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Energy Efficiency Cost-Benefit Analysis Avoided Cost Assumptions

Technical Memo

May 1, 2019 Update

This memo provides the inputs and methods utilized to update the avoided cost assumptions for integration into cost-benefit analyses of the New Jersey Clean Energy Program (NJCEP). This update builds upon a spreadsheet-based tool developed previously by the Center for Economic, Energy and Environmental Policy (CEEEP) at the Edward J. Bloustein School of Planning and Public Policy and now maintained by the Rutgers Center for Green Building (RCGB). During the process of updating this document, several other avoided costs have been suggested to RCGB for possible future inclusion. These include "congested adjusted" forward trading price for the PJM Western Hub, Natural Gas Peak Demand by Sector, Distribution Level Demand Response, Avoided REC purchases, Avoided GasT&D, Electricity and Gas price suppression effects, Risk Mitigation adder, and using a societal discount rate. These potential avoided costs will be investigated by RCGB, in consultation with BPU and TRC staff.

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. Utilized by program managers and regulators and as a formal decision-making tool, CBA assists in determining which measures, programs or portfolios should be adopted, continued or altered in some fashion.

To achieve the most value, CBA should be integrated into both program planning and evaluation.[1] Program design should reflect CBA assumptions in order for CBA results to be meaningful. Program evaluations also should align with CBA assumptions; program impact evaluations are needed to assess the actual savings.[2]

Any CBA undertaking requires numerous assumptions and a consistent approach in the level of detail afforded the assumptions. There is a tradeoff between time and effort and the additional accuracy that may result from a more extensive, detailed analysis. Pursuing some assumptions more extensively than others can lead to biased CBA results. In this analysis, all assumptions are derived from independent and publicly available sources.[3] As such, they are transparent. All dollars are nominal unless stated otherwise.[4] The spreadsheet CBA tool employed by RCGB uses nominal dollars and adjusts assumptions for inflation as appropriate.

Currently, NJCEP CBAs are calculated using a spreadsheet tool developed by the Center for Energy, Economic, and Environmental Policy (CEEEP) based on standard industry CBA calculations. The Clean Energy Program moved this year to a CBA modeling platform that is widely used in the industry and

[1] 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.

[2] 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

[3] For previously used avoided cost assumptions please visit http://ceeep.rutgers.edu/publications/.

[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.

across multiple jurisdictions called e-Plan. RCGB will run the CEEEP model and e-Plan in parallel this year to ensure the robustness of the new tool.

Going forward a schedule for the performance of both prospective and retrospective CBA should be established for the duration of the most recent Comprehensive Resource Planning time horizon.

II. Electricity Prices

Retail Electricity Prices: Historic 2017 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 2018* for the Mid-Atlantic region. On average, the annual growth rate was about 3.33%. The NJ Clean Energy Programs do not distinguish between commercial and industrial sectors, therefore the commercial and industrial prices were averaged based on historic 2017 New Jersey retail electricity sales. Retail electricity prices reported to EIA include the Societal Benefits Charge (SBC)[5] and the 6.875% Sales and Use Tax.

Wholesale Electricity Prices: Historic 2017 New Jersey wholesale electric prices from PJM were escalated based on the annual percent change in the *EIA 2018 Annual Energy Outlook* using the Reliability First Corporation/East Electricity Generation Prices.[6] The annual percent change was, on average, about 2.37%. The seasonal peak and off-peak factors were derived using historic 2017 PJM LMP data.[7] 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.

