
Pennsylvania's Energy Efficiency Uncapped

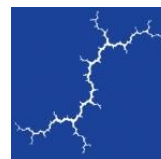
Assessing the Potential Impact of Expanding the
State's Energy Efficiency Program Beyond the
Current Budget Cap

Prepared for Keystone Energy Efficiency Alliance

May 8, 2018

AUTHORS

Kenji Takahashi
Erin Malone
Jamie Hall



Synapse
Energy Economics, Inc.

485 Massachusetts Avenue, Suite 2
Cambridge, Massachusetts 02139

617.661.3248 | www.synapse-energy.com

CONTENTS

1.	INTRODUCTION AND SUMMARY	1
2.	CURRENT PENNSYLVANIA ENERGY EFFICIENCY PROGRAMS	2
2.1.	Historical and Projected Savings	2
2.2.	Performance of Current and Projected Programs	4
	Cost-Effectiveness	4
	Cost of Saved Energy	5
3.	ECONOMIC ANALYSIS OF PENNSYLVANIA’S ENERGY EFFICIENCY PROGRAMS	6
3.1.	Key Assumptions and Methodologies	6
3.2.	Results.....	8
	Budget	8
	Energy Savings.....	9
	Capacity Savings	10
	TRC Benefits and Net Benefits.....	10

1. INTRODUCTION AND SUMMARY

Pennsylvania's utility energy efficiency programs currently save about 0.7 percent of sales per year and have been saving at roughly that level for the past several years. Meanwhile, leading states have demonstrated much greater annual energy savings of 2 to 3 percent of sales per year. Pennsylvania's 2015 energy efficiency potential study revealed that the state can achieve similarly high energy savings levels. Despite this finding, Pennsylvania did not set aggressive targets for the current energy efficiency program term, "Phase III" (which extends from June 2016 to May 2021). This is partly because the state's Public Utility Commission (PUC) developed utility program budgets based on an annual budget cap set at 2 percent of 2006 utility electric revenue. Under Phase III, the utilities are projecting to save 0.5 percent to 1.2 percent of sales annually from 2017 to 2020, with statewide averages at around 0.8 percent of sales for each year.

The Keystone Energy Efficiency Alliance (KEEA) tasked Synapse Energy Economics (Synapse) with analyzing the potential impact on energy savings, economic benefits, and net-benefits from expanding the state's utility energy efficiency programs by increasing budgets beyond the current budget cap. Synapse examined both a Base Case scenario and an Alternative Case scenario for the years from 2021 to 2025, the period immediately following Phase III. The Alternative Case illustrates a future with more robust energy efficiency programs, possible only if state policy makers remove the budget cap before the start of the next program phase in 2021.

For the Alternative Case, Synapse assumed annual savings across all sectors would increase by 0.2 percent of sales per year from 2020 until the utilities reach 1.2 percent of sales on average through 2025. For the Base Case, Synapse assumed annual savings would be constant at 2020 levels through 2025.

We found that the Alternative Case would result in 50 percent more investment and provide 50 percent more savings and net benefits relative to the Base Case. We summarize our more specific findings below.

- We project Pennsylvania ratepayers will experience benefits of \$3.8 billion from 2021 to 2025 under the Alternative Case, compared to \$2.6 billion in the Base Case. With the inclusion of costs, the Alternative Case results in \$770 million in net benefits while the Base Case produces \$530 million in net benefits. The incremental net benefit from the Alternative Case is approximately \$240 million.
- Under the Alternative Case, we project utilities will spend about \$1,260 million from 2021 to 2025. This budget is about 50 percent higher than the Base Case's projected spending of \$860 million during the same timeframe. Annually, the Alternative Case budget increases from about \$210 million in 2021 or about 1.7 percent of 2006 utility revenue, to \$265 million in 2025 or about 2.2 percent of 2006 utility revenue.
- For energy savings, under the Alternative Case, we project Pennsylvania ratepayers will experience annual energy savings of about 7,840 gigawatt hours (GWh) from 2021 to



2025. This compares to 5,400 GWh annual energy savings under the Base Case. The annual savings translate to lifetime savings of 58,000 GWh in the Base Case and 84,000 GWh in the Alternative Case—a 46 percent increase over the Base Case.

