

## DRAFT Energy Efficiency Cost-Benefit Analysis Avoided Cost Assumptions

Revised July 25, 2012

The key avoided cost assumptions for the energy efficiency cost-benefit analysis and the data sources and processes for determining these components are discussed below. The avoided costs presented here are assumptions and should not be considered forecasts or projections into the future. Additionally, these assumptions are intended to be used for Energy Efficiency cost-benefit analysis only.

This is an update of the June 5, 2012 draft report. This report reflects the recent EIA release of the Annual Energy Outlook 2012 final report and also corrects minor calculation errors in the Capacity Price forecast. CEEEP also updated the escalator for wholesale electricity based on comments from Rate Counsel and extended the avoided cost projections out to 2035 based on comments from New Jersey Natural Gas.

**Retail Electricity Prices:** Historic 2011 U.S. Energy Information Administration (EIA) New Jersey retail electricity prices were escalated using an annual growth rate derived from the EIA Annual Energy Outlook 2012 for the Mid-Atlantic region. On average, the annual growth rate was about 2.1%. The NJ Clean Energy Programs do not distinguish between commercial and industrial sectors, therefore the commercial and industrial prices were averaged based on historic 2011 New Jersey retail electricity sales. The 7% Sales and Use Tax and Societal Benefits Charge<sup>1</sup> were also included.

**Wholesale Electricity Prices:** Historic 2011 New Jersey wholesale electric prices from PJM were escalated based on the annual percent change in the Annual Energy Outlook Reliability First Corporation/East Electricity Generation Prices<sup>2</sup>. The annual percent change was, on average, about 2.2%. The seasonal peak and off-peak factors were derived using historic 2011 PJM LMP data. Summer is defined as May through September, winter is defined as October through April, on-peak is defined as Monday through Friday 8am-8pm, and off-peak is defined as Monday-Friday 8pm-8am and weekends and holidays.

**Table 1: Retail and Wholesale Electricity**

	<i>Retail (\$/kWh)</i>		<i>Wholesale (\$/MWh)</i>				
	Residential	Commercial & Industrial	Average Price	Summer Peak	Summer Off-Peak	Non-Summer Peak	Non-Summer Off-Peak
2011	\$0.18	\$0.15	\$47.39	\$64.09	\$37.03	\$49.40	\$40.80
2012	\$0.18	\$0.14	\$50.67	\$68.53	\$39.59	\$52.82	\$43.63
2013	\$0.18	\$0.14	\$49.36	\$66.75	\$38.56	\$51.45	\$42.49
2014	\$0.19	\$0.14	\$49.64	\$67.14	\$38.79	\$51.75	\$42.74
2015	\$0.19	\$0.14	\$49.48	\$66.93	\$38.66	\$51.58	\$42.60
2016	\$0.19	\$0.15	\$49.92	\$67.51	\$39.00	\$52.04	\$42.98
2017	\$0.20	\$0.15	\$52.92	\$71.58	\$41.35	\$55.17	\$45.56
2018	\$0.20	\$0.15	\$55.67	\$75.29	\$43.49	\$58.03	\$47.93
2019	\$0.20	\$0.15	\$54.51	\$73.73	\$42.59	\$56.83	\$46.93
2020	\$0.20	\$0.16	\$59.78	\$80.85	\$46.71	\$62.31	\$51.47
2021	\$0.21	\$0.16	\$62.79	\$84.92	\$49.06	\$65.45	\$54.06
2022	\$0.21	\$0.16	\$65.55	\$88.66	\$51.22	\$68.34	\$56.44
2023	\$0.22	\$0.17	\$68.99	\$93.31	\$53.91	\$71.92	\$59.40
2024	\$0.22	\$0.17	\$72.11	\$97.53	\$56.34	\$75.17	\$62.08

<sup>1</sup> The Societal Benefits Charge for electric customers was assumed to be 3.6% for residential and 4.8% for C&I.

<sup>2</sup> The RFCE Electricity Generation prices are approximately 16% higher than the wholesale electricity price assumptions CEEEP presents in Table 1.

