

Pennsylvania Demand Reduction Induced Price Effects Study

2026 TRC Test Order Docket M-2024-3048998

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For Pennsylvania Act 129 of 2008

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SUBMITTED BY:
PA Act 129 Statewide Evaluator

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Acknowledgments

The Statewide Evaluator (SWE) would like to acknowledge the contributions of the electric distribution companies (EDCs) and Rate Districts¹, their evaluation contractors, and the Bureau of Technical Utility Services (TUS) staff.

¹ The former FirstEnergy EDCs are now referred to as Rate Districts under the FirstEnergy EDC.

Acronyms

BRA	Base Residual Auction
DR	Demand Response
DRIPE	Demand Reduction Induced Price Effects
EDC	Electric Distribution Companies
EE	Energy Efficiency
FE	FirstEnergy Pennsylvania Electric Company
FRR	Fixed Resource Requirement
ICAP	Installed Capacity
LMP	Locational Marginal Price
MCP	Market Clearing Price
PA	Pennsylvania
RTO	Regional Transmission Organization
SWE	Statewide Evaluator
TUS	Bureau of Technical Utility Services
TRC	Total Resource Cost
UCAP	Unforced Capacity
VRR	Variable Resource Requirement

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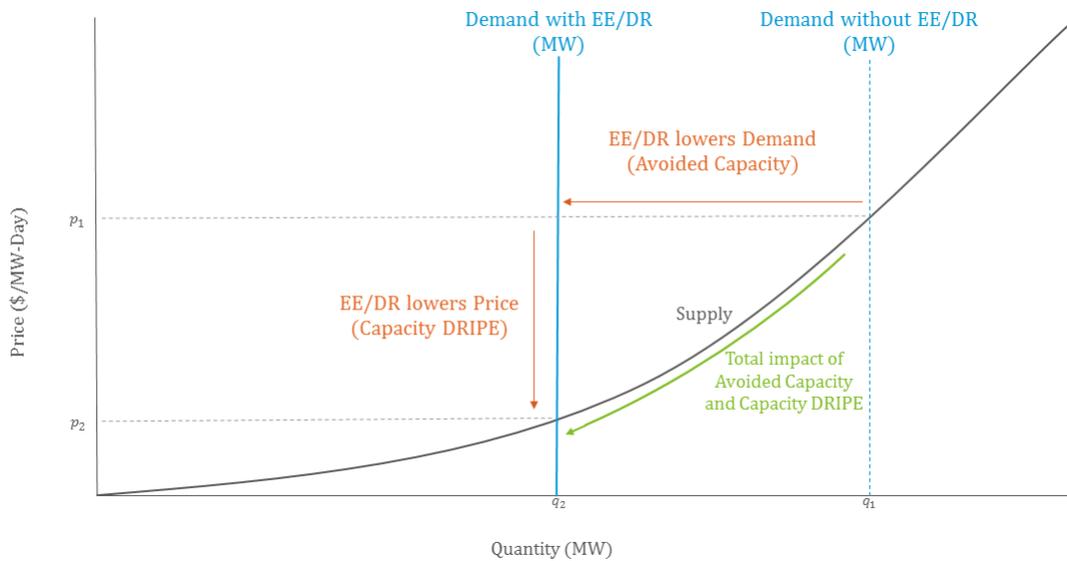
Section 1 Executive Summary

This report details the processes used to estimate Demand Reduction Induced Price Effects (DRIPE) values for avoided generation capacity and avoided electric energy purchases in Pennsylvania. This report also sets forth recommended values for inclusion in the 2026 TRC Test Tentative Order for use in cost-effectiveness testing in a potential Phase V of Act 129.

1.1 BACKGROUND

Wholesale electricity price suppression, or DRIPE, captures the value of changes in wholesale electricity prices caused by a shift in the demand curve in a marketplace. This study considers two types of DRIPE, electric capacity DRIPE and electric energy DRIPE. Figure 1 shows a conceptual overview of capacity DRIPE and how it differs from the base avoided cost of generation capacity. Energy DRIPE derives its value in an analogous way in the energy market. Reduced demand causes a shift in the demand curve to the left, lowering the clearing price and capacity quantity. The value of the avoided demand comes in two parts. The first is from the avoided purchases, which is the price, p_1 , multiplied by the change in quantity, $q_1 - q_2$. This is simply accounted for by the avoided cost of generation capacity.

