The Law Office Of Robert Dove

PO Box 13442
Columbus, Ohio 43213
(614) 286 4183
rdove@attorneydove.com

October 3, 2016

Ms. Barcy F. McNeal
Public Utilities Commission of Ohio
Docketing Division
180 East Broad Street, 11th Floor
Columbus, OH 43215

RE: ***In the Matter of the Application of Ohio Edison Company, The Cleveland Electric Company, and the Toledo Ohio Edison Company for Approval of Their Energy Efficiency and Peak Demand Reduction Program Portfolio Plans for 2017 through 2019***

Dear Ms. McNeal:

Enclosed please find for filing in the above-captioned case an Errata page for the Direct Testimony of Chris Neme Filed on behalf on the Natural Resources Defense Council. Subsequent to the filing of his testimony Mr. Neme discovered an error therein. This error has no substantive effect on Mr. Neme's testimony. The Errata applies to both the public and confidential versions of the testimony but only contains public information. Both a clean and a redlined version have been included.

Additionally, please find for filing in the above-captioned case a public version of the Revised Exhibits with the additional Exhibit CN-14 added as a result of the Errata.

If you have any questions please contact met at 614-286-4183.

Respectfully,

Robert Dove
Attorney & Counselor at Law

CERTIFICATE OF SERVICE

I, the undersigned counsel, certify that on this 3rd day of October, 2016, a true and accurate copy of the foregoing was served via electronic mail upon the following counsel of record:

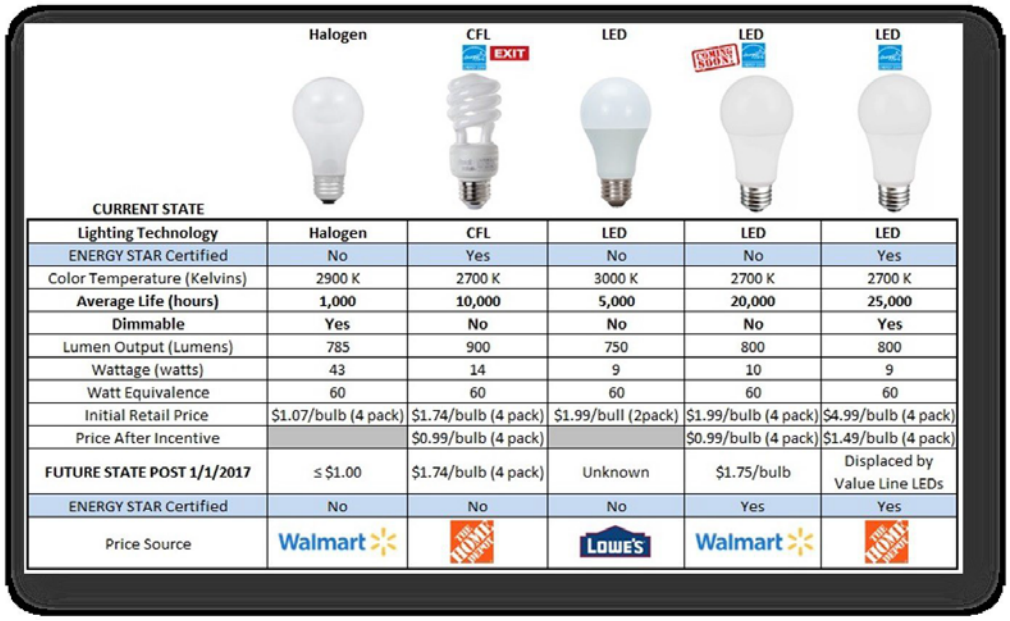
cdunn@firstenergycorp.com
eostrowski@firstenergycorp.com
mrgladman@jonesday.com
burkj@firstenergycorp.com
demiraye@firstenergycorp.com
kjklaw@yahoo.com
mpritchard@mwncmh.com
tdougherty@theoec.org
jfinnigan@edf.org
mfleisher@elpc.org
kfield@elpc.org
cmooney@ohiopartners.org
Bojko@carpenterlipps.com
Ghiloni@carpenterlipps.com
Christopher.healey@occ.ohio.gov
Kyle.kern@occ.ohio.gov
dstinson@bricker.com
callwein@keglerbrown.com
gpoulos@enernoc.com
sechler@carpenterlipps.com
joliker@igsenergy.com

/s/ Robert Dove
Robert Dove

announce that it was discontinuing the manufacturing of coiled CFLs for the U.S. market.[40] Ikea switched to selling only LEDs in its stores in September 2015.[41]

Moreover, less than 1% of — currently qualified ENERGY STAR CFLs - and none of the more than 1400 omni-directional CFLS - will meet the new federal STAR specification that goes into effect on January 2, 2017. (See Exhibit CN-14) That is also reflected in the information provided in Figure 1.

Figure 1: Comparison of Residential Lighting Products[42]



CURRENT STATE					
Lighting Technology	**Halogen**	**CFL**	**LED**	**LED**	**LED**
ENERGY STAR Certified	No	Yes	No	No	Yes
Color Temperature (Kelvins)	2900 K	2700 K	3000 K	2700 K	2700 K
Average Life (hours)	**1,000**	**10,000**	**5,000**	**20,000**	**25,000**
Dimmable	**Yes**	**No**	**No**	**No**	**Yes**
Lumen Output (Lumens)	785	900	750	800	800
Wattage (watts)	43	14	9	10	9
Watt Equivalence	60	60	60	60	60
Initial Retail Price	$1.07/bulb (4 pack)	$1.74/bulb (4 pack)	$1.99/bull (2pack)	$1.99/bulb (4 pack)	$4.99/bulb (4 pack)
Price After Incentive		$0.99/bulb (4 pack)		$0.99/bulb (4 pack)	$1.49/bulb (4 pack)
FUTURE STATE POST 1/1/2017	≤ $1.00	$1.74/bulb (4 pack)	Unknown	$1.75/bulb	Displaced by Value Line LEDs
ENERGY STAR Certified	No	No	No	Yes	Yes
Price Source	Walmart	The Home Depot	LOWE'S	Walmart	The Home Depot

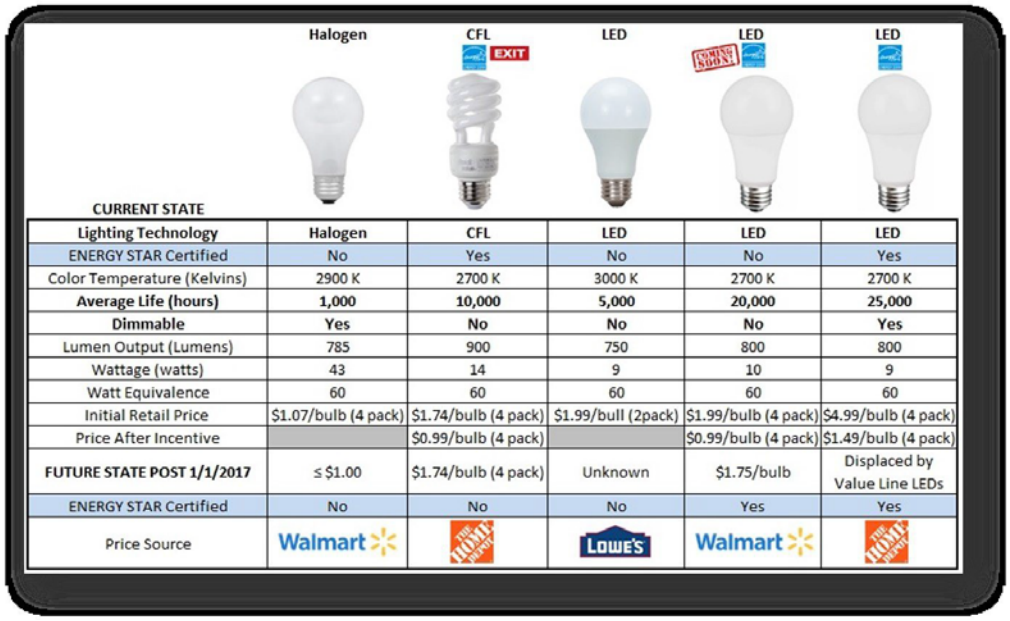
Thus, it is not surprising that numerous utilities and/or states have already stopped promoting CFLs or are planning to do so starting in 2017.[43] Prior to drafting their

[40] U.S. Dept. of Energy, *What Today's Lighting Efficiency Proposal Is And What It Isn't* (February 12, 2016), available at http://energy.gov/articles/what-today-s-lighting-efficiency-proposal-and-what-it-isn-t
[41] *Id*.
[42] Pernia, Jesus and Stan Mertz, *Connecticut & National Lighting Market Update*, presented at Connecticut Energy Efficiency Board retreat (June 22, 2016).
[43] Examples include: Commonwealth Edison in Illinois (presentation by Roger Baker, Commonwealth Edison, to the March 28, 2016 Illinois Stakeholder Advisory Group meeting regarding its next three year plan to be filed in the Fall of 2016 and covering the period June 1, 2017 through May 31, 2020 , available at

http://ilsagfiles.org/SAG_files/Meeting_Materials/2016/March_29-29_2016_Meeting/PY10-12_Program_Strawman_ComEd_March_SAG_v2.pdf); and New Jersey (Applied Energy Group, *Energy Efficiency and Renewable Energy Program Plan, Summary of Proposed Program Modifications for Fiscal Year 2017* (May 31, 2016)), available at http://www.njcleanenergy.com/files/file/public_comments/Summary%20of%20FY17%20Program%20Changes.pdf)

announce that it was discontinuing the manufacturing of coiled CFLs for the U.S. market.[40] Ikea switched to selling only LEDs in its stores in September 2015.[41] Moreover, less than 1% of currently qualified ENERGY STAR CFLs - and none of the more than 1400 omni-directional CFLS - will meet the new federal STAR specification that goes into effect on January 2, 2017. (See Exhibit CN-14) That is also reflected in the information provided in Figure 1.

Figure 1: Comparison of Residential Lighting Products[42]



CURRENT STATE					
Lighting Technology	**Halogen**	**CFL**	**LED**	**LED**	**LED**
ENERGY STAR Certified	No	Yes	No	No	Yes
Color Temperature (Kelvins)	2900 K	2700 K	3000 K	2700 K	2700 K
Average Life (hours)	**1,000**	**10,000**	**5,000**	**20,000**	**25,000**
Dimmable	**Yes**	**No**	**No**	**No**	**Yes**
Lumen Output (Lumens)	785	900	750	800	800
Wattage (watts)	43	14	9	10	9
Watt Equivalence	60	60	60	60	60
Initial Retail Price	$1.07/bulb (4 pack)	$1.74/bulb (4 pack)	$1.99/bull (2pack)	$1.99/bulb (4 pack)	$4.99/bulb (4 pack)
Price After Incentive		$0.99/bulb (4 pack)		$0.99/bulb (4 pack)	$1.49/bulb (4 pack)
FUTURE STATE POST 1/1/2017	≤ $1.00	$1.74/bulb (4 pack)	Unknown	$1.75/bulb	Displaced by Value Line LEDs
ENERGY STAR Certified	No	No	No	Yes	Yes
Price Source	Walmart	The Home Depot	LOWE'S	Walmart	The Home Depot

Thus, it is not surprising that numerous utilities and/or states have already stopped promoting CFLs or are planning to do so starting in 2017.[43] Prior to drafting their

[40] U.S. Dept. of Energy, *What Today's Lighting Efficiency Proposal Is And What It Isn't* (February 12, 2016), available at http://energy.gov/articles/what-today-s-lighting-efficiency-proposal-and-what-it-isn-t
[41] *Id*.
[42] Pernia, Jesus and Stan Mertz, *Connecticut & National Lighting Market Update*, presented at Connecticut Energy Efficiency Board retreat (June 22, 2016).
[43] Examples include: Commonwealth Edison in Illinois (presentation by Roger Baker, Commonwealth Edison, to the March 28, 2016 Illinois Stakeholder Advisory Group meeting regarding its next three year plan to be filed in the Fall of 2016 and covering the period June 1, 2017 through May 31, 2020 , available at

http://ilsagfiles.org/SAG_files/Meeting_Materials/2016/March_29-29_2016_Meeting/PY10-12_Program_Strawman_ComEd_March_SAG_v2.pdf); and New Jersey (Applied Energy Group, *Energy Efficiency and Renewable Energy Program Plan, Summary of Proposed Program Modifications for Fiscal Year 2017* (May 31, 2016)), available at http://www.njcleanenergy.com/files/file/public_comments/Summary%20of%20FY17%20Program%20Changes.pdf)

Exhibit CN-1 Confidential
Redacted

Exhibit CN-2

	(NPV in millions $)			
	Costs	Benefits	Delta	BCR
Ohio Edison	$287,089	$472,018	$184,929	1.64
Toledo Edison	$104,364	$178,428	$74,064	1.71
Cleveland Electric	$197,537	$337,978	$140,441	1.71
Total	$588,990	$988,424	$399,434	1.68

	Ohio Edison				Cleveland Electric				Toledo Edison				All Three Companies Combined			
	Costs	Benefits	Net Benefits	Benefit to Cost Ratio	Costs	Benefits	Net Benefits	Benefit to Cost Ratio	Costs	Benefits	Net Benefits	Benefit to Cost Ratio	Costs	Benefits	Net Benefits	Benefit to Cost Ratio
Residential Demand Response Program	927	1,250	323	1.35	546	712	166	1.30	150	168	18	1.12	1,623	2,130	507	1.31
Residential Appliance Turn In Program	7,062	23,067	16,005	3.27	5,076	16,549	11,473	3.26	2,240	6,781	4,541	3.03	14,378	46,397	32,019	3.23
Residential Energy Efficient Products Program	38,004	51,446	13,442	1.35	28,039	41,045	13,006	1.46	11,896	16,889	4,993	1.42	77,939	109,380	31,441	1.40
Residential Energy Efficient Homes Program	34,223	40,609	6,386	1.19	24,572	30,353	5,781	1.24	9,665	11,760	2,095	1.22	68,460	82,722	14,262	1.21
Residential Low Income Energy Efficiency Program	7,793	2,440	(5,353)	0.31	6,683	2,581	(4,102)	0.39	4,139	1,019	(3,120)	0.25	18,615	6,040	(12,575)	0.32
Residential Customer Action Program	4,349	27,940	23,591	6.42	2,427	16,488	14,061	6.79	1,193	7,636	6,443	6.40	7,969	52,064	44,095	6.53
Total Residential Portfolio	92,358	146,752	54,394	1.59	67,343	107,728	40,385	1.60	29,283	44,253	14,970	1.51	188,984	298,733	109,749	1.58
Small Enterprise C&I Energy Solutions for Business Program - Small	113,901	172,628	58,727	1.52	87,148	130,821	43,673	1.50	43,588	66,040	22,452	1.52	244,637	369,489	124,852	1.51
Customer Action Program - SCI	838	6,368	5,530	7.60	788	6,284	5,496	7.97	259	1,919	1,660	7.41	1,885	14,571	12,686	7.73
Total Small Enterprise Portfolio	114,739	178,996	64,257	1.56	87,936	137,105	49,169	1.56	43,847	67,959	24,112	1.55	246,522	384,060	137,538	1.56
Mercantile Customer Program	477	24,776	24,299	51.94	794	33,415	32,621	42.08	243	23,073	22,830	94.95	1,514	81,264	79,750	53.68
Total Mercantile Program	477	24,776	24,299	51.94	794	33,415	32,621	42.08	243	23,073	22,830	94.95	1,514	81,264	79,750	53.68
Mercantile Utility (Large Enterprise) C&I Demand Response Program - Large	14				14				14				42			
Mercantile Utility (Large Enterprise) C&I Energy Solutions for Business Program - Large	77,455	120,021	42,566	1.55	37,588	55,594	18,006	1.48	30,234	42,300	12,066	1.40	145,277	217,915	72,638	1.50
Mercantile Utility (Large Enterprise) Customer Action Program - LCI	487	496	9	1.02	1,836	3,158	1,322	1.72	513	674	161	1.31	2,836	4,328	1,492	1.53
Total Mercantile Utility (Large Enterprise)	77,956	120,517	42,561	1.55	39,438	58,752	19,314	1.49	30,761	42,974	12,213	1.40	148,155	222,243	74,088	1.50
Government Tariff Lighting Program	409	976	567	2.39	971	978	7	1.01	62	169	107	2.73			681	1.47
Total Government Tariff Lighting Program	409	976	567	2.39	971	978	7	1.01	62	169	107	2.73	1,442	2,123	681	1.47
								0					42			
Smart Grid Modernization Initiative																
Total - Other	14				14			0	14				42			
Total	**285,953**	**472,017**	**186,064**	**1.65**	**196,496**	**337,978**	**141,496**	**1.720024835**	**104,210**	**178,428**	**74,218**	**1.71**	**586,659**	**988,423**	**401,764**	**1.68**
	272,009	**409,997**	**137,988**	**1.51**	**183,968**	**276,052**	**92,098**	**1.500543573**	**97,863**	**144,107**	**46,244**	**1.47**	**553,840**	**830,156**	**276,316**	**1.50**

