Inventory of Existing and Proposed Offshore Energy Facilities and Associated Infrastructure

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1.0 INTRODUCTION

TRC Environmental Corporation (TRC) is pleased to provide this Inventory of Existing and Proposed Offshore Energy Facilities and Associated Infrastructure to the Massachusetts Executive Office of Environmental Affairs (EOEA) through the Office of Coastal Zone Management (CZM) for projects located within Massachusetts state waters and federal waters beyond state jurisdiction, up to 200 miles offshore. This work represents Task No. 1 of the Scope of Work (Request for Responses # ENV 06 CZM 15). TRC understands that the purpose of this effort is to gather descriptive and spatial information to further the Commonwealth's understanding of offshore energy facilities' siting parameters (i.e., technological capabilities/limitations and other feasibility issues) to help inform decision-making in these areas.

1.1 Scope of Work

Based on available information (i.e., not confidential) from the public and private sectors, TRC has conducted an inventory of existing and proposed energy facilities and associated infrastructure within Massachusetts state waters, in addition to federal waters beyond jurisdiction, up to 200 miles offshore (the United States Exclusive Economic Zone (U.S. EEZ) boundary). When referring to Massachusetts state waters, the following definition was used (CZM 2004):

> State jurisdiction generally extends from the low water mark to the seaward boundary of the Commonwealth. Typically, the Commonwealth's marine boundary extends three nautical miles offshore with the exception of areas within Massachusetts Bay, Cape Cod Bay, and Nantucket Sound that extend farther due to bay closure lines established by the U.S. Supreme Court.

In order to compile the most comprehensive list of existing or proposed offshore facilities for the inventory, TRC contacted the United States Army Corps of Engineers (USACE) New England Region Office, the Massachusetts Energy Facilities Siting Board (EFSB) within the Department of Telecommunications and Energy (DTE), the Massachusetts Environmental Policy Act (MEPA) office, the Massachusetts Department of Environmental Protection (MassDEP) Chapter 91 Waterways Regulation Program, and the Massachusetts Technology Collaborative (MTC).

The information obtained was used to create the project inventory found in Section 2.0, along with descriptions of purpose, location, physical description (aerial extent of a facility, type of facility from a technological standpoint, and electrical output or conductance), interconnections, and project schedule.

TRC recognizes the potential for new energy facilities to be proposed during the course of this study. As a result, and for the purpose of this effort, TRC defines proposed energy facilities and associated infrastructure as:

- Any project that is still seeking permits and/or approvals prior to or within the first month of CZM's project (through the first week in April 2006 – one month after CZM kickoff meeting);
- Any new project where information has been made available through the public sector prior to or within the first month of CZM's project and that has not filed for any permits; or
- Any new project where information has been obtained through the private sector prior to or within the first month of CZM's project and TRC has been given permission to release information on the project.

1.2 Definition of Energy Facilities

For the purposes of this effort, TRC defines "energy facilities" as electric generation and transmission facilities. In addition, fossil fuel-related importation or transmission facilities are included, as long as such facilities are located primarily in the ocean. Land based fossil fuel-related importation or transmission facilities are not within the scope of this work. Additionally, because the focus of this effort is ocean-based energy facilities, associated infrastructure listed on the inventory is limited to infrastructure that is associated with ocean-based energy facilities. For example, if an energy facility is land-based, but has associated infrastructure (i.e., electric transmission line) that is located within Massachusetts state waters or federal waters up to 200 miles out, the associated infrastructure is not considered in the inventory of existing, proposed, and associated infrastructure. Therefore, numerous existing transmission lines and pipelines located in the waters off of Massachusetts have not been included in the following inventory since they are unrelated to ocean-based energy facilities. For example, there are electric cables from the mainland to some of the Boston Harbor Islands, which are not included in this inventory. The only exception to this is the Nantucket Cables, which although they are not within the formal scope of this project, are included, because they are primarily located in the ocean and could be important to future energy projects located in that area. However, associated infrastructure that is a part of, or necessary to, an ocean-based energy facility is considered in the inventory of energy facilities and associated infrastructure. For example, the Algonquin HubLine has been included in the inventory due to the fact that other proposed offshore energy facilities may tie into this major offshore gas transmission facility in the near future.

