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# Department of Energy and Environment

Evaluation, Measurement, and Verification of Energy Efficiency and Renewable Energy Programs in the District of Columbia

**FY2014 Annual Evaluation Report** 

Volume I

Final Draft—September 30, 2015



DC SUSTAINABLE ENERGY UTILITY









# Department of Energy and Environment

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Volume I

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The table below displays the role of each evaluation team member and report content contributor.

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Leidos	Kendra Scott	C&I Impact Evaluation Lead
GDS Associates	Tim Clark	Residential and Solar Impact Evaluation Lead
Baumann Consulting	Jonathan Lemmond	Impact Evaluation–Onsite Verification Lead



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# ACRONYMS

ACEEE	American Council for an Energy Efficient Economy		
BER	Business Energy Rebates		
Btu	British thermal unit		
C&I	Commercial and institutional		
CAT	Comprehensive analysis tool		
CBE	Certified business enterprise		
CF	Coincidence factor		
CEI	Comprehensive efficiency improvements		
CFL	Compact fluorescent lamp		
DI	Direct install		
DCSEU	District of Columbia Sustainable Energy Utility		
DOEE	Department of Energy and Environment		
DDOE	District Department of the Environment		
DHW	Domestic hot water		
EC	Energy consultant		
ECM	Energy conservation measure		
EFI	Energy Federation Incorporated		
EFLH	Equivalent full load hours		
EISA	Energy Independence and Security Act		
EM&V	Evaluation, measurement, and verification		
FY	Fiscal year		
GWh	Gigawatt hour		
HERO	Home Energy Reporting Online		
HPwES	Home Performance with ENERGY STAR <sup>®</sup>		
HVAC	Heating ventilation and air conditioning		
ICDI	Implementation contractor direct install		
KITT	Knowledge Information Transfer Tool		
kW	Kilowatt		
kWh	Kilowatt hour		
LED	Light emitting diode		
LI	Low-income		
LIMF	Low-income multifamily		



mcf	1,000 cubic feet
MF	Multifamily
MMBtu	1 million British thermal unit
M&V	Measurement and verification
Ν	Population
n	Sample
NREL	National Renewable Energy Laboratory
NTG	Net-to-gross
PV	Photovoltaic
PY	Plan year
QA/QC	Quality assurance/quality control
RFP	Request for proposal
RR	Realization rate
SOME	So Others Might Eat
TRM	Technical Reference Manual
VEIC	Vermont Energy Investment Corporation
VFD	Variable frequency drive



# 1. EXECUTIVE SUMMARY

The Department of Energy and Environment (DOEE) has contracted with Tetra Tech (as the prime contractor), GDS Associates, Inc., Leidos, and Baumann Consulting to provide evaluation, measurement, and verification of the portfolio of energy efficiency and renewable energy initiatives offered in the District of Columbia (DC) along with the six performance benchmarks associated with these initiatives. The initiatives are implemented through the DC Sustainable Energy Utility (DCSEU) partnership.

The DCSEU is led by the Sustainable Energy Partnership and under contract to the Department of Energy and Environment (DOEE). The Sustainable Energy Partnership includes the following organizations<sup>1</sup>:

- Vermont Energy Investment Corporation (VEIC) Partnership Lead
- George L. Nichols & Associates
- Groundswell
- Institute for Market Transformation
- L. S. Caldwell and Associates, Inc.
- Nextility
- PEER Consultants
- PES Group / Stateline Energy Associates
- Taurus Development Group.

This report presents the evaluation and verification results for each initiative, or track, offered by the DCSEU as a part of the DCSEU Energy Efficiency and Renewable Energy Portfolio in the District of Columbia for fiscal year (FY) 2014. Overall portfolio results are also provided along with cross-sectional findings and evaluation team recommendations. The fiscal year is defined as October 1<sup>st</sup> through September 30<sup>th</sup>.

The independent evaluation and verification of the six performance benchmarks included within the DOEE contract with the DCSEU is reported separately. See the *Department of Energy and Environment Verification of the District of Columbia Sustainable Energy Utility Performance Benchmarks, F2014 Annual Evaluation Report.* 

Detailed summaries of the portfolio overall and crosscutting evaluation findings are presented in Section 3. Section 4 provides detailed track level assessments.

<sup>&</sup>lt;sup>1</sup> DC Sustainable Energy Utility website, https://www.dcseu.com/.



# 1.1 EVALUATION VERIFIED SAVINGS SUMMARY

The evaluation team's verified, or ex-post, results of the KITT reported electric savings, demand reduction, and natural gas savings for each track, or initiative, and for the overall portfolio are presented in Table 1-1. These verified results reflect portfolio level realization rate estimates of 0.98, 0.92, and 1.00 for kWh, kW, and MMBtu respectively. This means that the evaluation team estimates that the actual portfolio electric savings result is 98 percent of the DCSEU reported electric savings, the demand reduction result is 92 percent of the DCSEU reported demand reduction, and the actual portfolio gas savings result is 100 percent of the DCSEU reported gas savings. This compares to realization rate estimates at the portfolio level of 1.04, 1.07, and 1.00 for kWh, kW, and MMBtu, respectively, for the FY13 results.

Realization rates are the ratio of verified savings to the tracking system savings for a representative sample of projects reported within each track. Realization rates are typically calculated for each end-use category and then applied to the total end-use tracking system savings for a particular program, or track. The results are rolled up to develop program, or track, verified savings. The verified savings for all tracks are summed to obtain portfolio level verified savings.

These realization rate estimates are quite good and are comparable to realization rates in neighboring states. The Pennsylvania utilities, overall, achieved a realization rate for of approximately 92 percent for electric savings in its fourth year of Act 129 Program operation (3<sup>rd</sup> full year of implementation). Individual Pennsylvania utility results range from 87 to 95 percent.<sup>2</sup> The EmPOWER Maryland 2013 statewide verified results are reported in the *Verification of Reported Impacts from 2013 EmPOWER Maryland Energy Efficiency Programs*<sup>3</sup> as 93 and 100 percent of reported values for electric savings and demand reduction, respectively. Individual Maryland utility results range from 88 to 99 percent for kWh and 92 to 116 percent for kW.

These realization rates indicate that, overall, the tracking of the measures installed through the initiatives and the calculation of electric savings, demand reduction, and gas savings is accurate—although there are some calculation issues within individual initiatives as discussed in each track section, the adjustments to correct for over-reporting and under-reporting balance out across the portfolio. Tracking and calculation issues are not uncommon with energy efficiency program implementation, especially when programs are early in the implementation cycle.

<sup>&</sup>lt;sup>2</sup> ACT 129 STATEWIDE EVALUATOR ANNUAL REPORT, Program Year 5: June 1, 2013 – May 31, 2014 <u>http://www.puc.pa.gov/Electric/pdf/Act129/SWE\_PY5-Final\_Annual\_Report.pdf</u>

<sup>&</sup>lt;sup>3</sup> Verification of Reported Program Impacts from 2013 EmPOWER Maryland Energy Efficiency Programs with Recommendations to Improve Future Evaluation Research. <u>http://www.neep.org/sites/default/files/resources/9153-57-Itron2013VerificationReport-081314%20%282%29.pdf</u>



1-3

			kWh			kW		MMBtu - Gas Savings			
Track	Description	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	
7107PV	Solar Photovoltaic	561,838	561,838	1.00	72.4	72.4	1.00	-	-	n/a	
7110SHOT	Solar Hot Water	(11,664)	(11,664)	1.00	(1.4)	(1.4)	1.00	3,135	3,266	1.04	
7401FHLB	Income Qualified Home Improvement	27,089	26,618	0.98	1.4	1.3	0.87	537	530	0.99	
7420HPES	Home Performance with ENERGY STAR	12,061	12,023	1.00	0.1	0.1	0.84	472	427	0.90	
7511CIRX	Business Energy Rebates	4,301,800	4,228,906	0.98	383.0	506.7	1.32	1,326	1,326	1.00	
7512MTV	T12 Market Transformation Value	2,562,394	2,199,806	0.86	476.1	395.0	0.83	-	-	n/a	
7520CUST	Custom Services for Large C&I Customers	22,818,145	23,349,778	1.02	2,995.8	3,530.4	1.18	77,878	77,773	1.00	
7520MARO	Custom Market Opportunity	306,634	319,582	1.04	115.2	114.2	0.99	23,265	23,193	1.00	
7520NEWC	Custom New Construction	1,157,874	1,157,874	1.00	339.1	141.5	0.42	2,061	2,102	1.02	
7610ICDI	LI MF Implementation Contractor Direct Install	1,705,554	1,690,239	0.99	209.2	156.2	0.75	2,410	1,870	0.78	
7610LICP 7612LICP	LI MF Comprehensive Efficiency Improvements	814,246	811,473	1.00	109.4	109.7	1.00	20,981	20,984	1.00	
7710APPL	Retail Efficient Appliances	104,221	106,137	1.02	19.6	21.3	1.09	1,125	1,108	0.98	
7710FBNK	Efficient Products at Food Banks	736,100	723,326	0.98	79.1	64.9	0.82	-	-	n/a	
7710LITE	Retail Efficient Lighting	21,113,004	19,980,993	0.95	3,259.3	2,341.1	0.72	-	-	n/a	
Total Report	ed (ex-ante) / Verified (ex-post)	56,209,295	55,156,931	0.98	8,058.5	7,453.3	0.92	133,189	132,579	1.00	

#### Table 1-1. DCSEU FY14 Energy Efficiency and Renewable Energy Portfolio Gross Verified Savings, Meter Level

Note: Table total may not add; difference due to rounding.



#### 1. Executive Summary

Table 1-2 provides a summary by track and for the overall portfolio after adjustments for line losses<sup>4</sup> and, in the case of the solar initiatives, an adjustment for spillover.<sup>5</sup> The free-ridership and spillover for all other tracks are assumed to be 1.00, except for the Solar Photovoltaic and Solar Hot Water initiatives where it is assumed to be 1.15.

		kWh	, Net	kW, Net		
Track	Description	Ex-antegenerator	Ex-post <sub>generator</sub>	Ex-antegenerator	Ex-post <sub>generator</sub>	
7107PV	Solar Photovoltaic	697,803	697,803	88.2	88.2	
7110SHOT	Solar Hot Water	-14,486	-14,486	-1.7	-1.7	
7401FHLB	Income Qualified Home Improvement	29,256	28,748	1.5	1.3	
7420HPES	Home Performance with ENERGY STAR	13,026	12,985	0.1	0.1	
7511CIRX	Business Energy Rebates	4,645,943	4,567,219	405.9	537.1	
7512MTV	T12 Market Transformation Value	2,767,385	2,375,791	504.7	418.7	
7520CUST	Custom Services for Large C&I Customers	24,643,596	25,217,760	3,175.6	3,742.2	
7520MARO	Custom Market Opportunity	331,164	345,148	122.1	121.1	
7520NEWC	Custom New Construction	1,250,503	1,250,503	359.5	150.0	
7610ICDI	LI MF Implementation Contractor Direct Install	1,841,998	1,825,458	221.7	165.5	
7610LICP 7612LICP	LI MF Comprehensive Efficiency Improvements	879,386	876,391	116.0	116.2	
7710APPL	Retail Efficient Appliances	112,558	114,628	20.8	22.6	
7710FBNK	Efficient Products at Food Banks	794,988	781,192	83.9	68.8	
7710LITE	Retail Efficient Lighting	22,802,044	21,579,473	3,454.9	2,481.6	
Total Report	ted / Verified	60,795,166	59,658,614	8,553.3	7,911.7	

#### Table 1-2. DCSEU FY14 Net Verified Savings, Generator Level

Note: Table total may not add; difference due to rounding.

<sup>&</sup>lt;sup>4</sup> The reported and verified electric savings (kWh) and demand reduction (kW) results are adjusted for line losses (8 percent and 6 percent increases, respectively).

<sup>&</sup>lt;sup>5</sup> The savings and demand for the Solar PV program are increased by an additional 15 percent to reflect spillover; reference DCSEU memorandum to the DDOE and Tetra Tech, *Screening assumptions for the DCSEU solar renewable energy program portfolio*, dated August 30, 2012



# 2. EVALUATION METHODOLOGY

The FY14 evaluation effort followed the evaluation guidance provided in the *Department of Energy and Environment Energy Efficiency Evaluation Plan for Portfolio of Programs Offered in the District of Columbia* submitted December 5, 2014.

The FY14 impact evaluation effort was focused primarily on the verification of the individual track and overall portfolio reported, or ex-ante, results for electric savings (kWh), demand reduction (kW), and natural gas savings (MMBtu, mcf). The effort was prioritized by track or initiative, based upon the contribution to the portfolio to ensure those tracks providing the most savings received more robust evaluation.

Process evaluation and net savings assessments are planned according to the "DCSEU Portfolio Evaluation Strategic Timeline" developed to plan evaluation activities over a fouryear time period to maximize evaluation expenditures and to provide the DOEE, DCSEU, and other stakeholders with timely and useful data and information to support portfolio design and policy development. The evaluation strategic timeline is presented in Table 2-1.

Crit	eria Le	gend			Evaluation Legend
Criteria	н	М	L	Level	Activity
Contribution	high	medium	low	Low	Desk review
Complexity	high	medium	low	Medium	Project file review or desk review with limited onsite verification and/or supplemental phone survey verification
Criteria	S	MS	MA	High	Project file review with onsite verification and phone survey verification, market actor interviews
Implementation Phase	start- up	mid- stream	mature	Expanded	Medium or High plus additional study to verify key savings algorithm assumptions or process issues



				Criteria			E	Evaluation Ef	uation Effort & Timing (contract period)					
Track	Track Description	Current Contr. to Portfolio (H, M, L)	Expected Contr. Over 3- years (H, M, L)	Measure Complexity (H, M, L)	Impl'n Phase (S, MS, MA)	Typical Impl'n Maturity Year	Evaluation Budget Year	FY13	FY14	FY15	FY16			
Crosscutting a	and Portfolio Level	n/a	n/a	Н	S to MS	Year 3	Performance Benchmarks assessment	high-level	assess latest Performance Benchmark study and design evaluation effort for FY15-16	Assess achievement of DCSEU reported results	TBD			
					Technical Reference Manual review	robust for existing measures	robust for new measures; robust assessment of high- contribution measures (res lighting)	robust for new measures	robust for new measures					
							Data collection and savings estimation tools review	minimal	minimal	robust	FY15 results dependent			
						Cost effectiveness of Portfolio and Initiatives	validate DCSEU model	robust assessment of externality adders reasonableness	robust assessment of other key assumptions					
				Marketing and outreach	minimal	minimal	minimal	TBD						
							Workforce development	minimal	minimal	minimal	TBD			

#### Table 2-1. Evaluation of DCSEU Portfolio Strategic Timeline (continued)

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				Criteria			Evaluation Effort & Timing (contract period)					
Track	Track Description	Current Contr. to Portfolio (H, M, L)	Expected Contr. Over 3- years (H, M, L)	Measure Complexity (H, M, L)	Impl'n Phase (S, MS, MA)	Typical Impl'n Maturity Year	Evaluation Budget Year	FY13	FY14	FY15	FY16	
							and training					
							Administrative operations	minimal	robust	minimal	TBD	
7110SHOT	Solar Hot Water	L	L	L	S	Year 2	Impact	not offered	low	low	low	
							Process	not offered	low	low	high	
							NTG	not offered	low-indicators	low- indicators	low- indicators	
7107PV	Photovoltaic	L	L	L	S	Year 2	Impact	low	low	low	low	
							Process	low	low	low	high	
							NTG	none	low-indicators	moderate	moderate	
7401FHLB	Federal Home	L	L	L	S	Year 3	Impact	medium	medium	high	medium	
	Loan Bank						Process	low	low	medium	high	
							NTG	none	low-indicators	moderate	moderate	
7420HPES	Home	L	L	M to L	S	Year 3	Impact	medium	medium	high	medium	
	Performance with ENERGY						Process	low	low	medium	high	
	STAR®						NTG	none	low-indicators	moderate	moderate	



				Criteria			Evaluation Effort & Timing (contract period)					
Track	Track Description	Current Contr. to Portfolio (H, M, L)	Expected Contr. Over 3- years (H, M, L)	Measure Complexity (H, M, L)	Impl'n Phase (S, MS, MA)	Typical Impl'n Maturity Year	Evaluation Budget Year	FY13	FY14	FY15	FY16	
7510BLTZ	T12 Lighting	Н	Н	М	MS	Year 2	Impact	high	high	Discont'd	Discont'd	
	Replacement						Process	low	high			
							NTG	none	full	-		
7511CIRX	Business Energy Rebates	М	М	Mixed	S	Year 2	Impact	high	high	Expanded – include Hotel HOU study	high	
							Process	low	low	medium	low	
				NTG	none	low-indicators	medium	high				
7512MTV	12 Market	L	М	М	S	Year 3	Impact	not	medium	high	high	
	Transformation						Process	offered	low	medium	low	
							NTG		low-indicators	medium	high	
7520CUST	Custom Services	Н	Н	H to M	MS	Year 3	Impact	high	high	high	high	
7520MARO	for C&I Customers						Process	low	high	high	high	
7520NEWC							NTG	none	high	Expanded – include case study approach	high	
7610BLTZ	Low Income T12	L	L	L		Year 2	Impact	medium	Discont'd	Discont'd	Discont'd	
	Lighting				Discont'd		Process	low	_			
							NTG	none				
7610ICDI	Low Income	L	L	L	MS	Year 2	Impact	medium	medium	high	medium	
	Contractor Direct						Process	low	low	medium	low	

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				Criteria			Evaluation Effort & Timing (contract period)					
Track	Track Description	Current Contr. to Portfolio (H, M, L)	Expected Contr. Over 3- years (H, M, L)	Measure Complexity (H, M, L)	Impl'n Phase (S, MS, MA)	Typical Impl'n Maturity Year	Evaluation Budget Year	FY13	FY14	FY15	FY16	
	Install						NTG	none	low-indicators	low- indicators	low- indicators	
7620LICP	Low Income	L	L	M to L	MS	Year 3	Impact	medium	medium	high	medium	
Comprer	Comprehensive						Process	low	low	medium	high	
							NTG	none	low-indicators	low- indicators	low- indicators	
7710APPL	Energy Efficient	Н	Н	L	S	Year 2	Impact	medium	expanded	medium	medium	
	Appliances	(Res CFL					Process	low	high	medium	low	
		lighting)					NTG	none	high	high	low- indicators	
7710FBNK	Food Bank	М	L	L	MS	Year 2	Impact	medium	medium	medium	medium	
	Lighting				Process	low	low	medium	low			
							NTG	none	none	low- indicators	low- indicators	



# 2.1 PORTFOLIO RESULTS EXAMINATION

Since inception, the DCSEU plans have shifted from early "quick start" direct install initiatives to a combination of direct install and incentive-based initiatives consisting of upstream buydowns, rebates, give-away events, and negotiated incentive agreements. A comparison of initiative design types for FY12, FY13, and FY14 based on reported electric savings is presented below. These charts illustrate a steady shift from direct install initiative design to a more "market-based" approach with 8 percent of portfolio savings associated with direct install initiatives in FY14 compared 16 percent in FY13 and 35 percent in FY12. This illustrates a shift toward market-based programming. Market-based programming reduces the DC SEU acquisition cost of programs by shifting the costs to upgrade to more energy efficient technologies from the DC SEU to the customer. Upstream lighting has steadily increased each year from 13 percent in FY12 to 37 percent in FY14.



#### Figure 2-1. Portfolio Electric Savings by Initiative Design Type Comparison, Reported Savings



The following figure provides a summary of the contribution to the portfolio overall savings by measures and by sectors. The contribution to the overall electric savings by the type of initiative is dominated by the Custom initiatives targeted at commercial and institutional entities followed closely by retail lighting.





Lighting measures made up 71 percent of portfolio saving in FY14 compared to 75 percent in FY13 and 80 percent in FY12. It is common for portfolios to rely upon lighting measures due to ease of implementation and low acquisition cost.



Figure 2-3. FY14 Portfolio Electric Savings by Measure Type, Reported Savings

The contribution to overall natural gas savings is due primarily to boiler and furnace replacements and other heating systems improvements which contributed 89 percent to portfolio natural gas savings. This compares to 58 percent and 50 percent for heating systems improvements in FY13 and FY12, respectively.



#### Figure 2-4. FY14 Portfolio Natural Gas Savings by Measure Type, Reported Savings

Commercial and institutional tracks contributed 56 percent in FY14 to electric savings (Figure 2-5) compared to 59 percent in FY13 and 64 percent in FY12. Seventy-eight percent of gas savings were from the commercial and institutional sector in FY14 (Figure 2-6) compared to 84 percent in FY13.





Figure 2-6. FY14 Portfolio by Sector, Reported Gas Savings





## 2.2 SAMPLING METHODOLOGY

Tetra Tech conducted the sampling for each track as summarized in Table 2-2 based on the preliminary KITT<sup>6</sup> extract results snapshot. Table 2-3 and Table 2-4 provide a summary by fuel type of those projects sampled with certainty and those randomly sampled.

The evaluation team considered each track's characteristics when approaching sampling. Some tracks have relatively few or no differences from one project to the next, while others can vary widely. The evaluation team took one of three approaches to sampling, determined by each track's characteristics.

- 1. For tracks with little variation in project savings, we selected a simple random sample. These are likely to have similar measures installed with less uncertainty and variability in the inputs to savings calculations.
- 2. For tracks with higher variation in project savings, we sampled the top ten percent of projects by electricity and/or gas savings (first stratum) with certainty (100 percent sample), and supplemented these projects with a random sample of other projects (second stratum). This approach allows us to include a larger portion of the savings in our sample to increase the level of precision and confidence in the results at the initiative level.
- 3. For tracks with differences in measure types, we stratified that track's sample by measure type and sampled randomly within each stratum. Thus, we are able to calculate realization rates by end-use category and roll up the results to improve the accuracy of the overall track realization rate.

Track	Measure Category	Total Projects	Population kWh	Population Gas Savings	Sampled Projects	Sampled kWh	Sampled Gas Savings	Sampled % kWh	Sampled % Gas
7107PV	Solar PV	108	561,838	0	10	250,253	0	45%	n/a
	Total	108	561,838	0	10	250,253	0	45%	n/a
7110SHOT	Solar Hot Water	6	0	3,135	5	0	2,964	n/a	95%
	Total	6	0	3,135	5	0	2,964	n/a	95%
7401FHLB,	Building Shell	79	16,622	664	25	4,984	206	30%	31%
7420HPES	Lighting	8	5,264	0	3	1,989	0	38%	n/a
	Refrigeration	4	1,936	0	3	1,238	0	64%	n/a
	Space Cooling	1	233	0	0	0	0	0%	n/a
	Space Heating	18	14,170	291	8	5,716	207	40%	71%

#### Table 2-2. Sampling Summary by Track and Measure Category<sup>7</sup>

<sup>6</sup> VEIC tracks program tracking in their proprietary database, KITT. KITT is an acronym for "Knowledge Information Transfer Tool".

Table 2-2 represents the original sample plan. As the evaluation effort progressed, the sample was adjusted for some programs to attempt greater onsite verification opportunity and to match replacement onsite evaluation with project file reviews. Table 2-3 provides a summary of the actual number of completed activities.

# 2. Evaluation Methodology

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Track	Measure Category	Total Projects	Population kWh	Population Gas Savings	Sampled Projects	Sampled kWh	Sampled Gas Savings	Sampled % kWh	Sampled % Gas
	Water Heating	14	2,260	85	3	939	0	42%	0%
	Total	81	40,485	1,040	25	14,866	413	37%	40%
7511CIRX	Food Service	4	9,427	1,326	3	7,548	1,326	80%	100%
	Lighting	130	4,155,574	0	35	2,650,059	0	64%	n/a
	Refrigeration	53	136,830	0	16	47,900	0	35%	n/a
	Space Cooling	5	4,581	0	2	3,778	0	82%	n/a
	Total	179	4,306,412	1,326	50	2,709,285	1,326	63%	100%
7512MTV	Lighting	94	2,704,896	0	50	2,117,298	0	78%	n/a
	Total	94	2,704,896	0	50	2,117,298	0	78%	n/a
7520CUST,	Food Service	2	21,411	120	2	21,411	120	100%	100%
7520MARO, 7520NEWC	Fuel Switching	1	0	97	1	0	97	n/a	100%
	Lighting	39	10,153,312	0	27	7,414,494	0	73%	100%
	Motors	37	9,413,974	44	27	7,762,979	44	82%	100%
	Other	1	0	41	1	0	41	n/a	100%
	Plug Load	1	99,506	0	1	99,506	0	100%	n/a
-	Refrigeration	1	84,000	0	1	84,000	0	100%	n/a
	Space Cooling	21	3,129,831	0	15	2,681,818	0	86%	n/a
	Space Heating	16	221,174	96,121	12	221,174	67,380	100%	70%
	Ventilation	13	2,018,744	3,438	10	1,220,606	3,438	60%	100%
	Water Heating	10	0	2,341	9	0	2,324	n/a	99%
	Total	106	25,141,952	102,202	75	19,505,988	73,444	78%	72%
7610ICDI	Lighting	57	1,543,991	0	34	1,199,373	0	78%	n/a
	Space Cooling	1	5,230	0	0	0	0	0%	n/a
	Space Heating	1	2,997	114	0	0	0	0%	0%
	Water Heating	46	138,404	2,024	28	130,984	1,476	95%	73%
	Total	59	1,690,622	2,138	35	1,330,356	1,476	79%	69%
7610LICP,	Building Shell	5	15,986	508	3	7,704	466	48%	92%
7612LICP	Food Service	7	81,725	507	4	73,744	479	90%	95%
	Fuel Switching	1	16,620	0	0	0	0	0%	n/a
	Industrial Process	1	0	8,574	1	0	8,574	n/a	100%
	Lighting	6	233,184	0	3	190,894	0	82%	n/a
	Motors	1	3,025	0	1	3,025	0	100%	n/a
	Other	2	30,598	0	0	0	0	0%	n/a
	Plug Load	2	1,962	0	1	120	0	6%	n/a

### 2. Evaluation Methodology



Track	Measure Category	Total Projects	Population kWh	Population Gas Savings	Sampled Projects	Sampled kWh	Sampled Gas Savings	Sampled % kWh	Sampled % Gas
	Refrigeration	7	54,064	0	4	34,894	0	65%	n/a
	Space Cooling	9	143,857	0	4	94,427	0	66%	n/a
	Space Heating	11	184,913	8,496	5	177,147	7,372	96%	87%
	Ventilation	5	49,602	0	3	44,494	0	90%	n/a
	Water Heating	12	2,358	2,961	8	2,358	2,656	100%	90%
	Total	19	817,893	21,046	10	628,806	19,547	77%	93%

#### Table 2-3. Sampled Electric Savings by Sampling Method

Track	Total kWh	Certainty kWh	% of Total kWh	Certainty Site kWh	% of Total kWh	Random Sample kWh	% of Total kWh	kWh Not Sampled	% of Total kWh
7107PV	561,838	233,069	41%	0	0%	17,184	3%	311,585	55%
7110SHOT	0	0	n/a	0	n/a	0	n/a	0	n/a
7401FHLB, 7420HPES	40,485	0	0%	0	0%	14,866	37%	25,618	63%
7511CIRX	4,306,412	2,267,274	53%	4,940	0%	437,071	10%	1,597,127	37%
7512MTV	2,704,896	1,387,295	51%	123,444	5%	606,559	22%	587,598	22%
7520CUST, 7520MARO, 7520NEWC	25,141,952	10,231,231	41%	1,438,732	6%	7,836,025	31%	5,635,964	22%
7610ICDI	1,690,622	904,316	53%	65,130	4%	360,911	21%	360,266	21%
7610LICP, 7612LICP	817,893	437,766	54%	12,383	2%	178,657	22%	189,087	23%
Total	35,264,098	15,460,951	44%	1,644,629	5%	9,451,273	27%	8,707,246	25%

### Table 2-4. Sampled Gas Savings by Sampling Method

Track	Total MMBtu	Certainty MMBtu	% of Total MMBtu	Certainty Site MMBtu	% of Total MMBtu	Random Sample MMBtu	% of Total MMBtu	MMBtu Not Sampled	% of Total MMBtu
7107PV	0	0	n/a	0	n/a	0	n/a	0	n/a
7110SHOT	3,135	1,510	48%	0	0%	1,455	46%	170	5%
7401FHLB, 7420HPES	1,040	0	0%	0	0%	413	40%	628	60%
7511CIRX	1,326	1,326	100%	0	0%	0	0%	0	0%
7512MTV	0	0	n/a	0	n/a	0	n/a	0	n/a
7520CUST, 7520MARO , 7520NEWC	102,202	29,996	29%	18,109	18%	25,339	25%	28,759	28%
7610ICDI	2,138	784	37%	26	1%	666	31%	662	31%
7610LICP, 7612LICP	21,046	17,999	86%	57	0%	1,491	7%	1,499	7%



Track	Total MMBtu	Certainty MMBtu	% of Total MMBtu	Certainty Site MMBtu	% of Total MMBtu	Random Sample MMBtu	% of Total MMBtu	MMBtu Not Sampled	% of Total MMBtu
Total	130,887	51,615	39%	18,191	14%	29,363	22%	31,717	24%

Note: Table total may not add; difference due to rounding.

# 2.3 SUMMARY OF EVALUATION ACTIVITIES

The evaluation activities to support the impact, process, and net savings efforts for FY14 results are described below and a summary is presented in Table 2-5. Interview guides, survey instruments, and updated logic models can be found in Volume II of this report.

**DCSEU Program Staff Interviews:** Staff interviews were conducted to ensure evaluators understood how the program operated in FY14 as well as to identify any changes for FY15 The FY13 program logic models were also reviewed at that time to update the characterization of the program resources and key activities, the outputs from those activities, and the expected short-term and long-term program outcomes.

**Desk review:** Project files were reviewed to ensure project file data and information support the reported, or ex-ante, savings. Typically, quantities of measures installed were identified and checked to reported quantities in tracking system and deemed measures were reviewed to ensure calculations were accurate and done in accordance with the DCSEU FY14 final Technical Reference Manual<sup>8</sup>.

**Project file review:** In addition to a desk review, other documentation in the project files (invoices, applications, equipment specification sheets, quality assurance forms, etc.) were reviewed and cross-referenced to each other to ensure accuracy and consistency of data reported and used in the savings calculations for the project.

**Onsite Verification:** Evaluator onsite visits were conducted to verify such things as equipment installation and quantities, operating characteristics, hours of use, fuel sources, and location of equipment in facility.

**Engineering analysis:** Projects that contained measures that were not deemed savings measures in accordance with the DCSEUTechnical Reference Manual were assessed through engineering analysis review and/or engineering modeling. The analysis was conducted to ensure reported, or ex-ante, savings are reasonable given completed project scope. Information collected during onsite verification was also used where appropriate to inform the review.

**Participant survey:** Participant surveys were conducted to understand how the program operated from the customer perspective to support process evaluation and/or to verify the installation of measures reported by the program to support impact evaluation. Additionally, net-to-gross questions (free-ridership and spillover) were asked to support program design and to understand program attribution.

<sup>&</sup>lt;sup>8</sup> DCSEU Technical Reference Manual (TRM)—Measure Savings Algorithms and Cost Assumptions Savings Verification, Fiscal Year 2014.



**Market Actor Interviews:** Market actor interviews were conducted with contractors to understand how the programs are operating from the market actor perspectives. Market actors are a key component of successful program implementation. It is critical to understand the barriers and challenges market actors face and document their ideas for improvements to drive more participation in programs.



Track	Track Description	FY14 Project Count	Program Staff Interviews	Project File Reviews	Desk Audits	Engineering Analysis/Modeling	On-site Measure Verification	Onsite Metering	Participants Surveys - Verification/NTG/	Market Actor Interviews
7110SHOT	Solar Hot Water	6	1	5	0	0	5	0	5	0
7107PV	Photovoltaic	108	1	10	0	0	5	0	25	0
7401FHLB	Federal Home Loan Bank	29	1	25	0	0	0	0	50	0
7420HPES	Home Performance with ENERGY STAR®	50								
7511CIRX	Business Energy Rebates	179	1	50	40	5	20	3	60	0
7512MTV	T12 Market Transformation	94	1	50	0	0	20	0	35	10
7520CUST, 7520MARO, 7520NEWC	Custom Services for C&I Customers	107	5	75	0	25	20	5	40	5
7610ICDI	Low Income Contractor Direct Install	59	1	0	35	0	15	0	15	10
7610LICP, 7612LICP	Low Income Comprehensive	19	1	0	10	0	0	0	10	10
7710APPL	Energy Efficient Appliances	912	1	0	70	0	0	0	70	0
7710FBNK	Food Bank Lighting	19,338	1	0	6 report reviews	0	0	0	70	2
7710LITE	Energy Efficient Lighting	413,262	1	0	6 report reviews	0	0	0	0	12
Total		434,163	15	215	159	30	85	8	380	49

#### Table 2-5. Evaluation Completed Activity Summary

Evaluation, Measurement, and Verification of Energy Efficiency and Renewable Energy Programs in the District of Columbia—FY14 Annual Evaluation Report— Final Draft. September 30, 2015



### 2.4 PROCESS EVALUATION METHODOLOGY SUMMARY AND ACTIVITIES DESCRIPTION

Process evaluations tell the story behind the impact evaluation results, net-to-gross assessments, and participation levels. Process evaluations examine factors such as program design and procedures, administration and delivery, customer satisfaction and/or response, marketing and education effectiveness, internal and external program barriers, market response, and non-energy benefits of the program (e.g., more money to spend on other needs, more comfortable living spaces).

