Memo

To: **Delaware Department of Natural Resources & Environmental Control**
Attn: Rob Underwood, Energy Programs Section Administrator
From: Optimal Energy's Eric Belliveau, Partner and Sam Ross, Consultant
CC:
Date: November, 2019
Subject: 2019 Delaware Energy Efficiency Market Potential Study Update

CONTENTS

INTRODUCTION

During the summer of 2019, Optimal Energy, Inc. conducted a high-level energy efficiency potential study on behalf of the Delaware Department of Natural Resources and Environmental Control (DNREC) with the purpose of updating results from our prior Delaware potential study conducted in 2014. Potential studies estimate the total potential that exists for energy efficiency to offset energy consumption and demand. Potential study results are frequently used as guideposts for energy efficiency programs, in particular for estimating the total pool of savings that programs might be able to ramp up to over time, and the costs to achieve those savings. The present study utilized key Delaware-specific data streams as well as leveraging recent similar potential study work Optimal Energy conducted in New York and New Jersey.

REVIEW OF POTENTIAL STUDY CONCEPTS

If you are comfortable with key concepts for potential studies, like 'economic potential', go ahead and skip down to the 'Key Takeaways' section. Otherwise, this section will provide a quick refresher on how to think about and understand potential studies.

Economic electric and gas efficiency potential: "Economic potential" captures all savings that are cost effective and technically feasible, assuming no market barriers and 100 percent adoption of all efficiency opportunities. A measure is considered to be cost-effective if total benefits over its lifetime are equal to or greater than the costs. *This study provided estimates of economic potential for Delaware.*

Maximum achievable electric and gas efficiency potential: "Maximum achievable potential" captures the maximum level of program activity and savings that is possible, given the market barriers to adoption of energy-efficient technologies, with no limits on incentive payments, but including programs' administrative costs. *This study also provided estimates of maximum achievable potential for Delaware.*

Program achievable electric and gas efficiency potential: "Program achievable potential" captures the level of savings possible with all the same market barriers as maximum achievable, but with lower levels of incentives, typically not large enough to cover the full incremental cost to program participants in most sectors (Low income is often an exception, for example). *While this study did not estimate program achievable potential due to the high-level questions it sought to answer, it could be expanded to do so.*

KEY TAKEAWAYS

- Overall, **the updated study finds large amounts of cost-effective efficiency savings continue to be possible for both electricity and natural gas** in Delaware.

- Programs which capture **all achievable savings would have benefits 2.18 times greater than their costs, and result in net benefits of over one billion dollars**.

- This **2019 study was only used to update the 2014 study**, with updated sales forecasts, and updated avoided costs derived using the same data sources and methods as were recommended by the EEAC's EM&V subcommittee in 2017, complimented by data from other recent, nearby state-level potential studies.

- Where the 2014 study found maximum achievable electric savings potential of 19.8% of forecasted sales after 10 years (2023), **the updated 2019 study found a slight decrease in maximum achievable electric savings potential, 16.6% of forecasted sales, after 10 years (2029).**
    - This reflects that some progress has been made in capturing savings in Delaware, and that some markets are undergoing transformation, which means less electric savings can be claimed in those markets.

- For natural gas, the 2014 study found maximum achievable savings of 10.1% after 10 years (2023), while **the 2019 study found a similar maximum achievable savings of 10.8% of forecasted sales after 10 years (2029).**
    - There has been less market transformation among key natural gas measures, so it is no surprise that the 2019 estimate is closer to the 2014 estimate for gas than for electricity. Program maturation in DE can explain the slight increase in gas savings potential.

STUDY CONTENTS

Before presenting results from the potential study, it is important to discuss the scope and purpose of the study. There are three key points to keep in mind when interpreting the study's results:

1. The study focuses on economic and maximum achievable potential,
2. The study is only updating the 2014 Delaware potential study, and

3. The study's primary purpose is to level-set what is possible, not provide specific guidance on program design. Though potential studies can assess specific program designs, this is a high-level study and was not developed for this purpose.

