DCSEU FY2021 Performance Benchmarks Report

FINAL

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SUBMITTED TO:
District of Columbia Department of Energy and Environment

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Glossary

Term	Definition
Average emissions rate	Average greenhouse gas emissions rate (CO2 equivalent per MWh) among all electricity production.
Avoided costs	System costs avoided due to reductions in energy and capacity requirements.
Cost of saved energy	Cost to acquire first-year energy savings. Expressed in units of $/MWh, $/therm, or $/MMBtu.
Energy savings (MMBtu)	Cumulative energy savings reflecting both electric savings and gas savings.
Evaluated or verified savings	Tracked savings values from DCSEU that have been verified by the NMR team.
First-year savings	Estimated energy savings achieved during the first year after the installation of energy-efficient equipment or other measure.
Free-ridership	The portion of program savings that would have occurred in the absence of the program.
Gross electric savings (MWh)	The electric savings that the customer is expected to receive at the meter.
Gross gas savings (Therms)	Gross gas savings includes both cross-fuel and like-fuel interactive effects. Interactive effects reflect the increase or decrease in energy usage due to the installation of an energy-efficiency measure. A common example is an LED bulb installed in conditioned space that produces less waste heat than an incandescent bulb. This reduces the energy consumption from cooling equipment (a like-fuel interactive effect) but increases consumption from gas-fired heating equipment (a cross-fuel interactive effect).
Impact evaluation	Component of the evaluation that verifies the tracked savings reported by DCSEU.
Lifetime savings	Estimated energy savings achieved over the course of the full lifetime of the installed energy-efficient equipment or other measure.
Marginal emissions rate	Greenhouse gas emissions rate (CO2 per MWh) for the final electric generation unit committed to match supply and demand.
Modified gross electric savings (MWh)	The modified gross generator-level savings are calculated by increasing all gross meter-level electric savings to adjust for line losses. Modified gross savings are used to assess the performance benchmarks.
Modified gross gas savings (Therms)	The modified gross gas savings excludes cross-fuel interactive effects. Modified gross savings are used to assess the performance benchmarks.
Net-to-gross ratio	NTG ratio = 1 – Free-ridership % + Participant Spillover %
Non-energy impacts	Non-energy impacts are the impacts beyond energy savings and energy bill savings, such as water savings or improved thermal comfort, attributable to energy efficiency improvements.
Participant spillover	Participant spillover can manifest in participants who take actions beyond the tracked program savings and without financial assistance from the program.
Peak demand savings	Demand savings that occur during the summer peak demand period of 2:00 p.m. and 6:00 p.m. from June through September.
Realization rate	The realization rate equals the ratio of evaluated savings to tracked savings.
Tracked savings	Savings values reported by DCSEU from their program tracking database.

Term	Definition
Societal Cost Test	The Societal Cost Test calculates the cost-effectiveness of programs including the costs and benefits from the program administrator, program participants, and non-participants.

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Key Highlights

This report presents the results of an independent assessment of the performance of the District of Columbia Sustainable Energy Utility (DCSEU) energy programs against established benchmarks for Fiscal Year 2021 (FY2021). In FY2021, the DCSEU achieved both the minimum and maximum targets for all benchmarks (Table 1). As FY2021 was the final year of a five-year contract, the FY2021 results reflect the ultimate achievement of DCSEU under the contract, which is most pertinent for the four benchmarks with cumulative targets.

Table 1: FY2021 Performance Benchmarks Summary

Benchmark Type	Benchmark		Minimum Target	Maximum Target
Annual Cumulative Target	1. Reduce Electricity Consumption		✓	✓
	2. Reduce Natural Gas Consumption		✓	✓
	3. Increase Renewable Energy Generating Capacity		✓	✓
Annual Target	4. Improve Energy-efficiency of Low-income Properties	a. Expenditures	✓	*n/a*
		b. Savings	✓	✓
	5. Increase Green-collar Jobs		✓	✓
Five-year Cumulative Target	6. Leverage External Funds		✓	✓

The costs of first-year energy savings increased by about 12% from FY2017 to FY2021. In addition, the cost of first-year energy savings for the DCSEU in FY2021 was higher than that of nearby PECO Energy and Philadelphia Gas Works but less than Baltimore Gas & Electric. Lastly, cost-effectiveness testing found that the DCSEU portfolio was cost-effective in FY2021 and over the course of the five-year contract period.

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Executive Summary

NMR Group, Inc., EcoMetric Consulting, Demand Side Analytics, BluePath Labs, and Setty – collectively referred to as "the NMR team" – were contracted by the District of Columbia Department of Energy and Environment (DOEE) to evaluate the energy-efficiency and renewable energy programs implemented by the District of Columbia Sustainable Energy Utility (DCSEU). This report presents the results of our independent assessment of the DCSEU's Fiscal Year 2021 (FY2021) programs, including performance against established benchmarks. The DCSEU FY2021 programs began on October 1, 2020 and ended on September 30, 2021.

The DCSEU contract has a five-year base period that began in FY2017 and ended in FY2021, with an option to extend for an additional five years. The DCSEU officially began working under this multiyear contract in April 2017. The DCSEU's performance against established benchmark targets is based on all results attained against performance benchmarks under Option Year 6 of Contract No. DDOE-2010-SEU-001 that began in FY2010, combined with results achieved under the FY2017 multiyear contract.

Due to the uncertainty surrounding the COVID-19 pandemic's impact on DC energy usage and savings, the DOEE elected to maintain the contracted FY2021 saving goals for DCSEU. While several DCSEU performance benchmarks are measured by first-year energy savings, a single year's impact is relatively small compared to the lifetime energy savings for equipment that participants may install for many years. Therefore, our evaluation approach for FY2021 estimates energy savings assuming a typical year under normal operating conditions.

This report focuses on the core DCSEU programs funded through the Sustainable Energy Trust Fund.[1] Our evaluation of the FY2021 programs found that DCSEU expended the appropriate amount of effort and rigor on their savings calculations. In general, the documentation provided was sufficient, and the methods and assumptions were suitable. The evaluation team believes the DCSEU calculated energy savings with a reasonable degree of accuracy. For more details on our evaluation methodology and findings for each of the DCSEU residential and commercial programs selected for evaluation in FY2021, please review the *DC Sustainable Energy Utility FY2021 Program Evaluation* report.

In addition, Appendix A provides descriptions for each of the program tracks offered by the DCSEU in FY2021.

[1] Appendix C contains cost-effectiveness results for the Solar For All programs. In addition, Appendix C of the *DC Sustainable Energy Utility FY2021 Program Evaluation* report contains details of the evaluation of the Solar For All programs.

PERFORMANCE BENCHMARK AND TRACKING GOALS ASSESSMENT

The DCSEU FY2017-FY2021 multiyear contract specifies performance benchmarks related to energy savings, renewable energy generation capacity, expenditures, leveraging funds, and job creation that the DCSEU is responsible for achieving, as outlined in Table 2. Three of the benchmarks provide performance incentives associated with meeting or exceeding the minimum performance targets on an annual basis and a cumulative basis. The leveraging external funds benchmark provides an incentive at the end of the five-year contract period in FY2021. Additionally, the low-income and green jobs benchmarks provide incentives for meeting or exceeding targets on an annual basis. Likewise, penalties could be assessed on an annual basis if the DCSEU failed to achieve the minimum targets for the low-income and green jobs benchmarks, while penalties for the electric, gas, renewable energy, and leveraging funds benchmarks could be assessed at the end of the five-year contract period if the DCSEU failed to achieve the cumulative minimum targets.

In FY2021, the DCSEU achieved both the minimum and maximum targets for all benchmarks, including those with annual cumulative targets, annual targets, and cumulative targets (Table 2).

Table 2: FY2021 Performance Benchmarks Summary

Benchmark Type	Benchmark	Verified Results*	Minimum Benchmark		Maximum Benchmark	
			Target*	Achieved	Target*	Achieved
Annual Cumulative Target	1. Reduce Electricity Consumption (MWh)	592,331 *(5.1%)*	461,188 *(4.0%)*	✓	576,485 *(5.0%)*	✓
	2. Reduce Natural Gas Consumption (Therms)	10,636,307 *(3.1%)*	8,525,645 *(2.5%)*	✓	10,230,774 *(3.0%)*	✓
	3. Increase Renewable Energy Generating Capacity (kW)	17,558	4,350	✓	5,000	✓
Annual Target	4. Improve Energy-efficiency of Low-income Properties — a. Expenditures	$4,859,366	$4,320,871	✓	*n/a*	*n/a*
	4. Improve Energy-efficiency of Low-income Properties — b. Savings (MMbtu)	55,146	23,278	✓	46,556	✓
	5. Increase Green-collar Jobs	88.3	66	✓	88	✓
Five-year Cumulative Target	6. Leverage External Funds	$5.7M	$2.5M	✓	$5.0M	✓

* The percentage values in italics equal the ratio of cumulative savings to 2014 weather normalized DC consumption, which forms the basis of the contract savings benchmarks. The factor applied to convert electric savings to energy savings = 3.412 MMBtu/MWh and to convert gas savings to energy savings = 1 MMBtu/10 therms. For example, 592,331 MWh = 2,021,033 MMBtu and 10,636,307 therms = 1,063,361 MMBtu.

Figure 1 illustrates the percentage achievement for each of the benchmarks. The DCSEU exceeded all minimum targets by a moderate to substantial degree – ranging from 112% for low-income expenditures to 404% for renewable energy capacity. The DCSEU exceeded the maximum target for the energy savings benchmarks by a small amount – with achievements of 103% for electric savings and 104% for gas savings. At 100%, DCSEU just met the maximum target for the green jobs benchmark.

Figure 1: FY2021 Achievement of Performance Benchmarks

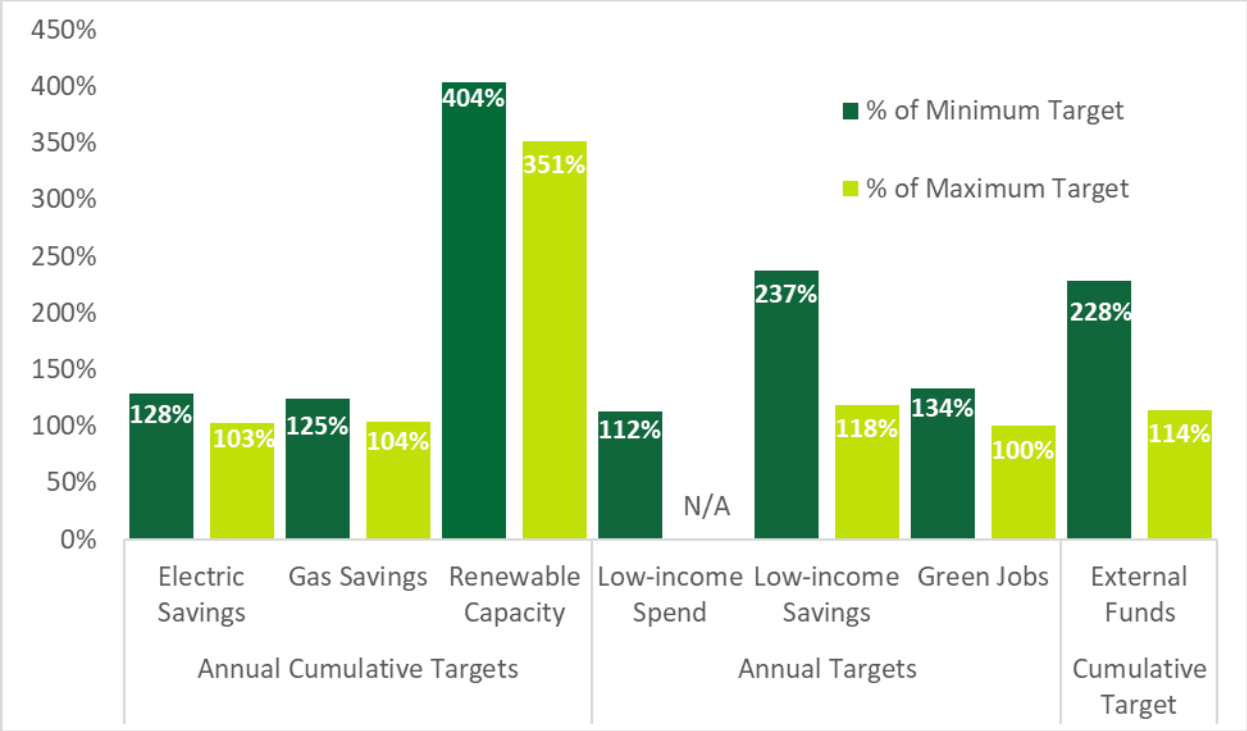

Table 3 displays our assessment of DCSEU's achievement of its tracking goals. The DCSEU achieved 17.7 MW of summer peak demand savings, which represents nearly 1% of District peak demand usage in 2021. In addition, DCSEU completed 169 projects with large energy users in FY2021.

Table 3: FY2021 Tracking Goals and Greenhouse Gas Emission Reductions

Tracking Goal	Evaluated Number
Reduce Growth in Peak Demand	17.7 MW
Reduce Growth in Energy Demand of Largest Energy Users	169 projects
Cumulative Avoided CO2 Emissions, Marginal Emission Rates	406,292 metric tons
Cumulative Avoided CO2 Equivalent Emissions, Average Emissions Rates	241,211 metric tons

The CO2 emissions reductions are calculated using two methodologies – one based on average greenhouse gas (GHG) emissions rates, and one based on marginal emissions rates.[2] Since FY2017, the DCSEU programs are estimated to have saved a combined 241,211 metric tons of annual GHG emissions based on average CO2 equivalent emission rates and 406,292 metric tons based on marginal CO2 emission rates (Table 3). The FY2021 avoided emissions of 37,292 metric tons based on average emission rates represents 0.5% of the estimated District-wide emissions of 7,172,238 metric tons in 2019.

We estimate the DCSEU programs yielded about 517,561 MMBtu in annual energy (electric plus gas) savings in FY2021 — which represents about 0.7% of 2014 weather-normalized DC consumption — and 3,084,661 MMBtu since FY2017. In addition, since FY2017, the DCSEU programs are projected to yield about 6,566,105 MWh (22,403,551 MMBtu) in lifetime electricity savings and 104,223,348 therms (10,422,335 MMBtu) in lifetime natural gas savings over the full life of the measures.

COST-EFFECTIVENESS ASSESSMENT

The NMR team calculated the costs of saved energy and conducted cost-effectiveness testing for the DCSEU's FY2021 programs.

Costs of Saved Energy

To inform future planning of budgets and savings goals, we calculated the DCSEU's cost of acquiring the verified energy savings. The cost of saved energy is a common metric that calculates the cost per unit of energy savings. The cost of FY2021 gross and modified gross first-year electricity savings,[3] excluding the DCSEU's renewables programs, was $43 per million British Thermal units ($43/MMBtu) and $41/MMBtu, respectively (Figure 2). In addition, we calculated that the DCSEU's cost for gross and modified gross electricity savings from renewables programs was $10/MMBtu. For natural gas savings, the DCSEU's cost of gross and modified gross savings[4] was $66/MMBtu and $48/MMBtu, respectively.

While the costs of portfolio-wide gross energy savings decreased from $42/MMBtu in FY2017 to $27/MMBtu in FY2019, the costs have since steadily increased to $47/MMBtu in FY2021. As lower cost energy savings opportunities are exhausted it is typical for the cost of saved energy to increase over time. However, the increase in portfolio-wide costs of energy savings is mostly driven by increased spending on higher cost low-income programs. Low-income spending almost doubled between FY2019 and FY2021 primarily due to the launch of a low-income multifamily gas program for Washington Gas.

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[2] The average emission rates are calculated using a DOEE spreadsheet tool for 2020. The marginal emission rates are based on 2019 PJM estimates. Details are provided in Section 1.2.3.

[3] Modified gross electricity savings exceed gross electricity savings due to adjustments for line losses (see Section 1.1.1 for more detail).

[4] Modified gross natural gas savings exceed gross natural gas savings due to the exclusion of cross-fuel interactive effects (see Section 1.1.2 for more detail).

Figure 2: DCSEU Trends for Costs of First-year Energy Savings

At $147/MWh, the DCSEU's FY2021 cost for gross electricity savings is less than Baltimore Gas & Electric's cost ($180/MWh) but higher than PECO's cost at $120/MWh. At $6.57/therm, the DCSEU's FY2021 cost for gross gas savings was almost double the cost for Philadelphia Gas Works ($3.48/therm). While these comparisons are useful, it is important to understand that these jurisdictions have different markets, savings goals, regulatory requirements, cost-effectiveness tests, program maturity, and delivery systems, which may affect both costs and savings.

The cost to reduce GHG emissions in FY2021 equals $334 per metric ton of CO2 based on the marginal emissions rate.