A well-designed and implemented process evaluation serves as a basis for recommendations to program managers involved in program design and implementation. The evaluation team strongly believes that an evaluator must be independent, but also able to work openly and collaboratively with program staff and the program implementers so that findings from the process evaluation are most valuable and result in timely program improvements.

#### A. Methodology

The process evaluation effort began with a review of the DCSEU FY14 Annual Report and the DCSEU portfolio tracking data provided by the DCSEU followed by DCSEU staff interviews to understand how the tracks operated in FY14 including significant changes from FY13 and how the evaluation recommendations had been incorporated as well as to identify changes that have or would occur in FY15.

Process evaluations were conducted for those initiatives, or tracks, contributing more savings to the overall DCSEU portfolio according to the Strategic Evaluation Timeline and are summarized in Table 2-6. Net-to-gross assessments were conducted in conjunction with process evaluations and are summarized as well.

Track	Track Description	Process	NTG
7110SHOT	Solar Hot Water	limited	limited
7107PV	Photovoltaic	limited	limited
7401FHLB	Federal Home Loan Bank	limited	limited
7420HPES	Home Performance with ENERGY STAR®	limited	limited
7511CIRX	Business Energy Rebates	full	full
7512MTV	T12 Market Transformation	full	full
7520CUST, 7520MARO, 7520NEWC	Custom Services for C&I Customers	full	full
7610ICDI	Low Income Contractor Direct Install	full	limited
7610LICP, 7612LICP	Low Income Comprehensive	limited	limited
7710APPL	Energy Efficient Appliances	limited	limited

#### Table 2-6. Evaluation Completed Activity Summary



Track	Track Description	Process	NTG
7710FBNK	Food Bank Lighting	full	limited
7710LITE	Energy Efficient Lighting	full	full

Key researchable issues and questions were identified through the initial meetings and interviews with the DCSEU staff and contractors, initiative documentation review, and participant database analysis. These researchable issues included program performance and operations, how marketing and implementation processes can be revised to optimize cost-effectiveness, satisfaction of participants and other market actors, barriers to participation and/or more effective implementation, means for overcoming those barriers, and the effectiveness of the initiative delivery mechanism. A sample of these cross-cutting researchable issues includes:

- Are the performance benchmarks reasonable and achievable in the short- and longer-terms?
- What are the forecasted levels of gas savings, how are they expected to be achieved, and are the reasonable?
- Are initiatives adequately staffed through DCSEU and contractors or partner resources?
- How does the September 30 cut-off for programs and projects affect the participation and ability to meet goals? How can the DCSEU overcome those barriers?
- To what extent do internal policies and procedures for institutional customers (federal facilities, universities, hospital, city government, etc.) affect the ability to participate in DCSEU initiatives? How can those barriers be mitigated?
- Are customers satisfied with the DCSEU initiatives? Are eligible measures appropriate? How effective are marketing efforts/channels? How appropriate are the incentives/financing options?
- Do KITT and CAT<sup>9</sup> provide the DCSEU staff with the information they need to gauge progress of their initiatives and to make changes when needed to meet goals and objectives? Is sufficient data being tracked? Is data quality control adequate?

## B. Activities description

**DCSEU Staff Interviews:** Staff interviews were conducted to ensure evaluators understood how the initiatives operated in FY13 as well as to identify any changes for FY14. The draft logic models were also discussed to characterize the initiatives' resources and key activities, the outputs from those activities, and the expected short-term and long-term outcomes.

**Participant survey:** Participant surveys were conducted to understand how the DCSEU and contractors performed from the customer perspective

**Market Actor Interviews:** Market actor interviews were conducted with to understand how the programs are operating from the market actor perspective. Market actors are a key component of successful program implementation. It is critical to understand the barriers and

<sup>&</sup>lt;sup>9</sup> "The DCSEU uses the Comprehensive Analysis Tool, or CAT, to estimate savings for custom projects.



challenges market actors face and document their ideas for improvements to drive more participation in programs.

2.5 NET-TO-GROSS ASSESSMENT: RESULTS, RECOMMENDATIONS, AND METHODOLOGY

## 2.5.1 Results and recommendations

The evaluation team conducted the net-to-gross (NTG) assessment for 10 of the 15 initiatives in FY14 to estimate the level of free-ridership and any associated like or unlike participant spillover attributable to the initiatives. Nonparticipant spillover was not assessed as a nonparticipant study was not conducted as a part of this evaluation effort. Due to limited participation in some tracks, caution is warranted when interpreting the net-to-gross results on a track, or measure level basis. NTG is presented in this report as an estimated percent of savings attributable to the track. For example, a net-to-gross value of 100 percent indicates that all program savings are attributable to the initiative.

The evaluation team recommends that this research be used for future program planning and design—including inclusion in cost effectiveness (CE) screening as quantitative data when research data is robust, or as qualitative data when small samples warrant caution. We do not recommend that this research be used to adjust verified savings as performance targets are set based on gross savings goals.

Track	FR	so	NTG	Application for CE	Comment
7110SHOT	0%	not quantified	100%	qualitative	This initiative does not have any indication of free-ridership; spillover was not quantified due to limited sample data
7107PV	0%	<1%	~100%	quantitative	
7420FHLB	~5%	<1%	95-100%	quantitative	Little to no spillover and free- ridership estimate based on 3 Rs stating they would have completed project without DCSEU assistance
7420HPES	~15%	5-8%	~90%	quantitative	
7510MTV	~10%	>0 percent, although not quantified	>=90%	quantitative	NTG is lower than what was found for in MD for commercial DI programs (74% in 2010)
7510CIRX	~50%	>0 percent, although not quantified	>=50%	quantitative	Commercial prescriptive rebates NTG ranges from about 20% to 80% in PA and MD; a case study assessment is also underway to better inform this effort

#### Table 2-7. Net-to-gross Results Summary by Track



Track	FR	so	NTG	Application for CE	Comment
7520CUST	~40%	>0 percent,	>=60%	quantitative	This is between Custom
7520MARO		although not quantified			(73%) NTG rates
7520NEWC	n/a	n/a	n/a	n/a	Not assessed
7610ICDI	n/a	n/a	n/a	n/a	Not assessed
7610LICP 7612LICP	n/a	n/a	n/a	n/a	Not assessed
7710APPL: appliances	~50%	~10-20%	~60-70%	quantitative	2 respondents indicated windows replacement and several mentioned equipment that could be eligible for DCSEU rebates
7710APPL: HVAC	~50%	~25-75%	~70-125%	quantitative	2 respondents indicated that they replaced a large number of windows and several mentioned purchasing equipment that could be eligible for DCSEU rebates
7710FBNK	n/a	n/a	n/a	n/a	Not assessed
7710LITE	n/a	n/a	n/a	n/a	Not assessed

The following table presents summary benchmarking comparisons for net-to-gross values in other states. Net-to-gross values vary widely and the science to assess free-ridership and spillover is not perfect, nor is it conducted similarly. However, when values tend to merge for similar programs regardless of the research methodology we can conclude that the net-to-gross values are reasonable. Detailed benchmarking data and information is located in Volume II, Appendix A.

Category	NTG Ratio	Inputs	Source
Nonresidential Retrofit	56–200%	Evaluation assessed	NV Energy Benchmarking Report
Nonresidential Retrofit	65%	Evaluation assessed	PA Act 129 Pennsylvania Utilities Phase I
Nonresidential	40–90%	Evaluation assessed	PA Act 129 PECO Phase II, PY5
C&I Prescriptive	72%	Evaluation assessed	Maryland Statewide 2011
C&I Prescriptive	23–78%	Evaluation assessed	PA Act 129 Pennsylvania Utilities Phase I
C&I Prescriptive	75%	Evaluation assessed	PA Act 129 PPL Phase II, PY5
Commercial	52%	Evaluation assessed	PA Act 129 Duquesne Light Phase II, PY5
C&I Custom	73%	Evaluation assessed	Maryland Statewide 2010
Industrial	78%	Evaluation assessed	PA Act 129 Duquesne Light

#### Table 2-8. Net-to-gross Benchmarks Summary

Evaluation, Measurement, and Verification of Energy Efficiency and Renewable Energy Programs in the District of Columbia— FY14 Annual Evaluation Report—Final Draft. September 30, 2015


Category	NTG Ratio	Inputs	Source
			Phase II, PY5
C&I Custom	52%	Evaluation assessed	PA Act 129 PPL Phase I PY4
C&I Custom	55%	Evaluation assessed	PA Act 129 PPL Phase II PY6
C&I Direct Install	74%	Evaluation assessed	Maryland Statewide 2010
Solar Thermal Water Heaters	100%	Assumed	NV Energy Benchmarking Report
Appliances and Electronics	49–72%	Evaluation assessed	PA Act 129 Pennsylvania Utilities Phase I
Residential Retail: Equipment	57%	Evaluation assessed	PA Act 129 PPL Phase II, PY5
Residential Retail: Upstream Lighting	84%	Evaluation assessed	PA Act 129 PPL Phase II, PY5
Appliances, Lighting, and Electronics	56%	Evaluation assessed	PA Act 129 Duquesne Light Phase II, PY5
Residential Lighting (Standard CFL)	34–85%	Evaluation assessed, Deemed	NV Energy Benchmarking Report
Residential Lighting (Specialty CFL)	60–105%	Deemed	NV Energy Benchmarking Report
Residential Lighting (LED)	85–100%	Evaluation assessed, Deemed	NV Energy Benchmarking Report
Residential Lighting	51%	Evaluation assessed	Maryland Statewide 2011
Residential HVAC	46–98%	Deemed, Evaluation assessed	NV Energy Benchmarking Report
Residential HVAC	58%	Evaluation assessed	PA Act 129 FirstEnergy PA PY4 (Met Ed)
Residential HVAC	44%	Evaluation assessed	Maryland Statewide 2011
Residential Retrofit	75–88%	Evaluation assessed	PA Act 129 Pennsylvania Utilities Phase I
Residential Retrofit	58%	Evaluation assessed	PA Act 129 PPL Phase II, PY5
Residential	30–90%	Evaluation assessed	PA Act 129 PECO Phase II, PY5
Low Income Energy Efficiency Program	54%	Evaluation assessed	PA Act 129 Duquesne Light Phase II, PY5

# 2.5.2 Methodology

This section describes the methodologies used to assess free-ridership (FR) and spillover (SO) for the determination of the net-to-gross value.

$$NTG = 100\% - FR\% + SO\%$$

A. Free-rider methodology



A program's *free-ridership rate* is the percentage of program savings attributed to free riders. A *free rider* refers to a program participant who received an incentive or other assistance through an energy efficiency program who would have installed the same high efficiency end use<sup>10</sup> on their own at that same time if the program had not been offered. For free riders, the program is assumed to have had no influence or only a slight influence on their decision to install or implement the energy efficient end use. Consequently, none or only some of the energy savings from the energy efficient measure installed or performed by this group of customers should be attributable to the energy efficiency program.

Free-ridership varies from pure free riders to non-free riders. A pure free rider (100 percent) is someone who would have adopted the exact same energy efficient end use at that time without the program. Partial free riders (1–99 percent) are customers who would have installed some end use on their own, but of a lesser efficiency or quantity, or at a later time. Thus, the program had some impact on their decision. Non-free riders (0 percent) are those who would not have installed or implemented any energy efficient end use (within a specified period of time) without program services.

Once calculated, each individual's free-ridership rate is then applied to the measure savings associated with that project. The total free-ridership estimates in this report include pure, partial, and non-free riders.

The FR, SO, and NTG results are presented as estimates, and often as estimated ranges. Estimated ranges represent a likely possible range of free-ridership and spillover given participant rating responses to the net-to-gross survey battery, error bounds on the point estimate, and verbatim responses from participants on other energy efficiency actions taken due to participating in at least one DCSEU initiative.

#### i. Free-ridership battery

Identifying and surveying the key decision-maker(s) is critical for collecting accurate information on free-ridership and spillover. Therefore, the initial part of the survey was devoted to identifying the appropriate decision-maker within the organization by asking if participants were involved in the decision to purchase the incentivized equipment and asking about the roles of others within or outside the organization that may have been involved. Once the appropriate respondent was identified, they were assured their responses would be kept confidential.

The net-to-gross battery includes two components of free-ridership: intention and influence. A flowchart diagram detailing these calculations has been included in Volume II, Appendix A.

#### Intention

Intention is calculated based on questions asking about how the project would have occurred without the receipt of program assistance. Those customers who would have postponed

<sup>&</sup>lt;sup>10</sup> For purposes of this discussion, an "energy efficient measure type" includes high efficiency equipment, an efficiency measure type such as building envelope improvements, or an energy efficient practice such as boiler tune-ups.



(longer than one year) or cancelled the project if program assistance was not received receive an intention score of zero. Customers who indicate they would not have changed the scope of the project and would have paid the additional cost receive the maximum intention score of 50.

#### Influence

Influence is calculated based on questions about how much the program influenced them to do the project the way it was done. Customers are asked to rate the influence of various program aspects (such as the incentive, program staff, contractor or retailer recommendations, and past DCSEU initiative participation) on a 1 to 5 scale. The program's influence is equal to the maximum influence rating for any of the program aspects. This calculation is based on the logic that if any aspect of the program was highly influential in the decision making process, then the program should get credit.

#### Free-ridership

The free-ridership score is calculated as the intention score added to the influence score multiplied by 0.01 to convert it to a percent for application to gross savings values.

B. Spillover methodology

*Spillover* refers to the purchase of additional energy efficient equipment by a customer because of program influences, but without any financial or technical assistance from the DCSEU. *Participant "like" spillover* refers to the situation where a customer installed energy efficient measures through the program, and then installed additional equipment of the same type due to program influences. *Participant "unlike" spillover* is where the customer installs other types of energy efficient equipment than those offered through the program, but are influenced by the program to do so.

A flowchart diagram detailing these calculations has been included in Volume II, Appendix A.

i. Spillover battery

The free-ridership battery survey questions were followed by questions designed to estimate both "like" and "unlike" spillover, but did not differentiate between the two. These questions asked about recent purchases of any additional energy efficient equipment that were made <u>without</u> any additional technical or financial assistance from the District.

A flowchart diagram detailing these calculations has been included in Volume II, Appendix A.

# 2.5.3 Activities description

**Participant survey:** Participant surveys were conducted to assess free-ridership and spillover to support program design and to begin to understand program attribution within the District.



# 2.6 IMPACT EVALUATION METHODOLOGY SUMMARY AND ACTIVITIES DESCRIPTION

#### A. Methodology

The impact evaluation reviews the energy savings and demand reduction claimed through the initiatives for reasonableness and accuracy to determine the savings attributable to the initiatives. This effort results in verified, or ex-post, savings. Because it is very expensive to review 100 percent of initiative activity and projects, a sample of projects and other initiative documentation is selected. Refer to Section 2.2 for detail on sampling.

#### B. Activities

**Desk review:** Project files were reviewed to ensure project file data and information support the reported, or ex-ante, savings. Typically, quantities of measures installed were identified and checked to reported quantities in KITT and deemed measures were reviewed to ensure calculations were accurate and done in accordance with the DCSEU FY14 TRM.

**Project file review:** In addition to a desk review, other documentation in the project files (invoices, applications, equipment specification sheets, quality assurance forms, etc.) were reviewed and cross-referenced to each other to ensure accuracy and consistency of data reported and used in the savings calculations for the project.

**Onsite Verification:** Evaluator onsite visits were conducted to verify such things as equipment installation and quantities, operating characteristics, hours of use, and location in facility.

**Engineering analysis:** Projects that contained measures that were not deemed savings measures in accordance with the DCSEU Technical Reference Manual were assessed through engineering analysis review and/or engineering modeling. The analysis was conducted to ensure reported, or ex-ante, savings were reasonable given completed project scope. Information collected during onsite verification was also used where appropriate (such as technical data, hours of use, equipment nameplate data, location of equipment in facility, etc.).

**Participant survey:** Participant surveys were conducted to verify the installation of measures reported by the track to support impact evaluation.

# 2.7 DCSEU TRACKING SYSTEM AND ESTIMATION TOOL REVIEW

The DCSEU uses the following tools to track program and project data and information and to estimate electric savings, demand reductions, and natural gas savings at the measure, project, program and portfolio levels.

**KITT:** tracks and calculates prescriptive measures and savings by project status (opportunity, cancelled, in-progress, completed) and by program track; KITT also tracks measures, status, and savings for completed custom projects.



**CAT:** the Comprehensive Analysis Tool is the interface with the cost-effectiveness screening tool and is used to calculate the savings associated with custom projects and associated measures. It is also a repository for savings that are calculated using external tools. Project results and key information for completed projects are uploaded to KITT for reporting.

**HERO:** a web-based savings tool used by contractors performing work for the Home Performance with ENERGY STAR<sup>®</sup> (HPwES) program. HERO tracks key project parameters, estimates savings, and interfaces with KITT for reporting.

# 2.7.1 KITT Database Extract

The VEIC Evaluation, Measurement and Verification Services group provided the evaluation team with the final FY14 program results dataset from KITT as an Access database file (KITT, KITT extract) on November 24, 2014.

For FY14, the savings Performance Benchmark (Reduce per-Capita Energy Consumption<sup>11</sup>) calls for the exclusion of the interactive effects associated with the installation of energy efficient lighting. Specifically, the benchmark states, "Energy and demand savings measure the amount of energy and demand saved as a result of the SEU programs without the inclusion of the facility heating and cooling interactive effects whether they are gas or electric." The DCSEU removes these effects by applying an interactive effect adjustment factor separately within KITT for indoor lighting measures to counteract the TRM algorithm waste heat factor when calculating energy and demand savings. That is, KITT calculates energy and demand savings based on the TRM algorithm which includes the waste heat factor interactive effect as benefits for cooling and penalties for heating. Custom measures are handled similarly, but using the Comprehensive Analysis Tool.<sup>12</sup>

For the proposes of the impact evaluation and verification of reported energy and demand savings, the evaluation team divided the KITT gross "ex ante" savings values by the pertinent KITT interactive effectives adjustment factor to determine the energy and demand ex ante values for evaluation. For example, to quantify the reported, or ex ante, kWh savings the following calculation was performed:

#### kWh ex ante = KWHTotal (KITT kWh savings field) / CoolingBonusKWHFactor (KITT kWh Interactive Effects Adjustment field)

The table below lists the fields used for the verification of reported, or ex-ante, electric savings, demand reduction, and gas savings.

Field Name	Table Name(s)	Description
Track	Project	Code used to identify the project's program

<sup>&</sup>lt;sup>11</sup> Contract Number DDOE-2010-SEU-0001, Amendment/Modification No. M07

<sup>&</sup>lt;sup>12</sup> For more information, see the DCSEU Technical Reference Manual (TRM) Measure Savings Algorithms and Cost Assumptions, September 30, 2014, page 4.



Field Name	Table Name(s)	Description		
ProjectID	Project, ActionSummary	Unique system ID for a project, used to link a project with its measures and site location		
MAS90Project	Project	Public project identifier used to locate project files and HERO records		
MeasureID	ActionSummary, ActionSave	Unique system ID for a measure installation, used to link the installation record with the savings record		
MeasureCode, MeasureDesc	ActionSummary	Measure description text		
ItemCode, Description	ItemCode	Additional measure description		
Qty	ActionSummary	Quantity of measure installed		
KWHTotal	ActionSave	Gross kWh savings		
KWReductionSummer	ActionSave	Gross summer peak kW reduction		
SaveNGas	ActionSave	Gross natural gas savings (MMBtu)		
ReportDate	ActionSummary	Date when savings are claimed		
CoolingBonusKWHFactor	ActionSave	Interactive Effects adjustment factor that integrates both cooling and heating interactive effects		
CoolingBonusKWSummerFactor	ActionSave	Interactive Effects adjustment factor for cooling only (there is no heating interactive effect during summer kW period)		

# 2.7.2 Comprehensive Analysis Tool (CAT)

For evaluation of the FY14 program results, CAT files associated with the sampled projects for relevant programs were reviewed by evaluation team members to ensure data entered into CAT were consistent with project file records, calculations of savings were accurate, and savings were accurately reflected in KITT.

# 2.7.3 Home Energy Reporting Online (HERO)

The HERO tool was reviewed for Home Performance with ENERGY STAR projects to ensure agreement with other project files and KITT.

# 3. PORTFOLIO AND CROSSCUTTING EVALUATION

Process evaluations examine factors such as program design and procedures, administration and delivery, customer satisfaction and/or response, marketing and education effectiveness, internal and external program barriers, market response, and non-energy benefits of the program (e.g., more money to spend on other needs, more comfortable living spaces). Process evaluations also address crosscutting strategic and policy issues related to organizational structure, resources to conduct programs, regulatory requirements, reasonableness of program goals and objectives, brand identity, and other factors that affect overall program portfolio performance.

As a part of the impact evaluation implementation, several crosscutting process-related improvement opportunities were identified and are summarized in this section along with recommendations to address.

### 3.1 KEY FINDINGS

Evaluation of the DCSEU portfolio reported savings and delivery is in its third year. Since inception, the DCSEU plans have shifted from early "quick start" direct install initiatives to a combination of direct install and incentive-based initiatives consisting of upstream buy-downs, rebates, give-away events, and negotiated incentive agreements.

# 3.1.1 Key Findings—Strengths

The Evaluation Team noted during interviews that program staff are knowledgeable and enthusiastic about their initiatives. In addition, the VEIC evaluation lead was very helpful in responding in a timely manner to numerous requests from the evaluation team for program data, reviews, and other information requests.

# A. The portfolio of energy efficiency initiatives is cost effective and the DCSEU cost effective results are accurate.

The evaluation team's review of the cost effectiveness of the programs and overall portfolio per the Societal Cost Test indicates that the portfolio was cost effective for FY14.<sup>13</sup> This is true for each scenario tested: (1) DCSEU costs included; (2) DCSEU costs plus third-party evaluation costs; (3) all costs with realization rates applied; and, (4) all costs with realization rates and net-to-gross estimates applied.

In addition, the comparison of test results using a third-party independent cost benefit model indicated that the results are accurate.

<sup>&</sup>lt;sup>13</sup> For detailed discussion on the cost effectiveness assessment, see Department of Energy and Environment Verification of the District of Columbia Sustainable Energy Utility Performance Benchmarks, FY2014 Annual Evaluation Report.



B. Acquisition costs continue to decline as the DCSEU builds the infrastructure for managing and delivering the suite of energy efficiency and renewable energy programs.

The FY14 acquisition costs of \$195 per MWh is 15 percent less than for FY13. In the year prior, the acquisition costs per MWh declined by 59 percent from FY12. The acquisition costs per MMBtu declined by 46 percent from FY13 to FY14. For FY13, acquisition costs per MMBtu declined by 52 percent from the prior year. Acquisition costs are now in line with those of neighboring states; the 2013 Pennsylvania average acquisition costs for were \$170 per MWh and Maryland was \$206 per MWh. Acquisition costs include all DCSEU expenditures for kWh or MMBtu within each FY."

C. Results are reported accurately in aggregate.

All but one of the 14 tracks' verified results, or ex-post savings, determined by the evaluators fall within 10 percent of the reported kWh and MMBtu savings and the overall portfolio level realization rate estimate is 98 percent for electric savings, 92 percent for demand reduction?, and 100 percent for natural gas savings. There was less variance between verified and reported savings across most tracks and measures for FY14 than in prior years, although there are some opportunities to tighten savings estimates and KITT calculations.

D. The DCSEU tracking and estimation tools are transparent and robust with some exceptions.

KITT was able to provide all key metrics required by the evaluation team and estimation tools were found to be intuitive and transparent. Additionally, the project documentation for non-prescriptive projects showed improvement from FY13 to FY14, indicating that processes for tracking and reporting are improving with time.

E. The DCSEU Technical Reference Manual (TRM) provides a good foundation for energy savings calculations but has opportunity for expansion in order to more accurately calculate and report on achievements.

The DCSEU TRM is easy to follow and clearly documents key assumptions, algorithms and sources of data and information. In this initial evaluation effort, the evaluators found the assumptions reasonable and generally applicable within the District.

F. Participants and contractors in the DCSEU initiatives are very satisfied.

Satisfaction in aggregate is high across key program components, including for commercial and institutional customers. This speaks to the success of the DCSEU efforts to become the "trusted energy advisor" for commercial and institutional customers in the District.

G. DCSEU improved project documentation and file organization in FY14.

As with most tracking and file systems, there is still opportunity for improvement, but the evaluators found the DCSEU project files to be better organized in FY14 allowing for a more efficient evaluation effort.



# 3.1.2 Key Findings—Weaknesses and Barriers

It is worthwhile to note that many of these key findings are common to program implementation efforts, both new and more mature. At the same time, these issues should be assessed for more effective operations and, ultimately, more effective and efficient acquisition of energy savings.

A. For larger, more complex projects, it was not always clear how savings were estimated or what the baseline was.

For larger complex projects, it is essential to have a well-documented baseline, key assumptions and inputs identified, and transparent algorithms.

B. Waste-heat-factor adjustments to reverse the impact of the penalties and benefits were not consistently applied in the FY14 reported results.

The replacement of interior lighting with more energy efficient lighting will result in a decrease in cooling energy needed (kWh additional savings benefits) and an increase in heating requirements (kWh usage penalties for electric heating, or mcf usage penalties for natural gas heating). These increases (penalties) or decreases (benefits) in energy usage are reflected in energy savings algorithms as waste-heat-factor adjustments. The DCSEU removed the waste-heat-factor penalties and benefits associated with lighting system efficiency improvements from the FY14 reported savings using a waste-heat-factor adjustment ratio based on end-use lighting measure type and heating and cooling fuel types. However, the evaluation found that these adjustments were not consistently applied across or within all initiatives that include interior lighting measures.

### 3.2 FY2014 RESULTS EVALUATION RECOMMENDATIONS

# A. Complete a baseline study to identify and validate and/or update the potential study results performed in FY14.

A baseline and market potential study is a key foundation on which to identify and build energy efficiency programs. The evaluation team has not yet seen the results from the potential study but understands that effort was somewhat compromised by the lack of District specific baseline data. However, updating the potential study with District baseline data is a feasible task. The potential study was made public April 17, 2015 and can be found on the DOEE website.

# B. Coordinate third-party onsite evaluation efforts with the DCSEU quality assurance onsite reviews.

The evaluation effort will be conducted independently of the DCSEU quality assurance review ensuring a third-party objective effort. However, coordinating the onsite visit will reduce the number of contacts and site visits the customer will experience. Additionally, the evaluation effort will occur much closer to the completion of the project which will improve data and information gathering as customer recall will likely be sharper.



C. Ensure the waste-heat-factor adjustments to reverse the impact of the penalties and benefits for the replacement of interior lighting with more energy efficient systems are consistently applied in the FY15 reported results.

This will ensure reported results are based on consistent calculations across the portfolio for lighting efficient measures.

D. Consider eliminating the waste-heat-factor adjustment to reverse the impact of the penalties and benefits for the replacement of interior lighting with more energy efficient systems when the site uses electric heating.

The DCSEU removed the impact of the waste-heat-factor penalties and benefits after a review of reporting practices in other jurisdictions for the treatment of penalties when the heating fuel type was not electric. In addition, the mcf savings targets are based on the installation of energy efficient natural gas equipment and are not adjusted for interactive effects (or waste heat factor benefits and penalties) for the installation of energy efficient interior lighting. However, when the heating and cooling is electric based, interactive effects are typically included within the savings algorithms and reported as such.



# 4. TRACK EVALUATION REPORTS

The evaluation team's verified, or ex-post, results of the KITT reported electric savings, demand reduction, and natural gas savings for each track, or initiative, and for the overall portfolio are presented in Table 1-1. These verified results reflect portfolio level realization rate estimates of 0.98, 0.92, and 1.00 for kWh, kW, and MMBtu respectively. This means that the evaluation team estimates that the actual portfolio electric savings result is 98 percent of the DCSEU reported electric savings, the demand reduction result is 92 percent of the DCSEU reported demand reduction, and the actual portfolio gas savings result is 100 percent of the DCSEU reported gas savings. This compares to realization rate estimates at the portfolio level of 1.04, 1.07, and 1.00 for kWh, kW, and MMBtu, respectively, for the FY13 results.

Realization rates are the ratio of verified savings to the tracking system savings for a representative sample of projects reported within each track. Realization rates are typically calculated for each end-use category and then applied to the total end-use tracking system savings for a particular program, or track. The results are rolled up to develop program, or track, verified savings. The verified savings for all tracks are summed to obtain portfolio level verified savings.

		kWh	kW	MMBtu
Track	Description	RR	RR	RR
7107PV	Solar Photovoltaic	1.00	1.00	n/a
7110SHOT	Solar Hot Water	1.00	1.00	1.04
7420FHLB	Forgivable Loan for Home Efficiency Improvements	0.98	0.87	0.99
7420HPES	Home Performance with ENERGY STAR	1.00	0.84	0.90
7510MTV	T12 Market Transformation Value	0.98	1.32	1.00
7510CIRX	Business Energy Rebates	0.86	0.83	n/a
7520CUST	Custom Services	1.02	1.18	1.00
7520MARO	Custom Market Opportunity	1.04	0.99	1.00
7520NEWC	Custom New Construction	1.00	0.42	1.02
7610ICDI	LI MF Implementation Contractor Direct Install	0.99	0.75	0.78
7620LICP	LI MF Comprehensive Efficiency Improvements	1.00	1.00	1.00
7710APPL	Retail Efficient Appliances	1.02	1.09	0.98
7710FBNK	Efficient Products at Food Banks	0.98	0.82	n/a
7710LITE	Retail Efficient Lighting	0.95	0.72	n/a
Reported (ex-	ante) / Verified (ex-post)	0.98	0.92	1.00

Table 4-1	. Track Level	Realization	Rates	Summary
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# 4.1 7110SHOT SOLAR HOT WATER SYSTEMS

## 4.1.1 Track description

The solar thermal track targets solar domestic hot water systems in low-income multifamily buildings and commercial and institutional facilities with high hot water demand. The track is designed to replace existing inefficient hot water heating systems.

The DCSEU provides support in this developing market through the development of contractor capacity and capability – sometimes directly to implementation contractors, which allows for greater control over materials and methods. Other contractor development activities include contractor training for market-based activities, focusing specifically on both sales training and technical training. When DCSEU incentives are used, whether directly through contracting or indirectly by customer payments, quality control and quality assurance protocols are implemented to mentor contractors in the field and ensure best-practice installations. The incentive funds are not offered as incentives to the open market because of the limited budget and the expected number of projects.

	FY2012	FY2013	FY2014
Metric	Reported Result	Reported Result	Reported Result
Participants (Units=projects)	n/a	12	6
MMBtu	n/a	4,620	3,135

Table 4-2 provides a summary of initiative metrics since inception.

#### Table 4-2. Initiative Summary Metrics—7110SHOT

Table 4-3 provides a summary of the reported and verified kWh, kW, and MMBtu along with the resulting realization rates. The negative kWh savings reflect the addition of electric control units to support the thermal hot water system.

Table 4-3. FY14 Reported and Verified Results—7110SHOT

Metric	Reported	Verified	Realization Rate
kWh	-11,664	-11,664	1.00
kW	-1.36	-1.36	1.00
MMBtu	3,135	3,266	1.04

# 4.1.2 Overall sampling methodology

There were six projects completed in FY14 and five projects were reviewed for the impact evaluation and for the assessment of the Low Income Performance Benchmark.



		Project File Evaluation Sample						
Measure	N <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>n</sub>	kW <sub>n</sub>	MMBtu <sub>n</sub>	% kWh	% kW	% MMBtu
Solar Hot Water	7	6	1	0.0	2,965	n/a	n/a	94.6%
Total	7	6	0	0.0	2,965	n/a	n/a	94.6%

#### Table 4-4. FY14 Population and Sample Summary—7110SHOT

# 4.1.3 **Process evaluation**

A process evaluation was not scheduled or performed for this track in this evaluation cycle; a staff interview was conducted to understand how the track worked in FY2014. We did assess the recommendation from the FY13 evaluation effort to better structure and organize project files and this has been implemented. The evaluators were able to easily find the needed data and information for the evaluation effort.

