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District Department of the Environment

Verification of the District of Columbia Sustainable Energy Utility

FY13 Annual Evaluation Report for the Performance Benchmarks

Final—September 29, 2014

DISTRICT DEPARTMENT OF THE ENVIRONMENT green forward

DC SUSTAINABLE ENERGY UTILITY
Your Guide to Green

leidos

BAUMANN CONSULTING
Formerly Ebert & Baumann Consulting Engineers

GDS Associates, Inc.
Engineers and Consultants

District Department of the Environment

Verification of the District of Columbia Sustainable Energy Utility

FY13 Annual Evaluation Report for the Performance Benchmarks

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ACKNOWLEDGEMENTS

This evaluation effort was conducted by Tetra Tech, GDS Associates, Inc., Leidos,[1] and Baumann Consulting[2] under the leadership of Tetra Tech. GDS Associates led and completed the cost effectiveness testing.

This effort was supported by the provision of project data in the form of KITT data extracts, project files, memos, staff interviews, and responses to other requests for data and information by the DDOE, DC SEU, and VEIC Evaluation, Measurement, and Verification Services group.

The evaluation team thanks the DDOE, DC SEU, and VEIC teams for their timely and thorough responses to all data requests and follow-up questions. In particular, we thank Asa Parker, VEIC EM&V Services Group, for his tremendous support and timely responses to the many questions from the evaluation team as we conducted our impact evaluation activities.

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[1] Formerly SAIC, International.
[2] Ebert and Baumann Consulting Engineers, Inc. d/b/a Baumann Consulting.

ACRONYMS

ACEEE	American Council for an Energy-Efficient Economy
AMI	Advanced Metering Infrastructure
Btu	British thermal unit
C&I	Commercial and institutional
CA SPM	California Standard Practice Manual
CAEA	Clean and Affordable Energy Act
ccf	100 cubic feet
CPUC	California Public Utility Commission
DC SEU	District of Columbia Sustainable Energy Utility
DDOE	District Department of the Environment
DI	Direct install
EM&V	Evaluation, measurement, and verification
FTE	Full time equivalent
FY	Fiscal year
ICDI	Implementation contractor direct install
KITT	Knowledge Information Transfer Tool
kW	Kilowatt
kWh	Kilowatt hour
LI	Low-income
LPG	Liquefied petroleum gas
M&V	Measurement and verification
mcf	1,000 cubic feet
MF	Multifamily
MMBtu	1 million Btu
NAPEE	National Action Plan for Energy Efficiency
NTG	Net-to-gross
O&M	Operation and maintenance
PAC	Program administrator cost
PCT	Participant Cost Test
PJM	Pennsylvania New Jersey Maryland
RIM	Rate Impact Measure
RPM	Reliability Pricing Model
SCT	Societal cost test
SETF	Sustainable Energy Trust Fund
SREC	Solar renewable energy certificate
T&D	Transmission and distribution

TRM	Technical reference manual
TRC	Total Resource Cost
Tt	Tetra Tech
VEIC	Vermont Energy Investment Corporation

1. EXECUTIVE SUMMARY

The District Department of the Environment (DDOE) has contracted with Tetra Tech (as the prime contractor), GDS Associates, Inc., Leidos[3], and Baumann Consulting[4] to provide evaluation, measurement, and verification (EM&V) of the portfolio of energy efficiency and renewable energy programs, or initiatives, offered in the District of Columbia (DC), along with the six performance benchmarks[5] associated with these initiatives. The initiatives are implemented through the DC Sustainable Energy Utility (SEU, or DC SEU) partnership.

The Clean and Affordable Energy Act of 2008 (CAEA) requires the Mayor, through DDOE, to contract with a private entity to conduct sustainable energy programs on behalf of the District of Columbia. The CAEA authorizes the creation of a Sustainable Energy Utility (SEU) and designates the SEU to be the one-stop resource for energy efficiency and renewable energy services for District residents and businesses.

The DC SEU is led by the Sustainable Energy Partnership and under contract to the District Department of the Environment. The Sustainable Energy Partnership includes the following organizations:

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

The SEU Advisory Board provides monitoring of the DC SEU and advice to the DDOE and the Council of the District of Columbia according to the *Bylaws of the Sustainable Energy Utility Advisory Board ("Board") adopted pursuant to Section 204(b) of the Clean and Affordable Energy Act ("Act")*[6], Article 1, Section 1.2.

> "In accordance with the Clean and Affordable Energy Act of 2008, D.C. Official Code § 8-1774.03, the Board shall: (a) Provide advice, comments, and recommendations to the District Department of the Environment ("DDOE") and Council of the District of Columbia ("Council") regarding the procurement and administration of the Sustainable Energy Utility (hereinafter referred to as the "SEU") contract described in sections 201 and 202 of the Act; (b) Advise the DDOE on the performance of the SEU under the SEU contract; and, (c) Monitor the performance of the SEU under the SEU contract. Section 203(a) of the Act."

[3] Formerly SAIC, International
[4] Ebert and Baumann Consulting Engineers, Inc. d/b/a Baumann Consulting
[5] The DDOE is verifying the "Increase the number of green-collar jobs in the District of Columbia" performance benchmark reported results.
[6] SEU Advisory Board Bylaws, http://green.dc.gov/page/seu-advisory-board-bylaws.

The DC SEU began implementing energy efficiency and renewable energy programs in FY11.

This report summarizes the evaluation and verification of the six performance benchmarks included within the DDOE contract with the DC SEU for fiscal year 2013 (FY13). The fiscal year is defined as October 1st through September 30th.

The six performance benchmarks, in summary, include:

1. Reduce per-capita energy consumption in the District of Columbia
   - Reduce per-capita energy consumption - electricity (MWh)
   - Reduce per-capita energy consumption - natural gas (mcf)
2. Increase renewable energy generating capacity in the District of Columbia
3. Reduce the growth of peak demand in the District of Columbia
4. Improve the energy efficiency of low-income housing in the District of Columbia
5. Reduce the growth of the energy demand of the District of Columbia's largest energy users
6. Increase the number of green-collar jobs in the District of Columbia.

1.1 PERFORMANCE BENCHMARK ASSESSMENT RESULTS

The results of the evaluation team's verification of the six performance benchmarks are summarized in Table 1-1. In summary, the DC SEU fully achieved 2 performance benchmarks and exceeded of the minimum targets for 2 of the performance benchmarks:

Performance benchmark targets achieved

2. Increase renewable energy generating capacity: Cost per MMBtu reduction from FY12. The DC SEU reduced the MMBtu acquisition cost from $2,253 in FY12 to $380 in FY13, a reduction of 83 percent.

4. Improve energy efficiency in low-income housing: 30 percent spend ($). The DC SEU reached 118 percent of this performance benchmark target.

Minimum performance benchmark targets achieved

1a. Reduce per-capita energy consumption - electricity (MWh). The DC SEU achieved 101 percent of the minimum performance benchmark.

3. Reduce growth in peak demand (kW). The DC SEU exceeded this minimum benchmark by more than 300 percent.

Table 1-1. FY13 DC SEU Performance Benchmarks Verification Summary

Item	Benchmark	Performance Target[7]	Minimum Target[8]	FY13 Reported[9]	FY13 Verified	Performance Target Achieved	Minimum Target Achieved
1a	Reduce per-capita energy consumption – electricity, MWh	103,690	51,845	50,361	52,303	50.4%	100.9%
						Not achieved	Achieved
1b	Reduce per-capita energy consumption - natural gas, mcf	273,428	136,714	52,717	50,608	18.5%	37.0%
						Not achieved	Not achieved
2	Increase renewable energy generating capacity: Cost per MMBtu reduction from FY12, %	20%	10%	80%	83%	Exceeded by 315%	Exceeded by 730%
						Achieved	Achieved
3	Reduce growth in peak demand, kW	20,000	2,000	7,468	8,016	40.1%	400.8%
						Not achieved	Achieved
4	Improve energy efficiency in low-income housing: 30 percent spend, $	$4,620,000	$3,080,000	$5,689,466	$5,456,049	118.1%	177.1%
						Achieved	Achieved
5	Reduce growth in energy demand of largest users	not defined	not defined	n/a	n/a	n/a	n/a
6	Increase number of green-collar jobs: green-job hours directly worked by District residents, FTE	77	62	45[10]	40	51.9%	64.5%
						Not achieved	Not achieved

[7] Source: DDOE “DC SEU FY12-FY14 Performance Targets and Results” Table
[8] ibid.
[9] ibid.
[10] ibid.

1.2 PERFORMANCE BENCHMARK ASSESSMENT

The evaluation team completed a review of the *Independent Review and Update of The District of Columbia SEU's Annual Performance Benchmarks* report[11] submitted by Jerome S. Paige & Associates, LLC to District Department of the Environment in September 2013 ("Paige report"). The DC SEU contract with the DDOE contains six performance benchmarks that were primarily based upon the initial Paige report conducted on behalf of the DDOE and submitted in September 2010.

The updated report states the study objectives as: "(i) undertake an independent assessment of the reasonableness of the current annual performance benchmarks of the District of Columbia Sustainable Energy Utility (DC SEU), (ii) update of the current targets or performance requirements for each benchmark, and (iii) review and update the at-risk performance compensation and penalty schemes for each performance benchmark." The conclusion drawn as stated in that report is that "while all the six DC SEU benchmarks are valid, changes are needed in the specification of the targets or performance milestones for five of the benchmarks."[12]

The Paige report concludes that, although all six performance benchmarks are valid, changes to five of the six benchmarks are required to establish "reasonable" benchmarks, or minimal targets of performance. These recommendations are represented within each performance benchmark section of this report.

[11] Contract Number DCKG-2013-R-9310

[12] *Independent Review and Update of The District of Columbia SEU's Annual Performance Benchmarks*, Jerome S. Paige & Associates, LLC for the District Department of the Environment, September 2013, page 4.

2. Reduce Per capita Energy Consumption in the District of Columbia (CAEA §201(D)(1))

2.1 DESCRIPTION[13]

The Contractor shall develop and implement renewable energy and energy efficiency programs for electricity and natural gas users that directly lead to an annual reduction equivalent to one percent of the weather-normalized total electricity consumption in the District for 2009 and an annual reduction equivalent to one percent of the weather normalized natural gas consumption in the District for 2009. These are separate benchmarks for electricity and natural gas, and Contractor is required to meet both benchmarks to be eligible for the performance incentive.

2.2 EVALUATION AND VERIFICATION APPROACH

The independent evaluation team verified the impacts on electric and gas usage from the installation of measures by track and for the portfolio as a whole as described in the *District Department of the Environment Energy Efficiency Evaluation Plans for Portfolio of Programs Offered in the District of Columbia.* Verified results for each program and in total are reported in the *District Department of the Environment Evaluation, Measurement, and Verification of Energy Efficiency and Renewable Energy Programs in the District of Columbia FY13 Annual Evaluation Report, Volume I*.

2.3 VERIFICATION RESULT

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 2-1. These verified results reflect portfolio level realization rate estimates of 1.04, 1.07, and 1.00 for kWh, kW, and MMBtu, respectively. This means that the evaluation team estimates that the actual portfolio electric savings result is 104 percent of the DC SEU reported electric savings, the demand reduction result is 107 percent of the DC SEU reported demand reduction, and the actual portfolio gas savings result is 100 percent of the DC SEU reported gas savings. This compares to realization rate estimates at the portfolio level of 0.92, 0.95, and 0.99 for kWh, kW, and MMBtu, respectively for the FY12 results.

Realization rates are the ratio of verified savings to the tracking system savings for a representative sample of projects reported with 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—especially for programs in their second year of implementation. Comparatively, the Pennsylvania Act 129 Statewide Evaluator Annual Report for Plan Year 2,[14] reported that the utilities, overall, achieved a realization rate of

[13] Contract Number DDOE-2010-SEU-0001, Attachment J.1, page 53.
[14] http://www.puc.pa.gov/electric/pdf/Act129/SWE_PY3-Annual_Report.pdf.

approximately 96 percent for electric savings in its second year of Act 129 Program operation. The EmPOWER Maryland 2012 statewide verified results are reported in the *Verification of Reported Impacts from 2012 EmPOWER Maryland Energy Efficiency Programs*[15] as 100.1 and 115.1 percent of reported values for electric savings and demand reduction, respectively.

As for the FY12 results evaluation, 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 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 differences between claimed and verified results are not uncommon.

The reported and verified electric savings (kWh) and demand reduction (kW) results are adjusted for line losses (8 percent and 6 percent increases, respectively) to express savings at the electric generator rather than at the customer meter.

$$\textit{Non-solar electric savings at generator} = 1.08 * kWh_{KITT/verified}$$

$$\textit{Non-solar demand savings at generator} = 1.06 * kW_{KITT/verified}$$

In addition, the savings and demand for the renewable energy tracks are increased by an additional 15 percent to account for assumed spillover[16]. For the Solar PV tracks (7710SHOT and 7710PV), therefore, the total savings are multiplied by 1.242 (1.08*1.15) and demand is multiplied by 1.219 (1.06*1.15).

$$\textit{Solar electric savings at generator} = 1.08 * 1.15 * kWh_{KITT/verified}$$

$$\textit{Solar demand savings at generator} = 1.06 * 1.15 * kW_{KITT/verified}$$

The gas savings results are converted from MMBtu as reported in KITT to mcf according to the following equation:

$$\textit{one mcf} = 1.02^{17} * MMBtu$$

The DC SEU achieved the electric savings minimum performance benchmark but not the natural gas savings minimum performance benchmark for FY13.