Cost-effectiveness Testing

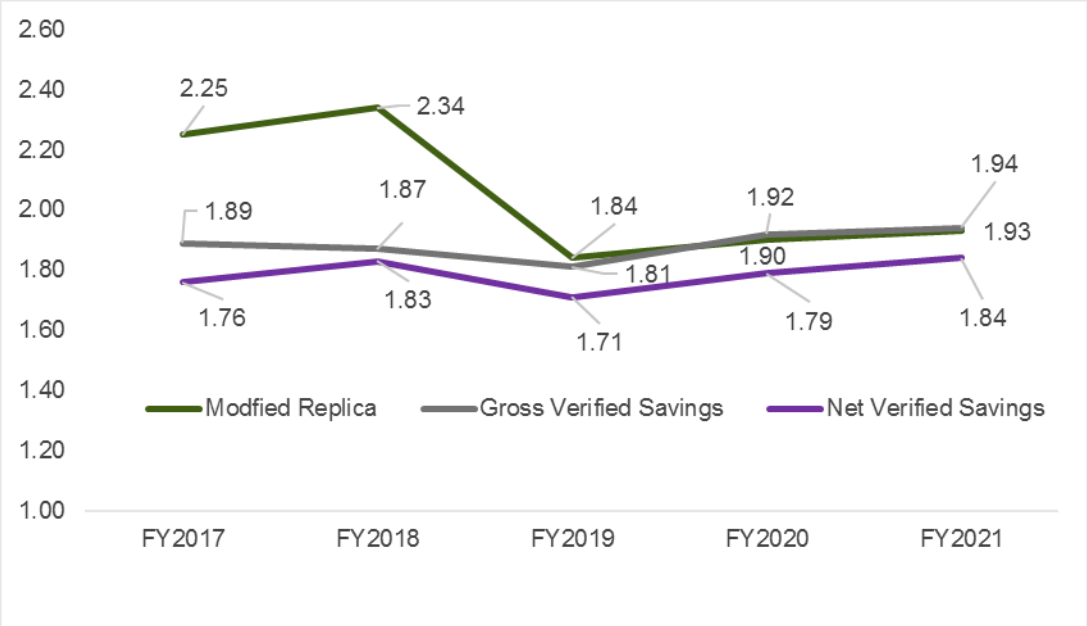
The NMR team conducted a benefit-cost analysis of the DCSEU's FY2021 offerings at the program and portfolio level using a Societal Cost Test (SCT). The SCT examines cost-effectiveness from the perspective of the utility, program participants, and non-participants. The NMR team primarily took model inputs from DCSEU tracking data, which were then adjusted using the results of the FY2021 evaluation. The mechanics of the DCSEU tracking database are well-organized to facilitate benefit cost modeling, and their application was well-documented. Therefore, the NMR team considered three scenarios for the FY2021 benefit-cost analysis:

- **Modified Replica**: This scenario replicated the DCSEU cost-effectiveness calculations to ensure that our model returned comparable results to the DCSEU model. Once we confirmed that our model produced similar results with the same data, we implemented some corrections to inputs and formulas.
- **Gross Verified Savings**: This scenario incorporated the realization rates as determined by the impact evaluation.
- **Net Verified Savings**: This scenario adjusted the tracked savings by both the realization rate and the net-to-gross (NTG) ratio. Incremental measure costs are discounted by the applicable free-ridership rate.

Figure 3 displays the DCSEU portfolio-level cost-effectiveness ratios under each scenario for FY2017 through FY2021. The NMR team found that the DCSEU program portfolio, when taken as a whole, was cost-effective under each of the three scenarios in FY2021. To interpret these

results from a SCT perspective, for every $1.00 spent, the District realized about $1.93 return on its investment in the Modified Replica Scenario, $1.94 return in the Gross Verified Scenario, and $1.84 in the Net Verified Scenario. Since FY2017, the benefit/cost ratios have remained fairly stable, with the exception of the modified replica scenario, which declined in FY2019 after DCSEU incorporated updated avoided cost assumptions.

Figure 3: DCSEU Societal Cost Test Ratio Trends



FY2021 was the fifth and final year of a five-year contract cycle for DCSEU. Table 4 shows the SCT ratio for the five-year cycle as a whole on a gross verified basis. To facilitate aggregation across years, all SCT costs and benefits are expressed in 2017 dollars[5] to align with the beginning of the cycle. The total societal benefits achieved exceed the societal costs to deliver the portfolio by over $376 million and return $1.88 of benefit to society for each $1.00 of investment.

[5] The discount factor was an average of the Real discount factor (3.87%) used by the program over the last 5 years and an additional 2% adder for inflation per the Consumer Price Index (CPI) of All Domestic Goods. The CPI calculator and data can be seen here: https://www.bls.gov/data/inflation_calculator.htm and https://data.bls.gov/timeseries/CUUR0000SA0

Table 4: SCT 5-Year Cycle for Gross Verified Savings Scenario ($2017)

Year	SCT Benefit (thousands)	SCT Cost (thousands)	SCT Net Benefits (thousands)	SCT Ratio
FY2017	$164,103	$86,622	$77,481	1.89
FY2018	$194,752	$104,025	$90,727	1.87
FY2019	$194,785	$107,871	$86,915	1.81
FY2020	$131,011	$68,226	$62,786	1.92
FY2021	$119,989	$61,761	$58,227	1.94
SCT Total	**$804,641**	**$428,505**	**$376,136**	**1.88**

In Section 2.2.3, we offer recommendations to improve the accuracy of future cost-effectiveness testing.

DISCUSSION

Our assessment of DCSEU's achievement of its FY2021 benchmarks found that the DCSEU succeeded in meeting both the minimum and maximum targets for all performance benchmarks. As FY2021 was the final year of a five-year contract, the FY2021 results reflect the ultimate achievement of DCSEU under the contract, which is most pertinent for the four benchmarks with cumulative targets. To provide a broader perspective of DCSEU performance over the course of the five-year contract, Table 5 displays the achievement of benchmarks each year from FY2017 to FY2021.

The DCSEU achieved both the minimum and maximum targets for the electricity savings, gas savings, and renewable energy benchmarks each year. In addition, DCSEU achieved the minimum targets for the annual low-income expenditures, low-income savings, and green jobs each year. However, DCSEU fell short of the maximum targets for the annual low-income savings benchmark for the first four years and for the green jobs benchmark for the first three years. The launch of the Washington Gas Income Qualified Efficiency Gas Fund program in FY2020 contributed to the achievement of the external funds benchmark as well as the low-income savings benchmark in FY2021.

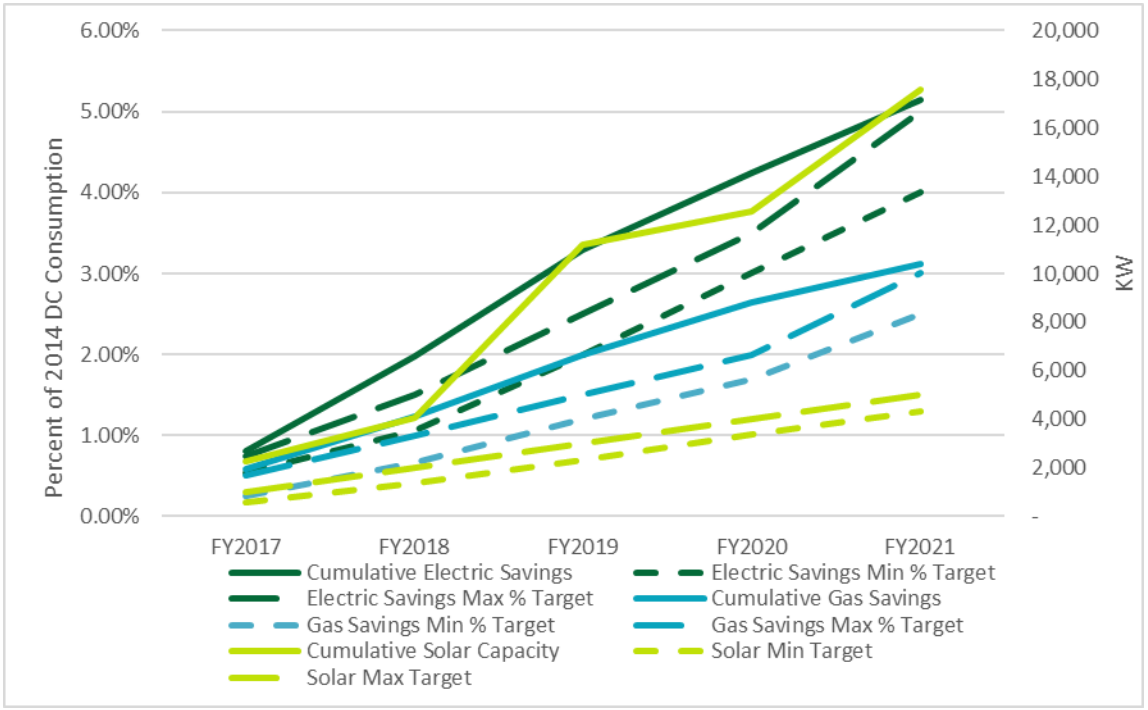
It is important to recognize that the COVID-19 pandemic disrupted programs in FY2020 and, to a lesser extent, in FY2021. In addition, because the full array of benchmarks reflects diverse and sometimes competing objectives, DCSEU must constantly monitor performance to achieve benchmarks. In light of these challenges, DCSEU's achievement of all minimum benchmarks and most maximum benchmarks over the course of five years is notable.

Table 5: Five-Year Performance Benchmarks Summary

Benchmark Type	Benchmark	FY2017		FY2018		FY2019		FY2020		FY2021	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Annual Cumulative Target	1. Electricity Savings	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	2. Natural Gas Savings	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	3. Renewable Energy Generating Capacity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Annual Target	4a. Low-income Expenditures	✓	*n/a*	✓	*n/a*	✓	*n/a*	✓	*n/a*	✓	*n/a*
	4b. Low-income Savings	✓	X	✓	X	✓	X	✓	X	✓	✓
	5. Green-collar Jobs	✓	X	✓	X	✓	X	✓	✓	✓	✓
Five-year Cumulative Target	6. External Funds	18%	9%	28%	14%	41%	21%	✓	61%	✓	✓

Figure 4 displays the annual progress towards as well as the minimum and maximum targets for the three annual cumulative benchmarks: electricity savings, gas savings and renewable capacity. The electricity savings (dark green lines) and gas savings (blue lines) are shown as a percentage of 2014 weather-normalized DC consumption while renewable capacity (light green lines) is shown in kW units. Overall, DCSEU exceeded the annual electricity and gas savings targets each year by a moderate degree, but exceeded the annual renewable capacity target by a large degree.

Figure 4: DCSEU Cumulative Benchmark Trends



DCSEU's cost of first-year energy savings increased in FY2021 for the second year in a row after declining in previous years. As lower cost energy savings opportunities are exhausted it is typical for the cost of energy savings to increase over time. However, the increase in the portfolio-wide cost of energy savings was mostly driven by increased spending on higher cost low-income programs. In addition, while the cost of first-year energy savings for the DCSEU was lower than one neighboring utility (BG&E), it was higher than two other neighboring utilities (PECO and PGW). In prior years, DCSEU had lower costs than all three utilities.

The cost-effectiveness testing found that the DCSEU portfolio was cost-effective as a whole in FY2021, with benefit-cost ratios in line with previous years. The portfolio's performance over the five-year contract period was cost-effective as well.

In addition, Appendix A provides descriptions for each of the program tracks offered by the DCSEU in FY2021. For detailed recommendations regarding specific DCSEU programs, please see Appendix B.

Section 1 Assessment of Performance Benchmarks and Tracking Goals

In this section, we assess the District of Columbia Sustainable Energy Utility's (DCSEU's) Fiscal Year 2021 (FY2021) achievement of its performance benchmarks and tracking goals. We also provide information regarding cumulative energy savings, lifetime energy savings and reductions in greenhouse gas (GHG) emissions.

1.1 Performance Benchmarks

In this section, we assess the DCSEU's FY2021 achievement of each of the following performance benchmarks:

1. Reduce Electricity Consumption
2. Reduce Natural Gas Consumption
3. Increase Renewable Energy Generating Capacity
4. Improve the Energy-efficiency of Low-income Properties
5. Increase the Number of Green-collar Jobs
6. Leverage External Funds

1.1.1 Reduce Electricity Consumption

The enumerated benchmark for reductions in electricity consumption states that DCSEU shall develop and implement energy-efficiency programs that directly lead to annual reductions of weather-normalized total electricity consumption, measured as a percentage of the total consumption of electricity in the District in 2014. The contract requires that DCSEU achieve a minimum of 461,188 MWh savings across the full five-year contract, which represents 4% of 2014 weather-normalized consumption in the District. The maximum target equals 576,485 MWh savings, which represents 5% of 2014 weather-normalized consumption in the District.

The DCSEU tracks electric savings in two ways: gross meter-level savings and modified gross generator-level savings. The gross meter-level savings reflect the annual electric savings that the customer is expected to receive at the meter. The modified gross generator-level savings are calculated by increasing all gross meter-level electric savings by 4.6% to adjust for line losses. The formula is displayed below.

*Modified gross electric savings = Gross electric savings * 1.04599*

Modified gross generator-level savings are used to assess this performance benchmark.

Table 6 displays the modified gross generator-level electric savings as tracked by DCSEU, our calculated portfolio-level realization rate, and the evaluated savings. The realization rate equals the ratio of evaluated savings to tracked savings (i.e., DCSEU savings recorded in their tracking database). The NMR team estimates that the actual portfolio electric savings equals 104,228 MWh for FY2021, which is 100% of the DCSEU reported tracked electric savings. The cumulative evaluated savings from FY2017 through FY2021 equals 592,331 MWh, which reflects 5.1% of 2014 weather-normalized DC consumption.

Table 6: Modified Gross Electric Savings Verification

Year	Tracked Modified Gross Savings (MWh)	Realization Rate	Evaluated Modified Gross Savings (MWh)	Percent of 2014 Weather Normalized DC Usage
FY2021	104,214	100%	104,228	0.9%
FY2020	106,183	103%	109,368	0.9%
FY2019	155,799	97%	151,321	1.3%
FY2018	135,898	99%	134,728	1.2%
FY2017	93,958	99%	92,686	0.8%
Total	**596,052**	**99%**	**592,331**	**5.1%**

Our gross savings verification of the FY2021 programs found that DCSEU expended the appropriate amount of rigor on their savings calculations. In general, the documentation provided was sufficient, and the methods and assumptions were suitable. The NMR team believes the DCSEU calculated energy savings with a reasonable degree of accuracy.

Table 7 displays our assessment of the DCSEU's achievement of the electric savings benchmark. Our evaluation found that the DCSEU achieved 592,331 MWh in electric savings from FY2017 through FY2021, which represents 128% of the minimum five-year cumulative benchmark and 103% of the maximum benchmark.

Table 7: Reduce Electricity Consumption Benchmark Performance

Modified Gross Annual Electric Savings	Minimum Target (MWh)	Maximum Target (MWh)	Evaluated Savings (MWh)	Percent of Minimum Target	Percent of Maximum Target
Five-year Cumulative Progress	461,188	576,485	592,331	128%	103%

1.1.2 Reduce Natural Gas Consumption

The contract requires that DCSEU achieve a minimum of 8,525,645 therms of natural gas savings across the full five-year contract, representing 2.5% of 2014 weather-normalized consumption in the District. The maximum target equals 10,230,774 therms of natural gas reductions, representing 3.0% of 2014 weather-normalized consumption in the District.

The DCSEU tracks natural gas savings in two ways: gross savings and modified gross savings. The gross savings reflect the estimated annual savings, including both cross-fuel and like-fuel interactive effects. Per the contract, DCSEU calculates modified gross savings by excluding cross-fuel interactive effects. The modified gross savings are used to assess this performance benchmark. Neither the gross nor modified gross gas savings includes upstream gas leakage, which would yield higher savings.

Interactive effects reflect the increase or decrease in energy usage due to the installation of an energy-efficiency measure. A common example is energy-efficient lighting: an LED bulb installed in conditioned space produces less waste heat than an incandescent bulb, which then reduces the energy consumption from cooling equipment but increases consumption from heating equipment. In this case, the cooling savings is a like-fuel interactive effect (the lighting

and cooling equipment both use electricity), while the heating penalty could be a cross-fuel interactive effect (the lighting uses electricity, while the heating equipment could use gas).

The NMR team converted the gas savings, which the DCSEU tracks in MMBtu, to therms by multiplying by a factor of 10.

Table 8 displays the modified gross gas savings as tracked by the DCSEU, the NMR team's calculated portfolio-level realization rate, and the evaluated savings. The realization rate equals the ratio of evaluated savings to tracked savings. The NMR team estimates that the actual portfolio gas savings equals 1,619,344 therms in FY2021, which is 100% of the DCSEU tracked gas savings of 1,622,150 therms. The cumulative five-year figure of 10,636,307 therms represents 3.1% of 2014 weather-normalized consumption in DC.

Table 8: Modified Gross Gas Savings Verification

Year	Tracked Modified Gross Savings (Therms)	Realization Rate	Evaluated Modified Gross Savings (Therms)	Percent of 2014 Weather Normalized DC Usage
FY2021	1,622,150	100%	1,619,344	0.5%
FY2020	2,203,353	100%	2,211,174	0.6%
FY2019	2,718,547	95%	2,569,795	0.8%
FY2018	2,300,391	97%	2,237,961	0.7%
FY2017	2,114,138	95%	1,998,033	0.6%
Total	**10,958,579**	**97%**	**10,636,307**	**3.1%**

Table 9 displays our assessment of the DCSEU's achievement of the gas savings benchmark. Our evaluation found that the DCSEU achieved 10,636,307 therms in gas savings since FY2017, representing 125% of the minimum five-year cumulative benchmark and 104% of the maximum benchmark.

Table 9: Reduce Gas Consumption Benchmark Performance

Modified Gross Annual Gas Savings	Minimum Target (Therms)	Maximum Target (Therms)	Evaluated Savings (Therms)	Percent of Minimum Target	Percent of Maximum Target
Five-year Cumulative Progress	8,525,645	10,230,774	10,636,307	125%	104%

To compare gas savings to electricity savings, we converted the gas savings from therms to MWh.[6] At the equivalent of 311,732 MWh, the cumulative FY2017-FY2021 evaluated gas savings represent about 53% of the comparable electricity savings.

1.1.3 Increase Renewable Energy Generation Capacity

The DCSEU is tasked with increasing the renewable energy generation capacity in the District, primarily through the installation of solar photovoltaic (PV) and solar thermal systems. The

[6] We converted therms to MWh by first dividing by 10 therms per MMBtu then dividing by 3.412 MMBtu per MWh.

contract requires that the DCSEU provide incentives to fund the installation of a minimum of 4,350 kW of renewable energy generating capacity across the five-year year contract period. The maximum target is 5,000 kW.

According to the DCSEU tracking database, solar PV systems were installed at nine sites during FY2021. These installations spanned three programs, as illustrated in Table 10.

Table 10: FY2021 Solar System Summary

Program Name	Track Number	Number of Sites	Tracked Solar Capacity (kW)	Verified Solar Capacity (kW)
Solar PV Market Rate	7101PVMR	5	4,715	4,715
New Construction - Comm Custom	7520NEWC	2	221	221
Low-income Multifamily Comprehensive	7612LICP	2	61	61
Total			**4,997**	**4,997**

For these nine sites, we summed the renewable energy capacity of solar PV systems using the *KWLoad* variable[7] included in the DCSEU tracking database. The NMR team evaluated four FY2021 projects from the solar PV market rate track and found that the tracked generation capacity was accurate. The nine sites are projected to generate a total of 8,909 MWh in annual electric savings.

