BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF HAWAI'I

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PUBLIC UTILITIES
COMMISSION

---- In the Matter of ----	)	
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PUBLIC UTILITIES COMMISSION	)	
	)	
Opening a Proceeding to	)	Docket No. 2013-0169
Investigate Whether an O'ahu-Maui	)	
Interisland Transmission System	)	
May Be in the Public Interest	)	
	)	

THE DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT, AND TOURISM'S INITIAL PUBLIC COMMENTS IN RESPONSE TO HAWAI'I PUBLIC UTILITIES COMMISSION ORDER NO. 31356

AND

CERTIFICATE OF SERVICE

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Glossary

AC	Alternating Current
AHPA	Archaeological and Historic Preservation Act
AIRFA	American Indian Religious Freedom Act
ARPA	Archaeological Resources Protection Act
BOEM	Bureau of Ocean Energy Management
Cable Investigation Order	Hawai'i Public Utilities Commission Order No. 31356
CCC	Certified Cable Company
CDA	Cable Development Agreement
CO_2	Carbon Dioxide
COA	Coordinated Operating Agreement
Competitive Guidance Order	Hawai'i Public Utilities Commission Order No. 31354
COA	Coordinated Operating Agreement
CPCN	Certificate of Public Convenience and Necessity
Commission	The Hawai'i Public Utilities Commission
DBEDT	The Department of Business, Economic Development, and Tourism
DOE	The United States Department of Energy
EIS	Environmental Impact Statement
EPA	The United States Environmental Protection Agency
EPAct 2005	The Energy Policy Act of 2005

ESP	Electrostatic Precipitator
FTCPA	Firm Transmission Capacity Purchase Agreement
GWh	Gigawatt Hours
HECO	Hawaiian Electric Company, Inc.
HELCO	Hawai'i Electric Light Company, Inc.
HECO Companies	Hawai'i Electric Company, Inc., Hawai'i Electric Light Company, Inc., and Maui Electric Company, Limited
HEPA	Hawai'i Environmental Procedures Act
HERA	Hawai'i Electricity Reliability Administrator
HVAC	High-Voltage Alternating Current
HVDC	High-Voltage Direct Current
IRP	Integrated Resources Plan
HCEI	Hawai'i Clean Energy Initiative
kV	Kilovolt
kWh	Kilowatt Hour
LNG	Liquified Natural Gas
MECO	Maui Electric Company, Limited
MMBtu	One Million British Thermal Units
MW	Megawatt
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Procedures Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Association

NMSA	National Marine Sanctuaries Act
NOx	Nitrogen Oxides
NPV	Net Present Value
O&M	Operations and Maintenance
ONMS	The National Oceanic and Atmospheric Association's Office of National Marine Sanctuaries
PEIS	Programmatic Environmental Impact Statement
PM	Particulate Matter
POM	Portfolio Optimization Model
RPS	Renewable Portfolio Standard
RSWG	Reliability Standards Working Group
S.B.	Senate Bill
SCFF	Self-Contained Fluid-Filled
SHPD	The Department of Land and Natural Resources' State Historic Preservation Division
SOEST	The University of Hawai'i's School of Ocean and Earth Science and Technology
SOx	Sulfur Oxides
SO_2	Sulfur Dioxide
TDCA	Transmission Development and Control Agreement
TRC	Technical Review Committee
VSC	Voltage Source Converter
XLPE	Cross-linked Polyethylene

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INITIAL PUBLIC COMMENTS OF THE
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT, AND TOURISM
IN RESPONSE TO ORDER NO. 31356

The Department of Business, Economic Development, and Tourism ("Department" or "DBEDT"), by and through its Director in his capacity as the Energy Resources Coordinator, through the undersigned Deputy Attorney General, respectfully submits its Initial Public Comments ("Comments") in the above-captioned matter before the Hawai'i Public Utilities Commission ("Commission") in Docket No. 2013-0169. DBEDT, a named party to this proceeding, appreciates the opportunity provided by the Commission in its July 11, 2013 Order ("Cable Investigation Order") to assist the Commission in developing a record for its investigation of whether an O'ahu-Maui interisland marine electric transmission cable may be in the public interest.[1] In support of its Comments, DBEDT states as follows:

[1] *Opening a Proceeding to Investigate Whether an O'ahu-Maui Interisland Transmission System May Be in the Public Interest*, Docket No. 2013-0169, Order No. 31356 Initiating Proceeding, at 8-9 (July 11, 2013) ("Cable Investigation Order").

I. EXECUTIVE SUMMARY

1. The principal question for the Commission to answer through the instant investigation is: Is an interisland transmission cable connecting O'ahu and Maui in the public interest? As explained herein, DBEDT addressed this question by utilizing a sophisticated optimization model to analyze relevant cost data, load and generation forecasts, and relevant operational characteristics of the O'ahu and Maui systems. DBEDT's economic analysis demonstrates that the answer to this question is an unequivocal "yes;" an interisland transmission cable connecting O'ahu and Maui is in the public interest.

2. *DBEDT is Uniquely Qualified to Provide Input*: As the State's Energy Resources Coordinator, DBEDT plays an important and distinctive role regarding the State's energy planning and policy initiatives, and has substantial experience with respect to the issues presented in this proceeding. Accordingly, DBEDT is able to evaluate the questions posed and issues identified in the Cable Investigation Order with considerable technical, policy, and legal expertise. In addition to its expertise, DBEDT's analysis and conclusions are informed by technical, policy, and regulatory analyses performed by firms and individuals with extensive experience in all areas encompassed within this docket, including, but not limited to, undersea electric transmission cable project development and finance, transmission line siting, utility regulation, and power flow modeling, as well as the significant multi-faceted issues that must be addressed in this investigative proceeding. *See* Appendix A.

3. *DBEDT's Analysis Demonstrates that the Benefits of an Interisland Cable Outweigh the Costs*: DBEDT's consultants used a sophisticated generation Portfolio Optimization Model ("POM") to study five scenarios, each with varying inputs to reflect potential conditions in the future. DBEDT's first scenario, the "Base Case," is largely based on

the "Stuck in the Middle" scenario from the Hawaiian Electric Company, Inc.'s ("HECO")[2] 2013 Integrated Resource Planning Report and Action Plan ("IRP") in Docket No. 2012-0036, which was used for convenience and as a conservative approach. The other four scenarios DBEDT analyzed included the "Base Case Plus Cable," which adds the Cable Project[3] in 2020 to the Base Case, and three scenarios that assume construction of the Cable Project and also shift wind generation from O'ahu to Maui, in 50 MW increments. DBEDT refers to these incremental wind shift scenarios as low (*i.e.*, 100 MW), medium (*i.e.*, 150 MW), and high (*i.e.*, 200 MW) wind shift scenarios. Even the Base Case Plus Cable, which analyzes benefits assuming construction of the Cable Project and assumes no change in generation resources, results in a slight economic savings compared to the Base Case. The analysis grows more compelling with scenarios that assume shifts in wind generation from O'ahu to Maui. For example, when Maui wind resources are added beginning with a conservative wind shift scenario of 100 MW, DBEDT's analyses reached the inescapable conclusion that the net benefits of constructing the Cable Project outweigh the costs. In addition to cost savings, the other benefits conclusively establish that the Cable Project is in the public interest. These benefits include:

- Conservatively estimated overall savings to ratepayers on both islands of up to $423 million for the 2020-2050 period,
- Reduced dependence on fossil fuels,
- Lower fuel costs and less exposure to price volatility,

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[2] HECO has two subsidiaries: (1) Hawai'i Electric Light Company, Inc. ("HELCO"), which serves the Island of Hawai'i; and (2) Maui Electric Company, Limited ("MECO"), which serves the Islands of Maui, Moloka'i, and Lana'i. DBEDT refers to the three companies, collectively, as the "HECO Companies".

[3] DBEDT refers to the "Cable Project" generally as any interisland transmission system connecting O'ahu and Maui. For purposes of its Comments and underlying analysis, DBEDT assumes that the Cable Project is likely to encompass a 200 MW undersea cable, two converter stations and the required AC infrastructure located on the Islands of O'ahu and Maui between the Point of Interconnection and the converter station.

- Increased flexibility in siting new renewable energy generation,
- Lower nitrogen oxides ("NOx"), sulfur oxides ("SOx"), particulate matter ("PM"), and carbon dioxide ("CO_2") emissions,
- Increased capacity factors for wind generation,
- Reduced curtailment of renewable generation,
- Electric reliability benefits,
- Lower operating reserve requirements,
- Enabling lower cost generation resources to serve additional load, and
- Helping the State meet its Renewable Portfolio Standard ("RPS") requirements and the objectives of the Hawai'i Clean Energy Initiative ("HCEI").

4. It must be emphasized that DBEDT's conclusions are conservative because DBEDT's economic analysis is predicated on publicly available information. DBEDT is confident that its analysis would have produced greater benefits associated with the Cable Project if more refined commercial and operating data had been made available from the utilities and other sources. For example:

- Hourly Load Data – Hourly load data for the HECO and MECO systems would have shown the diversity between usage on the two islands which would further optimize the project benefits.
- Hourly Data for Wind Generation by Site – More granular data from wind generation sites would have improved the accuracy of the deliverable energy and curtailments and ultimately, the overall economics.
- Cost of Wind Generation Sites – The shifting of planned wind generation from

O'ahu to Maui assumed no change in costs. However, it would be expected that the sites on Maui would entail a lower property cost, which was not reflected in the analysis.

- Operating Cost Savings – Installing the Cable Project will allow the O'ahu and Maui grids to operate as an integrated system with numerous synergy savings, such as reducing the operating reserves on Maui. These estimated savings have not been quantified.
- Wind Project Capacity Factors – DBEDT's analysis was predicated on historical wind capacity factors for O'ahu and Maui, which are considered low, particularly for Maui. More specific information from meteorological towers on O'ahu and Maui would have resulted in higher capacity factors, thereby improving benefits.

5. *An Interisland Cable Enables Efficiencies from the Coordinated Operation of Two Islands' Power Systems*: Connecting O'ahu and Maui electric systems with a high voltage direct current ("HVDC") transmission cable would accommodate transmission of power and ancillary services in both directions and allow the two systems to operate in a coordinated fashion, which would improve the power system economics and reliability on both islands. In fact, the need for an additional 53 MW of ancillary services (*i.e.*, operating reserves) for Maui will be eliminated with the operation of the Cable Project.

6. *An Interisland Cable Will Result in Reduced Renewable Resource Curtailments*: Installation of the Cable Project is projected to significantly reduce projected renewable energy generation curtailments, particularly on Maui. This benefit is expected to inure to current and future renewable energy resources and, consequently, to Hawai'i's ratepayers.

7. *An Interisland Cable Will Reduce Fossil Fuel Costs*: Installation of the Cable Project is projected to reduce exposure to price volatility associated with fossil fuels. Moreover, the Cable Project is anticipated to reduce fuel oil costs in the range of $636 million to more than $1 billion during the period of 2020 through 2050.

8. *An Interisland Cable Provides Environmental Benefits*: Because the Cable Project is anticipated to facilitate greater renewable energy development that will displace current fossil generation and reduce the need to develop future fossil generation, an interisland cable will provide direct health benefits associated with reduced air emissions of filterable PM, carbon CO_2, NOx, and sulfur dioxide ("SO_2"). For that same reason, development of the Cable Project will also accommodate lower environmental compliance costs, namely, by facilitating the development of further renewable resources that can either displace the need for future expansion of fossil and petroleum generation, or by using the renewable generation as a replacement to retire some of the dirtier, older fossil/petroleum units. Although these benefits of the Cable Project have not been captured in DBEDT's economic analysis as there is no social cost of pollutants in effect in Hawai'i at this time, the value for the CO_2 reductions alone is $551 million during the period of 2020 through 2050.[4]

9. *An Interisland Cable Advances Efforts to Comply with the State's RPS Requirements*: The Cable Project is expected to make an important contribution toward meeting Hawai'i's RPS mandated levels of renewable energy sales because it will facilitate further renewable development.

[4] This calculation was based on the United States Department of Energy's ("DOE") calculation of the social cost of carbon for 2013 as $36/ton. *See* footnote 57, *infra*.

10. *Risks and Challenges Posed by the Cable Project can be Overcome*: Notwithstanding all the potential benefits, DBEDT readily acknowledges that certain costs are unknown at this point, and that there are various risks in developing the Cable Project. For example, there are risks relating to siting and permitting the Cable Project, and permitting requirements will depend on the ultimate route that is selected. There are various other risks of increased costs due to technical reasons, such as those related to installing the cable itself, upgrades to existing facilities, integrating the O'ahu and Maui systems, and potential cost overruns related to delays and unforeseen challenges. DBEDT's analysis accounts for these challenges, proposes solutions to mitigate costs associated with such risks, and demonstrates that such challenges do not undermine the conclusion that it is in the public interest to develop the Cable Project.

11. *Procedural Path Forward*: DBEDT's Comments are premised on a process that begins with selecting a Certified Cable Company ("CCC") through a competitive process resulting in the issuance of a Certificate of Public Convenience and Necessity ("CPCN"). Consistent with DBEDT's role as the Energy Resources Coordinator, DBEDT intends to take an active role in the selection process and in advising the Commission. For example, while the Commission determines the appropriate path of a competitive solicitation for selection of a CCC, DBEDT urges the Commission to keep in mind Hawai'i's market size and future electricity demand forecast, while recognizing that the timing and execution of process decisions not overshadow the substantive objective of urgently furthering the State's energy policies. In this regard, DBEDT notes that a Programmatic Environmental Impact Statement ("PEIS") is already underway. In addition, DBEDT identifies several studies that could be performed in the near term to reduce potential costs and provide greater clarity. Assuming the Commission agrees

with DBEDT and finds that an interisland cable that connects O'ahu and Maui is strongly in the public interest, developing the Cable Project will entail a number of other actions (*i.e.*, commencing the competitive solicitation, studying needed upgrades, a CPCN filing, etc.) All of these efforts will provide insight into, and further inform, the Commission's decision as to the process to implement to achieve swift and cost-effective solicitation, procurement, and development of the Cable Project.

12. *DBEDT's Analysis Considers Relevant Ratemaking and Regulatory Issues*: Based on extensive prior experience, DBEDT's consultants projected the capital costs of the project and the anticipated revenue requirement. Building upon that analysis, DBEDT discusses a host of ratemaking and regulatory issues to ensure that ratepayers get the benefits of a Cable Project that is developed in a cost-effective and efficient manner.

13. In sum, DBEDT plays a key role with respect to energy planning and policy initiatives to benefit Hawai'i's economy and inhabitants. Accordingly, the Commission should afford due weight to DBEDT's analysis, comments and conclusion that developing the Cable Project is in the public interest. DBEDT respectfully urges the Commission to find that an interisland transmission cable connecting O'ahu and Maui is in the public interest and proceed, in an expedited fashion, with commencing a competitive solicitation process to develop the interisland transmission system.

II. RELEVANT BACKGROUND

14. On July 11, 2013, the Commission commenced this investigative proceeding in Docket No. 2013-0169 to "solicit information and establish whether an interisland transmission system interconnecting the O'ahu and Maui Island electric grids...may be in the public interest."[5]

[5] Cable Investigation Order at 1.

The issue of potential development of an undersea electric transmission cable emerged in connection with potential wind projects as part of a 2007-2008 competitive bidding process by HECO. HECO and its subsidiaries took part in transmission system studies for routing, costs, configuration, and technical feasibility, among other things, to investigate the need for an interisland marine transmission cable.[6] Pursuant to the Commission's directive to HECO to submit a new request for proposals to acquire approximately 200 MW (600 to 800 GWh)[7] or more of new, renewable energy to be delivered to or on the island of O'ahu, HECO ultimately filed a draft request for proposals on October 14, 2011 in Docket No. 2011-0225 and posted a revised draft request for proposals on September 28, 2012.[8]

15. Other proceedings that inform the instant investigation that were going on in parallel to the above actions include the Reliability Standards Working Group ("RSWG") proceeding, in Docket No. 2011-0206.[9] The RSWG proceeding was opened to assess, develop, and recommend fact-based standards, metrics, rules criteria and processes to facilitate the interconnection of the maximum amount of renewable generation to the grid while preserving grid reliability.[10] The RSWG concluded its work on January 24, 2013.[11] Work products

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6 *See generally* O'ahu Wind Integration and Transmission Study and Transmission/Cable Routing & Permitting Studies, Application of Hawaiian Electric Company, Inc.; Verification; and Certificate of Service, filed in Docket No. 2011-0112. *See also* Integrated Resource Plan Report and Action Plan, filed in Docket No. 2012-0036 on June 28, 2013 by HECO Companies at 8-5 - 8-8.

7 According to the handout available in the following link, 200 MW can be converted to 600 to 800 GWh: http://energy.Hawai'i.gov/wp-content/uploads/2012/02/Interisland-Undersea-Cable-System-Handout-ver.2.pdf.

8 *Instituting a Proceeding Related to a Competitive Bidding Process for 200 MW or More of Renewable Energy Delivered to or on Oahu*, Docket No. 2011-0225, Order No. 31354, Providing Guidance for Development of the Draft Final Oahu 200 MW Renewable Energy RFP, at 4-10 (July 11, 2013) ("Competitive Guidance Order").

9 *Instituting a Proceeding to Investigate the Implementation of Feed-In Tariffs*, Docket No. 2008-0273, Order Regarding Reliability Standards Working Group Process, (June 14, 2011).

10 Order Regarding Reliability Standards Working Group Process, Docket No. 2008-0273 at 7 (June 14, 2011).

11 *Instituting a Proceeding to Investigate the Implementation of Reliability Standards for Hawaiian Electric Company, Inc., Hawaii Electric Light Company, Inc., and Maui Electric Company, Limited*, Docket No. 2011-0206, Reliability Standards Working Group Independent Facilitator's Final Report at 1 (March 17, 2013).

produced by the RSWG included among other things, development of ten reliability standards, recommendations for cycling capabilities and minimum load capabilities of new generation, recommendations related to ancillary services requirements, and recommendations for contractual treatment for curtailment.[12] DBEDT anticipates that the Commission will issue an order pertaining to the recommendations produced by the RSWG.

16. In addition, in March 2012, the Commission initiated the HECO Companies' Integrated Resource Planning Process in compliance with a "Revised Framework" that was adopted by the Commission in March 14, 2011 and which incorporated the concept of scenario planning.[13] Among the issues the HECO Companies were required to address as part of their IRP Report and Action Plan were: (1) strategies to replace the existing fossil fuel based electricity generating plants with renewable energy resources; and (2) transmission of firm or intermittent electricity between islands, including plans to develop undersea electricity transmission cables.[14] On June 28, 2013, the HECO Companies' filed their IRP Report and Action Plan with the Commission. The IRP Report and Action Plan are pending final Commission action.

17. The State Legislature also, by enacting Act 165, provided guidance and additional authority to the Commission regarding the "regulatory structure under which interisland undersea transmission cables can be developed, financed, and constructed on commercially reasonable terms, such as those upon which successful cable projects have been undertaken in

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[12] *Id.* at 11-12.

[13] *Regarding Integrated Resource Planning*, Docket No. 2012-0036, Order No. 30233, Initiating HECO Companies' Integrated Resource Planning Process, at 2 (March 1, 2012).

[14] *Regarding Integrated Resource Planning*, Docket No. 2012-0036, Order No. 30534, Identifying Issues and Questions for the Hawaiian Electric Companies' Integrated Resource Planning Process, at 3 (July 19, 2012).

several locations around the world."[15] The Legislature stated that interconnecting the islands via a high-voltage undersea electric transmission cable system would provide the islands with increased energy security and system efficiencies and enable the islands to provide each other with backup power.[16] The Act requires the selection of a CCC "through a request for proposals, or other process approved by the commission" prior to installation of a high-voltage electric transmission cable system.[17] Moreover, the CCC "shall not commence commercial operations of the ... cable system until it is issued a certificate of public convenience and necessity by the commission pursuant to section 269-7.5."[18] However, Act 165 did not require construction of an interisland cable from any particular island.[19]

18. Also on June 27, 2012, the State Legislature enacted Act 166, providing the Commission with authority to perform necessary electric system reliability and grid access oversight functions, and to allow the Commission to contract for the services of a Hawai'i Electricity Reliability Administrator ("HERA") to support the Commission in its efforts to enhance the reliability and resiliency of the Hawai'i electric grids.[20] Act 166 provides the Commission with the authority to establish interconnection requirements, which shall apply to any electric utility and any user of the Hawai'i electric system.[21]

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15 Senate Bill ("S.B.") 2785, Act 165, Sess. Laws of Haw. 2012 (codified as Haw. Rev. Stat §§ 269-131 to -135, *et seq.*) ("Act 165"), Section 1.

16 *Id.*

17 Haw. Rev. Stat. § 269-132(a).

18 *Id.*

19 Act 165, Section 1.

20 S.B. 2787, Act 166, Sess. Laws of Haw. 2012 (codified as Haw. Rev. Stat. §§ 269-141 – 269-149) ("Act 166").

21 Haw. Rev. Stat § 269-142(b).

19. In the Competitive Guidance Order, which issued the same day as the Cable Investigation Order, the Commission noted the various changed circumstances related to renewable energy project development and the need for an interisland transmission cable.[22] In particular, the Commission found that "the current [request for proposals] draft has become overly complex, and involves greater elements of uncertainty."[23] The Commission listed various technical, market and public policy changes that have and continue to occur.[24] In order to "reduce the number of variables and complexity" that accompanied the draft 200 MW HECO request for proposals, which included both generation and transmission components, the Commission ordered that the O'ahu-to-Maui interisland transmission cable be separately considered in its own docket to "increase the likelihood of well-reasoned decisions that result in long-term beneficial impacts for the ratepayers."[25]

20. It was against this backdrop that the Commission issued the Cable Investigation Order, soliciting information on whether an interisland transmission system interconnecting the O'ahu and Maui Island electric grids ("O'ahu-Maui Island grid interconnection") may be in the public interest. The Commission clarified that its position on an O'ahu-Maui Island grid interconnection is presently neutral,[26] and solicited comments and information on the selection process, policy issues and overall objective with respect to how, where, and at what cost a cable may be developed.[27] The Commission also sought input on potential solutions to develop an interisland transmission infrastructure that can minimize risk, maximize utilization of existing

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22 Competitive Guidance Order at 1.

23 *Id.* at 3.

24 *Id.* at 15.

25 *Id.* at 3-4.

26 Cable Investigation Order at 6.

27 *Id.*

and new infrastructure, and achieve greater efficiencies and cost effectiveness to augment and complement the Hawai'i electric system, and ultimately, serve the public interest (*i.e.*, a no regrets" strategy).[28] DBEDT's Comments are timely filed pursuant to the procedural schedule set forth on pages 15 and 16 of the Cable Investigation Order.

III. STATEMENT OF DBEDT'S INTEREST

21. DBEDT has the lead role for Hawai'i in energy planning and policy initiatives to benefit Hawai'i's economy and inhabitants.[29] The Cable Investigation Order recognizes that DBEDT, as the State's Energy Resources Coordinator,[30] is required by law to assist in evaluating proposals relating to the interisland electric transmission cable systems.[31] These responsibilities are identified in Act 165.[32]

22. DBEDT's interests in exploring the development of an interisland electric transmission cable system are also guided by the State's bold energy agenda of achieving 70% clean energy by the year 2030, including 40% of energy generation from State renewable energy

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28 *Id.* at 5-7.

29 Hawai'i Interisland Renewable Energy Program Background Information, Prepared by AECOM (April 2012 Final Revised) at 1-1; available at: http://energy.Hawai'i.gov/wp-content/uploads/2012/02/Undersea-Cable-Hawai'i_Background_all.pdf.

30 The powers and duties of the Energy Resources Coordinator are contained in Haw. Rev. Stat §§ 196-4 and 201N-3.

31 Cable Investigation Order at 8-9, n.7.

32 Haw. Rev. Stat § 269-131 ("Request for proposals" means a request for proposals issued pursuant to a competitive process authorized, reviewed, and approved by the Commission, and developed and conducted by the electric utility company or companies to which the capacity of a high-voltage electric transmission cable system will be made available, with input and assistance from the state energy resources coordinator, to select a cable company.); Haw. Rev. Stat § 269-132 ("The electric utility company and the energy resources coordinator or the energy resources coordinator's designee, shall develop the request for proposals, and energy resources coordinator or the energy resources coordinator's designee shall be a member of the selection committee that will review and evaluate the proposals.").

resources and 30% from energy conservation.[33] In furtherance of the State's clean energy goals, DBEDT is a collaborating agency with the DOE in preparing the Hawai'i Clean Energy PEIS. As part of planning for sustained penetration of renewable energy in Hawai'i, the PEIS is analyzing five clean energy categories at a programmatic level, including undersea electrical transmission options.[34] The installation and implementation of an interisland electric transmission cable, from Maui to O'ahu, is a critical path to achieving the State's clean energy goals.[35] As highlighted in DBEDT's 2012 Energy Resources Coordinator Annual Report, "[i]nterconnecting the islands will provide an effective and efficient means to introduce significantly more renewable energy into a stable grid environment and is an important step in securing more uniform and predictable electricity rates throughout the State."[36]

23. The State legislature has acknowledged the benefits of installation of an interisland cable when it enacted Act 165:

> An interisland undersea cable system has been identified as an effective and efficient means to introduce the variety of utility scale renewable energy available throughout the Hawaiian islands into a stable grid environment; to stabilize and equalize rates in all areas served by the cable; to increase Hawai'i's energy independence; to support "increased energy self-sufficiency where the ratio of indigenous to imported energy use is increased" and "greater energy security and diversification in the face of threats to Hawai'i's energy supplies and systems"; and to support the achievement of the renewable portfolio standards established in

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33 Haw. Rev. Stat §§ 269-92, 269-96; *see also* Hawai'i Clean Energy Initiative Scenario Analysis, Quantitative Estimates Used to Facilitate Working Group Discussions (2008-2010), prepared by National Renewable Energy Laboratory ("NREL"), at iv (March 2012); available at:

http://www.Hawai'icleanenergyinitiative.org/storage/pdfs/Hawai'i%20Clean%20Energy%20Initiative%20Scenario%20Analysis_March%202012.pdf; State of Hawai'i Energy Resources Coordinator's Annual Report 2012 at 13, available at: http://energy.Hawai'i.gov/wp-content/uploads/2011/10/2012-ERC-Report_FINAL_R3.pdf.

34 *See* "Summary--Hawaii Clean Energy Programmatic EIS," U.S. Department of Energy, *available at* http://hawaiicleanenergypeis.com.

35 State of Hawai'i Energy Resources Coordinator's Annual Report 2012 at 44, available at: http://energy.Hawai'i.gov/wp-content/uploads/2011/10/2012-ERC-Report_FINAL_R3.pdf.

36 *Id.*

section 269–92, Hawai'i Revised Statutes, which requires twenty-five per cent of Hawai'i's net electricity sales to come from renewable sources by 2020, increasing to forty per cent by 2030.[37]

24. Enactment of Act 165 demonstrates recognition by the Hawai'i legislature that the Cable Project will accommodate the ability of Hawai'i's utilities to further develop renewable energy, thereby making a crucial contribution toward meeting Hawai'i's RPS mandated levels of renewable energy sales.[38]

25. DBEDT believes the viability of interisland cables connecting resources from Maui to O'ahu should be explored as an essential component of achieving the State's energy goals and as a means for enhancing energy security and reliability, permitting fuel diversity, securing more predictable and uniform electricity rates, and contributing to Hawai'i's economy. In this regard, DBEDT notes that the HECO Companies' recent IRP Report concedes that "approximately 91% of generation by the Companies comes predominantly from petroleum-based fuels."[39] In addition, the 2012 renewable generation percentage on the Island of O'ahu is only 7.6%.[40] Moreover, as the HECO Companies asserted in their IRP Report, an interisland cable system could transfer renewable energy from neighboring islands to O'ahu,[41] and "interisland projects may prove to be more economical than projects on O'ahu, and the best way to determine this is through competitive solicitation."[42] Thus, it is consistent with the long-term

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37 Act 165, Section 1.

38 The RPS mandate requires that electricity sales include the following portion generated from renewable energy: (1) 10% by the end of calendar year 2010; (2) 15% by the end of 2015; (3) 25% by the end of 2020; and (4) 40% by the end of 2030.

39 Hawaiian Electric Companies 2013 Integrated Resource Plan Report, Hawai'i Public Utilities Commission, Docket No. 2012-0036 (June 28, 2013), at 7-2.

40 *Id.* at 7-3.

41 *Id.* at 7-3.

42 *Id.* at ES-16.

objective of energy planning to reduce the relative cost of remaining highly dependent on foreign and fossil fuels as compared to the cost of using off-island renewable resources that are transported via an interisland transmission system.

IV. ANALYSIS

A. The Benefits to Hawai'i Ratepayers of an Undersea O'ahu to Maui Grid Interconnection Would Exceed Costs, Rendering the Cable Project Cost Effective and in the Public Interest.

26. The principal issue raised in the Cable Investigation Order is whether an interisland transmission cable connecting O'ahu and Maui is in the public interest. Based on its analysis, DBEDT anticipates that the Cable Project[43] will produce numerous benefits to Hawai'i's ratepayers. Ratepayers on both O'ahu and Maui are expected to enjoy benefits such as lower energy costs, and the State as a whole will benefit from other consequences of the Cable Project, such as reduced greenhouse gas emissions. DBEDT's benefits analysis is set forth below, and is addressed in more detail in Appendix F.

1. The Cable Project Will Provide Economic Benefits for Ratepayers.

27. The analysis of the potential energy cost savings begins with a set of assumptions and the development of a Base Case assuming no Cable Project. The major assumptions applicable to the instant analysis, which are predicated on the Hawaiian Electric Companies' 2013 IRP, are set forth in Appendix C. In particular, the analysis largely uses the IRP's "Stuck in the Middle" scenario, which is the Base Case and is considered a conservative approach. The assumed build plan is the IRP contingency plan assuming that no LNG facilities are

[43] As indicated above, DBEDT refers to the "Cable Project" generally as any interisland transmission system connecting O'ahu and Maui. For purposes of its Comments and underlying analysis, DBEDT assumes that the Cable Project is likely to encompass a 200 MW undersea cable, two converter stations and the required AC infrastructure located on the Islands of O'ahu and Maui between the Point of Interconnection and the converter station.

constructed.[44]

28. The following description explains some of the key characteristics of DBEDT's Base Case:[45]

O'ahu

- 500 MW of self generation by 2032
- 700 MW of Wind added between 2015 and 2032
- 180 MW of Solar added between 2015 and 2032
- 51 MW of biofuel added in 2017
- Fuel Switch Waiau and Kahe to Ultra Low Sulfur Diesel ("ULSD") in 2022
- Convert CIP to combined cycle in 2018
- Deactivate Honolulu 8 & 9 and Waiau 3&4

Maui

- 81 MW of self-generation by 2033
- 90 MW of Wind added by 2025
- 15 MW of Solar added by 2033
- 39 MW of biofuel added in 2021
- Fuel Switch Ma'alaea to ULSD in 2022

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[44] DBEDT submits that this is a conservative assumption given the likelihood that LNG facilities will be constructed, and the fact that the availability of LNG facilities is expected to further improve the economics of the Cable Project. Such improvement would be due to the LNG units being used to send cheaper natural gas power to Maui from O'ahu, which would allow turning off more of Maui's oil-fired generating units. A portion of this benefit would be offset because adding the LNG units would decrease the amount of oil-fired generation that is being replaced by renewables on O'ahu.

[45] DBEDT notes that by use of these assumptions from the HECO Companies IRP it is in no way endorsing the assumptions, in particular the amount of renewable resources that can be added to O'ahu.

29. The economic analysis was performed using the proprietary Portfolio Optimization Model, or POM, of one of DBEDT's consultants, *i.e.*, Navigant. The POM, which is described in detail in Appendix D, analyzes hourly load data and a variety of other inputs in order to determine least-cost dispatch. As more specifically set forth in the major assumptions listed in Appendix C, the POM input data, for the most part, was culled from the IRP. DBEDT's first step was to set up a Base Case for POM, which models O'ahu and Maui as isolated systems without the Cable Project. Next, DBEDT added a 200 MW Cable Project to the Base Case in 2020 (referred to as "Base Case Plus Cable") with no change in generation resources. The purpose of the Base Case Plus Cable scenario was to determine the economic impact of adding the cable alone. Thereafter, DBEDT ran three individual cases in POM, shifting low, medium, and high blocks of wind generating capacity from O'ahu to Maui, in recognition of the superior wind resource capability in Maui.[46] This renewable generation shift, combined with reduced renewable energy curtailments, represents a lynchpin for the economic justification of the Cable Project. Because of some questionable assumptions in the IRP in regarding the amount of renewable energy generation in the O'ahu system over the 2013 to 2030 period (reaching 35% of the total O'ahu energy requirement), including additional renewables in excess of those incorporated in the IRP was not considered in the analysis.[47]

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[46] Average capacity factors of wind resources on Maui are 37.5% compared to 21% on O'ahu based on historical data for the islands and not site-specific. These capacity factors are conservative and it would be expected that the capacity factors realized by new wind generation projects would be higher, particularly on Maui. The solar capacity factor employed for both islands is 30%. The analysis assumes that the revenue requirements for the wind projects are the same on O'ahu and Maui. Shifting solar production from O'ahu to Maui was not analyzed as the average capacity factors for installations on O'ahu and Maui would be expected to be the same.

[47] *See, e.g.*, IRP Independent Entity's July 29, 2013 Final Certification of the HECO/MECO/HELCO IRP Process at 28-29, 56-57 (asserting that the IRP Report contains uncertainties including whether the amount of renewable resources assumed on the HECO system can feasibly be sited on the island of O'ahu). While DBEDT does not endorse the validity of the information in the IRP or the reasonableness of the methodologies the HECO Companies used to derive the results, DBEDT notes that it used the information contained in the IRP as a conservative set of assumptions.

30. On each island, it is necessary to maintain capacity as base load, which leads to significant renewable curtailments when potential renewable generation exceeds island load net of the minimum generation level of the base load units. A benefit of the Cable Project is that it will allow the two islands to pool resources while maintaining system reliability. The impact of reducing base load generation is to increase system flexibility when integrating renewables versus the Base Case.

31. Pooling the system resources through the Cable Project reduces the up regulation (*i.e.*, the requirement for generation to instantaneously follow load) needed to accommodate hour to hour drops in renewable generation by at least 10%. To show the impacts of less required up regulation, it is assumed that either Waiau 8 or 9 on O'ahu would be allowed to be removed from the base load requirements and to cycle as indicated in Appendix C. It is also assumed in Appendix C that the Ma'alaea combined cycle facility on Maui would be allowed to run in 1x1[48] configuration when operating as base load.

32. The Base Case Plus Cable analysis entails the installation of a 200 MW HVDC cable by a CCC by 2020. The Schedules 1 through 7 of Appendix F show certain scenarios[49] with respect to the net cost (benefit) of the Cable Project and wind shifts (Schedule 1), projected fuel costs (Schedule 2), the projected amounts of available renewable energy that can be delivered (Schedule 3), the projected renewable and fossil generation (Schedule 4), the projected emissions (Schedule 5), the projected fuel consumed (Schedule 6) and projected retail rate

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[48] This is a combined cycle plant with two combustion turbines and one steam turbine, referred to as a "2x1." If it is operating with only one combustion turbine and one steam turbine, the mode is referred to as "1x1."

[49] The scenarios shown in Schedules 2 through 7 are: (1) the Base Case, (2) the Base Case Plus Cable and (3) Cable Plus high wind shift. As previously indicated, annual impacts were also estimated for low and medium wind shifts from O'ahu to Maui for increments. To limit the volume of pages to this response, those annual impacts have not been included, but are available upon request.

impacts (Schedule 7). It should be noted that the results shown in the foregoing schedules as well as the tables below should be considered directional, *i.e.*, the results are not presented as definitive calculations for any specific project proposal, but serve as a credible indicator of likely results based on the conservative assumptions used for the analysis, including the major assumptions described in Appendix C. Moreover, as previously indicated, these results should be considered conservative for the reasons already noted.

33. Of particular note is Schedule 1, pages 1 to 3 of Appendix F, which shows net costs and benefits of the Cable Project. Review of that schedule shows that the Base Case Plus Cable scenario alone is projecting Cumulative Present Value of Revenue Requirement savings of $10 million over the review period. While these savings may not be considered substantial, the important point is that the benefits attributable to the Cable Project are sufficient to cover its costs even when using conservative assumptions, attributing no benefits to shifting wind or other renewables from O'ahu to Maui, and attributing no benefits to the other attributes of the Cable Project, such as the substantial reduction in pollutants and curtailments. Comparing the fuel costs under the high wind shift scenario to the Base Case shows projected savings of $423 million. Because of the conservative nature of DBEDT's analysis, it would be expected that ultimate savings will be even greater.

34. Schedule 2 of Appendix F (Projected Fuel Costs) shows the expected fuel costs for the cases analyzed. Schedule 3 (Projected Available Renewable Energy that can be Delivered) shows the expected improvements attributed to the Cable Project and the High Wind Shift & Cable with respect to the available renewable energy that ultimately can be delivered to customers. Schedule 4 shows the annual amounts of both renewable and fossil generation on O'ahu and Maui associated with the Base Case, the Base Case Plus Cable and the High Wind

Shift & Cable. The impacts on emissions associated with the Cable Project and the High Wind Shift & Cable case is shown in Schedule 5. Schedule 6 shows the changes in fuel consumed, as measured in MMBtu. Finally, Schedule 7 shows the projected impacts on retail rates in ¢/kWh. The foregoing impacts are discussed below.

35. As indicated herein, the Cable Project is expected to provide reliability, economic, and emissions reductions benefits. However, additional capital costs of the Cable Project must be factored in, including the associated alternating current ("AC") infrastructure costs on O'ahu and Maui. Section IV.A.9 below shows the details of the projected capital cost of the project along with the CCC's estimated revenue requirement. As shown in Appendix E (Schedule 2), the Cumulative Present Value of Revenue Requirement of the Cable Project is estimated to be $74.96 million per year spread over the expected project service life. Applying the Cumulative Present Value of Revenue Requirement for the CCC for the review period to the Base Case Plus Cable scenario indicates that, solely from an economic perspective, and not factoring in the reliability, fuel diversity and emissions reductions benefits, the Cable Project still results in savings to ratepayers as compared to the Base Case. Shifting wind generation from O'ahu to Maui along with the Cable Project produces improved ratepayer savings and adds to the value of the Cable Project.

36. These results are presented in Table 1 on the following page. The net benefits for each scenario are determined by combining the fuel costs and CCC Cumulative Present Value of Revenue Requirement and subtracting the Base Case fuel costs.

Table 1

Projected Net Benefit (Cost) of Cable Project

(NPV $ millions—Benefits Reflected in Parenthesis as a Negative)

	Base Case	Base Case Plus Cable	Low Wind Shift	Medium Wind Shift	High Wind Shift
Fuel Cost O'ahu and Maui[50]	20,564	19,928	19,638	19,552	19,515
CCC Cumulative Present Value of Revenue Requirement[51]	-	626	626	626	626
Net Benefit	-	(10)	(300)	(386)	(423)

37. With respect to retail rate impacts, Schedule 7 of Appendix F shows the estimated average rate impacts (in ¢/kWh) for retail customers in O'ahu and Maui. On a levelized basis, the Base Case Plus Cable Project has no impact on retail rates, while average rate reductions of .41¢/kwh, .53¢/kwh and .58¢/kWh are projected for the low, medium and high wind shifts, respectively.

38. The foregoing discussion demonstrates that, in the scenarios analyzed, installing the Cable Project and shifting a high level of MW of wind generation from O'ahu to Maui is estimated to produce the maximum economic benefit to ratepayers on both islands. In addition, ratepayers on both islands would enjoy improved reliability, as discussed below, with the interconnection and coordination of the HECO and the MECO systems. Finally, developing and constructing the Cable Project itself, along with the anticipated ancillary renewable energy

[50] Changes in fuel usage in MMBtu are shown in Appendix F, Schedule 7.

[51] The $626 million represents the Cumulative Present Value of Revenue Requirement for the Cable Project in $2013 for the review period.

projects that will utilize the Cable Project, will provide significant jobs for the coming years, including in the construction industry, as well as technical fields such as engineering and design. These benefits are not quantified in DBEDT's analysis.

2. Effective Use of Available, Dispatchable Capacity Will Increase Reliability.

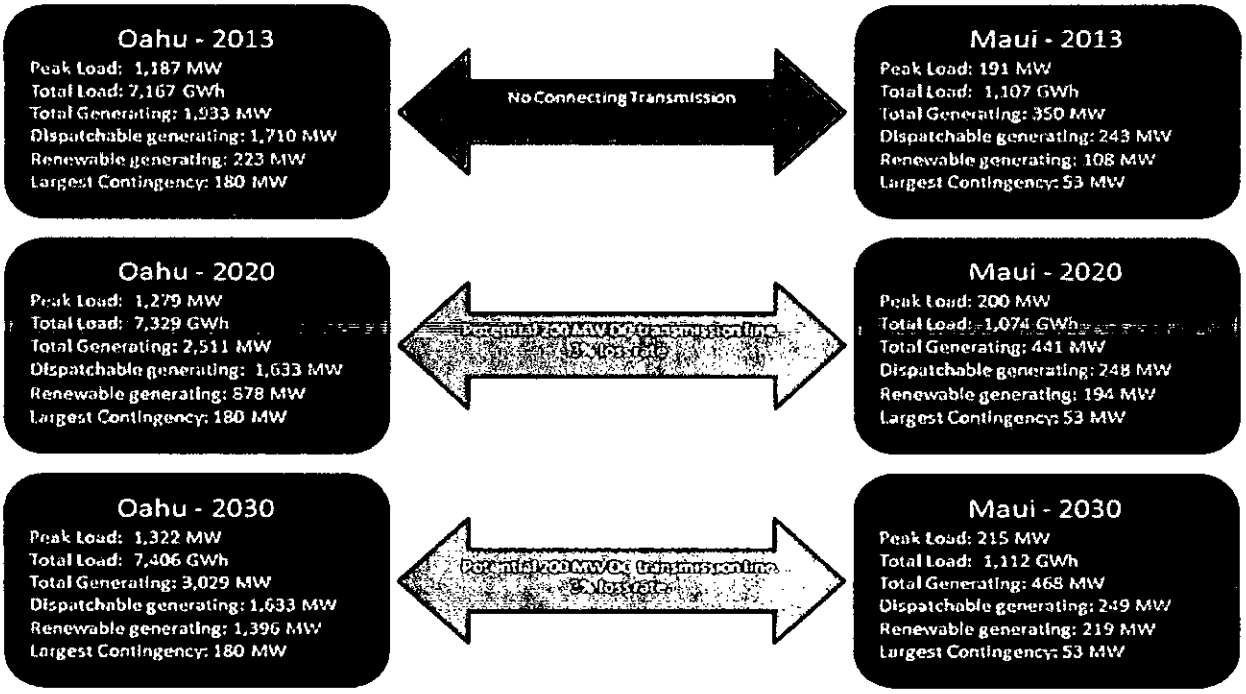
39. Reliability requirements mandate that the utilities have sufficient dispatchable generating capacity to meet peak loads along with the required spinning or quick-start reserves (referred to as operating reserves) to satisfy the largest single contingency on the system. For HECO, the largest single contingency is 180 MW. It is 53 MW for MECO. Intermittent resources such as wind and solar generation are not dispatchable and typically do not qualify as operating reserves. As such, notwithstanding the substantial amounts of intermittent renewable resources that are expected to be added to the HECO and MECO systems to meet the HCEI's requirements, for the most part, those resources will need to be backed up by dispatchable generation.[52] A Cable Project can contribute to meeting the reliability criteria by reducing the amount of dispatchable generation that would otherwise be required.

40. While projections are that HECO will have sufficient operating reserves through 2030, such is not the case for MECO which projects peak load increasing by 24 MW, but on-Island dispatchable generation increasing by only 6 MW. As described herein, the Cable Project will not only resolve this issue, but will eliminate the need for separate operating reserves currently retained on Maui, among other things. The configuration of the HECO and MECO systems from a load and capacity perspective for 2013, 2020 and 2030 is shown in Figure A below. It should be noted that the renewable capacity projection for O'ahu depends on the

[52] Of course, Hawaii has been aggressively implementing battery storage, which helps address the intermittency problem. In addition, geothermal resources, which have base load characteristics, could be expanded.

assumption that HECO can procure substantial amounts of renewable resources on O'ahu in coming years.[53]

Figure A



41. The addition of a 200 MW HVDC transmission cable between O'ahu and Maui would allow for more efficient use of generation resources, both dispatchable and intermittent renewable. For example, under the scenarios depicted in Figure A, the excess generation on O'ahu could potentially serve load on Maui during on-peak and off-peak hours. Balancing the variability or intermittency of the renewable resources could be accomplished via resources on O'ahu or on Maui to allow firming of the renewable resources. It is clear that the Cable Project improves reliability of both the HECO and MECO systems even without HECO's questionable assumption on the amounts of renewable energy that could be procured on O'ahu in the future. If

[53] As explained below, however, a 200 MW HVDC cable between O'ahu and Maui would allow for more efficient use of resources. This is a significant consideration because increased reliability is driven by the use of available unused capacity.

the substantial amounts of renewable energy cannot be developed on O'ahu, the Cable Project would provide even greater reliability benefits on both islands.

42. Providing a transmission interconnection between O'ahu and Maui will increase the reliability of both the O'ahu and Maui systems by providing both islands access to additional resources. From a technical perspective, the Cable Project will allow the two grids to operate as a single integrated system. It is noteworthy that the availability made possible by an undersea transmission cable is greater than the availability of generator resources. Therefore, the 200 MW cable will increase overall system reliability more than a new 200 MW generator in all scenarios because HVDC cables have demonstrated higher reliability factors than power plants because of fewer moving parts.

43. While there are several components that contribute to the prospects for reduced energy costs, the primary factors are: (1) shifting up to 200 MW of proposed new wind energy generation from O'ahu to Maui, where the capacity factor would be substantially higher (21% on O'ahu and 37.5% on Maui, based on historical data); and (2) reducing the projected renewable energy generation curtailments, particularly on Maui. These factors directly result in lower fuel costs for HECO and MECO by displacing oil-fired thermal plants, as shown in Table 1 above.