[5] 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.
[6] Wholesale electricity prices are not weather normalized.
[7] 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	Weighted Avg. C&I	Average Price	Summer Peak	Summer Off-Peak	Non-Summer Peak	Non-Summer Off-Peak
2017	$0.16	$0.12	$28.42	$30.21	$24.59	$34.68	$28.07
2018	$0.16	$0.13	$29.23	$31.07	$25.30	$35.68	$28.87
2019	$0.17	$0.13	$25.04	$26.62	$21.67	$30.56	$24.73
2020	$0.19	$0.14	$27.06	$28.77	$23.42	$33.03	$26.73
2021	$0.20	$0.14	$28.17	$29.94	$24.38	$34.37	$27.82
2022	$0.20	$0.15	$28.44	$30.23	$24.61	$34.71	$28.09
2023	$0.21	$0.15	$29.13	$30.97	$25.21	$35.55	$28.77
2024	$0.22	$0.16	$30.02	$31.91	$25.98	$36.63	$29.64
2025	$0.24	$0.16	$32.84	$34.90	$28.42	$40.07	$32.43
2026	$0.24	$0.17	$32.38	$34.42	$28.03	$39.52	$31.98
2027	$0.25	$0.18	$34.43	$36.60	$29.80	$42.02	$34.01
2028	$0.26	$0.18	$35.39	$37.62	$30.63	$43.19	$34.96
2029	$0.27	$0.19	$35.89	$38.14	$31.06	$43.79	$35.44
2030	$0.27	$0.19	$36.36	$38.65	$31.47	$44.37	$35.91
2031	$0.28	$0.19	$36.89	$39.21	$31.92	$45.01	$36.43
2032	$0.29	$0.20	$37.02	$39.35	$32.04	$45.18	$36.56
2033	$0.29	$0.20	$37.30	$39.65	$32.28	$45.52	$36.84
2034	$0.30	$0.21	$38.01	$40.40	$32.90	$46.38	$37.54
2035	$0.31	$0.21	$38.83	$41.28	$33.61	$47.39	$38.35
2036	$0.32	$0.22	$40.17	$42.69	$34.76	$49.02	$39.67
2037	$0.33	$0.22	$41.14	$43.72	$35.60	$50.20	$40.63
2038	$0.33	$0.23	$42.38	$45.05	$36.68	$51.72	$41.86
2039	$0.34	$0.24	$43.84	$46.60	$37.94	$53.50	$43.30
2040	$0.35	$0.24	$45.33	$48.18	$39.23	$55.31	$44.77

Ancillary Services Prices: Ancillary services include regulation, scheduling, dispatch and system control, reactive power, and synchronized reserves, and their cost in 2018 was $1.05/MWh.[8] 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 2021 were weighted by each utility's historic 2017 peak load[9] to estimate an average New Jersey capacity price. From 2022 to 2040, 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.[10] To calculate avoided capacity benefits, the peak savings are multiplied by the numbers in Table 2 and again by the numbers in Table 3.

[8] Monitoring Analytics, LLC, 2018 State of the Market Report, p. 436 (Table 10-4), http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2018/2018q2-som-pjm.pdf
[9] Downloaded from Data Miner 2 https://dataminer2.pjm.com/feed/hrl_load_metered/definition
[10] 2017 PJM Reserve Requirement Study, October 12, 2017, PJM Staff, p. 10 for FPR values and p. 42 for definition of FPR. https://www.pjm.com/-/media/planning/res-adeq/2017-pjm-reserve-requirement-study.ashx?la=en

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

	$/kW- year
2017	$62.38
2018	$73.44
2019	$58.65
2020	$57.94
2021	$68.41
2022	$70.06
2023	$71.79
2024	$73.53
2025	$75.29
2026	$77.01
2027	$78.75
2028	$80.45
2029	$82.16
2030	$83.93
2031	$85.76
2032	$87.64
2033	$89.59
2034	$91.60
2035	$93.67
2036	$95.82
2037	$98.02
2038	$100.25
2039	$102.56
2040	$104.93

Table 3: PJM Forecast Pool Requirements

Delivery Year Period	Forecast Pool Requirement (FPR)
2018/2019	1.0905
2019/2020	1.0896
2020/2021	1.0898
2021/2022*	1.0898

*Assume 2021/2022 FPR for years 2023 and later.