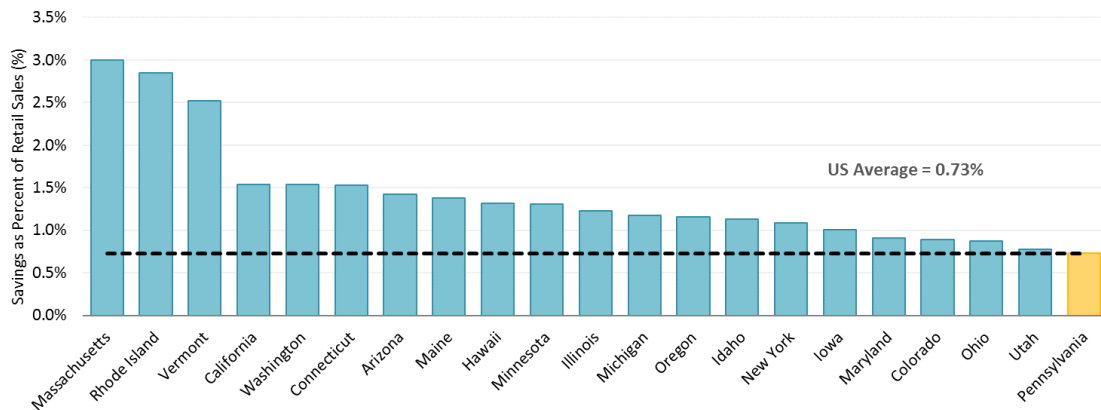
- For capacity savings, we project the utilities will achieve about 1,050 megawatts (MW) in summer capacity savings from 2021 to 2025 under the Alternative Case. This compares to 720 MW in summer capacity savings for the Base Case. The difference in savings between the two scenarios is 330 MW, which is equivalent to a single small natural gas power plant.

2. CURRENT PENNSYLVANIA ENERGY EFFICIENCY PROGRAMS

2.1. Historical and Projected Savings

Pennsylvania’s utility energy efficiency programs currently save approximately 0.7 percent of sales per year on average, according to the American Council for an Energy Efficient Economy (ACEEE) (Figure 1). This is consistent with the national average savings level. While Pennsylvania’s utilities significantly expanded their programs in 2011, ACEEE’s past State Energy Efficiency Scorecard reports show that the utilities’ annual savings have been around 0.6 to 1.0 percent of sales over the past five years.¹

Figure 1. 2016 electric savings by top 20 states and Pennsylvania (% of sales)



Source: ACEEE 2017 State Energy Efficiency Scorecard.

As shown in Figure 1, multiple states have achieved substantially greater annual savings. The top three states—Massachusetts, Rhode Island, and Vermont—saved 2.5 to 3.0 percent of sales in 2016. Further, these leading states have been saving energy at 2 to 3 percent of sales per year over the past several

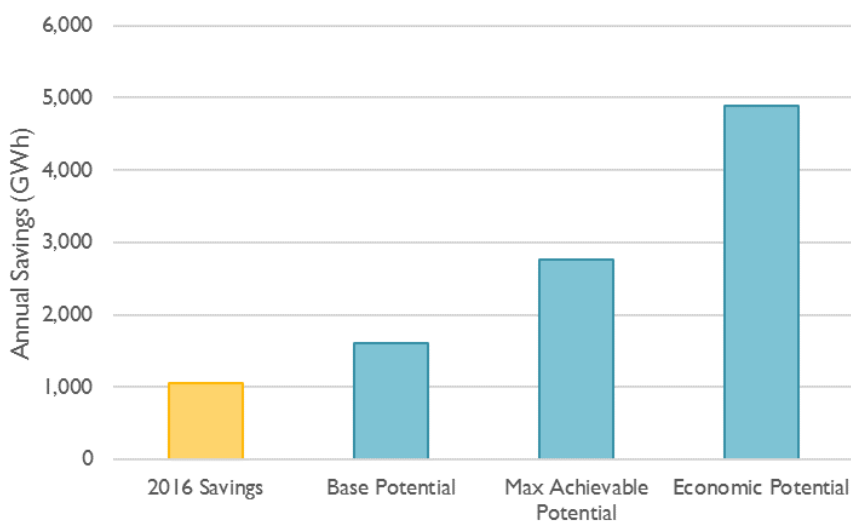
¹ Available at <http://aceee.org/state-policy/scorecard>.



years.² This suggests that Pennsylvania utilities have ample opportunity to expand their programs and ramp-up annual energy savings to levels achieved by leading states.