3. An Interisland Cable Will Reduce Fuel Oil Usage, Resulting in Air Quality Benefits and Cost Savings.

44. Approximately 86 percent of the electricity generated on the mainland United States comes from coal, natural gas, and nuclear, and approximately 1 percent comes from petroleum fuel.[54] In contrast, Hawai'i's generation portfolio mix relies heavily on oil and diesel-based fuels, and the mainland percentages are almost completely reversed for Hawai'i. The

[54] Hawaiian Electric Companies 2013 Integrated Resource Plan Report, Hawai'i Public Utilities Commission, Docket No. 2012-0036 (June 28, 2013), at 7-2.

overwhelming majority—approximately 73 percent—of Hawai'i's generation comes from petroleum fuel. The categories of coal, natural gas and nuclear that make up the vast majority of mainland generation comprise only 16 percent of Hawai'i's generation mix, all of which comes from coal because natural gas is not available in Hawai'i and nuclear is legally prohibited.[55] This heavy dependence on petroleum fuels has several unfavorable consequences, such as reliance on imported oil, and creates various economic and technical risks, such as being exposed to fuel price swings, challenges in meeting certain environmental compliance regulations, and the costs and logistics of ensuring widespread fuel availability.

45. Interconnecting the O'ahu and Maui grids will increase the renewable energy percentage, help to reduce curtailed energy, and will improve energy security, as compared with the no Cable Project scenario, as shown in the tables below.[56] Thus, completing the Cable Project would provide several potential benefits, including expanded opportunities for increased renewable generation, along with the accompanying ability to reduce the reliance on petroleum fuel and diversify Hawai'i's generation mix. Moreover, accommodating increased renewable energy generation and more effective dispatching of currently-curtailed energy will displace a portion of petroleum fuel generation, thus improving local air quality by reducing local concentrations of PM, SO_2, CO_2, and NOx, related to petroleum generation, as shown in Table 2 below. It should be noted that CO_2 is a greenhouse gas that traps heat in the atmosphere which can lead to climate change. In sum, these outcomes would provide increased flexibility to address some of the risks related to Hawai'i's present reliance on petroleum fuels. Such displacement of fossil fuel will also result in significant environmental benefits over the period

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[55] *Id.*

[56] *Id.* at 11-17, Figures 257 and 258.

2020 through 2050, specifically:

- 1.1% - 3.5% reduction in PM,
- 2.0% - 5.5% reduction in CO_2,
- 0.8% - 4.0% reduction in SO_2, and
- 2.0% - 5.4% reduction in NOx emissions.

These pollutants have been associated with numerous health issues including breathing problems in asthmatic children, emphysema and bronchitis, among other things.

46. Below, Table 2 shows the total projected reductions in emissions for the two islands over the review period for the scenarios analyzed. Annual projections of emissions are set forth in Schedule 5 of Appendix F.

Table 2

PROJECTED EMISSIONS REDUCTIONS

2020 – 2050
(Tons)

Pollutant	Base Case Plus Cable	Low Wind Shift	Medium Wind Shift	High Wind Shift
PM	2,076	4,339	4,814	4,841
CO_2	4,354,883	6,955,031	7,651,157	7,826,520
SO_2	9,022	19,636	22,220	22,707
NOx	10,657	17,151	18,879	19,291

47. Although there currently are no carbon taxes or socialized cost valuations in effect in Hawai'i for carbon reductions, using DOE's calculation of $36/ton social cost of carbon value

for 2013[57] would result in the estimated benefits shown below in Table 3, which should be compared with the projections in Table 1 as a reference, *i.e.*, the "Net Benefit" for the high level wind shift increases from $423 million to $551 million. Note that the net benefits for the various scenarios are determined by combining the fuel costs, CCC revenue requirement and social costs of carbon and subtracting the sum of the Base Case fuel costs and social costs of carbon.

Table 3

Projected Net Benefit (Cost) of Cable Project Including Social Cost of Carbon

(NPV $ millions—Benefits Reflected in Parenthesis as a Negative)

	Base Case	Base Case Plus Cable	Low Wind Shift	Medium Wind Shift	High Wind Shift
Fuel Cost O'ahu and Maui	20,564	19,928	19,638	19,552	19,515
CCC Revenue Requirement	-	626	626	626	626
Social Cost of Carbon	3,533	3,463	3,420	3,408	3,405
Net Benefit	-	(79)	(412)	(511)	(551)

48. As indicated above, installing the Cable Project and shifting wind generation from O'ahu to Maui is expected to produce economic benefits for ratepayers by displacing fossil-fired generation with renewable energy, as shown in Schedule 1 of Appendix F.

49. Given that installation of the Cable Project is projected to reduce the usage of fuel oil, fuel oil costs will also be reduced. Shifting wind generation from O'ahu to Maui will further

[57] On June 17, 2013, DOE finalized its "Rulemaking for Microwave Ovens Energy Conservation Standard," and revised the social cost of carbon for purposes calculating the economic benefits of reductions to CO_2. *See* 78 Fed. Reg. 36316 (June 17, 2013). DOE's updated social cost of carbon uses the central estimate of $36 per ton for 2013. For materials related to the Rulemaking for Microwave Ovens Energy Conservation Standard, *see* http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/37.

contribute to reduced fuel oil costs, as shown below. It should be noted that replacing the oil-fired generation with wind capacity will not result in higher wind energy costs. This is because the location of new wind projects has been shifted from O'ahu to Maui. As this shift does not involve installing any additional wind capacity beyond the assumptions in the HECO Companies' IRP,[58] the total capital cost of wind projects does not change with the shift. Rather, the Cable Project and the wind shift result in the planned wind facilities generating more energy than projected in the Base Case because of the higher capacity factor in Maui. DBEDT believes it is likely that additional wind capacity will be installed. Moreover, DBEDT understands that some power purchase agreements are structured such that the per-unit price is reduced as production is increased. This contract structure results in a direct savings to ratepayers as curtailments of renewable generation are reduced. These additional benefits are not included in DBEDT's conservative analysis. Thus, the following Table 4 shows the projected fuel oil costs for the two islands combined on a Cumulative Present Value of Revenue Requirement basis for the scenarios reviewed along with estimated fuel oil cost reductions. The impacts in Table 4 were computed by subtracting the Base Case fuel costs from the projected fuel costs for the various scenarios. The economic impacts of these reduced fuel oil costs are reflected in the results shown in Table 1 above.

[58] As explained above, the IRP contains questionable assumptions concerning the amount of renewable energy generation in the O'ahu system over the 2013 to 2030 period. However, DBEDT used the information contained in the IRP as a conservative set of assumptions and, therefore, did not quantify benefits that would result if additional renewables in excess of those incorporated in the IRP were to be developed.

Table 4

PROJECTED FUEL OIL COST REDUCTIONS

2020- 2050

(NPV $ millions—Benefits Reflected in Parenthesis as a Negative)

	Base Case	Base Case Plus Cable	Low Wind Shift	Medium Wind Shift	High Wind Shift
Fuel Costs	20,564	19,928	19,638	19,552	19,515
Net Benefit	-	(636)	(926)	(1,012)	(1,049)

4. An Interisland Cable Will Provide Environmental and Permitting Benefits.

50. State and federal laws govern various environmental standards and emissions levels, often impacting the way generating facilities are operated, how new facilities are designed and constructed, and how wastes and by-products are cleaned up and disposed. Future compliance with air and water pollution regulations will require significant capital and annual expenditures for the utilities and independent generators operating in Hawai'i. For example, U.S. Environmental Protection Agency ("EPA") air quality standards for filterable PM, NOx, and SO_2 have potentially significant cost impacts related to compliance. To the extent that a utility or generator must add pollution control equipment, those capital costs are significant.[59] Specifically, according to the 2013 Hawaiian Electric Companies IRP Report, the total cost to

[59] An electrostatic precipitator ("ESP") is a common PM control device that traps and removes PM produced by boilers. SO2 emissions can be controlled by either reducing the sulfur content in the fuel or by installing scrubbers coupled with ESPs to remove sulfur from exhaust gases. ESPs integrated with scrubbers can also remove mercury and other air toxic pollutants subject to federal and state air quality standards. NOx, including nitric oxide and nitrogen dioxide, emissions can be controlled by combustion hardware improvements such as low NOx burners and overfire air.

the HECO Companies of implementing air quality control equipment to comply with the required U.S. EPA environmental regulations is approximately $1.4 billion, which also includes planned retirements of certain units that will not be upgraded with pollution control equipment.[60]

51. A potential compliance alternative to installing pollution prevention equipment would involve fuel switching, and the costs would also be significant, though lower, to convert existing units to switch to lower-sulfur content fuel and/or liquefied natural gas. Specifically, according to the HECO Companies' IRP Report, such costs would exceed $570 million over the 10-year IRP review period.[61]

52. Regardless of the scenario, compliance with environmental standards will be costly for the utilities and the independent power producers within Hawai'i, and these costs will ultimately be borne by HECO and MECO ratepayers. The HECO Companies' IRP Report estimates that, even under a scenario where environmental compliance is achieved through fuel switching, a sample utility customer using 600 kWh would see an electric bill increase of approximately $20 per month, solely to account for environmental compliance.[62]

53. Development of the Cable Project will allow for lower environmental compliance costs by accommodating the development of more renewable resources that can either displace the need for future expansion of fossil and petroleum generation, or by using the renewable generation as a replacement to retire some of the dirtier, older fossil/petroleum units. As mentioned elsewhere in these comments, most of the population and the system load in Hawai'i are located on O'ahu. O'ahu, however, has limited renewable resources and a somewhat limited

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60 Hawaiian Electric Companies 2013 Integrated Resource Plan Report, Hawai'i Public Utilities Commission, Docket No. 2012-0036 (June 28, 2013), at 9-5.

61 *Id.* at 9-5, Table 71 and Table 72.

62 *Id.* at 9-7, Figure 214.

ability for future energy diversity projects relative to other islands. Many of the best renewable resources and potential for future development are on different islands, including Maui.[63] The Cable Project would provide for the transfer capability to supply renewable energy from Maui to O'ahu. Accommodating more renewables to load centers would help displace the need for meeting the load with dirtier, older fossil/petroleum generation.

5. The Cable Project Will Produce Ancillary Services Benefits.

54. Ancillary services are required by electric utilities to support the transmission of energy from generation resources to loads, while maintaining reliable operation of the system. Currently, HECO and MECO must separately provide ancillary services on a stand-alone basis to their own systems because the two systems are not interconnected and, as such, are not able to share ancillary services. The Cable Project, which will interconnect their two systems, will provide additional benefits and efficiencies by facilitating the transfer of these necessary electricity services between HECO and MECO systems once the two systems are interconnected. Both HECO and MECO systems will benefit from the added flexibility to transfer ancillary services among interconnected systems to increase capacity factors of renewable generation, and Maui's system will see particular benefits. For example, the Cable Project will eliminate the need for an additional 53 MW of ancillary services (*i.e.*, operating reserves) for Maui. This could potentially provide an opportunity to deactivate or retire some old and inefficient generating units.

55. Utilities, including HECO and MECO, require various ancillary services to ensure reliable operations, including Voltage Support Service, Regulation and Frequency Response Service, and Operating Reserve Service.

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[63] *Id.* at 7-3.

- *Voltage Support Service*: Power systems depend on stable and reliable control of voltage to avoid system collapses and the resulting customer outages. In order to maintain voltages on the transmission systems within acceptable limits, facilities (primarily generators) are operated to produce or absorb reactive power. The ability of a generator to produce or absorb reactive power is limited, and therefore some amount of Voltage Support Service must be provided to maintain the transmission voltages within limits.
- *Regulation and Frequency Response Service*: Regulation and Frequency Response Service is necessary for the continuous (*i.e.*, instantaneous) balancing of generation resources with load. This service is provided by generators whose output is capable of following moment-by-moment changes in load.
- *Operating Reserve Service*: Operating Reserve Service provides backup generation in the event that the system experiences a contingency requiring emergency corrective action. This service is provided by spinning and non-synchronized (quick start) reserves. The total operating reserve must be greater than or equal to the largest single contingency.

56. Because the Cable Project will presumably employ Voltage Source Converter ("VSC") technology, it will have the capability to provide substantial ancillary services benefits, which is a unique feature of this particular technology. In the case of frequency response, managing frequency bias is crucial to reliably operating the system. This is particularly significant to isolated systems such as HECO and MECO because they cannot, unlike most utilities, rely on other interconnected utilities for support when the frequency begins to drop. VSC converters have the ability to almost instantly control real and reactive power

independently which can provide Voltage Support Service to support the system during stressed conditions.

57. With respect to Regulation and Frequency Response Service, the Cable Project will allow the HECO and MECO systems to share capacity set aside for following load in an optimal manner rather than each system needing to have its own capacity. In connection with Operating Reserve Service, the Cable Project will allow HECO and MECO to function as a single coordinated system. For HECO, the largest single contingency is the loss of the 180 MW AES coal plant. For MECO, the loss of combustion turbines (53 MW) at the Ma'alaea generating plant represents the largest single contingency. Once the Cable Project facilitates the ability of the two systems to coordinate their use of ancillary services, O'ahu's contingency becomes the largest for the coordinated system, thereby eliminating the need for Maui to independently provide an additional 53 MW of ancillary services (*i.e.*, operating reserves) in addition to the required operating reserves of the coordinated system.

58. As discussed in DBEDT's Comments, development of the Cable Project is expected to facilitate further renewable generation projects. Increasing penetrations of wind and solar generation can result in excess energy that must be curtailed during periods when generation exceeds demand on the HECO and MECO systems. The Cable Project will provide increased ancillary service capability and provide the operator with needed flexibility to utilize a broader supply of ancillary services to help alleviate the need to curtail more environmentally friendly or lower cost generation instead of having to rely on non-renewable or more expensive generation.

6. The Cable Project Will Reduce Curtailment of Renewable Generation.

59. Schedule 3 of Appendix F shows the projected levels of renewable energy on

O'ahu and Maui that (i) will be available and (ii) will ultimately be delivered, with the difference being the estimated curtailments. As indicated in Appendix 3, the delivered renewable energy increases with the addition of the Cable Project and increases further as the Wind generation is shifted to Maui. Table 5 below shows the reductions in curtailments associated with the various scenarios. While Table 5 indicates that the maximum reduction in curtailments is associated with the Base Case Plus Cable, it must be recognized that the Wind Shift scenarios involve increases in renewable energy generation and correspondingly, increases in curtailments. However, the ultimate impact is a net increase in the renewable energy delivered as Wind generation is shifted, which results in savings to ratepayers.

Table 5

PROJECTED RENEWABLE ENERGY CURTAILMENTS REDUCTIONS

2020 -2050
(GWH)

	Projected Curtailments	**Projected Reductions in Curtailments O'ahu and Maui**			
Renewable Resource	**Base Case**	**Base Case Plus Cable**	**Low Wind Shift**	**Medium Wind Shift**	**High Wind Shift**
Wind	15,049	5,811	4,948	3,721	1,795
Solar	970	333	485	560	619
Total	16,019	6,144	5,433	4,281	2,414

7. Meeting Renewable Energy Mandates, Decreasing Reliance on Foreign Oil, and Providing Jobs.

60. With the 2012 enactment of Act 165, the Hawai'i legislature made several policy findings in support of development of an interisland electric transmission cable relating to Hawai'i's RPS, national security, fuel diversity and energy security. Specifically, Act 165

identifies the Cable Project as "an effective and efficient means to introduce [a] variety of utility scale renewable energy available throughout the Hawaiian islands...to support the achievement of the [Hawai'i] renewable portfolio standards."[64] Additionally, Act 165 identifies the Cable Project as a means to "increase Hawai'i's energy independence [and] provide the islands with increased energy security and system efficiencies and enable the islands to provide each other with backup power."[65] The identified benefits of the Cable Project also include "greater energy security and diversification in the face of threats to Hawai'i's energy supplies and systems."[66]

61. Under Hawai'i's RPS requirements,[67] each Hawai'i electric utility company must ensure that certain percentages of electricity sales come from renewable energy sources. The Hawai'i RPS law defines "renewable energy" as energy generated from the sun (*i.e.* solar), wind, falling water, bioenergy,[68] geothermal, ocean water (including ocean thermal energy conversion and wave energy), and hydrogen produced from renewable energy sources.[69]

62. The RPS mandate requires that utilities' electricity sales include the following portion generated from renewable energy:

- 10% by the end of calendar year 2010 (standard achieved),
- 15% by the end of 2015,
- 25% by the end of 2020, and

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64 Act 165, Section 1.

65 *Id.*

66 *Id.*

67 Haw. Rev. Stat. § 269-91 *et seq.*

68 Biomass includes biomass crops, agricultural and animal residues and wastes, and municipal solid waste and other solid waste. § 269-91(2)(B)(7).

69 Haw. Rev. Stat. § 269-91(2)(B).

- 40% by the end of 2030.[70]

63. The Hawai'i RPS law allows energy efficiency and renewable energy displacement projects to count toward meeting the RPS requirements through December 31, 2015. However, beginning in 2016, the RPS requirements may only be met with strictly renewable energy generation, including customer-sited photovoltaics. After 2015, energy efficiency efforts, including domestic solar water heating and sea water air conditioning, will count towards meeting separate requirements under Hawai'i's Energy Efficiency Portfolio Standards.[71] The Hawai'i RPS law also allows generation from existing renewable energy facilities to be counted in the total. In addition, an electric utility company and its electric utility affiliates may aggregate their renewable portfolios in order to achieve the RPS objectives.

64. As recognized by the Hawai'i legislature when it enacted Act 165, the Cable Project will accommodate the ability of Hawai'i's utilities to further develop renewable energy by providing an interconnected grid between O'ahu, where the majority of the load resides, and Maui, where there are more plentiful renewable energy resources. In this respect, the Cable Project will make a crucial contribution toward meeting Hawai'i's RPS mandated levels of renewable energy sales.

65. As discussed above, there are also several economic, health and environmental benefits related to reducing greenhouse gases by meeting the RPS objectives. Moreover, the ability to transfer electricity between islands will necessarily provide greater flexibility in the way that HECO and MECO provide electric service to their customers. This flexibility will allow greater fuel diversity options—especially as more renewable energy projects come on

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[70] Haw. Rev. Stat. § 269-92(a).

[71] Haw. Rev. Stat. § 269-96 *et seq.*

line—and will allow more efficient use of existing fuel sources, thereby reducing the reliance on oil as a generating resource and furthering the State's efforts to meet its RPS requirements. Reducing reliance on foreign oil provides national security benefits and can mitigate the volatility in fuel prices that are characteristic of the global oil markets, especially when unrest threatens infrastructure and political stability in oil-producing countries.

8. Other Benefits Produced by the Cable Project.

a. Enable Efficiencies from Coordinated Operation.

66. As indicated above, the O'ahu and Maui electric systems are currently operated as isolated islands. Connecting those systems with an HVDC cable (a grid tie) would accommodate power flowing in both directions and would allow the two systems to essentially operate as a coordinated system, which would improve the power system economics and reliability on both islands. Currently, generation on each of the two islands is economically, but separately, dispatched. Connecting the two systems would result in a single economically dispatched system that, among other things, would benefit from any load diversity between the two islands. Under a connected arrangement, the more efficient generators would likely operate at higher capacity factors resulting in fuel cost savings that would directly benefit ratepayers. Such coordination may also support the retirement of one or more inefficient (and higher polluting) generators.

67. In the event that a competitive solicitation process results in development of a new generating project, the potential location for siting such projects would be substantially expanded with the Cable Project, especially on Maui with respect to wind generating projects and the expansion of solar installations (assuming land or rooftop locations are more accessible). The wind resource on Maui, as well as the availability of potential sites, is considered to be

superior to O'ahu's resources.[72] In addition, the need for two separate 24 x 7 control centers (one on O'ahu and one on Maui) could possibly be eliminated with the installation of a Cable Project.

b. Aid in Utilizing Existing Infrastructure.

68. The Cable Project should, to the maximum extent possible, utilize existing infrastructure. Doing so will further ensure that the Cable Project is in the public interest because maximizing existing infrastructure should reduce project risk, thereby resulting in lower cost. For example, utilizing existing infrastructure will minimize, and could in some instances eliminate, certain siting and permitting requirements. By streamlining the siting and permitting processes, the Cable Project will avoid delays and unnecessary expenditures. Moreover, the incremental cost of upgrades is likely to be significantly less than the cost of building new infrastructure. It would be preferable that the locations for the cable landing sites, converter stations and Points of Interconnection for both islands utilize existing utility sites to the extent feasible.

69. On both O'ahu and Maui, the extent to which the existing infrastructure will be available to advance the Cable Project is not clear. To the extent that there may be an existing open breaker position in a HECO 138 kV substation, the need to construct a new substation on O'ahu to interconnect the cable project may be eliminated. However, with respect to Maui, it is likely that a new 138/69 kV substation will need to be constructed to accommodate the Cable Project. In the event that some amount of re-conductoring of existing MECO 69 kV transmission to a higher voltage level is required, efforts should be made to use existing

[72] *See, e.g.*, Hawaiian Electric Companies 2013 Integrated Resource Plan Report, Hawai'i Public Utilities Commission, Docket No. 2012-0036 (June 28, 2013), at ES-16. As indicated earlier in these comments, average capacity factors of wind resources on Maui are 37.5% compared to 21% on O'ahu based on historical data.

transmission rights-of-way to the maximum extent possible. As explained in more detail below, DBEDT recommends that system impact studies be conducted by HECO and MECO, as applicable, in the near term in order to identify the extent of transmission upgrades, and the associated costs of such upgrades, that may be needed on both O'ahu and Maui. Performing such studies in the near term will provide greater clarity as to the costs and benefits of particular proposals submitted in response to a Commission-approved solicitation process.

70. The Cable Project will require construction of new infrastructure and it will not always be possible to utilize existing infrastructure. However, utilizing existing infrastructure, where possible, will magnify the benefits of the Cable Project. In instances where existing infrastructure cannot be used, analyses resulting from system impact studies could complement the Commission's efforts to: (1) better understand when and why curtailment occurs; and (2) develop transparent policies and rules that do not markedly increase curtailment and partial curtailment of existing and planned renewable generators.

c. Potential for Future Interconnection to Other Islands.

71. The proposed Cable Project could be a major step to ultimately interconnecting the Hawaiian Islands and maximizing load diversity benefits and the benefits of the geographic diversity of resources in Hawai'i. With its central location among the islands, Maui could be the natural hub for a fully integrated Hawaiian Islands electric system. The relatively short distances between Maui and Lana'i and Maui and Moloka'i could readily be spanned with AC cables and associated infrastructure, which is more cost effective at shorter distances than DC cables and their required infrastructure. While the current and projected very small loads on Lana'i and Moloka'i would not support the cost of an interconnection at this time, in the event that a substantial generating project were to be developed on one or both of those islands, it could be integrated with the rest of the system through an AC generator lead cable interconnection to

Maui.

72. Moreover, with the substantial undeveloped geothermal resources on the Big Island, an HVDC cable connecting the Big Island to Maui could very substantially reduce the State's dependence on fossil fuels. Once the Cable Project is in operation, an HVDC cable interconnecting Maui and the Big Island should be considered as another major step in achieving the fully integrated state-wide electric system. Of course, without the Cable Project being operational, this step is likely to be cost-prohibitive, if not wholly impractical. The long-term goal of a broader, interconnected system should be pursued in a phased approach. The Cable Project is a reasonable and necessary first step in such approach.

d. Reducing/Eliminating the Need to Build Other Facilities.

73. As previously indicated, installing the Cable Project would be expected to improve the capacity factors of the more efficient generators both on O'ahu and Maui. The Cable Project accommodates the benefits of greater load diversity among a broader base of customers on the two islands. In turn, this serves to support resource adequacy by improving the utilization of existing generators and obviating or delaying (i) the need to expand generation facilities to meet load growth, and (ii) the need to replace retiring generation units. Further, as briefly discussed in the HECO Companies' IRP, the Cable Project allows for more potential generation projects on Maui to compete in HECO's solicitations for additional renewable generation to meet the requirements of the HCEI. In addition, installing the Cable Project would result in reliability improvements for both the O'ahu and Maui systems, as described above.

9. Assessment of Costs.

74. Members of DBEDT's consulting team have extensive experience with virtually all aspects involving the development of undersea HVDC cable projects including the Cross Sound Project (interconnecting New York and Connecticut utilities), the Neptune Project

(interconnecting New York and New Jersey utilities) and the Hudson Transmission Partners Project (also connecting New York and New Jersey utilities). That experience includes managing all phases of request for proposals for HVDC projects, negotiating Firm Transmission Capacity Purchase Agreements ("FTCPA") and Interconnection Agreements, project management (including monitoring and reporting on the construction), financing projects, negotiating Engineering, Procurement and Construction agreements with cable/converter station manufacturers/installers and developing technical specifications. This is a unique team that has represented both buyers of HVDC project capacity and developers. *See* Appendix A. Based on that prior experience, DBEDT developed an analysis of estimated capital cost for the Cable Project of $702 million.[73] These costs are comprised of the undersea cable, the converter stations on O'ahu and Maui, and the AC infrastructure on both islands to connect the converter stations to the HECO and MECO systems. The CCC would be responsible for all of these costs. The cost estimates for the undersea cable and converter stations were prepared by DBEDT's technical consultant based on actual installed costs for recent U.S. HVDC undersea cable projects. As those projects were substantially larger than the 200 MW Cable Project contemplated herein, some scaling of costs was required. The AC infrastructure cost estimates used were based on such estimates included in the HECO Companies IRP.

75. HECO's IRP estimated the cost of an O'ahu-Maui cable (without redundancy) to be between $553 million and $969 million and used $765 million in its analysis. This comparison demonstrates that DBEDT's $702 million cost estimate for the Cable Project is in the range of HECO's estimated costs and only about 8% lower than the $765 million estimate

[73] A breakdown of this cost estimate is set forth in Appendix E, Schedule 1. The basis for the cost estimate was the actual installed costs for HVDC projects. As those projects were substantially larger than the 200 MW Cable Project contemplated herein, some scaling of costs was required.

used by HECO. Thus, the DBEDT and HECO cost estimates for the Cable Project are generally consistent. HECO's and DBEDT's benefit analysis are also generally consistent as each show the Cable Project is cost effective given additional renewable generation on Maui.

10. Identification of Risks.

76. The major risks or other factors that could impose additional costs to the Cable Project and/or impact the stated benefits are: (1) the cost of installing the cable resulting from unforeseen factors such as environmental restrictions; (2) the costs of installing the converter stations due to location restrictions; (3) the need/desire to increase the capacity of the Cable Project to above 200 MW; (4) the costs of mitigating transmission constraints and installing upgrades on O'ahu and Maui to accommodate the Cable Project; (5) the costs of schedule delays/additional costs imposed by issues such as permitting delays and litigation risks; (6) the impact of increases/decreases in estimated fuel prices; (7) the potential that the need for the Cable Project is significantly reduced; and (8) potential increases in costs resulting from routing and site issues. Each of these items is discussed below:

77. *Cost of installing the cable resulting from unforeseen factors such as environmental restrictions*: The major potential risks of additional costs for the cable installation are environmental restrictions that would result in either a longer route than anticipated or restrictions on laying the cable. As the cable costs represent about one-third of the overall estimated cost of the Cable Project (including necessary electrical infrastructure on O'ahu and Maui to accommodate the cable), a 10% increase in the cable costs would be expected to add 3% to the costs of the Cable Project.

78. *Costs of installing the converter stations due to location or other restrictions:* The costs of installing the two converter stations are well known as there are ample precedents of

similar stations that have recently been installed across the world. The major unknown is the availability of a site in close proximity to the desired landing for the Cable Project on Maui. If a suitable site is not available in such close proximity, additional costs would be required to underground the cable on Maui to the chosen site.

79. *Need/desire to increase the capacity of the Cable Project to above 200 MW:* As discussed above, the assumed capacity of the Cable Project is 200 MW. This capacity was not chosen at random, but was selected by HECO as it generally corresponds with the largest single generating unit (*i.e.*, the largest contingency) on the HECO system, specifically the AES Coal Plant. HECO is not able to increase the capacity size of its largest single project unless it is willing to incur substantial costs for additional spinning and non-spinning reserves and be subject to reliability risks. Thus, if it is determined that capacity greater than 200 MW is needed/desired, a second cable and second set of converter stations would be required.

80. *Costs of interconnecting the Cable Project on O'ahu and Maui to the HECO/MECO Systems*: As discussed in Section IV.C.4 below, transmission upgrades and other costs to accommodate the Cable Project on O'ahu interconnecting at the Ko'olau 138 kV substation were included in the cost estimate herein. That discussion demonstrates that the Ko'olau substation has been studied in some detail. To DBEDT's knowledge, costs to interconnect the Cable Project on Maui have not been studied in similar detail as is the case on O'ahu. However, facilities that would be required on Maui are likely to be quite substantial, as the maximum existing voltage on Maui is only 69 kV. As such, the high end of MECO's estimate of such costs included in the HECO Companies IRP has been included in the economic analysis herein. As more detailed studies are performed by HECO and MECO closer to the time of completion of the Cable Project, the cost estimates for the interconnections will be refined.

81. *Costs of schedule delays/additional costs imposed by issues such as permitting delays and litigation risks*: The Cable Project is a relatively complex project for Hawai'i. Several permitting challenges have not yet been addressed for electrical facilities. For example, the Cable Project would constitute the first electric transmission cable routed through or around whale sanctuaries. There are a number of communication cables connecting the islands where such issues have been addressed, which offer precedents that may inform the approach and help avoid lengthy delays. The greatest uncertainty in this area is litigation risk related to environmental reviews which would have unpredictable impacts on costs and schedule. In addition, as addressed in subparts a., b., and c. below, navigating through the applicable statutory provisions and processes could result in delay.

82. *Impact of increases/decreases in estimated fuel prices*: Since one of the primary benefits of the Cable Project is the reduction of consumption of fossil fuels, increases to fuel prices over estimates included in the analysis will increase the estimated benefits of the Cable Project and decreases to such fuel prices will decrease benefits. The analysis included in these comments uses HECO's "Stuck in the Middle" scenario which assumes starting with 2012 fuel prices with modest increases thereafter. DBEDT views this as a middle-of-the road forecast as one can easily project either higher or lower fuel prices than forecast.

83. *Potential for need for Cable Project being significantly reduced*: The need for the Cable Project is largely driven by the favorable economics that the cable provides for additional renewable generation (both due to reduced curtailments from existing projects and increased generation from the shifted new projects) and the reliability and environmental benefits. Significant reduction to this need could occur if fuel prices dropped to low levels compared to current prices and remained at low levels for an appreciable period of time or if Hawai'i decided

to significantly reduce the levels set forth in the HCEI.

84. *Potential increases in costs resulting from routing and site issues*: As discussed in greater detail in Section IV.B.9 below, siting and permitting requirements are complex and could result in delay and increased cost.

a. Potential Risks Associated with Complying with State Laws.

85. *Risks and Need to Address Cultural Resources*: Any process to develop the Cable Project must incorporate effective management of Hawaiian cultural and natural resources, including with regard to Native Hawaiians. Several federal and state laws exist to ensure that development in Hawai'i protects remaining cultural and historical resources. Developers must understand that an interisland cable could potentially impact resources of major cultural significance to Native Hawaiians, and development of the Project must be carried out under a carefully developed plan. There are various federal and state laws that must be followed to develop the interisland cable to ensure the protection and preservation of cultural and historic resources in Hawai'i, including the laws identified below:

86. *National Environmental Policy Act ("NEPA")*: Under Section 101(b)(4) of NEPA, federal agencies must coordinate and plan their actions and, whenever practicable, preserve important historic, cultural, and natural aspects of our national heritage, including the development of Environmental Impact Statements for major federal actions..

87. *National Historic Preservation Act ("NHPA")*: Cultural and historic resources are archaeological sites, historic structures and objects, and traditional cultural properties. Historic properties are cultural resources that are listed in or eligible for listing in the *National Register of Historic Places* because they are significant and retain integrity.[74] Section 106 of the NHPA[75]

[74] 36 C.F.R. § 60.4.

requires that federal agencies take into account the effects of their actions on historic properties.

88. Under NHPA, each state appoints a State Historic Preservation Officer to direct and conduct a comprehensive statewide survey of historic properties and to maintain an ongoing inventory of those properties. Section 106 of the NHPA defines the process for identifying and evaluating cultural resources. Cultural resources that meet the eligibility criteria for listing in the NHPA are formally referred to as historic properties and may include property that is associated with: significant historical events; significant people in the culture's past; embodiment of distinctive characteristics of a type, period, or method of construction; embodiment of the work of a master, or one that possesses high artistic value; and potential to yield information important to the culture's history. Federal agencies must take into consideration the effects on historic properties of any project under direct or indirect jurisdiction before they approve expenditures or issue permits, rights-of-way, or other land use authorizations.

89. Cultural resources may also include archaeological sites and properties that are important to a community's practices and beliefs and that are necessary for maintaining the community's cultural identity. Cultural resources refer to both man-made and natural physical features associated with human activity and, in most cases, are finite, unique, fragile, and nonrenewable.

90. *Archaeological Resources Protection Act ("ARPA")*: Under ARPA both civil and criminal penalties may be extended for the destruction or alteration of cultural resources. It governs the excavation and archaeological practices of all sites in the U.S. In addition, it establishes protocols for the removal and disposition of archaeological collections from such sites.

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[75] 16 U.S.C. §§ 470 *et seq.*

91. *Archaeological and Historic Preservation Act ("AHPA")*: AHPA directly addresses impacts to cultural resources resulting from federal activities that would significantly alter the landscape. The law focuses on activities such as the creation of dams and the impacts resulting from flooding, worker housing, creation of access roads, etc.; however, its requirements are applicable to any federal action. AHPA aims to protect the recovery of data and the salvage of scientific, historic, and archaeological resources that may otherwise be irreparably damaged by those activities.

92. *Antiquities Act*: The Antiquities Act of 1906 makes it illegal to remove cultural resources from federal land without permission. This law establishes a permitting process for conducting archaeological fieldwork on federal lands. It also allows the U.S. President to establish historical monuments and landmarks with the aim of protecting these sites from excavation or destruction of the antiquities they hold.

93. *American Indian Religious Freedom Act ("AIRFA")*: Federal agencies are also required to consider the effects of their actions on sites, areas, and other resources that are of religious significance to Native Americans, including Native Hawaiians. AIRFA protects the rights of Native Hawaiians to have access to their sacred places, to worship through ceremonial and traditional rights, and to use and possess all objects considered sacred. It requires consultation with Native Hawaiian organizations if an agency action will affect a sacred site on federal lands.

94. *Native American Graves Protection and Repatriation Act ("NAGPRA")*: Under NAGPRA, federal agencies must consult with the appropriate Native American tribes, including Native Hawaiian organizations like the Office of Hawaiian Affairs, prior to the intentional excavation of human remains and funerary objects. The law also extends to cultural items such

as sacred objects and objects of cultural patrimony. It requires the repatriation of human remains found on federal and tribal lands and museums and establishes a program of federal grants to assist in the repatriation process.

95. *Abandoned Shipwreck Act*: To discourage treasure hunters and others from damaging and looting abandoned shipwrecks, Congress passed the Abandoned Shipwreck Act of 1987.[76] The law specifies that any wreck embedded within a state's submerged lands is the property of that state and subject to its laws and jurisdictions provided the shipwreck is determined to be abandoned.

96. *State Requirements*: The State of Hawai'i recognizes an obligation to preserve and protect historic property and the rights of certain land and water uses within the state. Under state laws, "historic property" means any building, structure, object, district, area, or site, including heiau (temple) and underwater site, which is over fifty years old. The State Historic Preservation Division ("SHPD"), under the Department of Land and Natural Resources, is responsible for administering programs of the NHPA and other state mandates related to historic property and preservation. More specifically, the SHPD is responsible for programs related to archaeology, history and culture, and architecture. The SHPD is the official keeper of the Hawai'i Register of Historic Places, which formally recognizes districts, sites, structures, buildings and objects and their significance in Hawai'i's history, architecture, archaeology, engineering and culture.

97. It is clear that Hawai'i contains unique cultural resources that require careful study and management. Potential developers of the Cable Project must proceed in a culturally respectful manner and actively engage the Hawaiian community, as well as the communities that

[76] 43 U.S.C. § 2101.

might be affected by the Cable Project. Potential developers must properly address the unique cultural, social and environmental concerns of each affected community as part of the Cable Project.

b. Potential Risks Associated with Complying with Federal Laws.

98. As discussed above, the U.S. EPA has implemented a variety of regulatory rulemaking activities over the past several years to implement increasingly stringent air emissions limitations, including from the power generation sector. The Commission and major stakeholders have been actively engaged in a process to achieve compliance with the various existing air quality and emissions standards.[77] Notwithstanding the ability of the state and its utilities to execute a compliance strategy that accounts for existing regulations, the potential exists that future agency rulemaking activities, *e.g.*, at the U.S. EPA and/or State environmental agency, will impose further or new limitations on air quality standards.

99. Specifically, the U.S. EPA is expected to regulate power plant greenhouse gas emissions under section 111 of the Clean Air Act, which authorizes EPA and the states to set "standards of performance" for emissions from major emitting facilities. The EPA has already proposed greenhouse gas performance standards for *new* power plants under section 111(b) of the Clean Air Act. More recently, President Obama issued a memorandum on June 25, 2013, directing the EPA to revise its proposed rule for new power plants in light of the comments received and to issue a new proposal by September 20, 2013.[78]

100. With regard to the question of regulating greenhouse gases in existing power

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[77] *See, e.g.*, Hawaiian Electric Companies 2013 Integrated Resource Plan Report, Hawai'i Public Utilities Commission, Docket No. 2012-0036 (June 28, 2013), at Chapter 9.

[78] Memorandum from President Obama to Administrator of the Environmental Protection Agency, Power Sector Carbon Pollution Standards (June 25, 2013) (hereinafter "Presidential Memorandum), *available at*: http://www.whitehouse.gov/the-press-office/2013/06/25/presidential-memorandum-power-sector-carbon-pollution-standards.

plants, the Presidential Memorandum further directs EPA to develop greenhouse gas emission standards for existing power plants, and for modified and reconstructed power plants, on a more extended schedule, with EPA issuance of proposed rules by June 1, 2014, and issuance of final rules by June 1, 2015.[79] Although environmental regulations relating to electricity generation do not directly apply to the Cable Project, these regulations may have significant indirect effects on the way the cable would be operated to allow the State of Hawai'i and its utilities and generating units to navigate the environmental requirements. Because the existence of a Cable Project would accommodate growth in renewables and provide increased fuel diversity, environmental compliance plans could vary, depending on the existence or absence of the Cable Project. However, because the existence of the cable will likely play a constructive role in meeting current and future environmental standards, there appear to be few risks related to future environmental regulations that would threaten the fundamental need for the Cable Project itself. In fact, future issuance of new environmental regulations will likely provide further support for the project's need since it promotes the reduction of pollutants as discussed in detail earlier in these comments.

c. Project-on-Project Risk.

101. Project-on-project risk is a function of the coordination of two or more separate but related components of a project, each of which must be successfully completed to have a successful and viable project. Combining multiple projects creates multiple layers of risk that should be allocated among the parties. Project-on-project risk mitigation strategies include: (1) requiring a single project risk mitigation for all components of the total project; (2) providing each component project developer with a transparent view of the other component project

[79] *Id.* at § 1(b).

developers' risk mitigation strategies; and (3) starting construction only when all components of the project have achieved financial close.

102. In this case, the Cable Project would comprise a grid-tie that connects the Maui grid and the O'ahu grid—there are no other transmission links or associated generation projects that come under the umbrella of this Cable Project. Accordingly, this Cable Project is generally devoid of major project-on-project risks because there is only one general element of this project that needs to be completed for success.[80] Thus, the principal component that will drive success of this project is the grid-to-grid connection, including the development of a Coordinated Operations Agreement ("COA"), as described below, among the CCC, MECO and HECO, which will enhance the public interest and benefit HECO and MECO's existing operations by providing grid stability, increased reliability and more efficient operations.

103. Even if no new generation is developed, this project will provide reliability benefits as soon as it is put into service.[81] The Cable Project will enable existing renewable generation on Maui, that during some hours would otherwise be curtailed, to be scheduled to serve customer loads on O'ahu.[82] The results of the economic model clearly show increased renewable generation on Maui and reduced fossil generation on O'ahu when the Cable Project is added. In addition to existing projects, new projects will have a larger market made possible by the cable, thereby creating economic development opportunities, in addition to improving grid stability on both O'ahu and Maui.

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[80] This conclusion assumes that HECO and MECO complete all transmission upgrades on schedule that may be required to ensure that the Cable Project is used and useful.

[81] See the discussion of reliability benefits in section IV.A.2, above.

[82] DBEDT was unable to fully value this benefit in its economic analysis included *supra* as it did not have access to hourly load data.

B. Procedural Path Toward the Swift and Cost-Effective Solicitation, Procurement, and Development of an O'ahu to Maui Interisland Cable.

104. As an initial matter, DBEDT notes that its Comments are premised on a process that begins with selecting a CCC through a competitive process resulting in the issuance of a CPCN, in which DBEDT would take an active role in the selection process and advise the Commission, consistent with DBEDT's role as the Energy Resources Coordinator. DBEDT reiterates that the selection process used to develop the Cable Project should not overshadow the substantive objective—advancing the State's clean energy policies by developing the interisland cable. Below, DBEDT describes the major components of the solicitation process it envisions.

1. Cable Construction and Ownership by a Third-Party.

105. DBEDT envisions that a third-party would construct and own the Cable Project.[83] The legislature, in enacting Act 165, amended "sections of the Hawai'i Revised Statutes to reflect the existence of a separate and distinct entity transmitting power to and receiving revenue from an existing electric utility that is not owned or controlled by that electric utility."[84] For instance, the definition of a CCC includes the concept of a person or corporation that "owns or controls" the transmission cable.[85] Consistent with this authority, DBEDT believes that the Cable Project should be developed and owned by a certified cable company applicant who would ultimately become a CCC. By enabling the CCC to be subject to regulation by the Commission and defined as a public utility, notwithstanding any law to the contrary,[86] there is legislative

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[83] DBEDT notes that the HECO Companies IRP Report and Action Plan also assumed that a third-party would own the inverter-converter stations and the undersea cable and finance the undersea cable to interconnect the O'ahu and Maui Grids. Hawaiian Electric Companies 2013 Integrated Resource Plan Report, Hawai'i Public Utilities Commission, Docket No. 2012-0036 (June 28, 2013) at 11-2, 11-9.

[84] S.B. No. 2785 (Codified as Act 165) at Section 1, page 2, lines 18-22.

[85] Haw. Rev. Stat. § 269-131.

[86] Haw. Rev. Stat. § 269-132(a).

support for allowing the CCC to remain a stable part of the State's electric industry (as opposed to requiring the CCC to transfer ownership of the Cable Project to the incumbent utilities).

106. There are benefits to requiring the Company to maintain ownership of the Cable Project throughout development and beyond commercial operation. For instance, maintaining ownership with a person/company that has demonstrated its ability to meet the financial and experience requirements for development and operation of the Cable Project would be consistent with the public interest. In addition, permitting a person/company to maintain ownership of the Cable Project may be viewed favorably by financial institutions providing the financing for such projects. The involvement of a separate entity that is solely involved in the development of the Cable Project could also reduce project risks. Moreover, embracing the concept of a new experienced, credit-worthy owner into the State's electric industry would demonstrate a commitment to contributing to the collective responsibility of enhancing the State's ability to maximize cost-effective and reliable renewable penetration. However, if the CCC were to own the project subsequent to development of the Cable Project, as discussed elsewhere in these comments, it would be necessary for the CCC to enter into a Coordinated Operating Agreement ("COA") to govern the coordinated and reliable operation of the Cable Project with the electrical systems of HECO and MECO.

2. Near-Term Actions that Could Reduce Potential Project Development Costs and Uncertainties.

107. There are a number of actions that can be undertaken in the near term that can mitigate risks of the Cable Project, improve the efficiency of a solicitation process, and facilitate the efficient evaluation of developers' proposals. Many of these actions, or the rationale underlying such actions, are embedded in DBEDT's comments and discussed throughout. In this section, DBEDT draws from that related discussion and highlights the following actions.

108. *Discourage, but not Prohibit, Routing through Honolulu Harbor*: Results of the University of Hawai'i's School of Ocean and Earth Science and Technology ("SOEST") studies indicate that Honolulu Harbor may not be a viable option for an undersea cable, due to sea bed debris and the risk of anchor drags. Through discussions with experienced undersea cable developers and equipment suppliers, DBEDT understands that such entities are unlikely to pursue a project that would involve a route through Honolulu Harbor. Moreover, these entities indicated that it may be problematic to obtain insurance for the project even if they were inclined to utilize a route that traversed Honolulu Harbor. Thus, DBEDT recommends discouraging use of Honolulu Harbor as a potential route/cable landing spot. Given the limited routes/landing spots, eliminating a route through Honolulu Harbor will serve to focus proposals on a narrower geographic area, which will facilitate evaluation and comparison of responses. Nonetheless, if any potential developer wishes to propose a route that traverses Honolulu Harbor, it should be free to do so, provided that any such developer is required to present a compelling case that the proposed route will result in a project that will be financially and technologically feasible and insurable.

109. *Commission Confirmatory Studies of the Technical Feasibility/Practicality of the Kane'ohe Cable Landing Site*: As explained below, DBEDT's analysis indicates that the Kane'ohe cable landing site represents a potentially suitable landing site on O'ahu. While DBEDT's analysis is preliminary, the results support further exploration of the Kane'ohe cable landing site.

110. *Perform System Impact Studies to Identify Transmission System Upgrades*: Constructing and interconnecting the Cable Project will required transmission system upgrades on Maui and on O'ahu. As discussed in Section IV.C.4 with respect to technical challenges and

potential solutions, studies of the transmission upgrades needed to accommodate a cable project on O'ahu have been performed in some detail, whereas similar detailed studies for the Maui system have not been performed. Studying the transmission upgrades needed on Maui, and the associated costs of such upgrades, will further inform the solicitation process and assist developers in understanding the nature of the project.