III. Natural Gas Prices

Retail Natural Gas Prices: Historic 2017 EIA New Jersey retail natural gas prices were escalated using an annual growth rate derived from the Mid-Atlantic Region *EIA Annual Energy Outlook 2018* natural gas price forecasts. On average, the annual growth rate was about 3.82%. Retail natural gas prices reported to EIA include the Societal Benefits Charge (SBC)[11] 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 2018. The winter and summer prices were derived from the 1994 to 2017 historic average ratio of summer and winter prices to Henry Hub. The summer average ratio was 97.4% and the winter average ratio was 102.6%. With the continued development of shale natural gas in Pennsylvania, using a Mid-Atlantic regional wholesale hub for natural gas may be appropriate going forward. RCGB is tracking this issue.

[11] 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.

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

	Retail Prices			Henry Hub Wholesale Prices		
	Residential	Commercial	Industrial	Average Price	Summer	Winter
2017	$8.87	$8.87	$7.68	$3.05	$2.97	$3.12
2018	$8.86	$9.05	$8.32	$3.13	$3.05	$3.21
2019	$9.62	$9.79	$9.03	$3.55	$3.46	$3.64
2020	$10.23	$10.51	$9.57	$3.96	$3.86	$4.06
2021	$10.74	$11.11	$9.65	$4.02	$3.92	$4.12
2022	$11.27	$11.73	$9.86	$4.16	$4.05	$4.27
2023	$11.96	$12.58	$10.26	$4.42	$4.31	$4.53
2024	$12.29	$12.89	$10.62	$4.66	$4.54	$4.78
2025	$12.74	$13.36	$11.04	$4.93	$4.81	$5.06
2026	$13.05	$13.65	$11.32	$5.10	$4.97	$5.23
2027	$13.43	$14.03	$11.63	$5.28	$5.15	$5.42
2028	$13.71	$14.27	$11.86	$5.42	$5.28	$5.56
2029	$14.16	$14.75	$12.28	$5.62	$5.48	$5.77
2030	$14.47	$15.01	$12.54	$5.75	$5.60	$5.90
2031	$14.83	$15.36	$12.82	$5.88	$5.73	$6.03
2032	$15.20	$15.71	$13.13	$6.02	$5.87	$6.18
2033	$15.60	$16.09	$13.42	$6.15	$5.99	$6.31
2034	$16.00	$16.46	$13.73	$6.29	$6.13	$6.45
2035	$16.41	$16.85	$14.03	$6.41	$6.25	$6.57
2036	$16.94	$17.38	$14.58	$6.70	$6.53	$6.87
2037	$17.41	$17.84	$14.94	$6.87	$6.70	$7.05
2038	$17.90	$18.32	$15.43	$7.14	$6.96	$7.32
2039	$18.38	$18.77	$15.87	$7.38	$7.19	$7.57
2040	$18.84	$19.21	$16.28	$7.59	$7.40	$7.78

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 2018* 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 3.3% for the residential prices and 2.9% for the prices for all users. In addition, RCGB added the 6.875% Sales and Use Tax.[12]

Heating Oil Prices: Historic 2017 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 2018* 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 was about 5.3% for the residential prices and 4.9% for the prices for all users. In addition, CEEEP added the 6.875% Sales and Use Tax.[13]

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

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

	Propane		Heating Oil	
	Residential	Wholesale/Resale	Residential	Wholesale/Resale
2017	$3.88	$1.17	$3.02	$1.92
2018	$3.76	$1.12	$3.21	$2.03
2019	$3.87	$1.09	$3.44	$2.13
2020	$4.17	$1.17	$4.13	$2.52
2021	$4.35	$1.22	$4.54	$2.74
2022	$4.52	$1.27	$4.82	$2.87
2023	$4.69	$1.32	$5.10	$3.01
2024	$4.84	$1.36	$5.28	$3.12
2025	$4.97	$1.39	$5.45	$3.23
2026	$5.10	$1.43	$5.59	$3.31
2027	$5.22	$1.46	$5.77	$3.42
2028	$5.36	$1.50	$5.95	$3.54
2029	$5.54	$1.55	$6.16	$3.66
2030	$5.69	$1.59	$6.34	$3.77
2031	$5.87	$1.64	$6.56	$3.90
2032	$6.08	$1.70	$6.75	$4.01
2033	$6.28	$1.76	$6.96	$4.14
2034	$6.48	$1.81	$7.19	$4.27
2035	$6.70	$1.87	$7.38	$4.39
2036	$6.93	$1.94	$7.58	$4.51
2037	$7.11	$1.99	$7.88	$4.69
2038	$7.40	$2.07	$8.10	$4.82
2039	$7.62	$2.13	$8.35	$4.97
2040	$7.84	$2.19	$8.59	$5.12

