International Experiences in Marine Hydrokinetic Technology Advancement and Public Support Programs: Insights for the U.S. and Opportunities for International Collaboration

Letter Report

Prepared for:
National Renewable Energy Laboratory and
US Department of Energy

Prepared by:

Clean Energy States Alliance
50 State St Suite 1
Montpelier, VT 05602

February 2010

BACKGROUND

The Department of Energy (DOE) and the National Renewable Energy Laboratory (NREL)'s objectives related to marine energy technology (MHK) include:

1. Reduce costs and improve performance through technology development and testing
2. Move technologies toward deployment and commercialization
3. Encourage information –sharing among states, institutions, and other stakeholders on MHK technologies
4. Provide states with increased opportunity to test and evaluate marine energy projects
5. Document and communicate lessons learned from early projects

To help in achieving the above objectives, DOE and NREL have contracted with a group of state-based organizations led by the Clean Energy States Alliance (CESA). The other organizations involved include the National Association of State Energy Officials (NASEO) and the Association of State Energy Technology Transfer Institutions (ASERTTI). The primary consultant for this project is Clean Markets. This project is named the Marine Energy Technology Advancement Partnership (METAP).

In fulfillment of Task 4.1 of the METAP Work Plan, the objective of this report is to "Provide insights from international experience in public MHK funding support and cooperative solicitation models, particularly the experiences of the UK Carbon Trust."

Lessons learned from international experiences may provide important examples of how DOE's MHK programs can better collaborate with states and the international community, more effectively encourage information sharing across projects and accelerate the MHK industry's commercialization in the US.

This report focuses on MHK programs in the U.K. as it is the country with the most advanced the MHK sector at this time. This report also suggests a number of opportunities for international collaboration to further accelerate the industry. Through the research for this report, CESA identified a number of areas where a coordinated, international effort to share information could overcome common barriers to MHK industry development.

OVERVIEW OF MHK ACTIVITIES IN THE UNITED KINGDOM

The U.K. MHK industry is significantly more advanced than the industry in the U.S. in terms of technology development, testing and deployment. Many experts identify a few factors responsible for this early MHK leadership: the UK (1) has made MHK technology a priority area of energy interest for energy security and economic development; (2) has set clear national renewable energy targets and an MHK specific target; (3) has established a streamlined regulatory and planning process and (4) has fostered a coordinated government framework by which both federal and local governments are investing jointly, strongly and consistently in the MHK technology development, testing

and deployment, including the establishment of a number of innovative public funding programs.

Major Elements of Successful UK MHK Support Program

1. **Federal, local, regional and international coordination**

The U.K. MHK program is well coordinated across national, regional, local and multi-national governments, with many projects and initiatives receiving funding from federal, local and European Community sources, and with projects working across countries. Indeed most European Community research funding requires project teams to be made up of representatives from at least three EU countries, most project teams represent many more countries. Many of the policies and programs involve coordinated local and regional government initiatives, and in fact, many of the programs and policies would not be successful in achieving their objectives without the coordinated participation of local governments. One excellent example of this multi-government cooperation is the European Marine Energy Centre (EMEC)- the UK's full scale 10 berth marine energy test center. An investment of this would have not been possible without the coordinated investment and policy of federal, regional and local governments. There is a more detailed description of EMEC below. The success of these policies/programs in Europe underscores the importance of coordinating clean energy technology policies and investments across multiple levels of government.

2. **Targets**

The U.K. has set national targets for renewable energy and MHK technologies. This is an important leadership step as it creates market expectations, strengthens developer and investor confidence, and provides predictability for future funding and program deployment continuity. The U.K.'s current targets are:

- 15% renewable energy target for 2020
- 2GW of MHK technologies producing power in U.K. by 2020
- The Scottish government set an even more aggressive regional target for wave and tidal, the Scottish Marine Supply Obligation, for 4.2% by 2016

3. **Public Investment**

U.K. national and local governments have consistently dedicated large amounts of public funding to MHK activities. Sustained public funding to support emerging renewable energy technologies such as MHK devices is critical to enabling significant cost reductions and to leveraging private investment in these riskier technologies. The next section of this report provides greater detail on specific programs. However, here is a summary of the major public funding sources for MHK technology today:

- £115M invested through 2008 ($172M), £48M in 2009 and £60M in 2010
- Marine Renewables Deployment Fund (MRDF) (established in 2005): £42m in grants to early stage devices to include 25% capital cost support and Revenue support of £100/MWh, with a maximum of £9m/project. However, this program has not been successful to date because no company has been able to meet the eligibility requirement of having a device in continuous operation for three

months. An additional £8 million was dedicated to supporting environmental research and infrastructure.

