DE-EE0006714 Final Report

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Prepared by

Lake Erie Energy Development Corporation

Project Icebreaker™

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Table of Contents

List of Acronyms

ACHP	Advisory Council on Historic Preservation
AEP	American Electric Power
AMP	American Municipal Power
BOD	Basis of Design
BP	Budget Period
CPP	Cleveland Public Power
CPT	Cone Penetration Test
CVA	Certified Verification Agent

DOE	U.S. Department of Energy
EA	Environmental Assessment
EPC	Engineering Procurement & Construction
ESA	Electric Service Agreement
FAA	Federal Aviation Administration
GW	Gigawatts
HDD	Horizontal Directional Drilled
HSEQ	Health Safety, Environment and Quality
kV	Kilovolts
LEEDCo	Lake Erie Energy Development Corporation
MOU	Memorandum of Understanding
MW	Megawatts
NEPA	National Environmental Policy Act
NRA	Navigational Risk Assessment
NTIA	National Telecommunications and Information Administration
O&M	Operations and Maintenance
ODNR	Ohio Department of Natural Resources
ODOT	Ohio Department of Transportation
OEM	Original Equipment Manufacturer
OPSB	Ohio Power Siting Board
PATON	Permit for Private Aids to Navigation
PJM	PJM Interconnection L.L.C.
PPA	Power Purchase Agreement
RFI	Request for Information
RFP	Request for Proposal
SHPO	Ohio State Historic Preservation Office
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
WTG	Wind Turbine Generator

SUMMARY

Project Icebreaker, a 20 Megawatt (MW) offshore wind project 8 miles north of Cleveland, OH in Lake Erie, has been under development by the Lake Erie Energy Development Corporation (LEEDCo) since 2009. Prior U.S. Department of Energy (DOE) awards, combined with significant private sources have funded the development efforts to date. The DOE organized the scope into five (5) distinct Budget Periods (BP). The account of work described in this report corresponds to BP2.

Project Icebreaker will promote and accelerate responsible offshore wind development in Lake Erie and the Great Lakes. Lake Erie is an ideal location that offers over 56,000 MW of gross potential that is next to 2.8 Gigawatts (GW) of abandoned substations as well as large load centers. Offshore wind energy in Lake Erie will help the Midwest reduce its greenhouse gas emissions, diversify its energy supply, provide cost-competitive electricity, and stimulate economic revitalization of key sectors of the economy.

However, in order to realize these benefits, key challenges to the development and deployment of offshore wind technology must be overcome, including the relatively high cost of energy, technical challenges surrounding installation and grid interconnection, and the permitting/approval processes. Project Icebreaker will utilize an innovative foundation technology, the Mono Bucket. This no noise, no seabed disturbance foundation has the potential to reduce the installation costs by one-third. In addition, it is significantly lighter than the alternatives, thereby offering a reduction in the fabrication cost as well. The Mono Bucket does not require any pile driving, which makes year round installation possible where marine mammals are present, i.e., Eastern Atlantic.

Fundamentally, Icebreaker will demonstrate and validate the wind farm's innovative technology and benchmark its performance under real world conditions. This world class demonstration facility will enable the development of infrastructure for offshore wind installations and operations throughout Lake Erie. In terms of reducing market barriers, Icebreaker has made significant progress in establishing a permitting protocol that will be the basis for future projects in state waters across the Great Lakes.

BP2 Objectives:

The objective of BP2, as outlined in this Statement of Project Objectives below, is to advance the development of the project to the point where it is ready to achieve Financial Close. More specifically, the objectives of BP2 are:

- Complete the engineering for all major elements of the project;
- Complete competitive bid processes for major elements of the project and be ready for contract award;
- Obtain all state and federal permits and authorizations through the respective statutory processes, including the National Environmental Policy Act (NEPA) process;
- Execute off-take agreements sufficient to secure the debt and equity;

1 Baseline of the BP2 Technical Scope of Work

Significant work has been performed over the past several years to advance Project Icebreaker toward completion. Work began in January 2013 under DE-EE0005989, continued under DE-EE0006714 beginning in December 2014, and continues through to the present. The collection of this work formed the basis or starting point for work performed under DE-EE0006714 BP2.

1.1 State and Federal Permits Baseline

During DE-EE0005989, a Submerged Lands Lease was secured from the State of Ohio in February 2014 that establishes site control for the wind farm, cable route, and on-shore substation. Also during DE-EE0005989, in February 2014, all applications and submissions required to obtain all state and federal permits and authorizations, including the Environmental Assessment (EA) for the NEPA process, were prepared and submitted to the appropriate state and federal agencies. The list of applications and requests submitted in February 2014 includes: 1) Ohio Power Siting Board (OPSB) Certificate of Environmental Compatibility and Public Need; 2) EA pursuant to NEPA; 3) Private Aids to Navigation and U.S. Coast Guard (USCG) Navigational Risk Assessment (NRA); 4) Endangered Species Act Section 7 NEPA Consultation; 5) National Historic Preservation Action Section 106 NEPA Consultation; 6) Clean Water Act Section 404/Rivers and Harbors Act Section 10 Permit; 7) Clean Water Act Section 401 Water Quality Certification; 8) International Joint Commission Order of Approval; 9) Federal Aviation Administration (FAA) No Hazard to Air Navigation; 10) Applications to Alter or Use a Federal Navigation Project; 11) Coastal Zone Management Act Section 307 Consistency Determination.

