Status of Hawaii's Ocean Energy Projects and Permitting Regime

A. T. Gill[1] and C. B. Black[2]

[1] Department of Business, Economic Development & Tourism,
State of Hawaii,
99 Aupuni Street #214, Hilo, HI 96720 USA
E-mail: agill@dbedt.hawaii.gov

[2] Department of Business, Economic Development & Tourism,
State of Hawaii,
235 S. Beretania Street 5th Floor, Honolulu, HI 96813 USA
E-mail: cameron.b.black@dbedt.hawaii.gov

Abstract

Hawaii's wave energy resource is abundant enough, theoretically, to supply most of the state's electricity. In addition, the Hawaiian Islands are situated perfectly for ocean thermal energy conversion (OTEC). Tidal and ocean current resources, however, are less promising.

The State of Hawaii's Renewable Portfolio Standard requires that 40% of its electricity come from renewable resources by the year 2030, a significant change from today—Hawaii is presently highly dependent on fossil fuels for both electricity and transportation. In 2009, Hawaii relied on imported petroleum for nearly 85% of its primary energy and 75% of the net megawatt-hours of electricity generated in the state.

Ocean energy is anticipated to play a role in achieving Hawaii's clean energy goal. Toward that end, the University of Hawaii's Hawaii Natural Energy Institute (HNEI) has been designated as one of three National Marine Renewable Energy Centers by the U.S. Department of Energy. HNEI is implementing projects to test components, devices, and interconnection systems for wave energy at sites on the islands of Oahu and Maui, and is supporting OTEC R&D at the existing Natural Energy Laboratory of Hawaii Authority facility on the island of Hawaii.

Recognizing that obtaining permits for renewable energy projects is a major barrier to their implementation, the state has drafted a guide to renewable energy facility permits in Hawaii and has established a facilitated permitting process. Electrical generation projects with a capacity of 200 MW or more are automatically eligible to enter into the Renewable Energy Facility Siting Process (REFSP), and smaller projects may also request facilitation. Companies wishing to use the state's facilitated permitting process will meet with the Hawaii State Energy Office permitting coordinator. If the company is accepted into the REFSP, the coordinator will assist in developing a permit plan.

The permitting coordinator has authority to convene an interagency working group with representatives from all the government agencies which will require permits for the project. Because incomplete applications and applicants' delays in responding to agency requests for additional information can slow the process, early meetings will help all parties understand their responsibilities and facilitate communication.

In addition, the State of Hawaii is developing an online permitting system which would coordinate and streamline certain state permits. In its first phase, online applications for several critical permits required of the State Department of Health are being created. Future expansion of the system is expected to include other State of Hawaii permitting agencies.

Other barriers to achieving Hawaii's clean energy goals also exist, including the impact of a high percentage of intermittent renewable electricity on isolated island grids. Solutions such as smart grid demonstrations, tests of battery storage systems, and interisland cables are being pursued.

A number of ocean energy developers are pursuing RD&D projects in Hawaii. Several companies are also proposing pilot ocean thermal energy conversion plants in Hawaiian waters. In addition, in 2009, a 500-kW project by Oceanlinx off the northern coast of Maui was granted a preliminary permit by the Federal Energy Regulatory Commission. Also that year, OPT redeployed its third PowerBuoy in Kaneohe Bay, an effort supported by the US Navy. The permitting process for this project is explained.

Keywords: Hawaii, permitting, renewable portfolio standard, wave energy

1. Introduction

The State of Hawaii, a semi-tropical archipelago in the Pacific Ocean, is rich in natural renewable energy resources including wave and ocean thermal energy. Although the islands have tapped many of their indigenous renewables—such as solar, wind, biomass, geothermal and conventional hydroelectricity—the state is still extremely dependent on imported fossil fuels for power generation. In 2009, Hawaii relied upon petroleum, nearly all of which was imported from foreign nations, for about 85% of its primary energy and approximately 75% of the net megawatt-hours of electricity generated.