3. Convene Pre-Proposal Conference for Prospective Developers.

111. As part of the solicitation process, DBEDT anticipates a mandatory pre-proposal conference for prospective developers, which would occur after the commencement of the formal solicitation process, and before the deadline for prospective developers to submit a proposal. The purpose of the pre-proposal conference will be to facilitate a clear understanding of the requirements and expectations for response at an early stage. It will also provide an opportunity for potential developers to ask questions. In the case of the Cable Project, such a pre-proposal conference should be mandatory because of the complex technical aspects of the project and because of the State's ongoing interest in ensuring the success of this major project.

112. The mandatory pre-proposal conference will give interested parties an opportunity to address major issues early in the process. The pre-proposal conference may also offer an opportunity for potential developers to submit questions regarding the competitive solicitation in writing prior to the pre-proposal conference so that those questions can be addressed by DBEDT. It is anticipated that technical questions that arise at the pre-proposal conference would be required to be submitted to DBEDT in writing to allow DBEDT to reference the question in formulating a response. A summary of the questions addressed at the pre-proposal conference and any subsequent answers would be publicly produced and form part of the solicitation materials.

4. Contents of Responses to a Solicitation Process.

113. In order to assist potential developers in preparing proposals, and to facilitate evaluation of such responses, we recommend that the competitive solicitation process established by the Commission set forth certain preferred elements of the Cable Project[87] as follows: (1) Project structure—the selected developer would become the CCC, as defined in the statute; (2) Specified cable capacity and technology—the solicitation would specify that the Cable Project will have a capacity of 200 MW and will use VSC technology;[88] (3) Role of developer in project permitting, development, operations—the formal solicitation document and the Cable Development Agreement ("CDA"), which is discussed in more detail below, would clearly set forth the risks that are to be borne by the developer;[89] and (4) Commercial Operation Date ("COD")—the formal solicitation document should specify the preferred COD for the Cable Project.

114. All potential developers should include in their proposals the above-preferred elements, in addition to identifying the expected points of interconnection with the HECO and MECO grids. Potential developers should also have the option of submitting additional bids specifying alternatives to any, or all, of the above elements. Any alternatives to the preferred elements should explain why the alternatives are equivalent or superior to the preferred elements.

5. Determining Feasible Routes.

115. DBEDT asserts that the following are the studies that should be reviewed or developed to assist in determining feasible cable routes: (1) all applicable SOEST Studies and

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87 Complying with the preferred cable project requirements does not eliminate or replace the need to successfully complete and all State and federal permitting and review processes.

88 *See* Appendix H.

89 DBEDT's summary of the CDA is included in section IV.B.6, below.

Reports; (2) all Draft PEIS materials, when available; (3) specific route side scan sonar, magnetometer, video and dives where feasible of entire route; (4) a study of practical burial depth and condition of sea bottom along route; (5) Studies of sea life (*e.g.*, fish, sea mammals, mollusks) for potential impact; (6) a sedimentation impact study; (7) a historical and Hawai'i cultural study of route; (8) a study of regulatory requirements for proposed route; and (9) insurance underwriting study of the route (if available).

6. Documents Associated with Competitive Solicitation.

116. DBEDT recommends that the required draft tariff/contract documents be included as part of the solicitation process. These documents include: (1) the proposed CCC Transmission Tariff; and (2) the Cable Development Agreement, as described below and in Appendix G. Other pertinent agreements, such as a potential HECO/MECO Reimbursement Agreement,[90] Interconnection Agreements, and the Coordinated Operations Agreement between HECO/MECO and the CCC, which would govern other terms as described in Appendix G, would be referenced, but not included in the solicitation.[91]

117. *The CCC Transmission Tariff:* The proposed CCC Transmission Tariff would not be effective until after commercial development of the Cable Project. However, the CCC Transmission Tariff would be approved by the Commission prior to issuance of the competitive solicitation so that proposers know with certainty the terms and conditions of their cost reimbursement to help inform their bids. The CCC Transmission Tariff administered by the CCC as approved by the Commission, would govern the terms by which the CCC would recover

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[90] HECO and MECO would be collection agents on behalf of the CCC whereby those utilities would collect from their retail ratepayers (pursuant to Commission approved tariff riders) their allocated share of the CCC revenue requirement as determined by the Commission.

[91] It is recommended that DBEDT, within its role as the Energy Resources Coordinator, prepare the initial drafts of these documents.

its revenue requirement and the terms and conditions under which the CCC would provide service. For instance, the CCC Transmission Tariff would include terms such as the monthly allocation of the CCC's revenue requirements, balancing account adjustments and the CCC's responsibilities on cable availability and operations and maintenance for the Cable Project.[92]

118. *The Cable Development Agreement:* The CDA would govern the terms of construction and development of the Cable Project between O'ahu and Maui to ensure that the CCC meets its development obligations.[93] The CDA would terminate once the Cable Project is developed. DBEDT believes that the Commission could designate DBEDT, or another entity that the Commission believes would be an appropriate entity, to serve as the counterparty to the CCC to oversee the CCC's successful and timely development of the Cable Project under the terms of the CDA. In this regard, DBEDT notes that as part of the Draft request for proposals for Renewable Energy and Undersea Cable System Projects Delivered to the Island of O'ahu (Docket No. 2011-0225), HECO included a proposed Transmission Development and Control Agreement ("TDCA") to which HECO and the CCC would be parties. DBEDT envisions that in order to focus on the development of the Cable Project as an initial matter, the contemplated CDA would be a scaled down, limited version of the TDCA. While HECO would have been a

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[92] While a tariff has been used in the past, it is not the typical arrangement for causing a transmission project to be constructed. The cost recovery provisions and terms and conditions for development and service following completion for such transmission projects are usually included in a FTCPA between the cable developer and one of the interconnecting utilities; HECO in the instant case. However, a FTCPA model generally works when the buyer of the transmission capacity is the counterparty. In the case of a grid tie, the structure is a typical utility rate-based project in which there is no formal "Buyer."

[93] DBEDT envisions that the competitive solicitation process would, at a minimum, include the above-described CDA and the CCC Transmission Tariff. As noted, HECO/MECO would be able to commence technical studies identifying accommodations needed on their systems to accommodate the Cable Project beyond the points of interconnection. The appropriate entities would evaluate the proposals based on criteria established in advance and set forth in the solicitation. The selected proposer and the Commission-designated counterparty to the CDA would execute the CDA. The CPCN application process would commence pursuant to the Commission's procedures. Consistent with the underlying statute, DBEDT is ready and willing to advise and assist the Commission with regard to all of these procedures. *See* paragraph 21, *supra*.

counter-party to the TDCA, given the limited scope of the CDA, DBEDT believes that another party could serve as an appropriate counterparty to facilitate timely and smooth development of the Cable Project. For instance, DBEDT, in furtherance of its role as Energy Resources Coordinator,[94] could be a potential counterparty to the CDA under a delegation of authority from the Commission. Since the O'ahu to Maui Cable Project would be pursued only if the State determines it is in the public interest, it is fitting for the State to have a role during its development (through the development of the competitive solicitation and/or in executing the CDA) and its operating period (the Commission through its regulation of the CCC Transmission Tariff).[95] The primary CCC obligation would be to achieve commercial operation of the Cable Project by the Target Commercial Operation Date set forth in the CDA. Failure to meet the obligations in the CDA, which would be effective from the date of selection through commercial operation, would result in penalties (liquidated damages) and possibly early termination of the project. As noted above, the scope of the CDA would be limited to terms and conditions that would be necessary to ensure lawful, timely and successful construction and development of the cable. The following is a listing of the pertinent components of a potential CDA:

- Land Rights and Site – The CCC shall be responsible for acquiring all land rights required for the construction, operation and maintenance of the project, either via ownership or lease (that is for a term as long as the useful life of the project).

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[94] *See, e.g.*, Haw. Rev. Stat. § 201-4 (DBEDT may contract with qualified private and public agencies, associations, firms, or individuals within or without the State in pursuance of its duties and functions."); Haw. Rev. Stat. § 201-12.5 (DBEDT's renewable energy facilitator will carry out duties including facilitating the efficient permitting of renewable energy projects, including any energy transmission line from the facility to a public utility's electricity system.).

[95] Appendix B to these comments provides various examples in which states have assumed large roles in the development of major utility transmission (and generation) projects that were in the public interest and would not otherwise have been constructed.

- Permits – The CCC shall apply for and obtain, maintain and comply with the requirements of all permits, including, but not limited to, all local siting, construction or operating permits necessary for the project.
- Milestones – The CDA would include certain milestones (*e.g.*, financial close, commencement of construction, achieving commercial operation) and target dates that the CCC would be required to meet.
- Financial Statements and Filings – Copies of all publicly available filings shall be provided. Applicable documents that are not publicly available shall be provided pursuant to the terms of a non-disclosure agreement.
- CPCN – At the appropriate time in the development process, the CCC should be certified as a public utility by the Commission.
- Credit Assurance and Security – The CCC will need to provide Security in support of its obligations under the CDA.
- Liquidated Damages – The CCC would be subject to Liquidated Damages for failing to meet specified milestones and in an event of default as defined in the CDA.
- Interconnection Facilities – The CCC shall cause the Cable Project to interconnect with the HECO and MECO systems. All provisions governing the interconnection shall be included in applicable interconnection agreements between HECO and the CCC and MECO and the CCC.
- Operation and Maintenance – The CDA would provide that, following commercial operation of the project, the CCC shall operate and maintain the Cable Project in accordance with appropriate criteria (including good engineering

and operating practices), any applicable reliability standards and in coordination with HECO and MECO, as set forth in the CCC Transmission Tariff and Reimbursement Agreement and the COA.

- Insurance – The CCC will need to maintain specified levels and types of insurance starting with the construction of the cable and throughout the life of the project.
- Demonstrated transmission capacity – The CCC shall ensure that the undersea cable performs in accordance with the specified transmission capacity requirements.
- Monitoring and Inspection of Construction – DBEDT/HECO Companies shall have the right to monitor construction and development of the undersea cable in accordance with specific notice procedures (HECO Companies limited to the interconnection facilities).
- Testing of Work – The CCC shall perform or cause to be performed, all approvals and inspections of the Cable Project required by applicable laws, permits and in accordance with the CDA, including capacity testing and line ratings. Cable testing shall be coordinated with HECO and MECO pursuant to the COA.
- Environmental Requirements – The CCC shall be responsible for compliance with all applicable environmental review requirements.
- Commission Approvals and Certification – The CCC shall apply for and be certified as a public utility by the Commission.
- Costs – The CCC shall be responsible for all costs and expenses related to the Cable Project that the Commission requires.

- Technical Specifications for the Cable Project.
- Scheduling and Monitoring of Milestones – The CCC shall develop a project schedule and achieve the requisite milestones.
- Monthly Progress Reports – The CCC shall provide the counterparty the monthly progress reports (weekly after construction begins).[96]
- Good Engineering and Operating Practices – the CCC would agree to develop and construct the Cable Project in accordance with Good Engineering and Operating Practices and Applicable Laws.
- Project Completion Date – The CCC shall ensure that the project is completed by a specified target commercial operation date ("Target COD"). If the CCC does not achieve the guaranteed completion date, it must develop a plan to remediate any delay and achieve all remaining milestones. The CDA would include appropriate terms for the consequences for incompletion of the Cable Project by the Target COD if such incompletion is due to actions/inactions of the CCC.
- Indemnification – The CCC would indemnify, defend, and hold the counterparty harmless for damages, losses, claims in accordance with the law and per the negotiations of the counterparties.
- Miscellaneous – The CDA would include standard miscellaneous terms including, but not limited to, representations, disclaimers, warranties, governing law (*i.e.*,

[96] The CDA could be drafted to require the CCC to file monthly "snapshots" with the Commission. The snapshots would explain major developments since the last snapshot, identify short-term action dates, provide a brief summary of the project's status in terms of permitting or construction. These filings would be used to ensure that the major milestones are being met and/or remain achievable. They could also identify issues that may need to be reconsidered as practical experience is gained in moving toward an operational line.

Hawai'i), venue (*i.e.*, Hawai'i), amendment, execution, waiver, enforceability and assignment, that reflect best practices in the electric industry, that are consistent with applicable laws, regulations or policies, and the organizational nature of each party.

119. DBEDT emphasizes that the objective of including the CCC Transmission Tariff in the CDA is to promote certainty and transparency, and is not intended to prohibit the ability of any potential developer that submits a solicitation to identify any requested exceptions to the tariff/contract documents.

7. Assumptions on Financial Responsibilities.

120. Financial responsibility and related risks for the cable system are anticipated to rest with the CCC until the COD. Accordingly, prior to COD, the risks of financing, technology, permitting, equipment availability, delay, litigation, cost over-runs, will all be borne solely by the CCC pursuant to the CDA,[97] and relevant Commission orders. Once COD has been achieved, the CCC will be responsible for operating and maintaining the cable, pursuant to the CCC Transmission Tariff and Reimbursement Agreement. Dispatch of resources over the cable would be coordinated by HECO and MECO through a COA. Outages of the cable system for planned maintenance (which are very infrequent compared to generators) will be coordinated with HECO and MECO operational staff, pursuant to the terms and conditions of the COA. Failure to meet the standards set forth in the tariff (*e.g.*, availability, lines losses) for these matters may result in a reduction in payments to the CCC under the tariff since the CCC would be responsible for facilities under its control. It should be noted that, except in the event of an outage of the cable caused through the fault of the CCC, it is expected that the inability of sending or receiving

[97] As noted above, the counter-party to the CDA would be DBEDT or another appropriate entity.

power over the cable would not result in any reduction in payments to the CCC. This is a standard industry practice and the Cable Project would not be financeable otherwise.

8. Requisite Characteristics of a CCC.

121. In order to be qualified to develop, implement and operate the Cable Project, each prospective CCC developer must clearly demonstrate that it is financially, managerially, and technically qualified to develop, construct, and operate the cable.[98] Moreover, any eventual developer, prior to commencing commercial operation to become a CCC under Hawai'i State law, will be required to obtain a CPCN from the Commission.[99] Any potential developer must demonstrate as part of the solicitation process that it is fit, willing and able to undertake and complete the project, and demonstrating such fitness will be a key part of the evaluation of responses to the proposal. These requirements include a clear demonstration of prior experience on a scale and scope reasonably comparable to that of the Cable Project. Moreover, potential developers will have to demonstrate financial ability and access to capital that can provide adequate assurances of completion of the project, as well as a credit-worthiness demonstration, *e.g.*, investment-grade credit ratings from the major ratings agencies, or other similar demonstrations.

122. The CPCN Application is governed by Hawai'i statutes and the Hawai'i Commission's Rules of Practice and Procedure, including Hawai'i Revised Statutes § 269-7.5 (addressing CPCNs) and § 269-132 (addressing "Certification"), as well as Hawai'i Administrative Rules § 6-61-74 (which prescribes the contents for applications and petitions generally) and Subchapter 7 ("Applications for Certificates of Public Convenience and Necessity

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[98] *See* Haw. Rev. Stat. § 269-7.5; *see also, In the Matter of the Application of Charley's Tour and Transportation, Inc.*, 55 Haw. 463, 468 (Haw. 1974).

[99] *See* Haw. Rev. Stat. § 269-132(a).

or Permits"). The CPCN application will require, among other things, any potential developer to demonstrate that it is fit, willing and able to perform under the proposal.[100] This standard is referred to as the "Fitness Standard."[101]

123. The thrust of the 2012 legislation advances a competitive selection process to determine the CCC developer, while preserving flexibility for the shape of the selection process itself.[102] Thus, there are various approaches to the competitive solicitation that the Commission may determine to pursue for selection of the CCC. For instance, an alternative might involve allowing potential developers to first apply for and pursue a CPCN during a pre-selection period, to be followed by formal selection by the designated selection committee. Such an approach could require multiple potential CCC developers initially pursuing the same authorizations for substantially similar and competing projects, *e.g.*, each developer would file a separate CPCN application and seek the same review by Commission Staff of each application during the same limited time frame. In order for the Commission to make a determination of which competing project(s) are in the public interest, it would necessarily need to compare the benefits and risks of each project against the others in one or more formal proceedings. On the other hand, an evaluation in a request for proposals process is intended to first solicit responses, review responses, and ultimately select a CCC developer before requiring extensive permitting and CPCN applications to be filed. It appears less costly for developers to prepare and submit a proposal and participate in a request for proposals process than to perform similar functions in a

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[100] *See In the Matter of the Application of Charley's Tour and Transportation, Inc.*, 55 Haw. 463, 468 (Haw. 1974).

[101] *See* Decision and Order filed Dec. 1, 2008 (Docket No. 2008-0109) at 25 (referring to the requirements in Haw. Rev. Stat. § 269-7.5 as the "Fitness Standard").

[102] *See* Haw. Rev. Stat. § 269-132(a) (detailing generally that "a cable company shall be selected through a request for proposals, or other process approved by the commission").

formal CPCN process. However, a CPCN first approach could ultimately result in reduced risks and associated ultimate cost reductions for ratepayers.

9. Discussion of Environmental Review and Permitting Requirements.

124. Because the permitting and siting of an interisland cable is a complex process requiring various authorizations from different levels of government, potential developers must approach the environmental permitting aspect of this project with a clear understanding of the requirements and a path to lead to a successful outcome. To that end, each developer will be required to submit as part of its proposal package of information a list of all permits/consents it will be required to obtain to achieve commercial operation of the Cable Project along with a flow chart (or other demonstration) listing the realistic estimated timelines and milestones to navigate the permitting process. The timeline shall identify the assumptions, with the understanding that actual implementation of the project plan may vary with initial estimated variables and timelines. DBEDT notes the following key components, which may not be exhaustive.

125. *Department of Energy Programmatic Environmental Impact Statement*: As explained further below, an Environmental Impact Statement ("EIS") will be required under NEPA and Hawai'i Environmental Procedures Act ("HEPA") as part of any Cable Project. We note that, independent of this Docket No. 2013-0169 proceeding at the Commission, the DOE has embarked on a broad PEIS to address impacts of a wide variety of potential clean energy technologies in Hawai'i, referred to as the Hawai'i Clean Energy PEIS. The Hawai'i Clean Energy PEIS will analyze, at a programmatic level, the potential environmental impacts of clean energy activities and technologies in the following clean energy categories: (1) Energy Efficiency; (2) Distributed Renewables; (3) Utility-Scale Renewables; (4) Alternative Transportation Fuels and Modes; and (5) Electrical Transmission and Distribution. It will also

provide guidance for the federal government to use in future funding decisions and other actions to support Hawai'i in achieving the HCEI's stated goal to meet 70% of the State's energy needs by 2030 through utilization of energy efficiency and renewable energy.[103] The Cable Project is not dependent on the process or finalization of DOE's Hawai'i Clean Energy PEIS, so the Cable Project can proceed in parallel with the Hawai'i Clean Energy PEIS. However, to the extent that the Hawai'i Clean Energy PEIS is developed ahead of development activities of the interisland cable, the Hawai'i Clean Energy PEIS could help establish best practices and identify a process that can be used by potential developers of the Cable Project.

126. *HEPA*: An applicant must prepare an EIS under HEPA for certain proposed actions enumerated under Hawai'i Revised Statute § 343-5 that would use State or county lands and significantly affect Hawai'i's environment. In large part, the State's HEPA process and the federal NEPA process can be overlapping and addressed in coordination, but there are portions of the HEPA process that differ from the federal NEPA process. For example, HEPA review is triggered by any of nine identified factors, as opposed to a "major federal action" under NEPA.[104] HEPA separates disclosure from the permitting/implementation and draws a boundary between the disclosure process and the permitting/implementation process. Additionally, it is a requirement of the State's HEPA process that the applicant send responses to everyone that commented on the Draft EIS.

127. The interisland cable EIS will presumably be coordinated between the federal and

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[103] *See* Hawai'i Clean Energy PEIS, (accessed Aug. 25, 2013), *available at*, http://energy.gov/nepa/eis-0459-hawaii-clean-energy-programmatic-environmental-impact-statement

[104] *See* "Practice and Implementation of Hawai'i Environmental Procedures Act," State of Hawai'i, Office of Environmental Quality Control, (January 2012), *available at:*

http://oeqc.doh.Hawaii.gov/Shared%20Documents/Misc_Documents/Guide%20to%20the%20Implementation%20and%20Practice%20of%20the%20HEPA.pdf

State agencies in order to produce a single, joint HEPA/NEPA product. For example, the Bureau of Ocean Energy Management ("BOEM") could be the lead federal agency to ensure the NEPA requirements are met through the EIS process, working in coordination with corresponding Hawai'i agencies. In addition to HEPA and NEPA review, in some cases other environmental permitting can be conducted in parallel to the NEPA/HEPA process. However, the review and approval process for a number of permits cannot commence until the completion of the NEPA/HEPA process.

128. *Siting and Permitting*: The Commission also seeks comment on the cost considerations related to the siting and routing of any interisland transmission cable. The estimated costs for siting the converter stations, the AC infrastructure on O'ahu and Maui, and cable costs are included in the economic analysis herein. Successful siting of the interisland cable under this Project will involve extensive permitting authorizations from a range of federal, State and local authorities. The siting and permitting process will be complex and presents permitting risks, especially with the possibility of a route that traverses the Hawaiian Islands Humpback Whale National Marine Sanctuary ("Hawaiian Sanctuary").

a. Local and State Permitting.

129. Local permitting authorities require permits for various activities, including coastline construction activities. The county responsible for regulating the particular island targeted for construction will issue the Special Management Area Permit and Shoreline Setback Variance required for projects impacting the coastline, in addition to the construction and zoning permits typically required for a given project.

130. The State of Hawai'i also issues various approvals to use the seafloor within three miles of the coastline, Conservation District Use Permits (for shoreline construction activities in State Conservation Districts), Coastal Zone Management review and approvals, species review

and protection approvals, archaeological and cultural review and protection approvals, clean water approvals, approvals to impact local transportation activities, clean air approvals, solid waste approvals, and other required approvals.

131. This section discusses several of the major permitting authorizations required, and a fuller list of potential permits is included as Appendix I. The discussion in these Comments of relevant permits and the list provided at Attachment I are intended to be illustrative of the scope of permitting and may not be considered an exhaustive list. In any event, successfully obtaining the permits listed in these Comments does not guarantee authorization for the CCC developer to proceed with the Cable Project. The obligation of successfully obtaining each and every applicable permit is explicitly the CCC developer's responsibility, whether or not all the required permits appear in these Comments or on the list in Appendix I.

b. Siting and Permitting in Federal Waters and Within the Hawaiian Islands Humpback Whale National Marine Sanctuary.

132. Because the Hawaiian Sanctuary occupies an expansive portion of the waters between the islands of O'ahu and Maui, any consideration of siting and routing an interisland cable must address the potential difficulty, process, cost and timing for siting the marine cable within the waters of the Hawaiian Sanctuary. The Hawaiian Sanctuary was created under federal law by Congress in 1992 and was ultimately authorized by the Governor of Hawai'i in 1997 to protect humpback whales and their habitat in Hawai'i.[105] The Hawaiian Sanctuary surrounds all or portions of six of the eight main Hawaiian Islands, and approximately 65 percent of the Hawaiian Sanctuary came from the State of Hawai'i, and approximately 35 percent of the

[105] *See* "Sanctuary Designation – Hawaiian Islands Humpback Whale National Marine Sanctuary," U.S. National Oceanic & Atmospheric Administration, National Marine Sanctuaries, (accessed Aug. 24, 2013), *available at* http://Hawaiihumpbackwhale.noaa.gov/management/designation.html.

Sanctuary came from federal lands and waters. As a result, the Hawaiian Sanctuary is managed in partnership between various federal and State agencies, including by the National Oceanic and Atmospheric Association ("NOAA") Hawaiian Sanctuary Superintendent and the State of Hawai'i co-manager.[106]

133. To date, at least three marine communications cable projects and one marine electric cable project have been permitted in national sanctuaries.[107] The NOAA Office of National Marine Sanctuaries ("ONMS") oversees policies and permit guidance for installing and maintaining undersea cables in National Marine Sanctuaries pursuant to Section 304(d) of the National Marine Sanctuaries Act ("NMSA").[108] Under NMSA, certain provisions apply to all marine sanctuaries. For example, in all national marine sanctuaries, including the Hawaiian Sanctuary, the federal agency issuing any required permit must first consult with ONMS in accordance with section 304(d) of the NMSA.[109] In the case of the Hawaiian Sanctuary, other special considerations also apply.[110] Because of the lack of clear precedent regarding permitting an electric transmission cable within the Hawaiian Sanctuary, there is uncertainty about the permitting process and outcome.[111] Under the Energy Policy Act of 2005 ("EPAct 2005"),

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106 *See* "Management Overview – Hawaiian Islands Humpback Whale National Marine Sanctuary," U.S. National Oceanic & Atmospheric Administration, National Marine Sanctuaries, (accessed Aug. 8, 2013), *available at* http://Hawai'ihumpbackwhale.noaa.gov/management/mgmt_overview.html .

107 The electric generating project, with a 3.7 mile transmission line, was permitted in the Olympic Coast Sanctuary, but under authority of the Federal Power Act. *See Finavera Renewables Ocean Energy, Ltd.*, 121 FERC ¶ 61,288 (2007). The project was later cancelled for economic considerations. *See also* National Oceanic & Atmospheric Administration, "Final Report Fair Market Value Analysis for a Fiber Optic Cable Permit in National Marine Sanctuaries" (2002).

108 16 U.S.C. § 1434(d).

109 *Id.*

110 *See* "Final Policy and Permit Guidance for Submarine Cable Projects," U.S. National Oceanic & Atmospheric Administration, Office of National Marine Sanctuaries, at 1, 10 (accessed Sept. 9, 2013), *available at* www.sanctuaries.noaa.gov/library/national/cable_guidelines.pdf.

111 *But see* 15 C.F.R. § 922.184(a)(5); *see also "Hawai'i OCS Renewable Energy Task Force,"* at 8 (2013), *available at* http://www.boem.gov/Renewable-Energy-Program/State-Activities/Hawaii.aspx.

BOEM is authorized to issue leases, easements and rights-of-way for alternate energy-related uses on submerged federal lands.[112] However, BOEM is not authorized to issue such rights-of-way through national marine sanctuaries, such as the Hawaiian Sanctuary.[113]

134. Separate from the Hawai'i Sanctuary lands, development of the Cable Project will require permitting and consultation with several federal agencies. For example, under EPAct 2005 BOEM is authorized to issue leases, easements and rights-of-way for alternate energy-related uses on submerged federal lands.[114] As part of the permitting process, federal agencies must consult with the NOAA Fisheries Office on potential effects to areas designated as Essential Fish Habitat under the Magnuson-Stevens Fishery Conservation and Management Act of 1976.[115] Consultation among federal agencies must also be carried out with the National Marine Fisheries Service Office of Protected Resources and the Department of Interior's Fish and Wildlife Service pursuant to the Endangered Species Act.[116]

135. The technical, environmental, and permitting complexities involved with a Cable Project warrant a competitive process that is coordinated at the State level. Such coordination will allow for more efficient considerations of response documents by virtue of the different areas of expertise at the State level. Specifically, the Commission and the State's Energy Resources Coordinator (*i.e.*, DBEDT) could combine expertise and staffing capacities to jointly issue and evaluate proposals to develop the Cable Project. For example, the Hawai'i Commission Staff can apply its expertise to evaluate issues such as energy transfer and cost

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[112] EPAct 2005 at § 388 (codified at 43 U.S.C. § 1337(p)).

[113] 43 U.S.C. § 1337(p)(10).

[114] EPAct 2005 at § 388 (codified at 43 U.S.C. § 1337(p)).

[115] 16 U.S.C. § 1801 *et seq.*

[116] 16 U.S.C. § 1531 *et seq.*

recovery, while DBEDT could assist in that evaluation, and could also advise the Commission with respect to policy issues. This coordinated effort could serve to provide a more thorough and expeditious determination when evaluating proposals.

C. System Configuration and Operational and Technical Issues.

1. Recommended System Configuration.

136. The HECO system on O'ahu operates to accommodate the loss of a single 200 MW contingency while continuing to maintain the required reliability level. Accordingly, while more than one cable between O'ahu and Maui can be considered, no single cable can have a capacity greater than 200 MW. For the purpose of this report, it is assumed that one cable is installed with a capacity of 200 MW. As discussed below, there are several configurations and cable types under which such a cable facility could be designed.

137. In general, HVDC cables are better suited for long distances than HVAC cables. This is because HVDC systems tend to be less expensive at longer distances; they also experience lower electrical losses. With respect to submarine transmission cables specifically, HVAC systems are not technically feasible at longer distances. Thus, HVDC cables are commonly used. For example, the Neptune Cable between New York and New Jersey is an underwater HVDC cable that spans approximately 65 miles. The Trans Bay Cable in San Francisco Bay is an underwater HVDC cable that extends 53 miles. Because of the substantial distance between O'ahu and Maui, a distance of more than 100 miles, an undersea AC cable would not be technically feasible. Accordingly, an HVDC cable with converter stations on each island would be required.

138. Given the likelihood that the Cable Project will be used to some extent to deliver renewable energy to O'ahu, it is imperative that VSC technology be employed because of the

radial nature of the renewable energy projects, *i.e.*, interconnecting larger renewable projects with the MECO 69 kV transmission system may be limited, thus requiring a direct interconnection to the converter station switchyard on Maui. It should be noted that VSC technology is recognized as the most efficient option for offshore wind farms since VSC easily connects variable energy resources to the AC grid. VSC technology is also generally less expensive, smaller, and quieter than conventional HVDC converter technology. Conventional HVDC technology consumes significant reactive power and would require the installation of large compensation banks. It should also be noted that the VSC converter can deliver both real and reactive power, a critically important factor on a weak AC system, as well as the availability of certain ancillary services such as black start capability. As such, a VSC cable project can provide reliability benefits to a system even when it is not transmitting energy. VSC is a proven technology and there are numerous VSC projects in operation throughout the world.

139. With respect to the electrical configuration of the Cable Project, two configurations may be considered – monopole and bipole. A monopole configuration consists of one insulated conductor and a return conductor, while a bipole configuration uses two insulated conductors and a third cable as a return path. Since the two conductors of a bipolar system must be insulated, this arrangement has a higher cost than a monopole with a return conductor. One line diagrams of these arrangements are shown in Appendix H. The first one line diagram shows the 200 MW monopole system employing two cables. The second one line diagram shows a 200 MW bipolar system employing three cables. Under this arrangement, up to 100 MW is transferred on each of two of the cables at equal, but opposite voltage levels. The third cable is the return path. If any one of the cables faults, the system would continue to have the capability to transfer 100 MW.

140. While either a monopole or a bipole configuration is feasible and meet HECO's requirements, the monopole system is recommended. The monopole system is less expensive due to the smaller number of cables that must be purchased, installed, and maintained. In addition, the technical design of a bipolar system requires that the individual cables must be physically separated, which would require three installation campaigns, rather than a single installation for the monopole system. Moreover, there are potential operating issues with the bipolar arrangement. This arrangement may have higher transmission losses if there is unequal dispatch between the two poles due to current differential in the neutral cable. In addition, if the neutral cable is out of service, to maintain even 100 MW of transfer capability, both poles would need to be equally loaded, which may be difficult. Finally, the bipolar arrangement requires complicated control and protection systems and extra switching equipment. A third potential configuration would involve two completely separate monopole systems of 100 MW each. However, such an arrangement would require four converter stations, which would substantially impact project economics.

141. The bipolar system and the two separate monopole systems offer the capability to maintain one half of the cable capacity, while the single monopole system is essentially all or nothing. However, the reliability experience of HVDC monopole systems has been such that the extra cost of the other is not justified. Accordingly, after considering the costs, benefits, and requirements of each electrical configuration, the monopole configuration stands out as the best option.

142. There are three cable types typically used for HVDC submarine applications, specifically: (1) Mass Impregnated Paper Insulated Cables; (2) Self-contained fluid-filled ("SCFF") pressure assisted cables; and (3) Cross-linked polyethylene ("XLPE") insulated

extruded cables. For the O'ahu to Maui Cable Project, XLPE is recommended since it does not use insulating fluid.

143. While DBEDT is not proposing a particular cable landing site for either island, with respect to O'ahu, there appear to be three locations that have been considered in the past, specifically, Honolulu Harbor, Pearl Harbor and the Marine Corps Base in Kane'ohe. In connection with Honolulu Harbor and Pearl Harbor, it should be noted that several issues have been raised concerning risks of anchor drags damaging the cable as well as certain physical impediments including debris and munitions. There do not appear to be any issues with respect to the Marine Corps Base which is three miles from the HECO Ko'olau 138 kV Substation. The development and ownership responsibility of the "on-island AC transmission infrastructure" (the facilities connecting the O'ahu converter station with the HECO transmission system) should be with the CCC.

144. Based on a preliminary review of maps including the diagram of the MECO transmission system, it appears that the cable landing point, converter station site, and Point of Interconnection for Maui would need to be in the general areas of either Kahului or Ma'alaea. As the cable project would interconnect with MECO's 69 kV transmission system, the economic analysis included herein includes a conservative estimate of upgrades that would be required on the MECO side of the Point of Interconnection. Such upgrades would be identified in a system reliability impact study that would need to be conducted by MECO. It should be noted that it is assumed based on existing precedent, that permitting and construction responsibility for any transmission upgrades required on the MECO side of the Point of Interconnection (as well as the HECO side of the Point of Interconnection on O'ahu) would be with the interconnection utility and the capital costs of such upgrades would be included in the utility's rate base. The

development and ownership responsibility of any "on-island AC transmission infrastructure" in Maui (the facilities interconnecting the Maui converter station with the MECO system) would be afforded the same treatment as applicable to similar facilities in O'ahu.

2. Cable Maintenance.

145. While the Cable Project can be dispatched from a remote location, such is not the case for maintenance. Unless the CCC has a major presence in Hawai'i, it would be expected that maintenance services for the Cable Project would be contracted to an experienced contractor. Required outages of the Cable Project to perform maintenance would be scheduled in advance (except for forced outages) with HECO and MECO in accordance with the terms and conditions of the COA.

146. Based on experience with other cable systems, it is expected that the Cable Project will require on-going preventative maintenance on the order of $5 million per year ($2013) to cover all project facilities. Such maintenance costs represent a very small portion of the CCC revenue requirement. As many of the primary components in the converter station are designed as redundant systems, it is often possible to perform maintenance on an off-line component of a duplicated system without impacting power flow over the Cable Project.

3. Cable Operation and Dispatch.

147. DBEDT notes that there are two separate aspects of cable operation to be discussed here. The first is the dispatch function and the second is the physical operation (including availability) of the cable, converter stations and associated equipment. The cable system is defined as running from the bus bar at the point of receipt to the bus bar at the point of delivery. The cable is said to be "available" when it has the ability to (i) transfer power delivered to it at the point of receipt and (ii) deliver that power to the point of delivery. Since the

Cable Project would be a grid tie, the point of receipt and point of delivery at any point in time would alternate based on the direction of power flow. There may be circumstances when the cable is available to transfer power but the utility system on the other side of the bus bar at either the point of receipt or the point of delivery may not be prepared to receive or deliver power. Generally, the economic risk of such inability of the interconnected systems to deliver or to receive power from the cable system is borne by the interconnected utility and not the cable system, *i.e.*, the CCC would be entitled to cost recovery as long as it is considered to be available.

148. The CCC, as owner of the Cable Project, will ultimately be responsible for the cable's O&M functions. The CCC may operate the Cable Project itself, possibly from a remote operator work station. Another option involves the CCC entering into an O&M contract with an experienced third party, which may include the company[117] that manufactured the cable or major converter station components. Either model is accepted in the industry.

149. It should be noted that there are numerous HVDC cable projects currently in operation that interconnect two otherwise isolated systems similar to the instant project. The development of operation arrangements for such interconnections, while often complex, is well understood and is not considered to represent a significant risk to any of the parties.

4. Technical Challenges and Proposed Solutions.

150. As with any project of this size and scope, technical challenges exist. As explained in these comments, the technical challenges associated with the O'ahu-Maui interisland cable can be overcome and managed in a manner that benefits the public interest. For

[117] It is not unusual for the company that installs and/or manufactures the Cable Project facilities to enter into a long term repair and maintenance agreement with the project owner. Such arrangements may provide improved commercial terms such as longer warranties.

purposes of this discussion, we focus on the following three major technical challenges associated with the O'ahu-Maui cable project: (1) installing the cable in the waters between O'ahu and Maui; (2) integrating the large new 200 MW cable resource with HECO's O'ahu and MECO's Maui electrical systems, particularly if the Cable Project is used to deliver renewable energy to O'ahu; and (3) ensuring the coordinated operation of the O'ahu and Maui electrical systems.

151. *Cable Installation Risk:* With respect to the first risk, there are several reasons why, although challenging, it is technically feasible to install an undersea electric cable between Maui and O'ahu in a manner that furthers the public interest:

- The contemplated capacity of the cable is only 200 MW, which is on the low end of installed capacity for existing undersea cables in the U.S. and other parts of the world. For example, the Neptune Cable off the New Jersey coast has 660 MW of capacity, and the Trans Bay Cable near San Francisco has a capacity of 400 MW.
- Although the proposed cable is relatively long [120 miles] and depths for some portions of the route are expected to be over [1,800 feet], several much larger cable systems have been successfully installed at substantially longer distances and deeper depths than is contemplated here. As an example, the submarine portion of the Italy to Sardinia cable, a cable with 1,000 MW of capacity (five times as much capacity as the proposed O'ahu-Maui cable) that was constructed in 2009, is more than 250 miles long with a maximum water depth of 5,249 feet.
- Commercially available survey tools make it possible to map a safe and technically feasible cable route along the seafloor. In fact, SOEST has already

studied much of the seafloor that could encompass the proposed route in conjunction with previous project studies.

- The type of power cable using submarine power transmission technology that will likely be used for the O'ahu-Maui cable system is technologically sufficient for the proposed installation, (*i.e.*, XLPE), has been successfully installed extensively throughout the U.S. and other parts of the world, and is commercially available.
- Although cable laying vessels capable of performing the proposed installation are in high demand due to the large number of cable projects being developed around the world, based on our discussions with HVDC undersea cable project developers and equipment suppliers we understand a suitable vessel can be made available given sufficient lead time of a year or more.

152. *Integrating the Cable into the O'ahu and Maui Grids*: The second major technical challenge consists of integrating the 200 MW O'ahu-Maui cable into HECO's O'ahu grid and MECO's Maui grid. While the proposed Cable Project is intended to be a grid tie, it is expected that all or some portion of the cable capacity will be used to deliver renewable energy from Maui to O'ahu. The issue of integrating large amounts of intermittent renewable energy into the O'ahu grid was analyzed in detail by the Technical Review Committee ("TRC") in conjunction with the Big Wind Project and summarized by Navigant Consulting in its April 19, 2011 report entitled "Status and Perspectives on the Big Wind/Cable Project" (the "Navigant Report"). The TRC concluded that, although technically challenging, the O'ahu grid could accommodate a new 400 MW cable injecting intermittent wind power into the system. As explained in more detail below, the TRC also discussed the specific actions needed (both additions of new equipment and changes to operations) to maintain reliability and continuity of service to HECO's O'ahu

customers. These actions were referred to in the Navigant Report as the "Upgrade Project." Since the technical issues of accommodating the 200 MW Cable Project are similar to accommodating the Big Wind Project, many of the actions identified by the TRC in its study of the Big Wind Project are identical to those needed for the Cable Project. By taking many of these same actions, the O'ahu grid could readily accommodate a new 200 MW O'ahu-Maui cable. There has not been a similar study performed to determine actions needed for the Maui grid to accommodate the O'ahu-Maui cable project. While it is expected that substantial upgrades to the Maui system would be required, the need for these upgrades does not constitute an unmanageable impediment.

153. *O'ahu Grid*: As alluded to above, the solutions for accommodating the O'ahu-Maui cable project on O'ahu would be substantially similar to the Upgrade Project determined by the TRC to be required to accommodate the Big Wind Project. This is due to the fact that like the Big Wind Project, the O'ahu-Maui cable is expected to largely carry intermittent wind and other renewable resources. It is the intermittency of the resource and the relatively large size of the cable compared to O'ahu's roughly 1200 MW peak load that are the source of the technical challenges. Since several of these challenges are solely related to the intermittency of the renewable resource, the recommended measures would need to be implemented whether the renewable resource were on Maui or O'ahu.

154. The major challenges to be resolved include: (1) avoiding wind energy curtailments at high penetrations;[118] (2) operating thermal units more often at minimum power; (3) responding to a trip of a 200 MW submarine cable; and (4) thermal generators responding to sudden drops, rises and swings in wind generation. To deal with these challenges, the TRC

[118] This solution would be achieved through an operating instruction implemented by HECO and MECO.

developed strategies to improve wind generation forecasting, refine reserve requirements, reduce the minimum power requirements of thermal units, and increase the thermal unit ramp rates, among other things. These strategies and measures are not included in the economic analysis set forth in these comments. To the extent they are implemented, economics of the Cable Project would be improved.

155. The TRC determined that reducing the minimum power requirements of seven HECO base load units would reduce the wind curtailment probabilities from 10 percent to three percent. The TRC also determined that unit commitment should be performed well in advance of any forecasted curtailments and should reflect the wind energy forecast. Integrating energy from the wind projects required improved system operations, heat rates and reliability. For certain generators, it would be necessary to increase the automatic generation control ramp rates by three times. In particular, improving the ramp rates significantly improves the ability of the HECO system to counteract wind generation changes as compared to current ramp rates.

156. The results of the TRC's analysis related to the Upgrade Project included recommendations for new wind projects, HECO Operations, HECO regulation *(i.e.*, load following), forecasting and monitoring and thermal unit modifications. With respect to new wind projects, the TRC recommended that wind projects be required to provide inertial response to improve performance during events that cause large under-frequencies. New wind projects should also be required to respond to curtailment requests in less than ten minutes.

157. In connection with HECO operations, a wind power forecast should be implemented as part of unit commitment. This should result in a reduced variable cost of system operations with a more optimal commitment of cycling units. Also related to HECO Operations, the wind variability should be measured and recorded by output power for different plants to

reduce the reliance on expensive quick-start units.

158. To reduce the cost of operating the system through the commitment of cycling units, the regulation requirement should be redistributed to other resources such as load control and quick-start units. In addition, the regulation requirement should be based on wind power variability and loss of load criteria. This should result in reduced wind curtailment during light loads.

159. With respect to forecasting and monitoring, the TRC recommended that the wind power forecast be discounted to account for unavailable turbines so that sufficient thermal generators can be committed. Also, during severe weather, thermal generators should be committed to address increased wind generation variability.

160. Substantial modifications were also recommended for the HECO thermal units. Such modifications included reducing minimum power points to maintain adequate regulation, which would accommodate more wind energy at light loads thereby reducing overall variable costs. Improvements to thermal unit ramp rates were also recommended. Such improved ramp rates would compensate for the largest wind generation reduction in a ten minute period and the largest load increase in a 10-minute period. These modifications are largely required to accommodate significant amounts of new renewable generation with or without a new interisland cable. Thus, many of them have already been implemented or are planned for implementation.

161. Implementing the above measures is expected to fully address the stated challenges. Based on the large blocks of new wind capacity that HECO is anticipating in the IRP, it is imperative that the foregoing measures be implemented regardless of whether the Cable Project is ultimately installed. However, since the Cable Project in conjunction with shifting wind capacity from O'ahu to Maui, results in additional wind generation, it serves to amplify the

need for these measures.

162. *Maui Grid*: As stated above, there have not been technical studies performed to date on actions needed to integrate an undersea cable such as the envisioned 200 MW O'ahu-Maui cable system into the Maui grid. Given that the total load on Maui is currently only about 200 MW, and the fact that the Maui transmission system is only 69 kV, integrating the cable will be challenging and may require many of the same actions as outlined above for the O'ahu system. Technical studies should be launched at an early date—prior to the issuance of the competitive solicitation, if possible—to identify the necessary specific actions. Depending on the amount of renewable resources ultimately developed in Maui, and the upgrades to the Maui transmission system needed to accommodate the Cable Project, it may be warranted to interconnect larger renewable projects directly to the new 138/69 kV Substation that likely will need to be constructed in conjunction with the Maui converter station.

163. *Coordinated Operation*: The third major technical challenge associated with the O'ahu-Maui cable project relates to the need for HECO and MECO to operate their two systems in a coordinated fashion—*i.e.*, as an interconnected system. Historically, HECO and MECO have operated their utilities as isolated systems. Given the novelty of interconnecting the island systems, converting to a coordinated system will present new challenges to HECO and MECO (*e.g.*, reliability standards should be reviewed to determine their adequacy). These challenges may be heightened by the infusion of the CCC, which is also a new construct in Hawai'i. As such, it will be necessary for those three parties to agree to the terms of the COA, which will govern operation of the cable. COAs typically take the form of an agreement among the parties setting forth each party's role and responsibilities, including responsibility for scheduling cable outages. Among other things, the COA will include: (1) the procedures for scheduling energy

over the Cable Project; (2) the procedures for coordinating outages and maintenance; (3) a description of the arrangements for normal operations; and (4) a communications protocol. The COA will be required to conform to the operating standards of HECO and MECO, as may be modified by the Commission. Typically, one of the COA parties (other than the CCC) would be designated in the COA as having dispatch operational control of the Cable Project. As it is expected that the predominant flows over the cable will be from Maui to O'ahu, it is reasonable to presume that HECO would be responsible for dispatch operational control of the Cable Project using non-discriminatory protocols that will need to be developed and approved by the Commission. DBEDT and the Commission will also need to actively participate in this process as this agreement will affect reliability for electric customers on both O'ahu and Maui. A very detailed plan for transitioning to coordinated operation along with training for all affected personnel will be required early in the process. The plan will need to include a provision for returning to the isolated island mode in the event of a cable outage.

5. Generation Interconnection Issues.

164. Interconnecting the O'ahu-Maui undersea cable is not expected to have any adverse impact on existing renewable or fossil-fired generation on Maui or O'ahu. In fact, the Cable Project will further aid existing renewable output on Maui because the cable project will allow for reductions in curtailments of renewable generation, as discussed.[119]

165. Generation interconnection issues may arise with respect to new, large renewable generation projects on Maui following the cable's commercial operation. Notably, even though the cable would be constructed as a grid-tie (*i.e.*, a cable interconnecting two electric systems)

[119] The economic analysis discussed *supra* quantifies the expected reduced curtailments resulting from installation of the O'ahu-Maui cable assuming that loads on O'ahu can accept the Maui energy in every hour of the year. This assumption was necessary as DBEDT did not have access to hourly load data for HECO's system at the time it prepared this report.

rather than a gen-tie (*i.e.*, a cable connecting a generator and an electric system), new renewable energy projects of roughly [50 MW] or larger may need to directly interconnect with the converter station switchyard (or new AC substation) located on Maui to avoid overloads on the MECO grid, given that the MECO transmission system operates at a relatively low voltage of 69 kV. The specific interconnection arrangement for new large generation projects would need to be determined through a system reliability impact study that would need to be conducted for each such project by MECO. It is noteworthy that the use of VSC technology for the cable would allow for large amounts of variable renewable energy resources to be interconnected without the need to install large and expensive capacitor banks.

