THOMAS, NIESEN & THOMAS, LLC
Attorneys and Counsellors at Law

CHARLES E. THOMAS, JR.
Direct Dial: 717.255.7611
cthomasjr@tntlawfirm.com

July 17, 2020

Via Electronic Mail

Deputy Chief Administrative Law Judge Mark A. Hoyer
Pennsylvania Public Utility Commission
Piatt Place
301 5th Avenue
Pittsburgh, PA 15222

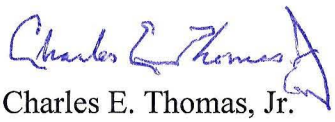
Re: Docket No. P-2020-3019522
Petition of Duquesne Light Company for Approval of Its Default Service Plan for the Period June 1, 2021 Through May 31, 2025

Dear Judge Hoyer:

Attached, in accordance with the schedule in Your Honor's Prehearing Order is the prepared proposed Direct Testimony of MAREC-Action Witness Elizabeth Stanton in the above matter. A copy of Ms. Stanton's testimony is being provided to the persons listed on the attached Certificate of Service.

Very truly yours,

THOMAS, NIESEN & THOMAS, LLC

By 
Charles E. Thomas, Jr.

Enclosure
cc: Rosemary Chiavetta, Secretary (w/o attachment)
Bruce H. Burcat, Esquire

CERTIFICATE OF SERVICE

I hereby certify that I have this 17th day of July, 2020, served a true and correct copy of the foregoing Direct Testimony of Elizabeth A. Stanton, Ph.D. on behalf of MAREC Action, upon the persons listed below which MAREC-Action believes are participating in the proceeding:

VIA ELECTRONIC MAIL

Honorable Mark A. Hoyer
Deputy Chief Administrative Law Judge
Pennsylvania Public Utility Commission
Piatt Place, Suite 220
301 Fifth Avenue
Pittsburgh, PA 15222
mhoyer@pa.gov

David T. Evrard
Aron J. Beatty
Office of Consumer Advocate
Forum Place, 5th Floor
555 Walnut Street
Harrisburg, PA 17101-1923
devrard@paoca.org
abeatty@paoca.org

Sharon E. Webb
Office of Small Business Advocate
555 Walnut Street, 1st Floor
Harrisburg, PA 17101
swebb@pa.gov

Richard Kanaskie
Scott Granger
Bureau of Investigation and Enforcement
Pennsylvania Public Utility Commission
P.O. Box 3265
Harrisburg, PA 17105-3265
rkanaskie@pa.gov
sgranger@pa.gov

Michael Zimmerman
Tishekia E. Williams
Emily Farah
Duquesne Light Company
411 Seventh Avenue, 15-7
Pittsburgh, PA 15219
mzimmerman@duqlight.com
twilliams@duqlight.com
efarah@duqlight.com

Michael W. Gang
Anthony D. Kanagy
Post & Schell, P.C.
17 North Second Street, 12th Floor
Harrisburg, PA 17101
mgang@postschell.com
akanagy@postschell.com

John F. Lushis, Jr.
Norris McLaughlin, PA
515 West Hamilton Street, Suite 502
Jamestown, NY 14701
jlushis@norris-law.com

Todd S. Stewart
Hawke McKeon and Sniscak, LLP
100 North 10th Street
Harrisburg, PA 17101
tsstewart@hmslegal.com

Elizabeth R. Marx
John Sweet
Ria Pereira
Pennsylvania Utility Law Project
118 Locust Street
Harrisburg, PA 17101
pulp@palegalaid.net

Mark Szybist
Natural Resources Defense Council
1152 15th Street, NW, Suite 300
Washington, DC 20005
mszybist@nrdc.org

James Laskey
Norris McLaughlin, PA
400 Crossing Boulevard, 8th Floor
Bridgewater, NJ 08807
jlaskey@norris-law.com

James M. Van Nostrand
Keyes & Fox LLP
275 Orchard Drive
Pittsburgh, PA 15228
jvannostrand@keyesfox.com

Gregory Peterson
Phillips Lytle, LLP
201 West Third Street, Suite 205
Jamestown, NY 14701-4907
gpeterson@phillipslytle.com

Thomas F. Puchner, Esquire
Phillips Lytle LLP
Omni Plaza
30 South Pearl Street
Albany, NY 12207-1537
tpuchner@phillipslytle.com

Kevin C. Blake, Esquire
Phillips Lytle LLP
125 Main Street
Buffalo, NY 14203
kblake@phillipslytle.com

James M. Van Nostrand
Keyes & Fox, LLP
275 Orchard Drive
Pittsburgh, PA 15228
jvannostrand@keyesfox.com

Emily Collins
Andrew Karas
Fair Shake Environmental Legal Services
647 E. Market Street
Akron, OH 44304
ecollins@fairshake-els.org
akaras@fairshake-els.org

Charles E. Thomas, Jr. (PA ID # 07262)

BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

Petition of Duquesne Light Company for Approval of Its Default Service Plan for the Period June 1, 2021 through May 31, 2025	**:** **:** **:**	**Docket No. P-2020-3019522**

DIRECT TESTIMONY OF ELIZABETH A. STANTON, PHD

On Behalf of
Intervener MAREC Action

July 17, 2020

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I. INTRODUCTION

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

A. My name is Elizabeth A. Stanton, Ph.D. I am the Director and Senior Economist of the Applied Economics Clinic, 1012 Massachusetts Avenue, Arlington MA 02476.

Q. Please summarize your work experience and educational background.

A. I am the founder and Director of the Applied Economics Clinic, a non-profit consulting group. The Applied Economics Clinic ("the Clinic") provides expert testimony, analysis, modeling, policy briefs, and reports for public interest groups on the topics of energy, environment, consumer protection, and equity. The Clinic provides training to the next generation of expert technical witnesses and analysts through applied, on-the-job experience for graduate students in related fields and works proactively to support diversity among both student workers and professional staff.

I am a researcher and analyst with more than 19 years of professional experience as a political and environmental economist. I have authored more than 140 reports, policy studies, white papers, journal articles, and book chapters as well as more than 40 expert comments and oral and written testimony in public proceedings on topics related to energy, the economy, the environment, and equity. My articles have been published in Ecological Economics, Climatic Change, Environmental and Resource Economics, Environmental Science & Technology, and other journals. I have also published books, including Climate Change and Global Equity (Anthem Press, 2014) and Climate Economics: The State of the Art (Routledge, 2013), which I co-wrote with Frank

Ackerman. I am also co-author of Environment for the People (Political Economy Research Institute, 2005, with James K. Boyce) and co-editor of Reclaiming Nature: Worldwide Strategies for Building Natural Assets (Anthem Press, 2007, with Boyce and Sunita Narain).

My recent work includes Integrated Resource Plan (IRP) and Demand-Side Management (DSM) planning review, analysis and testimony of state climate laws as they relate to proposed capacity additions, and other issues related to consumer and environmental protection in the electric and gas sectors.

In my previous position as a Principal Economist at Synapse Energy Economics, I provided expert testimony in electric and gas sector dockets, and led studies examining environmental regulation, cost-benefit analyses, and the economics of energy efficiency and renewable energy. Prior to joining Synapse, I was a Senior Economist with the Stockholm Environment Institute's (SEI) Climate Economics Group, where I was responsible for leading the organization's work on the Consumption-Based Emissions Inventory (CBEI) model and on water issues and climate change in the western United States. While at SEI, I led domestic and international studies commissioned by the United Nations Development Programme, Friends of the Earth-U.K., and Environmental Defense Fund, among others.

I earned my Ph.D. in economics at the University of Massachusetts-Amherst, and have taught economics at Tufts University, the University of Massachusetts-Amherst, and the College of New Rochelle, among other colleges and universities. My curriculum vitae is attached to this testimony as Attachment A.

Q. On whose behalf are you testifying in this proceeding?

A. I am testifying on behalf of MAREC Action.

Q. Have you previously testified in any formal hearings before regulatory bodies?

- A. Yes. I have submitted expert testimony and comments in dockets in Florida, Illinois, Indiana, Louisiana, Massachusetts, Minnesota, New Hampshire, New York, and Vermont as well as several federal dockets. Our study, entitled Pennsylvania Long Term Renewable Contracts Benefits and Costs was an attachment to MAREC's Comments to the Commission's Order entered February 26, 2017 in *Investigation Into Default Service and PJM Interconnection, LLC Settlement and Reform* at Docket No. M-2019-3007101.