First, the study focuses on estimating the "economic potential" and "maximum achievable potential" energy efficiency savings for the state. Economic potential is the total amount of energy that could be saved by installing all efficiency technologies for which the total benefits to Delaware exceed the costs. This is an important data point, but does not account for some realistic constraints, like the fact that some individuals will not participate in efficiency programs even if they could save money by doing so (this can be due to a variety of reasons for different people), or the challenge of landlord-tenant split incentives. Maximum achievable potential accounts for this and other realistic constraints, like the degree to which programs can train new staff and engage in effective marketing. Within these constraints, maximum achievable potential typically assumes well-funded efficiency programs with access to well-trained staff, and large incentives that cover most or all out of pocket costs for program participants. Maximum achievable potential is typically used to demonstrate that lots of efficiency savings remain possible, thus grounding efficiency programs in objective quantitative analysis.

Second, this study's scope was to update the estimate of Delaware's efficiency savings potential from the 2014 study, not to undertake an entirely new study. As a result, the Optimal Energy team worked with DNREC and the EEAC to determine which key data needs should be filled with updated Delaware data, and which data from Optimal's recent potential studies in other nearby states could be relied on while still providing reasonable results for Delaware. It was determined that the study would use technology characterizations and a few other inputs from other studies, with Delaware-specific sales forecasts, and avoided costs of energy and capacity.

Third, the results of this type of potential study are not intended to directly inform program design, though studies certainly *can* be designed to estimate potential from a specific portfolio of energy efficiency and demand programs. Potential studies are intentionally built from market data, and engineering information about efficiency technologies. A key reason potential studies are based on these types of data is to estimate the amount of energy (and capacity) that can be saved *even if the way to achieve those savings is different than current programs*. Potential studies account for realistic barriers to energy savings and program implementation without directly assuming a specific program design, and especially without presuming that past programs represent the best possible future programs. This approach ensures that the results are not constrained by challenges specific to existing programs, which could bias results downward.

As highlighted by these three key points, it is important to understand that the maximum achievable potential savings estimates should be viewed as validation that there is a great deal of energy consumption and demand which can be avoided through investing in electric and natural gas efficiency programs in Delaware. These numbers are not estimates of what Delaware's future programs will likely achieve. The study also does not seek to identify the best program designs that Delaware could implement. Instead, the study provides confidence that efficiency programs in Delaware can drive sizable cost-effective energy savings, and associated financial benefits, that significantly outweigh the costs of delivering those programs. In other words, many opportunities exist where the cost to create a unit of energy efficiency – kWh or therm – is less than that of the next available unit of energy supply.

KEY RESULTS

The most important takeaway from this study is that large amounts of energy can be saved through efficiency in Delaware over the coming 10 years. As Figure 1 shows, cumulative electric economic potential is 30.6% of 2029 sales[1], while cumulative electric maximum achievable potential is 16.6%. Similarly, Figure 2 shows that cumulative natural gas economic potential is about 18.0% of 2029 sales, while cumulative natural gas maximum achievable potential is about 10.8%.

