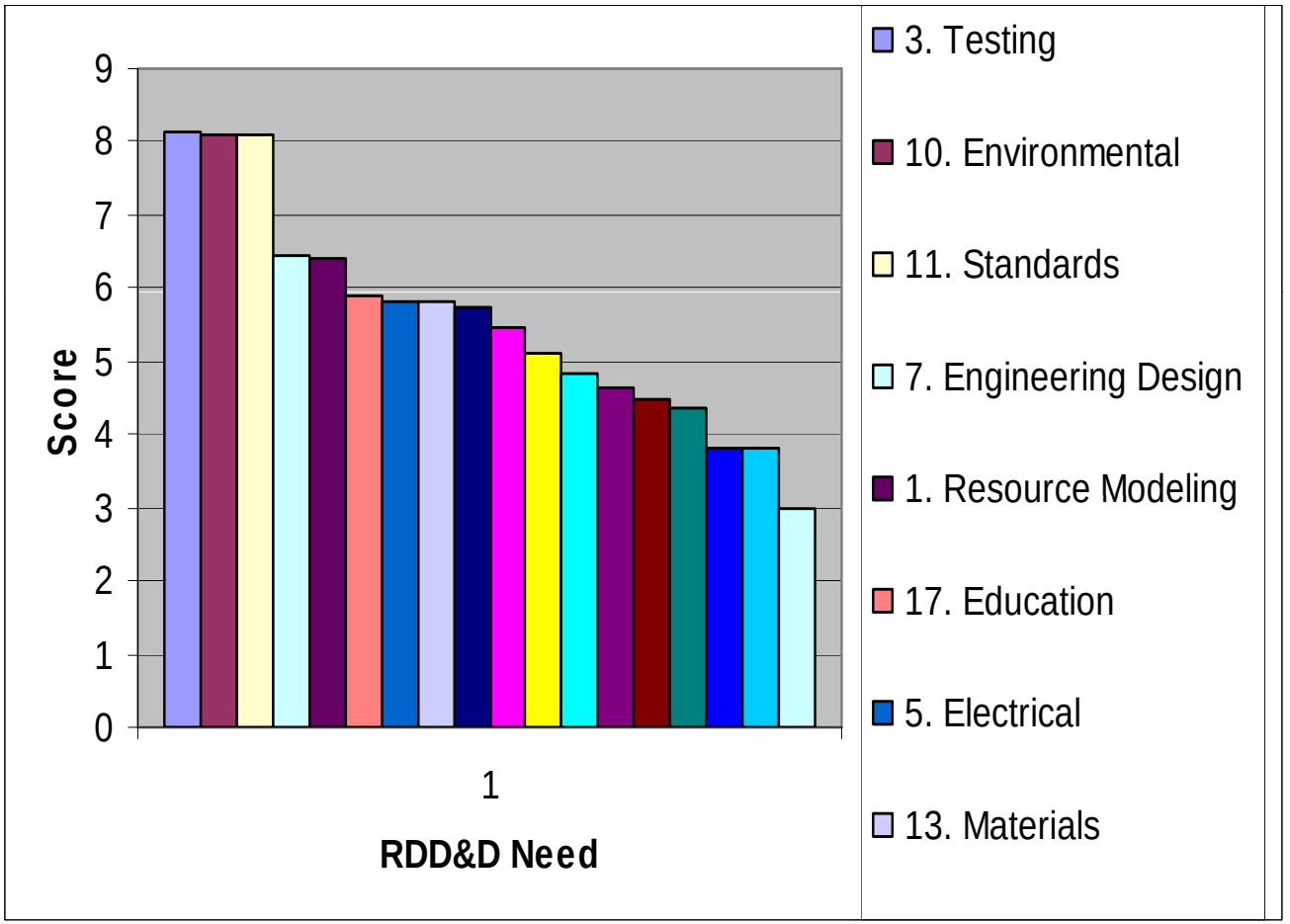
Voting Results of Full MHK Workshop Voting (40 Participants)