Q. What is the purpose of your direct testimony?

A. The purpose of my testimony is to discuss the benefits of long-term contracts for renewables in the context of Duquesne Light's DSP Proposal.

II. COMMISSION'S ORDER REGARDING LONG-TERM RENEWABLES CONTRACTS

Q. Has the Pennsylvania Public Utility Commission ("PUC" or "Commission") issued any orders or recommendations regarding EDC procurement of long-term contracts for renewables?

A. Yes. In its Secretarial Letter regarding the Investigation into Default Service and PJM Interconnection, LLC. Settlement Reforms (Docket M-2019-3007101), which I previously referenced, the Commission references MAREC's comments on long-term contracts for renewables, agreed on the importance of this issue and requested EDC's

address this procurement mechanism in their default service plan (DSP) proposals stating that:

> Concerning procurement and long-term contracts, the Commission agrees that long-term contracts need to be carefully considered and that we need to consider this topic further in upcoming DSP proceedings. We request that the EDCs include in their filings evidence showing how its DSP proposal complies with the prudent mix requirements of the Public Utility Code [Act 129] and case law.[1]

Q. In its Petition for approval of its DSP, does Duquesne Light intend to enter into any long-term renewables contracts?

A. Yes, Duquesne Light intends to enter into a long-term solar power purchase agreement (PPA) during the DSP program term of June 1, 2021 to May 31, 2025. As stated in the Petition:

> Duquesne Light intends to enter into a long-term Solar PPA (i.e., more than four years and less than twenty years) to support a utility-scale solar project (up to a total of 7 MW) in Pennsylvania, preferably in Duquesne Light's service area.[2]

The Company states that the "alternative energy credits ("AECs") associated with this project (or projects up to the 7 MW cap) would be used to help satisfy the solar requirements of serving all default service customers."[3]

[1] Pennsylvania Public Utility Commission ("PUC" or "Commission") Docket No. M-2019-3007101. January 23, 2020. *Secretarial Letter regarding the Investigation into Default Service and PJM Interconnection, LLC. Settlement Reforms* ("*Secretarial Letter*"). Available at: http://www.puc.pa.gov/about_puc/consolidated_case_view.aspx?Docket=M-2019-3007101 p.8

[2] Duquesne Light Petition. ¶ 54.

[3] Davis, C.J. April 20, 2020. *Direct Testimony of C. James Davis*. Testimony before the Pennsylvania Public Utility Commission on behalf of Duquesne Light Company. Docket No. P-2020-3019522. Available at: http://www.puc.pa.gov/about_puc/consolidated_case_view.aspx?Docket=P-2020-3019522 p.14.

Q. Why does Duquesne Light seek to support utility-scale solar facilities in Pennsylvania through a long-term solar PPA?

A. Duquesne Light seeks to support utility-scale solar facilities in Pennsylvania through a long-term solar PPA to be consistent with the "prudent mix" and "least cost" requirements of Act 129. The Company also is considering a long-term solar PPA since it has the potential to "provide greater opportunity for cost-effective financing for the developer of a utility-scale solar project."[4] Duquesne Light also notes how the development of solar facilities addresses requirements set out by the Alternative Energy Portfolio Standards:

> The development of solar facilities is consistent with Act 129's objectives, as it addresses the Alternative Energy Portfolio Standards ("AEPS") "prudent mix" and "least cost" requirements.[5]

Q. What process will Duquesne follow to obtain a long-term solar PPA?

A. In accordance with the requirements of Act 129, Duquesne Light plans to conduct a competitive solicitation for the PPA. The results of the competitive solicitation would be reported to the Commission consistent with the process used for the Company's other default service supply auctions. The Commission would have the opportunity to review the results and approve or reject the competitive solicitation outcome.[6]

[4] Duquesne Light Petition. ¶ 55.
[5] *Direct Testimony of C. James Davis*. Docket No. P-2020-3019522. p.14.
[6] Duquesne Light Petition. ¶ 57.

Q. Does Duquesne plan to purchase the associated energy provided by the solar facility?

A. Yes, Duquesne plans to purchase the associated energy from the solar facility. The Company wants to provide greater opportunity for cost-effective financing for developers of utility-scale solar projects and believes that a PPA that includes energy may be the best means to do so. In addition to purchasing the associated energy, the Company "intends to assess the potential of purchasing the associated capacity and ancillary services from the facility."[7]

Q. What is required of electric utilities by Pennsylvania's Alternative Energy Portfolio Standards Act of 2004?

A. By 2021, Pennsylvania's Alternative Energy Portfolio Standards Act of 2004 (AEPS) requires the Commonwealth's electric distribution companies (EDC) to purchase Tier I AECs equal to 8 percent of their retail sales, and Tier II AECs equal to an additional 10 percent of their retail sales. At present, Pennsylvania EDCs purchase renewable generation and the "AECs" associated with it at procurement auctions every six months.

Q. How does Duquesne Light's proposed PPA for solar compare to the Company's obligations to obtain AECs?

A. According to Duquesne Light's proposed DSP, the Company's total load (or retail sales) amounted to 7,342 GWh in 2019.[8] By 2021, Duquesne Light will be required to purchase Tier I AECs equal to 8 percent of their retail sales, which is roughly equal to 587 GWh.

[7] Duquesne Light Petition. ¶ 56.
[8] Ogden, D.B. April 20, 2020. *Direct Testimony of David B. Ogden*. Exhibit DBO-4. Testimony before the Pennsylvania Public Utility Commission on behalf of Duquesne Light Company. Docket No. P-2020-3019522. Available at: http://www.puc.pa.gov/about_puc/consolidated_case_view.aspx?Docket=P-2020-3019522

Using Lazard's solar capacity factor of 32 percent, Duquesne Light's proposed solar PPA of 7 MW is equivalent to approximately 20 GWh, which amounts to only 3 percent of the Company's 2021 AEC obligation of 587 GWh.[9]

Q. Please describe the standards used for Duquesne Light's procurement methodologies.

A. Duquesne Light's procurement methodologies under its DSP are based upon the standards set forth by Act 129. These standards require that "electric power acquired shall be procured through competitive procurement processes" and the procurement plan must include a "prudent mix" of spot market purchases, short-term contracts and long-term contracts.[10] These standards also specify that the prudent mix of contracts must be "the least cost to customers over time".[11]

Q. In its Petition for approval of its DSP, what does Duquesne Light claim regarding a prudent mix of contracts?

A. In its Petition, Duquesne Light claims to achieve a prudent mix of contracts for its DSP and satisfy the requirement that this mix is "the least cost to customers over time":

> [T]his Plan includes a prudent mix of contracts given the current levels of, and experience with, switching for each class of customers, and the competitive market enhancements proposed in the Petition.[12]

[9] Lazard. November 2019. *Levelized Cost of Energy Analysis 13.0*. pp.16-17. Available at: https://www.lazard.com/perspective/lcoe2019
[10] 66 Pa.C.S. 2807(e)(3.1-3.2).
[11] 66 Pa.C.S. 2807(e)(3.4).
[12] Pennsylvania Public Utility Commission ("PUC" or "Commission") Docket No. P-2020-3019522. April 20, 2020. *Petition of Duquesne Light Company For Approval of Default Service Plan For The Period June 1, 2021 Through May 31, 2025*. Submitted by Duquesne Light Company ("Dusquene Light Petition"). Available at: http://www.puc.pa.gov/about_puc/consolidated_case_view.aspx?Docket=P-2020-3019522 ¶ 41

Q. What evidence does Duquesne Light provide to support this claim?

A. Duquesne Light does not appear to provide support for its claim that 7 MW of solar is sufficient to result in a prudent mix of resources. If any analysis was conducted along these lines, the Company did not provide it in its Petition.

Q. Has Duquesne Light conducted any analysis to determine a prudent mix of contracts?

A. Duquesne Light does not discuss an analysis to determine a prudent mix of contracts in its Petition.

Q. What would be an appropriate analysis to determine a prudent mix of contracts?

A. An appropriate analysis to determine a prudent mix of contracts would be an all-resource Request for Proposals followed by Integrated Resource Modelling to determine the least-cost mix of resources that meet the Company's other requirements including its AECs obligation.

