

DIRECT TESTIMONY

OF

CLIFF W. HAMAL

December 9, 2009

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1 **I. Introduction**

2 **Q. Please state your name, position, and business address.**

3 A. My name is Cliff W. Hamal. I am a Director at LECG, an expert services and consulting
4 firm. My address is 1725 Eye Street, NW, Suite 800, Washington, DC 20006.

5 **Q. What is the purpose of your testimony?**

6 A. I have been asked by National Grid to collect recent price data for renewable energy
7 contracts, particularly those for wind projects, and where available, offshore wind
8 projects. It is my understanding that this information may be used by the Rhode Island
9 Public Utilities Commission (Commission) in determining whether to approve the power
10 purchase agreement (PPA) between National Grid and Deepwater Wind Block Island,
11 LLC (Deepwater).

12 **Q. What is your professional background?**

13 A. I have worked in the electric power industry for approximately thirty years, the past
14 twenty as an economic consultant. As I outline in my resume, which is attached as
15 Exhibit 1, my work frequently involves market design, competitive strategy, power
16 purchase agreements, investment analysis, environmental strategy, antitrust analyses, and
17 electricity market behavior. The review and interpretation of electricity market price
18 information is a routine element of my work, and I have also often worked with PPAs,
19 having reviewed hundreds of them over the years.

1 **Q. Please describe your educational background.**

2 A. I have a Master of Science degree in Industrial Administration from Carnegie Mellon's
3 Graduate School of Industrial Administration (now the Tepper School), and a Bachelor of
4 Science degree with a dual major in Marine Engineering and Marine Transportation from
5 the US Merchant Marine Academy.

6 **Q. Have you previously offered expert testimony?**

7 A. Yes, I have testified in more than 30 proceedings. I have presented this testimony before
8 the Federal Energy Regulatory Commission, federal courts, state agencies, arbitration
9 panels and the Ontario Energy Board. Issues pertaining to power contracting and market
10 prices have been relevant to approximately a third of the cases in which I have provided
11 expert testimony. My resume lists my prior testimony.

12 **Q. What material did you rely on in preparing your testimony?**

13 A. I present a list of documents that I have specifically relied on in preparing my testimony
14 in Exhibit 2. Internet addresses where this material can be found are also provided.

15 **II. Data on the Cost of Electricity and Electric Prices in Long Term Contracts**

16 **Q. What data have you collected regarding offshore wind projects?**

17 A. The data for other offshore wind projects are sparse, and the information I found is
18 summarized in Exhibit 3. There has been considerable experience with offshore wind
19 applications in Europe, where the first project was put in operation in 1991 and where
20 there were 1,471 MW of capacity associated with 33 projects in eight countries in

1 operation at the end of 2008. Numerous additional projects are in development, with five
2 additional countries expected to have projects in operation by 2015.¹ The first data in
3 Exhibit 3 relate to current feed-in tariffs for offshore wind projects. I compiled data from
4 the UK, Germany, France, Spain, Denmark and Sweden. All data was converted from
5 euros to US dollars for ease of comparison. Projecting prices for 2013 was not always
6 possible without making assumptions that were not entirely straightforward, and I have
7 opted to only present 2009 prices in those cases. Prices for 2009 were in the \$196/MWh
8 to \$230/MWh range for the UK, Germany and France. The other countries had lower
9 prices.

10
11 The next entry in the exhibit is the PPA for the offshore Bluewater Wind Delaware
12 project with Delmarva Power & Light. This contract, signed June 23, 2008, is a 25-year
13 PPA for the purchase of electricity from an unspecified number of wind generators
14 totaling 200 MW. The Bluewater price in 2013 is \$139/MWh, and the PPA price has a
15 fixed escalation rate of 2.5% a year.

16
17 The last entry is an offer price under the new feed-in tariff in Ontario, which is
18 \$186/MWh in 2013. While not (as yet) tied directly to the new program, there has been

¹See http://awea.org/pubs/factsheets/Offshore_Factsheet.pdf and
http://ewea.org/fileadmin/ewea_documents/documents/publications/reports/Offshore_Fact_Sheet.pdf

1 an announcement of the largest offshore power project in the world, a 4,400 MW facility
2 on Lake Erie. The Ontario offshore wind projects are obviously for installations in the
3 Great Lakes, which will likely be in much shallower water than offshore ocean
4 applications, since Lake Erie's average depth is 62 feet. These units will also be
5 operating in a freshwater environment, rather than being exposed to corrosive saltwater in
6 ocean application.

7
8 Electricity restructuring has taken a different path in Ontario, with a competitive hourly
9 electricity market structured to produce prices below the level needed to attract new
10 investment when needed. The quasi-governmental agency Ontario Power Authority
11 ("OPA") provides contracts to attract new generation investment. In order to meet load
12 growth and consistent with plans to shut down all coal units for environmental reasons,
13 OPA has signed contracts for 11,998 MW of new power projects in the past few years,
14 and I believe there is no other entity in North America that has purchased as much
15 capacity from new projects in this time. Renewable projects total 3,144 MW, over two-
16 thirds of which is wind. On September 30, 2009, OPA launched a new purchase program
17 for renewable energy. The program is referred to as the "Feed-In Tariff" standard offer,
18 and OPA enters into long term contracts at specified prices for projects that meet the
19 specifications. The prices above are from the recent standard offer.