This overdependence on imported oil is a threat to Hawaii's economy, environment, and security, and is being addressed by aggressive energy self-reliance policies implemented by the Hawaii State Energy Office, part of the Department of Business, Economic Development and Tourism (DBEDT).

Ocean energy research activities within Hawaii are directed primarily by the Hawaii Natural Energy Institute (HNEI) of the University of Hawaii, which has been designated as one of three National Marine Renewable Energy Centers in the U.S. [1]

In 2008, the State of Hawaii and the U.S. Department of Energy initiated a partnership, the Hawaii Clean Energy Initiative (HCEI), which established the goal of transforming Hawaii's energy supply to 70% clean energy by 2030. This goal has been codified by laws establishing both a Renewable Portfolio Standard (RPS) and an Energy Efficiency Portfolio Standard (EEPS). The RPS's goal is 40% renewable electricity, while the EEPS mandates saving 4,300 gigawatt-hours by 2030.

HCEI has achieved a number of its initial objectives in addition to establishing the RPS and EEPS. Regulatory barriers, including creating feed-in tariffs and decoupling utility electricity sales from profits, are also being addressed. Nevertheless, serious issues remain which will influence the state's ability to rapidly integrate renewables into its electricity grid.

Among these barriers is the impact of a high percentage of intermittent renewable electricity on an isolated grid. Each of Hawaii's major islands has its own utility grid; none can transfer excess power to another grid or rely on a neighboring grid for support during an outage or other incident which threatens grid stability.

Already, the "Big Island" of Hawaii has experienced up to 60% penetration by renewable electricity, a significant portion of which is intermittent wind and solar. Intermittent renewables supply 10-15% of the electricity carried by specific feeder distribution lines in a number of communities on several islands. HCEI partners are studying the situation and devising methods to allow increased penetration of renewable electricity without impacting utility grid stability and quality of service.

As part of HCEI, DBEDT is also exploring the possibility of establishing Renewable Energy Zones. Such zones could make project development easier by defining required permits and enabling the preparation of programmatic environmental documents.

2. Permitting in Hawaii

There are many factors contributing to the large number of potential permits required for renewable energy developers in Hawaii. Like other U.S. states, Hawaii has a complex permitting regime which involves multiple agencies at the federal, state, and county government levels.

Hawaii has numerous land use and zoning laws which govern development, including such special districts such as Enterprise Zones and Agricultural Lands of Importance to the State. Developers must comply with state and county land use laws, generally resulting in two layers of zoning which must be observed.

Often, whether a project needs state or county approval depends on the acreage required, parcel boundaries and zoning, and facility activity. In addition, there are strict protections for natural resources; for instance, Hawaii has many endangered species as well as numerous historic and archaeological sites of importance to Native Hawaiians, cultural practitioners, and other citizens of the state.

These permits and approvals may require lengthy studies to identify the protected resources and proper mitigation measures, often involving passionate public participation and involvement throughout. Marine projects must also address the interests of recreational and commercial boating communities. Some projects, while technically and economically feasible, may not ever clear these hurdles.

Due to their need to access the shoreline and to lease government-owned submerged lands or shoreline, as well as their impact on often-protected marine resources, ocean-based renewable energy projects will require many permits and approvals.

Renewable energy developers are very concerned with the myriad permits and lengthy approval process for new power facilities in Hawaii. Despite the fact that Hawaii has a number of laws—notably, Chapters 46-19.4 and 226-18, Hawaii Revised Statutes (HRS)—which mandate priority handling of renewable energy permits at the state and county levels, the time required to obtain required permits is a deterrent to many developers.

The cost of permitting is also an issue, with an energy project developer potentially paying at least $200,000 and possibly more than $1 million for permits; much of this investment is made without any guarantee a facility will ultimately be built. Reducing the unknown aspects of permitting will reduce the perceived risks of development and make it easier to acquire development capital.