2.0 INVENTORY OF OFFSHORE ENERGY FACILTIES

The following is a description of existing and proposed offshore energy facility projects. Refer to Figure 1 at the end of the report to see the locations of these projects relative to the Massachusetts coastline.

2.1 Existing Projects

2.1.1 Algonquin HubLine Pipeline Project

Purpose

The Algonquin HubLine Pipeline Project is designed to increase reliance of winter gas supply availability and deliverability in the Boston area. Additionally, by creating a new physical interconnection between the existing pipeline grid in northeastern Massachusetts with the existing pipeline grid south of the Boston metropolitan area, the project gives consumers access to multiple gas supply sources, with benefits for increased reliability of gas supplies and increased competitiveness in the natural gas market.

Location

The HubLine Project is located primarily in the offshore waters of Massachusetts between Salem/Beverly and Weymouth (see Figure 1). The mainline route travels offshore in a southerly direction through the municipal corporate boundaries of Beverly, Salem, Marblehead, Swampscott, Lynn, Nahant, Winthrop, Boston, Hull, Quincy, and Weymouth.

Physical Description

The HubLine Project consists of approximately 29.4 miles of 30-inch diameter pipeline with approximately 99 percent of the route being placed in the ocean along the coast of Massachusetts.

Interconnections

Algonquin interconnects with the proposed Maritimes gas transmission system in Beverly. The HubLine Project terminates with an interconnect to the Algonquin I-9 pipeline system at the Sithe Fore River Power Plant in Weymouth, Massachusetts.

Schedule

Construction on the HubLine Project began in September 2002 and the project was in service by December 2003. The facilities are operated and maintained by Algonquin Gas Transmission LLC. Algonquin operates and maintains the newly constructed pipeline facilities in accordance with the requirements of the United States Department of Transportation (USDOT). Algonquin has not identified any current or proposed future

expansion or abandonment of the facilities. Any new facilities would be designed to be compatible with existing or proposed facilities. However, several recently proposed offshore liquefied natural gas (LNG) importation terminals have included a pipeline interconnection with the HubLine in order to transport re-vaporized LNG from LNG vessels into the northeast gas markets via HubLine.

2.1.2 Nantucket Cable Projects

Purpose

The first Nantucket Cable project was designed to improve the reliability of the electric supply and stabilize rates. According to Nantucket Electric, power outages are a rare occurrence on the island of Nantucket since the first project became operational (Nantucket Electric 2006). The project also made it possible for a generating facility on the island to be taken offline and dismantled since it replaced that energy source with a connection to electricity sold on the regional power grid. The second Nantucket Cable project was designed to increase capacity to the island as well as provide redundancy in case the first cable needed to be taken out of service or was damaged.

Location

The first cable connects the town of Harwich on Cape Cod to Nantucket Island by way of Nantucket Sound (see Figure 1). The second project is further to the west and connects the town of Barnstable to Nantucket Island.

Physical Description

The first project was a 26-mile, 46 kilovolt (kV) buried submarine cable that was buried approximately 8 feet below the seabed using a jet plow. The second project was an approximately 33-mile long route (including some land based facilities) and also was a 46 kV.

Interconnections

The first Nantucket cable interconnects with the power grid at a location in Harwich on Cape Cod. The Candle Street substation in Harwich transforms the 115,000 volt power from the transmission grid to the 46,000 volt power that travels through the town on a 1.5-mile underground cable which ultimately links the substation to the undersea cable in Nantucket Sound. The second cable interconnects with the grid in Barnstable.