In fact, Pennsylvania’s own energy efficiency potential study conducted in 2015 revealed a base level of economic savings potential (“Base Potential”) that is higher than the current savings level. Further, the maximum achievable economic potential (“Max Achievable Potential”) is close to three times higher than the current savings level, as shown Figure 2. The Max Achievable Potential is the study’s best estimate of attainable savings assuming comprehensive implementation of all cost-effective measures and no restrictions on budget. It is important to note that even in this scenario plenty of cost-effective energy efficiency opportunities remain untapped, as indicated by the Economic Potential bar in Figure 2.³

Figure 2. Historical energy savings level vs. savings potential estimates for 2016



Source: GDS Associates et al. 2015. *Energy Efficiency Potential Study for Pennsylvania*; NMR et al. 2018. *Statewide Evaluator Annual Report Act 129 Program Year 8*.

Despite evidence of substantial annual energy savings opportunities, Pennsylvania did not expand its savings goals for Phase III, which extends from June 2016 to May 2021. This is partly because Act 129 established an annual budget cap, set a two percent of 2006 utility revenue.⁴ Each investor-owned

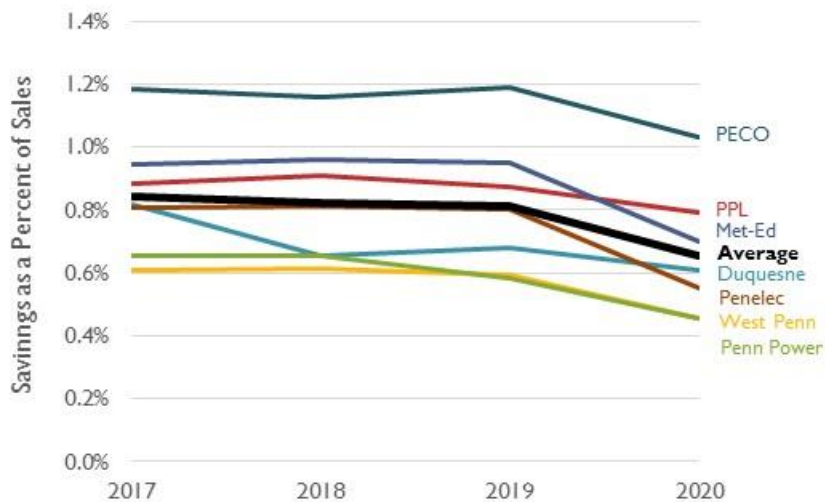
² For more information on Massachusetts and Rhode Island as examples, see Malone et al. 2016. “Rhode Island and Massachusetts Eclipse Efficiency Targets,” available at <http://www.synapse-energy.com/about-us/blog/rhode-island-and-massachusetts-eclipse-efficiency-targets>.

³ Statewide Evaluator Annual Reports available at http://www.puc.state.pa.us/filing_resources/issues_laws_regulations/act_129_information/electric_distribution_company_act_129_reporting_requirements.aspx.

⁴ Implementation Order, Energy Efficiency and Conservation Program, Docket No. M-2014-2424864 (Order entered June 19, 2015) (“PUC Implementation Order”).

utility in the state has filed Phase III implementation plans consistent with Act 129 and the PUC’s direction, but two utilities (PECO and Duquesne) proposed program budgets that are 10 to 20 percent lower than the budget cap. Based on the utilities’ plans and our load forecasts, we estimated the utilities’ annual savings projections as a percent of sales. As shown in Figure 3, the utilities are projecting to save about 0.5 percent to 1.2 percent of sales from 2017 to 2020. Statewide averages are at around 0.8 percent of sales for the next three years and 0.7 percent of sales in the last year. Based on the Max Achievable Potential scenario noted above, the utilities should be able to more than double their current annual savings to slightly above 2 percent of sales per year. In fact, the PUC’s Phase III implementation order stated that “without a budget cap, incremental annual savings could achieve roughly 1.2% to 2.0% of 2010 load in the base achievable and maximum achievable scenarios, respectively.”⁵

Figure 3. Pennsylvania utilities’ savings projection under Phase III



Source: Utility Phase III filings available at http://www.puc.pa.gov/filing_resources/issues_laws_regulations/act_129_information/energy_efficiency_and_conservation_e_e_c_program.aspx