2025	\$0.23	\$0.17	\$74.03	\$100.12	\$57.84	\$77.17	\$63.74
2026	\$0.23	\$0.17	\$75.49	\$102.09	\$58.98	\$78.69	\$64.99
2027	\$0.24	\$0.17	\$77.37	\$104.65	\$60.45	\$80.66	\$66.62
2028	\$0.25	\$0.18	\$79.97	\$108.16	\$62.49	\$83.37	\$68.86
2029	\$0.25	\$0.18	\$82.86	\$112.07	\$64.74	\$86.38	\$71.34
2030	\$0.26	\$0.19	\$84.83	\$114.73	\$66.28	\$88.43	\$73.03
2031	\$0.27	\$0.19	\$88.13	\$119.20	\$68.86	\$91.87	\$75.88
2032	\$0.27	\$0.20	\$90.37	\$122.23	\$70.61	\$94.21	\$77.81
2033	\$0.28	\$0.20	\$94.00	\$127.14	\$73.45	\$97.99	\$80.93
2034	\$0.29	\$0.21	\$99.44	\$134.49	\$77.70	\$103.66	\$85.62
2035	\$0.30	\$0.22	\$104.78	\$141.71	\$81.87	\$109.22	\$90.21

**Retail Natural Gas Prices:** Historic 2011 EIA New Jersey retail natural gas prices were escalated using an annual growth rate derived from the Mid-Atlantic Region EIA Annual Energy Outlook 2012 electric price forecasts. On average, the annual growth rate was about 2.9%. Missing monthly Residential and Industrial Retail Natural Gas prices were estimated using a linear interpolation. The 7% Sales and Use Tax and Societal Benefits Charge<sup>3</sup> were also included.

**Wholesale (Henry Hub) Natural Gas Prices:** Wholesale natural gas prices are taken from the EIA Annual Energy Outlook 2012.

**Table 2: Retail and Wholesale Natural Gas (\$/MMBtu)**

	<i>Retail Prices</i>			<i>Henry Hub Wholesale Prices</i>		
	Residential	Commercial	Industrial	Average Price	Summer	Winter
2011	\$13.68	\$10.44	\$9.95	\$4.02	\$3.89	\$4.15
2012	\$13.85	\$10.66	\$9.36	\$3.70	\$3.58	\$3.82
2013	\$13.88	\$10.62	\$9.65	\$4.24	\$4.10	\$4.37
2014	\$13.77	\$10.60	\$10.00	\$4.41	\$4.27	\$4.56
2015	\$14.16	\$10.87	\$10.32	\$4.62	\$4.47	\$4.78
2016	\$14.39	\$10.99	\$10.37	\$4.67	\$4.52	\$4.82
2017	\$14.67	\$11.15	\$10.51	\$4.79	\$4.63	\$4.95
2018	\$15.06	\$11.44	\$10.80	\$4.93	\$4.77	\$5.10
2019	\$15.50	\$11.76	\$11.15	\$5.16	\$4.99	\$5.33
2020	\$15.98	\$12.12	\$11.56	\$5.39	\$5.21	\$5.56
2021	\$16.59	\$12.61	\$12.12	\$5.77	\$5.58	\$5.95
2022	\$17.24	\$13.13	\$12.73	\$6.22	\$6.01	\$6.42
2023	\$17.82	\$13.57	\$13.24	\$6.58	\$6.37	\$6.80
2024	\$18.32	\$13.94	\$13.64	\$6.88	\$6.65	\$7.10
2025	\$18.94	\$14.43	\$14.21	\$7.23	\$6.99	\$7.47
2026	\$19.54	\$14.88	\$14.74	\$7.56	\$7.31	\$7.80
2027	\$20.14	\$15.33	\$15.25	\$7.93	\$7.67	\$8.19
2028	\$20.74	\$15.76	\$15.74	\$8.22	\$7.95	\$8.49
2029	\$21.38	\$16.24	\$16.27	\$8.57	\$8.29	\$8.85
2030	\$22.11	\$16.79	\$16.91	\$8.95	\$8.66	\$9.25
2031	\$22.96	\$17.43	\$17.67	\$9.35	\$9.04	\$9.66
2032	\$23.81	\$18.09	\$18.42	\$9.81	\$9.49	\$10.13
2033	\$24.54	\$18.63	\$19.04	\$10.19	\$9.85	\$10.52
2034	\$25.60	\$19.48	\$20.08	\$10.94	\$10.59	\$11.30
2035	\$26.63	\$20.29	\$21.05	\$11.67	\$11.28	\$12.05

<sup>3</sup> The Societal Benefits Charge for natural gas customers was assumed to be 4.1% for residential and 5.0% for C&I.