Additionally, as a part of the onsite verification, participants were asked a short series of questions to assess participation experience and the decision to implement the project.

Activity	Plan	Actual	Explanation for Variance
DCSEU staff in-depth interviews	1	1	
Participant phone survey	5	0	Conducted limited survey during onsite verification due to small number of participants
Onsite verification survey	5	5	

#### Table 4-5. FY14 Process Evaluation Plan vs. Actual

### A. Summary of key findings

- All participants are satisfied with the equipment and installation.
- Three of the five participants do not know if there is a maintenance contract in place for the equipment. One stated that after the one-year manufacturer warranty expires, they will pursue a maintenance contract.
- We assessed the recommendation from the FY13 evaluation effort to better structure and organize project files and this has been implemented. The evaluators were able to easily find the needed data and information for the evaluation effort.

# 4.1.4 Net-to-gross methodology and results

A. Methodology

Participants were asked a short series of questions to assess participation experience and the decision to implement the project as a part of the onsite verification effort.

Activity	Plan	Actual	Explanation for Variance
Onsite verification survey	5	5	

#### Table 4-6. FY14 Net-to-gross Assessment Evaluation Plan vs. Actual



#### B. Summary of results

A net-to-gross ratio was not calculated for this initiative given the small number of participants, although there are strong indications that there is zero free-ridership. One participant expressed interest in learning more about renewable technology applications outside of the DCSEU initiative, an indication of spillover.

- Participants indicate that they would not have completed the project without incentives from the DCSEU.
- Four participants report that they would not consider implementing additional renewable energy projects without the DCSEU assistance. One participant indicated they are interested in learning more about renewable technology applications outside of the DCSEU initiative, an indication of spillover.

#### C. Drivers net-to-gross results

This initiative does not have any indication of free-ridership in FY2014 and spillover was not quantified due to limited sample data.

## 4.1.5 Impact evaluation

The initial task for the impact evaluation was to review and verify the variables used to calculate claimed savings for FY14. Using a standard solar hot water algorithm, the evaluation team calculated program MMBtu savings using measure data from the tracking system. Once this was completed realization rates were calculated by dividing verified savings by reported savings.

Physical site inspections were performed for five SHOT projects. The onsite inspector confirmed the equipment listed in the project files were indeed in place and working, although for one project some equipment was in need of maintenance or repair (Project ID 6376: 5-6 tubes are not operational). Realization rates were not adjusted due to this finding.

### A. Impact sampling methodology for onsite measurement and verification

A census was attempted for onsite verification.

		Onsite M&V Sample Subset						
Measure	N <sub>measure</sub>	<b>n</b> <sub>onsite</sub>	kWh <sub>onsite</sub>	<b>kW</b> onsite	MMBtu <sub>onsite</sub>	% kWh	% kW	% MMBtu
Solar Hot Water	7	6	0	0.0	2,965	n/a	n/a	94.6%
Total	7	6	0	0.0	2,965	n/a	n/a	94.6%

Table 4-7. FY14 Onsite M&V Sample Summary

#### B. Verification of impacts

Reported savings for the SHOT projects are based on the Polysun modeling tool, used by the program implementation contractor. Variables that were available from the Polysun model output which was included in the SHOT file were input into the Pennsylvania TRM algorithm



used to estimate project MMBtu savings. The evaluator was able to verify the reported MMBtu savings and recommends a 104 percent realization rate for solar hot water projects.

	kWh				kW		MMBtu		
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR
Solar Hot Water	-11,664	-11,664	1.00	-1.36	-1.36	1.00	3,135	3,266	1.04
Track Total	-11,664	-11,664	1.00	-1.36	-1.36	1.00	3,135	3,266	1.04
Relative Precision at 90% Confidence		<1%			<1%			6.8%	

#### Table 4-8. FY14 Summary of Impact Evaluation Results

#### C. Impact evaluation planned activities and completed activities comparison

Activity	Plan	Actual	Explanation for Variance
Conduct desk audits	5	5	
Conduct onsite Verification	5	5	

#### D. Summary of key findings describing adjustments to ex-ante savings

- Project file documentation were updated and well organized. The data collection process was very easy to identify and use to verify reported savings.
- The project contractors used Polysun modeling estimated the MMBtu savings. The variable used in the model was available to the evaluator and the evaluator was able to verify reported savings. The 4 percent difference for verified MMBtu savings is due to using actual variables from the Polysun outputs; specifically, for hot water usage, hot water temperature and incoming water temperature of 58 degrees. The incoming water temperature is based on the results pulled from the Polysun thermal output file for project 6709. The Polysun software is very reliable and used throughout the industry. It blends additional variables into the overall savings calculations that a simple algorithm cannot.

#### 4.1.6 Recommendations

- A. To improve design, operations, customer experience, and recruitment
- i. Ensure participants are aware of the one-year manufacturer equipment warranty and recommend a maintenance contract to ensure equipment remains operational and efficient.
- B. To improve impact evaluation results
- i. No recommendations.
- C. Net-to-gross assessment

#### 4. Track Evaluation Reports



i. This initiative does not have any indication of free-ridership in FY2014. Therefore, there are no recommendations.



# 4.2 7107PV SOLAR ENERGY SYSTEMS

# 4.2.1 Track description

These initiatives encourage renewable energy development in low-income communities. Beginning in fiscal year 2012, the DCSEU began supporting customer-sited renewable energy in low-income markets in Wards 7 and 8 in the District of Columbia that would likely be otherwise underserved, absent the DCSEU incentives. The District of Columbia has a strong foundation in supporting sustained development of customer-sited renewable energy systems. During the 2011 Quick-Start Renewable Energy Program, the DCSEU implemented activities in two market segments, commercial solar hot water and rooftop PV for small scale (<10 kW) installations.

. The DCSEU works directly with contractors to identify potential properties. The initiative is not marketed to the public. At the start of a project, the contractor submits project information (the Interconnection Application Agreement) to Pepco and the DCSEU. Pepco reviews the form and checks for completeness, determines circuit impact and operating conditions, etc., and requests amendments to the contractor as needed. Upon Pepco approval of this form, Pepco sends an "Approval to Install" notification to the contractor. Concurrently, at the DCSEU, the DCSEU checks the income qualification materials, scope of work, spec sheets, and other materials, and generates a work order. With Pepco's approval and a work order from DCSEU in hand, the contractor can begin installation. Once the project is completed, the DCSEU schedules an inspection with the contractor. After an EM&V review of the project by the DCSEU submits a check request and pays the contractor. Following receipt of payment, the contractor submits a Certificate of Completion and an Electrical Inspection Certification to Pepco. Pepco then prepares the customer meter for the interconnection and notifies the contractor, who can then activate the solar PV system.

Table 4-10 provides a summary of initiative metrics since inception.



	FY2012	FY2013	FY2014
Metric	Reported Result	Reported Result	Reported Result
Participants (Units=projects)	42	56	108
kWh savings, meter level	148,368	192,877	561,838
kW	25.7	31.6	72.4

#### Table 4-10 Initiative Summary Metrics—7107PV

Table 4-11 provides a summary of the reported and verified kWh, kW, and MMBtu along with the resulting realization rates.

Metric	Reported	Verified	Realization Rate
kWh	561,838	561,838	1.00
kW	72.4	72.4	1.00

#### Table 4-11. FY14 Reported and Verified Results—7107PV

# 4.2.2 Overall sampling methodology

There is generally little variation within the Solar PV program and there is only one type of measure installed by this track. However, there were five multifamily projects that contributed significantly higher amounts to the track's overall savings. These projects were sampled with certainty; the remaining projects were randomly sampled.

#### Table 4-12. FY14 Population and Sample Summary—7107PV

		Project File Evaluation Sample										
Measure	N <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>n</sub>	kW <sub>n</sub>	MMBtu <sub>n</sub>	% kWh	% kW	% MMBtu				
Solar PV	112	13	250,253	28.1	0.0	44.5%	38.8%	-				
Total	112	13	250,253	28.1	0.0	44.5%	38.8%	-				

### 4.2.3 **Process evaluation**

A staff interview was conducted November 18, 2014, to understand how the track has been working. Telephone surveys of participants were conducted from December 22, 2014 through January 20, 2015. Advance letters were sent to sampled participants notifying them of their selection to participate in the evaluation.

#### Table 4-13. FY14 Process Evaluation Plan vs. Actual

Activity	Plan	Actual	Explanation for Variance
DCSEU staff in-depth interviews	1	1	
Participant phone surveys	25	35	To increase robustness of analysis, more surveys were completed



### A. Summary of key findings

#### i. Awareness

More than half of respondents (22 out of 35) mentioned hearing about the program through word of mouth or through a colleague. Nine respondents indicated they heard about the program through the DCSEU, either through a mailing or email (five respondents) or from the DCSEU website (four respondents). "From the DCSEU website" is surprising as there is no mention of the initiative since the DCSEU does not market this initiative through the DCSEU website.

We asked respondents about their awareness of and participation in DOEE energy saving initiatives and their awareness of the DCSEU website. Ten out of 35 respondents had participated in the DOEE Energy Assistance and Weatherization program in addition to the DCSEU PV initiative. Ten respondents also reported visiting the DCSEU website, and all of these respondents found the information to be relevant and useful.

#### ii. Verification of installation

All 35 of the PV program participants reported that their equipment is installed. However, 13 of the respondents said that the systems were not operating because they were either awaiting inspection or the hookup was not complete.

#### iii. Household experience

The majority of respondents (29 out of 35) indicated that they were satisfied with the contractor's work, assigning a rating of either 4 or 5 on a scale of 1 to 5, where 1 was not at all satisfied and 5 was very satisfied. Five respondents provided scores of 1 or 2. These low scores are the result of:

- Some participants are not fully aware of the installation requirements. One person specifically stated that they would not have agreed to the project if they had known that the installation required physical changes to the inside of their house.
- Some participants are not aware that full completion of the project requires an inspection from Pepco and therefore delays can occur before the new PV system is operating.
- One participant also complained that the installation contractor left tools and equipment on the roof and has not yet come back to retrieve them.

Of the 18 people who indicated they had realized energy savings from the PV equipment, 12 rated the savings highly (4 or 5 on a 5-point scale).

#### iv. Lighting spillover

We asked respondents if they had purchased energy efficient lighting since participating in the program. Of the 35 respondents, 14 indicated they had purchased efficient lighting; most of these purchases were for CFLs (10 respondents), and 2 people said they purchased LEDs. Two respondents had purchased both types. Seven of 13 respondents said they purchased bulbs outside the District, and 1 said they purchased both inside and outside the District.



#### v. Demographics

Most respondents own their home, but six reported renting. None of the participants planned to move away from the area in the next year. Seven respondents said someone in their household works from home.

### 4.2.4 Net-to-gross methodology and results

#### A. Methodology

Net-to-gross for this track was assessed through self-report phone surveys. See Section 2.4 for a description of the net-to-gross survey battery.

Activity	Plan	Actual	Explanation for Variance					
Participant phone surveys	25	35	To increase robustness of analysis, more completes were added to the PV quota.					
Participant onsite survey	5	4	Did not obtain cooperation from 5 participants					

for onsite verification effort

#### Table 4-14. FY14 Net-to-gross Assessment Evaluation Plan vs. Actual

#### B. Summary of results

We interviewed 35 PV participants but removed three records from the free-ridership analysis. One respondent believed that the equipment they received was old and said they would have paid for new equipment. Additionally, two respondents reported that they would have paid the full cost of the equipment they received. It is important to note that reason would suggest that it is unlikely limited-income program participants would be able to fund projects with these considerable costs; therefore, a free-ridership value of 0 percent is more likely.

Three of the 35 PV participants indicated they took additional energy efficiency actions as a result of participating in the PV initiative. These additional actions included purchasing an energy efficient clothes washer, plastic insulation, and weather-stripping. We estimate spillover is less than 1 percent.

#### C. Drivers net-to-gross results

Net-to-gross is assumed to be 100 percent.

#### Table 4-15. FY14 Net-to-gross Results Summary

N <sub>project</sub>	n <sub>survey</sub>	Free- ridership	Spillover	90% Margin Error (±)	Net-to-Gross	Comment
108	32	~0%	<1%	2.4%	~100%	Little to no free-ridership or spillover



# 4.2.5 Impact evaluation

The initial task for the impact evaluation was to review and verify the variables used to calculate claimed savings for FY14. Using the National Renewable Energy Laboratory's (NREL) PV Watts 2 software, the evaluation team calculated program kWh savings using the measure data from the Solar PV files. Once this was completed realization rates were calculated by dividing verified savings by reported savings.

Physical site inspections were performed on four projects to verify installed measures. The onsite inspector confirmed the equipment listed in the project files were indeed in place and working.

#### A. Impact sampling methodology for onsite measurement and verification

There is generally little variation within the Solar PV program, and again there is only one type of measure installed by this track. However, there were five multifamily projects that contributed significantly higher amounts to the track's overall savings. These projects were sampled with certainty; the remaining projects were randomly sampled.

	Onsite M&V Sample Subset									
Measure	N <sub>measue</sub>	n <sub>onsite</sub>	kWh <sub>onsite</sub>	<b>kW</b> <sub>onsite</sub>	<b>MMBtu<sub>onsite</sub></b>	% kWh	% kW	% MMBtu		
Solar PV	112	4	135,055	16.2	0	24.0%	22.4%	-		
Total	112	4	135,055	16.2	0	24.0%	22.4%	-		

#### Table 4-16. FY14 Onsite M&V Sample Summary

### B. Verification of impacts

The evaluation team conducted reviews of the DCSEU savings estimates for reasonableness by inputting individual solar project variables into the National Renewable Energy Laboratory's (NREL) PV Watts 2 software. The evaluation team also reviewed the Mid-Atlantic TRM to assess potential variations in inputs and methods from those implemented in the District.

Reported savings for the PV Solar projects are based on the National Renewable Energy Laboratory's (NREL) PV Watts 2 modeling tool, used by the program implementation contractor. Variables that were available from the PV Watts 2 output were included in the PV Solar files. Based on the variables available in the PV Watts 2 outputs, the evaluator was able to verify the reported savings based on re-running PV Watts 2 software. Based on the review of the PV Watts 2 model, the evaluator is comfortable with a 100 percent realization rate for the PV Solar program based on the PV Watts 2 model output. For this program, the net-to-gross ratio is assumed to be 1.15<sup>14</sup>.

<sup>&</sup>lt;sup>14</sup> Reference VEIC memo to the DDOE, Screening assumptions for the DCSEU solar renewable energy program portfolio, August 30, 2012; the evaluation team reviewed this memo and finds the recommendations reasonable at this time.



	kWh				kW		MMBtu		
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR
Solar PV	561,838	561,838	1.00	72.4	72.4	1.00	0	-	n/a
Track Total	561,838	561,838	1.00	72.4	72.4	1.00	0	-	n/a
Relative Precision at 90% Confidence	21.4%		21.4%				-		

#### Table 4-17, FY14 Summary of Impact Evaluation Results

#### С. Impact evaluation deviation from plan

Table 4-10. FT 14 impact Evaluation Fian VS. Actual Sample								
Activity	Plan	Actual	Explanation for Variance					
Conduct desk audits	25	10	Adjusted effort to move resources to completion of additional phone surveys					
Conduct onsite Verification	5	4	Did not obtain cooperation from 5 participants for onsite verification effort					
Conduct phone verification	25	35	Increased sample to provide more data for analysis, in part to better assess the number of systems reported to not yet be operational					

# Table 4.19 EV14 Impact Evoluction Plan vo. Actual Sa

#### D. Summary of key findings describing adjustments to ex-ante savings

- Project file documentation were updated and well organized. The data collection • process was very easy to identify and use to verify reported savings.
- The project contractors used PV Watts 2 modeling tool to estimate the kWh savings. The variables they used in the model were available to the evaluator. Based on this situation, the evaluator was able to verify reported savings.
- Participant phone surveys verified 100 percent of equipment is installed: however, 13 participants were still awaiting system hook-up. This lowers the realization rate to 63 percent for those systems in place and operational for FY2014. This reduced realization rate is provided as information only, as the DCSEU is not penalized for systems awaiting connection as this step is outside the DCSEU control.

#### 4.2.6 Recommendations

#### Α. To improve design, operations, customer experience, and recruitment

i. To improve the customer experience it is important to ensure participants fully understand the installation requirements and process, including the possible delay in hookup once the equipment has been installed. Additionally, routine follow-up with households as they await hookup when there are delays will reduce participant frustration. Thirty-five of the participants participated in the phone surveys; 13 of them reported that the units were not functioning and 5 did not know whether they were functioning or not. The process relies upon Pepco to complete customer meter changes before hookup can occur. This is outside of the DCSEU's and the



installation contractor's control. These findings are similar to last year's evaluation results, where respondents reported communication issues regarding hookup of the equipment. Two verbatim responses below highlight the need for improved communication:

It was just a lack of communication between the homeowners and the people installing it. No one discussed with me the installation process.

I feel like if you come to a house to do a job, you should do a job completely. [The contractor] did this and the house across the street and never finished the job. They finally came back a month ago and then they said that they have to talk to Pepco and I have not heard from them again.

- B. To improve impact evaluation results
- i. No recommendations.
- C. Net-to-gross assessment
- i. The evaluation team recommends that this be evaluated more robustly for FY15 to determine is an adjustment to the deemed spillover rate is warranted. This track assumes a deemed spillover rate of 15 percent, but this evaluation did not find indication that it exceeds 1 percent.



# 4.3 7401FHLB INCOME QUALIFIED

# 4.3.1 Track descriptions

The Income Qualified Home Performance initiative (formerly the Federal Home Loan Bank initiative) provides income eligible customers with funding sources to implement audit recommendations. In FY2014, the Federal Home Loan Bank funding for this initiative was suspended. To counter, the DCSEU is adapting this initiative to become an Income Qualified program. Through this initiative income qualified homeowners may receive up to \$5,000 in home energy efficiency improvements and up to \$1,000 in health and safety improvements for a total of up to \$6,000 in incentive cost. Within the low income community, many of the homes are in varying states of disrepair and require some health and safety improvements in order to make durable and safe energy efficiency improvements. When health and safety issues arise, the DCSEU reviews each on a case-by-case basis, and tackles those that are within the DCSEU capabilities. The DCSEU views these projects as integral to supporting District businesses by contributing to the increase of District-based green jobs, the growth of District-based businesses, and the growth of the DCSEU work with the low income community.

This initiative is promoted to potential households through referrals from contractors and program partners. The DCSEU also markets to households that have expressed interest in the prior Federal Home Loan Bank initiative. This initiative is not promoted through the DCSEU website.

Please see the Home Performance with ENERGY STAR (HPwES) section for a description of the process and measures eligible for this initiative. More emphasis was placed on the installation of more comprehensive, or deeper savings, measures in FY14.

Table 4-19 provides a summary of initiative metrics since inception. FY2012 and FY2013 reported results include the interactive effects for the installation of energy efficient lighting. FY2014 excludes these effects.

	FY2012	FY2013	FY2014		
Metric	Reported Result	Reported Result	Reported Result		
Participants (Units=projects)	21	43	29		
kWh savings, meter level	12,912	30,531	27,089		
kW savings, meter level	1.4	3.2	1.4		
MMBtu	1	152	537		

#### Table 4-19. Initiative Summary Metrics—7401FHLB

Table 4-20 provides a summary of the reported and verified kWh, kW, and MMBtu along with the resulting realization rates.



Metric	Reported	Verified	Realization Rate
kWh	27,089	26,618	0.98
kW	1.4	1.3	0.87
MMBtu	536.5	529.9	0.99

#### Table 4-20. FY14 Reported and Verified Results—7401FHLB

# 4.3.2 Overall sampling methodology

Because of the similarities between the 7420FHLB and 7420HPES tracks, we treated the tracks as one for the purposes of sampling. While there are various measures installed by this program, choosing a random sample of projects is likely to result in a representative distribution of measures for evaluation. In addition, this track will have a higher number of projects evaluated, so coverage of measures is not expected to be an issue. The evaluation team selected a random sample of projects, and reviewed the resulting list of projects to ensure that various measures have appropriate representation.

		Project File Evaluation Sample							
Measure	N <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>n</sub>	kW <sub>n</sub>	MMBtu <sub>n</sub>	% kWh	% kW	% MMBtu	
Building Shell	28	6	1,330	0.0	40.9	14.6%	-	16.8%	
Cooling	1	0	0	0	0	-	-	-	
Lighting	7	2	1,191	0	0	26.7%	23.6%	-	
Refrigeration	4	3	1,238	0	0	63.9%	75.0%	-	
Space Heating	10	4	1,258	0	181	13.6%	-	84.9%	
Ventilation	4	1	88	0	0	25.0%	25.0%	-	
Water Heating	11	8	797	0	0	45.4%	47.4%	0.3%	
Total	65	24	5901	0.6	222.4	21.8%	42.4%	41.5%	

Table 4-21. FY14	<b>Population and</b>	Sample Summary-	-7401FHLB

# 4.3.3 **Process evaluation**

A staff interview was conducted November 17, 2014, to understand how the track is intended to work. Telephone surveys of participants were conducted from December 22, 2014, through January 20, 2015. Advance letters were sent to sampled participants notifying them of their selection to participate in the evaluation.

Activity	Plan	Actual	Explanation for Variance
DCSEU staff in-depth interviews	1	1	
Participant phone surveys	29	17	We attempted to achieve a census of participants, and we were not able to interview all prospective respondents.

#### Table 4-22. Process Evaluation Plan vs. Actual



### A. Summary of key findings

#### i. Awareness

Seven out of the 17 participants interviewed indicated they heard about the program through the DCSEU, either by a direct mailing or email (4) or through the DCSEU website (3). More than one-third (6 out of 17) respondents reported hearing about the program through word of mouth.

We asked respondents about their awareness of and participation in DOEE energy saving initiatives. Seven indicated they have participated in the DOEE's Energy Assistance and Weatherization program.

#### ii. Verification of installation

The survey included questions for lighting equipment and water saving equipment verification. The tracking database indicates that few households received CFLs or water saving equipment. For those surveyed, six respondents said they received CFLs from their contractor during the home audit; all of these bulbs are still installed. One participant received water-saving measures through the program (faucet aerators and a low-flow showerhead). The respondent indicated that the equipment is still installed.

#### iii. Household experience

Fourteen of the 17 respondents rated their level of satisfaction highly (rating it 4 or 5 on a scale of 1 to 5, where 1 is not at all satisfied and 5 is very satisfied) for the contractor performing the work. Eleven out of 12 respondents were highly satisfied with the amount of the incentive, and most (7 out of 8) people were highly satisfied with the time it took to receive the rebate.<sup>15</sup>

People providing ratings of 1 or 2 for various components stated the following reasons:

[Contractor rating = 2] Because I felt I had to chase behind them to just get that much done. And then the thing with the door happened and he never said a word. He just left that for me to find on my own. They did some weather-stripping that has since come off the door, so that was worthless to me. Whatever weather-stripping they did, but the basement door he took the screen door off and because of the weatherstripping the screen door no longer fits and he never said anything to me. He just left the screen door there. I am really dissatisfied with that.

[Amount of time to receive rebate = 2] Because first they told me someone would be out in 90 days. Then I called back and kept getting a recording. They put my name on a list. The funding ran out. After a year and a half they called back to tell me that they received the funds, but I wasn't eligible. So in lieu of that, they sent someone out to install showerheads and lightbulbs.

<sup>&</sup>lt;sup>15</sup> Some respondents answered "Not applicable" to questions about the rebate.



Eight of the 17 respondents reported visiting the DCSEU website to get information about the program; 5 of these respondents rated their level of satisfaction with the information available on the site highly (4 or 5 on a scale of 1 to 5, where 1 is not at all satisfied and 5 is very satisfied).

#### iv. Adoption of energy saving behaviors

Fifteen of the 17 participants said they received information on how to save energy in their home after their audit was completed. All respondents were able to recall at least one recommendation, and all reported that they adopted at least one. The open-ended responses indicate that customers are already attempting to save energy where they can and are receptive to more suggestions. Recommendations recalled include behavioral changes, such as turning off the lights, unplugging unused equipment, and doing the wash at a different time of day. Other recommendations were home improvement-related, such as replacing windows, adding insulation, and applying weather-stripping.

#### v. Demographics

All of the respondents indicated they own their home, and none said they planned to move out of the area in the next year. One respondent said a member of the household works from home.

We asked households about their household size and their income range in comparison to the low-income eligibility guidelines, or 200 percent of the Federal Poverty Level. Fifteen respondents provided both household size and income range, and of those, 11 are eligible for this initiative based on their responses. This is curious given that the initiative targets income eligible households. Also, the desk reviews for the low income verification check did not reveal issues with household eligibility. Therefore, the evaluation team does not believe there is a concern with the eligibility of the participants on this initiative and additional quality control is not warranted.

Household Size	Less than \$23,340	Between \$23,340 and \$31,459	Between \$31,460 and \$39,579	Between \$47,670 and \$55,819	Refused	Total
1	2	0	1	1	1	5
2	0	3	1	0	0	4
3	1	2	0	1	0	4
4	1	0	0	0	0	1
5	0	1	0	0	0	1
6	0	0	1	0	1	2
Total	4	6	3	2	2	17
	Meets income eligibility		Does not m eligii	ieet income bility		

#### Table 4-23 Income and Household Size Matrix



# 4.3.4 Net-to-gross methodology and results

#### A. Methodology

Net-to-gross for this track was assessed through self-report phone surveys. Households were asked about their project in total and not individual measures installed through the project. See Section 2.4 for detailed descriptions of the net-to-gross survey battery.

Activity	Plan	Actual	Explanation for Variance
Participant phone surveys	29	17	We attempted to achieve a census of participants, and we were not able to interview all prospective respondents.

#### B. Summary of results

This track had limited participation and therefore there are limited data points for the net-togross assessment warranting caution for the interpretation of results.

Free-ridership is estimated to be about 5 percent. We asked respondents if they had purchased energy efficient lighting since participating in the program, and 8 out of 17 had, with an even mix of both CFLs and LEDs purchased. Interestingly, three respondents said they had received discounts on the CFL bulbs and one did not, and this was reversed for the respondents who purchased LEDs where 3 reported not receiving a discount and 1 reporting they did. The bulbs were purchased both inside and outside the District. Other equipment installed as a result of participation in this initiative was limited to one washer and one dryer. We estimate spillover is less than 1 percent.

We estimate that net-to-gross is between 95 and 100 percent.

#### C. Drivers net-to-gross results

There were three respondents who indicated that they would have completed their projects in whole or in part within the same timeframe without the incentives from the DCSEU.

N <sub>project</sub>	n <sub>survey</sub>	Free- ridership	Spillover	90% Margin Error (±)	Net-to-Gross	Comment
29	17	~5%	<1%	5.6%	95-100%	Little to no spillover and free-ridership estimate based on 3 Rs stating they would have completed project without DCSEU assistance

	Table 4-25.	FY14	Net-to-gross	Results	Summary
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### 4.3.5 Impact evaluation

The initial task for impact evaluation was to review the DCSEU TRM, compare it to the Mid-Atlantic TRM, and verify variables used to calculate claimed savings for FY14. Using both the



Mid-Atlantic TRM and the DCSEU TRM the evaluation team calculated program kWh, kW, and MMBtu savings using the measure data from the tracking system. Once this was completed, realization rates were calculated by dividing verified savings by reported savings.

### A. Impact sampling methodology for onsite measurement and verification

Onsite verification was not conducted for the FY14 results evaluation due to the low contribution to portfolio savings and limited issues found in prior onsite verification efforts.

	Onsite M&V Sample Subset							
Measure	N	n <sub>onsite</sub>	kWh <sub>onsite</sub>	kW <sub>onsite</sub>	MMBtu <sub>onsite</sub>	% kWh	% kW	% MMBtu
Not applicable								
Total						-	-	-

#### Table 4-26. FY14 Onsite M&V Sample Summary

#### B. Verification of impacts

The evaluation team conducted reviews of the HERO inputs and outputs compared to project files documentation.

		kWh		kW			MMBtu		
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR
Building Shell	9,110	9,110	1.00	0.0	0.0	0.00	243.8	237.2	0.97
Cooling	233	233	1.00	0.2	0.2	1.00	0.0	0.0	0.00
Lighting	4,466	4,010	0.90	0.5	0.3	0.64	0.0	0.0	0.00
Refrigeration	1,936	1,920	0.99	0.6	0.6	1.00	0.0	0.0	0.00
Space Heating	9,238	9,238	1.00	0.0	0.0	0.00	213.6	213.6	1.00
Ventilation	350	350	1.00	0.0	0.0	0.00	0.0	0.0	0.00
Water Heating	1,756	1,757	1.00	0.2	0.2	1.00	79.1	79.1	1.00
Track Total	27,089	26,618	0.98	1.4	1.3	0.87	536.5	529.9	0.99
Relative Precision at 90% Confidence	0.10%			1.17%			18.7%		

#### Table 4-27. FY14 Summary of Impact Evaluation Results

C. Impact evaluation planned activities and completed activities comparison

#### Table 4-28. FY14 Impact Evaluation Plan vs. Actual

Activity	Plan	Actual	Explanation for Variance
Conduct desk audits	6	6	
Conduct phone verification	29	17	We attempted to achieve a census of participants, and we were not able to interview



Activity	Plan	Actual	Explanation for Variance
			all prospective respondents.

- D. Summary of key findings describing adjustments to ex-ante savings
  - Building Shell: Insulation and air sealing savings were calculated using the raw algorithms from the DCSEU TRM which produced either higher or lower kWh savings than expected. HERO takes into account measure interaction which directly affects the savings. The realization rates for most of the measures are in range using basic algorithms. HERO has been vetted a number of times so the evaluator is confident the numbers that have been reported by DCSEU are accurate.
  - Space Heating: There is not enough data available in HERO to verify the duct and insulation savings numbers. HERO has been vetted a number of times so the evaluator is confident the numbers that have been reported by DCSEU are accurate. Programmable T-Stat savings calculations is substantially higher using the DCSEU TRM. This caused the combined realization rate to increase dramatically. DCSEU TRM calculations for heat pumps and electric furnaces with Programmable T-Stat was not available in the DCSEU or Mid-Atlantic TRM. Based on past comments regarding HERO the evaluator has confidence in the reported savings.
  - Refrigeration: There was a 10 kWh subtraction error on Project ID 7713 causing the realization rate to drop to 99 percent; kW savings were adjusted to 100 percent based on actual deem kW savings in the DCSEU TRM. The original RR was based on using the calculation in the TRM
  - The phone verification effort focused on verifying participation and the installation of direct measures. There were few direct measures installed in FY14 and for those surveyed with this type of installation indications are that the equipment was installed.

# 4.3.6 Recommendations

- A. To improve design, operations, customer experience, and recruitment
- i. **Continue to promote the programs sponsored by DCSEU through existing channels and consider** additional avenues, such as during DCSEU food bank and other community events or through referrals by District agencies that provide support for low income residents. Nearly half of respondents reported hearing about the program via communication from DCSEU. Word of mouth was another important source and this means that customers have had positive experiences with the program and are willing to recommend it to others.
- B. To improve impact evaluation results
- i. For programmable thermostat measure, calculate savings using the TRM algorithm.
- C. Net-to-gross assessment

#### 4. Track Evaluation Reports



i. This initiative has low indication of free-ridership. Therefore, there are no recommendations for changes.



# 4.4 7420HPES HOME PERFORMANCE WITH ENERGY STAR<sup>®</sup>

# 4.4.1 Track description

The Home Performance with ENERGY STAR (HPwES) Program is a national program sponsored by the U.S. Department of Energy (US DOE) and operated locally by the DCSEU. Typical HPwES home improvement projects begin with a comprehensive energy audit of a home conducted by a certified HPwES contractor. Using a number of diagnostic tests, the contractor provides the homeowner with a home energy audit report. The comprehensive report includes recommendations for energy efficient improvements specific to the home, along with each improvement's associated annual energy savings. The homeowner then works with the contractor to decide on which improvements make the best sense for the home and the homeowner's budget. The certified contractor then completes the agreed upon home efficiency improvements.

Information about the HPwES initiative is available on the DCSEU website and leads are also generated by contractors. The HPwES initiative targets DC residents living in single-family homes, row homes (each unit is ground to sky), or converted (1 to 4 unit) apartments and row homes. Both owner-occupied homes and rental properties with the property owners' authorization are eligible to participate. The DCSEU is responsible for establishing a network of contractors who are qualified to perform a comprehensive energy audit and complete the recommended improvements or work closely with other contractors who can.

All audit data are entered into the Home Energy Reporting Online (HERO) web based savings tool by the contractor. DCSEU staff reviews the HERO application for completeness, accuracy, and health and safety requirements for recommended measures. The contractors then install the recommended equipment and perform a test-out, and enter the test-out data into HERO. DCSEU reviews the test-out data, and if approved, forwards a document to the customer for signature. Participants receive incentive payment upon the contractor's completion of qualified home energy retrofit work. The DCSEU offers financial incentives of up to \$1,800 for qualifying home energy upgrades, such as air sealing and insulating a home.