Source: Attachement A, Appendix C-4

3-Year UCT NPV Net Benefits for Shared Savings - No Opt Outs

	Ohio Edison				Cleveland Electric				Toledo Edison				Total for All 3 Companies						
	Benefits	Costs	Net Benefits	UCT	Benefits	Costs	Net Benefits	UCT	Benefits	Costs	Net Benefits	UCT	Benefits	Costs	Net Benefits	UCT			
Appliance Turn In Program	$23,067,100	$9,135,267	$13,931,833	2.5	$16,549,242	$6,563,860	$9,985,382	2.5	$6,781,202	$2,849,394	$3,931,808	2.4	$46,397,545	$18,548,522	$27,849,023	2.5	4.4%		
Energy Efficient Products Program	$51,446,199	$15,314,257	$36,131,943	3.4	$41,044,624	$10,780,288	$30,264,337	3.8	$16,888,997	$4,832,527	$12,056,470	3.5	$109,379,821	$30,927,071	$78,452,749	3.5	12.4%		
Energy Efficient Homes Program	$40,609,094	$30,688,501	$9,920,594	1.3	$30,352,931	$21,660,332	$8,692,599	1.4	$11,760,243	$9,050,284	$2,709,959	1.3	$82,722,269	$61,399,116	$21,323,152	1.3	3.4%		
Smart Thermostat	$0	$0	$0		$0	$0	$0		$0	$0	$0		$0	$0	$0		0.0%		
Low Income Energy Efficiency Program	$2,439,829	$7,765,002	-$5,325,174	0.3	$2,580,845	$6,660,703	-$4,079,858	0.4	$1,018,964	$4,129,166	-$3,110,202	0.2	$6,039,637	$18,554,871	-$12,515,234	0.3	0.0%		
C&I Energy Solutions for Business Program - Small	$150,943,751	$55,522,976	$95,420,775	2.7	$114,133,023	$42,926,647	$71,206,376	2.7	$56,998,044	$21,494,161	$35,503,883	2.7	$322,074,817	$119,943,784	$202,131,033	2.7	31.9%		
Government Tariff Lighting Program	$169,572	$256,606	-$87,034	0.7	$355,291	$495,888	-$140,596	0.7	$19,387	$53,401	-$34,014	0.4	$544,250	$805,895	-$261,644	0.7	0.0%		
C&I Energy Solutions for Business Program - Large	$112,579,194	$29,094,787	$83,484,407	3.9	$51,930,258	$14,992,039	$36,938,220	3.5	$39,469,612	$12,771,902	$26,697,711	3.1	$203,979,065	$56,858,728	$147,120,338	3.6	23.2%		
Customer Action Program - Res	$27,939,920	$836,144	$27,103,776	33.4	$16,488,233	$353,362	$16,134,871	46.7	$7,635,731	$233,034	$7,402,697	32.8	$52,063,884	$1,422,540	$50,641,344	36.6	8.0%		
Customer Action Program - SCI	$6,367,756	$838,237	$5,529,519	7.6	$6,284,116	$788,087	$5,496,029	8.0	$1,918,965	$258,670	$1,660,294	7.4	$14,570,837	$1,884,994	$12,685,842	7.7	2.0%		
Customer Action Program - LCI	$496,237	$308,214	$188,023	1.6	$3,158,240	$692,987	$2,465,253	4.6	$673,920	$264,261	$409,658	2.6	$4,328,396	$1,265,462	$3,062,934	3.4	0.5%		
Mercantile Customer Program	$24,776,318	$476,972	$24,299,346	51.9	$33,415,236	$793,799	$32,621,437	42.1	$23,073,012	$243,289	$22,829,723	94.8	$81,264,566	$1,514,060	$79,750,506	53.7	12.6%	23.0%	23.4%
Transmission & Distribution Upgrades	$6,016,288	$13,858	$6,002,430	434.1	$3,345,287	$13,858	$3,331,429	241.4	$1,398,827	$13,858	$1,384,969	100.9	$10,760,402	$41,574	$10,718,828	258.8	1.7%		
Smart Grid Modernization Initiative	$0	$0	$0		$0	$0	$0		$0	$0	$0		$0	$0	$0		0.0%		
Residential Demand Response Program	$1,250,052	$927,239	$322,813	1.3	$711,584	$545,985	$165,598	1.3	$168,288	$149,787	$18,501	1.1	$2,129,923	$1,623,011	$506,912	1.3	0.1%		
C&I Demand Response Program - Large	$0	$14,412	-$14,412	0.0	$0	$14,412	-$14,412	0.0	$0	$14,412	-$14,412	0.0	$0	$43,237	-$43,237	0.0	0.0%		
STIP - Res	$0	$277,160	-$277,160	0.0	$0	$0	$0		$0	$0	$0		$0	$277,160	-$277,160	0.0	0.0%		
STIP - SCI	$0	$647,413	-$647,413	0.0	$0	$783,153	-$783,153	0.0	$0	$41,253	-$41,253	0.0	$0	$1,471,819	-$1,471,819	0.0	0.0%		
STIP-LCI	$0	$211,183	-$211,183	0.0	$0	$256,981	-$256,981	0.0	$0	$111,369	-$111,369	0.0	$0	$579,533	-$579,533	0.0	0.0%		
Energy Special Improvement District	$0	$0	$0		$0	$0	$0		$0	$0	$0		$0	$0	$0		0.0%		
Total	$448,101,310	$152,328,226	$295,773,084	$0	$320,348,911	$108,322,380	$212,026,530	$0	$167,805,191	$56,510,771	$111,294,420	$0	$936,255,412	$317,161,378	$619,094,034	0.0			
Total w/o Programs UCT <1			$302,335,459				$217,301,531				$114,605,672				$634,242,662				
Customer Action and Mercantile Customer only													$152,227,683	$6,087,057	$146,140,627	25.0			
All Other programs													$784,027,729	$311,074,321	$472,953,408	2.5			

From OCC Set 1 RPD-020 Attachments 1-3

	OE	CE	TE	Total		
Appliance Turn In Program	64,267,196	46,117,042	18,874,078	129,258,316	5.4%	
Energy Efficient Products Program	120,308,774	96,808,954	39,832,756	256,950,484	10.6%	
Energy Efficient Homes Program	226,798,760	159,803,016	61,673,060	448,274,836	18.6%	
Smart Thermostat						
Low Income Energy Efficiency Program	7,528,724	7,992,242	3,150,694	18,671,660	0.8%	
C&I Energy Solutions for Business Program - Small	330,082,775	253,681,027	130,254,687	714,018,489	29.6%	
Government Tariff Lighting Program	546,051	1,309,197	53,346	1,908,594	0.1%	
C&I Energy Solutions for Business Program - Large	228,227,152	106,157,118	80,822,382	415,206,652	17.2%	
Customer Action Program - Res	80,761,435	47,642,671	22,085,809	150,489,915	6.2%	
Customer Action Program - SCI	14,354,816	14,166,267	4,325,917	32,847,000	1.4%	
Customer Action Program - LCI	1,104,363	7,040,368	1,516,310	9,661,041	0.4%	
Mercantile Customer Program	65,044,022	88,237,947	61,079,246	214,361,215	8.9%	16.9%
Transmission & Distribution Upgrades	12,800,000	6,900,000	2,970,000	22,670,000	0.9%	
Smart Grid Modernization Initiative						
Residential Demand Response Program						
C&I Demand Response Program - Large						
STIP - Res						
STIP - SCI						
STIP-LCI						
Energy Special Improvement District						
	1,151,824,068	835,855,849	426,638,285	2,414,318,202		

Budget

	OE		CE	TE	All Comp	
	2019	Total	Total	Total	Total	
CAP-Res	$301,886	$905,008	$382,465	$252,228	$1,539,701	0.5%
CAP-SCI	$302,651	$907,273	$853,001	$279,972	$2,040,246	0.6%
CAP-LCI	$111,451	$333,565	$750,065	$285,992	$1,369,622	0.4%
Mercantile	$159,162	$513,273	$853,179	$262,334	$1,628,786	0.5%
Total "no role"	$875,150	$2,659,119	$2,838,710	$1,080,526	$6,578,355	2.0%
Total all progs	$53,015,683	$156,272,565	$109,691,246	$57,005,340	$322,969,151	
"no role" %	2%	2%	3%	2%	2%	

MWh Savings

	OE		CE	TE	All Comp	
	2019	Total	Total	Total	Total	
CAP-Res		80,761	47,643	22,086	150,490	6.2%
CAP-SCI		14,355	14,166	4,326	32,847	1.4%
CAP-LCI		1,104	7,040	1,516	9,660	0.4%
Mercantile		65,044	88,238	61,079	214,361	8.9%
Total "no role"		161,264	157,087	89,007	407,358	16.9%
Total all progs		1,151,824	835,856	426,638	2,414,318	
"no role" %		14%	19%	21%	17%	

Exhibit CN-3 Confidential
Redacted

Exhibit CN-4 Confidential
Redacted

Exhibit CN-5

RAP | Energy solutions for a changing world

Valuing the Contribution of Energy Effi to Avoided Marginal Line Losses and Reserve Requirements

Principal authors

Jim Lazar and Xavier Baldwin

August 2011

Electronic copies of this paper and other RAP publications
can be found on our website at www.raponline.org.

To be added to our distribution list,
please send relevant contact information to
info@raponline.org.

RAP

Valuing the Contribution of Energy Effi to Avoided Marginal Line Losses and Reserve Requirements

by Jim Lazar, RAP Senior Advisor
Xavier Baldwin, P.E., Principal Electrical Engineer, Burbank Water and Power[1]

Introduction

Utilities and their regulators have become familiar, comfortable, and sometimes enthusiastic about the energy savings that energy efficiency measures provide. These savings reduce fuel usage, reduce air pollution, and reduce consumer bills.

Energy efficiency measures also provide very valuable peak capacity benefits in the form of marginal reductions to line losses that are often overlooked in the program design and measure screening. On-peak energy efficiency can produce twice as much ratepayer value as the average value of the energy savings alone, once the generation, transmission, and distribution capacity, line loss, and reserves benefits are accounted for. Geographically or seasonally targeted measures can further increase value.

This paper is one of two that the Regulatory Assistance Project (RAP) is publishing on this topic; the second looks in a more detailed fashion at the transmission and distribution system benefits of energy efficiency.[2]

Principal Conclusions

The line losses avoided by energy efficiency measures are generally underestimated. Most analysts who consider line losses at all use the system-average line losses, not the marginal line losses that are actually avoided when energy efficiency measures are installed. Generally this is because average line losses are a measured and published figure, while determining marginal line losses requires more information and more detailed calculations.

Because losses grow exponentially with load, the marginal losses avoided are much greater than the average losses on a utility distribution system. As calculated in Figure 4, marginal line losses at the time of the system peak of 20% are entirely consistent with average line losses of 7% on a utility distribution system.

Because energy efficiency measures reduce loads at the customer premises, they also avoid the associated marginal line losses. As a result, the utility avoids the need for as much as 120% of the generating capacity needed to serve the avoided load.

1 This paper builds on work originally presented to the Northwest Power and Conservation Council's Regional Technical Forum (RTF); it has benefited greatly from the contribution of Charlie Grist of the Council staff and Adam Hadley, P.E., a consultant to the RTF. See: http://www.nwcouncil.org/energy/rtf/meetings/2008/09/Marginal%20Distribution%20System%20Losses%203.ppt http://www.nwcouncil.org/energy/rtf/meetings/2008/09/Marginal%20Distribution%20System%20Losses%20Illustration%20v.xls

2 *US Experience with Efficiency as a Transmission and Distribution System Resource,* Chris Neme, Regulatory Assistance Project, November 2011. http://www.raponline.org/docs/

Utilities maintain generating reserves so that when one generating unit goes out of service, customers continue to receive service. Because energy efficiency reliably reduces energy loads and avoids marginal line losses, thus achieving reliable reductions in loads to be served at the generation level, the utility avoids the need for expensive reserves to assure reliable service. When compounded with the avoided marginal line losses, energy efficiency measures can save about 1.4 times as much capacity at the generation level as is measured at the customer's meter. While the energy benefit of line loss avoidance by investment in energy efficiency is relatively well-understood, the capacity benefit is a separate and additional benefit that is seldom quantified by efficiency analysts.

Efficiency Has a Favorable Daily and Seasonal Resource Shape

Most electric utilities have loads that rise during the day and decline at night. They also have seasonal increases in the summer, winter, or both, compared with the spring and autumn seasons. This variation is caused by people waking up and turning on appliances, going to work and turning on lights and office equipment, and using air conditioners following the heat of the afternoon.

A typical utility will have an on-peak demand during the peak season that is twice as high as the average demand over the year. The ratio of average demand to peak demand is called the *system load factor,* and in this example, would be 50%. Figure 1 shows a typical utility daily load shape.

Because investments in energy efficiency reduce the very loads that cause the overall system load, they generally have about the same load shape as the loads themselves – rising at peak hours and declining at night. Therefore, efficiency measures generally contribute more to the reduction of peak demands than they do on average. They have a better "load shape" than baseload power plants, and the savings are consequently more valuable.

This load shape is not uniform from measure to measure. Some types of efficiency, such as Energy Star air conditioners, provide very large peak demand savings relative to the energy savings. Others, like more efficient street lights, may only reduce demand during shoulder or off-peak hours.

Analysis is required to determine the peak demand of various efficiency measures. This is measured by the typical *load factor* of the individual measure (ratio of average to peak demand reduction) and the *coincidence factor* of the measure (the portion of the demand reduction of the individual measure that will occur at the time of the system peak demand). Measures that provide most of their savings during the high-load hours are said to have a favorable load shape. All three of these measures are important to valuing the energy savings from efficiency measures.

The peaking capacity value of different measures varies by region of the country, depending both on climate and on whether the local utility system is summer-peaking or winter-peaking. A summer-peaking region, like Texas or Florida, will value the capacity benefits of air conditioning savings, but will derive much less capacity value from electric space-heating savings. Winter-peaking regions will have the opposite perspective. Utilities with dual peaks will generally assign a greater value to measures other than space conditioning (i.e., that reduce peak demand in both seasons) compared to regions with a strong peak demand in one season or the other.

Figure 2 shows the relative on-peak summer and winter savings of some typical energy efficiency measures as evaluated in the Pacific Northwest, a winter-peaking region.

Figure 1:

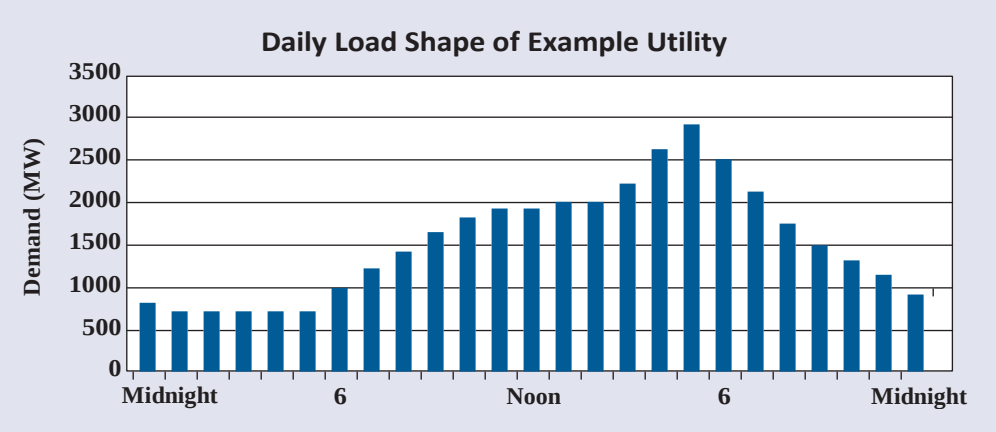


Figure 2

Ratio of Coincident Peak Savings to Average Annual Energy Savings [3]

Measure	Summer Peak	Winter Peak
Residential Lighting	0.90	1.37
Residential Water Heat	0.94	2.63
Residential Space Heat	0.28	4.00
Residential Air Conditioning	1.72	0.08
Residential Refrigerators	1.11	0.87
Commercial Lighting	2.17	2.00
Commercial Air Conditioning	2.86	0.08

As is evident in a winter-peaking region like the Pacific Northwest, investments in space heating conservation (floor, ceiling, and wall insulation) will provide very large peak demand benefits, whereas in summer-peaking regions, it is natural that air conditioning measures are most valuable. One of the more interesting findings of this particular analysis, however, was the relatively high winter-peak coincidence factor of residential water heating consumption.[4] This might be very different on a summer-peaking system.