3. Renewable Energy Facility Siting Process (REFSP)

The Hawaii State Energy Office is addressing the situation by facilitating renewable energy permitting.

Under HRS 201N, electrical generation projects with a capacity of 200 MW or more are automatically eligible to enter into the REFSP. However, smaller projects which are at least 5 MW in capacity, and biofuel production facilities which can produce one million gallons or more annually, may also request facilitation under the REFSP.

A business plan may be requested from those companies asking for permitting assistance, and fees may be charged to cover expenses incurred by the coordinator, the coordinator's staff, and the relevant county and state permitting agencies in processing an applicant's permits under the REFSP.

The coordinator will also explore facilitation opportunities with the company/applicant and the relevant permitting agencies.

The purpose of the facilitated permitting law, which is described in HRS 201N, is to expedite renewable energy facility permitting and enable the timely development of renewable energy. The process covers permits for siting, construction, and operation of renewable energy facilities. Interim administrative rules guiding the facilitated permitting process have been implemented (Title 15, Chapter 36, Hawaii Administrative Rules).

In addition to facilitating permitting under the REFSP, DBEDT offers a variety of services to energy project developers, including the creation of permit plans, writing letters of support, introducing project developers to permitting authorities at other agencies, assisting site location and control, and identifying potential available resources such as land and water.

Companies wishing to utilize the REFSP should meet with the permit facilitator at DBEDT's energy office. The permit facilitator will confirm that the company requesting assistance is eligible and appropriate for REFSP participation. Full descriptions of the property where the project will be developed, as well as its structure, infrastructure and equipment will be necessary. The facilitator will discuss the specific permits necessary for the project and develop a permit plan. This step is vital to identify and address potential development risks and to inform an applicant of the expected processes.

Incomplete permit applications and applicants' delays responding to agency requests for additional information have also been identified as slowing the process. Early meetings with the applicant and the relevant permitting agencies will help the applicant understand their responsibilities in the permit facilitation and application process. This includes the important step of obtaining community input and support prior to significant project planning and development.

The facilitator will also convene an interagency working group with representatives from all the government agencies which will require permits for the project. The relevant state and county agencies may provide the coordinator an estimate of the costs anticipated to be incurred by the agencies in processing the applicant's permits under the REFSP. The company and DBEDT may sign a cost reimbursement agreement wherein the company agrees to pay for such costs in exchange for facilitated permit processing. When all required permits are identified, the project developer can file a permit plan application with DBEDT.

At the same time, the developer must begin the environmental assessment/impact study process per HRS 343. Acceptance of the Final Environmental Impact Statement or Environmental Assessment is required for the permit plan application to be complete. For projects participating in the permit facilitation process, DBEDT serves as the approving agency for their environmental review documents under HRS 201N-8.

The permit facilitator will also coordinate required public meetings, working with the various levels of government to combine hearings and meetings as much as possible.

While the authority to issue permits remains with the various state, federal, and county agencies, the new permit facilitation law requires the relevant state and county agencies to make a decision to either grant or deny REFSP permits no later than 12 months after the approval of a complete permit application, unless extended by DBEDT for up to 18 months. This is intended to provide a guaranteed timeline for the permit process.

HRS 201N-13 and -14 also provide for renewable energy project exemptions from county or state subdivision requirements on state agricultural or conservation lands. This would allow a developer to construct a renewable energy facility on a large lot and use the remainder of the lot for another project without undergoing an often lengthy subdivision process. Such "remainder lot" projects must conform to allowable uses within the district and are subject to county or state approval.

The Hawaii State Energy Office is now working with the relevant state and county agencies to implement the REFSP.

4. e-Permitting Portal Project

DBEDT is creating an online permit application process for all permits required of the State of Hawaii Department of Health Environmental Health Administration (DOHEHA), such as those governing clean water, clean air, soil, sanitation, noise and solid waste. This process will streamline the acquisition of these environmental permits and will serve as an electronic database for individual applicants to store their permits and permitting materials. Most ocean-based renewable energy projects will require multiple DOHEHA permits.