[15] *Verification of Reported Program Impacts from 2012EmPOWER Maryland Energy Efficiency Programs with Recommendations to Improve Future Evaluation Research*, June 4, 2013. http://neep.org/Assets/uploads/files/emv/emv-library/MDPSC_2012_Verification_Report_Compiled.pdf.

[16] Reference DC SEU memorandum to the DDOE and Tetra Tech, *Screening assumptions for the DC SEU solar renewable energy program portfolio*, dated August 30, 2012.

[17] The 1.02 conversion factor is slightly conservative compared to the conversion factor of 1.023 established by the U.S. Energy Information Administration last updated March 20, 2013; see http://www.eia.gov/tools/faqs/faq.cfm?id=45&t=8.

Table 2-1. FY13 Per Capita Energy Consumption Results Summary

Metric	Minimum Target	Reported	Verified	Minimum Target Achieved
Electric, MWh	51,845	50,361	52,303	Yes (100.9%)
Natural gas, mcf	136,714	52,717	50,608	No (37.0%)

2.4 PERFORMANCE BENCHMARK ASSESSMENT

2.4.1 Background

In its second full year of portfolio implementation,[18] the DC SEU was able to achieve the minimum performance benchmark for electric savings. However, the natural gas savings minimum performance benchmark remains a challenge. There is an indication of a "building of momentum"; that is, energy resource acquisition costs are declining as energy savings increase in greater proportion than expenditures increase. The FY13 minimum performance benchmarks for electric and natural gas savings each increased by 13 percent over the FY12 targets while the budget increased by 11 percent. For FY14, the budget has increased by 14 percent while minimum savings targets each increased by 18 percent.

Table 2-2. FY13 Per Capita Energy Consumption Minimum Performance Target Comparison: FY12, FY13, and FY14

Metric	FY12 Minimum Target/$Actual	FY13 Minimum Target/$Actual	FY12 to FY13 % Change	FY14 Minimum Target/Budget	FY13 to FY14 % Change
Electric, MWh	45,746	51,845	13%	60,994	18%
Natural gas, mcf	120,630	136,714	13%	160,840	18%
Portfolio actual/budget, $m	$13,836	$15,400	11%	$17,500	14%

The verified electric savings increased by 144 percent over FY12 results and natural gas savings went from a negative value[19] exceeding 11,000 mcf to just over 50,000 mcf in FY13.

Table 2-3. FY13 Per Capita Energy Consumption Verified Comparison: FY12 and FY13

Metric	FY12 Verified	FY13 Verified	% Change Verified
Electric, MWh	21,448	52,303	144%
Natural gas, mcf	(11,284)	50,608	-

[18] The DC SEU offered quick start programs in FY11.

[19] The DC SEU reports natural gas savings net of the facility heating and cooling interactive effects associated with the replacement of less efficient lighting with energy efficient lighting equipment. The negative mcf value for FY12 indicates that the DC SEU did not incent enough natural gas savings projects in FY12 to offset the penalties (or negative values) associated with these interactive effects.

2.4.2 Assessment

A. Acquisition Cost Comparisons

The Paige report discussed the reasonableness of the benchmarks in terms of yield, or the energy savings achieved per $10,000 spent. This discussion reverses the formula to represent the analysis in terms of the acquisition cost of energy efficiency resources, or dollars spent per MWh or MMBtu achieved and excludes renewable energy savings and expenditures as benchmark data excludes this technology in this review.

i. Acquisition cost: $ per MWh, excluding renewable energy

The DC SEU Portfolio of Energy Efficiency electric track offerings gained 144 percent of reported MWh savings over the FY12 implementation period, while electric spending increased by 2 percent[20] in absolute terms.

The acquisition cost, or MWh achieved (based on verified savings adjusted for line losses) per dollar spent excluding renewable energy tracks, was $228 in FY13 compared to $549 in FY12—a 58 percent decrease.[21] To achieve the minimum performance benchmark for FY14 within the FY14 budget allocated, the acquisition cost must remain at the FY13 level. In comparison, a report titled, *The Future of Utility Customer-Funded Energy Efficiency Programs in the United States: Projected Spending and Savings to 2025* prepared by the Ernest Orlando Lawrence Berkeley National Laboratory[22] states that, "Low-cost states were… assumed to have average program costs equal to $150 per first-year MWh saved at a savings level of 1.0% of retail sales, based on data compiled by ACEEE (Sciortino et al. 2011)."

Another report completed by ACEEE titled, *An Empirical Model for Predicting Electric Energy Efficiency Resource Acquisition Costs in North America: Analysis and Application*[23], provides analysis regarding savings over time and suggests that acquisition costs should decline over the first five to six years of implementation as savings targets increase and then begin to rise as acquisition costs increase with portfolio maturity.

Figure 2-1 and Figure 2-2 illustrate the DC SEU annual expenditures for FY12 and FY13 and the budget for FY14 compared to the savings achieved in FY12 and FY13, and the targets for FY14.[24] Acquisition costs per MWh for FY12 and FY13 were $549 and $228 (based on

[20] Although the FY13 budget increased by 14 percent over FY12, the DC SEU allocated more funding to natural gas and renewable energy measures in FY13.

[21] Excludes renewable energy expenditures and associated energy savings.

[22] *The Future of Utility Customer-Funded Energy Efficiency Programs in the United States: Projected Spending and Savings to 2025*, Galen L. Barbose, Charles A. Goldman, Ian M. Hoffman, Megan Billingsley, prepared for the Office of Electricity Delivery and Energy Reliability National Electricity Delivery Division U.S. Department of Energy, January 2013. http://emp.lbl.gov/sites/all/files/lbnl-5803e.pdf.

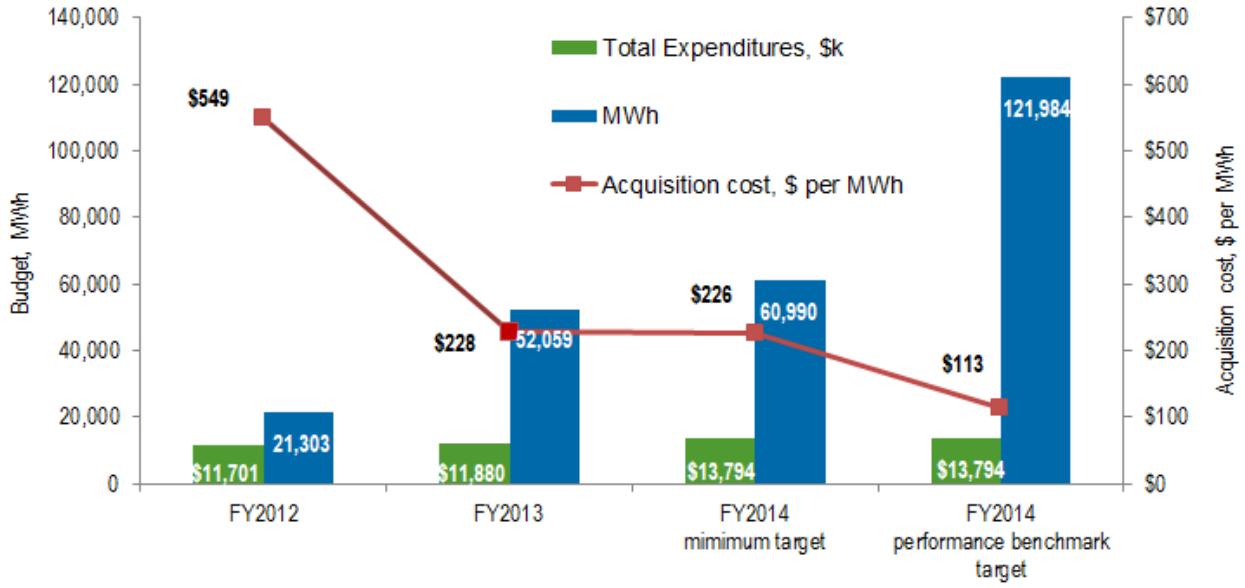
[23] *An Empirical Model for Predicting Electric Energy Efficiency Resource Acquisition Costs in North America: Analysis and Application,* John Plunkett, Theodore Love, and Francis Wyatt, Green Energy Economics Group, Inc., Summer 2012. http://www.aceee.org/files/proceedings/2012/data/papers/0193-000170.pdf.

[24] Actual costs and budget exclude third-party evaluation costs.

reported non-renewable electric savings adjusted for line losses), respectively. In comparison, the average electric distribution company acquisition costs in year three of Pennsylvania's Act 129 implementation was $163.[25] In order for the DC SEU to meet the minimum electric performance benchmark reduction goal for FY14 under the current budget, they must achieve an acquisition cost of $226 per MWh and to achieve the performance benchmark MWh target, acquisition cost must decrease to $113 per MWh. This cost comparison does not speak to the differences between the regulatory requirements in Pennsylvania and the contractual requirements for the DC SEU. It is presented here to provide a sense of the challenge the DC SEU faces for FY14 outside of the achievement of the other goals and benchmarks. The evaluation team will conduct a more detailed review and analysis of the DC SEU administrative costs later in this evaluation cycle and those results will be reported separately.

Acquisition cost comparisons between jurisdictions and similar, or differing, implementation models are meaningful as there is no need to distinguish how various costs are categorized since the cost is the sum of direct, indirect, and incentive expenditures associated with acquiring these energy efficiency resources. As with many metric comparisons, though, this is not perfect. The high-level acquisition cost does not provide insight into differences in cost drivers such as portfolio maturity or jurisdictional specific requirements, markets served, and constraints in acquiring energy efficiency resources.

Figure 2-1. Total Electric Savings: FY12 and FY13 Actual (A), FY14 Budget (B) at Generator Level



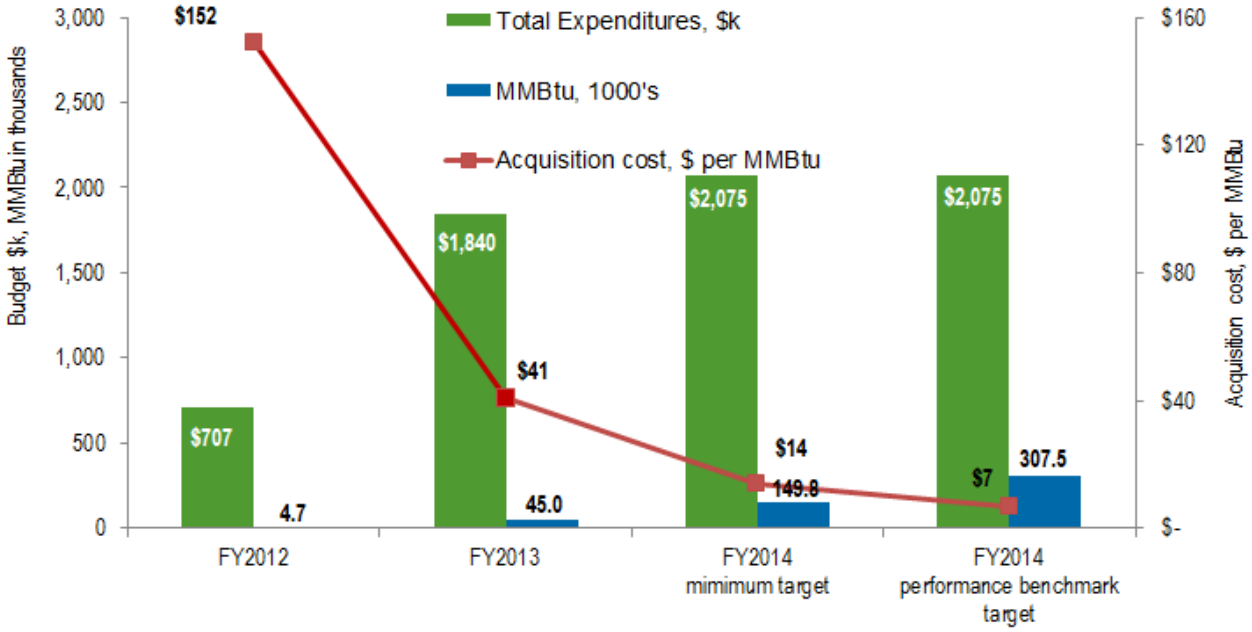
ii. Acquisition cost: $ per MMBtu, excluding renewable energy

The FY13 non-renewable savings for energy efficient natural gas measures increased by 867

[25] PA Act 129 Phase I Electric Distribution Reports can be found here: http://www.puc.pa.gov/filing_resources/issues_laws_regulations/act_129_information/electric_distribution_company_act_129_reporting_requirements.aspx.

percent while the expenditures increased by 160 percent.[26] The acquisition cost, or dollars spent per MMBtu saved, decreased by 73 percent. To achieve the minimum performance benchmark for FY14 within the FY14 budget, the acquisition cost must decrease by 66 percent to $14 over the FY13 results. To achieve the performance benchmark target, it must decrease to $7 per MMBtu. Reductions of these magnitudes is highly unlikely, indicating achievement of both the MWh and mcf targets are not likely. The ACEEE report, *A National Review of Natural Gas Energy Efficiency Programs*,[27] provides data for 40 states over various periods from 2005 to 2010 with acquisition costs ranging from $0.67 to $400.