Energy Efficiency Provides Significant Distribution and Transmission Loss Savings at the Time of Critical System Peak Demands

Because energy effi reduces loads at the customer premises, the utility does not have to supply these avoided demands with generating facilities. Generating facilities are often located at great distances from customers and require step-up transformers to get the power onto the transmission system, long transmission lines, transmission substations, step-down transformers to distribution voltages, distribution lines, and distribution line transformers.

Losses occur at each of these steps of the transmission and distribution system. Typical utility-wide average annual losses from generating plants to meters ranges from 6% to 11%, depending on the transmission distances, system density, distribution voltages, and the characteristics of transmission and distribution system components.[5]

Energy efficiency is often credited with avoiding these average losses when regulators and utilities value efficiency investments and set the program cost-effectiveness thresholds based on avoided cost. However, the losses on utility transmission and distribution systems are not uniform through the day and the year, and the peak capacity savings from energy efficiency are typically much greater than the average savings.

Line Losses on a Distribution System

Many utility conservation programs credit efficiency measures with line loss reduction, but most of these calculations are based on the *average* losses, not the *marginal* losses avoided by efficiency measures.

There are two types of losses on the transmission and distribution system. The first are *no-load* losses, or the losses that are incurred just to *energize* the system – to create a voltage available to serve a load. Nearly all of these occur in step-up and step-down transformers. The second are *resistive* losses, which are caused by friction released as heat as electrons move on increasingly crowded lines and transformers. Typically, about 25% of the average

3 Northwest Power and Conservation Council Regional Technical Forum, 2001; see: http://www.nwcouncil.org/energy/rtf/measures/support/procost/MC_AND_LOADSHAPE_6P.XLS

4 Water heat usage is concentrated in the early morning and early evening hours, when households are beginning and ending their day. System peaks typically occur when residential and commercial loads overlap – in the morning around 8 a.m. and the evening around 5 p.m.; therefore electric water heat usage is highly peak-coincident at least for a winter-peaking system. By contrast, while gas water heat usage occurs in the same hours, water heat is a very high load factor usage on gas systems, because in the natural gas industry, peak demand is measured on a daily basis, not an hourly (or sub-hourly) basis as is the standard for the electricity sector. Prior to the 1960s, timers were common on electric water heaters to keep them from contributing to peak demand; with the advent of smart grid resources, electric water heaters are now being looked to for demand response and to complement intermittent generation from wind.

5 Page 401a of the FERC Form 1 shows system losses and system retail sales, and generally fall in this range for vertically integrated utilities. Line losses attributable to wholesale sales and wholesale purchases are typically reported in part by the seller and in part by the buyer – and therefore the losses reported in the Form 1 may not refl all losses attributable to retail sales by the reporting utility.

annual losses are no-load or core losses, and about 75% are resistive losses. Utility loss studies generally separate the core losses from the resistive losses.[6]

Losses increase significantly during peak periods. The mathematical formula for the resistive losses is I^2R, where "I" is the amperage (current) on any particular transformer or distribution line, and "R" is the resistance of the wires through which that current flows. While the "R" is generally constant through the year, since utilities use the same wires and transformers all year long, the "I" is directly a function of the demand that customers place on the utility. Thus, resistive losses increase with the square of the current, meaning losses increase as load increases.

Let's start with a very simple calculation: the load (current times voltage) of a utility during the highest on-peak hours is two times the average load for the year, a system load factor of 50%. Because the voltage is constant, losses are a function of the square of the load, and that load is two times as high on-peak as the average, the total resistive losses are *four times* as great during the summer afternoon peak as they average over the year. It's a bit more complicated than that, but this example gives a general idea.

Depending on the load shape of the utility (how sharp the "needle peak" is), the percentage of generation that is "lost" before it reaches loads are typically at least twice as high as the average annual losses on the system. During the highest critical peak hours (perhaps 5-25 hours per year) when the system is under stress, the losses may be four to six times as high as the average.

There are many tools available to utilities for line loss reduction, including voltage upgrades, reconductoring, and improved transformers. While these are valuable and may often be cost-effective, the focus of this paper is on the avoidable marginal losses as a result of load reductions from implementation of energy effi measures.

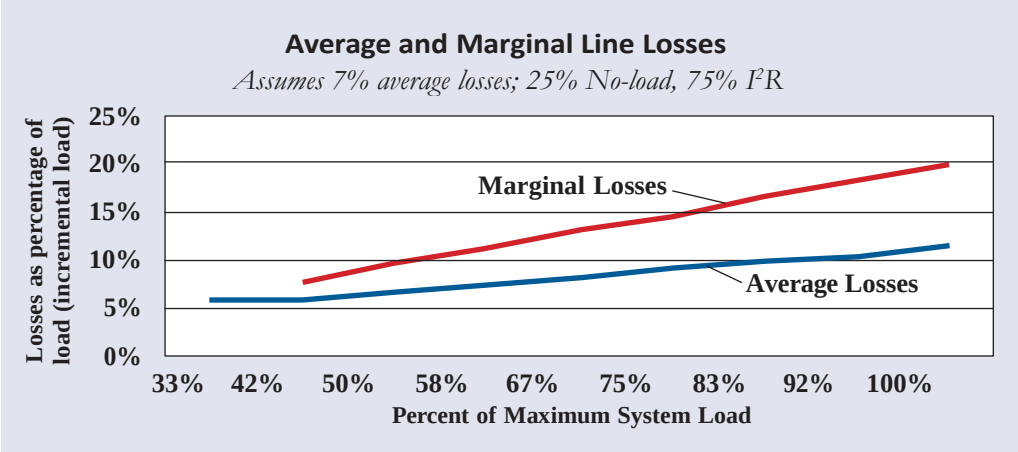
Marginal Losses Are Greater Than Average Losses

Important to valuing any investment is how much the *incremental* cost of the measure is, and what the incremental savings are.[7] Because the average losses increase with the square of the load, the marginal line losses at any point are signifi higher than the average losses at that same point on the load curve. It turns out that the incremental system losses during the peak hours are *much* greater than the average losses during these hours. As noted above, this is due to the total losses growing with the square (I^2R) of the load in response to linear growth in the loads, and the incremental losses (the change in losses with respect to the change in loads) are therefore more than exponential.

The graph below shows the average losses at various load levels for a hypothetical small utility with an average annual resistive loss of 7% on its system. It also shows the incremental losses sustained as load increased from the minimum level of about 100 megawatts to the system record peak demand of nearly 300 megawatts for this utility.

This utility's average resistive losses on their distribution system are only about 7% over the course of the year. At their system extreme peak, the estimated total losses

Figure 3



6 In preparing this paper, the authors reviewed line loss studies for several utilities; they indicated no-load losses ranging from 18.5% to 30% of total annual losses. A mean fi e of 25% is used for simplicity in illustrating the principle of marginal line loss calculation.

7` The most comprehensive and most commonly accepted cost-effectiveness test is the Total Resource Cost (TRC) test, which, when properly applied, measures both energy and non-energy benefi but the principles in this analysis apply equally to the Program Administrator Cost (PAC) test used by some utilities and regulators to value energy effi investments.

Figure 4:

Calculation of Average and Marginal Line Losses

Load Level	No-Load Losses MW	Resistive Losses MW	Square of Load	Loss %	Total Loss MW	Incremental Load	Incremental Loss	Marginal Loss %
100	2.625	3.5	10,000	6.1%	6.1			
125	2.625	5.5	15,625	6.5%	8.1	25	2.0	8%
150	2.625	7.9	22,500	7.0%	10.5	25	2.4	10%
175	2.625	10.7	30,625	7.6%	13.3	25	2.8	11%
200	2.625	14.0	40,000	8.3%	16.6	25	3.3	13%
225	2.625	17.7	50,625	9.0%	20.3	25	3.7	15%
250	2.625	21.9	62,500	9.8%	24.5	25	4.2	17%
275	2.625	26.5	75,625	10.6%	29.1	25	4.6	18%
300	2.625	31.5	90,000	11.4%	34.1	25	5.0	20%

reached about *11%,* one and one-half times the average losses for the year. At that extreme peak, however, the *marginal* resistive losses – those that would be avoided if load had been a little bit lower if an efficiency measure were installed – were *20%.*

The graphic in Figure 3 is derived from the calculations above in Figure 4.

Few utilities or regulators have studied the marginal losses that can be avoided with incremental investment in efficiency measures that provide savings at the time of extreme peak demands. This type of analysis suggests a very significant benefit from measures that reduce peak demand, including energy efficiency, demand response, and use of emergency generators located at customer premises.

Mathematically, the formula I^2R reduces the marginal resistive loses to a calculation. At any point on the load duration curve, marginal resistive loses are two-times the average resistive losses at that same point on the load duration curve. During off-peak hours, when average resistive losses may be only 3%, the marginal losses are 6%. During the highest peak hours, when average resistive losses may be 10%, the marginal losses are 20%.

However, because part of the overall losses at every hour are (no-load) losses, the marginal losses are not two times the total losses – only two times the resistive losses. The no-load losses are not reduced by energy effi measures. A variety of utility loss studies indicate that 20%-30% of total losses are no-load losses, meaning that about 75% are resistive losses. Therefore this paper uses a rule of thumb that marginal losses are about 1.5 times average losses (it's actually a bit lower at low loads, and a bit higher at high loads where the no-load losses are a smaller part of total losses.)

This means that a conservation measure that saved 1 kilowatt at the time of the system peak measured at the customer's meter would save about 1.25 kilowatts measured at the generation level.[8] The critical peak-period marginal line-loss savings of energy efficiency therefore adds another 25% to the value of the load reduction itself, in determining the amount of generating capacity required to meet critical peak period demand. If the utility has 1.25 kW of generating capacity, and loses at the margin 20% of this capacity during the highest peak hours, it has 1 kW available to serve the load.

The hypothetical analysis may not be universally applicable, but the principles are universal: losses increase with the square of the demand, and incremental losses during the critical peak period are much larger than the average losses over the year.

Avoidable Transmission and Distribution Capacity Costs Are Significant

In addition to the avoided losses and the reduced need for generating capacity that can be achieved through

8 [1.25 – (.20 x 1.25) = 1.0]; If the utility must serve a 1 kW incremental load on-peak, it needs 1.25 kW of additional generating capacity to feed the transmission and distribution system.

energy efficiency investment at the distribution level, the peak load reduction from energy efficiency investment also reduces transmission and distribution capacity costs. Recognizing this value may be especially important for those jurisdictions that actually review T& D investments against targeted energy efficiency program opportunities.[9]

Transmission and distribution systems must be designed to carry extreme peak demands. The costs of oversizing systems for these demands are quite significant. In states where marginal cost of service studies are used to set rates, utilities regularly examine the cost of adding capacity to their transmission and distribution grids. The results of these studies vary widely, in part due to regional conditions and in part due to a lack of standardized methodologies.

The capital cost of augmenting transmission capacity is typically estimated at $200 to $1,000 per kilowatt, and the cost of augmenting distribution capacity ranges between $100 and $500 per kilowatt.[10] Annualized values (the average rate of return multiplied by the investment over the life of the investment) are about 10% of these figures, or $20 to $100 per kilowatt-year for transmission and $10 to $50 per kilowatt-year for distribution. There are also marginal operations and maintenance costs for transmission and distribution capacity, but these are modest in comparison to the capital costs.

In valuing energy effi investments, it is important to consider the avoided energy and capacity not only at the generation level, but also at the transmission and distribution levels. Inclusion of these values, particularly considering the marginal capacity benefi from incremental effi investments, can greatly increase the value of these measures, and therefore the level of fi assistance or incentives that utilities may offer to encourage implementation.

Another important benefit of increased energy efficiency at the distribution/customer level is the significant extension in useful life of distribution system components and the resulting deferral of capital expenditures for upgrade or replacement of electrical equipment, including conductors, transformers, etc. In effect, energy efficiency allows the system to absorb additional load growth without the need to upgrade system components as soon. This capital deferral translates more or less directly into avoided distribution-capital investment costs for capacity expansion. A prudent assumption is that the avoided capacity benefits are at least one-half of the utility's estimated marginal transmission and distribution capacity costs, based on their most recent cost-of-service analysis.[11]

Another benefit of reducing marginal losses is lower loss of service life due to a reduction in winding and insulation temperatures in distribution transformers, which are normally operated at up to 200% of their nameplate rating during peak load periods, a condition that causes accelerated aging of these components.

Efficiency Reduces System Generating Reserve Requirements

Utilities must provide *reserves* of generating facilities in order to ensure that service is not interrupted if (and when) generating units fail to operate as planned. Generating reserve requirements in the United States range from as low as 7% on hydro-rich utilities to as much as 25% for isolated small utilities in Alaska and Hawaii. Ten to fifteen percent is typical for large thermal-based systems.[12]

Effi investments reduce loads at the customer's meter, and, as we have seen, provide even larger reductions at the generation level during system peak periods when losses skyrocket and capacity/reserve requirements are greatest.

Since the reserve requirement is tied to the amount of generation required to serve load, efficiency reduces the reserve requirement not only by a percentage of the

9 Id footnote 2.

10 These wide ranges reflect the wide possible range of outcomes for distance, topography, real estate costs, and construction costs that may be incurred.

11 The capacity benefit may not be monetized immediately, due to temporary excess capacity; but over the life of a distribution circuit, eventually components will need to be replaced due to age or upsized due to growth. Using one-half of marginal cost implies that, on average, the capacity benefits will be realized within a half-lifetime of the circuit components.

12 The level of required reserves is a function of the size of the total system, the size of the largest single generating units, and the reliability of the various generating units. Because hydro units are generally relatively small and extremely reliable, utilities that rely on hydro for reserves have the lowest reserve requirements. Small island systems, like those in Hawaii, with a few relatively large generating units typically have the highest reserve requirements.

savings that customers enjoy, but also by a percentage of the incremental peak losses on the transmission and distribution system that reduce the utility's generation requirements. The reserve requirement is measured against the amount of generation needed – *including that needed to cover line losses*. Therefore, the avoided reserves resulting from efficiency investments are increased in value by the avoided marginal line losses.

The table below looks at the capacity savings during an off-peak period and an on-peak period for two hypothetical resources, one with a low coincidence factor relative to the system peak (efficient lighting), and one with a high coincidence factor, efficient air conditioning. The table shows that after considering the coincidence of different loads to the system peak, the marginal line losses, and the avoided reserve requirement, the capacity benefit of energy efficiency measures increases significantly from that measured at the customer's meter.

As is evident, the total capacity benefit of each of these measures is 1.44 times the capacity savings at the customer's meter, because of the value of the marginal line losses and avoided reserves during peak periods (line 8 divided by line 3). Thus the generation capital cost savings are significantly higher than if only average line losses were used and if the reserves benefits were not included.

Efficiency Is The Most Reliable Resource

Energy efficiency is the most reliable resource in which a utility can invest. Unlike any type of generating unit, efficiency investments are composed of hundreds or thousands of small, distributed units, each of which saves anywhere from a few watts (e.g., a compact fluorescent lamp) to a few kilowatts (e.g., a high-efficiency commercial air conditioning unit).

It has long been recognized that a utility network made up of a large number of small generating units provides a more reliable system simply because they will not all fail simultaneously. The same principle applies to energy efficiency investments, which are a large number of small energy-saving devices. But these go beyond this mathematical advantage in at least two ways:

First, the individual units (efficient light bulbs, refrigerators, and air conditioners) are, as a population, extremely reliable, far more so than any type of generating plant.[13] Energy Star windows, attic insulation, or variable speed drive in a commercial HVAC system are almost certainly not going to "fail" during a heat wave. Conversely, generating plants, transmission lines, and even distribution transformers are most susceptible to failure when under stress. Even the most reliable type of generating units (hydro turbines) have higher "forced outage rates" than energy savings devices.

Second, if one energy efficient unit does fail, such a "failure" often actually reduces electric demand (i.e., when a high-efficiency air conditioner breaks, the customer may be entirely without air conditioning – uncomfortable, but using less energy). The utility loses an "efficient" load, but nonetheless, the load goes down when the unit fails, generally reducing the load-related stress and threats to reliability on the system. When a generating plant or transmission line fails, it leaves the utility with the same load, and less ability to serve that load and with increased risk of a system outage affecting hundreds, thousands, or even millions of consumers.