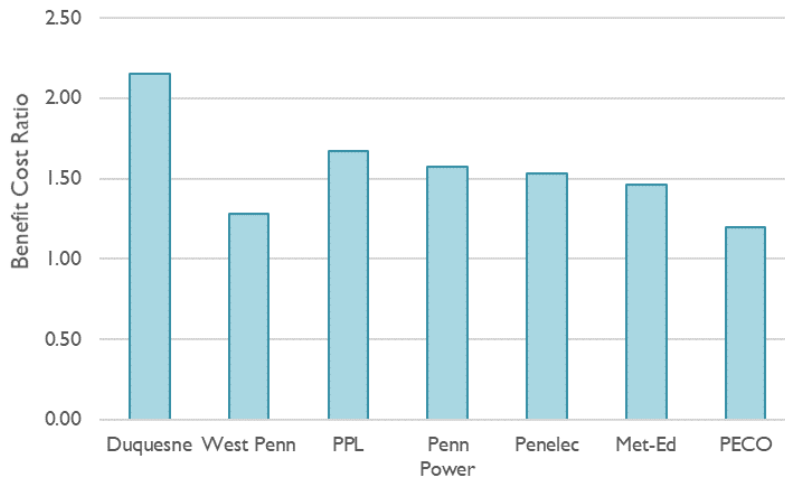
2.2. Performance of Current and Projected Programs

Cost-Effectiveness

All the utilities’ current energy efficiency programs are cost-effective for Program Year 8 (PY8) (from June 2016 to May 2017). Their benefit-cost ratios range from 1.2 to over 2.0 based on the state’s Total Resource Cost (TRC) test, with most averaging around 1.5 (see Figure 4).

⁵ Ibid., p. 49.

Figure 4. Benefit-cost ratios for PY8 energy efficiency programs by utility



Source: NMR et al. 2018. Statewide Evaluator Annual Report Act 129 Program Year 8.

The TRC test includes costs and benefits experienced by the utilities as well as program participants. The costs typically include program costs and participants' out-of-pocket costs for energy efficiency measures. The benefits typically include the utilities' avoided system costs such as generation, capacity, transmission, and distribution. The benefits can also include participants' benefits such as avoided costs of fuels, water, and operation and maintenance within buildings. Most Pennsylvania utilities do not appear to include these participant benefits when evaluating the cost-effectiveness of their programs.

Some states include other benefits such as reduced wholesale energy market price impacts, reduced renewable energy compliance costs, reduced emissions, risk avoidance values, reliability improvement, reduced costs of utility collection, health benefits, improved comfort, or increased property value. We did not find any of these additional benefits accounted for in the Pennsylvania utilities' benefit-cost analyses. Thus, the benefit-cost ratios reported by the utilities are likely significantly underestimated.

Cost of Saved Energy

The portfolio levelized cost of saved energy is similar among the utilities at about \$0.02 per kilowatt hour (kWh), as shown in Table 1. We estimated levelized costs based on first-year program costs (expenditures divided by first-year savings), average measure lives, and the utilities' weighted average cost of capital for the discount rate.

Table 1. Costs of saved energy for PY8 programs by utility

PA Electric Utilities	Levelized Costs (\$ per kWh lifetime)	First-Year Costs (\$ per kWh first year)	Measure Life
Duquesne	\$0.02	\$0.17	9
West Penn	\$0.02	\$0.13	7
PPL	\$0.02	\$0.15	10
Penn Power	\$0.02	\$0.13	9
Penelec	\$0.02	\$0.13	8
Met-Ed	\$0.02	\$0.12	8
PECO	\$0.03	\$0.21	8

Source: NMR et al. 2018. *Statewide Annual Report Act 129 Program Year 8*.

The weighted average first-year cost of saved energy for PY8 is \$0.14 per kWh for the residential sector and \$0.15 per kWh for the commercial and industrial (C&I) sector (see Table 2). As shown in Table 2, the actual cost of saved energy reported at the end of 2017 is less than the projected cost of saved energy for all of Phase III reported in 2015, especially for the residential sector. The levelized cost of the residential program is about \$0.026 per kWh for PY8, which is consistent with residential program costs in 2014 and 2015 available in the U.S. Energy Information Administration’s (EIA) 861 database. Because of this historical consistency, we used the average cost of saved energy across PY8 and the utilities’ projection, as shown in Table 2 as the Average First-Year Cost.