20

1 The Ontario program offers separate prices for onshore and offshore wind, providing a
2 directly comparable measure of the relative value of the resources, as perceived in
3 Ontario. The offer prices provide a 40% premium for offshore wind, relative to onshore.
4 One presumes that this reflects either an assessment of perceived relative benefits of
5 offshore wind, or a premium to promote the development of this supply option in the
6 hopes of lowering its costs in the future. I am not aware of any other direct comparison
7 between onshore and offshore wind.

8
9 **Q. What data have you collected regarding the price of other renewable generators,
10 particularly wind?**

11 A. A summary of the prices I have collected for renewable energy other than offshore wind
12 projects is presented in Exhibit 4. The first entry on the exhibit is the average all-in price
13 of a comprehensive survey of onshore wind PPAs from 2006 to 2008, as compiled by the
14 United States Department of Energy, which is \$48/MWh. The individual prices making
15 up this average ranged between \$20/MWh and \$126/MWh, although it should be noted
16 that the highest price was a bit of an outlier, with the next highest price at \$80/MWh.
17 This exhibit also contains data from other sources, including individual PPAs and other
18 offer prices from Ontario's programs. Most of the onshore wind power prices are below
19 \$100/MWh, with just a few ranging up to \$127/MWh. Price data was somewhat limited
20 as most current contracts are kept confidential.

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These price comparisons, as was true for the prices of offshore wind projects, include all revenue: energy, capacity, and renewable energy credits (RECs). The price information in the exhibit has not been adjusted for inflation, because the effects are small and I did not feel it necessary to introduce such complications with this data. I have also not made adjustments for the possibility of a premium associated with energy supplies located in New England, preferring to present the data in its raw form and leave open for judgment the extent that adjustments might be appropriate for comparisons across different locations.

Q. Can you provide data on the general level of forecasted electricity prices for Rhode Island?

A. Yes. I am aware of two energy price forecasts covering the 2012 to 2031 period. The long term all-in price forecast for Rhode Island from the ESAI and Synapse reports range from \$100/MWh to approximately \$150/MWh during the 2012 – 2031 period. The ESAI forecast is a long term study of the renewable energy supply and demand conditions in New England and the outlook for Rhode Island given its position in a competitive New England marketplace. The Synapse report, 2009 Avoided-Energy-Supply-Component report, developed projections of marginal energy supply costs that were avoided due to reductions in the use of electricity, natural gas, and other fuels resulting from energy efficiency programs offered to customers throughout New England. These forecasts

1 include forecasts of all potential revenue components, including energy, capacity and
2 renewable energy credits. Both forecasts are discussed in more detail in Mr. Milhous'
3 pre-filed direct testimony in this docket.

4 **Q. Does this conclude your testimony?**

5 A. Yes, it does.



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Overview

Cliff Hamal specializes in economic issues in the electric power and related industries. For thirty years he has been involved in a wide variety of engagements, as an economic consultant since 1989 and in technical roles involving power system operations in prior years. Mr. Hamal brings to each assignment a deep understanding of the industry, its operations, and the dynamics of its markets. He approaches each engagement openly, allowing the unique circumstances of each situation to determine the analysis needed and methodologies most likely to provide insights into the relevant issues. He particularly enjoys unique challenges that require tailored solutions. His clients have included vertically integrated electric utilities, unregulated electric generation companies, load serving entities, a debt rating agency, a hedge fund and the US Department of Justice. He has provided testimony in cases before the Federal Energy Regulatory Commission, federal courts, a state public utility commission, and the Ontario Energy Board.

Topical Summary of Prior Engagements

Market Design

Support electricity market development, including analysis of rules, development of modifications, evaluation of likely participant behavior, and assessment of strategic implications. Analyze capacity markets and provide recommendations for their development and evolution. Review dispatch algorithms to determine how subtle changes could affect market prices and efficiencies. Develop market rules that address the potential exercise of market power during periods of congestion.

Competitive Strategy

Assess investment opportunities in electricity generation market. Evaluate a new merchant transmission project that would face unique technical challenges. Analyze the potential for repowering a generation facility. Assist in the establishment of a power marketing organization and the development of its strategy. Model a large generation portfolio and evaluate divestiture options.

Power Purchase Agreements

Negotiate and renegotiate power purchase agreements. Review whether changes to force majeure practices could lower energy costs. Evaluate contract pricing terms in light of changed market circumstances. Review implications of "good faith" terms on specific circumstances related to changed market circumstances. Analyze the value of a power contract to assess employee compensation claims. Work with investors to structure power purchase terms that might replace an industrial firm's ownership in power generation facilities. **hibit 1**



Investment Analysis

Evaluate the value of power generation facilities for a potential buyer. Analyze partnership opportunities related to new projects in development. Evaluate price forecasts and revenue projections for project-financed investments to support credit ratings by Standard & Poor's. Evaluate investment opportunities at existing facilities related to repowering, pollution control upgrades, and other modifications. Review a company's acquisition history to evaluate its investment decisions.

Environmental Strategy

Analyze public policy implications of climate change initiatives. Investigate strategic implications of changing environmental regulations. Evaluate pollution control equipment upgrades and fuel switching options related to meeting emission standards. Consider implications of new environmental regulations on asset values.

Antitrust Analyses

Evaluate the implication of mergers and asset acquisitions on market power before the Federal Energy Regulatory Commission and the US Department of Justice. Prepare market based rate applications using FERC's market screen and Appendix A methodologies. Evaluate claims of antitrust violations under the Clayton Act.

