RUTGERS
Edward J. Bloustein School
of Planning and Public Policy

Center for Energy, Economic & Environmental Policy
Rutgers, The State University of New Jersey
33 Livingston Avenue, First Floor
New Brunswick, NJ 08901

http://ceeep.rutgers.edu/

732-932-5680
Fax: 732-932-0394

Energy Efficiency Cost-Benefit Analysis Avoided Cost Assumptions

March 13, 2018

The Center for Energy, Economic, and Environmental Policy (CEEEP) has been asked by the New Jersey Office of Clean Energy to provide avoided cost assumptions to the Program Administrator for the New Jersey Clean Energy Program for use in its cost-benefit analyses. The data sources and processes for determining these components are also discussed. All assumptions have been derived from independent and publicly available sources to be transparent.[1]

On August 3, 2015, the U.S. Environmental Protection Agency released the Clean Power Plan to reduce carbon emissions from existing power plants.[2] The Clean Power Plan, depending if and how it is implemented, may impact many of these assumptions going forward. In addition, relatively recently there have been major changes in PJM's capacity market that may affect future projections of capacity prices.[3]

All dollars are nominal unless stated otherwise.[4] CEEEP's CBA tool uses nominal dollars and adjusts assumptions for inflation as appropriate.

I. Cost-benefit Analysis of Energy Efficiency Programs

Cost-benefit analysis (CBA) is a tool that compares the monetized costs and benefits of energy efficiency measures, programs and portfolios. It can be used both to inform program managers and regulators as well as employed as a formal decision-making tool that determines which measures, programs or portfolios should be adopted. As an informational tool, CBA should be conducted at the measure, program and portfolio level; decision-makers will therefore be fully informed, but of course retain the ability to consider non-CBA factors as appropriate.

For its full value to be achieved, CBA should be integrated into program planning and evaluation.[5] Program design should reflect the assumptions used in the CBA for CBA results to be useful. Moreover, there may be other policies that need to be put in place to ensure these savings materialize. Finally, evaluations should also be aligned with CBA. For example, program impact evaluations are needed to assess the actual savings.[6]

Any CBA requires numerous assumptions. Many of these assumptions can be further developed at increasing levels of detail. There is a tradeoff between time and effort and the additional accuracy that may come from a more extensive analysis. In addition, the level of detail across assumptions needs to be consistent. Pursuing some assumptions to one level of detail but not others may bias the CBA results.

---

[1] For previously used avoided cost assumptions please visit http://ceeep.rutgers.edu/publications/. Staff is currently reviewing some prior avoided costs assumptions, which are not posted until the completion of the review.
[2] http://www2.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants#CPP-final
[3] http://www.natlawreview.com/article/ferc-accepts-pjm-capacity-performance-proposal
[4] *Nominal prices*, sometimes referred to as *current dollar prices*, measure the dollar value of a product or service at the time it was produced. In contrast, *real prices* are adjusted for inflation. See https://www.stlouisfed.org/publications/inside-the-vault/fall-2007/nominal-vs-real-oil-prices.
[5] The 2017 Evaluation Plan is posted at http://www.njcleanenergy.com/main/public-reports-and-library/market-analysis-protocols/market-analysis-baseline-studies/market-an . It is currently being updated for 2018.
[6] The last impact evaluations were conducted in 2009. See http://www.njcleanenergy.com/main/public-reports-and-library/market-analysis-protocols/market-analysis-baseline-studies/market-an

Currently, CBAs are calculated using a spreadsheet tool developed by CEEEP based on standard industry CBA calculations. The Clean Energy Program should consider moving towards an CBA modeling platform that is widely used in the industry and across multiple jurisdictions.

Going forward, a schedule for the performance of CBAs, both prospectively and retrospectively, should be established for the duration of the most recent Comprehensive Resource Planning time horizon.

II. Electricity Prices

Retail Electricity Prices: Historic 2016 U.S. Energy Information Administration (EIA) New Jersey retail electricity prices were escalated using an annual price growth rate derived from the *EIA Annual Energy Outlook 2017* for the Mid-Atlantic region. On average, the annual growth rate was about 2.8%. The NJ Clean Energy Programs do not distinguish between commercial and industrial sectors, therefore the commercial and industrial prices were averaged based on historic 2016 New Jersey retail electricity sales. Retail electricity prices reported to EIA include the Societal Benefits Charge (SBC)[7] and the 6.875% Sales and Use Tax.