Figure 2-2. Total Gas Savings: FY12 and FY13 Actual (A), FY14 Budget (B) [28]



The DC SEU reports natural gas savings net of the facility heating and cooling interactive effects of the installation of more energy efficiency lighting, which reduces the savings claimed from the installation of more energy efficient natural gas equipment. A review of seven states with both electric and natural gas energy efficient programs indicates that the District is outside the norm in reporting the interactive effects as a penalty. The only other state reviewed that reports net gas savings is Vermont.

Table 2-4. A Review of the Reporting of Natural Gas Net Interactive Effects

State	Resource	Summary finding
MD	BGE Semiannual Report, 2013	None of the EmPOWER Maryland utilities report gas savings or penalties for residential or commercial lighting measures-including BGE which also provides gas service in Maryland.

[26] Excludes renewable energy expenditures and associated MMBtu energy savings.
[27] York, Dan, Witte, Patti, Friedrich, Katherine, Kushler, Marty, Report Number U121, January 2012, http://www.aceee.org/sites/default/files/publications/researchreports/u121.pdf.
[28] Gross MMBtu savings excludes penalties, source DC SEU FY12 and FY13 Annual reports.

State	Resource	Summary finding
DE	DE TRM, STATE ENERGY EFFICIENCY PROGRAMS EM&V REPORT, 2009-2011, July 2012	Report "n/a" for lighting measure therms indicating that they are not expected to account for fossil fuel penalties for reporting or for EM&V
NJ	CLEAN ENERGY PROGRAM Energy Savings Protocols, August 2012	Fossil fuel cooling savings and heating penalties are not addressed; New Jersey's Clean Energy Program does not report fossil fuel savings for non-gas savings measures
VT	2013 Annual Plan and 2012 Annual Report	The MMBtu performance indicator target is, "Annual incremental net MMBtu savings"; Efficiency Vermont reports NET MMBtu (that is, it appears to include the effect of residential and nonresidential heating penalties)
PA	2014 TRM	Does not calculate fossil fuel heating penalties
IL	TRM, June 2013	The TRM provides algorithms to calculate the heating penalty, but it does not appear that the utilities report on this factor
TX	TRM v01, December 2013.	The Texas energy efficiency programs target and report on electricity only; therefore, there are no fossil fuel penalties

iii. Acquisition cost: renewable energy tracks

The acquisition costs ($ per MWh and $ per MMBtu) for the solar PV track (7120PV) and the solar hot water track (7110SHOT) are considerably higher than for non-renewable energy efficiency tracks. In FY12, the $ per MWh spent for solar PV savings was $7,681 and in FY13 it was $4,140, This is approximately 1300 percent and 1700 percent higher, respectively, than the acquisition of non-renewable MWh savings. For solar hot water MMBtu savings offered in FY13, the acquisition cost was $230 per MMBtu, compared to $41 per MMBtu in FY12 excluding renewable energy savings and expenditures.

B. Paige Report Recommendations[29]

The Paige report, in addition to recommendations listed below, states that the targets for electric and natural gas savings should be combined into a single target measured by MMBtu savings and that the "target value should be based on: (a) on the likely yields (energy savings/$ spent) attainable in the District; (b) on making the package as a whole reasonable, taking account of the target values set for the other benchmarks and the District's features that adversely affect costs and performance; and (c) taking account of the DC SEU's budget."

The Paige report recommendations are to:[30]

[29] *Independent Review and Update of The District of Columbia SEU's Annual Performance Benchmarks*, Jerome S. Paige & Associates, LLC for the District Department of the Environment, September 2013, pages 28-29.
[30] ibid, page 4.

i. Undertake fresh analysis that will allow DDOE to revise the target based on an estimate of a reasonable yield in terms of energy savings, a better sense of the external funds that the DC SEU can bring in, and the impact of the constraints faced by the DC SEU on the yields.

ii. In the interim, maintain at the Fiscal Year (FY) 2013 level of 0.85% for FY14.

iii. In assessing possible penalties for not meeting this benchmark's target value for FY14, take account of the complex set of issues discussed in the report.

2.4.3 Conclusion

The evaluation team concurs with the Paige recommendation to conduct additional analysis to more fully understand the interactive effects of all benchmarks. This analysis should review in more depth the implications of moving to a combined energy savings target for electric and natural gas. Additionally, the District could consider using the gross verified natural gas savings as the claimed savings; that is, measure the progress towards the mcf targets without inclusion of the interactive effects for the installation of more energy efficient lighting. Finally, the District potential study should provide key data and information for informing meaningful targets and should the District conduct a baseline study, this data in conjunction with the DC SEU portfolio savings data to date can be used to update and calibrate the potential study.

3. INCREASE RENEWABLE ENERGY GENERATING CAPACITY IN THE DISTRICT OF COLUMBIA (CAEA §201(D)(2))

3.1 DESCRIPTION[31]

The Contractor shall design and implement a cost-effective renewable energy program(s) for installations of renewable energy within the borders of the District. Beginning in Year 3 of the SEU contract, the Contractor shall receive 50% of the compensation at risk allocated for this benchmark for a 10% decrease in $/kWh of the first year of energy production of renewable energy installations incentivized by the renewable energy program(s), compared to the $/kWh for the previous year (energy production from non-electricity producing renewable energy calculations shall be converted to kWh).

3.2 EVALUATION AND VERIFICATION APPROACH

In FY13, the DC SEU offered two renewable energy measures: photovoltaic rooftop panels and solar thermal hot water systems. The rooftop photovoltaic track (7120PV) primarily targets single-family housing, but is not exclusively applied to this type of facility. The solar thermal track (7110SHOT) targets solar domestic hot water systems in low-income multifamily buildings and commercial and institutional facilities with high hot water demand and is designed to replace existing inefficient hot water heating systems. The solar thermal track comprised 85 percent of the renewable energy savings in FY13.

The evaluation team compared the financial summary files received from the DC SEU for FY12 titled “Electric-Gas Split Values” and for Fy13 “Support and Direct Cost Breakdown FY 13 DCSEU” and “Annual Electric Gas Split Calc_SV_20Aug2014”. These files provided the administrative costs overall and the direct spend costs per track. The administrative costs were allocated to the track based on the percent direct spend of each track and the total track costs were derived by adding the direct spend to the allocated administrative cost. Next, the verified kWh savings values for the solar photovoltaic track (7120PV) at the generator level were converted to MMBtu per the following conversion:

one MMBtu = 293.3 kWh

After adding the two renewable MMBtu savings and total costs, the renewable acquisition cost per MMBtu was calculated as:

Renewable acquisition costs per MMBtu = Total renewable cost divided by renewable MMBtu

The change from FY12 to FY13 was then calculated.

[31] Contract Number DDOE-2010-SEU-0001, Attachment J.1, page 55.

Table 3-1. Renewable Energy Initiatives Acquisition Cost per MMBtu (with Administrative cost allocation)

Track	7120PV	7110SHOT	Total
FY12 Expenditure[32]	$1,427,696	$ -	$1,427,696
FY12 Verified Savings (MMBtu)	634	-	634
FY12 Acquisition Cost	$2,252.86	$ -	$2,252.86
FY13 Expenditure[33]	$1,011,473	$1,060,768	$2,072,241
FY13 Verified Savings (MMBtu)	833	4,620	5,453
FY13 Acquisition Cost	$1,214.12	$229.60	$380.01
Acquisition cost change FY12 to FY13			**-83%**

The results excluding the allocation of the administrative cost is slightly lower:

Table 3-2. Renewable Energy Initiatives Acquisition Cost per MMBtu (without administrative cost allocation)

Track	7120PV	7110SHOT	Total
FY12 Expenditure[34]	$843,121	$ -	$843,121
FY12 Verified Savings (MMBtu)	634	0	634
FY12 Acquisition Cost	$1,330.42	$ -	$1,330.42
FY13 Expenditure[35]	$687,583	$721,093	$1,408,676
FY13 Verified Savings (MMBtu)	833	4,620	5,453
FY13 Acquisition Cost	$825.34	$156.08	$258.33
Acquisition cost change FY12 to FY13			**-81%**

3.3 VERIFICATION RESULT

This performance benchmark was achieved.

[32] Source: file provided by DC SEU titled " Electric-Gas Split Values", 'Electric - Gas Split' worksheet, cell N33
[33] Source: file provided by DC SEU titled "Annual Electric Gas Split Calc_SV_20Aug2014", 'Table' worksheet", cells J15 and J16
[34] Source: file provided by DCS EU titled " Electric-Gas Split Values", 'Electric - Gas Split' worksheet, cell K33
[35] Source: file provided by DC SEU titled "Annual Electric Gas Split Calc_SV_20Aug2014", 'Table' worksheet", cells C15 and C16

Table 3-3. FY13 Renewable Energy Generation Capacity Cost Results Summary

Benchmark	Performance Target	Minimum Target	FY13 Reported	FY13 Verified	Performance Target Achieved	Minimum Target Achieved
Cost per MMBtu reduction from FY12	20%	10%	80%	83%	Exceeded by 315%	Exceeded by 730%
					Achieved	Achieved

3.4 PERFORMANCE BENCHMARK ASSESSMENT

3.4.1 Background

In FY12, the DC SEU was tasked with delivering a cost effective renewable program within the District. The DC SEU offered the Solar PV initiative, a solar photovoltaic rooftop offering, which targeted low-income housing. The FY12 cost effectiveness results for this effort was 0.82. In FY13, the DC SEU offered an additional measure, solar thermal hot water systems.

3.4.2 Assessment

For FY13, the energy efficiency resource acquisition cost per MMBtu saved for this track dropped by 83 percent from the FY12 cost. This was driven primarily by the FY13 solar thermal hot water initiative that contributed 85 percent of the renewable energy savings and produced a cost benefit ratio of 2.36 (including 3rd party evaluation cost and the application of the FY13 realization rates). The cost effectiveness of the solar photovoltaic initiative improved to 1.96. The solar expenditures increased by 45 percent from FY12 to FY13 while the MMBtu savings increased by 760 percent-resulting in a steep decline in the acquisition cost for FY13.

A. Paige Report Recommendations[36]

In its assessment of this benchmark, the Paige report states that, “The cost-reduction definition of this target does not appear to be a suitable definition for a performance contract (as is the case for the DC SEU) because the costs are beyond the DC SEU’s control, and do not reflect the DC SEU’s performance. Costs are largely determined by regional, national, and international markets, in which the District is a relatively small participant. For example, in the case of solar photovoltaic (solar PV) panels, costs have been declining steadily for the last 30 years, and this trend is expected to continue, regardless of what the DC SEU does.”

The Paige report recommendations for this benchmark are:

[36] *Independent Review and Update of The District of Columbia SEU's Annual Performance Benchmarks*, Jerome S. Paige & Associates, LLC for the District Department of the Environment, September 2013, page 19-20.

i. To define the role the DC SEU should play in promoting renewable energy in the District

ii. To define a target that reflects the DC SEU's performance, and not broader market forces.

3.4.3 Conclusion

Although the evaluation team agrees there are several costs associated with renewable energy initiatives beyond the control of the DC SEU, the DC SEU can control the cost of administering these initiatives. The evaluation team will assess the DC SEU administrative cost trend in more detail as part of a follow-on effort after the completion of the FY13 evaluation reports.

4. REDUCE GROWTH OF PEAK DEMAND IN THE DISTRICT OF COLUMBIA (CAEA §201(D)(3))

4.1 DESCRIPTION[37]

The SEU is not required to undertake any programs aimed exclusively at reducing the growth of peak demand. However, the SEU is required to estimate, using protocols developed by PJM for evaluating the capacity effects of energy efficiency projects for base residual auction, the impact on peak demand of its energy efficiency programs. The forecast increase in electric demand in the District between July 2010 and July 2011 is 40.8 MW. The minimum performance benchmark is 2,000 kW.

4.2 EVALUATION AND VERIFICATION APPROACH

To assess this benchmark, the independent evaluator verified the demand reductions associated with the energy efficiency and renewable programs within the SEU portfolio and for the portfolio as a whole as described in the *District Department of the Environment Energy Efficiency Evaluation Plans for Portfolio of Programs Offered in the District of Columbia.* Verified results for each program and in total are reported in the *District Department of the Environment Evaluation, Measurement, and Verification of Energy Efficiency and Renewable Energy Programs in the District of Columbia FY13 Annual Evaluation Report, Volume I*.

4.3 VERIFICATION RESULT

The evaluation team's verified, or ex-post, results for the overall portfolio are presented in the table below. These results reflect a realization rate estimate of 1.07 for kW. This means that the evaluation team estimates that the verified portfolio electric demand reduction result is 107 percent of the DC SEU reported demand reduction.

The evaluation team determined that the DC SEU exceeded this minimum performance benchmark by nearly 61 percent.