166. It should also be noted that in addition to the converter stations, new facilities will need to be constructed on both islands to interconnect the Cable Project with the local utility systems (referred to as the "on-island AC transmission infrastructure" in the Cable Investigation Order). In addition, substantial transmission upgrades may be required on the utility side of the Point of Interconnection, particularly on Maui to accommodate the Cable Project.

6. Reliability Standards for Interconnected Systems.

167. In order to meet the State's aggressive renewable energy goals, the Hawai'i electric system must undergo a fundamental transformation. Of particular interest, Hawai'i's generation fleet is experiencing, and will continue to experience, material changes in terms of resource base (renewable generation v. fossil fuel), resource size (distributed generation v. utility-scale generation), and ownership of resources (third parties v. host utilities). The overwhelming impact of this transformation is positive and will inure to the benefit of Hawai'i, ratepayers, and the environment—*i.e.*, reduced curtailment of renewable generation, decreased dependence on imported fuels and fossil fuels, etc. However, this transformation will create operational challenges that will need to be addressed. One such operational challenge is how to

maintain or improve electric reliability while adding large amounts of renewable resources. As discussed above, the Cable Project improves electric reliability.

168. To assist the State in achieving its aggressive renewable energy goals and addressing operational challenges, DBEDT has been a persistent proponent of expeditiously developing formal reliability standards[120] and interconnection requirements, as well as an appropriate structure and implementation strategy for such standards and requirements.[121] As demonstrated above, the transformation of the Hawai'i electric system makes the need for formalization of electric system reliability oversight readily apparent. In fact, with the Commission's leadership and guidance, interested parties have been working towards developing reliability standards and interconnection requirements in furtherance of maximizing reliable renewable penetration for the past few years.[122] DBEDT submits that formal reliability standards and interconnection requirements should govern *all* segments of the electric power system, including a Commission-approved Cable Project. Thus, an inquiry into whether an interisland

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[120] *See generally* Docket No. 2011-0206. The HECO Companies proposed convening a reliability standards working group to allow stakeholders and technical experts an opportunity to review and provide input into the studies. HECO February 8, 2010 Report at 4. It was that process that led to the initiation of the RSWG proceeding in Docket No. 2011-0206. DBEDT was an active participant in the RSWG. The RSWG's TRC submitted its comments on the RSWG's final recommendations on May 2013. The TRC's report is currently before the Commission.

[121] In pertinent part, Hawai'i statutes define the term "reliability standard" as an electric reliability requirement, adopted by the Commission, which ensures the reliable design and operation of the Hawai'i electric system. Haw. Rev. Stat. § 269-141. The term "interconnection requirement" is generally defined as any rule, adopted by the Commission, concerning the performance levels, processes, practices, equipment, or facilities of any entity interconnecting to the Hawai'i electric system under procedures established pursuant Haw. Rev. Stat. § 269-145 to ensure the reliable operation of the Hawai'i electric system. *Id.*

[122] For example, in enacting Act 166, the legislature acknowledged the Commission's efforts to advance the development of local grid reliability standards and procedures via proceedings such as the Feed-in Tariff ("FIT") investigation in Docket No. 2008-0273. S.B. 2787 at 3:7-10. In the FIT proceeding, the HECO Companies proposed to defer the interconnection of additional distributed renewable generation systems on the HELCO and MECO grids until mitigation measures were identified and employed to integrate additional variable generation while maintaining system reliability. HECO Companies' February 8, 2010 Report, Docket No. 2008-0273, at 4.

cable is in the public interest should also consider the related issues pertaining to reliability standards. This link is illustrated by the following two examples.

169. First, there have been no formal reliability standards in Hawai'i from a historical perspective. Rather, technical and operational requirements for grid reliability and interconnection have been determined and enforced by the host utility. However, new and emerging technologies—including, but not limited to, an interisland cable—are introducing other parties into the process of assuring the reliable operation of the Hawai'i electric system. Thus, the historical model is no longer an appropriate means of ensuring adequate levels of reliability. Significantly, Hawai'i statutes recognize this changing paradigm. The "Hawai'i electric system" is broadly defined as encompassing "*all* electric elements located within the State together with all interconnections located within the State that collectively provide for the generation, *transmission*, distribution, storage, regulation, or physical control of electricity over a geographic area...." Haw. Rev. Stat. § 269-141 (emphasis added). Moreover, compliance with any applicable reliability standard is required of any "[u]ser, owner, or operator of the Hawai'i electric system" that is engaged in the "transmission...of electricity" and that transmits electricity "directly to a public utility for either transmission or distribution to the public." *Id.* The practical implications of the emerging technologies and rapid deployment of renewable energy projects in Hawai'i, coupled with legislative recognition of the broad range of entities playing a role under the new paradigm, confirms that any Commission-approved CCC should be included in any formal reliability standards structure the Commission may adopt.

170. Second, in establishing the RSWG, the Commission described its overarching goal for the RSWG as "assur[ing] that Hawai'i has a clear, objective, fair, and reliability-advancing set of processes and procedures in place that can be used to assess new generation

interconnection requests and accept those that will not compromise feeder or grid reliability."[123] The rationale underlying this goal remains valid as the Commission considers the RSWG's work product and the Technical Review Committee's comments on that work product. While the Cable Project provides many benefits, enabling new renewable generation to interconnect to the HECO and MECO systems is a major benefit of the Cable Project. Given the intersection between reliability, the Cable Project, and the interconnection of intermittent resources, it would be imprudent to assess the Cable Project in a vacuum. Conversely, the prudent course is to view the Cable Project through the prism of the processes and procedures that the Commission establishes for governing grid reliability (as well as generation interconnections).

171. While DBEDT recognizes that creation of reliability standards is a distinct matter that is separate from determining whether an interisland cable is in the public interest, the foregoing discussion demonstrates the impetus of considering these inter-related issues together. Therefore, DBEDT recommends that the Commission proceed on concurrent tracks. On one track, the Commission should incorporate the comments contained herein and work toward developing a competitive solicitation for an interisland cable. On another track, the Commission should move forward with establishing the HERA and the framework for establishing, implementing, and enforcing reliability standards. These tracks may be separate and parallel at times, and they may converge at other times. On balance, however, these concurrent paths will inform the Commission's decision making on inter-related issues on qualitative and holistic bases.

[123] Order Regarding Reliability Standards Working Group Process, Docket No. 2008-0273, at 8 (June 14, 2011).

D. Regulatory and Ratemaking Issues.

1. Access to Transmission and Obligation to Provide Utility Service.

172. Access to transmission should be pursuant to objective interconnection requirements that are non-discriminatory in terms of HECO-owned generation versus third party generation. However, preferential access to the cable is warranted, and should be provided to, renewable resources. The legislature has made clear that an interisland cable "would enable Hawai'i to make better use of its abundant natural renewable energy resources...."[124] Thus, there should be no discrimination among renewable resources.

173. With respect to an obligation to provide utility service, the CCC will not be similar to traditional, load-serving utilities. Thus, all aspects of the traditional obligation to serve may not apply to the CCC. However, the common element is that the selected CCC, as a certificated public utility, will be subject to a continuing obligation to operate the Cable Project, and would not be allowed to discontinue this obligation without prior authorization from the Commission.

2. Cost of Service/Revenue Requirement.

174. The threshold question of costs and benefits of the project are before the Commission in the instant proceeding.[125] In this regard, Chapter 269-132(c)(5) of the Hawai'i Revised Statutes provides important guidance on issues pertaining to cost.[126] Any competitive

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[124] Haw. Rev. Stat. § 269-132; *see also id.* (stating that "[a]n interisland undersea cable has been identified as an effective and efficient means to introduce the variety of utility scale renewable energy available through the Hawaiian islands....").

[125] *See* Cable Investigation Order at 10 (stating that "the instant proceeding shall invite comment [on] and evaluate...[w]hether and to what extent the benefits to Hawai'i ratepayers of an undersea O'ahu-Maui grid interconnection would exceed its costs").

[126] *See* Haw. Rev. Stat. § 269-132(c)(5) (stating that, in the certification process, "the commission shall review and determine ratemaking principles appropriate and applicable to the high-voltage electric transmission cable system during commercial operations"); *see also* Haw. Rev. Stat. § 269-132(c)(6) (discussing the determination of the CCC's authorized rate of return).

solicitation the Commission may issue should not be overly prescriptive in terms of how bidders may propose to recover costs and/or develop revenue requirements. Nonetheless, the competitive solicitation should provide guidance as to the fundamental ratemaking considerations bidders should address to: (1) provide guidance to potential bidders; (2) facilitate evaluation of the various proposals by enabling comparisons on common, threshold issues; and (3) ultimately inform the Commission's determination of costs and benefits.

175. *Projected Capital Costs*: As indicated above, DBEDT's analysis is based on capital cost projection of $702 million, which is roughly commensurate to the capital expenditure figure contained in the HECO Companies' IRP. The Commission should require bidders to identify the projected capital costs of the proposal. If and when a revenue requirement and rates are ultimately established, the initial capital cost projection will serve as an important baseline in evaluating the reasonableness and prudence of actual costs.

176. *Timing for Submitting Revenue Requirement Proposals*: The statutory provision that sets forth the CCC certification process states that, in that process, "the commission shall review and determine ratemaking principles appropriate and applicable to the high-voltage electric transmission cable system during commercial operations."[127] While the statute is clear that those "ratemaking principles shall be used in determining the [C]ertified [C]able [C]ompany's revenue requirement,"[128] it is not explicit as to when the determination of the CCC's revenue requirement is to be made. To the extent the Commission and interested parties can identify costs earlier in the development process, as opposed to later, overall costs are likely to be reduced, thereby facilitating project financing and further ensuring that the Cable Project is

[127] Haw. Rev. Stat. § 269-132(c)(5).

[128] *Id.*

in the public interest. Accordingly, the competitive solicitation should ask parties to propose both a: (1) fixed revenue requirement that assumes none of the environmental review and permitting requirements have been undertaken; and (2) a floating revenue requirement that assumes environmental review and permitting requirements have been established. This information is important because project risks, and therefore costs, may change depending on the point in time in which the revenue requirement is established. For example, holding all else equal, developing a revenue requirement prior to completion of environmental review and permitting processes may result in higher costs than would be expected if the revenue requirement were developed after environmental review and permitting processes are complete.

177. *Credit Ratings*: Today, major generation/transmission projects are often developed by an unrated limited liability company using project finance to avoid recourse to the limited liability company's parent. To address this situation, we recommend doing what has been done in a number of solicitations for large utility projects—either requiring one grade above investment grade rating or other demonstration of creditworthiness/financial security. These alternatives can include the entity putting up a letter of credit or parental guaranty in a sufficient amount to cover identified risks. In addition, the developer's sources of debt and equity would need to be reviewed to evaluate the entity's financial wherewithal to complete the project. However, all relevant credit rating information that is available should be presented in the competitive solicitation.

178. *Incentive Adders to Return on Equity*: DBEDT recognizes that a competitive rate of return is required to facilitate the financing for the Cable Project. Accordingly, the Commission should not preclude bidders from including incentive rate proposals in bids. For example, the Federal Energy Regulatory Commission awarded incentive return on equity adders

to independent transmission companies because these entities' for-profit nature, combined with a transmission- only business model, has been found to enhance asset management and access to capital markets, as well as provide greater incentives to develop innovative services.[129] However, the competitive solicitation should require any bidders seeking incentive rates to explain the basis for the incentives, including but not limited to an explanation of how benefits of the project result directly from the incentives requested.

179. *Cost Recovery for Project Cancellation/Termination*: The legislature provided bidders the opportunity to recover prudently incurred costs if the project is cancelled or terminated. However, bidders may want to forgo that opportunity, at least to some degree, in order to distinguish their proposals or signal a willingness to assume more risk in exchange for a better opportunity at being selected to construct the Cable Project. Thus, the competitive solicitation should ask proposers to explain, in detail, whether their proposed cost recovery mechanism would be limited to some of the costs of permitting, development, and construction, etc., or whether bidders would intend to pursue the maximum abandoned plants costs available.

180. *Regulatory Process for Adjusting Rates*: In order to attract potential investors in the project, the Commission should, consistent with the enabling legislation, state a preference for providing rate certainty through a "rate moratorium." Specifically, DBEDT recommends that the competitive solicitation require bidders to specify short-term, mid-term, and long-term rate moratoria to which the bidders would agree. Bidders should explain the benefits and detriments of each proposed period. The competitive solicitation should contemplate that the initially authorized return on equity would be in effect through the rate moratorium and, if circumstances warrant, could be subject to change in the subsequent rate filing that would be required at the end

[129] *See, e.g., Startrans IO, L.L.C.*, 122 FERC ¶ 61,306 at P 19 (2008).

of the moratorium period. In addition, as a means of facilitating development of the Cable Project and reducing risk and uncertainty, the Commission should consider whether an *ex ante* prudence determination (*i.e.*, pre-approval) is authorized and warranted.

181. *Other Cost Considerations*: The Cable Project will be a long-lived asset that is an important component of the HCEI and the State's efforts to meet its renewable energy goals. Therefore, the Commission should acknowledge the potential for advancements in technology that could further positively impact the Cable Project, as well as the potential beneficial impact those advancements may have on rates.

182. *Other Ongoing Regulatory and Ratemaking Policies or Processes*: As discussed above, a PEIS is currently underway. In addition, a competitive solicitation process will be used to select a Cable Project developer as the CCC, and the CCC will be required to filed an application for a CPCN. These processes may give rise to additional considerations, or may provide new insight, that may warrant reconsideration of the ratemaking process to better facilitate development of the Cable Project. Through its role in overseeing the development process, DBEDT will be diligent in identifying any such issues and will advise the Commission accordingly.

V. CONCLUSIONS AND RECOMMENDATIONS

183. DBEDT commends the Commission for initiating this investigation and seeking to build a record on which it can base a finding as to whether an interisland transmission system connecting O'ahu and Maui is in the public interest. As the Commission is well aware, Hawai'i has embarked on an aggressive, yet necessary, 21st century energy agenda. That agenda is based on the following five principles: (1) a diversified energy portfolio; (2) connecting the islands through integrated, modernized grids; (3) balancing technical, economic, and cultural

considerations; (4) leveraging our international status as a clean energy test bed; and (5) allowing the market to pick winners. With these principles serving as a guide, the fundamental question for the Commission to answer in the instant investigation is: Is an interisland transmission cable connecting O'ahu and Maui in the public interest? As set forth herein, DBEDT's analysis demonstrates that the answer to this question is an unequivocal "yes."

184. DBEDT's experienced consultants applied a sophisticated engineering model that studied multiple scenarios with a variety of inputs. At conservative levels of wind shift from O'ahu to Maui (of just 100 MW—the low wind shift case), DBEDT reached one inescapable conclusion—the net benefits of constructing an interisland transmission cable that connects O'ahu and Maui outweigh the costs. The benefits would be more pronounced if DBEDT's studies had the benefit of the data identified above in paragraph 4. These benefits include reduced dependence on fossil fuels, lower fuel costs and less exposure to price volatility, environmental benefits, increased capacity factors for wind generation, reduced curtailment of renewable generation, reliability benefits, increased energy security, lower reserve margins, enabling lower cost generation resources to serve additional load, and helping the State meet its Renewable Portfolio Standard. DBEDT acknowledges that the costs of an interisland grid tie are not inconsequential, and the proposed Cable Project poses many challenges. However, DBEDT's analysis confirms that the costs are outweighed by the benefits and the challenges are manageable. Thus, a grid tie connecting O'ahu and Maui is not only consistent with the principles underlying the State's 21st century energy agenda, but would make a substantial contribution to achieving the State's clean energy policies.

185. In addition to presenting its analysis, DBEDT stresses that the time for action is now. Achieving the State's clean energy goals and promoting Hawai'i's clean energy economy

are part of a transformational process that is required to redefine the energy landscape in Hawai'i. There is no meaningful difference between a delay to that transformational process and opposition to it. Accordingly, urgency for action is a core strategy for furthering the State's energy policies. Based on the foregoing, DBEDT respectfully urges the Commission to find that an interisland transmission cable connecting O'ahu and Maui is in the public interest. Thus, the Commission should proceed with commencing a competitive solicitation process in order to facilitate development of an interisland transmission system connecting O'ahu and Maui.

WHEREFORE, the Department of Business, Economic Development, and Tourism respectfully requests that the Commission consider the foregoing comments and, in an expeditious manner, take action consistent with the positions set forth therein.

Respectfully submitted,

Gregg J. Kinkley
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Commerce and Economic Development Division
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(808) 586-1205 facsimile

Index of Appendices

Initial Comments of the Department of Business, Economic Development, and Tourism Docket No. 2013-0169 (September 9, 2013)

Appendix A
Curricula Vitae

The project team that participated in the development of these Comments includes:

- Mark Glick
- Robert Mould
- Jeffrey Genzer
- Bhaveeta Mody
- Seth Lucia
- Jason Gray
- James Broder
- Amanvir Chahal
- Robert Marks
- Robert Kendall
- Dia Koujak
- Laurie Oppel
- James Peterson
- Matthew Tanner

Address: P.O. Box 2479, Honolulu Hawai'i 96804
Phone: 808-347-8745
Email: markglick808@gmail.com
Date of Birth: 23 May 1958
Nationality: USA

CV: Mark B. Glick

Career Summary:
Glick has been at the forefront of energy and environmental policy in the United States and abroad dating back to his tenure as senior advisor to the Texas Land Commissioner from 1987 to 1991. For the next decade, Glick was a successful small business owner focused on reducing air pollution in urban areas, securing contracts and grants for clean fuel and emissions reductions projects from the U.S. Department of Energy, the Gas Research Institute, Southern California Gas Company, Pacific Gas & Electric and the New York City Department of Transportation in Los Angeles, Boston, San Francisco and New York City.
Returning to the public sector in 2003, Glick headed two divisions for the Office of Hawaiian Affairs from 2003 to 2010. As Director of Economic Development, Glick managed four cost centers with an annual budget of approximately $4 million and more than $30 million under management; leading changes to the agency's 17-year old low-interest financing program resulting in greater than ten-fold productivity gains and self-sufficiency for the first time in the program's history; and helping Hawai'i businesses secure more federal and state contracts with the establishment of the Hawai'i Procurement Technical Assistance Center.

Glick joined the Department of Business, Economic Development, and Tourism (DBEDT) in July of 2010 and was selected as Administrator of the State Energy Office in October of 2011.

Specialties: *Public management, energy programs and policies, business development, environmental advocacy and policy, grant management & writing, lending programs, Native Hawaiian issues.*

Community Service:

- ***Board of Directors,* Washington Place Foundation** (2011–present)
- ***Vice President, Board of Directors*, Friends of Honouliuli** (2008-present)
- ***Member*, Hawai'i Energy Policy Forum (2005-present)**
- **Chairman of the Executive Committee, Sierra Club Hawai'i Chapter** (2008-2011)
- **Native Hawaiian Revolving Loan Fund Board** (member, 2007-2010)
- **Hawai'i Community Based Economic Development Advisory Council** (member, 2005-2010)

Professional Experience

10/14/11 to present ***Administrator***

Hawai'i State Energy Office

Department of Business, Economic Development, and Tourism

Manages, develops, oversees and implements statewide energy programs, policies, and initiatives that support Hawaii's nationally regarded clean energy agenda, as well as moving the State forward in Hawaii's pursuit of a clean energy economy.

7/23/10 to 10/14/11 ***Energy Project Manager & Senior Advisor***

Hawai'i State Energy Office

Department of Business, Economic Development, and Tourism

Glick managed $9.59 million in Recovery Act projects to increase the number of renewable energy and energy efficiency installations in Hawai'i and introduced the GreenSun Hawaii low-interest loan program featuring major Hawai`i financial institutions and credit unions.

8/16/05 to 3/15/10 **Director of Economic Development**

Office of Hawaiian Affairs (OHA), Honolulu, Hawai'i

Glick developed and managed various business development, financial, grant, and training & technical assistance programs. Primary accomplishments included the innovative restructuring of the $28 million Native Hawaiian Revolving Loan Fund program, overseeing the formation of Pacific Network Television (www.pacificnetwork.tv) and the Hawai'i Procurement Technical Assistance Center and managing the Consumer Micro Loan and the Consumer Based Economic Development (CBED) Grant programs. Glick often served as signatory for the Deputy Administrator in the Deputy's absence.

7/21/03 to 8/16/05 **Director, *Office of Board Services, OHA***

Inaugural director of the Office of Board Services, a division of the Office of Hawaiian Affairs (OHA) created in mid-2003 with the primary responsibility to ensure that OHA Administration effectively and efficiently carries out the policies and actions of the Board of Trustees. Glick established OHA's Action Item Monitoring & Reporting process and Records Management Program, including consolidation of all Board of Trustees minutes, policies, by-laws and related materials that support the actions of the Trustees. Other key responsibilities included managing OHA facilities in O`ahu, Maui, Moloka`i, Hawai`i and Kaua`i; contract coordination of capital grants for facilities; and publishing the Native Hawaiian Data Book.

May 1996- ***President, GANA INC.***

July 2003 ***Austin, Texas***

Co-founder and manager of a business systems integration and consulting firm dedicated to establishing alternative fuel transportation, including pioneering efforts in the marine environment.

- Secured contracts and grants from the U.S. Department of Energy, the Gas Research Institute, Keyspan Energy Delivery, Pacific Gas & Electric and the New York City Department of Transportation for clean fuel and emissions reductions projects in Boston, San Francisco and New York City.
- Formed a strategic partnership with Keyspan Energy Delivery and the Urban Harbors Institute – University of Massachusetts Boston to develop a comprehensive natural gas ferry initiative in Boston Harbor funded by federal grants, state Chapter 91 mitigation funds and private sources.
- Assisted in passage of California SB-428 creating the San Francisco Bay Water Transit Authority.
- Advised the Federal District of Mexico in developing a price of LNG and CNG for retail fuel vehicle sales.

March 1994- ***President, Global Environmental Technologies, Inc.***
May 1996 ***Austin, Texas***

- Managed operations of international firm that assembled fuel stations dispensing natural gas vehicular fuel. Negotiated international letters of credit & project financing for major projects.
- Built and delivered the world's three largest containerized CNG refueling stations under contract to the country of Bangladesh.
- Served as Acting CEO and crisis manager of the firm's publicly-traded corporation parent.

January 1991- ***Partner, 4E Technologies, Inc.***

March 1994 ***Austin, Texas and Los Angeles, California***

Co-founder of a consulting firm dedicated to cost-effective environmental solutions for air, water and soil. Created the "Texas Commitment" for the Governor of Texas, a successful strategy to maintain operations of a General Motors vehicle assembly plant. Conceived and coordinated the formation of EcoTrans Industries, Inc., an $8 million joint venture with Southern California Gas Company to produce the first vehicle ever certified by EPA to the Inherently Low Emission Vehicle standard.

October 1987- ***Executive Assistant to the Commissioner, Texas General Land Office***
January 1991 ***Austin, Texas***

Senior Advisor to the Texas Land Commissioner, an appointed position to a statewide elected official responsible for managing more than 20 million acres of state-owned lands and waters. Supported and monitored all of the Commissioner's work outputs and represented the Commissioner in his absence at public functions and policy-making forums. Was a key member of the Commissioner's senior management team responsible for managing the agency's 600 employees and $20 million operating budget. Helped establish the agency's energy resource initiatives, including creation of the State of Texas' acclaimed alternative fuels program. Accomplishments included:

- Assisted in writing and gaining passage of amendments to the Texas Clean Air Act in 1989.
- Assisted in writing and gaining passage of the federal Clean Air Act Amendments of 1990.
- Assisting agency efforts secure designation of the Wider Caribbean as a special area under MARPOL Annex V and establishment of Texas' comprehensive oil spill response program.
- Raising $1.1 million from a consortium of 10 electric and gas utilities to build GMC Sierra pickup trucks operating on CNG in the first commercial natural gas vehicle roll-out by a major auto manufacturer.

August 1986- ***Special Assistant for Economic Development & Systems Planning***

October 1987 ***Office of the Chancellor, Lamar University System; Beaumont, TX***

Assisted the Chancellor with university system reorganization and special projects. Authored two studies for the University's John E. Gray Institute on economic development opportunities for the software and plastics industries in S.E. Texas.

June 1977- **Operator, Port Arthur Refinery, Gulf Oil Corporation; Port Arthur**
August 1984

Operated a four-person petrochemical unit producing high-octane gasoline and jet fuel in Gulf Oil's largest refinery, the last four years while attending college full-time.

Education

Master of Science, Public Management and Policy; Carnegie-Mellon University, May 1986
Bachelor of Arts, Mathematics; Lamar University, August 1983

Supplementary Education

Post-graduate studies in Political Economy, concentration in regional and economic development; University of Texas at Dallas, 1987-1992

Professional & Community Service Affiliations

- *Senior Associate*, Urban Harbors Institute, University of Massachusetts Boston (www.uhi.umb.edu) (1999-present)
- Vice President, Board of Directors, Friends of Honouliuli (2008-present)
- Director, Washington Place Foundation www.washingtonplacefoundation.org (2011-present)
- *Hawaii Energy Policy Forum* www.hawaiienergypolicy.hawaii.edu (2005-present)
- *Executive Committee,* Sierra Club Hawai'i Chapter (2006-2011) www.hi.sierraclub.org
- Member, Native Hawaiian Revolving Loan Fund Board (Nov. 2007-July 2010)
- *Board of Directors, Secretary*, KAHEA: The Hawaiian-Environmental Alliance (www.kahea.org) (2002-2010)
- *Committee Member, US Coast Guard Alternative Fuels Project Committee* (1996-1997)
- *Member, Natural Gas Advisory Committee*, Texas Air Control Board (1993-1994)
- *Member, Federal Fleet Conversion Task Force Working Group on Federal, State and Local Programs and Regulations* (1993)
- *Member, Natural Gas/Electric Utility Dialogue Group* (Coordinated by CONSAD Research Corp. and the US Environmental Protection Agency – 1989-1991)
- *Member, Gas Research Institute NGV Technology Project Advisory Group* (1989-1991)
- *Founding Member, Clean Air Texas* (established in 1988)
- *Member, Natural Gas Policy Group* (Coordinated by the World Resources Institute – 1988)

Publications, Special Reports & Certifications

FY 2002 CMAQ Proposal: Introducing Compressed Natural Gas Passenger Ferries in Boston Harbor. Submitted to the Boston Metropolitan Planning Organization by GANA Inc. & the Urban Harbors Institute – University of Massachusetts Boston. (April 2001)

Natural Gas as a Transportation Fuel: Energy and Environmental Benefits in Urban Ferry Service, Alex Farrell, Carnegie-Mellon University; Mark Glick, GANA, Inc.; Presented at the Transportation Research Board 2000 Annual Meeting and published in Transportation Research Records (2000)

The Clean Urban Transportation Initiative, GANA Inc. & the Urban Harbors Institute – University of Massachusetts Boston. Gas Research Institute publication (1998)

Certification: Inherently Low-Emission Vehicle (ILEV). Issued by: The United States Environmental Protection Agency, Office of Mobile Sources. #PAS-LDT-94-01. [note: This was the 1st ILEV certificate ever issued for the ILEV standard](October 19, 1993)

Presidential Executive Order 12844 -- Prepared by: 4E Technologies, Inc. and the Texas General Land Office. (Signed by President Clinton on April 21, 1993)

Natural Gas Vehicles for Mexico City: Emissions Reductions and Economic Benefits, 4E Technologies Inc. and Tren Fuels, Inc., Report to the Federal District of Mexico (June 1992)

Estimating Emissions Reductions from a Comprehensive Dallas-Ft. Worth NGV Program, 4E Technologies, Inc. Report to the Dallas City Council (July 1992)

"Texas Commitment to Natural Gas Vehicles and the General Motors-Arlington Plant." Action Plan to Governor Ann Richards, Prepared by: Mark B. Glick, B. Thomas Henderson, and Blanton Moore (Executive Summary: January 6, 1992; Action Plan: January 14, 1992)

Putting Together the Pieces, Recapitalization of the Texas Economy, B. Thomas Henderson, Craig Donegan, Lee Solsbery, Mark Glick, et al; a Texas General Land Office publication (1989)

Software Development in Southeast Texas, a John E. Gray Institute publication (1987)

Establishing the Plastics Industry in Southeast Texas, a John E. Gray Institute publication (1987).

The Beaumont Plan, an Organizational Guide, a comprehensive management plan for the City of Beaumont after the ESM crisis, a Carnegie-Mellon University graduate report (1986)

Advocacy & Rulemaking

Hawai`i Legislature:

Since 2003, Glick has testified before the Hawai`i Legislature on several hundred legislative proposals relating to energy, economic development and the environment as Administrator of the Hawai`i State Energy Office, an officer of the Office of Hawaiian Affairs, board member of KAHEA: The Environmental Alliance and the Sierra Club Hawai`i Chapter, and member of the Hawai`i Energy Policy Forum. For two consecutive years, Glick also helped organize a statewide coalition advocating priority environmental measures. (see below)
http://www.hi.sierraclub.org/press/releases04-05/2005/2.1.05BriefingBook.pdf
Presentation: "Boston Harbor CNG Passenger Ferry Initiative." Massachusetts Clean Cities Executive Committee Meeting, December 18, 2001 (JFK Federal Bldg, Boston)

"Workshop on Alternative Fuels for Ferries/Ships." Panel Discussion. Hosted by the Maritime Administration, November 1-2, 2000 (Naval Air Station Officer's Club - Alameda, California)

"Next Generation Ferry/Coastal Ship Cooperative Research Meeting." Panel Discussion. Hosted by the Maritime Administration. August 25, 1998 (Merchant Marine Academy, Great Neck, New York)

"Development of Rules for Natural Gas on Ships," US Coast Guard Alternative Fuels Working Group Meeting, March 12-13, 1997 (Washington DC)

USA Representative, "The Use of CNG, LNG and LPG as Fuels for Internal Combustion Engines." Organized by the United Nations Economic Commission for Europe, Committee on Energy, Working Party on Gas. Helped prepare & present "Report of the Symposium" at the invitation of symposium Vice-Chairman E.I. Williamson (United Kingdom) September 23-27, 1991 (Kiev, Ukraine)

California Foundation on the Environment & the Economy, "Roundtable Gas Conference." October 18-19, 1990 (Carmel, California)

Robert Rockwell Mould
Renewable Energy Branch
Hawaii State Energy Office
Division of the Department of Business, Economic Development and Tourism (DBEDT)
Email: Robert.R.Mould@dbedt.hawaii.gov
Tel: (808) 587-3880

Description of Current Roles and Responsibilities

- Provides technical and analytic support and project management for integrated and comprehensive energy planning and policy development functions, program activities and projects to support the DBEDT Director's statutory role and functions as State Energy Resources Coordinator, the SEP objectives, and the achievement of the State's energy goals and policies.

- Designs, develops, evaluates, and recommends energy plans, policies, programs, and projects to support the ERC's statutory roles and objectives. Prepares and develops impact analysis of energy plans, policies, projects and program activities to determine the financial, economic and environmental benefits and costs. Develops quantitative models to support recommendations.

- Analyses and applies up-to-date working knowledge of market data and information, and public and private sector sources relating to energy, fuel supplies, prices, transportation, distribution and storage infrastructure; and other energy data and information.

- Attends meetings with Federal, State, and local government officials and staff, representatives of the private business sector, and other energy stakeholders to obtain and provide information about energy planning and policy matters; serves as staff resource person on committees and tasks forces dealing with energy-related matters, and to represent DBEDT or SID, as assigned by the Renewable Energy Branch Chief.

- Develops, evaluates, drafts, and recommends proposed legislation on energy and related functional areas; reviews and prepares analysis of legislations under consideration; and formulates and recommends DBEDT positions and testimonies.

Prior Professional Experience

Lumen Solar LLC, Honolulu, HI Jan. 2011 to Jul. 2013
Partner, Business Development Director

- Led business development initiatives and consulting practice for Hawaii-based wholesaler of PV, solar thermal, and energy efficiency products.
- Developed economic cost/benefit models for residential, commercial and utility-scale energy projects.
- Consulted clients and prospective customers on optimum project financing structures.
- Provided market and company analysis on global, national and local renewable energy trends and best practices.

Estramina Capital, LLC, New York, NY Mar. 2009 to Dec. 2010
Co-founder, Managing Principal

- Managed investment fund focused on US municipal property tax liens and related assets.
- Oversaw buy/sell decision-making, credit analysis and due diligence with primary accountability for portfolio risk and return; developed the firm's proprietary investment process and portfolio management tools.
- Built the firm's operating and financial model; prepared all financial reports for investors.

AIG Investments, New York, NY Jan. 2005 to Jan. 2009
Research Analyst, Global Equities

Lead Analyst, Canada *Nov. 2007 to Jan. 2009*
- Managed stock selection and sector allocation for $100 million Canadian portfolio.
- Covered over 100 stocks across all sectors and industries with concentration in energy, materials, utilities and financials.
- Implemented fundamental investment process and company research combining elements of growth, value and quantitative investing styles.
- Built detailed company financial models and valuation analyses; wrote sector and stock recommendation reports for management and clients.

Global Equity Analyst *Jan.2005 to Nov. 2007*
- Responsible for fundamental analysis, stock selection and portfolio construction for the Developed Europe segment of global equity portfolio (~$400 million).
- Prior to specific European portfolio responsibility, researched stocks across all sectors for ~$2 billion global equity portfolio.
- Identified and developed macro investing strategies across industries, asset classes and regions, e.g., mortgage crisis hedge, global food and agriculture, emerging market infrastructure, emerging market financial services, EU market expansion.
- Recommended monthly sector allocation and portfolio positioning to Global Head of Equities and the AIG Global Asset Allocation Committee consisting of firm's senior executive committee.
- Sat on firm's sustainable investment committee; developed and wrote firm's sustainable investment policy for integrating environmental, social and governance criteria into equity investment process.

The McKenna Group, LLC, Mountain View, CA 2000-2002
Consultant
- Consulted Fortune 500 firms and start-up ventures on market development and commercialization strategies for new and emerging technologies.
- Led "Innovation 100" survey initiative designed to identify best practice innovation strategies.

I-Drive.com, Inc., San Francisco, CA 1999-2000
Business Development Manager, Universities and Education
- Created and implemented sales and marketing strategy for education vertical.
- Identified new revenue opportunities and negotiated partnerships with universities, educational technology companies, and software service providers throughout the United States.
- Recruited and managed a consortium of over 30 universities for co-developing, hosting and marketing our internet file-sharing and social media services platform.

AltAmerica, LLC, Buenos Aires, Argentina 1998-1999
Co-founder, Director of Business Development
- Co-founder of consumer-targeted, community-based website for Argentina, Brazil, Chile, Colombia and Mexico.

- Responsible for revenue generation strategy; led business development initiatives.

Lowe & Partners/ SMS, New York, NY 1994-1997
Senior Project Manager, Lowe / Critical Mass Interactive
- Managed Internet communications and marketing account for a Mercedes-Benz of North America, including construction of the company's initial web site.
- Developed and launched national e-commerce, customer retention and dealer relationship strategy.

Education

Johns Hopkins School of Advanced International Studies (SAIS) Washington, DC
M.A., Economics and International Relations May 2004
- Graduated with Honors; top 5% of class.
- Concentrations in International Economics and Latin American Studies; specialization in Emerging Markets Finance.

Yale University New Haven, CT
B.A., History May 1993
- Senior essay on U.S.-Latin American Trade Relations.

Jeffrey C. Genzer

Education

- Haverford College, B.A. (Honors/History), 1978
- Washington College of Law, The American University, J.D., 1983

Bar Admissions

- District of Columbia
- United States Claims Court
- United States District Court for the District of Columbia
- United States Court of Appeals for the District of Columbia Circuit

Honors

- "2010 Champion of Energy Efficiency in Buildings" - American Council for an Energy Efficient Economy

Experience

Mr. Genzer joined Duncan, Weinberg, Genzer, & Pembroke, P.C. (DWGP or Firm) in 1985 and currently serves at the Firm's Vice President. His practice has concentrated on energy and environmental counseling, project development, legislative advocacy and litigation. He has worked on electric and natural gas ratemaking, energy project development, bulk power supply, transmission system issues and developments, contract negotiation and implementation, franchise issues, alternative energy resources (including wind, solar, geothermal, ocean, biomass, waste, etc.) and conservation and energy efficiency programs. Through his career, Mr. Genzer has appeared before a variety of federal and state agencies and courts, including especially the Federal Energy Regulatory Commission, the Department of Energy, the Environmental Protection Agency, and a variety of state public utility commissions. His environmental work has included compliance under the National Environmental Policy Act (NEPA), including Environmental Impact Statement development and review; Clean Air and Clean Water Act compliance; and all types of permitting.

Mr. Genzer has specific expertise that is pertinent to the questions posed and issues raised in Docket No. 2013-0169. Notably, Mr. Genzer has been regularly involved in counseling clients on issues relating to environmental permitting and environmental reviews for energy projects. Mr. Genzer also has a wealth of experience on clean energy related issues in Hawaii. Specifically, Mr. Genzer has advised the Department of Business, Economic Development, and Tourism (DBEDT) since the 1980s on activities ranging from dedicated access to the strategic petroleum reserve, state energy legislation, energy emergency planning, and matters before the Public Utilities Commission. In an advisory capacity to DBEDT, Mr. Genzer helped to draft portions of the four major state energy laws in Hawaii in 2006: (1) Act 95, Hawaii's Renewable Portfolio Standard; (2) Act 96, which established green building practices; (3) Act 162, which established and funded the public benefit fund that administers Hawaii's energy-efficiency and demand-side management programs; and (4) Act 240, which increased renewable tax credits, established a renewable hydrogen program that is administered by our client, and established a

20% renewable fuels standard. Mr. Genzer has also led DWGP's efforts to counsel DBEDT on a variety of dockets, Docket Nos. 2008-0083, 2008-0273, 2009-0108, 2011-0206, and 2012-0036.

In addition, Mr. Genzer has worked with a number of local and state governments throughout the United States from New York to Hawaii. He is often called upon to serve as a speaker or panelist regarding federal and state legislative activities, energy, environmental and utility issues. Mr. Genzer presently serves as General Counsel to the following organizations, among others: the National Association of State Energy Officials (NASEO), the National Association of Energy Service Companies, the National Energy Assistance Directors' Association and the Energy Programs Consortium. Mr. Genzer has served as NASEO's counsel since the organization was formed in 1986. He advises the state energy directors on federal and state activities, shares "best practices," develops model programs, and works closely with federal agencies and Congress. He represents and has represented scores of other associations over the years.

Prior to joining DWGP, Mr. Genzer served as Staff Counsel to the Committee on Energy and Environment of the National Governors Association. In that role he drafted legislation in the energy and environmental area, and served as the chief energy lobbyist for the Association. He provided legal analysis for the Governors on such issues as electric utility regulation, environmental law issues, nuclear waste, oil overcharge refunds, toxic victims compensation and natural gas regulation. Mr. Genzer also coordinated the activities of the state energy offices. Mr. Genzer was also employed at the National Consumer Law Center. He monitored legislative and regulatory activities and wrote legal and policy memoranda in the field of energy law. Mr. Genzer also served as a Peace Corps Volunteer in Micronesia. He worked on a number of development projects and served as the first energy planner in the region. Mr. Genzer supervised, planned, and constructed numerous water systems and other construction projects.

Organizations

- American Bar Association
- Energy Bar Association
    - (Vice Chairman, Energy Research and Development Committee 1990-1991)
    - (Chair, Legislation and Regulation Committee (1994-95))
- The District of Columbia Bar

Bhaveeta Kapoor Mody

Education

- Syracuse University College of Law, J.D., *cum laude*, 1999
- Rutgers College, Rutgers University, B.S., 1997

Bar Admissions

New Jersey
New York
District of Columbia
United States Court of Appeals for the Third Circuit
United States Court of Appeals for the Ninth Circuit
United States Court of Appeals for the District of Columbia Circuit

Experience

Ms. Mody's practice focuses on public utility and administrative law and litigation, with emphasis on representation in electric matters, including ratemaking, rulemaking, restructuring, and other regulatory proceedings before the Federal Energy Regulatory Commission, state commissions and the Federal courts.

Ms. Mody has regulatory and policy experience that is directly relevant to assisting the Department of Business, Economic Development, and Tourism (DBEDT) in Docket No. 2013-0169, the investigation on whether an Oahu-Maui inter-island transmission system may be in the public interest. Ms. Mody has provided regulatory and policy guidance to DBEDT in various proceedings before the Hawaii Public Utilities Commission (HPUC). For instance, Ms. Mody has served DBEDT in an advisory capacity with respect to the Hawaiian Electric Companies' 2012-2013 Integrated Resources Planning process proceeding in HPUC Docket No. 2012-0036. Ms. Mody also actively participated as part of DBEDT's consulting team in the Reliability Standards Working Group proceeding in HPUC Docket No. 2011-0206. Ms. Mody also served in an advisory capacity pertaining to the Feed-in Tariff proceeding in HPUC Docket No. 2008-0273. Ms. Mody has also advised DBEDT with respect to a variety of legislative matters (both pending and enacted legislation), including: (1) Act 162, which established and funded the public benefit fund that administers Hawaii's energy-efficiency and demand-side management programs, (2) Act 166, the Hawaii Electric Reliability Administrator, (3) Act 165, the Inter-Island Transmission System; and (4) SB 379 (2013), virtual net metering.

In addition, Ms. Mody has counseled clients on various issues pertaining to transmission ownership and transmission service, including matters concerning public utility requests for transmission incentive rate treatment, transmission planning and cost allocation, transmission-related agreements and tariffs, and rate cases involving both formula and cost-of-service rates.

Ms. Mody has represented municipal entities, electric cooperatives and state commissions on matters involving also has significant experience representing entities located within or adjacent

to Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs) throughout the nation, including with respect to market design issues such as locational marginal design, seams elimination charges, intertie pricing, and provision of ancillary services and capacity. Ms. Mody has also counseled clients on a wide range of state and Federal regulatory and legal matters, including as to feed-in-tariffs, merger and divestiture proceedings, government tort claims laws, and various energy-related contracts.

Ms. Mody also has experience counseling clients regarding the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 and regulations stemming therefrom issued by the Commodity Futures Trading Commission. Ms. Mody has advised clients on the implications of those rules, regulations and proposed rulemakings on their energy-related activities and to ensure their compliance with applicable rules and regulations.

Ms. Mody also has experience in telecommunications law, including representation on matters involving various Federal Communications Commission rules and regulations and state and local cable franchise regulations. For instance, Ms. Mody has counseled clients on compliance with rules and regulations pertaining to customer proprietary network information and retransmission of copyright broadcasted programming. Ms. Mody has also assisted clients in legislative matters pertaining to cable franchising.

Prior to joining DWGP in 2004, Ms. Mody worked as a Deputy Attorney General for the New Jersey Office of the Attorney General, Division of Law for approximately three years. As a Deputy Attorney General, Ms. Mody represented the New Jersey Board of Public Utilities and in that capacity, litigated rate cases involving electric, gas, cable, telecommunications and water utilities. Ms. Mody also litigated solid waste compliance violations and permit appeal matters on behalf of the New Jersey Department of Environmental Protection in administrative and appellate courts.

Publications

- Contributing Author, *CAISO and the California Markets*, in CAPTURING THE POWER OF ELECTRIC RESTRUCTURING (Joey Lee Miranda ed., 2009).
- Contributing Author, *FERC Practice and Administrative Law Judges Committee Report*, ENERGY LAW JOURNAL, Volume 32, No. 2 (2011).
- Contributing Editor, *FERC Practice and Administrative Law Judges Committee Report*, ENERGY LAW JOURNAL, Volume 33, No. 2 (2012).

Organizations

- Energy Bar Association –Co-Chair of the FERC Practice & Administrative Law Judges Committee (April 2012 – May 2013).

Presentations

- American Public Power Association, Legal Seminar 2011, "FERC's Transmission Rate Incentives: Trends and Outlook" (with Peter J. Scanlon).

Seth T. Lucia

Education

- University of Colorado School of Law, J.D. 2005
- Georgetown University, B.A. *cum laude*, Honors in English, 2000

Bar Admission

- Colorado
- District of Columbia
- United States Court of Appeals for the District of Columbia Circuit
- United States Court of Appeals for the Ninth Circuit

Honors

- Recipient of the Student Award in Natural Resources for outstanding scholarship and service in natural resources and environmental law, 2005
- Articles Editor and Member of the Editorial Board, Colorado Journal of International Environmental Law & Policy, 2004-2005
- Member of winning interdisciplinary team, Andersen Sustainable Venturing Competition, University of Colorado Leeds School of Business, 2004

Experience

Prior to law school, Mr. Lucia worked as an environmental consultant, regularly performing Phase I due diligence assessments and environmental audits of energy and manufacturing facilities in the U.S., as well as Latin America. Between second and third years of law school, Mr. Lucia accepted a Summer Associate position with the Firm where he gained experience in administrative law and litigation and energy and environmental regulatory matters. Since joining the firm, Mr. Lucia has gained extensive experience in the areas of communications law, project development, energy law and economic regulation, environmental law, and administrative law. Mr. Lucia also has extensive knowledge of federal Indian law from broad experience representing the interests of a federally-recognized American Indian tribe in various legal contexts. He has also successfully assisted clients through the process of securing federal funding in the form of grants and loans.

Mr. Lucia has legal experience that is directly relevant to assisting the Department of Business, Economic Development, and Tourism (DBEDT) in Docket No. 2013-0169. Mr. Lucia participates in a variety of environmental matters and regularly counsels clients on renewable energy development and greenhouse gas policy. He has assisted in developing environmental impact statements, and drafting comments in rulemakings at the Environmental Protection Agency, the Federal Energy Regulatory Commission (FERC) and state public utility commissions.