Wholesale Electricity Prices: Historic 2016 New Jersey wholesale electric prices from PJM were escalated based on the annual percent change in the *EIA 2017 Annual Energy Outlook* using the Reliability First Corporation/East Electricity Generation Prices.[8] The annual percent change was, on average, about 2.5%. The seasonal peak and off-peak factors were derived using historic 2015 PJM LMP data.[9] Summer is defined as May through September, winter is defined as October through April, on-peak is defined as Monday through Friday 8am-8pm (hour beginning or HB), and off-peak is defined as Monday-Friday 8pm-8am (HB) and weekends and holiday.

[7] The Societal Benefits Charge for electric customers of 3.6% for residential and 4.8% for C&I is included in the retail prices reported to EIA by the utilities.
[8] Wholesale electricity prices are not weather normalized.
[9] http://www.pjm.com/markets-and-operations/energy.aspx

Table 1: Retail Electricity Prices and Wholesale Energy Prices (Nominal Dollars)

	Retail ($/kWh)		Wholesale Energy ($/MWh)				
	Residential	Commercial & Industrial	Average Price	Summer Peak	Summer Off-Peak	Non-Summer Peak	Non-Summer Off-Peak
2015	$0.16	$0.13	$35.05	$36.88	$22.69	$48.51	$37.12
2016	$0.16	$0.11	$24.77	$23.44	$18.83	$28.24	$22.03
2017	$0.17	$0.10	$18.32	$17.34	$13.93	$20.89	$16.30
2018	$0.18	$0.11	$17.16	$16.24	$13.04	$19.56	$15.26
2019	$0.18	$0.11	$21.35	$20.21	$16.23	$24.34	$18.99
2020	$0.20	$0.12	$23.57	$22.31	$17.92	$26.87	$20.97
2021	$0.21	$0.12	$25.14	$23.79	$19.10	$28.66	$22.36
2022	$0.22	$0.13	$26.15	$24.75	$19.88	$29.82	$23.26
2023	$0.23	$0.13	$27.85	$26.36	$21.17	$31.75	$24.77
2024	$0.24	$0.14	$29.59	$28.01	$22.49	$33.74	$26.32
2025	$0.25	$0.14	$30.94	$29.28	$23.51	$35.27	$27.52
2026	$0.26	$0.15	$31.93	$30.22	$24.27	$36.40	$28.40
2027	$0.27	$0.16	$33.33	$31.55	$25.33	$38.00	$29.65
2028	$0.28	$0.16	$34.86	$32.99	$26.49	$39.74	$31.00
2029	$0.29	$0.17	$36.43	$34.48	$27.69	$41.53	$32.40
2030	$0.30	$0.17	$37.95	$35.92	$28.85	$43.27	$33.75
2031	$0.30	$0.18	$38.35	$36.30	$29.15	$43.72	$34.11
2032	$0.31	$0.18	$38.07	$36.03	$28.93	$43.40	$33.86
2033	$0.32	$0.19	$38.55	$36.49	$29.30	$43.95	$34.29
2034	$0.32	$0.19	$38.68	$36.61	$29.40	$44.10	$34.40
2035	$0.33	$0.19	$38.84	$36.76	$29.52	$44.28	$34.54
2036	$0.34	$0.20	$39.46	$37.35	$29.99	$44.99	$35.09
2037	$0.34	$0.20	$40.11	$37.96	$30.48	$45.72	$35.67
2038	$0.35	$0.21	$40.90	$38.71	$31.08	$46.63	$36.38

Ancillary Services Prices: Ancillary services include regulation, scheduling, dispatch and system control, reactive power, and synchronized reserves, and their cost in 2016 was $.96/MWh.[10] The cost of ancillary reserves should be added to wholesale electricity prices.

Capacity Prices: New Jersey Utility PJM Reliability Pricing Model (RPM) prices for the four electric utilities (AE, JCP&L, PSE&G and RECO) for 2010 to 2019 were weighted by each utility's historic 2015 peak load[11] to estimate an average New Jersey capacity price. From 2020 to 2038, the capacity prices were escalated based on the EIA projected annual change in U.S. GDP Chain-type Price Index, which is reported in Table 6. PJM's Forecast Pool Requirement (FPR) is provided in Table 3; the FPR is a multiplier that converts load values into capacity obligation.[12] To calculate avoided capacity benefits, the peak savings are multiplied by the numbers in Table 2 and again by the numbers in Table 3.