The applications and requests were submitted based on the proposed monopile with friction wheel design and the Siemens 3.0 Wind Turbine Generator (WTG) with 113 m rotor. The OPSB responded with 14 items that required additional information/clarification/resolution. The FAA determined that the WTG structures exceeded obstruction standards. In May 2014, the state and federal permit activities were placed on hold and all of the agencies were notified. No other responses were provided for the remaining applications/requests after that notification. Some contact was maintained with OPSB and the U.S. Army Corp of Engineers (USACE) between May 2014 and March 2016. In March 2016, the agencies were informed that the permitting process was being re-started and engagement resumed.

Geotechnical & Geophysical Investigation. In 2010, prior to any DOE cooperative agreement, a geophysical survey of the project site was conducted. In 2013, under DE-EE0005989, a geotechnical investigation was performed at the project site consisting of several Cone Penetration Tests (CPTs) and boreholes. Although this information was not sufficient for a detailed engineering of the foundation, it was extremely useful in assessing various foundation concepts. In August/September 2015, under DE-EE0006714, a thorough geotechnical investigation was performed at all sites of the wind farm. The data and samples collected, along with the subsequent lab tests and geotechnical interpretation, formed the basis for the detailed design of the Mono Bucket foundation for the project.

1.2 Foundation Engineering Baseline

At the conclusion of DE-EE0005989, the monopile with friction wheel foundation concept was selected for the project. Then, under DE-EE0006714, the Mono Bucket concept was compared to the monopile with friction wheel concept. The decision was made that the Mono Bucket was the best choice for the project. Still under DE-EE0006714, detailed engineering of the primary steel, sufficient to solicit accurate vendor bids, was completed in March 2016.

1.3 Design Verification Baseline

Under DE-EE0006714, beginning in October 2015, DNV GL was engaged to serve as project Certified Verification Agent (CVA) and verify the Basis of Design (BOD) with the intent to go on and verify the complete design as the project progresses. The CVA focused on the BOD verification and completed verification of much, but not all, of the BOD in April 2016.

1.4 BOD Baseline

Under DE-EE0005989, a BOD was developed based on the 2010 geophysical survey data, the 2013 geotechnical data, assessment of the wind data collected for many years at the water intake crib near the project site, and numerous public sources of metocean data for the project site and vicinity. During DE-EE0006714, the BOD was refined based on the 2015 geotechnical investigation and additional wind and wave analyses, some of which were included in DE-EE0006714 and others were not. The collective work was compiled into an updated BOD and that BOD was reviewed by the CVA under DE-EE0006714.

1.5 Construction Engineering Baseline

Under DE-EE0005989, preliminary construction/installation plans addressing the monopile and friction wheel, the Siemens 3.0-113 WTG, and the submarine cable were developed. During DE-EE0006714, those plans were reviewed and updated based on the Mono Bucket foundation and the MHI Vestas Offshore Wind V126-3.45 WTG. The cable installation plans were not reviewed/updated.

1.6 Electrical Engineering & Grid Interconnection Baseline

Under DE-EE0005989, the interconnect point was selected: Cleveland Public Power (CPP) Lake Road Substation – 69 Kilovolts (kV). A conceptual design was completed for the onshore substation and the cable route. An interconnection application was submitted to PJM Interconnection L.L.C. (PJM) in July 2013 and the feasibility study was completed in February 2014 and found no violations; no overloads; no upgrades required. Outside the scope of DE-EE0005989 and DE-EE0006714, the interconnection process proceeded. The System Impact Study was completed in September 2014 and the final study, the Facilities Study was completed in May 2015; the project was approved for interconnection and a Wholesale Market Participation Agreement was offered by PJM.

Since the completion of the Facilities Study in May 2015, two simple modifications to the project have developed. First, LEEDCo decided to change the WTG from six Siemens 3.0 MW turbines to six Vestas 3.45 MW. Second, CPP decided to change the interconnect point from its 69 kV system to its 138 kV system; both within the Lake Road substation.

PJM indicated that modifications such as the WTG change are common and the process to address them is straightforward. They also indicated that since CPP decided to change the interconnect point/voltage, status in the interconnect queue would not be affected. In order to finalize these modifications, a simple update to the application is required and PJM will update their models and re-assess the interconnection impacts based on the updated parameter.

No additional impacts are anticipated from the interconnect voltage change. The CPP 138 kV system was already included in the three completed studies. Based on the 69 kV interconnect scenario, power flows from the project to the 69 kV system to the CPP 138 kV system to the American Transmission Systems, Incorporated 138 kV system. Thus the impact of the project power on the CPP 138 kV system has already been modeled and assessed. However, PJM must formally document that analysis by reviewing the updated application.

1.7 Power Purchase Agreements (PPA) Baseline

Under DE-EE0005989, by February 2014, pledges for 105% of the project output were secured but not under PPA at that time. Outside the scope of DE-EE0005989 and DE-EE0006714, between May 2014 and April 2016, many developments occurred resulting in a) some of the commitments falling off due to limitations of some organizations to enter into a long term PPA and/or creditworthiness of some organizations, b) other new commitments secured, and c) execution of a 16-year PPA with CPP for 63.6% of the project output.