Table 11 displays the tracked and verified solar generation capacity for FY2017 through FY2021. Overall, a total of 17,558 kW in solar generation capacity has been installed.

Table 11: Renewable Energy Capacity Verification

Year	Tracked Solar Capacity (kW)	Realization Rate	Verified Solar Capacity (kW)
FY2021	4,997	100%	4,997
FY2020	4,200	32%	1,352
FY2019	7,129	100%	7,129
FY2018	1,836	100%	1,836
FY2017	2,244	100%	2,244
Total	**20,406**	**86%**	**17,558**

[7] The *KWLoad* variable reflects the electric generation capacity of solar PV systems in Alternating Current kilowatts.

Table 12 displays our assessment of the DCSEU's achievement of the renewable energy generating capacity benchmark. Our evaluation found that the DCSEU incentivized 17,558 kW of renewable generation capacity since FY2017, representing 404% of the minimum five-year cumulative benchmark and 351% of the maximum benchmark.

Table 12: Renewable Energy Capacity Benchmark Performance

Electric Generation Capacity from Solar PV and Solar Thermal Sources	Minimum Target (kW)	Maximum Target (kW)	Evaluated Capacity (kW)	Percent of Minimum Target	Percent of Maximum Target
Five-year Cumulative Progress	4,350	5,000	17,558	404%	351%

DCSEU also implements the Solar For All programs which install solar PV systems in the District; the Solar For All programs underwent separate supplemental evaluation and cost-effectiveness testing.[8]

1.1.4 Improve the Energy-efficiency and Renewable Energy Generating Capacity at Low-income Properties

Per the DCSEU contract, the low-income benchmark includes two separate metrics that must be met on an annual basis:

1. Spend 20% of the Sustainable Energy Trust Fund (SETF) funds on low-income housing, shelters, clinics, or other buildings serving low-income residents in the District.
2. Achieve 46,556 MMBtu in electricity and natural gas savings from low-income programs.

To verify that tracked low-income program expenditures and savings were accrued to eligible low-income projects, we reviewed the 51 low-income multifamily projects that we sampled for the FY2021 evaluation to ensure that they met the low-income program requirements.

For FY2021, "low-income households" are defined as those with annual incomes equal to or below 80% of the Area Median Income (AMI) or 60% of the State Median Income (SMI). Affordable, low-income housing in the District is defined as one of the following:

1. A single home where the owner or occupant meets the definition of *low-income household*;
2. A multifamily building where at least 66% of the households meet the definition of *low-income household;*
3. Buildings owned by non-profit organizations or the government that meet the definition of low-income households; or
4. Buildings where there are contracts or other legal instruments in place that assure that at least 66% of the housing units will be occupied by low-income households.[9]

[8] Appendix C contains cost-effectiveness results for the Solar For All programs. In addition, Appendix C of the *DC Sustainable Energy Utility FY2021 Program Evaluation* report contains details of the evaluation of the Solar For All programs.

In addition to low-income housing, the DCSEU contract allows low-income programs to target shelters, clinics, or other buildings serving low-income residents in the District. These 51 low-income multifamily projects are comprised of 46 unique sites, and all met at least one of these low-income criteria. Table 13 displays the 46 sites and notes the verification category they met to achieve low-income status.

Table 13: FY2021 Low-income Site Verification

Program Track	Site ID	Project ID	Site Name	Verified (Y/N)	Verification Criteria
Income Qualified Gas Efficiency Fund (4335IGEF)	35865	20158	LeDroit Apartments[10]	Y	Listed as DCHA Public Housing Property
	710	20160	Claridge House Towers10	Y	Listed as DCHA Public Housing Property
	2514	20161	Syphax Gardens[11]	Y	Listed as DCHA Public Housing Property
	31298	20166	Bennington Station Apartments[12]	Y	Participates in DC Housing Choice Voucher Program
	8331	20167	Glendale Plaza Apartments[13]	Y	Participates in DC Housing Choice Voucher Program
	35963	20173	215 Oakwood St SE	Y	All rent values are below HUD Home Rent Limit[14]
	36054	20174	39 Mississippi Ave SE	Y	All rent values are below HUD Home Rent Limit
	35962	20175	1525 28th St SE	Y	All rent values are below HUD Home Rent Limit
	24635	20176	Christ House: Kairos House	Y	All rent values are below HUD Home Rent Limit
	23857	20178	300 62nd St NE	Y	All rent values are below HUD Home Rent Limit
	8369	20180	JW King Senior Center[15]	Y	Listed on HUD as receiving LIHTC
	31865	20181	503 Valley Ave SE	Y	All rent values are below HUD Home Rent Limit
	24186	20184, *20603 (IQEF)*	4180 Livingston Rd SE	Y	All rent values paid by tenants are below HUD Home Rent Limit
	2623	20185	2201 Champlain St NW	Y	All rent values are below HUD Home Rent Limit

[9] "Low-income – Income Qualification FY17."
[10] https://www.dchousing.org/vue/customer/properties_view.aspx
[11] https://www.hrsa.gov/opa/eligibility-and-registration/health-centers/fqhc/index.html
[12] https://www.benningtonstationdc.com/
[13] https://www.glendaleplazadc.com/
[14] https://www.huduser.gov/portal/datasets/HOME-Rent-limits.html
[15] https://resources.hud.gov/#

Program Track	Site ID	Project ID	Site Name	Verified (Y/N)	Verification Criteria
Income Qualified Efficiency Fund (7610IQEF)	25502	19997	Unity Healthcare – Anacostia	Y	Classified as a Federally Qualified Health Center 11,[16]
	24936	20511, *19215 (IQEF)*	Douglass Knolls Apartments[17]	Y	Participates in Federal LIHTC Program
	209	21082	Southern Homes & Gardens	Y	All rent values are below HUD Home Rent Limit
	24195	21468	Marshall Heights Community Development Organization[18]	Y	Listed as a HUD Approved Housing Counseling Agency
	27465	21826	The Gregory Apartments[19]	Y	Listed as affordable housing on Open Data DC
	37268	21827	Naylor Gardens Cooperative Housing	Y	All rent values are below HUD Home Rent Limit
	25504	21828	Unity Healthcare – Upper Cardozo	Y	Classified as a Federally Qualified Health Center
Low-income Multifamily Implementation Contraction Direct Install (7610ICDI)	4763	20966	Marbury Plaza	Y	All rent values are below HUD Home Rent Limit
Low-income Multifamily Comprehensive (7612LICP)	13270	15155	South Capitol Multifamily Building[20]	Y	Listed as affordable housing; funded through HPTF.
	11083	17666	4811 North Capitol St NE19	Y	Listed as affordable housing on Open Data DC
	16028	18013	Petworth Station Apartments[21]	Y	Participates in Federal LIHTC Program
	30748	18231	809 Kennedy St NW19	Y	Listed as affordable housing on Open Data DC
	24230	18232	Capitol Vista Apartments19	Y	Listed as affordable housing on Open Data DC

[16] https://doh.dc.gov/sites/default/files/dc/sites/doh/DC%20FQHC%20Site%20List%202013.pdf

[17] https://affordablehousingonline.com/housing-search/District-Of-Columbia/Washington/Douglas-Knoll-Coop/10026003

[18] https://www.publichousing.com/details/dc_marshall-heights-community-development-organization

[19] https://opendata.dc.gov/datasets/affordable-housing/explore

[20] https://mocrs.dc.gov/release/mayor-bowser-makes-historic-investment-138-million-affordable-housing

[21] https://wcsmith.com/apartments/petworth-station/

Program Track	Site ID	Project ID	Site Name	Verified (Y/N)	Verification Criteria
	9940	18462	Randle Hill Apartments19	Y	Listed as affordable housing on Open Data DC
	31295	18655	The Madison 5616 13th St NW	Y	70% of rent values are below HUD Home Rent Limit
	8302	18918	Delta Towers19	Y	Listed as affordable housing on Open Data DC
	25505	20483	Unity Healthcare - Brentwood	Y	Classified as a Federally Qualified Health Center
	25501	20484	Unity Healthcare – Minnesota Ave	Y	Classified as a Federally Qualified Health Center
	421	20979	Northwest Cooperative Homes[22]	Y	Listed as affordable and subsidized housing by DC Housing Authority
	37233	21555	Livingston Road Senior Apartments19	Y	Listed as affordable housing on Open Data DC
	37305	21710	The Robinson Apartments	Y	Participates in DC Housing Choice Voucher Program[23]
	37304	21711	Mills Place19	Y	Listed as affordable housing on Open Data DC
	207	21915	Greenleaf Gardens Apartments10	Y	Listed as DCHA Public Housing Property
	23898	21917	Horizon House10	Y	Listed as DCHA Public Housing Property
	37460	22042	1550 1st St SW19	Y	Listed as affordable housing on Open Data DC
	1451	22156	1111 Massachusetts Ave NW20	Y	Listed as affordable housing; funded through HPTF.
	37787	22320	128-146 Wayne Place SE	Y	All rent values are below HUD Home Rent Limit
	32027	22954	The Solstice19	Y	Listed as affordable housing on Open Data DC
	7199	23185	Nannie Helen Burroughs10	Y	Listed as DCHA Public Housing Property
	28928	23196, *20165 (IGEF), 20457*	Langston Lane Apartments15	Y	Listed by HUD as low-income, subsidized housing

[22] http://www.dchousing.org/docs/housing_resources.pdf

[23] https://washington.dc.networkofcare.org/mh/services/agency.aspx?pid=DCHousingAuthorityHousingChoiceVoucherPrograms_2_1347_1

Program Track	Site ID	Project ID	Site Name	Verified (Y/N)	Verification Criteria
		(IQEF), 20458 (IQEF)			
	36772	23374	1820 California St Co-op22	Y	Listed as affordable and subsidized housing by DC Housing Authority
	7104	23375	Deanwood Rehabilitation & Wellness Center	Y	All rent values are below HUD Home Rent Limit

Based on our review of the 46 sampled sites, we assume that all program costs and savings allocated to low-income programs were accrued by eligible low-income properties.

Next, we assess the expenditure benchmark, followed by the savings benchmark.

1.1.4.1 Spend 20% of SETF funds at Low-income Housing, Shelters, Clinics, or Other Buildings

The DCSEU contract specifies that the calculation of the low-income spend percentage include portfolio-wide administrative and support costs in the denominator but not the numerator.[24] Therefore, the NMR team applied the following equation:

$$\text{Low-income spend \%} = \frac{\text{Low-income program costs}}{\text{Cumulative program costs} + \text{Portfolio administrative \& support costs}}$$

Table 14 displays our assessment of DCSEU's achievement of the low-income expenditure benchmark. Based on the total FY2021 portfolio expenditures of $21,604,353, the contract requires that DCSEU spend a minimum of $4,320,871 (20%) on low-income programs. There is no maximum target for low-income expenditures.

DCSEU reported spending $4,859,366 across seven low-income programs, representing 112% of the target.

Table 14: FY2021 Low-income Expenditure Benchmark Performance

Measurement	Minimum Target	Evaluated Number	Percent of Minimum Target
Dollars spent on low-income properties	$4,320,871	$4,859,366	112%

[24] The denominator includes all SEU SETF costs but does not include the costs of DOEE oversight or the NMR team evaluation.

1.1.4.2 Achieve 46,556 MMBtu in Electricity and Gas Savings from Low-income Programs

In Table 15, we list the tracked energy (electric plus gas) savings and evaluated savings for each of the seven low-income programs offered by the DCSEU with claimed savings in FY2021. Overall, the DCSEU tracking database reported 55,312 MMBtu in savings, and we verified 55,146 MMBtu.[25]

Table 15: FY2021 Low-income Energy Savings by Program

Program	Track	Tracked Modified Gross Savings (MMBtu)	Evaluated Modified Gross Savings (MMBtu)
Income Qualified Gas Efficiency Fund	4335IGEF	9,095	9,009
Implementation Contractor Direct Install	7610ICDI	6,390	6,390
Income Qualified Efficiency Fund	7610IQEF	5,662	5,668
Low-income Multifamily Comprehensive	7612LICP	15,613	15,528
Low-income Prescriptive Rebate	7613LIRX	1,378	1,378
Retail Lighting Food Bank	7717FBNK	16,839	16,838
Low-income Home Energy Conservation Kit	7717HEKT	335	335
Total		**55,312**	**55,146**

Table 16 displays our assessment of DCSEU's achievement of the low-income savings benchmark. The contract requires that the DCSEU achieve a minimum of 23,278 MMBtu savings from low-income programs. The maximum target equals 46,556 MMBtu.

Our evaluation found that DCSEU achieved 55,146 MMBtu in energy savings from low-income programs, representing 237% of the minimum target and 118% of the maximum target. As discussed in more detail in Section 2.1, the cost of saved energy for low-income programs is typically multiple times greater than for other types of programs.

[25] The DCSEU tracking database reports natural gas savings in MMBtu and electricity savings in kWh. The NMR team converted kWh electricity savings to MMBtu by multiplying by a factor of 0.003412.

Table 16: FY2021 Low-income Savings Benchmark Performance

Measurement	Minimum Target	Maximum Target	Evaluated Number	Percent of Minimum Target	Percent of Maximum Target
Modified gross electric savings plus modified gross gas savings from low-income programs (MMBtu)	23,278	46,556	55,146	237%	118%

1.1.5 Increase the Number of Green-collar Jobs

This benchmark requires that the DCSEU fund green jobs in the District during each year of the contract. The contract requires that the DCSEU fund a minimum of 66 full-time equivalent (FTE) jobs each year. The maximum annual target is 88 jobs.

To calculate the number of FTE jobs funded, the contract specifies the following criteria:

- One FTE green job equals 1,950 hours worked by DCSEU staff and subcontractors.
- One FTE green job equals $200,000 worth of DCSEU incentives provided to customers or manufacturers.
- Only direct jobs are to be considered. Indirect jobs and induced jobs are not counted.

To calculate the number of green jobs funded by the DCSEU staff and subcontractors, DOEE provided a spreadsheet of payroll hours worked by the DCSEU staff and subcontractors during FY2021. The NMR team divided the total number of hours worked by 1,950 to yield the number of green jobs created by the DCSEU (Table 17).

In addition, the DCSEU provided a spreadsheet with the total incentive amount distributed in FY2021, which equaled $9,255,573. However, a portion of these incentives flowed through DCSEU subcontractors, whose jobs were already counted under the payroll hours calculation. Therefore, we excluded a total of $1,753,917 in subcontractor incentives and used the remaining $7,501,655 in customer incentives as the basis for the calculation of jobs funded due to incentives (Table 17).

Table 17: FY2021 Green Jobs Calculation

Category	Total Hours or Dollars (A)	Assumed Hours or Dollars per Job (B)	Number of Green Jobs Funded (A / B)
DCSEU Staff Hours	55,362 hours	1,950 annual hours	28.4
DCSEU Subcontractor Hours	43,721 hours	1,950 annual hours	22.4
Incentive Dollars	$7,501,655	$200,000	37.5
Total Green Jobs Created			**88.3**

Table 18 displays our assessment of the DCSEU's achievement of the green jobs benchmark. We calculated that the DCSEU funded 88.3 jobs, representing 134% of the 66 jobs minimum target and 100% of the 88 jobs maximum target.

Table 18: FY2021 Green Jobs Benchmark Performance

Measurement	Minimum Target	Maximum Target	Evaluated Number	Percent of Minimum Target	Percent of Maximum Target
Number of FTE jobs funded by the DCSEU	66	88	88.3	134%	100%

1.1.6 Leverage External Funds

The contract requires the DCSEU to secure outside funds, excluding SETF funds or other District government funds (such as Solar For All funding), to support the SETF programs implemented by the DCSEU. The DCSEU is required to obtain a total of $5,000,000 of outside funds over the five-year period of the base contract. There is no annual target for this benchmark; there is only a cumulative five-year goal. Therefore, we have assessed the DCSEU's achievement of the $5,000,000 five-year benchmark.

The DCSEU provided the NMR team with a spreadsheet listing details regarding the outside funds received during FY2021. The DCSEU reported obtaining a total of $2.7 million in outside funds during FY2021, mostly from delivering a low-income multifamily gas program for Washington Gas and participating in the PJM forward capacity market (Table 19).

Table 19: FY2021 Leveraged Funds Calculation

Funding Source	Description	Amount
PJM	Forward Capacity Market Credits	$85,894
Sergio Pombo	Miscellaneous	$211
Washington Gas	Low-Income Multifamily Gas	$2,572,832
Total		**$2,658,937**

The NMR team calculates that the DCSEU has secured a total of $5.7 million since FY2017, including the reported outside funding of $439,111 from FY2017, $268,881 from FY2018, $317,131 from FY2019 and $2,019,762 in FY2020 (Table 20).

Table 20: Leveraged Funds Annual Summary

Year	Amount
FY2021	$2,658,937
FY2020	$2,019,762
FY2019	$317,131
FY2018	$268,881
FY2017	$439,111
Total	**$5,703,822**

The $5.7 million figure represents 228% of the $2.5 million minimum target and 114% of the $5.0 million maximum target (Table 21).

Table 21: Cumulative Leveraged Funds Benchmark Performance

Measurement	Minimum Target	Maximum Target	Evaluated Number	Percent of Minimum Target	Percent of Maximum Target
Dollars received from external sources	$2,500,000	$5,000,000	$5,703,822	228%	114%

1.2 Tracking Goals and Other Metrics

In this section, we assess the DCSEU's FY2021 achievement of its two tracking goals:

1. Reduce Growth in Peak Demand
2. Reduce Growth in Energy Demand of Largest Energy Users

In addition, we present data on GHG reductions, net energy savings, and cumulative and lifetime energy savings.