The e-Permitting Portal is expected to be completed in late 2011. It will allow easy online identification of required permits, submittal of permit applications, and electronic payment. The user will create an account to store all reports and forms needed for a project. The portal provides immediate and direct

interaction with actual agency staff processing an applicant's permits.

This online process will, among other benefits, ensure that applications are complete before they can be submitted. Applicants will be able to track the status of their permit applications online from submission to permit issuance. The online submission process will ensure that there's a single, final submittal, and thus a single review.

In addition, the online application will save time by inserting common information, such as the applicant's name and contact information, into all pertinent permits. It is hoped that the DOHEHA e-Permitting Portal will be a model for other state and county agencies, thus simplifying the permitting process at several levels.

In addition, many other state and county agencies have initiated their own programs to streamline the renewable energy siting process.

5. Permitting Guidebook & Wizard

DBEDT, with assistance from consultants and the National Renewable Energy Laboratory, has prepared a detailed guide for permitting various renewable energy technologies, including marine and hydrokinetic devices.

The guide attempts to comprehensively identify all federal, state, and county permits potentially required for a specific project and provides guidance to obtaining the required permits and approvals in a timely manner. It lists all known possible permits, many of which will not be needed by any single project. As many as 40 county, state, and federal permits could theoretically be required; however, in reality, Hawaii renewable energy projects generally obtain 15-20 permits.

An online tool is also being developed to complement this guide. This Wizard will allow the user to enter data specific to a project—for instance, location and capacity—and be provided with a list of likely permits required. In essence, the Wizard will create a customized permit plan and permit schedule online in response to answers to questions about the project and site provided by the user.

The guidebook is intended to be a factual reference to the existing permitting regime in Hawaii and does not attempt to recommend changes to the permit process. Rather, its purpose is to better prepare renewable energy developers by identifying the potentially required permits, steps to obtain them, the general timeframe required, the specific statutory processes for each permit, and guidance on streamlined permit processing. Contact information for pertinent permitting offices is also provided.

The marine and ocean thermal energy conversion section of the guidebook outlines approvals at the state and federal levels as identified in late 2009. Users should refer to this guidebook in conjunction with the relevant county guidebook, based on facility location.

The Wizard will contain links to the actual state, federal, and county permitting agency websites, enabling a developer to access these agencies directly online. Electronic permit applications and relevant codes or rules are also available at the Hawaii Clean Energy Initiative website listed above.

The guidebook discusses the various categories of permits—environmental, construction and operation, land use, and utility—as well as the difference between ministerial and discretionary permits. It provides guidance on agencies to know in Hawaii, and enumerates the divisions or offices within those agencies. It also discusses the overlay between the state, federal, and county agencies in Hawaii. A summary of both the federal and state environmental review process helps explain expectations and requirements.

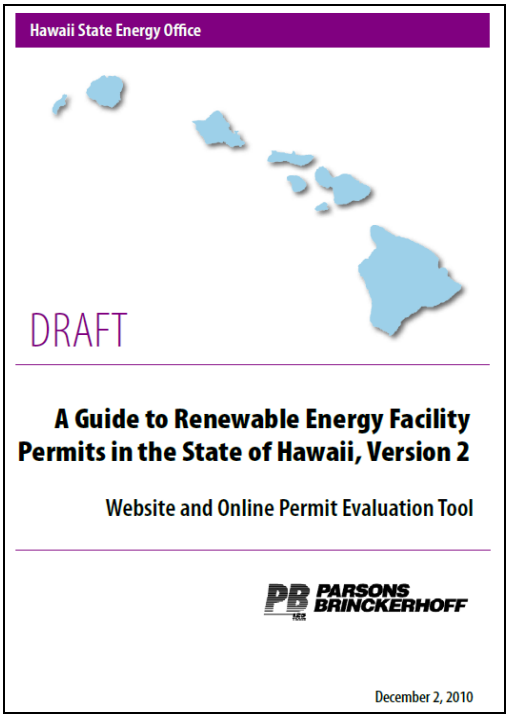

Figure 1: A guidebook to permitting renewable energy projects has been drafted by the State of Hawaii.