1.8 Wind Turbine Evaluation & Selection Baseline

Under DE-EE0005989, the selected WTG was the Siemens 3.0-113. The WTG selection was revisited beginning in October 2014. The Annual Energy Production for the project site for several different WTGs was performed. The MHI Vestas Offshore Wind V126-3.45 was selected based on the best Annual Energy Production among those evaluated at that time

1.9 Supply Chain Development Baseline

Under DE-EE0005989 and DE-EE0006714, an intensive effort to identify, vet, and develop domestic heavy metal fabricators capable of and interested in fabricating the foundations for the project was completed. Following the selection of the Mono Bucket foundation concept in March 2015, efforts intensified toward the goal of qualifying fabricators to bid on the Mono Buckets. In addition, significant efforts were undertaken to educate qualified and interested domestic fabricators about the Mono Bucket requirements. In March 2016, a Round 1 of 2 solicitation was issued to 10 pre-qualified fabricators. Bids were submitted by 7 fabricators. In early May 2016, each of the 7 fabricators were visited to clarify their bids. The first round was intended to short-list the field with the final bids to come after the 100% engineering milestone is achieved.

1.10 Project Finance Baseline

Under DE-EE0005989, a financial pro forma model was developed and many banks were approached to assess interest in providing the project debt. Letters of interest were obtained from 8 such banks in January 2014. Since that time and outside the scope of DE-EE0005989 and DE-EE0006714, the financial

model has been refined to reflect the current project configuration. A source of project debt has been identified and engagement with that bank continues.

2 Status of Work Performed in BP2

2.1 Task 9.0: State and Federal Permits

2.1.1 Subtask 9.1: OPSB Certificate of Environmental Compatibility and Public Need

LEEDCo met with officials from the OSPB, Ohio Department of Natural Resources (ODNR), and other relevant state agencies, in April 2016 to launch the process for the application of Certificate of Environmental Compatibility & Public Need. In the months that followed, LEEDCo completed preliminary work necessary before drafting of the application. Three significant tasks were completed during this time: 1) aquatic resources risk assessment, 2) avian and bat species risk assessment, and 3) visual impact assessment; each subsequently included in the OPSB application. In September 2016, the pre-application notice was filed with the OPSB and LEEDCo held a statutory Public Information Meeting in November 2016. The comprehensive application was completed and filed in February 2017.

After 60 days, the OPSB determined that the monitoring protocols for a) aquatic resources, and b) avian and bat species were required before the application would be deemed sufficient. LEEDCo developed the protocols with input from ODNR and reached agreement on the pre-, during-, and post–construction monitoring protocols and negotiated two (2) Memoranda of Understanding (MOU) concerning the protocols. The MOUs and protocol documents were submitted to OPSB in July 2017 and OPSB deemed the application sufficient on July 25, 2017.

The OPSB process schedule was set and preparations and planning for the first Public Hearing (November 8, 2017) followed.

2.1.2 Subtask 9.2: (EA)

LEEDCo coordinated with DOE, USCG, and USACE; all of which had an interest in or obligations under NEPA. The DOE became the lead agency and the other two agencies agreed to become cooperating agencies in pursuit of a single EA. LEEDCo then engaged a NEPA Contractor in accordance with DOE guidance.

The three agencies, the NEPA Contractor, and LEEDCo completed initial planning and preparation efforts which culminated in a public NEPA Scoping Session held in Cleveland on September 28, 2016. Following the scoping session, the NEPA Contractor began drafting the EA under the guidance of DOE in cooperation with USCG and USACE. Much of the assessments, studies, and plans that were utilized to prepare the OPSB application were shared with the team as input to the EA.

The Draft EA was finalized in August 2017. The Draft EA concluded that the project poses no significant impact to the environment, and that most impacts will be short term and minor. In parallel with the drafting of the Draft EA, statutory consultations were initiated by DOE (refer to Section 2.1.4 and 2.1.5). The public comment period was opened and planning for a public information meeting on the Draft EA

was completed. The public meeting was held on September 6, 2017 in Cleveland. The meeting was well attended. The public comment period continued into October 2017.

2.1.3 Subtask 9.3 Permit for Private Aids to Navigation (PATON) and USCG NRA

During the EA process, LEEDCo received guidance from the USCG concerning the requirements for PATON applicable to the Project. These requirements were then communicated to the wind turbine original equipment manufacturer (OEM) for inclusion. The USCG also indicated that the application process for PATON is very straightforward and, in comparison to the OPSB, NEPA, and USACE permits, is simple and low risk. USCG advised that LEEDCo not submit a PATON application until after the NEPA process is completed and the USACE permits are issued. LEEDCo incorporated that guidance into the plans and no further work was completed.

During the drafting phase of the EA (refer to Section 2.1.2), LEEDCo completed a NRA. The NRA was reviewed by the USCG and incorporated into the EA.

2.1.4 Subtask 9.4 Endangered Species Act Section 7 NEPA Consultation and other consultations required by applicable environmental statutes

In conjunction with drafting of the EA (refer to Section 2.1.2), the statutory Endangered Species Act Section 7 consultation with US Fish and Wildlife Service (USFWS) was initiated by DOE. USFWS completed the consultation and the result was issued on September 14, 2017, concluding that the project is not likely to adversely affect any federally listed threatened or endangered species (Indiana bat, northern long-eared bat, piping plover, rufa red knot, and Kirtland's warbler).