Figure 5:

Peak Capacity Savings from Energy Efficiency Investments

Line		Lighting	Air Conditioning
1	kW Savings at Customer Meter	10	10
2	Coincidence Factor	0.25	0.75
3	kW Savings at Customer Meter at Peak (1 X 2)	2.5	7.5
4	Marginal Line Losses At Peak @ 20% (3 / (1 - 20%) -3)	0.625	1.875
5	kW Savings at Busbar (3 + 4)	3.125	9.375
6	Reserve Margin Requirement	15%	15%
7	Avoided Reserve Capacity (@ 15%)	0.47	1.41
8	kW Savings At Generation Level (5 + 7)	3.59	10.78

13 The most reliable peaking units have on-peak availability of about 95%, and forced outage rates of about 5%.

How the Smart Grid Can Enhance the Application of Energy Efficiency Measures

At the time of the system peak demand, line losses are highest and marginal line losses may be 20% or higher. For this reason, actions that reduce load at the time of the system peak are extremely valuable. As utilities invest in smart grid assets and learn to deploy them, avoidance of expensive peak load related costs becomes more feasible. The application of smart grid technology will enhance the application of energy efficiency measures by:

- **Accurately measuring conditions on the distribution system before and after the application of load management tools, so that the value can be accurately known.**
  For the first time utilities will be able to accurately measure voltage, load, and reactive power at the distribution level down to individual customers. Data will be available to determine the level of losses occurring on a circuit and what control actions are needed. For example, the data will show when and how to optimally adjust circuit voltage level to reduce demand or save energy.
- **Providing the ability to control or shift demand at peak times**
  Customer load can be reduced or shifted by application of smart thermostats, pool pump controls, water heater controls, appliance controls, etc. This is most valuable during peak load events when the combination of energy savings and peak capacity savings is at its highest.
- **Providing the ability to utilize/control distributed generation (i.e. fuel cells, batteries, solar arrays, PHEV's etc.) as needed.**
  Customers may invest in distributed resources and energy storage to reduce their peak demand as measured by their electric meters, which typically measure non-coincident peak demand. With smart grid tools, the energy control center can interface with distributed generation to provide additional capacity at the utility's peak time or store renewable energy during off-peak periods, both of which benefit the system, but might not be apparent to the individual customer.

These types of control may enable the utility to avoid load during the needle peak hours – when marginal line losses may exceed 20%, and when generation reserves are stretched thin at a much lower cost than building additional generation, transmission, and distribution capacity. This will have a small effect on the value of energy conservation measures, such as those described here, which provide savings for thousands of hours per year. However, it may provide signifi cost relief to the utility and its consumers in avoiding the cost of seldom-used capacity, thereby adding great value to the types of measures that provide savings concentrated at the time of the system peak demand.

The measures mentioned above are part of the emerging *demand response* capability of smart grid, which promises to provide a verifiable *virtual* reserve of reliable capacity directly equivalent to a *spinning reserve* but at a much lower cost.

Summary: The Avoided Line Losses and Avoided Reserves Benefits of Energy Efficiency Are Very Important

This paper has attempted to highlight two often-overlooked attributes of energy efficiency investments.

First, energy efficiency measures typically provide significant savings at the time of the system peak demand, and that time occurs when the line losses are highest. The avoided line losses can add as much as 20% to the capacity value measured at the customer meter.

Second, because they are reducing loads, including marginal line losses, energy efficiency measures also reduce the level of required generating reserves.

Each of these benefits increases the economic savings provided by energy efficiency investments. The compounding of a 20% marginal line loss savings and a 15% reserves savings can produce a 44% total generating capacity benefit, over and above the peak load reduction measured at the customer's meter.

For peak-oriented loads like air conditioning, the annual capacity cost of generation, transmission, and distribution *capacity* needed to assure reliable service can equal or exceed the cost of the *energy* used during the year.

Add it all together, and the total capacity value of energy efficiency investments in peak-oriented loads like space conditioning can be as valuable as the energy savings are.

Marginal line loss calculations and avoided reserve requirements should be an integral part of any evaluation of the benefits of energy efficiency measures.

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts focused on the long-term economic and environmental sustainability of the power and natural gas sectors. We provide technical and policy assistance on regulatory and market policies that promote economic efficiency, environmental protection, system reliability and the fair allocation of system benefits among consumers. We have worked extensively in the US since 1992 and in China since 1999. We added programs and offices in the European Union in 2009 and plan to offer similar services in India in the near future.
Visit our website at **www.raponline.org** to learn more about our work.

Home Office
50 State Street, Suite 3
Montpelier, Vermont 05602
802-223-8199
www.raponline.org

Exhibit CN-6

OCC Set 1

Case No. 16-0743-EL-POR

In the Matter of the Application of Ohio Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison Company For Approval of Their Energy Efficiency and Peak Demand Reduction Program Portfolio Plans for 2017 through 2019

RESPONSES TO DATA REQUESTS

OCC Set 1 RPD-020 Please provide all documents that support your response to INT-16, including, but not limited to, projections, calculations, estimates, reports, analyses, and forecasts.

Response:

Original Response Dated: 5/31/16

Objection. This request is overbroad and unduly burdensome. Subject to and without waiving the foregoing objection, *see* OCC Set 1 RPD-20-Attachments 1-3.

Supplemental Response Dated: 6/21/16

Objection. This request is overbroad and unduly burdensome. Subject to and without waiving the foregoing objection, *see* OCC Set 1 RPD-20-Attachments 1-3 Supplemental (Errata).

OCC Set 1 RPD 20-Attachment 1- Supplemental (Errata)

	Benefits	Costs	Net Benefits	UCT
EE	$320,982,590	$108,307,968	$212,674,622	3.0
DR	$0	$14,412	-$14,412	0.0
Total	$320,982,590	$108,322,380	$212,660,210	3.0

OCC Set 1 RPD 20-Attachment 1- Supplemental (Errata)

	Benefits	Costs	Net Benefits	UCT
Res	$90,527,642	$45,665,183	$44,862,460	2.0
SCI	$114,133,023	$43,709,800	$70,423,223	2.6
Govt	$355,291	$495,888	-$140,596	0.7
LCI	$51,588,342	$15,249,020	$36,339,322	3.4
Res CAP	$16,488,233	$353,362	$16,134,871	46.7
SCI CAP	$6,284,116	$788,087	$5,496,029	8.0
LCI CAP	$3,137,445	$692,987	$2,444,459	4.5
Merc	$34,411,627	$793,799	$33,617,828	43.4
T&D	$3,345,287	$13,858	$3,331,429	241.4
Res DR	$711,584	$545,985	$165,598	1.3
LCI DR	$0	$14,412	-$14,412	0.0
SCI DR	$0	$0	$0	#DIV/0!

OCC Set 1 RPD 20-Attachment 1- Supplemental (Errata)

	Benefits	Costs	Net Benefits
Appliance Turn In Program	$16,549,242	$6,563,860	$9,985,382
Energy Efficient Products Program	$41,044,624	$10,780,288	$30,264,337
Energy Efficient Homes Program	$30,352,931	$21,660,332	$8,692,599
Smart Thermostat	$0	$0	$0
Low Income Energy Efficiency Program	$2,580,845	$6,660,703	-$4,079,858
C&I Energy Solutions for Business Program - Small	$114,133,023	$42,926,647	$71,206,376
Government Tariff Lighting Program	$355,291	$495,888	-$140,596
C&I Energy Solutions for Business Program - Large	$51,588,342	$14,992,039	$36,596,303
Customer Action Program - Res	$16,488,233	$353,362	$16,134,871
Customer Action Program - SCI	$6,284,116	$788,087	$5,496,029
Customer Action Program - LCI	$3,137,445	$692,987	$2,444,459
Mercantile Customer Program	$34,411,627	$793,799	$33,617,828
Transmission & Distribution Upgrades	$3,345,287	$13,858	$3,331,429
Smart Grid Modernization Initiative	$0	$0	$0
Residential Demand Response Program	$711,584	$545,985	$165,598
C&I Demand Response Program - Large	$0	$14,412	-$14,412
STIP - Res	$0	$0	$0
STIP - SCI	$0	$783,153	-$783,153
STIP-LCI	$0	$256,981	-$256,981
Energy Special Improvement District	$0	$0	$0

UCT
2.5
3.8
1.4
#DIV/0!
0.4
2.7
0.7
3.4
46.7
8.0
4.5
43.4
241.4
#DIV/0!
1.3
0.0
#DIV/0!
0.0
0.0
#DIV/0!

OCC Set 1 RPD 20-Attachment 1- Supplemental (Errata)

	Benefits	Costs	Net Benefits	UCT
Appliance Turn In	$16,549,242	$6,563,860	$9,985,382	2.5
Appliances	$4,044,068	$1,704,242	$2,339,826	2.4
Consumer Electronics	$2,386,359	$521,187	$1,865,172	4.6
EE Kits	$17,518,100	$8,712,591	$8,805,509	2.0
Lighting	$28,422,235	$5,716,430	$22,705,805	5.0
Behavioral	$3,456,970	$4,509,420	-$1,052,450	0.8
School Education	$2,055,669	$1,683,874	$371,795	1.2
Audits & Education	$2,145,966	$2,451,608	-$305,642	0.9
HVAC	$6,191,963	$2,838,429	$3,353,534	2.2
Smart Thermostat	$710,452	$1,417,320	-$706,868	0.5
New Homes	$4,465,774	$2,885,518	$1,580,256	1.5
Community Connections	$2,533,440	$6,497,387	-$3,963,947	0.4
LI - New Homes	$47,404	$163,316	-$115,911	0.3
Retro - Commissioning - SCI	$3,555,880	$2,038,039	$1,517,841	1.7
Custom Buildings - SCI	$11,769,903	$2,762,347	$9,007,557	4.3
Audits & Education - SCI	$15,035,009	$19,880,846	-$4,845,836	0.8
Data Centers - SCI	$1,531,518	$1,228,939	$302,578	1.2
Custom - SCI	$26,577,009	$5,442,445	$21,134,564	4.9
HVAC - SCI	$9,119,149	$1,460,386	$7,658,763	6.2
Lighting - SCI	$43,515,822	$8,160,931	$35,354,892	5.3
Food Service	$1,948,978	$517,288	$1,431,690	3.8
Consumer Electronics - SCI	$47,399	$149,854	-$102,455	0.3
Appliance Turn In - SCI	$311,823	$718,245	-$406,422	0.4
Appliances - SCI	$566,211	$228,517	$337,694	2.5
Agricultural	$154,321	$338,811	-$184,490	0.5
Government Tariff Lighting	$355,291	$495,888	-$140,596	0.7
Retro - Commissioning - LCI	$557,121	$510,883	$46,237	1.1
Custom Buildings - LCI	$7,739,063	$2,124,425	$5,614,638	3.6
Custom - LCI	$28,638,465	$6,603,646	$22,034,819	4.3
Energy Efficiency Auction - LCI	$0	$0	$0	#DIV/0!
Data Centers - LCI	$1,840,374	$1,010,592	$829,782	1.8
HVAC - LCI	$4,186,224	$890,125	$3,296,099	4.7
Lighting - LCI	$8,351,955	$1,793,321	$6,558,634	4.7
Audits & Education - LCI	$275,141	$2,059,046	-$1,783,906	0.1
Customer Action Program - Res	$16,488,233	$353,362	$16,134,871	46.7
Customer Action Program - SCI	$6,284,116	$788,087	$5,496,029	8.0
Customer Action Program - LCI	$3,137,445	$692,987	$2,444,459	4.5
Mercantile	$34,411,627	$793,799	$33,617,828	43.4
T&D Upgrades	$3,345,287	$13,858	$3,331,429	241.4
Smart Grid	$0	$0	$0	#DIV/0!
Direct Load Control	$711,584	$545,985	$165,598	1.3
Behavioral - DR	$0	$0	$0	#DIV/0!
Demand Response - LCI	$0	$14,412	-$14,412	0.0
STIP - Res	$0	$0	$0	#DIV/0!
STIP - SCI	$0	$783,153	-$783,153	0.0
STIP-LCI	$0	$256,981	-$256,981	0.0
Energy Special Improvement District	$0	$0	$0	#DIV/0!

plemental (Errata)

Plan	Sector	Program
EE	Res	Appliance Turn In Program
EE	Res	Energy Efficient Products Program
EE	Res	Energy Efficient Products Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Products Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Products Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Homes Program
EE	Res	Low Income Energy Efficiency Program
EE	Res	Low Income Energy Efficiency Program
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	Govt	Government Tariff Lighting Program
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	Res CAP	Customer Action Program - Res
EE	SCI CAP	Customer Action Program - SCI
EE	LCI CAP	Customer Action Program - LCI
EE	Merc	Mercantile Customer Program
EE	T&D	Transmission & Distribution Upgrades
EE	T&D	Smart Grid Modernization Initiative
EE	Res DR	Residential Demand Response Program
EE	Res DR	Energy Efficient Homes Program
DR	LCI DR	C&I Demand Response Program - Large
DR	LCI DR	C&I Demand Response Program - Large
EE	Res	STIP - Res
EE	SCI	STIP - SCI
EE	LCI	STIP-LCI
DR	T&D	Energy Special Improvement District

Sub-Program		Benefits
Appliance Turn In	Appliance Recycling	$16,549,242
Appliances	Appliances	$4,044,068
Consumer Electronics	Electronics	$2,386,359
EE Kits	EE Kits	$17,518,100
Lighting	Lighting	$28,422,235
Behavioral	Behavioral	$3,456,970
School Education	School Ed	$2,055,669
Audits & Education	Audit-Comp & Online	$2,145,966
HVAC	HVAC	$6,191,963
Smart Thermostat	Smart Thermostat	$710,452
New Homes	New Cnstruct	$4,465,774
Community Connections	LI Comm Connect	$2,533,440
LI - New Homes	LI New Construction	$47,404
Retro - Commissioning - SCI	RestroCommissioning - SCI	$3,555,880
Custom Buildings - SCI	Custom Buildings - SCI	$11,769,903
Audits & Education - SCI	Audits - SCI	$15,035,009
Data Centers - SCI	Data Centers - SCI	$1,531,518
Custom - SCI	Custom - SCI	$26,577,009
HVAC - SCI	HVAC - SCI	$9,119,149
Lighting - SCI	Lighting - SCI	$43,515,822
Food Service	Food Service - SCI	$1,948,978
Consumer Electronics - SCI	Electronics - SCI	$47,399
Appliance Turn In - SCI	Appliance Recycling - SCI	$311,823
Appliances - SCI	Appliance Rebate - SCI	$566,211
Agricultural	Agricultural - SCI	$154,321
Government Tariff Lighting	Gov - Outdoor Lighting	$355,291
Retro - Commissioning - LCI	RestroCommissioning - LCI	$557,121
Custom Buildings - LCI	Custom Buildings - LCI	$7,739,063
Custom - LCI	Custom - LCI	$28,638,465
Energy Efficiency Auction - LCI	EE Auction - LCI	$0
Data Centers - LCI	Data Centers - LCI	$1,840,374
HVAC - LCI	HVAC - LCI	$4,186,224
Lighting - LCI	Lighting - LCI	$8,351,955
Audits & Education - LCI	Audits - LCI	$275,141
Customer Action Program - Res	CAP Res	$16,488,233
Customer Action Program - SCI	CAP SCI	$6,284,116
Customer Action Program - LCI	CAP LCI	$3,137,445
Mercantile	Mercantile	$34,411,627
T&D Upgrades	T&D Upgrades	$3,345,287
Smart Grid	Smart Grid	$0
Direct Load Control	DR Res DLC	$711,584
Behavioral - DR	DR Res Behave	$0
Demand Response - LCI	DR LC&I Contracted	$0
Demand Response - LCI	DR LC&I ELR Tariff	$0
STIP - Res	STIP - Res	$0
STIP - SCI	STIP - SCI	$0
STIP-LCI	STIP-LCI	$0
Energy Special Improvement District	ESID	$0

Costs	Net Benefits	UCT
$6,563,860	$9,985,382	$2.52
$1,704,242	$2,339,826	$2.37
$521,187	$1,865,172	$4.58
$8,712,591	$8,805,509	$2.01
$5,716,430	$22,705,805	$4.97
$4,509,420	-$1,052,450	$0.77
$1,683,874	$371,795	$1.22
$2,451,608	-$305,642	$0.88
$2,838,429	$3,353,534	$2.18
$1,417,320	-$706,868	$0.50
$2,885,518	$1,580,256	$1.55
$6,497,387	-$3,963,947	$0.39
$163,316	-$115,911	$0.29
$2,038,039	$1,517,841	$1.74
$2,762,347	$9,007,557	$4.26
$19,880,846	-$4,845,836	$0.76
$1,228,939	$302,578	$1.25
$5,442,445	$21,134,564	$4.88
$1,460,386	$7,658,763	$6.24
$8,160,931	$35,354,892	$5.33
$517,288	$1,431,690	$3.77
$149,854	-$102,455	$0.32
$718,245	-$406,422	$0.43
$228,517	$337,694	$2.48
$338,811	-$184,490	$0.46
$495,888	-$140,596	$0.72
$510,883	$46,237	$1.09
$2,124,425	$5,614,638	$3.64
$6,603,646	$22,034,819	$4.34
$0	$0	#DIV/0!
$1,010,592	$829,782	$1.82
$890,125	$3,296,099	$4.70
$1,793,321	$6,558,634	$4.66
$2,059,046	-$1,783,906	$0.13
$353,362	$16,134,871	$46.66
$788,087	$5,496,029	$7.97
$692,987	$2,444,459	$4.53
$793,799	$33,617,828	$43.35
$13,858	$3,331,429	$241.40
$0	$0	#DIV/0!
$545,985	$165,598	$1.30
$0	$0	#DIV/0!
$0	$0	#DIV/0!
$14,412	$48,618,086	$3,374.37
$0	$0	#DIV/0!
$783,153	-$783,153	$0.00
$256,981	-$256,981	$0.00
$0	$0	#DIV/0!