[10] Monitoring Analytics, LLC, 2016 State of the Market Report, p. 395 (Table 10-4), http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2016/2016-som-pjm-sec10.pdf

[11] PJM Reliability Pricing Model User Information. Base Residual Auction Results www.pjm.com/markets-and-operations/rpm/rpm- auction-user-info.aspx#Item01; PJM. Historic Load Data.

[12] 2016 PJM Reserve Requirement Study, October 6, 2016, PJM Staff, p. 9 for FPR values and p. 41 for definition of FPR.

Table 2: Capacity Price (Nominal $/kW-year)

	$/kW- year
2015	$59.40
2016	$61.65
2017	$62.08
2018	$73.31
2019	$58.65
2020	$59.96
2021	$61.26
2022	$62.64
2023	$64.00
2024	$65.32
2025	$66.73
2026	$68.21
2027	$69.78
2028	$71.33
2029	$72.90
2030	$74.50
2031	$76.11
2032	$77.70
2033	$79.26
2034	$80.80
2035	$82.32
2036	$83.86
2037	$85.42
2038	$87.03

Table 3: PJM Forecast Pool Requirements

Delivery Year Period	Forecast Pool Requirement (FPR)
2016/2017	1.0952
2017/2018	1.0959
2018/2019	1.0883
2019/2020*	1.0881

*Assume 2019/2020 FPR for years 2021 and later.

III. Natural Gas Prices

Retail Natural Gas Prices: Historic 2016 EIA New Jersey retail natural gas prices were escalated using an annual growth rate derived from the Mid-Atlantic Region *EIA Annual Energy Outlook 2017* natural gas price forecasts. On average, the annual growth rate was about 2.4%. Retail natural gas prices reported to EIA include the Societal Benefits Charge (SBC)[13] and the 6.875% Sales and Use Tax.

Wholesale (Henry Hub) Natural Gas Prices: Wholesale natural gas prices are taken from the EIA Annual Energy Outlook 2017. The winter and summer prices were derived from the 1994 to 2016 historic average ratio of summer and winter prices to Henry Hub. The summer average ratio was 97.3% and the winter average ratio was 102.7%. With the continued development of shale natural gas in Pennsylvania,

[13] The Societal Benefits Charge for natural gas customers of 4.1% for residential and 5.0% for C&I is included in the retail prices.

using a Mid-Atlantic regional wholesale hub for natural gas may be appropriate going forward. CEEEP is tracking this issue.

Table 4: Retail and Wholesale Natural Gas Prices (Nominal $/MMBtu)

	Retail Prices			Henry Hub Wholesale Prices		
	Residential	Commercial	Industrial	Average Price	Summer	Winter
2015	$8.07	$7.70	$6.89	$2.62	$2.55	$2.69
2016	$8.02	$6.94	$5.09	$2.50	$2.43	$2.57
2017	$8.42	$7.45	$4.93	$3.06	$2.98	$3.14
2018	$8.65	$8.11	$5.19	$3.55	$3.45	$3.64
2019	$8.94	$8.90	$5.70	$4.22	$4.10	$4.33
2020	$9.33	$9.82	$6.39	$4.90	$4.77	$5.03
2021	$9.72	$10.23	$6.72	$4.88	$4.75	$5.01
2022	$10.12	$10.65	$7.05	$4.83	$4.70	$4.96
2023	$10.46	$10.99	$7.32	$4.97	$4.83	$5.10
2024	$10.76	$11.29	$7.55	$5.23	$5.09	$5.36
2025	$11.00	$11.50	$7.67	$5.45	$5.30	$5.59
2026	$11.22	$11.69	$7.76	$5.74	$5.59	$5.89
2027	$11.58	$12.04	$8.03	$6.01	$5.85	$6.17
2028	$11.99	$12.44	$8.34	$6.29	$6.12	$6.45
2029	$12.40	$12.84	$8.66	$6.56	$6.38	$6.73
2030	$12.79	$13.20	$8.94	$6.76	$6.58	$6.94
2031	$13.13	$13.51	$9.17	$7.05	$6.86	$7.23
2032	$13.51	$13.87	$9.44	$7.20	$7.00	$7.38
2033	$13.86	$14.18	$9.66	$7.23	$7.03	$7.42
2034	$14.35	$14.65	$10.06	$7.33	$7.13	$7.52
2035	$14.96	$15.28	$10.67	$7.60	$7.39	$7.80
2036	$15.43	$15.73	$11.06	$7.71	$7.50	$7.91
2037	$15.88	$16.14	$11.40	$7.86	$7.64	$8.06
2038	$16.35	$16.58	$11.76	$7.98	$7.76	$8.18