Table 4-1. Peak Demand Reduction Results Summary

Metric	Minimum Target	Reported	Verified	Minimum Target Achieved
Demand reduction (kW)	2,000	7,468	8,016	Yes (401%)

4.4 PERFORMANCE BENCHMARK REASONABLENESS ASSESSMENT

4.4.1 Background

Although not currently participating, the DDOE is interested in the eventual ability to participate in the PJM RPM capacity market by bidding on energy efficient resources that result from the implementation of the DC SEU initiatives. The DDOE faces an internal barrier to participation that it must resolve. Participation in the PJM RPM capacity market requires

[37] Contract Number DDOE-2010-SEU-0001, Attachment J.1, page 55.

commitments more than a year in advance—the base residual auction, for example, requires that energy efficient resource bids be submitted three years in advance. With that requirement, the DDOE must design a process that effectively handles the DDOE restriction for single fiscal year contracts. Additionally, it is unclear as to whether or not the DC SEU can submit bids until programs have been in place for at least three years in order to establish a baseline.

4.4.2 Assessment

The DC SEU portfolio has once again exceeded the minimum performance benchmark for this metric. The DC SEU is not developing initiatives with the specific intent of reducing demand savings; reported savings result from the installation of electric savings measures and the associated reduction in demand.

Pepco, the electric distribution company serving the District of Columbia, is implementing an Advanced Metering Infrastructure (AMI) and has completed the replacement of 99 percent of its legacy meters according to its website[38]. This infrastructure can be used to offer targeted demand reduction programs.

A. Paige Report Recommendations

The Paige report states that, "Given the role of AMI/SG and the role of large users, it seems appropriate that the DC SEU only have a supporting role in reducing peak demand [Pepco's Smart Grid Application 2009 claimed peak reduction amounts ranging from 176—347 MW]."[39] and concludes that this benchmark does not need any adjustments.

4.4.3 Conclusion

The evaluation team recommends that the DC SEU continue to calculate the peak demand savings from the DC SEU portfolio and engage PJM in direct discussions to better understand the PJM RPM capacity market participation requirements. Additionally, the completion of a business case for participation will quantify costs and potential revenue streams to aid in the decision for if, or when, participation makes good business sense. Completion of this business case may make more sense as a performance benchmark for FY15 with future benchmarks tied to the business case should it be determined that it is feasible and beneficial for the District to participate in the PJM capacity market.

[38] http://www.pepco.com/_res/documents/PepcoDCFactSheet.pdf downloaded March 10, 2014.
[39] *Independent Review and Update of The District of Columbia SEU's Annual Performance Benchmarks*, Jerome S. Paige & Associates, LLC for the District Department of the Environment, September 2013, page 22.

5. IMPROVE THE ENERGY EFFICIENCY OF LOW-INCOME HOUSING IN THE DISTRICT OF COLUMBIA (CAEA §201(D)(4))

5.1 DESCRIPTION[40]

On an annual basis, a minimum of 30 percent of the SETF funds expended by the SEU shall be dedicated to improving the energy efficiency of low-income housing in all eight wards of the District. Programmatic, administrative, evaluation, and other expenses of the SEU for all of its programs shall be included in the denominator (the SEU's total expenditures) but not the numerator (the amount spent on low-income programs). DDOE defines "low-income" as households earning 60 percent of state median income, or 200 percent of federal poverty level, whichever is higher. Households will qualify at or below that level. Qualifying structures will have at least two-thirds of its units at this income level or lower. A building that contains many lower-income families, but less than two-thirds of the units in the building, may be included in a low-income housing program if approved by DDOE.

5.2 EVALUATION AND VERIFICATION APPROACH

In addition to the project files requested to support the impact evaluation effort, the DC SEU provided a financial summary file titled, "Support and Direct Cost Breakdown FY 13 DCSEU". The evaluation team reviewed a sample of the project files for the low-income tracks (7420FHLB, 7610BLTZ, 7610ICDI, 7620LICP) as well as for the solar tracks (7110SHOT, 7120PV) to assess project low-income eligibility, and to the review project costs and check release dates.[41] A list of affordable housing units located within the District was also reviewed to check for property eligibility; however, this was found to have limited usefulness, as most properties reviewed were not included in this list. Exclusion from this list does not signal that the project did not met the eligibility requirements, as projects can qualify through other means. Properties are eligible when 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. The project file documentation reviewed included:

- Application and/or third party agreement
- Income eligibility form
- Contractor invoice
- Check Request
- Check copy, date, and amount
- Quality assurance or post project completion forms

[40] Contract Number DDOE-2010-SEU-0001, Attachment J.1, page 56.

[41] The evaluation team does not complete a detailed audit as a part of the scope-of-work associated with this contract; therefore, this assessment is based on the premise that the reported financials provided by the DC SEU are correct and accurate.

5.3 VERIFICATION RESULT

Table 5-1. Low-Income Housing Results Summary

Metric	Performance Benchmark	Minimum Performance Benchmark	Reported	Verified	Performance Benchmark Achieved	Minimum Benchmark Achieved
Improve energy efficiency in low-income housing: 30 percent spend ($)	$4,620,000	$3,080,000	$5,689,466	$5,456,049	Yes (118%)	Yes (177%)

5.3.1 Non-renewable energy tracks

The project file review indicates that there are varying levels of project file organization and completeness so a complete and thorough assessment was not possible. However, for those projects with all pertinent documents available, there were no issues found related to eligibility. Table 5-1 provides a summary of this desk review effort.

Table 5-2. Low-Income Track Desk Review Summary for Performance Benchmark Assessment

Track	Project Files Reviewed (n)	Application Available	Income Eligibility Documentation	Inspection/ QAQC Form Available	Check and/or Check Request	Contractor Invoice
7420FHLB	1	1 Funding Certification/ Application	Not available; Assume with detailed loan application documentation with bank	0	1	Not available for review
7610BLTZ	4	4	3	4	1	3 complete, 1 partial (material only); dates reasonable(1)
7610ICDI	6	6	6	3	3 check requests; dates reasonable	3; dates reasonable
7620LICP	3	3	1	3	3 checks; dates reasonable	0
7710FBNK	6	Not applicable	Assumed verified through partnering food banks; documentation not available	Not applicable	Not applicable	0

(1) Dates determined reasonable fall within two calendar months after FY closing (November 30, 2013) or sooner.

5.3.2 7120PV Track

The 7120PV track was not a high contributor to the overall portfolio savings and, thus, a smaller sample was drawn for the impact assessment. Sixteen 7120PV projects had been sampled for the impact evaluation effort. The project files for 13 of these 16 sampled projects

were provided for the income eligibility review. Of these projects, 10 fully pass the eligibility review, 1 partially passes, and 2 fail.

Table 5-3. 7120PV Income Eligibility Document Summary, n=13

Review Result (Pass or Fail)	All Criteria Verified to Meet	Criteria Partially Verified, but Meets "Minimum Threshold"	Criteria Partially Verified – Assume Intake Form valid	Criteria Verified to Not Meet	Total
Pass	5	5	1	0	11
Fail	0	0	0	2	2
Total	5	5	1	2	13

A "pass rate" of 0.8462 applied to the FY13 expenditures results in 7120PV Income Verified Expenditures of $855,862. If the full verified 10 projects are used, the pass rate is 0.7692 for Income Verified Expenditures of $778,056.

Table 5-4. FY13 7120PV Expenditure Adjustment (Pass Rate)

	FY13 Total Expenditures[42]	Adjustment Factor	Income Verified Expenditures
Partial Verifiable Documentation	$1,011,473	0.8462	$855,862
Full Verifiable Documentation	$1,011,473	0.7692	$778,056

The project pass rate is the number of project files that pass the review divided by the number of project files reviewed. Two pass rates were calculated based on full and partial verifiable documentation availability.

Partial Verifiable Documentation Pass Rate = 11 / 13 = 0.8462

Full Verifiable Documentation Pass Rate = 10 / 13 = 0.7692

[42] Source: file provided by DCSEU titled, "Support and Direct Cost Breakdown FY 13 DCSEU.xlsx"

Table 5-5. 7120PV Income Eligibility Document Summary, n=13

Low Income Tracks	Track Description	Direct Spend	Administration Allocation	Total	Adjusted Spend
7110SHOT	Solar Hot Water	$721,093	$339,675	$1,060,768	$1,060,768
7120PV	Solar Photo Voltaic	$687,583	$323,890	$1,011,473	$778,056
7420FHLB	Federal Home Loan Bank	$46,085	$21,709	$67,794	$67,794
7610BLTZ	LI MF CLEER Program (T12 LI)	$241,756	$113,881	$355,637	$355,637
7610ICDI	Implementation Contractor DI	$794,093	$374,062	$1,168,155	$1,168,155
7620LICP	Low Income MF Comprehensive	$1,254,952	$591,152	$1,846,103	$1,846,103
7710FBNK	Retail Lighting Food Bank	$122,045	$57,490	$179,535	$179,535
Total		**$3,867,608**	**$1,821,857**	**$5,689,466**	**$5,456,049**

5.4 PERFORMANCE BENCHMARK ASSESSMENT

5.4.1 Background

This benchmark has not changed over the contracting periods since inception.

5.4.2 Assessment

A. Acquisition Cost Review and Cost Effectiveness Assessment

The FY13 low-income initiatives acquisition costs per MWh for verified savings excluding the funding for the solar initiatives was $559 comparted to $614 in FY12[43]. This compares to the non-renewable energy portfolio acquisition cost per MWh excluding low-income tracks of $530 in FY12 and $181 in FY13. For the low-income tracks including renewable energy expenditures and associated savings, costs per MWh in FY12 and FY13 were $903 and $819, respectively[44]. The FY13 acquisition cost reflects the adjusted low-income spend for the solar PV track and an adjustment for the MWh savings based upon the income eligibility pass rate (0.7692).

The low-income initiatives are cost effective at the track level except for the Federal Home Loan track (7420FHLB). This track provides income qualified homeowners with loan assistance to implement the recommendations determined through a comprehensive home

[43] This analysis does not factor out the costs for the natural gas expenditures within the LI tracks primarily used to acquire MWh savings. This is because the evaluator does not have the level of detail needed to identify the MMBtu costs within the projects; however, these differences are minor as the MMBtu savings compared to the MWh savings within these tracks is quite small.

[44] Expenditures and MWh references all based upon evaluation verified results.

energy audit. The volume of projects within this track was limited; therefore, reported savings were limited.

B. Paige Report Recommendations[45]

The Paige report recognizes that programs offered to the low-income sector are typically more costly than those for other sectors, thus the yield is lower. This is the same as saying that acquisition costs for energy efficiency resources from low-income programs are typically higher than that for other programs. The report concludes that, "There is a need to reformulate this benchmark:

i. To ensure that the DC SEU pursues programs that have a reasonably high yield in terms of energy efficiency,

ii. To ensure that the DC SEU does not use renewable installations to meet the target for this benchmark, and

iii. To ensure that the target value for this benchmark is not a significant constraint for the overall energy efficiency benchmark."

5.4.3 Conclusion

The evaluation team agrees that considering this benchmark in conjunction with the energy savings benchmark is warranted. The acquisition costs associated with income-qualified initiatives are typically higher than that of other initiatives due to the higher contribution to measure costs. For example, the total portfolio acquisition cost per MMBtu was approximately $69 and the portfolio acquisition cost per MMBtu excluding low-income initiatives was about $60. Therefore, the impact of the low-income housing benchmark on overall acquisition cost of MMBtu savings was about $9 in FY13.

The decision regarding the inclusion or exclusion of the renewable energy measures when assessing the achievement of this initiative is a policy decision. If it is decided that these costs are not countable toward this benchmark, the low-income housing and overall savings performance benchmark targets should consider the energy savings potential within the District along with the funding available to acquire low-income related energy efficiency resources in conjunction with other sector energy savings acquisition.

[45] *Independent Review and Update of The District of Columbia SEU's Annual Performance Benchmarks*, Jerome S. Paige & Associates, LLC for the District Department of the Environment, September 2013, page 17-18.

6. REDUCE THE GROWTH OF ENERGY DEMAND OF THE DISTRICT OF COLUMBIA'S LARGEST ENERGY USERS (CAEA § 201(D)(5))

6.1 DESCRIPTION[46]

At this time, there is insufficient information to set a benchmark related to the growth of energy demand of the largest energy users. In order to define this benchmark and specify the calculation of this benchmark, the Contractor shall launch a detailed data collection and analysis, the elements of which would be agreed to and approved by DDOE. The study should be completed and a benchmark agreed to with DDOE within nine months of the SEU becoming operational.

6.2 EVALUATION AND VERIFICATION APPROACH

The evaluator reviewed the DC SEU's recommendation as described in the *Report on the Largest Energy Users in the District of Columbia* prepared by PEER Consulting (the PEER report) to define this benchmark.

6.3 VERIFICATION RESULT

The DC SEU submitted the *Report on the Largest Energy Users in the District of Columbia* to the DDOE September 30, 2013[47]. The DDOE has not yet established this performance benchmark as it related to the DC SEU.