The original drafts of the guidebook, with one volume for each energy resource, are online at: http://www.hawaiicleanenergyinitiative.org/permitting.html. The new version, expected to be publicly available in mid-2011, consolidates the original 11 guidebooks into a single document.

The Renewable Energy Permitting Wizard is under development and expected to become public during the fall of 2011, after outreach to permitting agencies, industry professionals, and other stakeholders.

6. Permitting for Ocean Power Technologies

The only wave energy device deployed in Hawaii's waters as of summer 2011 is a nominal 40-kW buoy

manufactured by Ocean Power Technologies (OPT) which is part of a research project sponsored by the U.S. Navy. This is the third buoy deployed offshore of Marine Corps Base Hawaii (MCBH) since the project began in 2004.

This third PowerBuoy, which was initially moored off Kaneohe Bay for a brief period in fall 2008, was removed for repair before redeployment in late 2009. OPT announced the grid connection of the device in September 2010. As of June 2011, the PowerBuoy has been generating electricity continually except for brief maintenance periods.

It is presently the only grid-connected wave device in the USA. Data on actual kWh output are not publicly available.

Because the project is intended to provide power only within the Marine Corps base and not to the island utility grid, a license from the Federal Energy Regulatory Commission (FERC) was not required. State permits were not applicable because the project is located within federally-owned submerged property. However, state agency consultation was required under the Coastal Zone Management Program, Section 106 of the National Historic Preservation Act, and fish and wildlife resource protection.

The land component of the project is on military property; access is limited. The offshore buoys have been deployed outside of the 457-meter (500-yard) buffer zone within the Naval Defensive Sea Area established by Executive Order 8681. Although the area outside the buffer zone is subject to access limitation, there are no plans to restrict public access to the area.

In accordance with the National Environmental Policy Act of 1969 (NEPA) as well as requirements by the state, the Navy and the Marine Corps, an Environmental Assessment (EA) was completed for the project by the Office of Naval Research in January 2003 [2]. The result was a Finding of No Significant Impact for the phased installation and operational testing of up to six wave energy buoys at Kaneohe Bay. The Department of the Navy determined that a full Environmental Impact Statement (EIS) was not required.

Ten potentially affected resources were identified for the project; none were found to be significantly impacted. The ten resources are: shoreline physiography, oceanographic conditions, marine biological resources, terrestrial biological resources, land and marine resource use compatibility, cultural resources, infrastructure, recreation, public safety, and visual resources.

Initial scoping meetings were held with a number of federal and state agencies, including the U.S. Army Corps of Engineers (USACE), the U.S. Department of Commerce National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (USFWS), the U.S. Coast Guard (USCG), the State of Hawaii Department of Land and Natural Resources (DLNR) Division of Aquatic Resources, the DLNR Division of Boating and Ocean Recreation, and the DBEDT Office of Planning Coastal Zone Management (CZM) Program.

Figure 2: OPT's third buoy as deployed in late 2008.

In an informal consultation under Section 7 of the Endangered Species Act, USFWS and NMFS both concurred with the Navy that the testing of OPT's buoys was not likely to adversely affect threatened or endangered species such as the Hawaiian monk seal, green sea turtle, hawksbill turtle or humpback whale.

The Navy also consulted with the State Historic Preservation Office under Section 106 of the National Historic Preservation Act, and both agencies agreed that no historic properties would be affected. Native Hawaiian organizations and individuals known to attach religious and cultural significance to the part of the Marine Corps Base Hawaii where the project is sited were also consulted and their support obtained.