Mr. Lucia has significant experience assisting clients in the development of renewable and alternative energy projects, including landfill gas, wind and solar projects. He has experience in negotiating and drafting the various transactional documents associated with the development of such renewable projects, including power purchase agreements, distribution and transmission

interconnection agreements, credit agreements, various financing agreements, and other procurement and construction contracts. Mr. Lucia also regularly advises clients on various aspects of the Clean Air Act, including the effects of the U.S. Environmental Protection Agency's various rulemakings on clients' operations and strategic planning.

Mr. Lucia has participated in litigation and has advised clients on matters relating to wholesale power and transmission, including rates, terms and conditions of service and the various requirements of state and federal regulations and laws. Such matters include transmission ownership and service, requests for transmission incentive rate treatment, transmission planning and cost allocation, transmission-related coordination agreements and tariffs, and regulatory rate proceedings involving both formula and cost-of-service rates.

Mr. Lucia has extensive experience advising governmental and Tribal clients in various facets of the government procurement process, including development of competitive solicitation processes, requirements and materials related to energy generation and transmission development. Mr. Lucia has also assisted clients with various aspects of grant management and compliance, including for broadband, smart-grid, energy efficiency and transmission and distribution development.

Mr. Lucia also advises clients on various matters before the Federal Communications Commission, including petitions to gain Eligible Telecommunications Carrier (ETC) status, spectrum lease and assignment applications, and Special Temporary Authority. Mr. Lucia has assisted clients negotiate and draft various related agreements, including spectrum lease agreements, spectrum asset and purchase agreements, interconnection agreements, and collocation agreements.

Mr. Lucia speaks and writes Spanish fluently and is proficient in Portuguese.

Organizations

- Colorado Bar Association
- Energy Bar Association
- Federal Communications Bar Association

Jason T. Gray

Education

- Washburn University School of Law, JD 2006
- University of Kansas, BGS 2003 (History)
- University of Kansas, BGS 2003 (Geography)

Bar Admission

- District of Columbia
- Kansas
- United States District Court for the District of Kansas
- United States Court of Appeals for the District of Columbia Circuit
- United States Court of Appeals for the Ninth Circuit

Honors

- Dean's Honors, 2006
- Delano E. Lewis Scholarship Recipient, 2005
- William H. Kurtis Entertainment and Media Law Scholarship Recipient, 2004
- Outstanding Junior in U.S. History, 2002

Experience

Mr. Gray is a Senior Associate with the law firm of Duncan, Weinberg, Genzer, & Pembroke, P.C. His practice concentrates on public utility regulation, energy law, and administrative law. Within these core practice areas, Mr. Gray regularly advises or represents clients in rulemaking proceedings and adjudications before various state and federal agencies, including the Hawaii Public Utilities Commission (HPUC), the New York Public Service Commission, the District of Columbia Public Service Commission, the Kansas Corporation Commission (KCC), and the Federal Energy Regulatory Commission (FERC).

More specifically, Mr. Gray has particular experience relevant to several of the Commission's inquiry in Docket No. 2013-0169. First, Mr. Gray is familiar with many of the dynamic changes that have transformed the Hawaii utility industry in recent years. In particular, Mr. Gray began serving in an advisory capacity to DBEDT in 2009, shortly after the HPUC began addressing many of the initiatives stemming from the October 2008 Comprehensive Energy Agreement and January 2008 Hawaii Clean Energy Initiative. For example, Mr. Gray has been involved in matters related to decoupling, feed-in tariffs, Clean Energy Scenario Planning and Integrated Resource Planning, the Technical Review Committee, and the Reliability Standards Working Group, Docket Nos. 2008-0083, 2008-0273, 2009-0108, 2011-0206, and 2012-0036. Mr. Gray has also advised DBEDT with respect to a variety of legislative matters, including pending legislation and the implementation of new legislation. Haw. Rev. Stat. §§ 269-141 *et al.* (2012) (the Hawaii Electricity Reliability Administrator), SB 379 (2013) (virtual net metering), and SCR 28 (2013) (photovoltaic systems and net metering).

In addition to his work in Hawaii, Mr. Gray also has experience in regulatory proceedings involving high voltage transmission lines. From 2009 to 2011, Mr. Gray represented a group of

municipally-owned utilities in a proceeding before FERC involving Trans Bay Cable, LLC (Trans Bay), FERC Docket No. ER10-116. The proceeding involved establishing the initial revenue requirement for Trans Bay's 53-mile, 400 MW high voltage direct current submarine transmission cable, which runs underneath San Francisco Bay. At the time of Trans Bay's filing, October 2009, the project was still in the development phase. On behalf of his clients, and in coordination with similarly situated intervenors, Mr. Gray evaluated and reviewed documents relating to ownership structure, arrangements with technology developers, asset retirement obligations, operations and maintenance responsibilities, financing obligations, ongoing environmental obligations, property leases, and cost benefit analyses. Ultimately, the proceeding was resolved by a settlement that was supported or not opposed by all parties.

Based on his previous role as Assistant General Counsel to the KCC (the public utility Commission in Kansas), Mr. Gray also has experience with respect to transmission line siting and regional transmission planning. In particular, in 2007, Mr. Gray represented the KCC's technical staff in investigating Westar Energy, Inc.'s application for a siting permit to construct a 35-mile, 345 kV transmission line in central Kansas. KCC Docket No. 07-WSEE-715-MIS. In coordination with technical staff, Mr. Gray evaluated the application under the Kansas Siting Act to determine the necessity for, and the reasonableness of, the location of the proposed electric transmission line, taking into consideration the benefit to both consumers in Kansas and consumers outside the state, as well as economic development benefits in Kansas. K.S.A. 66-1,180. Mr. Gray appeared on behalf of the KCC's technical staff at a community hearing regarding the application, as well as in the evidentiary hearing before the KCC commissioners. In its May 2007 order approving the application, the KCC agreed with technical staff and approved the proposed line on the condition that the proposed route be modified to address four specific landowner alternatives. In addition, Mr. Gray's responsibilities also included advising the KCC's commissioner-representative to the Southwest Power Pool's Regional State Committee. From 2006 to 2008, Mr. Gray was heavily involved in the development of state and regional policy on transmission planning and pricing.

Publications and Presentations

- Author, "Competing Views on the Permissible Scope of In-House Expert Witness Discovery at FERC: Without Guidance, FERC Litigants Face Risk and Uncertainty," EnergyPulse Weekly (2013).
- Panelist, "Litigation Discovery Disputes & Changes in the Federal Rules of Civil Procedure," Energy Bar Association Annual Meeting and Conference (2013).
- Contributing Author, *Natural Gas Regulation Committee Report*, ENERGY LAW JOURNAL, Volume 33, No. 2 (2012).
- Contributing Author, *Natural Gas Regulation Committee Report*, ENERGY LAW JOURNAL, Volume 32, No. 2 (2011).
- Contributing Author, *CAISO and the California Markets*, CAPTURING THE POWER OF ELECTRIC RESTRUCTURING (Joey Lee Miranda ed., 2009).
- Contributing Author, *State Commission Practice & Regulation Committee Report*, ENERGY LAW JOURNAL, Volume 30, No. 2 (2009).
- Contributor, WIND ENERGY: THE WHIRLWIND TOUR, Kansas Bar Association Continuing Legal Education Materials (May 2008).

Organizations

- Energy Bar Association
  - State Commission Practice & Regulation Committee
  - Natural Gas Regulation Committee
- American Public Gas Association
- Natural Gas Roundtable
- District of Columbia Bar Association
- Kansas Bar Association

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PRACTICES

Energy Law
Environmental and Natural Resources
Real Estate Law

RANKED IN
CHAMBERS
USA
2013
James N Broder

James N. Broder

Shareholder
jbroder@bernsteinshur.com

With 38 years of Washington, DC, and Portland, Maine legal experience, Jamie brings a national practice and extensive experience in energy project development. Jamie's energy practice includes electric transmission infrastructure projects in Maine, Massachusetts, New Jersey, New York, Vermont and Hawaii and biofuels manufacturing in Maine. His role as on these projects involved matters of project finance, permitting, contract law and multi-state utility power pool regulatory work.

Transmission Development

Jamie served as a member of the development team for the merchant transmission projects in the Northeast. Neptune Regional Transmission System, LLC ("Neptune") is such a merchant transmission company. Jamie serves as general counsel and led a legal team in all stages of developing a first of its kind 660 megawatt undersea transmission line and related electric converter stations became operational in 2007 linking two of the nation's most significant and complex power grids, PJM Interconnection and the NY Independent System Operator.

As general counsel Jamie was involved in developing the concept for the project, negotiating equipment and construction contracts, negotiating a novel contract for selling transmission line capacity to a public utility, organizing entities, coordinating permitting and FERC regulatory approvals, recruiting a successful management team, and obtaining multiple tiers of debt and equity financing approaching $750,000,000. Construction financing closed in 2005. The project was named 2005 North American Infrastructure Deal of the Year by Project Finance Magazine and 2005 Project Finance Deal of the Year by Institutional Investor Magazine. It was completed early and on budget and has been in operations since late 2005 providing more than 20 percent of the electric power to Long Island New York.

Jamie was also involved in providing counsel to Hudson Transmission Partners, a similarly sized project now in operation. The Hudson project connects northern New Jersey, crossing under the Hudson River, to interconnect at the Con Ed substation at West 49th Street in Manhattan. Jamie's role related primarily to tariff and interconnection matters at PJM, the jurisdictional Regional Transmission Organization.

Jamie has represented the State of Hawaii since 2011 as part of the Navigant Consulting team, in its efforts to facilitate the development of a high voltage direct current electric cable interconnecting on shore

wind resources on two neighbor islands with the urban power grid of Oahu.

He is also represents a New England state-wide transmission provider in New England in a joint venture to provide transmission across Lake Champlain to provide renewable generation in northern New York state with a delivery pathway to Southern New England.

LNG Receiving Terminal Developments

Jamie represented two international petrochemical companies and later an Indian Tribe in the initial development and municipal approvals proposals for LNG receiving terminals in Maine.

Biofuels

Jamie serves as general counsel to a joint venture of a Maine-based wood products company and infrastructure and industrial development company to construct Maine's first utility grade wood pellet manufacturing facility purpose built to meet strict environmental and sustainability standards of the EU and UK. The proposed off-taker is a large coal burning power station seeking to co fire its station to reduce harmful emissions.

In 1994 and 1998, Jamie was finance chair of the Angus King for Governor campaigns and played the same role in King's successful U.S. Senate campaign. In 1994, he took a brief leave of absence from his law practice to co-chair Governor King's transition team.

Jamie is named in *Best Lawyers in America*® for the fields of energy and project finance law and is AV-rated by Martindale Hubbell and recognized by Chambers USA for his energy and natural resources practice. He served four years in the Navy prior to attending law school. Later, as a member of Civil Air Patrol, a U.S. Air Force Auxiliary, he served as the Maine Wing Legal Officer.

Jamie resides in Cumberland with his wife Lee.

EDUCATION

JD, Georgetown University Law School, 1975
BA, University of Virginia, 1968. *Phi Beta Kappa*

ADMITTED TO PRACTICE

State of Maine

MEMBER

Maine State Bar Association
American Bar Association

NAVIGANT

Amanvir Chahal

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Managing Consultant

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Professional History

- Managing Consultant, Navigant Consulting
- Application Engineer - Power Economics Team, General Electric
- Intern – Planning Team, New York Independent System Operator (NYISO)

Education

- Master of Science in Electrical Engineering, SUNY Stony Brook, Stony Brook, NY
- Bachelor of Science in Electrical Engineering, Tufts University, Medford, MA

Professional Associations

- Member, IEEE 2004 - present

As a Managing Consultant in the Power Systems, Markets & Pricing, Mr. Chahal's expertise includes working on asset valuation decision making for various players in the power industry, demand and price forecasting, and production cost modeling using ProMod.

» Navigant Consulting, Managing Consultant – Energy Practice, Washington DC, September 2011– Current:

o Created renewal development plans for models across North America while assessing needs and impacts of using a variety of wind and solar profiles from NREL datasets.

o Wrote and presented paper at Power Gen 2011 on the economic and environmental impacts of coal displacement through increased renewable penetration vs. a natural gas approach.

o Written and updated market summaries for independent consultant reports across various regions in North America.

o Performed numerous asset valuation studies using capacity, intrinsic value, and production cost simulation models.

o Performed studies assessing the value of transmission projects in relation to benefit cost analysis and transmission congestion contracts.

- Developed coal-retirement tool to highlight potential economic retirements of coal-fired generation given existing and impending legislation.
- Led various Independent market consultant reports for clients looking to take a debt or equity stake in utility scale power projects.

» General Electric, Application Engineer – Energy Consulting Power Economics, Schenectady, NY, December 2007– August 2010:

- Performed forecasting of regulation and reserve requirements as part of the analysis on Wind Generation Impact on ERCOT Ancillary Services.
- Executed generation and reliability impact analysis for New England Wind Integration Study (NEWIS).
- Analyzed economic and reliability impacts of the Regional Greenhouse Gas Initiative (RGGI) for the New York State Energy Research and Development Association (NYSERDA).
- Co-authored CIGRE paper on RGGI project findings. Led update process of energy production simulation databases for the WECC and New York.
- Led effort in modeling hydro generation in the Pacific Northwest using hourly data available from the Army Corps of Engineers.

NAVIGANT

Robert W. Kendall

Robert W. Kendall
Managing Director

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bkendall@navigant.com

Professional History

- Navigant Consulting, Inc. (NCI) (7/2002 – Present) Managing Director
- Sunlaw Energy Corporation (Sunlaw) (2001- 4/2002) President
- NCI (1998-2001) Director
- Southern California Edison (SCE) (1968-1998) Director, Municipal Business Alliances
  Manager, Planning; Industry Policy Coordination; Power Contracts
  Manager of Regulatory Coordination

Education

- J.D., Corporate and Contract Law, Southwestern University
- M. B. A., Financial Management, University of Southern California
- B.S., Electrical Engineering, University of Illinois

Professional Associations

- Member, Los Angeles County and California Bar Associations

Honors and Fellowships

- Eta Kappa Nu & Sigma Tau Engineering Honor Societies
- Selected by the Board of Governors of California Bar Association to serve as a consultant on the state's bar examinations

Robert Kendall, Managing Director in Navigant Consulting, Inc.'s Energy Practice, has over 40 years of experience in the electric power industry. Representing investor-owned utilities, publically-owned entities, and independent developers, he has played key roles in the procurement of wind, solar, and other renewable resources; development of new electric generation and transmission projects; served as an expert and policy witness in numerous regulatory and court proceedings involving contract interpretation, damage assessment, and fuel and purchase power costs; negotiated new contracts for the purchase and sale of electric power and transmission services; managed environmental reviews of proposed projects; managed the operations of electric generation facilities; managed an independent generation development and operating company; managed regulatory and rate proceedings before federal and state regulatory commissions including fuel and purchase power cost proceedings; and managed the administration of contracts having payments of over $3 billion per year.

Included in the contracts Mr. Kendall has negotiated are: purchases of scores of renewable energy projects; purchases from over 50 MW of solar photovoltaic resources; purchase of 1000 MW of firm capacity from two HVDC undersea cables to serve Long Island, New York; purchase of over 1000 MW from gas-fired generation on Long Island, New York; participation agreements in joint coal and nuclear generation projects; a settlement of litigation having a financial exposure of over $4 billion; merger settlement agreement with the U.S. Department of Justice; and scores of long-term power purchase agreement each having life-time payments exceeding $5 billion. He has also either managed or provided key support services in numerous large competitive procurement processes for investor and municipal owned utilities and public authorities involving the selection of generation and transmission resources, negotiated contracts with selected proposers, and assisted in obtaining required regulatory and governmental approvals for the procurement process and the resulting contracts. He was also on a team that developed for the State of Hawaii a comprehensive white paper on interconnecting some of

Hawaiian Islands with undersea cables. Further, he implemented complex asset development strategies and has led statewide teams in California to develop new institutions (the California ISO and Power Exchange) to implement electric deregulation. Mr. Kendall is a qualified and recognized expert on electric system planning, project management, utility and independent power plant development and

operations, power marketing, utility regulation, complex contract negotiations, damage assessment, electric deregulation, transmission policy, and power contract economics and accounting.

Damage Assessments in Litigations;

Mr. Kendall has provided analysis and has testified as a policy and/or expert witness in a number of disputes involving power and other contracts including the calculation of damages resulting from contract breach and other non-performance issues. Such disputes included providing expert testimony before an international insurance arbitration panel in London in 2010. He has also provided damage assessments for clients to support settlements of contemplated litigation.

Competitive Procurements for Long Island Power Authority (LIPA):

Mr. Kendall's specific experience in competitive procurements for LIPA includes the following activities:

(i) development of the RFP and related documents, including the supporting contracts;
(ii) administrative support to LIPA throughout the procurement process;
(iii) participation in the qualitative and quantitative evaluation and selection process;
(iv) support for contract negotiations; and
(v) participation in the environmental review/permitting of projects.

Mr. Kendall has participated in most of LIPA's resource and resource related procurements since 1999 including the following specific procurements:

New Generation and/or Cables

- Mid-Term RFP—1999
- Cross Sound Cable RFP—2000
- Generation/Cable RFP—2003
- Combined Cycle RRP—2005
- Off-Shore Wind Development RFP—2005
- Mobile Generation RFP—2005
- Off-Island Generation RFP—2007
- Renewable Energy RFP--2008
- Solar Generation RFP—2008
- 2,500 MW Generation/Transmission RFP—2011-2013

Providers of Resource Related Services

- Power Supply Management Services and Fuel Management Services RFP—2005
- Power Supply Management Services RFP—2007
- Energy Efficiency—2005
- Energy Efficiency RFPs—2008
- Caithness Natural Gas Supply RFP—2009
- Caithness Fuel Management RFP—2009

In addition, Mr. Kendall worked on a team to assist LIPA with a competitive procurement for its entire transmission and distribution operations and maintenance services, customer care, energy efficiency, and other related customer services valued at over $6 billion.

Professional Experience

CORPORATE ATTORNEY
While at SCE in its law department as corporate counsel, he tried several contract and regulatory matters before the California Public Utilities Commission ("CPUC") and Federal Energy Regulatory Commission ("FERC") and he was on the lawyer team that defended three anti-trust lawsuits before the U.S. District Court and FERC.

REGULATORY INTERFACE
For three years, he managed SCE's regulatory proceedings before the CPUC and FERC, served as SCE's principal lobbyist with these regulatory bodies, and managed SCE's San Francisco Office.

ORGANIZATION/PROJECT MANAGEMENT
While serving as President of Sunlaw Energy Corporation, a small independent power producer headquartered in Los Angeles, he achieved record sales and earnings while simultaneously leading the development of new generation projects. He also managed the development and submittal of proposals in competitive solicitations from several Southern California municipal utilities.

While serving at NCI, he managed contract teams with responsibility for negotiating power purchase contracts, firm transmission capacity purchase agreements, and other agreements with 3rd parties. Managed or assisted in the management of six RFPs for LIPA to procure new generation and transmission resources from PJM, New England, and Long Island

While at SCE, he managed an organization of over 150 people with responsibility for negotiating and administering over 1000 contracts with over 500 entities involving expenditures of over $3 billion per year and defended the negotiation and administration of these contracts before the CPUC.

TRANSMISSION
While at NCI, he has obtained substantial experience in connection with the following high voltage undersea cable projects:

- 330 MW HVDC TransÉnergie Cross Sound Cable Project
- 660 MW HVDC Neptune Regional Transmission System
- 450 MW Northport - Norwalk Cable Replacement Project
- 400 MW Oahu - Molokai Project (Proposed)

The 330 MW HVDC project interconnects the United Illuminated System in New Haven, Connecticut with the Long Island Power Authority ("LIPA") system in Shoreham, New York. Jim was responsible for the 25 year Firm Transmission Capacity Purchase Agreement ("FTCPA") under which LIPA purchases the capacity from this project and also had a project management role for LIPA during the project's construction. In addition, Jim negotiated several long term Power Purchase Agreements ("PPA") that use the cable's capacity.

The Neptune cable interconnects First Energy in Sayreville, New Jersey with LIPA in Levittown, New York. Jim negotiated the FTCPA on behalf of LIPA and also negotiated a long term PPA with FPL under which LIPA purchases 685 MW of capacity from the Marcus Hook generating facility for delivery over the Neptune cable.

The 450 MW Northport – Norwalk Cable Replacement project entailed the replacement of a cable crossing Long Island Sound that was jointly owned by Northeast Utilities ("NU") in Connecticut and LIPA. Along with representatives from NU, Jim negotiated the EPC contract with Nexans under which the original cable that had been leaking oil in Long Island Sound was removed and replaced with a new cable.

The 400 MW Oahu – Molokai project involved a proposed HVDC cable that would interconnect wind farms (200 MW each) planned for Molokai and Lanai that would serve the load center on Oahu (an AC cable would interconnect the wind farm on Lanai with the converter station on Molokai). Jim was part of a team that prepared a report on behalf of the State of Hawaii that prepared a plan for developing the cable project.

He has also served as principal author of a statewide report titled "1998 Transmission Reliability Report" to the California legislature. Contributions were obtained from the California ISO, California Energy Commission, California Public Utilities Commission, the Western Electricity Coordinating Council, and others.

While at SCE and functioning as head of SCE's Power Contracts organization he:

- Managed negotiations and administration of all of SCE's transmission service agreements.
- Served as a policy witness on SCE's transmission policies before FERC and the CPUC in merger and other proceedings.
- Developed contracts for and testified in certification proceedings in support of several new high voltage transmission lines, including the California-Oregon Transmission project and HVDC Expansion projects.
- Managed SCE's activities associated with the development of the Western Transmission Association (WRTA).

While at SCE and functioning on its electricity deregulation team he:

» Led negotiations for the investor owned utilities with the California ISO to create the contract for turning over control of much of California's transmission resources to the ISO.

» Managed SCE's participation in the development of the California ISO's transmission tariff filing to FERC.

COMPETITIVE PROCUREMENTS & CONTRACTS

Over a twelve year period with NCI, he participated in 15 competitive solicitation processes and negotiated contracts with entities selected in the solicitations for the Long Island Power Authority ("LIPA"), a rate authority of the State of New York that resulted in the procurement of: over 1000 MW of new generation resources; 1000 MW of new HVDC undersea transmission facilities; renewable energy from solar, hydro-electric, and land-fill projects; professional services to manage the operation of LIPA's power system; and contractors to provide energy efficiency programs on Long Island. Together these contracts have contract values in excess of $7 billion. His participation in the procurement processes included:

» Developing the request for proposal,

» Coordinating communications with prospective proposers during the submittal process,

» Analyzing and evaluating proposals,

» Briefing LIPA's executive management and trustees on recommendations for selection,

» Negotiating contracts with successful proposers,

» Participating in the environmental review/permitting of projects;

» Obtaining approval of said contracts with the New York State Attorney General and Comptroller, and

» Conducting public and news briefings on the resulting contracts.

For ten years, he functioned as head of SCE's Power Contracts organization having responsibility for:

» Negotiating new contracts that add value to SCE.

» Managing the development and administration of all of SCE's 1000 utility power purchase, transmission, joint participation and independent power purchase contracts (jointly referred to as "Power Contracts").

» Maximizing the value of Power Contracts to SCE's shareholders and ratepayers.

» Negotiating amendments to and protecting SCE's rights under the Power Contracts.

» Defending reasonableness of contracts and amendments before the CPUC.

» Managing SCE's relationship with its QF suppliers and wholesale municipal customers.

ELECTRIC RESTRUCTURING

For three years, he functioned on SCE's electric restructuring team with responsibility for:

» Designing governance structure of California's Independent System Operator (ISO) and Power Exchange

» Developing transmission access charge pricing methodology and the terms and conditions for turning transmission control over to the ISO

» Serving as SCE's project manager for obtaining FERC approval of the ISO

» Serving as SCE's principal spokesperson on restructuring before high-profile customer and government groups.

Also while at SCE, he led statewide teams comprised of electric utility lawyers and engineers, environmentalists, consumer advocates, large electric consumers, and regulators to develop institutions and governing rules for electric deregulation.

MARKETING SALES

For eight months; he acted as head of SCE's Municipal Business Alliance Organization with responsibility for Marketing and selling Edison International's mass market, energy management, and utility-related services to municipal utilities and government entities across the U.S. and Canada.

INTERNATIONAL MATTERS

For four years, he served as manager of SCE's team involved in E7, a group of the world's largest electric utilities from the G7 countries with responsibilities for:

» Developing and implementing policies and projects to improve the global environment;

» Chairing group's Steering Committee responsible for helping developing countries formulate strategic plans and building environmentally responsible projects; and

» Working in partnership/cooperation with international utilities' senior management, national governments and entities such as the World Bank, Asian Development Bank and various UN organizations to accomplish objectives.

Attachment A
Robert Kendall Testimony
Commercial Litigation & Regulatory Proceedings
As of September 4, 2013

Matter Name	Court, Regulator, or Arbitration Name	Plaintiff(s) and Defendant(s)	Testified on Behalf of	Year	Subject Matter
Glacier Reinsurance AG v Global Credit Reinsurance Limited	A.I.D.A Reinsurance and Insurance Arbitration Society of the UK	Claimant: Glacier Reinsurance AG Respondent: Global Credit Reinsurance Limited	Global Credit Reinsurance Limited	2010	Whether transmission and distribution lines that allegedly caused wildfires in California in 2007 are part of power production industry in all its phases.
California Department of Water Resources (CDWR) v Sempra Energy Resources (Sempra)	Superior Court—San Diego County	Plaintiff: CDWR Defendant: Sempra	CDWR	2009	Breach of contract provisions related to Sempra having a commercially reasonable efforts obligation to construct a new power plant.
So Cal Edison v. Bonneville Power Administration (BPA)	Federal Claims Court	Plaintiff: So Cal Edison Defendant: BPA	So Cal Edison	2006	Dispute over contract terms in long-term power purchase agreement. I was to testify as a percipient witness and expert witness in utility power contracts. Case was settled right before trial.
SDG&E v. SCE	Arbitration	Plaintiff: San Diego Gas & Electric Defendant: So Cal Edison	So Cal Edison	2005	Dispute over meaning of provisions in ownership and operating agreement involving the San Onofre Nuclear Generating Facility. I testified as a percipient witness and expert witness in utility contracts.
Salton Sea Power Gen v. So Cal Edison	Imperial County Superior Court	Plaintiff: Salton Sea Power Gen Defendant: So Cal Edison	So Cal Edison	2003	Dispute involving breach of contract provision pertaining to payments for a power purchase. I was to testify as a percipient witness and expert witness in utility power contracts. Case was settled before trial.
Proceedings Re: Need for Generating Facilities in Arizona	Arizona Corp Commission	Investigation by the Arizona Corp Commission	Wellton-Mohawk Generating Facility	2003	A proceeding initiated by the Arizona Corp Commission regarding the need for new generation facilities in Arizona and plans to meet such needs. I presented expert testimony regarding needs in western Arizona, transmission congestion and constraints, and the benefits to the state provided by the proposed Wellton-Mohawk Generating Facility.
Certification of Wellton-Mohawk	Arizona Corp Commission	Wellton-Mohawk	Wellton-Mohawk	2003	Proceeding to obtain certification to construct a new gas combined cycle

Attachment A
Robert Kendall Testimony
Commercial Litigation & Regulatory Proceedings
As of September 4, 2013

Matter Name	Court, Regulator, or Arbitration Name	Plaintiff(s) and Defendant(s)	Testified on Behalf of	Year	Subject Matter
Generating Facility		Generating Facility—Private Developer	Generating Facility		generation facility in Yuma, Az. I presented an expert report on the need for the project and the marketing plan for the power output.
Coachella Valley Water Authority v. Imperial Irrigation District	San Bernardino County (California) Superior Court	Plaintiff: Coachella Valley Water Authority Defendant: Imperial Irrigation District	Imperial Irrigation District	2001	Testified as an expert witness on electric generation, electric utility regulation, electric utility accounting & economics, and utility power contracts in a dispute involving rights on sharing electric revenues from a series of contracts entered into by the parties with the federal government in the 1930's.
Chase Manhattan Bank v. PECO	Pennsylvania Superior Court	Plaintiff: Chase Manhattan Bank Defendant: PECO	PECO	1999	Qualified as an expert witness on utility power contracts in dispute involving alleged breach of a provision in a power purchase agreement pertaining to assignment rights. Case was settled before trial.
Cal Electric Co v. So Cal Edison	US Fed Court in Los Angeles	Plaintiff: Cal Electric Co Defendant: So Cal Edison	So Cal Edison	1998	Breach of contract case in which I was to testify as a percipient witness and as an expert witness in utility power contracts. The case was settled before trial.
So Cal Edison v. BPA	Arbitration	Plaintiff: So Cal Edison Defendant: BPA	So Cal Edison	1999	Dispute over contract term in long-term power sales agreement. I testified as an expert witness in utility power contracts.
Tucson Electric Power v. So Cal Edison	Arbitration	Plaintiff: Tucson Electric Power Defendant: So Cal Edison	So Cal Edison	1999	Dispute over contract term in long-term power sales agreement. I testified as an expert witness in utility power contracts.
So Cal Edison Gen Rate Case	Ca Pub Utility Commission (CPUC)	So Cal Edison	So Cal Edison	1994	General rate case. Witness on transmission policy & cost justification for investments in new extra high voltage transmission.
So Cal Edison Energy Cost Adj Clause	CPUC	So Cal Edison	So Cal Edison	1993	Testified in fuel cost adjustment proceedings on reasonableness of new power purchase agreements & contract administration.
So Cal Edison Energy Cost Adj	CPUC	So Cal Edison	So Cal Edison	1992	Testified in fuel cost adjustment proceedings on reasonableness of

Attachment A
Robert Kendall Testimony
Commercial Litigation & Regulatory Proceedings

As of September 4, 2013

Matter Name	Court, Regulator, or Arbitration Name	Plaintiff(s) and Defendant(s)	Testified on Behalf of	Year	Subject Matter
Clause					new power purchase agreements & contract administration.
So Cal Edison Gen Rate Case	CPUC	So Cal Edison	So Cal Edison	1992	Testified in general rate case on transmission policy and & support for costs expended on new large transmission line.
So Cal Edison Energy Cost Adj Clause	CPUC	So Cal Edison	So Cal Edison	1991	Testified in fuel cost adjustment proceedings on reasonableness of new power purchase agreements & contract administration.
So Cal Edison Energy Cost Adj Clause	CPUC	So Cal Edison	So Cal Edison	1990	Testified in fuel cost adjustment proceedings on reasonableness of new power purchase agreements & contract administration.
So Cal Edison Energy Cost Adj Clause	CPUC	So Cal Edison	So Cal Edison	1989	Testified in fuel cost adjustment proceedings on reasonableness of new power purchase agreements & contract administration.
Cert of Public Convenience & Necessity for COTP Project	CPUC	So Cal Edison	So Cal Edison, Pacific Gas & Electric, & San Diego Gas & Electric	1989	Testified as policy witness in proceedings to obtain a certificate to build a new large transmission line between Oregon and California.
So Cal Edison Gen Rate Case	CPUC	So Cal Edison	So Cal Edison	1989	Testified in general rate case on transmission policy and & support for costs expended on new transmission lines.
Merger of San Diego Gas & Electric with So Cal Edison	FERC	So Cal Edison	So Cal Edison	1988	Testified as transmission policy witness in merger proceeding.
Pacific Gas & Electric	FERC	So Cal Edison	So Cal Edison & Pacific Gas & Electric	1986	Testified as transmission policy witness in dispute over right to interconnect new large transmission line with existing lines.
City of Vernon v. So Cal Edison	US Fed Court in Los Angeles	Plaintiff: City of Vernon, Ca Defendant: So Cal Edison	So Cal Edison	1985	Anti-trust case involving monopolization of transmission. I was a transmission policy witness. I was deposed, but never testified at trial.
Cities of Anaheim, Riverside et al v. So Cal Edison	US Fed Court in Los Angeles	Plaintiff: Cities of Anaheim, Riverside et al	So Cal Edison	1985	Anti-trust case involving monopolization of transmission. I was a transmission policy witness. I was deposed, but never testified at

Attachment A
Robert Kendall Testimony
Commercial Litigation & Regulatory Proceedings
As of September 4, 2013

Matter Name	Court, Regulator, or Arbitration Name	Plaintiff(s) and Defendant(s)	Testified on Behalf of	Year	Subject Matter
		Defendant: So Cal Edison			trial.

NAVIGANT

Dia D. Koujak

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Professional History

- Managing Consultant, Navigant Consulting, 2009 - Present
- Senior Consultant, Navigant Consulting, 2007 – 2009
- Consultant, Navigant Consulting, 2005 – 2007
- Associate, Navigant Consulting, 2003 – 2005
- Financial Services Intern, Salomon Smith Barney, 2000 – 2001

Education

- JD (Candidate), Hofstra University School of Law
- MBA, Operations Management, State University of New York at Stony Brook
- B.S., Engineering Management, New York Institute of Technology

Dia Koujak is a Managing Consultant with Navigant's Energy Practice specializing in utility procurement, resource planning, energy efficiency and renewable energy. Specifically, Mr. Koujak has extensive energy procurement related consulting experience which includes energy and capacity from undersea HVDC transmission cables, gas-fired simple and combined cycle units, landfill gas units, utility-scale Solar Photovoltaic systems, and hydroelectric/pumped storage power. In addition, Mr. Koujak has worked on the evaluation and development of RFPs for energy efficiency services, natural gas supply and utility management services. Mr. Koujak graduated from the New York Institute of Technology with a BS degree in Engineering Management, and graduated with an MBA in Operations Management from the State University of New York at Stony Brook. He is currently pursuing a Juris Doctorate at Hofstra University School of Law.

Professional Experience

Competitive Procurement (RFP)

» **2010 Generation and Transmission RFP** – Develop the quantitative analysis evaluation process and assist with the development of the qualitative evaluation process adopted in advance of the RFP release. Prepare forms and matrices to capture the requirements set forth in the evaluation process manual to facilitate consulting staff review of proposals. Perform qualitative review of proposals for select categories. Engage in the quantitative review of proposals and develop the quantitative screening model and inputs for accuracy. Prepare trustee presentations summarizing the evaluation results and the recommendations of the Selection Committee. In performing the above analyses, evaluated a wide range of resource options proposed to the northeast public electric utility, including HVDC Transmission, Combustion Turbine generation, Hydro energy imports, Off-Shore Wind Farms, and Battery Storage.

» **New York Power Authority 100-MW Solar Initiative RFP** – Prepared detailed quantitative analysis spreadsheet tool which captures each respondent's proposed pricing across varying regions and estimated production curves/degradation to calculate the Levelized cost of energy for each proposal, region and category proposed by developers. For the purposes of comparing short listed bidders, prepared Solar Allocation Spreadsheet tool which factors in NYPA's major assumptions (utility rates, escalators, cost adders) to quickly compare the estimated cost to NYPA of varying proposal combinations (by Category & Region).

» **Massachusetts DOER Solar Stimulus Program RFP for Wastewater Facilities** – Provide assistance in the development of the RFP to design, build and install Solar Photovoltaic systems located on 12 town wastewater facilities ("Participants") in Massachusetts. In addition, provide assistance and facilitate the negotiation and execution of 11 of the Energy Service Agreements ("ESAs") within the American Recovery and Reinvestment Act deadline for project funding.

» **Natural Gas Supply RFP/Fuel Management RFP** – Developed RFP to procure 54,000 Dthms of Natural Gas on behalf of a northeast public utility to fuel a major energy center. In addition, developed an RFP to manage all aspects of Fuel Management for the center – which includes the management of liquid fuels and implementation of fuel optimization strategies.

» **Duke Carolinas Solar RFP** – For a 20 MW Solar PV solicitation, design technical characteristics and pricing response form that Respondents must complete in order to facilitate the quantitative and qualitative evaluation of proposals. In addition, review RFP draft and provide edits that will provide a common basis for evaluation of proposals.

» **Solar Photovoltaic RFP** – Manage the procurement of 50 MWs of Solar Photovoltaic energy projects on behalf of a northeast electric utility. Performed Phase I overview and Phase II detailed quantitative analysis of proposals. Reviewed proposed technologies, and capacity factor assumptions. Currently supporting the negotiations of Power Purchase Agreements with the selected respondents.

» **Renewable Energy RFP** – Managed the procurement of 325 GWhs of Energy and RECs from qualified resources that are capable of delivering to NYISO Zone K. Performed detailed quantitative evaluation which encompasses all aspects of power contract/delivery economics – including loss factors over transmission cables and benchmark comparisons to equivalent market energy on an hourly basis for the entire contract term for each proposal received.

» **Power Supply Management RFP** – Assistance in the management of a procurement that competitively bid the front office and back office utility functions currently provided by a long standing contractor. Researched Company background and related financial data (Due Diligence). Detailed analysis of Proposer qualifications, draft clarifying questions regarding material deficiencies and phase matrix analysis.

» **600 MW Generation Capacity RFP** – Assisted in the management of the procurement of on-island generation, transmission, and off-island generation resources. Perform detailed Phase analysis of proposals received. Assisted the development of the quantitative assessment plan of all proposals. Performed detailed quantitative analysis of all proposals received. Assistance in drafting Power Purchase Agreement language for contract awardees (286-MW On-Island Caithness Combined Cycle Generation Unit, 660-MW Neptune Undersea Transmission Cable). Provide post-award support including contract management assistance and forecasting of costs for budgetary purposes.

» **RFP for Temporary Generation** – On behalf of a northeast public electric utility, assisted in the management of the procurement of mobile generation units to fill an expected capacity shortfall in the summer of 2004. Performed analysis of financial data, credit ratings of firms; prepared and submitted report outlining findings to consulting staff. Technical Analysis of Generation Technology/Power Plant Systems.

» **2005 Capacity RFP** – Assisted consulting staff in preparation of interview materials; organizing proposal data in spreadsheet format in accordance to the current phase of the RFP process. Analysis of pricing, valuation and escalation factors involved with Power Plant Construction, provide assistance in contract negotiations.

» **Energy Efficiency RFPs** – As part of the landmark Energy Efficiency program on behalf of a northeast public electric utility, served as the coordinator, author, and facilitated the evaluation of proposals in response to the following energy efficiency RFPs and associated services contracts:

- **Solution Provider RFP** – seeks to select an experienced firm who can provide a range of energy efficiency services (technical guidance and evaluations) to Commercial and Industrial customers. Drafted the RFP solicitation, and qualitatively and quantitatively assessed proposals in conjunction with LIPA's selection committee.

- **Market Channel Coordinator RFP** – seeks to select an experienced firm that can manage, oversee, support and/or implement outreach services to all market channels (e.g., retailers, vendors, contractors, distributors).

- **Commercial and Residential Direct Install RFP** – seeks to select experienced firms which will perform home energy audits, perform cost/rebate estimates of eligible efficiency measures, and perform implementation services of the efficiency measures. Drafted the RFP solicitation

- **Home Energy Comparison Reports RFP** – seeks to select a firm which will analyze customer load data and provide comprehensive energy usage reports to homeowners.

- **Measurement and Verification RFP** – seeks to select a firm that will verify the savings estimated by the field implementation contractors.

- **Evaluation RFP** – sought to select a firm to provide a comprehensive review of the Authority's previous efficiency program evaluation studies (impact evaluation, process evaluation, market research, etc.) that were performed for the period of 1999 through the end of 2008 and provide ongoing evaluation services for ELI. Assisted in drafting the RFP solicitation and quantitatively and qualitatively assessed the responses received.

Energy Efficiency & Renewables

» **Energy Efficiency Project Management** – Served as a project manager and coordinator of a comprehensive energy efficiency initiative for a northeast public electric utility geared specifically to reduce Peak Energy Load. Assisted in the development and drafting of the ELI Program Plan, reviewing all aspects of the program design and assisted in the development of specific targeted measures. Provided all aspects of the subsequent project management of the program. Project management activities included the coordination of the ELI planning committee meetings, tracking of current action items to ensure schedule compliance, allocation of resources/personnel, financial/cost tracking and related analyses. Drafted regulatory input to PSC proceedings regarding the Efficiency Portfolio Standard, insuring all program measures are considered under the legislative framework. Provided assistance with the efficiency rider rate design and estimated overall bill impacts under a variety of scenarios (ie. various participant levels and customer classes, and non-participants). Served as an interim staff member during period of Efficiency department expansion to facilitate the implementation and management of the program.

» **Renewable Portfolio Standard ("RPS") Tracking** – Developed an RPS program tracking tool capable of amalgamating the cost, renewable attributes and energy generated and procured by all of a utility's eligible resources for the purposes of internal reporting and tracking.

» **RPS Program Certifications** – For a west coast client, provided technical assistance in completing utility RPS program participation response forms for Solar Photovoltaic installations. Estimate Solar production profile using utility's spreadsheet tools, and estimate most advantageous pricing option (Time of Day pricing options) offered by SDG&E, PG&E and SCE.

PPA Contract Valuation & EPC Contract Cost Tracking

» **PPA contract negotiations support** – determined capacity rate adjustments resultant from qualified cost increases, and delay costs among a wide variety of scenarios to determine range of economic impact. COD Interest Rate Adjustment Impacts and other Interest Rate impacts resultant from construction delays resulting from withholding NTP (Notice to Proceed).

» **PPA cost exhibit development** – Calculated Nominal and NPV cost of contractual payments. Modified contractual formulas to properly track and reflect various cost increases based upon Bureau of Labor Statistics data – CPI/PPI indices.

Nuclear Energy

» **Fuel Cycle Cost Analysis** – For multiple clients, provided detailed analysis of the pricing of each stage within the nuclear fuel cycle – ore, gas conversion, enrichment, fuel cladding, and disposal. Track and forecast Uranium ore prices, and enrichment pricing (US/EU, and Russian Enrichment). Analysis of the factors/prime movers effecting nuclear fuel pricing, and produce a forecast of uranium prices based on expected demand and supply.

» **Economic Analysis of Nuclear Generation** – Produced detailed cost comparison of nuclear generators by technology type and equivalent baseload power generation units, including coal, oil, and natural gas fired power plants. Constructed advanced excel model to track prices of fossil fuel, and nuclear fuel, to create a "Total Rolled In Cost" summary on a $/kW capacity basis and $/kWh energy basis.

Resource Planning

» **NALCOR Hydro** – Participated in an independent review of NALCOR's Decision Gate 2 process analysis of the Muskrat Falls Hydro and Labrador Link HVDC project. Review NALCOR's assumptions, analyses and reports outlining the comparative generation options arriving at the recommendation to proceed with the Muskrat Hydro/Labrador Link project.

» **Resource Planning Coordinating Committee ("RPCC")** support –Assisted in preparation of northeast public electric utility's Energy Plan. Prepared resource need projection graphs based on generator retirements, and expected online dates of energy resources. Provided locational data regarding generation capacity. Calculate and determine ICAP, UCAP requirements to meet locational, Statewide, and Regional regulations. Generation cost calculations – supported power resource contract negotiations through the calculation of contract cost and intrinsic value (based upon a capacity, energy price forecasts and the negotiated metrics).

» **Power Supply Agreement Analysis** – Develop capacity expansion plan fixed costs summary using available market intelligence on the cost of new generation capacity. Calculate out a pro-forma cost stream of various generation sources (HVDC transmission cables, Combined Cycle Turbines, Simple Cycle Turbines, etc.) required in the next 15-years to meet forecasted demand requirements. Develop multiple capacity expansion scenarios for further financial analysis in determining whether to continue existing resource operations, repower resources, and/or expand and replace contracted units soon to expire.

Financial Planning and Analysis

» **Developed Retail Pricing Strategies** – Developed excel tools that provide detailed analysis of customer load shapes with respect to temperature, season, and rate class.

» **Real Time LBMP/Day Ahead LBMP** – Advanced studies of the correlation between the Real Time and Day Ahead capacity prices and determine conditions that warrant price differential on behalf of a utility.

» **Natural Gas Price/Economic Dispatch Analyses** – In support of testimony, provided detailed correlation analysis between daily LBMP price and Natural Gas Price to determine whether a power generator was operated properly (economic dispatch).

» **Fuel Switching Strategy Analysis** – Developed a "look-back" analysis of the past 10-years in savings if the resource portfolio of power generators were to fully optimize their fuel-switching capability.

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Professional History

- Managing Director, Navigant Consulting, Inc.
- Director, Power Technologies, Inc.
- Instructor, University of Alaska

Education

- M.S., Electrical Engineering, University of Alaska Fairbanks, 1987
- B.S., Electrical Engineering, University of Alaska Fairbanks, 1986
- B.S., Mathematics, University of Alaska Fairbanks, 1985

Publications

- Over 40 publications in the areas of energy markets, reliability, electric and magnetic fields, and advanced T&D technologies.

Testimony

- Testimony provided in over 15 regulatory proceedings and 10 commercial litigation proceedings.

Awards

- Consulting Magazine's Top 25 Consultants of 2009

Honors and Fellowships

- Kappa Mu Epsilon
- Tau Beta Pi

Laurie Oppel is a Managing Director with managerial responsibility for Navigant's 60-person Power Systems, Markets and Pricing subpractice within the Energy Practice. Typical engagements are focused on energy markets, energy asset transactions, transmission planning and operations, resource procurement, portfolio optimization, regulatory compliance, and wholesale and retail rate design. She has approximately 25 years of experience as a trusted advisor, project manager, and team contributor for major domestic and international electric utilities and industrials. Her expertise includes:

» energy market pricing and policy development,
» asset valuation and transactions,
» portfolio optimization,
» transmission pricing and tariff development,
» transmission policy formulation,
» transmission planning and operations,
» capital planning,
» technical and economic analyses, and
» FERC compliance programs.

Ms. Oppel has provided expert testimony on various transmission issues and asset valuations, including:

» energy market structures,
» economic damages due to construction/operational disputes,
» generation and transmission asset valuations,
» capital planning and budgeting,
» needs assessments,
» good utility practices, and
» electric and magnetic field evaluations.

She currently serves on Navigant's Operating Committee. Prior corporate committees included Managing Director Screening Committee and Compensation Committee.

Professional Experience

Resource Planning:

» **Replacement Resources for Coal Retirements in Midwest. Confidential Gas Pipeline Client. 10/11 – 2/12.** Assessed likely coal plant retirements given various proposed environmental regulation, along with replacement resources including renewables based on likelihood of meeting state-by-state renewable portfolio standards and natural gas plants for economical and operational considerations.