Table 6-1. District Large Energy Users Summary

Metric	Minimum Target	Reported	Verified	Minimum Target Achieved
Large Energy Users	Undefined	n/a	n/a	n/a

6.4 PERFORMANCE BENCHMARK REASONABLENESS ASSESSMENT

6.4.1 Background

A report prepared by PEER Consultants (a teaming partner of DC SEU) was submitted to DDOE on September 30, 2012, titled *Report on Largest Energy Users in the District of Columbia*. The report noted that DC SEU does not have access to utility account information for either electricity or natural gas customers. As a result, the analysis derived information it believed was sufficient, although not rigorously accurate, to fulfill the Benchmark.

[46] Contract Number DDOE-2010-SEU-0001, Attachment J.1, page 56.
[47] The date is the date on the report and the assumed date it was submitted to the DDOE.

6.4.2 Assessment

A. Paige Report Recommendations[48]

The Paige report discusses the presumption that "DC SEU has a natural tendency to engage with the large users, because they offer potentially high yields in energy efficiency, which are needed in order to achieve the target in the overall energy efficiency benchmark." and recommends that, in lieu of a performance benchmark, the DC SEU be required to report on two tracking indicators:

i. Tracking indicator 1: The nature and scope of the DC SEU's engagement with the designated set of large users. The details of what constitutes the "nature and scope," i.e., what exactly the DC SEU has to report to DDOE, should be developed by DDOE in conjunction with the DC SEU.

ii. Tracking indicator 2: The yield of energy savings (energy savings/$ spent) from the DC SEU's engagement with the large users. (As in the case of low-income housing, the calculation of this yield is not burdensome.)

6.4.3 Conclusion

The evaluators concur with the recommendation, as this data can be used to define future metrics that may be more meaningful to the District's pursuit of cost-effective energy efficiency resource acquisition.

[48] *Independent Review and Update of The District of Columbia SEU's Annual Performance Benchmarks*, Jerome S. Paige & Associates, LLC for the District Department of the Environment, September 2013, page 17-18.

7. INCREASE THE NUMBER OF GREEN-COLLAR JOBS IN THE DISTRICT OF COLUMBIA (CAEA § 201(D)(6))

7.1 DESCRIPTION[49]

The SEU shall ensure that at least 77 green jobs [are created] in Year 3. The following criteria will be used in the calculations of what constitutes a green job for the purposes of this benchmark:

- Every job created from SEU expenditures is a green job whether the job is on the payroll of the SEU or contracted out.
- Job-years (expressed as full-time equivalents or FTEs) will be the standard of measurement.
- Only direct jobs are to be used in the green jobs calculation. Indirect (primarily suppliers to SEU contractors or subcontractors) and induced jobs (derived from a multiplier effect) are not counted.[50]
- A green job is further defined as being held by a District resident who is paid a living wage.[51]
- No distinction is required for new versus retained jobs.

7.2 EVALUATION AND VERIFICATION APPROACH

The DDOE conducted a detailed audit and review of the DC SEU reporting for this benchmark.

7.3 VERIFICATION RESULT

This performance benchmark was not achieved.

Table 7-1. Green-collar Jobs Summary

Metric	Minimum Target	Reported[52]	Verified[53]	Minimum Target Achieved
Green-collar Jobs, green job hours	128,128	94,956	40 FTE	No (64.5%)
Green-collar Jobs, FTE[54]	62	45		

[49] Contract Number DDOE-2010-SEU-0001, Attachment J.1, page 57.
[50] For a more complete definition of indirect and induced jobs, see Executive Office of the President, Council of Economic Advisors, Estimates of job Creation from the American Recovery and Reinvestment Act of 2009, May 2009, p. 6.
[51] The Living Wage Act of 2006 is Title I of the "Way to Work Amendment Act of 2006", D.C. Law 16-118 (D.C. Official Code §2-220.01 to .11), which became effective June 8, 2006. See the following cite for details: http://www.does.dc.gov/does/cwp/view,a,1233,q,636800,doesNav,%7C32064%7C.asp.
[52] Source: DC SEU Annual Report FY2013.
[53] DDOE verified.
[54] Source: DDOE "DC SEU FY12-FY14 Performance Targets and Results" Table.

7.4 PERFORMANCE BENCHMARK ASSESSMENT

7.4.1 Background

This benchmark is measured as the jobs *directly* created for District residents resulting from the DC SEU's implementation of the DC SEU energy efficiency and renewable energy portfolio. This includes jobs held with the DC SEU and those resulting from others in the District performing work directly associated with the DC SEU portfolio. It excludes indirect jobs—those jobs created in support of direct jobs such as suppliers of energy efficiency equipment—and induced jobs, which are those created due to the economic impact of hired workers spending incomes within the District.

7.4.2 Assessment

The DC SEU has not been able to achieve this benchmark since contract inception and a number of the green job hours achieved has been through direct install initiatives where the DC SEU hires contractors directly to install energy efficiency equipment through the DC SEU initiatives. This provides the DC SEU with the ability to require contractor reporting that is required to meet reporting strict requirements for auditing and verification purposes.

A. Paige Report Recommendations[55]

The Paige Report recognizes the challenges associated with reporting and verifying District green job hours worked by the DC SEU and its contractors…"there are some field work-hours that are actually created by the DC SEU's expenditures, but are not practically counted because compliance with the strict verification requirements is unlikely or too costly. Or, the DC SEU may simply be forgoing these opportunities, even though they are cost-effective, because it is difficult to get credit for the green jobs created." To resolve these challenges, it offers these recommendations:

i. DDOE should verify and develop an expenditures/jobs value based on the experience of the DC SEU and national studies. We recommend that DDOE continue to use the $200,000/job to estimate the total number of "total jobs", until such time a new factor can be developed and verified.

ii. DDOE should verify and develop a methodology to take full account of the split of jobs between District and non-District residents. The target value (which related to jobs going to District residents only) needs be based on an explicit recognition of the reality that some of the jobs created by the DC SEU will go to non-District residents. We recommend that DDOE use a factor of 90% to convert "total jobs" into "green jobs". This leads to target value of 88*0.90 = 79.9 FTE jobs for FY14 and beyond.

[55] *Independent Review and Update of The District of Columbia SEU's Annual Performance Benchmarks*, Jerome S. Paige & Associates, LLC for the District Department of the Environment, September 2013, page 17-18.

iii. We recommend that DDOE use a FTE conversion factor of 1,950 hours in estimating the number of jobs, i.e., 1 FTE = 1,950 work-hours.

iv. We recommend that DDOE allow a limited number (10-15%) of "green jobs" (as currently defined) to be counted on an estimated basis, where compliance with strict verification requirements is unlikely or costly, based on adequate causal evidence derived from an agreed-to methodology.

7.4.3 Conclusion

As the DC SEU continues to move toward a market-based programmatic approach, less of the green job creation will be within the control of the DC SEU—that is, District businesses and households will be driving job creation through their selection of who to hire to implement energy efficient projects and where to purchase energy efficient equipment. It would seem that this would lead to more efficient implementation and, thus, lower energy resource acquisition costs. The evaluation team agrees with the Paige report recommendations to restructure this benchmark, and the specific recommendations above are a start. The District now has three years of green jobs creation data that can assist in this assessment.

8. COST EFFECTIVENESS ASSESSMENT

GDS, under the direction of Tetra Tech, conducted a cost benefit analysis for 12 energy efficiency initiatives sponsored by the DC Sustainable Energy Utility (DC SEU). GDS performed a Societal Cost Test (SCT) for each program and compared the results to the SCT results provided by VEIC. The evaluation team completed a cost effectiveness assessment for three scenarios:

Scenario 1:

The DC SEU benefit cost model classifies two categories of cost and benefits differently than the GDS model. Operation and maintenance (O&M) expense savings for all programs are categorized in the DC SEU model as a negative cost, while these are categorized as a benefit in the GDS Model. The DC SEU 2014 Screening Tool was modified to classify O&M expense as a benefit. For FY2013, the cost benefit results provided to GDS manually made this reclassification and resulted in an overall portfolio benefit cost ratio of 5.02 according to the DC SEU cost effectiveness model. Additionally, the DC SEU model separates the total MMBtu savings from fossil fuels into two categories: cost penalties and benefits savings. The GDS model groups the MMBtu savings into the one category and nets the penalties and savings as a benefit. To reconcile the classification of MMBtu savings, GDS adjusted the DC SEU benefit cost results to show all MMBtu savings and penalties as a net benefit. The adjusted DC SEU model produces a benefit cost ratio of 4.60. This adjusted ratio is comparable to the GDS' Model benefit cost ratio of 4.44. This FY13 portfolio cost effectiveness result of 4.44 is an improvement of 120 percent over the FY2 result of 2.02. This is driven by two main differences from FY12 to FY13: (1) The environmental externalities benefit increase; and (2) lower acquisition costs.

Scenario 2:

The FY13 third-party evaluation (Tt evaluation team) costs totaled $696,179 that was not included in either the GDS or VEIC benefit cost models results discussed above. Adding this third-party evaluation expense decreases the overall portfolio benefit cost ratio to 4.35. The evaluation expense was allocated to specific programs based upon direct expense program allocations in the DC SEU benefit cost model.

Scenario 3:

The evaluation team developed realization rates for each track through the impact evaluation effort. These realization rates were applied to the kWh, kW and MMBtu savings in the benefit cost model for Scenario 2. The overall impact of incorporating realization rates increases the benefit cost ratio of the total portfolio to 4.54.

The results of these comparisons and scenarios are presented in Table 8-1.

Table 8-1. Societal Cost Test Comparison

Initiative	DC SEU (original)	DC SEU (adjusted)	Scenario 1	Scenario 2[1]	Scenario 3[2]
7110SHOT Solar Hot Water	1.90	2.12	2.40	2.36	2.36
7120PV Solar Photo Voltaic	1.20	1.33	1.95	1.92	1.96
7420FHLB Federal Home Loan Bank	0.86	0.82	0.49	0.46	0.47
7420HPES HP with Energy Star	1.46	1.39	1.00	0.91	0.87
7510BLTZ, 7510MTV T12 Lighting Replacement	4.44	3.81	4.72	4.51	5.54
7510CIRX Business Energy Rebates	5.75	5.26	5.00	4.92	4.85
7520CUST, 7520MARO, 7520NEWC Commercial Custom	6.98	6.81	5.95	5.84	6.05
7610BLTZ LI MF T12 Lighting Replacement for Low-income	6.59	5.65	5.66	5.52	4.80
7610ICDI Implementation Contractor Direct Install	2.73	2.44	2.46	2.28	2.32
7620LICP Low Income MF Comprehensive	2.24	2.15	2.07	2.05	2.02
7710FBNK Retail Lighting Food Bank	5.86	3.82	5.35	5.28	5.31
7710LITE, 7710APPL Retail Efficient Products	5.90	4.65	3.73	3.68	3.70
Portfolio	**5.02**	**4.60**	**4.44**	**4.35**	**4.54**

[1] Includes the cost of the third-party independent evaluation conducted by the Tetra Tech evaluation team.

[2] Includes the cost of the third-party independent evaluation and the effect of the realization rates determined through the evaluation effort.

Some variability in benefit cost ratio results is expected, as not all the calculation methods and assumptions between both models can be specifically quantified. However, the variances in results are considered minimal, especially at the portfolio level with all program administrative costs and third party evaluator costs included.

The main differences in the models are the calculations of 7710FBNK and the 7510BLTZ tracks cost benefit analyses. GDS is not able to confirm the level of costs produced by the DC SEU Screening model. From a review of the DC SEU Screening Model results, the customer share of cost for both of these tracks is listed as negative numbers, which GDS cannot reconcile. However, as mentioned above the overall portfolio results are close and consistent between the DC SEU and GDS models.

8.1 SOCIETAL COST TEST

The Societal Cost Test (SCT) measures the net direct economic impact to the utility service territory, state, or region, plus indirect benefits such as environmental benefits and direct non-energy related customer benefits. Below is a brief description of the benefits and costs included by DC SEU (and hence GDS) to determine the societal cost test results for this analysis.

Table 8-2. Benefits and Costs Included in the DC SEU Societal Cost Test

Benefits	Costs
Avoided Energy Costs Avoided Capacity Costs Avoided Transmission & Distribution Costs Avoided Fossil Fuel Costs Avoided Water Costs Risk Adder (Percent of Electric and Fossil Fuel Avoided cost) Non-Energy Benefits Adder (Percent of Electric and Fossil Fuel Avoided Costs) Avoided Environmental Externality Costs for Electric and Fossil Fuels ($/kWh and $/MMBTU)	Program Administrator Costs Energy Efficiency Measure Cost—Financial Incentives Energy Efficiency Measure Cost—Participant Contribution

8.1.1 Societal Cost Test Assumptions

The following table presents the SCT benefit/cost assumptions and sources used by DC SEU for FY13.