DBEDT's Office of Planning accepted the Navy's Notice of Negative Determination under its CZM Program.

According to the Environmental Assessment, the following federal laws were applicable to the project:

- **NEPA of 1969, as amended.** NEPA requires federal agencies to prepare an EA or EIS for federal actions that have potential to significantly affect the quality of the human environment. *An EA was prepared.*
- **Clean Water Act of 1977, as amended.** Sections 401, 402 and 404 require permits for proposed actions which involve wastewater discharges or the discharge of dredged or filled material into U.S. waters. *It was determined that no discharges would occur.*
- **Rivers and Harbors Act.** A Department of the Army permit is required for any activity that obstructs or alters navigable waters of the U.S. *A RHA Section 10 permit was obtained from USACE and renewed for successive buoys. In addition, Local Notice to Mariners and Navigational Aids concurrence from the USCG was secured.*
- **Coastal Zone Management Act**. Federal actions must be consistent with the state's coastal zone management (CZM) program. *The State Office of Planning's CZM program*

agreed that consistency determinations were not required for this project.

- **Endangered Species Act (ESA) of 1973.** Federal agencies must assure that their actions are not likely to jeopardize threatened or endangered species. *The Navy and MCBH completed an informal consultation under Section 7 of the ESA with USFWS and NMFS, which concurred that the project is not likely to affect threatened or endangered species.*
- **Fish and Wildlife Coordination Act (FWCA) of 1934, as amended.** FWCA provides for consultation with USFWS and other relevant agencies when a federal action proposes to modify or control U.S. waters for any purpose. *Recommendations were sought from the appropriate agencies.*
- **Magnuson-Stevens Fishery Conservation and Management Act.** This act is intended to stop or reverse the loss of marine fish habitat. *No Habitat Areas of Particular Concern are designated at the site.*
- **Marine Mammal Protection Act of 1972, as amended.** This act establishes a moratorium on the taking of marine mammals in U.S. waters. *The project was designed to comply with this Act.*
- **Migratory Bird Treaty Act (MBTA) of 1918, as amended.** The MBTA is a bilateral migratory bird treaty with Canada, Mexico, Japan and Russia. *No bird takes are anticipated with this project, so a permit is not required.*
- **National Historic Preservation Act (NHPA) of 1966.** Federal agencies are required to take into account any effects on historic districts, sites, and structures. *In accordance with regulations implementing Section 106 of the NHPA, the Hawaii State Historic Preservation Officer was consulted and concurred with the Navy's finding that no historic properties would be affected. Notification of this finding was also provided to the Native Hawaiian organizations and individuals that previously expressed an interest in actions involving the Mokapu Burial Area near the project site.*
- **Native American Graves Protection and Repatriation Act of 1990.** This Act protects Native Hawaiian human remains and cultural items discovered on federal lands. *The project was determined unlikely to result in the discovery of such remains or items.*
- **Coral Reef Protection (Executive Order 13089).** This EO is intended to protect and enhance coral reef ecosystems. *Underwater site assessments identified cable routes and locations for the buoys that minimized impacts to coral reefs. The assessments' findings are outlined in the EA.*
- **Responsibilities of Federal Agencies to Protect Migratory Birds (Executive Order 13186l).** Federal agencies taking actions which negatively impact migratory birds must implement a Memorandum of Understanding with USFWS to promote conservation of the bird populations. *The project avoids interaction with migratory bird populations.*
- **Environmental Justice (Executive Order 12898).** Federal agencies must address the potential for disproportionately high and adverse environmental effects of their actions on minority and low-income populations. *It was determined that potential temporary closures of small areas for the project tests would not result in such impacts.*
- **Protection of Children from Environmental Health Risks and Safety Risks (Executive Order 13045).** Federal agencies are required to address the potential for disproportionately high and adverse environmental effects of their actions on children. *Because no significant health and safety risks are anticipated and the project is not in an area frequented by children, no mitigation is needed.*
- **Greening the Government Through Efficient Energy Management (Executive Order 13123).** Federal agencies must expand the use of renewable energy within their facilities and in their activities. *The project is consistent with this goal, and with the policy mandated by the Energy Policy Act of 1992, which states that "it is the goal of the U.S. to carry out energy supply and energy conservation research and development… reducing the dependence on imported oil."*

