

THE STATE OF NEW HAMPSHIRE

SITE EVALUATION COMMITTEE

DOCKET NO. 2015-02

APPLICATION OF ANTRIM WIND ENERGY, LLC
FOR A CERTIFICATE OF SITE AND FACILITY

PREFILED SUPPLEMENTAL TESTIMONY OF LISA LINOWES

ON BEHALF OF THE WIND ACTION GROUP

1) Please state your name and address and qualifications.

My name is Lisa Linowes, and my address is 286 Parker Hill Road, Lyman, NH 03585. My qualifications remain the same as those presented in my pre-filed direct testimony submitted May 23, 2016.

2) Please summarize your current position as it relates to this matter.

I serve as Executive Director of the Industrial Wind Action Group (Windaction.org) a New Hampshire corporation form in 2006.

3) What is the purpose of this supplemental testimony?

My supplemental testimony relates to the Antrim Wind Energy LLC's ("Applicant") claimed benefits and costs. In particular, I provide greater detail for why I believe the economics of the project are not realistic. I also note that since filing testimony in this Docket, I have had the opportunity to review the confidential pro forma for Antrim Wind (the "Project"). Supplemental testimony that directly references the confidential pro forma figures has been omitted from the public version of my supplemental testimony but is included in a separate document filed with the Administrator for the Site Evaluation Committee ("SEC" or "Committee").

4) In responding to question 12 of your prefile testimony, you state that the future price for Class I renewable energy is likely to be lower than the \$81 bundled price cited in the Applicant's public pro forma. What analysis did you perform to support your claim?

Exhibit WA-01s (attached) presents a model of my analysis of Class I renewable energy pricing based on Henry Hub futures¹ for natural gas through to 2025. The analysis is similar to what others would follow in arriving at a fair price for wind energy when negotiating a long-term energy contract in the New England region. I relied on the following assumptions in preparing the model:

- a) Monthly Henry Hub gas futures (column B) are based on a gas pipeline located in Erath, Louisiana which serves as the official delivery location for futures contracts on the NYMEX. Natural gas sources closer to New England are likely to have lower delivery charges but for this analysis I present a low (\$0.25) and high (\$1.25) value for delivery charges (columns C and D);
- b) The conversion from \$/mBTU to \$/MWh assumes 8.0 mBTU/MWh heat rate based on the ISO-New England's Annual Emissions Report (columns E and F).
- c) The analysis uses 0.4 RGGI allowances per MWh based on CO₂/MWh rates cited in the ISO-NE Annual Emissions Report (columns G and H). The analysis sets the RGGI price at the cost containment reserve (CCR) price in each year starting at \$10 in 2017 and increasing by 2.5% each year after that. Recent auctions have resulted in allowances clearing at prices well below the CCR price.²
- d) Prices for Class I Renewable Energy Credits are assumed to be \$40 during the years 2017, 2018 and 2019. Beginning in January 2020, the analysis assumes a Class I REC price of \$25 (columns I and J).
- e) A \$20/MWh 'winter adder' is applied during the four months of winter (December-March) in the years 2017-2019 to address potential price spikes relating to recent fuel availability problems. I anticipate gas shortages to be resolved by 2020 but in the interim, oil is assumed to be the back-up fuel burned approximately 25% of the time. The \$20/MWh assumes oil priced at \$45/barrel, delivering 6 mBTU per barrel at an efficiency of 11 mBTU/MWh: adder = $(\$45/6) \cdot .25 \cdot 11$.

Based on these conservative assumptions, a more realistic long-term bundled price for the energy and RECs that also includes a price for RGGI allowances, would range between \$61.90 and \$69.90 per MWh. When compared to the \$81 price cited in the Applicant's public pro forma, ratepayers could be paying as much as

¹ The analysis shown in Exhibit WA-01s has been updated to reflect Henry Hub pricing as of August 13, 2016. I also introduced other factors such as the 'winter adder' which explains why some of the figures differ from statements made in my May 23, 2016 testimony.

² Auction 32 conducted on June 1, 2016 resulted in a clearing price of \$4.53 while the cost containment reserve price for 2016 is \$8/allowance. https://www.rggi.org/market/co2_auctions/results/auction-32

\$19/MWh above that of other eligible Class I generation in New England. With a winter adder included, the Project's \$81/MWh price would still be nearly \$17/MWh above competitively priced Class I resources.

5) Your analysis applies a \$40 REC price during the years 2017-2019 and then lowers that price to \$25 per REC. Please explain the basis for these numbers.

As cited in my prior testimony, there are several important trends occurring in the New England REC market that are placing downward pressure on the price of Class I RECs.

In 2014 and 2015, the five New England states with active RPS policies successfully met their Class I (or New in Rhode Island) mandates using renewable energy credits as opposed to alternative compliance payments. Although the 2016 compliance year is ongoing, I expect a similar outcome this year. Such compliance is reflected in lower REC prices through 2015-2016. Exhibit WA-02s (attached) includes REC trading sheets from 2016 showing Class I prices as low as \$23/MWh and now trading at/around \$35/MWh. The surplus of Class I RECs can be attributed to several factors including the growth of in-region resources, in particular behind-the-meter solar in Massachusetts and a growing supply of imports into New England especially from New York State. Figures 1 and 2 contain screen shots from the NEPOOL GIS that show how the number of wind and solar RECs have grown materially from Q1-2015 to Q1-2016.