V. Environmental Externalities

Environmental Externality Benefits: RCGB is researching reputable sources for determining a value for avoided mercury emissions, water savings, and methane leakage from the production and transportation of natural gas.[14] Avoided emission savings are calculated by multiplying the emission damages by the energy savings.

Forecasted Carbon Dioxide (CO_2) Social Cost: Values for the Social Cost of Carbon were taken from the U.S. Government Interagency Working Group on Social Cost of Carbon.[15] Values were reported in 2007$/metric ton, and were converted to nominal dollars using the EIA projected U.S. GDP Price Index[16]. 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.

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[14] 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 supplying cooling water.

[15] EPA Fact Sheet, "Social Cost of Carbon", August 2016. https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html

[16] *Energy Information Administration. Annual Energy Outlook 2018. http://www.eia.gov/outlooks/aeo/data/browser/#/?id=18-AEO2018&cases=ref2017&sourcekey=0*. 2005=1.0

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
2017	$41.63	1.13
2018	$43.64	1.16
2019	$45.78	1.19
2020	$48.12	1.22
2021	$49.31	1.25
2022	$51.70	1.28
2023	$54.21	1.31
2024	$56.79	1.34
2025	$59.44	1.37
2026	$62.12	1.40
2027	$64.87	1.44
2028	$67.65	1.47
2029	$69.10	1.50
2030	$72.02	1.53
2031	$75.06	1.56
2032	$78.22	1.60
2033	$81.49	1.63
2034	$84.89	1.67
2035	$88.42	1.71
2036	$92.09	1.75
2037	$95.89	1.79
2038	$99.80	1.83
2039	$103.85	1.87
2040	$108.05	1.91

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.[17] All values are in $/short ton. Estimates in 2007 $/short ton have been converted to 2018 $/short ton using U.S. GDP Chain-type Price Index shown in Table 6. 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.

[17] 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 and 2018 $/short ton)

From Coal-fired Power Plants	Unit	2007 $	2018 $
SO2	$/Short Ton	5,800	5,611
NOx	$/Short Ton	1,600	1,548
PM2.5	$/Short Ton	9,500	9,191
PM10	$/Short Ton	460	445
From Gas-fired Power Plants	**Unit**	**2007 $**	**2018 $**
SO2	$/Short Ton	13,000	12,577
NOx	$/Short Ton	2,200	2,128
PM2.5	$/Short Ton	32,000	30,959
PM10	$/Short Ton	1,700	1,645

PJM Marginal Units: Table 8 shows the type of fuel used by marginal resources in the PJM Real-Time Energy Market[18] in 2018. Please note that the category "Other" includes nuclear and emergency DR.

Table 8: 2018 (Jan-June) PJM Marginal Units

Fuel Type	% on the Margin
Coal	29.65%
Gas	60.91%
Oil	4.13%
Wind	3.71%
Other	0.35%
Municipal Waste	0.13%

Power Plant Emission Rates: Power plant emission rates for CO_2, NO_x, and SO_x are shown in Table 9.[19] Emission rates are in pounds per MWh. RCGB 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.

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

	CO_2	NO_x	SO_x
Coal[20]	2,249	6	13
Natural Gas[21]	1,135	1.7	0.1
Oil[22]	1,672	4	12
Wind	0	0	0
Other	0	0	0
Municipal Waste[23]	2,988	5.4	0.8

[18] Monitoring Analytics, LLC, 2018 State of the Market Report, Section 3 – Energy Market, pg. 110. http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2018/2018q2-som-pjm.pdf

[19] 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.

[20] U.S. EPA, eGRID 2000.