7. Permitting for Oceanlinx

Unlike the OPT research project at MCBH, the proposed Oceanlinx deployment of its oscillating water column technology off the northern coast of Maui island is a private sector project by an independent power producer. It is expected that federal, state, and county permits would apply.

Oceanlinx deployed its latest generation device, the one-third scale Mk3PC system, in waters off Port Kembla, Australia, in February 2010. This device was to be the model for the equipment expected to operate off Maui. It was grid connected on March 19, 2010 and produced energy through a Power Purchase Contract with Integral Energy, a first for Australia. The at-sea test was conducted in a 7 kW/m average wave climate. According to Oceanlinx, the unit confirmed its projected capability and validated all aspects of full scale design.

Unfortunately, extreme sea conditions on May 14, 2010, led to the failure of its mooring systems and the subsequent grounding of the device which later sank near the Port Kembla breakwater.

Oceanlinx Hawaii LLC is the first Hawaii wave energy project to obtain a preliminary permit from

FERC. This permit, which was issued on November 25, 2009, allows the Oceanlinx Maui Wave Energy Project to undertake activities such as gathering data necessary to secure a license from FERC. The preliminary permit also grants priority to Oceanlinx to file a license application for the project within three years. Because the preliminary permit only allows Oceanlinx to investigate the feasibility of the proposed project and to prepare a license application, it grants no land-disturbing or other property rights.

Figure 3: Oceanlinx' Mk3PC ocean energy system was deployed in February 2010 at Port Kembla, Australia.

As part of the requirements of the preliminary permit, Oceanlinx submitted a planned schedule of activities on January 6, 2010. The company has also submitted progress reports every six months. These documents are accessible online at www.ferc.gov; the preliminary permit number is P-13521.

In 2010, Oceanlinx announced its intent to downsize the Maui project from 2.7 MW to 0.5 MW and deploy it closer to shore. Oceanlinx and MECO have agreed to an alternative cable route which does not require directional drilling, significantly reducing costs. However, these changes in the project size and cabling route have caused delays to Oceanlinx' schedule. The company now expects to file the Notice of Intent and Preliminary Application Document and to specify which of FERC's three license application pathways it prefers by October 31, 2011.

Originally, a wave energy conversion device similar to the Mk3PC system deployed in Australia was proposed for Maui. Current plans call for a shallow water design which is suitable for depths less than 20 meters (65 feet). The single oscillating water column device will use less steel and will be mounted on driven piles rather than moored.

Oceanlinx is working with Maui Electric Company (MECO) to provide technical parameters for the utility's Interconnection Requirements Study. A Non-Utility Generator proposal was submitted to MECO on December 3, 2009.

MECO and Oceanlinx have agreed to split permitting responsibilities; Oceanlinx will be responsible for offshore permits, excluding cable laying, and MECO will take responsibility for onshore and cable laying permits. During 2010, it was established that DLNR will be the lead agency to process Oceanlinx' state environmental impact statement.

The National Marine Renewable Energy Center (NMREC) at the Hawaii Natural Energy Institute is providing support through its oceanographic and ocean engineering expertise. NMREC will conduct an oceanographic survey to provide bathymetric data for the cable route and mooring design.

For a more detailed discussion of federal, state and county permits which may apply to Oceanlinx and other wave energy projects in State of Hawaii waters, please refer to the draft guidebook, *A Guide to Renewable Energy Facility Permits in the State of Hawaii, version 2*. The guidebook will be posted online at the URL given above.