Solar RECs increased by nearly 100% from 150,888 in Q1-2015 to 298,562 in Q1-2016. Imports of wind RECs also increased by 26% as projects in New York State came off contract and their RECs flowed into New England. New England's higher REC prices, while below their highs, offer a powerful price signal to generators to move into the region. Some of the wind imports also flowed into New England from Canada.



Year - Quarter: 2015 - Q1

by Fuel Attribute | by RPS Eligibility | by Other Attributes

Number of Renewable Certificates by Fuel							
Year	Quarter	Fuel	Fuel Description	# Certificates	# Certificates IMP	# Certificates MSS	# Certificates NON
2015	1	Biomass	Biomass	630,022	0	384,456	245,566
2015	1	Digester gas	Digester gas	10,473	1,594	3,402	5,477
2015	1	Fuel cell	Fuel cell	50,456	0	29,130	21,326
2015	1	Geothermal	Geothermal	44	0	0	44
2015	1	Hydroelectric/Hydropower	Hydroelectric/Hydropower	1,944,931	191,558	1,710,378	42,995
2015	1	Hydrokinetic	Hydrokinetic	6,875	0	129	6,746
2015	1	Landfill gas	Landfill gas	315,511	160,909	127,023	27,579
2015	1	Municipal solid waste	Municipal solid waste	281,908	0	281,908	0
2015	1	Solar	Photovoltaic	150,888	0	5,636	145,252
2015	1	Solar	Thermal	1	0	0	1
2015	1	Trash-to-energy	Trash-to-energy	520,833	0	477,754	43,079
2015	1	Wind	Wind	1,022,073	363,225	628,813	30,035
2015	1	Wood	Wood	604,258	132,401	445,296	26,561
Total				5,538,273	849,687	4,093,925	594,661

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Figure 1: 2015-Q1 REC imports



Year - Quarter: 2016 - Q1

by Fuel Attribute | by RPS Eligibility | by Other Attributes

Number of Renewable Certificates by Fuel							
Year	Quarter	Fuel	Fuel Description	# Certificates	# Certificates IMP	# Certificates MSS	# Certificates NON
2016	1	Biomass	Biomass	645,184	0	454,577	190,607
2016	1	Digester gas	Digester gas	19,500	1,503	3,912	14,085
2016	1	Fuel cell	Fuel cell	58,159	0	32,711	25,448
2016	1	Geothermal	Geothermal	71	0	0	71
2016	1	Hydroelectric/Hydropower	Hydroelectric/Hydropower	2,660,189	289,440	2,315,238	55,511
2016	1	Hydrokinetic	Hydrokinetic	253	0	184	69
2016	1	Landfill gas	Landfill gas	324,219	163,830	134,111	26,278
2016	1	Municipal solid waste	Municipal solid waste	289,047	0	289,047	0
2016	1	Solar	Photovoltaic	298,562	0	9,606	288,956
2016	1	Solar	Thermal	5	0	0	5
2016	1	Trash-to-energy	Trash-to-energy	563,570	0	516,668	46,902
2016	1	Wind	Wind	1,192,550	457,696	701,373	33,481
2016	1	Wood	Wood	610,307	132,164	441,431	36,712
Total				6,661,616	1,044,633	4,898,858	718,125

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Figure 2: 2016-Q1 REC imports

6) Have you accounted for recent and potential RPS policy changes?

Yes. There is on-going tension within the region to see cleaner generation brought online while keeping costs under control. Rhode Island recently increased its RPS mandate to 40% by 2035 however, the effect of the change is still not clear. In July 2016, Massachusetts passed an omnibus energy bill which added a requirement for utilities to solicit contracts for up to 1,200 MW of clean generation that could include a mix of hydro, onshore wind and solar. The bill also requires utilities to competitively solicit proposals for offshore wind up to 1,600 MW by June 30, 2017 and to enter into 15-20 year contracts "provided that reasonable proposals have been received" and state regulators approve. There is no certainty that any proposals will be found acceptable in the near-term given the high price of offshore wind. Massachusetts lawmakers decided against a 1% increase in the RPS annual percentage.

Finally, New York State is moving forward with a clean energy standard³ that includes a subsidy for upstate nuclear power and that will also permit out-of-state generation to be eligible provided it is located adjacent to the NYISO control area. Although specifics such as the alternative compliance payment have not yet been defined, I continue to believe that the price differences between RECs in New England, New York and the PJM control area will direct the flow of Class I RECs into New England and drive down prices to \$25 in future years. As cited in my prior testimony, as much as 3 million wind RECs could flow from New York into New England in the next five years.

Exhibit WA-03s includes a spreadsheet showing the current New York wind resources placed under contract with NYSERDA beginning in 2005 and that are beginning to come off contract this year. The size of the solicitation and the contract price for the RECs is also included in the Exhibit. It is evident that New York State has historically paid considerably less for wind RECs. This helps further enforce that these same RECs are likely to flow into New England.

7) Why are these figures meaningful?

The financial success of Antrim Wind relies on how accurately the Applicant has assessed the Project's production level (capacity factor) and its after-tax cash flow. The Applicant is currently asserting one of the highest P50 capacity factors for the area (37%) and forecasting a bundled REC and energy price (\$81/MWh)

³ <http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={1A8C4DCA-E2CC-449C-AA0D-7F9C3125F8A5}>

that, according to my data, cannot be justified long-term under current market conditions. If the Project produces at a more realistic 31% capacity factor and energy/REC prices are more in line with my analysis, there may not be sufficient cash flow to cover debt and still operate the project in accordance with the certificate. This concern, coupled with the inexperience of the Applicant in building and operating wind energy facilities in New England raises real concerns over whether the Committee can make a positive finding that the Applicant has the financial, technical and managerial ability to proceed with the Project.