- Marine Renewables Proving Fund (MRPF)- This £22 million (US$33m) fund was created in 2009 to address the shortcomings of the MRDF and help companies qualify. The MRPF supports full scale technologies to meet the MRDF's eligibility criteria by co-funding demonstration projects for at least three months of continuous deployment. Carbon Trust manages the MRPF and the program is described in more detail below.
- Scottish Executive Fund - £13m allocated to assist 9 developers in deployment by 2010
- The UK has also invested in the creation of two national test centers:
    - European Marine Energy Center (EMEC)
    - U.K. Wave Hub installed September 2010 – £42M ($64.36M)

4. Regulatory Streamlining

U.K. laws strive to grant marine energy development permits within six months of application. This is a dramatic difference from the U.S. where a best-case regulatory approval process can take at least three years. While at the U.S. federal level, the Federal Energy Regulatory Commission has established a process that seeks to shorten the federal licensing timeframe for MHK devices, states and local governments also have regulatory jurisdiction over these projects with resulting lengthy regulatory review timeframes and often duplicative review at the state, federal, and local levels of government. In contrast, the U.K. has sought to streamline its permitting and regulatory process for marine energy deployment through three important actions:

- The Marine and Coastal Access Act of 2009 enacted comprehensive marine management in the UK and established the Marine Management Organization (MMO), which is charged with planning, monitoring, licensing and collecting data for all ocean activities, including marine energy deployment. The MMO combined the work the Marine and Fisheries Agency and marine related activities of the Department of Energy and Climate Change and the Department of Transportation into one responsible agency – the MMO. This has reduced the number of agencies with jurisdiction over siting of MHK devices to one lead agency, eliminating duplication, lack of coordination, and redundancy.
- In 2009, similarly Marine Scotland was established at the regional level, as a "one-stop-shop" for marine renewables in Scotland. The agency brings together the functions and resources of three environmental and regulatory agencies that oversaw marine energy permitting with the explicit mandate to "promote the marine renewables industry in Scotland through streamlined planning and regulatory frameworks." Marine Scotland's stakeholder workshop process could provide an excellent regulatory model for reforms in the US regulatory process- specifically the process gathers various stakeholders in a series of workshops so that they can discuss their different viewpoints and priorities together- also better understanding the values and needs of other stakeholders at the same time. This process has proven to speed up the regulatory process.
- An update of the U.K. Environment Ministry's Strategic Environmental Assessment (SEA) also improved the regulatory framework with specific

guidance provided for streamlined marine renewables siting. The significance of an SEA is important to note as it is the government, rather than the developer, preparing an upfront planning document and process to identify preferred sites for MHK and offshore wind projects. This is a very proactive approach for the government to take to support a nascent industry.

- The UK Crown Estate, which owns and leases the sea around the UK, further demonstrated the government's support of marine renewables through its 2010 leasing of 10 wave and tidal power sites around the Orkney islands and the Pentland Firth. Awarded leases would provide a total of 1.2 GW of power.

5. Creating a market for MHK through Renewable Procurement Obligations

The UK has sought to encourage a market for utilities to invest in and purchase marine energy through the Renewables Obligation Certificates (ROC) program. This program is similar to the Renewable Energy Credits system under US state RPS programs which establishes a trading scheme as part of the program that allows utilities to satisfy some or all of their renewable energy procurement obligations through purchase of renewable energy credits. In the UK, energy produced from offshore renewables is provided with a multiplier for each MWH generated of 2 ROCs, twice that of other technologies. Scotland is even more generous in its support of MHK technologies and offers 3 ROCs for tidal energy and 5 ROCs for wave energy. Spain and Portugal have developed similar support programs through generous marine energy feed-in tariffs.

These policies have been successful in securing the interest and investment of large utility and industrial companies in the U.K. For example, the Crown Estate's 2010 Pentland Firth leasing round included leases to four large utility companies, in partnership with device developers.