1.2.1 Reduce Growth in Peak Demand

While the DCSEU is not required to offer programs to exclusively reduce peak demand, demand savings result from the electric savings programs, and the DCSEU is required to report on demand savings. Because the peak demand savings goal is for tracking purposes only, it does not have a contractual performance target. Peak demand savings can help reduce the need to add electric generation, transmission, and distribution capacity to the system. In addition, it may avoid the need to activate peak load generation which may be more expensive and produce more pollutants and GHG emissions than baseload generation.

The DCSEU tracks peak demand savings in two ways: gross meter-level savings and modified gross generator-level savings. The contract requires using modified gross generator-level peak demand savings to assess this tracking goal.

The gross meter-level savings reflect the annual peak demand savings that the customer is expected to receive at the meter. The modified gross generator-level savings are calculated by increasing all gross meter-level peak demand savings by 7.7% to adjust for line losses. The formula is displayed below.

*Modified gross peak demand savings = Gross peak demand savings * 1.077076*

The peak demand period occurs between 2:00 p.m. and 6:00 p.m. from June through September. In 2021, the peak load usage for DC was 2,093 MW.[26]

Table 22 displays the modified gross peak demand savings as tracked by the DCSEU, our calculated portfolio-level realization rate, and the evaluated modified gross peak demand

[26] 2022 Consolidated Report. Potomac Electric Power Company. April 2022. Table 2.

savings. The realization rate equals the ratio of evaluated savings to tracked savings. The NMR team estimates that the actual portfolio peak demand savings equals 17.7 MW, 104% of the DCSEU tracked peak demand savings of 17.0 MW. The 17.7 MW figure represents 0.8% of the estimated peak load usage of 2,093 MW.

Table 22: Modified Gross Summer Peak Demand Savings Verification

Measurement	Tracked Savings (MW)	Realization Rate	Evaluated Savings (MW)
Modified gross electric demand savings during summer peak period	17.0	104%	17.7

The evaluated peak demand savings of 17.7 MW for FY2021 is higher than FY2020, but less than FY2018 and FY2019 (Table 23). Because electric savings lead to demand savings, the demand savings fluctuates with electric savings.

Table 23: Evaluated Modified Gross Summer Peak Demand Savings Trends

Measurement	FY2021	FY2020	FY2019	FY2018	FY2017
Evaluated modified gross electric demand savings during summer peak period (MW)	17.7	15.3	22.4	21.4	12.4

1.2.2 Reduce Growth in Energy Demand of Largest Energy Users

While the DCSEU is not required to offer programs aimed exclusively at reducing the energy usage of large energy users, they are required to track projects with large users. Because the large user goal is for tracking purposes only, it does not have any contractual performance targets. Because large energy users consume a disproportionately large share of energy in the District, completing these projects is important to reducing overall energy usage.

The DCSEU contract's definition of a large energy user is as follows:

> *Large energy users are defined as organizations, individuals, or government entities that own a building with more than 200,000 square feet of gross floor area or own a campus of buildings in a contiguous geographic area that share building systems or at least one common energy meter without separate metering or sub-metering, such that their energy use cannot be individually tracked. Gross floor area includes infrastructure that contain heated and unheated space that is connected to a qualifying building. Energy-efficiency or renewable energy measures must be installed in a qualified building or an infrastructure connected to a qualified building in order to qualify as a large energy user project.*

The DCSEU provided a spreadsheet that lists potential FY2021 large energy users, titled Largest_Energy_Users. The spreadsheet divided the large energy users into two categories: Divisions with SPECLEU Identifier; and Divisions where Parent Company has SPECLEU Identifier. Some companies appeared in both lists. Using the addresses listed in this spreadsheet or listed with the given company ID in the tracking database, we evaluated the large energy user status of the project sites listed for these companies.

Some projects included multiple site listings. Additionally, some sites participated in multiple projects and project tracks. The number of unique site IDs participating in each track are listed in Table 24.

Table 24: FY2021 Large Energy User Sites

Program	Track	Number of Unique Sites
CI RX – Equipment Replacement	7511CIRX	13
Market Transformation Value	7512MTV	0
Commercial Upstream	7513UPLT	225
Retrofit – Custom	7520CUST	37
Market Opportunities – Custom	7520MARO	1
New Construction – Custom	7520NEWC	13
Pay for Performance	7520P4PX	1
Low-Income Multifamily Comprehensive	7612LICP	7
Residential Upstream	7725RSUP	2
Total		**299**

To confirm that the company sites met these specifications, the NMR team reviewed the building size reported by the DCSEU for these companies' project sites, when available. However, some sites were listed with a square footage of zero. To confirm building size for sites where the area is not provided, the NMR team consulted the DOEE Covered Building List for 2021, which lists buildings over 50,000 gross square feet in the DC tax records. For locations not listed in this document, we sought external verification through institution websites, news articles, or government documents.

Based on input from DCSEU, the NMR team analyzed large energy users at the site level. Sites that only participated in the Commercial Upstream track were not counted as large energy users since there is no verification activity for these projects. Instead, each Commercial Upstream company is counted as a single large energy user. The Commercial Upstream/Midstream Lighting Program provides customers with point-of-purchase discounts when they buy qualified lighting products from participating distributors. There was sufficient data to confirm that 13 of the associated site IDs were not large energy users as they did not meet the 200,000 square foot threshold. The NMR team was unable to verify 117 site IDs due to insufficient data, but we were able to verify that 169 of the 299 site IDs were large energy users exclusive of the Commercial Upstream Program.

There are a similar number of completed projects with large energy users in FY2021 as in FY2020, which is greater than prior years (Table 25).

Table 25: Evaluated Large Energy User Trends

Measurement	FY2021	FY2020	FY2019	FY2018	FY2017
Number of large energy users with completed projects	169	165	89	127	104

1.2.3 Greenhouse Gas Reductions

Table 26 displays the avoided CO2 emissions in annual metric tons since FY2017 based on the evaluated gross savings, including line losses to reflect electric savings at the generator rather than the customer. The NMR team utilized a GHG emissions calculator spreadsheet from DOEE to calculate the avoided annual GHG emissions assuming 652 lbs. of CO2 equivalent per MWh, which we understand reflects an average emissions rate across the fleet of electric generators.[27] Overall, we estimate the DCSEU's programs saved an estimated 241,211 metric tons of annual CO2 emissions since FY2017 using the average emission rates. The FY2021 avoided emissions of 37,292 metric tons represents about 0.5% of the estimated District-wide emissions of 7,172,238 metric tons from 2019.

We also calculated CO2 emission reductions based on marginal emission rates because they more accurately reflect the impact of energy-efficiency and renewable energy programs on displacing generation across the fleet.[28] Energy-efficiency and renewable energy programs "are not generally assumed to affect baseload power plants that run all the time, but rather marginal power plants that are brought online as necessary to meet demand."[29] We estimated an annual weighted average marginal emissions rate that is consistent with the cost-effectiveness testing employed by the SEU and our evaluation and is based on the savings accumulated during each of four seasonal costing periods.[30] This calculation yielded an annual marginal emissions rate of 1,234 lbs. of CO2 per MWh and yielded FY2021 avoided emissions of 64,652 metric tons.

[27] The average GHG emission rates are calculated using a DOEE spreadsheet tool for 2020. The spreadsheet employs the method from the IPCC 5th Assessment GWP with a 100 year horizon. The electricity factors are from 2020 eGRID RFC-East.

[28] The marginal CO2 emission rates are based on 2019 PJM estimates. *PJM 2015 – 2019 CO2, SO2 and NOX Emission Rates*. April 9, 2020. https://www.pjm.com/~/media/library/reports-notices/special-reports/2019/2019-emissions-report.ashx

[29] https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references

[30] The four costing periods are summer on peak, summer off peak, winter on peak, and winter off peak. Each of these periods has a different marginal emissions rate and energy cost, and the single weighted average marginal emissions rate reflects the relative prevalence of energy savings among each period.

Table 26: Greenhouse Gas Emission Reductions

Year	Avoided GHG Emissions (Metric Tons)	
	CO2 Equivalent, Average Emission Rates	CO2, Marginal Emission Rates
FY2021	37,292	64,652
FY2020	44,602	74,772
FY2019	63,450	107,758
FY2018	55,478	92,963
FY2017	40,389	66,147
Total	**241,211**	**406,292**

1.2.4 Net Energy Savings

Table 27 displays the net energy savings for FY2021, which adjusts the gross savings for both free-ridership and participant spillover. Free-ridership reflects the portion of program savings that would have occurred in the absence of the program. Participant spillover manifests in participating customers who take actions that lead to additional savings beyond the tracked program savings and without financial assistance.

Overall, the net modified savings represent 62% of the gross modified savings for electricity, 60% for gas, and 62% across both fuels. The NTG ratio is lower for gas than electric because most gas savings derive from the Custom Retrofit program, which has one of the lowest NTG ratios among the DCSEU commercial programs.

Table 27: FY2021 Net Modified Energy Savings

	Electric Savings (MWh)	Gas Savings (Therms)	Total Energy Savings (MMBtu)
Gross Modified Savings	104,228	1,619,344	517,561
Net Modified Savings	65,109	966,903	318,843
Net-to-Gross Ratio (Net / Gross)	62%	60%	62%

The estimated portfolio NTG value for DCSEU equaled 60% in FY2020, 61% in FY2019 and 56% in FY2018. In comparison, the most recent portfolio NTG values for PECO[31] and BG&E[32] are 76% and 72%, respectively.

1.2.5 Cumulative Annual Energy Savings

Table 28 displays the annual modified gross energy (electric plus gas) savings. We estimate the DCSEU programs yielded energy savings of about 517,561 MMBtu in FY2021 and 3,084,661

[31] Pennsylvania SWE Annual Report, Act 129 Phase III and Program Year 12. NMR Group, Demand Side Analytics, Brightline Group, and Optimal Energy. March 31, 2022. http://www.puc.state.pa.us/filing_resources/issues_laws_regulations/act_129_information/act_129_statewide_evaluator_swe_.aspx

[32] *Verification of the 2020 Empower Maryland Electric Utility Energy Efficiency Program Impact and Cost Effectiveness Evaluations*. Loper Energy, Hungeling Analytics, and Tierra Resource Consultants. October 29, 2021.

MMBtu since FY2017. The 517,561 MMBtu figure represents about 0.7% of 2014 weather-normalized DC consumption.

Table 28: Annual Modified Gross Energy Savings

Year	Tracked Modified Gross Savings (MMBtu)	Realization Rate	Evaluated Modified Gross Savings (MMBtu)
FY2021	517,793	100%	517,561
FY2020	582,633	102%	594,280
FY2019	803,441	96%	773,286
FY2018	693,722	99%	683,487
FY2017	531,997	97%	516,047
Total	**3,129,586**	**99%**	**3,084,661**

1.2.6 Lifetime Energy Savings

Table 29 displays the modified gross electric savings projected over the lifetime of the measures. Since FY2017, the DCSEU programs are projected to save about 6.6 million MWh in lifetime electric savings, which equals about 22,403,551 MMBtu. The NMR team calculated the lifetime savings for each measure by multiplying the first-year energy savings by its expected lifetime. Because certain measures are subject to increased efficiency standards in the future, the lifetime savings may be adjusted to reflect this situation.

Table 29: Lifetime Modified Gross Electric Savings

Year	Tracked Lifetime Modified Gross Savings (MWh)	Realization Rate	Evaluated Lifetime Modified Gross Savings (MWh)
FY2021	1,058,833	99%	1,045,893
FY2020	1,100,670	102%	1,118,104
FY2019	1,807,714	99%	1,784,211
FY2018	1,507,610	99%	1,496,844
FY2017	1,140,086	98%	1,121,053
Total	**6,614,913**	**99%**	**6,566,105**

Table 30 displays the lifetime modified gross gas savings. Overall, the FY2017 through FY2021 programs are projected to save about 104 million therms in lifetime gas savings, which equals about 10,422,335 MMBtu. The NMR team calculated lifetime savings for each measure by multiplying the first-year energy savings by its expected lifetime. Because certain measures are subject to increased efficiency standards in the future, the lifetime savings may be adjusted to reflect this situation.

Table 30: Lifetime Modified Gross Gas Savings

Year	Tracked Lifetime Modified Gross Savings (Therms)	Realization Rate	Evaluated Lifetime Modified Gross Savings (Therms)
FY2021	22,081,674	100%	22,033,489
FY2020	21,100,023	101%	21,220,847
FY2019	24,817,702	96%	23,813,001
FY2018	18,562,650	102%	18,850,804
FY2017	20,298,108	90%	18,305,207
Total	**106,860,157**	**98%**	**104,223,348**

Section 2 Cost-effectiveness Assessment

In this section, we describe our evaluation efforts to assess the cost of saved energy and the cost-effectiveness of the DCSEU programs.

2.1 Cost of Saved Energy

To inform future planning of budgets and savings goals, we calculated the DCSEU's cost of first-year verified energy savings in FY2021. To calculate the cost of saved energy, the DCSEU provided the NMR team with program-specific incentive costs for electric and natural gas measures, as well as portfolio-wide administrative and support costs for FY2021. To calculate total electric and natural gas costs, we allocated the portfolio-wide administrative and support costs to each program and fuel type based on its program-specific incentive cost. We then summed the total costs by fuel type and program. To calculate the cost of saved energy, we divide reported annual costs by evaluated annual savings.

Because renewable energy projects may have a different cost per unit of savings than energy-efficiency projects, we calculated costs separately for energy efficiency vs. renewable energy. Therefore, we provide the costs for three categories of savings:

1. Electric savings from energy efficiency programs
2. Electric savings from renewable energy programs
3. Natural gas savings

As described in Section 1.1.1, modified gross electricity savings exceed gross electricity savings due to adjustments for line losses. In addition, as described in Section 1.1.2, modified gross gas savings exceed gross gas savings due to the exclusion of cross-fuel interactive effects. Therefore, the DCSEU's costs for modified gross energy savings are less than the costs for gross energy savings. We calculate costs for both types of savings because gross savings are more directly comparable to other jurisdictions, while the performance benchmarks are based on modified gross savings.

We calculated that the DCSEU's FY2021 cost for first-year gross and modified gross electricity savings from energy efficiency programs was $43/MMBtu and $41/MMBtu, respectively (Figure 5 and Figure 6). In addition, we calculated that the DCSEU's cost for gross and modified gross electricity savings from renewables programs was $10/MMBtu. For natural gas savings, we calculated that the DCSEU's cost of gross and modified gross savings was $66/MMBtu and $48/MMBtu, respectively.

While the costs of portfolio-wide gross energy savings decreased from $42/MMBtu in FY2017 to $27/MMBtu in FY2019, the energy costs have since steadily increased to $47/MMBtu in FY2021 (Figure 5). As shown in Figure 8, the cost of energy savings for low-income programs sharply increased in FY2020 but then declined in FY2021; the overall two-year increase is about 18%. The cost of energy savings for non-low-income programs has also increased, albeit more steadily – by about 7% in FY2020 and another 18% in FY2021. While these factors contribute to the increase in the portfolio cost of energy savings, the primary driver is increased spending on the higher cost low-income programs. Low-income spending almost doubled between FY2019

and FY2021 mostly due to the launch of a low-income multifamily gas program for Washington Gas.

Figure 5: DCSEU Trends for Costs of First-year Gross Energy Savings

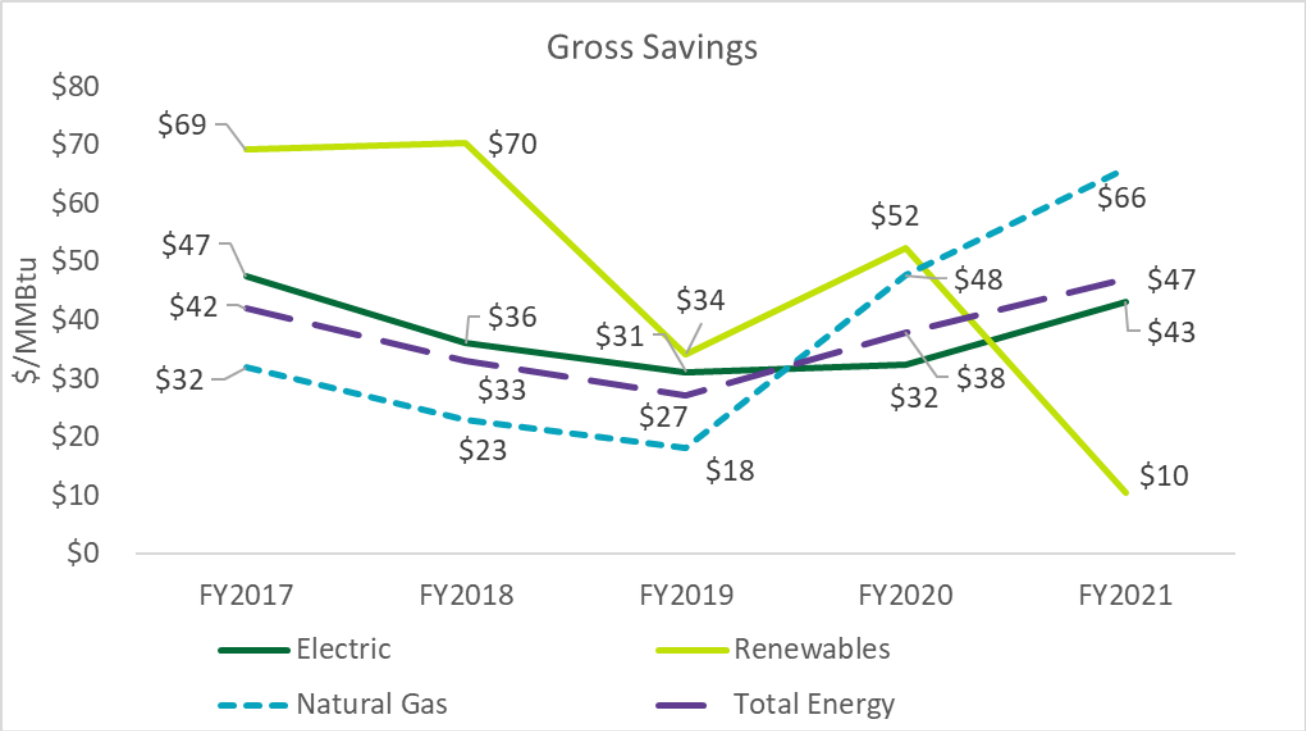
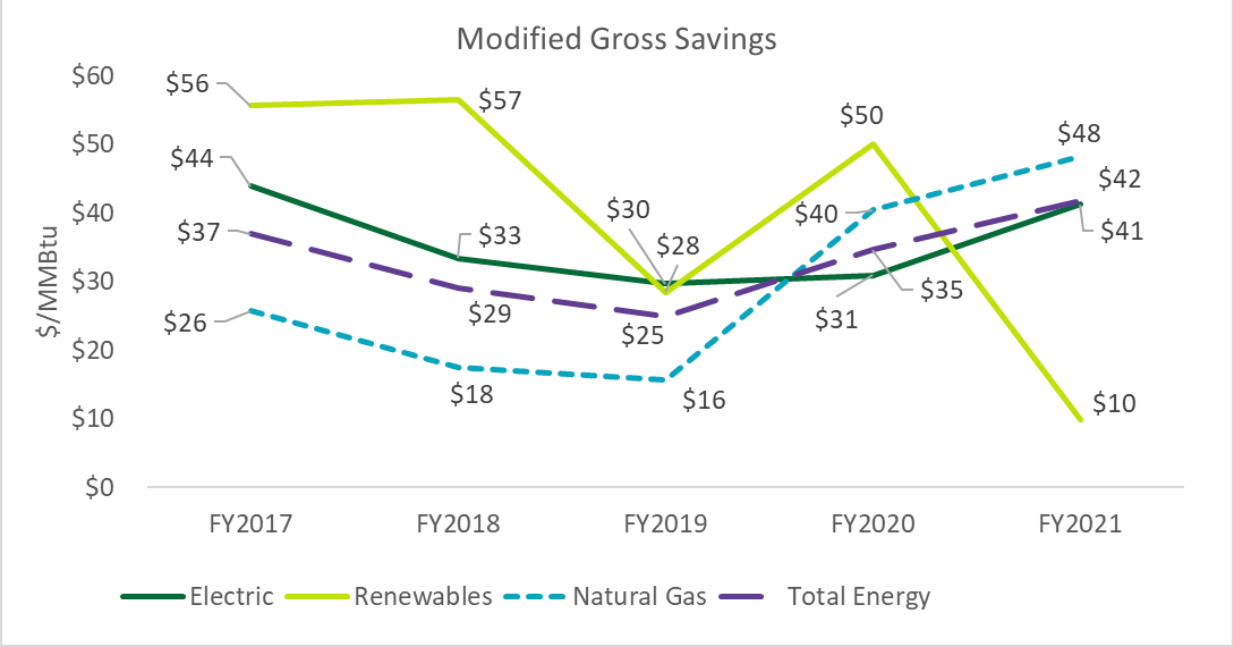