III. OVERVIEW OF ANALYSIS

Q. What is the importance for long-term contracts for developers of renewable energy projects?

A. Long-term contracts help renewable energy projects get built, often at a lower cost. In recent years, the price of natural gas has been the primary influence on wholesale energy markets, keeping energy prices low and reducing revenues to all generators. As demonstrated by the Brattle Group, new renewable generators can have difficulty

financing their projects due to low expected energy revenues and relatively small capacity payments that are not sufficient to cover their costs.[13]

Long-term contractual agreements for renewable energy between project developers and electric utilities or local distribution companies provide predictable revenue streams to developers, who tend to be smaller entities lacking ready access to the capital necessary to construct renewable energy projects. A steady, predictable revenue stream helps project developers secure financing from lenders, making possible the construction of the new renewable generation resources needed to meet state mandates for renewables, such as renewable portfolio standards (RPS). According to the Brattle Group's 2013 analysis:

> [W]ith increased price certainty for a project, investors require a lower return, which in turn reduces the cost of financing for the project, when compared with a project that relies purely on spot market dynamics for revenues.[14]

Q. Do long-term renewables contracts benefit consumers?

A. Yes, long-term renewables contracts, as well as the resulting increase in renewable generation, benefit consumers by providing:

- **Price stability:** Long-term contracts for renewable energy can offer price stability over a multi-year timeframe. Customers are protected from constant rate adjustments during periods when energy and capacity markets are unstable.

[13] Weiss, Jurgen, and Mark Sarro. 2013. *The Importance of Long-term Contracting for Facilitating Renewable Energy Project Development*. The Brattle Group. p. 7. http://www.brattle.com/system/publications/pdfs/000/004/927/original/The_Importance_of_Long-Term_Contracting_for_Facilitating_Renewable_Energy_Project_Development_Weiss_Sarro_May_7_2013.pdf?1380317003

[14] The Brattle Group. p. 12.

- **Incentives to renewable development:** Long-term contracts encourage the development of new renewable generation resources by offering increased price certainty and lower financing costs.
- **Lower renewable energy certificate (REC) prices:** The addition of renewable generators leads to an increase in the availability of RECs. An increase in the supply of RECs helps to lower the price, which in turn reduces the cost of meeting the RPS and benefits ratepayers.
- **Lower energy costs:** The addition of renewable generation to the wholesale market supply curve displaces the most expensive generating units and lowers the wholesale market price of energy. Utilities dealing directly with developers in a competitive process are able to pass along cost savings (such as lower financing costs) to customers.
- **Economic development:** In-state development of renewables adds jobs and economic development.
- **Reduced air pollution:** Displacement of fossil-fired generators with non-emitting renewables leads to a reduction in air emissions and a corresponding increase in health benefits for consumers.

Q. Please describe the analysis conducted by Applied Economics Clinic and Sommer Energy, LLC on behalf of the Mid-Atlantic Renewable Energy Coalition.

A. In December 2017, Applied Economics Clinic and Sommer Energy, LLC examined the potential benefits of longer-term contracting of 10 years and 20 years for the renewables needed to meet one-half of Pennsylvania's Alternative Energy Portfolio Standard (AEPS) as compared to the current practice of purchasing renewable generation and associated alternative energy credits (AEC) at procurement auctions every six months.

We compared the status quo auction purchasing to costs under long-term power purchase agreement (PPA) contracts for renewables. The difference between the PPA prices and the procurement auction prices is the per kilowatt-hour (kWh) benefit of procuring renewables through long-term contracts. The total dollar value of this benefit is the product of the amount of energy purchased in kWhs and the $/kWh benefit. The amount

of renewables and AECs procured is the same in all scenarios examined in our report, regardless of natural gas price, length of contract, and whether the purchase is through a PPA contract or an auction.

Q. Do long-term renewable contracts save money for consumers?

A. Yes, long-term renewable contracts save money for consumers. According to the analysis conducted by Applied Economics Clinic and Sommer Energy LLC, long-term contracts to purchase renewables save money for electric consumers. Over a ten-year period from 2018 to 2027, 20-year renewable PPAs for one-half of Pennsylvania's incremental AEPS requirement would save ratepayers $134 to $331 million (see Table 1, where red text indicates savings to consumers). These savings estimates do not account for long-term PPA contracts' potential to lower spot-market AEC prices. Instead, saving measures are limited to the result of differences in the price of renewable energy depending on whether it is purchased at auction or via contract.

Table 1. Net present value difference between PPA and auction costs (million 2016$)

		Natural Gas Price Projection		
		Low	Base	High
1/2 Total AEPS	10-year	$85	$18	($112)
	20-year	($134)	($201)	($331)

Source: Stanton, E.A., et al. 2017. *Pennsylvania Long-Term Renewables Contracts Benefits and Costs*. Applied Economics Clinic and Sommer Energy, LLC. Prepared on behalf of the Mid-Atlantic Renewable Energy Coalition. Available at: https://aeclinic.org/publicationpages/benefits-of-long-term-renewable-contracts-for-pennsylvania

Q. Does the advantage of long-term renewables contracts depend on the price of natural gas?

A. Yes, the advantages of long-term renewables contracts depend on the price of natural gas. Twenty-year PPA contracts are less expensive than auction purchases under any of the natural gas price scenarios examined, while 10-year contracts were less expensive than auction purchases under a high natural gas price future.

Q. Does the advantage of long-term renewables contracts depend on the length of the contract?

A. Yes, the advantages of long-term renewables contracts depend on the length of the contract. Twenty-year PPA contracts are substantially cheaper than 10-year contracts (see Table 2).

Table 2. Net present value of PPA costs (million 2016$)

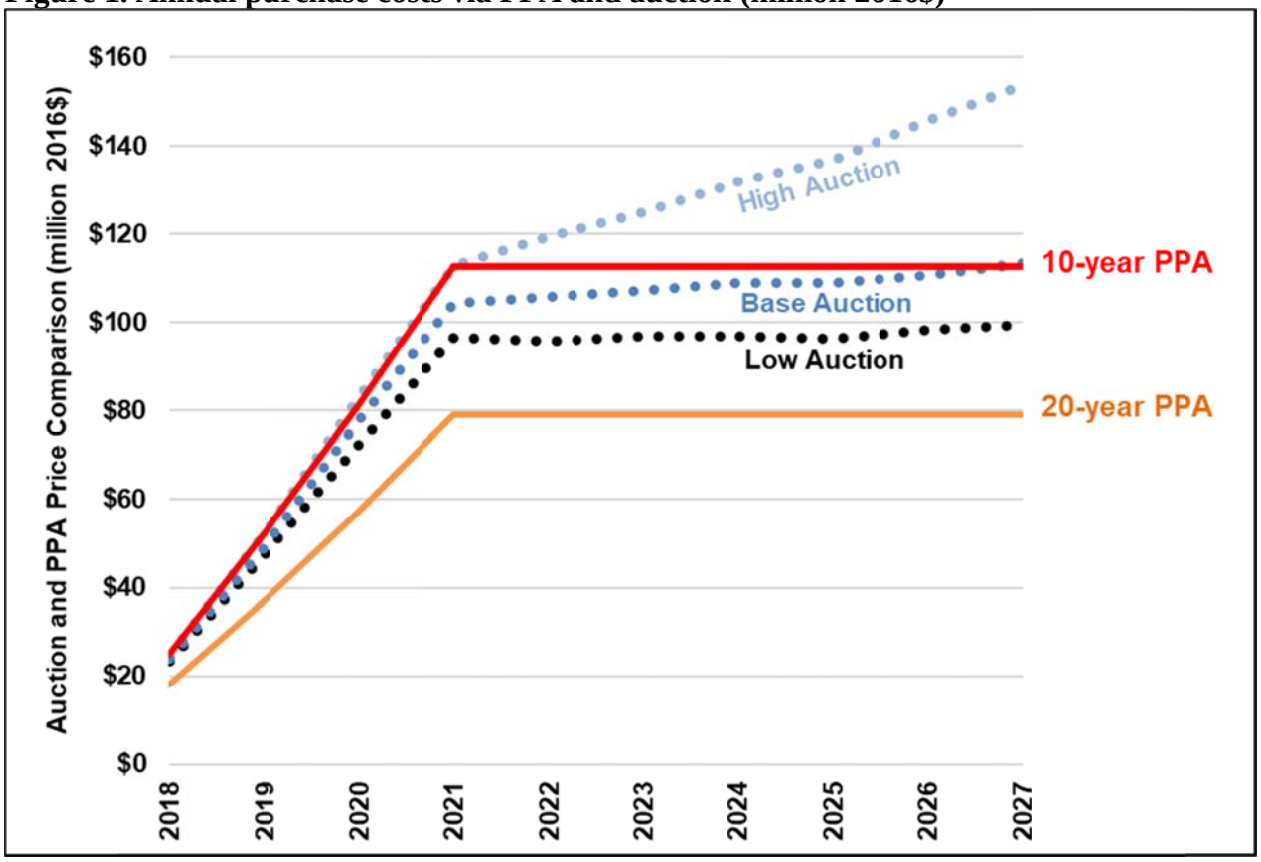
		Natural Gas Price Projection		
		Low	Base	High
1/2 Wind AEPS	10-year	$647		
	20-year	$459		
1/2 Solar AEPS	10-year	$90		
	20-year	$60		
1/2 Total AEPS	10-year	$738		
	20-year	$519		