8) Does this conclude the public portion of your supplemental testimony?

Yes. Additional pages containing confidential testimony with Exhibits follow but are redacted from this public document. A full, un-redacted hardcopy of this testimony has been sent to the SEC administrator, Pamela Monroe, via U.S. Mail.

EXHIBIT 01s

Analysis of Wind PPA Pricing for New England

Prepared by L. Linowes on behalf of Windaction.org

Date	Henry Hub Futures (\$/MBTU)	Low Cost transport (\$0.25)	High Cost transport (\$1.25)	Conversion to MWh (heat rate 8 MBTU/MWh)	Conversion to MWh (heat rate 8 MBTU/MWh)	Add RGGI (\$10+)	Add RGGI (\$10+)	Add REC (\$40 to \$25)	Add REC (\$40 to \$25)	Winter adder	Price with Winter Adder	Price with Winter Adder	% RGGI Increase
Oct-17	2.994	3.244	4.244	25.952	33.952	29.952	37.952	69.952	77.952	0.00	69.952	77.952	0
Nov-17	3.052	3.302	4.302	26.416	34.416	30.416	38.416	70.416	78.416	0.00	70.416	78.416	0
Dec-17	3.195	3.445	4.445	27.56	35.56	31.56	39.56	71.56	79.56	20.00	91.560	99.560	0
Jan-18	3.294	3.544	4.544	28.352	36.352	32.452	40.452	72.452	80.452	20.00	92.452	100.452	0.025
Feb-18	3.261	3.511	4.511	28.088	36.088	32.188	40.188	72.188	80.188	20.00	92.188	100.188	0.025
Mar-18	3.177	3.427	4.427	27.416	35.416	31.516	39.516	71.516	79.516	20.00	91.516	99.516	0.025
Apr-18	2.808	3.058	4.058	24.464	32.464	28.564	36.564	68.564	76.564	0.00	68.564	76.564	0.025
May-18	2.773	3.023	4.023	24.184	32.184	28.284	36.284	68.284	76.284	0.00	68.284	76.284	0.025
Jun-18	2.8	3.05	4.05	24.4	32.4	28.5	36.5	68.5	76.5	0.00	68.500	76.500	0.025
Jul-18	2.828	3.078	4.078	24.624	32.624	28.724	36.724	68.724	76.724	0.00	68.724	76.724	0.025
Aug-18	2.837	3.087	4.087	24.696	32.696	28.796	36.796	68.796	76.796	0.00	68.796	76.796	0.025
Sep-18	2.819	3.069	4.069	24.552	32.552	28.652	36.652	68.652	76.652	0.00	68.652	76.652	0.025
Oct-18	2.845	3.095	4.095	24.76	32.76	28.86	36.86	68.86	76.86	0.00	68.860	76.860	0.025
Nov-18	2.91	3.16	4.16	25.28	33.28	29.38	37.38	69.38	77.38	0.00	69.380	77.380	0.025
Dec-18	3.05	3.3	4.3	26.4	34.4	30.5	38.5	70.5	78.5	20.00	90.500	98.500	0.025
Jan-19	3.17	3.42	4.42	27.36	35.36	31.56	39.56	71.56	79.56	20.00	91.560	99.560	0.05
Feb-19	3.138	3.388	4.388	27.104	35.104	31.304	39.304	71.304	79.304	20.00	91.304	99.304	0.05
Mar-19	3.078	3.328	4.328	26.624	34.624	30.824	38.824	70.824	78.824	20.00	90.824	98.824	0.05
Apr-19	2.814	3.064	4.064	24.512	32.512	28.712	36.712	68.712	76.712	0.00	68.712	76.712	0.05
May-19	2.804	3.054	4.054	24.432	32.432	28.632	36.632	68.632	76.632	0.00	68.632	76.632	0.05
Jun-19	2.835	3.085	4.085	24.68	32.68	28.88	36.88	68.88	76.88	0.00	68.880	76.880	0.05
Jul-19	2.871	3.121	4.121	24.968	32.968	29.168	37.168	69.168	77.168	0.00	69.168	77.168	0.05
Aug-19	2.884	3.134	4.134	25.072	33.072	29.272	37.272	69.272	77.272	0.00	69.272	77.272	0.05
Sep-19	2.868	3.118	4.118	24.944	32.944	29.144	37.144	69.144	77.144	0.00	69.144	77.144	0.05
Oct-19	2.89	3.14	4.14	25.12	33.12	29.32	37.32	69.32	77.32	0.00	69.320	77.320	0.05
Nov-19	2.96	3.21	4.21	25.68	33.68	29.88	37.88	69.88	77.88	0.00	69.880	77.880	0.05
Dec-19	3.102	3.352	4.352	26.816	34.816	31.016	39.016	71.016	79.016	20.00	91.016	99.016	0.05
Jan-20	3.228	3.478	4.478	27.824	35.824	32.124	40.124	72.124	80.124	20.00	92.124	100.124	0.075