PUBLIC FUNDING SCHEMES

As mentioned, a hallmark of many of the U.K.'s funding schemes for renewable energy has been coordination between national, regional and local entities (governments and economic development agencies) and across public and private organizations. The U.K. Carbon Trust, in particular, has designed and implemented a number of innovative technology accelerator programs that encourage learning and information transfer across the MHK sector by working in close partnership with developers and industry players.

The major public funding schemes in the UK include:

- **SuperGen Marine Consortium**– This marine energy research program was designed as a consortium and includes teams of researchers from 11 U.K. universities collaborating on topics such as: resource modeling, control, engineering guidance, moorings, economics, device modeling, optimization, arrays, impact of currents & waves, power take off, generators, moorings, environment, and economic modeling. [i] Supergen is the flagship UK programme supporting basic, university, science and engineering in the energy area. Supergen

uses a consortium approach to building teams that have the breadth of coverage that energy research demands. The resulting multi-centre and multi-disciplinary teams collaborate closely and bring in industrial partners to increase the impact of the research.

- **Slatire Prize**- this innovative public funding mechanism is a £10 million challenge prize from the Scottish government that will be awarded to "the team that can demonstrate in Scottish waters, a commercially viable wave or tidal stream energy technology that achieves the greatest volume of electrical output over the set minimum hurdle of 100GWh over a continuous 2 year period using only the power of the sea." The Scottish government is supporting applicants by providing support for site identification and leasing.

  In principle, a prize challenge encourages new entrants into the market. However, whether the Saltire Prize it is sufficiently large to bring additional developers into the market remains to be seen. Crucially, the prize comes after the cost of deployment, and the £10m is only a fraction of the ~£150-200m required to build the farm to deliver the required energy.

- **Carbon Trust Technology Accelerators-** The Carbon Trust is a UK government funded non-profit with the mission to reduce carbon emissions in the UK. Its board includes representatives from public agencies and private companies and the organization's strategic role is to function with a private sector perspective. Its independence and unique public-private partneship structure have allowed it to develop innovative technology funding and finance programs, include public venture capital investments, business incubation, and revolving loan programs. Three programs in particular merit more detailed descriptions below.

CARBON TRUST PROGRAMS

Established in 2001, the Carbon Trust receives its mandate and funding from the UK government. It is considered an independent company and has its own equity investment arm, Carbon Trust Investments. The mission of the Carbon Trust is to accelerate the move to a low carbon economy by helping organizations reduce their carbon emissions and by developing commercial low-carbon technologies. The Carbon Trust is an integrated organization with many programs including providing carbon reduction solutions for businesses, developing new low carbon technologies, providing energy efficiency loan guarantees, and partnering with clean energy incubators. These programmes are all complementary and seek to minimize the business risks and facilitate the opportunities surrounding climate change.

Marine Renewables Proving Fund (MRPF)

The Carbon Trust was awarded management of the £22m MRPF by the UK Department of Energy and Climate Change. From this, Carbon Trust awarded a total of £21m to six of the most promising marine device developers in the UK to bring them towards the point where they can qualify for the Marine Renewables Deployment Fund (MRDF).

The program is unique because Carbon Trust has established a Technical Services Team (TST) to assist in the management and support of MHK projects that receive funding, rather than merely providing grants to a developer. Specifically, the mandate of the TST is to:

- Identify risks to delivery for each project milestone,
- Monitor, evaluate progress of project, mitigate risks,
- Help solve challenges as they arise,
- Capture learning across projects,
- Ensure the probability of successful deployment – and the impact of CT's funding - is maximized

Carbon Trust set aside £1m to support the TST. The TST is made up of:

- Offshore Engineering Experts
- Installation Advisors
- Technical Engineers
- Accountants
- Risk Assessors
- Consenting Experts

The TST is vital to helping CT understand and manage the risks associated with the new technologies that are being publicly funded by regularly reviewing the progress and results of awarded projects. The TST is responsible for ensuring that the awarded projects meet results, deadlines and progress rapidly against an ambitious timeline. Project developers can also request support from TST for project challenges that may arise.

The Carbon Trust reports that getting the right make up of the TST has been challenging so that the device developers trust and value the Team and receive useful assistance. Unless the TST is designed and composed of experts that can add value through their intervention and solve specific problems- the Team constitutes an expensive overhead.

Applicability to DOE: The DOE could consider using the TST concept, in a way that is appropriate to the U.S. context and agency authorities, to ensure a more hands-on management approach to projects that are awarded federal competitive grants to help accelerate the industry in the US. To work effectively, such a technical assistance approach should include provision not just of technical support and monitoring of funded demonstration projects but also the type of business and financing support that the TST provides.