Figure 1: Conceptual Overview of Capacity DRIPE



The second value component of lowered demand is DRIPE, which comes from the decrease in prices, due to market forces when demand is lowered, of all the remaining purchases that are still required. The equation for the value of DRIPE is shown in Equation 1. Where p_1 is the price of energy or capacity without any energy efficiency (EE) or demand response (DR) measures and p_2 is the price of energy or capacity with lowered demand. The quantity, q_2 , is the new market clearing point reflective of the reduced demand. Since the Commonwealth still requires significant

energy and generation after EE and DR (i.e. q_2 is large), even a small drop in price can have a substantial economic impact.

Equation 1: Example DRIPE Equation

$$DRIPE = (p_1 - p_2) * q_2$$

This study focuses on DRIPE for two key Act 129 avoided cost components. Both effects are real avoided costs of supplying electricity so they can be considered benefits in an Act 129 Total Resource Cost (TRC) Test Order.

- The first is capacity DRIPE for the load zones of each of the Pennsylvania (PA) EDC/Rate Districts. Reduced demand for capacity allows for all the remaining required generation capacity to be procured at a lower clearing price.
- The second is electric energy DRIPE for the service territories of the PA EDC/Rate Districts. Lowered demand for energy shifts the marginal price of the energy procured via wholesale markets downward making each unit of energy still procured slightly cheaper.

Capacity DRIPE was considered for inclusion in the TRC Test in PA in the past. The 2013 Demand Response Study² explored the value of capacity DRIPE, called “Wholesale Price Suppression”. Addendum I of the study details the methods used to estimate the value of capacity DRIPE for each PJM load zone and estimates the change in Phase I TRC ratios if capacity DRIPE were considered a TRC benefit. The study estimated that, in a single year, the overall value of capacity DRIPE to be over 635 million dollars in the load zones that the PA EDC/Rate Districts operate, but, because PJM load zones cross state lines, a large portion of that value would not be captured by PA ratepayers. Only 17% of the load in those zones is attributed to PA EDC/Rate Districts, so the value of capacity DRIPE to PA ratepayers was estimated to be closer to 110 million dollars per year. Ultimately the Commission directed the SWE not to include this benefit stream in the Phase III market potential study³. At the time, there was concern over the complexity of undertaking a more in-depth study as well as the number of assumptions required about future market conditions.

1.2 SUMMARY OF RESULTS

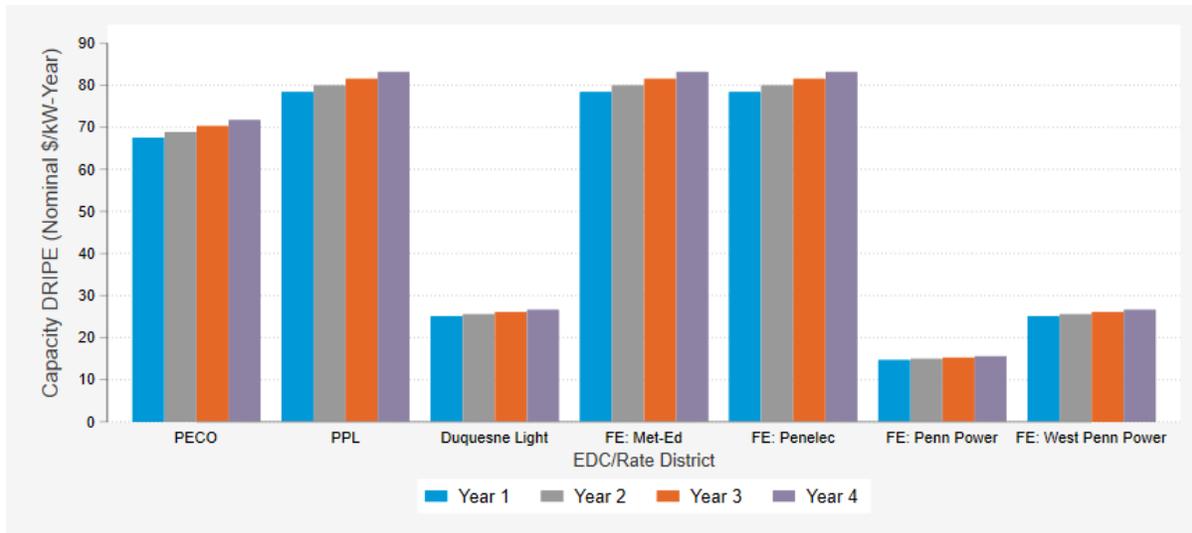
This section summarizes the recommended DRIPE values for both generation capacity and electric energy DRIPE. [Section 4](#) presents the full set of recommended DRIPE values. The DRIPE values are all calculated at the system level and presented in nominal dollars assuming a 2% inflation rate. Both capacity and energy DRIPE benefits are assumed to last for four years. After four years, markets are assumed to reach new equilibriums and DRIPE benefits go to zero.