» **Portfolio Optimization. Confidential Client in Southeast US. 1/11 – 9/11.** Evaluated economic optimization, as well as multi-variant optimization of various supply options to meet clean energy standard and develop a renewable strategy.

» **Resource Plan. Syracuse University. 5/02 - 12/02.** Evaluated alternatives to provide steam and electricity to Syracuse University and their steam clients upon end of existing contract with on-site co-generation plant.

» **Tolling Agreement and TCC Offering. Sithe. 1/01 – 12/01.** Supported the development of the offering memorandum for a tolling agreement and transmission congestion contracts (TCC) from Sithe Independence and the evaluation of the proposals. Evaluated historical value and the projected future value of the TCC's.

» **Resource Planning. Long Island Power** Authority. **01/00 – 12/05.** Developed and administered RFP for tie line capacity, resulting in award of contract for firm transmission capacity on Cross Sound Cable; developed technical requirements for interconnection and power purchase agreements for procurement of on-island resources; provided technical support on FTCPA for Neptune tie line between Long Island and PJM.

Energy Market Assessments & Asset Valuations

» **Bankruptcy Restructuring. EFH Creditors. 2/13 – Present.** Performed due diligence and assessed value of Energy Future Holdings (TXU Energy, Luminant, Oncor) in support of restructuring.

» **Sherman and Temple Market Consultant Reports. Panda Power Funds. 7/11 – 2/13.** Developed Independent Market Consultant reports to support financing for Sherman, Temple I and Temple II in ERCOT. Financing was received for purely merchant power plants (e.g., no bilateral contracts for energy off-take).

» **Asset Value Capture Study. Confidential Texas Public Power Company. 7/11 – 6/12.** Evaluate assets (land, buildings, electrical assets, contracts) that may be sold, and not impact the responsibility to deliver electricity and natural gas to customers, in order to raise capital to support renewable and smart grid initiatives.

» **Assess Oncor T&D Business. P. Schoenfeld Asset Management. 5/11 – 7/11.** Reviewed Oncor's T&D business, and evaluated future revenue and risk.

» **Independent Market Consultant Report for CPILP Assets, Highstar Capital 1/11 – 4/11.** Perform market assessment, revenue forecast under market and contracted conditions, for CPILP assets under acquisition consideration by Highstar. Assets included those hydro, biomass, and natural gas generation assets in Canada, Western and Eastern US.

» **Acquisition of biomass and biofuels assets and companies. Confidential Heavy Industry Manufacturing Company. 10/10 – 6/12.** Assisting in the development of a renewable energy strategy in the North America for an Asian Heavy Industry company. Identification of acquisition targets; performance of due diligence; valuation of assets and companies; negotiation of contracts.

» **Independent Market Consultant Report for Consolidated Edison Development Assets. AllCapital / IFM / NAEA. 8/07- 9/09.** Provided PJM and ISO-NE market expertise and estimate of future revenues to support acquisition of the generation assets.

» **Future Market Revenues for Calgary Energy Centre. Kelson Energy. 8/07 – 1/08.** Prepared expert report on anticipated future (2022 to 2026) market revenues that could be expected for Calgary Energy Centre for comparative analysis in contract repudiation dispute.

» **Asset Valuation for Calpine Asset Fleet. Kelson Energy. 7/07 – 10/07.** Assessed value of Calpine fleet as merchant facility and under bilateral contracts to assess impact on unsecured creditor under the proposed Restructured Agreement.

» **Market Assessment of Rensselaer Cogen. McNair Group. 1/07 – 3/07.** Developed projection of future energy and capacity revenues for plant in upstate New York.

» **Independent Market Consultant Report for Liberty Power. CPV. 10/06 – 1/07.** Provided PJM market expertise and estimate of future revenues for Liberty Power, LLC to support project financing.

» **Market Assessment for SCS Astoria Energy. Energy Investors Fund. 12/06 – 3/07.** Provided update of NYISO market and forward revenue projection for SCS Astoria Energy plant.

» **Market Assessment and Interconnection Costs for Next Generation Nuclear Plant. Confidential Client. 11/06 – 3/07.** Evaluated the transmission system and interconnection upgrade requirements and costs for next generation nuclear plant, as well as assessment of future energy market revenues to aid in site selection.

» **Independent Market Report for Longview Coal-Fired Project. GenPower, LLC. 10/06 – 2/07.** Developed independent market report to support project financing of the Longview coal-fired project. Provided rating agency and investment bank support leading to $1.1B financing.

» **Acquisition of Reliant New York City Assets. Madison Dearborn Partners. 07/05 – 02/06.** Assist Madison Dearborn on bidding on and successful acquisition of Reliant's New York City assets.

» **Market Assessment and Transmission Evaluation for Various Distressed Generation Assets. Strategic Value Partners. 05/05 – 08/05.** Assessment of market structures and transmission infrastructure associated with various distressed generation assets in NYISO, ISO-NE, PJM, MISO, SPP, and the Southwest.

» **Market Assessment and Transmission Evaluation for Power Plant in Georgia. British Gas. 02/05 – 06/05.** Assessment of transmission, interconnection, and energy pricing issues for proposed 550 MW, expandable to 1,200 MW in Southeastern Georgia.

» **Value of Androscoggin Plant. TransCanada. 12/04 – 02/06.** Evaluation of future financial viability of Androscoggin power plant, located in Jay, Maine. Reviewed current state of competitive energy market in ISO-NE, as well as financial pro-forma for future plant performance as part of Mirant and Androscoggin bankruptcy proceedings.

» **Future Energy Market Revenue for** Proposed **Generation Plant. SNC Lavalin. 2/04 - 4/04.** Evaluation of expected future revenues for proposed plant in New York City in support of investment decisions.

» **Valuation of Transmission Corridors. Confidential Client. 5/03 – 12/03.** Evaluation of potential loss of electric transmission corridor value due to portions of the right-of-way shared with gas pipelines.

» **Energy Market DataWarehouse. Confidential Client. 8/03 - 11/03.** Developed energy market datawarehouse containing data for New York, New England, and PJM markets to support large hedge fund trades in the day-ahead markets and financial transmission rights (FTR) auctions.

» **Congestion Costs on Delmarva Peninsula. Old Dominion Electric Cooperative. 5/03 - 12/06.** Determination of future congestion costs under locational marginal pricing (LMP) for the customers on Delmarva Peninsula. Modifications of PJM rules for determination of facilities to include in congestion management (e.g., calculation of LMP).

» **RTO Participation Cost-Benefits. Tennessee Valley Authority. 3/03 - 9/03.** Evaluation of various modes of RTO participation for TVA transmission.

» **FERC Standard Market Design NOPR Impacts. Various Transmission Owners and Generation Owners. 6/02 - 1/03.** Provide FERC NOPR overview. Analyze potential impacts of proposed market design on transmission owners, generation owners, and integrated utilities.

» **Midwest Market Outlook. Ameren Energy Resources. 7/02 - 12/02.** Evaluation of trends in the Midwest electric and gas markets and potential impacts on AER business.

» **Sale of Energy Marketing Company. Confidential. 5/01 - 9/01.** Supported the development of the offering memorandum for a marketing company and proposals submitted by interested firms. Evaluated value of transmission congestion contracts (TCC) portfolio.

» **Representation at NYISO Planning Issues Subcommittees. Long Island Power Authority. 12/99 – 12/04.** Represented LIPA on NYISO Transmission Planning Advisory Subcommittee (TPAS), Interconnection Issues Task Force (IITF), and Electric System Planning Working Group (ESPWG).

Transmission Business Restructuring:

» **Evaluation of Development of Separate Transmission Business Company in Vertically Integrated Utility, Confidential Client, 12/06 – 2/07.** Assisted client in evaluating various options to increase earnings with alternate structures of transmission business.

Transmission Pricing & Tariff Development:

» **Cost Allocation and Cost Recovery for Transmission Upgrades. Long Island Power Authority. 7/03 – 12/08.** Supporting LIPA in NYISO, PJM and FERC to develop appropriate cost allocation and cost recovery mechanisms for reliability and economic transmission upgrades.

» **Northeast RTO and ITC – Expansion, Planning, and Tariff. LIPA. 3/02 - 12/02.** Participation in Northeast RTO and ITC transmission expansion, planning, and tariff working groups on behalf of transmission owner, development of policies and procedures.

» **Transmission Tariff Development. Confidential Client. 2/02 - 5/02.** Development of a transmission tariff, comprehensive review of parameters included in FERC approved tariffs, evaluated transmission rate methods.

Transmission & Distribution Planning & Operations:

» **Benefits of Transmission Development for Integration of Renewables. Tennessee Valley Authority, 2/11 – 12/11.** Provide advisory support services to TVA in discussions with major investor owned utilities assessing transmission development in the Midwest, East, and Southeast to integrate renewable resources.

» **Evaluation of Transmission Impacts for New Nuclear Plants in Southeast and Florida. Confidential. 10/05 – 6/06.** Project manager on transmission feasibility study for the next generation of nuclear power plants, averaging in size between 1000 and 3000MW.

» **Evaluation of Transmission Impacts for Coal-Fired Generation Siting. Confidential. 10/05 – 6/06.** Project manager on transmission feasibility study for various potential coal-fired project sites, average size of 1000MW.

» **Evaluation of Transmission Impacts and Market Opportunities for Next Generation Nuclear Plant. NuStart Energy. 06/05 – 08/05.** Project manager on transmission feasibility study and market opportunities for the next generation of nuclear power plants, averaging in size between 1500 and 2200MW.

» **T&D Operations. Long Island Power Authority. 12/99 – 7/13.** Project manager on T&D Operations tasks performed for LIPA; these include review of historical capital and O&M spending; evaluation of future capital expenditures; audits of capital expenditures, storm costs, planning data, operational performance; review of AMR, OMS, and BPL technologies and business case development for deployment; transmission and resource planning analyses; development of T&D business model; development of T&D standards and guidelines; and assistance in procuring replacement control center.

Compliance:

» **NERC Compliance Program, California Independent System Operator, 6/08.** Reviewed and provided context and requirements for implementation of Axentis compliance tracking software at CA ISO. Quarterly updates are provided as part of the on-going services.

» **Assessment of three-party ISA and responsibility allocation of NERC compliance requirements, Panda Energy, 5/08.** Reviewed transition from two party interconnection agreement to three party interconnection services agreement under PJM. In addition, reviewed GOP requirements and allocated responsibilities for tolling arrangement.

» **NERC Compliance Program, New York Power Authority, 7/07 – 12/10.** Performed an in-depth gap analysis on all requirements for TO, GO, LSE, and PSE functions; Tracked compliance in the Microsoft Access database and implemented the OATI software; Assisted with self-certification; Designed and implemented a compliance program, manual, and training materials; Deliver training to responsible staff; Developed a compliance certification and management process within the organization; Performed additional "what if" scenarios; Identified and delegated standards that NYISO is responsible for; and Conducted on-site pre-audits.

» **Standards of Conduct for Transmission Providers, Edison Electric Institute, 3/07.** Developed affidavit for access to off-OASIS transmission information for IRP and competitive solicitations in RM-07-1-000.

» **Review of ERO Requirements, Long Island Power Authority, 2006-2007.** Assessed applicability of Electric Reliability Organization (ERO) requirements to LIPA, and prepared plan to demonstrate compliance.

Generation & Merchant Transmission Interconnection:

» **Standard Interconnection Agreement and Procedures. LIPA. 10/01 - 2/02.** Represented LIPA in the FERC ANOPR stakeholder process. Transmission owner spokesperson on Interconnection Procedures drafting team.

» **Needs Assessment, Competitor Analysis, and Interconnection Agreement. Developer – Confidential. 10/01 - 7/02.** Developed needs assessment portion of New York Siting Board Article VII application; provided in-depth analysis of competition seeking interconnection at same electrical point on transmission system; provided overview and analysis of NYISO cost allocation policy; assisting in strategic issues on interconnection agreement.

» **New York Siting Board Article X Application. PSEG New York – Bethlehem Energy Center. 2/01 - 12/02.** Supporting system impact assessment issues necessary to accommodate the Bethlehem Energy Center project.

Testimony or Expert Report Experience, Regulatory Proceedings

Docket No.	Jurisdiction	Proceeding	Client	Year	Subject Matter
	Supreme Court, State of New York	Eminent Domain, Condemnation	Syracuse University	2009	Affidavit in the Matter of a Proposed Acquisition Under Eminent Domain Procedure Law Article 2 by Project Orange Associates Services Corporation
RM-07-1-000	FERC	FERC, Standards of Conduct for Transmission Providers	EEI	2007	Affidavit for access to off-OASIS transmission information for IRP and Competitive Solicitations
PA03-12-000	FERC	FERC / PJM	Old Dominion Electric Cooperative	2003	Transmission Congestion on the Delmarva Peninsula
02-M-0132	NY	PSEG Power	PSEG Power	2002	Combined Docket for those projects wishing to interconnect to ConEd's W. 49th Street Substation
00-F-1522	NY	Orion Power (now Reliant)	Orion Power	2002	Article X for Orion's Astoria Repowering Project
00-F-0566	NY	ANP	LIPA	2002	Article X for ANP's Brookhaven Energy Project
01-T-1474	NY	PSEG Power	PSEG Power	2001-2002	Article VII for Cross Hudson Project
97-F-2162	NY	PSEG Power	PSEG Power	2001	Article X for PSEG Bethlehem Energy Center
	MI, Howard Township	Indeck	Indeck	2001	Zoning hearing for Niles, MI plant (EMF, need, interconnection)
98-F-1885	NY	Sithe	Sithe	1999	Article X for Sithe Tome Valley (now Sentry); project withdrawn in 2001
	IL	Indeck	Indeck	1999	Zoning hearing for Pleasant Valley Plant (EMF, need, interconnection)
	IL	Indeck	Indeck	1999	Zoning hearing for Libertyville Plant (EMF, need, interconnection)
	IL	Indeck	Indeck	1999	Zoning hearing for Holiday Hills Plant (EMF, need, interconnection)
Dockets 5841/5859	VT	Vermont Department of Public Service (VTDPS)	VTDPS	1996-1998	VTDPS vs. Citizens Utilities (prudent utility practices, 248 filings)
	PA, Richland Township	Destec	Destec	1995	Zoning hearing for conditional use permits (EMF, need, interconnection)
Advance Plan 7	WI	Wisconsin Utilities	Wisconsin Utilities	1994	Development and testimony on EMF portions of WI utilities filing for Advance Plan 7
	PA, Carbon County	Panther Creek Partners (joint venture between Constellation & Alsthom)	Panther Creek Partners / Kirkpatrick & Lockhart	1992	Zoning hearings for PCP plant in Tamaqua, PA (EMF, need, interconnection)

Testimony or Expert Report Experience, Commercial Litigation

Matter Name	Court/ Arbitration Name	Plaintiff(s) & Defendant(s)	Client	Year	Subject Matter
Case No. ARB/05/24	International Centre for Settlement of Investment Disputes	Hrvatska Elektroprivreda and The Republic of Slovenia	Hrvatska Elektroprivreda	2007-2009	Estimation of increased costs for replacement power for Krsko nuclear power plant
Action No. 0501-17864	Court of Queen's Bench of Alberta Judicial District of Calgary	Calpine Canada Energy Limited, et. al.	Kelson Energy	2007	Future Market Revenues for Calgary Energy Centre
Case Number: 16 Y 110 00065 04	American Arbitration Association	Bechtel Power Corporation and Athens Generating Company, LP	Bechtel Power Corporation	2007-2009	Athens' potential revenues during damage period
Case 04-12221-LHK	United States Bankruptcy Court, State of Maine	TransCanada claim in Mirant bankruptcy	TransCanada	2004-2005	Future feasibility of Androscoggin plant
Case 03-46590	United States Bankruptcy Court for the Northern District of Texas, Fort Worth Division	TransCanada Claim in Mirant Bankruptcy	TransCanada	2004-2005	Future feasibility of Androscoggin plant
GD03-24295, Energy Market Sales Losses	Court of Common Pleas of Allegheny County	FirstEnergy v. Safway Scaffold	Dickie, McCamey & Chilcote, P.C. for Safway Scaffolding	2004	Revenue sale losses due to damage to Bruce Mansfield #3 boiler during maintenance
Docket C-02-105-B, Shared Gas-Electric Corridor Valuation	United States District Court for the District of New Hampshire	Public Service Company of New Hampshire v. Portland Natural Gas Transmission Company & Maritimes and Northeast Pipeline, LLC	Gallagher, Callahan, & Gartrell for PNGTS	2003	Impairment damages
National Security Agency (NSA) brain tumors case	Maryland	Grimes and van Meter vs. Electro-Matic Products Co.	Law Offices of Peter Angelos	2002	Magnetic fields from degausser; exposure level for assessment of whether field levels contributed to brain tumor development
Stray Voltage	New York	Carharts and Migones vs. Hamilton Municipal Utility	Clippinger Law Office	1999	Stray voltage in cow barns
Docket 92-2051, Claim T-448239	Washington State Workman's Comp	Pilisuk vs. Seattle City Light	Seattle City Light	1993	Death claim due to electric and magnetic fields exposure during employment at SCL

Publications and Presentations

- "Transmission Summit 2013," Conference Chairperson for InfoCast's Transmission Summit 2013, Washington, February 25-27, 2013.
- "Shifting Control to the Customer: Consumer Engagement in a Smart Grid Era," CPS Energy EmpowerU panel discussion, San Antonio, Texas, February 19, 2013.
- "Coal-Fired Plant Retirements," Infocast Projects & Money conference, New Orleans, January 15, 2013.
- "Outlook for Independent Transmission and HVDC in the Eastern Interconnection," Energy Central TransForum East Conference, Arlington, VA, December 5, 2012.
- "Competition in Transmission Development – What Does it Look Like?", Platts Transmission Planning and Development Conference, Arlington, VA, September 11, 2012.
- "Transmission Planning and Development Conference," Conference Chairperson for Platts 2012 conference, Arlington, VA, September 11-12, 2012.
- "Northeast Power Markets," Conference Chairperson for Platts 7th Annual conference, New York City, April 30 – May 1, 2012.
- "Transmission Summit 2012," Conference Chairperson for InfoCast's Transmission Summit 2012, Washington, February 29 – March 2, 2012.
- "Transmission Summit 2011," Conference Chairperson for InfoCast's Transmission Summit 2011, Washington, March 22-25, 2011.
- "Transmission West Summit 2010," Conference Chairperson for InfoCast's Transmission West 2010, San Francisco, September 20-22, 2010.
- "Everyday Tools: The Direct and Cross-Examination of Witnesses," 2010 Section of Litigation Annual Conference, American Bar Association, New York, April 21-23, 2010.
- "Integration of Technologies: Renewables, Demand Response, Energy Storage, and the Smart Grid," EEI Strategic Issues Roundtable, Washington, DC, April 14-15, 2010.
- "Integrating New Nuclear Plants into Transmission Grids," The Canadian Institute's Nuclear Symposium, March 23-24, 2010.
- "Transmission Summit 2010," Conference Chairperson for InfoCast's Transmission Summit 2010, Washington, DC, March 3-5, 2010.
- "FERC Compliance Summit," Conference Co-Chairperson for InfoCast's FERC Compliance Summit, Washington, DC, March 23-25, 2009.

» "Transmission Summit 2009," Conference Chairperson for InfoCast's Transmission Summit 2009, Washington, DC, March 11-13, 2009.

» "FERC Compliance Summit," Conference Chairperson for InfoCast's FERC Compliance Summit, Washington, DC, October 20-22, 2008.

» "M&A and Financing Opportunities in the North American Energy & Utilities Sector," contributor to article, Financier Worldwide, May 2008.

» "FERC Compliance Summit," Conference Chairperson for InfoCast's FERC Compliance Summit, Washington, DC, May 19-21, 2008.

» "Transmission Summit 2008," Conference Chairperson for InfoCast's Transmission Summit 2008, Arlington, VA, March 5-7, 2008.

» "Dealing with Independent Investigations," panel presentation at Infocast's FERC Compliance Summit 2008, Washington, DC, January 18, 2008.

» "Doing What's Required: No Matter How Challenging," panel presentation on Reaching the Top: Women in Energy, Women's Council on Energy and the Environment, Washington, DC, June 28, 2007.

» "Transmission Summit 2007," Conference Chairperson for InfoCast's Transmission Summit 2007, Arlington, VA, March 7-9, 2007.

» "Post EPAct Transmission Siting 101: The Nuts and Bolts of Planning and Developing New Transmission Facilities in Today's Market," panel session speaker at Infocast Transmission Project Development Renaissance conference, Arlington, VA, October 4, 2006.

» "Reliability Summit 2006," Conference Co-chair and panel session leader for Infocast's Reliability Summit 2006, Washington, DC, September 6-8, 2006.

» "Transmission Summit 2006," Conference Chairperson for InfoCast's Transmission Summit 2006, Arlington, VA, March 13-15, 2006.

» "Reliability Summit 2005," Conference Chairperson for InfoCast's Reliability Summit 2005, Arlington, VA, September 27-29, 2005.

» "Cooking with Capacity," Project Finance Power Report, September 2005.

» "Think Again about Transmission – What KKR's ITC IPO says about the value of transmission assets....for some," co-author with Maschoff and Schroeder, Navigant Consulting Perspectives, September 2005.

» "Capacity Market Elements – Transmission Planning" FERC Technical Conference – Capacity Markets in PJM Region, Washington, DC, June 16, 2005.

- "Building the Grid of the Future," Conference Chairperson for InfoCast's Transmission Summit 2004, Washington, DC, March 7-9, 2005.
- "Asset Management Workshop," T&D World Expo, Indianapolis, May 24, 2004.
- "Getting Maximum Value from Transmission Expansion," Financing Transmission Seminar sponsored by Ballard Spahr, New York City, November 20, 2003.
- "Ensuring Grid Expansion with Appropriate Market Structures," CBI Transmission Expansion Conference, Alexandria, VA, October 8-9, 2003.
- "Interconnection Procedures and Policies: Why Generation Must Be Treated Differently from Transmission," EUCI Transmission Expansion and Reliability Conference, Atlanta, GA, May 7-9, 2003.
- "T&D Outsourcing Workshop," T&D World Conference, St. Petersburg, FL, November 4, 2002.
- "What's Under the Hood of FERC's NOPR?," NOPR Briefing for Canadian Market Participants, Calgary, September 26, 2002; Toronto, October 16, 2002.
- "Some Causes of Recent Major Outages," Infocast Distribution Reliability Conference, Washington, DC, January 24-26, 1999.
- "Information Technology: Its Increased Importance in the Power Industry After Deregulation," presented at the 1999 IEEE Summer Power Meeting, Edmonton, Alberta, July 1999.
- "EPRI's Substation Design Workstation," PTI's Power Technology Newsletter, 3rd quarter 1998.
- "Evaluation of the Performance of Line Protection Schemes on the NYSEG Six Phase Transmission System," presented at the 1998 IEEE Summer Power Meeting, San Diego, California, July 1998.
- "Corona and Field Effects Experience on an Operating Utility Six-Phase Transmission Line," presented at 1998 IEEE Winter Power Meeting, Tampa, Florida, February 1998.
- "Evaluation and Testing of a Single Terminal Step Distance Scheme for Use on a Six Phase Transmission System," presented at 1998 IEEE Winter Power Meeting, Tampa, Florida, February 1998.
- "Low Voltage Staged Faults on New York State Electric and Gas Six-Phase Transmission Line," submitted to Power System Relaying Committee of IEEE, December 12, 1996.
- "Environmental Advantage of Innovative Transmission Designs," World Council of Power Utilities First International Conference on Green Power, September 1996.
- "When Standard Designs Become Part of the Problem," PEA System Planning Committee Meeting, September 17, 1996.
- "Power Transmission," Encyclopedia of Applied Physics, VCH Publishers, New York, 1995.

» "The Effect of Demand Side Management Programs on Magnetic Field Exposure," 28th Annual Frontiers of Power Conference, Stillwater, Oklahoma, October 30-31, 1995.

» "System Implications of Magnetic Field Management," Pennsylvania Electric Association's System Planning Meeting, Valley Forge, Pennsylvania, May 24, 1995.

» "Magnetic Fields from a High Phase Order Transmission Line Operating Under Balanced and Unbalanced Current Conditions," Proceedings of CIGRE Study Committee 36 Colloquium on Power System Electromagnetic Compatibility, Foz do Iguacu, Brazil, May 21-27, 1995.

» "Practical Considerations of Reducing Magnetic Fields from Transmission and Distribution Lines," 56th Annual American Power Conference, Chicago, April 26, 1994.

» "Electric and Magnetic Fields from Overhead Transmission Lines," Training Session on EMF Management Techniques, 1994 IEEE/PES Transmission and Distribution Conference and Exposition, Chicago, April 14, 1994.

» "Electromagnetic Fields from Underground Cables," Doble Seminar, October 1993.

» "Selection and Application of Relay Protection for Six Phase Demonstration Project," IEEE Transactions on Power Delivery, October 1992, Vol. 7, No. 4, p. 1900.

» "Simulating Fast and Slow Dynamic Effects in Power Systems," IEEE Computer Applications in Power, July 1992, Vol. 5, No. 3, p. 33.

» "Insulation Coordination, Environmental and System Analysis of Existing Double Circuit Line Reconfigured to Six-Phase Operation," IEEE Transactions on Power Delivery, July 1992, Vol. 7, No. 3, p. 1628.

» "Transformer Winding Selection Associated with Reconfiguration of Existing Double Circuit Line to Six-Phase Operation," IEEE Transactions on Power Delivery, April 1992, Vol. 7, No. 2, p. 979.

» "Anchorage-Fairbanks Interconnected Power System Study," The Northern Engineer, Vol. 20, No. 1, Spring 1988.

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Robert A. Marks

Bob graduated from the University of Wisconsin in 1974 and the University of Cincinnati College of Law in 1977. He was admitted to the Ohio bar in 1977 and the Hawaii bar in 1978.

Before coming to Price Okamoto Himeno & Lum, Bob became Attorney General of Hawaii (1992-1994) after Warren Price left that post. Prior to that, he held various posts in the Hawaii Attorney General's office, including First Deputy Attorney General and supervisor of the Commerce and Economic Development Division, where he advised agencies and litigated commercial, contract and regulatory cases for the State.

Bob's current practice concentrates in complex litigation, including class action litigation, and appellate work in state and federal courts.

Bob was a trustee of Temple Emanu-El in Honolulu (1994-1996; 2001-2006).

NAVIGANT

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Professional History

- Director, Navigant Consulting, Inc.
  2008 - Present
- Director of Power Contracts, Long Island Power Authority
  2001 - 2008
- Director of Power Contracts and Billing, New York Power Authority
  1978 - 2001
- Associate Engineer, American Electric Power
  1977 - 1978
- Case Analyst, New York Public Service Commission
  1973 - 1977

Education

- MBA, Economics, Pace University
- Bachelor of Engineering (Industrial), Pratt Institute

Mr. Peterson is a Director in the Energy practice of Navigant Consulting, Inc. He has more than 39 years of utility experience with a focus on the electric, gas and water sectors. His principal areas of responsibility have involved (i) procuring power supply and transmission service, (ii) negotiating contracts for the purchase and sale of power and energy, transmission service and gas transportation, (iii) developing wholesale and retail rates and (iv) overseeing the operation of customer billing systems. Mr. Peterson has also testified in both regulatory and legal proceedings.

Professional Experience

» Managed all aspects of a utility Power Markets organization (including power procurement and contracts, project management, planning, fuel supply and energy scheduling) of a large electric New York utility that was responsible for meeting the energy requirements of more than one million retail customers.

» Oversaw the procurement process for more than 2,500 megawatts of generating and transmission capacity that was required to meet the growing peak load requirements of retail electric customers of a large electric utility.

» Managed the procurement of large blocks of renewable energy and related attributes to meet the RPS commitments of a major New York electric utility.

» Responsible for the negotiation of long term power purchase agreements ("PPAs") and firm transmission capacity purchase agreements, some of which are valued in excess of one billion dollars. Secured the requisite senior management and governmental approvals for such agreements.

» Negotiated transportation agreements for local gas delivery (firm and interruptible) and Facilities Construction Reimbursement Agreements for gas system upgrades for all new power plants added on Long Island since 2002.

» Negotiated long term PPAs for purchases of renewable energy and related green attributes.

» Negotiated Memorandum of Understanding with a pipeline company for a Scoping and Feasibility Study for a 22 mile high pressure natural gas pipeline along with a related Precedent Agreement.

» Administered new PPAs and vintage agreements with independent power producers; resolved issues pertaining to the interpretation of those agreements; and negotiated amendments to agreements as required.

» Along with representatives of a co-owning utility of a submarine high voltage transmission cable between New York and Connecticut, administered a procurement process and negotiated an EPC contract with the selected high voltage cable vendor for the removal and replacement of such facility.

» Negotiated and administered numerous long term agreements totaling in excess of 3,000 megawatts for the sale of low cost hydropower, nuclear power and pumped storage capacity to municipal electric utilities, neighboring state bargaining agencies, investor-owned utilities and large industries.

» Negotiated energy service agreements providing for the installation of solar generating facilities at twelve water filtration and wastewater treatment plants.

» Prepared Requests for Expressions of Interest and Requests for Proposals and administered the related procurement processes for large scale renewable energy projects including hydropower, wind, solar, fuel cells and landfill gas.

» Oversaw the administration of primarily wholesale long term power contracts and related transmission contracts involving the sale of more than 4,000 megawatts.

» Negotiated a Facilities and Marketing Agreement with the local electric utility for the installation and commercial operation of a 600 MW high voltage transmission cable between Westchester and Long, Island.

» Negotiated a Capacity Supply Agreement with the local electric utility providing for the construction of the first state-of-the-art combined cycle power plant to be installed on Long Island.

» Developed and negotiated agreements with investor-owned utilities for the transmission and distribution of low cost power that was made available to designated retail business customers throughout New York State pursuant to State law.

» Negotiated wheeling agreements with investor-owned utilities, including the development of applicable transmission rates, for the transmission of wholesale power and energy to municipal electric systems and rural electric cooperatives in New York State and in states neighboring New York State.

» Managed utility billing operations associated with the collection of more than two billion dollars in annual electric revenue.

» Coordinated the preparation and administration of wholesale and retail rate increase applications to be filed by investor-owned utilities with state and federal regulatory bodies.

» Prepared draft Administrative Law Judge Recommended Decisions in connection with retail rate increase applications filed by electric and gas investor-owned utilities with State regulatory authority.

» Testified in utility regulatory proceedings on power allocation and cost-of-service issues.

ATTACHMENT

Major Procurements Managed and Contracts

Negotiated for the Long Island Power Authority

Off-Island Resource RFP for up to 1,000 MW – Issued 2005

Pursuant to this procurement, 1,000 MW of capacity and energy was sought from generators located in the PJM and ISO – New England control areas. The ultimate selection process resulted in awards to the FPL Marcus Hook Combined Cycle Power Plant (685 MW) in PJM and the Bear Swamp pumped storage/hydro portfolio (345 MW). Long term Power Purchase Agreements ("PPAs")were negotiated with both parties.

2007 Generation and Transmission RFP – Issued 2003

Proposals for generating projects and/or merchant transmission lines (between 250 MW and 600 MW) to neighboring control areas were the subject of this RFP. After a thorough evaluation of all proposals pursuant to a multi-phase review process developed by Navigant, awards were granted to the Caithness Long Island Energy Center (new 326 MW combined cycle power plant) and the Neptune Regional Transmission System (new 660 MW DC cable between Sayreville, New Jersey and New Cassel, New York). A PPA was completed with Caithness and a Firm Transmission Capacity Purchase Agreement was negotiated Neptune, along with numerous ancillary agreements with both parties. The Neptune project became commercial in June 2007 and Caithness is expected to commence operations in second quarter of 2009.

2005 Combined Cycle Generation RFP – Issued 2004

Bids for combined cycle generation projects of 80 MW each were requested under this RFP. The projects needed to be constructed on an expedited basis to be commercial by the summer of 2005. To meet the ambitious schedule the procurement was conducted in an accelerated fashion. Two projects were selected (Pinelawn Power and Calpine Bethpage Energy Center) out of the 15 proposals received. PPAs were negotiated and both projects commenced commercial service on schedule.

Mobile Generation RFP - Issued 2003

To assist in meeting supper peak demands pending the completion of permanent solutions, an RFP for up to 120 MW of temporary generation for a period of four years. The multi-phase procurement process resulted in the selection of Cummins Metropower to install 88 MW of diesel generation at two locations. An agreement was negotiated with Cummins and the units provided service for the summers of 2004 through 2007.

Renewable Energy RFP – Issued 2007

In order to meet Renewable Energy Portfolio Standard commitments, an RFP seeking 300 GWH/year for ten years was issued. A thorough selection process was completed and proposals from Brookfield Power (hydro) and PPL EnergyPlus (landfill gas) were chosen. Two PPAs with Brookfield were completed and a PPA with PPL is currently under negotiation.

Power Supply Management RFP – Issued 2007

With the impending expiration of an Energy Management Agreement with KeySpan Energy Trading Services, the RFP for a new Power Supply Management service provider was issued. Among other things, the Power Supply Manager is responsible for bidding the generation from the 92 generating units under contract into the markets administered by the New York Independent System Operator. The multi-phase procurement process resulted in the selection of Con Edison Energy (for Front and Back Offices) and Pace Global (for Mid Office). Contracts were negotiated with Con Edison and Pace and the transition is currently underway.

Other RFPs

RFPs for Off-Shore Wind (2002), Fuel Cell Generation (2005) and Fuel Cell Cogeneration (2007) were also developed and administered, but did not result in contracts primarily due to pricing issues.

Competitive Negotiations

Employing competitive negotiations, PPAs were negotiated with the following developers during the 2001 through 2003 period, all for which projects were completed:

Developer	Project	MW
FPL	Bayswater	55
FPL	Jamaica Bay	55

KeySpan Generation	Glenwood	80
KeySpan Generation	Port Jefferson	80
Calpine	Bethpage	45
PPL	Brentwood	80
PPL	Shoreham	80
Equus Power	Freeport	45
Global Common	Greenport	52
Village of Freeport	Freeport	10
General Electric	Temporary	230

UNDERSEA CABLE EXPERIENCE

Jim Peterson, a Director in Navigant's Energy Practice, has substantial experience in connection with high voltage undersea cable projects. Following is a listing of the major projects with which Jim has been involved:

- 330 MW HVDC TransÉnergie Cross Sound Cable Project
- 660 MW HVDC Neptune Regional Transmission System
- 660 MW HVDC Hudson Transmission Partners Project
- 600 MW Long Island Sound Cable Project
- 450 MW Northport - Norwalk Cable Replacement Project
- 400 MW Oahu - Molokai Project (Proposed)
- 900 MW Labrador – Newfoundland Project (Proposed)

The 330 MW HVDC project interconnects the United Illuminated System in New Haven, Connecticut with the Long Island Power Authority ("LIPA") system in Shoreham, New York. Jim was responsible for the 25 year Firm Transmission Capacity Purchase Agreement ("FTCPA") under which LIPA purchases the capacity from this project and also had a project management role for LIPA during the project's construction. In addition, Jim negotiated several long term Power Purchase Agreements ("PPA") that use the cable's capacity.

The Neptune cable interconnects First Energy in Sayreville, New Jersey with LIPA in Levittown, New York. Jim negotiated the FTCPA on behalf of LIPA and also negotiated a long term PPA with FPL under which LIPA purchases 685 MW of capacity from the Marcus Hook generating facility for delivery over the Neptune cable.

The Hudson Transmission Partners ("HTP") project commenced commercial operation in 2013. This project will interconnect the PSEG system in North Bergen, New Jersey with the Consolidated Edison system in New York City, New York. The project is being constructed for the benefit of the New York Power Authority ("NYPA") and Jim assisted NYPA in the negotiation of the FTCPA with HTP and also oversaw the economic analyses of the costs and benefits associated with the project.

The 600 MW Long Island Sound Cable Project was installed by NYPA and interconnects the LIPA system in East Garden City, New York with the Consolidated Edison system, in Sprain Brook, New York. On behalf of NYPA, Jim negotiated the Sound Cable Project facilities and Marketing Agreement between NYPA and LIPA. In addition, Jim was responsible for the negotiation of the agreement between NYPA and Consolidated Edison that provided for the interconnection and operating arrangements applicable to the Consolidated Edison system.

The 450 MW Northport – Norwalk Cable Replacement project entailed the replacement of a cable crossing Long Island Sound that was jointly owned by Northeast Utilities ("NU") in Connecticut and LIPA. Along with representatives from NU, Jim negotiated the EPC contract with Nexans under which the original cable that had been leaking oil in Long Island Sound was removed and replaced with a new cable.

The 400 Mw Oahu – Molokai cable project involved a proposed HVDC cable that would interconnect wind farms (200 MW each) planned for Molokai and Lanai that would serve the load center on Oahu (an AC cable would interconnect the wind farm on Lanai with the converter station on Molokai). Jim was part of a team that prepared a report on behalf of the State of Hawaii setting forth a plan for developing the cable project.

The Labrador – Newfoundland project includes an 1100 KM HVDC project that would cross the Straits of Belle Island (30 KM undersea) for the purpose of delivering energy from a proposed Muskrat Falls generating facility in Labrador to the load center in Newfoundland. On behalf of Nalcor, the project developer, Jim reviewed the economic and technical aspects of the project.

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Professional History

- Managing Consultant, Navigant Consulting, Inc.
- Operations Research Analyst, U.S. Information Administration

Education

- Ph. D., Industrial Engineering, Texas A&M University
- BSE., Operations Research and Financial Engineering, Princeton University

Professional Affiliations

- Member of the US Association of Energy Economics

Mr. Tanner has ten years' experience in modeling, optimization, and software development. He has spent the last four years designing and developing energy models for Navigant and the U.S. Energy Information Administration.

Professional Experience

» **Electric Power Modeling for Navigant, Managing Consulting, 2012-Present.** Focuses on energy market analysis and asset planning. Responsible for designing, implementing, and updating NCI's proprietary suite of power market forecasting models. The Extrinsic Value Model (EVM) forecasts hourly dispatch and associated cash flow for the life-time of individual generating units treated as price takers. The Portfolio Optimization Model (POM) optimizes generating capacity portfolios and expansion plants, with an emphasis on the impacts of environmental regulations. The Capacity Market Model forecasts clearing prices and resource quantities in the Northeastern ISOs. The Delivered Price Test Model (DPT) provides market power analyses for FERC filings of asset transactions.

At Navigant, Dr. Tanner has contributed to a wide variety of energy planning projects focusing on scenario analysis of asset value, energy market price forecasting, and asset decision analysis.

» **Oil, Natural Gas, and Infrastructure Modeling for U.S. Energy Information Administration, Operations Research Analyst, 2009-2012.** Responsible for developing a long-term international oil market model, performed analysis on the U.S. natural gas industry focusing on the impact of shale gas on long-term prices and markets, analyzed the outlook for emerging technologies such as Carbon Capture and Sequestration in the power industry and natural gas vehicles in the transportation industry.

» **Research in Discrete Stochastic Optimization Algorithms and Implementation at Texas A&M University, Graduate Research Assistant, 2004-2009.** Developed and implemented algorithms for discrete stochastic optimization. Applications included optimal location problems and optimal allocations of vaccines under uncertainty.

Publications and Presentations

Mr. Tanner co-authored a number of publications and conference presentations on optimization algorithms and on energy sector modeling.

Appendix B

Examples of Significant State Involvement in Project Development

The following is a brief description of various examples in which states have assumed large roles in the development of major utility transmission (and generation) projects that were in the public interest and would not otherwise have been constructed.

- New York Power Authority Y-49 Cable Project – Y-49 is an underground and underwater transmission cable in New York interconnecting the then Long Island Lighting Company (now Long Island Power Authority) transmission system with the Consolidated Edison transmission system that became commercial in 1991. The cable was needed to provide reliable service to retail customers on Long Island, New York. However, because LILCO could not finance the project, the New York Power Authority (NYPA) (a State agency) was authorized to cause the 600 MW cable project to be installed. Although NYPA is a wholesaler of electric power in New York for specific identified customers, it did not perform this function for the benefit of its customers but as a facilitator for the State because the project was in the public interest.

See Long Island Lighting Company v. Federal Energy Regulatory Commission, 20 F.3d 494, (April 15, 1994) for a background of the Sound Cable Project Facilities and Marketing Agreement ("SCP Agreement") between Long Island Lighting Company and the New York Power Authority entered into in 1987.

- New York Power Authority – Hudson Transmission Partners – This 660 MW HVDC cable interconnecting the Consolidated Edison transmission system in New York City with the Public Service Electric and Gas Company transmission system in New Jersey became commercial this year. NYPA caused the project, which results in lower energy costs in New York City, by executing a Firm Transmission Capacity Purchase Agreement ("FTCPA") for 75 percent of the project capacity. The project was installed because it is considered to be in the public interest. It is not interconnected with the NYPA system nor does it directly benefit any NYPA customers.

See N.Y.P.S.C. Case 08-T-0034, *Order Granting Certificate of Environmental Compatibility and Public Need*, Application of Hudson Transmission Partners, LLC for a Certificate of Environmental Compatibility and Public Need for a 345 kV Submarine/Underground Electric Transmission Link Between Manhattan and New Jersey (September 15, 2010). See also, *New 7-Mile 660 Megawatt Hudson Transmission Power Line Enhancing Reliability and Energy Security in NYC*, New York Power Authority News Release (June 5, 2013).

- New York Public Service Commission/New York Power Authority – Indian Point Contingency Plan – Recognizing that the 2000 MW Indian Point Nuclear Power Plant may be retired shortly if it does not receive a license extension from the Nuclear Regulatory Commission, the Governor of New York recently directed the New York Public Service Commission and NYPA to develop a Request for Proposals ("RFP") for

new generation and/or transmission to potentially replace the nuclear capacity. The two agencies have been administering the RFP process. Upon selection, NYPA will negotiate Power Purchase Agreements ("PPAs") with the winning bidders. NYPA will be performing this role to support the public interest of the State and not on behalf of its customers.

See N.Y.P.S.C. Case 12-E-0503, *Order Instituting Proceeding and Soliciting Indian Point Contingency Plan*, Proceeding on Motion of the Commission to Review Generation Retirement Contingency Plans (November 30, 2012). See also, *Inquiry No. Q13-5441LW - Contingency Procurement of Generation and Transmission Request for Proposals Invitation Letter*, New York Power Authority (April 3, 2013).

- California Department of Water Resources – CDWR Solicitations – In the early 2000's, California needed additional generation to maintain service to the ratepayers in the State. As the Investor Owned Utilities were barred from building new generation, the California Department of Water Resources ("CDWR") conducted competitive solicitations for several thousand MWs and negotiated related PPAs that resulted in the construction of numerous power plants.

- New York Power Authority – Simple Cycle Generating Units – Similar to the CDWR situation discussed above, in 2000, New York City was in jeopardy of not having sufficient generation to reliably serve the load. Recognizing that no other party was stepping up, NYPA quickly installed 11 simple cycle generating plants throughout the area. These plants were not connected to the NYPA transmission system, nor were they used to serve NYPA customers. Rather, NYPA installed the plants to serve the public interest needs of this region of the State.

See PowerNow! Small, Clean Plants, New York Power Authority, available at: http://www.nypa.gov/facilities/powernow.htm.

- State of Rhode Island – Deepwater Wind Offshore Project – The State of Rhode Island has entered into a Joint Development Agreement ("JDA") with Deepwater Wind concerning an offshore wind project. The State's obligations, to the extent lawful, include (i) assisting the developer in expediting permits and approvals and (ii) assisting the developer in securing one or more PPAs or other related arrangements.

See Joint Development Agreement Between the State of Rhode Island and Deepwater Wind Rhode Island, LLC (January 2, 2009), entered into by the Honorable Donald L. Carcieri, Governor, State of Rhode Island and Deepwater Wind Rhode Island, LLC. See also, R.I.P.U.C. Docket No. 4185, *Report and Order*, In Re: Review of Amended Power Purchase Agreement Between Narragansett Electric Company D/B/A National Grid and Deepwater Wind Block Island, LLC Pursuant to R.I. Gen. Laws § 39-26.1-7 (August 16, 2010). See also, Long Term Contracting Standard for Renewable Energy Act, codified at R.I. Gen. Laws § 39-26.1-26.8.