Marine Energy Accelerator

In 2005-6, Carbon Trust carried out a Marine Energy Challenge to assess which, if any, of the then current wave and tidal devices had potential to be commercial and cost competitive compared with offshore wind. None passed the test. However, some components within some devices showed promise; and there was sufficient creativity and imagination within the marine energy community to warrant the development of the

Marine Energy Accelerator: to encourage closer working between teams; to explore the landscape for new devices; and to address generic issues such as fouling, tethering and power to shore systems.

Carbon Trust's Marine Energy Accelerator program was established in 2006 and focuses on funding support and technical assistance to earlier stage technologies than the MRPF. Currently three areas of MHK technology focus include: new device concepts, device component projects, and installation, operation and maintenance projects. This program is another example of how the CT funding programs employ a more hands-on role management and technical assistance role in advancing accelerator devices through the technology value chain rather than just providing grants and relying solely on the grantee to pursue the project deployment.

During the first phase, the Accelerator funded tens of device developers, inventors, and university research teams to further develop early device concepts and determine which held promise for broader commercial development. To assess the viability of their technologies, device developers were partnered with engineering firms to help improve the technology design for scale, cost effectiveness, survivability, etc. Device developers were also provided with business support on business plan, private fund raising, and management.

A particularly valuable aspect of the Accelerator program is that the CT awards stipulate that data and analysis resulting from the funded projects will be shared with Carbon Trust and may be aggregated to develop industry-wide cost models and to determine key areas for public investment to reduce technology costs, although individual project data is not shared publically.

Some of these device developers (the most promising presumably) also eventually were offered equity funding through Carbon Trust's Public Venture Fund, Carbon Trust Investments (CTI).

Launched in 2002, Carbon Trust Investments created the Clean Energy Fund to encourage the participation of private venture capital and private equity funds within the clean energy sector. The £25m fund provides capital to facilitate the commercial potential of clean energy companies based in the United Kingdom. The fund has invested approximately of £10 million across 11 early and late stage companies. CTI makes direct investments in clean energy companies. CTI typically invests between £250k and £4m in any given business and always invests alongside other investors. CTI does not invest more than 50% into any one round and the average total transaction size is typically between £500k and £10m. CTI is currently invested in two MHK companies, Pelamis Wave Power and Marine Current Turbines.

Applicability to DOE: DOE could consider employing the Accelerator program's approach to proactive assessment of technology viability, to project design, and to information sharing in the context of competitive grant programs for MHK technologies. This would involve DOE taking a more hands-on approach in administering its research

grants, partnering with developers on device design and deployment challenges, and providing technical and business support that developers may be lacking. In particular, the Accelerator's data-sharing requirement is valuable to ensure public funding leads to and allows for learning across the industry and within DOE. For example, gathering this level of data as a condition of public support would allow DOE to more clearly determine key technology cost bottlenecks in the industry and focus public support accordingly.

DOE could take an even more ambitious approach to learn from Carbon Trust venture investment arm, to help facilitate the commercialization of the marine energy R&D it funds- and better link research to industry development. This kind of an approach might require legislative action, or DOE might be able to use funds to capitalize an independent public venture fund.

Offshore Wind Accelerator

Although not an MHK support scheme, Carbon Trust's also has established an Offshore Wind Accelerator that merits recognition because the program has effectively engaged private industry in jointly funding technology research initiatives and projects.

The goal of the program is to reduce the cost of offshore wind energy by 10% by 2020. The Accelerator hopes to achieve this goal by targeting four key areas that are most promising and critical for achieving cost reductions. These are:

- Turbine foundations and installation techniques,
- Access to and maintenance of distant turbines,
- Optimal wind farm array layouts, and
- Reduction in electricity transmission losses and costs.

To better inform the cost reduction priorities, they were jointly identified by CT and their eight industrial partners, some of the leading international offshore wind farm developers:

- Dong Energy, the leading Danish offshore wind developer
- EON, Germany's largest utility
- Mainstream Renewable Power
- Innogy, of the German RWE group.
- ScottishPower Renewables, the UK's largest onshore wind developer
- SSE Renewables (formerly Airtricity), the renewable energy development division of Scottish and Southern Energy.
- Statkraft, the Norwegian state owned utility and Europe's largest renewable energy company
- Statoil, Norwegian international energy company

Common R&D projects in the four identified areas are funded by all the partners. Once ideas have been shortlisted, developed further and sufficiently de-risked, they may be ready for demonstration and testing. This demonstration and testing is critical in moving towards wide-scale deployment and to ensure that the identified cost reductions are realized. Since some technologies/developments will be more suitable for some

developers than others, developers propose projects that they'd like to take forward for demonstration, perhaps with other partners and each project is judged on its merits.