Table 2. Costs of saved energy: actual PY8 vs. projected Phase III estimates (\$ per kWh first year)

Sector	PY8 First-Year Cost	Projected First-Year Cost	Average First-Year Cost
Residential	0.14	0.21	0.18
C&I	0.15	0.16	0.15

3. ECONOMIC ANALYSIS OF PENNSYLVANIA’S ENERGY EFFICIENCY PROGRAMS

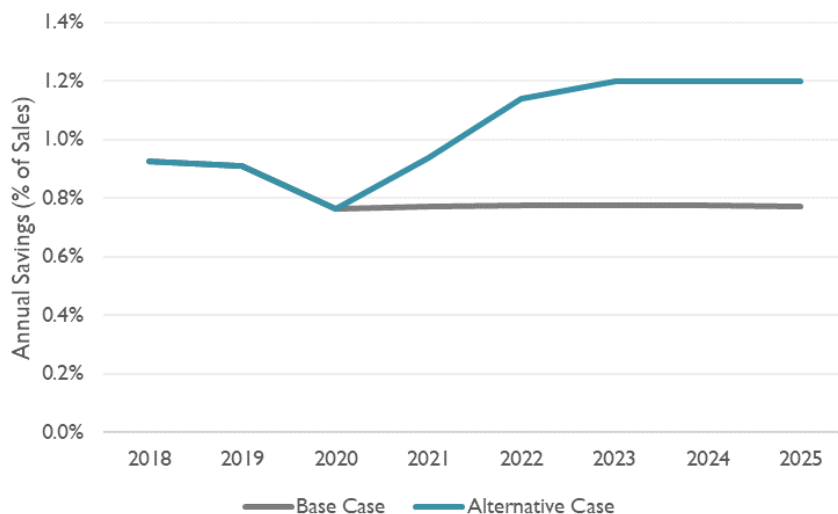
3.1. Key Assumptions and Methodologies

Synapse analyzed how expanding the state’s utility energy efficiency programs beyond the current budget cap would affect energy savings, economic benefits, and net benefits. We examined the potential impacts of an alternative energy efficiency future for Pennsylvania in which the state’s seven investor-owned utilities collectively expand their programs from 2021 through 2025 (immediately following Phase III). The purpose of our analysis is to inform policymakers of the magnitude of such impacts should they lift the current 2 percent budget cap.

We developed the following two scenarios and then assessed the incremental impact of the Alternative Case relative to the Base Case. The two savings trajectories are summarized in Figure 5.

- **Base Case:** Savings and costs are based on PY8 performance for 2016 and the utilities’ Phase III projections for 2017 through 2020. Thereafter, we assumed annual savings and costs would be constant at 2020 levels (about 0.74 percent of sales) through 2025.
- **Alternative Case:** Savings and costs are based on PY8 performance for 2016 and the utilities’ Phase III projections for 2017 through 2020. Thereafter, we assumed annual portfolio level savings would increase by 0.2 percent of sales per year from 2020 until the state reaches 1.2 percent of sales through 2025. We determined program budgets after 2020 based on the statewide average cost of saved energy for 2020 available in the utilities’ Phase III filings.

Figure 5. Projected savings trajectories for the Base Case and the Alternative Case



Synapse developed an Excel spreadsheet model to analyze the Base Case and Alternative Case. The user of the tool can customize the Base Case and Alternative Case by setting the savings targets for 2021 through 2030 or the budget for the Alternative Case. This tool includes all our supporting assumptions and inputs. We summarize our key methodologies and assumptions below.

The program cost of saved energy is based on the utilities’ performance in PY8 for 2016 and the utilities’ Phase III projections for 2017 through 2020. We used a statewide weighted average cost of saved energy (\$ per kWh) for our analysis. As mentioned above in Section 2.2, we used an adjusted cost of saved energy for 2017 to 2020 by taking the average between the actual performance and the projected performance. Literature on nationwide energy efficiency programs suggests that the cost of

saved energy has been stable for many years, even when savings levels have increased.⁶ In some cases, the cost of saved energy declined and exhibited economies of scale. Thus, we assume the same cost of saved energy in 2017 dollars for 2021 through 2025 for both the Base Case and the Alternative Case.