Figure 6: DCSEU Trends for Costs of First-year Modified Gross Energy Savings



To compare the cost of saved electricity to the cost of saved gas, we converted the gas savings from therms to a MWh equivalent.[33] Over the past two years, the cost of gross gas savings has been about 50% higher than the cost of gross electricity savings, after being lower by one-third or more in the prior three years.

Table 31: DCSEU Comparison of Costs of First-year Gross Energy Savings

Fuel Savings Type	FY2021	FY2020	FY2019	FY2018	FY2017
Electric savings, excluding renewables programs	$147/MWh	$110/MWh	$106/MWh	$123/MWh	$162/MWh
Gas savings equivalent	$225/MWh	$163/MWh	$62/MWh	$78/MWh	$109/MWh
Ratio of Gas Cost to Electric Cost	152%	147%	58%	63%	67%

Due to the similar geographic location and climate, we compare the DCSEU's costs of first-year electricity savings to those from two nearby utilities: PECO Energy in Pennsylvania and Baltimore Gas & Electric (BG&E) in Maryland. In addition, we compare DCSEU's costs of first-year gas savings to the costs for Philadelphia Gas Works (PGW), which serves the city of Philadelphia. While these comparisons are useful, it is important to understand that these jurisdictions have different markets, savings goals, regulatory requirements, cost-effectiveness tests, program maturity, and delivery systems, which may affect both costs and savings.

PECO Energy serves the city of Philadelphia and surrounding counties, which are less urban than DC. PECO is subject to Pennsylvania's Act 129, which requires that energy-efficiency programs achieve nearly a 4% cumulative reduction in annual electricity use (or approximately 0.8% per year) over the five-year period of the Phase III programs that launched in 2016. In addition, at least 5.5% of savings must come from programs solely directed at low-income customers in multifamily housing and at least 3.5% from government, non-profit, and institutional organizations. Pennsylvania Act 129 requires the portfolio of programs offered by each electric distribution company to be cost-effective using a modified version of the Total Resource Cost (TRC) test. The TRC typically includes a more limited range of benefits than the Societal Cost Test (SCT) employed by DC.

BG&E services the city of Baltimore, as well as surrounding counties, which are less urban than DC. Beginning with the 2016 program year, the Maryland EmPOWER programs are designed to achieve an annual incremental gross energy savings equivalent of 2.0% of the weather normalized gross retail sales baseline, with a ramp-up rate of 0.2% per year. The programs are screened on four factors: cost-effectiveness, impact on the rates of each ratepayer class, impact on jobs, and impact on the environment. Maryland requires that each utility's programs be cost-effective at both the residential and commercial sector-level using the TRC test.

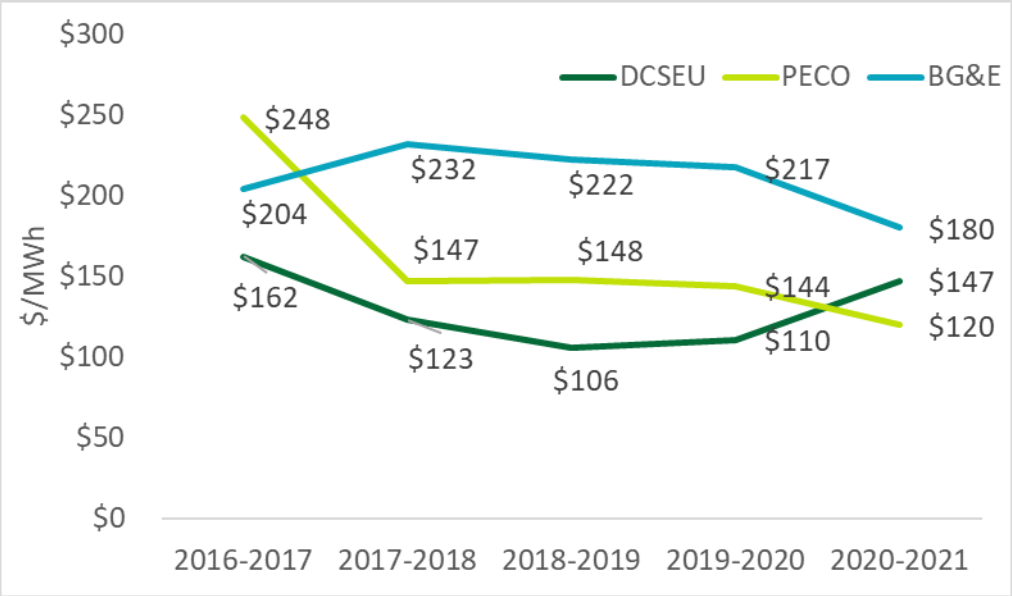
In comparison, the DCSEU has multiple benchmarks – in particular low-income and green jobs – that may impact costs. In addition, the DCSEU FY2021 electric energy efficiency program budget represents about 20% of PECO's budget and about 12% of BG&E's budget, although

[33] We converted therms to MWh by first dividing by 10 therms per MMBtu then dividing by 3.412 MMBtu per MWh.

DCSEU's gas program budget is over eight times greater than PGW. To facilitate the comparison with PECO and BG&E, we calculated the total electric program budget per electric customer.[34] In FY2021, DCSEU spent about $51 per customer while PECO spent about $57 per customer and BG&E spent about $110 per customer.

At $147/MWh, the DCSEU's FY2021 cost for gross electricity savings is less than BG&E's cost ($180/MWh) but higher than PECO's cost at $120/MWh (Figure 7).[35,36] Because PECO and BG&E only offer electric energy-efficiency programs, we only compare the costs to save electricity.

Figure 7: Comparison of Costs of First-year Gross Electricity Savings



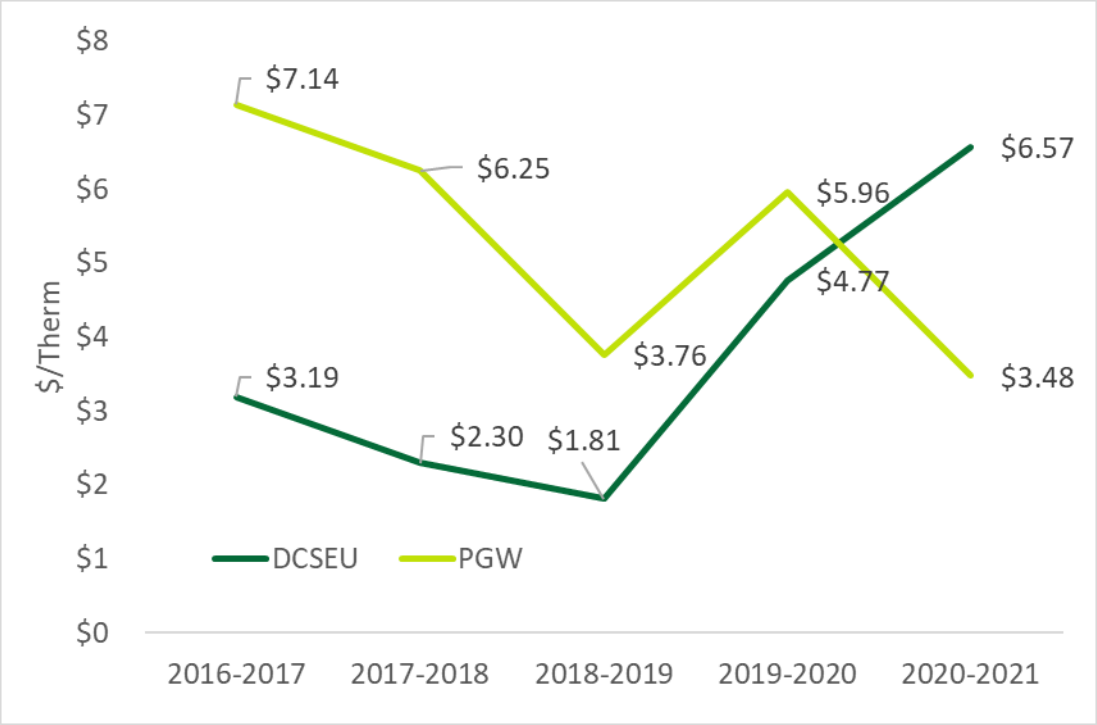
[34] Customer counts were obtained from EIA 2020 Utility Bundled Sales to Ultimate Customers, Table 10. https://www.eia.gov/electricity/sales_revenue_price/

[35] *Verification of the 2020 Empower Maryland Electric Utility Energy Efficiency Program Impact and Cost Effectiveness Evaluations*. Loper Energy, Hungeling Analytics, and Tierra Resource Consultants. October 29, 2021. *The Empower Maryland Energy Efficiency Act Report of 2021 with Data for Compliance Year 2020*. Maryland Public Service Commission. April 2021.

[36] Pennsylvania SWE Annual Report, Act 129 Phase III and Program Year 12. NMR Group, Demand Side Analytics, Brightline Group, and Optimal Energy. March 31, 2022. http://www.puc.state.pa.us/filing_resources/issues_laws_regulations/act_129_information/act_129_statewide_evaluator_swe_.aspx

At $6.57/therm, the DCSEU's FY2021 cost for gross gas savings is greater than the cost for PGW ($3.48/therm) for September 2020 to August 2021 (Figure 8).[37] The increased DCSEU gas costs is largely due to rising costs for the Custom tracks as well as the launch of the Washington Gas Income Qualified Gas Efficiency Fund program in FY2020.

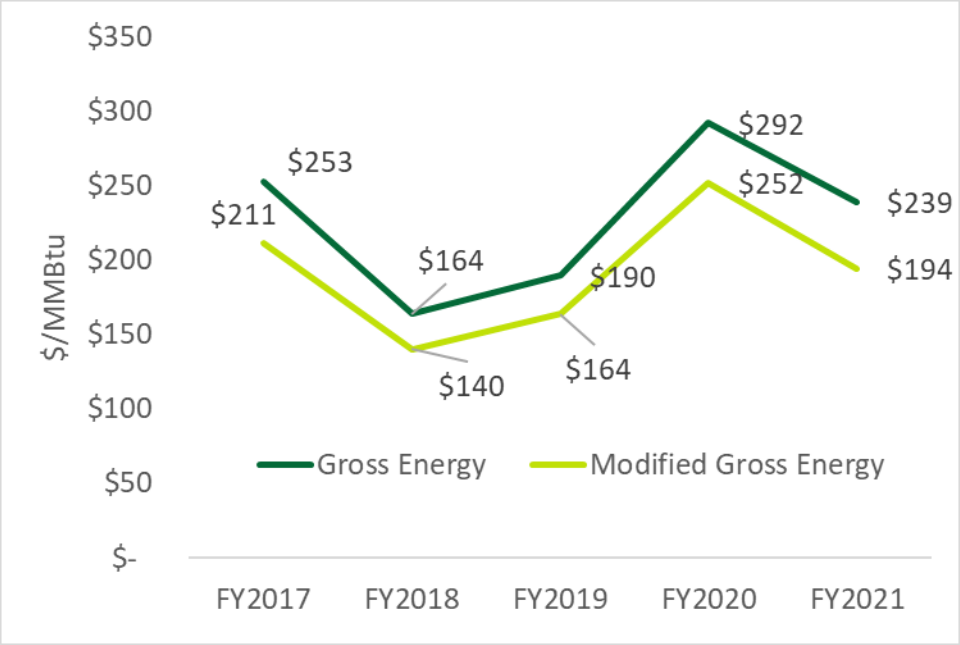
Figure 8: Comparison of Costs of First-year Gross Gas Savings



[37] *Demand Side Management Program Annual Report, FY 2021 Results.* Philadelphia Gas Works. December 2021.

Figure 8 displays the costs of saved energy across all seven DCSEU low-income programs listed in Table 15. The costs of gross and modified gross energy savings have fluctuated over the past five years – first declining, then increasing, and then declining again in FY2021.

Figure 9: Costs of First-year Energy Savings for Low-income Programs



Because low-income projects typically require greater levels of program investment, the costs of saved energy are higher than for other types of programs. We calculated the cost of saved electricity for DCSEU's low-income programs to be about eight times greater than the cost of non-low-income programs. This is similar, though higher, than the findings from a national study that estimated the cost of saved electricity for low-income programs as approximately four times greater than for other types of programs.[38]

The cost to reduce GHG emissions in FY2021 equals $334 per metric ton of CO2 based on the marginal emissions rate.

[38] *The Cost of Saving Electricity Through Energy Efficiency Programs Funded by Utility Customers: 2009–2015.* Lawrence Berkeley National Laboratory. June 2018.

2.2 COST-EFFECTIVENESS ASSESSMENT

The NMR team modeled the cost-effectiveness of the DCSEU FY2021 program offerings at the portfolio level and for each of the programs that were active in FY2021. In this section, we report results for the core SETF programs. Appendix C contains results for the two Solar for All (SFA) programs, which are funded separately from the SETF. We did all of our modeling using a Societal Cost Test (SCT) perspective. The SCT is a variant of the TRC Test, which includes various externalities and a lower societal discount rate than the discount rate based on the utility weighted average cost of capital used in the TRC. The discount rate determines the net present value of future resource savings. Table 32 lists the cost and benefit elements included in the SCT Test.

Table 32: Societal Cost Test – Costs and Benefits

SCT Costs	SCT Benefits
Incremental Measure Cost	Avoided Energy Costs (kWh, MMBtu)
Other Financial or Technical Support Costs	Avoided Generating Capacity Costs
Program Administration Costs	Avoided T&D Capacity Costs
NMR Evaluation, Measurement, & Verification (EM&V) Costs	Avoided Water Costs
DOEE Oversight Costs	Reduced Risk/Increased Reliability
	Reduced Operation and Maintenance (O&M) Costs
	Benefits from reducing environmental externalities, including air and water pollution, GHG emissions, and cooling water use.
	Non-energy Benefits (NEBs), including comfort, noise reduction, aesthetics, health and safety, ease of selling/leasing home or building, improved occupant productivity, reduced work absences due to illness, ability to stay in home/avoided moves, and macroeconomic benefits.

The primary data sources that the NMR team used for the cost-effectiveness assessment were as follows:

- Measure-level energy savings, effective useful life (EUL) assumptions, incremental measure cost values, incentive amounts, and projections of O&M savings from the DCSEU tracking database.
- Non-incentive expenditures for program administration and delivery, as provided by the DCSEU. This includes both costs that were allocated to specific tracks and common costs for support services that are assigned at the portfolio level.
- Avoided cost assumptions, as documented in a series of memos and workbooks that outline the latest values. These values are provided in Section 2.2.1.
- Realization rates and net-to-gross ratios, as determined by the FY2021 impact evaluation.

In addition to the detailed information contained in the DCSEU program tracking database, the DCSEU provided the NMR team with its own cost-effectiveness findings for FY2021. The DCSEU calculated a portfolio SCT ratio of 1.87 with $70 million of net benefits at the portfolio level for FY2021. As a first step in the analysis, the NMR team developed a parallel set of calculations using DCSEU inputs, assumptions, and formulas. This analysis returned a portfolio SCT ratio of 1.89 and $71.6 million in net benefits. After closely replicating the DCSEU model, the NMR team made a few adjustments to address different assumptions. The NMR team produced three additional cost-effectiveness scenarios using different inputs and assumptions. The additional scenarios are described below. The results are summarized in Table 33 and presented in detail in Section 2.2.2.