Schedule

The first cable became operational in 1996. All of the permitting for the second cable was completed in 2005. Due to shellfish bed restrictions and other environmental conditions, the in-water portion of second cable was installed that same year. The landfall portions of the project are currently under constructions

2.2 Proposed Projects

2.2.1 Cape Wind Energy Project

Purpose

As independently determined by the USACE, the purpose and need of the Cape Wind Energy Project is "to provide a utility-scale renewable energy facility providing power to the New England grid" (USACE 2004).

Location

The proposed wind park would be located on Horseshoe Shoal in Nantucket Sound, Massachusetts (see Figure 1). The northernmost turbines will be approximately 4.7 miles from the nearest point of the mainland. To the southeast the wind park will be approximately 11 miles from Nantucket Island, and the westernmost turbines will be 5.5 miles from Martha's Vineyard.

Physical Description

The applicant proposes to install and operate a wind-powered electric generating facility comprising 130 offshore wind turbine generators, a centrally located Electrical Service Platform (ESP) and associated transmission cables and equipment. The wind park will be capable of producing an average annual output of approximately 170 megawatts (MW), with a maximum deliverable capacity of approximately 454 MW.

Interconnections

Wind-generated electricity from each of the 130 turbines will be transmitted via a 33-kV submarine transmission cable system to the Electric Service Platform located centrally within the turbine array. Two 115 kV alternating current submarine cable circuits will transmit the electric power from the ESP to the Cape Cod mainland and ultimately interconnect with an existing NSTAR electric transmission line. The proposed submarine cable system route is approximately 12.2 miles in length, 6.6 miles of which is within Massachusetts' waters. The cable runs from the ESP to a landfall location in Yarmouth.

Schedule

The anticipated project schedule is dependent upon receipt of all necessary local, state and federal approvals, as well as financing. As stated in the Draft Environmental Impact Report (EIS) dated November 2004, the project originally intended to install the submarine cables during the first two quarters of 2006 and the wind turbines beginning in the third quarter of 2006. However, no construction has occurred to date as permits and approvals are still pending. As a result of the Energy Policy Act of 2005, the project National Environmental Policy Act (NEPA) review was transferred from the USACE in the fall of 2005 to the United States Minerals Management Service (MMS). The MMS is

currently developing regulations to address offshore renewable electric generation facilities, which are due in the fall of 2007, and will be preparing additional NEPA analyses and a final EIS for the project.

2.2.2 Neptune Project

Purpose

According to Neptune LNG LLC, the primary purpose for the Neptune project is to "provide an additional reliable long-term supply of natural gas, at a competitive price, to meet the increasing demand for natural gas in Massachusetts and New England" (USDOT 2006). The applicant also states that the region is heavily dependent on natural gas as a source of energy for electricity and home heating and other uses.

Location

Neptune is a deepwater port to be located in the federal waters of the Outer Continental Shelf blocks NK 19-04 6525 and NK 19-04 6575, approximately 22 miles to the northeast of Boston, Massachusetts (see Figure 1). Water depth at the proposed location is approximately 250 feet.

Physical Description

The deepwater port would be used to temporarily moor LNG carriers, vaporize LNG, odorize and meter natural gas, and send-out natural gas by pipeline. According to the applicant's Deepwater Port License Application, up to two LNG carriers (approximately 140,000 cubic meter capacity each) would temporarily moor at the proposed deepwater port by means of a submerged unloading buoy system for approximately 4 to 8 days during each offloading.

Interconnections

A proposed 24-inch gas transmission pipeline will connect the deepwater port to the existing 30-inch Algonquin HubLine located approximately 9 miles west of the proposed site. The tie-in point to HubLine is located approximately 3 miles southeast of the entrance to Salem Sound, at about Milepost 6 on the HubLine Pipeline.

Schedule

It is expected that construction of the deepwater port components will take 36 months. Neptune has filed its application with the United States Coast Guard (USCG) and is presently proceeding through the NEPA process. Other state and federal environmental permits will need to be obtained. While initially envisioned to start-up commercial operations in mid-2009, the Neptune LNG port is unlikely to get the necessary permits and approvals to allow operations to start prior to 2010. The operating life of the facility is approximately 20 years.