**Capacity Prices:** New Jersey Utility PJM Reliability Pricing Model (RPM) prices for the 4-utilities (AE, JCP&L, PSE&G and RECO) for 2010 to 2015 were weighted by each utility’s historic 2011 peak load<sup>4</sup> to estimate an average New Jersey capacity price. From 2016 to 2030, the capacity prices were escalated based on the EIA projected annual change in U.S. Consumer Price Index (CPI), which is also reported.<sup>5</sup>

**Table 3: Capacity Price (\$/kW-year) and U.S. Consumer Price Index**

	\$/kW-year	CPI
2011	\$49.87	2.25
2012	\$49.11	2.28
2013	\$75.38	2.31
2014	\$70.93	2.36
2015	\$59.41	2.42
2016	\$60.64	2.47
2017	\$61.62	2.51
2018	\$63.10	2.57
2019	\$64.32	2.62
2020	\$65.55	2.67
2021	\$66.78	2.72
2022	\$68.25	2.78
2023	\$69.48	2.83
2024	\$70.95	2.89
2025	\$72.42	2.95
2026	\$73.90	3.01
2027	\$75.62	3.08
2028	\$77.33	3.15
2029	\$79.30	3.23
2030	\$81.02	3.30
2031	\$83.23	3.39
2032	\$85.44	3.48
2033	\$87.16	3.55
2034	\$89.12	3.63
2035	\$91.33	3.72

**Discount Rate:** Discount rates are used to convert future economic values into present day dollars. A nominal discount rate of 8% is used.<sup>6</sup>

**Avoided Electric and Natural Gas Losses:** Avoided electric transmission losses are assumed to be 7.6%<sup>7</sup> and avoided natural gas losses are assumed to be 1.4%<sup>8</sup> based on data calculations from EnerNOC Utility Solutions<sup>9</sup>. The unreferenced New Jersey Protocols assume 11% and 1% respectively. The updated avoided loss estimates have been submitted to Applied Energy Group to update the New Jersey Protocols in the future.

**Avoided Electric and Natural Gas Transmission and Distribution (T&D):** Estimated Electric T&D costs from various studies have been compiled and are presented in Table 4.

<sup>4</sup> PJM Reliability Pricing Model User Information. Base Residual Auction Results [www.pjm.com/markets-and-operations/rpm/rpm-auction-user-info.aspx#Item01](http://www.pjm.com/markets-and-operations/rpm/rpm-auction-user-info.aspx#Item01); PJM. Historic Load Data.

<sup>5</sup> U.S. Department of Labor [ftp://ftp.bls.gov/pub/special.requests/cpi/cpi.txt](http://ftp.bls.gov/pub/special.requests/cpi/cpi.txt); EIA Annual Energy Outlook 2010.

<sup>6</sup> Levitan & Associates, Inc. Long-term Capacity Agreement Pilot Program (March 2011).

<sup>7</sup> 10 year (2001-2010) Average: "New Jersey Supply and Disposition of Electricity"

<http://www.eia.gov/electricity/state/newjersey>

<sup>8</sup> Energy Information Administration natural Gas Transmission: <http://www.eia.gov/pub/itg/ghgp9.htm>

<sup>9</sup> EnerNOC Utility Solutions performed the calculations as part of the 2012 Energy Efficiency Market Potential Study for the New Jersey Clean Energy Program. The line losses are derived from EIA data referenced above.