Table 8-3. Societal Cost Test Benefits Assumptions and Sources

Assumptions	Assumption Value	Source: DDOE-2010-SEU-0001
General		
Real discount rate	1.87%	Section B.10.4 Societal Benefit Test
Inflation rate	2.60%	Section B.10.4.2.4
On and off peak summer and winter energy line-loss factors	8.00%	Not specified in contract; based on a Pepco screening tool used for EmPOWER Maryland program screening
Summer peak demand line-loss factor	6.00%	Not specified in contract; based on a Pepco screening tool used for EmPOWER Maryland program screening

Assumptions	Assumption Value	Source: DDOE-2010-SEU-0001
Benefits		
Electric adders (used to determine societal benefits)	20%	B.10.4.1.5 – 10% Reduced risk/uncertainty benefits B.10.4.1.6 – 10% Non-Energy Benefits
Environmental (Electric) externalities adder	$0.0753 per kWh	DC SEU 2013 Screening Model Assumption[56]
Fossil fuel adders	20%	B.10.4.1.5 – 10% Reduced risk/uncertainty benefits B.10.4.1.6 – 10% Non-Energy Benefits
Water avoided cost	$10.81 per ccf	Not specified in contract; based on the value in the DC SEU screening tool
Environmental (Fossil Fuels) externalities adder	$4.83per MMBTu	DC SEU 2013 Screening Model Assumption[57]
Electric avoided cost	2013 through 2041 forecast	B.10.4.1.1; see Table 8.3 below
Capacity avoided cost	2013 through 2041 forecast	B.10.4.1.1; see Table 8.3 below
T&D avoided cost	2013 through 2041 forecast	B.10.4.1.2; see Table 8.3 below
Fossil fuel avoided cost for distillate, LPG, natural gas and kerosene	2013 through 2041 forecast	B.10.4.1.1; see Table 8.3 below B.10.4.1.3; 5% natural gas and local delivery benefits is included in the avoided costs forecast[58]

The table below presents the avoided supply costs for 2013 (in 2013 dollars) included in the DC SEU screening tool. For the 2012 screening period, the DC SEU based the avoided electric and demand costs for the years 2012–2015 and 2020 on Pepco's filed 2012 through 2014 EmPOWER Maryland Energy Efficiency Plan.

[56] "Proposed DC Externality values for FY 13" memorandum from DC SEU to DDOE dated September 28, 2012.
[57] ibid.
[58] Also see, "DC SEU screening assumptions" memorandum from DC SEU to DDOE dated October 25, 2013, page 2, "Note: that the original memo specified that the environmental externality adder would only be applied to avoided costs associated with electricity generation and distribution. Upon further consideration and review of the contract language, we are recommending that this environmental externality adder should not be limited solely to electricity, but rather be applied to all energy and demand costs. Ultimately, this adder is intended to credit the prevention of emissions due to fossil fuel combustion, and therefore the end use of the fuel is irrelevant, whether used to generate electricity or heat a home."

Table 8-4. Avoided Cost Assumptions for the District of Columbia

Avoided Cost (in 2013 dollars)	DC SEU Screening Tool
Summer peak energy ($/kWh)	$0.0975
Summer off peak energy ($/kWh)	$0.0632
Non-summer peak energy ($/kWh)	$0.0842
Non-summer off peak energy ($/kWh)	$0.0643
Electric Externality Adder ($/kWh)	$0.0753
Capacity ($/kW-Yr.)	$98.70
T&D Capacity ($/kW-Yr.)	$174.14
Natural gas ($/MMBtu)	$9.51
Natural gas Externality Adder ($/MMBtu)	$4.83

8.1.2 Evaluation of the DC SEU Societal Costs Test Model and Recommendations

In its FY12 evaluation report, the evaluation team noted that the general calculation framework of the SCT cost-effectiveness screening as implemented by DC SEU closely follows the prescribed methodology detailed in the California Standard Practice Manual (CA SPM). The California Standard Practice Manual establishes standard procedures for cost-effectiveness evaluations for utility-sponsored programs and is generally considered the authoritative source for defining cost-effectiveness criteria, and is often referenced by many other states and utilities. In addition, the screening tool is capable of evaluating cost-effectiveness based on various market replacement approaches, including replace-on-burnout, retrofit, and early retirement.

The evaluation team made the following recommendations for future model refinements in the FY12 report. The status of action taken on each recommendation is also shown.

i. **Consider expanding functionality of model beyond measure level screening.** For instance, include the ability to quickly and easily screen for cost-effectiveness at both the measure and program level. Current model functionality requires societal cost-effectiveness at the program and portfolio level to be calculated manually for quarterly and annual reporting purposes. Also, provide the ability to include program administrative costs at either the measure level and/or program-specific level.

   Status (According to VEIC): Alternative mechanisms/reports already exist to quickly and easily screen for program cost-effectiveness, albeit outside the screening tool. The screening tool runs behind the scenes and DC SEU staff do not interact with it directly; therefore building this functionality is unnecessary, as it exists elsewhere in user-facing systems. Attempting to parse out and assign administrative costs at the measure level would be a convoluted exercise with costs far exceeding the benefits.

Evaluation Response: It is not clear that the DC SEU does not want or need this functionality. However even if that is the case, VEIC should consider such an improvement if it will improve the cost-effectiveness screening process and help streamline the evaluation process. Regarding the assignment of administrative costs, GDS agrees that the costs of doing this at the measure level will likely exceed the benefits and may not be appropriate for measure level screening. However, once measures are bundled into program offerings it will be useful to assign administrative costs to programs to determine which programs are providing the best savings per dollar invested and which programs may have higher than expected administrative costs. Such an analysis will help the DC SEU, VEIC and evaluators determine where program processes might be improved and delivery costs reduced.

ii. **Provide for the capability to include net-to-gross (NTG) factors into the model once they are developed.** A NTG factor of 1.0 is currently being used. In the SCT, benefits should be calculated using net program savings. Although this model is utilized for measure screening prior to program implementation, as programs are evaluated and NTG values are determined, it will be beneficial to have the ability to factor the prescribed NTG ratios into the cost-effectiveness screen.

Status (According to VEIC): An external and more streamlined process is used to calculate NTG numbers and is handled within the DC SEU database. Because all results are verified on gross numbers, it makes sense to have this be a back-end calculation to maintain traceability and consistency among all other DC SEU data systems.

Evaluation Response: GDS understands that NTG ratios are calculated outside of the VEIC cost effectiveness model. We are simply recommending that the model include the capability to explicitly input NTG ratios to make it easier to conduct sensitivity analysis around NTG values and enhance transparency.

iii. **For O&M costs, classify O&M Expense Savings as a benefit in their future cost benefit model runs.** This recommendation is supported by the National Action Plan for Energy Efficiency (NAPEE) report on understanding cost-effectiveness, which classifies O&M expense savings a benefit when determining cost effectiveness.

Status (According to VEIC): This change was implemented for FY14 screening tools. The revision was not made for FY13 tools, as the final evaluation report was released mid-year.

Evaluation Response: This recommendation has been adequately addressed.

iv. **Fossil Fuel Savings: classify fossil fuel savings into the benefit category.** The National Action Plan for Energy Efficiency specifies that co-benefits in water, natural gas, fuel oil, etc. be regarded as energy savings benefits.

Status: (According to VEIC): Fuel savings are treated as benefits when savings occurs. They are treated as costs when increased usage occurs.

Evaluation Response: The stated approach for treating fuel savings and increased fuel use is appropriate.

v. **Avoided costs:** Accurate avoided costs are a critical component in any evaluation of cost-effectiveness and the DC SEU should ensure that their screening tool employs the latest and most accurate estimates of avoided supply costs, as they are revised and updated. In addition, the societal benefit/cost test is impacted by the use of a societal discount rate and the quantification of environmental externalities and non-energy benefits. The DC SEU should also ensure that the societal screening tool utilizes the most recent approved societal discount rate (DC SEU screening tool currently utilizes a real discount rate of 1.87 percent equal to the 10-year treasury rate posted on Oct. 1, 2011) and potentially undertake a review of externality adder best practices in an effort to refine their current estimates.

Status (According to VEIC): For FY13, the externality adder was replaced by values derived from a more refined process.[59] Avoided costs are updated annually, as they become available. Discount rates and solar renewable energy certificate (SREC) prices are updated on an annual basis based on market trends.

Evaluation Response: This recommendation has been adequately addressed.

vi. **Evaluate the current SREC market price to determine if the value of $241 is a reasonable assumption to calculate avoided compliance payments.**

Status: Under review

8.1.3 Environmental Adders Used in the DC SEU Societal Cost Test

For FY12, the District of Columbia estimated the value of externalities as a 10 percent adder onto the avoided costs for electricity or fossil fuels. The 10 percent adder was not based on any specific environmental benefit or avoided externality costs, such as reduced pollutants. This approach was changed for FY13 when an alternative method for calculating the externality avoided costs based more specifically on reduced CO_2 emissions was used.

Fossil Fuel Externalities

All of the fossil fuel externality values are based on the $80 per ton CO_2 (2011 dollars). This is the value recommended in a report prepared for the Avoided-Energy-Supply-Component (AESC) Study Group, titled Avoided Energy Supply Costs in New England: 2011 Report, July 21, 2011, by Synapse Energy Economics, Inc. The benefits of reduced CO_2 emissions are global, so this value was considered to be applicable in the District of Columbia. The AESC 2011 Report provided the values for natural gas and residential, commercial, and industrial distillate (fuel oil). The commercial and industrial distillate externality values were combined into one value based on 2010 Energy Information Administration (EIA) data, which indicated 99.8 percent commercial versus 0.2 percent industrial distillate consumption. These values were inflated to 2012 dollars using a 2.6 percent inflation assumption.

[59] "Proposed DC Externality values for FY 13" memorandum from DC SEU to DDOE dated September 28, 2012.

The externality values for propane and kerosene were not provided in the AESC 2011 Report. These were calculated using the $80 per ton CO_2 and EIA emission factors of 63.07 kg CO_2/MMBtu and 72.31 kg CO_2/MMBtu for propane and kerosene, respectively.

The following table shows the externality values for fossil fuels and the approximate increase in the adder compared to the 10 percent value used in FY12. As can be seen, basing the fossil fuel externalities on the value of CO_2 emissions reductions gives significantly higher results than the 10 percent adder that was used in FY12.

Table 8-5. Fossil Fuel Externality Values FY13 (in 2012 dollars)

	Natural Gas	Residential Distillate	Residential Propane	Commercial Distillate	Commercial Propane	Kerosene
$/MMBtu	$4.84	$7.10	$5.71	$6.73	$5.71	$6.54
Increase vs. 10% Adder	500%	250%	150%	300%	150%	250%

Electric Externalities

The electric externalities are also based on $80 per short ton of CO_2. Calculating the marginal electric externality value also required the marginal type of generation mix, the heat rate for each generation type, and the CO_2 emissions rates by fuel type.

Combining all of the above factors together produced a weighted average electric externality for CO_2 emissions of $0.066/kWh in 2011 dollars. Inflating by 2.6% annual gives an electric externality value of $0.068/kWh in 2012 dollars. This is about 8.5 times the electric externality based on the 10% adder.

The above electric externality value assumes that none of the costs for CO_2 abatement are internalized in the Pepco electric avoided costs used for efficiency cost-effectiveness analysis in DC.

Note: An inflation rate was applied to electric avoided costs for the FY13 cost effectiveness analysis resulting in an electric externalities adder of approximately $0.070/kWh in 2013 dollars. A similar inflation rate was mistakenly not applied to the fossil fuel adders in the VEIC model.

8.1.4 Other Adders Used in the DC SEU Societal Cost Test

In addition to environmental externality adders, DC SEU also includes Risk and Non-Energy Benefits adders in its program cost effectiveness analysis. A value of 10 percent is assumed for each of these adders. The adders are applied to total energy and capacity avoided costs.

Per the DC SEU contract, the definitions of these adders are as follows:

Risk Adder: Recognizes the benefits of energy efficiency and conservation in addressing risk and uncertainty.

Non-Energy Benefits (NEBs) Adder: Recognizes the non-energy benefits of energy efficiency including comfort, noise reduction, aesthetics, health and safety, ease of selling/leasing home or building, improved occupant productivity, reduced work absences due to reduced illnesses, ability to stay in home/avoided moves, and macroeconomic benefits.