Participants Voted either High, Medium or Low

Installation and O&M

An example of low consensus

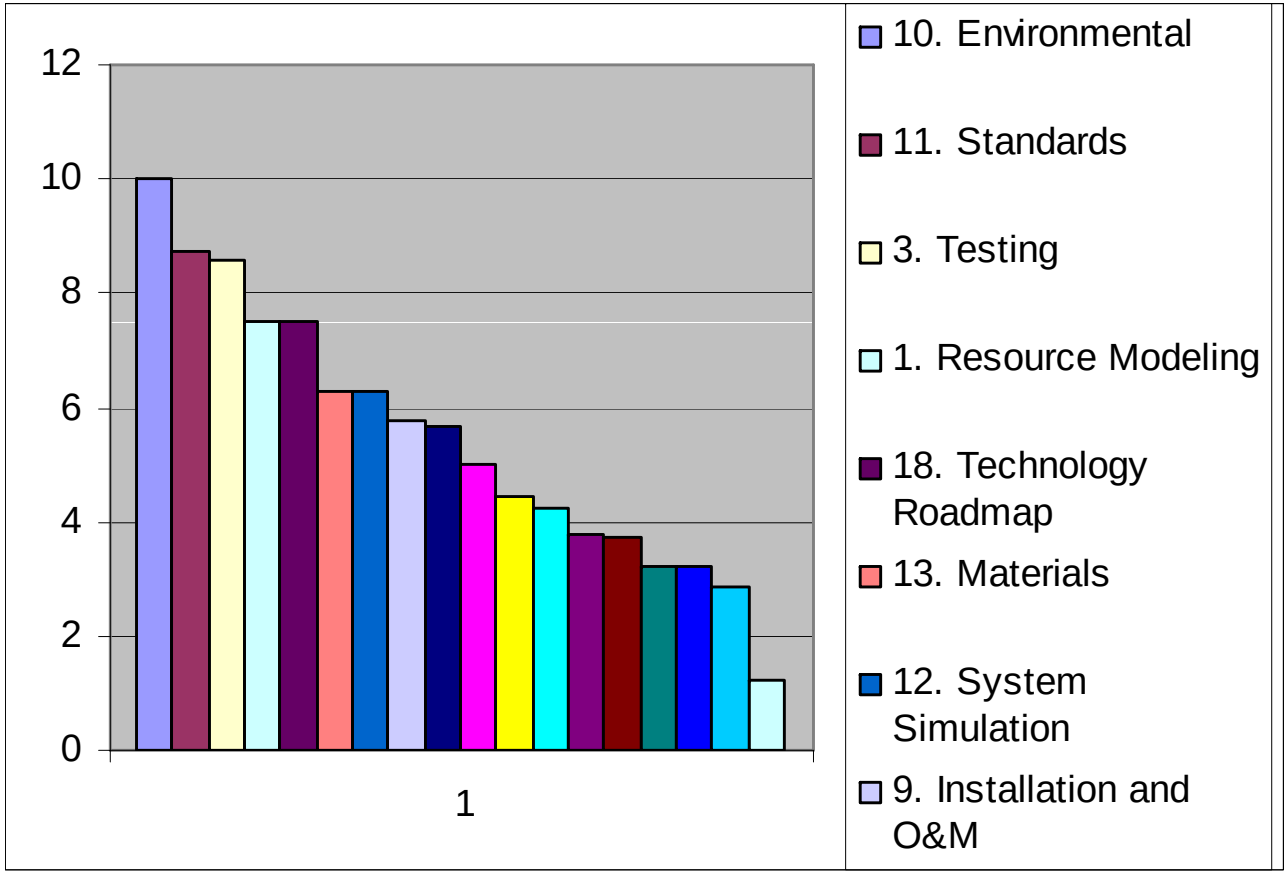


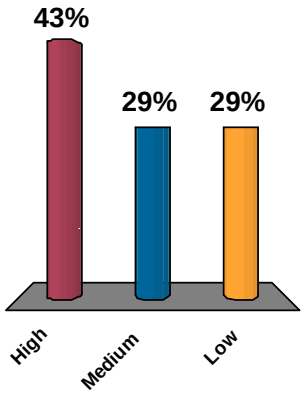


Results of Steering Committee Voting

Steering Committee

R. Bedard/EPRI
S. O'Neill/OREC
R. Thresher/NREL
D. Lockard/AEA
B. Paasch/OSU
B. Polagye/UW
M. Quinney/MMS
J. Hill/FERC





Installation and O&M Topic Results

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Summary Results

The three highest prioritized topical MHK RDD&D Technology Need areas were:

1) Testing (development including experimental through pilot demonstration)

2) Environmental (which will require device testing and deployed projects)

3) Standards

Summary Recommendations

- Once funding is available, specific programs and projects identified in this workshop should be developed and implemented.
- Development of a Near Term Technology Roadmap
- Consideration be given to a Utility-Focused Workshop:
  - MHK impacts on utility reliability and price
  - The capacity value of MHK
  - How the variability and capacity factor of marine energy reduces the value of the power
  - What generation resources would match well with MHK (storage hydro, diesel, etc?)
  - Low vs. high penetration impacts on utility operations