OCC Set 1 RPD 20-Attachment 1- Supplemental (Errata)

Program	Benefits	Costs	Net benefits	UCT
Appliance Recycling	$16,549,242	$6,563,860	$9,985,382	2.52
Appliances	$4,044,068	$1,704,242	$2,339,826	2.37
Electronics	$2,386,359	$521,187	$1,865,172	4.58
EE Kits	$17,518,100	$8,712,591	$8,805,509	2.01
Lighting	$28,422,235	$5,716,430	$22,705,805	4.97
Behavioral	$3,456,970	$4,509,420	-$1,052,450	0.77
School Ed	$2,055,669	$1,683,874	$371,795	1.22
Audit-Comp & Online	$2,145,966	$2,451,608	-$305,642	0.88
HVAC	$6,191,963	$2,838,429	$3,353,534	2.18
Smart Thermostat	$710,452	$1,417,320	-$706,868	0.50
New Cnstruct	$4,465,774	$2,885,518	$1,580,256	1.55
LI Comm Connect	$2,533,440	$6,497,387	-$3,963,947	0.39
LI New Construction	$47,404	$163,316	-$115,911	0.29
RestroCommissioning - SCI	$3,555,880	$2,038,039	$1,517,841	1.74
Custom Buildings - SCI	$11,769,903	$2,762,347	$9,007,557	4.26
Audits - SCI	$15,035,009	$19,880,846	-$4,845,836	0.76
Data Centers - SCI	$1,531,518	$1,228,939	$302,578	1.25
Custom - SCI	$26,577,009	$5,442,445	$21,134,564	4.88
HVAC - SCI	$9,119,149	$1,460,386	$7,658,763	6.24
Lighting - SCI	$43,515,822	$8,160,931	$35,354,892	5.33
Food Service - SCI	$1,948,978	$517,288	$1,431,690	3.77
Electronics - SCI	$47,399	$149,854	-$102,455	0.32
Appliance Recycling - SCI	$311,823	$718,245	-$406,422	0.43
Appliance Rebate - SCI	$566,211	$228,517	$337,694	2.48
Agricultural - SCI	$154,321	$338,811	-$184,490	0.46
Gov - Outdoor Lighting	$355,291	$495,888	-$140,596	0.72
RestroCommissioning - LCI	$557,121	$510,883	$46,237	1.09
Custom Buildings - LCI	$7,739,063	$2,124,425	$5,614,638	3.64
Custom - LCI	$28,638,465	$6,603,646	$22,034,819	4.34
EE Auction - LCI	$0	$0	$0	#DIV/0!
Data Centers - LCI	$1,840,374	$1,010,592	$829,782	1.82
HVAC - LCI	$4,186,224	$890,125	$3,296,099	4.70
Lighting - LCI	$8,351,955	$1,793,321	$6,558,634	4.66
Audits - LCI	$275,141	$2,059,046	-$1,783,906	0.13
CAP Res	$16,488,233	$353,362	$16,134,871	46.66
CAP SCI	$6,284,116	$788,087	$5,496,029	7.97
CAP LCI	$3,137,445	$692,987	$2,444,459	4.53
Mercantile	$34,411,627	$793,799	$33,617,828	43.35
T&D Upgrades	$3,345,287	$13,858	$3,331,429	241.40
Smart Grid	$0	$0	$0	#DIV/0!
DR Res DLC	$711,584	$545,985	$165,598	1.30
DR Res Behave	$0	$0	$0	#DIV/0!
DR LC&I Contracted	$0	$0	$0	#DIV/0!
DR LC&I ELR Tariff	$48,632,498	$14,412	$48,618,086	3374.37
STIP - Res	$0	$0	$0	#DIV/0!

OCC Set 1 RPD 20-Attachment 2- Supplemental (Errata)

	Benefits	Costs	Net Benefits	UCT
EE	$448,143,322	$152,313,814	$295,829,508	2.9
DR	$0	$14,412	-$14,412	0.0
Total	$448,143,322	$152,328,226	$295,815,096	2.9

OCC Set 1 RPD 20-Attachment 2- Supplemental (Errata)

	Benefits	Costs	Net Benefits	UCT
Res	$117,562,223	$63,180,186	$54,382,036	1.9
SCI	$150,943,751	$56,170,389	$94,773,362	2.7
Govt	$169,572	$256,606	-$87,034	0.7
LCI	$112,081,745	$29,305,970	$82,775,775	3.8
Res CAP	$27,939,920	$836,144	$27,103,776	33.4
SCI CAP	$6,367,756	$838,237	$5,529,519	7.6
LCI CAP	$494,044	$308,214	$185,830	1.6
Merc	$25,317,972	$476,972	$24,841,000	53.1
T&D	$6,016,288	$13,858	$6,002,430	434.1
Res DR	$1,250,052	$927,239	$322,813	1.3
LCI DR	$0	$14,412	-$14,412	0.0
SCI DR	$0	$0	$0	#DIV/0!

OCC Set 1 RPD 20-Attachment 2- Supplemental (Errata)

	Benefits	Costs	Net Benefits
Appliance Turn In Program	$23,067,100	$9,135,267	$13,931,833
Energy Efficient Products Program	$51,446,199	$15,314,257	$36,131,943
Energy Efficient Homes Program	$40,609,094	$30,688,501	$9,920,594
Smart Thermostat	$0	$0	$0
Low Income Energy Efficiency Program	$2,439,829	$7,765,002	-$5,325,174
C&I Energy Solutions for Business Program - Small	$150,943,751	$55,522,976	$95,420,775
Government Tariff Lighting Program	$169,572	$256,606	-$87,034
C&I Energy Solutions for Business Program - Large	$112,081,745	$29,094,787	$82,986,958
Customer Action Program - Res	$27,939,920	$836,144	$27,103,776
Customer Action Program - SCI	$6,367,756	$838,237	$5,529,519
Customer Action Program - LCI	$494,044	$308,214	$185,830
Mercantile Customer Program	$25,317,972	$476,972	$24,841,000
Transmission & Distribution Upgrades	$6,016,288	$13,858	$6,002,430
Smart Grid Modernization Initiative	$0	$0	$0
Residential Demand Response Program	$1,250,052	$927,239	$322,813
C&I Demand Response Program - Large	$0	$14,412	-$14,412
STIP - Res	$0	$277,160	-$277,160
STIP - SCI	$0	$647,413	-$647,413
STIP-LCI	$0	$211,183	-$211,183
Energy Special Improvement District	$0	$0	$0

UCT
2.5
3.4
1.3
#DIV/0!
0.3
2.7
0.7
3.9
33.4
7.6
1.6
53.1
434.1
#DIV/0!
1.3
0.0
0.0
0.0
0.0
#DIV/0!

OCC Set 1 RPD 20-Attachment 2- Supplemental (Errata)

	Benefits	Costs	Net Benefits	UCT
Appliance Turn In	$23,067,100	$9,135,267	$13,931,833	2.5
Appliances	$5,620,147	$2,364,763	$3,255,384	2.4
Consumer Electronics	$2,659,572	$588,565	$2,071,007	4.5
EE Kits	$24,419,960	$12,334,704	$12,085,256	2.0
Lighting	$34,352,131	$8,379,470	$25,972,661	4.1
Behavioral	$5,313,965	$6,325,545	-$1,011,581	0.8
School Education	$2,742,375	$2,766,398	-$24,022	1.0
Audits & Education	$2,165,369	$3,500,503	-$1,335,134	0.6
HVAC	$8,814,349	$3,981,459	$4,832,890	2.2
Smart Thermostat	$990,568	$1,810,244	-$819,676	0.5
New Homes	$4,976,858	$3,951,106	$1,025,751	1.3
Community Connections	$2,381,182	$7,545,013	-$5,163,831	0.3
LI - New Homes	$58,647	$219,989	-$161,342	0.3
Retro - Commissioning - SCI	$4,288,989	$2,400,837	$1,888,152	1.8
Custom Buildings - SCI	$15,673,192	$3,606,468	$12,066,724	4.3
Audits & Education - SCI	$19,878,477	$25,865,415	-$5,986,938	0.8
Data Centers - SCI	$2,058,843	$1,334,919	$723,925	1.5
Custom - SCI	$35,433,956	$7,189,472	$28,244,484	4.9
HVAC - SCI	$12,068,121	$1,907,641	$10,160,480	6.3
Lighting - SCI	$57,508,934	$10,733,590	$46,775,344	5.4
Food Service	$2,601,407	$669,317	$1,932,089	3.9
Consumer Electronics - SCI	$63,932	$182,000	-$118,068	0.4
Appliance Turn In - SCI	$418,470	$917,704	-$499,234	0.5
Appliances - SCI	$743,968	$281,099	$462,869	2.6
Agricultural	$205,462	$434,514	-$229,052	0.5
Government Tariff Lighting	$169,572	$256,606	-$87,034	0.7
Retro - Commissioning - LCI	$1,286,790	$911,265	$375,526	1.4
Custom Buildings - LCI	$15,864,952	$4,096,846	$11,768,107	3.9
Custom - LCI	$64,369,528	$14,379,423	$49,990,105	4.5
Energy Efficiency Auction - LCI	$0	$0	$0	#DIV/0!
Data Centers - LCI	$3,911,899	$1,923,866	$1,988,033	2.0
HVAC - LCI	$8,877,929	$1,760,253	$7,117,676	5.0
Lighting - LCI	$17,231,094	$3,568,540	$13,662,554	4.8
Audits & Education - LCI	$539,551	$2,454,594	-$1,915,043	0.2
Customer Action Program - Res	$27,939,920	$836,144	$27,103,776	33.4
Customer Action Program - SCI	$6,367,756	$838,237	$5,529,519	7.6
Customer Action Program - LCI	$494,044	$308,214	$185,830	1.6
Mercantile	$25,317,972	$476,972	$24,841,000	53.1
T&D Upgrades	$6,016,288	$13,858	$6,002,430	434.1
Smart Grid	$0	$0	$0	#DIV/0!
Direct Load Control	$1,250,052	$927,239	$322,813	1.3
Behavioral - DR	$0	$0	$0	#DIV/0!
Demand Response - LCI	$0	$14,412	-$14,412	0.0
STIP - Res	$0	$277,160	-$277,160	0.0
STIP - SCI	$0	$647,413	-$647,413	0.0
STIP-LCI	$0	$211,183	-$211,183	0.0
Energy Special Improvement District	$0	$0	$0	#DIV/0!

plemental (Errata)

Plan	Sector	Program
EE	Res	Appliance Turn In Program
EE	Res	Energy Efficient Products Program
EE	Res	Energy Efficient Products Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Products Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Products Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Homes Program
EE	Res	Low Income Energy Efficiency Program
EE	Res	Low Income Energy Efficiency Program
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	Govt	Government Tariff Lighting Program
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	Res CAP	Customer Action Program - Res
EE	SCI CAP	Customer Action Program - SCI
EE	LCI CAP	Customer Action Program - LCI
EE	Merc	Mercantile Customer Program
EE	T&D	Transmission & Distribution Upgrades
EE	T&D	Smart Grid Modernization Initiative
EE	Res DR	Residential Demand Response Program
EE	Res DR	Energy Efficient Homes Program
DR	LCI DR	C&I Demand Response Program - Large
DR	LCI DR	C&I Demand Response Program - Large
EE	Res	STIP - Res
EE	SCI	STIP - SCI
EE	LCI	STIP-LCI
DR	T&D	Energy Special Improvement District

Sub-Program		Benefits
Appliance Turn In	Appliance Recycling	$23,067,100
Appliances	Appliances	$5,620,147
Consumer Electronics	Electronics	$2,659,572
EE Kits	EE Kits	$24,419,960
Lighting	Lighting	$34,352,131
Behavioral	Behavioral	$5,313,965
School Education	School Ed	$2,742,375
Audits & Education	Audit-Comp & Online	$2,165,369
HVAC	HVAC	$8,814,349
Smart Thermostat	Smart Thermostat	$990,568
New Homes	New Cnstruct	$4,976,858
Community Connections	LI Comm Connect	$2,381,182
LI - New Homes	LI New Construction	$58,647
Retro - Commissioning - SCI	RestroCommissioning - SCI	$4,288,989
Custom Buildings - SCI	Custom Buildings - SCI	$15,673,192
Audits & Education - SCI	Audits - SCI	$19,878,477
Data Centers - SCI	Data Centers - SCI	$2,058,843
Custom - SCI	Custom - SCI	$35,433,956
HVAC - SCI	HVAC - SCI	$12,068,121
Lighting - SCI	Lighting - SCI	$57,508,934
Food Service	Food Service - SCI	$2,601,407
Consumer Electronics - SCI	Electronics - SCI	$63,932
Appliance Turn In - SCI	Appliance Recycling - SCI	$418,470
Appliances - SCI	Appliance Rebate - SCI	$743,968
Agricultural	Agricultural - SCI	$205,462
Government Tariff Lighting	Gov - Outdoor Lighting	$169,572
Retro - Commissioning - LCI	RestroCommissioning - LCI	$1,286,790
Custom Buildings - LCI	Custom Buildings - LCI	$15,864,952
Custom - LCI	Custom - LCI	$64,369,528
Energy Efficiency Auction - LCI	EE Auction - LCI	$0
Data Centers - LCI	Data Centers - LCI	$3,911,899
HVAC - LCI	HVAC - LCI	$8,877,929
Lighting - LCI	Lighting - LCI	$17,231,094
Audits & Education - LCI	Audits - LCI	$539,551
Customer Action Program - Res	CAP Res	$27,939,920
Customer Action Program - SCI	CAP SCI	$6,367,756
Customer Action Program - LCI	CAP LCI	$494,044
Mercantile	Mercantile	$25,317,972
T&D Upgrades	T&D Upgrades	$6,016,288
Smart Grid	Smart Grid	$0
Direct Load Control	DR Res DLC	$1,250,052
Behavioral - DR	DR Res Behave	$0
Demand Response - LCI	DR LC&I Contracted	$0
Demand Response - LCI	DR LC&I ELR Tariff	$0
STIP - Res	STIP - Res	$0
STIP - SCI	STIP - SCI	$0
STIP-LCI	STIP-LCI	$0
Energy Special Improvement District	ESID	$0

Costs	Net Benefits	UCT
$9,135,267	$13,931,833	$2.53
$2,364,763	$3,255,384	$2.38
$588,565	$2,071,007	$4.52
$12,334,704	$12,085,256	$1.98
$8,379,470	$25,972,661	$4.10
$6,325,545	-$1,011,581	$0.84
$2,766,398	-$24,022	$0.99
$3,500,503	-$1,335,134	$0.62
$3,981,459	$4,832,890	$2.21
$1,810,244	-$819,676	$0.55
$3,951,106	$1,025,751	$1.26
$7,545,013	-$5,163,831	$0.32
$219,989	-$161,342	$0.27
$2,400,837	$1,888,152	$1.79
$3,606,468	$12,066,724	$4.35
$25,865,415	-$5,986,938	$0.77
$1,334,919	$723,925	$1.54
$7,189,472	$28,244,484	$4.93
$1,907,641	$10,160,480	$6.33
$10,733,590	$46,775,344	$5.36
$669,317	$1,932,089	$3.89
$182,000	-$118,068	$0.35
$917,704	-$499,234	$0.46
$281,099	$462,869	$2.65
$434,514	-$229,052	$0.47
$256,606	-$87,034	$0.66
$911,265	$375,526	$1.41
$4,096,846	$11,768,107	$3.87
$14,379,423	$49,990,105	$4.48
$0	$0	#DIV/0!
$1,923,866	$1,988,033	$2.03
$1,760,253	$7,117,676	$5.04
$3,568,540	$13,662,554	$4.83
$2,454,594	-$1,915,043	$0.22
$836,144	$27,103,776	$33.42
$838,237	$5,529,519	$7.60
$308,214	$185,830	$1.60
$476,972	$24,841,000	$53.08
$13,858	$6,002,430	$434.14
$0	$0	#DIV/0!
$927,239	$322,813	$1.35
$0	$0	#DIV/0!
$0	$0	#DIV/0!
$14,412	$74,382,375	$5,162.03
$277,160	-$277,160	$0.00
$647,413	-$647,413	$0.00
$211,183	-$211,183	$0.00
$0	$0	#DIV/0!