2.1.5 Subtask 9.5 National Historic Preservation Act Section 106 NEPA Consultation and E.O. 13175 Consultation and Coordination with Indian Tribal Governments

In parallel with drafting of the EA (refer to Section 2.1.2), the statutory Section 106 consultation with Ohio State Historic Preservation Office (SHPO) and consultations with Indian Tribal Governments were initiated by DOE.

Two significant reports formed the basis of the Section 106 consultation: 1) Section 106 Geophysical Survey Review for Icebreaker Wind (January 2017); and 2) Visual Impact Assessment. The Section 106 Geophysical Survey Review report was prepared based on the results of the Cable Route Survey (refer to Section 2.4). Both were included in the Draft EA as Appendix T, and Appendix U, respectively.

On July 28, 2017, SHPO responded with several questions/issues concerning the consultation. SHPO identified instances wherein the Section 106 report was not in compliance with appropriate standards. LEEDCo prepared a supplemental report that addressed SHPO's concerns and submitted it to DOE, which was then sent to SHPO. SHPO also did not concur with the visual impact assessment concerning four historic properties. DOE reached out to the property owners and the Advisory Council on Historic Preservation (ACHP). ACHP and SHPO are currently reviewing the supplemental filings and comments; as of September 30, 2017, the issues were not yet resolved.

DOE sent two rounds of consultation letters to all of the USACE designated Indian Tribal Governments. No responses were received and as of September 30, 2017, no further action is planned/required by DOE unless one or more tribal governments responds.

2.1.6 Subtask 9.6 Clean Water Act Section 404/Rivers and Harbors Act Section 10 Permit

LEEDCo met with officials from the USACE in July 2016 to launch the process for the Section 404 and Section 10 permits (and Section 408 permit – refer to Section 2.1.10). In the time that followed, LEEDCo completed preliminary work necessary before drafting of the application, including many discussions and exchanges of information with USACE describing the technical elements of the project. USACE provided guidance that the Section 404/Section 10 application process would follow the schedule of the NEPA process. As the OPSB application and Draft EA were developed, elements were shared with USACE.

A great deal of discussion was related to the USACE's Section 404 jurisdictional authority over the three main relevant aspects of the project: 1) Horizontal Directional Drilled (HDD) conduit under the inner harbor and breakwater, 2) the cable burial from the exit of the HDD conduit to the turbines, and 3) the installation of the Mono Bucket foundations. The USACE ultimately determined that elements 1) and 3) were subject to Section 404, while 2) was not. This decision allowed LEEDCo to finalize the Section 404/Section 10 application.

Once the Draft EA was released in August 2017, the path was clear to submit the Section 404/Section 10 application. LEEDCo submitted the application on September 1, 2017 and the public comment period opened in September. As of September 30, 2017, the public comment period was open and due to close on October 13, 2017 and no further work was performed pending the public comment process.

2.1.7 Subtask 9.7 Clean Water Act Section 401 Water Quality Certification

LEEDCo conducted a pre-application coordination meeting with Ohio Environmental Protection Agency in May 2017. The need for a Section 401 application was triggered by the Section 404 permit application; with the scope of the Section 401 application limited to the scope of the Section 404 application. The determination re. the jurisdictional authority of the Section 404 was not made until August 2017. Following that determination, the Section 401 permit application was developed and as of September 30, 2017, the draft was in process. (The application was submitted on October 17, 2017.) LEEDCo reached an agreement with the Cleveland Water Department to conduct monitoring during the cable lay operation to ensure no adverse impact on drinking water, which the Department determined was unlikely.

2.1.8 Subtask 9.8 International Joint Commission Order of Approval

LEEDCo submitted an application to U.S. Department of State on December 9, 2016, seeking approval for uses of waters under the Boundary Waters Treaty of 1909. On June 30, 2017, LEEDCo was notified by the Office of Canadian Affairs, U.S. Department of State, that the project does NOT require approval under the Boundary Waters Treaty of 1909.

2.1.9 Subtask 9.9 FAA No Hazard to Air Navigation

On July 22, 2016, LEEDCo filed Form 7460-1, Notice of Proposed Construction or Alteration, with the FAA for each of the seven (7) WTG sites (six planned sites and one alternate site) seeking to obtain a No Hazard

to Air Navigation ruling. On February 22, 2017, the FAA issued a Determination of No Hazard to Air Navigation for each of the seven (7) sites.

LEEDCo also consulted with the National Telecommunications and Information Administration (NTIA) to determine if the project would impact the radar system under the jurisdiction of the NTIA. On September 11, 2017, the National Weather Service issued a determination that the impacts to the Cleveland, OH WSR-88D KCLE radar will be low.

Following receipt of the FAA No Hazard to Air Navigation rulings, LEEDCo consulted with the Ohio Department of Transportation (ODOT). On April 17, 2017, ODOT issued authorization to initiate construction.

2.1.10 Subtask 9.10 Applications to Alter or Use a Federal Navigation Project

On February 2, 2017, LEEDCo submitted a Section 408 Request to Alter, Impact, or Encroach upon a Buffalo District Navigation Project, to the USACE. The planned submarine cable route under the Cleveland East Breakwater and outer harbor federal navigation channel, via HDD, triggered the need for a Section 408 permit. The USACE issued a letter granting permission to construct the submarine cable as requested on September 8, 2017, subject to standard conditions as outlined in the Alteration Conditions Form.