Electricity Market Participant Behavior

Evaluate participant behavior in markets, including bidding patterns and generation unit availability. Analyze differences in market dynamics and participant behavior in real-time, day-ahead, and longer-term energy markets. Evaluate claims of inappropriate market behavior by generators. Evaluate the behavior of a financial participant in energy and financial transmission rights (FTR) markets. Evaluate ancillary services markets regarding the implications of different market structures on participant behavior. Analyze the potential for specific trades to influence reported market prices.

Economic Testimony

Testify regarding damages in cases involving breach of contract. Serve as an arbitrator in an insurance claim matter involving the value of lost electricity generation. Testify on power contracting issues. Opine on market design issues. Testify regarding cost responsibilities for must run generation in a dispute centering on changes in the electricity market structure. Testify regarding electricity price forecasts associated with stranded cost recovery.

Experience

1996- Present	LECG, LLC
1995-1996	The Tesla Group, Inc.
1993-1994	JFG Associates, Inc.
1989-1993	Putnam, Hayes and Bartlett, Inc.
1983-1989	Westinghouse Electric Corporation
1981-1983	General Electric Corporation
1980-1981	Trinidad Lines and Marine Transport Line



Education

M.S. (with Distinction), Industrial Administration, Carnegie Mellon University, 1989.

B.S. (with Honors), Marine Engineering and Marine Transportation, U.S. Merchant Marine Academy, 1980.

Testimony

On behalf of Ontario Power Generation Energy Trading, Inc., before the Federal Energy Regulatory Commission (FERC), June 19, 2009 (filed June 23, 2009), Docket no. ER08-580-002. Subject: Market power evaluation for market based rate application for the Midwest ISO market

On behalf of COALSALES II, L.L.C., before the U.S. District Court for the Northern District of Florida, Pensacola Division, August 19, 2008, and December 11, 2008, Docket no. 3:06 CV 270/MCR/MD, in the matter of Gulf Power Company v. COALSALES II, L.L.C. Subject: Damages analysis associated with a claimed breach of a coal sales agreement.

On behalf of the U.S. Department of Justice, before the U.S. Court of Federal Claims, report dated August 4, 2008, Docket no. 04-0033C, in the matter of Consolidated Edison Company v. The United States of America. Subject: Analysis of sale prices of coal and nuclear generation units.

On behalf of Ontario Power Generation Energy Trading, Inc., before the FERC, June 19, 2008 (filed June 27, 2008), Docket no. ER08-580-001. Subject: Market power evaluation for market based rate application for the New York ISO market.

In a non-public investigation before the FERC, June 3, 2008, in response to a request for information. Subject: Analysis of financial transmission right (FTR) trading activity.

On behalf of the Ameren Energy Marketing Company, before the FERC, June 12, 2007 (filed June 18, 2007), Docket no. EL07-47-000. Subject: Review and comment on the economic issues raised in a complaint by the Illinois Attorney General concerning the September 2006 auction used to procure wholesale electricity supplies in Illinois.

On behalf of the Narragansett Electric Company, before the U.S. District Court for the District of Massachusetts, Central Division, May 18, 2007, and June 11, 2007, Docket no. C.A. No. 05-40076, in the matter of TransCanada Power Marketing, LTD v. Narragansett Electric Company. Subject: Review of pricing issues in a wholesale power contract and pricing issues in electricity power contracting more generally.

On behalf of The Association of Power Producers of Ontario (APPo), before the Ontario Energy Board, March 9, 2007, Docket no. MR-0031-R00. Subject: Evaluation of a proposed change in the pricing algorithm in the Ontario electricity market, with the change related to how generator ramp rates are considered in setting prices.

On behalf of American Electric Power Service Corporation, before the FERC, January 29, 2007, Docket no. EC07-56-000. Subject: Evaluation of the competitive effects of the acquisition of the Lawrenceburg Electric Generation Station.



On behalf of American Electric Power Service Corporation, before the FERC, January 19, 2007, Docket no. EC07-49-000. Subject: Evaluation of the competitive effects of the acquisition of the Darby Electric Generation Station.

On behalf of the U.S. Department of Justice, before the U.S. Court of Federal Claims, report dated June 29, 2006, testimony on October 12 and 16, 2007, and declaration dated September 17, 2008, Docket no. 00-697-C, in the matter of Wisconsin Electric Power Company v. The United States of America. Subject: Evaluation of decisions made by the utility in managing spent nuclear fuel at the Point Beach Nuclear Power Plant.

On behalf of Reliant Energy Services, Inc., before the U.S. Superior Court of California for the County of San Diego, May 25, 2006, in the matter of Jerry Egger, et al., v. Reliant Energy Services, Inc. et al., Wholesale Electricity Antitrust Cases I and II. JCCP Case Nos. 4204 and 4205. Subject: Analysis of purchases made by Montana-based utilities in California markets.

On behalf of The United Illuminating Company, before the FERC, January 20, 2006 and February 28, 2006, Docket no. EL05-76-001. Subject: Evaluation of issues in a contract dispute involving cost responsibilities for reliability must-run generators.