OCC Set 1 RPD 20-Attachment 2- Supplemental (Errata)

Program	Benefits	Costs	Net benefits	UCT
Appliance Recycling	$23,067,100	$9,135,267	$13,931,833	2.53
Appliances	$5,620,147	$2,364,763	$3,255,384	2.38
Electronics	$2,659,572	$588,565	$2,071,007	4.52
EE Kits	$24,419,960	$12,334,704	$12,085,256	1.98
Lighting	$34,352,131	$8,379,470	$25,972,661	4.10
Behavioral	$5,313,965	$6,325,545	-$1,011,581	0.84
School Ed	$2,742,375	$2,766,398	-$24,022	0.99
Audit-Comp & Online	$2,165,369	$3,500,503	-$1,335,134	0.62
HVAC	$8,814,349	$3,981,459	$4,832,890	2.21
Smart Thermostat	$990,568	$1,810,244	-$819,676	0.55
New Cnstruct	$4,976,858	$3,951,106	$1,025,751	1.26
LI Comm Connect	$2,381,182	$7,545,013	-$5,163,831	0.32
LI New Construction	$58,647	$219,989	-$161,342	0.27
RestroCommissioning - SCI	$4,288,989	$2,400,837	$1,888,152	1.79
Custom Buildings - SCI	$15,673,192	$3,606,468	$12,066,724	4.35
Audits - SCI	$19,878,477	$25,865,415	-$5,986,938	0.77
Data Centers - SCI	$2,058,843	$1,334,919	$723,925	1.54
Custom - SCI	$35,433,956	$7,189,472	$28,244,484	4.93
HVAC - SCI	$12,068,121	$1,907,641	$10,160,480	6.33
Lighting - SCI	$57,508,934	$10,733,590	$46,775,344	5.36
Food Service - SCI	$2,601,407	$669,317	$1,932,089	3.89
Electronics - SCI	$63,932	$182,000	-$118,068	0.35
Appliance Recycling - SCI	$418,470	$917,704	-$499,234	0.46
Appliance Rebate - SCI	$743,968	$281,099	$462,869	2.65
Agricultural - SCI	$205,462	$434,514	-$229,052	0.47
Gov - Outdoor Lighting	$169,572	$256,606	-$87,034	0.66
RestroCommissioning - LCI	$1,286,790	$911,265	$375,526	1.41
Custom Buildings - LCI	$15,864,952	$4,096,846	$11,768,107	3.87
Custom - LCI	$64,369,528	$14,379,423	$49,990,105	4.48
EE Auction - LCI	$0	$0	$0	#DIV/0!
Data Centers - LCI	$3,911,899	$1,923,866	$1,988,033	2.03
HVAC - LCI	$8,877,929	$1,760,253	$7,117,676	5.04
Lighting - LCI	$17,231,094	$3,568,540	$13,662,554	4.83
Audits - LCI	$539,551	$2,454,594	-$1,915,043	0.22
CAP Res	$27,939,920	$836,144	$27,103,776	33.42
CAP SCI	$6,367,756	$838,237	$5,529,519	7.60
CAP LCI	$494,044	$308,214	$185,830	1.60
Mercantile	$25,317,972	$476,972	$24,841,000	53.08
T&D Upgrades	$6,016,288	$13,858	$6,002,430	434.14
Smart Grid	$0	$0	$0	#DIV/0!
DR Res DLC	$1,250,052	$927,239	$322,813	1.35
DR Res Behave	$0	$0	$0	#DIV/0!
DR LC&I Contracted	$0	$0	$0	#DIV/0!
DR LC&I ELR Tariff	$74,396,787	$14,412	$74,382,375	5162.03
STIP - Res	$0	$277,160	-$277,160	0.00

STIP - SCI	$0	$647,413	-$647,413	0.00
STIP-LCI	$0	$211,183	-$211,183	0.00
ESID	$0	$0	$0	#DIV/0!

STIP - SCI	$0	$783,153	-$783,153	0.00
STIP-LCI	$0	$256,981	-$256,981	0.00
ESID	$0	$0	$0	#DIV/0!

OCC Set 1 RPD 20-Attachment 3- Supplemental (Errata)

	Benefits	Costs	Net Benefits	UCT
EE	$168,770,412	$56,496,359	$112,274,053	3.0
DR	$0	$14,412	-$14,412	0.0
Total	$168,770,412	$56,510,771	$112,259,640	3.0

OCC Set 1 RPD 20-Attachment 3- Supplemental (Errata)

	Benefits	Costs	Net Benefits	UCT
Res	$36,449,406	$20,861,371	$15,588,035	1.7
SCI	$56,998,044	$21,535,415	$35,462,629	2.6
Govt	$19,387	$53,401	-$34,014	0.4
LCI	$39,986,786	$12,883,271	$27,103,515	3.1
Res CAP	$7,635,731	$233,034	$7,402,697	32.8
SCI CAP	$1,918,965	$258,670	$1,660,294	7.4
LCI CAP	$682,750	$264,261	$418,489	2.6
Merc	$23,512,229	$243,289	$23,268,939	96.6
T&D	$1,398,827	$13,858	$1,384,969	100.9
Res DR	$168,288	$149,787	$18,501	1.1
LCI DR	$0	$14,412	-$14,412	0.0
SCI DR	$0	$0	$0	#DIV/0!

OCC Set 1 RPD 20-Attachment 3- Supplemental (Errata)

	Benefits	Costs	Net Benefits
Appliance Turn In Program	$6,781,202	$2,849,394	$3,931,808
Energy Efficient Products Program	$16,888,997	$4,832,527	$12,056,470
Energy Efficient Homes Program	$11,760,243	$9,050,284	$2,709,959
Smart Thermostat	$0	$0	$0
Low Income Energy Efficiency Program	$1,018,964	$4,129,166	-$3,110,202
C&I Energy Solutions for Business Program - Small	$56,998,044	$21,494,161	$35,503,883
Government Tariff Lighting Program	$19,387	$53,401	-$34,014
C&I Energy Solutions for Business Program - Large	$39,986,786	$12,771,902	$27,214,884
Customer Action Program - Res	$7,635,731	$233,034	$7,402,697
Customer Action Program - SCI	$1,918,965	$258,670	$1,660,294
Customer Action Program - LCI	$682,750	$264,261	$418,489
Mercantile Customer Program	$23,512,229	$243,289	$23,268,939
Transmission & Distribution Upgrades	$1,398,827	$13,858	$1,384,969
Smart Grid Modernization Initiative	$0	$0	$0
Residential Demand Response Program	$168,288	$149,787	$18,501
C&I Demand Response Program - Large	$0	$14,412	-$14,412
STIP - Res	$0	$0	$0
STIP - SCI	$0	$41,253	-$41,253
STIP-LCI	$0	$111,369	-$111,369
Energy Special Improvement District	$0	$0	$0

UCT
2.4
3.5
1.3
#DIV/0!
0.2
2.7
0.4
3.1
32.8
7.4
2.6
96.6
100.9
#DIV/0!
1.1
0.0
#DIV/0!
0.0
0.0
#DIV/0!

OCC Set 1 RPD 20-Attachment 3- Supplemental (Errata)

	Benefits	Costs	Net Benefits	UCT
Appliance Turn In	$6,781,202	$2,849,394	$3,931,808	2.4
Appliances	$1,678,168	$701,914	$976,254	2.4
Consumer Electronics	$978,781	$222,393	$756,388	4.4
EE Kits	$7,182,124	$3,643,186	$3,538,938	2.0
Lighting	$11,650,952	$2,740,764	$8,910,188	4.3
Behavioral	$1,285,988	$1,799,797	-$513,809	0.7
School Education	$1,137,589	$919,352	$218,237	1.2
Audits & Education	$558,816	$1,010,321	-$451,505	0.6
HVAC	$2,581,097	$1,167,456	$1,413,640	2.2
Smart Thermostat	$291,273	$542,663	-$251,390	0.5
New Homes	$1,304,453	$1,134,965	$169,487	1.1
Community Connections	$997,859	$4,057,805	-$3,059,946	0.2
LI - New Homes	$21,105	$71,361	-$50,256	0.3
Retro - Commissioning - SCI	$1,529,291	$849,592	$679,699	1.8
Custom Buildings - SCI	$5,884,952	$1,343,716	$4,541,235	4.4
Audits & Education - SCI	$8,157,606	$10,288,563	-$2,130,957	0.8
Data Centers - SCI	$580,579	$465,520	$115,058	1.2
Custom - SCI	$13,138,329	$2,659,814	$10,478,514	4.9
HVAC - SCI	$3,998,745	$644,075	$3,354,671	6.2
Lighting - SCI	$22,412,601	$4,174,389	$18,238,212	5.4
Food Service	$866,820	$241,720	$625,100	3.6
Consumer Electronics - SCI	$16,496	$73,930	-$57,434	0.2
Appliance Turn In - SCI	$133,569	$511,521	-$377,952	0.3
Appliances - SCI	$227,841	$105,412	$122,429	2.2
Agricultural	$51,215	$135,909	-$84,694	0.4
Government Tariff Lighting	$19,387	$53,401	-$34,014	0.4
Retro - Commissioning - LCI	$426,538	$435,381	-$8,843	1.0
Custom Buildings - LCI	$5,342,252	$1,531,978	$3,810,274	3.5
Custom - LCI	$22,964,865	$5,490,289	$17,474,576	4.2
Energy Efficiency Auction - LCI	$0	$0	$0	#DIV/0!
Data Centers - LCI	$1,290,956	$774,100	$516,856	1.7
HVAC - LCI	$3,321,901	$911,565	$2,410,336	3.6
Lighting - LCI	$6,480,157	$1,594,758	$4,885,399	4.1
Audits & Education - LCI	$160,117	$2,033,830	-$1,873,713	0.1
Customer Action Program - Res	$7,635,731	$233,034	$7,402,697	32.8
Customer Action Program - SCI	$1,918,965	$258,670	$1,660,294	7.4
Customer Action Program - LCI	$682,750	$264,261	$418,489	2.6
Mercantile	$23,512,229	$243,289	$23,268,939	96.6
T&D Upgrades	$1,398,827	$13,858	$1,384,969	100.9
Smart Grid	$0	$0	$0	#DIV/0!
Direct Load Control	$168,288	$149,787	$18,501	1.1
Behavioral - DR	$0	$0	$0	#DIV/0!
Demand Response - LCI	$0	$14,412	-$14,412	0.0
STIP - Res	$0	$0	$0	#DIV/0!
STIP - SCI	$0	$41,253	-$41,253	0.0
STIP-LCI	$0	$111,369	-$111,369	0.0
Energy Special Improvement District	$0	$0	$0	#DIV/0!

plemental (Errata)

Plan	Sector	Program
EE	Res	Appliance Turn In Program
EE	Res	Energy Efficient Products Program
EE	Res	Energy Efficient Products Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Products Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Products Program
EE	Res	Energy Efficient Homes Program
EE	Res	Energy Efficient Homes Program
EE	Res	Low Income Energy Efficiency Program
EE	Res	Low Income Energy Efficiency Program
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	SCI	C&I Energy Solutions for Business Program - Small
EE	Govt	Government Tariff Lighting Program
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	LCI	C&I Energy Solutions for Business Program - Large
EE	Res CAP	Customer Action Program - Res
EE	SCI CAP	Customer Action Program - SCI
EE	LCI CAP	Customer Action Program - LCI
EE	Merc	Mercantile Customer Program
EE	T&D	Transmission & Distribution Upgrades
EE	T&D	Smart Grid Modernization Initiative
EE	Res DR	Residential Demand Response Program
EE	Res DR	Energy Efficient Homes Program
DR	LCI DR	C&I Demand Response Program - Large
DR	LCI DR	C&I Demand Response Program - Large
EE	Res	STIP - Res
EE	SCI	STIP - SCI
EE	LCI	STIP-LCI
DR	T&D	Energy Special Improvement District

Sub-Program		Benefits
Appliance Turn In	Appliance Recycling	$6,781,202
Appliances	Appliances	$1,678,168
Consumer Electronics	Electronics	$978,781
EE Kits	EE Kits	$7,182,124
Lighting	Lighting	$11,650,952
Behavioral	Behavioral	$1,285,988
School Education	School Ed	$1,137,589
Audits & Education	Audit-Comp & Online	$558,816
HVAC	HVAC	$2,581,097
Smart Thermostat	Smart Thermostat	$291,273
New Homes	New Cnstruct	$1,304,453
Community Connections	LI Comm Connect	$997,859
LI - New Homes	LI New Construction	$21,105
Retro - Commissioning - SCI	RestroCommissioning - SCI	$1,529,291
Custom Buildings - SCI	Custom Buildings - SCI	$5,884,952
Audits & Education - SCI	Audits - SCI	$8,157,606
Data Centers - SCI	Data Centers - SCI	$580,579
Custom - SCI	Custom - SCI	$13,138,329
HVAC - SCI	HVAC - SCI	$3,998,745
Lighting - SCI	Lighting - SCI	$22,412,601
Food Service	Food Service - SCI	$866,820
Consumer Electronics - SCI	Electronics - SCI	$16,496
Appliance Turn In - SCI	Appliance Recycling - SCI	$133,569
Appliances - SCI	Appliance Rebate - SCI	$227,841
Agricultural	Agricultural - SCI	$51,215
Government Tariff Lighting	Gov - Outdoor Lighting	$19,387
Retro - Commissioning - LCI	RestroCommissioning - LCI	$426,538
Custom Buildings - LCI	Custom Buildings - LCI	$5,342,252
Custom - LCI	Custom - LCI	$22,964,865
Energy Efficiency Auction - LCI	EE Auction - LCI	$0
Data Centers - LCI	Data Centers - LCI	$1,290,956
HVAC - LCI	HVAC - LCI	$3,321,901
Lighting - LCI	Lighting - LCI	$6,480,157
Audits & Education - LCI	Audits - LCI	$160,117
Customer Action Program - Res	CAP Res	$7,635,731
Customer Action Program - SCI	CAP SCI	$1,918,965
Customer Action Program - LCI	CAP LCI	$682,750
Mercantile	Mercantile	$23,512,229
T&D Upgrades	T&D Upgrades	$1,398,827
Smart Grid	Smart Grid	$0
Direct Load Control	DR Res DLC	$168,288
Behavioral - DR	DR Res Behave	$0
Demand Response - LCI	DR LC&I Contracted	$0
Demand Response - LCI	DR LC&I ELR Tariff	$0
STIP - Res	STIP - Res	$0
STIP - SCI	STIP - SCI	$0
STIP-LCI	STIP-LCI	$0
Energy Special Improvement District	ESID	$0

Costs	Net Benefits	UCT
$2,849,394	$3,931,808	$2.38
$701,914	$976,254	$2.39
$222,393	$756,388	$4.40
$3,643,186	$3,538,938	$1.97
$2,740,764	$8,910,188	$4.25
$1,799,797	-$513,809	$0.71
$919,352	$218,237	$1.24
$1,010,321	-$451,505	$0.55
$1,167,456	$1,413,640	$2.21
$542,663	-$251,390	$0.54
$1,134,965	$169,487	$1.15
$4,057,805	-$3,059,946	$0.25
$71,361	-$50,256	$0.30
$849,592	$679,699	$1.80
$1,343,716	$4,541,235	$4.38
$10,288,563	-$2,130,957	$0.79
$465,520	$115,058	$1.25
$2,659,814	$10,478,514	$4.94
$644,075	$3,354,671	$6.21
$4,174,389	$18,238,212	$5.37
$241,720	$625,100	$3.59
$73,930	-$57,434	$0.22
$511,521	-$377,952	$0.26
$105,412	$122,429	$2.16
$135,909	-$84,694	$0.38
$53,401	-$34,014	$0.36
$435,381	-$8,843	$0.98
$1,531,978	$3,810,274	$3.49
$5,490,289	$17,474,576	$4.18
$0	$0	#DIV/0!
$774,100	$516,856	$1.67
$911,565	$2,410,336	$3.64
$1,594,758	$4,885,399	$4.06
$2,033,830	-$1,873,713	$0.08
$233,034	$7,402,697	$32.77
$258,670	$1,660,294	$7.42
$264,261	$418,489	$2.58
$243,289	$23,268,939	$96.64
$13,858	$1,384,969	$100.94
$0	$0	#DIV/0!
$149,787	$18,501	$1.12
$0	$0	#DIV/0!
$0	$0	#DIV/0!
$14,412	$51,698,387	$3,588.10
$0	$0	#DIV/0!
$41,253	-$41,253	$0.00
$111,369	-$111,369	$0.00
$0	$0	#DIV/0!