2.1.11 Subtask 9.11 Coastal Zone Management Act Section 307 Consistency Determination

A Section 307 Consistency Determination from the ODNR is required as part of the USACE Section 404/Section 10 permit. On September 1, 2017, LEEDCo filed a Coastal Zone Management Program Consistency Certification Statement with the USACE Section 404/Section 10 permit application. As of September 30, 2017, no further work was performed pending USACE Section 404/Section 10 permit process.

2.1.12 Subtask 9.12 Aquatic Species Studies

LEEDCo consulted with ODNR and USFWS to establish an appropriate pre-, during-, and post-construction aquatic species monitoring protocol. By spring 2016, sufficient details were agreed upon between LEEDCo and ODNR to initiate the first of two pre-construction monitoring seasons. LEEDCo completed the first season monitoring from May – October. During that time, aquatic species monitoring protocol continued to evolve based on discussions between LEEDCo and ODNR with the protocol finalized in January 2017. LEEDCo issued the annual report of the first pre-construction monitoring season in March 2017 and then initiated the second monitoring season. In July 2017, LEEDCo reached formal agreement with ODNR regarding the aquatic species monitoring protocol and executed an MOU with ODNR. As of September 30, 2017, the second season field monitoring was in progress and scheduled to be completed at the end of October 2017.

2.1.13 Bird and Bat Species Studies

LEEDCo consulted with ODNR to establish an appropriate pre-, during-, and post-construction avian and bat species monitoring protocol. In July 2017, LEEDCo reached formal agreement with ODNR regarding the monitoring protocol and executed an MOU with ODNR (refer to Section 2.1.1). The 2017 bat acoustic monitoring survey was completed in accordance with the MOU. Planning for the waterfowl/waterbird

aerial survey was completed and the survey was scheduled to commence in mid-October 2017 and run through May 2018. Discussions regarding a pre-construction radar survey to determine the altitudinal density and flight height of nocturnal migrants at the project site with the USFWS commenced in late 2016 and continued through September 30, 2017. LEEDCo, ODNR, and the USFWS agreed to engage a third party radar expert for an assessment of the viability of conducting a radar survey from a large vessel to collect the data sought by the agencies. Those discussions were ongoing as of September 30, 2017.

2.2 Task 10.0: 100% Engineering Completion of the Mono Bucket

2.2.1 Subtask 10.1: Complete Coupled Loads Analysis

The Mono Bucket design was updated based on the updates made to the BOD since the first iteration coupled loads analysis that was completed in BP1. The updated BOD and updated Mono Bucket design were provided to the WTG OEM to perform a second iteration coupled loads analysis. The loads were simulated in accordance with the IEC 61400-1:2005 and IEC 61400-3:2009 and were calculated for one representative WTG location and included ice as well as hydrodynamic induced foundation dynamics.

Following the completion of the second iteration coupled loads analysis, it was determined that a third iteration (which would be the final iteration) coupled loads analysis would be required due to a combination of factors, namely: a) the wind and wave time series misalignment to reduce fatigue uncertainty; b) the seismic conditions; and c) the corrosion protection scheme using anodes. As of September 30, 2017, these issues were not completely resolved and consequently the third iteration was not completed. It will be completed in next phase.

2.2.2 Subtask 10.2: Optimize Variants of Mono Bucket for all Six (6) Sites

A penetration analysis was performed for all seven (7) sites and characterized, although only six of those seven sites will be used. Following the penetration analysis, bearing capacity and deformation analysis was performed for all sites as well. The results of both these analyses were combined to develop the 'design graph', which is the tool used to identify all bucket diameters and skirt lengths, that meet the performance criteria. From the design graph, a single solution was identified which meets the criteria for all seven sites: diameter = 18.5 m; skirt length = 12.5 m. Following the third iteration coupled loads analysis, this 'design graph' will be updated to reflect any design changes which may impact the bucket performance. This will be completed in next phase.

2.2.3 Subtask 10.3: Secondary/Tertiary Detailed Design

Preliminary design of the secondary and tertiary steel was completed in BP1. During BP2, the detailed design processes and methodologies for these systems were updated in preparation of performing the detailed design. The design considerations for all of the secondary steel and appurtenances were documented in the BOD Part C, including corrosion protection, WTG tower-foundation mounting requirements, permanent safe access arrangements, ice cone, boat landing and access ladder, access platform, handrail, internal platforms, internal ladders, and J-tubes. A series of discrete design briefs were also issued to document the detailed design approach for transportation analysis, ship impact, and corrosion protection.

2.2.4 Subtask 10.4: Final Round Fabrication Competitive Bid Process

The bid process that was initiated with ten (10) U.S. fabricators in BP1 generated seven (7) responses at the end of BP1. During BP2, the fabrication team conducted site visits to each of the seven respondents to ensure that all open questions/issues related to the bids were addressed and clarified. The results of all of the responses, clarifications, observations, etc. were evaluated and the field of seven (7) fabricators was shortlisted to five (4). Three of the fabricators are located in the Great Lakes region and one is located in the Gulf region.

In December 2016 – January 2017, the fabrication team visited each of the four shortlisted fabricators. The scope of each visit included a review of the fabricator's Health Safety, Environment and Quality (HSEQ) systems, review of the Fabricator Method Statement, and technical discussion regarding possible improvements/limitations etc.