Figure 1. Delaware's Cumulative Electric Efficiency Potential

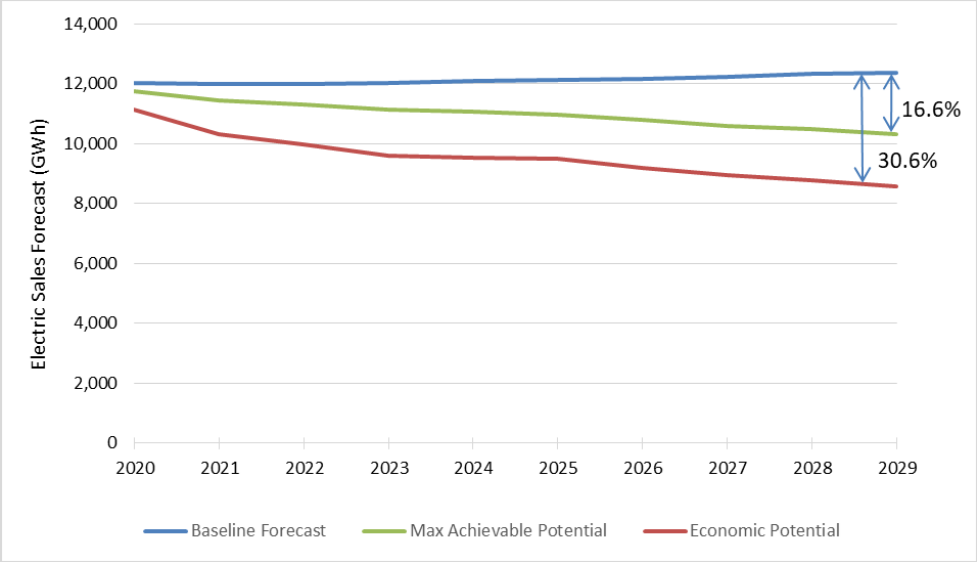
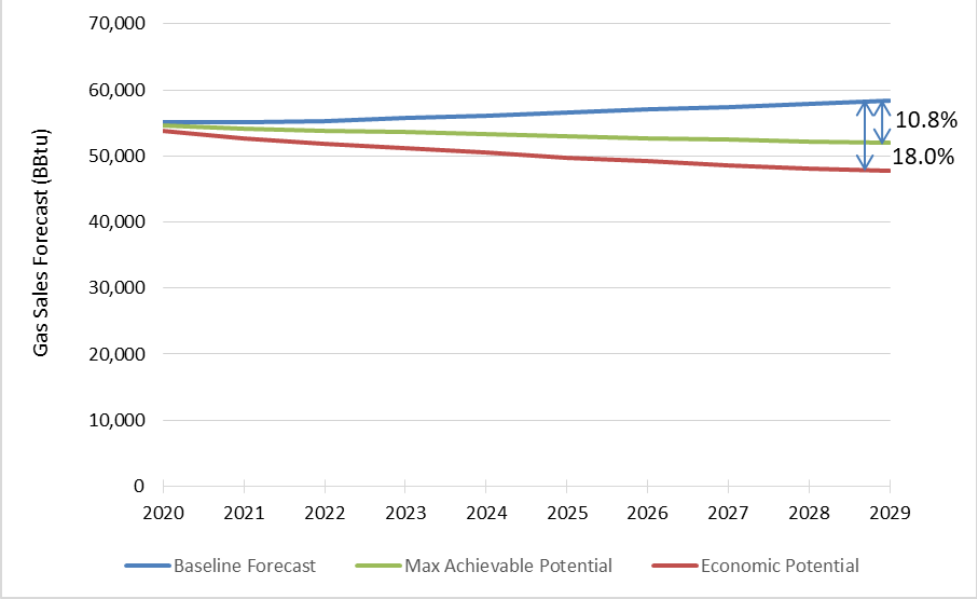


Figure 2. Delaware's Cumulative Natural Gas Efficiency Potential



[1] Forecasted energy sales for Delaware were obtained from the EIA's Detailed State Data site: https://www.eia.gov/electricity/data/state/

DETAILED RESULTS

In this section, the potential study results are broken down in a few different ways. Figure 3 shows electric potential savings by sector. Here, "Residential" and "Commercial and Industrial" (C&I) are reported separately, as are the electric energy savings, measured in megawatt-hours (MWh), and electric capacity savings, measured in megawatts (MW).

Figure 3. Cumulative Electric Energy and Capacity Savings by Sector

Year	Scenario	Residential Savings (MWh)	Residential Savings (% of Sales)	C&I Savings (MWh)	C&I Savings (% of Sales)	Total Savings (MWh)	Total Savings (% of Sales)
Cumulative Energy, 2029	Economic Potential	1,215,839	23.0%	2,566,665	36.3%	3,782,504	30.6%
	Max Achievable Potential	515,438	9.7%	1,536,686	21.7%	2,052,123	16.6%
		(MW)	**(% of Load)**	**(MW)**	**(% of Load)**	**(MW)**	**(% of Load)**
Cumulative Peak Demand Reduction, 2029	Economic Potential	457	Not Available	507	Not Available	964	Not Available
	Max Achievable Potential	262	Not Available	288	Not Available	550	Not Available