DCSEU incentives include:

- \$200 off a BPI energy audit
- 50% cash back on air sealing work, up to \$800 upon completion of project
- 50% cash back on insulation work, up to \$800 upon completion of project
- A personal Home Energy Coach who will review the home energy audit and provide guidance on what improvements will help achieve the most energy savings.

Table 4-29 provides a summary of initiative metrics since inception. FY2012 and FY2013 reported results include the interactive effects for the installation of energy efficient lighting. FY2014 excludes these effects.



	-		
	FY2012	FY2013	FY2014
Metric	Reported Result	Reported Result	Reported Result
Participants (Units=projects)	108	272	50
kWh savings, meter level	70,750	171,098	12,061
kW	7.6	16.9	0.10
MMBtu	13	802	472

#### Table 4-29. Initiative Summary Metrics—7420HPES

Table 4-30 provides a summary of the reported and verified kWh, kW, and MMBtu along with the resulting realization rates.

Table 4-30. FY14 Reported and Verified Results—7420HPES

Metric	Reported	Verified	Realization Rate
kWh	12,061	12,023	1.00
kW	0.10	0.08	0.84
MMBtu	472	427	0.90

# 4.4.2 Overall sampling methodology

Because of the similarities between 7420FHLB and 7420HPES, we treated these tracks as one for the purposes of sampling. While there are various measures installed by this program, choosing a random sample of projects is likely to result in a representative distribution of measures for evaluation. In addition, this track will have a higher number of projects evaluated, so coverage of measures is not expected to be an issue. The evaluation team selected a random sample of projects and ensured that the resulting list of projects has appropriate representation for measure types.

			-					
	Project File Evaluation Sample							
Measure	N <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>n</sub>	kWn	MMBtu <sub>n</sub>	% kWh	% kW	% MMBtu
Building Shell	49	19	2,778	0.0	139.3	45.1%	-	-
Lighting	1	1	798	0	-1	105%	100.0%	#DIV/0!
Space Heating	7	3	4,421	0	25	89.9%	-	-
Water Heating	2	2	188	0	6	100%	100.0%	100.0%
Total	59	25	8,185	0.1	169.3	68.1%	100.0%	35.9%

Table 4-31. FY14 Population and Sample Summary—7420HPES

# 4.4.3 **Process evaluation**

A staff interview was conducted November 18, 2014, to understand how the track is intended to work. Telephone surveys of participants were conducted from December 22, 2014, through



January 20, 2015. Advance letters were sent to sampled participants notifying them of their selection to participate in the evaluation.

Activity	Plan	Actual	Explanation for Variance
DCSEU staff in-depth interviews	1	1	
Participant phone surveys	50	25	We attempted to achieve a census of participants, and we were not able to interview all prospective respondents.

#### Table 4-32. Process Evaluation Plan vs. Actual

#### A. Summary of key findings

#### i. Awareness

Nine (of 25 participants) mentioned hearing about the program through word of mouth, and 10 heard about it through the DCSEU, either from a mailing or email (3) or from the DCSEU website (7). We asked respondents about their awareness of and participation in DOEE energy saving initiatives and one respondent said they had also participated in the Energy Assistance and Weatherization program.

#### ii. Verification of installation

The survey included questions for lighting equipment and water saving equipment verification. The tracking database indicates that only one household received lighting or water saving equipment.

In years prior to FY14, the energy savings for this initiative were driven primarily from the direct install measures implemented during the hoe energy audit-there was limited uptake to deeper retrofit measures. In FY14, the DCSEU stressed to contractors working in this track a need to improve the conversion rate to deeper retrofit work. This focus improved the conversion rate from less than 10 percent in FY13 to almost 50 percent in FY14. The increased conversion rate to deeper retrofit measures is the right tactic; however, the overall track savings have declined significantly with drop in the installation of direct install measures.

#### iii. Household experience

Almost half of respondents (12 out of 25) rated their satisfaction with the information about the program on the DCSEU website highly (4 or 5 on a scale of 1 to 5, where 1 is not at all satisfied and 5 is very satisfied). Respondents were less satisfied with the time it took to receive the rebate; 8 participants rated their satisfaction as 1 or 2. Following are some reasons given for the lower ratings:

- Because it took several follow-up emails to even confirm that we would be receiving the rebate. And then it took approximately two months to receive the rebate.
- Because the contractor did not submit it until I reminded him.
- We just had to send stuff in multiple times and it took much longer than we were promised.
- Well, it took many months and it looked like it wasn't going to happen. It took six or eight months, as I recall. I had to call a couple of times.



#### iv. Adoption of energy saving behaviors

Twenty-four out of the 25 respondents indicated that they received information on how to save energy in their home after their audit was completed, with all of the respondents able to name at least one recommendation. The vast majority (22 out of 24 respondents) reported adopting at least one of the recommendations.

#### v. Lighting spillover

We asked respondents if they had purchased energy efficient lighting since participating in the program, and 17 of the 25 said they had, with a near even split between CFLs and LEDs, and some respondents purchasing both. Five out of eight respondents claim they did not receive a discount for their CFL purchases, and five out of nine respondents stated they did not receive a discount on their LED bulbs. Most respondents (9 out of 13) said they purchased their bulbs in the District.

#### vi. Demographics

All 25 respondents own their home, and only one planned to move away from the area in the next 12 months. Nine respondents reported that they work from home, and the lowest level of education was some college but no degree.

## 4.4.4 Net-to-gross methodology and results

#### A. Methodology

Net-to-gross for this track was assessed through self-report phone surveys. Households were asked about their project in total and not independent measures within their project. See Section 2.5 for detailed descriptions of the net-to-gross survey battery.

#### Table 4-33. FY14 Net-to-gross Assessment Evaluation Plan vs. Actual

Activity	Plan	Actual	Explanation for Variance
Participant phone surveys	50	25	We attempted to achieve a census of participants, and we were not able to interview all prospective respondents.

#### B. Summary of results

Free-ridership is estimated to be about 15 percent. The distribution of free-ridership scores ranges from 13 respondents who indicate 0 percent free-ridership, 5 who indicate up to 25 percent, and 7 who indicate up to 50 percent (see the table below).

#### Table 4-34. Free-ridership Score Distribution (n=25)

Free-ridership Score	0%	1-25%	26-50%	51-75%	77-99%	100%
Household count	13	5	7	0	0	0

To assess spillover, households were asked if and what type of energy efficiency equipment they purchased without DCSEU incentives since participating in the HPES initiative. Based on



these responses, spillover is estimated to be range from about 5 to 8 percent. The upper range includes respondents who reported replacement of windows.

The net-to-gross is estimated to be about 7 to 10 percent.

#### C. Drivers of net-to-gross results

There were ten respondents who indicated that they would have completed their projects in whole or in part within the same timeframe without the incentives from the DCSEU. There were five respondents who indicated they would have completed their projects in whole and would have paid the entire cost of the project in the absence of DCSEU incentives. However, all respondents gave an influence score for the DCSEU rebate of at least 3 on a scale of 1 to 5, where 1 is not at all influential and 5 is extremely influential, so there were no full free riders identified.

For spillover, energy efficiency actions that were quantified include refrigerators, water heaters, furnaces, windows, insulation, and dishwashers. It is important to note that some of the measures mentioned and quantified are eligible for DCSEU incentives; however, since the household was asked about equipment purchased without an incentive, these results were not adjusted. In addition to quantified spillover, energy efficiency actions taken that were not quantified included the installation of solar panels, solar water heaters, weather-stripping, and various cooking appliances.

When asked to rate the influence of the DCSEU on the household's decision to pursue other energy savings actions, the mean score was less than 3 on a scale of 1 to 5, where 1 is not at all influential and 5 is very influential for each category.

Influence category	n	Mean score	Standard Deviation
Information about savings from DCSEU advertising or staff, retailers, or contractors	9	2.67	1.414
Satisfaction with the program financial assistance, equipment, or services	9	2.56	1.667
Experience with the DCSEU program that made the respondent want to do more to save energy	9	2.44	1.333

Table 4-35. Influence Score Categories on Spillover, Appliances and HVAC

The evaluation for FY15 results will include follow-up questions in the spillover battery to assess why households did not apply for DCSEU rebates for energy efficient appliances claimed to be purchased after participating in one or more other DCSEU initiatives. This will help better quantify spillover and the influence of the DCSEU on additional energy efficiency actions taken.


N <sub>project</sub>	n <sub>survey</sub>	Free- ridership	Spillover	90% Margin Error (±)	Net-to-Gross	Comment
50	25	~15%	5-8%	7.0%	~90%	90% is better than the PA Act 129 Phase I results of 75-88% NTG, likely driven by thee direct install measures of PA Act 129 utilities' programs

### Table 4-36. FY14 Net-to-gross Results Summary

# 4.4.5 Impact evaluation

The initial task for impact evaluation was to review the DCSEU TRM, compare it to the Mid-Atlantic TRM, and verify variables used to calculate claimed savings for FY14. Using both the Mid-Atlantic TRM and the DCSEU TRM, the evaluation team calculated program kWh, kW, and MMBtu savings using the measure data from the tracking system. Once this was completed, realization rates were calculated by dividing verified savings by reported savings.

### A. Impact sampling methodology for onsite measurement and verification

Onsite verification was not conducted for the FY14 results evaluation due to the low contribution to portfolio savings and limited issues found in prior onsite verification efforts.

	Onsite M&V Sample Subset									
Measure	N <sub>measure</sub>	n <sub>onsite</sub>	kWh <sub>onsite</sub>	kW <sub>onsite</sub>	MMBtu <sub>onsite</sub>	% kWh	% kW	% MMBtu		
Not applicable										
Total										

### Table 4-37. FY14 Onsite M&V Sample Summary

### B. Verification of impacts

The evaluation team conducted reviews of the HERO inputs and outputs compared to project files documentation.

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	kWh			kW			MMBtu		
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR
Building Shell	6,159	6,159	1.00	0.0	0.0	0.00	391.9	347.5	0.89
Lighting	798	760	0.95	0.1	0.1	0.82	0.0	0.0	0.00
Space Heating	4,916	4,916	1.00	0.0	0.0	0.00	74.1	74.1	1.00
Water Heating	188	188	1.00	0.01	0.01	1.00	6.0	5.3	0.89
Track Total	12,061	12,023	1.00	0.10	0.08	0.84	472.0	426.9	0.90
Relative Precision at 90% Confidence	0.00%			0.00%			3.39%		

### Table 4-38. FY14 Summary of Impact Evaluation Results

## C. Impact evaluation planned activities and completed activities comparison

	•		•
Activity	Plan	Actual	Explanation for Variance
Conduct desk audits	19	19	
Conduct phone verification	50	25	We attempted to achieve a census of participants, and we were not able to interview all prospective respondents.

### Table 4-39. FY14 Impact Evaluation Plan vs. Actual Sample

### D. Summary of key findings describing adjustments to ex-ante savings

- Building Shell: Insulation and air sealing savings were calculated using the raw algorithms from the DCSEU TRM and Mid-Atlantic TRM which produced higher or lower kWh savings than expected. Using the same algorithms the MMBTU savings were closer in to the reported data. Some of the explanation for discrepancy could be based on the heating system install, i.e. heat pump, electric heat, gas furnace or air conditioning. This is something that needs further investigation in the next evaluation cycle. HERO takes into account measure interaction which directly affects the savings. The realization rates for most of the measures are in range using basic algorithms. HERO has been vetted a number of times so the evaluator is confident the numbers that have been reported by DCSEU are accurate.
- Space Heating: There is not enough data available in HERO to verify the duct and insulation savings numbers. HERO has been vetted a number of times so the evaluator is confident the numbers that have been reported by DCSEU are accurate.
- Water Heating: The water heater kWh savings is based on the installation of 2 lowflow showerheads. The MMBtu savings is based on a gas hot water heater using the DCSEU TRM, dated 09/30/2014, page 154 algorithm.
- The phone verification effort focused on verifying participation and the installation of direct measures. There were few direct measures installed in FY14 and for those surveyed with this type of installation indications are that the equipment was installed.



# 4.4.6 Recommendations

- A. To improve design, operations, customer experience, and recruitment
- i. Encourage contractors to use the direct install measures during energy audits while continuing to focus on the converting households to deeper retrofit projects. This will provide households with immediate benefit by providing energy savings equipment during the home energy audit. It can also generate energy savings education by talking with the household about 'simple' ways they can adjust how they use energy *in addition to* taking more comprehensive action to improve the home.
- ii. **Examining the rebate process to improve turn-around time.** Some customers reported having to wait months to receive their rebate, and in some cases customers needed to initiate contact several times to inquire about the status of their payment. The DCSEU states that the current 100 percent quality assurance review creates delay in payment. They are considering moving to the EPA ENERGY STAR Partner Quality Assurance Recommendation for quality assurance.<sup>16</sup> This is outlined in the Partner Agreement as:

"In addition to the above, the Partner will conduct on-site inspections, at a set inspection rate, of the work of all participating contractors. The minimum on-site job inspection rate is set at 5% (1 in every 20 jobs). NOTE: It is recommended that the Partner establish an adjustable on-site inspection rate for contractors based on job experience and performance. This inspection rate reduces as the contractor gains experience in the program and as on-site inspections show the contractor is performing well. Contactors may drop down a tier if performance slips. Here is the recommended set of tiers:

- a. Tier 1 Contractor The first 3-5 jobs will be inspected on-site or mentored.
- b. Tier 2 Contractor 20% of the next 20 jobs are inspected on-site (4 out of 20).
- c. Tier 3 Contractor 5% of all jobs inspected on-site (1 in 20)."
- B. To improve impact evaluation results
- i. There are no recommendations as a result of this evaluation effort.
- C. Net-to-gross assessment
- i. A net-to-gross ratio of about 10 percent comprised of about 15 percent free-ridership and 5 to 8 percent spillover is on the low end when compared to other residential retrofit programs. Therefore, we do not recommend any changes to manage freeridership.

<sup>&</sup>lt;sup>16</sup> See

http://www.energystar.gov/ia/home\_improvement/downloads/HPwES\_Partnership\_Agreement.pdf?fa9 3-da30



# 4.5 7512MTV T12 MARKET TRANSFORMATION VALUE

# 4.5.1 Track description

The T12 Market Transformation initiative targets small-to-medium sized businesses (less than 10,000 square feet or less than 5,000 kWh/month). While larger customers can participate, they are encouraged to participate in an appropriate Custom track. MTV provides upgrades for old, inefficient T12 fluorescent tube lighting to high efficiency T8 products in qualifying businesses, institutions, and multifamily residential buildings in DC, by the DCSEU Implementation Contractors. The DCSEU staff interview applicants to determine incentive levels needed to move viable projects forward.

The existing T12 lighting must be replaced by HPT8 28W lamps with low ballast factors (except in cases where specific conditions warrant higher ballast factors). The program also provides incentives for replacing incandescent or fluorescent exit signs with higher efficiency LED models. DCSEU covers 70% of the cost of the project.

To participate in the program, customers download application forms from the DCSEU website. All downloaded forms are tracked in KITT, along with the contact information of the person downloading the form. The pre-approval process consists of screening projects for custom eligibility – projects that contain over 100 items for lighting, or have an annual energy use of 65,000 kWh/year are considered more of a custom project. As part of the pre-approval process, the customer submits spec sheets. After being pre-approved, the customer then installs the products and provides a proof of purchase. A submittal checklist is filled out by the customer and verified by the DCSEU Staff (the submittal checklist interactively calculates rebates). The DCSEU Staff conduct follow-up quality assurance and quality control inspection on 100 percent of projects.

Eligible measures include:

- T8 lighting upgrades
- LED exit signs
- CFLs.

DCSEU staff and Certified Business Enterprise (CBE) contractors are responsible for outreach to potential participants. The CBE contractors install eligible equipment, and DCSEU staff inspect 100 percent of the projects prior to release of the financial incentive.

Table 4-40 provides a summary of initiative metrics since inception. FY2012 and FY2013 reported results include the interactive effects for the installation of energy efficient lighting. FY2014 excludes these effects.



	FY2012	FY2013	FY21014
Metric	Reported Result	Reported Result	Reported Result
Participants (Units=projects)	n/a	39	94
kWh savings, meter level	n/a	1,079,285	2,562,394
kW	n/a	238	476

### Table 4-40. Initiative Summary Metrics—7512MTV

Table 4-41 provides a summary of the reported and verified kWh, kW, and MMBtu along with the resulting realization rates.

Metric	Reported	Verified	Realization Rate
kWh	2,562,394	2,199,806	0.86
kW	476.1	395.0	0.83

### Table 4-41. FY14 Reported and Verified Results—7512MTV

# 4.5.2 Overall sampling methodology

This track focuses on nonresidential lighting projects. Because the track focuses on only one technology, the only variation between projects is the number of measures installed. The evaluation team sampled the top ten percent of projects by total electricity savings from these combined tracks and supplemented with randomly selected smaller projects to fill out the sample. This resulted in 9 projects sampled with certainty from the highest savings stratum and 41 selected randomly from the second stratum of all other electricity savings for impact evaluation activities.

Table 4-42.	FY14 Population	and Sample Summar	y—7512MTV
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	Project File Evaluation Sample								
Measure	N <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>n</sub>	kW <sub>n</sub>	MMBtu <sub>n</sub>	% kWh	% kW	% MMBtu	
Lighting	94	36	1,854,668	369.0	0	72.4%	77.5%	-	
Total	94	36	1,854,668	369.0	0	72.4%	77.5%	-	

## 4.5.3 Process evaluation

A staff interview was conducted on November 17, 2014, to understand how the track is intended to work and to identify key researchable questions, in particular, how the move toward the market-based initiative is understood and perceived.

In January 2015, in-depth interviews were conducted with two market actors and customers representing 29 participating projects to elicit feedback on their project experiences, including satisfaction, how they learned of the rebates, how the decision was made to install rebatequalifying equipment, installation verification, and company characteristics.



Activity	Plan	Actual	Explanation for Variance
Conduct DCSEU staff in-depth Interview	1	1	
Conduct participant surveys	35	29	Did not reach all customers attempted although multiple attempts were made to each contact
Conduct Market Actor Interviews	10	2	Difficulty scheduling contractor interviews

### A. Summary of key findings

- Commercial customers are returning to the DCSEU for multiple projects. We found that almost half (40 of 94) of the MTV projects were completed by 14 customers, compared with 54 single projects within the evaluation timeframe, some of which had likely completed projects in previous years.
- Participants are diverse, as expected for this type of offering. Interviewed participants occupied office buildings (6), liquor stores/breweries (6), houses of worship (5), banks (3), warehouses (2), and kitchen/restaurants (2). Only two businesses were open around the clock (24/7) and typical operating hours per week ranged from as little as 20 up to 100. Most (16 of 29) had less than 10 employees and another 9 had 10-20 employees. All businesses occupy less than 100,000 square feet, with most (23) utilizing less than 15,000 square feet. Seventeen own their space and twelve lease it.

### i. Awareness

- Primary sources of rebate awareness were area contractors (10 of 23), the DCSEU staff (8), industry peers (7), and the DCSEU website and mailings (5 each).
   Contractors we spoke with have been involved with the DCSEU for a few years now and make use of all available DCSEU financial assistance as they develop proposals for new projects. This demonstrates that a knowledgeable contractor network operation in the District is taking hold.
- Industry peers as a source of program awareness is high, and given that 15 of the 23 participants said they have recommended the DCSEU to someone else and the other 8 said they would, it is not surprising.
- All participants interviewed would contact the DCSEU again for assistance.
- Contractors mentioned some uncertainty around the amount of rebate customers would receive approaching the end of each year. Although the MTV track is structured to cover 70 percent of the improvement costs, contractors felt that the DCSEU would incentivize more if they were not meeting targets at year end. This creates uncertainty for contractors and misunderstanding on the part of customers, especially those that participate more than once, as to what they should expect to receive on any given project. It may also lead to potential participants waiting until close to year-end to implement projects in the hope that a greater incentive will be available.
- ii. DCSEU staff interaction
  - Implementing energy efficiency projects with assistance from DCSEU has increased the likelihood of participants considering (18 of 23) and installing (19 of 23) energy



efficient equipment in the future. In addition, it has increased confidence in the financial benefits (17 of 23) and nonfinancial benefits (19 of 23) of energy efficient equipment (such as improved comfort, better lighting, higher productivity, etc.).

- iii. Satisfaction
  - Ratings were generally respectable, with means between 4.0 and 4.7 on a 5-point scale<sup>17</sup>. Performance of the new equipment, assistance from the installation contractor, overall experience with the project, and the application/preapproval processes received some of the highest ratings. The amount of incentive, the time it took to receive payment, and information about the DCSEU energy efficiency offerings received lower average ratings, although ratings are 4.0 or higher. For those who rated rebates and rebate timing lower stated perceived delays in receiving rebates as the reason. With no Account Representative or Energy Advisor outreach, a few participants also found it difficult to get clear, up-to-date information on what DCSEU had to offer.

	7512MTV			
Aspect	n <sub>sample</sub>	n <sub>score=5</sub>	Mean Rating	
The performance of the new equipment	29	22	4.66	
The assistance from the contractor who installed your equipment	29	22	4.66	
The application process	29	20	4.62	
Your experience overall	29	19	4.62	
The preapproval process, if applicable	26	18	4.62	
The type of eligible equipment	26	17	4.54	
The technical assistance you received from the DCSEU	22	12	4.50	
The rebate amount or financial incentive	22	10	4.18	
The amount of time it took to receive the rebate or financial incentive	21	11	4.10	
The information about DCSEU energy efficiency offerings	29	11	4.00	

### Table 4-44. Number of Highly Satisfied (Rating=5) Ratings by Aspect

- All participants asked (23)<sup>18</sup> had some direct exposure to filling out the rebate application. However, 13 of the 23 enlisted at least some assistance filling it out about half from the DCSEU and the other half from contractors. One contractor has some concerns about how the application is operating and that there may be flaws in the calculations. This was mentioned for the CIRX track as well.
- Contractors are happy with the funding and assistance provided by the DCSEU. One contractor even stated that he feels the DCSEU "cares more" about what they are

<sup>&</sup>lt;sup>17</sup> 1 is not at all satisfied and 5 is extremely satisfied.

<sup>&</sup>lt;sup>18</sup> The number of responses to each question may be lower than the total number of completed surveys, which were counted at the project level. For overarching questions at the customer level, their response was only counted once and not for every project for which they completed a survey.



offering than at least one other utility they work with. While they recognize some growing pains for the DCSEU with new staff, communication is working well.

- iv. Economic transfer
  - Of the 29 projects, 11 participants interviewed said they have realized savings since participating but 14 were unsure. Use of those savings varied from paying bills (4), investing in additional energy efficiency projects (3), general investments (2), and building maintenance (1). This may be an indication that the DCSEU initiatives are funding both energy efficiency improvement projects and producing other economic benefits for participating businesses and for the community. We did not specifically ask about job creation as a result of energy savings projects implemented with the DCSEU assistance, but the responses suggest that this is occurring on some level. A few participants had not thought about how savings would be used.

## v. Future plans

- At the time of the interviews, 15 of 23 participants had future plans to implement energy efficient improvements in next two years and all would consider involving the DCSEU in those future plans. Many will do so very early in the process, while a few will wait until they have a good idea for what the project would entail. When asked what the DCSEU could do to assist them, the overwhelming response was to keep them informed of what was available. That included either ensuring the website had the most current information or sending them emails or mailed information on current opportunities.
- Both contractors interviewed feel that the DCSEU will need to start considering moving to T5 and LED lighting in the near future due to increasing saturation in the market and customers looking for greater efficient lighting as they consider future projects. In addition, nearby territories are offering rebates for those technologies and customers often question contractors about them.

## 4.5.4 Net-to-gross methodology and results

### A. Methodology

Self-report surveys were used to assess net-to-gross for this track. See Section 2.5 for detailed descriptions of these batteries.

Activity	Plan	Actual	Explanation for Variance
Participant surveys: 7510MTV	35	29	Did not reach all customers attempted although multiple attempts were made for each contact

### Table 4-45. FY14 Net-to-gross Assessment Evaluation Plan vs. Actual

### B. Summary of results

Free-ridership is estimated to be about 10 percent for this direct install lighting initiative. Spillover was not quantified for this initiative as the scale and scope of projects can be difficult



to gather during telephone surveys; therefore, this data was gathered as qualitative information.

Net-to-gross is estimated to be 90 percent or greater.

## C. Drivers net-to-gross results

There were 18 respondents who indicated that they would not have completed their projects in whole or in part within the same timeframe without the incentives from the DCSEU. There were zero 100 percent free riders. The influence of the incentive was the highest rated influence category on participation with a score of 4.8 on a scale of 1 to 5 where 1 in 'not at all influential' and 5 is 'extremely influential', and all categories score well. Only 5 participants participated in the DCSEU projects before and this experience was rated 3.4.

Free-ridership Score	0%	1-25%	26-50%	51-75%	76-99%	100%
Respondent Count	18	3	6	2	0	0

### Table 4-46. Free-ridership Score Distribution

l able 4-47	. Free-ridership	Influence	ce Sc	ores	
					C

Influence Category	n	Mean	Standard Deviation
Incentive or rebate	25	4.84	0.374
Recommendation from installation contractor	25	4.60	0.645
Technical assistance received from DCSEU staff	20	4.30	0.801
Previous experience implementing projects through DCSEU	5	3.40	1.342

For spillover, 6 respondents (out of 29) indicated that they took additional energy efficiency actions without DCSEU incentives. Of these six, one respondent indicated that the equipment would have qualified for a DCSEU incentive, but that the "cost savings was not worth the effort of applying and there wasn't time to apply as they needed the equipment immediately." This same respondent indicated that they chose to install the higher efficient equipment due to contractor recommendation and their experience with other energy efficiency projects implemented with the DCSEU in one case. Another respondent also indicated that the equipment would have qualified but they chose not to contact DCSEU because "the DCSEU website stated that rebates were not available". This same respondent was a "zero percent free rider" for the completed MTV project, and rated the influence of the rebate, the DCSEU assistance, and a recommendation from the contractor all 5 on a scale of 1 to 5, where 1 is "not all influential" and 5 is "extremely influential."

The additional actions taken or energy efficient equipment installed included HVAC system and operation improvements, LED and other lighting installations, and photovoltaic system installation.

N <sub>project</sub>	n <sub>survey</sub>	Free- ridership	Spillover	90% Margin Error (±)	Net-to-Gross	Comment
94	29	~10%	>0 percent, although	7.6%	>=90%	NTG is lower than what was found for in MD for

### Table 4-48. FY14 Net-to-gross Results Summary



	not quantified			commercial DI programs (74% in 2010)
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## 4.5.5 Impact evaluation

The impact evaluation for the T12 lighting replacement tracks consisted of conducting file reviews, desk audits and on-site inspections to verify key energy savings characteristics.

## A. Impact sampling methodology for onsite measurement and verification

### Table 4-49. FY14 Onsite M&V Sample Summary

	Onsite M&V Sample Subset								
Measure	N <sub>measure</sub>	n <sub>onsite</sub>	kWh <sub>onsite</sub>	<b>kW</b> onsite	MMBtu <sub>onsite</sub>	% kWh	% kW	% MMBtu	
Lighting	94	15	431,076	77.3	0	16.8%	16.2%	-	
Total	94	15	431,076	77.3	0	16.8%	16.2%	-	

## B. Verification of impacts

The evaluation team conducted reviews of the claimed savings for reasonableness and in accordance with the DCSEU TRM. The evaluation team also reviewed the Mid-Atlantic TRM to assess potential variations in inputs and methods from those implemented in the District. For these tracks, the net-to-gross ratio is assumed to be 1.00 for FY13.

	kWh			kW			MMBtu		
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR
Lighting	2,562,394	2,199,806	0.86	476.1	395.0	0.83	0.0	0.0	-
Track Total	2,562,394	2,199,806	0.86	476.1	395.0	0.83	0.0	0.0	n/a
Relative Precision at 90% Confidence	5.09%		8.42%				-		

### Table 4-50. FY14 Summary of Impact Evaluation Results

### C. Impact evaluation planned activities and completed activities comparison

### Table 4-51. FY14 Impact Evaluation Plan vs. Actual

Activity	Plan	Actual	Explanation for Variance
Conduct project file reviews	35	36	Additional project sampled because of on-site activity.
Conduct onsite verification	10	15	Additional onsite verifications were scheduled to mitigate possible customer cancellations and additional onsite verifications were conducted before they could be cancelled.

### D. Summary of key findings describing adjustments to ex-ante savings

• Overall, it was unclear how the claimed savings were calculated. The "as built" audit spreadsheets contained data on the existing fixture description, and some

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descriptions on the proposed and baseline fixtures. The evaluation methodology followed the TRM along with the fixture descriptions, and in most cases the results did not match up precisely with the claimed savings.

- In some instances, the proposed or baseline fixture type was adjusted in the verified savings calculations due to different nominal lamp wattage, lamp length or the number of lamps per fixture.
- The two largest projects sampled during the desk reviews had the same inconsistencies with the documentation around CFL interior fixtures. For both of these line items, the invoice appeared to offer the most clarifying evidence that these were 1L 26W CFL screw-in lamps (100W incandescent lamps). In the ex-ante savings, these appeared to have been entered as three lamps fixtures, which greatly exaggerated the energy savings.
- For projects with exterior lighting, the hours-of-use in the ex-ante was either 8,760 or 4,380 and in some cases, the coincident factor did not match with the correct loadshape. Also, during an on-site a project that installed exterior lighting with a loadshape of 8,760 hours of use was found to have photocell control and was changed 4,380 hours in the ex-post savings calculations.

# 4.5.6 Recommendations

- A. To improve program design, operations, customer experience, and recruitment
- i. **Consider an application online portal that will step applicants through the rebate form and allow for online submission.** The DCSEU currently provides contractors with a direct service portal and is working on a customer portal. This type of tool could reduce the time required by DCSEU staff to assist with application completion and ensure that needed data and information are collected through the rebate process. An online portal could also provide project application approval review and rebate status tracking for businesses and contractors.
- ii. Increase visibility of DCSEU assistance in the public either through events, advertisements, and/or sponsorships earlier in the funding cycle. The DCSEU is already implementing more increased targeting to sectors, or 'impact zones', and balances the cost of outreach with the expected value. However, contractors and participants both mentioned a general lack of awareness of the funding available. Visibility will increase awareness, interest, and legitimacy of the programs offered. Launching events and marketing as early as possible in the funding cycle may help bring projects in earlier, minimizing the need to change rebate levels at the end of the year.
- iii. **Avoid changing incentive levels late in the year.** A few of the customers and contractors indicated that they thought rebate levels became higher as it got later in the year in order for the DCSEU to make targets. Any changes to the incentives offered can complicate or cloud lessons learned from track activity as it is confusing to the customer. Late year rebate amount changes can also retrain customers the other way to wait until later in the year for potentially higher incentives.
- iv. **Review T5 and LED lighting technologies for potential rebate opportunities.** Building on feedback from last year, the active contractors we spoke with are fielding



more frequent questions regarding higher efficiency lighting than the T8s that are currently rebated, some because they are aware of rebates in other territories; others are looking to understand what the best options are for future projects. This recommendation is in line with steps the DCSEU is currently taking to assess adding new technologies and evolving to more a comprehensive approach such as heating and cooling controls.

- B. To improve impact evaluation results
- i. **During QA/QC, document the differences between what is found during the onsite inspection and/or other project documentation.** The "as built" audit spreadsheets and invoices were utilized for the desk reviews. In Leidos' experience, invoices do not always accurately reflect the project that was undertaken. Where discrepancies are found, such as lamp counts that do not line up with expectations based on fixture quantities in the application or ballasts on the invoice, more follow-up should be conducted with the customer. For many of the projects, the lamp and ballast model numbers shown on the audit spreadsheet, invoice, and post-installation inspection form did not match up. Also, on-site inspections found quantity differences with the project documentation while the QA/QC inspection appeared to validate the ex-ante quantities exactly. This is a repeated recommendation from the FY13 results evaluation effort.
- ii. To facilitate evaluation efforts, the calculations used to produce the ex-ante savings should be fully documented including such factors as the hours-of-use, coincident factors, heat/cool interactive factors, baseline fixture wattage and proposed fixture wattage. For many projects, determining the basis of the ex-ante savings calculations was difficult, and for others it was impossible to reproduce the ex-ante results after determining the key factors from the project documents. Having these key factors from the tracking database would reduce efforts and clarify assumptions prior to the evaluation of each project. This is a repeated recommendation from the FY13 results evaluation effort.
- C. Net-to-gross assessment
- i. Net-to-gross is high and free-ridership is estimated to be low for this initiative; therefore, there are no recommendations to manage free-ridership.