Feb-20	3.196	3.446	4.446	27.568	35.568	31.868	39.868	71.868	79.868	20.00	91.868	99.868	0.075
Mar-20	3.135	3.385	4.385	27.08	35.08	31.38	39.38	71.38	79.38	20.00	91.380	99.380	0.075
Apr-20	2.875	3.125	4.125	25	33	29.3	37.3	69.3	77.3	0.00	69.300	77.300	0.075
May-20	2.868	3.118	4.118	24.944	32.944	29.244	37.244	69.244	77.244	0.00	69.244	77.244	0.075
Jun-20	2.9	3.15	4.15	25.2	33.2	29.5	37.5	69.5	77.5	0.00	69.500	77.500	0.075
Jul-20	2.937	3.187	4.187	25.496	33.496	29.796	37.796	69.796	77.796	0.00	69.796	77.796	0.075
Aug-20	2.965	3.215	4.215	25.72	33.72	30.02	38.02	70.02	78.02	0.00	70.020	78.020	0.075
Sep-20	2.966	3.216	4.216	25.728	33.728	30.028	38.028	70.028	78.028	0.00	70.028	78.028	0.075
Oct-20	2.996	3.246	4.246	25.968	33.968	30.268	38.268	70.268	78.268	0.00	70.268	78.268	0.075
Nov-20	3.069	3.319	4.319	26.552	34.552	30.852	38.852	70.852	78.852	0.00	70.852	78.852	0.075
Dec-20	3.217	3.467	4.467	27.736	35.736	32.036	40.036	72.036	80.036	0.00	72.036	80.036	0.075
Jan-21	3.352	3.602	4.602	28.816	36.816	33.216	41.216	73.216	81.216	0.00	73.216	81.216	0.1
Feb-21	3.32	3.57	4.57	28.56	36.56	32.96	40.96	72.96	80.96	0.00	72.960	80.960	0.1
Mar-21	3.258	3.508	4.508	28.064	36.064	32.464	40.464	72.464	80.464	0.00	72.464	80.464	0.1
Apr-21	2.991	3.241	4.241	25.928	33.928	30.328	38.328	70.328	78.328	0.00	70.328	78.328	0.1
May-21	2.986	3.236	4.236	25.888	33.888	30.288	38.288	70.288	78.288	0.00	70.288	78.288	0.1
Jun-21	3.018	3.268	4.268	26.144	34.144	30.544	38.544	70.544	78.544	0.00	70.544	78.544	0.1
Jul-21	3.055	3.305	4.305	26.44	34.44	30.84	38.84	70.84	78.84	0.00	70.840	78.840	0.1
Aug-21	3.089	3.339	4.339	26.712	34.712	31.112	39.112	71.112	79.112	0.00	71.112	79.112	0.1
Sep-21	3.092	3.342	4.342	26.736	34.736	31.136	39.136	71.136	79.136	0.00	71.136	79.136	0.1
Oct-21	3.128	3.378	4.378	27.024	35.024	31.424	39.424	71.424	79.424	0.00	71.424	79.424	0.1
Nov-21	3.208	3.458	4.458	27.664	35.664	32.064	40.064	72.064	80.064	0.00	72.064	80.064	0.1
Dec-21	3.362	3.612	4.612	28.896	36.896	33.296	41.296	73.296	81.296	0.00	73.296	81.296	0.1
Jan-22	3.511	3.761	4.761	30.088	38.088	34.588	42.588	75.588	83.588	0.00	75.588	83.588	0.125
Feb-22	3.486	3.736	4.736	29.888	37.888	34.388	42.388	75.388	83.388	0.00	75.388	83.388	0.125
Mar-22	3.424	3.674	4.674	29.392	37.392	33.892	41.892	74.892	82.892	0.00	74.892	82.892	0.125
Apr-22	3.159	3.409	4.409	27.272	35.272	31.772	39.772	71.772	79.772	0.00	71.772	79.772	0.125
May-22	3.154	3.404	4.404	27.232	35.232	31.732	39.732	71.732	79.732	0.00	71.732	79.732	0.125
Jun-22	3.186	3.436	4.436	27.488	35.488	31.988	39.988	72.988	80.988	0.00	72.988	80.988	0.125
Jul-22	3.224	3.474	4.474	27.792	35.792	32.292	40.292	73.292	81.292	0.00	73.292	81.292	0.125
Aug-22	3.26	3.51	4.51	28.08	36.08	32.58	40.58	73.58	81.58	0.00	73.580	81.580	0.125
Sep-22	3.265	3.515	4.515	28.12	36.12	32.62	40.62	73.62	81.62	0.00	73.620	81.620	0.125
Oct-22	3.305	3.555	4.555	28.44	36.44	32.94	40.94	74.94	82.94	0.00	74.940	82.940	0.125
Nov-22	3.385	3.635	4.635	29.08	37.08	33.58	41.58	75.58	83.58	0.00	75.580	83.580	0.125
Dec-22	3.543	3.793	4.793	30.344	38.344	34.844	42.844	76.844	84.844	0.00	76.844	84.844	0.125
Jan-23	3.693	3.943	4.943	31.544	39.544	36.144	44.144	78.144	86.144	0.00	78.144	86.144	0.15