There is a steering group and technical working group, both include Carbon Trust and the private company members of the OWA. Collectively they make decisions on proposals.

Carbon Trust has contributed £25m in public funds to the Accelerator effort, while the eight companies have together provided matching funds of £25m each or £3.125m collectively. The incentive for these companies to participate and fund the initiative is that they are the end users of wind energy technologies, the final project developers who are looking to see cost reductions and improvements in access and maintenance, foundations, and transmission. As part of the funding consortium, the companies also have the added benefit of a right of first refusal on the sale of any IP resulting from the funded projects. Despite these benefits to industry, establishing the partnership took considerable effort on the part of Carbon Trust to convince the private companies of the benefits to the private partners in comparison to the costs.

Two solicitations have been released to date for foundations and access-related projects. Researchers or companies who win the competitive bid receive:

- Funding of up to £100,000 per concept to support the design and development of the successful concepts
- Potentially several million pounds of funding to take the concepts to full-scale demonstration
- The opportunity to work with eight leading offshore wind developers with licenses to construct 30GW of offshore wind in UK waters (60% of the UK's licensed capacity).

This public-private model works well in the offshore wind sector because the core industrial partners are not interesting in owning new technologies; instead they are the end users who want to see problems solved. Technology innovators are keen to come forward and engage since they know that their IP is not exposed, and that the chances of getting to market are greatly improved by partnering with large project developers.

Applicability to DOE: The U.S. and international marine energy industry is likely not yet close enough to commercialization to engage large industrial players in this type of public/private funding initiative. However, this unprecedented public-private model provides an interesting example of how federal incentive structures in technology research and project demonstration can be designed to more effectively engage large private companies to help accelerate an industry.

JOINTLY FUNDED TEST FACILITIES

Another area where lessons from the UK's MHK experience may be informative for DOE's programs and for structuring DOE collaboration with the states, is in test facility establishment and funding.

At present, there are two dedicated marine energy test facilities in the UK: the European Marine Energy Center (EMEC) in Scotland and Wavehub in southwest England.

- EMEC's is the first center in the world to offer wave and tidal developers the ability to test full- scale grid-connected prototypes in powerful wave and tidal conditions. EMEC also offers consultancy support, and research and development project involvement. EMEC's initial capital costs and early operations and maintenance were jointly funded by three levels of government agencies: (a) at the national level, by the UK Department of Energy and Climate Change and the Carbon Trust; (b) at the "state" level, by the Scottish Government through funding by the Scottish Enterprise, an economic development agency, and (c) at the local level, by the Highlands and the Islands economic development agency, which invested 10% of their budget into EMEC in its first year. The total capital costs for the facility were on the order of £50m. Since it establishment in 2001, EMEC has transitioned into a commercial company. Today, EMEC's ten test berths are fully leased and fees are covering all operating costs.
- Wavehub is a new MHK testing facility, which allows developers to test arrays of devices. It opened in September 2010. The total capital costs were £42M, which were jointly funding by £12.5m from local economic development agency, South West RDA; £20m from the European Regional Development Fund for the local area and £9.5m from the U.K. government.

LESSONS FOR US STATE-FEDERAL COLLABORATION

The UK's success has been closely tied to its ability to coordinate policy and funding among multiple levels of government- from the European Union to national to local agencies. Many of the projects described above would not be possible without such multi-government and industry coordination.

- **Test Facilities- too capital intensive for any one agency**
  In the case of capital-intensive projects like the MHK test facilities, it is unlikely that any single public entity would have the capability to fund the total costs. Joint funding also builds buy in and support from multiple players and better coordinates the efforts of local and federal agencies which may be supporting the same companies but not communicating on funding objectives.