# 4.6 7511CIRX BUSINESS ENERGY REBATES

# 4.6.1 Track description

The Business Energy Rebate (BER) initiative provides a comprehensive set of services and financial incentives to serve the varied needs of small-to-medium sized business and institutions located within the district. The program covers prescriptive rebates for lighting, HVAC, compressed air, refrigeration, food service equipment, and vending machines. The program, which was based on other implemented VEIC programs, was launched in the second quarter of FY2012.

BER targets small-to-medium sized business (less than 10,000 square feet or less than 5,000 kWh/month). While larger customers can participate, they are encouraged to participate in an appropriate Custom program. The program is implemented through individual contractors selected by the participant. The DCSEU Account Managers generate leads based on prior years' participation or interest. Customers can also call into the DCSEU or visit the DCSEU website. Contractors are also trained on how to upsell energy efficient equipment.

The DCSEU Project Intake Coordinator (PIC) screens projects, answers questions, and directs projects to the appropriate track. Program Managers and Program Assistants assist customers or customer agents to develop viable projects and offer "pre-approval". Although that was not a requirement for FY2013 participation, some customers wanted assurance ahead of project investment. A two-phase, multi-page application spreadsheet is downloadable from website. CBE contractors are not a requirement, although they do promote and participate.

The list of measures includes:

- Lighting (e.g., LED, occupancy sensors, day-lighting and high efficiency T5/T8, parking)
- HVAC
- Compressed air
- Refrigeration
- Food service and vending
- Spray rinse valves
- Domestic hot water heaters
- Faucet aerators, low flow showerheads, and commercial clothes washers.

Table 4-52 provides a summary of initiative metrics since inception. FY2012 and FY2013 reported results include the interactive effects for the installation of energy efficient lighting. FY2014 excludes these effects.

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	FY2012 FY2013		FY2014
Metric	Reported Result	Reported Result	Reported Result
Participants (Units=projects)	19	60	179
kWh savings, meter level	1,047,000	2,194,303	4,301,800
kW	129.3	372.9	383.0
MMBtu	n/a	191	1,326

## Table 4-52. Initiative Summary Metrics—7511CIRX

Table 4-53 provides a summary of the reported and verified kWh, kW, and MMBtu along with the resulting realization rates.

Metric	Reported	Verified	Realization Rate
kWh	4,301,800	4,228,906	0.98
kW	383.0	506.7	1.32
MMBtu	1,325.6	1,325.6	1.00

## Table 4-53. FY14 Reported and Verified Results—7511CIRX

# 4.6.2 Overall sampling methodology

The C&I Prescriptive Rebates track includes a wider variety of equipment types than most other C&I programs. There is also wide variety in the savings of prescriptive projects. The priority for this initiative is to account for larger projects first, and then to randomly select additional projects. Selecting the top ten percent of electric and gas projects within each measure category results in 18 projects sampled with certainty. Two projects were also sampled with certainty because another larger project was completed at the site.

	Project File Evaluation Sample									
Measure	N <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>n</sub>	kW <sub>n</sub>	MMBtu <sub>n</sub>	% kWh	% kW	% MMBtu		
Appliances	4	3	7,548	5.2	1,326	80.1%	95.0%	100.0%		
Cooling	5	1	3,578	2.1	0	78.1%	78.3%	-		
Lighting	130	23	2,031,362	170.7	0	48.9%	46.8%	-		
Refrigeration	53	7	24,495	2.4	0	17.9%	22.6%	-		
Total	192	34	2,066,982	180.3	1,326	48.0%	47.1%	100.0%		

### Table 4-54. FY14 Population and Sample Summary—7511CIRX

# 4.6.3 **Process evaluation**

A staff interview was conducted November 17, 2014, to understand how the track is intended to work and to identify key researchable questions. In particular, the DCSEU staff was interested in learning if commercial customers viewed their experience as a comprehensive



effort, if that experience was positive, and whether or not customers would come back to them for future advice and solutions.

In January 2015, in-depth interviews were conducted with one market actor and customers representing 51 participating projects to elicit feedback on their project experiences, including satisfaction, how they learned of the rebates, how the decision was made to install rebatequalifying equipment, installation verification, and company characteristics.

Activity	Plan	Actual	Explanation for Variance
Conduct DCSEU staff in-depth Interview	1	2	Additional call to program staff to clarify application questions
Participant phone surveys	60	51	Did not reach all customers attempted although multiple attempts were made for each contact
Market actor interviews	0	1	Spoke with one contractor also serving MTV and ICDI track

### Table 4-55. FY14 Process Evaluation Plan vs. Actual Sample

### A. Summary of key findings

- Commercial customers are returning to the DCSEU for multiple projects. We found that 27 customers accounted for 128 projects in FY14, compared to 51 single projects within the same timeframe. Some of the single project participants for FY14 had completed projects in previous years.
- Participants are diverse, as expected for this type of offering. One-third of the projects were apartments/condos, 20 percent offices, 16 percent hotels, 10 percent commercial kitchens, and 8 percent retail space. Of those, 63 percent are open 24/7. About 55 percent are small business (half <10, other half 10-20 employees) and 24 percent have 100-500 employees. Over half the participants occupy 100,000 to 750,000 square feet. Almost half (46 percent) own, 26 percent lease, and 28 percent are managed properties.</li>
- i. Awareness
  - Primary sources of rebate awareness were area contractors (50 percent), industry
    peers (35 percent), and the DCSEU website (23 percent). Industry peers as a source
    of program awareness is high, but given that 75 percent of participants said they have
    recommended the DCSEU to someone else and the other 25 percent said they would,
    it is not surprising. Some of the DCSEU website traffic is driven both by referrals from
    industry peers and customers researching what is available in the DC territory
    because of experience with other utility programs.
  - All participants interviewed stated that they would contact the DCSEU again for assistance.
- ii. The DCSEU staff interaction
  - Implementing energy efficiency projects with assistance from the DCSEU has increased the likelihood of participants considering (93 percent) and installing (89 percent) energy efficient equipment in the future. In addition, it has increased



business's confidence in the financial benefits (85 percent) and nonfinancial benefits (59 recent) of energy efficient equipment (such as improved comfort, better lighting, higher productivity, etc.).

- Due to overlap with custom projects, 6 of the 51 CIRX participants worked with an Energy Advisor or Energy Consultant and 5 of them found it very helpful. In addition to making efforts to work closely with customers, the DCSEU is keeping an open dialogue with contractors regarding rebates, assistance needed, and other potential improvements.
- iii. Satisfaction
  - Ratings generally were high with means between 3.4 and 4.8 on a 5-point scale<sup>19.</sup> Performance of the new equipment, overall experience with the project, and the technical assistance from the DCSEU received some of the highest ratings. The amount of incentive, preapproval process, and information about the DCSEU energy efficiency offerings received slightly lower ratings. Reasons for ratings below 4 included receiving less than expected in rebates or running up against initiative funding cap, feeling that the spreadsheet application contained calculation errors (this was mentioned for the MTV track as well), and being unaware that rebates had changed or were only available through different tracks.

		7510CIRX	(
Aspect	n <sub>sample</sub>	n <sub>score=5</sub>	Mean rating
The performance of the new equipment	51	43	4.80
Your experience overall	51	37	4.73
The technical assistance you received from the DCSEU	16	11	4.63
The amount of time it took to receive the rebate or financial incentive	51	27	4.47
The application process	50	31	4.20
The assistance from the contractor who installed your equipment	16	5	4.13
The type of eligible equipment	51	13	4.02
The rebate amount or financial incentive	51	10	3.61
The preapproval process, if applicable	47	26	3.57
The information about DCSEU energy efficiency offerings	49	11	3.37

### Table 4-56. Number of Highly Satisfied (5) Ratings and Mean Score

 Most participants (13 of 17) had some direct exposure to filling out the rebate application. However, 70 percent enlisted at least some assistance to complete the form. The number of helpers with the application ranged from one (40 percent) to three (12 percent). In 34 percent of the cases, the customer turned to the DCSEU for assistance, another 40 percent received assistance from the contractor. Just over half the participants (7 of 11) found the application easy to use. One participant found it

<sup>&</sup>lt;sup>19</sup> 1 is not at all satisfied and 5 is extremely satisfied



easier to use than some of the Maryland utility applications. One recommended change was to make it more of a portal than a spreadsheet, where it would ask a few questions, calculate, and print out a form for submission.

- iv. Economic transfer
  - Eighty-four percent of those we interviewed said they have realized savings since participating and 10 percent were unsure. Nine of those thought they had reinvested the savings into the business to cover operating costs. Another eight participants utilized their savings for future investments or projects. One participant spent it on charitable contributions and another reduced future fees. These might be indications that the DCSEU initiatives are funding both energy efficiency improvement projects and producing other economic benefits for participating businesses and for the community. We did not specifically ask about job creation as a result of energy savings projects implemented with the DCSEU assistance, but the responses suggest that this is occurring on some level.
- v. Future plans
  - At the time of the interviews, 21 of 25 had future plans to implement energy efficient improvements within the next two years and all would consider involving DCSEU in those future plans. Many will do so very early in the process, while a few still intend to wait until the application is needed. When asked what the DCSEU could do to assist them, common responses were to continue offering the rebates (with increases) and continuing to provide the technical assistance and advice which customers appreciate.

## 4.6.4 Net-to-gross methodology and results

### A. Methodology

Self-report surveys were used to assess net-to-gross for this track. See Section 2.5 for detailed descriptions of these batteries.

Activity	Plan	Actual	Explanation for Variance
Participant phone surveys	60	51 <sup>20</sup>	Did not reach all customers attempted although multiple attempts were made for each contact
Market actor interviews	10	1	Spoke with one contractor also serving MTV and ICDI track

Table 4-57	EV14 No	t to groce	Accoccmont	Evaluation	Dian ve	Actual
1 able 4-57.	F 114 Ne	t-to-gross	Assessment	Evaluation	Plan vs.	Actual

<sup>&</sup>lt;sup>20</sup> One respondent we spoke with was not the decision maker so he or she was not asked the decisionmaking series of questions but was asked the spillover questions.



#### В. Summary of results

Free-ridership is estimated to be about 50 percent. Spillover was not quantified for this initiative as the scale and scope of projects can be difficult to gather during telephone surveys; therefore, this data was gathered as gualitative information.

Net-to-gross is estimated to be 50 percent or greater.

#### С. Drivers net-to-gross results

There were 7 respondents who indicated that they would not have completed their projects in whole or in part within the same timeframe without the incentives from the DCSEU. There was 1 respondent who is estimated to be a 100 percent free rider. The remaining 42 respondents are estimated to be partial free riders, that is, they would have completed the projects in part or in whole but at a different time without the DCSEU influence. The influence of the contractor was the highest rated influence category on participation with a score of 4 on a scale of 1 to 5 where 1 in 'not at all influential' and 5 is 'extremely influential', and all categories score well.

······································									
Free-ridership Score	0%	1-25%	26-50%	51-75%	76-99%	100%			
Respondent Count	7	9	14	12	7	1			

Table 4-58. Free-ridership Score Distribution (n=50)

Respondent Count	7	9	14	12	7	1			
Table 4-59. Free-ridership Influence Scores									

Influence Category	n	Mean	Standard Deviation
Recommendation from installation contractor	20	4.05	1.468
Previous experience implementing projects through DCSEU	23	3.91	0.996
Incentive or rebate	50	3.56	1.312
Technical assistance received from DCSEU staff	11	2.91	1.300

### For spillover, seven respondents indicated that they took additional energy efficiency actions since participating in the DCSEU CIRX initiative – all of these were reported to be lighting projects. The additional actions taken or energy efficient equipment installed included HVAC system and operation improvements, LED and other lighting installations, and photovoltaic system installation.

Table 4-60.	FY14 Net-to-o	aross Results	Summary
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	gi 000 i 1000 i 10	o anna y

N <sub>project</sub>	n <sub>survey</sub>	Free- ridership	Spillover	90% Margin Error (±)	Net-to-Gross	Comment
179	51	~50%	>0 percent, although not quantified	9.9%	>~50%	Commercial prescriptive rebates NTG ranges from about 20% to 80% in PA and MD

Α.



# 4.6.5 Impact evaluation

The impact evaluation for Business Energy Rebates consisted of conducting file reviews, desk audits, and on-site inspections to verify key energy savings characteristics.

Impact sampling methodology for onsite measurement and verification

	Onsite M&V Sample Subset										
Measure	N <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>onsite</sub>	kW <sub>onsite</sub>	MMBtu <sub>onsite</sub>	% kWh	% kW	% MMBtu			
Appliances	4	0	0	0.0	0	-	-	-			
Cooling	5	0	0	0.0	0	-	-	-			
Lighting	130	10	671,734	38.8	0	16.2%	10.6%	-			
Refrigeration	53	0	0	0.0	0	-	-	-			
Total	192	10	671,734	38.8	0	15.6%	10.1%	-			

### Table 4-61. FY14 Onsite M&V Sample Summary

## B. Verification of impacts

The evaluation team conducted reviews of the engineering algorithms documented by the DCSEU for reasonableness and in accordance with the DCSEU TRM. The evaluation team also reviewed the Mid-Atlantic TRM to assess potential variations in inputs and methods from those implemented in the District. For this track, the net-to-gross ratio is assumed to be 1.00 for FY14.

	kWh			kW			MMBtu		
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR
Appliances	9,427	9,427	1.00	5.5	5.5	1.00	1,326	1,326	1.00
Cooling	4,581	5,334	1.16	2.7	2.3	0.87	0	0	0.00
Lighting	4,150,962	4,041,481	0.97	364.4	483.3	1.33	0	0	0.00
Refrigeration	136,830	172,664	1.26	10.4	15.6	1.50	0	0	0.00
Track total	4,301,800	4,228,906	0.98	383.0	506.7	1.32	1,326	1,326	1.00
Relative Precision at 90% Confidence	4.3%			16.6%			0.0%		

## Table 4-62. FY14 Summary of Impact Evaluation Results

C. Impact evaluation planned activities and completed activities comparison

Activity	Plan	Actual	Explanation for Variance						
Conduct project file reviews	30	50	Conducted cursory review of all potential projects						

### Table 4-63. FY14 Impact Evaluation Plan vs. Actual



Activity	Plan	Actual	Explanation for Variance
Conduct desk audits	15	30	Conducted additional reviews to provide more robust results
Engineering analysis / modeling	5	1	All but one desk audit projects were deemed
Conduct onsite verification	10	10	
Onsite Metering	3	0	No projects required onsite metering

## D. Summary of key findings describing adjustments to ex-ante savings

During the desk audits and on-site inspections, several factors were found that led to adjustments in the ex-ante savings as well as a few calculation outliers:

- There was inconsistent use of coincident factors when compared to loadshapes and hours of use across multiple types of projects. For instance, it was common to find exterior lighting fixtures with hours of use corresponding to the "Commercial Outdoor Lighting" or "Flat" loadshapes using the coincident factor from "Commercial Indoor Lighting Blended".
- During the on-site inspections, fixture quantities were found to differ from the claimed savings, application, and invoices. Overall, quantity adjustments were minor.
- The energy savings calculations packaged air conditioners in the cooling projects did not appear to follow the TRM calculation procedure.
- There are some concerns with use of customer reported hours of use in the claimed savings calculations for lighting. The use of Commercial Indoor Lighting Blended for non-exterior fixtures would result in a realization rate of 0.74 for kWh when compared to 0.97 for the use of the application hours. From a review of 23 projects, it is possible that the energy savings are being overstated based on customer reported hours for some of the projects. Since the customer's incentive is not affected by the hours of use, there is no reason for the customer to exaggerate the hours of use on the application. However, we do believe there is an amount of exaggeration bias occurring in the estimated hours as a few cases were found where the hours of operation stated and observed during the on-site inspection were lower than the application amounts. The impact evaluation did not adjust realization rates for this observation; rather, this finding is shared to highlight the potential for bias in using customer reported hours of use to estimate energy savings and demand reduction.
- The DCSEU collects data for all projects completed to update the "Commercial Indoor Lighting - Blended" loadshape annually. For the FY14 results evaluation, comparing the "Commercial Indoor Lighting - Blended" to site-specific loadshapes in the sample drawn for the evaluation effort indicated the population for the initiative is not representative of the Blended loadshape. However, the difference between the evaluated lighting savings and the reported lighting savings was only 3 percent. Therefore, it may not warrant further action but it is an indication that continuing annual updates is good practice since participating projects lighting-use profiles will vary from year to year.



# 4.6.6 Recommendations

- A. To improve program design, operations, customer experience, and recruitment
- i. **Continue to provide personalized support to customers as requested.** Participants are finding the DCSEU assistance very useful, whether it is for application completion which requires additional input for most participants, better understanding of rebate options, or technical assistance for selection of energy efficient equipment. A high proportion of participants have future plans for projects, many as a result of savings from previous projects with DCSEU.
- ii. **Consider an application online portal that will step applicants through the rebate form and allow for online submission.** This could reduce the time required by the DCSEU staff to assist with application completion and ensure that needed data and information are collected through the rebate process. An online portal could also provide project application approval review and rebate status tracking for businesses and contractors. The DCSEU changed the rebate form in March 2015 and is using the prescriptive process to feed leads to other initiatives. The updated form and referral process will be reviewed in the next evaluation cycle.
- iii. Review the spreadsheet application for any calculation issues and consider additional methods for clarifying the rebate amount customers will be eligible to receive. In addition, with the frequency of repeat participants, investigate methods for alerting customers of rebate changes or coverage in other tracks.
- B. To improve impact evaluation results
- i. **Provide example calculations outside of the database for selected projects to verify the ex-ante calculation procedures.** Across the lighting projects that were examined, there was a 2 percent difference between ex-ante and ex-post savings for items with no found discrepancies. We would like to learn the reason for these discrepancies so we can more accurately evaluate savings in the future.
- C. Net-to-gross assessment
- i. It is common for prescriptive rebate programs to have higher incidents of freeridership. To manage this, continue to stay ahead of energy efficiency standards changes. Additionally, an assessment of District marketing indicators, or identifying and quantifying what is becoming the "standard" equipment recommended by contractors and stocked by distributors, may provide insight into a District "baseline" for equipment rebated under this initiative. This information can be used to identify eligible equipment and determine associated rebates.



## 4.7 7520CUST, 7520MARO, AND 7520NEWC CUSTOM SERVICES FOR C&I CUSTOMERS

# 4.7.1 Track description

The C&I Custom Services ("Non-prescriptive") initiative was launched in Q2 of FY2012. The initiative provides a comprehensive set of energy services to owners of typically larger buildings who are replacing old equipment, renovating an existing building, or beginning a new construction project.

The initiative targets building envelope, lighting, and HVAC system -measures. The key features of the incentive structure are to offset the incremental costs of adding more energy efficient equipment (), provide comprehensive technical services, and share the economic effects with the customer. Technical services can include and is not limited to:

- 1. Provide a reality or "sniff" test to vendors' equipment, design, and commissioning claims
- 2. Perform walkthroughs at customer sites and follow up with relevant recommendations that the customer should consider (working with their preferred contractors/vendors) in order to improve energy efficiency at their site
- 3. Develop savings estimates and thus economic effects, based on conservative analysis methodology for implementation of more efficient equipment
- 4. Create an appropriate incentive amount to offset the incremental costs of adding such equipment.

Account Managers recruit large customers into the non-prescriptive tracks. Other projects may come in from sources such as business and trade associations, the General Services Administration, city government, and through trade allies. A DCSEU Project Intake Coordinator assigns projects in KITT to the appropriate track. Energy Consultants (ECs) or Energy Associates (EAs) - then provide technical assistance to customers, determine energy savings, and provide incentive calculations for measures. The ECs conduct a technical savings analysis to determine energy savings metrics (kWh, kW and therms) and determine incentives based on the project savings and DCSEU performance contract spend requirements.. The customer selects the contractor or contractors to complete the project. A follow-up QA/QC inspection is conducted by DCSEU ECs/EAs. Based on the results of the follow-up inspection, the final incentive is determined and paid to the customer.

Description and list of measures included:

- Lighting
- HVAC
- Compressed Air
- Chiller Performance
- Demand-Controlled Ventilation/Economizer
- Energy Recovery Ventilation
- VFD
- Refrigeration Analysis
- New construction



• Other

Table 4-64 provides a summary of initiative metrics since inception. FY2012 and FY2013 reported results include the interactive effects for the installation of energy efficient lighting. FY2014 excludes these effects.

	FY2012	FY2013	FY2014
Metric	Reported Result	Reported Result	Reported Result
7520CUST			
Participants (Units=projects)	39	98	94
kWh savings, meter level	7,836,030	19,751,948	22,818,145
kW savings, meter level	124.7	2,858.8	2,995.8
MMBtu	2,076	65,839	77,878
7520MARO			
Participants (Units=projects)	n/a	4	9
kWh savings, meter level	n/a	636,671	306,634
kW savings, meter level	n/a	55.1	115.2
MMBtu	n/a	0	23,265
7520NEWC			
Participants (Units=projects)	n/a	1	4
kWh savings, meter level	n/a	88,749	1,157,874
kW savings, meter level	n/a	8.8	339.1
MMBtu	n/a	0	2,061

### Table 4-64. Initiative Summary Metrics—7520CUST, 7520MARO, 7520NEWC

The following tables provide a summary of the reported and verified kWh, kW, and MMBtu along with the resulting realization rates.

Table 4-65. FY14 Reported and Verified Results—7520CUST

Metric	Reported	Verified	Realization Rate
kWh	22,818,145	23,349,778	1.02
kW	2,995.8	3,530	1.18
MMBtu	77,878	77,773	1.00

### Table 4-66. FY14 Reported and Verified Results—7520MARO

Metric	Reported	Verified	Realization Rate
kWh	306,634	319,582	1.04
kW	115.2	114.2	0.99
MMBtu	23,265	23,193	1.00



	•		
Metric	Reported	Verified	Realization Rate
kWh	1,157,874	1,157,874	1.00
kW	339.1	141.5	0.42
MMBtu	2,061.4	2,102.3	1.02

### Table 4-67. FY14 Reported and Verified Results—7520NEWC

# 4.7.2 Overall sampling methodology

These initiatives are similar in the methodology for estimating energy savings, so they will be sampled together. There is very wide variability in the energy savings resulting from these initiatives' projects, so the highest-saving projects stratum will again be sampled with certainty (15 projects). This includes all four of the new construction projects. The remainder of projects will be randomly sampled.

Table 4-68. FY14 Population and Sa	ample Summary—7520CUST
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	Project File Evaluation Sample							
Measure	N <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>n</sub>	kW <sub>n</sub>	MMBtu <sub>n</sub>	% kWh	% kW	% MMBtu
Appliances	1	0	0	0.0	0	-	-	-
Cooling	16	6	1,633,168	291.4	0	56.5%	70.5%	-
Fuel Switching	1	0	0	0.0	0	-	-	-
Industrial Process	1	0	0	0.0	0	-	-	-
Lighting	35	9	3,435,693	447.0	0	37.9%	37.2%	-
Motors & Drives	36	11	4,133,492	257.9	0	48.0%	23.4%	-
Other	1	0	0	0.0	0	-	-	-
Plug Load	1	0	0	0.0	0	-	-	-
Space Heating	9	5	0	0.0	45,778	-	-	60.9%
Ventilation	11	4	942,509	73.0	336	46.6%	26.8%	16.1%
Water Heating	5	1	0	0.0	268	-	-	66.3%
Total	117	36	10,144,862	1,069.4	46,382	44.5%	35.7%	59.6%

	Project File Evaluation Sample							
Measure	N <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>n</sub>	kW <sub>n</sub>	MMBtu <sub>n</sub>	% kWh	% kW	% MMBtu
Cooling	4	1	25,813	3.9	0	12.6%	4.2%	-
Lighting	1	1	102,382	23.0	0	100.0%	100.0%	-
Space Heating	6	5	0	0.0	20,880	-	-	97.1%
Water Heating	4	4	0	0.0	1,754	-	-	100.0%
Total	15	11	128,194	26.9	22,634	41.8%	23.3%	97.3%

### Table 4-70. FY14 Population and Sample Summary—7520NEWC

	Project File Evaluation Sample							
Measure	N <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>n</sub>	kW <sub>n</sub>	MMBtu <sub>n</sub>	% kWh	% kW	% MMBtu
Appliances	1	1	20,460	2.4	119	100.0%	100.0%	100.0%
Cooling	1	1	1,059	0.0	0	100.0%	-	-
Lighting	3	1	115,762	10.7	0	64.1%	43.9%	-
Motors & Drives	1	1	599,228	271.4	0	100.0%	100.0%	-
Refrigeration	1	0	0	0.0	0	-	-	-
Space Heating	1	0	0	0.0	0	-	-	-
Ventilation	2	1	4,322	0.8	447	8.4%	12.7%	33.1%
Water Heating	1	1	0	0.0	127	-	-	100.0%
Total	11	6	740,832	285.3	692	64.0%	84.1%	33.6%

## 4.7.3 Process evaluation

Tetra Tech staff conducted an in-depth interview with the DCSEU program leads November 17, 2014 and with the Energy Consultant staff in January to gain a better understanding of the initiative similarities and differences between the three sub-tracks, as well as any opportunities or challenges faced by the initiative and what information from the evaluation would be useful.

In January 2015, in-depth interviews were conducted with four market actors and customers representing 41 participating projects to elicit feedback on their experiences with the DCSEU and the initiatives, including program satisfaction, how they learned of the program, how the decision was made to install program-qualifying equipment, and company characteristics.



Activity	Plan	Actual	Explanation for Variance
Conduct DCSEU staff in- depth Interview	5	4	Interviewed track lead and Energy Consultant staff
Conduct contractor interviews	5	4	Difficulty scheduling participating contractors
Conduct participant surveys	40	41	35 CUST, 4 MARO, 2 NEWC

### Table 4-71. FY14 Process Evaluation Plan versus Actual

## A. Summary of key findings

- Commercial customers are returning to DCSEU for multiple projects. We found that 27 customers accounted for over half of the projects (54), compared with 40 single projects within the evaluation timeframe; some of which had completed projects in previous years.
- A large number of participating locations were office buildings (44 percent), 18 percent hotels, 15 percent universities, 12 percent apartment/condos, with the remainder made up of garages, a church, and a daycare. Overall, 59 percent are open around the clock (24/7). While there are a few small businesses that have participated in the non-prescriptive tracks, 38 percent had between 250-1000 employees and 48 percent occupy buildings between 200,000 to 750,000 square feet. Over half (56 percent) own, 10 percent lease, and 33 percent are managed properties.

## i. Awareness

- Half of the participants learned of the non-prescriptive incentive opportunities from the DCSEU staff (14 of 28). Other key sources of awareness were industry peers (10 of 28), area contractors/retailers (6), and the DCSEU website (4). Due to the wide variety of outreach sources, customers are not always receiving full information on what is available from the DCSEU and both customers and contractors feel like they may not be receiving all the information they could be.
- For the two New Construction projects, the DCSEU became involved in the later phases after the energy efficient equipment was selected. These companies also have policies in place to design and build to higher energy efficiency standards. Therefore, this suggests free-ridership for these cases.
- ii. DCSEU staff interaction
  - One-third of the participants confirmed that they worked with DCSEU staff and all of them found it very helpful.
  - Implementing energy efficiency projects with assistance from the DCSEU has increased the likelihood of participants considering (23 of 28) and installing (20 of 28) energy efficient equipment in the future. In addition, it has increased business' confidence in the financial benefits (21 of 28) and to a degree the nonfinancial benefits (13 of 28) of energy efficient equipment (such as improved comfort, better lighting, higher productivity, etc.).
  - Contractors report good communication with the DCSEU and that staff have been helpful and responsive. One contractor's first source of information is the DSIRE



website<sup>21</sup>, Acknowledging that the DCSEU has had to bring staff on quickly, a couple of contractors thought that the DCSEU staff could use more training, particularly training that is 'vendor neutral' or based on testing facility research.

- iii. Satisfaction
  - Ratings are generally high with means between 3.7 and 4.7 on a 5-point scale<sup>22</sup>. Performance of the new equipment, overall experience with the project, and the amount of time to get the incentive received the highest ratings. The information about DCSEU energy efficiency offerings and the incentive amount had the lowest mean ratings-both just below 3.8.Overall, the 7520CUST and 7520MARO tracks received more 1 and 2 ratings than the other commercial tracks.
  - In general, commercial customers did not feel there was enough information out to the public regarding the incentives available to businesses. Four participants provided dissatisfied (2) ratings. One participant said he has been a property owner in the District for five years and had never heard of the DCSEU incentives.
  - Reasons for lower ratings regarding the incentive amount were due to comparisons that participants were making both in terms of previous participation and participation in other territories. A few respondents mentioned they felt they had received higher incentives in the past and were confused about why they would decrease. Others thought the DCSEU was offering some of the lower incentive amounts compared to neighboring territories. One contractor thought they would complete more projects if the DCSEU offered more incentives for parking garage lighting.

<sup>&</sup>lt;sup>21</sup> DSIRE is the most comprehensive source of information on incentives and policies that support renewables and energy efficiency in the United States. Established in 1995, DSIRE is currently operated by the N.C. Solar Center at N.C. State University, with support from the Interstate Renewable Energy Council, Inc. DSIRE is funded by the U.S. Department of Energy. http://www.dsireusa.org/

<sup>&</sup>lt;sup>22</sup> 1 is not at all satisfied and 5 is extremely satisfied



	75200	CUST / 7520	MARO
Aspect	n <sub>survey</sub>	n <sub>score=5</sub>	Mean rating
The performance of the new equipment	37	27	4.65
Your experience overall	39	22	4.56
The amount of time it took to receive the rebate or financial incentive	38	21	4.37
The technical assistance you received from the DCSEU	29	14	4.28
The assistance from the contractor who installed your equipment	26	9	4.23
The type of eligible equipment	36	11	4.06
The application process	39	14	4.03
The preapproval process, if applicable	28	5	3.93
The information about DCSEU energy efficiency offerings	38	8	3.79
The rebate amount or financial incentive	39	10	3.72

### Table 4-72. Number of Highly Satisfied Ratings (5 Score)

• New construction participants also mentioned that it took a long time to receive the results of DCSEU savings analysis and the amount of funding they would receive. In that span of time the DCSEU incentive and assistance can become less influential as the customer has to make a decision on how to proceed.

### iv. Economic transfer

- Sixty-eight percent of those we interviewed said they have realized savings since participating and 25 percent were unsure. Most of the participants realizing savings from projects will either apply it to operating costs or invest in additional site improvements, some of which may include energy efficiency upgrades. One participant will spend it on charitable contributions and another will use it to delay fee increases. These are indications that the DCSEU initiatives are funding both energy efficiency improvement projects and producing other economic benefits for participating businesses and for the community. We did not specifically ask about job creation as a result of energy savings projects implemented with the DCSEU assistance, but the responses suggest that this could be occurring on some level.
- v. Future plans
  - At the time of the interviews, 22 of 28 had future plans to implement energy efficient improvements in the next 2 years and all of them would consider involving the DCSEU in those future plans..
  - Both New Construction participants we spoke with will likely have additional projects coming up and both of their organizations are increasing the importance of energy efficiency considerations. However, these projects may warrant closer scrutiny to ensure that the DCSEU is influencing the adoption of higher efficiency building and rehabilitation practices and not incentivizing projects that would proceed as-is without the DCSEU support.



# 4.7.4 Net-to-gross methodology and results

### A. Methodology

Self-report surveys were used to assess net-to-gross for this track. See Section 2.5 for detailed descriptions of these batteries. The commercial new construction initiative was not assessed for free-ridership or spillover.

Activity	Plan	Actual	Explanation for Variance
Participant surveys-CUST	35	35	
Participant surveys-MARO	4	4	

<b>Fable 4-73</b> .	FY14	Net-to-gross	Assessment	Evaluation	Plan vs.	Actual

## B. Summary of results

Custom and Market Opportunity tracks were combined for free-ridership analysis. Freeridership is estimated to be about 40 percent. Spillover was not quantified for this initiative as the scale and scope of projects can be difficult to gather during telephone surveys; therefore, this data was gathered as gualitative information. Four respondents (out of 39) indicated that they took additional energy efficiency actions without the DCSEU incentives. Of these six, one respondent indicated that the equipment would have qualified for a DCSEU incentive but that the "cost savings was not worth the effort of applying and there wasn't time to apply as they needed the equipment immediately." This same respondent indicated that they chose to install the higher efficient equipment due to contractor recommendation and their experience with other energy efficiency projects implemented with the DCSEU in one case. Another respondent also indicated that the equipment would have qualified but they chose not to contact the DCSEU because "the DCSEU website stated that rebates were not available." This same respondent was a "zero percent free rider" for a project assigned to the MTV track, and rated the influence of the incentive the DCSEU assistance, and a recommendation from the contractor all 5 on a scale of 1 to 5, where 1 is 'not all influential' and 5 is 'extremely influential'. This indicates that the DCSEU may be influencing the installation of more efficient equipment without the need for incentive payments and that the DCSEU is heightening awareness of District businesses to the benefits of more efficient equipment. Net-to-gross is estimated to be 60 percent or greater.