² Act 129 SWE Demand Response Study Final Report - Amended November 1, 2013. Dated November 1, 2013. Released with the Commission’s Peak Demand Cost Effectiveness Determination Tentative Order at Docket Nos. M-2012-2289411 and M-2008-2069887. Entered on Nov 14, 2013. See <https://www.puc.pa.gov/pcdocs/1256728.docx>

³ Final Order on the Act 129 SWE to Perform a Demand Response Potential Study. From the Public Meeting of February 20, 2014 at Docket Nos. M-2012-2289411 and M-2008-2069887. Entered on February 20, 2014. See <https://www.puc.pa.gov/pcdocs/1269801.doc>

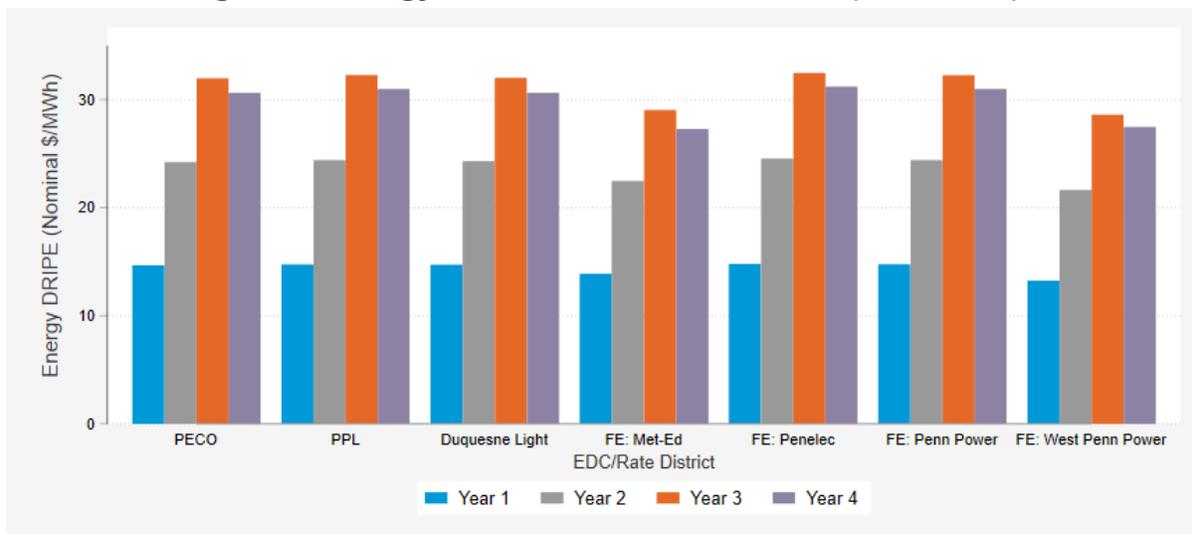
The capacity DRIPE estimates for each EDC/Rate District for the first program year (PY) of Phase V of Act 129 (PY18), shown in Figure 2, are all the same in subsequent years on a real dollar basis and only vary on a nominal basis. Since the Base Residual Auctions (BRAs) for generation capacity for Phase V program years have not yet taken place; the SWE team used the average of the estimated values of generation capacity DRIPE from the three most recent completed BRAs (2022/2023, 2023/2024, and 2024/2025) as a proxy.