2.2.3 Northeast Gateway

Purpose

Excelerate Energy L.L.C. (Excelerate) owner of the Northeast Gateway Energy Bridge, L.L.C. Project, has proposed a deepwater LNG port, to provide "a reliable supply of clean burning natural gas into the natural gas distribution system for Massachusetts and New England while minimizing environmental impacts, mitigating safety concerns and increasing energy diversity for the onshore industries and communities that it serves" (Excelerate 2006; Northeast Gateway 2006).

Location

The project site is located offshore in Massachusetts Bay, approximately 13 miles southeast of the city of Gloucester (see Figure 1). The project would be located in federal waters 270 to 290 feet deep.

Physical Description

The project will use Energy Bridge™ technology, which is an offshore LNG regasification and delivery system owned by Excerelate. The Energy Bridge™ system requires modified LNG tankers for the transportation and vaporization of LNG through specially designed offshore receiving facilities such as the proposed Northeast Gateway project. The project will consist of two submerged buoys, two flexible risers, two subsea manifolds, and two subsea flowlines to connect to the pipeline lateral.

Interconnections

Northeast Gateway intends to connect the deepwater port to onshore markets via a new 24-inch pipeline lateral that is approximately 16.1 miles in length. Algonquin Gas Transmission, LLC will construct, own, and operate the pipeline which will connect to the existing HubLine Pipeline System that traverses the Massachusetts Bay. The interconnection is located at about Milepost 8 on the HubLine Pipeline. Northeast Gateway is designed to deliver an average of 400 million cubic feet per day (MMcfd) of natural gas with a peak send out of 800 MMcfd.

Schedule

Excelerate filed its Deepwater Port Application with the USCG on June 13, 2005. Preparation of applications for federal, state, and local permits is on-going. Construction of the Northeast Gateway lateral and Northeast Gateway Deepwater Port will be done simultaneously and is scheduled to commence in the late 2006. Construction is relatively short in duration and is anticipated to be completed by the spring of 2007.

2.2.4 Brewster Island

Purpose

AES Inc. (AES) of Arlington, Virginia has made public its intention of constructing a $500 million dollar LNG terminal on Outer Brewster Island in Boston Harbor (Boston Globe 2005). The purpose of the project is to provide LNG supplies to the metropolitan Boston region.

Location

The site on Outer Brewster Island is 8 miles east of the downtown Boston waterfront and one mile northeast of Boston Light located on Little Brewster Island (see Figure 1). The island is part of a state and national park called the Boston Harbor Islands National Recreation Area (NPS 2006; Boston Islands 2006). The approximate center of the island is at 42 20' 23.8" N, 70 52' 36.1 W. The property is owned by state and local governments. The island is managed by the Massachusetts Department of Conservation & Recreation (DCR). The island is approximately 20 acres in size and 78 feet at the highest elevation point.

According to the Outer Brewster Island Fact page on the Boston Islands website, the island is a bedrock island which supports the most diverse assemblage of breeding waterbirds in Boston Harbor.

Physical Description

AES is proposing to build the LNG tanks in shafts quarried 80 feet into the island rock to make the project safer and less conspicuous. The project would add approximately 20 to 30 feet of visible structures to the landscape. The terminal would occupy the north side of the island, mostly invisible to residents of Point Allerton in Hull which is 2 miles to the south. Approximately 50 to 80 deliveries of LNG to the site could be made annually with tankers docked for a day each time.

Interconnections

A new 1.2-mile undersea pipeline is proposed to feed gas into the existing HubLine Pipeline located between Beverly and Weymouth. The closest location of the HubLine Pipeline to Outer Brewster Island is at about Milepost 19.5, although AES has not provided details on its intended interconnection location or design.

Schedule

The AES Brewster Island project has not yet filed with the FERC, the federal agency with jurisdiction over coastal LNG facilities, and state and federal environmental permitting agencies. The project is likely to proceed at a pace one to two years behind the Neptune and Northeast Gateway projects.