Feb-23	3.668	3.918	4.918	31.344	39.344	35.944	43.944	60.944	68.944	0.00	60.944	68.944	0.15
Mar-23	3.607	3.857	4.857	30.856	38.856	35.456	43.456	60.456	68.456	0.00	60.456	68.456	0.15
Apr-23	3.342	3.592	4.592	28.736	36.736	33.336	41.336	58.336	66.336	0.00	58.336	66.336	0.15
May-23	3.337	3.587	4.587	28.696	36.696	33.296	41.296	58.296	66.296	0.00	58.296	66.296	0.15
Jun-23	3.369	3.619	4.619	28.952	36.952	33.552	41.552	58.552	66.552	0.00	58.552	66.552	0.15
Jul-23	3.407	3.657	4.657	29.256	37.256	33.856	41.856	58.856	66.856	0.00	58.856	66.856	0.15
Aug-23	3.443	3.693	4.693	29.544	37.544	34.144	42.144	59.144	67.144	0.00	59.144	67.144	0.15
Sep-23	3.452	3.702	4.702	29.616	37.616	34.216	42.216	59.216	67.216	0.00	59.216	67.216	0.15
Oct-23	3.497	3.747	4.747	29.976	37.976	34.576	42.576	59.576	67.576	0.00	59.576	67.576	0.15
Nov-23	3.577	3.827	4.827	30.616	38.616	35.216	43.216	60.216	68.216	0.00	60.216	68.216	0.15
Dec-23	3.731	3.981	4.981	31.848	39.848	36.448	44.448	61.448	69.448	0.00	61.448	69.448	0.15
Jan-24	3.878	4.128	5.128	33.024	41.024	37.724	45.724	62.724	70.724	0.00	62.724	70.724	0.175
Feb-24	3.853	4.103	5.103	32.824	40.824	37.524	45.524	62.524	70.524	0.00	62.524	70.524	0.175
Mar-24	3.788	4.038	5.038	32.304	40.304	37.004	45.004	62.004	70.004	0.00	62.004	70.004	0.175
Apr-24	3.523	3.773	4.773	30.184	38.184	34.884	42.884	59.884	67.884	0.00	59.884	67.884	0.175
May-24	3.513	3.763	4.763	30.104	38.104	34.804	42.804	59.804	67.804	0.00	59.804	67.804	0.175
Jun-24	3.545	3.795	4.795	30.36	38.36	35.06	43.06	60.06	68.06	0.00	60.060	68.060	0.175
Jul-24	3.59	3.84	4.84	30.72	38.72	35.42	43.42	60.42	68.42	0.00	60.420	68.420	0.175
Aug-24	3.626	3.876	4.876	31.008	39.008	35.708	43.708	60.708	68.708	0.00	60.708	68.708	0.175
Sep-24	3.637	3.887	4.887	31.096	39.096	35.796	43.796	60.796	68.796	0.00	60.796	68.796	0.175
Oct-24	3.687	3.937	4.937	31.496	39.496	36.196	44.196	61.196	69.196	0.00	61.196	69.196	0.175
Nov-24	3.769	4.019	5.019	32.152	40.152	36.852	44.852	61.852	69.852	0.00	61.852	69.852	0.175
Dec-24	3.921	4.171	5.171	33.368	41.368	38.068	46.068	63.068	71.068	0.00	63.068	71.068	0.175
Jan-25	4.063	4.313	5.313	34.504	42.504	39.304	47.304	64.304	72.304	0.00	64.304	72.304	0.2
Feb-25	4.038	4.288	5.288	34.304	42.304	39.104	47.104	64.104	72.104	0.00	64.104	72.104	0.2
Mar-25	3.973	4.223	5.223	33.784	41.784	38.584	46.584	63.584	71.584	0.00	63.584	71.584	0.2
Apr-25	3.698	3.948	4.948	31.584	39.584	36.384	44.384	61.384	69.384	0.00	61.384	69.384	0.2
May-25	3.684	3.934	4.934	31.472	39.472	36.272	44.272	61.272	69.272	0.00	61.272	69.272	0.2
Jun-25	3.717	3.967	4.967	31.736	39.736	36.536	44.536	61.536	69.536	0.00	61.536	69.536	0.2
AVERAGES				28.133	36.133	32.546	40.546	61.901	69.901		64.481	72.481	
Notes:													
Henry Hub source as of August 13, 2016 - http://www.cmegroup.com/trading/energy/natural-gas/natural-gas.html													
Assumptions -													
1	Natural gas sources closer to New England are likely to have lower delivery charges.												
2	0.4 RGGI allowances per MWh based on CO2/MWh rates cited in ISO-NE Annual Emissions Report												
3	price per RGGI allowance of \$10 in 2017 and increasing 2.5% annually after that												
4	a transport range from \$0.25 to \$1.25. Prices at the New England hub will be at the low end.												
5	heat rate of 8000 btu/kwh or 8 MBTU/MWh (ISO-NE Annual Emissions Report)												
6	\$40 REC value until Jan 2020 and then drops to \$25												
7	Winter adder assumes oil burned approximately 25% of the time; 6 MBTU per barrel. \$45/barrel at 11,000 efficiency (adder = (\$45/6)*.25*11)												
Prepared by Llinowes, windaction.org													