8.2 REVIEW OF EXTERNALITIES METHODOLOGY

It is the Evaluation Teams understanding that DC SEU used the methodology presented in the *Avoided Energy Supply Costs in New England: 2011 Report*, July 21, 2011, by Synapse Energy Economics, Inc. (AESC 2011). Some key points and recommendations from that report regarding the determination of an environmental externalities value are as follows:

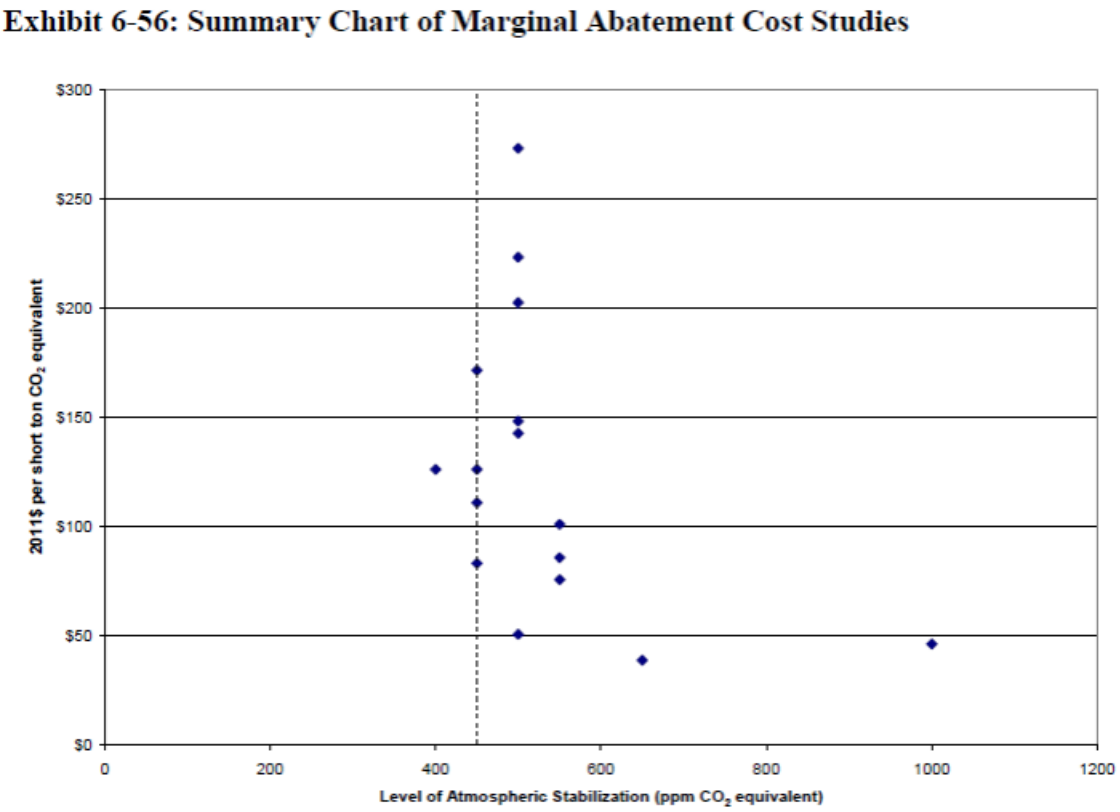
1. AESC 2011 identifies CO2 as the key significant non-internalized environmental cost for evaluation of energy-efficiency programs. Other air pollutants from generators (NO_x, SO_2, particulates, mercury) have been and are being significantly reduced through direct regulation, and NO_x and SO_2 are subject to cap-and-trade regulations that charge generators for their remaining emissions.

2. It was recommended that the Study Group use a marginal abatement cost value, which is based on the cost of controlling emissions. For AESC 2011, Synapse recommended using a long-run marginal abatement cost (in 2011 dollars) of $80 per short ton of CO2. In 2011, approximately 2 percent of the $80 per ton is internalized in the market price of electricity, through RGGI, and 98 percent is an externality. By 2026, Synapse estimated that approximately 49 percent of that amount will be internalized.

3. Based on knowledge of the electric system and review of model runs, Synapse concluded that the dominant environmental externality in New England over the study period will be the un-internalized cost of carbon dioxide emissions.

4. The study uses the “sustainability target” approach which relies on the assumption that the nations of the world will not tolerate unlimited damages. It also relies partly on an expectation that policy leaders will realize that it is cheaper to reduce emissions now and achieve a sustainability target than it is not to address climate change. It is worth noting that a cost estimate based on a sustainability target will be a bit lower than a damage cost estimate. Specifically, the carbon externality can be valued by looking at the marginal costs associated with controlling total carbon emissions at, or below, the levels that avoid the major climate change risks according to current expectations.

Figure 8-1. Summary Chart of Marginal Abatement Cost Studies[60]



5. AESC 2011 recommends that the estimated long-run marginal abatement cost be used as a practical and reasonable measure of the societal cost of carbon dioxide emissions. Based on a review of these different sources, and Synapse's experience and judgment on the topic, they believe that it is reasonable to use an estimated long-term marginal abatement cost (LT MAC) of $80 per short ton CO_2 equivalent (in 2011 dollars) in evaluating the cost-effectiveness of energy efficiency measures. Thus, states that have established targets for climate mitigation comparable to the targets discussed in the report, or that are contemplating such action, could view the $80 per ton long term-abatement cost as a reasonable estimate of the societal cost of carbon emissions, and hence as the long-term value of reductions in carbon emissions required to achieve those targets.

8.3 COMPARING DC SEU NON-ENERGY IMPACTS TO OTHER STATES

The impact of environmental externalities, the risk adder and NEBS adder on avoided costs and hence on the benefits associated DC SEU is significant. Table 8-6 shows the impact of all non-energy adders on electric avoided costs.

[60] *Avoided Energy Supply Costs in New England: 2011 Report*, July 21, 2011, by Synapse Energy Economics, Inc.

Table 8-6. Impact of Non-Energy Adders on Avoided Electric Energy Cost

2013 Avoided Energy Cost (No Adders)	2013 Avoided Energy Cost (With Adders)	Percent Increase in Avoided Energy Cost (Due to Adders)
$64,172,666	$100,792,501	57%

A recent ACEEE study[61] found that a total of 44 states plus the District of Columbia have ratepayer-funded energy efficiency programs in operation. All of the jurisdictions surveyed by ACEEE use some type of benefit-cost test in connection with their ratepayer-funded energy efficiency programs.

The study found that only five states plus the District of Columbia consider the Societal Cost Test (SCT) as their primary benefit cost test. A majority of states (71 percent) consider the Total Resource Cost (TRC) test to be their primary test.

Regarding the quantification of energy efficiency benefits other than avoided costs, the ACEEE study found that:

- 14 states quantify environmental externality benefits
- 12 states quantify customer non-energy benefits
- 5 states quantify other "societal" benefits (not including "environmental" benefits)

Probing deeper into specific customer non-energy benefits included by each state in their primary benefit-cost test, ACEEE found that:

- Most of the non-energy participant benefits are limited water and other fuel savings
- Only 2 states include a quantified benefit for participant operation and maintenance savings
- No state quantifies benefits for things like comfort, health, safety, or improved productivity in their primary benefit-cost test.

Table 8-7 compares District of Columbia's quantification of non-energy impacts with other states policies and practices based on a review of recent literature.

Table 8-7. Comparison of Non-Energy Adders in Cost Effectiveness Testing

State/Jurisdiction	Environmental Externality Benefits	Risk Benefits	Participant Non-Energy Benefits
District of Columbia	Electric avoided cost adder of $0.070/kWh in 2013 dollars plus fossil fuel externality adders. Based on $80/ton CO2.	10% of avoided electric and fuel cost	10% of avoided electric and fuel cost

[61] ACEEE, A national Survey of State Policies and Practices For The Evaluation Of Ratepayer-Funded Energy Efficiency Programs, February 2012.

State/Jurisdiction	Environmental Externality Benefits	Risk Benefits	Participant Non-Energy Benefits
California (3)	$12.50/ton in 2008 and rising		
Colorado (1)	10% adder (25% for low-income programs)		
Illinois (ComEd) (4)	CO2 ($0.0139/kWh) - Based on carbon at $18.50/ton		
Iowa (1)	10% adder for electric; 7.5% adder for gas		
Maryland (5)	Electric avoided cost adder of $0.0115/kWh		
Minnesota (Xcel Energy) (6)	Calculated and reported but do claim value - Non-gas fuel environmental damage factor of $0.02132/kWh and gas environmental damage factor $0.35/ MCF.		
New York (3)	Carbon ($15/ton)		
Oregon (1)	Carbon ($15/ton)	10% adder	
Vermont (2)	CO2 ($80/ton)	10% discount of energy efficiency costs	15% adder to energy benefits
Washington (1)	10% adder		
Wisconsin (7)	Levelized carbon value of $30 per ton		

(1) Addressing Non-energy Benefits in the Cost-Effectiveness Framework. This paper was prepared by CPUC Energy Division staff, based on research provided by Ed Vine of the California Institute for Energy and the Environment.

(2) Energy Efficiency Cost-Effectiveness Screening How to Properly Account for 'Other Program Impacts' and Environmental Compliance Costs Authors Tim Woolf, William Steinhurst, Erin Malone; Synapse Energy Economics, November 2012.

(3) Optimal Energy, Inc., Pennsylvania 2013 – 2018 Energy Efficiency Goals, 2011.

(4) ComEd's latest Energy Efficiency Program Plan Filing.

(5) State mandated value for all utilities.

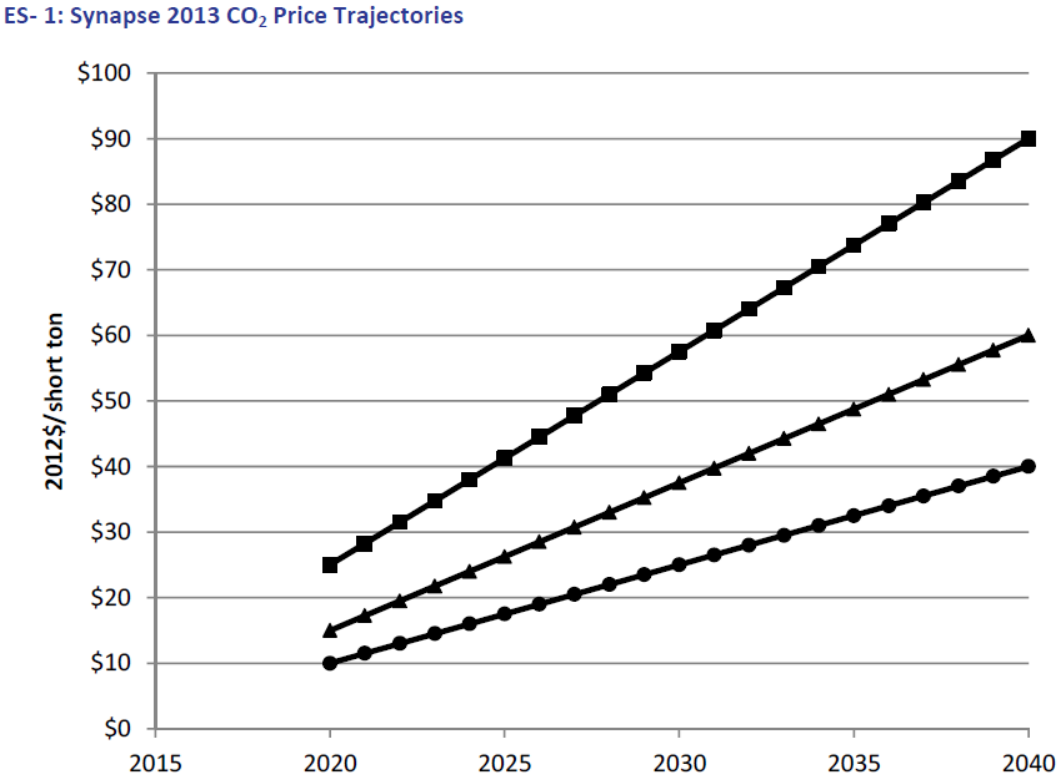
(6) Inputs to Bencost for Natural Gas Cips for the 2013–2015 Conservation Improvement Program Triennium, Xcel Energy

(7) PSC November 10, 2010 Order in docket 5-GF-191 (PSC reference number 141173).

The above comparison shows that the District's non-energy impact values are very similar to Vermont's. Both use environmental externality values based on $80 per ton of CO_2 and a 10 percent risk adder. The NEBs adder in Vermont is 15 percent, compared to 10 percent for the District. These two jurisdictions both offer DSM programs that are delivered by VEIC. Compared to the other states included in our review, the DC SEU includes a significantly

higher level of non-energy impacts in its cost effectiveness screening of energy efficiency programs. The $80 per ton of CO_2 assumed by DC SEU (and Vermont) is significantly higher than all of the other states included in our comparison. A recent report by Synapse Energy Economics[62] presented the following high, medium and low forecasts of CO_2 prices. Only the high case forecast reaches $80 per ton and that does not occur until the year 2037.

Figure 8-2. Synapse 2013 CO_2, Price Trajectories[63]



Regarding risk and NEBs adders, none of the other states included in our comparison, except Vermont, explicitly include separate adders for these factors. Several states (Colorado, Iowa, and Washington) do employ a single 10 percent adder that covers all non-energy impacts, including environmental externalities. Oregon is the only other state to include an explicit environmental externality factor plus an additional 10 percent adder that addresses risk and NEBs combined.

8.4 IMPACT OF ADDERS AND EXTERNALITIES ON COST EFFECTIVENESS

To determine how the Risk, NEBs and Environmental Externality adders impact the program and portfolio cost effectiveness, the evaluation team ran the cost benefit model scenario with "zero" values for all adders and externalities. Specifically, the 10 percent risk adder and the

[62] 2013 Carbon Dioxide Price Forecast, November 1, 2013, Synapse Energy Economics.
[63] *Avoided Energy Supply Costs in New England: 2011 Report*, July 21, 2011, by Synapse Energy Economics, Inc.