Source: Stanton, E.A., et al. 2017. *Pennsylvania Long-Term Renewables Contracts Benefits and Costs*. Applied Economics Clinic and Sommer Energy, LLC. Prepared on behalf of the Mid-Atlantic Renewable Energy Coalition. Available at: https://aeclinic.org/publicationpages/benefits-of-long-term-renewable-contracts-for-pennsylvania

Q. Does the advantage of long-term renewables contracts vary over time?

Yes, the advantages of long-term renewables contracts vary over time. Figure 1 presents the annual costs of the PPA and auction purchases themselves (it does not present the difference or "delta" between the two). Throughout the period modeled, the annual costs of the 10-year PPA contracts are within the range of the auction costs. The costs of meeting one-half Pennsylvania's incremental renewable energy needs using 20-year PPAs are below that of the auction costs, even at the lowest natural gas price predictions.

Figure 1. Annual purchase costs via PPA and auction (million 2016$)



Source: Stanton, E.A., et al. 2017. *Pennsylvania Long-Term Renewables Contracts Benefits and Costs*. Applied Economics Clinic and Sommer Energy, LLC. Prepared on behalf of the Mid-Atlantic Renewable Energy Coalition. Available at: https://aeclinic.org/publicationpages/benefits-of-long-term-renewable-contracts-for-pennsylvania

Q. Has the December 2017 Applied Economics Clinic and Sommer Energy, LLC analysis been updated since its original release?

A. No, the analysis conducted by Applied Economics Clinic and Sommer Energy, LLC has not been updated since its original release in December 2017. Underlying data used in our December 2017 analysis included forecasted future natural gas prices, capital investments in wind and solar electric generation, and Pennsylvania' six-month electric procurement auction prices available at the time of publication. Predictions of future prices have changed over the last two and half years, and more up-to-date predictions could lead to small changes in the results of our analysis. Although a new economic analysis was not conducted, I have considered how updated gas prices, renewable capital costs, and procurement auction prices would mostly likely affect the analysis' results.

Q. How have procurement auction prices changed since the December 2017 analysis?

A. On average, Pennsylvania procurement auction prices fell by roughly 6 percent per year from 2015 to 2020 (see Table 4 and Table 5).

Table 4. Procurement auction results, by utility ($/MWh)

	Average Price										
	Jan - June 2015	July - Dec 2015	Jan - June 2016	July - Dec 2016	Jan - June 2017	July - Dec 2017	Jan - June 2018	July - Dec 2018	Jan - June 2019	July - Dec 2019	Jan - June 2020
PECO	$ 55.42	$ 63.95	$ 38.90	$ 55.35	$ 44.10	$ 52.65	$ 44.67	$ 54.24	$ 40.82	$ 48.81	$ 38.61
PPL	$ 55.01	$ 57.80	$ 38.18	$ 53.36	$ 42.06	$ 50.96	$ 39.60	$ 54.04	$ 36.05	$ 45.60	$ 29.16
DLCO	$ 53.91	$ 52.81	$ 44.68	$ 48.36	$ 43.60	$ 50.50	$ 44.61	$ 52.89	$ 39.82		
METED	$ 61.97	$ 61.11	$ 46.09	$ 55.93	$ 56.31	$ 57.68	$ 54.01	$ 56.34	$ 50.86	$ 55.43	$ 47.77
PENLC	$ 59.05	$ 57.75	$ 47.14	$ 54.18	$ 53.93	$ 54.85	$ 52.43	$ 53.17	$ 50.53	$ 51.84	$ 46.37
Penn Power (ATSI)	$ 73.20	$ 63.59	$ 54.49	$ 61.42	$ 61.88	$ 64.43	$ 64.51	$ 65.03	$ 61.34	$ 59.56	$ 54.25
West Penn Power (APS)	$ 55.31	$ 53.59	$ 42.85	$ 54.00	$ 52.97	$ 53.94	$ 53.03	$ 52.15	$ 48.12	$ 48.34	$ 41.66

See Attachment B for sources and calculations

Table 5. Procurement auction results, by sector ($/MWh)

	Average Price										
	Jan - June 2015	July - Dec 2015	Jan - June 2016	July - Dec 2016	Jan - June 2017	July - Dec 2017	Jan - June 2018	July - Dec 2018	Jan - June 2019	July - Dec 2019	Jan - June 2020
Residential	$ 64.45	$ 57.76	$ 50.43	$ 53.42	$ 55.50	$ 53.46	$ 55.36	$ 53.40	$ 51.12	$ 48.88	$ 46.84
Commercial	$ 66.95	$ 61.13	$ 53.02	$ 58.66	$ 56.23	$ 59.16	$ 55.70	$ 58.39	$ 52.61	$ 55.54	$ 46.37
Industrial	$ 22.18		$ 13.50								
Large Commercial & Industrial	$ 5.14		$ 3.54		$ 2.07		$ 1.86		$ 1.97		$ 3.10
Medium Commercial	$ 57.65	$ 67.06									
Medium Commercial & Industrial	$ 52.14	$ 51.85	$ 43.22	$ 47.22	$ 47.56	$ 50.45	$ 50.27	$ 58.65	$ 45.43		
Small Commercial	$ 60.86	$ 58.60	$ 47.28	$ 51.08	$ 51.57	$ 49.79	$ 52.43	$ 51.04	$ 48.07	$ 47.32	$ 45.89
Small Commercial & Industrial	$ 66.50	$ 57.80	$ 45.84	$ 52.84	$ 51.35	$ 51.11	$ 48.16	$ 53.39	$ 43.38	$ 44.55	$ 35.78

See Attachment B for sources and calculations

Q. How have renewable capital costs changed since the December 2017 analysis?

A. Average overnight capital costs for solar and wind fell by 11-13 percent and 6 percent per year, respectively, from 2016 to 2019 (see Table 3). Overnight capital costs are one of the key components driving PPA prices and can be a good indicator of changes in PPA prices.

Table 3. Comparison of renewable capital costs factors

		Utility Scale— Crystalline				Solar PPA
		LAZARD 2016		LAZARD 2019		2017 Analysis
		Low	High	Low	High	Assumptions
Size	MW	30	30	100	100	50
Overnight Capital Cost	2019$/kW	$1,545	$1,385	$1,100	$900	$1,438
Fixed O&M	2019$/kW-yr	$13	$10	$12	$9	$15
Variable O&M	2019$/MWh	$0	$0	$0	$0	$0
Capacity Factor	%	30%	21%	32%	21%	22%
Construction Period	Months	9	9	9	9	12
Economic Lifetime	Years	30	30	30	30	20
Levelized Cost of Energy	2019$/MWh	$52	$65	$36	$44	N/A

		Wind—On Shore				Wind PPA
		LAZARD 2016		LAZARD 2019		2017 Analysis
		Low	High	Low	High	Assumptions
Size	MW	100	100	150	150	100
Overnight Capital Cost	2019$/kW	$1,332	$1,811	$1,100	$1,500	$1,491
Fixed O&M	2019$/kW-yr	$37	$43	$28	$37	$57
Variable O&M	2019$/MWh	$0	$0	$0	$0	$0
Capacity Factor	%	55%	38%	55%	38%	35%
Construction Period	Months	12	12	12	12	24
Economic Lifetime	Years	20	20	20	20	20
Levelized Cost of Energy	2019$/MWh	$34	$66	$28	$54	N/A