2.2.5 Subtask 10.5: Complete Mono Bucket Design Verification

Substantial work was performed to advance the verification of the BOD, work that was initiated prior to the beginning of the award period of performance for BP2 but not completed. The CVA recommended splitting the BOD into three main parts, Part A – site conditions, Part B – load cases, and Part C – foundation design, while also determining that additional work was required to further clarify these sections. Consequently, work was performed in the areas of geotechnical site conditions; geotechnical design methodology, ice loads, wind and wave combinations, and foundation design briefs.

The geotechnical and geophysical Cable Route Survey (refer to Section 2.4.4) results at the WTG sites were analyzed and compared to the site characterization analysis prepared based on the geotechnical survey, completed in 2015. Refinements were made to elements of the original site characterization. A supplemental geotechnical report was prepared. The supplemental report was utilized to refine the relevant aspects of the BOD. The geotechnical site conditions and characterization were further updated based on feedback from the CVA.

As a result, the foundation designer then updated its geotechnical design methodology and associated design briefs. Ice loading parameters were developed to reflect the most conservative case with ice keels extending the full length of the 18 m below the water line. Additionally, it was demonstrated that fatigue due to ice loading is a small fraction of that due to wave loading. New times series were developed to reflect both of these results. For the wind/wave misalignment, the original tables were normalized to the CVA approved wind distribution, and a new joint probability was developed, closing out this task. The vast majority of the updates/refinements to the BOD were verified by the CVA. However, some open items remained as of September 30, 2017.

Work was also initiated to refine the seismic characteristics for the 3rd iteration and the anode design for corrosion mitigation. However, this work was not yet completed and thus the BOD was not finalized as of September 30, 2017. The seismic and corrosion related tasks, and the balance of the other open BOD issues will be completed in the next phase.

2.3 Task 11.0: Construction and Installation Engineering/Planning

2.3.1 Subtask 11.1: Detailed Marine Construction/Installation Plan

A comprehensive marine operations installation plan was developed that encompassed the following key elements related to the construction phase:

- Detailed marine construction phase
- Investigation and verifications of vessel capabilities
- Staging port activities
- Logistics from staging port to installation site
- Installation of Mono Bucket foundations
- Installation of WTG's
- Marine coordination
- Crew transfer, guard vessels, service vessels

The first step in the plan was the development of a relevant BOD for the scope of the marine operations. A detailed vessel screening was developed to identify all heavy lift vessels that meet the minimum performance requirements and that could access Lake Erie. The overall installation concept and method statement for the WTGs and Mono Buckets were developed. A key element of the concept was the conversion of a deck barge to serve as the heavy lift vessel. A ship design feasibility study was completed for the barge conversion concept. In addition, the plan included port management elements (which fall under the scope of Subtask 11.2 below). Finally, a budgetary cost and schedule was developed. The marine operations installation plan served as the basis for Marine Construction Spread Competitive Bid Process (Subtask 11.3).

2.3.2 Subtask 11.2: Quayside Requirements, Logistics, and Management Plan

The marine operations installation plan developed under Subtask 11.1 addressed the quayside operations as described in the Port Management Report. The plan outlines the requirement for appropriate HSEQ documentation, a Hazard Identification workshop, and Hazard operability study workshop prior to commencement of work. Roles and responsibilities of various parties engaged in the operations were defined. The material handling and other equipment that is required to perform the work was identified. A methodology for performing the work was developed and a port layout to support the methodology was also developed. An initial structural assessment of quayside for load out operations was performed and included in the plan.

2.3.3 Subtask 11.3: Marine Construction Spread Competitive Bid Process

After a marine operations installation plan was developed, a market survey of appropriate Engineering Procurement & Construction (EPC) contractors and marine contractors in the U.S. and Europe was conducted to identify potential bidders for the marine installation scope of work. The first round bid document package, Request for Information (RFI), was developed based on the installation plan. A list of viable contractors was developed and interest was confirmed with the contractors. The RFI was sent out to a bidders list of fifteen (15) contractors in August 2017.

The team met with all of the contractors that confirmed an intention to respond in late August 2017. As of September 30, 2017, the responses were not yet received. (Subsequently, the last response was received in November 2017; a total of eleven (11) responses were received.)

2.3.4 Subtask 11.4: Quayside Equipment and Facilities Competitive Bid Process

The quayside requirements, logistics, and management requirements were not included in the RFI for round one (Refer to Section 2.3.3). As of September 30, 2017, no solicitation was issued for the quayside logistics scope of work. That scope of work will be included in the second round bid process for the marine operations scope of work to be completed in the next phase.

2.4 Task 12.0: Cable Route Survey

2.4.1 Subtask 12.1: Survey Planning Process

Requirements for the cable route survey in each of the relevant aspects of the project including permitting, cable design, onshore switchgear, installation/construction, quayside utilization, geophysical survey, geotechnical, etc. were defined. Input form the various teams was combined to develop a comprehensive specifications/scope of work for the cable route survey.

2.4.2 Subtask 12.2: Survey Competitive Bid Process

A competitive bid package based on the requirements defined in Subtask 12.1 was developed. A list of eleven (11) qualified firms to perform the survey was developed and vetted. The bid package was sent out in June 2016. A competitive bid process was executed to a successful conclusion. Evaluations were completed for each of the elven (11) responses received, including appropriate clarifications to responses and pricing of some of the respondents. A contractor was selected and a contract was executed in August 2016 for turnkey execution of the complete cable route survey scope of work.