Appendix C
Major Assumptions Used in Quantitative Analysis

Assumption	Description	Support
Base Case	Hawaii IRP 2013 "Stuck in the Middle" Contingency Plan	Chosen because "Stuck in the Middle" is Hawaiian Companies' Reference case. (This contingency plan assumes no LNG facility on Oahu).
Study Period	2013-2050	Forecast of the cable value over the first 30 years of operation. (2020 – 2050)
Run Years	2013; 2015; 2020; 2024; 2028; 2032; 2036; 2040, 2045, 2050	Years chosen to speed model solution time. Intermediate years are interpolated.
Footprint	HECO and MECO (Maui) Electric Systems	The Cable Project would only affect these systems.
Load Forecast	from Base Case	See Base Case above.
Fuel Cost Forecast	from Base Case	See Base Case above.
Generation Builds and Retirements	from Base Case	See Base Case above.
Generator Capacities	from Base Case	See Base Case above.
Generator Heat Rates	Historic realized heat rates pulled from SNL.com. For units that do not report heat rates (<50 MW), values are taken from the 2012 Solar Integration Study Technical Report - Maui and the Oahu Wind Integration Study 2011.	SNL aggregates publically available historic generation data submitted to EIA for all units over 50 MW. Units under 50MW do not report capacity and thus the only available heat rate information is from the two NREL studies.
Must Run Base load Constraints	Values are taken from the Hawaii IRP with adjustments made according to the "Stuck in the Middle" Contingency Plan. Assumes that the cable allows Waiau 8 or 9 to cycle and Maalaea CC to run in 1X1 configuration to represent the reduction in up and down regulation.	Units that are currently base load are assumed to remain base load unless specifically changed to cycling per the Hawaii IRP plans. The addition of the cable should allow additional units to cycle as the two systems are combined and less up and down regulation would be required. Modeling the system with no changes gives lower bounds on the cable value as this is a conservative assumption.
Generator Min Loads	Values are taken from the 2012 Solar Integration Study Technical Report - Maui and the Oahu Wind Integration Study 2011..	This is the only publically available source of information.
Operating Reserves	Operating reserves are met through maintaining base load constraints taken from the Hawaii IRP and "Stuck in the Middle" Contingency Plan.	This is a typical requirement of utilities.
Renewable Generation Shapes and Capacity Factors	NREL WECC data for shapes and historic unit specific capacity factors. New renewables have the following capacity factors 22% Oahu wind, 37.5% Maui wind, 30% utility solar.	The NREL WECC generation shapes are used because no Hawaii specific shapes are available. The new wind capacity factors on the two islands are created by averaging the historic capacity factors of existing units. The new solar capacity factors are an assumption based on the estimated capacity factors employed by Navigant in other high quality solar project applications.
Carbon Credits	No monetary value included except in a	There is no legislation mandating a carbon

Assumption	Description	Support
	sensitivity using recent information from DOE.	price.
Annual Costs of Renewables	Held constant between scenarios based on amount built in "Stuck in the Middle" Contingency Plan.	The assumption is that building wind has the same cost on the two islands and so shifting wind from Oahu to Maui will not impact the overall investment in new generation. Thus it does not need to be considered when calculating the impacts of the different scenarios.
Discount Rate	7.0%	This is an assumed discount rate applicable to the State of Hawaii
Electric Rate Calculation Approach	Is a partial electric rate calculation that considers system fuel costs and any additional capital costs specific to the scenario being analyzed. Partial rates will be calculated for HECO and MECO individually.	This is used because the key output of the model is the impacts of the scenario on overall system cost and none of the rest of the costs of the system will change due to the cable or shifting wind resources.
Cable Project Costs	$75 million/yr (levelized cost)	See Appendix E.
Assumed Annual Availability of Cable	100.00%	Availability of existing cable projects in the U.S. are at or very close to 100%.
Energy Loss for Cable	3.0%	This is based on losses experienced in similar projects.
Unit ramp rates and intra-hour variability	Not considered in POM.	The model is unable to factor this.
AC Transmission Infrastructure	Included in Cable Costs	See Appendix E.
Cable Project Capital Cost	702.2 million	Details provided in Appendix E.
Debt %	60%	This is a typical amount of leverage for projects of this type.
Equity %	40%	This is a typical amount of leverage for projects of this type.
Debt Rate	6.0%	This is a typical rate for the current market in this type of arrangement.
Equity Rate	11.0%	This is a typical rate of return for projects with this level of risk.
Overall Rate of Return	8.0%	This is a computed value based on the debt/equity ratio and associated rates.
Rate of Depreciation	2.0%	This is based on current accounting rules
O&M Cost	$5 million/year	This is based on such costs in similar projects.
O&M Annual Escalation	3.0%	This is the amount of escalation that we are generally experiencing in this economy.

Appendix D
Description of Model Used in Quantitative Analysis

1. For purposes of these comments, the quantitative analysis supporting the development of the estimated benefits attributable to the inter-island cable employed Navigant's proprietary Portfolio Optimization Model ("POM"). POM is a linear dispatch and capacity expansion model that emphasizes the impacts of environmental policies and focuses on renewable generation, while being suitable for risk analysis. POM solves for the least cost dispatch and recognizes system constraints and variable costs by simultaneously simulating economic investment decisions and power plant dispatch. The inputs include generation base, demand forecasts, fuel prices, renewable shapes, other operating costs, and plant parameters, such as minimum run constraints. In addition, POM incorporates capital costs, reserve margin planning requirements, renewable portfolio standards, fixed and variable O&M costs, emissions allowance costs, and transmission interface limits. POM's algorithmic structure and solution methods are also compatible with Navigant's models for forecasting fuel prices, capacity market prices, and emissions prices.

2. POM includes constraints on 1 transmission, and adopts a load duration curve representation to speed computational times. The Department of Business, Economic Development, and Tourism ("DBEDT") did not have access to detailed Hawaii Electric Company, Inc. ("HECO") or Maui Electric Company, Ltd ("MECO") hourly load data at the time these comments were prepared. While hourly load data was employed, better load data/wind shape data would have been preferred. The instant analysis used the average daily shape and scaled the energy to fit each month. While this results in an 8,760 hourly shape for each year, it lacks the variability that would result from more representative data, such as historic

hourly loads. However, by capturing all load blocks during which net load shows the potential for curtailment, POM did calculate forecasted curtailment of intermittent resources without running a hourly dispatch. The use of better hourly load data could provide more refined results.

3. DBEDT also did not have access to relative costs of wind and PV resources on O'ahu and Maui; therefore, it assumed they were the same for both islands. Further, although DBEDT did have access to data on average capacity factors for wind resources on O'ahu and Maui, it did not have access to wind generation shapes specific to these islands. Therefore, it used wind shapes for wind resources located in California having like capacity factors.

4. POM includes every individual generating unit on the MECO Maui system and HECO system which allows for detailed reporting of generation data. Optionally, POM can perform multivariate optimization, which considers more than costs, and includes such variables as sustainability, technological innovation, or spurring economic development. This makes it especially suitable for modeling future renewable generation expansion.

5. For this project, POM was set up to model the HECO and MECO systems in a stand-alone set-up. The impacts of a 200MW inter-island transmission line connecting the two systems have been assessed for each case.

6. The HECO/MECO reference case representation of POM is matched to the Hawaiian Electric Companies' 2013 Integrated Resource Planning Report and Action Plan covering the planning period 2014 – 2033 (the "IRP"). In particular, the forecast matched to the "Stuck in the middle – Contingency" action plan.[1]

[1] DBEDT notes that it used the information contained in the IRP as a conservative set of assumptions and does not endorse the validity of the information or the reasonableness of the methodologies that were used to derive the IRP results.

Appendix E

Schedule 1 – Cable Project Costs

Item	Projected Cost (millions $2012)
Undersea Cable (120 miles)	225.6
Converter Stations	152.3
Contingencies (20%)	75.6
Interest During Construction (3.25%)	14.7
AC Substation	25.0
AC Infrastructure	209.0
TOTAL (assumes CCC owns AC infrastructure)	702.2

Appendix E

Schedule 2 – CCC Revenue Requirements

Year	Equity Return ($M)	Debt Finance ($M)	Federal Income Tax (FIT) ($M)	Depreciation ($M)	O&M ($M)	Total Annual Revenue Requirement ($M)	Cummulative Present Value of Revenue Requirement ($M)
2020	30.90	25.28	16.64	14.04	5.00	91.86	74.96
2021	29.66	24.27	15.97	14.04	5.15	89.09	74.96
2022	29.04	23.76	15.64	14.04	5.30	87.79	74.96
2023	28.43	23.26	15.31	14.04	5.46	86.50	74.96
2024	27.81	22.75	14.97	14.04	5.63	85.20	74.96
2025	27.19	22.25	14.64	14.04	5.80	83.92	74.96
2026	26.57	21.74	14.31	14.04	5.97	82.63	74.96
2027	25.95	21.23	13.97	14.04	6.15	81.36	74.96
2028	25.34	20.73	13.64	14.04	6.33	80.08	74.96
2029	24.72	20.22	13.31	14.04	6.52	78.82	74.96
2030	24.10	19.72	12.98	14.04	6.72	77.56	74.96
2031	23.48	19.21	12.64	14.04	6.92	76.30	74.96
2032	22.86	18.71	12.31	14.04	7.13	75.05	74.96
2033	22.25	18.20	11.98	14.04	7.34	73.81	74.96
2034	21.63	17.70	11.65	14.04	7.56	72.58	74.96
2035	21.01	17.19	11.31	14.04	7.79	71.35	74.96
2036	20.39	16.68	10.98	14.04	8.02	70.12	74.96
2037	19.77	16.18	10.65	14.04	8.26	68.91	74.96
2038	19.16	15.67	10.31	14.04	8.51	67.70	74.96
2039	18.54	15.17	9.98	14.04	8.77	66.50	74.96
2040	17.92	14.66	9.65	14.04	9.03	65.31	74.96
2041	17.30	14.16	9.32	14.04	9.30	64.12	74.96
2042	16.68	13.65	8.98	14.04	9.58	62.94	74.96
2043	16.07	13.15	8.65	14.04	9.87	61.77	74.96
2044	15.45	12.64	8.32	14.04	10.16	60.61	74.96
2045	14.83	12.13	7.99	14.04	10.47	59.46	74.96
2046	14.21	11.63	7.65	14.04	10.78	58.32	74.96
2047	13.59	11.12	7.32	14.04	11.11	57.19	74.96
2048	12.98	10.62	6.99	14.04	11.44	56.06	74.96
2049	12.36	10.11	6.65	14.04	11.78	54.95	74.96
2050	11.74	9.61	6.32	14.04	12.14	53.85	74.96
2051	11.12	9.10	5.99	14.04	12.50	52.76	74.96
2052	10.50	8.59	5.66	14.04	12.88	51.68	74.96
2053	9.89	8.09	5.32	14.04	13.26	50.61	74.96

Year	Equity Return ($M)	Debt Finance ($M)	Federal Income Tax (FIT) ($M)	Depreciation ($M)	O&M ($M)	Total Annual Revenue Requirement ($M)	Cummulative Present Value of Revenue Requirement ($M)
2054	9.27	7.58	4.99	14.04	13.66	49.55	74.96
2055	8.65	7.08	4.66	14.04	14.07	48.50	74.96
2056	8.03	6.57	4.33	14.04	14.49	47.47	74.96
2057	7.42	6.07	3.99	14.04	14.93	46.45	74.96
2058	6.80	5.56	3.66	14.04	15.37	45.44	74.96
2059	6.18	5.06	3.33	14.04	15.84	44.44	74.96
2060	5.56	4.55	2.99	14.04	16.31	43.46	74.96
2061	4.94	4.04	2.66	14.04	16.80	42.49	74.96
2062	4.33	3.54	2.33	14.04	17.30	41.54	74.96
2063	3.71	3.03	2.00	14.04	17.82	40.60	74.96
2064	3.09	2.53	1.66	14.04	18.36	39.68	74.96
2065	2.47	2.02	1.33	14.04	18.91	38.78	74.96
2066	1.85	1.52	1.00	14.04	19.48	37.89	74.96
2067	1.24	1.01	0.67	14.04	20.06	37.02	74.96
2068	0.62	0.51	0.33	14.04	20.66	36.16	74.96
2069	0.00	0.00	0.00	14.04	21.28	35.33	74.96

Appendix F
Schedule 1: Page 1 of 2 – Net Cost/(Benefit) of Cable Project and Wind Shift
No Consideration of Social Cost of Carbon

Year	Base Case ($Million)	Base Case Plus Cable ($Million)	Low Wind Shift & Cable ($Million)	Medium Wind Shift & Cable ($Million)	High Wind Shift & Cable ($Million)
2013	-	-	-	-	-
2014	-	-	-	-	-
2015	-	-	-	-	-
2016	-	-	-	-	-
2017	-	-	-	-	-
2018	-	-	-	-	-
2019	-	-	-	-	-
2020	-	47	22	12	6
2021	-	41	15	5	(0)
2022	-	34	7	(2)	(7)
2023	-	27	0	(9)	(13)
2024	-	20	(7)	(16)	(20)
2025	-	15	(13)	(22)	(25)
2026	-	10	(18)	(27)	(30)
2027	-	4	(24)	(32)	(35)
2028	-	(1)	(30)	(37)	(40)
2029	-	(5)	(35)	(43)	(46)
2030	-	(9)	(41)	(49)	(53)
2031	-	(13)	(46)	(55)	(59)
2032	-	(17)	(52)	(61)	(65)
2033	-	(19)	(56)	(65)	(70)
2034	-	(22)	(60)	(70)	(74)
2035	-	(24)	(64)	(74)	(79)
2036	-	(27)	(68)	(78)	(83)
2037	-	(29)	(72)	(83)	(88)
2038	-	(32)	(76)	(88)	(93)
2039	-	(35)	(80)	(93)	(98)
2040	-	(37)	(85)	(98)	(103)
2041	-	(40)	(89)	(103)	(109)
2042	-	(43)	(94)	(108)	(114)
2043	-	(46)	(99)	(114)	(120)
2044	-	(48)	(103)	(119)	(125)
2045	-	(51)	(108)	(124)	(130)
2046	-	(55)	(114)	(130)	(137)
2047	-	(59)	(120)	(137)	(144)
2048	-	(63)	(125)	(143)	(150)
2049	-	(67)	(131)	(150)	(157)
2050	-	(71)	(137)	(156)	(164)
CPVRR	-	(10)	(300)	(386)	(423)

Appendix F
Schedule 1: Page 2 of 2 – Net Cost/(Benefit) of Cable Project and Wind Shift Includes Social Cost of Carbon

Year	Base Case ($Million)	Base Case Plus Cable ($Million)	Low Wind Shift & Cable ($Million)	Medium Wind Shift & Cable ($Million)	High Wind Shift & Cable ($Million)
2013	-	-	-	-	-
2014	-	-	-	-	-
2015	-	-	-	-	-
2016	-	-	-	-	-
2017	-	-	-	-	-
2018	-	-	-	-	-
2019	-	-	-	-	-
2020	-	45	15	3	(4)
2021	-	37	7	(5)	(11)
2022	-	29	(1)	(12)	(18)
2023	-	22	(9)	(20)	(25)
2024	-	14	(18)	(28)	(32)
2025	-	8	(24)	(34)	(38)
2026	-	2	(30)	(40)	(43)
2027	-	(4)	(37)	(46)	(49)
2028	-	(10)	(43)	(52)	(54)
2029	-	(14)	(49)	(58)	(61)
2030	-	(18)	(55)	(64)	(68)
2031	-	(22)	(61)	(71)	(75)
2032	-	(27)	(67)	(77)	(82)
2033	-	(29)	(71)	(82)	(87)
2034	-	(32)	(75)	(87)	(92)
2035	-	(35)	(80)	(92)	(97)
2036	-	(38)	(84)	(96)	(102)
2037	-	(41)	(89)	(102)	(107)
2038	-	(43)	(94)	(107)	(113)
2039	-	(46)	(98)	(112)	(118)
2040	-	(49)	(103)	(118)	(124)
2041	-	(52)	(108)	(124)	(130)
2042	-	(55)	(114)	(130)	(136)
2043	-	(58)	(119)	(135)	(142)
2044	-	(62)	(124)	(141)	(148)
2045	-	(65)	(129)	(147)	(154)
2046	-	(69)	(136)	(154)	(161)
2047	-	(73)	(142)	(161)	(169)
2048	-	(78)	(149)	(169)	(176)
2049	-	(82)	(155)	(176)	(183)
2050	-	(86)	(162)	(183)	(191)
CPVRR	-	(79)	(412)	(511)	(551)

Appendix F
Schedule 2: Page 1 of 3 – Projected Fuel Costs
Base Case (No Cable)

Year	Oahu Fuel Cost ($Million)	Maui Fuel Cost ($Million)	Cable Costs ($Million)	Total Cost ($Million)
2013	893	141		1,034
2014	893	146		1,039
2015	892	151		1,043
2016	912	156		1,068
2017	932	160		1,092
2018	952	164		1,116
2019	972	169		1,140
2020	992	173		1,165
2021	1,024	183		1,207
2022	1,056	193		1,249
2023	1,088	204		1,291
2024	1,120	214		1,334
2025	1,162	222		1,384
2026	1,204	230		1,435
2027	1,247	239		1,485
2028	1,289	247		1,536
2029	1,341	257		1,598
2030	1,393	267		1,660
2031	1,445	277		1,722
2032	1,497	287		1,784
2033	1,553	297		1,850
2034	1,609	307		1,916
2035	1,664	317		1,982
2036	1,720	327		2,048
2037	1,785	340		2,125
2038	1,849	353		2,201
2039	1,913	365		2,278
2040	1,977	378		2,355
2041	2,051	392		2,443
2042	2,125	407		2,532
2043	2,199	421		2,620
2044	2,273	436		2,709
2045	2,347	451		2,797
2046	2,424	466		2,890
2047	2,502	481		2,982
2048	2,579	496		3,075
2049	2,657	511		3,168
2050	2,734	526		3,260
CPVRR	17,384	3,180	-	20,564

Appendix F
Schedule 2: Page 2 of 3 – Projected Fuel Costs
Base Case Plus Cable

Year	Oahu Fuel Cost ($Million)	Maui Fuel Cost ($Million)	Cable Costs ($Million)	Total Cost ($Million)
2013	893	141	-	1,034
2014	893	146	-	1,039
2015	892	151	-	1,043
2016	912	156	-	1,068
2017	932	160	-	1,092
2018	952	164	-	1,116
2019	972	169	-	1,140
2020	941	196	75	1,212
2021	971	202	75	1,248
2022	1,000	208	75	1,283
2023	1,030	213	75	1,319
2024	1,060	219	75	1,354
2025	1,098	226	75	1,399
2026	1,136	234	75	1,445
2027	1,174	241	75	1,490
2028	1,211	249	75	1,535
2029	1,266	252	75	1,593
2030	1,321	255	75	1,651
2031	1,376	258	75	1,710
2032	1,431	262	75	1,768
2033	1,485	271	75	1,831
2034	1,539	280	75	1,894
2035	1,593	290	75	1,958
2036	1,647	299	75	2,021
2037	1,710	310	75	2,095
2038	1,773	321	75	2,169
2039	1,837	332	75	2,244
2040	1,900	343	75	2,318
2041	1,973	355	75	2,403
2042	2,047	367	75	2,489
2043	2,120	379	75	2,575
2044	2,194	392	75	2,660
2045	2,267	404	75	2,746
2046	2,342	417	75	2,835
2047	2,418	430	75	2,923
2048	2,493	444	75	3,012
2049	2,569	457	75	3,101
2050	2,644	470	75	3,189
CPVRR	16,822	3,106	626	20,554

Appendix F
Schedule 2: Page 3 of 3 – Projected Fuel Costs
High Wind Shift & Cable

Year	Oahu Fuel Cost ($Million)	Maui Fuel Cost ($Million)	Cable Costs ($Million)	Total Cost ($Million)
2013	893	141	-	1,034
2014	893	146	-	1,039
2015	892	151	-	1,043
2016	912	156	-	1,068
2017	932	160	-	1,092
2018	952	164	-	1,116
2019	972	169	-	1,140
2020	914	182	75	1,171
2021	944	188	75	1,207
2022	974	193	75	1,242
2023	1,004	199	75	1,278
2024	1,034	205	75	1,314
2025	1,072	213	75	1,359
2026	1,110	220	75	1,405
2027	1,148	228	75	1,451
2028	1,186	235	75	1,496
2029	1,238	239	75	1,552
2030	1,290	242	75	1,608
2031	1,343	246	75	1,663
2032	1,395	250	75	1,719
2033	1,447	258	75	1,781
2034	1,500	267	75	1,842
2035	1,552	276	75	1,903
2036	1,605	285	75	1,964
2037	1,666	295	75	2,036
2038	1,728	305	75	2,108
2039	1,789	316	75	2,180
2040	1,851	326	75	2,252
2041	1,923	337	75	2,335
2042	1,994	348	75	2,418
2043	2,066	360	75	2,501
2044	2,138	371	75	2,584
2045	2,210	382	75	2,667
2046	2,283	395	75	2,753
2047	2,356	407	75	2,839
2048	2,430	420	75	2,925
2049	2,503	433	75	3,011
2050	2,576	445	75	3,097
CPVRR	16,533	2,982	626	20,141

Appendix F
Schedule 3: Page 1 of 6 – Projected Available Renewable Energy that Can be Delivered Base Case (No Cable) - Oahu

Year	Total Load (GWh)	Available Renewables (GWh)	Delivered Renewables (GWh)	Available Renewables (%)	Delivered Renewables (%)
2013	7,167	781	776	11%	11%
2014	7,194	868	861	12%	12%
2015	7,220	954	947	13%	13%
2016	7,241	1,119	1,106	15%	15%
2017	7,263	1,283	1,265	18%	17%
2018	7,284	1,447	1,425	20%	20%
2019	7,305	1,612	1,584	22%	22%
2020	7,327	1,684	1,676	23%	23%
2021	7,327	1,808	1,774	25%	24%
2022	7,328	1,931	1,872	26%	26%
2023	7,329	2,055	1,970	28%	27%
2024	7,330	2,179	2,068	30%	28%
2025	7,339	2,214	2,091	30%	28%
2026	7,349	2,249	2,115	31%	29%
2027	7,359	2,284	2,138	31%	29%
2028	7,368	2,320	2,162	31%	29%
2029	7,392	2,380	2,196	32%	30%
2030	7,416	2,441	2,231	33%	30%
2031	7,440	2,502	2,266	34%	30%
2032	7,463	2,563	2,301	34%	31%
2033	7,490	2,563	2,305	34%	31%
2034	7,516	2,563	2,309	34%	31%
2035	7,542	2,563	2,313	34%	31%
2036	7,568	2,563	2,317	34%	31%
2037	7,595	2,563	2,321	34%	31%
2038	7,622	2,563	2,324	34%	30%
2039	7,648	2,563	2,328	34%	30%
2040	7,675	2,563	2,332	33%	30%
2041	7,698	2,563	2,334	33%	30%
2042	7,721	2,563	2,336	33%	30%
2043	7,744	2,563	2,339	33%	30%
2044	7,767	2,563	2,341	33%	30%
2045	7,789	2,563	2,343	33%	30%
2046	7,795	2,563	2,344	33%	30%
2047	7,800	2,563	2,345	33%	30%
2048	7,805	2,563	2,345	33%	30%
2049	7,811	2,563	2,346	33%	30%
2050	7,816	2,563	2,347	33%	30%

Appendix F

Schedule 3: Page 2 of 6 – Projected Available Renewable Energy that Can be Delivered Base Case (No Cable) - Maui

Year	Total Load (GWh)	Available Renewables (GWh)	Delivered Renewables (GWh)	Available Renewables (%)	Delivered Renewables (%)
2013	1,107	321	238	29%	22%
2014	1,100	283	210	26%	19%
2015	1,093	244	182	22%	17%
2016	1,089	247	183	23%	17%
2017	1,085	251	185	23%	17%
2018	1,081	254	187	23%	17%
2019	1,078	257	189	24%	18%
2020	1,074	260	191	24%	18%
2021	1,077	310	213	29%	20%
2022	1,080	360	236	33%	22%
2023	1,083	410	259	38%	24%
2024	1,086	460	281	42%	26%
2025	1,090	485	287	45%	26%
2026	1,095	510	292	47%	27%
2027	1,099	536	298	49%	27%
2028	1,104	561	304	51%	28%
2029	1,110	568	311	51%	28%
2030	1,117	574	318	51%	28%
2031	1,124	581	325	52%	29%
2032	1,131	588	332	52%	29%
2033	1,138	592	337	52%	30%
2034	1,145	595	341	52%	30%
2035	1,152	598	346	52%	30%
2036	1,159	601	351	52%	30%
2037	1,166	601	354	52%	30%
2038	1,173	601	356	51%	30%
2039	1,180	601	359	51%	30%
2040	1,188	601	361	51%	30%
2041	1,194	601	364	50%	30%
2042	1,201	601	366	50%	30%
2043	1,207	601	368	50%	31%
2044	1,214	601	371	50%	31%
2045	1,221	601	373	49%	31%
2046	1,222	601	374	49%	31%
2047	1,224	601	374	49%	31%
2048	1,225	601	374	49%	31%
2049	1,226	601	375	49%	31%
2050	1,228	601	375	49%	31%

Appendix F
Schedule 3: Page 3 of 6 – Projected Available Renewable Energy that Can be Delivered Base Case Plus Cable – Oahu

Year	Total Load (GWh)	Available Renewables (GWh)	Delivered Renewables (GWh)	Available Renewables (%)	Delivered Renewables (%)
2013	7,167	781	776	11%	11%
2014	7,194	868	861	12%	12%
2015	7,220	954	947	13%	13%
2016	7,241	1,119	1,106	15%	15%
2017	7,263	1,283	1,265	18%	17%
2018	7,284	1,447	1,425	20%	20%
2019	7,305	1,612	1,584	22%	22%
2020	7,327	1,776	1,758	24%	24%
2021	7,327	1,900	1,849	26%	25%
2022	7,328	2,023	1,940	28%	26%
2023	7,329	2,147	2,030	29%	28%
2024	7,330	2,271	2,121	31%	29%
2025	7,339	2,306	2,143	31%	29%
2026	7,349	2,341	2,165	32%	29%
2027	7,359	2,376	2,188	32%	30%
2028	7,368	2,412	2,210	33%	30%
2029	7,392	2,472	2,243	33%	30%
2030	7,416	2,533	2,276	34%	31%
2031	7,440	2,594	2,309	35%	31%
2032	7,463	2,655	2,342	36%	31%
2033	7,490	2,655	2,346	35%	31%
2034	7,516	2,655	2,350	35%	31%
2035	7,542	2,655	2,354	35%	31%
2036	7,568	2,655	2,359	35%	31%
2037	7,595	2,655	2,363	35%	31%
2038	7,622	2,655	2,367	35%	31%
2039	7,648	2,655	2,371	35%	31%
2040	7,675	2,655	2,375	35%	31%
2041	7,698	2,655	2,378	34%	31%
2042	7,721	2,655	2,380	34%	31%
2043	7,744	2,655	2,383	34%	31%
2044	7,767	2,655	2,385	34%	31%
2045	7,789	2,655	2,388	34%	31%
2046	7,795	2,655	2,388	34%	31%
2047	7,800	2,655	2,389	34%	31%
2048	7,805	2,655	2,390	34%	31%
2049	7,811	2,655	2,391	34%	31%
2050	7,816	2,655	2,392	34%	31%

Appendix F
Schedule 3: Page 4 of 6 – Projected Available Renewable Energy that Can be Delivered Base Case Plus Cable - Maui

Year	Total Load (GWh)	Available Renewables (GWh)	Delivered Renewables (GWh)	Available Renewables (%)	Delivered Renewables (%)
2013	1,107	321	238	29%	22%
2014	1,100	283	210	26%	19%
2015	1,093	244	182	22%	17%
2016	1,089	247	183	23%	17%
2017	1,085	251	185	23%	17%
2018	1,081	254	187	23%	17%
2019	1,078	257	189	24%	18%
2020	1,074	260	248	24%	23%
2021	1,077	310	285	29%	26%
2022	1,080	360	323	33%	30%
2023	1,083	410	361	38%	33%
2024	1,086	460	398	42%	37%
2025	1,090	485	414	45%	38%
2026	1,095	510	431	47%	39%
2027	1,099	536	447	49%	41%
2028	1,104	561	463	51%	42%
2029	1,110	568	467	51%	42%
2030	1,117	574	472	51%	42%
2031	1,124	581	476	52%	42%
2032	1,131	588	481	52%	43%
2033	1,138	592	486	52%	43%
2034	1,145	595	490	52%	43%
2035	1,152	598	495	52%	43%
2036	1,159	601	499	52%	43%
2037	1,166	601	501	52%	43%
2038	1,173	601	502	51%	43%
2039	1,180	601	504	51%	43%
2040	1,188	601	505	51%	43%
2041	1,194	601	507	50%	42%
2042	1,201	601	508	50%	42%
2043	1,207	601	510	50%	42%
2044	1,214	601	511	50%	42%
2045	1,221	601	513	49%	42%
2046	1,222	601	513	49%	42%
2047	1,224	601	513	49%	42%
2048	1,225	601	514	49%	42%
2049	1,226	601	514	49%	42%
2050	1,228	601	514	49%	42%

Appendix F
Schedule 3: Page 5 of 6 – Projected Available Renewable Energy that Can be Delivered High Wind Shift & Cable – Oahu

Year	Total Load (GWh)	Available Renewables (GWh)	Delivered Renewables (GWh)	Available Renewables (%)	Delivered Renewables (%)
2013	7,167	781	776	11%	11%
2014	7,194	868	861	12%	12%
2015	7,220	954	947	13%	13%
2016	7,241	1,119	1,106	15%	15%
2017	7,263	1,283	1,265	18%	17%
2018	7,284	1,447	1,425	20%	20%
2019	7,305	1,612	1,584	22%	22%
2020	7,327	1,408	1,408	19%	19%
2021	7,327	1,532	1,524	21%	21%
2022	7,328	1,655	1,640	23%	22%
2023	7,329	1,779	1,756	24%	24%
2024	7,330	1,903	1,873	26%	26%
2025	7,339	1,938	1,902	26%	26%
2026	7,349	1,973	1,931	27%	26%
2027	7,359	2,008	1,960	27%	27%
2028	7,368	2,044	1,989	28%	27%
2029	7,392	2,105	2,033	28%	27%
2030	7,416	2,165	2,076	29%	28%
2031	7,440	2,226	2,119	30%	28%
2032	7,463	2,287	2,162	31%	29%
2033	7,490	2,287	2,165	31%	29%
2034	7,516	2,287	2,167	30%	29%
2035	7,542	2,287	2,170	30%	29%
2036	7,568	2,287	2,173	30%	29%
2037	7,595	2,287	2,175	30%	29%
2038	7,622	2,287	2,177	30%	29%
2039	7,648	2,287	2,180	30%	29%
2040	7,675	2,287	2,182	30%	28%
2041	7,698	2,287	2,184	30%	28%
2042	7,721	2,287	2,185	30%	28%
2043	7,744	2,287	2,186	30%	28%
2044	7,767	2,287	2,187	29%	28%
2045	7,789	2,287	2,189	29%	28%
2046	7,795	2,287	2,189	29%	28%
2047	7,800	2,287	2,190	29%	28%
2048	7,805	2,287	2,190	29%	28%
2049	7,811	2,287	2,191	29%	28%
2050	7,816	2,287	2,191	29%	28%

Appendix F
Schedule 3: Page 6 of 6 – Projected Available Renewable Energy that Can be Delivered
High Wind Shift & Cable - Maui

Year	Total Load (GWh)	Available Renewables (GWh)	Delivered Renewables (GWh)	Available Renewables (%)	Delivered Renewables (%)
2013	1,107	321	238	29%	22%
2014	1,100	283	210	26%	19%
2015	1,093	244	182	22%	17%
2016	1,089	247	183	23%	17%
2017	1,085	251	185	23%	17%
2018	1,081	254	187	23%	17%
2019	1,078	257	189	24%	18%
2020	1,074	917	840	85%	78%
2021	1,077	967	837	90%	78%
2022	1,080	1,017	835	94%	77%
2023	1,083	1,067	832	99%	77%
2024	1,086	1,117	830	103%	76%
2025	1,090	1,142	831	105%	76%
2026	1,095	1,167	832	107%	76%
2027	1,099	1,193	833	108%	76%
2028	1,104	1,218	834	110%	76%
2029	1,110	1,225	830	110%	75%
2030	1,117	1,231	826	110%	74%
2031	1,124	1,238	822	110%	73%
2032	1,131	1,245	818	110%	72%
2033	1,138	1,249	825	110%	72%
2034	1,145	1,252	831	109%	73%
2035	1,152	1,255	838	109%	73%
2036	1,159	1,258	845	109%	73%
2037	1,166	1,258	849	108%	73%
2038	1,173	1,258	853	107%	73%
2039	1,180	1,258	858	107%	73%
2040	1,188	1,258	862	106%	73%
2041	1,194	1,258	865	105%	72%
2042	1,201	1,258	868	105%	72%
2043	1,207	1,258	871	104%	72%
2044	1,214	1,258	874	104%	72%
2045	1,221	1,258	877	103%	72%
2046	1,222	1,258	878	103%	72%
2047	1,224	1,258	879	103%	72%
2048	1,225	1,258	880	103%	72%
2049	1,226	1,258	881	103%	72%
2050	1,228	1,258	882	102%	72%

Appendix F
Schedule 4: Page 1 of 6 – Projected Generation
Base Case (No Cable) – Oahu

Year	Wind (GWh)	Solar (GWh)	Other Renewables (GWh)	Oil (GWh)	Coal (GWh)	Total (GWh)
2013	177	46	553	4,973	1,419	7,167
2014	194	115	553	4,914	1,419	7,194
2015	211	183	553	4,855	1,418	7,220
2016	302	272	532	4,715	1,420	7,241
2017	393	362	511	4,575	1,422	7,263
2018	484	451	490	4,435	1,424	7,284
2019	575	541	469	4,296	1,425	7,305
2020	666	630	448	4,156	1,427	7,327
2021	738	640	448	4,095	1,407	7,327
2022	810	649	448	4,034	1,387	7,328
2023	882	658	448	3,974	1,367	7,329
2024	955	667	448	3,913	1,347	7,329
2025	969	673	448	3,906	1,343	7,339
2026	983	680	448	3,899	1,340	7,349
2027	997	686	448	3,892	1,336	7,359
2028	1,011	692	448	3,886	1,332	7,368
2029	1,037	696	448	3,885	1,327	7,392
2030	1,063	699	448	3,885	1,322	7,416
2031	1,089	702	448	3,885	1,316	7,440
2032	1,114	706	448	3,885	1,311	7,463
2033	1,119	706	448	3,905	1,312	7,490
2034	1,124	707	448	3,925	1,313	7,516
2035	1,128	707	448	3,945	1,314	7,542
2036	1,133	707	448	3,965	1,315	7,568
2037	1,137	708	448	3,986	1,317	7,595
2038	1,141	708	448	4,007	1,318	7,622
2039	1,145	709	448	4,027	1,319	7,648
2040	1,149	710	448	4,048	1,321	7,675
2041	1,152	710	448	4,067	1,322	7,698
2042	1,155	710	448	4,085	1,323	7,721
2043	1,157	710	448	4,104	1,325	7,744
2044	1,160	711	448	4,123	1,326	7,767
2045	1,162	711	448	4,141	1,327	7,789
2046	1,163	711	448	4,146	1,327	7,795
2047	1,164	711	448	4,150	1,328	7,800
2048	1,165	711	448	4,154	1,328	7,805
2049	1,166	711	448	4,158	1,328	7,811
2050	1,166	711	448	4,162	1,328	7,816

Appendix F
Schedule 4: Page 2 of 6 – Projected Generation
Base Case (No Cable) – Maui

Year	Wind (GWh)	Solar (GWh)	Other Renewables (GWh)	Oil (GWh)	Coal (GWh)	Total (GWh)
2013	146	6	86	869	-	1,107
2014	156	9	44	890	-	1,100
2015	166	13	2	911	-	1,093
2016	165	16	2	906	-	1,089
2017	164	19	2	900	-	1,085
2018	163	22	2	894	-	1,081
2019	162	25	2	889	-	1,078
2020	161	28	2	883	-	1,074
2021	183	28	2	863	-	1,077
2022	205	28	2	844	-	1,080
2023	228	29	2	824	-	1,083
2024	250	29	2	805	-	1,086
2025	255	29	2	803	-	1,090
2026	261	29	2	802	-	1,095
2027	266	29	2	801	-	1,099
2028	272	30	2	800	-	1,104
2029	273	35	2	800	-	1,110
2030	274	41	2	799	-	1,117
2031	275	47	2	799	-	1,124
2032	277	53	2	799	-	1,131
2033	278	56	2	801	-	1,138
2034	280	59	2	803	-	1,145
2035	282	62	2	806	-	1,152
2036	284	65	2	808	-	1,159
2037	286	65	2	812	-	1,166
2038	289	65	2	817	-	1,173
2039	291	65	2	822	-	1,180
2040	294	65	2	826	-	1,188
2041	296	66	2	830	-	1,194
2042	298	66	2	835	-	1,201
2043	300	66	2	839	-	1,207
2044	303	66	2	843	-	1,214
2045	305	66	2	847	-	1,221
2046	305	66	2	849	-	1,222
2047	306	66	2	850	-	1,224
2048	306	66	2	851	-	1,225
2049	306	66	2	852	-	1,226
2050	307	66	2	853	-	1,228

Appendix F
Schedule 4: Page 3 of 6 – Projected Generation
Base Case Plus Cable – Oahu

Year	Wind (GWh)	Solar (GWh)	Other Renewables (GWh)	Oil (GWh)	Coal (GWh)	Total (GWh)
2013	177	46	553	4,973	1,419	7,167
2014	194	115	553	4,914	1,419	7,194
2015	211	183	553	4,855	1,418	7,220
2016	302	272	532	4,715	1,420	7,241
2017	393	362	511	4,575	1,422	7,263
2018	484	451	490	4,435	1,424	7,284
2019	575	541	469	4,296	1,425	7,305
2020	680	631	448	3,939	1,438	7,135
2021	760	641	448	3,885	1,417	7,151
2022	840	652	448	3,832	1,396	7,167
2023	920	662	448	3,778	1,375	7,183
2024	1,001	673	448	3,724	1,354	7,199
2025	1,016	679	448	3,710	1,348	7,202
2026	1,032	686	448	3,696	1,343	7,205
2027	1,048	692	448	3,683	1,337	7,208
2028	1,064	698	448	3,669	1,332	7,211
2029	1,093	702	448	3,683	1,328	7,254
2030	1,123	705	448	3,698	1,324	7,297
2031	1,152	709	448	3,712	1,320	7,340
2032	1,181	713	448	3,726	1,316	7,384
2033	1,185	713	448	3,746	1,317	7,410
2034	1,189	713	448	3,767	1,319	7,436
2035	1,193	714	448	3,787	1,320	7,462
2036	1,197	714	448	3,807	1,322	7,488
2037	1,201	714	448	3,831	1,323	7,517
2038	1,205	715	448	3,854	1,325	7,546
2039	1,208	715	448	3,878	1,326	7,575
2040	1,212	716	448	3,901	1,327	7,604
2041	1,214	716	448	3,923	1,328	7,630
2042	1,216	716	448	3,945	1,330	7,655
2043	1,219	717	448	3,968	1,331	7,681
2044	1,221	717	448	3,990	1,332	7,707
2045	1,223	717	448	4,012	1,333	7,733
2046	1,224	717	448	4,017	1,334	7,739
2047	1,224	717	448	4,021	1,334	7,744
2048	1,225	717	448	4,026	1,334	7,750
2049	1,226	717	448	4,031	1,334	7,756
2050	1,227	718	448	4,036	1,334	7,762

Appendix F
Schedule 4: Page 4 of 6 – Projected Generation
Base Case Plus Cable – Maui

Year	Wind (GWh)	Solar (GWh)	Other Renewables (GWh)	Oil (GWh)	Coal (GWh)	Total (GWh)
2013	146	6	86	869	-	1,107
2014	156	9	44	890	-	1,100
2015	166	13	2	911	-	1,093
2016	165	16	2	906	-	1,089
2017	164	19	2	900	-	1,085
2018	163	22	2	894	-	1,081
2019	162	25	2	889	-	1,078
2020	217	29	2	1,024	-	1,272
2021	254	30	2	974	-	1,260
2022	291	30	2	924	-	1,247
2023	328	31	2	874	-	1,235
2024	365	31	2	824	-	1,223
2025	380	32	2	820	-	1,234
2026	396	32	2	816	-	1,246
2027	412	32	2	811	-	1,258
2028	428	33	2	807	-	1,269
2029	426	39	2	790	-	1,257
2030	424	46	2	773	-	1,245
2031	422	52	2	756	-	1,232
2032	420	59	2	739	-	1,220
2033	421	62	2	742	-	1,227
2034	423	65	2	744	-	1,234
2035	424	68	2	747	-	1,242
2036	425	72	2	750	-	1,249
2037	427	72	2	753	-	1,254
2038	428	72	2	756	-	1,259
2039	430	72	2	760	-	1,263
2040	431	72	2	763	-	1,268
2041	433	72	2	765	-	1,272
2042	434	72	2	768	-	1,276
2043	436	72	2	770	-	1,280
2044	437	72	2	772	-	1,283
2045	438	72	2	775	-	1,287
2046	439	72	2	775	-	1,288
2047	439	72	2	776	-	1,289
2048	439	72	2	777	-	1,290
2049	440	72	2	777	-	1,291
2050	440	72	2	778	-	1,292

Appendix F
Schedule 4: Page 5 of 6 – Projected Generation
High Wind Shift & Cable – Oahu

Year	Wind (GWh)	Solar (GWh)	Other Renewables (GWh)	Oil (GWh)	Coal (GWh)	Total (GWh)
2013	177	46	553	4,973	1,419	7,167
2014	194	115	553	4,914	1,419	7,194
2015	211	183	553	4,855	1,418	7,220
2016	302	272	532	4,715	1,420	7,241
2017	393	362	511	4,575	1,422	7,263
2018	484	451	490	4,435	1,424	7,284
2019	575	541	469	4,296	1,425	7,305
2020	329	631	448	3,826	1,406	6,641
2021	432	644	448	3,776	1,387	6,687
2022	536	657	448	3,725	1,368	6,734
2023	639	670	448	3,674	1,349	6,780
2024	742	683	448	3,624	1,330	6,827
2025	764	690	448	3,615	1,326	6,843
2026	786	697	448	3,605	1,323	6,859
2027	808	704	448	3,596	1,319	6,875
2028	830	711	448	3,586	1,315	6,891
2029	870	715	448	3,596	1,311	6,940
2030	909	719	448	3,606	1,307	6,989
2031	949	723	448	3,617	1,303	7,039
2032	988	727	448	3,627	1,299	7,088
2033	990	727	448	3,646	1,301	7,112
2034	992	727	448	3,666	1,303	7,136
2035	995	728	448	3,686	1,304	7,160
2036	997	728	448	3,705	1,306	7,184
2037	999	729	448	3,728	1,308	7,211
2038	1,001	729	448	3,751	1,310	7,239
2039	1,003	729	448	3,773	1,312	7,266
2040	1,005	729	448	3,796	1,314	7,293
2041	1,006	730	448	3,818	1,316	7,318
2042	1,008	730	448	3,840	1,317	7,342
2043	1,009	730	448	3,862	1,319	7,367
2044	1,010	7 30	448	3,885	1,320	7,392
2045	1,011	730	448	3,907	1,322	7,417
2046	1,011	730	448	3,911	1,322	7,422
2047	1,012	730	448	3,915	1,322	7,427
2048	1,012	730	448	3,920	1,322	7,432
2049	1,013	730	448	3,924	1,323	7,437
2050	1,013	731	448	3,928	1,323	7,443

Appendix F
Schedule 4: Page 6 of 6 – Projected Generation
High Wind Shift & Cable – Maui

Year	Wind (GWh)	Solar (GWh)	Other Renewables (GWh)	Oil (GWh)	Coal (GWh)	Total (GWh)
2013	146	6	86	869	-	1,107
2014	156	9	44	890	-	1,100
2015	166	13	2	911	-	1,093
2016	165	16	2	906	-	1,089
2017	164	19	2	900	-	1,085
2018	163	22	2	894	-	1,081
2019	162	25	2	889	-	1,078
2020	809	29	2	942	-	1,781
2021	806	29	2	900	-	1,737
2022	803	30	2	858	-	1,693
2023	800	30	2	817	-	1,649
2024	797	30	2	775	-	1,605
2025	798	31	2	772	-	1,603
2026	799	31	2	769	-	1,601
2027	800	31	2	766	-	1,599
2028	800	31	2	764	-	1,597
2029	790	37	2	749	-	1,579
2030	780	43	2	734	-	1,560
2031	770	50	2	719	-	1,541
2032	760	56	2	705	-	1,523
2033	764	59	2	707	-	1,532
2034	768	62	2	710	-	1,541
2035	771	65	2	712	-	1,550
2036	775	68	2	715	-	1,560
2037	779	68	2	717	-	1,567
2038	783	68	2	720	-	1,573
2039	787	68	2	723	-	1,580
2040	792	68	2	725	-	1,587
2041	795	68	2	727	-	1,592
2042	798	68	2	728	-	1,596
2043	801	68	2	730	-	1,601
2044	804	68	2	731	-	1,606
2045	807	68	2	733	-	1,611
2046	808	68	2	734	-	1,612
2047	809	68	2	735	-	1,614
2048	810	68	2	735	-	1,616
2049	811	68	2	736	-	1,617
2050	811	68	2	737	-	1,619

Appendix F
Schedule 5: Page 1 of 3 – Projected Emissions
Base Case (No Cable)