IV. Propane and Heating Oil Prices

Propane Prices: Historic 2015 and 2016 EIA New Jersey residential and wholesale/resale propane prices were escalated using an annual growth rate derived from the Mid-Atlantic Region *EIA Annual Energy Outlook 2017* propane price forecasts (Residential Prices and Prices for All Users, respectively). Propane prices were initially presented as weekly averages from January to March and October to December and were averaged to develop an annual price. On average, the annual growth rate was about 1.7% for the residential prices and 1.4% for the prices for all users. In addition, CEEEP added the 7% Sales and Use Tax.[14]

Heating Oil Prices: Historic 2015 and 2016 EIA New Jersey residential and wholesale/resale heating oil prices were escalated using an annual growth rate derived from the Mid-Atlantic Region *EIA Annual Energy Outlook 2017* heating oil price forecasts (Residential Prices and Prices for All Users, respectively). Heating oil prices were initially presented as weekly averages from January to March and October to December and were averaged to develop an annual price. On average, the annual growth rate

[14] Based upon communications with the U.S. EIA, CEEEP believes that EIA does not inlcude the 7% sales and use tax. CEEEP is unclear whether utiilties when submitting this data to the EIA include the 7% sales tax.

was about 2.6% for the residential prices and 3.0% for the prices for all users. In addition, CEEEP added the 7% Sales and Use Tax.[15]

Table 5: Residential and Wholesale Propane and Heating Oil Prices (Nominal $/Gallon)

	Propane		Heating Oil	
	Residential	Wholesale/Resale	Residential	Wholesale/Resale
2015	$3.55	$0.85	$3.00	$1.76
2016	$3.52	$0.78	$2.54	$1.44
2017	$3.63	$0.83	$3.11	$1.84
2018	$3.93	$0.82	$3.51	$2.52
2019	$4.03	$0.83	$3.80	$2.81
2020	$4.10	$0.85	$4.00	$3.01
2021	$4.19	$0.86	$4.18	$3.16
2022	$4.38	$0.90	$4.36	$3.30
2023	$4.54	$0.94	$4.51	$3.48
2024	$4.65	$0.96	$4.67	$3.64
2025	$4.74	$0.98	$4.86	$3.85
2026	$4.86	$1.00	$5.05	$4.05
2027	$5.01	$1.03	$5.20	$4.20
2028	$5.14	$1.06	$5.33	$4.31
2029	$5.26	$1.08	$5.49	$4.49
2030	$5.42	$1.12	$5.71	$4.72
2031	$5.64	$1.17	$5.93	$4.95
2032	$5.84	$1.21	$6.17	$5.20
2033	$5.98	$1.24	$6.27	$5.30
2034	$6.16	$1.28	$6.47	$5.51
2035	$6.30	$1.31	$6.64	$5.67
2036	$6.52	$1.35	$6.90	$5.96
2037	$6.68	$1.39	$7.04	$6.10
2038	$6.90	$1.43	$7.22	$6.27

V. Environmental Externalities

Environmental Externality Benefits: Avoided emission savings are calculated by multiplying the emission damages by the energy savings. CEEEP is currently researching reputable sources for determining a value for avoided mercury emissions, water savings, and methane leakage from the production and transportation of natural gas.[16]

Forecasted Carbon Dioxide (CO2) Social Cost: Values for the Social Cost of Carbon were taken from the U.S. Government Interagency Working Group on Social Cost of Carbon[17]. Values were reported in 2007$/metric ton, and were converted to nominal dollars using the EIA projected U.S. GDP Price Index[18].

[15] Based upon communications with the U.S. EIA, CEEEP believes that EIA does not inlcude the 7% sales and use tax. CEEEP is unclear whether utiilties when submitting this data to the EIA include the 7% sales tax.