For electric economic potential, the residential sector energy savings (1.2 million MWh) are about half as large as the C&I savings (2.6 million MWh), whereas the two sectors show close to the same level of potential capacity savings (457 MW for residential, 507 MW for C&I). For electric maximum achievable potential, the residential sector energy savings (0.5 million MWh) are only one third the size of commercial and industrial savings (1.5 million MWh), whereas the two sectors continue to have similar levels of capacity savings (262 MW for residential, 288 for C&I). Figure 4, below, shows the same break down for natural gas. Residential natural gas energy savings (1,262 BBtu) are only about 13.7% of C&I savings (9,234 BBtu). In contrast to electric potential, the gas capacity potential show a similar split between residential (16 Peak BBtu) and C&I (117 Peak BBtu), with residential again about 13.7% of C&I. For natural gas maximum achievable potential, residential energy savings (916 BBtu) are about 17.1% of C&I savings (5,368 BBtu). Again, the gas capacity savings show a similar split to the energy savings, with residential savings potential (12 Peak BBtu) estimated as about 17.6% as large as C&I (68 Peak BBtu).

Figure 4. Cumulative Natural Gas Energy and Capacity Savings by Sector[2]

Year	Scenario	Residential Savings (BBtu)	Residential Savings (% of Sales)	C&I Savings (BBtu)	C&I Savings (% of Sales)	Total Savings (BBtu)	Total Savings (% of Sales)
Cumulative Energy, 2029	Economic Potential	1,262	11.3%	9,234	19.6%	10,496	18.0%
	Max Achievable Potential	916	8.2%	5,368	11.4%	6,284	10.8%
		(Peak BBtu)	**(% of Load)**	**(Peak BBtu)**	**(% of Load)**	**(Peak BBtu)**	**(% of Load)**
Cumulative Peak Demand Reduction, 2029	Economic Potential	16	Not Available	117	Not Available	133	Not Available
	Max Achievable Potential	12	Not Available	68	Not Available	80	Not Available

[2] Peak Demand Reduction isn't available as a percent of peak load, as the sales forecast is annual energy sales.

Figure 5 shows the estimated costs and benefits of capturing the maximum achievable potential, aggregated across electric and natural gas efficiency opportunities. The most important takeaway from the benefit-cost analysis (BCA) is that programs which capture all maximum achievable savings would have a benefit-cost ratio (BCR) of 2.18[3], meaning the programs' total benefits would be 2.18 times their costs. These programs would be estimated to produce net benefits of over one billion dollars.

Figure 5. Total Resource Cost Test Results[4]

Sector/Program	Costs (Millions$)	Benefits (Millions$)	Net Benefits (Millions$)	BCR
Residential	$ 230	$ 539	$ 309	2.34
New Construction	$ 17	$ 39	$ 21	2.24
Equipment Replaceme	$ 130	$ 301	$ 171	2.32
Retrofit	$ 83	$ 199	$ 116	2.40
Commerical & Industri	$ 670	$ 1,419	$ 749	2.12
New Construction	$ 55	$ 112	$ 57	2.05
Equipment Replaceme	$ 122	$ 280	$ 159	2.31
Retrofit	$ 493	$ 1,027	$ 533	2.08
Total	$ 900	$ 1,958	$ 1,058	2.18

CONCLUSION

In summary, the 2019 Delaware energy efficiency potential study update study identifies over 2 million MWh of achievable electric savings by 2029, and over 6,000 BBtu of cumulative achievable gas savings during the same time period. In other words, very large quantities of highly cost-effective efficiency savings are well within reach for both electricity and natural gas in Delaware. These results are broadly similar to the results from 2014, reflecting that efficiency program activity to date has not captured the full potential for energy efficiency in Delaware. In addition, electric and gas capacity needs have the potential to be positively impacted by efficiency programs in the state.

Taken together, the results of the 2019 efficiency potential update reaffirm that Delaware has significant unrealized energy efficiency savings potential, and that efficiency programs in the state are not at any risk of being constrained by the savings opportunity available in the state.

[3] Benefit-Cost Ratios (BCRs) are calculated as the total benefits divided by the total costs. As a result, a BCR of 1.0 represents benefits equal to costs, and anything higher than 1.0 corresponds to benefits exceeding costs.

[4] In this study, the Total Resource Cost (TRC) test was used, which included avoided costs for electric and gas energy, and electric capacity. The test utilized a 4.7% real discount rate, and calculated savings at source for cost-effectiveness screening.