### C. Drivers net-to-gross results

In these initiatives, there were four respondents who indicated that they would not have completed their projects in whole or in part within the same timeframe without the incentives from the DCSEU, indicating that for these participants, the DCSEU was 100 percent influential in project completions. There were zero 100 percent free riders. However, 35 respondents indicated that they would have completed some portion of their project without DCSEU incentives. When asked to rate influences for the project, previous experience with the DCSEU scored highest at almost 4 on a scale of 1 to 5 where 1 is 'not at all influential' and 5 is 'extremely influential.' The incentive also rated higher at 3.6.



### Table 4-74. Free-ridership Score Distribution (n=39)

Free-ridership Score	0%	1-25%	26-50%	51-75%	76-99%	100%
Respondent Count	4	13	8	13	1	0

## Table 4-75. Free-ridership Influence Scores

Influence Category	n	Mean	Standard Deviation
Previous experience implementing projects through DCSEU	23	3.91	1.311
Incentive or rebate	37	3.59	1.212
Technical assistance received from DCSEU staff	28	2.89	1.197
Recommendation from installation contractor	26	2.85	1.377

Four respondents indicated that they took additional energy efficiency actions since participating in the DCSEU initiative. The additional actions taken or energy efficient equipment installed included HVAC system and operation improvements and LED and other lighting installations.

N <sub>project</sub>	n <sub>survey</sub>	Free- ridership	Spillover	90% Margin Error (±)	Net-to-Gross	Comment
103	39	~40%	>0 percent, although not quantified	10.2%	>~60%	This is between Custom programs in PA (52%) and MD (73%) NTG rates

### Table 4-76. FY14 Net-to-gross Results Summary

# 4.7.5 Impact evaluation

The impact evaluation consisted of a combination of desk audits and onsite verification results in order to cover all of the projects in the sample given the short time frame. Fourteen sites received onsite verifications and an additional 36 projects received file reviews and/or engineering analysis for calculation of the realization rates. Engineering analysis was conducted from the onsite inspection and project file review findings based on the identification of measures with possible calculation methodology shortcomings, questionable key assumptions or incorrect inputs from the available on-site and program documentation evidence.

## A. Impact sampling methodology for onsite measurement and verification

A weighted sampling methodology was applied to the savings values for each project to develop the onsite sample. Out of a total of 107 projects in the programs, 50 were selected for project file reviews, out of which 14 were successfully recruited for onsite verifications. Out of the 50 project file and on-site reviews, 24 individual measure types were identified for an engineering analysis and recalculation of the savings for the ex-post data. The additional measure types without engineering analysis were deemed to have sufficiently documented calculations with reasonable assumptions and accurate inputs to include as 100% realized savings measures.

		Onsite M&V Sample Subset										
Measure	N <sub>measure</sub>	n <sub>onsite</sub>	kWh <sub>onsite</sub>	kW <sub>onsite</sub>	MMBtu <sub>onsite</sub>	% kWh	% kW	% MMBtu				
Appliances	1	0	0	0.0	0	-	-	-				
Cooling	16	1	12,200	0.2	0	0.4%	0.0%	-				
Fuel Switching	1	0	0	0.0	0	-	-	-				
Industrial Process	1	0	0	0.0	0	-	-	-				
Lighting	35	5	902,312	139.4	0	10.0%	11.6%	-				
Motors & Drives	36	4	2,672,915	160.9	0	31.0%	14.6%	-				
Other	1	0	0	0.0	0	-	-	-				
Plug Load	1	0	0	0.0	0	-	-	-				
Space Heating	9	2	0	0.0	3571	-	-	4.7%				
Ventilation	11	1	5,196	1.3	0	0.3%	0.5%	-				
Water Heating	5	1	0	0.0	198	-	-	49.1%				
Total	117	14	3,592,624	301.8	3,769	15.7%	10.1%	4.8%				

### Table 4-77. FY14 Onsite M&V Sample Summary—7520CUST

Table 4-78. FY14 Onsite M&V Sample Summary—7520MARO

	Onsite M&V Sample Subset									
Measure	N <sub>measure</sub>	n <sub>onsite</sub>	kWh <sub>onsite</sub>	kW <sub>onsite</sub>	MMBtu <sub>onsite</sub>	% kWh	% kW	% MMBtu		
Cooling	4	1	25812.6	3.9	0.0	12.6%	4.2%	-		
Lighting	1	1	102381.6	23.0	0.0	100.0%	100.0%	-		
Space Heating	6	2	0	0.0	14980.6	-	-	69.6%		
Water Heating	4	2	0	0.0	517.0	-	-	29.5%		
Total	15	6	128,194	26.9	15,498	41.8%	23.3%	66.6%		

Table 4-79. FY14 Onsite M&V Sample Summary—7520NEWC

		Onsite M&V Sample Subset										
Measure	N <sub>measure</sub>	n <sub>onsite</sub>	kWh <sub>onsite</sub>	kW <sub>onsite</sub>	MMBtu <sub>onsite</sub>	% kWh	% kW	% MMBtu				
Appliances	1	0	0	0.0	0	-	-	-				
Cooling	1	0	0	0.0	0	-	-	-				
Lighting	3	1	136,600	14.3	0	75.7%	58.8%	-				
Motors & Drives	1	0	0	0.0	0	-	-	-				
Refrigeration	1	0	0	0.0	0	-	-	-				
Space Heating	1	0	0	0.0	0	-	-	-				
Ventilation	2	0	0	0.0	0	-	-	-				





Water Heating	1	0	0	0.0	0	-	-	-
Total	11	1	136,600	14.3	-	11.8%	4.2%	-

## B. Verification of impacts

The evaluation team conducted reviews of the engineering algorithms documented by the DCSEU for reasonableness and in accordance with the DCSEU TRM for those measures with valid TRM calculation protocols or assumptions. For measures without valid TRM protocols, a review of the custom calculations was conducted.

	kWh				kW		MMBtu			
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	
Appliances	951	951	1.00	0.1	0.1	1.00	1	1	1.00	
Cooling	2,888,678	2,793,476	0.97	413.3	435.0	1.05	0	0	1.00	
Fuel Switching	0	0	1.00	0.0	0.0	1.00	97	97	1.00	
Industrial Process	134,858	134,858	1.00	0.0	0.0	1.00	0	0	1.00	
Lighting	9,062,838	8,838,333	0.98	1,201.3	1,227.7	1.02	0	0	1.00	
Motors & Drives	8,618,384	9,469,725	1.10	1,100.7	1,587.1	1.44	44	44	1.00	
Other	0	0	1.00	0.0	0.0	1.00	41	41	1.00	
Plug Load	91,356	91,356	1.00	8.0	8.0	1.00	0	0	1.00	
Space Heating	0	0	1.00	0.0	0.0	1.00	75,202	75,202	1.00	
Ventilation	2,021,080	2,021,080	1.00	272.5	272.5	1.00	2,088	2,088	1.00	
Water Heating	0	0	1.00	0.0	0.0	1.00	404	299	0.74	
Track total	22,818,145	23,349,778	1.02	2,995.8	3,530	1.18	77,878	77,773	1.00	
Relative Precision at 90% Confidence	1.64%			0.11%			0.00%			

## Table 4-80. FY14 Summary of Impact Evaluation Results—7520CUST

### Table 4-81. FY14 Summary of Impact Evaluation Results—7520MARO

	kWh				kW		MMBtu		
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR
Cooling	204,252	204,252	1.00	92.2	92.2	1.00	0	0	0.00
Lighting	102,382	115,330	1.13	23.0	22.0	0.96	0	0	0.00
Space Heating	0	0	0.00	0.0	0.0	0.00	21,511	21,499	1.00
Water Heating	0	0	0.00	0.0	0.0	0.00	1,754	1,694	0.97
Track Total	306,634	319,582	1.04	115.2	114.2	0.99	23,265	23,193	1.00
Relative Precision at 90% Confidence		17.7%			30.3%			0.00%	

## 4. Track Evaluation Reports

		kWh			kW		MMBtu		
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR
Appliances	20,460	20,460	1.00	2.4	2.4	1.00	118	118	1.00
Cooling	1,059	1,059	1.00	0.0	0.0	0.00	0	0	0.00
Lighting	180,466	180,466	1.00	24.3	24.3	1.00	0	0	0.00
Motors & Drives	599,228	599,228	1.00	271.4	73.7	0.27	0	0	0.00
Refrigeration	84,000	84,000	1.00	9.6	9.6	1.00	0	0	0.00
Space Heating	221,174	221,174	1.00	25.2	25.2	1.00	466	466	1.00
Ventilation	51,486	51,486	1.00	6.2	6.2	1.00	1,350	1,350	1.00
Water Heating	0	0	0.00	0.0	0.0	0.00	127	168	1.32
Track Total	1,157,874	1,157,874	1.00	339.1	141.5	0.42	2,061	2,102	1.02
Relative Precision at 90% Confidence		19.8%			22.2%			6.65%	

### Table 4-82. FY14 Summary of Impact Evaluation Results—7520NEWC

C. Impact evaluation planned activities and completed activities comparison

Table 4-83. Impact Evaluation Plan vs. Actual

Activity	Plan	Actual	Explanation for Variance
Conduct project file reviews	50	50	
Conduct engineering analysis	25	24	24 individual measure types from the 50 project file reviews received engineering analysis
Conduct onsite verification	10	14	CUST/MARO/NEWC were oversampled due to the number of measures
Conduct onsite metering	5	5	

D. Summary of key findings describing adjustments to ex-ante savings

- For projects with bin analysis, a summer demand period bin analysis was conducted for the ex-post savings, which increased savings in most cases.
- In some instances, the proposed fixture input power was adjusted in the verified savings calculations due to different nominal lamp wattage, ballast factor, or the number of lamps per fixture.
- For one project, monitoring of the chiller demand and correlating to ambient temperature led to a recalculation of the bin analysis.
- For another project, load factors were calculated from handheld readings taken during an on-site visit.
- In many cases, NEMA premium efficiency ratings were used in VFD calculations while the ex-post calculations used the actual motor efficiencies from the nameplates.





- A combined space and water heating project was found to have used the total gas use for the building as the basis for the space heating savings and in the ex-post analysis the water heating load was subtracted out. This was a minor adjustment.
- Some of the water heater baseline efficiencies appeared to be incorrectly categorized during the ex-ante analysis. Of the three discrepancies, one resulted in increased savings and two resulted in decreased savings.
- For one project, a spreadsheet error led to a large under calculation of the ex-ante savings. The error was the main driver in the RR being above 1.0 for the 7520CUST track.

# 4.7.6 Recommendations

- A. To improve program design, operations, customer experience, and recruitment
- i. In order to better establish the DCSEU staff as trusted "energy advisors," consider branding as such on business cards and other forms of marketing. As most of the customers come in through the PIC, that individual could utilize the term Energy Advisor when describing who customers will be working with.
- B. To improve impact evaluation results
  - i. During QA/QC, document the differences between what is found during the onsite inspection and/or other project documentation. The QA/QC process seems to focus on counts of measures and less about the key inputs into each of those measures. The simplified, often handwritten, checklist of items does not give the same rich detail as a report documenting potential differences found on-site, and how those differences were handled in calculation adjustments. For instance, many VFD projects had pictures of motor nameplate efficiencies; however, these were not used to recalculate the energy savings for the project, despite being a key input to the savings models.
  - ii. **Provide clear documentation for the savings calculations on lighting projects.** Since the ex-ante savings come from a database calculation algorithm, it was very difficult in many cases to follow the calculations for individual line items from the available ex-ante documents. Similarly, many of the variations in demand could not be tracked through the CAT or supporting files and the reasons for those variances is therefore unknown.
  - iii. Use supplemental data to validate key energy savings assumptions. There were 2 large ventilation projects that represented 4% of the overall energy savings in the 7520CUST program. The larger of the projects assumed an 85% reduction in fan operation due to the carbon monoxide monitoring, which may be valid given a review of available studies. However, we would caution against granting such large incentives and savings values without reviewing the baseline energy use against the historical utility data for the building.
  - iv. Use a consistent approach for demand and energy savings. For projects using a bin analysis approach for energy savings, conducting a summer demand period bin



analysis for the demand reduction would be more accurate than using loadshape factors based on connected load reduction.

- C. Net-to-gross assessment
  - i. Continue to work closely with prospective customers to identify DCSEU opportunities to influence project scope for greater energy savings beyond what customers are already planning. Ensure that project incentives align with the DCSEU-influenced project scope, and ensure documentation and tracking identifies the components of the project attributable to the DCSEU, along with the scope of work not attributable.



# 4.8 7610ICDI LI MF IMPLEMENTATION CONTRACTOR DIRECT INSTALL

# 4.8.1 Track description

The Low Income Multi Family (LIMF) Implementation Contractor Direct Install (ICDI) initiative provides specific services and products to LIMF community residents of the District of Columbia. The initiative is promoted to property owners, property managers, developers, architects, and engineers and is designed to serve a wide variety of energy efficiency needs. The ICDI program, initially launched as the Property Manager Direct Install (PMDI) program in April of 2012, covers 100 percent of the costs (products and direct installation) and hires implementation contractors to perform the direct installation instead of the property managers.

The track also covers the replacement of fixtures inside rental units of qualifying low income multi-family residential buildings. Multi-family residential buildings that do not qualify as low income can still have common space fixtures incented under the program.

Once there is an interested party and eligibility for the program has been confirmed, the DCSEU evaluation team assesses the site and provides recommendations. After three-party agreements (between DCSEU, Contractor, and Owner) have been signed, the implementation contractors start the project and install the products. Through the LIMF ICDI initiative all spaces in a building can be served, including common areas and individual residential units.

The initiative's products include:

- LED bulb replacement in property-owned fixtures
- CFL replacement in resident-owned fixtures
- Upgraded water-saving shower head replacement
- Low-flow faucet aerator replacement
- Pipe wrap
- Hot water heater tank wrap (electric only)
- Window AC units Energy Star® \*certain restrictions apply
- Exterior lighting; wall packs and parking lot lighting
- Lighting controls.

During implementation, the DCSEU performs QA/QC on 100% of the projects, visiting a representative sample of the total number of units in a project (30 units maximum per property or 20 percent of the total, whichever is lower).

Table 4-84 provides a summary of initiative metrics since inception. FY2012 and FY2013 reported results include the interactive effects for the installation of energy efficient lighting. FY2014 excludes these effects.


	FY2012	FY2013	FY2014	
Metric	Reported Result	Reported Result	Reported Result	
Participants (Units=projects)	23	26	59	
kWh savings, meter level	1,007,783	1,187,537	1,705,554	
kW savings, meter level	113.5	124.0	209.2	
MMBtu	865	418	2,410	

## Table 4-84. Initiative Summary Metrics—7610ICDI

Table 4-85 provides a summary of the reported and verified kWh, kW, and MMBtu along with the resulting realization rates.

Table 4-85	. FY14 Reported	and Verified	Results—7610ICDI
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Metric	Reported	Verified	Realization Rate
kWh	1,705,554	1,690,239	0.99
kW	209.2	156.2	0.75
MMBtu	2,410	1,870	0.78

# 4.8.2 Overall sampling methodology

This track primarily includes two types of measures (lighting and water-saving devices).<sup>23</sup> Therefore, we sample the top ten percent of electricity- and gas-saving projects to ensure that we account for a sufficient proportion of program savings. This results in 10 projects sampled with certainty from the high energy savings stratum and 25 sampled randomly from the all other savings stratum.

<sup>&</sup>lt;sup>23</sup> One project also included cooling and space heating. This project was a low contributor to the track level savings and was not sampled.

Tuble - continue opination and cample cuminary reference											
		Project File Evaluation Sample									
						%	%	%			
End-use	<b>N</b> <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>n</sub>	kWn	MMBtu <sub>n</sub>	kWh	kW	MMBtu			
Cooling	1	0	0	0.0	0	-	-	-			
Lighting	57	34	1,195,348	165.9	0	77.8%	83.3%	-			
Space Heating	1	0	0	0.0	0	-	-	-			
Water Heating	46	28	152,226	9.1	1,692	94.4%	96.2%	73.7%			
Total	105	62	1,347,573	175.0	1,692	79.0%	83.7%	70.2%			

## Table 4-86. FY14 Population and Sample Summary—7610ICDI

# 4.8.3 **Process evaluation**

The evaluation team activities included in-depth interviews with the DCSEU program manager and interviews with contractors and participants.

The interview with the DCSEU program manager was conducted in January 2015. The purpose was to understand the changes in implementation and to update the logic model.

The team also conducted interviews with contractors and participating facility owners or managers. The goal of the contractor interviews was to learn how the initiative operates from their perspective and to identify potential areas of improvement and document aspects that are working well. The purpose of the participant interviews was to gather satisfaction levels with different program aspects, along with the equipment they received, and to see if their current or future actions will change as a result of participating.

Activity	Plan	Actual	Explanation for Variance
Conduct DCSEU staff in-depth Interview	1	1	
Conduct contractor interviews	10	2	There were only six contractors that participated in the ICDI track. We reached out all of them and only 2 agreed to participate.
Conduct participant phone surveys	15	10	There were only 28 participants in the ICDI track. We reached out to all that listed contact information and 10 agreed to participate.

## Table 4-87. FY14 Process Evaluation Plan vs. Actual

## A. Summary of key findings

Below we present key findings from the FY2014 results process evaluation activities. Due to the small number of completed interviews, these findings should be viewed qualitatively.



- i. Participating Facility Owners and Managers
  - The decision makers for participating were primarily property managers not owners. Eight of the ten participants were property managers. Only two were owners with one of those two being a low income community provider.
  - Participants plan to work with the DCSEU for other properties. Of the eight participants that were asked all of them said they plan to work with the DCSEU on future projects.
  - Email was the preferred method of contact for program information. All participants said they prefer to receive program information from the DCSEU by email. One indicated they would like a personal follow up after the email is sent.
  - Completing paperwork for determining eligibility was not an issue for participants and obtaining tenant buy-in was not difficult. Only one participant said they had some initial difficulty completing the paperwork to determine if they were eligible. The reason stated was that it was difficult for them to get the tenant income information. This same participant struggled to get tenant buy-in for the project. The tenants wanted to know what kind of savings they would receive if they participated and that was not something the property manager could answer.
  - Not knowing what the potential energy savings from project implementation was cited as the only barrier to participation. One property manager had to obtain buy-in from their supervisor and the supervisor wanted to know what sort of energy savings they would see if they were to participate. None of the other participants reported any barriers to participation.
  - Water saving measures were the most likely measure to be turned down for installation. Four of the ten participants turned down the installation of showerheads or aerators. One stated they were concerned about the showerhead type for their tenants from a satisfaction standpoint so they declined those measures and the three other participants refused installation because they already were participating in a water conservation program and had water saving measures already installed.
  - Bulb failure is cited as the only reason for removal of installed measures. Two participants reported having bulb failure as a reason for removal but also said the bulbs were replaced by the contractor at no charge. All other participants said all measures installed are still installed and operating.
  - Overall program satisfaction is high among all participants. When asked to rate their satisfaction on a scale of 0 to 10, where 0 is very dissatisfied and 10 is very satisfied, all ten participants gave a rating higher than six. Almost half (n=4) gave it a rating of nine or ten.

Table 4-88 shows the ratings of various program aspects.

	Total (n)	Rating 1 to 5 (n)	Rating 6 to 8 (n)	Rating >8 (n)
Type of equipment eligible for the program	10	0	5	5
Interactions with DCSEU staff (if applicable)	9	0	4	5
Contractor who installed the equipment	10	1 (contractor went too fast, rushed things)	3	6
Performance of the new equipment	10	1 (performance issues with showerheads and LED failures)	3	6
Information provided about the program	10	1 (would like energy educational packets for tenants)	5	4
The program overall	10	0	6	4

#### Table 4-88. Satisfaction Levels with Program Aspects

#### ii. Participating Contractors

- Contractors would like more information on program budgets and spend ability. Both
  of the contractors interviewed said it was hard to propose projects to clients because
  they did not know how much they could sell. They did not want to promise work that
  may not be able to be done. Both said they really like the DCSEU initiative and it does
  help their business but they could risk their client relationships if they make promises
  that they may not be able to keep.
- Contractors absorb a lot of upfront costs which can be difficult for larger projects. Contractors have limited stock space so they order most of the materials as they are needed but then they have to wait for installation and an approved QA to get reimbursed which is generally at least a month. It is not until then when they can pay their supplier. One reported having to absorb \$6,000 in late fees over the course of the year because of the payment turnaround time.
- The process for submitting paperwork for contractors has been difficult at times. One contractor said the project workbook has errors in it so they are forced to create their own spreadsheet to track project details, then it is entered again into the DCSEU project workbook where they can then verify the numbers are correct. The other contractor felt the use of email as a means to implement a project can sometimes be difficult to manage. Having multiple points of contact with multiple documents being sent through email created a concern for something falling through the cracks. And extra time was needed to track the process so that does not happen. Both contractors have had experience with other utility programs where an interactive database was used instead and they both stated that was easier to use and less work for them.
- Overall program satisfaction with contractors has room for improvement. When asked to rate the program overall on a scale of 1 to 5 where 1 means very dissatisfied and 5 means extremely satisfied, both contractors gave a 3 to 3.5 rating.



# 4.8.4 Net-to-gross methodology and results

## A. Methodology

A net-to-gross study was not conducted for this initiative.

## B. Summary of results

#### Table 4-89. FY14 Net-to-gross Results Summary

End Use	N	n	Population kWh	Free- ridership	90% Margin Error (±)	Like Spillover	90% Margin Error (±)	Net-to- Gross
Not applicable								
Total								

## C. Drivers net-to-gross results

Not applicable.

## 4.8.5 Impact evaluation

The impact evaluation effort for this track included onsite measure installation, verification, and desk audits to verify KITT reports for measures and calculations and to confirm these were supported by onsite efforts and project file information such as internal desk reviews, QA/QC reports, calculators/calculation methods, and applications or incentive agreements. Desk reviews also check the veracity of the deemed values and user inputs for measures, to inform the onsite data collection plans, and to identify any issues to be addressed.

## A. Impact sampling methodology for onsite measurement and verification

The selection of onsite visits was based upon availability of property facility managers during onsite measurement timeframe. Fewer onsite verification efforts were conducted than originally planned due to the availability of participants.



	Onsite M&V Sample Subset									
						%	%	%		
Measure	N <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>onsite</sub>	<b>kW</b> onsite	MMBtu <sub>onsite</sub>	kWh	kW	MMBtu		
Cooling	1	0	0	0.0	0	-	-	-		
Lighting	57	11	618,457	64.9	0	40.3%	32.6%	-		
Space Heating	1	0	0	0.0	0	-	-	-		
Water Heating	46	9	0	0.0	863	-	-	37.6%		
Total	105	20	618,457	64.9	863	36.3%	31.0%	35.8%		

## Table 4-90. FY14 Onsite M&V Sample Summary

## B. Verification of impacts

For the desk review, the evaluation team reviewed the project file documents uploaded to Tetra Tech's Attunity MFT Web Client by the VEIC Evaluation. In particular, the project files most critical and utilized for the evaluation were mostly located in the 'Agreement', 'Desk Review' and 'QAQC' "project folders. Data was most commonly found in the 'Desk Review' Excel file on the 'Audit', 'QA Desk Review' and 'Workbook' tabs. Measure information within these Excel files were compared to the KITT reported quantities by measure type. The evaluation team also spot-checked QA/QC forms and other various project data and information such as the application and direct install worksheets. The folder titled 'Agreement', which contained files for applications and income verification, contained files for all projects. However, some files did not contain all information necessary for the evaluation team to verify major measure inputs (e.g., space heating fuel type and DHW heating fuel type). Most projects included multiple end uses (lighting and hot water heating) and multiple deemed calculation methodologies for each end use. The desk reviews included a review of all reported measures, savings calculations, user input data and/or TRM assumptions.

For the onsite verification, the evaluation team attempted to verify the installation of the measures listed in the KITT file. However, it was not possible to visit every occupied unit within the facilities, so a sample of units were reviewed. If a site had common area installed measures (e.g. common area lighting, central boilers, central hot water heaters), then the onsite verification typically reviewed a census of those measures. The onsite verification information was primarily used to inform the evaluation process in general and to confirm major algorithm inputs such as space heating fuel type and DHW heating fuel type, as well as common area installations of lighting measures, which were used to establish realization rates.

	kWh			kW				MMBtu		
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex- ante Gross	Ex- post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	
Cooling	5,230	5,230	1.00	0.6	0.6	1.00	0	0	0.00	
Lighting	1,536,047	1,463,717	0.95	199.1	143.6	0.72	0	0	0.00	
Space Heating	2,997	2,997	1.00	0.0	0.0	0.00	114	114	1.00	
Water Heating	161,280	218,295	1.35	9.4	11.9	1.27	2,297	1,757	0.76	
Track Total	1,705,554	1,690,239	0.99	209.2	156.2	0.75	2,410	1,870	0.78	
Relative Precision at 90% Confidence	1.61%			5.29%			9.60%			

## Table 4-91. FY14 Summary of Impact Evaluation Results

C. Impact evaluation planned activities and completed activities comparison

Table 4	4-92. FY	14 Impac	t Evaluation	Plan vs.	Actual

Activity	Plan	Actual	Explanation for Variance
Conduct Desk audits	35	35	
Conduct onsite verification	15	11	Onsite verifications were not producing different results across those sites visits

D. Summary of key findings describing adjustments to ex-ante savings

# i. Crosscutting

- The project folders showed much improvement from last year. Subfolders were organized including consistent sub folder naming, which made locating files necessary for the evaluation. Another improvement was older versions were contained within an 'Archive' sub folder, which made it easier to locate and identify the final document versions used to support the reported savings.
- The assumptions made to generate savings values for the projects implemented through this track often underestimated or overestimated savings. This was due to most lighting measures assumed to be installations with "unknown" heating type, while all faucet aerators were assumed to be bathroom installations.
- Necessary documentation of key savings inputs, such as fuel type (heating and water heating) was greatly improved upon from last year's documentation. This information was available from about two thirds of project files as compared to most all projects from last year. Most sites with water savings measures utilized the known water heating fuel type. However, a default assumption of unknown heating fuel type was still utilized by most of the lighting measures.
- As the fuel type (heating and water heating) was absent from about one third of project files, the on-site verification process was relied upon to determine these sites savings impacts.



## ii. Lighting measures:

- The decrease in kWh and most of the decrease in kW for lighting measures were mostly driven from the evaluation removing interactive effects that were not removed in reported savings. Additionally the reductions in kW were driven by updates to two projects that had large kW savings components for LED measures. These projects seem to be using custom factors that were not verified from project documentation and therefore the evaluation used deemed TRM values and assumptions that resulted in these additional impacts to the kW savings.
- An observation made during the evaluation included what appears to be the use of a default savings value of "Unknown" heat type for all lighting measures. The "Unknown" heat type is not a conservative approach. Even though the space heat type was provided within a good portion of the sites' project documentation (the application in particular), most projects assumed the "Unknown" heat type. For 21 of 28 evaluated projects with interior lighting measures, corrections were made to the site heating fuel type during the evaluation. There were multiple projects, though, that did not have documentation to confirm the sites heating fuel type. For these seven sites, the evaluation team did not adjust fuel type to calculate verified savings.
- For some projects, the review of project files and/or the onsite verification process determined that some lighting measures were installed in common areas. This necessitated a change in savings algorithms for these measures as those measures assumed to be "In-unit" installations were confirmed as "Common Area" installations. The evaluation team, in some cases, was able to confirm whether these measures were installed in areas with high usage (hallways, stairwells, etc.) or low usage (maintenance rooms, kitchens, etc.).
- Four projects evaluated had fluorescent fixture retrofits either within the common areas, in-unit apartments or both. All fluorescent fixtures utilized custom hours of use. These hours were clearly marked in the T12 audit form within the projects CAT file. These hours were utilized by the evaluation team, however, no other documentation or explanation was provided to indicate how these hours were developed.
- iii. Water Heating Measures:
  - The increases in kWh and kW and approximately half the decrease in MMBtu for water heating measures were mostly driven by correcting the hot water system heating fuel type (from 'Fossil Fuel' to 'Electric') for four projects. The other half of the impact to the MMBtu decrease was driven by correcting the location for 45 percent of the aerators (i.e., from "bath" to "kitchen" areas).
  - As discussed above, an observation made during the evaluation included the use of a default savings value of the "bath" apartment location for all faucet aerator measures. The "bath" location selection is not the most conservative approach. In addition, the 'Audit' and 'QA Desk Review' tabs of the desk review Excel file accounted for differences between locations of installation. All sites included this documentation detail, therefore such corrections were made during the evaluation.
  - Four project sites were corrected for DHW heating fuel type from the details within the application provided. There were a few projects though, that did not have an application, the DHW fuel type was not selected, there was not sufficient detail within the application to determine water heating fuel type and did not receive an onsite survey. For these sites, the evaluation team did not adjust fuel type to calculate verified savings.

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# 4.8.6 Recommendations

- A. To improve design, operations, customer experience, and recruitment
- i. Use an interactive database open to property owners/managers and contractors to document and track projects. Contractors cited this as being the most difficult and time consuming part of the program. Using an interactive database would allow data entry control, log progress of the project, and provide a secure means to transfer information back and forth between the DCSEU and contractors.
- ii. **Review project application tools to ensure they operate correctly.** Contractors mentioned that there are errors in the DCSEU provided Excel workbooks.
- B. To improve impact evaluation results
- i. **Modify project application to include both the space and water heating fuel types and verify during QA inspection.** The evaluation found an improvement over last year in the level of detail captured for the space heating and DHW heating systems within project documentation (e.g., application, desk review file). However, approximately, 20 percent did not. The application was revised to capture this detail for FY14; however, only for the DHW system. The heating system fuel type is not requested. Also, the backup fuel type for solar hot water systems is necessary too. As all of the measures installed through this track require the input of fuel type (e.g., gas, electric, heat pump, solar) in order to calculate savings through their prescribed algorithms, this information is crucial for accurate estimation of savings.
- ii. **Use site specific information to inform reported savings.** Several adjustments to hot water fuel type were made based upon evaluation team onsite verification efforts. Additionally, faucet aerators were assumed to be installed in all 'bath' locations, when about half are installed in 'kitchen' locations. These issues were found during the FY13 results evaluation effort as well.
- iii. **To ease both project development and evaluation efforts, use deemed TRM assumptions for all fluorescent lighting retrofits.** All fluorescent lighting projects evaluated in PY2014 utilized custom versus deemed TRM assumptions. This takes additional time and effort. The deemed approach offers numerous efficiencies.
- iv. Provide an explanation for why measures described within project documentation but were not passed during the QA process may allow for the potential of more eligible savings. An example includes additional exterior lighting retrofits, which was identified within all project documentation. No notes were provided to explain their omission within the final project KITT savings. Therefore, it was unclear whether this omission was purposeful or erroneous.
- C. Net-to-gross assessment
- i. Not applicable.



# 4.9 7610LICP AND 7612LICP LI MF COMPREHENSIVE EFFICIENCY IMPROVEMENTS

# 4.9.1 Track description

This initiative, launched near the end of February 2012, is designed to serve low-income multifamily housing, specifically new construction, substantial renovation, and redevelopment housing. Each project is independently evaluated and specific energy conservation measures (ECM) are chosen depending on the project's needs. Some of these ECMs will include measures affecting the thermal envelope (air and thermal barriers, doors, and windows), domestic hot water systems, in-unit and common area lighting, appliances, and controls.

Description and list of measures included:

- Heating, ventilation, air conditioning (HVAC), and domestic hot water systems
- Solar thermal hot water heating systems for gas heated central hot water systems
- Major appliances, such as refrigerators and laundry equipment
- Lighting (in-unit and common area lighting)
- Building air and thermal barriers, doors, and windows.

The initiative works with developers and owners of low-income multifamily projects who are constructing, redeveloping, or rehabilitating affordable housing projects. To be eligible for participation, multifamily projects must meet the following criteria:

- Be located in the District of Columbia
- Be in the design or planning stage of a new construction or substantial rehabilitation development
- Be able to document that at least 66 percent of the residential units per building are designated for or inhabited by households with incomes at or below 60 percent Area Median Income
- Have substantial funding commitments in place.

Table 4-93 provides a summary of initiative metrics since inception. FY2012 and FY2013 reported results include the interactive effects for the installation of energy efficient lighting. FY2014 excludes these effects.