OCC Set 1 RPD 20-Attachment 3- Supplemental (Errata)

Program	Benefits	Costs	Net benefits	UCT
Appliance Recycling	$6,781,202	$2,849,394	$3,931,808	2.38
Appliances	$1,678,168	$701,914	$976,254	2.39
Electronics	$978,781	$222,393	$756,388	4.40
EE Kits	$7,182,124	$3,643,186	$3,538,938	1.97
Lighting	$11,650,952	$2,740,764	$8,910,188	4.25
Behavioral	$1,285,988	$1,799,797	-$513,809	0.71
School Ed	$1,137,589	$919,352	$218,237	1.24
Audit-Comp & Online	$558,816	$1,010,321	-$451,505	0.55
HVAC	$2,581,097	$1,167,456	$1,413,640	2.21
Smart Thermostat	$291,273	$542,663	-$251,390	0.54
New Cnstruct	$1,304,453	$1,134,965	$169,487	1.15
LI Comm Connect	$997,859	$4,057,805	-$3,059,946	0.25
LI New Construction	$21,105	$71,361	-$50,256	0.30
RestroCommissioning - SCI	$1,529,291	$849,592	$679,699	1.80
Custom Buildings - SCI	$5,884,952	$1,343,716	$4,541,235	4.38
Audits - SCI	$8,157,606	$10,288,563	-$2,130,957	0.79
Data Centers - SCI	$580,579	$465,520	$115,058	1.25
Custom - SCI	$13,138,329	$2,659,814	$10,478,514	4.94
HVAC - SCI	$3,998,745	$644,075	$3,354,671	6.21
Lighting - SCI	$22,412,601	$4,174,389	$18,238,212	5.37
Food Service - SCI	$866,820	$241,720	$625,100	3.59
Electronics - SCI	$16,496	$73,930	-$57,434	0.22
Appliance Recycling - SCI	$133,569	$511,521	-$377,952	0.26
Appliance Rebate - SCI	$227,841	$105,412	$122,429	2.16
Agricultural - SCI	$51,215	$135,909	-$84,694	0.38
Gov - Outdoor Lighting	$19,387	$53,401	-$34,014	0.36
RestroCommissioning - LCI	$426,538	$435,381	-$8,843	0.98
Custom Buildings - LCI	$5,342,252	$1,531,978	$3,810,274	3.49
Custom - LCI	$22,964,865	$5,490,289	$17,474,576	4.18
EE Auction - LCI	$0	$0	$0	#DIV/0!
Data Centers - LCI	$1,290,956	$774,100	$516,856	1.67
HVAC - LCI	$3,321,901	$911,565	$2,410,336	3.64
Lighting - LCI	$6,480,157	$1,594,758	$4,885,399	4.06
Audits - LCI	$160,117	$2,033,830	-$1,873,713	0.08
CAP Res	$7,635,731	$233,034	$7,402,697	32.77
CAP SCI	$1,918,965	$258,670	$1,660,294	7.42
CAP LCI	$682,750	$264,261	$418,489	2.58
Mercantile	$23,512,229	$243,289	$23,268,939	96.64
T&D Upgrades	$1,398,827	$13,858	$1,384,969	100.94
Smart Grid	$0	$0	$0	#DIV/0!
DR Res DLC	$168,288	$149,787	$18,501	1.12
DR Res Behave	$0	$0	$0	#DIV/0!
DR LC&I Contracted	$0	$0	$0	#DIV/0!
DR LC&I ELR Tariff	$51,712,799	$14,412	$51,698,387	3588.10
STIP - Res	$0	$0	$0	#DIV/0!

STIP - SCI	$0	$41,253	-$41,253	0.00
STIP-LCI	$0	$111,369	-$111,369	0.00
ESID	$0	$0	$0	#DIV/0!

Exhibit CN-7

NRDC Set 1
Witness: Eren G. Demiray
As to objections: Carrie M. Dunn

Case No. 16-0743-EL-POR

In the Matter of the Application of Ohio Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison Company For Approval of Their Energy Efficiency and Peak Demand Reduction Program Portfolio Plans for 2017 through 2019

RESPONSES TO DATA REQUESTS

NRDC Set 1 INT-008 Referring to the quote in INT-6, is FirstEnergy proposing that benefits from ESID projects that are not already directly attributed to the Companies' other efficiency programs would nevertheless be counted when computing the shared savings to which FirstEnergy shareholders are entitled?

Response: Objection. This request is vague and ambiguous and mischaracterizes the application, testimony and facts. Subject to and without waiving the foregoing objection, all cost effective energy efficiency programs are eligible for shared savings, subject to the exclusions as noted in Section 7.1 of the Companies' Plan.

Exhibit CN-8

NRDC Set 1
Witness: Edward C. Miller
As to objections: Carrie M. Dunn

Case No. 16-0743-EL-POR

In the Matter of the Application of Ohio Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison Company For Approval of Their Energy Efficiency and Peak Demand Reduction Program Portfolio Plans for 2017 through 2019

RESPONSES TO DATA REQUESTS

NRDC Set 1 INT-004 Is FirstEnergy planning any specific actions to help communities establish ESIDs? If so, please explain such efforts.

Response: Objection. This request is vague and ambiguous and assumes facts not in evidence or testimony. Subject to and without waiving the foregoing objections, the Companies have no specific plans to help communities establish ESIDs at this time.

Case No. 16-0743-EL-POR

In the Matter of the Application of Ohio Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison Company For Approval of Their Energy Efficiency and Peak Demand Reduction Program Portfolio Plans for 2017 through 2019

RESPONSES TO DATA REQUESTS

NRDC Set 1 INT-005 Is FirstEnergy planning to provide any additional financial incentives beyond those provided through its other programs for efficiency investments in ESIDs? If so, please explain.

Response: The Companies have no specific plans to provide additional financial incentives for efficiency investments in ESIDs at this time.

Exhibit CN-9

NRDC Set 2
Witness: Edward C. Miller
As to objections: Carrie M. Dunn

Case No. 16-0743-EL-POR

In the Matter of the Application of Ohio Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison Company For Approval of Their Energy Efficiency and Peak Demand Reduction Program Portfolio Plans for 2017 through 2019

RESPONSES TO DATA REQUESTS

NRDC Set 2 INT-042 Referring to Appendix C-1 of Attachment A to the Application, for each measure life assumption that is different from the value in the Ohio TRM, please provide an explanation of why a value different than the value in the Ohio TRM was used.

Response: Objection. This request is overbroad and unduly burdensome. Subject to and without waiving the foregoing objection, *see* NRDC-Set 2-INT-042 Attachment 1.

Sector	Program	Sub-Program	Measure	Msre Life	Measure Life Source	Reasoning in lieu of OH TRM
Residential	Appliance Turn In Program	Appliance Turn In	Refrigerator Recycling	8	Ohio TRM	
			Freezer Recycling	8	Ohio TRM	
			Room Air Conditioner Recycling	3	Ohio TRM	
			Dehumidifier Recycling	3	EM&V Consultant	Not in OH TRM
	Energy Efficient Homes Program	School Education	School Education	7	EM&V report for PY2014	Align with evaluation, not all components in OH TRM
		EE Kits	Energy Efficiency Measures	7	EM&V report for PY2014	Align with evaluation, not all components in OH TRM
		Audits & Education	Comprehensive Audit	12	EM&V report for PY2014	Align with evaluation, not all components in OH TRM
			On-Line Audit	3	EM&V report for PY2014	Not in OH TRM
		Behavioral	Behavioral	1	EM&V report for PY2014	Not in OH TRM
		New Homes	New Construction -Townhouse and Duplexs	15	EM&V report for PY2014	Align with evaluation
			New Construction - Two-on-Two Condos	15	EM&V report for PY2014	Align with evaluation
			New Construction - Single Family Detached	15	EM&V report for PY2014	Align with evaluation
			New Construction - Multi Family Low Rise	15	EM&V report for PY2014	Align with evaluation
			New Manufactured Housing	15	PA TRM	Not in OH TRM
		Smart Thermostat	Smart Thermostat	11	PA TRM	Not in OH TRM
	Energy Efficient Products Program	Appliances	Clothes Washer	11	Ohio TRM	
			Clothes Dryer - (Elec w Moisture Sensor)	16	EM&V Consultant	Not in OH TRM
			Freezers	14	Ohio TRM	
			Refrigerators	14	Ohio TRM	
			Dehumidifiers	12	Ohio TRM	
			Water Heater - Heat Pump	10	Ohio TRM	
		Consumer Electronics	Home Technology & Automation	8	EM&V Consultant	Not in OH TRM
			Monitors	4	PA TRM	Not in OH TRM
			Computers	4	PA TRM	Not in OH TRM
			Imaging	5	PA TRM	Not in OH TRM
			TVs	6	PA TRM	Not in OH TRM

Sector	Program	Sub-Program	Measure	Msre Life	Measure Life Source	Reasoning in lieu of OH TRM
Residential	Energy Efficient Products Program	Lighting				
			CFL Fixtures	10	Ohio TRM	
			LED Fixtures	15	PA TRM	Not in OH TRM
			LED Lamps	15	PA TRM	Not in OH TRM
			Residential Lighting Controls	10	PA TRM	Not in OH TRM
		HVAC	Heat Pump	18	Ohio TRM	
			Central Air Conditioner	18	Ohio TRM	
			Room Air Conditioner	12	Ohio TRM	
			Ductless Mini-Split Heat Pump	15	PA TRM	Not in OH TRM
			PTAC - Multi Family	15	PA TRM	Not in OH TRM
			PTHP - Multi Family	15	PA TRM	Not in OH TRM
			Heat Pump - Water & GeoT	18	Ohio TRM	
			HVAC - Maintenance	5	Ohio TRM	
			Furnace Fans	14	PA TRM	Not in OH TRM
			Circulation Pumps	10	EM&V Consultant	Not in OH TRM
			Programmable / SMART Thermostat	11	PA TRM	Not in OH TRM
	Customer Action Program - Res	Customer Action Program - Res	Customer Action Program - Res	9	EM&V Consultant	Not in OH TRM
	Residential Demand Response Program	Direct Load Control	Res Direct Load Control	1	EM&V Consultant	Not in OH TRM
	Low Income Energy Efficiency Program	Community Connections	Community Connections	8	EM&V report for PY2014	Align with evaluation
		LI - New Homes	LI New Construction	15	PA TRM	Not in OH TRM

Sector	Program	Sub-Program	Measure	Msre Life	Measure Life Source	Reasoning in lieu of OH TRM
Small Enterprise	C&I Energy Solutions for Business Program - Small	HVAC - SCI	Room Air Conditioner - SCI	12	Ohio TRM	
			Air Conditioning - <=5.4 Tn - SCI	15	Ohio TRM	
			Air Conditioning - >5.4 < 20 Tn - SCI	15	Ohio TRM	
			Air Conditioning - >=20 Tn - SCI	15	Ohio TRM	
			Chiller - Water Cld w Full Load - SCI	20	PA TRM	Matches OH TRM
			Heat Pump - <=5.4 Tn - SCI	15	Ohio TRM	
			Heat Pumps - >5.4 Tn - SCI	15	Ohio TRM	
			Heat Pumps - Water & GeoT - SCI	15	Ohio TRM	
			HVAC - Maintenance - SCI	5	Ohio TRM	
			Circulation Pumps - SCI	10	EM&V Consultant	Not in OH TRM
			Ductless Mini-Split HP - SCI	15	PA TRM	Not in OH TRM
			PTAC - SCI	15	PA TRM	Not in OH TRM
			PTHP - SCI	15	PA TRM	Not in OH TRM
		Lighting - SCI	CFL Fixtures - SCI	15	Ohio TRM	
			CFL Lamps - SCI	3	Ohio TRM	
			Lighting Controls (Daylight & Occupancy) - SCI	8	PA TRM	Matches OH TRM
			Linear Fluorscent T8 / T5 - SCI	15	Ohio TRM	
			LED Linear - SCI	15	Ohio TRM	
			LED Channel Signage - SCI	15	PA TRM	Not in OH TRM
			Exit Signs - SCI	16	Ohio TRM	
			LED Fixtures External - SCI	15	Ohio TRM	
			LED Fixtures Internal - SCI	15	Ohio TRM	
			LED Lamps - SCI	15	Ohio TRM	
			LED Reach in Refrigerator / Freezer Lights - SCI	8	PA TRM	Matches OH TRM
			Street & Area Lighting (Customer Owned) - SCI	10	EM&V Consultant	Not in OH TRM

Sector	Program	Sub-Program	Measure	Msre Life	Measure Life Source	Reasoning in lieu of OH TRM
Small Enterprise	C&I Energy Solutions for Business Program - Small	Food Service	Refrigerators - Reach In - SCI	12	Ohio TRM	
			Freezers - Reach In - SCI	12	Ohio TRM	
			Ice Machines - SCI	9	Ohio TRM	
			Refrigerated Case Cover - SCI	5	PA TRM	Matches OH TRM
			Strip Curtains - SCI	6	Ohio TRM	
			Anti Sweat Heater Controls - SCI	12	PA TRM	Matches OH TRM
			Beverage Vending Machine - Controls - SCI	5	PA TRM	Matches OH TRM
			Beverage Vending Machine - New EE- SCI	14	PA TRM	Not in OH TRM
			Combination Oven - SCI	12	Ohio TRM	
			Convection Oven - SCI	12	Ohio TRM	
			Steam Cookers - SCI	12	Ohio TRM	
			Fryers - SCI	12	Ohio TRM	
			Griddles - SCI	12	Ohio TRM	
			Hot Food Holding Cabinet - SCI	12	Ohio TRM	
		Appliance Turn In - SCI	Refrigerator Recycling - SCI	8	Ohio TRM	
			Freezer Recycling - SCI	8	Ohio TRM	
			Room Air Conditioner Recycling - SCI	3	Ohio TRM	
			Dehumidifiers Recycling - SCI	3	EM&V Consultant	Not in OH TRM
		Appliances - SCI	Clothes Washer - SCI	10	Ohio TRM	
			Clothes Dryer (Elec w Moisture Sensor) - SCI	10	EM&V Consultant	Not in OH TRM
			Refrigerators - SCI	12	Ohio TRM	
			Water Heater - Heat Pump - SCI	10	Ohio TRM	
			Freezers - SCI	12	Ohio TRM	
			Pre-Rinse Sprayers - SCI	5	Ohio TRM	

Sector	Program	Sub-Program	Measure	Msre Life	Measure Life Source	Reasoning in lieu of OH TRM
Small Enterprise	C&I Energy Solutions for Business Program - Small	Consumer Electronics - SCI	Uninterruptible Power Supply - SCI	4	EM&V Consultant	Not in OH TRM
			Monitors - SCI	4	PA TRM	Not in OH TRM
			Computers - SCI	4	PA TRM	Not in OH TRM
			Imaging - SCI	5	PA TRM	Not in OH TRM
			Small Network - SCI	4	PA TRM	Not in OH TRM
		Agricultural	Efficienct Dairy Equipment - SCI	15	PA TRM	Not in OH TRM
			High Efficiency Fans - SCI	10	PA TRM	Not in OH TRM
		Data Centers - SCI	DC - Custom Servers- SCI	8	EM&V Consultant	Not in OH TRM
			DC - Custom HVAC - SCI	15	EM&V Consultant	Not in OH TRM
			DC - Audit - SCI	0	N/A	Not in OH TRM
		Custom - SCI	Custom - Process Improvement - SCI	15	PA TRM	Not in OH TRM
			Custom - HVAC & Chillers - SCI	20	PA TRM	Matches OH TRM
			Custom - Compressed Air - SCI	10	PA TRM	Broader applications
			Custom - VFDs < 10HP - SCI	15	PA TRM	Matches OH TRM
			Custom - VFDs > 10 HP - SCI	15	PA TRM	Matches OH TRM
			Custom Motors - Three Phase - SCI	16	Ohio TRM	
			Custom - Refrigeration - SCI	15	PA TRM	Not in OH TRM
		Retro - Commissioning - SCI	Custom Retrocommissioning - SCI	5	DEER 2014 EUL Table	Not in OH TRM
		Custom Buildings - SCI	Custom - Building Improvements - SCI	15	EM&V Consultant	Broader applications
			Custom - Energy Management - SCI	10	EM&V Consultant	Not in OH TRM
		Audits & Education - SCI	Energy Manager - SCI	1	Co Assumption	Not in OH TRM
			Energy Efficiency Measures - SCI	5	PA TRM	Align with evaluation, not all components in OH TRM
			Multi Family Audit - SCI	7	EM&V report for PY2014	Align with evaluation, not all components in OH TRM
			Benchmarking - SCI	0	N/A	Not in OH TRM
			Audit - SCI	0	N/A	Not in OH TRM
			Audits w Direct Install - SCI	12	Co Assumption	Not in OH TRM
			Behavioral - SCI	1	Current Practice	Not in OH TRM
	Customer Action Program - SCI	Customer Action Program - SCI	Customer Action Program - SCI	13	EM&V Consultant	Not in OH TRM