[16] Water savings that are a direct result of a measure, e.g., low-flow shower heads, should be calculated as part of the New Jersey Technical Resource Manual. Water savings due to less electricity generation occurs by reducing the amount of evaporation associated with cooling of thermal power plants. In addition, there may be less thermal heat returned to the body of water that is suppling cooling water.

[17] EPA Fact Sheet, "Social Cost of Carbon", December 2015 http://www3.epa.gov/climatechange/Downloads/EPAactivities/social-cost-carbon.pdf.

[18] EIA Annual Energy Outlook 2017. 2005=1.0

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 in Table 6.

Table 6: Social Cost of Carbon (Nominal $/metric ton) and U.S. GDP Chain-type Price Index

	Social Cost of CO_2	GDP Chain-type Price Index
2015	$37.22	1.10
2016	$39.17	1.12
2017	$41.29	1.14
2018	$43.41	1.16
2019	$45.62	1.19
2020	$47.97	1.21
2021	$50.04	1.24
2022	$52.12	1.27
2023	$54.12	1.29
2024	$56.13	1.32
2025	$58.21	1.35
2026	$60.39	1.38
2027	$62.64	1.41
2028	$64.97	1.44
2029	$67.40	1.47
2030	$69.94	1.51
2031	$72.89	1.54
2032	$75.97	1.57
2033	$79.15	1.60
2034	$82.45	1.63
2035	$85.88	1.67
2036	$89.38	1.70
2037	$92.99	1.73
2038	$96.70	1.76

Historical Emissions Damage Estimates: Damage estimates for sulfur dioxide (SO_2), nitrogen oxide (NO_x), and particulate matter (PM) in Table 7 were taken from the National Research Council's 2010 study - Hidden Costs of Energy.[19] All values are in $/short ton. Note that for emissions that are part of a cap-and-trade program, their allowance or permit price is partially incorporated into the price of energy. If the emission cap is binding, then a reduction in electricity usage will not lower total emissions but will free up an allowance that then can then be used resulting in no net change in emissions.

[19] National Research Council. *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use*. Washington DC: The National Academies Press, 2010. http://www.aaec.arkansas.gov/Solutions/Documents/Hidden%20Costs%20of%20Energy%20Unpriced%20Consequences%20of%20Energy%20Production%20and%20Use.pdf

Table 7: Mean Damages per Short Ton of Criteria-Pollutant-Forming Emissions (2007 $/short ton)

From Coal-fired Power Plants	Unit	2007 $
SO2	$/Short Ton	5,800
NOx	$/Short Ton	1,600
PM2.5	$/Short Ton	9,500
PM10	$/Short Ton	460
From Gas-fired Power Plants	**Unit**	**2007 $**
SO2	$/Short Ton	13,000
NOx	$/Short Ton	2,200
PM2.5	$/Short Ton	32,000
PM10	$/Short Ton	1,700

PJM Marginal Units: Table 8 shows the type of fuel used by marginal resources in the PJM Real-Time Energy Market[20] in 2016. Please note that the category "Other" includes nuclear and emergency DR.

Table 8: 2016 (Jan-June) PJM Marginal Units

Fuel Type	% on the Margin
Coal	43.38%
Gas	44.39%
Oil	7.73%
Wind	3.37%
Other	1.11%
Municipal Waste	0.06%

Power Plant Emission Rates: Power plant emission rates for CO_2, NO_x, and SO_x are shown in Table 9.[21] Emission rates are in pounds per MWh. CEEEP is currently researching externality values for mercury and particulates. The NJ DEP estimated in October 2014 that the emission rate for mercury is 2.11 mg/MWh for electricity. Note that energy efficiency displaces some renewables given that the Renewable Portfolio Standard (RPS) is a percentage of electricity retail sales. This displacement should be accounted for when calculating emission reductions due to energy efficiency. CEEEP is reviewing possible methodologies to do so.