2.2.5 Cashman Windpark

Purpose

While Jay Cashman Inc. (Cashman) has not yet filed any permit applications, it has made public its intentions to build 6 proposed offshore wind-energy projects which would produce a total of some 3,000 MW of electricity (Providence Journal 2005).

Location

Only one of the sites for these projects has been announced. However it has been confirmed by Cashman (Providence Journal 2005) that they are all off the coast of Massachusetts and Rhode Island. Jay Cashman, Inc. stated that that one of the sites would be 3 to 4 miles off the coast of New Bedford and Fairhaven, Massachusetts, would have a generating capacity of 300 megawatts, and would be operational in approximately 5 years (Providence Journal, 5/24/06). No further information was provided on location, so this and Jay Cashman's other Projects were not included in the map of existing and proposed facilities that is attached.

Physical Description

Details have not yet been provided on the physical description of the proposed projects and the technologies to be installed.

Interconnections

The proposed interconnections necessary for the 6 proposed projects are not yet known.

Schedule

According to Cashman, it may take about five years to permit the facilities, which will be phased and each should come on line about five years after the permitting commences. Cashman anticipates $10 billion in construction work will be provided by these projects over the next 20 years.

2.2.6 Cape and Islands Tidal Energy Project

Purpose

The Massachusetts Tidal Energy Company (MATidal) proposes to construct one or more clusters of Tidal In-Stream Energy Conversion (TISEC) devices to generate electricity via tidal currents in Vineyard Sound and sell the electricity to the grid to be called the Cape and Islands Tidal Energy Project. The project would consist of 50 to 150 TISEC devices, each having the generating capacity of 500 kilowatts (kW) to 2 MW (FERC Preliminary Permit Application 2006).

Location

The project is located in navigable waters of the United States in Vineyard Sound in approximately 40 to 75 feet of water. The underwater area begins at the southeast end of Naushon Island in Vineyard Sound and extends northeast in two separate areas that are located on either side of Lucas Shoal and Middle Ground, to their terminus at an existing underwater cable crossing that runs between Nobska point in Falmouth and an area west of Lake Tashmoo on Martha's Vineyard. Potential transmission line routes to the shore would intersect an existing underwater cable crossing and would come ashore in Falmouth and/or on the north shore of Tisbury, in Martha's Vineyard (FERC Preliminary Permit Application 2006).

Physical Description

The nature of the TISEC devices is currently being researched by the EPRI in a study titled "EPRI North American Tidal In Stream Energy Conversion Feasibility Demonstration Project." Because this technology is not yet commercially available, the physical description of the devices may only be described in general terms. It is envisioned that each TISEC device would consist of: (1) rotating propeller blades, approximately 20 to 50 feet each in diameter; (2) an integrated generator, producing 500 kW to 2 MW of electricity; (3) anchoring systems supporting the TISEC device at varying depths underwater; (4) a mooring umbilical line to an anchor on the sea bottom; and (5) an interconnection transmission line to shore. Monitoring systems for parameters including but not necessarily limited to pressure, temperature, vibration, revolutions per minute (RPM), and power output may be located on the TISEC devices and onshore. Transmission from the TISEC device cluster to shore will also be by submerged cable, which may be buried beneath the seabed in its inshore portion. Onshore underground transmission cables will carry the electricity to where it will be fed into the land-based electrical use infrastructure (FERC Preliminary Permit Application 2006).

Interconnections

Potential transmission line routes to the shore would intersect an existing underwater cable crossing and would come ashore in Falmouth and/or on the north shore of Tisbury, in Martha's Vineyard. Information regarding the location of on-land interconnects is not provided in the FERC preliminary permit filing (FERC Preliminary Permit Application 2006).

Schedule

The schedule indicates that the project will take place in three phases. The first phase will be for testing the devices and will take approximately 20 months to permit, followed by approximately 17 months of testing. The schedule shows that this in turn is followed by permitting and installation of a partial build-out, followed by permitting and installation of the full build-out. The entire timeline for the project from start to

completion of permitting for full build-out is approximately 51 months (FERC Preliminary Permit Application 2006).