On behalf of Reliant Energy Services, Inc. and four individuals, before the U.S. District Court for the Northern District of California, San Francisco Division, October 7, 2005, Docket no. CR 04-0125 VRW, in the matter of United States of America v. Reliant Energy Services, Inc. et al. Designated as an expert in case involving claims of price manipulation and a criminal violation of the Commodity Exchange Act. Subject: The operation of the California electricity market, price artificiality, and the behavior of market participants.

On behalf of American Electric Power Service Corporation, et al, before FERC, September 8, 2005, Docket no. EC05-134-000. Subject: Evaluation of the market power implications of the acquisition of Reliant Energy's Ceredo generation station with respect to capacity and ancillary service markets.

On behalf of Niagara Mohawk Power Corporation, et al, before FERC, July 19, 2005, Docket no. ER96-2585, et al. Subject: Market-based ratemaking application for National Grid USA affiliated companies.

On behalf of American Electric Power Service Corporation, et al, before FERC, June 24, 2005, Docket no. EC05-98-000. Subject: Evaluation of market power implications of the acquisition of the PSEG Waterford generation unit with respect to capacity and ancillary services markets.

On behalf of Ontario Energy Trading International Corp., and Ontario Power Generation, Inc., before the FERC, April 11, 2005, Docket no. ER02-1021-000. Subject: Evaluation of the potential for market power in U.S. markets using pivotal supplier and market share screens.

On behalf of the U.S. Department of Justice, before the U.S. Court of Federal Claims, report dated November 22, 2004, testimony on March 28, 2005 and April 1, 2005, Docket no. 98-488C, in the matter of Sacramento Municipal Utility District v. The United States of America. Subject: Review of the damages claim made by SMUD associated with alleged breach of contract for the disposal of spent nuclear fuel.

On behalf of National Grid USA, before FERC, November 4, 2004 (revised November 19, 2004), January 10, 2005, January 28, 2005, March 14, 2005, and March 17, 2005, Docket no. ER03-563-030. Subject: Review of the locational capacity market proposal filed by ISO New England with



consideration given to market design, participant behavior, the mechanics of implementing the market, and the cost of new generation capacity.

On behalf of Reliant Energy Services, Inc. and four individuals, before the U.S. District Court for the Northern District of California, San Francisco Division, December 10, 2004, Docket no. CR 04-0125 VRW, in the matter of United States of America v. Reliant Energy Services, Inc. et al. Subject: Review of a report concerning the market effects of certain bidding actions by Reliant on California electricity markets in the summer of 2000.

On behalf of New England Power Co. before FERC, December 24, 2003, March 9, 2004, and April 15, 2004, Docket no. EL03-37-000. Subject: Evaluation of the electricity price forecast used for setting a contract termination charge, as well as the determination of variable costs and generation asset sale prices.

On behalf of Koch Power, Inc., before the Harris County, Texas District Court, Cause no. 2001-48858, in the Matter of Tim Beverick v. Koch Power, Inc., provided testimony summary on August 25, 2003. Subject: Evaluation of the potential for savings under a renegotiated power purchase agreement and the contributions of certain individuals to the renegotiation process.

On behalf of Reliant Energy Services, Inc. before the FERC, April 16, 2003, Docket no. EL03-59-000. Subject: Evaluation of the implications of certain trades of forward energy contracts on the overall electricity market.

On behalf of Reliant Energy Power Generation, Inc. and Reliant Energy Services, Inc. before the FERC, March 3, 2003, with rebuttal March 20, 2003, Docket nos. EL00-95-069 and EL00-98-058. Subject: Investigation into alleged manipulative practices by market participants in the California electricity markets in the 2000-2001 timeframe.

On behalf of Ontario Energy Trading International Corp., and Ontario Power Generation, Inc. subsidiary, before the FERC, February 14, 2002, Docket no. ER02-1021-000. Subject: Evaluation of the potential for market power in U.S. markets.

On behalf of The New Power Company before the FERC, July 13, 2001 (filed July 17, 2001), Docket no. EL01-105-000. Subject: Evaluation of the capacity credit market in PJM, primarily focusing on market power issues.

On behalf of National Grid USA before the FERC, January 16, 2001, Docket no. EL00-62-005 and EL00-62-013. Subject: Analysis of the incentives for new generation facilities in New England, and in particular the role of the \$8.75/kw-month installed capacity deficiency charge.

On behalf of Oklahoma Gas & Electric before the Arkansas Public Service Commission, November 30, 2000, Docket no. 00-326-U. Subject: Analysis of OG&E's potential market power in a restructured, retail open-access environment.

On behalf of National Grid USA and TransCanada OSP Holdings, LTD before the FERC, August 7, 2000, Docket no. EC00-122. Subject: Analysis of the competitive effects of the proposed acquisition of interests in the Ocean State Power generation facility by TransCanada.

On behalf of Central Illinois Light Company and the AES Corporation before the FERC, February 19, 1999, Docket no. EC99-40. Subject: Analysis of competitive effects of the proposed acquisition of Central Illinois Light Company by the AES Corporation.



On behalf of Public Service Electric & Gas Co., before the United States District Court for the Eastern District of Pennsylvania, Docket no. 96-CV1705, in the Matter of Delmarva Power & Light Company and PECO Energy Company v. Public Service Enterprise Group, Inc. and Public Service Electric and Gas Co., March 28, 1997. Subject: Replacement power costs associated with the multi-year forced outage of the Salem Nuclear Station.