See Attachment B for sources and calculations

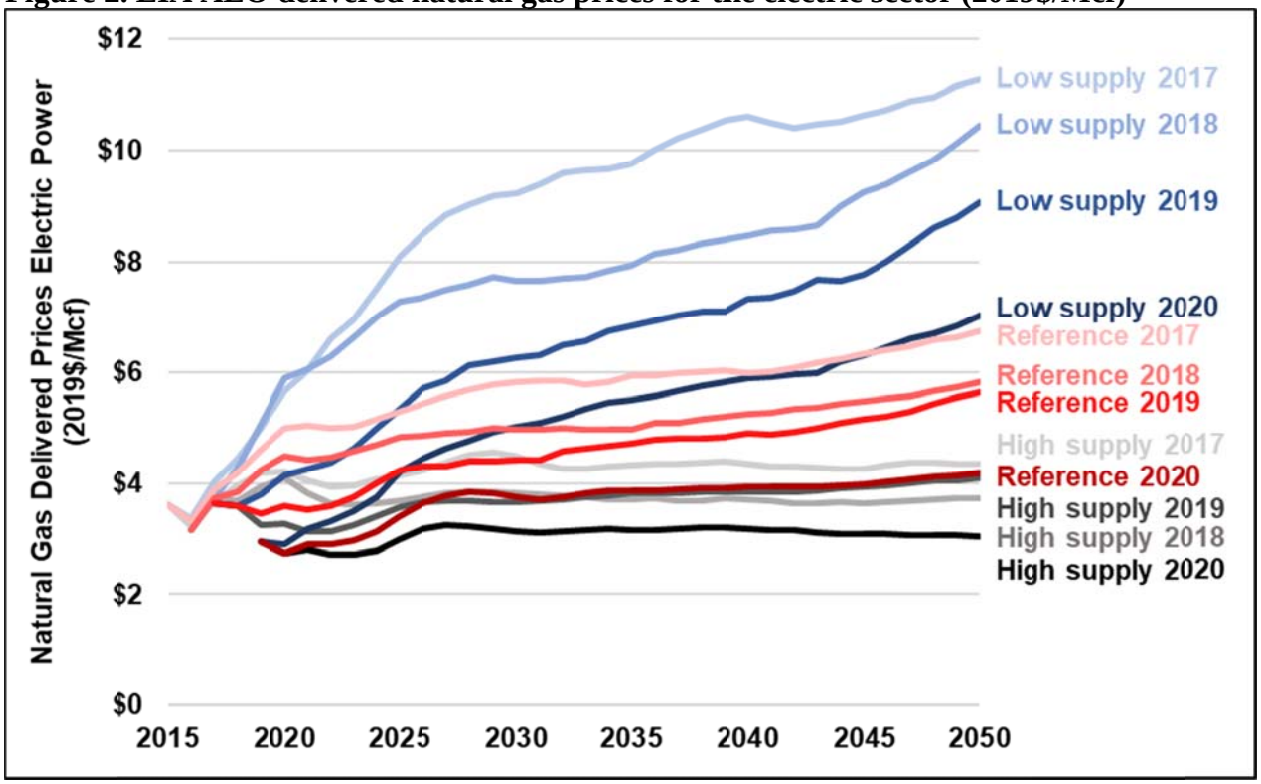
Q. What effect would these updated procurement prices have on the December 2017 analysis?

A. From these simple trends it appears that solar prices are dropping more quickly than those of auction prices, while wind prices are dropping at the same rate. This suggests that the advantage of a solar long-term contract is even greater now than it was in 2017, whereas wind likely maintains the same advantage that it did in 2017.

Q. How have gas price predictions changed since the December 2017 analysis?

A. Gas prices predictions released in 2020 are lower than they were in 2017 (see Figure 2).

Figure 2. EIA AEO delivered natural gas prices for the electric sector (2019$/Mcf)



See Attachment B for sources and calculations. *Note*: AEO's "Low gas and oil" scenario assumes lower gas and oil supply and higher prices, while the "High gas and oil scenario" assumes higher gas and oil supply and lower prices.

Q. What effect would these updated gas prices have on the December 2017 analysis?

A. Lower natural gas prices are the most likely cause of lower auction prices. Solar prices, however, have been dropping even more rapidly, suggesting that an update of the December 2017 analysis would show even more favorable results for renewable PPAs.

IV. OVERVIEW OF LONG-TERM CONTRACTS

Q. What is the status of long-term renewables contracts in Pennsylvania?

A. Long-term renewables contracts are currently limited in Pennsylvania, and solar sources are mostly small-scale and behind-the-meter. As of April 2020, Pennsylvania holds 90.9

MW of utility-scale net summer capacity and 402.2 MW in behind-the-meter capacity.[15] According to the Pennsylvania Department of Environmental Protection's (PA DEP) 2018 *Solar Future Plan*,[16] independent power producers (IPPs) are having trouble securing long-term contracts due to utilities' stated concerns over ratepayer burden. Utilities have asserted that ratepayers will pay more over time due to flat load growth and stable or declining energy prices. As a result, IPPs are looking elsewhere for investors. According to PA DEP, "Because long-term contracts are often more readily available in other states, IPPs are more likely to obtain investor financing for these projects outside Pennsylvania where the Return on Investment (ROI) is guaranteed for a longer term."[17]

PA DEP's *Solar Future Plan* discusses strategies to encourage both utility-scale and distributed (behind-the-meter) solar generation. As part of its utility-scale strategies, PA DEP plans to "develop guidelines for the limited use of long-term contracts for 10 or more years to ensure Pennsylvania benefits from grid scale solar," evaluate the pros and cons of utility ownership of solar generation, and investigate opportunities for grid modernization.[18] According to the *Plan*, the Commonwealth could increase utility-scale and distributed solar by 37 times and 2.5 times 2015 levels, respectively.[19]

[15] U.S. Energy Information Administration (EIA). June 2020. *Table 6.2.B. Net Summer Capacity Using Primarily Renewable Energy Sources and by State, April 2020 and 2019 (Megawatts)* [Table]. Electric power monthly with data for April 2020. Available at: https://www.eia.gov/electricity/monthly/current_month/epm.pdf
[16] Pennsylvania Department of Environmental Protection (PA DEP). November 2018. *Pennsylvania's Solar Future Plan*. Available at: http://files.dep.state.pa.us/Energy/Office%20of%20Energy%20and%20Technology/OETDPortalFiles/Pollution%20prevention%20and%20Energy%20assiatance/SolarFuture/Pennsylvania%27s%20Solar%20Future%20Plan.pdf. p.80
[17] Ibid.
[18] Ibid. p. xv
[19] Ibid. p. xi

Q. Can municipalities enter into long-term renewables contracts?

A. Yes, municipalities can enter into long-term renewables contracts. According to 2019 analysis conducted by Community Energy, a Pennsylvania-based clean energy developer, long-term contracts for renewable projects for small- to medium-sized municipalities contribute to a greener electricity mix in the Commonwealth. Community Energy concluded that total annual demand for power of at least 40 MW is necessary for a PPA to be price competitive. To increase the feasibility of PPAs, therefore, municipalities should collaborate and aggregate their demand to enter into joint long-term contracts for solar projects.[20]

Community Energy also recommends that, due to land constraints, municipalities should consider developing or purchasing an existing project outside their borders, selecting an experienced large-solar developer or project owner with which to collaborate. In addition to contracting for energy in a solar PPA, municipalities also commonly contract for this energy's associated RECS, which can be sold on the market by a municipality, but the municipality cannot then claim credit for generating renewable energy.[21] Municipalities are not regulated by the Commission and therefore are not required to meet the Commonwealth's Alternative Energy Portfolio Standards.

[20] Community Energy. 2019. *White paper: Introduction to off-site solar power purchase agreements for small to medium municipalities in Pennsylvania*. Available at: https://www.communityenergyinc.com/munippas.
[21] Ibid.