Year	Oahu CO2 (tons)	Maui CO2 (tons)	Total CO2 (tons)	Oahu SO2 (tons)	Maui SO2 (tons)	Total SO2 (tons)	Oahu NOx (tons)	Maui NOx (tons)	Total NOx (tons)	Oahu PM (tons)	Maui PM (tons)	Total PM (tons)
2013	4,895,810	568,711	5,464,520	33,410	4,112	37,522	12,321	1,397	13,717	4,802	239	5,041
2014	4,852,608	582,218	5,434,826	33,098	4,210	37,308	12,215	1,430	13,644	4,783	245	5,028
2015	4,809,407	595,725	5,405,132	32,786	4,307	37,094	12,108	1,463	13,571	4,764	250	5,015
2016	4,703,681	591,970	5,295,651	32,019	4,280	36,299	11,849	1,454	13,303	4,723	249	4,972
2017	4,597,956	588,214	5,186,170	31,252	4,253	35,505	11,590	1,444	13,034	4,683	247	4,930
2018	4,492,231	584,458	5,076,689	30,485	4,226	34,711	11,331	1,435	12,766	4,642	246	4,887
2019	4,386,505	580,703	4,967,208	29,718	4,199	33,917	11,071	1,426	12,497	4,601	244	4,845
2020	4,280,780	576,947	4,857,727	28,951	4,172	33,123	10,812	1,417	12,229	4,560	242	4,802
2021	4,218,688	552,747	4,771,435	25,788	3,292	29,080	10,655	1,357	12,013	4,495	232	4,727
2022	4,156,597	528,547	4,685,144	22,624	2,413	25,037	10,499	1,298	11,797	4,430	222	4,652
2023	4,094,505	504,348	4,598,853	19,460	1,534	20,995	10,342	1,239	11,581	4,365	212	4,577
2024	4,032,414	480,148	4,512,561	16,297	655	16,952	10,185	1,179	11,364	4,300	202	4,501
2025	4,024,222	479,533	4,503,755	16,258	654	16,912	10,164	1,178	11,342	4,289	201	4,491
2026	4,016,030	478,918	4,494,948	16,219	653	16,873	10,144	1,176	11,320	4,279	201	4,480
2027	4,007,839	478,303	4,486,142	16,181	653	16,833	10,123	1,175	11,297	4,268	201	4,469
2028	3,999,647	477,688	4,477,335	16,142	652	16,794	10,102	1,173	11,275	4,258	201	4,459
2029	3,994,782	477,413	4,472,195	16,099	651	16,750	10,089	1,172	11,261	4,246	201	4,446
2030	3,989,916	477,138	4,467,054	16,056	651	16,707	10,076	1,172	11,247	4,233	200	4,434
2031	3,985,051	476,863	4,461,914	16,014	651	16,664	10,063	1,171	11,234	4,221	200	4,421
2032	3,980,186	476,588	4,456,774	15,971	650	16,621	10,050	1,170	11,220	4,209	200	4,409
2033	3,995,655	478,041	4,473,696	16,008	652	16,661	10,088	1,174	11,262	4,217	201	4,418
2034	4,011,124	479,495	4,490,619	16,046	654	16,700	10,126	1,177	11,303	4,226	201	4,427
2035	4,026,593	480,948	4,507,541	16,083	656	16,739	10,164	1,181	11,345	4,234	202	4,436
2036	4,042,062	482,402	4,524,464	16,121	658	16,779	10,202	1,185	11,387	4,243	203	4,445
2037	4,058,191	485,432	4,543,623	16,160	662	16,822	10,242	1,192	11,434	4,252	204	4,456
2038	4,074,320	488,463	4,562,783	16,200	666	16,866	10,282	1,199	11,482	4,262	205	4,467
2039	4,090,449	491,493	4,581,942	16,239	671	16,910	10,322	1,207	11,529	4,271	207	4,478
2040	4,106,578	494,524	4,601,102	16,278	675	16,953	10,362	1,214	11,576	4,281	208	4,488
2041	4,121,363	497,384	4,618,746	16,312	679	16,990	10,399	1,221	11,620	4,289	209	4,498
2042	4,136,147	500,244	4,636,391	16,346	682	17,028	10,435	1,228	11,664	4,298	210	4,508
2043	4,150,932	503,104	4,654,036	16,379	686	17,065	10,472	1,235	11,707	4,307	211	4,518
2044	4,165,716	505,964	4,671,681	16,413	690	17,103	10,508	1,242	11,751	4,315	213	4,528
2045	4,180,501	508,824	4,689,325	16,446	694	17,140	10,545	1,249	11,794	4,324	214	4,538
2046	4,183,723	509,521	4,693,245	16,453	695	17,148	10,553	1,251	11,804	4,326	214	4,540
2047	4,186,946	510,218	4,697,164	16,460	696	17,156	10,561	1,253	11,814	4,327	214	4,542
2048	4,190,168	510,916	4,701,084	16,467	697	17,164	10,569	1,255	11,823	4,329	215	4,544
2049	4,193,390	511,613	4,705,003	16,474	698	17,172	10,577	1,256	11,833	4,331	215	4,546
2050	4,196,613	512,310	4,708,923	16,481	699	17,180	10,585	1,258	11,843	4,333	215	4,548

Appendix F
Schedule 5: Page 2 of 3 – Projected Emissions
Base Case Plus Cable

Year	Oahu CO2 (tons)	Maui CO2 (tons)	Total CO2 (tons)	Oahu SO2 (tons)	Maui SO2 (tons)	Total SO2 (tons)	Oahu NOx (tons)	Maui NOx (tons)	Total NOx (tons)	Oahu PM (tons)	Maui PM (tons)	Total PM (tons)
2013	4,895,810	568,711	5,464,520	33,410	4,112	37,522	12,321	1,397	13,717	4,802	239	5,041
2014	4,852,608	582,218	5,434,826	33,098	4,210	37,308	12,215	1,430	13,644	4,783	245	5,028
2015	4,809,407	595,725	5,405,132	32,786	4,307	37,094	12,108	1,463	13,571	4,764	250	5,015
2016	4,703,681	591,970	5,295,651	32,019	4,280	36,299	11,849	1,454	13,303	4,723	249	4,972
2017	4,597,956	588,214	5,186,170	31,252	4,253	35,505	11,590	1,444	13,034	4,683	247	4,930
2018	4,492,231	584,458	5,076,689	30,485	4,226	34,711	11,331	1,435	12,766	4,642	246	4,887
2019	4,386,505	580,703	4,967,208	29,718	4,199	33,917	11,071	1,426	12,497	4,601	244	4,845
2020	4,136,007	658,033	4,794,039	27,890	4,758	32,648	10,459	1,616	12,075	4,519	276	4,796
2021	4,075,970	616,470	4,692,440	24,981	3,736	28,717	10,307	1,514	11,821	4,453	259	4,712
2022	4,015,933	574,907	4,590,841	22,072	2,714	24,786	10,155	1,412	11,567	4,388	242	4,629
2023	3,955,897	533,345	4,489,241	19,163	1,693	20,855	10,003	1,310	11,313	4,322	224	4,546
2024	3,895,860	491,782	4,387,642	16,254	671	16,925	9,851	1,208	11,059	4,256	207	4,462
2025	3,881,354	488,993	4,370,347	16,184	667	16,851	9,815	1,201	11,015	4,239	205	4,445
2026	3,866,848	486,204	4,353,052	16,115	663	16,778	9,778	1,194	10,972	4,222	204	4,427
2027	3,852,342	483,415	4,335,757	16,046	660	16,705	9,741	1,187	10,928	4,206	203	4,409
2028	3,837,837	480,626	4,318,462	15,977	656	16,632	9,704	1,180	10,885	4,189	202	4,391
2029	3,844,942	468,966	4,313,908	15,955	640	16,595	9,721	1,152	10,873	4,184	197	4,381
2030	3,852,048	457,306	4,309,354	15,933	624	16,557	9,738	1,123	10,861	4,180	192	4,372
2031	3,859,153	445,647	4,304,800	15,911	608	16,519	9,754	1,094	10,849	4,175	187	4,362
2032	3,866,258	433,987	4,300,245	15,889	592	16,481	9,771	1,066	10,837	4,170	182	4,353
2033	3,882,362	435,639	4,318,001	15,929	594	16,523	9,811	1,070	10,880	4,180	183	4,363
2034	3,898,465	437,292	4,335,757	15,968	597	16,565	9,851	1,074	10,924	4,190	184	4,373
2035	3,914,569	438,944	4,353,513	16,007	599	16,606	9,890	1,078	10,968	4,199	184	4,384
2036	3,930,672	440,597	4,371,269	16,047	601	16,648	9,930	1,082	11,012	4,209	185	4,394
2037	3,948,790	442,660	4,391,450	16,090	604	16,694	9,975	1,087	11,062	4,219	186	4,405
2038	3,966,907	444,724	4,411,631	16,133	607	16,740	10,020	1,092	11,112	4,229	187	4,416
2039	3,985,024	446,787	4,431,812	16,176	610	16,785	10,065	1,097	11,162	4,239	188	4,427
2040	4,003,142	448,851	4,451,992	16,219	612	16,831	10,109	1,102	11,212	4,250	189	4,438
2041	4,020,354	450,308	4,470,662	16,256	614	16,871	10,152	1,106	11,258	4,259	189	4,448
2042	4,037,566	451,765	4,489,331	16,294	616	16,910	10,194	1,109	11,304	4,269	190	4,459
2043	4,054,778	453,222	4,508,001	16,331	618	16,949	10,237	1,113	11,350	4,279	190	4,469
2044	4,071,991	454,679	4,526,670	16,369	620	16,989	10,279	1,117	11,396	4,288	191	4,479
2045	4,089,203	456,136	4,545,339	16,406	622	17,028	10,322	1,120	11,442	4,298	192	4,490
2046	4,092,818	456,526	4,549,344	16,414	623	17,037	10,331	1,121	11,452	4,300	192	4,492
2047	4,096,432	456,916	4,553,348	16,422	623	17,045	10,340	1,122	11,462	4,302	192	4,493
2048	4,100,047	457,305	4,557,353	16,430	624	17,054	10,349	1,123	11,472	4,303	192	4,495
2049	4,103,662	457,695	4,561,357	16,438	624	17,062	10,358	1,124	11,482	4,305	192	4,497
2050	4,107,277	458,085	4,565,361	16,446	625	17,071	10,367	1,125	11,491	4,307	192	4,499

Appendix F
Schedule 5: Page 3 of 3 –Projected Emissions
High Wind Shift & Cable

Year	Oahu CO2 (tons)	Maui CO2 (tons)	Total CO2 (tons)	Oahu SO2 (tons)	Maui SO2 (tons)	Total SO2 (tons)	Oahu NOx (tons)	Maui NOx (tons)	Total NOx (tons)	Oahu PM (tons)	Maui PM (tons)	Total PM (tons)
2013	4,895,810	568,711	5,464,520	33,410	4,112	37,522	12,321	1,397	13,717	4,802	239	5,041
2014	4,852,608	582,218	5,434,826	33,098	4,210	37,308	12,215	1,430	13,644	4,783	245	5,028
2015	4,809,407	595,725	5,405,132	32,786	4,307	37,094	12,108	1,463	13,571	4,764	250	5,015
2016	4,703,681	591,970	5,295,651	32,019	4,280	36,299	11,849	1,454	13,303	4,723	249	4,972
2017	4,597,956	588,214	5,186,170	31,252	4,253	35,505	11,590	1,444	13,034	4,683	247	4,930
2018	4,492,231	584,458	5,076,689	30,485	4,226	34,711	11,331	1,435	12,766	4,642	246	4,887
2019	4,386,505	580,703	4,967,208	29,718	4,199	33,917	11,071	1,426	12,497	4,601	244	4,845
2020	4,027,195	609,122	4,636,317	27,147	4,404	31,551	10,185	1,496	11,681	4,413	256	4,669
2021	3,971,780	572,188	4,543,968	24,321	3,461	27,781	10,045	1,405	11,450	4,353	240	4,593
2022	3,916,365	535,254	4,451,619	21,495	2,517	24,011	9,905	1,314	11,219	4,292	225	4,517
2023	3,860,949	498,320	4,359,270	18,668	1,573	20,242	9,765	1,224	10,988	4,232	209	4,442
2024	3,805,534	461,386	4,266,920	15,842	629	16,472	9,625	1,133	10,758	4,172	194	4,366
2025	3,795,636	459,643	4,255,279	15,796	627	16,423	9,600	1,129	10,728	4,161	193	4,354
2026	3,785,739	457,899	4,243,638	15,749	625	16,374	9,575	1,124	10,699	4,150	192	4,342
2027	3,775,841	456,156	4,231,997	15,703	622	16,325	9,549	1,120	10,670	4,138	192	4,330
2028	3,765,943	454,412	4,220,355	15,656	620	16,276	9,524	1,116	10,640	4,127	191	4,318
2029	3,769,845	444,268	4,214,114	15,630	606	16,236	9,533	1,091	10,624	4,121	187	4,308
2030	3,773,747	434,125	4,207,872	15,604	592	16,196	9,542	1,066	10,608	4,114	182	4,297
2031	3,777,649	423,982	4,201,631	15,578	578	16,156	9,551	1,041	10,592	4,108	178	4,286
2032	3,781,551	413,838	4,195,389	15,552	565	16,117	9,559	1,016	10,575	4,102	174	4,276
2033	3,797,480	415,336	4,212,817	15,593	567	16,159	9,599	1,020	10,619	4,112	175	4,286
2034	3,813,409	416,835	4,230,244	15,634	569	16,202	9,638	1,024	10,662	4,122	175	4,297
2035	3,829,339	418,333	4,247,672	15,675	571	16,245	9,678	1,027	10,705	4,133	176	4,308
2036	3,845,268	419,831	4,265,099	15,716	573	16,288	9,717	1,031	10,748	4,143	176	4,319
2037	3,863,477	421,476	4,284,953	15,762	575	16,337	9,762	1,035	10,797	4,154	177	4,332
2038	3,881,686	423,120	4,304,807	15,808	577	16,386	9,808	1,039	10,847	4,166	178	4,344
2039	3,899,896	424,765	4,324,660	15,855	579	16,434	9,853	1,043	10,896	4,178	178	4,356
2040	3,918,105	426,409	4,344,514	15,901	582	16,483	9,898	1,047	10,945	4,189	179	4,368
2041	3,935,451	427,424	4,362,875	15,943	583	16,526	9,941	1,050	10,990	4,199	180	4,379
2042	3,952,797	428,438	4,381,235	15,984	584	16,569	9,984	1,052	11,036	4,209	180	4,389
2043	3,970,142	429,453	4,399,595	16,026	586	16,611	10,027	1,055	11,081	4,219	180	4,400
2044	3,987,488	430,468	4,417,956	16,067	587	16,654	10,069	1,057	11,127	4,230	181	4,411
2045	4,004,834	431,482	4,436,316	16,108	589	16,697	10,112	1,060	11,172	4,240	181	4,421
2046	4,008,231	431,952	4,440,183	16,115	589	16,705	10,121	1,061	11,181	4,242	182	4,423
2047	4,011,628	432,421	4,444,049	16,122	590	16,712	10,129	1,062	11,191	4,244	182	4,425
2048	4,015,024	432,890	4,447,915	16,129	591	16,720	10,138	1,063	11,201	4,245	182	4,427
2049	4,018,421	433,360	4,451,781	16,136	591	16,727	10,146	1,064	11,210	4,247	182	4,429
2050	4,021,818	433,829	4,455,647	16,143	592	16,734	10,154	1,065	11,220	4,249	182	4,431

Appendix F
Schedule 6: Page 1 of 6 – Projected Fuel Consumption
Base Case (No Cable) – Oahu

Year	LSFO (MMBtu)	Coal (MMBtu)	Diesel (MMBtu)	Low Sulfur Diesel (MMBtu)	Biodiesel (MMBtu)	Biomass/ Landfill (MMBtu)
2013	48,139,108	14,622,600	-	-	-	8,322,111
2014	47,554,085	14,619,186	-	-	-	8,322,111
2015	46,969,062	14,615,773	-	-	-	8,322,111
2016	40,098,362	14,634,335	5,404,655	-	-	7,930,497
2017	33,227,663	14,652,897	10,809,311	-	-	7,538,883
2018	26,356,964	14,671,458	16,213,966	-	-	7,147,269
2019	19,486,264	14,690,020	21,618,621	-	-	6,755,655
2020	12,615,565	14,708,582	27,023,277	-	-	6,364,041
2021	12,409,941	14,501,287	20,267,457	6,378,777	-	6,364,041
2022	12,204,318	14,293,992	13,511,638	12,757,554	-	6,364,041
2023	11,998,695	14,086,697	6,755,819	19,136,331	-	6,364,041
2024	11,793,071	13,879,402	-	25,515,108	-	6,364,041
2025	11,764,695	13,842,261	-	25,479,106	-	6,364,041
2026	11,736,318	13,805,121	-	25,443,104	-	6,364,041
2027	11,707,942	13,767,981	-	25,407,102	-	6,364,041
2028	11,679,565	13,730,840	-	25,371,100	-	6,364,041
2029	11,648,169	13,675,976	-	25,406,103	-	6,364,041
2030	11,616,772	13,621,112	-	25,441,106	-	6,364,041
2031	11,585,375	13,566,249	-	25,476,109	-	6,364,041
2032	11,553,979	13,511,385	-	25,511,113	-	6,364,041
2033	11,581,839	13,522,059	-	25,680,674	-	6,364,041
2034	11,609,698	13,532,734	-	25,850,236	-	6,364,041
2035	11,637,558	13,543,409	-	26,019,797	-	6,364,041
2036	11,665,418	13,554,084	-	26,189,359	-	6,364,041
2037	11,692,161	13,568,358	-	26,364,449	-	6,364,041
2038	11,718,905	13,582,632	-	26,539,539	-	6,364,041
2039	11,745,648	13,596,906	-	26,714,629	-	6,364,041
2040	11,772,391	13,611,180	-	26,889,719	-	6,364,041
2041	11,790,876	13,624,380	-	27,056,097	-	6,364,041
2042	11,809,360	13,637,581	-	27,222,474	-	6,364,041
2043	11,827,845	13,650,781	-	27,388,852	-	6,364,041
2044	11,846,329	13,663,981	-	27,555,230	-	6,364,041
2045	11,864,813	13,677,181	-	27,721,608	-	6,364,041
2046	11,868,583	13,679,279	-	27,759,123	-	6,364,041
2047	11,872,353	13,681,376	-	27,796,638	-	6,364,041
2048	11,876,123	13,683,473	-	27,834,153	-	6,364,041
2049	11,879,894	13,685,571	-	27,871,669	-	6,364,041
2050	11,883,664	13,687,668	-	27,909,184	-	6,364,041

Appendix F
Schedule 6: Page 2 of 6 – Projected Fuel Consumption
Base Case (No Cable) – Maui

Year	LSFO (MMBtu)	Coal (MMBtu)	Diesel (MMBtu)	Low Sulfur Diesel (MMBtu)	Biodiesel (MMBtu)	Biomass/ Landfill (MMBtu)
2013	7,375,637	-	383,035	-	-	1,261,440
2014	7,472,329	-	470,618	-	-	630,720
2015	7,569,022	-	558,202	-	-	-
2016	7,553,457	-	522,529	-	-	-
2017	7,537,893	-	486,857	-	-	-
2018	7,522,328	-	451,184	-	-	-
2019	7,506,764	-	415,511	-	-	-
2020	7,491,199	-	379,839	-	-	-
2021	5,618,399	-	284,879	1,637,612	-	-
2022	3,745,600	-	189,919	3,275,224	-	-
2023	1,872,800	-	94,960	4,912,835	-	-
2024	-	-	-	6,550,447	-	-
2025	-	-	-	6,542,057	-	-
2026	-	-	-	6,533,667	-	-
2027	-	-	-	6,525,277	-	-
2028	-	-	-	6,516,886	-	-
2029	-	-	-	6,513,136	-	-
2030	-	-	-	6,509,385	-	-
2031	-	-	-	6,505,634	-	-
2032	-	-	-	6,501,884	-	-
2033	-	-	-	6,521,712	-	-
2034	-	-	-	6,541,540	-	-
2035	-	-	-	6,561,367	-	-
2036	-	-	-	6,581,195	-	-
2037	-	-	-	6,622,540	-	-
2038	-	-	-	6,663,884	-	-
2039	-	-	-	6,705,229	-	-
2040	-	-	-	6,746,573	-	-
2041	-	-	-	6,785,591	-	-
2042	-	-	-	6,824,610	-	-
2043	-	-	-	6,863,628	-	-
2044	-	-	-	6,902,647	-	-
2045	-	-	-	6,941,665	-	-
2046	-	-	-	6,951,177	-	-
2047	-	-	-	6,960,688	-	-
2048	-	-	-	6,970,200	-	-
2049	-	-	-	6,979,711	-	-
2050	-	-	-	6,989,223	-	-

Appendix F
Schedule 6: Page 3 of 6 – Projected Fuel Consumption
Base Case Plus Cable – Oahu

Year	LSFO (MMBtu)	Coal (MMBtu)	Diesel (MMBtu)	Low Sulfur Diesel (MMBtu)	Biodiesel (MMBtu)	Biomass/ Landfill (MMBtu)
2013	48,139,108	14,622,600	-	-	-	8,322,111
2014	47,554,085	14,619,186	-	-	-	8,322,111
2015	46,969,062	14,615,773	-	-	-	8,322,111
2016	40,098,362	14,634,335	5,404,655	-	-	7,930,497
2017	33,227,663	14,652,897	10,809,311	-	-	7,538,883
2018	26,356,964	14,671,458	16,213,966	-	-	7,147,269
2019	19,486,264	14,690,020	21,618,621	-	-	6,755,655
2020	12,287,749	14,817,453	25,237,149	-	-	6,364,041
2021	12,230,070	14,600,931	18,927,861	5,824,103	-	6,364,041
2022	12,172,390	14,384,410	12,618,574	11,648,206	-	6,364,041
2023	12,114,711	14,167,888	6,309,287	17,472,308	-	6,364,041
2024	12,057,032	13,951,366	-	23,296,411	-	6,364,041
2025	11,996,375	13,894,719	-	23,231,430	-	6,364,041
2026	11,935,718	13,838,071	-	23,166,448	-	6,364,041
2027	11,875,060	13,781,423	-	23,101,466	-	6,364,041
2028	11,814,403	13,724,775	-	23,036,485	-	6,364,041
2029	11,780,205	13,683,939	-	23,219,710	-	6,364,041
2030	11,746,007	13,643,102	-	23,402,936	-	6,364,041
2031	11,711,809	13,602,265	-	23,586,161	-	6,364,041
2032	11,677,611	13,561,428	-	23,769,386	-	6,364,041
2033	11,703,204	13,576,956	-	23,943,680	-	6,364,041
2034	11,728,796	13,592,484	-	24,117,974	-	6,364,041
2035	11,754,389	13,608,012	-	24,292,267	-	6,364,041
2036	11,779,981	13,623,539	-	24,466,561	-	6,364,041
2037	11,809,591	13,637,086	-	24,666,837	-	6,364,041
2038	11,839,201	13,650,633	-	24,867,114	-	6,364,041
2039	11,868,811	13,664,180	-	25,067,391	-	6,364,041
2040	11,898,420	13,677,727	-	25,267,667	-	6,364,041
2041	11,918,395	13,690,700	-	25,465,965	-	6,364,041
2042	11,938,369	13,703,672	-	25,664,262	-	6,364,041
2043	11,958,344	13,716,644	-	25,862,560	-	6,364,041
2044	11,978,318	13,729,617	-	26,060,857	-	6,364,041
2045	11,998,293	13,742,589	-	26,259,155	-	6,364,041
2046	12,003,846	13,744,097	-	26,300,993	-	6,364,041
2047	12,009,398	13,745,605	-	26,342,830	-	6,364,041
2048	12,014,951	13,747,113	-	26,384,668	-	6,364,041
2049	12,020,504	13,748,621	-	26,426,506	-	6,364,041
2050	12,026,057	13,750,129	-	26,468,343	-	6,364,041

Appendix F
Schedule 6: Page 4 of 6 – Projected Fuel Consumption
Base Case Plus Cable – Maui

Year	LSFO (MMBtu)	Coal (MMBtu)	Diesel (MMBtu)	Low Sulfur Diesel (MMBtu)	Biodiesel (MMBtu)	Biomass/ Landfill (MMBtu)
2013	7,375,637	-	383,035	-	-	1,261,440
2014	7,472,329	-	470,618	-	-	630,720
2015	7,569,022	-	558,202	-	-	-
2016	7,553,457	-	522,529	-	-	-
2017	7,537,893	-	486,857	-	-	-
2018	7,522,328	-	451,184	-	-	-
2019	7,506,764	-	415,511	-	-	-
2020	8,755,562	-	221,690	-	-	-
2021	6,566,672	-	166,267	1,677,292	-	-
2022	4,377,781	-	110,845	3,354,584	-	-
2023	2,188,891	-	55,422	5,031,877	-	-
2024	-	-	-	6,709,169	-	-
2025	-	-	-	6,671,119	-	-
2026	-	-	-	6,633,069	-	-
2027	-	-	-	6,595,019	-	-
2028	-	-	-	6,556,969	-	-
2029	-	-	-	6,397,900	-	-
2030	-	-	-	6,238,831	-	-
2031	-	-	-	6,079,761	-	-
2032	-	-	-	5,920,692	-	-
2033	-	-	-	5,943,237	-	-
2034	-	-	-	5,965,781	-	-
2035	-	-	-	5,988,326	-	-
2036	-	-	-	6,010,870	-	-
2037	-	-	-	6,039,021	-	-
2038	-	-	-	6,067,172	-	-
2039	-	-	-	6,095,323	-	-
2040	-	-	-	6,123,473	-	-
2041	-	-	-	6,143,353	-	-
2042	-	-	-	6,163,233	-	-
2043	-	-	-	6,183,112	-	-
2044	-	-	-	6,202,992	-	-
2045	-	-	-	6,222,871	-	-
2046	-	-	-	6,228,187	-	-
2047	-	-	-	6,233,502	-	-
2048	-	-	-	6,238,818	-	-
2049	-	-	-	6,244,133	-	-
2050	-	-	-	6,249,449	-	-

Appendix F
Schedule 6: Page 5 of 6 – Projected Fuel Consumption
High Wind Shift & Cable – Oahu

Year	LSFO (MMBtu)	Coal (MMBtu)	Diesel (MMBtu)	Low Sulfur Diesel (MMBtu)	Biodiesel (MMBtu)	Biomass/ Landfill (MMBtu)
2013	48,139,108	14,622,600	-	-	-	8,322,111
2014	47,554,085	14,619,186	-	-	-	8,322,111
2015	46,969,062	14,615,773	-	-	-	8,322,111
2016	40,098,362	14,634,335	5,404,655	-	-	7,930,497
2017	33,227,663	14,652,897	10,809,311	-	-	7,538,883
2018	26,356,964	14,671,458	16,213,966	-	-	7,147,269
2019	19,486,264	14,690,020	21,618,621	-	-	6,755,655
2020	11,935,906	14,494,161	24,516,906	-	-	6,364,041
2021	11,857,293	14,297,384	18,387,679	5,702,838	-	6,364,041
2022	11,778,680	14,100,607	12,258,453	11,405,676	-	6,364,041
2023	11,700,067	13,903,830	6,129,226	17,108,514	-	6,364,041
2024	11,621,454	13,707,053	-	22,811,352	-	6,364,041
2025	11,580,706	13,669,584	-	22,764,864	-	6,364,041
2026	11,539,958	13,632,116	-	22,718,377	-	6,364,041
2027	11,499,210	13,594,648	-	22,671,889	-	6,364,041
2028	11,458,461	13,557,179	-	22,625,402	-	6,364,041
2029	11,426,505	13,514,279	-	22,765,313	-	6,364,041
2030	11,394,549	13,471,378	-	22,905,224	-	6,364,041
2031	11,362,593	13,428,478	-	23,045,135	-	6,364,041
2032	11,330,637	13,385,577	-	23,185,046	-	6,364,041
2033	11,356,674	13,404,943	-	23,351,622	-	6,364,041
2034	11,382,710	13,424,308	-	23,518,199	-	6,364,041
2035	11,408,747	13,443,674	-	23,684,775	-	6,364,041
2036	11,434,783	13,463,040	-	23,851,351	-	6,364,041
2037	11,465,072	13,483,760	-	24,043,054	-	6,364,041
2038	11,495,361	13,504,480	-	24,234,756	-	6,364,041
2039	11,525,649	13,525,200	-	24,426,458	-	6,364,041
2040	11,555,938	13,545,920	-	24,618,160	-	6,364,041
2041	11,582,732	13,561,078	-	24,808,672	-	6,364,041
2042	11,609,527	13,576,236	-	24,999,184	-	6,364,041
2043	11,636,321	13,591,395	-	25,189,696	-	6,364,041
2044	11,663,115	13,606,553	-	25,380,208	-	6,364,041
2045	11,689,910	13,621,711	-	25,570,720	-	6,364,041
2046	11,692,711	13,624,134	-	25,611,168	-	6,364,041
2047	11,695,513	13,626,557	-	25,651,617	-	6,364,041
2048	11,698,315	13,628,979	-	25,692,066	-	6,364,041
2049	11,701,116	13,631,402	-	25,732,515	-	6,364,041
2050	11,703,918	13,633,825	-	25,772,963	-	6,364,041

Appendix F
Schedule 6: Page 6 of 6 – Projected Fuel Consumption
High Wind Shift & Cable – Maui

Year	LSFO (MMBtu)	Coal (MMBtu)	Diesel (MMBtu)	Low Sulfur Diesel (MMBtu)	Biodiesel (MMBtu)	Biomass/ Landfill (MMBtu)
2013	7,375,637	-	383,035	-	-	1,261,440
2014	7,472,329	-	470,618	-	-	630,720
2015	7,569,022	-	558,202	-	-	-
2016	7,553,457	-	522,529	-	-	-
2017	7,537,893	-	486,857	-	-	-
2018	7,522,328	-	451,184	-	-	-
2019	7,506,764	-	415,511	-	-	-
2020	8,128,524	-	181,465	-	-	-
2021	6,096,393	-	136,099	1,573,623	-	-
2022	4,064,262	-	90,733	3,147,247	-	-
2023	2,032,131	-	45,366	4,720,870	-	-
2024	-	-	-	6,294,493	-	-
2025	-	-	-	6,270,706	-	-
2026	-	-	-	6,246,919	-	-
2027	-	-	-	6,223,132	-	-
2028	-	-	-	6,199,344	-	-
2029	-	-	-	6,060,961	-	-
2030	-	-	-	5,922,578	-	-
2031	-	-	-	5,784,195	-	-
2032	-	-	-	5,645,812	-	-
2033	-	-	-	5,666,253	-	-
2034	-	-	-	5,686,693	-	-
2035	-	-	-	5,707,133	-	-
2036	-	-	-	5,727,574	-	-
2037	-	-	-	5,750,009	-	-
2038	-	-	-	5,772,444	-	-
2039	-	-	-	5,794,879	-	-
2040	-	-	-	5,817,314	-	-
2041	-	-	-	5,831,156	-	-
2042	-	-	-	5,844,999	-	-
2043	-	-	-	5,858,841	-	-
2044	-	-	-	5,872,683	-	-
2045	-	-	-	5,886,525	-	-
2046	-	-	-	5,892,928	-	-
2047	-	-	-	5,899,330	-	-
2048	-	-	-	5,905,733	-	-
2049	-	-	-	5,912,135	-	-
2050	-	-	-	5,918,538	-	-

Appendix F
Schedule 7: Rate Impacts
(in Nominal Dollars)

Year	Base Case Plus Cable(¢/KWh)	Low Wind Shift & Cable (¢/KWh)	Medium Wind Shift & Cable (¢/KWh)	High Wind Shift & Cable (¢/KWh)
2020	0.6	0.3	0.1	0.1
2021	0.5	0.2	0.1	(0.0)
2022	0.4	0.1	(0.0)	(0.1)
2023	0.3	0.0	(0.1)	(0.2)
2024	0.2	(0.1)	(0.2)	(0.2)
2025	0.2	(0.2)	(0.3)	(0.3)
2026	0.1	(0.2)	(0.3)	(0.4)
2027	0.1	(0.3)	(0.4)	(0.4)
2028	(0.0)	(0.4)	(0.4)	(0.5)
2029	(0.1)	(0.4)	(0.5)	(0.5)
2030	(0.1)	(0.5)	(0.6)	(0.6)
2031	(0.1)	(0.5)	(0.6)	(0.7)
2032	(0.2)	(0.6)	(0.7)	(0.8)
2033	(0.2)	(0.6)	(0.8)	(0.8)
2034	(0.3)	(0.7)	(0.8)	(0.9)
2035	(0.3)	(0.7)	(0.9)	(0.9)
2036	(0.3)	(0.8)	(0.9)	(1.0)
2037	(0.3)	(0.8)	(1.0)	(1.0)
2038	(0.4)	(0.9)	(1.0)	(1.1)
2039	(0.4)	(0.9)	(1.1)	(1.1)
2040	(0.4)	(1.0)	(1.1)	(1.2)
2041	(0.4)	(1.0)	(1.2)	(1.2)
2042	(0.5)	(1.1)	(1.2)	(1.3)
2043	(0.5)	(1.1)	(1.3)	(1.3)
2044	(0.5)	(1.2)	(1.3)	(1.4)
2045	(0.6)	(1.2)	(1.4)	(1.4)
2046	(0.6)	(1.3)	(1.4)	(1.5)
2047	(0.7)	(1.3)	(1.5)	(1.6)
2048	(0.7)	(1.4)	(1.6)	(1.7)
2049	(0.7)	(1.5)	(1.7)	(1.7)
2050	(0.8)	(1.5)	(1.7)	(1.8)

Appendix G
Contracts/Tariffs Description

AGREEMENTS/TARIFFS IN COMPETITIVE PROCUREMENT

Cable Development Agreement ("CDA")

PARTIES

OBEDT Or Other Entity ⟺ CCC

KEY TERMS

- Term: Execution Date – Cable Project COD
- Termination provisions
- Roles/responsibilities for development of Cable Project
- Definition of Cable Project (size, route, facilities)
- Schedule and Target COD
- Remedies for CCC's delay/failure to perform
- Requirements for COD
- Security provisions

CCC Transmission Tariff

KEY TERMS

- Monthly Allocation of CCC Revenue Requirement
- Balancing Account Adjustment
- CCC's responsibilities on cable availability and O&M

AGREEMENTS/TARIFFS NOT IN COMPETITIVE PROCUREMENT

Reimbursement Agreements ("RA")

PARTIES

1: Hawaiian Electric Company ⟺ CCC

2: Maui Electric Company ⟺ CCC

KEY TERMS

- Term: Evergreen
- Termination provisions
- Reimbursement obligation (Allocated share of CCC's revenue requirement)
- HECO's/MECO's responsibilities as collection agent
- Mechanism for over or under-recovery of CCC monthly revenue requirement
- Mechanics of HECO/MECO payments to CCC from proceeds of transmission tariff
- Remedies for a Party's default/failure to perform

Interconnection Agreements

PARTIES

1: Hawaiian Electric Company ⟺ CCC

2: Maui Electric Company ⟺ CCC

KEY TERMS

- Term: Execution Date – 50 yrs.
- Termination provisions
- Interconnection of cable w/HECO or MECO system
- HECO's/MECO's responsibilities to provide system capable of interconnection with cable
- Interconnection technical standards
- Remedies for each party's default/failure to perform

HECO/MECO Retail Tariff

KEY TERMS

- ¢/kWh charge to all retail customers of HECO or MECO for Cable Project

Coordinated Operations Agreement ("COA")

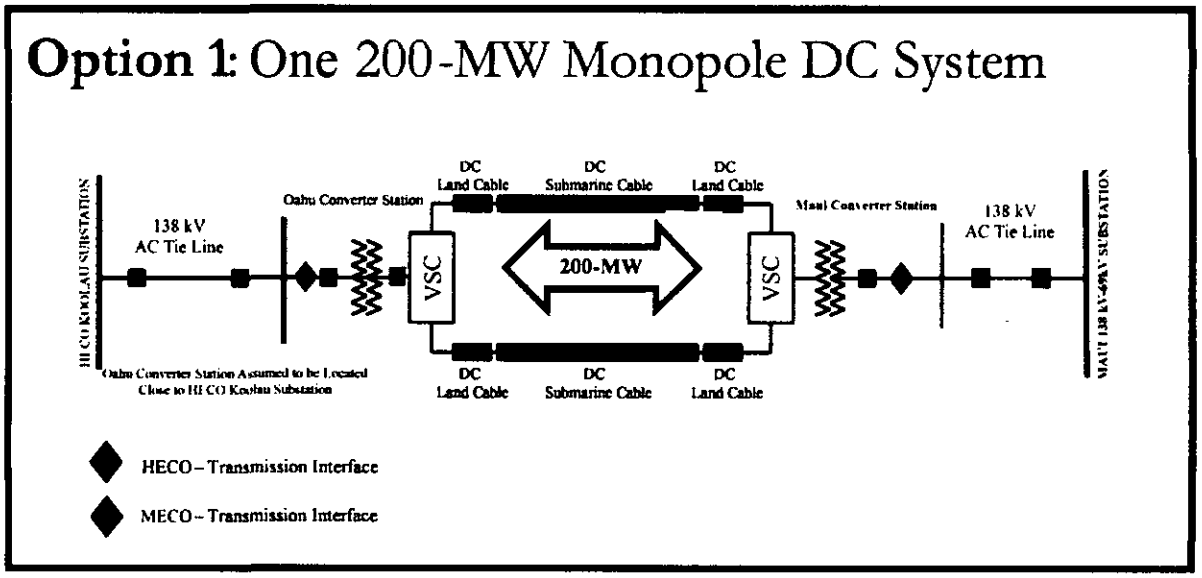
PARTIES

Hawaiian Electric Company, Maui Electric Company ⟹ CCC

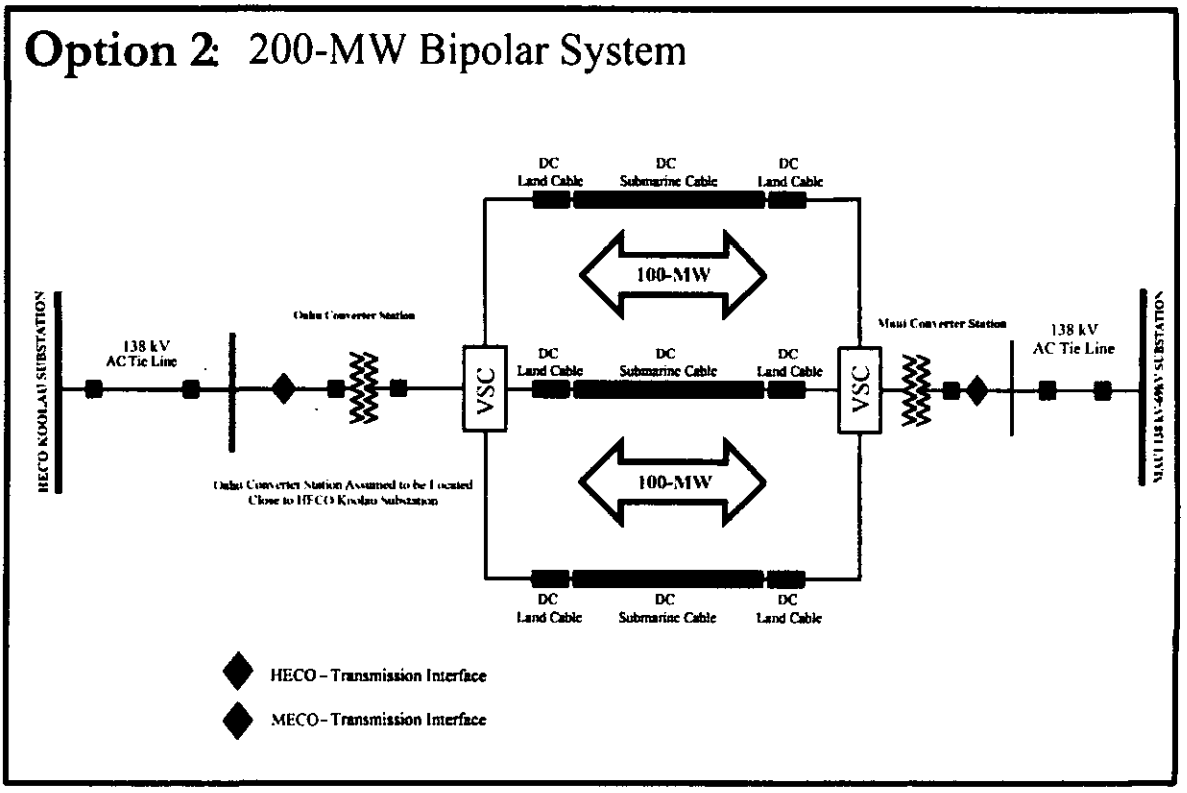
KEY TERMS

- Term: Evergreen
- Termination provisions
- Coordinated operations of the cable
- Dispatch obligations
- Outage coordination
- Requirement to develop operating instructions
- Remedies for each Party's default
- Communications procedures

Appendix H
Cable Configurations (Monopole/Bi-pole Diagrams)
Schedule 1–Potential Electrical Configuration: Monopole DC System



Appendix H
Cable Configurations (Monopole/Bi-pole Diagrams)
Schedule 2–Potential Electrical Configuration: Bipolar System



Appendix I
List of Relevant Permits[2]

RELEVANT PERMITS – FEDERAL

PERMIT	RESPONSIBLE AGENCY
Right-of-way (ROW) grant in federal waters on the Outer Continental Shelf	Bureau of Ocean Energy Management (BOEM), Pacific Region
NEPA Decision Record as part of NEPA environmental review	NOA A or BOEM most likely will be lead federal agency for a cable project carrying renewable energy.
Consultation with the Hawaiian Islands Humpback Whale National Marine Sanctuary and the Office of National Marine Sanctuaries to established conditions for issuance of proper permit	National Oceanic & Atmospheric Administration (NOAA) –Office of National Marine Sanctuaries (ONMS) State Office of Hawaiian Islands Humpback Whale National Marine Sanctuary (OHHWS)
Marine Mammal Protection Act (1972) Incidental Take Authorization or Letter of Authorization (LOA) or Incidental Harassment Authorization (IHA)	National Oceanic & Atmospheric Administration (NOAA) – National Marine Fisheries Service (NMFS)
Endangered Species Act (1973) If there is a federal nexus, Section 7 consultation is required to obtain an incidental take statement. If there is no federal nexus, Section 10 consultation is required to obtain an incidental take permit (ITP). Section 7 consultation is assumed.	U.S. Fish and Wildlife Service (USFWS), Region 1, Pacific Region, Pacific Islands Office for fresh-water and wildlife species. National Oceanic & Atmospheric Administration (NOAA) – National Marine Fisheries Service (NMFS) for marine and anadromous species.
Consultation with NOAA under Magnuson-Stevens Fishery Conservation Act regarding potential effects to areas designated as Essential Fish Habitat	National Oceanic & Atmospheric Administration (NOAA) – National Marine Fisheries Service Western Pacific Regional Fishery Management Council
Executive Order 13089 for Coral Reef Protection	U.S. Coral Reef Task Force, co-chaired by the Secretary of the Interior and the Secretary of Commerce through the Administrator of NOAA.
Rivers and Harbors Act 1899 Section 10 Permit	U.S. Army Corps of Engineers (USACE), Pacific Ocean Division, Honolulu District

[2] DBEDT notes that this List of Relevant Permits is intended to be illustrative of the scope of permitting and may not be considered an exhaustive list. The obligation of successfully obtaining each applicable permit is explicitly the CCC developer's responsibility.

	Regulatory Branch
Clean Water Act (CWA) Section 404 Permit	USACE, Pacific Ocean Division, Honolulu District Regulatory Branch
National Historic Preservation Act (NHPA) Section 106	Head of federal agency engaged in a qualifying undertaking, in consultation with Hawaii State Historic Preservation Division (SHPD)
Land and Water Conservation Fund (LWCF) Section 6(f) coordination where project impacts land/water funded by LWCF	U.S. National Park Service
Marine and Harbor Activities Notice	US Coast Guard (USCG)
Coordination	US Coast Guard (USCG) Waterways Management Coordination
Coordination	Local Military Installations

RELEVANT PERMITS – STATE

PERMIT	RESPONSIBLE AGENCY
Hawaii Incidental Take License and State Habitat Conservation Plan (Can be coordinated with NOAA / NMFS incidential take process)	DLNR, Division of Forestry and Wildlife
Certificate of Public Convenience and Necessity (CPCN)	Hawaii Public Utilities Commission
Special Use Permit	Department of Business, Economic Development and Tourism (DBEDT), Land Use Commission, Honolulu Department of Planning and Permitting (DPP), Planning Division, Maui County Planning Department.
Land Use District Boundary Amendment	DBEDT, Land Use Commission
State Submerged Lands Lease	DLNR, Office of Conservation and Coastal Lands
Conservation District Use Permit (CDUP)	DLNR, Office of Conservation and Coastal Lands
Stream Channel Alteration Permit, Section 404 of the CWA–NWP	DLNR, Commission on Water Resource Management, Regulatory Division
Stream Diversion Works Permit	DLNR, Commission on Water Resource Management, Regulatory Division
Water Quality Certification under Section 401 of the CWA/Compliance with Revised Statutes HAR 11-54 (Water Quality Standards)	Department of Health (DOH), Environmental Management Division, Clean Water Branch
Chapter 343, Hawaii Revised Statutes (HRS) EA or EIS	Office of Environmental Quality and Control (OEQC) to determine, as necessary, the accepting agency or agencies for the environmental review documents. OEQC of the Department of Health is the processing agency
Archaeological Inventory Survey – marine and land based	DLNR, SHPD and the appropriate Burial Council, if applicable.
Historic, archeological, and cultural resources, to include the Burial Sites and Human Remains Program (HRS Section 6E/NHPA Section 106)	DLNR, SHPD and the appropriate Burial Council, if applicable.
Rights of Entry; Access; Request for Use of State Lands	DLNR, Land Division
National Pollutant Discharge Elimination System (NPDES) Construction and Operational General Stormwater Permit under Section 402 of the CWA and preparation of associated	DOH, Environmental Management Division, Clean Water Branch

Stormwater Pollution Prevention (SWPP) Plan	
Hawaii Emergency Planning and Community Right-To-Know-Act Chemical Inventory Reporting	DOH, Office of Hazard Evaluation and Emergency Response
Notification of the Intent to Construct; Community Noise Permit, Noise Variance Application; Application for Stationary Sources; Application for Construction Activities	DOH, Environmental Management Division, Indoor and Radiological Health Branch, Noise Section
Oversize and/or Overweight Permit	State of Hawaii Department of Transportation (DOT), Highways Division
Use and Occupancy Agreement	State of Hawaii DOT Harbors Division Coordination
Use and Occupancy Agreement (for crossing of highway)	DOT, Highways Division
Routine construction within a state highway	DOT, Highways Division
Coastal Zone Management (CZM) Consistency Determination	DBEDT, Office of Planning

RELEVANT PERMITS – LOCAL (City and County of Honolulu)

PERMIT	RESPONSIBLE AGENCY
Special Use Permit (SUP)	DBEDT, Land Use Commission and Honolulu DPP, Planning Division
Conditional Use Permit (CUP) – Major or Minor	DPP – Land Use Permits Division
Special Management Area (SMA) Permit - Major or Minor	DPP – Land Use Permits Division
Development Plan Amendment	DPP – Planning Division
Zoning Change	DPP – Planning Division
Construction Permits	DPP – Land Use Permits Division
Waiver Permit from Development/Design Standards of Land Use Ordinance	DPP – Land Use Permits Division
Shoreline Set Back Variance	DPP – Land Use Permits Division

RELEVANT PERMITS – LOCAL (Maui County)

PERMIT	RESPONSIBLE AGENCY
Special Use Permit (SUP)	DBEDT, Land Use Commission (when project area >15 acres) Maui County, Department of Planning (DPP), Current Planning Division Maui/Molokai/Lanai Planning Commission
Conditional Permit (CP)	Maui County, DPP, Current Planning Division Maui/Molokai/Lanai Planning Commission
Special Management Area (SMA) Permit - Major or Minor	Maui Planning Department, Current Planning Division
Community Plan Amendment	Maui Planning Department, Current Planning Division
Project District Development Approval	Maui Planning Department, Current Planning Division
Zoning Change	Maui Planning Department, Current Planning Division
Construction and Building Permits (including Building Plans Review; Grading, Grubbing, and Stockpiling Permit; Driveway Permit)	Department of Public Works and Environmental Management, Development Services Administration - Building Permit
Shoreline Set Back Variance	Maui Planning Department, Current Planning Division