2.4.3 Subtask 12.3: Survey Field Work

Prior to commencing the field work, approval to conduct physical sampling was secured from SHPO and DOE under NEPA.

The cable route survey was performed between mid-August and mid-October of 2016. The survey consisted of a geophysical survey scope first. The geophysical survey includes the following elements: multibeam echosounder, single beam echosounder, sidescan sonar, magnetometer, sub-bottom profiler, and seismic reflection. Following the geophysical survey, the vessel was mobilized with the geotechnical survey equipment and the geotechnical investigation, consisting of the acquisition of 11 piston core samples, 4 box core samples, and 44 gravity CPT in situ tests, was completed.

2.4.4 Subtask 12.4: Post Survey Analysis

Following the completion of the field work, the geotech samples were evaluated and prepared for laboratory testing. Lab testing was completed and the results were interpreted by the geotechnical engineer. The results of the gravity CPT tests were analyzed and interpreted. Two reports were completed

and issued: 1) Geotechnical Survey Factual Data Report, and 2) Geotechnical Data Report, Cable Route Alignments.

Likewise, the geophysical mapping data was compiled and analyzed to produce an interpretive report. A Marine Geophysical Survey Results report was completed and issued. Based on that report, an Archaeological Survey Report for Section 106 for the SHPO was prepared and issued to SHPO, which was required for National Historic Preservation Act Section 106 NEPA Consultation (Refer to Section 2.1.5).

2.5 Task 13.0: Electrical System Design

The electrical system consists of three main elements: the physical/mechanical submarine cable system, the onshore switchgear lineup, and the finalization of the PJM interconnection process.

2.5.1 Subtask 13.1: Inter-array & Export Cable Design

The cable design team provided input into the Requirements for the cable route survey (Refer to Section 2.4.1). Design parameters were defined to enable the Mono Bucket design team to incorporate cable installation considerations into the foundation design. The results of the cable route survey were reviewed and considered in the cable system design. A cable system functional specification was developed to define the requirements for the complete supply and installation of the submarine cable, including the HDD segment. A cable burial risk assessment was performed to determine what cable burial depth is required to ensure a given protection level against anthropogenic threats (fishing and shipping) and non-anthropogenic threats (namely, ice gouging) to the cables. The study was conducted according to guidance presented in the "Cable Burial Risk Assessment Methodology" document published by The Carbon Trust.

The design documents and specifications were compiled into a comprehensive competitive bid package to solicit bids for all work associated with the design, manufacturing, transport, installation and commissioning of the submarine cable system. The bid package required a "turnkey" solution for the submarine cable that will connect the WTGs to the onshore substation and which shall be designed for a 25 year operating life minimizing risk of failure and providing for repair as necessary during the operating life.

A list of qualified firms to perform the EPC scope of work was developed and vetted, resulting in a final list of six (6) firms. A competitive bid process was executed beginning in June 2017 and four (4) compliant responses were received in September 2017. As of September 30, 2017, the responses were not yet evaluated and no selection of a contractor was made; these tasks will be completed in the next phase.

2.5.2 Subtask 13.2: Onshore Switchgear Electrical Design

The electrical and civil design of the onshore switchgear was performed as a unified task. Therefore, the report of work performed under Task 13.2 is encompassed in the report stated below under Task 13.3.

2.5.3 Subtask 13.3: Onshore Switchgear Civil Design

A geotechnical survey was completed for the substation site and surrounding HDD pit. The electrical conceptual design was completed to determine the specification of the major components. The civil site

plan, grading plan, and foundation design was completed. The detailed electrical design, considering all relevant requirements and factors including but not limited to the WTG requirements, the CPP and PJM grid interconnect requirements, grounding and lightning protection requirements, Supervisory Control and Data Acquisition requirements, interface/termination of the submarine cable, was completed. A comprehensive package of civil and electrical engineering drawings and specifications was developed. A detailed engineering cost estimate was developed based on the detailed design.

The engineering drawings and specifications were compiled into a comprehensive competitive bid package to solicit bids for all work associated with the design, manufacturing, transport, construction, installation and commissioning of the onshore substation and integration to the transmission grid in the CPP substation. The bid package required a "turnkey" solution for the substation that will connect the WTGs to the transmission grid and which shall be designed for a 25 year operating life minimizing risk of failure and providing for repair as necessary during the operating life.

A list of firms to perform the EPC scope of work was developed and vetted, resulting in a final list of three (3) firms qualified to perform the work and interested in competing for the work. A competitive bid process was executed beginning in June 2017 and two (2) compliant responses were received in August 2017. As of September 30, 2017, the responses were not yet evaluated and no selection of a contractor was made; these tasks will be completed in the next phase.

2.5.4 Subtask 13.4: PJM Interconnection

PJM Impact Study Data describing the project was updated to reflect two simple modifications. First, the WTG was changed from six Siemens 3.0 MW turbines to six Vestas 3.45 MW. Second, CPP decided to change the interconnect point from its 69 kV system to its 138 kV system; both within the Lake Road substation.

The updated study data was submitted to PJM on July 22, 2016, which triggered PJM to perform the requisite studies necessary to revise the System Impact Study Report of May 2015. PJM completed the study and issued a Draft Revised Generation Interconnection System Impact Study Report in June 2017. The final report was issued in October 2017.