The program costs and savings share between residential and C&I programs for 2021 to 2025 were assumed to be the same as the projected statewide average in 2020 based on the utilities' Phase III filings.

Avoided costs in terms of levelized cost per megawatt hour (MWh) were developed based on TRC benefits, measure lives, and verified gross annual savings for PY8.

Sales forecasts were developed based on PJM's load forecast and Pennsylvania utilities' current sales. For the Base Case and Alternative Case, we adjusted the sales forecast by the expected savings in each case.

3.2. Results

Budget

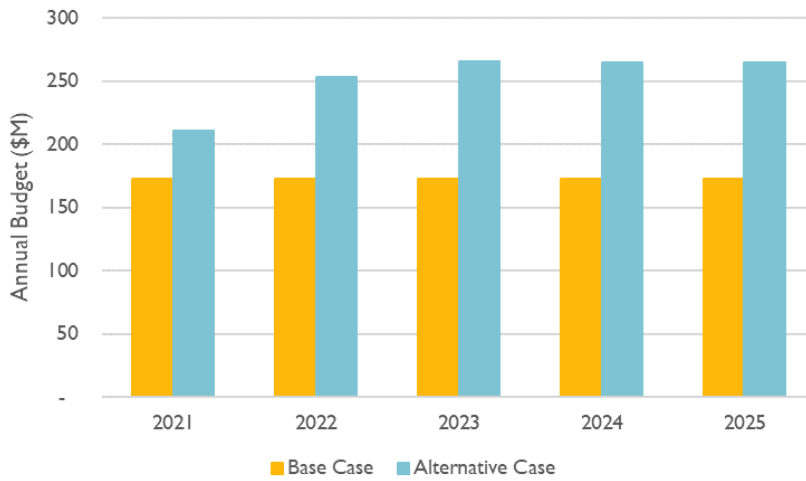
Figure 6 shows projected annual budgets for Pennsylvania's utilities from 2021 to 2025 for both the Base Case and the Alternative Case. Under the Base Case, we project utilities will invest about \$860 million from 2021 to 2025. Annually, this is about \$173 million or 1.4 percent of 2006 utility revenue.

Under the Alternative Case, we project utilities will invest about \$1,260 million from 2021 to 2025. This budget is about 50 percent higher than the Base Case's projected spending of \$860 million during the same timeframe. Annually, the budget increases from about \$210 million in 2021 or about 1.7 percent of 2006 utility revenue, to \$265 million in 2025 or about 2.2 percent of 2006 utility revenue.

For both scenarios, we expect TRC costs, which include both the utility's program costs and the participant's costs, will be about twice as much as the program costs discussed above.

⁶ Malone et al. 2016. "Rhode Island and Massachusetts Eclipse Efficiency Targets," Available at <http://www.synapse-energy.com/about-us/blog/rhode-island-and-massachusetts-eclipse-efficiency-targets>; Ackerman et al. 2016. *Estimating the Cost of Saved Energy – The EIA 861 database*. Figure 8. Available at <http://www.synapse-energy.com/sites/default/files/COSE-EIA-861-Database-66-017.pdf>; Molina. 2014. *The Best Value for America's Energy Dollar: A National Review of the Cost of Utility Energy Efficiency Programs*. Prepared by ACEEE. Available at [https://in.gov/iurc/files/ACEEE Attachment G ACEEE Cost of Saved Energy Report.pdf](https://in.gov/iurc/files/ACEEE%20Attachment%20G%20ACEEE%20Cost%20of%20Saved%20Energy%20Report.pdf)