Figure 2: Capacity DRIPE Estimates for PY18 (2026-2027)



The energy DRIPE estimates for each EDC/Rate District also rely on past relationships between zonal energy prices and systems load to estimate future DRIPE benefits. Figure 3 shows the energy DRIPE estimates for the first program year of Phase V.

Figure 3: Energy DRIPE Estimates for PY18 (2026-2027)



The SWE believes that these estimates of DRIPE benefits are reasonable and should be included in Phase V TRC testing.

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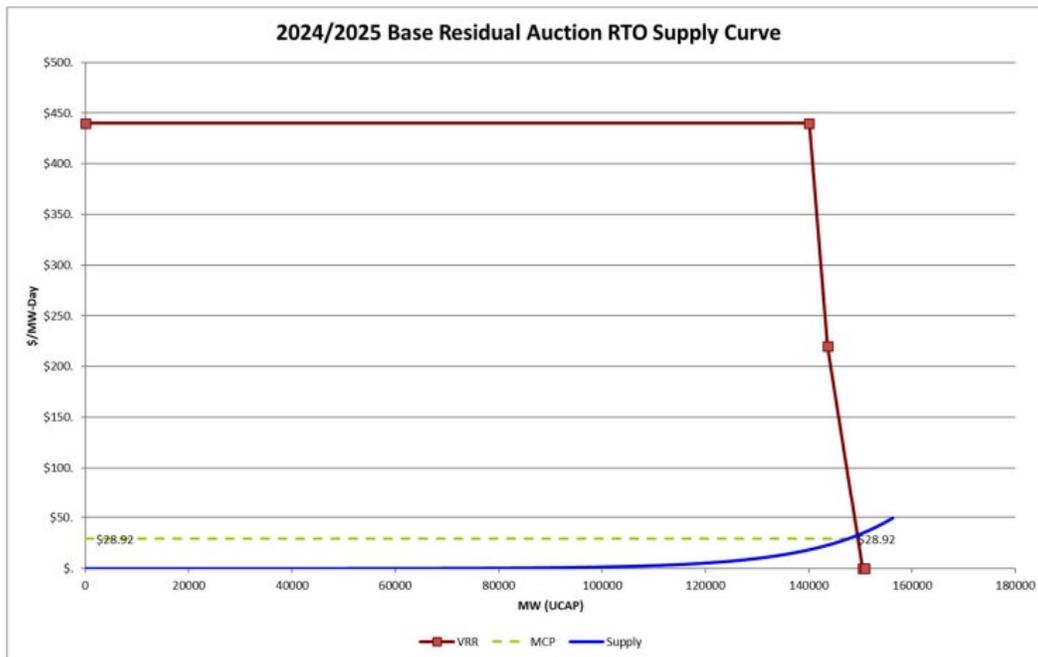
Section 2 Electric Capacity DRIPE

2.1 METHODOLOGY AND ESTIMATION

Each year, the PJM conducts a Base Residual Auction (BRA) to secure adequate power supply resources for projected energy demand by load zone within the PJM territory.⁴ Through the BRA, a Market Clearing Price (MCP) for each load zone is determined for the expected supply conditions, called the base scenario, as well as for scenarios with theoretically altered supply and demand conditions. PJM develops these theoretically altered supply conditions by either removing the lowest cost bids or adding in zero cost bids and re-solving for the resource clearing points in each load zone. This set of hypothetical scenarios along with the actual results of the auction are called the BRA scenario analysis.