- ***Scenario #1 – Modified Replica:*** Replicates the DCSEU calculations with corrections to inputs and formulas. The first modification in Scenario #1 was formulaic and was also noted in the FY2017, FY2018, FY2019, and FY2020 evaluation reports. Some measures have interactive effects on other fuels. For example, installation of cooler LED lighting increases the consumption of fossil fuel heating systems because there is less waste heat in the space. The DCSEU treated this heating *penalty* as a cost for fossil fuels and a benefit for electricity and water. The NMR team standardized the accounting across resources and treated all interactive penalties (and associated externalities) as a negative benefit. This does not affect the Present Value of Net Benefits (PVNB) calculation but does change the SCT ratios because dollars are moved from the denominator to the numerator. The DCSEU model also redefines the *present* for costs by inflating costs by half a year. The modified replica model assumes all costs occur in the present, in current dollars, and does not apply a cost adjustment.
- ***Scenario #2 – Gross Verified Savings****:* This scenario incorporates the realization rates as determined by the impact evaluation. Realization rates are applied to the first-year savings and future adjusted savings (in the case of measures with dual baselines) equally.
- ***Scenario #3 – Net Verified Savings****:* This scenario adjusts the reported savings in the DCSEU system by both the realization rate and net-to-gross (NTG) ratio. Regardless of program delivery mechanism (incentive vs. direct install), incremental measure costs are discounted by the applicable free-ridership rate.

Appendix A provides descriptions for each of the program tracks offered by the DCSEU in FY2021. The program groupings shown in Table 33 and subsequent tables are a function of the way DCSEU reports direct costs. DCSEU provided direct costs at the four-digit *job* level and some jobs include multiple tracks. For example, job number 7520 includes four Commercial Custom tracks: Retrofit (7520CUST), Market Opportunities (7520MARO), New Construction (7520NEWC), and Pay for Performance (7520P4PX).

Table 33: Societal Cost Test Ratios by Scenario

Program	DCSEU Replica	Modified Replica Scenario #1	Gross Verified Savings Scenario #2	Net Verified Savings Scenario #3
C& I RX - Equipment Replacement/Small & Medium Business Rebates	5.69	6.36	6.58	6.26
Retrofit/Market Opportunity/New Constriction/Pay for Perform - Commercial Custom	1.99	2.03	2.01	1.90
Market Transformation Value	2.91	3.04	3.41	3.28
Commercial Midstream - Lighting	5.34	5.93	6.26	6.13
Low-income Multifamily Comprehensive	1.80	1.84	1.83	1.83
Income Qualified Gas Efficiency Fund	1.15	1.16	1.17	1.17
Low Income Prescriptive Rebate	2.38	2.65	2.65	2.65
Retail Efficient Appliances/Heating and Cooling/Lighting/Seasonal Savings	2.25	2.44	2.45	2.32
Retail Lighting Food Bank/Home Energy Conservation Kit - Low-income	6.47	12.35	12.35	12.35
Residential Midstream	5.43	6.68	6.68	5.54
Solar PV Market Rate	1.31	1.33	1.33	1.29
Innovation - Market Rate	0.00	0.00	0.00	0.00
Total Job Level	**2.05**	**2.12**	**2.12**	**2.14**
Total Portfolio Level with Administrative Cost	**1.89**	**1.93**	**1.94**	**1.84**
Portfolio Level with EM&V and DOEE Oversight Costs	**1.84**	**1.89**	**1.90**	**1.77**

Incentives are neither a cost nor a benefit in the SCT Test. The incremental cost of the efficient measure is included in the SCT regardless of the proportion paid by the participant and program administrator. Program administration costs are treated as a cost in the SCT and include planning, IT, marketing, customer service, and all other non-incentive costs. Table 34 provides a breakdown of the FY2021 cost elements after moving increased fuel consumption to the benefits side of the ledger. These costs are only for the core SETF programs; a similar table of SFA-specific costs is presented in Appendix C.

Table 34: FY2021 Cost Summary

Parameter	Cost Component	FY2021 Portfolio Total
A	Incentive Payments	$9,268,264
B	Participant Cost (Net of Incentives)	$61,725,875
C	Incremental Measure Cost (A + B)	$70,994,138
D	Track-specific Administrative Costs (Non-incentive)	$3,111,558
E	Portfolio Administrative Costs	$6,651,700
F	Total Program Administration Cost (D+E)	$9,763,258
G	**Total SCT Costs (C+F)**	**$80,757,396**
H	DOEE Oversight and NMR EM&V Costs	$1,810,746
I	**Total SCT Costs with Oversight and EM&V (C+F+H)**	**$82,568,142**

There are two different bins of administrative costs listed in Table 34. The track-specific administrative costs (Parameter D) are allocated to a specific program track, and therefore are included as a cost in the track-level SCT results. The portfolio-level results presented in this report include both the track-specific administrative costs and the portfolio administrative costs (Parameter E). This is the same approach used by the DCSEU to calculate cost-effectiveness and is commonly used by other states and utilities.

The implication of this methodology is that each of the track-level results is slightly overstated because the SCT ratio does not reflect its share of costs allocated to the portfolio as a whole. If track-level cost-effectiveness results are important to DOEE, we could work with the DCSEU to develop an allocation method. Possible allocation approaches could include kWh contribution, MMBtu contribution, or spending (Parameters A + D). Parameter H includes costs of oversight from DOEE and the NMR team's EM&V costs for the core SETF programs. The total SCT costs with oversight are presented in Parameter I. As in prior years' reports, all references to SCT ratios do not include the DOEE Oversight and NMR EM&V costs contained in Parameter H unless otherwise noted.

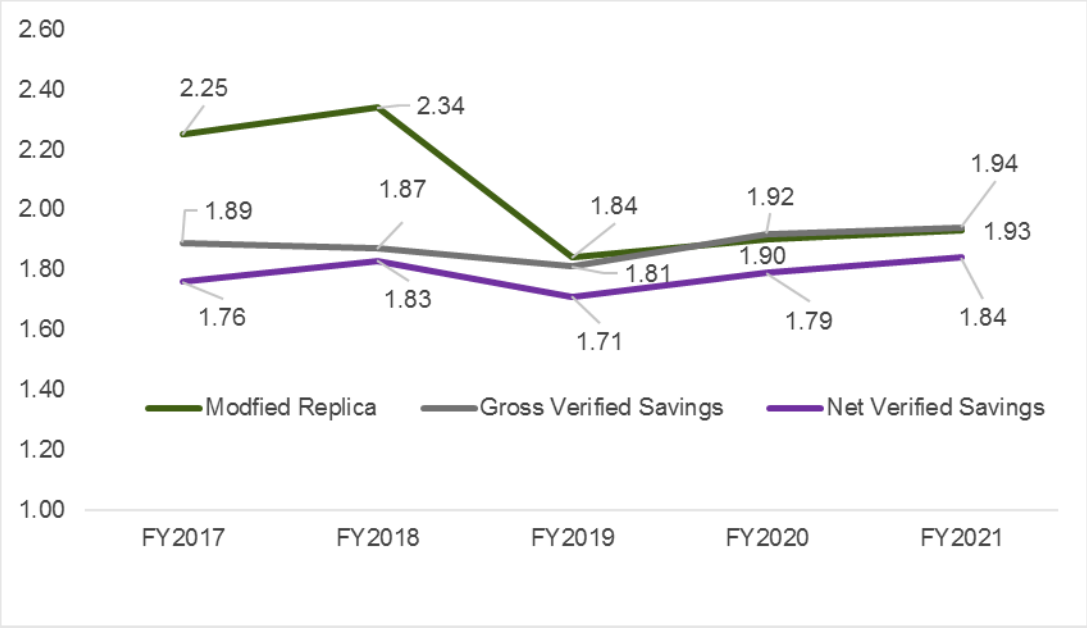
The DCSEU takes a strong position on the valuation of non-energy benefits (NEBs). In addition to a general 5% adder for the items listed in Table 32, a $100 per short ton ($110.23 per metric ton) benefit is assigned to all avoided CO2 emissions. In our modified replica model, the NEBs (general 5% adder for select items plus $100 per short ton for CO2) account for 56% of all SCT benefits. For the remaining scenarios, NEBs represent approximately the same percent of all SCT benefits. Without NEBs, the portfolio ratios are closer to one, at 1.08, 1.09, and 1.04 for Scenarios #1, #2, and #3, respectively. Table 35 shows the estimated lifetime reduction in CO2 emissions attributable to FY2021 programs by scenario, using the marginal emissions rate assumptions (marginal emissions rates were used to calculate all SCT results).

Table 35: Lifetime CO2 Emission Reductions – FY2021 Programs

Scenario	Lifetime Avoided CO2 Emissions (Metric Tons)
1 – Modified Replica	568,140
2 – Gross Verified Savings	561,363
3 – Net Verified Savings	332,462

Figure 10 displays the SCT results from FY2017 to FY2021. Compared to prior years, the modified replica results declined starting in FY2019 because DCSEU applied our recommended updated avoided cost assumptions. However, the gross verified savings and net verified savings results are similar each year. The SCT results for FY2021 are similar to FY2020, reflecting routine annual updates to avoided costs and benefits and changes to the portfolio composition.

Figure 10: DCSEU Societal Cost Test Ratio Trends



2.2.1 Avoided Costs

For FY2021, the DCSEU model, as well as the three presented scenarios, use the same avoided cost assumptions. Table 36 summarizes the values and sources applied by DCSEU in their cost-effectiveness testing.

Table 36: FY2021 Avoided Cost Summary

Screening Assumption	Value	Source
Future Inflation Rate	1.760%	Based on the past ten years of consumer price index data published by the U.S. Labor Department for the month of August.
Water Avoided Cost	$3.13/CCF	Approved_fy_2018_operating_and_capital_budgets_final.pdf, 2017 Engineering Feasibility Report WATER.pdf
Real Discount Rate	2.677%	10-year treasury rate posted in the Wall Street Journal on the first business day of October 2020 (0.677%) plus 2% (as specified in the DC SEU contract no. DOEE-2016-C-0002).
Line Losses	1.046 (energy) 1.077 (demand)	PEPCO Zone Capacity and Transmission Peak Load Calculations for Year 2018.
Natural Gas Capacity Adder	5%	Per Section C.40.10.3 of contract DOEE-2016-C-0002.
Transmission Cost	$32.32/kW-year	PEPCO's 2020 filing of the FERC formula transmission rate update.
Distribution Cost	$65.17/kW-year	Distribution rate deduced from the 2017 DC Public Commission order re: Pepco distribution rate increase request.
Electric & Fuel Externalities	$100 per short ton of CO2 (2,000 pounds) ($110.23 per metric ton)	Avoided Energy Supply Components in New England: 2018 Report and PJM's 2013-2017 CO2, SO2, and NOx Emissions Rate Report, published in March 2018.
Electric Energy Cost	Forecast by Year and Period	Hourly real-time locational marginal prices (LMPs) for PEPCO zone from January 2015 to May 2018 are used in conjunction with hourly load data for PEPCO zone for the same period to calculate load-weighted marginal price by energy period. This establishes the 2017 value. Price escalation over the remainder of the forecast horizon (2018-2050) is calculated by averaging growth projections from a series of EIA Annual Energy Outlook forecasts for the Mid-Atlantic region.
Generation Capacity	Actual Clearing Prices for PJM delivery years with completed auctions. $69.10/kW-yr for 2023 and beyond	PJM Base Residual Auction clearing prices for PEPCO zone. Historic prices used for forecasting.
Natural Gas Cost	Forecast by Year and Sector	Projected prices for the industrial sector (Mid-Atlantic region) are adopted from the EIA Annual Energy Outlook 2019 supporting tables for energy price by sector and source.
Other Fuels Cost	Forecast by Year, Fuel, and Sector	Projected prices for the industrial sector (Mid-Atlantic region) (where possible, transportation sector used as a substitute for kerosene cost) are adopted from the EIA Annual Energy Outlook 2019 supporting tables for energy price by sector and source.
Risk Adder	5%	Specified in the DCSEU contract no. DOEE-2016-C-0002.
NEB Adder	5%	Specified in the DCSEU contract no. DOEE-2016-C-0002.

2.2.2 Cost-effectiveness Results

Table 37 presents the results of the NMR team's modified replica model. This scenario utilizes the reported gross savings values as stored in the program tracking system and the same array of avoided costs as DCSEU's calculations but incorporates a set of modifications. Of the 12 program groups, 11 are cost-effective in this scenario. The portfolio is estimated to achieve $72.5 million of net benefits (benefits minus costs). The program that was not cost-effective has zero tracked benefits for the SCT analysis. This is not unusual for new programs or programs that are designed to support the benefits of related programs. The SCT ratio is 1.93; the DCSEU analysis found a lower ratio of 1.87.

- The NMR model treats increased fossil fuel usage as a negative benefit rather than a positive cost. It is more appropriate to compare net benefit figures because the DCSEU model differed from the NMR team model in its treatment of interactive effects between space conditioning and lighting, as discussed in the Scenario #1 description.
- There were some differing cost and benefit values between the DCSEU results summary and the NMR team's replica model using the detailed program tracking data. The NMR team treated all cost data in the program tracking system as nominal 2021 dollars. DCSEU's model inflates all measure costs by a half-year, effectively assuming that costs occur in future dollars. In contrast, the NMR team's model follows the industry-standard accounting assumption that costs are incurred in the present and no temporal adjustment is made to costs. In addition, the 2021 tracking data uses a mix of 2016 and 2021 as the present value base year, and the entries with 2016 present value base year are actually in 2021 dollars.
- For commercial lighting projects, when site-specific hours of operation are utilized instead of TRM default assumptions, DCSEU scales the avoided capacity benefits by the ratio of the site-specific operating hours to the TRM default assumptions. The spirit of the DCSEU adjustment is correct – coincidence factors tend to be correlated with hours of operation. However, we recommend making the adjustment to the kW impacts themselves, rather than the capacity benefits. In the NMR replica model, any differences between the site-specific assumptions and the TRM default assumption are reflected in the demand realization rate, incorporated into Scenario #2 and Scenario #3.

Table 37: Scenario #1 Modified Replica – SCT Results

Program	Sector	SCT Benefit ($1,000)	SCT Cost ($1,000)	SCT Net ($1,000)	SCT Ratio
C& I RX - Equipment Replacement/Small & Medium Business Rebates	Commercial	$10,108	$1,590	$8,518	6.36
Retrofit -Commercial Custom/Market Opp – Commercial Custom/New Construction - Commercial Custom/Pay for Performance	Commercial	$74,053	$36,488	$37,565	2.03
Market Transformation Value	Commercial	$473	$156	$317	3.04
Commercial Midstream - Lighting	Commercial	$15,560	$2,623	$12,938	5.93
Low Income MF Comprehensive	Residential	$7,034	$3,822	$3,211	1.84
Implementation Contractor DI/Income Qualified Efficiency Fund	Residential	$2,992	$2,569	$424	1.16
Low Income Prescriptive Rebate	Residential	$294	$111	$183	2.65
Retail Efficient Appliances	Residential	$12,573	$5,149	$7,423	2.44
Retail Lighting Food Bank	Residential	$2,848	$231	$2,617	12.35
Residential Midstream	Residential	$7	$1	$6	6.68
Solar PV Market Rate	Solar	$24,130	$18,206	$5,924	1.33
Innovation - Market Rate	Residential	$0	$3	-$3	0.00
Total Portfolio Level	**Portfolio**	**$150,071**	**$77,601**	**$72,470**	**1.93**
Portfolio Level with EM&V and DOEE Oversight Costs	**Portfolio**	**$150,071**	**$79,411**	**$70,660**	**1.89**

Table 38 presents the results for Scenario #2. The electric energy, peak demand, and natural gas savings realization rates developed through the FY2021 impact evaluation were generally close to 100%, so the Scenario #2 SCT results are similar to Scenario #1 at the portfolio level. In this scenario, 11 of the 12 program groups are cost-effective. Not including EM&V and oversight costs, the portfolio is estimated to achieve $73.2 million of net benefits (benefits minus costs). The one program that is not cost-effective has SCT benefits of zero dollars because benefits were not tracked for this program, as was the case in Scenario #1.

Table 38: Scenario #2 Gross Verified Savings – SCT Results

Program	Sector	SCT Benefit ($1,000)	SCT Cost ($1,000)	SCT Net ($1,000)	SCT Ratio
C& I RX - Equipment Replacement/Small & Medium Business Rebates	Commercial	$10,469	$1,590	$8,879	6.58
Retrofit -Commercial Custom/Market Opp – Commercial Custom/New Construction - Commercial Custom/Pay for Performance	Commercial	$73,430	$36,488	$36,943	2.01
Market Transformation Value	Commercial	$532	$156	$376	3.41
Commercial Midstream - Lighting	Commercial	$16,421	$2,623	$13,798	6.26
Low Income MF Comprehensive	Residential	$7,012	$3,822	$3,190	1.83
Implementation Contractor DI/Income Qualified Efficiency Fund	Residential	$3,002	$2,569	$433	1.17
Low Income Prescriptive Rebate	Residential	$294	$111	$183	2.65
Retail Efficient Appliances	Residential	$12,592	$5,149	$7,443	2.45
Retail Lighting Food Bank	Residential	$2,847	$231	$2,617	12.35
Residential Midstream	Residential	$7	$1	$6	6.68
Solar PV Market Rate	Solar	$24,154	$18,206	$5,948	1.33
Innovation - Market Rate	Residential	$0	$3	-$3	0.00
Total Portfolio Level	**Portfolio**	**$150,760**	**$77,601**	**$73,160**	**1.94**
Portfolio Level with EM&V and DOEE Oversight Costs	**Portfolio**	**$150,760**	**$79,411**	**$71,349**	**1.90**

Table 39 presents the results of Scenario #3. This scenario adjusts energy savings by incorporating both realization rates (from Scenario #2) and net-to-gross ratios. Eleven of the twelve program groups are cost-effective in this scenario. Both the benefits and costs are reduced in this scenario because no savings (or benefits) are assigned to free riders and the incremental measure costs associated with free riders are not included as an SCT cost (because they would have purchased the efficient equipment absent the program). The portfolio SCT ratio is slightly lower in Scenario #3 (1.84) than Scenario #2 (1.94), and the net benefits are significantly lower ($40.0 million vs. $73.2 million).