Q. What are some examples of existing long-term renewables contracts in Pennsylvania?

A. According to an April 2020 article in *Penn Today*, the University of Pennsylvania (UPenn) aims to be 100 percent carbon neutral by 2042. To meet this goal, UPenn signed a long-term contract for the largest solar project in Pennsylvania The PPA contains two 25-year contracts for two new solar facilities in central Pennsylvania With a combined capacity of 220 MW, the facilities could produce up to 450,000 MWh of annual generation or 75 percent of campus electric demand.[22]

Similarly, the *Philadelphia Inquirer* reports that four other Pennsylvania schools (Lehigh University, Lafayette College, Muhlenberg College, and Dickinson College) have collectively signed a long-term contract for a 45.9 MW "virtual" share in a solar farm in Texas. Under this virtual PPA, the schools will purchase only the RECs associated the generation and not the energy.[23]

According to a 2017 press release, the City of Philadelphia aims to have 100 percent renewable electricity by 2030.[24] In 2018, the City signed a long-term contract for an 80 MW Community Energy-developed solar project in Adams County, about 140 miles west of Philadelphia. With this contract, the City can meet 20 percent of its energy demand

[22] Mott, A. Rizzi, J. April 13, 2020. "Penn signs power purchase agreement for largest solar project in Pennsylvania". Penn Today. Available at: https://penntoday.upenn.edu/news/penn-signs-power-purchase-agreement-largest-solar-project-pennsylvania

[23] Maykuth, A. February 24, 2020. "These Pa. colleges are going all in on renewable energy – with a little help from a Texas solar farm." *The Philadelphia Inquirer*. Available at: https://www.inquirer.com/business/lehigh-lafayette-muhlenberg-dickinson-sign-solar-supply-agreement-20200224.html

[24] City of Philadelphia Office of Sustainability. September 27, 2017. "City officials launch new efforts to stem climate change." Available at: https://www.phila.gov/press-releases/office-of-sustainability/city-officials-launch-new-efforts-to-stem-climate-change/

with renewable electricity. The solar project is now owned by ENGIE, an independent power producer, and will be operational in 2021.[25]

Q. Does the PJM planning queue include new renewable energy and capacity resources?

A. Yes, the PJM planning queue includes 38 GW of new wind (2 GW of which is in Pennsylvania) and 77 GW of utility-scale solar (10 GW of which is in Pennsylvania).[26]

Q. Does evidence exist from other jurisdictions that support the use of long-term contracts for the acquisition of renewable resources to meet renewable portfolio standard (RPS) requirements?

A. Yes, evidence from other jurisdictions supports the use of long-term contracts for the acquisition of renewable resources to meet RPS requirements, including actual and proposed long-term renewables contracts in the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, and through the U.S. Environmental Protection Agency.

Q. Please discuss the long-term renewables contract example from the District of Columbia.

A. In April 2019, the Public Service Commission of the District of Columbia (DC PSC) filed an order in Formal Case No. 1017 that established "a pilot program to procure renewable energy through long-term power purchase agreements ('PPA') for electricity generated by solar or wind power facilities located within the PJM

[25] City of Philadelphia Office of Sustainability. February 6, 2020. "City and ENGIE announce power purchase agreement staffing plan." Available at: https://www.phila.gov/2020-02-06-city-and-engie-announce-power-purchase-agreement-staffing-plans/

[26] PJM Interconnection. "New Services Queue." Available at: https://www.pjm.com/planning/services-requests/interconnection-queues.aspx

Interconnection region ('PJM') with a target quantity of five (5) percent of the [Standard of Service] load."[27] At the direction of the DC PSC, Potomac Electric Power Company (Pepco) filed a draft Request for Proposals (RFP) on July 31, 2019 for "long-term renewable energy PPAs, including the renewable energy credits ('RECs') associated with the energy…"[28]

In October 2019, DC PSC filed another order to solicit comments from interested parties regarding "the Commission's long-term renewable energy power purchase agreement pilot program for Standard Offer Service ('SOS'), Potomac Electric Power Company's ('Pepco' or 'Company') draft request for proposals('RFP'), and the individual Working Group members' comments on the draft RFP."[29] Since the issuance of this order, DC PSC, Pepco, and other stakeholders have conducted multiple rounds of comments and revisions of the draft RFP with the most recent revision being filed by Pepco on May 21, 2020. Although not finalized, the draft RFP seeks "one or more wind or solar Facilities for an annual target amount of 154,000 MWh" representing "approximately 5% of Pepco DC Standard Offer Service Load" and notes that "[b]idders may propose a term of agreement that is fifteen (15) years or twenty (20) years."[30]

[27] Public Service Commission of the District of Columbia ("DC PSC"). *Formal Case No. 1017, In the Matter of the Development and Designation of Standard Offer Service in the District of Columbia* ("*Formal Case No. 1017*"), Order No. 19897, released April 12, 2019 ("Order No. 19897"), ¶ 1.
[28] Public Service Commission of the District of Columbia. *Formal Case No. 1017*. Order No. 19897, ¶ 35
[29] Public Service Commission of the District of Columbia. *Formal Case No. 1017*. Order No. 20232, released October 10, 2019 ("Order No. 20232"), ¶ 1.
[30] Public Service Commission of the District of Columbia. *Formal Case No. 1017*. May 29, 2020. *Pepco's drafts of the Request for Proposal and Renewable Energy Purchase Agreement*. Submitted by Potomac Electric Power Company ("Pepco"). Available at: https://edocket.dcpsc.org/apis/api/filing/download?attachId=103803&guidFileName=52d4a216-982c-4730-b0a2-a5ff024e8136.pdf

Q. Please discuss the long-term renewables contract example from Maine.

A. In February 2020, the Maine Public Utilities Commission initiated a procurement process through a request for proposals for solar and other renewable distributed generation projects. To qualify for the sale of energy or renewable energy credits, the facility must be a Class 1A resource as described in the *Act to Reform Maine's Renewable Portfolio Standard of 2019*.[31] The procurement terms must be 20-year contracts with transmission and distribution utilities, and contracts for energy alone are preferred by the Commission over renewable energy credits.[32]

Long-term contracts are requested by the Commission, which releases Requests for Proposals (RFP), resulting in selected bidders entering into contracts with Maine's investor-owned transmission and distribution utilities. In 2017, an energy purchase agreement was enacted between Dirigo Solar, LLC and the electric utilities Central Maine Power Company and Emera Maine for a twenty-year term with two pricing options for solar energy. [33]

Q. Please discuss the long-term renewables contract example from Maryland.

A. Long-term contracting for renewable generating resources was proposed by Levitan & Associates in a study prepared for the state of Maryland on the options available to the

[31] Maine Public Utilities Commission. 2020. "2020 Request for Proposals for the Sale of Energy or Renewable Energy Credits from qualifying Renewable Resources". Available at: https://www.maine.gov/mpuc/electricity/rfps/class1a2020/

[32] Maine Public Utilities Commission. March 12, 2020. "RPS Procurement Tranche 1" *Bidders Information Session Presentation.* Available at: https://www.maine.gov/mpuc/electricity/rfps/class1a2020/documents/RPS-Bidders-Information-Session-03-12.pdf

[33] Maine Public Utilities Commission. December 18, 2017. *Order Approving Agreement*. Docket No. 2015-00026. Available at: https://www.maine.gov/mpuc/electricity/rfps/longterm2015/documents/Dirigo-Solar-2015_00026_Order_12_18_17.pdf.

state to restore its influence over electric rates and new generation construction following electricity market restructuring. The study's authors noted that state RPS and other environmental requirements "have made renewable generation resources and demand response more significant components of states' energy plans, but existing competitive markets have proven ill-suited to their development."[34] They found that, at the time of the study, wholesale markets encouraged generation owners to maintain the status quo and rewarded persistent capacity shortages, which resulted in higher wholesale prices and jeopardized reliability.[35] Levitan & Associates proposed strategic long-term contracts as a solution that would reduce both wholesale market prices and capacity prices, improve reliability, and achieve state environmental goals.

Long-term contracting was emphasized as an action that Maryland could take that would allow it the flexibility to tailor resource procurement in a way that met state needs. Contracts that emphasized renewable resources would both diversify Maryland's fuel mix and lower energy and capacity charges in the state through the addition of lower-cost resources in areas where prices were highest. Low cost renewable resources would displace the more expensive fossil-fired units that were setting high wholesale prices during peak periods, resulting in lower Locational Marginal Prices (LMPs) at energy price nodes and leading to lower and more stable retail prices for consumers over time.[36]

[34] Levitan & Associates. 2007. *State Analysis and Survey on Restructuring and Reregulation. Prepared for Maryland Public Service Commission.* Page 1. http://www.psc.state.md.us/wp-content/uploads/KayeScholer_State-Analysis-and-Survey-on-Restructuring-and-Re-Regulation-_11.30.07.pdf
[35] Levitan & Associates. Page 75.
[36] Levitan & Associates. Page 81.