Figure 4 below shows an example of the Variable Resource Requirement (VRR) curve, also known as the demand curve, and a smoothed supply curve for the 2024/2025 BRA for the full PJM RTO. The point where the VRR curve and the smoothed supply curve meet is the MCP. The points of the VRR curve are published before each BRA and the portion that intersects the supply curve is linear, so the demand curve does not need to be estimated. The supply curve points, however, are not published outright and therefore the slope of the supply curve must be estimated using the MCPs from the BRA scenario analysis described above.

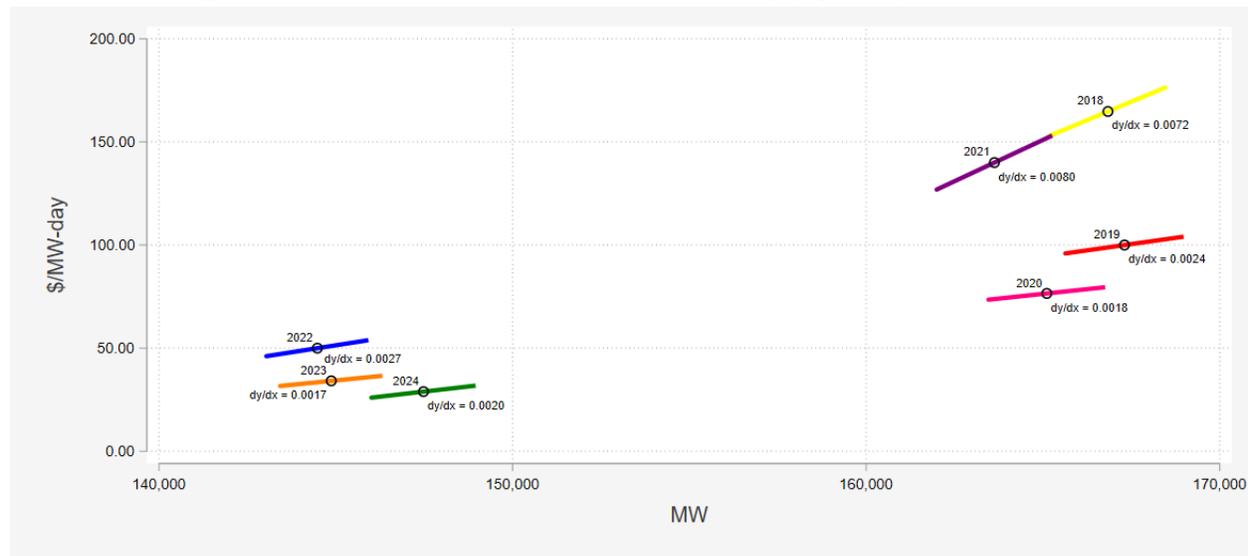
Figure 4: Example VRR and Supply Curves



⁴ PJM is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia. See <https://www.pjm.com/about-pjm>

To estimate the value of capacity DRIPE, the MCP values from the base scenario and the theoretical supply curve shifted scenarios can be used to approximate the supply curve slope. The three most recent BRAs which have been completed as of the time of writing this report are 2022/2023, 2023/2024, and 2024/2025. These recent auctions can be used to estimate capacity DRIPE in subsequent years. Figure 5 below shows the supply curve slope estimates for these recent BRAs as well as the auctions from 2018 – 2021. Over time, MCPs have dropped and the slopes of the supply curves for the RTO have become flatter, meaning that any capacity DRIPE will be decreased.

Figure 5: BRA PJM RTO 2018 – 2024 Supply Slope Estimates



The approximated supply curve slope along with the slope of the VRR curve of a given year can inform estimates of the price change associated with a 1 MW change in demand. This value can then be multiplied by the base scenario clearing quantity of MWs to estimate the capacity DRIPE value of an avoided MW of capacity. Equation 1 shows the calculation. The slopes in Figure 5 are equal to $p_1 - p_2$ for a given auction year, meaning all that is required to estimate capacity DRIPE is to multiply the slope by the clearing quantity. The estimate for 2018 would be 0.0072 multiplied by 166,836, which equals \$1,201 per MW-day saved.