EXHIBIT WA-02s



March 31, 2016

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Carbon			PJM			NEPOOL		
RGGI	Bid	Offer	NJ Class I	Bid	Offer	MA Class I	Bid	Offer
Apr'16 v'16	5.23	5.29	RY 2014	12.50	13.25	2015	23.00	30.00
Dec'16 v'16	5.28	5.33	RY 2015	12.75	13.75	2016	25.00	35.00
			RY 2016	13.00	14.00	2017	30.00	40.00
			RY 2017	13.75	14.50	2018	30.00	40.00
			RY 2018	14.75	15.50	2019	30.00	40.00
			RY 2019	15.25	16.00	2020	35.00	40.00
			RY 2020	15.00	16.00			
CCA	Bid	Offer	NJ Class II	Bid	Offer	MA Class II Waste	Bid	Offer
ICE - Apr'16 v'16	12.45	12.55	RY 2016	6.00	7.00	2015	6.00	6.75
ICE - Dec'16 v'16	12.60	12.70	RY 2017	8.50	9.50	2016	6.25	7.25
ICE - Dec'17 v'17	12.93	13.20	RY 2018	9.00	10.00	MA Class II Non-Waste	Bid	Offer
			RY 2019	9.50	10.50	2015	26.50	27.50
						2016	26.50	28.50
Solar			PA Tier I	Bid	Offer	MA APS	Bid	Offer
NJ Solar	Bid	Offer	RY 2014	12.50	13.00	2015	21.00	21.50
RY 2014	270.00	280.00	RY 2015	12.75	13.50	2016	20.75	21.75
RY 2015	275.00	285.00	RY 2016	12.75	13.75	CT Class I	Bid	Offer
RY 2016	280.00	288.00	RY 2017	13.50	14.50	2015	22.75	29.75
RY 2017	280.00	290.00	RY 2018	14.50	15.25	2016	24.75	34.75
RY 2018	235.00	245.00	PA Tier II	Bid	Offer	2017	29.75	39.75
RY 2019	180.00	190.00	RY 2015	0.03	0.10	2018	29.75	39.75
RY 2020	153.00	163.00	RY 2016	0.05	0.10	2019	29.75	39.75
PA Solar	Bid	Offer	DE Tier I	Bid	Offer	CT Class II	Bid	Offer
RY 2015	12	16	RY 2014	13.75	14.50	2015	0.75	1.50
RY 2016	15	17	RY 2015	14.00	14.75	2016	1.25	1.75
RY 2017	16	20	RY 2016	14.25	15.00	2017	1.00	2.25
RY 2018	17	21	DE Existing	Bid	Offer	CT Class III	Bid	Offer
MD Solar	Bid	Offer	RY 2015	0.50	-	2015	27.00	28.50
2015	75	100	DC Tier I	Bid	Offer	2016	27.00	28.25
2016	70	85	2015	0.75	1.75	2017	26.25	27.75
2017	75	85	2016	1.25	3.00	2018	25.50	27.00
2018	45	75	DC Tier II	Bid	Offer	RI New	Bid	Offer
2019	40	65	2015	0.40	1.00	2015	22.75	29.75
DC Solar	Bid	Offer	2016	0.60	1.50	2016	24.75	34.75
2015	480	495	MD Tier I	Bid	Offer	2017	29.75	39.75
2016	480	495	2014	10.00	12.00	2018	29.75	39.75
2017	320	345	2015	12.00	13.00	RI Existing	Bid	Offer
DE Solar	Bid	Offer	2016	12.75	13.25	2015	0.50	0.95
CY 2015	28	32	2017	12.75	14.40	ME New	Bid	Offer
NC Solar Out-of-State	Bid	Offer	2018	12.75	15.50	2015	20.00	27.00
2015	1.50	3.00	MD Tier II	Bid	Offer	2016	23.00	33.00
MA SREC I	Bid	Offer	2014	0.25	0.50	2017	27.00	37.00
2015	460	470	2015	0.40	1.00	ME Existing	Bid	Offer
2016	450	457.5	2016	0.60	1.50	2015	0.30	0.50
2017	300	305	OH Certified	Bid	Offer	2016	0.50	0.75
2018	275	290	2014	1.00	2.25	NH Class I	Bid	Offer
2019	265	285	2015	1.25	2.50	2015	22.75	29.75
MA SREC I Reminted	Bid	Offer	IL ARES Wind	Bid	Offer	2016	24.75	34.75
2013	460	470	BH 2014	0.27	0.35	2017	29.75	39.75
2014	460	470	FH 2015	0.27	0.40	NH Class II	Bid	Offer
MA SREC II	Bid	Offer	BH 2015	0.30	0.40	2015	54.00	-
2015	265	275	FH 2016	0.35	0.45	NH Class III	Bid	Offer
2016	260	270	BH 2016	0.40	0.50	2015	43.50	-
2017	255	265	IL ARES Non-Wind	Bid	Offer	NH Class IV	Bid	Offer
2018	255	265	Call for pricing			2015	25.25	26.00
2019	210	240	TEXAS			Emissions		
OH Certified Solar	Bid	Offer	TX RECs Green-e	Bid	Offer	CSAPR NOx Annl	Bid	Offer
2015	16	23	BH 2014	0.30	0.36	2015	65	110
2016	17	25	FH 2015	0.30	0.37	2016	45	100
Texas			BH 2015	0.33	0.38	CSAPR NOx Seasonal	Bid	Offer
TX RECs Green-e	Bid	Offer	FH 2016	0.35	0.40	2016	125	175
BH 2014	0.30	0.36	CAL 2015	0.33	0.38	CSAPR SO2 Grp 1	Bid	Offer
FH 2015	0.30	0.37	CAL 2016	0.35	0.41	2015	0.50	5
BH 2015	0.33	0.38	CAL 2017	0.40	0.45	CSAPR SO2 Grp 2	Bid	Offer
FH 2016	0.35	0.40	PNW Wind	Bid	Offer	2015	1	7
CAL 2015	0.33	0.38	CAL 2015	0.85	1.00	Climate Action Reserve		
CAL 2016	0.35	0.41	CAL 2016	1.00	1.50	Forestry	Bid	Offer
CAL 2017	0.40	0.45	National Green-e Any	Bid	Offer	Call for pricing		
TX Compliance RECs	Bid	Offer	G-e RY 2014	0.30	0.38	Ag Methane	Bid	Offer
2013	0.30	0.35	G-e RY 2015	0.30	0.38	Call for pricing		
2014	0.30	0.36	National Green-e Wind	Bid	Offer	LFG	Bid	Offer
2015	0.30	0.39	BH 2014	0.30	0.35	Call for pricing		
Michigan			FH 2015	0.30	0.36	CEC TREC	Bid	Offer
MI-RECs	Bid	Offer	BH 2015	0.34	0.37	Call for pricing		
2014	0.50	1.50	FH 2016	0.35	0.40			
2015	0.75	2.00	BH 2016	0.36	0.41			
WECC			CAL 2015	0.34	0.38			
WECC REC	Bid	Offer	CAL 2016	0.36	0.41			
2014	0.30	0.95						
2015	0.40	1.00						