In 2018, the 100 percent Clean Renewable Energy Equity Act was introduced to the Maryland Senate. This Act would establish new state subsidies for solar and onshore wind, and requires utilities to sign long-term contracts with offshore wind providers.[37] The bill specifically calls for electric companies to enter into long-term contracts beginning in 2021, with terms from 10 to 20 years.[38]

Q. Please discuss the long-term renewables contract example from Massachusetts.

A. In 2008, electric distribution companies in Massachusetts were required to begin executing long-term PPAs for energy and/or RECs with renewable developers for a term of 10 to 15 years under Section 83 of the Green Communities Act. A 2012 study by Peregrine Energy Group examined whether that long-term contracting requirement had met state goals by facilitating the development, financing, and construction of new renewable energy projects.[39] The Massachusetts Department of Public Utilities (MA DPU) was responsible for approval of long-term contracts, and new projects were required to be cost effective to ratepayers, contribute to moderating peak loads, and provide enhanced electric reliability. Following passage of Section 83, five PPAs were executed between renewable project developers and distribution companies.[40] Renewable

[37] Feldman, et. al. February 6, 2018. *Renewable Energy Portfolio Standard Requirements-Standard Offer Service*. State of Maryland OPC. Senate Bill 391. p.2. Available at: http://opc.maryland.gov/Portals/0/SenateBills/2018%20Senate%20Bills/SB391%20Electric%20Companies%20-%20RPS%20Requirements%20-%20SOS%20Final.pdf?ver=2019-09-10-143134-407

[38] Ibid. p. 3.

[39] Peregrine Energy Group. 2012. *Study on Long-Term Contracting Under Section 83 of the Green Communities Act*. Prepared for the Massachusetts Department of Energy Resources. Available at: http://www.mass.gov/eea/docs/doer/pub-info/long-term-contracting-section-83-green-communitiesa-act.pdf

[40] Note that four of the five projects were constructed. The fifth, the offshore Cape Wind project, failed to meet contractual deadlines, causing the two distribution utilities with which it had entered a PPA to terminate their contracts.

project developers stated that the PPAs "were critically important in their ability to finance and build their projects."[41]

The Peregrine study notes that one of the benefits of long-term contracting for renewables is that the projects resulting from those contracts increase the supply of Class 1 RECs needed to meet demand under the RPS, thereby reducing REC market prices. A shortage of RECs, conversely, would cause REC prices to move toward the Alternative Compliance Price, resulting in higher rates for customers.[42] An increase in the amount of renewable energy generation resulting from long-term contracts suppresses the wholesale price of energy; when zero or low variable cost resources are added to the supply curve, the wholesale market clearing price falls in many hours of the year.[43]

Massachusetts' Act to Promote Energy Diversity, signed into law by Governor Baker in 2016, also has a section pertaining to renewable long-term contracts. The law specifies that in order to assist the financing of offshore wind resources in Massachusetts, no later than June 30, 2017, each distribution company must jointly and competitively solicit proposals for offshore wind, and assuming that reasonable proposals are received, the companies must enter into cost-effective long-term contracts.[44]

[41] Peregrine Energy Group. p.4.
[42] Peregrine Energy Group. p.35.
[43] Peregrine Energy Group. p.36.
[44] The Commonwealth of Massachusetts. July 31, 2016. *An Act to promote energy diversity*. House Bill No. 4568. Available at: https://malegislature.gov/Bills/189/House/H4568. P. 18

In 2019, MA DPU approved the contract between offshore wind developer, Vineyard Wind and the states' electric distribution companies.[45] The order permits Vineyard Wind to develop 800 MW of wind resources near Cape Cod. Local electric companies will purchase 100 percent of the energy and associated RECs over a 20-year period at $89 per MWh.[46]

Q. Please discuss the long-term renewables contract example from New Hampshire.

A. In 2019, New Hampshire's Senate Bill 167—to create a commission with regard to the acquisition of long-term renewable contracts—was vetoed by Governor Sununu after passing in the House and Senate.[47] The bill focused on increasing the state's clean energy resources through an official procurement process, which would be determined after conducting a state-commissioned study. [48]

In spite of the veto of Senate Bill 167, the state of New Hampshire has commissioned renewable resources amounting to 10.6 GWh per year (10 percent of governmental electric consumption) through a competitive bidding process for a five-year duration.[49] As part of the state's initiative to reduce reliance on fossil fuels per New Hampshire's

[45] Massachusetts Department of Public Utilities. April 16, 2019. "Department of Public Utilities Approves Offshore Wind Energy Contracts". Available at: https://www.mass.gov/news/department-of-public-utilities-approves-offshore-wind-energy-contracts
[46] Ibid.
[47] New Hampshire Senate. September 19, 2019. *Senate Bill 167*. Available at: https://legiscan.com/NH/text/SB167/2019.
[48] Ibid.
[49] U.S. EPA. April 27, 2020. "Green Power Partnership Long-term Contracts". *United States Environmental Protection Agency*. Available at: https://www.epa.gov/greenpower/green-power-partnership-long-term-contracts.

Energy Conservation Plan, New Hampshire aims to power all government buildings with 25 percent renewable energy by 2025.[50]

Q. Please discuss the long-term renewables contract example from New Jersey.

A. In July 2008, New Jersey's Board of Public Utilities issued an order requiring the state's electric distributors to submit plans for purchasing solar RECs (SRECs) through long-term contracts. Some mandatory elements of this requirement within the SREC Registration Program include contract terms of 10-15 years, separate markets for small solar (projects of 0.05 megawatts (MW) or less) and larger projects between 0.05 and 2 MW, and an initial 3-year pilot program ending in 2012.[51]

A 2015 study by Sustainable Energy Advantage examined the potential benefits of using long-term contracts to meet 50 percent of New Jersey's incremental RPS obligation between 2017 and 2025, compared to purchasing 100 percent of required RECs on the spot market.[52] Sustainable Energy Advantage found that the presence of long-term contracts leads to an increased ability to finance new renewable energy facilities, which lowers energy costs, REC prices, and costs to ratepayers.[53] The cost savings associated with meeting 50 percent of incremental RPS obligations through long-term contracting was estimated to be more than $600 million over the study period.[54]

[50] New Hampshire State Energy Management Office. "Energy Management." *Plant and Property Management.* Available at: https://das.nh.gov/EnergyManagement/index.aspx.
[51] DSIRE. January 6, 2019. "Solar Renewable Energy Certificates (SRECs) Registration Program". Available at: https://programs.dsireusa.org/system/program/detail/5687
[52] Sustainable Energy Advantage. 2015. *Potential Benefits of Long-Term Contracts for RPS Compliance in New Jersey*. Prepared for the Mid-Atlantic Renewable Energy Coalition.
[53] Sustainable Energy Advantage. p.1.
[54] Sustainable Energy Advantage. p.7.

Customers would realize savings on their electric bills as well. The study estimated ratepayer savings of approximately 50 cents per month compared to New Jersey's current procurement policies.[55] Sustainable Energy Advantage did not model a price suppression affect associated with renewable additions, and because these additions tend to reduce wholesale energy prices, their estimates of rate impacts are conservative.