Figure 5 shows two distinct clusters of results approximately 20,000 MW apart on the x-axis. After the 2021/2022 auction, there was a significant change in the clearing quantity required for PJM. This is due to allocating some of the load, which previously cleared in the PJM market, through Fixed Resource Requirement (FRR) alternative⁵. FRR resources are an alternative way for load serving entities to serve customer’s needs from outside of the PJM marketplace. Table 1 shows the internal PJM capacity and amount of capacity allocated through FRR in the PJM RTO by auction year. The portion of PJM load served by FRR resources has increased since the 2021/2022 auction. This means that there are fewer resources clearing within the competitive PJM market through auctions. Since capacity DRIPE derives a portion of its value from the

⁵ See Fixed Resource Requirements Fact Sheet. <https://pjm.com/-/media/about-pjm/newsroom/fact-sheets/securing-resources-through-fixed-resource-requirement-fact-sheet.ashx>

quantity of capacity required in the market, capacity requirements being met by FRR resources, which are outside of the market, lowers the value of the capacity DRIPE.

Table 1: Internal PJM Capacity Available and FRR Commitments in Each Auction Year (2017/2018 – 2023/2024)⁶

Auction Supply (MW)	PJM RTO						
	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024
Internal PJM Capacity	202,477.4	203,300.6	207,579.6	207,555.1	211,625.2	207,339.8	204,006.6
FRR Commitments	15,776.1	15,793.0	15,385.3	13,931.6	13,657.4	33,297.1	33,500.7

The SWE then calculated capacity DRIPE for each of the four load zones that had a separate clearing price in the last three BRAs. [Appendix A](#) of this report includes a mapping table of load zone to EDC/Rate District for reference. We use the average of the three most recent BRAs as a proxy for future values. [Table 2](#) shows the results in \$/kW-year as those are the units typically used in the Act 129 TRC Test for avoided capacity costs. The conversion from \$/MW-day to \$/kW-year is simply a multiplication by 0.365 (365 days divided by 1,000 kW per MW). The values are displayed in nominal 2026/2027 dollars, which is the start of a potential Phase V (PY18), when these values can be used in TRC tests. Because each EDC/Rate District does not represent all the load for its load zone, PA ratepayers may not experience all the DRIPE benefits for each load zone.

[Table 2](#) includes one row to show the DRIPE value of each load zone overall as well as one that covers only the PA loads. The columns represent the last three BRAs, which correspond to Act 129 PY14, PY15, and PY16. The APS load zone, which contains West Penn Power, does not publish a VRR curve before the BRAs so it is not included in our estimates, and the RTO DRIPE estimate is used in its place.

⁶See 2023/2024 BRA Auction Report. Page 18. <https://www.pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2023-2024/2023-2024-base-residual-auction-report.ashx>

Table 2: Capacity DRIPE Impact Estimates by Load Zone (2026/2027 Nominal \$/kW-Year ICAP Incremental Reduction, Gen Level)

Load Zone	Affected Load	2022/2023	2023/2024	2024/2025	3-Year Average
RTO	All	\$140.37	\$89.95	\$104.57	\$111.63
	PA	\$31.43	\$20.34	\$23.35	\$25.04
MAAC	All	\$166.71	\$185.22	\$261.93	\$204.62
	PA	\$63.78	\$70.91	\$100.39	\$78.36
EMAAC	All	\$132.94	\$294.42	\$310.95	\$246.10
	PA	\$36.49	\$80.52	\$85.59	\$67.54
ATSI	All	\$455.84	\$137.33	\$142.92	\$245.37
	PA	\$27.26	\$8.37	\$8.31	\$14.65