Speeches & Papers

“Credit Coverage Requirements for FTR and Virtual Bidding.” Session moderated for EUCI’s conference, “Unsecured Credit: Is it the right policy for RTOs/ISOs?” Alexandria, Virginia, April 29, 2009.

“Force Majeure Risk and Ontario Power Authority’s Power Contracts.” Whitepaper with Julie M. Carey, on behalf of the Ontario Power Authority, March 31, 2008.

“Financial Accommodation for Force Majeure Events.” Whitepaper with Julie M. Carey, on behalf of Ontario Power Authority, January 21, 2008.

“Market Design Choices for Ancillary Services Products,” with Cleve Tyler. Presented at the EUCI Ancillary Services Conference, Minneapolis, Minnesota, September 12, 2007.

“Cost-Benefit Analysis In the Evaluation of Market Rule Changes: Comments on MR-00332-R00.” Whitepaper on behalf of Ontario Power Generation, Inc., July 12, 2007.

“Adopting a Ramp Charge to Improve Performance of the Ontario Market.” Whitepaper with Arun Sharma, on behalf of The Association of Power Producers of Ontario (APPrO), June 21, 2006.

“Shifting Regulatory Oversight of Utility Mergers,” with Cleve Tyler, *Innovating for Transformation*, The Energy and Utilities Project, Volume 6, 2006, page 37.

“Allocation of Emission Allowances for the Regional Greenhouse Gas Initiative.” Whitepaper regarding an initiative under consideration in mid-Atlantic and Northeastern regions of the United States, written with Alan Madian, September 20, 2005.

“Toward a Capacity Demand Curve Market,” with Julie Murphy, *Innovation for the Future*, The Energy and Utilities Project, Volume 5, 2005, page 46.

“LICAP Key Issues.” Presented to Commissioners and staff of the Massachusetts Department of Telecommunications and Energy, Boston, Massachusetts, March 28, 2005.

“Market Power Screens.” Presented at the Electric Power Supply Association (EPSA) Annual Fall Membership Meeting, Washington, DC, November 10, 2004.

“Ancillary Service Pricing Dynamics.” Presented at the EUCI Ancillary Service Conference, Westminster, Colorado, March 13, 2003.

“California’s Electricity Markets: Structure, Crisis, and Needed Reforms.” Contributor, January 16, 2003.



“Capacity Payment Schedules: A Workable Approach for Resource Adequacy.” Presented to the Energy Bar Association, Washington, D.C., December 12, 2002.

“Power Market Panel.” Speaker in the Standard & Poor’s 2002 Project, Power & Energy Credit Conference, New York, New York, November 13, 2002.

“Market-Based Pricing of Ancillary Services: Market Design Choices, Consequences and Performance.” Presented at the EUCI Ancillary Services Conference, Atlanta, Georgia, September 27, 2002.

“Ancillary Service Market Performance During the Summer of 2002.” Presented at the EUCI Ancillary Services Conference, Atlanta, Georgia, September 26, 2002.

“Revenue and Risk from the Lender’s Perspective.” Presented at the Merchant Plant Development and Finance Conference, Houston, Texas, March 30, 2000.

“Preparing for Antitrust Scrutiny.” Panel discussion at the Utility Mergers & Acquisitions Conference, Washington, D.C., July 15, 1998.

“Perspectives of Investors and Developers.” Presented at the American Education Institute Conference on Power Contracts in affiliation with the United States Energy Association to the Romanian Electric Authority, Washington, D.C., March 19, 1997.

“Risk and Risk Management in Electricity Markets.” Presented at the Electric Load Aggregation Conference, Washington, D.C., November 18, 1996.

“Developing Firm Plans During Uncertain Times: Anticipating Change.” Presented during a session titled “Integrated Resource Planning and Demand Side Management After Federal Endorsement,” to the Institute of Public Utilities, Williamsburg, Virginia, December 15, 1992.

Numerous speeches and training programs regarding nuclear power plant operations, accident analysis, nuclear engineering and related subjects were given to operators and technical engineering personnel from power plants around the world, 1984-1986.

Affiliations

Member, International Association for Energy Economics.

Member, Non-Attorney Professional, Energy Bar Association.

Associate Member, American Bar Association, and its Environment, Energy and Resources Section.

Mentor, The Tepper School, Carnegie Mellon University, and formerly with The Dingman Center for Entrepreneurship, University of Maryland College of Business.

Member of the Convergence Forum sponsored by the Consumer Energy Council of America/ Research Foundation, 1998-2000, with the final report, “The Convergence Phenomenon: A Consumer Perspective” issued in April, 2000.

Member of the Board of Directors, Ridge Utilities Inc., 1996-1997.



Program Planning Committee Member for PennWell's EnergyMart '96 and EnergyMart '97 conferences on electric power marketing.

Mr. Hamal has held U.S. Coast Guard licenses as Third Assistant Engineer and Third Mate; U.S. Department of Energy qualifications as Nuclear Plant Engineer and Nuclear Engineer Officer of the Watch; and U.S. Nuclear Regulatory Commission certification as Senior Reactor Operator.