[21] Ibid.

[22] Ibid.

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[24]. The utility cost of capital should be used for utility specific cost-benefit analyses of energy efficiency programs.

Avoided Electric and Natural Gas Losses: According to the 2019 New Jersey Protocols, avoided average electric transmission and distribution losses are assumed to be 8.1%.[25] Marginal losses are assumed to be approximately 1.5 times average losses.[26] 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. Electric utilities report losses on their respective webpages.[27] In calculating peak reductions due to energy efficiency measures, realized demand savings must be appropriately calculated.[28] An analysis conducted by ComEd for its Chicago service territory estimated marginal loss rates at the time of system peak to be about 1.96 times the average annual marginal loss rate[29]. Distribution marginal line loss rate multiplier for avoided energy (kWh) is 12.2% (i.e. 1.5 times the 8.1% portion of T&D losses that are assumed).

The avoided natural gas loss factor are assumed to be 1.0[30] based on the 2019 New Jersey Protocols.

Avoided Electric Transmission and Distribution (T&D): In 2012, EnerNOC recommended that the NJCEP use an Avoided Electric T&D cost of $30/kW-yr.[31] 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[32] found that the range of avoided distribution costs range from $0 to $171/kW-year with

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[23] U.S. EPA, Compilation of Air Pollutant Emission Factors (AP-42).

[24] This is the weighted average cost of capital (cost of capital or WACC) for PSE&G https://nj.pseg.com/aboutpseg/regulatorypage/-/media/86A2603B2DB04B9FAA1B6AB1ABF1631E.ashx . RCGB found a range of possible discount rate values from publicly available documents. The most recent OMB circular on cost-benefit analysis is using a nominal discount rate of 1.8% (10 years) and 2.2% (20 years) https://www.gpo.gov/fdsys/granule/FR-2018-02-08/2018-02520 while the WACC for JCP&L is 7.47% https://www.firstenergycorp.com/content/dam/customer/OpCoHome/files/JCPLRegulatory/07-13-2018-JCPL-reliability-plus-filing.pdf (page 416)

[25] New Jersey Board of Public Utilities "New Jersey's Clean Energy Program Protocols to Measure Resource Savings", June 22, 2018 (pg 12). http://www.njcleanenergy.com/files/file/Board%20Orders/FY19/1g2%20-%20NJCEP%20Protocols%20to%20Measure%20Resource%20Savings%20FY19%20%20v3a.pdf

[26] 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.

[27] 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

[28] 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.

[29] Illinois Commerce Commission, "Approval of the Energy Efficiency and Demand Response Plan and Update to the Energy Efficiency Formula Rate Cost Inputs Pursuant to Section 8-103B of the Public Utilities Act", June 30 2017. https://www.icc.illinois.gov/downloads/public/edocket/449637.pdf

[30] New Jersey Board of Public Utilities "New Jersey's Clean Energy Program Protocols to Measure Resource Savings", June 22, 2018 (pg 12). http://www.njcleanenergy.com/files/file/Board%20Orders/FY19/1g2%20-%20NJCEP%20Protocols%20to%20Measure%20Resource%20Savings%20FY19%20%20v3a.pdf

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

[32] 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. http://mendotagroup.com/wp-content/uploads/2018/01/PSCo-Benchmarking-Avoided-TD-Costs.pdf .

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. The average avoided transmission + distribution costs are $66.03 with a range from $0 to $200.01/kW-year.

RCGB recommends using the average avoided electric T&D of $66.03 based upon the 2014 Mendota Group study and that a comprehensive avoided T&D study be conducted in the near future. 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.

Table 10: New England Avoided T&D Cost Estimates (2015$/kW-yr)[33]

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)[34]

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

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 previously conducted a review of studies on this topic[35] and RCGB has updated this review. Additional consideration for including non-energy benefits and costs is anticipated. Non-energy benefits and costs presently 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

[33] 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

[34]
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

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

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 currently are not included in the administrative costs for the NJCEP EE programs. Further consideration should be given as to whether and how to include these costs in the future.