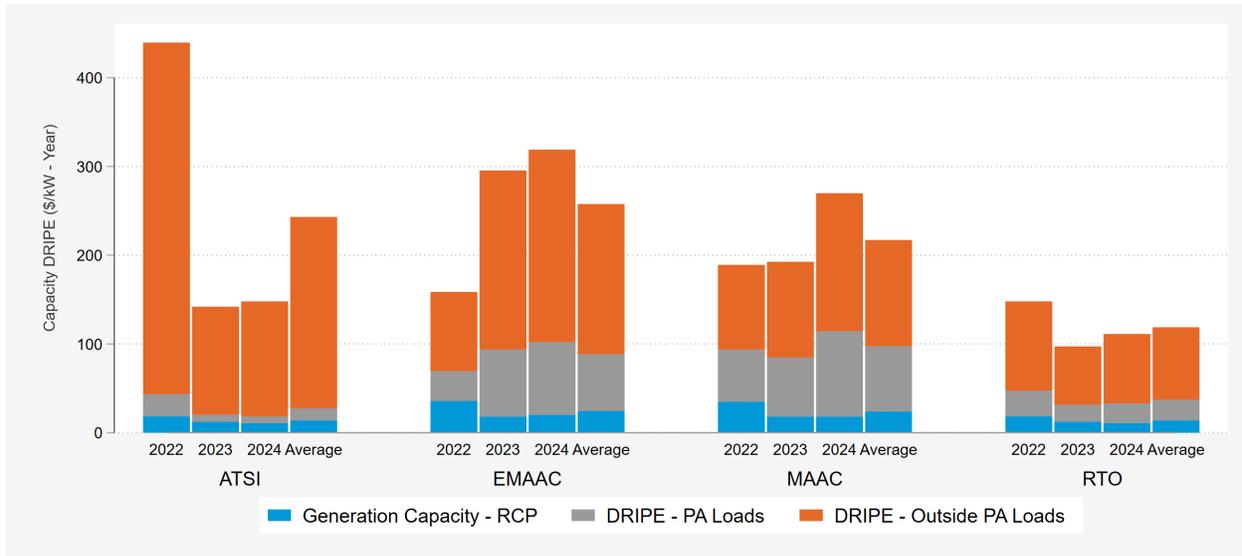
2.2 DISCUSSION AND SENSITIVITY ANALYSIS

The estimated capacity DRIPE values per load zone in Table 2 range from \$8 to \$455 per kW-year. This large range of estimated DRIPE values comes from two sources, both seen in Equation 1. First is q_2 , which is the quantity of the unforced capacity (UCAP) requirement for an individual load zone. The UCAP requirement for each load zone varies in size. In all cases, PA load is only a portion of the load in its zone. That is why the PA DRIPE estimates are lower than the estimates for the overall respective load zones. When deciding on whether to include capacity DRIPE as a benefit, which load to include must be considered. The 2021 TRC Test Final Order⁷ states, “The purpose of using a TRC test to evaluate EE&C programs is to track the relationship between the benefits to the Commonwealth and the costs incurred to obtain those benefits.” This means that only the benefit to the Commonwealth is considered in the current cost-effectiveness test.

If the Commission elected to use the Societal Cost Test rather than the TRC Test, then the benefits to all society should be considered. Figure 6 shows the capacity DRIPE values for each load zone along with the MCP for each of the three most recent BRA years and the three-year average. The gray portion of each bar is the portion that is attributable to the Commonwealth. The MCP value of capacity itself has decreased over time and, in many zones, is less than the value of the DRIPE. As discussed above, our interpretation of PA indicates that only the capacity DRIPE benefits to the Commonwealth’s ratepayers should be used in the cost effectiveness tests. Benefits to Maryland, Ohio, New Jersey, and Delaware ratepayers are excluded from the results.

⁷ Pennsylvania Public Utility Commission, 2021 TRC Test Final Order. From the Public Meeting of December 19, 2019, at Docket No. M-2019-3006868 (2021 TRC Test Order). Entered December 19, 2019. <https://www.puc.pa.gov/pcdocs/1648126.docx>

Figure 6: DRIPE Makeup by Load Zone



The second portion of the DRIPE equation comes from the change in price, $p_1 - p_2$. Load zones that are more constrained will typically change prices more quickly than ones that are less constrained. The resource clearing price for a constrained zone comes from a segment of the supply curve that is steeper, meaning that the avoided marginal demand would have been very expensive. Avoiding any extra demand in the constrained zones will be much more valuable than in less constrained zones. The 2022/2023 DRIPE estimates for the ATSI load zone in Table 2 demonstrate this best. Because generation in ATSI was so constrained in that year, avoiding any amount of demand would have lowered the price of the required capacity substantially and therefore been extremely valuable.