Based on the change from 69 kV to 138 kV point of interconnection, PJM determined that the form of interconnection agreement would be two agreements: 1) Interconnection Service Agreement, and 2) Interconnection Construction Service Agreement.

2.6 Task 15.0: Finalize PPA(s) for Balance of the Energy Output

LEEDCo worked closely with CPP, Cuyahoga County, and American Municipal Power (AMP) to address several conditions precedent in the PPA with CPP. On November 15, 2016, the County Council passed a resolution authorizing an Electric Service Agreement (ESA) with City of Cleveland/Department of Public Utilities/Division of CPP for electric power services for various County-owned buildings. The ESA includes the purchase of 8.6% of Icebreaker power through CPP. Execution of the ESA would satisfy one of the conditions precedent in the CPP PPA. The ESA was negotiated between CPP and the County. As of September 30, 2017, the ESA was not yet executed. (It was subsequently executed on December 27, 2017.)

LEEDCo worked with AMP to provide AMP the materials needed for AMP to develop a package to solicit subscription of Icebreaker power by its members. Subscribed members for the full amount of power committed by AMP is a condition precedent in the CPP PPA. The package was in draft as of September 30, 2017. Continuing work and coordination with AMP through their subscription process will continue in the next phase.

LEEDCo responded to a Request for Proposals (RFP) to purchase power issued by American Electric Power (AEP) and submitted a proposal to AEP on February 16, 2017. As of September 30, 2017, AEP did not provide any feedback re. the disposition of the submitted proposal.

LEEDCo responded to a RFP to purchase power issued by New York Power Authority (NYPA) and submitted a proposal to NYPA on September 7, 2017. As of September 30, 2017, NYPA did not provide any feedback re. the disposition of the submitted proposal. (On October 31, 2017, NYPA informed LEEDCo that its proposal was not selected by NYPA for consideration under the RFP.)

LEEDCo responded to a RFP to purchase power issued by Facebook. LEEDCo drafted a proposal in response to the RFP. As of September 30, 2017, the proposal was in the process of being drafted. (The proposal was submitted on October 20, 2017.)

LEEDCo also engaged with several non-profit organizations and companies located within the Northeast Ohio region and outside the region but within the PJM grid territory for the purpose of soliciting power purchase commitments. Numerous productive discussions occurred. As of September 30, 2017, none of the engagements culminated in a commitment to purchase power.

2.7 Task 16.0: Project Costs and Risk Management

2.7.1 Subtask 16.1: Development of Total Project Costs

The cost estimates for all of the major capex categories were updated based on the most currently available information including indicative pricing from suppliers and contractors for the major equipment (WTG, Mono Bucket foundations, submarine cable, onshore substation); updated estimates for the permitting process including the pre-, during-, and post construction monitoring; updated estimates for the development and project management teams. In addition, the cost estimates for the major opex categories were updated based on more current information and quotes from suppliers.

2.7.2 Subtask 16.2: 3rd Party Review of Project Costs and Schedule

As of September 30, 2017, the formal review by a 3rd party entity was not completed. The task will be completed in the next phase after all of the capex and opex cost estimates are firm.

2.7.3 Subtask 16.3: Project Risk Register

A risk register was developed to capture all of the identified project risks associated with the Mono Bucket foundation, likelihood of occurrence, impact of occurrence, risk owner, and mitigation strategy. The risk register will be updated in the next phase and risks associated with all other aspects of the project will be added.

2.8 Task 17.0: Operations and Maintenance (O&M) Planning

Negotiations progressed with the WTG OEM encompassing the scope and budget of a 15-year service agreement for the WTGs. A scope of services was defined with a local marine operator for facilities and services during O&M. Crew transfer vessel solutions for the O&M period were explored and assessed. As of September 30, 2017, an update to the O&M plan incorporating the work performed during this project was not completed. Work to complete the O&M plan will be performed in the next phase.

2.9 Task 18.0: Domestic Supply Chain Development

LEEDCo continued to engage with the four shortlisted U.S. fabricators for the Mono Bucket fabrications (refer to Section 2.2.4). A supplier database and website was developed in November 2016. In December 2016, a Supply Chain Open House event was conducted to inform all interested suppliers of the opportunities to participate in the supply chain for the project. The event was focused on but not limited to regional suppliers. The event attendance was overwhelming – over 270 attendees. All attendees were registered in the database. Following the event, outreach continued to register additional firms. As of September 30, 2017, approximately 350 companies were registered in the database.

The supply chain database was included in the bid packages for the submarine cable system (refer to Section 2.5.1) and the onshore substation (refer to Section 2.5.3). The bid packages also included requirements and targets for local sourcing and community benefits.

2.10 Task 19.0: Instrumentation Planning

The conceptual design of a sensor system for monitoring the performance of the Mono Bucket foundations for the Icebreaker project was completed. The design specifies how the system will monitor the in-situ behaviors of the offshore wind turbine structure and foundation, which involves multiple types of sensors and the data acquisition system. A design report was developed. The report addressed the raw data that will be collected continuously on site by the monitoring system installed offshore and then transmitted to the onshore data management center.

2.11 Task 20.0: DOE Review (June 2017)

LEEDCo submitted a package of deliverables that were completed as of the interim review submission deadline of June 9, 2017. LEEDCo also participated in an in-person interim review meeting with DOE on July 12, 2017.