Table 9: Power Plant Emission Rates (lbs/MWh)

	CO_2	NO_x	SO_x
Coal[22]	2,249	6	13
Natural Gas[23]	1,135	1.7	0.1
Oil[24]	1,672	4	12
Wind	0	0	0
Other	0	0	0
Municipal Waste[25]	2,988	5.4	0.8

[20] PJM State of the Market – 2016, Section 3 – Energy Market, pg. 88.
http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2016.shtml
[21] The New Jersey Technical Resource Manual, which provides the calculations of energy savings for different energy efficiency measures, uses an average emission rate per pollutant.
[22] U.S. EPA, eGRID 2000.
[23] Ibid.
[24] Ibid.
[25] U.S. EPA, Compilation of Air Pollutant Emission Factors (AP-42).

VI. Other Assumptions

Discount Rate: Discount rates are used to convert future economic values into present day dollars. A nominal discount rate of 7% is used[26]. The utility cost of capital should be used for utility specific cost-benefit analyses of energy efficiency programs.

Avoided Electric and Natural Gas Losses: Avoided average electric transmission and distribution losses are assumed to be 6.2%.[27] Marginal losses are assumed to be approximately 1.5 times average losses.[28] PJM wholesale energy prices include marginal transmission losses. It is unknown what part of the T&D losses are transmission related and what are distribution related. To account for marginal distribution losses, assume that average distribution losses are 5%. Electric utilities report losses on their respective webpages.[29] In calculating peak reductions due to energy efficiency measures, realized demand savings must be appropriately calculated.[30] Distribution marginal line loss rate multiplier for avoided energy (kWh) is 7.5% (i.e. 1.5 times the 5% portion of T&D losses that are assumed).

Avoided natural gas losses are assumed to be 1%[31] based on the 2014 New Jersey Protocols. CEEEP is currently researching reputable sources for updating avoided natural gas T&D costs.

Avoided Electric and Natural Gas Transmission and Distribution (T&D): In 2012, EnerNOC has recommended that CEEEP use an Avoided Electric T&D cost of $30/kW-yr.[32] Tables 10 and 11 provide estimates from the Avoided Energy Supply Costs in New England 2015 Report and EnerNOC respectively. In addition, the Mendota Group[33] found that the range of avoided distribution costs range from $0 to $171/kW-year with the average avoided cost of $48.37. The range of avoided transmission cost was found to be $0 to $88.64/kW-year with an average avoided cost of $21.21. Most avoided T&D cost estimates were between $40 and $60/kW-year with four companies assuming $0/kW-year.

CEEEP recommends using the average avoided electric T&D based upon the 2014 Mendota Group study and that a comprehensive avoided T&D study be conducted in the near future.

---

[26] This is approximately the average of the prevailing weighted average cost of capital (cost of capital or WACC) for utilities in NJ as compiled by CEEEP from publicly available documents. Note U.S. Federal Government uses 7 percent. See Circular No. A-94 Revised https://www.whitehouse.gov/omb/circulars_a094/

[27] 10 year (2005-2014) Average: "New Jersey Supply and Disposition of Electricity" http://www.eia.gov/electricity/state/newjersey and http://www.eia.gov/tools/faqs/faq.cfm?id=105&t=3

[28] See RAP's 2011 *Valuing the Contribution of Energy Efficiency to Avoid Marginal Line Losses and Reserve Requirements* p. 5, http://www.raponline.org/wp-content/uploads/2016/05/rap-lazar-eeandlinelosses-2011-08-17.pdf . ICF's 2005 *Avoided Energy Supply Costs in New England* https://www9.nationalgridus.com/masselectric/non_html/avoided-cost-study.pdf p. 100 (Exhibit 3-6) suggests a ration of 1.25 for New England.

[29] PSEG: https://www.pseg.com/business/energy_choice/third_party/rate_class.jsp
Orange Rockland: https://www.oru.com/documents/tariffsandregulatorydocuments/ny/electrictariff/electricGI31.pdf
Atlantic City: http://www.pepcoholdings.com/about-us/do-business-with-phi/energy-suppliers/retail-energy-suppliers/new-jersey/registered-suppliers/settlement-informaton/class-load-profile-information/
JCP&L: https://www.firstenergycorp.com/content/dam/supplierservices/files/interval-data/JC%20Loss%20Factors.pdf

[30] NREL, Chapter 10: Peak Demand and Time-Differentiated Energy Savings Cross-Cutting Protocols, The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, April 2013.