In 2020, New Jersey's Clean Energy Program includes a SREC financing model that provides both energy certificates and additional long-term financing for utilities to invest in solar projects.[56]

Q. Please discuss the long-term renewables contract example from New York.

A. In 2013, the Brattle Group performed a study investigating the potential effect of long-term contracting on the development of renewable generating resources in New York. Evidence from previous years showed that most renewable energy projects in restructured U.S. power markets were built with the support of long-term contracts, and that there are important reasons that long-term contracts have been the dominant approach to support the development of renewable energy projects.[57] The study authors conclude that financing costs for renewable projects can be lowered as a result of the price certainty associated with bundled (energy, capacity, and RECs) long-term contracts over 15 to 20 years, and that the impact of lower financing costs could be materially beneficial to New York ratepayers. They estimate that contracts awarded between 2013

[55] Sustainable Energy Advantage. p.8.
[56] New Jersey Clean Energy Program. 2020. "SREC Registration Program". Available at: https://www.njcleanenergy.com/srec.
[57] Weiss, Jurgen, and Mark Sarro. 2013. *The Importance of Long-term Contracting for Facilitating Renewable Energy Project Development*. The Brattle Group. p.1.

and 2015 to meet the remaining 2015 New York RPS commitment "could realistically range from $450 million to close to $1 billion" under simple examples and reasonable assumptions.[58] In addition to reducing the net retail price of electricity, the Brattle Group identified a number of other benefits to consumers associated with an increase in the amount of renewable generation in New York: 1) displacement of fossil-fired generation and reduction in air emissions, which reduces the cost of emission reductions needed from other parts of the economy; 2) creation of jobs and income associated with new facilities, as well as payments for land leases and purchases of materials and services; 3) a reduction in health impacts from air pollutants; and 4) a reduction in peak demand from increased solar generation, displacing more expensive peaking generation units, and possibly leading to a reduction in the need for new peaking capacity resources.

Similarly, the New York Department of Public Service (DPS), assisted by the New York State Energy Research and Development Authority (NYSERDA) issued a study examining the cost impact to consumers of meeting the state's Clean Energy Standard (CES), varying key input variables. One such variable was procurement structure—"bundled PPAs" versus "REC only"—to develop new renewables. Study findings show that bundled PPAs result in greater revenue certainty to developers, giving projects a lower expected gross program cost than a "REC only" procurement approach. Total benefits to consumers of the CES under a "REC only" scenario were estimated to be $65

[58] Brattle Group. p.3.

million, compared to a benefit of more than $1.5 billion under a "PPA only" procurement scenario.[59]

In January 2020, New York's State Energy Research and Development Authority (NYSERDA) authorized an order requiring 1.6 million 1-MWh Tier 1 REC procurements under the state's most recent Renewable Energy Standard solicitation, which will award long-term contracts to eligible resource developers. [60]

Q. Please discuss the long-term renewables contract example through the U.S. Environmental Protection Agency.

A. The Green Power Partnership (GPP) is a voluntary initiative offered by the Environmental Protection Agency (EPA) that supports businesses, states, government agencies, nonprofits, and educational institutions in their efforts to procure a larger share of energy usage from clean sources. The program highlights 429 partners that have signed a long-term contract to purchase renewable electricity, with term lengths ranging from five to thirty years.[61] Participation in GPP is available to any entity with an annual electricity use of 100 megawatt-hours (MWh) or more. Individual and private residences, as well as electric service providers, are barred from participating. Since the establishment of its GPP in 2001, EPA reports that the U.S. clean energy market has grown by almost 5,000 percent. The program is designed to increase organizations' clean

[59] New York State Department of Public Service. 2016. *Clean Energy Standard White Paper – Cost Study*. Slide 39.
[60] New York State Public Service Commission. January 16, 2020. *Proceeding on Motion of the Commission to Implement a Large-Scale Renewable Program and a Clean Energy Standard*. Case No. 15-E-0302. Available at: https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Standard/Renewable-Generators-and-Developers/RES-Tier-One-Eligibility/Solicitations-for-Long-term-Contracts.
[61] U.S. EPA. April 27, 2020. "Green Power Partnership Long-term Contracts". *United States Environmental Protection Agency*. Available at: https://www.epa.gov/greenpower/green-power-partnership-long-term-contracts.

energy consumption and to advance domestic development of renewable resources.[62] EPA provides verification of energy sources and publicity to organizations that voluntarily commit to source all or a portion of their electricity consumption from renewable resources.[63] Outside of environmental benefits, other incentives to participate include press coverage, credibility in partnering with EPA, and differentiation from competitors. Another benefit in joining the Green Power Partnership is access to expert advice in several forms: communications support, trainings on green power purchasing and generation, and technical assistance.

The combined renewable power consumption from Green Power partners totals 24 million MWh annually,[64] or 0.6 percent of total U.S. electric demand in 2018.[65]

V. RECOMMENDATIONS

Q. Based on the findings in your testimony, what are your recommendations for the Commission?

A. I recommend that the Commission require Duquesne to do issue a bundled renewables RFP. In the absence of such an RFP, the Commission should require Duquesne to initiate a pilot program amounting to 10 percent or more of its total AECs obligation (or a minimum of 21 MW solar or 12 MW wind renewables contracts).[66] For optimal results for ratepayers, the Commission should direct the Company to work together with

[62] U.S. EPA. 2018. "Green Power Partnership Program Overview". *United States Environmental Protection Agency*. Available at: https://www.epa.gov/greenpower/green-power-partnership-program-overview.
[63] Ibid.
[64] Ibid.
[65] U.S. Energy Information Administration. October 2019. "Total electric power industry summary statistics". Electric Power Annual. Available at: https://www.eia.gov/electricity/annual/.
[66] Calculated using solar and wind capacity factors of 32 percent and 55 percent, respectively. Lazard. November 2019. *Levelized Cost of Energy Analysis 13.0*. pp.16-17. Available at: https://www.lazard.com/perspective/lcoe2019

stakeholders to design a prudent mix that allows customers to receive the benefits of long-term contracts for renewables.

Q. Does this conclude your direct testimony?

A. Yes. However I may wish to comment briefly on Duquesne Light's responses to MAREC-Action's Set I Interrogatories which were received after the foregoing testimony had been completed and submitted for service without the ability, due to virus restrictions, to review the responses with other member of the MAREC-Action team.

Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

Elizabeth A. Stanton, Ph.D., Director and Senior Economist

1012 Massachusetts Avenue, Arlington MA 02476 ꕥ liz.stanton@aeclinic.org ꕥ 781-819-3232

PROFESSIONAL EXPERIENCE

Applied Economics Clinic, Arlington, MA. *Director and Senior Economist*, February 2017 – Present.

The Applied Economics Clinic provides technical expertise to public service organizations working on topics related to the environment, consumer rights, the energy sector, and community equity. Dr. Stanton is the Founder and Director of the Clinic (www.aeclinic.org).

Liz Stanton Consulting, Arlington, MA. *Independent Consultant*, August 2016 – January 2017.

Providing consulting services on the economics of energy, environment and equity.

Synapse Energy Economics Inc., Cambridge, MA. *Principal Economist*, 2012 – 2016.

Consulted on issues of energy economics, environmental impacts, climate change policy, and environmental externalities valuation.

Stockholm Environment Institute - U.S. Center, Somerville, MA. *Senior Economist*, 2010 – 2012; *Economist*, 2008 – 2009.

Wrote extensively for academic, policy, and general audiences, and directed studies for a wide range of government agencies, international organizations, and nonprofit groups.

Global Development and Environment Institute, Tufts University, Medford, MA. *Researcher*, 2006 – 2007.

Political Economy Research Institute, University of Massachusetts-Amherst, Amherst, MA. *Editor and Researcher – Natural Assets Project*, 2002 – 2005.

Center for Popular Economics, **University of Massachusetts-Amherst**, Amherst, MA. *Program Director*, 2001 – 2003.

EDUCATION

University of Massachusetts-Amherst, Amherst, MA

Doctor of Philosophy in Economics, 2007

New Mexico State University, Las Cruces, NM

Master of Arts in Economics, 2000

School for International Training, Brattleboro, VT

Bachelor of International Studies, 1994

AFFILIATIONS

Global Development and Environment Institute, Tufts University, Medford, MA.

Senior Fellow, Visiting Scholar, 2007 – Present

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Stanton, E.A. and J. K. Boyce. 2005. *Environment for the People*. Political Economy Research Institute: Amherst, MA.

TEACHING EXPERIENCE

University of Massachusetts-Amherst, Amherst, MA

Adjunct Professor, Department of Economics, 2003 – 2006, 2020

Tufts University, Medford, MA

Adjunct Professor, Department of Urban Environmental Policy and Planning, 2007, 2017, 2018

College of New Rochelle, New Rochelle, NY

Assistant Professor, Department of Social Sciences, 2007 – 2008

Fitchburg State College, Fitchburg, MA

Adjunct Professor, Social Sciences Department, 2006

Castleton State College and the Southeast Vermont Community Learning Collaborative, Dummerston, VT

Adjunct Professor, 2005

School for International Training, Brattleboro, VT

Adjunct Professor, Program in Intercultural Management, Leadership, and Service, 2004

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