Sector	Program	Sub-Program	Measure	Msre Life	Measure Life Source	Reasoning in lieu of OH TRM
Large Enterprise (Mercantile Utility)	C&I Energy Solutions for Business Program - Large	HVAC - LCI	Air Conditioning - <=5.4 Tn - LCI	15	Ohio TRM	
			Chiller - Water Cld w Full Load - LCI	20	PA TRM	Matches OH TRM
			Air Conditioning - >5.4 < 20 Tn - LCI	15	Ohio TRM	
			Air Conditioning - >=20 Tn - LCI	15	Ohio TRM	
			Heat Pump - <=5.4 Tn - LCI	15	Ohio TRM	
			Heat Pumps - >5.4 Tn - LCI	15	Ohio TRM	
			Heat Pumps - Water & GeoT - LCI	15	Ohio TRM	
			Ductless Mini-Split HP - LCI	15	PA TRM	Not in OH TRM
			PTAC - LCI	15	PA TRM	Not in OH TRM
			PTHP - LCI	15	PA TRM	Not in OH TRM
		Lighting - LCI	CFL Fixtures - LCI	15	Ohio TRM	
			CFL Lamps - LCI	3	Ohio TRM	
			Lighting Controls (Daylight & Occupancy) - LCI	8	PA TRM	Matches OH TRM
			Linear Fluorscent T8 / T5 - LCI	15	Ohio TRM	
			LED Linear - LCI	15	Ohio TRM	
			LED Channel Signage - LCI	15	PA TRM	Not in OH TRM
			Exit Signs - LCI	16	Ohio TRM	
			LED Fixtures External - LCI	15	Ohio TRM	
			LED Fixtures Internal - LCI	15	Ohio TRM	
			LED Lamps - LCI	15	Ohio TRM	
			Street & Area Lighting (Customer Owned) - LCI	10	EM&V Consultant	Not in OH TRM
		Data Centers - LCI	DC - Custom HVAC - LCI	15	EM&V Consultant	Not in OH TRM
			DC - Custom Servers - LCI	8	EM&V Consultant	Not in OH TRM
			DC - Audit - LCI	0	N/A	Not in OH TRM

Sector	Program	Sub-Program	Measure	Msre Life	Measure Life Source	Reasoning in lieu of OH TRM
Large Enterprise (Mercantile Utility)	C&I Energy Solutions for Business Program - Large	Custom - LCI	Custom - Process Improvement - LCI	15	PA TRM	Not in OH TRM
			Custom - HVAC & Chillers - LCI	20	PA TRM	Matches OH TRM
			Custom - Compressed Air - LCI	10	PA TRM	Broader applications
			Custom - VFDs < 10HP - LCI	15	PA TRM	Matches OH TRM
			Custom - VFDs > 10 HP - LCI	15	PA TRM	Matches OH TRM
			Custom-Motors - Three Phase - LCI	16	Ohio TRM	
			Custom - Refrigeration - LCI	15	PA TRM	Not in OH TRM
		Retro - Commissioning - LCI	Custom Retrocommissioning - LCI	5	DEER 2014 EUL Table	Not in OH TRM
		Custom Buildings - LCI	Custom - Building Improvements - LCI	15	EM&V Consultant	Broader applications
			Custom - Energy Management - LCI	10	EM&V Consultant	Not in OH TRM
		Audits & Education - LCI	Audit - LCI	0	N/A	Not in OH TRM
			Continuous Improvement - LCI	1	Co Assumption	Not in OH TRM
			Energy Manager - LCI	1	Co Assumption	Not in OH TRM
			Benchmarking - LCI	0	N/A	Not in OH TRM
	C&I Demand Response Program - Large	Demand Response LCI	LC&I Contracted DR - PJM	1	EM&V Consultant	Not in OH TRM
			ELR Interruptible Tariff	1	EM&V Consultant	Not in OH TRM
	Customer Action Program - LCI	Customer Action Program - LCI	Customer Action Program - LCI	13	EM&V Consultant	Not in OH TRM

Sector	Program	Sub-Program	Measure	Msre Life	Measure Life Source	Reasoning in lieu of OH TRM
Government	Government Tariff Lighting Program	Government Tariff Lighting	LED - Traffic Signals - Gov	10	Ohio TRM	
			Street & Area Lighting (Tariff / Utility Owned) - Gov	10	EM&V Consultant	Not in OH TRM
			Street & Area Lighting (Tariff / Customer Owned) - Gov	10	EM&V Consultant	Not in OH TRM

Sector	Program	Sub-Program	Measure	Msre Life	Measure Life Source	Reasoning in lieu of OH TRM
Mercantile	Mercantile Customer Program	Mercantile	Mercantile Customer Projects	10	Co Assumption	Not in OH TRM
Other	Transmission & Distribution Upgrades	T&D Upgrades	Transmission & Distribution Upgrades	15	Co Assumption	Not in OH TRM
	Smart Grid Modernization Initiative	Smart Grid	Smart Grid Modernization Initiative	N/A	N/A	Not in OH TRM
	Energy Special Improvement District	Energy Special Improvement District	Energy Special Improvement District	N/A	N/A	Not in OH TRM

Exhibit CN-10 Confidential
Redacted

Exhibit CN-11

NRDC Set 1
Witness: Edward C. Miller

Case No. 16-0743-EL-POR

In the Matter of the Application of Ohio Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison Company For Approval of Their Energy Efficiency and Peak Demand Reduction Program Portfolio Plans for 2017 through 2019

RESPONSES TO DATA REQUESTS

NRDC Set 1 INT-019 If the Response to INT-18 is both, please provide a breakdown of the forecast percent of CFL lamps incented through the program that will be standard vs. specialty products.

Response: The Companies' do not have this forecast.

Exhibit CN-12 Confidential
Redacted

CHRISTOPHER NEME, PRINCIPAL

EDUCATION

M.P.P., University of Michigan, 1986
B.A.., Political Science, University of Michigan, 1985

EXPERIENCE

2010 present: Principal, Energy Futures Group, Hinesburg, VT
1999 2010: Director of Planning & Evaluation, Vermont Energy Investment Corp., Burlington, VT
1993 1999: Senior Analyst, Vermont Energy Investment Corp., Burlington, VT
1992 1993: Energy Consultant, Lawrence Berkeley National Laboratory, Gaborone, Botswana
1986 1991: Senior Policy Analyst, Center for Clean Air Policy, Washington, DC

PROFESSIONAL SUMMARY

Chris Neme leads a variety of consulting projects for clients across the United States, Canada, and Europe. He specializes in analysis of markets for energy efficiency measures and the design and evaluation of programs and policies to promote them. Prior to co founding Energy Futures Group, he served as Director of the Vermont Energy Investment Corporation's 30 person consulting division. During his 20+ years in the energy efficiency industry, Mr. Neme has conducted or critically reviewed analyses of efficiency potential in ten states; reviewed or developed efficiency programs in more than 30 states and provinces and in Europe; and defended expert witness testimony before regulatory commissions in ten different jurisdictions. Mr. Neme has led training courses on the elements of good efficiency program design and published/presented assessments of efficiency markets, programs and policies through a variety of publications, conferences, Consortium for Energy Efficiency Committees, ENERGY STAR working groups and other forums. He previously served as Co Chair of NEEP's EM&V Research and Evaluation Committee.

SELECTED PROJECTS

- *New Jersey Board of Public Utilities.* Serve on multi firm management team responsible for administration and delivery of statewide New Jersey Clean Energy Programs (annual budget of >$200 million). Lead strategic planning and program design for the team; also support regulatory filings, cost effectiveness screening and evaluation work. (2015 to present).
- *Home Performance Council.* Part of five person drafting team for development of new National Standard Practice Manual for cost effectiveness screening of energy efficiency measures, programs and portfolios. Manual expected to be completed, after several rounds of external review, in early 2017. (2016 to present)
- *Regulatory Assistance Project - U.S.* Providing guidance on efficiency policy and program design. Lead author on strategic reports, including what it would take to achieve 30% electricity savings over ten years, lessons from U.S. experience using efficiency programs to defer T&D system investments, and history of bidding of efficiency resources into New England ISO and PJM capacity markets. Also provide technical assistance to several state regulators, technical support to various Energy Foundation grantees across the U.S., and assistance in RAP's work with the U.S. EPA on efficiency's role in 111d carbon emission regulations. (2010 to present)

- *Natural Resources Defense Council (Illinois & Michigan).* Critically reviewed multi year DSM plans filed by Illinois and Michigan utilities. Drafted and defended regulatory testimony on critiques. Represent NRDC in monthly stakeholder utility meetings to review and provide feedback on efficiency potential studies, program designs, evaluation priorities, draft evaluation reports, cost effectiveness screening, TRM savings assumptions, and other related topics. Also, assisting with strategy for maximizing the cost effective use of efficiency to address EPA's proposed 111(d) regulations of carbon emissions from power plants. (2010 to present)
- ***Ontario Energy Board:*** Appointed by Ontario Energy Board to serve provincial gas DSM Evaluation and Audit Committee. Previously elected by non utility stakeholders to serve on provincial Technical Evaluation Committee overseeing gas DSM evaluation planning and individual evaluation studies. Also served on Enbridge Gas's annual Audit Committee which oversaw an annual savings verification process. (2000 to present)
- *Green Energy Coalition (Ontario).* Representing a coalition of environmental groups in various regulatory proceedings. Present recommendations on DSM policies (including integrated resource planning on pipeline expansions), critically review and negotiate with utilities on proposed DSM Plans, and defend expert witness testimony. (1993 to present)
- *Regulatory Assistance Project - Europe.* Providing on going technical support on efficiency policy and program design to RAP and its partners in the United Kingdom, Germany, and other countries. Reviewed draft European Union policies on Energy Savings Obligations, EM&V protocols and other related issues. Drafted a policy brief on design considerations for efficiency feed in tariffs, a report on bidding of efficiency resources into capacity markets, and a roadmap for achieving deep retrofits in half of the residential building stock. (2009 to present)
- *Northeast Energy Efficiency Partnerships.* Managed Regional EM&V forum project estimating savings for emerging technologies. Also, led project to assess national best practices and develop policy guidance on the use of efficiency to defer T&D investments. (2009 to 2015)
- *Ontario Power Authority.* Managed jurisdictional scans of how efficiency programs leverage building efficiency labeling/disclosure requirements and how non energy benefits are addressed in cost effectiveness screening. Also supported staff workshop on the role efficiency can play in deferring T&D investments. Presented assessment of future efficiency policy and program trends for Advisory Council on Energy Efficiency. (2012 2015)
- **Vermont Public Interest Research Group.** Conducted comparative analysis of the economic and environmental impacts of fuel switching from oil/propane heating to either natural gas or efficient, cold climate electric heat pumps. Filed regulatory testimony on findings. (2014 2015)
- **New Hampshire Electric Co-op**. Led assessment of the co op's environmental and social responsibility programs' promotion of whole building efficiency retrofits, cold climate heat pumps and renewable energy systems. Presented recommendations to the co op Board. (2014)
- *National Association of Regulatory Utility Commissioners (NARUC).* Assessed alternatives to basing state energy efficiency goals on first year savings to eliminate disincentives to invest in longer lived (but often more expensive) measures and programs. Work was ultimately for the Michigan Public Service Commission and was used by Commission staff to establish lifetime savings metrics for utility programs it regulates. (2013)

- *California Investor-Owned Utility*. Senior advisor on EFG project to compare the cost of saved energy across ~10 leading U.S. utility portfolios. The research sought to determine if there are discernable differences in the cost of saved energy related to utility spending in specific non incentive categories, including administration, marketing, and EM&V. (2013)
- *Green Mountain Power.* Helped develop new program to introduce ultra efficient cold climate heat pumps to Vermont residential and small business markets. (2012 2013)
- *DC Department of the Environment (Washington DC).* Part of VEIC team administering the DC Sustainable Energy Utility (SEU). Primary responsibilities are characterizing the DC efficiency market and supporting the design of efficiency programs that the SEU will be implementing. (2011 to 2012)
- *Ohio Sierra Club.* Filed and defended expert witness testimony on the implications of not fully bidding all efficiency resources into the PJM capacity market. Also critically reviewing First Energy's and other utilities' multi year DSM plans. (2012)
- *Regulatory Assistance Project – Global.* Assisted RAP in framing several global research reports. Co authored the first report an extensive "best practices guide" on government policies for achieving energy efficiency objectives, drawing on experience with a variety of policy mechanism employed around the world. (2011)
- *Tennessee Valley Authority.* Assisted CSG team providing input to TVA on the redesign of its residential efficiency program portfolio to meet aggressive new five year savings goals. (2010)
- *Efficiency Vermont.* Oversaw residential program planning, input to the VT Department of Public Service on evaluation planning, input to NEEP's regional EM&V forum, and development of M&V plan and other aspects of bids of efficiency resources into New England's Forward Capacity Market (FCM) from March 2000 through Spring 2010.
- *Ohio Public Utilities Commission.* Senior Advisor to a project to develop a web based Technical Reference Manual (TRM). The TRM includes deemed savings assumptions, deemed calculated savings algorithms and custom savings protocols. It was designed to serve as the basis for all electric and gas efficiency program savings claims in the state. (2009 to 2010)
- *New Jersey Clean Energy Program.* Oversaw support of Honeywell led team delivering all statewide residential efficiency and renewable energy programs. Led work on program design, regulatory filings, savings algorithms, and evaluation planning. (2006 to 2010)
- *New York State Energy Research and Development Authority (NYSERDA).* Led several analyses of residential electric and gas efficiency potential (over 20 years) for New York State. Scenarios included continuation of existing initiatives, new budget constraints and a least cost approach to meeting greenhouse gas emission reduction targets. (2001 to 2010)
- *Long Island Power Authority Clean Energy Plan.* Led team that designed the four major residential programs (three efficiency, one PV) incorporated into the plan in 1999. Oversaw extensive technical support to the implementation of those programs. This involved assistance with the development of goals and budgets, development of savings algorithms, cost effectiveness screening, and on going program design refinements. (1998 to 2009)

SELECTED PUBLICATIONS

- "The Next Quantum Leap in Efficiency: 30% Electricity Savings in Ten Years", published by the Regulatory Assistance Project, February 2016 (with Jim Grevatt)
- "Energy Efficiency as a T&D Resource: Lessons from Recent U.S. Efforts to Use Geographically Targeted Efficiency Programs to Defer T&D Investments", published by Northeast Energy Efficiency Partnerships, January 9, 2015 (with Jim Grevatt)
- "Unleashing Energy Efficiency: The Best Way to Comply with EPA's Clean Power Plan", Public Utilities Fortnightly, October 2014, pp. 30 38 (with Tim Woolf, Erin Malone and Robin LeBaron)
- "The Resource Value Framework: Reforming Energy Efficiency Cost Effectiveness Screening", published by the National Efficiency Screening Project, August 2014 (with Tim Woolf et al.)
- "Energy Efficiency Participation in Electricity Capacity Markets the US Experience", published by the Regulatory Assistance Project, August 2014, (with Richard Cowart).
- "Alternative Michigan Energy Savings Goals to Promote Longer Term Savings and Address Small Utility Challenges", prepared for the Michigan Public Service Commission, September 2013 (with Optimal Energy)
- "An Energy Efficiency Feed in Tariff: Key Policy and Design Considerations", 2013 ECEEE Summer Study Proceedings, pp. 305 315 (with Richard Cowart)
- "U.S. Experience with Efficiency as a Transmission and Distribution System Resource", published by the Regulatory Assistance Project, February 2012 (with Rich Sedano)
- "Achieving Energy Efficiency: A Global Best Practices Guide on Government Policies", published by the Regulatory Assistance Project, February 2012 (with Nancy Wasserman)
- "Residential Efficiency Retrofits: A Roadmap for the Future", published by the Regulatory Assistance Project, May 2011 (with Meg Gottstein and Blair Hamilton)
- "Is it Time to Ditch the TRC?" Proceedings of ACEEE 2010 Summer Study on Energy Efficiency in Buildings, Volume 5 (with Marty Kushler).
- "Energy Efficiency as a Resource in the ISO New England Forward Capacity Market", in *Energy Efficiency*, published on line 06 June 2010 (with Cheryl Jenkins and Shawn Enterline).
- "Shareholder Incentives for Gas DSM: Experience with One Canadian Utility", Proceedings of ACEEE 2004 Summer Study Conference on Energy Efficiency in Buildings, Volume 5 (with Kai Millyard).

Exhibit CN-14

Based on analysis of performance characteristics of September 2, 2016 list of currently qualified ENERGY STAR CFLs (https://www.energystar.gov/productfinder/download/certified-light-bulbs/) relative to the performance characteristics of the ENERGY STAR specification that goes into effect on January 2, 2017. (https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Lamps%20V2_0%20Revised%20AUG-2016.pdf).

Summary: Correspondence Errata to the Direct Testimony of Chris Neme with updated Exhibits (Public Redacted Version of Exhibits) electronically filed by Mr. Robert Dove on behalf of The Natural Resources Defense Council