[31] "New Jersey Clean Energy Program Protocols to Measure Resource Savings", updated March 17, 2014. http://njcleanenergy.com/files/file/Appeals/NJ%20Protocols%20Revisions%202013%20Update_04-16-2014_clean.pdf

[32] http://www.njcleanenergy.com/main/public-reports-and-library/market-analysis-protocols/market-analysis-baseline-studies/market-po

[33] The Mendota Group collected data for 36 companies estimating T&D benefits over the last 3 years in most regions of the country. "Benchmarking Transmission and Distribution Costs Avoided by Energy Efficiency Investments." Filed on behalf of Public Service Company of Colorado. October 23 2014. https://www.dora.state.co.us/pls/efi/efi.show_document?p_dms.

Table 10: New England Avoided T&D Cost Estimates (2015$/kW-yr)[34]

Company	State	Transmission	Distribution	Total
NStar		$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		$2.54	$45.96	$48.50

Table 11: Various Avoided T&D Cost Estimates ($/kW-yr)[35]

State - Area	Cost
CT-CL&P	$29.20
WI - Statewide	$30.00
NY - Upstate	$33.50
CA - SCE	$54.60
CA - SDG&E	$74.80
CA - PG&E	$76.60
NY - Con Edison	$100.00

An evaluation of both what New Jersey specific avoided T&D costs are and whether actual T&D investments have been avoided because of EE should be performed.

Renewable Energy Credits and Solar Renewable Energy Credits: The New Jersey Renewable Portfolio Standard (RPS) is based upon a percentage of retail electricity sales. CEEEP has projected the additional cost that SRECs and RECs add to the wholesale cost of energy based upon current REC and SREC prices, projections of the levelized cost of electricity, and the wholesale energy and capacity revenue that wind and solar earn.[36] These projections are provided in Table 12. The BPU has announced a review of its solar programs, which may affect future SREC projections. CEEEP recommends that after that review is conducted, an update of the REC and SREC price projections be conducted.

[34] Avoided Energy Supply Costs in New England: 2015 Report. Prepared for Avoided Energy Supply Component Study Group by Synapse Energy Economics, Inc. http://ma-eeac.org/wordpress/wp-content/uploads/2015-Regional-Avoided-Cost-Study-Report.pdf

[35]

PA: Potential study, Appendix 1: 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
NY: Appendix 2, Table 2 at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B329FD000-D108-47AC-ADAF-9E37730B68CA%7D
CT: "Assessment of Avoided Cost of Transmission and Distribution" Prepared for: Connecticut Light and Power Company by: ICF International, October 30, 2009. www.dpuc.state.ct.us

[36] http://markets.flettexchange.com/new-jersey-srec/, https://www.eia.gov/forecasts/aeo/electricity_generation.cfm

Table 12: Renewable Energy Adder ($/MWh)

Year	Renewable Adder
2015	$5.78
2016	$7.49
2017	$9.26
2018	$11.72
2019	$14.56
2020	$7.77
2021	$9.04
2022	$7.85
2023	$7.38
2024	$7.00
2025	$6.79
2026	$6.34
2027	$6.18
2028	$5.96
2029	$5.56
2030	$5.43
2031	$5.23
2032	$4.98
2033	$4.63
2034	$4.14
2035	$3.76
2035	$3.38
2035	$2.95
2035	$2.46

Non-Energy Benefits and Costs: Non-energy benefits and costs, typically referred to as non-energy benefits, include additional benefits and costs that occur due to energy efficiency measures. CEEEP has conducted a review of studies on this topic.[37] Currently, non-energy benefits and costs are not tabulated in the New Jersey Technical Energy Protocol.

Administrative Costs: The administrative costs considered as part of the Energy Efficiency program include program administration, program development, marketing and sales costs, training, rebates and direct incentives, rebate processing, inspections, evaluation and quality control. Administrative costs should be included at the appropriate level of analysis based upon the type of administrative costs. For instance, costs associated with marketing a program should be included in that program's CBA but not assigned to the CBA at the measure level. Administrative costs that are for a portfolio should be included in the portfolio CBA. Administrative costs should also include those of relevant BPU Staff.

BPU Overhead Costs: The associated BPU staff and overhead costs are currently not included in the administrative costs for the NJCEP EE programs. Further consideration should be given as to whether and how these costs should be included in the future.

[37] Freed, M. & Felder, F. (2017). Non-energy benefits: Workhorse or unicorn of energy efficiency programs? *The Electricity Journal*, 30(1), 43-46.