#### Table 4-93. Initiative Summary Metrics—7610LICP, 7612LICP

	FY2012	FY2013	FY2014
Metric	Reported Result	Reported Result	Reported Result
7620LICP			
Participants (Units=projects)	5	10	19
kWh savings, meter level	773,711	1,959,041	814,246
kW savings, meter level	99.4	184.3	109.4
MMBtu	1,139	6,200	20,981

Table 4-94 provides a summary of the reported and verified kWh, kW, and MMBtu along with the resulting realization rates.

Metric	Reported	Verified	Realization Rate
kWh	814,246	811,473	1.00
kW	109.4	109.7	1.00
MMBtu	20,981	20,984	1.00

Table 4-94. FY14 Reported and Verified Results—7610LICP, 7612LICP

# 4.9.2 Overall sampling methodology

The Low Income Multifamily Comprehensive track includes a wide variety of installed measure types. Three projects had particularly high savings and will be sampled with certainty. The remaining seven projects will be randomly sampled.

	Project File Evaluation Sample									
End-use	N <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>n</sub>	kW <sub>n</sub>	MMBtu <sub>n</sub>	% kWh	% kW	% MMBtu		
Appliances	7	4	73,744	3.2	478.4	90.2%	77.4%	94.5%		
Building Shell	5	3	7,704	6.4	466	48.2%	87.4%	91.7%		
Cooling	9	4	94,427	20.2	0	65.6%	66.3%	-		
Fuel Switching	1	0	0	-	0	-	-	-		
Lighting	6	3	188,378	19.9	0	82.1%	83.5%	-		
Motors & Drives	1	1	3,025	-	0	100.0%	-	-		
Other	2	0	0	-	0	-	-	-		
Plug Load	2	1	120	0.0	0	6.1%	21.1%	-		
Refrigeration	7	4	34,894	29.5	0	64.5%	92.1%	-		
Space Heating	12	6	177,147	-	15,946	95.8%	-	93.4%		
Ventilation	5	3	44,494	3.8	0	89.7%	76.1%	-		
Water Heating	12	8	2,358	0.1	2,656	100.0%	100.0%	89.7%		
Total	69	37	626,290	83.2	19,547	76.9%	76.0%	93.2%		

#### Table 4-95. FY14 Population and Sample Summary—7610LICP, 7612LICP

# 4.9.3 **Process evaluation**

The evaluation activities included in-depth interviews with the DCSEU program manager and interviews with contractors and participants.

The interview with the DCSEU staff was conducted in January 2015. The purpose was to understand the changes in implementation, update the logic model, and identify key researchable issues.

The team also conducted interviews with a contractor and participating facility managers or owners. The goal of the contractor interview was to learn how the program operates from their perspective and to identify potential areas of improvement and document aspects that are working well. The purpose of the participant interviews was to gather satisfaction levels with different program aspects along with the equipment they received, their decision to participate, and to see if their current or future actions will change as a result of participating.

Activity	Plan	Actual	Explanation for Variance
Conduct DCSEU staff in-depth Interview	1	1	
Conduct contractor interviews	10	1	There were only two contractors that participated in the LICP track; 1 agreed to participate in the interview.
Conduct participant surveys	10	3	There were only 11 participants in the LICP track; 3 agreed to participate in the interview.

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# A. Summary of key findings

Below we present key findings from the FY2015 process evaluation activities. Due to the small number of completed interviews, these findings should be viewed qualitatively.

- The initiative is allowing property managers and owners to install better systems and equipment than they would normally install within their budget. One owner said they would be doing the project they are doing regardless but the initiative incentives allows them to increase the energy efficiency of the equipment without having to spend more. This could be an indication of free-ridership; however, a full free-ridership battery was not conducted for this initiative; this finding is offered as an early-warning indicator only given small sample.
- Participating facility managers/owners would like more transparency in the process of determining incentive amounts. Two of the three participants we spoke with stated they would like to understand how the incentive amounts are calculated. They were both skeptical of the process and stated they would like to be shown the details.
- One contractor felt he lacked direction on proceeding with the program upon sign up. The contractor we spoke to said he only recently signed on to the program (although the tracking data indicates that he participated in a project in FY14, the contractor did not understand that it was through this initiative). He was invited to, and attended, an introductory meeting where one slide mentioned the LICP track but did not show the details of the program, such as incentive amounts. The contractor felt he lacked direction on what to do next to begin participating in the program and had a number of questions.
- Overall program satisfaction is high among all participants. When asked to rate their satisfaction on a scale of 0 to 10, where 0 is very dissatisfied and 10 is very satisfied, two of the three gave a rating of 9. The third, which was not asked the scale question, stated, "We really enjoy working with DCSEU and receive a huge benefit from our partnership". Two participants also gave a rating of 9 when asked how satisfied they were with the type of equipment eligible for the program. The third was not asked the scale question.

# 4.9.4 Net-to-gross methodology and results

## A. Methodology

A net-to-gross study was not conducted for this initiative.

## Table 4-97. FY14 Net-to-gross Assessment Evaluation Plan vs. Actual

Activity	Plan	Actual	Explanation for Variance
Not applicable			

## B. Summary of results

Not applicable.



End Use	N	n	Population kWh	Free- ridership	90% Margin Error (±)	Like Spillover	90% Margin Error (±)	Net-to- Gross	
Not applicable									
Total									

## Table 4-98. FY14 Net-to-gross Results Summary

# C. Drivers net-to-gross results

Not applicable.

# 4.9.5 Impact evaluation

The impact evaluation effort for this track included onsite measure installation verification and desk audits to verify KITT reports for measures and calculations and to confirm these were supported by onsite efforts and project file information such as QA/QC reports, external calculators/calculation methods, and applications or incentive agreements. Desk reviews also check the veracity of the deemed values and user inputs for measures, to inform the on-site data collection plans, and to identify any issues to be addressed.

## A. Impact sampling methodology for onsite measurement and verification

The Low Income Multifamily Comprehensive track includes a wide variety of measures with 19 projects in FY2014 each installing a variety of major end-use types. Onsite samples for this track were identified and completed in conjunction with onsite verification efforts for multi-track participates.

	Project File Evaluation Sample									
End-use	N <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>n</sub>	kW <sub>n</sub>	MMBtu <sub>n</sub>	% kWh	% kW	% MMBtu		
Appliances	7	0	-	0.0	0.0	-	-	-		
Building Shell	5	0	-	0.0	0.0	-	-	-		
Cooling	9	0	-	0.0	0.0	-	-	-		
Fuel Switching	1	0	-	0.0	0.0	-	-	-		
Lighting	6	0	-	0.0	0.0	-	-	-		
Motors & Drives	1	1	-	0.0	0.0	-	-	-		
Other	2	0	-	0.0	0.0	-	-	-		
Plug Load	2	0	-	0.0	0.0	-	-	-		
Refrigeration	7	0	-	0.0	0.0	-	-	-		
Space Heating	12	3	-	0.0	6,970	-	-	40.8%		
Ventilation	5	0	-	0.0	0.0	-	-	-		
Water Heating	12	3	-	0.0	164	-	-	5.5%		
Total	69	7	-	-	7,134	-	-	34.0%		

## Table 4-99. FY14 Onsite M&V Sample Summary

## B. Verification of Impacts

For the desk review, the evaluation team reviewed the project file documents uploaded to Tetra Tech's Attunity MFT Web Client by the VEIC Evaluation group. In particular, the project files most critical and utilized for the evaluation were the CAT Excel files located in the "CAT Analysis" project folder. Data was most commonly found within the "Review" worksheet and compared to the KITT reported quantities by measure type. The evaluation team also reviewed all external calculators and calculation methodologies referenced in the within the "Overview" tab of the CAT file. Other critical files reviewed included the project application, spot-checks of equipment specifications, and other various project data and information available. The evaluation team was able to verify major measure inputs (e.g., space and DHW heating fuel types) from the CAT as that space and water heating equipment was typically a retrofit measure itself for all sites. Most 7610 LICP projects included both a space and water heating retrofit using custom assumptions and deemed or custom calculation methodologies. Most 7612 LICP projects included multiple end uses (e.g., lighting, heating, cooling, and appliances) and multiple deemed and/or custom calculation methodologies for each end-use. The desk reviews included a review of all reported measures, savings calculations, user input data, and/or TRM assumptions.

For the onsite verification, the evaluation team attempted to verify the installation of the measures listed in the KITT file. As the measures reviewed during the onsite surveys were part of central systems and located within common area/maintenance rooms, the onsite team was able to verify a census of the equipment. The onsite verification information was primarily used to inform the evaluation process in general and to confirm major algorithm inputs such as equipment capacity and efficiency, which were used to establish realization rates.

				, ,					
	kWh			kW			MMBtu		
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR
Appliances	81,725	81,725	1.00	4.2	4.2	1.00	506	506	1.00
Building Shell	15,986	15,986	1.00	7.3	7.3	1.00	508	508	1.00
Cooling	143,857	143,857	1.00	30.4	30.4	1.00	-	-	0.00
Fuel Switching	16,620	16,620	1.00	3.2	3.2	1.00	(64)	(64)	1.00
Lighting	229,536	229,789	1.00	23.8	24.0	1.01	-	-	0.00
Motors & Drives	3,025	0	0.00	0.0	0.0	0.00	-	-	0.00
Other	30,598	30,598	1.00	3.2	3.2	1.00	-	-	0.00
Plug Load	1,962	1,962	1.00	0.2	0.2	1.00	-	-	0.00
Refrigeration	54,064	54,064	1.00	32.0	32.0	1.00	-	-	0.00
Space Heating	184,913	184,913	1.00	0.0	0.0	0.00	17,070	17,073	1.00
Ventilation	49,602	49,602	1.00	5.1	5.1	1.00	-	-	0.00
Water Heating	2,358	2,358	1.00	0.1	0.1	1.00	2,961	2,961	1.00
Track Total	814,246	811,473	1.00	109.4	109.7	1.00	20,981	20,984	1.00
Relative Precision at 90% Confidence		8.11%			9.29%		I	60.5%	

#### Table 4-100. FY14 Summary of Impact Evaluation Results

C. Impact Evaluation Planned Activities and Completed Activities Comparison

## Table 4-101. FY14 Impact Evaluation Plan vs. Actual

Activity	Plan	Actual	Explanation for Variance
Conduct desk audits	10	10	
Conduct onsite verification	0	3	Onsite verification was conducted for sites that were selected for other track onsite verification efforts and for which LICP projects were also completed

## D. Summary of Key Findings Describing Adjustments to Ex-ante Savings

- i. Cross-cutting
  - All the CAT files reviewed during the evaluation matched the tracking data in the KITT for claimed savings values. The new project file organization allowed for easier identification of the final CAT file for which claimed savings were developed. As compared to last year, no mismatches were identified by the evaluation team.
  - This year, the evaluation found that all online and/or external calculators were clearly stated within the CAT file. This was an improvement from last year's evaluation.



- ii. Lighting Measures:
  - Realization rates for kWh and kW are at 100 percent.
  - One project utilized custom loadshapes and operating hours. The loadshapes were provided through edits to the loadshape values for the end use building type identified as "Commercial Indoor Lighting Blended" within the CAT Excel file. Compared to the TRM, these values are slightly higher for on-peak kWh, on-peak kW and slightly lower for off-peak kWh and off-peak kW. All values appear reasonable, however references and/or backup documentation (i.e. custom loadshape tool) was not provided to further assess these values used.
- iii. Cooling Measures:
  - Realization rates for kWh and kW are at 100 percent.
- iv. Water Heating Measures:
  - Realization rates for kWh and MMBtu are at 100 percent.
- v. Building Shell Measures:
  - Realization rates for kWh, kW, and MMBtu are at 100 percent.
- vi. Space Heating Measures:
  - Realization rates for kWh and MMBtu are near 100 percent.
  - One site utilized the boilers output capacity versus input capacity for which the evaluation corrected. However, this change only impacted this site's MMBtus by two percent and had an insignificant impact to the overall realization rate for the measure at the track level.
- vii. Appliance Measures, including Refrigeration:
  - Realization rates for kWh, kW and MMBtu are at 100 percent.
- viii. Plug Load
  - Realization rates for kWh and kW are at 100 percent.
- ix. Ventilation
  - Realization rates for kWh and kW are at 100 percent.
- x. Motors & Drives
  - Realization rate for kWh are at zero percent. The significant decrease in kWh is due to one site that had this measure and whose VFDs were found in place but not fully installed or operational. The site is awaiting arrival of further equipment to connect the VFD controls to the pump motors.



# 4.9.6 Recommendations

- A. To Improve Design, Operations, Customer Experience, and Recruitment
  - i. Conduct one-on-one follow up meetings between the DCSEU and contractors following the introductory kick off meeting. The contractor we spoke to felt they lacked direction on what to do next to begin participating in the program and had a number of questions following the meeting. They stated they would have benefited from a personal contact after the kick off meeting to further discuss next steps and offer direction to begin participating in the program.
  - ii. **Consider providing transparency around incentive determination.** The DCSEU determines incentive eligibility through discussions with participants based upon a series of incentive qualifying questions. Making this discussion more transparent may reduce participant dissatisfaction with this process and assist property owners in future project planning and budgeting.
  - iii. Review incentive eligibility review process to identify projects or project components likely to proceed without the DCSEU incentives. Given that only three facility managers/owners participated in interviews and only one provided an indication that he or she could be a free rider, this recommendation is offered as a process improvement consideration to address the early-warning indication of possible free-ridership in the initiative.
- B. To Improve Impact Evaluation Results
  - i. **Provide an explanation when calculations or key inputs deviate from standards.** However, some measures were found without any reference or explanation for the use of custom values. Per the CAT manual, whenever a default value is changed, an explanation should be provided to substantiate that change in the "Notes" field in the "Custom" tab."
  - ii. Improve the level of detail captured for the space and water heating systems within project documentation (i.e. application), to confirm critical input assumptions for lighting and hot water saving measures. The evaluation team was able to verify the space and water heating fuel types as projects with lighting and hot water saving measures also included retrofits to these space and water heating systems. The equipment specifications of this new equipment confirmed the fuel types. However, in the future sites may not have such inclusive retrofits and other documentation is necessary to confirm these critical input assumptions.
  - iii. When creating project documentation, such as the CAT spreadsheets, make all information accessible to the evaluation team. This includes specifically the 'unhiding' of columns containing crucial information. This finding was not as frequent as last year. However, many projects still contained these hidden cells which could not be unhidden due to locked worksheets.
  - iv. Avoid hard coding of savings values so that algorithms can be easily determined. As discussed above, the CAT Excel file contained hard-coded savings

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values, whereas the rest of the tabs retained the formulas used to generate savings. This resulted in our inability to verify some of the savings claimed in KITT through recreation of savings algorithms. This finding was not as frequent as last year, however did limit the evaluation efforts for some projects. As the projects in this track are custom, transparency of the methodology and critical inputs used are necessary for fully evaluating the track.

- C. Net-to-gross assessment
- i. A net-to-gross study was not conducted for this initiative.



# 4.10 7710FBNK EFFICIENT PRODUCTS AT FOOD BANKS PROGRAM

# 4.10.1 Track description

The Food Bank Energy Efficient Lighting Distribution initiative supplies free compact fluorescent light bulbs (CFLs) and light-emitting diodes (LEDs) to low-income households in the DC area who receive goods from participating food banks. The DCSEU provided up to 12 CFLs or LEDs per household after verifying that the household is located in the DC area and conducting a short survey with the client to determine the appropriate number of bulbs.

The program began in FY2012 as a free lighting giveaway held at local food banks in different wards of DC. Participating food banks were allowed to give out up to 12 CFLs per household after verifying that the household is located in the District and falls within the program's income requirements. If the household is eligible, the food bank asks a series of questions to determine how many CFLs should be distributed based on their household needs.

In FY2013 the program stopped distributing free lighting at the various food banks and instead worked solely with Bread for the City. The plan was for Bread for the City to be the sole distributor of the program but they encountered issues where they were not able to distribute as many bulbs as anticipated so the Covenant Baptist Church and the DC Housing Authority were added to the program to help reach program goals. The DCSEU staff were always in attendance for events at these locations.

During the FY2014, the DCSEU held events at food banks located in all wards in the District with exception of Ward 3. The evaluation effort included events held at five locations in October and November of FY2015.

Table 4-102 provides a summary of initiative metrics since inception. FY2012 and FY2013 reported results include the interactive effects for the installation of energy efficient lighting. FY2014 excludes these effects.

	FY2012	FY2013	FY2014
Metric	Reported Result	Reported Result	Reported Result
CFL units (units=bulbs)	42,954	49,581	2,584
LED units (units=bulbs)	0	0	16,754
kWh savings, meter level	2,392,132	2,416,513	736,100
kW savings, meter level	281.7	269.6	79.1

## Table 4-102. Initiative Summary Metrics—7710FBNK

Table 4-103 provides a summary of the reported and verified kWh, kW, and MMBtu along with the resulting realization rates.



Metric	Reported	Verified	Realization Rate
kWh	736,100	723,326	0.98
kW	79.1	64.9	0.82

#### Table 4-103. FY14 Reported and Verified Results—7710FBNK

# 4.10.2 Overall sampling methodology

These tracks are not sampled by participant or project as these initiatives do not collect data at the customer level. A separate data request will be submitted for these tracks. We anticipate selecting retail stores and food banks based on their location within the district and the volume through each participating location.

# 4.10.3 Process evaluation

The evaluation team conducted several research activities for the FY2014 results process evaluation. The activities included an in-depth interview with the DCSEU program manager, an interview with a participating food bank, and telephone surveys of program participants.

The interview with the DCSEU program manager was conducted in November 2014 and February 2015. The purpose was to understand the changes in program implementation, update the organizational chart, and collect any program-related materials that are available such as educational materials.

The team also conducted an interview with one of the hosts of a community food distribution event. The goal of this discussion was to understand the impacts of the DCSEU's lighting giveaway on them and the event as a whole. Topics included marketing activities implemented by the food bank, awareness of the lighting giveaway's activities at the event, and recommendations for ways to reach out to more low income households within the community.

In addition to the in-depth interviews, the evaluation team conducted computer assisted telephone interviews (CATI) with recipients of free lighting at the community events in FY2014 and for October FY2015. Recipient contact information was collected at the point of exchange and was provided to the evaluation team by the DCSEU staff. A total of 73 records had phone numbers and were used for this effort. A total of 22 completes were obtained over a three week period in January 2015.

Activity	Plan	Actual	Explanation for Variance
Conduct DCSEU staff in-depth Interview	1	2	One in-person on November 17, 2014 and one by telephone on February 11, 2015
Market actor interviews	2	1	One of the two event locations declined to be interviewed
Participant surveys	70	22	Limited population from which to call

Table 4-104.	FY14 Process	Evaluation	Plan vs.	Actual
	1 1 1 4 1 1 0 0 0 0 0		1 1011 10.	Aotuui



# A. Summary of key findings

Below we present key findings from the FY2014 results process evaluation activities. Due to the small number of completed interviews, these findings should be viewed qualitatively.

- Participant awareness of the DCSEU increased due to the events. Prior to the events 68 percent of the respondents said they had heard of the DCSEU. After the event, 95 percent of participants said they recall the DCSEU being in attendance.
- The CFL and LED demonstrations were successful in educating those who were not previously familiar with the bulbs. Of the 15 respondents who said they remember seeing a lighting demonstration, 13 previously did not know anything about CFLs or LEDs. All 15 said they found the demonstrations useful.
- The majority of bulbs received have since been installed in the DC area. Of the 22 respondents, 14 reported installing 100 percent of what they received. Seven installed approximately half of what they received and one, who said they received ten bulbs, said none of them were installed. Six reported using their LED bulbs to replace CFL bulbs in their home.
- Participants said they are likely to purchase LEDs in the future. All but one respondent said they are somewhat or very likely to purchase LEDs in the future, an indication that this initiative will be successful in raising awareness of LED technology and driving participation in the retail lighting initiative.
- Participation in DOEE programs and workshops is low among respondents. Less than half (7) of the respondents reported participating in DOEE Energy Assistance and Weatherization program. Of those, only three participated in one of the DOEE workshops. Nobody participated in the DOEE Energy Smart DC Solar Initiative.
- Utilizing Allen Chapel's annual community event is a successful way to reach the lowincome community. Both the DCSEU and Allen Chapel staff agreed that hosting a booth at the event was a successful way to distribute bulbs. Since an attendee's eligibility is checked upon arrival at the event, the DCSEU did not need to use their resources to determine eligibility. Instead, they were able to concentrate their efforts on demonstrations, questions, bulb distribution, and tracking.
- Participants are more often renters (82 percent) who live in an apartment (64 percent). About 67 percent indicate that they are responsible for their utility bill and 94 percent indicate that they replace light bulbs rather than the landlord.
- The income eligibility check based on self-reported information resulted in 3 of the 19 households providing income information not meeting the eligibility requirement. All three households had just one person less reported than what would have put them in a low income status. The mean household size is 2.36 and no respondents reported household income greater than \$55,819. The evaluation team did not adjust program eligibility results based on this self-reported result.

## Table 4-105 Income and Household Size Matrix

HH Size	Less than \$23,340	Between \$23,340 and \$31,459	Between \$31,460 and \$39,579	Between \$39,580 and \$47,669	Between \$47,700 and \$55,819	Refused	Total
1	7	1	0	0	0	0	8
2	3	1	1	0	0	0	5
3	0	0	0	0	0	0	0
4	2	2	0	0	1	0	5
5	0	0	0	0	0	0	0
6	1	0	0	0	0	0	1
Total	13	4	1	0	1	3	22
	Meets income eligibility		Does not meet i	ncome eligibility			

Table 4-106. Household Characteristics

Home ownership	Percent	Who replaces bulbs in residence	Percent
Own	18.2%	Respondent	94.4%
Rent	81.8%	Landlord	5.6%
Respondents (n)	22	Respondents (n)	22
Who pays utility bill	Percent	Type of home	Percent
Respondent	66.7%	Single-family	13.6%
Landlord	33.3%	Attached	22.7%
Respondents (n)	22	Apartment	63.6%
		Respondents (n)	22

Source: D1 – D2

Note: Totals may not sum to 100 percent due to rounding

#### Table 4-107. Respondent Characteristics

Demographic Information	Percent	
Age of respondent	20 to 29	4.5%
	40 to 49	4.5%
	50 to 64	72.7%
	65 or over	18.2%
	Respondents (n)	22
Household size	One	45.5%
	Тwo	22.7%
	Four	22.7%
	Six	9.1%
	Respondents (n)	22



Demographic Information		Percent
Education of respondent	Ninth to twelfth grade, no diploma	36.4%
	High school graduate (includes GED)	36.4%
	Some college, No degree	13.6%
	Associates degree	13.6%
	Respondents (n)	22
2014 household income	Less than \$23,340	68.4%
	\$23,340 to less than \$31,459	21.1%
	\$31,460 to less than \$39,579	5.3%
	\$47,700 to less than \$55,819	5.3%
	Respondents (n)	19

Source: Questions d5, d8, d9, d10 Note: Totals may not sum to 100 percent due to rounding

# 4.10.4 Net-to-gross methodology and results

## A. Methodology

A net-to-gross evaluation was not conducted for this track. However, households were asked if they had purchased LEDs prior to receiving from the food bank event and two respondents indicated that they had purchased this equipment at the Home Depot store located within the District. Households were also asked if they had purchased LEDs since the food bank event and none stated that they had.

## Table 4-108. FY14 Net-to-gross Assessment Evaluation Plan vs. Actual

Activity	Plan	Actual	Explanation for Variance
Participant surveys	70	22	Limited population from which to call

## B. Summary of results

Not applicable.

## C. Drivers net-to-gross results

Not applicable.

## 4.10.5 Impact evaluation

The impact evaluation involved review of tracking data and supporting invoices. There were no differences identified between tracked and evaluated savings.



## A. Impact sampling methodology for onsite measurement and verification

Onsite verification of measure installation was not conducted. The evaluation team attended two food bank distribution events and reviewed participant screening and data tracking procedures with the DCSEU staff.

## B. Verification of impacts

The evaluation team verified impacts for the retail lighting initiative by comparing tracked savings to deemed savings established in the DCSEU TRM. In addition, we reviewed tracked quantities in conjunction with reported quantities directly from the DCSEU purchasing records.

The only discrepancy found during impact evaluation was that the reported savings did not consistently remove interactive effects. The realization rates reflect the evaluation team's exclusion of these effects in verified savings.

	kWh			kW			MMBtu		
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR
LEDs	620,421	613,156	0.99	66.2	54.3	0.82	0	0	-
Specialty CFL	21,724	20,683	0.95	2.4	2.0	0.82	0	0	-
Standard CFL	93,955	89,488	0.95	10.5	8.6	0.82	0	0	-
Track Total	736,100	723,326	0.98	79.1	64.9	0.82	0	0	n/a
Relative Precision at 90% Confidence		0.0%			0.0%			n/a	

## Table 4-109. FY14 Summary of Impact Evaluation Results

C. Impact evaluation planned activities and completed activities comparison

#### Table 4-110. FY14 Impact Evaluation Plan vs. Actual

Activity	Plan	Actual	Explanation for Variance
Report file reviews	12	1	DC consolidated purchasing report

- D. Summary of key findings describing adjustments to ex-ante savings
  - Verified savings remove interactive effects that were not removed in reported savings.

## 4.10.6 Recommendations

- A. To improve program design, operations, customer experience, and recruitment
- i. Continue to use community events and efficient lighting technology demonstrations to increase public awareness of the DCSEU and to lead residents to participation in other initiatives. The DCSEU staff at food bank



events increases awareness of the DCSEU and can lead to participation in other initiatives.

- B. To improve impact evaluation results
- i. **Remove interactive effects from reported savings, where applicable.** The evaluation found that the interactive effects adjustments to remove penalties and benefits associated with the waste hear factor for the replacement of lighting with more energy efficient lighting were not handled consistently in KITT.
- C. Net-to-gross assessment
- i. A net-to-gross assessment was not conducted for this initiative.



# 4.11 7710APPL RETAIL EFFICIENT APPLIANCES

# 4.11.1 Track description

In January 2013, the DCSEU began offering mail-in rebates for qualifying energy efficient ENERGY STAR refrigerators and clothes washers. These rebates continued through FY13, and starting July 1, 2013, additional rebates were offered for natural gas water heaters, furnaces, and boilers. The DCSEU has partnered with local retailers and contractors to promote these rebates, including providing rebate forms in retail stores where possible. These stores include 5 within Washington, DC, and 19 in Maryland. Stores outside of the DC are included because of the relatively small number of stores that sell appliances within the DC and the proximity of the surrounding stores. The rebates are processed by EFI.

Rebated measures included in this track are:

- Refrigerators
- Dehumidifiers
- Clothes washers
- Furnaces and boilers
- Central air conditioning units and ductless mini-split air conditioning systems.

In FY14, rebates of \$50 to \$75 were offered for ENERGY STAR clothes washers and refrigerators based on efficiency level. In FY13, the DCSEU realized that the majority of appliances sold at DC appliance retailers were ENERGY STAR-qualified. In an effort to encourage customers to purchase the most energy efficient appliances, in FY14 the DCSEU changed the appliance rebates to tiered rebate amounts based on efficiency level of the equipment.

In FY14, ENERGY STAR gas boilers qualified for a flat \$500 rebate but water heater and furnace rebates were tiered. Boilers must be ENERGY STAR-rated with a minimum AFUE of 85 percent. Furnace rebates were tiered, ranging from \$500 to \$800. Setback thermostats and dehumidifiers were eligible for a \$25 rebate. Central air conditioner rebates ranged from \$150 to \$500.

Water heater rebates depended on the type of equipment installed as well as the efficiency level. Storage water heaters must be ENERGY STAR rated, and incentives ranged from \$100 to \$150. Tankless water heaters qualified for a rebate of \$300 to \$500.

Table 4-111 provides a summary of initiative metrics since inception.



	FY2012	FY2013	FY2014
Metric	Reported Result	Reported Result	Reported Result
Participants (Units=rebates)	n/a	875	912
kWh savings, meter level	n/a	99,569	104,221
kW savings, meter level	n/a	14.3	19.6
MMBtu savings	n/a	162	1,125

#### Table 4-111. Initiative Summary Metrics—7710APPL

Table 4-112. FY14 Reported and Verified Results—7710APPL

Metric	Reported	Verified	Realization Rate
kWh	104,221	106,137	1.02
kW	19.6	21.3	1.09
MMBtu	1,125	1,108	0.98

# 4.11.2 Overall sampling methodology

The Retail Efficient Products initiative includes several types of measures. Some of these measures are simply purchased from a retailer, while others require contractor installation. The measures that require contractor installation vary in savings depending on efficiency levels, so we will focus more of our evaluation activities on these measures. We will conduct five desk reviews each for the two retail appliance types (refrigerators and clothes washers) to verify that application details were tracked correctly, and the remaining desk reviews will be dedicated to the larger equipment (boilers, furnaces, and water heaters). All of the rebates will be randomly selected for each of these measures.

	Project File Evaluation Sample							
Measure	N <sub>measure</sub>	n <sub>measure</sub>	kWh <sub>n</sub>	kWn	MMBtu <sub>n</sub>	% kWh	% kW	% MMBtu
Clothes Washers	566	19	2,196	0.3	10	3.2%	3.2%	3.2%
Cooling	43	6	1,914	1.7	0	17.7%	22.5%	-
Refrigeration	170	9	1,275	0.2	0	5.2%	5.2%	-
Space Heating	101	28	0	0.0	198	-	-	26.7%
Water Heating	32	5	0	0.0	13	-	-	16.8%
Track Total	912	67	5,385	2.1	221	5.2%	11.0%	19.7%

## Table 4-113. FY14 Population and Sample Summary—7710APPL

# 4.11.3 Process evaluation

A staff interview was conducted November 17, 2014, to understand how the track is intended to work. Telephone surveys of participants were conducted from December 22, 2014, through January 20, 2015. Advance letters were sent to sampled participants notifying them of their selection to participate in the evaluation.



Activity	Plan	Actual	Explanation for Variance
DCSEU staff in-depth interviews	1	1	
Conduct participant surveys - appliances	65	65	
Conduct participant surveys - HVAC	35	28	We attempted the sample points multiple times but were not able to reach the target number of completes for this program.

## Table 4-114. Process Evaluation Plan vs. Actual

## A. Summary of key findings

## i. Awareness

About 54 percent of appliance respondents heard about the program from a retail store employee. Other commonly mentioned methods included signs in the retail store (26 percent) or from the DCSEU website (14 percent).

Half of respondents who purchased HVAC equipment mentioned hearing about the program from their contractor, and 25 percent said they heard about the program through the DCSEU website.

We asked respondents about their awareness of and participation in DOEE energy saving initiatives. Four people said they had also participated in the DOEE Energy Assistance and Weatherization program, and five had participated in a DOEE Energy Workshop.

More than half (54 percent) of respondents have visited the DCSEU website, and the vast majority (92 percent) said the information they found was relevant.

## ii. Verification of installation

Of the 93 participants who installed equipment through the program, only 1 removed their appliance (a refrigerator) because it did not work properly.

iii. Household experience

The majority of respondents were very satisfied with the program aspects. We asked respondents to rate their satisfaction on a scale of 1 to 5, where 1 was not at all satisfied and 5 was very satisfied. The table below displays the percentages of respondents who assigned ratings of 4 or 5 to the various program aspects along with the mean rating.

	Ар	oliances	HVAC			
Program aspect	% Rating 4 or 5	Mean	n	% Rating 4 or 5	Mean	n
Time it took to receive rebate	91.7%	4.48	64	81.5%	4.37	27
Online rebate application experience	81.1%	4.41	37	95.0%	4.50	20
Energy savings from equipment	78.4%	4.33	51	79.2%	4.42	24
Information on DCSEU website	71.4%	4.02	42	78.3%	4.26	23
Amount of incentive	64.7%	3.94	65	76.9%	4.19	26

## Table 4-115. Satisfaction Levels of Program Aspects

## iv. Lighting spillover

We asked respondents if they had purchased energy efficient lighting since participating in the program, and most (84 percent) of respondents said they had. In an indication that LEDs are continuing to gain market share, 36 percent of respondents said they had purchased LEDs, while only 19 percent said they had purchased CFLs; 29 percent purchased both. Only 22 percent of respondents indicated they had received a discount on their CFL purchases, while the percentage of those who stated they received a discount on their LED purchases was higher (44 percent). Sixty-three percent of these bulb sales were within the District, an indication that leakage into the District continues as 37 percent purchased outside of the District.

## v. Refrigerator-specific questions

All 12 respondents who said they received a rebate for a refrigerator through the program said the refrigerator is used as their main unit. All of the refrigerators purchased replaced an existing model, and most (9 out of 12) were more than ten years old. Half of respondents said they had their old refrigerator removed by the store from which they purchased their new model, most others disposed of it in some other way, and one person said they still have it.