10 percent non-electric benefits adder were removed. Additionally, the electric avoided cost externality adder of $0.0753 per kWh and the fossil fuel externality adder of $4.84 per MMBtu for natural gas were eliminated. The results of removing the adders are presented in Table 8.8. The overall Portfolio without adders produces a Societal Benefit Cost Ratio of 2.67 versus a 4.54 with adders and externalities. Overall, the portfolio is cost effective both with and without adder and externalities included.

Table 8-8. Benefit Cost Results With and Without Adders

Initiative	GDS with 3rd Party Evaluation Cost and Realization Rates with Adder	GDS with 3rd Party Evaluation Cost and Realization Rates without Adder
Solar Hot Water 7110SHOT	2.36	1.72
Solar Photo Voltaic 7120PV	1.96	1.96
Federal Home Loan Bank 7420FHLB	0.47	0.27
HP with Energy Star 7420HPES	0.87	0.52
CLEER (T12 Blitz) and 7510MTV 7510BLTZ	5.54	3.32
C&I RX 7510CIRX	4.85	2.93
Commercial Custom, 7520MARO, 7520NEWC 7520CUST	6.05	3.43
LI MF CLEER Program (T12 LI) 7610BLTZ	4.80	3.12
Implementation Contractor DI 7610ICDI	2.32	1.59
Low Income MF Comprehensive 7620LICP	2.02	1.15
Retail Lighting Food Bank 7710FBNK	5.31	2.94
Retail Lighting 7710LITE	3.70	2.13
Portfolio	**4.54**	**2.67**

8.5 INCREMENTAL COST ASSESSMENT

The evaluation team performed a review of the top 10 measures related to kWh savings and evaluated their incremental cost estimates versus the DC SEU TRM incremental cost values dated September 30, 2013. We were not able to reconcile all the incremental costs to either the DC SEU TRM or the Mid-Atlantic TRM. These issues are identified below in the chart showing the top 10 measures and their model based incremental cost versus the TRM cost. Many of the values that could not be reconciled were those installed through the custom measure program. Often, custom programs do not use the TRM values for savings or incremental cost, as these costs are based upon actual installation equipment cost and expected savings.

Table 8-9. Top Ten Measures Comparison of Measure Costs to DC SEU TRM Values (based on contribution to FY13 savings)

Rank	Measure Description	Total kWh Savings	Unit Cost	TRM Unit Cost	TRM Source
1	CFL screw-base	12,092,100	$1.90	$1.90	DC SEU TRM 2013 pg. 84
2	Variable frequency drive motor control	4,576,205	$28,877.16	$215/HP	The installed cost for VFD is most often based upon HP of motor that VFD acts upon. Additional information regarding motor size is required to verify the VFD incremental cost. The Mid-Atlantic TRM pg. 269 list the cost of 10 HP VFD as $215 per HP.
3	Linear T8, super	3,421,654	$93.41	$50–100	69% of all job measure's incremental cost fall within the $50-$100 range specified in the DC SEU TRM pg. 96.
4	LED Screw Base Lamp	2,701,611	$42.97	$35–45	63% of all job measure's incremental cost fall within the $35-$45 range specified in the DC SEU TRM pg. 39.
5	Specialty Bulb	2,504,838	$5.15	$4.55–$5.45	93% of measures incremental cost match the DC SEU TRM pg. 92 incremental cost of $4.55 for installations greater than 15 W or $5.45 for bulbs greater than 15W
6	Occupancy sensors	1,378,766	$119.95	$125.00	Unit cost is an average of all Tracks. Some of the Occupancy Sensors projects match the DC SEU TRM 2013 pg. 48. Cost of occupancy sensors range from $50–$125 per controller.
7	LED Parking Garage/ Canopy Fixture	1,326,117	$556.51	$125–$375	33% of the projects are for the Commercial CIRX Prescription program and they all match the DC SEU TRM 2013 pg. 39. The other projects are listed as part of the Custom Program.

Rank	Measure Description	Total kWh Savings	Unit Cost	TRM Unit Cost	TRM Source
8	New Super T8 Industrial/Strip	1,245,933	$235.72	$57.50	15% of measures are in the Commercial CIRX Prescription program and their incremental cost match the DC SEU TRM 2013 pg. 12 cost of $57.50. The other projects are listed as Custom Programs.
9	Water chilling system	1,156,091	$191,385.90	Not included DC SEU TRM (treated as custom)	The Mid-Atlantic TRM states, regarding Electric Water Chilling systems: "The incremental cost for this measure is assumed to be custom."
10	Relamp/ reballast conversion existing fixture	874,653	$68.35	$50–$65	The incremental cost is in a reasonable range of the DC SEU TRM pg. 12. However, could not match any specific incremental costs directly to the TRM values.

8.6 SOCIETAL COST TEST AND OTHER COST EFFECTIVENESS TESTS

The primary purpose of program cost effectiveness screening is to ensure that ratepayer-funded energy efficiency programs are resulting in sufficient benefits. Different tests measure costs and benefits from the different perspectives of customers, utility systems, and society as a whole. Many states have adopted requirements that program administrators procure all available cost-effective energy efficiency. The Societal Cost Test (SCT), which is used by DC SEU, includes all program impacts to all members of society. This means that it includes all of the costs and benefits of the Total Resource Cost Test (TRC), plus additional societal impacts such as environmental impacts, reduced health care costs, increased employment, reduced tax burdens, and improved national security. The TRC test includes all costs and benefits to the program administrator and program participants. In both the SCT and TRC the full incremental cost of the efficiency measure is included, regardless of which portion of that cost is paid for by incentives and which portion is paid for by the program participant.

The TRC test is the most commonly used cost effectiveness test by states and program administrators. A recent study[64] of screening practices in the Northeast and Mid-Atlantic states (CT, DE, DC, MA NH, NY, RI, VT) revealed that in 5 of these 8 states plus the District of Columbia, the TRC is the primary program screening test. Vermont and the District apply the SCT as the primary test and one state, CT uses the Program Administrator Cost (PAC) test as the primary screening test. A broader study by ACEEE found that 71 percent of 45

[64] Energy Efficiency Cost-Effectiveness Screening in the Northeast and Mid-Atlantic States, Synapse Energy Economics, October 2013.

states offer ratepayer funded energy efficiency programs that rely on the TRC as the primary cost effectiveness screening test.[65]

One of the reasons that states have chosen the TRC test as the primary screening test is that it avoids the need to account for difficult to quantify societal impacts while still allowing the inclusion of other more easily quantified non-electric benefits associated with other fuel savings and water savings. This refers to the savings of other fuels and water that is associated with the installation of an electric energy efficiency measure. It also allows for the inclusion of other non-energy related participant benefits such as reduced O&M costs. In theory, all eligible benefits (energy and non-energy) associated with each test should be included in the determination of test results. So, if a program administrator like DC SEU decides that it will use the SCT as the primary cost effectiveness screen, then it should attempt to quantify at some level all of the eligible benefits and costs associated with that test. This is more likely to be the case when the SCT is the chosen primary test for policy reasons. However, many states that use the TRC as a primary test ignore non-energy benefits, even though they are allowed to be included. Again, in many cases this is done for convenience or to limit the expense associated with applying the test and adjudicating test results.

Given the challenges associated with determining the value program non-energy benefits, some states such as Connecticut are using the Program Administrator Cost (PAC) test as the primary test. The PAC examines the costs and benefits of an energy efficiency program from the perspective of the entity implementing the program. The costs included in the PAC include program administration and customer incentive costs. The benefits from the utility perspective are the savings derived from not delivering the energy to customers.

It is very difficult to compare cost effectiveness test results from different states, even for similar programs for the following reasons:

- Program delivery approaches and costs may vary
- There are regional differences in installed measure costs
- Differences in market characteristics can affect the mix of installed measures and overall program costs and lifecycle savings
- Avoided energy, demand and transmission/distribution avoided costs will vary across states
- Inclusion and quantification of non-energy benefits varies across states
- Other cost-effectiveness analysis assumptions such as discount rate vary by utility and state.

The National Action Plan for Energy Efficiency[66] states that, "*A common misperception is that there is a "best" perspective for evaluating the cost-effectiveness of energy efficiency. On the contrary, no single test is more or less appropriate for a given jurisdiction. A useful analogy for the value of the five cost-effectiveness tests is the way doctors use multiple diagnostics to*

[65] A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs, ACEEE, February 2012

[66] Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers A RESOURCE OF THE NATIONAL ACTION PLAN FOR ENERGY EFFICIENCY, NOVEMBER 2008.

assess the overall health of a patient: each test reflects different aspects of the patient's health."

As discussed above, the SCT used by the DC SEU provides a societal perspective and a positive SCT result indicates that the District, the region, or the United States will be better off overall. Cost-effectiveness overall as analyzed by the TRC and SCT is not necessarily the only important aspect to evaluate when designing an energy efficiency portfolio. Even if benefits outweigh costs, some stakeholders can be net winners and others net losers. Therefore, many states also include one or more of the distributional tests -- Participant Cost Test (PCT), Program Administrator Cost (PAC) test, and Rate Impact Measure (RIM) test -- to evaluate cost-effectiveness from different vantage points. Using the results of the distribution tests, the energy efficiency measures and programs offered, their incentive levels, and other elements in the portfolio design can be balanced to provide a reasonable distribution of costs and benefits among stakeholders.

Using the PCT along with the TRC or SCT can help set incentive levels and gauge potential adoption rates. The PAC can be used to help assess the likelihood that a large number of customers would make the efficiency investment without the program. A poor PAC test result might also indicate that larger incentives are required to induce sufficient market penetration of a particular measure. Finally, the RIM test can be used to evaluate the relative impacts of the overall energy efficiency program on rates.

The choice of a primary cost effectiveness test should be highly dependent on the policy goals in the District. For example, the use of the SCT or TRC is supportive of Resource Portfolio Standards and green house policies. Another important aspect of achieving such policy goals is to maximize the number and type of programs and measures that are cost effective by focusing on cost-effectiveness at the portfolio level, instead of the program or measure level. Cost-effectiveness tests can be applied at different points in the design of an energy efficiency portfolio and the choice of when to apply which test can have a significant impact on the energy efficiency measures that will be offered. In general, cost effectiveness screening can be applied at the measure, program and portfolio level. Evaluating cost-effectiveness at the measure level means that each individual measure that is included in a utility program must be cost-effective. Evaluation at the program level means that collectively the measures offered through a program must be cost-effective, but some measures can actually be uneconomical; however, it may make sense to include measures that, as stand-alone measures, are not cost effective because they can make projects more complete. Evaluating cost-effectiveness at the portfolio level means that all of the programs as a whole must be cost-effective, but individual programs need not be cost effective. When cost effectiveness is required at the measure level, savings will be lower as the portfolio is not able to bundle less cost effective measures with more cost effective measures. Very few states require measure level rigor.

It is clear that policy makers must determine not only which tests will be applied, but when they will be applied to help maximize the likelihood of achieving their policy goals.

8.7 CONCLUSIONS—ENVIRONMENTAL EXTERNALITIES AND OTHER NON-ENERGY BENEFITS

The inclusion of externalities and other non-energy benefits in cost effectiveness analysis is appropriate for the societal test. The decision to use the societal test and further the magnitude of the environmental externalities and other NEBs can have significant implications for the cost-effectiveness of energy efficiency programs and can sometimes make the difference between a program being cost-effective or not. For that reason it is important to understand that the selection of the societal test and the quantification of adders allowed under this test is essentially a policy decision. Our major conclusions regarding the environmental externality, risk and NEBS adder used by VEIC in its cost effectiveness analysis of the DC SEU energy efficiency programs are as follows:

1. The environmental externalities estimate is reasonable, given that such a value is allowed in the societal test used by DC SEU and that is based on an appropriate (but not the only) method of measuring the value of environmental externalities. The VEIC approach is to use the marginal abatement cost as the basis from which to gauge the societal benefit. A concern regarding this approach is the selection of the marginal abatement technology (MAT) and assumptions that underlie the selection, pricing, and use. The core assumption regarding the MAT is that it is a natural gas plant with carbon capture and storage (CCS). This is described in Synapse's discussion of the 2010 McKinsey report. CCS has been shown to be very expensive and particularly so for natural gas plants. It also makes up a very large block of the carbon reduction technologies in the McKinsey supply curve of carbon abatement options. It is not clear to how they arrived at the potential for each technology.
2. It is acceptable to choose a value of $80 per ton CO_2 if we accept the technology analysis done by McKinsey that is cited in the Synapse report. However, it is reasonable to assume that a range of uncertainty exists around this value, given concerns we have with the assumption made regarding the MAT and the likelihood that CCS technology can be implemented in the volume or timeframe assumed in the study.
3. Another possible concern with the Synapse' study is that the marginal abatement cost is based on getting to no more than 450 ppm atmospheric carbon. This is a number used to estimate no more than a 2 degree C increase in mean global temperatures and is considered a threshold that would avoid substantial economic disruption due to climate change. It is the outer bound of "climate stability."
4. Applying a global goal approach to the District raises a question regarding how such global benefits will actual accrue to the District. It would be incorrect to assume that there is no benefit to the District helping reduce global emissions, but it may also be incorrect to assume that it will receive the same benefits implied in global climate change goals.
5. Overall, the DC SEU includes a significantly high level of non-energy impacts in its cost effectiveness screening of energy efficiency programs.