Figure 6. 2021-2025 projected program budgets



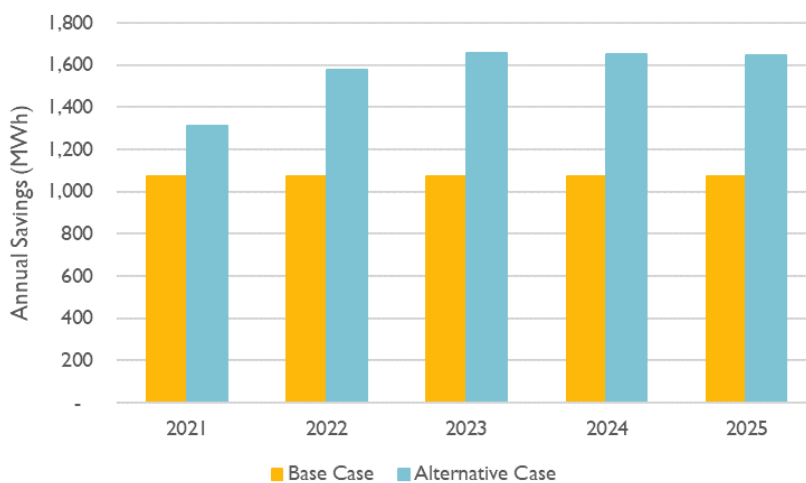
Energy Savings

Figure 7 summarizes projected annual savings for Pennsylvania from 2021 to 2025, for both the Base Case and the Alternative Case. Under the Base Case, we project the utilities will save about 5,400 GWh from 2021 to 2025, which is about 1,100 GWh annually.

The Alternative Case savings are about 50 percent more than the Base Case savings during the same timeframe. Under the Alternative Case, we project the utilities will save about 7,840 GWh from 2021 to 2025. Annually, savings increase from about 1,300 GWh in 2021 to 1,650 GWh in 2025.

Based on PY8, residential programs have an average measure life of six years and C&I programs have an average measure life of 14 years. This translates to lifetime savings of 58,000 GWh in the Base Case and 84,000 GWh in the Alternative Case—a 46 percent increase over the Base Case.

Figure 7. 2021-2025 projected program annual savings



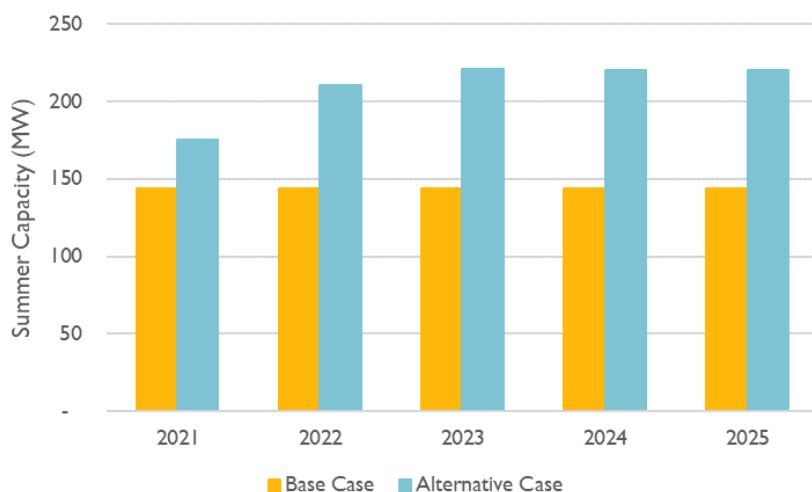
Capacity Savings

Figure 8 summarizes projected annual summer capacity savings for Pennsylvania from 2021 to 2025 for both the Base Case and the Alternative Case. Under the Base Case, we project the state will save 720 MW from 2021 to 2025, which is about 145 MW annually.

Under the Alternative Case, we project the state will save 1,050 MW from 2021 to 2025. Annually, saving increase from about 175 MW in 2021 to about 2,020 MW in 2022 and stay at that level through 2025.

The difference in savings between the two scenarios is 330 MW, equivalent to a single small natural gas power plant.

Figure 8. 2021-2025 projected program summer capacity savings



TRC Benefits and Net Benefits

Figure 9 summarizes projected lifetime TRC benefits for Pennsylvania from 2021 to 2025 for both the Base Case and the Alternative Case. Under the Base Case, we project the state will experience benefits of about \$2,580 million from 2021 to 2025 (\$1,790 million in present value), which is about \$490 million from each year of program implementation.

The Alternative Case is expected to experience considerably greater benefits than the Base Case during the same timeframe. Under the Alternative Case, we project the state will experience benefits of \$3,760 million from 2021 to 2025 (\$2,590 million in present value), which is slightly over \$1 billion additional benefit (\$750 million in present value). Annually, benefits increase from \$630 million in 2021 to \$800 million in 2023 and stay at that level through 2025.

With the inclusion of TRC costs, the Alternative Case results in \$770 million in net benefits while the Base Case produces \$530 million in net benefits. The incremental net benefit from the Alternative Case is approximately \$240 million.

Figure 9. 2021-2025 projected program TRC benefits