In general, there are several categories of permits which apply to this project.

- **Environmental Permits and Reviews**. These are issued by federal and state agencies and include permits related to the Clean Air Act, Clean Water Act, and Endangered Species Act. Environmental reviews are conducted at the federal, state, and county levels. Many state and local permits may require that an EA or EIS be completed successfully before the permit can be reviewed. The respective counties are tasked with Special Management Area and shoreline permitting, according to SMA mapping. SMA permitting is analogous to zoning.
- **Construction and Operation Permits**. Permits are required for the construction and operation of energy-related structures, buildings, water systems, road systems, etc., in order to assure proper design, safety, and consistency with codes and standards. These are typically under state and county jurisdiction, with federal oversight.
- **Land Use and Right-of-Way Permits**. Land use permits uphold zoning laws, which relate to appropriate uses of urban, rural, agricultural and conservation land. Hawaii's waters are considered conservation districts and a permit is required for their use. The use of or access to state lands (e.g., ocean floor, shoreline area, parcels, easements) will also require right-of-way approval from DLNR.
- **Utility Permits**. At the federal level, FERC regulates hydrokinetic devices. At the state level, the Public Utilities Commission administers utility permits and requires energy projects to work with the appropriate island's utility.

Although the guidebook attempts to describe all possible permits, not every permit will be needed for Oceanlinx or any other specific project.

Oceanlinx, like many project developers in Hawaii, is taking advantage of private sector expertise by employing a permitting consultant. This is highly recommended. DBEDT and NMREC also are available for assistance in coordinating and facilitating the permitting process.

8. Ocean Thermal Energy Conversion

Ocean Thermal Energy Conversion (OTEC) generates electricity using the differences in

temperature between warm, surface seawater and cold water from the ocean depths. There are currently no commercial OTEC plants, though a number of pilot plants and demonstrations have been showcased at the Natural Energy Laboratory of Hawaii Authority (NELHA) and other locations worldwide. More demonstrations have been recently proposed in Hawaii and elsewhere.

The Office of Naval Research and the Naval Facilities Engineering Command have jointly funded construction of a new OTEC Heat Exchanger Test Facility at NELHA. The facility, designed and operated by Makai Ocean Engineering, is being used to conduct performance and corrosion testing of several heat exchanger designs. In a laboratory setting, coupons of metal alloys are being tested for corrosion resistance in both warm and cold ocean water. A test tower has been built to observe the performance of heat exchangers and to simulate the effect of generating power; an actual turbine-generator could be added to the tower at a later date.

Figure 4: Heat exchanger test tower operated by Makai Ocean Engineering at NELHA.

NELHA's unique infrastructure also includes large pipes which bring volumes of warm surface water and deep, cold ocean water to the laboratory, where it is used for aquaculture and other purposes in addition to OTEC-related RD&D.

Technology developers generally agree that commercial OTEC plants will be at-sea devices on the order of 100 MW, while pilots and pre-commercial scale demonstrations may be located close to shore or even on shore. On-shore and near-shore devices will likely have State of Hawaii permitting requirements similar to those for wave energy.

The federal agency responsible for licensing commercial OTEC facilities located within the territorial sea of the United States is the National Oceanographic and Atmospheric Administration (NOAA) Office of Ocean and Coastal Resource Management (OCRM). NOAA's licensing authority was conferred by the Ocean Thermal Energy Conversion Act (OTECA) of 1980.

There are presently no commercial OTEC facilities, nor has NOAA received any license applications. In 1996, due to the lack of applications, the OTEC regulations were rescinded. However, recent increased interest and investments in OTEC project planning and design have resulted in queries to OCRM about licensing. As a result, OCRM is now rebuilding its OTEC licensing capacity, including holding a number of workshops focusing on environmental and other pertinent information.

Pre-commercial demonstration projects must be authorized by the USDOE after consulting with NOAA. A license from NOAA is not needed for demonstration projects.

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