- **Linking Federal Research push to State Market Creation Pull**
  Many of the policies and programs described above simply would not have been possible without the active participation of both national and local agencies. The ROC system is an example, with a clear parallel with the US's RPS system and Renewable Energy Credit technology carve outs or multipliers. Many states have such programs to support distributed technologies like solar. New Jersey is in the process of establishing a marine energy REC carve out. In the US, utilities are regulated at the state level and thus states will be at the center of creating a market

demand for marine energy. The DOE and other federal agencies alone will not be able to create a commercial market for marine energy technologies. They need the support of state agencies and regulators to pull these new technologies into the market.

- **Coordinating State and Federal Regulatory Agencies with Overlapping Mandates.** Similarly, many environmental and ocean permitting requirements are managed by state agencies. This is a specific, priority area in which federal agencies must work more closely with state agencies if we are to develop a consistent, coordinated, streamlined, and informed permitting process for MHK projects and achieve national marine energy goals.

OPPORTUNITIES FOR INTERNATIONAL COLLABORATION

Our research into international programs and best practices in marine energy RDD also revealed a number of opportunities where DOE and other federal agencies could collaborate more effectively with other nation's marine energy programs. An internationally coordinated market acceleration approach could support faster learning and cost reductions in the MHK industry.

Here are few areas that we have identified that represent meaningful opportunities to remove international market barriers and accelerate the marine energy industry globally through nation-to-nation collaborative actions:

- **Share device and component performance and cost data and computer models.** Increased sharing of device performance and cost data across countries would allow national agencies to have a critical mass of data to prioritize areas of research and public funding. There are so few projects in the water currently that such assessments are difficult for an individual country to perform. There may be particular areas of non-core value IP where developers may be convinced that the benefits of sharing information across the industry outweigh any lost proprietary edge. These could include, for example, sub-system components such as establishing a component reliability statistical database, sharing insights on improved sealing and coating, or "balance of systems" technologies, such as installation, maintenance, electrical infrastructure and mooring techniques.
- **Testing facilities**. Sharing information, lessons learned, experience, business and management plans and skills on test facility establishment and operation across countries could also more rapidly improve testing facility performance, transfer of information, and reduce both test facility-related and MHK technology costs. Specific information that could be shared are in the areas of test berth design experiences, offshore electrical cables and hook ups, and installation and maintenance lessons learned.
- **Managing environmental and regulatory risks.** There is a significant opportunity to advance cooperation among nations in the areas of MHK environmental assessments, ecological impact information sharing, monitoring results, and managing risk through the regulatory processes. For example, a U.S.

study recently concluded that many industry players "found the lack of knowledge or lack of access to information just as limiting as the lack of funding for studies… A collaborative effort could develop consensus on the basic information needs for a technology being deployed in a specific region (i.e., wave energy on the west coast or current turbines off the cost of Florida), evaluate existing data, and identify and fund studies to address gaps in existing information. The results could be used to help developers, agencies, and other stakeholders assess new potential projects. Further, the identified gaps could be used to channel new federal, state, or other funding."[ii] If an international database of environmental impact data and assessments was created and made publically available, it could be invaluable in advancing regulatory processes for review and understanding of MHK projects and their potential effects in all jurisdictions. To meet this objective, a tool and database should be developed for transparent data sharing and to serve as a repository for compiling existing information and collecting future data.

CONCLUSION

The examples from the UK described above, demonstrate that there are many opportunities for the federal government and interested state agencies to design joint funding solicitations and more creative, coordinated public support programs to accelerate learning across the industry and to leverage greater private investment with limited public dollars. DOE could look to the creative examples of Carbon Trust's technology accelerators and should take into consideration programs that facilitate the journey of early stage technologies to commercialization. There may be opportunities for DOE to involve private industrial players and end project developers to partner with DOE in solicitation planning and funding, as is occurring with the Carbon Trust Offshore Wind Accelerator.

Of particular merit, DOE could readily employ the more hands-on project management approach that the Carbon Trust has used to successfully accelerate learning across the industry and to require more extensive information sharing from publicly funded projects that will benefit the whole industry. Carbon Trust's Technology Accelerators' grant management and information sharing approaches all could be tailored to the U.S. context to leverage faster progress and more resources to the MHK sector.

Finally, DOE should continue to actively seek concrete opportunities for information sharing with international MHK programs to accelerate the global market that will benefit US companies.

[i] http://www.supergen-marine.org.uk/drupal/content/research-team
[ii] Pacific Energy Ventures, Siting Methodologies for Hydrokinetics: Stakeholder Perspectives. March 10, 2010.