Table 39: Scenario #3 Net Verified Savings – SCT Results

Program	Sector	SCT Benefit ($1,000)	SCT Cost ($1,000)	SCT Net ($1,000)	SCT Ratio
C& I RX - Equipment Replacement/Small & Medium Business Rebates	Commercial	$7,258	$1,160	$6,098	6.26
Retrofit -Commercial Custom/Market Opp – Commercial Custom/New Construction - Commercial Custom/Pay for Performance	Commercial	$38,397	$20,210	$18,187	1.90
Market Transformation Value	Commercial	$443	$135	$308	3.28
Commercial Midstream - Lighting	Commercial	$11,513	$1,877	$9,636	6.13
Low Income MF Comprehensive	Residential	$7,012	$3,822	$3,190	1.83
Implementation Contractor DI/Income Qualified Efficiency Fund	Residential	$3,002	$2,569	$433	1.17
Low Income Prescriptive Rebate	Residential	$294	$111	$183	2.65
Retail Efficient Appliances	Residential	$6,455	$2,783	$3,672	2.32
Retail Lighting Food Bank	Residential	$2,847	$231	$2,617	12.35
Residential Midstream	Residential	$3	$1	$3	5.54
Solar PV Market Rate	Solar	$10,534	$8,194	$2,340	1.29
Innovation - Market Rate	Residential	$0	$3	-$3	0.00
Total Portfolio Level	**Portfolio**	**$87,758**	**$47,747**	**$40,011**	**1.84**
Portfolio Level with EM&V and DOEE Oversight Costs	**Portfolio**	**$87,758**	**$49,558**	**$38,201**	**1.77**

2.2.3 Cost-effectiveness Recommendations

The FY2021 cost-effectiveness analysis required the NMR team to thoroughly explore several of the energy, economic, and policy assumptions used by the DCSEU. Based on our review, we offer the following observations and recommendations:

- Although the DCSEU's calculation of SCT benefits and costs occurs in external workbooks, the mechanics of the DCSEU tracking system are expertly organized to facilitate benefit cost modeling. The application was well-documented and the DCSEU

staff was responsive to our inquiries. The tracking database details participation in all program measures and provides costs, benefits, energy use, and savings estimates.

- Since FY2017, the NMR team has suggested various improvements to the cost-effectiveness assumptions and calculations and DCSEU have adopted many of these. At the beginning of each year, we conduct a detailed review of DCSEU screening assumptions. The FY2022 review was more involved due to some of the policy changes in the new DCSEU contract.
- One input we recommend a careful review of for FY2022 is the avoided cost of generation capacity. The next four PJM capacity auctions (covering delivery years 2023/2024 to 2026/2027) will be held over the next two years, starting in June 2022. At minimum, these auction results should be reflected in the near-term avoided costs. However, the final clearing prices may also warrant a change to the long-term value for this component.
- DCSEU applies a cost adjustment that assumes participant costs are incurred a half year in the future. Conventional accounting calculates costs as if they are incurred in the present. Investments in energy efficiency are fundamentally an upfront capital investment today for energy savings realized over many years. This adjustment to the timing of cost occurrence by DCSEU should be omitted.
- The handling of dual baselines was well executed in the DCSEU tracking system. The most important dual baseline measure is LED lighting. The DCSEU savings assumptions for FY2021 assume implementation of the 2020 Energy Independence and Security Act (EISA) Phase II backstop. Energy savings from screw-based LED bulbs were assigned full savings for one year and then a significantly reduced annual savings value for the remainder of their useful life.
    - The residential lighting market is rapidly transforming to majority-LED sales and DOE recently released its final rulemaking establishing a 45 lumen/W baseline for virtually all screw-based lighting. Based on the timing and enforcement schedule of the federal standard, DCSEU's dual baseline assumption for FY2021 is sound.
    - For FY2022, we recommend that the DCSEU carefully review the measure life assumptions of any remaining residential LED measures with the NMR team and DOEE as early as possible because of the sensitivity of SCT results to this key input.
- Avoided CO2 emissions and other NEBs represent a significant share (56%) of the SCT benefits from FY2021 programs.
    - The DCSEU assumption of $100 per short ton value was based on the 2018 Avoided Energy Supply Cost (AESC) report. An updated 2021 AESC report uses a recommended carbon price of $128 per short ton (in 2021 dollars). The 2021 AESC report provides other options for the SCC – ranging from $92 to $493 – depending on the perspective used (abatement cost vs damages) and the region. For FY2022, DCSEU and DOEE have adopted the $128 per short ton assumption.

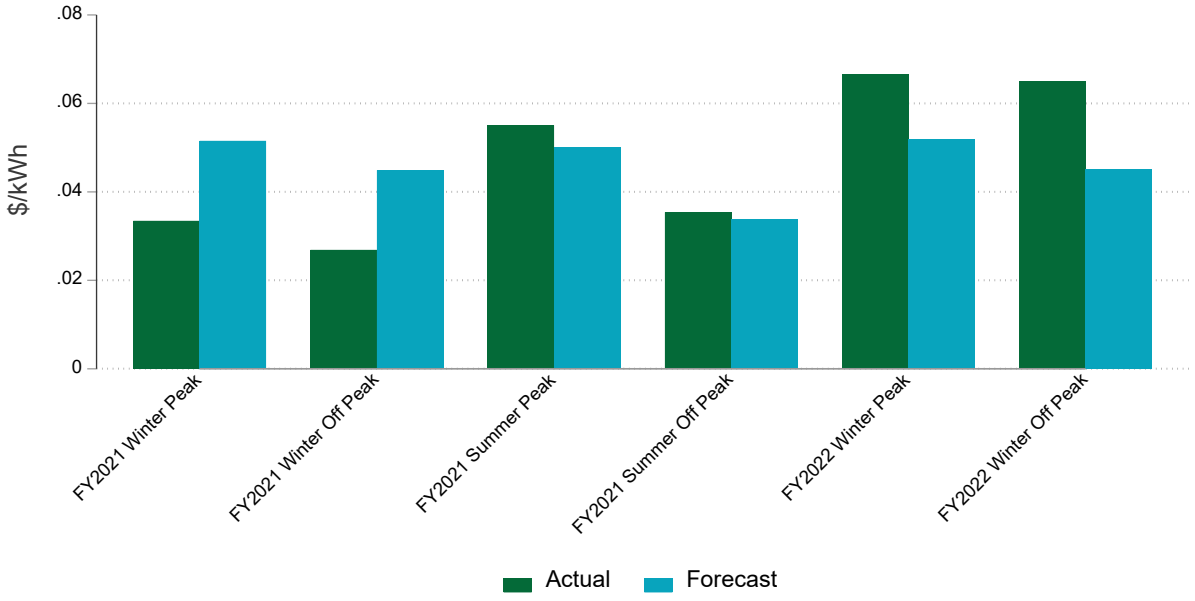
  - In October 2021, the AESC study was amended[39] to recommend a social cost of carbon of $393 per short ton. Massachusetts program administrators have adopted the $393 per short ton assumption in their 2022 – 2024 plan for energy efficiency and demand resources.

- To illustrate the sensitivity of the FY2021 cost-effectiveness results, the NMR team re-calculated the cost-effectiveness results with alternative assumptions for the value of avoided CO2 emissions.
  - Using the Massachusetts assumption of $393 per short ton, the Gross Verified Portfolio SCT ratio for FY2021 would be 4.29, over double the current ratio (1.94).
  - At $0 per short ton of CO2, but still including the 5% NEB and 15% low-income solar adders, Scenario #2 does remain cost-effective with a portfolio SCT ratio of 1.12. At $50 per short ton, while still including the NEB and low-income solar adders, the portfolio Level SCT ratio is 1.53 for Scenario #2. As shown in Table 38, the $100 per short ton assumption results in a portfolio SCT ratio of 1.94.
  - While the value of avoided CO2 assumption does not determine whether the FY2021 SETF portfolio is cost-effective, it does have a significant impact on the magnitude of the net benefits and SCT ratio. The $100 per short ton ($110.23 per metric ton) assumption for avoided CO2 emissions should be reviewed to ensure it is consistent with the District's policy objectives and other regional research on the value of reduced carbon emissions. The current federal social cost of carbon is approximately $46 per short ton ($51 per metric ton).

[39] See AESC_2021_Supplemental_Study-Update_to_Social Cost_of_Carbon_Recommendation.pdf (synapse-energy.com) for the updated recommendations and detailed discussion of SCC and relevant literature.

- The avoided cost of electricity forecast for FY2021 was developed from an analysis completed by the NMR team in 2017 that extends to 2050. As seen below in Figure 11, winter months of FY2021 had lower wholesale electric prices[40] than forecasted due to the COVID-19 pandemic and low fuel prices. Just one year later we see the opposite as war in Ukraine and other factors have increased fuel prices drastically. In general, we recommend not updating long-term forecasts based on short-term fluctuations. However, the avoided electricity forecast in place for FY2022 is lower than the FY2021 screening assumptions. If natural gas price futures look to remain elevated for several years, DOEE and DCSEU may wish to consider an update to the avoided cost of electricity and natural gas for FY2023.

Figure 11: Electric Energy Costs Over Time



- Beginning in FY2022, DCSEU will account for upstream emissions from natural gas extraction and processing in the SCT Test. This change raises the emissions rate of natural gas from 11.72 to 14.25 lbs. CO2/therm and raises the marginal emissions rate of electricity generation by approximately 11%. Scenario #1 for FY2021 is repeated with the inclusion of upstream emissions in Table 40. The result led to an additional 63,116 metric tons of avoided CO2 emissions and a slightly higher SCT ratio of 1.99.

[40] Load weighted real-time locational marginal pricing (LMP)s for PEPCO zone pulled from PJM's Data Miner 2 platform can be sourced here: https://dataminer2.pjm.com/feed/rt_fivemin_hrl_lmps/definition

Table 40: Modified Replica 1 with Upstream CO2 emissions – SCT Results

Program	Scenario #1 Modified Replica	Scenario #1 With Upstream Emissions
C& I RX - Equipment Replacement/Small & Medium Business Rebates	6.36	6.64
Retrofit/Market Opportunity/New Constriction/Pay for Perform -Commercial Custom	2.03	2.15
Market Transformation Value	3.04	3.17
Commercial Midstream - Lighting	5.93	6.20
Low-income Multifamily Comprehensive	1.84	1.92
Income Qualified Gas Efficiency Fund	1.16	1.24
Low Income Prescriptive Rebate	2.65	2.76
Retail Efficient Appliances/Heating and Cooling/Lighting/Seasonal Savings	2.44	2.53
Retail Lighting Food Bank/Home Energy Conservation Kit - Low-income	12.35	12.77
Residential Midstream	6.68	6.94
Solar PV Market Rate	1.33	1.38
Innovation - Market Rate	0.00	0.00
Total Portfolio Level	**2.12**	**2.23**
Total Portfolio Level with Administrative Cost	**1.93**	**2.04**
Portfolio Level with EM&V and DOEE Oversight Costs	**1.89**	**1.99**
Avoided CO2 Metric Tons	**568,140**	**631,256**

- The 5% adder for NEBs (other than CO2 emissions) is a proxy value to recognize tangible benefits that are challenging to directly quantify. The NMR team will continue to collaborate with DCSEU and DOEE to assess the appropriate value for the overall NEBs adder, the feasibility of supplemental health or low-income NEB adders, and the possibility of incorporating NEB research into our future evaluation activities.

A

Appendix A Program Descriptions

This appendix provides a description for each of the program tracks offered by DCSEU in FY2021.

A.1 Commercial Sector

7520CUST – Retrofit – Commercial Custom

The Custom Retrofit program offers incentives to owners of large buildings to install energy-efficient equipment or make operational changes to their facility that result in energy savings. The program focuses on retrofit projects where the equipment is being replaced prior to the end of its life. Incentives are offered for a variety of equipment types, including lighting, chillers, boilers, heat pumps, steam systems, insulation, refrigeration, and various building or equipment controls. Through this program, the DCSEU offers technical assistance to help decision makers design, scope, and fund their projects. Rebates are paid on a traditional per-unit of energy saved basis.

7520MARO – Market Opportunities – Commercial Custom

The Market Opportunity Custom program focuses on retrofit projects where equipment is at the end of its life. It offers incentives to large building owners who update equipment to energy-efficient options or update operational controls to achieve energy savings. This track includes measures in lighting, HVAC, and various commercial/residential appliances. Key objectives of the incentive are to offset the costs of adding energy-efficient equipment beyond the current energy code; provide comprehensive technical services to help decision makers design, scope, and fund their projects; and share the economic benefits with the customer. Funding is available through a traditional rebate structure where participants are paid per unit of energy saved.

7520NEWC – New Construction – Commercial Custom

This program focuses on construction of new buildings or facilities that exceed energy code standards. The New Construction Track covers a large range of new construction measures, including lighting; HVAC; building controls; building envelope elements, such as insulation and windows; and plug loads, such as icemakers, refrigerators, and freezers. DCSEU provides technical assistance in the design stage to help decision makers design, scope, and fund their projects. The key features of the incentive structure are to offset the incremental costs of adding more energy-efficient equipment than the current code requires, provide comprehensive technical services during design stage, and share the economic benefits with the customer.

7520P4PX – Pay for Performance

The P4P program launched in FY2019 to incentivize complex, multi-measure energy-efficiency projects that are not covered under existing program tracks. It focuses on existing commercial and industrial buildings, which implement multiple measures simultaneously or behavioral or operational changes where it is difficult to estimate savings. This may include re-/retro-commissioning, upgrades to the building controls, or fault detection. Incentives are paid based

on pre- and post- project metered data where actual energy saved is determined using multivariate linear regression of AMI (PEPCO) or monthly (WGL) meter data.

7511CIRX – C&I RX – Equipment Replacement

The Business Energy Rebate (BER) initiative provides small- to medium-sized businesses located in DC with a comprehensive set of services and financial incentives to help them transition to more energy-efficient equipment. The initiative provides prescriptive incentives for lighting, refrigeration, HVAC, compressed air, and food service and vending equipment. Rebates require written pre-approval and are given for facility improvements that result in a permanent reduction in electrical and/or natural gas energy usage persisting for a minimum of five years.

The initiative is implemented through individual contractors selected by the participant. The DCSEU Account Managers generate leads based on prior years' participation or interest. Customers can also call the DCSEU or visit the DCSEU website. Contractors are also trained on how to upsell energy-efficient equipment.

7511SMRX – Small & Medium Business Rebates

This track is for Small Businesses, under 10,000 square feet. The DCSEU has been offering higher incentives to them as part of an ongoing campaign. The measures offered are the same as 7511CIRX, but with slightly higher incentives.

7512MTV – Market Transformation Value

The T12 MTV initiative targets small- to medium-sized businesses (less than 10,000 square feet or less than 5,000 kWh/month). While larger customers can participate, they are encouraged to participate in an appropriate Custom track. MTV provides upgrades for old, inefficient equipment. The DCSEU staff interview applicants to determine incentive levels needed to move viable projects forward.

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

7513UPLT – Commercial Upstream

The Commercial Upstream/Midstream Lighting Program provides customers with point-of-purchase rebates when they buy qualified lighting products from participating distributors. Through this program, customers can receive rebates for ENERGY STAR 2.0 certified LED directional, omnidirectional, and decorative bulbs, as well as DLC certified linear LED tubes. This program format enables closer and more efficient tracking of product purchases. Distributors provide sales information directly to DCSEU, enabling higher levels of quality control. It also means that incentives can be adjusted more frequently "behind the scenes." In this way, the DCSEU can ensure that incentives more closely match changing conditions in the market. The DCSEU piloted this approach in FY2017 with lighting distributors.

A.2 SOLAR SECTOR

7101PVMR – Solar PV Market Rate

The PV Market Rate program provides incentives to buildings that install solar panels to reduce their consumption from the electric grid. The DCSEU works directly with contractors to identify potential properties. At the start of a project, the contractor submits project information (the Interconnection Application Agreement) to Pepco and the DCSEU. Pepco reviews the form and checks for completeness, determines circuit impact and operating conditions, and requests amendments to the contractor, as needed. Upon Pepco approval of this form, Pepco sends an "Approval to Install" notification to the contractor. Concurrently, the DCSEU checks the income qualification materials, scope of work, spec sheets, and other materials, and generates a work order. With Pepco's approval and a work order from DCSEU in hand, the contractor can begin installation. Once the project is completed, the DCSEU schedules an inspection with the contractor. As of FY2015, proof of interconnection from Pepco is required for DCSEU to issue payment to the contractor.

The program contributes to electricity savings, installed renewable energy capacity, the formation of green jobs, and low-income spending and savings. It also helps meet the DCSEU performance benchmark and address the needs of the solar market by serving as a low or no cost technical assistance center for solar installations.

A.3 LOW-INCOME SECTOR

4335IGEF – Income Qualified Gas Efficiency Fund

Washington Gas is partnering with the DCSEU to provide funding for natural gas efficiency upgrades for low- and limited-income residents of affordable multifamily housing in the District of Columbia. These projects consist of natural gas saving measures on old, inefficient equipment that can now be replaced with this available funding. These projects are classified as retrofits.

7610ICDI – Implementation Contractor Direct Install

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

7612LICP - Low-income Multifamily Comprehensive

The Low-income Multifamily Comprehensive program is designed to support low-income multifamily housing (specifically new construction or gut-rehab) in the installation of energy-efficient measures. The program allows DCSEU to provide technical expertise and funding. Each project is independently evaluated, and specific energy conservation measures (ECM) are chosen depending on the project's needs. Some of these ECMs will include measures affecting

the thermal envelope (air and thermal barriers, doors, and windows), domestic hot water systems, in-unit and common area lighting, appliances, and controls.

The initiatives work with developers and owners of low-income multifamily projects constructing, redeveloping, or rehabilitating affordable housing projects. The initiatives provide custom technical services and incentives for energy-efficiency improvements to low-income multifamily projects.