July 2009

**National Grid - Review of the Town of New Shoreham Project
Documents Relied Upon**

	Document	Source / Weblink
1	Power Purchase Agreement between DeMarVa Power and Light Company and Bluewater Wind Delaware LLC, June 23, 2008	http://www.ceoe.udel.edu/Windpower/DE-Qs/bwwppa062308.pdf
2	Renewable Wind Energy Power Purchase Agreement between DeMarVa Power and Light Company and AES Armenia Mountain Wind, LLC, June 6, 2008	http://www.delmarva.com/_res/documents/AESPPA.pdf
3	Renewable Wind Energy Power Purchase Agreement between DeMarVa Power and Light Company and Synergics Eastern Wind Energy, LLC, May 30, 2008	http://www.delmarva.com/_res/documents/SynergicsPhaseIIPPA(executionversion).pdf
4	Renewable Wind Energy Power Purchase Agreement between DeMarVa Power and Light Company and Synergics Roth Rock Wind Energy, LLC, May 30, 2008	http://www.delmarva.com/_res/documents/SynergicsPhaseIIPPA(executionversion).pdf
5	Ontario Power Authority Feed-In Tariff Program: FIT Rules, September 30, 2009	http://fit.powerauthority.on.ca/Storage/98/10725_FIT_Rules.pdf
6	Ontario Power Authority Feed-In Tariff Contract	http://fit.powerauthority.on.ca/Storage/98/10741_FIT_Contract.pdf
7	Feed-In Tariff Prices for Renewable Energy Projects in Ontario, September 30, 2009	http://fit.powerauthority.on.ca/Storage/98/10718_FIT_Pricing_Schedule_-_Final_September_30_2009_PV_10MW.pdf
8	Ontario Power Authority Feed-In Tariff Program, Appendix 1 -- Standard Definitions	http://fit.powerauthority.on.ca/Storage/97/10640_FIT_Appendix_1_-_Standard_Definitions.pdf
9	2008 Wind Technologies Market Report, U.S. Department of Energy, July 2009	http://eetd.lbl.gov/ea/ems/reports/2008-wind-technologies.pdf
10	Rhode Island Renewable Energy - A Study of the New England & Rhode Island Renewable Energy Supply and Demand Outlook to 2030, for National Grid	[Provided as an attachment to the Direct Testimony of Madison N. Milhous]
11	Avoided Energy Supply Costs in New England: 2009 Report, Synapse Energy Economics, August 21, 2009	http://www.synapse-energy.com/Downloads/SynapseReport.2009-08.AESC.AESC-Study-2009.09-020.pdf
12	Proposed 4,440-MW Offshore Wind Farm in Lake Erie is Awaiting Govt. Approval, Power Magazine, October 7, 2009	http://www.powermag.com/POWERnews/2218.html

**National Grid - Review of the Town of New Shoreham Project
Documents Relied Upon**

	Document	Source / Weblink
13	A Progress Report on Electricity Supply, Ontario Power Authority, Second Quarter 2009	http://www.powerauthority.on.ca/Storage/106/15329_2009_Q2_A_Progress_Supply_on_Electricity_Supply.pdf
14	Historical Customer Payments for OPA Management Contracts, from "Generation Procurement Cost Disclosure" on OPA's website	http://www.powerauthority.on.ca/SOP/Page.asp?PageID=122&ContentID=6670&SiteNodeID=120&BL_ExpandID=93
15	Southern California Edison Renewable Power Purchase and Sale Agreement [template]	http://www.sce.com/NR/rdonlyres/49A78CEC-38FC-4D7D-8452-A8D71B262816/0/090121_Renewables_Standard_Contracts_20mw.doc accessed via: http://www.sce.com/EnergyProcurement/renewables/renewables-standard-contracts.htm
16	California Public Utilities Commission, Feed-In Tariff Price, December 18, 2008	http://www.cpuc.ca.gov/PUC/energy/Renewables/Feed-in+Tariff+Price.htm
17	California Public Utilities Commission, Summary of Feed-In Tariffs, February 14, 2008	http://www.cpuc.ca.gov/PUC/energy/Renewables/feedintariffsum.htm
18	Currency Forward, Canadian Dollar and Euro Exchange Rates	Bloomberg
19	Monetary Policy - Inflation, Bank of Canada	http://www1.bank-banque-canada.ca/en/inflation/index.html?style=print
20	Monetary Policy - Data, Consumer Price Index, 1995 to present	http://www1.bank-banque-canada.ca/en/cpi.html?style=print
21	Third Amended Power Purchase Agreement between Schwendiman Wind LLC and PacifiCorp, 10/16/2007	http://www.puc.idaho.gov/internet/cases/elec/PAC/PACE0509/company/20071119THIRD%20AMENDED%20AGREEMENT.PDF
22	Power Purchase Agreement 50 MW between Mid-Kansas Electric Company, LLC as Purchaser and Aquila, Inc. as Seller, 8/15/2006	http://elibrary.ferc.gov/idmws/common/downloadOpen.asp?downloadfile=20060906%2D0164%2815929806%29%2Epdf&folder=8457744&fileid=11127270&trial=1
23	Power Purchase Agreement between Lower Valley Energy, Inc. and PacifiCorp, 5/22/2009	http://www.puc.idaho.gov/internet/cases/elec/PAC/PACE0905/20090528APPLICATION.PDF
24	Offshore Wind Energy Factsheet, the European Wind Energy Association, September 2009	http://ewea.org/fileadmin/ewea_documents/documents/publications/reports/Offshore_Fact_Sheet.pdf
25	Offshore Wind Energy, American Wind Energy Association, April 2009	http://awea.org/pubs/factsheets/Offshore_Factsheet.pdf