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August 5, 2016

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Carbon			PJM			NEPOOL		
RGGI	Bid	Offer	NJ Class I	Bid	Offer	MA Class I	Bid	Offer
Aug '16 v'16	4.49	4.69	RY 2014	11.00	12.00	2016	35.00	40.00
Dec'16 v'16	4.55	4.70	RY 2015	12.25	13.00	2017	36.50	40.00
			RY 2016	12.75	13.50	2018	38.50	42.00
			RY 2017	13.25	13.75	2019	41.00	43.50
			RY 2018	14.25	14.75	2020	40.00	44.00
			RY 2019	14.75	15.25			
			RY 2020	14.25	14.75			
CCA	Bid	Offer	NJ Class II	Bid	Offer	MA Class II Waste	Bid	Offer
ICE - Aug '16 v'16	12.77	12.83	RY 2016	5.00	6.00	2016	6.25	7.25
ICE - Dec'16 v'16	12.80	12.85	RY 2017	7.00	7.50			
ICE - Dec'17 v'17	12.95	13.25	RY 2018	9.00	10.00	MA Class II Non-Waste	Bid	Offer
			RY 2019	9.50	10.50	2016	26.50	28.50
Solar			PA Tier I	Bid	Offer	MA APS	Bid	Offer
NJ Solar	Bid	Offer	RY 2014	10.75	12.00	2016	20.75	21.75
RY 2014	240.00	250.00	RY 2015	12.00	13.00			
RY 2015	242.50	250.00	RY 2016	12.50	13.50	CT Class I	Bid	Offer
RY 2016	242.50	250.00	RY 2017	13.00	13.75	2016	35.00	40.00
RY 2017	245.00	252.50	RY 2018	14.00	14.75	2017	36.50	40.00
RY 2018	205.00	215.00				2018	38.50	42.00
RY 2019	145.00	160.00	PA Tier II	Bid	Offer	2019	41.00	43.50
RY 2020	130.00	150.00	RY 2015	0.03	0.10	2020	40.00	44.00
			RY 2016	0.05	0.10	CT Class II	Bid	Offer
PA Solar	Bid	Offer	DE Tier I	Bid	Offer	2016	0.90	1.60
RY 2015	12	13	RY 2014	11.00	12.00	2017	1.00	2.25
RY 2016	12.75	14	RY 2015	12.25	12.75			
RY 2017	13	15	RY 2016	12.75	13.25	CT Class III	Bid	Offer
RY 2018	14	16	DE Existing	Bid	Offer	2016	27.00	28.25
			RY 2015	0.50	-	2017	26.25	27.50
MD Solar	Bid	Offer	DC Tier I	Bid	Offer	2018	25.50	26.50
2015	20	35	2015	2.50	3.50	2019	24.75	25.50
2016	25	35	2016	2.75	3.75	RI New	Bid	Offer
2017	20	40	2017	3.00	4.00	2016	35.00	40.00
2018	20	40	2018	3.25	4.25	2017	36.50	40.00
2019	20	40	DC Tier II	Bid	Offer	2018	38.50	42.00
			2015	0.40	0.75			
DC Solar	Bid	Offer	2016	0.60	1.00	RI Existing	Bid	Offer
2015	480	495	MD Tier I	Bid	Offer	2016	0.75	1.25
2016	480	495	2014	10.50	11.50			
2017	320	345	2015	11.25	11.75	ME New	Bid	Offer
			2016	11.50	12.00	2016	30.00	37.50
DE Solar	Bid	Offer	2017	12.25	13.25	2017	30.00	37.50
CY 2015	28	32	2018	13.50	14.50	ME Existing	Bid	Offer
NC Solar Out-of-State	Bid	Offer	MD Tier II	Bid	Offer	2016	0.50	0.75
2015	1.50	3.00	2014	0.25	0.50			
			2015	0.40	0.60	NH Class I	Bid	Offer
MA SREC I	Bid	Offer	2016	0.50	0.60	2016	35.00	40.00
2016	440	445	OH Certified	Bid	Offer	2017	36.50	40.00
2017	350	360	2015	1.25	2.50			
2018	300	310	2016	1.50	2.75	NH Class II	Bid	Offer
2019	285	295	IL ARES Wind	Bid	Offer	2016	-	-
			BH 2014	0.27	0.35	NH Class III	Bid	Offer
MA SREC I Reminted	Bid	Offer	FH 2015	0.32	0.45	2016		
2014	420	435	BH 2015	0.40	0.50	NH Class IV	Bid	Offer
			FH 2016	0.40	0.50	2016		
MA SREC II	Bid	Offer	BH 2016	0.50	0.60	Emissions		
2016	272.5	280	IL ARES Non-Wind	Bid	Offer	CSAPR NOx Annl	Bid	Offer
2017	287.5	297.5	Call for pricing			2016	10	30
2018	287.5	297.5	VOLUNTARY and GREEN-e			CSAPR NOx Seasonal	Bid	Offer
2019	242.5	247.5	MRO Green-e Wind	Bid	Offer	2016	190	240
2020	195	210	BH 2015	0.30	0.35	CSAPR SO2 Grp 1	Bid	Offer
OH Certified Solar	Bid	Offer	FH 2016	0.30	0.38	2016	1.00	3
2015	10	13	PNW Wind	Bid	Offer	CSAPR SO2 Grp 2	Bid	Offer
2016	11	14	CAL 2016	1.00	1.75	2016	2	6
			CAL 2017	1.00	1.75	Climate Action Reserve		
Texas			National Green-e Any	Bid	Offer	Forestry	Bid	Offer
TX RECs Green-e	Bid	Offer	G-e RY 2016	0.30	0.35	Call for pricing		
BH 2015	0.30	0.35	National Green-e Wind	Bid	Offer	Ag Methane	Bid	Offer
FH 2016	0.32	0.36	BH 2015	0.30	0.35	Call for pricing		
BH 2016	0.32	0.38	FH 2016	0.30	0.35	LFG	Bid	Offer
CAL 2016	0.32	0.38	BH 2016	0.32	0.38	Call for pricing		
CAL 2017	0.34	0.43				CEC TREC	Bid	Offer
CAL 2018	0.37	0.45				Call for pricing		
CAL 2019	0.40	0.47						
TX Compliance RECs	Bid	Offer						
2014	0.27	0.33						
2015	0.27	0.34						
2016	0.30	0.36						
Michigan								
MI-RECs	Bid	Offer						
2015	0.75	2.00						
WECC								
WECC REC	Bid	Offer						
2015	0.65	1.40						
2016	0.75	1.50						