7610IQEF – Income Qualified Efficiency Fund

The Income Qualified Efficiency Fund program is designed to serve low-income multifamily housing, shelters, and approved clinics. Funding and priority are competitively awarded to approved contractors for energy-efficiency projects that generate significant energy savings and pass the associated financial benefits on to low-income DC residents. Efficiency measures that maximize energy savings, reach a large number of low-to-moderate income residents, and/or assist residents who face a loss of heating or air conditioning due to inoperable equipment receive priority. Supported measures include domestic hot water systems, lighting, appliances, controls, and measures improving the thermal envelope.

7613LIRX – Low-income Prescriptive Rebate

The Low-income Prescriptive Rebate program provides financial support for lighting installations in low-income multifamily housing and low-income shelters and clinics. Approved installations must be EnergyStar or DLC qualified. Projects tracked under 7613 LI RX are generally focused on specific end uses. 7613LIRX is focused on in-unit and common area lighting. The initiatives work with developers and owners of low-income multifamily projects who are constructing, redeveloping, or rehabilitating affordable housing projects. The initiatives provide custom technical services and incentives for energy-efficiency improvements to low-income multifamily projects.

7717FBNK – Retail Lighting Food Bank

The Food Bank Energy Efficient Lighting Distribution initiative provides LED lighting to low-income households in DC that receive goods from participating food banks. The DCSEU provides LEDs to these residents after verifying that their household is located in the District and conducting a short survey with the client to determine the appropriate number of bulbs needed.

7717HEKT – Home Energy Conservation Kit – Low-income

The Home Energy Conservation Kit – Low-income program sends energy conservation kits to low-income District residents. The only measures in this track are home energy conservation kits, which include an Advanced Power Strip, a Faucet Aerator, and six LEDs. They offer low-income DC residents a free, easy way to implement energy saving measures.

A.4 RESIDENTIAL SECTOR

7710APPL – Retail Efficient Appliances

The Retail Efficient Appliances program offers mail-in and online rebates for qualifying refrigerators, clothes washers, clothes dryers, heat pumps, air conditioners, boilers, furnaces, thermostats, and other products. Under this initiative, DCSEU partners with local retailers and contractors to promote these rebates, providing rebate forms in retail stores when possible.

7710LITE – Retail Lighting

The Retail Efficient Lighting program coordinates with lighting retailers and manufacturers to increase the availability of LEDs and offer them at lower prices for District residents and small businesses. This initiative works to educate customers on the benefit of LED lights and increase awareness as LEDs are less familiar to residents than CFLs or incandescent bulbs. Retailers and manufacturers are provided incentives on a per-bulb basis. The initiative is implemented by DCSEU with EFI providing support for incentive payment and data tracking. EFI is responsible for compiling and verifying manufacturer invoices and processing payments. Manufacturers submit invoices to EFI for payment and work with stores to gather sales reports that they submit along with the invoice requests.

7710HTCL – Retail Heating and Cooling

The Retail Heating and Cooling program works with contractors in the District to install heating and cooling equipment in residential applications. Measures include advanced and programmable thermostats (not smart thermostats), central air conditioners, domestic hot water heaters, boilers, furnaces, and ductless and air-source heat pumps. The only measure that does not require a contractor to install is a smart thermostat. Smart thermostats have their install verification through a confirmation with the manufacturer that the thermostat is connected to the internet and actively working.

7725RSUP – Residential Upstream

The Residential Upstream program is used to track residential, efficient lighting projects purchased through electrical distributors. Participating electrical distributors buy down the price of the lighting products and offer a point-of-sale rebate to their customers. After sale, they submit documentation to the DCSEU for reimbursement on the products.

A.5 SOLAR FOR ALL

7109LISF – Solar for All Low-income Single-family PV

Solar for All aims to provide low-income DC residents with the benefits of solar electricity. The program was established by the Renewable Portfolio Standard (RPS) act of 2016, which is funded by the Renewable Energy Development Fund (REDF). Upon enrolling in the Solar for All program, an installed system will offset the homeowner's electricity costs by about $500 per year or more. Renters who meet income requirements are eligible for the program if they agree to the terms and conditions. Once a homeowner is qualified, the system is installed at no cost and is fully funded by the DCSEU through the Solar for All program. The Solar for All program

operates on a first-come, first-served basis and fulfillment is dependent upon funding availability.

7108CREF – Solar for All Community Renewable PV

In addition to installing solar directly on income-qualified single-family homes, the DCSEU is also working with solar developers to install large community renewable energy facilities (CREFs), or community solar, on structures around the District as part of the Solar for All program. Once installed and operational, these systems can provide electricity bill credits to save income-qualified District residents up to 50% off their electricity bill each year. This allows residents who live in multifamily buildings or whose roofs are not suitable for solar to access savings from Solar for All.

Appendix B Detailed Program Recommendations

This section contains detailed program recommendations from the *DC Sustainable Energy Utility FY2021 Program Evaluation* report.

Our evaluation of the FY2021 programs found that DCSEU expended the appropriate amount of effort and rigor on their savings calculations. In general, the documentation provided was sufficient, and the methods and assumptions were suitable. The evaluation team believes the DCSEU calculated energy savings with a reasonable degree of accuracy.

However, our evaluation yielded specific recommendations for most programs, as described below. We offer two general types of recommendations: to improve the accuracy of savings calculations and to improve program design and delivery. Because most of the evaluation effort focuses on verifying the DCSEU tracked savings, the savings accuracy recommendations represent the majority of our recommendations. To more easily distinguish between the two types of recommendations, we have bolded and italicized the program design and delivery recommendations.

While DCSEU prescriptive savings estimates were reasonable in aggregate for the FY2021 programs, the NMR team believes the DCSEU can continue to improve calculation methods and should prioritize improvements that offer the most cost-effective outcomes. The NMR team provides one recommendation that applies to multiple programs.

- Apply project- specific efficiency levels, fixture wattages, peak summer coincident demand factors, and other inputs to improve the accuracy of tracked peak demand savings when feasible. DCSEU applied deemed load shapes from the TRM to the custom project calculations. In these cases, project-specific input values could be used, which would improve the accuracy of tracked peak demand savings. DCSEU should examine how integrating site-specific information within the tracking system can be done efficiently when these data are already collected from customers.

For the Custom Retrofit program, we offer the following recommendations:

- Six of the 31 sampled projects were not retrofits or equipment replacements; rather, they were new construction or gut rehab projects. Consider including all new construction projects (i.e., those with theoretical baselines based on building energy code) in the Commercial New Construction program.
- Include a narrative within each project that describes the approach to estimating energy savings for all measures. Provide references to relevant spreadsheets and external sources of inputs for savings calculations.
- Consider adding a separate load shape peak demand value for air conditioning systems in school facilities. The “Commercial A/C” value is not appropriate for schools, which typically have limited operation over the summer (i.e., during most of the peak coincident period).

For the Commercial New Construction program, we offer the following recommendations:

- The NMR team recommends that SEU change their approach to estimating peak coincident demand savings for projects for which a building simulation model was developed. The outputs from most building simulation software includes only total load reduction by end-use category. SEU then typically applies the "Commercial A/C" load shape value for peak coincident demand to calculate peak demand savings. The NMR team recommends determining a project-specific load shape (or coincidence factor) value for each project, based on the actual operating conditions of the facility.
- If TRM deemed load shape values are used to calculate peak demand savings, ensure that each measure involved in the project is assigned the most appropriate load shape value.

For the Market Opportunities program, we offer the following recommendations:

- Utilize Typical Meteorological Year weather data to weather-normalize the energy consumption of weather-dependent systems and measures in custom analyses.
- Ensure that all building systems that use electricity during the peak period (2:00 – 6:00 p.m. on non-holiday weekdays between June and August) are included in estimates of peak coincident demand savings for projects. Such systems typically include interior lighting, space cooling, heat rejection, and ventilation.
- ***Consider ways to make the application process more user-friendly and guide the customer through the steps of application submission and approval.*** *This participant reported difficulties with the application and thought the amount of the rebate did not justify the level of effort required.*

For the CIRX Equipment Replacement program, we offer the following recommendations:

- Project files should include a lighting specification sheet and/or certification (DLC or Energy Star) listing for every unique installed fixture type. Each specification sheet or certification listing should show the manufacturer, model number, fixture wattage and lumen output.
- Consider requiring program applicants to provide a full list of spaces within the facility that were affected by the project.

For the Commercial Upstream Lighting program, we offer the following recommendations:

- Project files should include a specification sheet and/or certification (DLC or Energy Star) listing for every unique installed fixture type. Each specification sheet or certification listing should show the manufacturer, model number, fixture wattage, and lumen output.
- Consider requiring distributors to collect additional site-specific information at the time of sale, to be used in the energy savings calculations for each project. This should help in calculating more accurate energy consumption and savings estimates at the project level. Examples of additional inputs could include baseline fixture types and wattages, schedules (and associated hours of use and peak coincidence factor), heating fuel type, and facility and space type(s).

- Similarly, consider requiring distributors to collect contact information for the purchaser at the time of sale. Not only could it provide an opportunity for DCSEU to market additional savings opportunities to new commercial customers, but it would also improve the quality of the evaluation. The NMR team could only contact Commercial Upstream Lighting participants who had contact information on file from participating in another DCSEU program, which biases the study results towards more highly engaged participants.

For the Pay for Performance program, we offer the following recommendations:

- Continue to leverage the existing modeling scripts and data analytics processes for the P4P program. The modeling continues to be robust, accurate and consistent with data science best practices.
- When accounting for anomalous events in the baseline or efficient time periods, ensure that the effects of these anomalous events are removed from all fuel savings including energy (kWh), demand (kW), and natural gas (MMBTU).

For the Solar PV Market Rate program, we offer the following recommendations:

- Peak demand savings should be calculated as the average load savings during peak period hours (2:00 – 6:00 p.m. on non-holiday weekdays between June and August). Provide the 8,760-hour spreadsheet output from the PV Watts tool that was used for ex ante savings.
- Ensure the proper module type is selected for each project in PV Watts, based on the efficiencies of the installed equipment.

For the Low-Income Multifamily Comprehensive program, we offer the following recommendations:

- Ensure that savings calculations are based on the appropriate hours of use and waste heat factors given the building heating fuel types and rooms in which lighting was installed.
- Ensure that any savings inputs used in calculations match those listed on supporting documentation.
- Review post-installation photos to ensure that savings inputs are derived from the appliance models installed.
- Review procedures for faucet aerator and ceiling exhaust fan peak demand calculations to ensure they are consistent across measures.

For the Income Qualified Efficiency Fund program, we offer the following recommendation:

- Ensure that savings inputs used in calculations match those listed in supporting documentation.

For the Retail Heating & Cooling program we offer the following recommendations based on feedback from participant surveys:

- ***Consider increasing the rebate amount for eligible equipment types where feasible.*** *When asked to suggest any changes DCSEU could make to the program, survey respondents most commonly cited increasing the rebate amount.*
- ***Identify opportunities to simplify the application process, in particular the paperwork that participants need to complete.*** *Although most participants were generally satisfied with the application process, some survey respondents reported that the application process was too lengthy and burdensome.*

For the Retail Efficient Appliances program, we offer the following recommendations based on feedback from participant surveys:

- ***Consider increasing the rebate amount and expanding the types of eligible equipment where feasible****. When asked to suggest any changes DCSEU could make to the program, survey respondents most commonly cited increasing the rebate amount and the variety of eligible equipment.*
- ***Continue to offer education about savings from energy-efficient appliances so customers are prepared to choose an energy-efficient model when their current equipment fails.*** *Survey respondents rated energy efficiency and reduced energy bills as non-programmatic factors that exhibited little influence on their purchasing decision relative to more important factors such as product features and product reviews. Consequently, there appears to be an opportunity for DCSEU to increase awareness concerning the benefits of selecting energy-efficient models.*

Appendix C Solar For All Cost Effectiveness Results

This appendix presents results for two Solar For All (SFA) programs that the DCSEU tracks performance for but that are not funded through the core Sustainable Energy Trust Fund (SETF) or leveraged funds. The two programs are Solar for All Community Renewable PV Energy and Solar for All Low-income Single-family PV. These programs seek to provide disadvantaged DC communities with access to affordable renewable energy.

The Low-Income Single Family (LISF) program allows low-income residents access to the energy and money saving benefits of solar energy. Participants receive a credit back on their monthly electricity bill. In FY2021, the LISF program provided incentives for 122 projects and claimed 0.51 MW of generation capacity.

The Community Renewable Energy Facility (CREF) initiative strives to deliver sustainable energy services to residential, commercial, and industrial institutions. Community solar provides the benefits of solar technology to residents who traditionally would not be able to take advantage of solar power, such as renters, residents in multifamily buildings, or those with rooftops that need repairs. In FY2021, the CREF program claimed 5.00 MW of generation capacity.

Table 41 shows the SCT results for each scenario, which is similar to Table 33 in the main section of the report. Both programs have SCT ratios well above 1.0. The main difference between the Modified Replica and the Gross and Net Verified Savings is the inclusion of avoided costs from complying with the DC Renewable Portfolio Standard (RPS)[41]. The addition of RPS leads to a higher SCT ratio across the entire solar portfolio. Note that the realization rates for both programs are above 100%, so the SCT ratio in Scenario #2 is higher than in Scenario #1. In addition, Scenario #3 is exactly the same as Scenario #2 because the NTG ratio is 100% for both programs.

[41] This is because each MWh of solar energy (electric or thermal) qualifies as one SREC, which can be traded on the DC SREC market to satisfy renewable energy generation requirements of the DC Renewable Portfolio Standard (RPS). Electricity suppliers must acquire, on an annual basis, the appropriate number of SRECs as required by the RPS or make Solar Alternative Compliance Payments (SACP) for any SREC not acquired. The SACP price is set at $500 through 2023, or $0.50 per kWh. It is reasonable to assume that every SREC created eliminates the need for one SACP purchase. Therefore, the avoided costs attributable to renewable measures will include the value of the SREC creation (the difference between SACP price and SREC price), which will be added to the standard avoided costs. The latest year's average SREC trading price for the DC market is used to establish the SREC value for the subsequent program year. For FY2021, the weighted average SREC price from November 26, 2018, through November 18, 2019 ($390.41 per MWh, or $0.39 per kWh) is used as a basis to calculate the value of avoided compliance payments. In 2024, the SACP begins an annual decline and therefore the SREC price is taken to be 78.08% of the SACP (ratio of $390.41 to $500.00) until the RPS expires at the end of 2032. Beginning in 2033, this additional benefit stream drops to zero.

Table 41: Cost Test Ratios by Scenario – SFA Programs

Program	Modified Replica Scenario #1	Gross Verified Savings Scenario #2	Net Verified Savings Scenario #3
Solar for All Community Renewable PV Energy	1.39	1.39	1.39
Solar for All Low-income Single-family PV	1.72	2.04	2.04
Total Portfolio Level	**1.30**	**1.33**	**1.33**
Portfolio Level with EM&V and DOEE Oversight Costs	**1.26**	**1.29**	**1.29**

Table 42 shows the costs for the SFA programs, which is similar to Table 34. In Parameter E, we assume that the SFA programs do not account for any additional portfolio costs. The value for Parameter H – $0.7 million – represents an estimate of the DOEE oversight costs dedicated to SFA programs. All NMR EM&V costs are assigned to the SETF portfolio, and none are assigned to the SFA programs. The total SCT costs without oversight and EM&V are roughly $25 million, compared with $80.1 million in SCT costs for the core SETF programs.

Table 42: FY2021 Cost Summary – SFA Programs

Parameter	Cost Component	FY2021 Portfolio Total
A	Incentive Payments	$8,207,595
B	Participant Cost (Net of Incentives)	$14,611,260
C	Incremental Measure Cost (A + B)	$22,818,855
D	Track-specific Administrative Costs (Non-incentive)	$0
E	Portfolio Administrative Costs	$2,073,999
F	Total Program Administration Cost (D+E)	$2,073,999
G	**Total SCT Costs (C+F)**	**$24,892,854**
H	DOEE Oversight and NMR EM&V Costs	$666,991
I	**Total SCT Costs with Oversight and EM&V (C+F+H)**	**$25,559,845**

The avoided cost assumptions for the SFA programs are the same as shown in Table 36. Table 43 shows the lifetime avoided CO2 emissions associated with the SFA programs (similar to Table 35 in the main report). Avoided CO2 emissions are approximately 97,000 metric tons for the SFA programs compared to 568,140 for the core SETF programs.

Table 43: Lifetime CO2 Emission Reductions – FY2021 Programs

Scenario	Lifetime Avoided CO2 Emissions (Metric Tons)
1 – Modified Replica	96,566
2 – Gross Verified Savings	99,755
3 – Net Verified Savings	99,755

Table 44 shows detailed SCT results for Scenario #1 and Table 45 shows detailed results for Scenarios #2 and #3. Because the realization rate is slightly above 100% and the NTG ratio is assumed to be 100%, the results are similar for all three scenarios.

Table 44: Scenario #1 Modified Replica – SCT Results

Program	Sector	SCT Benefit ($1,000)	SCT Cost ($1,000)	SCT Net ($1,000)	SCT Ratio
Solar for All Community Renewable PV Energy	Solar For All	$29,236	$21,071	$8,165	1.39
Solar for All Low-income Single-family PV	Solar For All	$3,074	$1,782	$1,292	1.72
Total Portfolio Level	**SFA Portfolio**	**$32,310**	**$24,928**	**$7,382**	**1.30**
Portfolio Level with EM&V and DOEE Oversight Costs	**SFA Portfolio**	**$32,310**	**$25,595**	**$6,715**	**1.26**

Table 45: Scenarios #2 and #3 Gross and Net Verified Savings – SCT Results

Program	Sector	SCT Benefit ($1,000)	SCT Cost ($1,000)	SCT Net ($1,000)	SCT Ratio
Solar for All Community Renewable PV Energy	Solar For All	$29,393	$21,071	$8,322	1.39
Solar for All Low-income Single-family PV	Solar For All	$3,639	$1,782	$1,857	2.04
Total Portfolio Level	**SFA Portfolio**	**$33,033**	**$24,928**	**$8,105**	**1.33**
Portfolio Level with EM&V and DOEE Oversight Costs	**SFA Portfolio**	**$33,033**	**$25,595**	**$7,438**	**1.29**