**National Grid - Review of the Town of New Shoreham Project
Documents Relied Upon**

	Document	Source / Weblink
26	Offshore Wind Energy (The <i>Windenergie-Agentur Bremerhaven/Bremen Magazine</i>), 2009 Issue	http://windenergie-agentur.de/deutsch/downloads/pdf/WAB_OFFSHORE_Engl_2009_LowRes.pdf
27	Offshore Wind Farms in Europe, KPMG, 2007	http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/Documents/Offshore-wind-farms.pdf
28	Global Wind Energy Council, Germany Section	http://www.gwec.net/index.php?id=129
29	Financing of Offshore Wind Farms - Challenges and Solutions, HSH Nordbank, March 2009	http://www.ewec2009proceedings.info/allfiles2/631_EWEC2009presentation.pdf

Summary of PPA Prices for Offshore Wind Power Projects

	Project	2009 Price	2013 Price	2023 Price	Source/Note
1	United Kingdom	\$229/MWh			1
2	France	\$196/MWh			2
3	Spain	\$167/MWh			3
4	Denmark	\$101/MWh			4
5	Sweden	\$93/MWh			5
6	Germany Feed-In Tariff Price	\$196/MWh and \$226/MWh for projects in operation by the end of 2015	\$196/MWh and \$226/MWh for projects in operation by the end of 2015	\$202/MWh and \$233/MWh for projects in operation by the end of 2015	6
7	Delmarva Bluewater	\$126/MWh	\$139/MWh	\$177/MWh	7
8	Feed-In Tariff Prices for Renewable Energy Projects in Ontario, Canada Base Date: September 30, 2009	\$176/MWh	\$186/MWh	\$190/MWh	8

Sources/Notes:

- 1) Financing of Offshore Wind Farms - Challenges and Solutions, HSH Nordbank, March 2009, p. 5. HSH Nordbank estimate of UK Offshore Wind Price as equal to power price from long term PPA + green certificate. Offshore Wind Energy, 2009 Issue, p. 35. UK price of 15.23 cents/kWh (Euros) = 8.82 cents/kWh certificate + an estimated 6.41 cents/kWh for market price. Euro exchange rates and forwards (used for projects 1 - 6) from Bloomberg, accessed 12/4/2009. We use the average of the bid and ask price. For the 2013 price, we use the the 4 year forward, dated 12/9/13; for the 2023 price, we use the 15 year forward dated 12/9/2024 (the closest date available).
- 2) Offshore Wind Energy, 2009 Issue, p. 35. France's price appears fixed for 10 years and then has a variable tariff.
- 3) Offshore Wind Farms in Europe, KPMG, 2007, p. 20, 27. Spain provides a fixed price of 8.43 cents/kWh (Euros) plus the market price (estimated at 3.6 cents/kWh (Euros) in 2007) for 20 years for offshore wind projects. Payment is capped at 16.4 cents/kWh (Euros).
- 4) Offshore Wind Energy, 2009 Issue, p. 35. Denmark's price is fixed for about 14 years (50,000 full load hours) and then the market price applies. This price may be in addition to the market price -- the reports are ambiguous. "The tariff is guaranteed in addition to the market and the basic price and is calculated on the basis of the offer made by the bidders in the tender procedure" (Offshore Wind Farms in Europe, KPMG, 2007, p. 20).
- 5) Offshore Wind Farms in Europe, KPMG, 2007, p. 20, 27. Sweden provides an estimated 6.19 cents/kWh for offshore wind projects in 2007 comprised of a certificate component of 2.18 cents/kWh (Euros) plus the market price (estimated at 2.49 cents/kWh (Euros) in 2007 and a environmental bonus of 1.52 (bonus through 2009).
- 6) Global Wind Energy Council, Germany Section. The initial 15 cents/kWh (Euros) will be paid for a period of 12 years, and 3.5 cents/kWh (Euros) thereafter. For offshore wind farms starting operation after 2015, the initial tariff is reduced by 5% per year, so projects starting operation in 2016 will receive 13 cents/kWh – 5%, etc.
- 7) PPA between DelMarVa Power and Light Company and Bluewater Wind Delaware LLC, June 23, 2008. Price starts at \$120 in 2007 and escalates at 2.5% per year thereafter.
- 8) Feed-In Tariff Prices for Renewable Energy Projects in Ontario; Base Date: September 30, 2009, Commercial Operation Date: 9/30/2012; http://fit.powerauthority.on.ca/Storage/98/10718_FIT_Pricing_Schedule_-_Final_September_30_2009_PV_10MW.pdf; http://fit.powerauthority.on.ca/Storage/98/10741_FIT_Contract.pdf; CPI information from the Bank of Canada. See <http://www1.bank-banque-canada.ca/en/cpi.html>
We assume a 2% annual increase in inflation/CPI, per the Bank of Canada's target rate. See <http://www1.bank-banque-canada.ca/en/inflation/index.html>
Prices converted to US dollars at exchange rate forwards from Bloomberg. For the 2009 rate, we use the exchange rate on 10/27/2009. For the 2013 rate, we use the 4 year forward, dated 10/28/13; for the 2023 rate, we use the 15 year forward, dated 10/28/2024 (the closest date available), and use the average of the bid and ask price.