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EXHIBIT WA-03s

New York State Wind Contracts (2005-2014)

Facility	County	Year Solicitation	Bid Capacity (MW)	Maximum Contract (MWh)	\$/MWh	
Maple Ridge I	Lewis	Jan-05	231	605,820	\$22.90	
Dutch Hill WF	Steuben	Feb-07	4.3	8,513	\$15.52	
Cohocton WF	Steuben	Feb-07	8.3	23,372	\$15.52	
Clinton WP	Clinton	Feb-07	95.5	180,747	\$15.52	
Ellenburg WP	Clinton	Feb-07	77	167,381	\$15.52	
Bliss WP	Wyoming	Feb-07	95.5	191,720	\$15.52	
Altona WP	Clinton	Feb-07	96.9	188,282	\$15.52	
Chateaugay WP	Franklin	Feb-07	101.2	215,058	\$15.52	
Wethersfield WP	Wyoming	Oct-07	119.7	314,572	\$14.75	
Dutch Hill WF	Steuben	Oct-07	11.3	28,200	\$14.75	
Cohocton WF	Steuben	Oct-07	26.3	65,700	\$14.75	
Hardscrabble	Herkimer	Dec-09	43.7	121,508	\$19.76	
Hardscrabble	Herkimer	Mar-10	26.6	74,141	\$21.17	
Steel Winds II	Erie	Mar-10	14.3	37,430	\$21.17	
High Sheldon WF	Wyoming	Mar-10	106.9	228,200	\$21.17	
Marble River WF	Clinton	Apr-11	204.5	581,510	\$22.01	
Howard WF	Steuben	Apr-11	46.1	115,184	\$22.01	
Orangeville WF	Wyoming	Apr-11	88.2	279,103	\$22.01	
Locust Ridge WF	Schuykill PA	Dec-11	24.7	54,093	\$28.70	
Howard WF Expansion	Steuben	Dec-11	3.9	9,849	\$28.70	
Howard WF	Steuben	Jan-13	2.6	6,359	\$34.95	
Zotos Intl Wind	Ontario	Jan-13	3.1	3,847	\$34.95	
Marsh Hill WF	Steuben	Jan-13	15.4	52,526	\$34.95	
Black Oak WF	Tompkins	Jan-13	12	40,894	\$34.95	
Cody Road WF	Madison	Jan-13	9.5	27,463	\$34.95	
Arkwright Summit	Chautauqua	Oct-14	73.8	229,873	\$22.96	(20 Years)
Jericho Rise	Franklin	Oct-14	73.8	206,272	\$22.96	(20 Years)
			1,616	4,057,617		

Source:

NYSERDA 2016 RPS Annual Report: <http://www.nysedra.ny.gov/-/media/Files/Publications/Energy-Analysis/RPS/2016-RPS-Annual-Report.pdf>