## vi. Demographics

All of the participants said they own their home, and only a few (4 out of 93) said they planned to move away from the District in the next year. A sizable number (36 percent) of respondents said that a household member works from home. Sixty-two percent of respondents have a graduate or professional degree, and another 25 percent have a bachelor's degree. Nearly half (45 percent) of respondents reported earning more than \$125,000 in 2014.

For the FY14 results evaluation effort, we asked respondents to provide household size and incomes according to the ranges used to determine income eligibility for the DCSEU income qualified initiatives. The objective of this research is to assess the level of participation of income-qualified households in non-income qualified initiatives. Of those that provided household (HH) size and income range (19 refused), 2 households (about 2 percent) could be eligible for income-qualified initiatives. The incidence based on self-reported information is not large enough to recommend additional spend contribution towards the low income spend performance benchmark.



4-92



HH Size	Less than \$23,340	Between \$31,460 and \$39,579	Between \$47,670 and \$55,819	Between \$55,820 and \$63,939	Between \$63,940 and \$72,059	Between \$72,060 and \$80,179	\$81,180 to \$99,999	\$100,000 to \$125,000	More than \$125,000	Refused	Total
1	1	0	0	1	0	0	1	2	4	1	10
2	0	1	0	0	1	3	4	5	17	0	31
3	0	0	2	1	0	2	0	2	9	8	24
4	0	0	0	0	1	0	2	1	7	2	13
5	0	0	0	0	0	0	0	0	5	5	10
6	1	0	0	0	0	0	0	1	0	3	5
Total	2	1	2	2	2	5	7	11	42	19	93
	Meets income eligibility					Does not meet income eligibility					

#### Table 4-116. Income and Household Size Matrix

# 4.11.4 Net-to-gross methodology and results

## A. Methodology

Net-to-gross for this track was assessed through self-report phone surveys. See Section 2.4 for detailed descriptions of the net-to-gross survey battery.

Table 4-117 F	FV14 Net-to-gross	Assassment	Evaluation	Plan vs	<b>∆</b> ctual
	F 1 14 Net-10-91055	ASSESSIIIEIII		riaii vs.	Actual

Activity	Plan	Actual	Explanation for Variance
DCSEU staff in-depth interviews	1	1	
Conduct participant surveys - appliances	65	65	
Conduct participant surveys - HVAC	35	28	We attempted the sample points multiple times but were not able to reach the target number of completes for this program.

## B. Summary of results

The free-ridership for HVAC and appliances is estimated to be about 50 percent. For appliances, the distribution of free-ridership scores ranges from 1 respondent who indicate 0 percent free-ridership and 5 who indicate 100 percent free-ridership. For HVAC, the distribution of free-ridership ranges from 4 respondents in the 25 percent range and 1 person who indicates he or she is a full free rider (see the tables below).

## Table 4-118. Appliances Free-ridership Score Distribution (n=65)

Free-ridership Score	0%	1-25%	26-50%	51-75%	76-99%	100%
Household count	1	6	27	22	4	5

## Table 4-119. HVAC Free-ridership Score Distribution (n=28)



Free-ridership Score	0%	1-25%	26-50%	51-75%	76-99%	100%
Household count	0	4	12	8	3	1

To assess spillover, households were asked if and what type of energy efficiency equipment they purchased without DCSEU incentives since participating in the appliances and HVAC initiative along with how influential participation in the rebate program was on their decision. For HVAC, spillover ranged from about 25 percent to about 75 percent. Spillover for appliances is estimated to be about 20 percent.

Net-to-gross for appliances is estimated to be about 60 to 70 percent for appliances and about 70 to 125 percent for HVAC.

#### C. Drivers of net-to-gross results

The DCSEU updates appliance and HVAC equipment eligibility regularly to stay ahead of equipment efficiency standards and provides tiered rebate levels to encourage the adoption of the most energy efficient equipment. Net-to-gross results of 50 percent for appliances and HVAC equipment rebate programs are common in portfolios across the US.

For appliances, spillover estimates based on participants in the DCSEU initiative reporting additional actions in FY14 offset free-ridership by about 10 to 20 percent. The high estimate of 20 percent is based on two households replacing windows (17 and 5 for a total of 22). Households in the appliances track also report purchasing and installing additional energy efficient equipment such as refrigerators, clothes washers and dryers, furnaces and central air conditioning, as well as taking other actions to save energy such as installing weather-stripping and insulation after participating in the DCSEU appliance rebate initiative. One respondent indicated that they installed a more efficient toilet. Many of these additional equipment purchases could be eligible for DCSEU rebates (this was not confirmed through the survey), so the spillover estimate is believed to be high as some of these households may have received rebates and therefore, be counted in gross and verified savings estimates. The low estimate excludes appliances that could be eligible for a DCSEU appliance rebate and window replacements.

For HVAC equipment, spillover ranges from 15 to 75 percent with the high estimate of 75 percent the result of 2 respondents who indicated that they completed a window replacements (48 and 25 windows, for a total of 73) as a result of participating in the DCSEU initiative. Other HVAC rebate participants reported similar additional actions to the appliances participants. Many of these additional equipment purchases could be eligible for DCSEU rebates (this was not confirmed through the survey), so the spillover estimate is believed to be high as some of these households may have received rebates and therefore, be counted in gross and verified savings estimates. The low estimate excludes appliances that could be eligible for a DCSEU appliance rebate and window replacements. When asked to rate the influence of the DCSEU on the household's decision to pursue other energy savings actions, the mean score was less than 3 on a scale of 1 to 5, where 1 is not at all influential and 5 is very influential for each category.

#### Table 4-120. Influence Score Categories on Spillover, Appliances and HVAC

		Mean	Standard
Influence category	n	score	Deviation



Influence category	n	Mean score	Standard Deviation
Information about savings from DCSEU advertising or staff, retailers, or contractors	30	2.50	1.570
Satisfaction with the program financial assistance, equipment, or services	30	2.43	1.633
Experience with the DCSEU program that made the respondent want to do more to save energy	30	2.60	1.404

The evaluation for FY15 results will include follow-up questions in the spillover battery to assess why households did not apply for DCSEU rebates for energy efficient appliances claimed to be purchased after participating in one or more other DCSEU initiatives. This will help better quantify spillover and the influence of the DCSEU on additional energy efficiency actions taken.

Table 4-121. FY14 N	et-to-gross Results	<b>Summary-Appliances</b>
---------------------	---------------------	---------------------------

N <sub>project</sub>	n <sub>survey</sub>	Free- ridership	Spillover	90% Margin Error (±)	Net-to- Gross	Comment
811	65	~50%	~10-20%	9.8%	~60-70%	2 respondents indicated windows replacement and several mentioned equipment that could be eligible for DCSEU rebates

#### Table 4-122. FY14 Net-to-gross Results Summary-HVAC

N <sub>project</sub>	n <sub>survey</sub>	Free- ridership	Spillover	90% Margin Error (±)	Net-to- Gross	Comment
101	28	~50%	~20-75%	13.2%	~70- 125%	2 respondents indicated that they replaced a large number of windows and several mentioned purchasing equipment that could be eligible for DCSEU rebates

## 4.11.5 Impact evaluation

The evaluation team reviewed the algorithms for new measures added to the TRM in FY14.

The DCSEU applies a blended average of fuel savings for clothes washers since the savings are dependent on what water heater and clothes dryer fuel the participant uses. The DCSEU used the data collected on rebate forms about these fuels to arrive at proportions of customers who use gas, electric, or other fuels for water heating and clothes drying. These averages were applied in the savings algorithm to produce a single savings estimate for each efficiency level of appliance.

The evaluation team conducted a tracking system review of all fully-deemed measures rebated by the appliance track, as well as a review of a sample of rebate applications to verify tracked quantities and efficiency levels. We conducted more extensive project file reviews for



measures whose savings are calculated rather than deemed. We also conducted a telephone survey with a sample of participants.

## A. Impact sampling methodology for onsite measurement and verification

Onsite verification was not conducted.

## B. Verification of impacts

The tracking system review of fully-deemed savings measures found no discrepancies. The evaluation team identified several issues while conducting project file reviews, occurring within the furnace, boiler, and air conditioner measures.

There were two apparent discrepancies within the sampled furnace project files. First, one project claimed significantly higher savings (39.3 MMBtu) than calculated by the evaluation team (6.7 MMBtu). The evaluation team treated this case as an outlier and did not use it when computing a realization rate so that it would not incorrectly adjust weighted results. There were two cases where the model number on the application was not very clear. The realization rates for these two cases are the furthest outliers remaining, but the evaluation team believes them to be correct based on the model information provided. We reviewed the tracked per-unit savings for all other furnace measures and the remainder were within a reasonable range. The evaluation team was not able to reproduce reported savings exactly for any of the furnace measures. There were minor differences in savings for the remaining furnace measures ranging from 96 percent to 103 percent. This could be attributable to rounding in any of the inputs, in particular capacity and AFUE. The overall realization rate for furnaces, excluding the extreme outlier case, is 101 percent.

The TRM entries for both furnaces and boilers include unit capacity as an input to the savings calculations. Neither case specifically states whether this is the input or output (heating) capacity of the unit. On review of the formula, it appears that it should be output capacity since the TRM formula calculates input capacity for the baseline and efficient units:

 $BTUh_{input-b} = BTUh / AFUE_{BASE}$ 

The evaluation team reviewed project files for eight boiler rebates. In all eight cases, it appears that the savings were calculated using the input capacity instead of the output capacity. Realization rates for boilers range from 85 percent to 92 percent depending on the capacity and efficiency of the boiler. The overall realization rate for boilers is 89 percent.

Figure 4-1 shows the overall distribution of space heating equipment from the realization rate for that end use.





Figure 4-1. Distribution of ex-ante and ex-post savings.

For air conditioners, the TRM states that deemed savings will be used if unit capacity and efficiency levels are not available. However, the deemed savings values were used despite all applications being submitted along with detailed capacity and efficiency information. Calculating savings using the TRM algorithm produces individual measure realization rates ranging from 67 percent to 182 percent. The average realization rate for air conditioners was 120 percent.

		kWh			kW		MMBtu		
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR
Clothes Washers	68,844	68,844	1.00	8.2	8.2	1.00	306	306	1.00
Cooling	10,801	12,718	1.18	7.5	9.2	1.24	0	0	-
Refrigeration	24,575	24,575	1.00	3.9	3.9	1.00	0	0	-
Space Heating	0	0	-	0.0	0.0	-	742	725	0.98
Water Heating	0	0	-	0.0	0.0	-	77	77	1.00
Track Total	104,221	106,137	1.02	19.6	21.3	1.09	1,125	1,108	0.98
Relative Precision at 90% Confidence	0.25%		3.59%			0.98%			

Table 4-123. FY14 Summary of Impact Evaluation Results



## C. Impact evaluation planned activities and completed activities comparison

#### Table 4-124. FY14 Impact Evaluation Plan vs. Actual

Activity	Plan	Actual	Explanation for Variance
Desk reviews	70	69	Additional review not required to achieve 90/10 confidence precision
Phone verification - appliances	65	65	
Phone verification - appliances	35	28	We attempted the sample points multiple times but were not able to reach the target number of completes for this program.

#### D. Summary of key findings describing adjustments to ex-ante savings

- Some space heating equipment used the input capacity in the savings calculation when the output capacity should be used.
- Two space heating measures had difficult-to-read model numbers on their applications. It appears that incorrect inputs may have been used in calculating savings.
- Despite having all of the necessary inputs to the savings algorithms, air conditioning measures applied a deemed savings value from the TRM.

## 4.11.6 Recommendations

- A. To improve program design, operations, customer experience, and recruitment
  - i. **Continue to educate retailers and contractors about the DCSEU rebates.** Forty percent of appliance respondents said they heard about the DCSEU rebates from their retailers and 50 percent of HVAC respondents heard about the DCSEU rebate from their contractors.
- B. To improve impact evaluation results
  - i. Use TRM algorithms when all of the required information is collected. This enhances accuracy by representing the actual sizes and efficiency levels of equipment installed by the DCSEU, rather than averages from other sources.
  - ii. **Collect AHRI certificates for all applicable types of equipment.** Currently, the DCSEU requires AHRI certificates for air conditioning measures, but they are also relevant to furnaces, boilers, and heat pumps. This can help avoid confusion with illegible or incorrect model numbers and increases the completeness and accuracy of data used to calculate savings.
  - iii. Update the TRM to use output capacity for furnace and boiler measures. The TRM does not specify input or output capacity, and this distinction is important since the savings formula assumes output capacity.
- C. Net-to-gross assessment


i. Continue to encourage higher levels of efficiency by providing higher rebate levels for Top Ten and Most Efficient products. Actions taken by the DCSEU to stay ahead of increasing energy efficiency standards and offerings are keeping free-ridership at an expected level when compared to like programs in other states.

4-99



# 4.12 7710LITE ENERGY EFFICIENT PRODUCTS

This section presents the evaluation findings for the Energy Efficient Products Retail Lighting track. The section will provide a brief description of the initiative, followed by process and impact evaluation results and recommendations for future initiative operation.

## 4.12.1 Track description

The Retail Efficient Lighting initiative works with retailers and manufacturers to lower prices on CFLs and LEDs in the District of Columbia. LED bulbs are not as familiar to residents and are less commonly used than incandescent or CFL equivalents. The DCSEU initiative provides educational material to increase awareness of different types of efficient light bulbs and works with participating retailers and manufacturers to increase availability of the LED bulbs.

The Retail Efficient Lighting initiative targets lighting manufacturers and retailers for participation to reach residents and small businesses as end-use customers. The manufacturers and retailers are provided incentives on a per-bulb basis. The initiative is implemented by DCSEU with Energy Federation Incorporated (EFI) providing support for incentive payment and data tracking. EFI is responsible for compiling and verifying manufacturer invoices and processing payments. Manufacturers submit invoices to EFI for payment and work with stores to gather sales reports that they submit along with the invoice requests.

Table 4-125 provides a summary of initiative metrics since inception. FY2012 and FY2013 reported results include the interactive effects for the installation of energy efficient lighting. FY2014 excludes these effects.

	FY2012	FY2013	FY2014
Metric	Reported Result	Reported Result	Reported Result
CFL units (units=bulbs)	43,454	218,621	321,007
LED units (units=bulbs)	0	6,336	92,255
kWh savings, meter level	2,725,914	12,699,881	21,113,004
kW savings, meter level	401.4	1,895.3	3,259.3

### Table 4-125. Initiative Summary Metrics—7710LITE

The DCSEU is successfully moving to greater sales in LED lighting. CFL bulbs are still the larger component; however, sales form LED bulbs rose by over 1300 percent from FY2013 to FY2014.

Table 4-126 provides a summary of the reported and verified kWh and kW, along with the resulting realization rates.



Metric	Reported	Verified	Realization Rate	
kWh	21,113,004	19,980,993	0.95	
kW	3,259.3	2,341.1	0.72	

### Table 4-126. FY14 Reported and Verified Results—7710LITE

## 4.12.2 Overall sampling methodology

These tracks are not sampled by participant or project as these initiatives do not collect data at the customer level. A separate data request will be submitted for these tracks. We anticipate selecting retail stores and food banks based on their location within the district and the volume through each participating location. For the retail efficient products lighting initiative, a sample file of participating retailers was provided to the evaluation team. From this list, Tetra Tech selected a sample of 26 retailers; the list of retailers was submitted to DCSEU staff, where contact information was appended and returned to Tetra Tech. The prospective respondents ranged in size from small, independently owned stores to large home improvement chains.

### 4.12.3 Process evaluation

To inform the process evaluation, the evaluation team conducted interviews with DCSEU staff on November 17, 2014, and in-depth telephone interviews with retailers in January 2015. The types of retailers interviewed ranged from small, independently owned stores to larger chains. The evaluation team used telephone and email to schedule interviews with prospective respondents.

Table 4-127 displays the number of interviews completed for the process evaluation.

Activity	Plan	Actual	Explanation for Variance
DCSEU staff in-depth interviews	1	1	
Retailer interviews	12	10 <sup>24</sup>	Two stores were either out of business or going out of business. One person did not recall participating and suggested speaking to the corporate office.

#### Table 4-127. Process Evaluation Plan vs. Actual

<sup>&</sup>lt;sup>24</sup> One interviewed respondent represented four franchises in the sample. We counted this person's answers for one complete interview and one partial interview where the original respondent could not answer some questions.



Figure 4-2 shows the geographic distribution of the retailers we interviewed.

Figure 4-2. Geographic Distribution of Retailers



### A. Summary of key findings

- The DCSEU incentives were rated as the highest factor that influenced the retailers' decision to participate in the initiative. Retailers interviewed indicated that the incentives were effective in encouraging customers to purchase efficient lighting, particularly the standard CFLs that were discounted. Respondents said that the initiative provided a good introduction to LEDs and there was increase in sales reported, but not all stores carried them, and the market still appears to favor consumers who are predisposed to adopting them.
- Although retailers reported receiving promotional materials from the DCSEU (and, at times, added their own marketing), some retailers indicated that customers were not aware that the discounts originated with the DCSEU or that they may have been unfamiliar with the DCSEU. Additionally, although many retailers reported that they make an effort to educate their customers on the benefits of efficient lighting, some also indicated that holding trainings or in-store informational events would contribute to understanding and awareness.
- Retailers reported that acceptance of efficient lighting varied among customers. Some respondents informed us that their customers were skeptical of the low price of the CFL bulbs and equated the low price with inferiority (although there were no actual complaints about the bulbs in the program). Some dislike of CFL bulbs persists among consumers, but retailers are making an effort to educate consumers on the advances in technology that have improved on the shortcomings of the earliest models.



Additionally, acceptance of efficient lighting varies among geographic areas within the District; retailers indicated that younger, "more urban" customers were more enthusiastic about efficient lighting, especially LEDs.

- The DCSEU initiative is increasing the awareness, availability, and sales of LEDs within the District. Although the increase in sales of LEDs was not as significant as that of CFLs, LEDs also benefited from the initiative. Market share of LEDs continues to increase, although some stores reported that they do not carry LEDs. One store reported carrying LEDs exclusively. An observation of the evaluator is that the District appears to be more progressive on the sustainability front than other areas in which he has experience. This will be a researchable issue we will explore more in future evaluation efforts.
- Although retailers indicated that the program was administered effectively and smoothly, several respondents informed us that they had difficulty obtaining qualifying bulbs from the manufacturers and sometimes were without product for several weeks. However, respondents were pleased with the help provided by the DCSEU staff in working through these challenges.
- Retailers do not have difficulty meeting the reporting requirements. However, some retailers would like to see changes to the ordering process. Interviewees reported that completing a separate paper ordering form was cumbersome; they would like to see a fax or email option instead and be able to include their lighting order with the other products they carry.
- Despite the popularity of the lighting buy-down initiative, there was no indication of direct spillover into other efficient products. One retailer said that it "opened up conversation points with customers," and another respondent indicated that their customer base was already looking for energy efficient products.
- Retailers still carry incandescent bulbs across a wide range of wattages, but respondents noted that efficient lighting continues to increase in market share and push out incandescent lighting. Some customers still prefer incandescent bulbs even after hearing an explanation of the benefits of efficient lighting. Retailers report that this customer segment is older, and these customers may have had negative experiences with the earliest CFLs.
- B. Detailed findings
- i. Program effect on market share of efficient lighting

The lighting buy-down initiative was very effective in encouraging customers to purchase efficient lighting, particularly standard CFLs. Some retailers reported a decrease in incandescent sales in conjunction with the initiative, and some indicated that although sales of efficient lighting increased, there was no effect on sales of incandescent bulbs. There was mixed awareness of the Energy Independence and Security Act (EISA) and its effect on lighting sales; however, one person alluded to the decrease in availability of incandescent lighting when asked about the impact of the initiative on sales of those bulbs:

More of an impact on our stocking and sales of incandescent light bulbs is the inability to buy them. We still have customers who prefer the traditional incandescent bulbs but trying to buy them in anything other than a 40 watt, or a high-wattage bulb is almost impossible now.



The initiative had little or no effect on the sales of halogen bulbs. Retailers noted that the market share of halogens is already very small; one retailer said they do not carry halogens.

The retailers we spoke with also said the initiative did not have a large effect on the sales of specialty CFL bulbs. One respondent said they are usually able to upsell customers to CFL variants of specialty bulbs without the program, and another remarked that specialty bulb sales are not driven by price.

Most retailers said that the initiative increased sales of standard CFLs. We asked respondents to estimate the percentage of light bulb sales that CFLs occupied before and after the program. Sales of CFLs varied considerably before the initiative, with the average being around 25 to 30 percent of sales; the average increase in the percentage of CFLs sales after the promotion was about 20 percent. Following are comments from respondents regarding the influence of the initiative on standard CFL sales:

People were more likely to buy the CFLs because of the discounted price—more likely to try those out, whereas before they would have gone with the incandescent bulb.

Our movement [of standard CFLs] went through the roof; 200% increase on 60 watt bulbs; the 100 watt not as much, probably about 50%; 75 watt was about 50%.

We did have a spike on those as those were a big part of the promotion, so definitely increased sales of CFLs.

The DCSEU initiative is increasing the awareness, availability, and sales of LEDs within the District. We asked retailers to estimate the percentage of light bulb sales that were LEDs before and after the promotion. Respondents indicated that LED bulb sales were 10 percent or less of their sales before the initiative, and the percentage increased 5 to 10 percent. However, one retailer said that they now exclusively carry LEDs in their store. Following are remarks by respondents regarding LED sales:

It was a good way to introduce LEDs at a very affordable price, so it was good in that respect.

People are more likely to try out the LEDs because of the discounted prices.

Traditionally priced LED bulbs range anywhere from \$8 a bulb to \$50 a bulb, and for the average homeowner, that's just not a reasonable price point. So the DCSEU LED bulbs bring the price point down so that it's actually a choice for a consumer to make. I probably had two or three SKUs of LEDs in stock before the DCSEU program, and now I think I have seven.

Only one retailer said that they carried program-qualifying bulbs during the promotion that were not included in the program. They estimated that these bulbs accounted for 15 to 20 percent of their stock.

There was no observation of direct spillover into purchasing other efficient products by customers who purchased discounted bulbs through the initiative. However, one retailer noted that it "opened up conversations" about efficient products.



#### ii. Influence of the DCSEU incentives and other factors on retailer participation

Although there were other contributing factors that prompted customers to turn to efficient lighting during the buy-down initiative, the incentive was the most influential, according to retailers. When asked to rate the influence of several factors on their decision to offer standard CFLs through the initiative, respondents rated the incentive an average of 3.9 on a scale of 1 to 5, where 1 was not at all influential and 5 was very influential. Support from DCSEU staff was also highly rated (3.7 on average), and consumer demand was the next highest-rated factor (3.6).

We were eager to pair with the city and promote this; it was an initiative from our company to piggyback with DC, and it was a great success, I would say.

Retailers were happy with the support they received from the DCSEU, reporting that the DCSEU staff visited their stores to check on stock and promotional materials.

*I* was impressed with the staff. They were very responsive and forthcoming with information and sales materials.

Consumer demand was also rated as highly influential. Retailers said that more customers are increasingly looking for CFLs. Some respondents who did not rate consumer demand as highly noted that their stores are taking their own initiative in moving towards efficient products. Following are comments by retailers concerning consumer demand for standard CFLs:

As these are becoming more mainstream, customers are asking about them, and they're improving the quality of the bulbs and everything; prices are getting better.

CFLs are a product we stock regardless, and we as a company would encourage people to use them. So it was more about us selling to the customer than them coming to us.

The buy-down incentive was also rated highly in the decision to carry LEDs in the program.

[The incentive] puts it in a price range that makes it easy to encourage customers to purchase.

The availability of product in competitor stores had mixed influence on the decision to offer standard CFLs as part of the program. Some retailers said it had little or no bearing on their decision, either because of their own policies on what products to carry or the proximity of their nearest competitors. Some retailers expressed the need to carry what their competitors were offering.

Retailers were happy with the program promotion and advertising provided by DCSEU, though some retailers said they augmented the advertising with their own materials or relied on their own entirely.

There was limited awareness of EISA among retailers, and they were generally not able to assess the influence of the act on the decision to carry standard CFLs in the program or rated it low.



### iii. Barriers/challenges to participation and ways to improve the program

Some respondents reported that a few customers were suspicious of the low prices of CFLs in the program and believed that the promotion was "too good to be true" or that the bulbs were inferior in some way. Retailers reported being successful in easing customers' concerns and explaining how the promotion worked. Although retailers did not report receiving complaints specifically about the discounted bulbs, a few respondents mentioned that there are still customers who, even after explaining the benefits of efficient lighting, still insist on purchasing incandescent bulbs. Respondents characterized these customers as often older and preferring incandescent bulbs because they are familiar with them. Additionally, there is still some persistence of the negative image of CFLs based on the earliest models and their deficiencies.

Some people, even if you tell them that this is the best for energy, especially the elderly people, they like the incandescents.

People are skeptical about energy saving bulbs, because light bulbs can be confusing, and folks tend to sort of think CFL is, you know, the initial CFL turned a lot of people off. And so even as much as you explain the differences, people are sort of turned off. So I guess that's sort of a general complaint.

For the most part, we probably sell more of the DCSEU CFL bulbs. One image we've had to overcome with the DCSEU bulbs is because they are so reasonably priced, a lot of folks think there's something wrong with them.

Retailers were pleased with the signage and other promotional material provided by the DCSEU to advertise the program. Customers knew that the bulbs were discounted, but they did not always know that the discount originated with DCSEU. Retailers said they educated customers when they could and trained their sales staff to answer questions from customers. Retailers would like to have a training by DCSEU staff in the store for their employees to educate them about the program and about efficient lighting. One retailer mentioned that they know about DCSEU's program offerings, but they would like to see more outreach from DCSEU in promoting their programs.

If they really want to get their bang out of their buck, they need to maximize training for the retail stores that are participating in it.

One challenge that was mentioned by several retailers was running out of product or having difficulty with ordering product from manufacturers. However, retailers were pleased with DCSEU's intervention in helping them resolve the issues. Retailers would also like to be able to order product via fax or email or include the orders with their regular orders. Following is a comment by a respondent concerning the ordering process:

Having to put in a special order, lag time from the supplier; with new supplier I had to wait upwards of a month for a couple of the bulbs. I'm not sure if that's because they weren't prepared for the number of orders or if there was a manufacturing problem. I can order from my other primary suppliers and I have my product in a couple of days. Waiting for weeks for something is a challenge.

Overall, retailers did not report challenges with reporting requirements.



## 4.12.4 Net-to-gross methodology and results

A. Methodology

Not conducted.

B. Summary of results

Not applicable.

C. Drivers net-to-gross results

Not applicable.

### 4.12.5 Impact evaluation

The impact evaluation involved review of tracking data, sales reports from EFI, and invoices from manufacturers. The evaluation team verified that the correct TRM algorithms were applied to the tracked measures. Overall, the impacts claimed by the initiative were evaluated to be quite accurate. Minimal issues were identified that did not significantly affect claimed savings.

Currently the DCSEU TRM assumes average wattages based on sales data from Efficiency Vermont. Because EFI tracks bulb wattage and model number for a significant portion of the incentivized lighting products, the evaluation team recommends that average wattages be calculated based on the DCSEU sales data now that sufficient sales data is available.

### A. Impact sampling methodology for onsite measurement and verification

Not applicable.

- B. Verification of impacts
  - Commercial Sector bulbs applied a different coincidence factor than expected. The TRM indicates that commercial bulbs should use loadshape #3, which is 57.8 percent demand on peak. The DCSEU applied a coincidence factor of 72.4 percent.
  - Bulbs sold in calendar year 2013 appropriately excluded interactive effects in DCSEU's reported results, but bulbs sold in 2014 did not. This is reflected in the realization rates to remove the interactive effects from 2014 savings.

	kWh			kW			MMBtu		
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR
LEDs	4,205,275	3,947,209	0.94	627.1	449.2	0.72	0	0	-
Specialty CFL	2,627,868	2,481,204	0.94	387.4	292.8	0.76	0	0	-
Standard CFL	14,279,861	13,552,581	0.95	2,244.9	1,599.1	0.71	0	0	-

### Table 4-128. FY14 Summary of Impact Evaluation Results



kWh			kW			MMBtu			
Measure	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR	Ex-ante Gross	Ex-post Gross	RR
Track Total	21,113,004	19,980,993	0.95	3,259.3	2,341.1	0.72	0	0	n/a
Relative Precision at 90% Confidence		0.00%			0.00%			-	

Another important subject to consider is the impact of the Energy Independence and Security Act of 2007, or EISA, on the baseline for energy savings. This legislation prohibits the manufacture of standard incandescent bulbs, phasing out certain wattages year by year. This act has already taken effect for 100- and 75-watt bulbs, and 60- and 40-watt bulbs took effect in January 2014. EISA does not, however, prohibit the sale of any existing stock of these bulbs. During the evaluation team's visit to stores in 2013, there was some evidence of this stock still being significant, as some stores had equal numbers of incandescent bulbs as they did energy efficient options.

In the FY13 evaluation, the evaluation team conducted in-store intercept interviews and follow-up phone surveys to identify whether products sold through the retail initiative ended up installed in homes or businesses. The result was that 14 percent of bulbs were installed in businesses, and the evaluation team recommended that DCSEU use this instead of the 10 percent used previously. This update was applied correctly in FY14.

Some of the deemed savings values for lighting are split into 2 bins for high- and low-wattage bulbs, such as specialty CFLs less than or equal to 15W and specialty CFLs over 15W. The evaluation team identified some bulbs that were placed into the wrong bin and therefore were allocated incorrect deemed savings values. This tended to be for measure codes with small quantities, so the overall impact on the realization rate is less than one percent.

While researching bulb wattages for this issue, the evaluation team looked up some of the tracked model numbers on manufacturer and retailer websites to ensure that the correct wattage was tracked in the database. Largely the tracked information was correct, but a few cases were incorrect and others were uncertain. For example, the bulb model BPCEAG/500/3 was tracked on separate records as both a decorative and an omnidirectional LED. The evaluation team's research indicates that the omnidirectional record is correct. The uncertain records were predominantly cases where the tracked wattage was 10W, which falls into the high-wattage deemed savings bin, but the actual bulb wattage was 9.5W. Depending on how the deemed savings calculation treats rounding in wattage allocation, these bulbs might be incorrectly allocated. Finally, some model numbers were not identifiable by the evaluation team, so we were not able to verify wattage or bulb type information. We did not make any adjustments to savings given that these issues were not systematic and applied to a very small quantity of bulbs. We recommend that the DCSEU maintain a record of product attributes, such as the entries from the ENERGY STAR qualified products list, for all products sold through the program.



C. Impact evaluation planned activities and completed activities comparison

#### Table 4-129. FY14 Impact Evaluation Plan vs. Actual

Activity	Plan	Actual	Explanation for Variance
Report reviews	6	6	

#### D. Summary of key findings describing adjustments to ex-ante savings

- The sector allocation for commercial and residential applications was correctly applied in reported savings.
- Bulbs sold in calendar year 2014 did not remove interactive effects in reported savings. This finding accounts for the nearly all of the verified savings adjustment for kWh savings.
- Commercial measures had the wrong coincidence factor applied based on the loadshape specified in the TRM.
- Some LEDs that were split into high-wattage and low-wattage categories had the incorrect deemed savings values applied. The overall impact for this finding is less than one percent.



# 4.12.6 Recommendations

- A. To improve program design, operations, customer experience, and recruitment
- i. Work with retailers and manufacturers to identify ways to foresee or mitigate product shortages. A few retailers mentioned running out of product and were not sure when they would get more. Retailers were happy with the responsiveness of the DCSEU in resolving issues, but in the interim they were not able to let their customers know when they would receive more product.
- ii. **Continue to conduct in-store events to promote the lighting initiative as well as the overall DCSEU brand.** The extensive presence of the lighting initiative offers a way to reach a significant number of customers and encourage them to participate in other initiatives within the DCSEU portfolio. Some retailers mentioned this as something they would like to see; continuing to reach out to more stores would enhance recognition of the brand and encourage buy-in by retailers.
- iii. **Document the presence of inefficient alternatives, especially the sell-through of incandescent bulbs phased out by EISA.** This supports impact savings claims and the overall effect of the lighting initiative.
- iv. Encourage more retailers to buy into LED bulbs. Some retailers reported that they did not carry LEDs. LEDs continue to improve in design and offer advantages over CFLs.
- B. To improve impact evaluation results
- i. Review deemed savings by measure type to ensure that the correct savings values are being applied.
- ii. Use EFI-reported wattages from incentivized products to update the average wattages used in TRM algorithms for FY14.
- iii. **Remove interactive effects from reported savings, where applicable.** The evaluation found that the interactive effects adjustments to remove penalties and benefits associated with the waste hear factor for the replacement of lighting with more energy efficient lighting were not handled consistently in KITT.
- iv. The DCSEU should maintain a record of product attributes, such as the entries from the ENERGY STAR-qualified products list, for all products sold through the program.
- C. To manage free-ridership results
- i. Not applicable.