**Table 4: Avoided Electric T&D Cost Estimates (\$/kW-yr)<sup>10,11</sup>**

Company/Area	State	Transmission	Distribution	Total
NStar	MA	\$14.41	\$85.28	\$99.69
CL&P	CT	\$1.25	\$29.74	\$30.99
WMECo	ME	\$20.30	\$60.87	\$81.17
National Grid MA	MA	\$19.95	\$109.25	\$129.20
National Grid RI	RI	\$19.95	\$87.13	\$107.08
UI	CT	\$2.54	\$45.96	\$48.50
CL&P	CT			\$29.20
Statewide	WI			\$30
Upstate	NY			\$33.50
SCE	CA			\$54.60
SDG&E	CA			\$74.80
PG&E	CA			\$76.60
Con Edison	NY			\$100

Based on the estimates presented in Table 4, EnerNOC has recommended that CEEEP use an Avoided Electric T&D cost of \$30/kW-yr.

CEEEP is currently researching reputable sources for Avoided Natural Gas T&D costs.

**Environmental Externality Benefits:** Avoided emission savings are calculated by multiplying the emission permit prices by the energy savings. In the cost benefit analysis, CEEEP assumes that the emission allowance prices for SO<sub>2</sub> and NO<sub>x</sub> are already accounted for in energy prices. CEEEP is currently researching reputable sources of SO<sub>2</sub> and NO<sub>x</sub> allowance price projections.

- **Forecasted CO<sub>2</sub> Social Cost:** Values for the Social Cost of Carbon were taken from the Interagency Working Group on Social Cost of Carbon<sup>12</sup>. Values were reported in 2007\$/metric ton, and were converted to nominal dollars using the EIA projected U.S. CPI (Table 3). The study presented three values for the social cost of carbon, using a discount rate of 2.5%, 3%, and 5%. The scenario using a discount rate of 3% is presented here.

<sup>10</sup> Avoided Energy Supply Costs in New England: 2011 Report. Prepared for Avoided Energy Supply Component Study Group by Synapse Energy Economics, Inc.

<sup>11</sup> PA: Potential study, Appendix 1: [http://www.puc.state.pa.us/electric/pdf/Act129/Act129-PA\\_Market\\_Potential\\_Study\\_App1.pdf](http://www.puc.state.pa.us/electric/pdf/Act129/Act129-PA_Market_Potential_Study_App1.pdf)

WI: Page EE-13 of study: <http://psc.wi.gov/reports/documents/wipotentialfinal.pdf>

CA: Page 37 of Word Doc at: [http://docs.cpuc.ca.gov/PUBLISHED/FINAL\\_DECISION/128594.htm#P84\\_2869](http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/128594.htm#P84_2869)

NY: Appendix 2, Table 2 at: <http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B329FD000-D108-47AC-ADAF-9E37730B68CA%7D>

<sup>12</sup> Interagency Working Group on Social Cost of Carbon, "Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866", United States Government, February 2010.

**Table 5: Social Cost of Carbon (Nominal \$/ton)**

	<b>CO2</b>
2011	\$23.77
2012	\$24.63
2013	\$25.40
2014	\$26.52
2015	\$27.66
2016	\$28.95
2017	\$30.14
2018	\$31.48
2019	\$32.85
2020	\$34.25
2021	\$35.94
2022	\$37.54
2023	\$39.31
2024	\$41.12
2025	\$43.11
2026	\$45.01
2027	\$47.09
2028	\$48.92
2029	\$51.09
2030	\$53.31
2031	\$55.41
2032	\$57.73
2033	\$60.08
2034	\$62.49
2035	\$64.94

- **Historical Emissions Permit Prices:** Historical emission permit prices for SO<sub>2</sub> and NO<sub>x</sub> were taken from EIA<sup>13</sup>. All emission permits are in \$/ton.

**Table 6: Historical SO<sub>2</sub> and NO<sub>x</sub> Emissions Allowance Prices (Nominal \$/ton)**

	<b>SO<sub>2</sub></b>	<b>NO<sub>x</sub></b>
2007	\$534.43	\$776.04
2008	\$278.50	\$807.33
2009	\$81.11	\$304.33
2010	\$16.52	\$44.66
2011	\$2.12	\$15.89

<sup>13</sup> <http://www.eia.gov/todayinenergy/detail.cfm?id=4830>