2.2.7 Other Projects

At the request of CZM, TRC investigated information from an undocumented source regarding a proposed offshore wind turbine project off the coast of Hull proposed by the Hull Municipal Light Department. The Hull Municipal Light Department could not be reached to confirm this information, and we did not obtain information on this via Web based searches or from the telephone calls to regulatory agencies regarding proposed offshore projects". Accordingly, this was not discussed further herein.

TRC also is aware of the Electric Power Research Institute (EPRI) feasibility studies for the development of TISEC and wave energy devices off the coast of Massachusetts. These are feasibility studies that do not yet have financial backing of a developer or have begun the permitting process, so they are not included herein, though they will be discussed in the Task 4 report.

3.0 RESEARCH METHODS

3.1 Agency Correspondence

3.1.1 USACE

On March 15, 2006 TRC contacted Ms. Karen Adams, Chief of the Permits and Enforcement Branch of the USACE requesting information on any known or proposed offshore energy projects in the study area that have filed with the USACE (Adams 2006). On that day, Ms. Adams confirmed via email that the agency knew of no other projects than those previously identified by TRC (i.e. those mentioned here in this report).

3.1.2 EFSB

The EFSB under the Massachusetts DTE is a review board "charged with ensuring a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost" (EFSB 2006). There are three projects listed on the EFSB Docket for on-going activities. The only offshore project listed is the Cape Wind Energy Project discussed above. TRC contacted Mr. Bill Febiger, Acting Director at EFSB who confirmed that the EFSB had no knowledge of additional existing or proposed offshore energy facilities other than those previously identified by TRC (Febiger 2006).

3.1.3 MassDEP

TRC tried to contact Mr. Ben Lynch, Acting Program Chief of the Chapter 91 Waterways Program at MassDEP, however Mr. Lynch was unavailable at the time. TRC was able to reach Mr. David Slagle, Director of the Northeast Region of the Chapter 91 Waterways Program who knew of no other existing or recently proposed facilities for the inventory (Slagle 2006).

3.1.4 MEPA

TRC tried to contact Mr. Richard Bourré, Assistant Director at MEPA, however he was unavailable. Mr. Deerin Babb-Brott, Director at MEPA, was reached. Mr. Babb-Brott referred to potential tidal projects and possible expansion of wind services associated with the Wind facility in Hull, but he had no specifics that he could share at this time (Babb-Brott 2006).

3.1.5 MTC

TRC contacted Ms. Diedre Matthews at MTC who knew of no other publicly known energy facilities, existing or proposed, for the CZM inventory (Matthews 2006).

3.2 FERC Hydroelectric Preliminary Permits

TRC conducted a search of FERC preliminary permits issued for hydroelectric projects (inclusive of underwater current turbine projects) in Massachusetts. A preliminary permit is often the very first filing submitted by a proponents. It does not authorize construction; but rather, it maintains priority of application for license (i.e., guaranteed first-to-file status) for up to three years (FERC 2006). Preliminary permits generally cover the time period when the potential permittee studies the site and prepares to apply for a license.

TRC accessed the preliminary permit application for the Cape and Islands Tidal Energy Project in this way. As of May 26, 2006, there are no other preliminary permit application filings in Massachusetts for offshore energy facilities.

3.3 FERC Online eLibrary

TRC utilized the FERC Online eLibrary (formerly known as FERRIS) in an attempt to identify energy facilities offshore of Massachusetts that have filed with FERC in the last year (FERC 2006). Using the general search function, no additional projects were identified.

3.4 Mapping

TRC produced a map of the existing and proposed energy facilities referenced in this report. Existing facilities were inserted via georeferenced coordinates and or other georeferenced information as available. TRC has plotted the information on CZM's human use data base map as necessary. The metadata accompanying the map explains in detail the sources of the data used and characteristics of the data.

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FIGURE 1

Existing and Proposed Offshore Energy Facilities in Massachusetts

(Provided with this Report as a Separate PDF File)