Summary of PPA Prices for Renewable Power Projects

Renewable Project	Price	Source/Note
1 2008 Capacity-Weighted Average Wind Power Price (From PPAs) for projects built between 2006-2008	\$48/MWh	1
2 2008 Wind Power PPA prices for projects built between 2006-2008	\$20 to \$126/MWh	2
3 2009 Feed-In Tariff Price for Renewable Power Projects (<20MW) California PUC/SCE	\$100 - \$111/MWh	3
4 Feed-In Tariff Prices for Renewable Energy Projects in Ontario Base Date: September 30, 2009	Biomass \$122 - \$130/MWh Biogas \$98 - \$183/MWh Hydro \$11 - \$123/MWh Landfill Gas \$97 - \$104/MWh Solar PV \$416 - \$754/MWh Onshore Wind \$127/MWh Offshore Wind \$179/MWh	4
5 Ontario Power Authority All In Customer Payments for Renewables for 2003 to 2008 (There more than 439 Renewable Energy contracts with a contracted capacity of more than 1,411 MW)	Wind \$72 - \$128/MWh Hydro \$61 - \$95/MWh By Product & Biofuels \$70 - \$92/MWh CHP \$107 - \$225/MWh Solar PV \$395/MWh	5
6 Renewable Wind Energy PPA between DelMarVa Power and Light Company and Synergics Eastern Wind Energy, LLC, and DelMarVa Power and Light and Synergics Roth Rock Wind, LLC May 30, 2008	\$83/MWh	6
7 Renewable Wind Energy PPA between DelMarVa Power and Light Company and AES Armenia Mountain Wind, LLC, June 6, 2008	\$92/MWh	7
8 Hydro PPA between Lower Valley Energy and Pacificorp, May 29, 2009	\$77/MWh (2009 price) \$80/MWh (2012 price)	8
9 Wind PPA between Schwendiman and Pacificorp, January 27, 2006	\$56/MWh (2009 price) \$62/MWh (2013 price)	9

Sources/Notes:

- 1) 2008 Wind Technologies Market Report, DOE Energy Efficiency & Renewable Energy, July 2009, page 30-31; the prices are from the Berkeley Lab database and reflect 60 projects and 5,465 MW. They reflect the bundled price of electricity and RECs as sold by the project owner under a PPA (page 25). Wind power PPAs of 62 MW located in Hawaii were excluded from the DOE analysis because the price was linked to oil and was considered to be outliers (2008 revenue ranged from \$130/MWh to \$230/MWh) (page 25). Price is approximated from Figure 18.
- 2) Ibid. The next highest price point below \$126 was \$80/MWh.
- 3) These prices are used in the CA PUC Feed-In Tariff Program for all utilities and Southern California Edison references these prices in its standard contract template. Price varies for contract term 10 years to 25 years. The rates are calculated by using set market price referents (MPR) and adjusted by time of use (TOU) factors as authorized by the Commission. The MPR is the predicted annual average cost of production for a combined-cycle natural gas fired baseload proxy plant. Energy produced during utility peak hours should command a higher price reflecting the higher cost of generation during those hours. Conversely, energy produced during off-peak hours is less valuable to the utility and the tariff should vary accordingly. Using time of delivery (TOD) adjustment factors will result in annual payments under this program that better match with the MPR. <http://www.cpuc.ca.gov/PUC/energy/Renewables/Feed-in+Tariff+Price.htm> http://www.sce.com/NR/rdonlyres/49A78CEC-38FC-4D7D-8452-A8D71B262816/0/090121_Renewables_Standard_Contracts_20mw.doc
accessed via: <http://www.sce.com/EnergyProcurement/renewables/renewables-standard-contracts.htm>
- 4) Feed-In Tariff Prices for Renewable Energy Projects in Ontario; Base Date: September 30, 2009
http://fit.powerauthority.on.ca/Storage/98/10718_FIT_Pricing_Schedule_-_Final_September_30_2009_PV_10MW.pdf.
Projects that use renewable biomass, bio-gas, landfill gas or waterpower as their renewable fuel will receive a time differentiated price under the FIT Contract. For all Hourly Delivered Electricity, such Suppliers will receive the price as otherwise determined in accordance with this Section 7, multiplied by the Peak Performance Factor for the corresponding hour. The application of the Peak Performance Factor will result in higher payments during On-Peak Hours and lower payments during Off-Peak Hours to encourage such Projects to schedule their production during On-Peak Hours to the extent practicable. http://fit.powerauthority.on.ca/Storage/98/10725_FIT_Rules.pdf
- 5) Historical Customer Payments for OPA Management Contracts, from "Generation Procurement Cost Disclosure" on OPA's website.
http://www.powerauthority.on.ca/SOP/Page.asp?PageID=122&ContentID=6670&SiteNodeID=120&BL_ExpandID=93
http://www.powerauthority.on.ca/Storage/106/15329_2009_Q2_A_Progress_Supply_on_Electricity_Supply.pdf
- 6) Renewable Wind Energy PPA between DelMarVa Power and Light Company and Synergics Eastern Wind Energy, LLC, May 30, 2008. Included 2.5% escalation to reflect 2009 price.
- 7) Renewable Wind Energy PPA between DelMarVa Power and Light Company and AES Armenia Mountain Wind, LLC, June 6, 2008.
- 8) PPA between Lower Valley Energy and Pacificorp for run of River hydro, May 29, 2009. Price reported is for 2012.
- 9) Wind PPA between Schwendiman and Pacificorp (2009 and 2013 prices) January 27, 2006.