Table 3 shows the average capacity DRIPE values that will be used in the current EmPOWER Maryland cycle (2024/2026) by EDC for benchmarking. EmPOWER Maryland uses multiple cost-effectiveness tests each year to assess its programs. The Utility Cost Test only includes capacity DRIPE for Maryland loads, while the Societal Cost Test includes the DRIPE benefits to load outside of Maryland. In Baltimore Gas and Electric’s case, these numbers are the same as they serve an entire load zone that cleared separately. For the other EDCs, there is a substantial difference in the value of capacity DRIPE for only Maryland and all loads.

Table 3: EmPOWER Maryland Capacity DRIPE Comparison

EDC	Maryland Load (\$/kW-year)	All Load (\$/kW-year)
Baltimore Gas & Electric	\$127	\$127
Pepco	\$18	\$88
Delmarva Power & Light	\$118	\$171
Potomac Edison	\$10	\$99

The effects of capacity DRIPE are assumed to last for four years. After this period, the generation capacity markets are expected to take the new levels of demand into account for the auctions that dictate the MCP in the following years. The lowered prices due to demand reductions may cause some generation sources to retire or leave the market, shifting the supply curve and eventually

eliminating the price effects from demand reduction. The four-year life of capacity DRIPE is in line with cost-effectiveness tests in other states like Maryland.

To give context to the magnitude of capacity DRIPE values estimated in this report, the SWE team conducted a sensitivity analysis on the impact of including capacity DRIPE on PY13 non-residential EE programs. Table 4 shows the results using the average DRIPE values from Table 2.

Table 4: Cost-Effectiveness Sensitivity Analysis – Non-Residential EE Programs – Capacity DRIPE

EDC/Rate District	TRC ratio w/o DRIPE	TRC ratio w/ PA DRIPE	TRC ratio w/ Full DRIPE
PECO	0.88	0.91	0.99
PPL	2.31	2.37	2.46
Duquesne Light	2.49	2.52	2.62
FE: Met-Ed	1.34	1.37	1.44
FE: Penelec	1.41	1.47	1.59
FE: Penn Power	1.04	1.04	1.08
FE: West Penn Power	1.21	1.22	1.25

In each case, the inclusion of capacity DRIPE as a benefit caused a modest increase in the TRC ratio of the non-residential EE programs for each EDC/Rate District. In the case of PECO, if the full value of capacity DRIPE for the EMAAC load zone was included, the non-residential program would have gone from not being considered cost-effective by the TRC Test to being nearly cost-effective. While this sensitivity analysis shows the effect of DRIPE on an EE focused program, a DR program, which gets almost all its benefits from avoided capacity, would be more sensitive to its inclusion.

The SWE team shared the preliminary results of this report with TUS staff in Q4 of 2023. Using feedback from TUS staff, the SWE team recommends including the four-year capacity DRIPE values that only take PA loads into account in TRC tests during Phase V. Section 4 contains tables with the recommended capacity DRIPE values.

3

Section 3 Electric Energy DRIPE

3.1 METHODOLOGY AND ESTIMATION

Electric energy DRIPE and capacity DRIPE derive their benefits from the same underlying market clearing mechanics. For every avoided MWh purchase, all other purchased energy becomes slightly cheaper. The same principles of supply and demand dictate this relationship for energy. [Figure 1](#) in [Section 1](#) depicts the process by which DRIPE benefits occur for capacity DRIPE but can be applied to electric energy DRIPE as well.

The following steps describe the data and methods used to estimate electric energy DRIPE values.

- 1) To estimate energy DRIPE, first, the relationship between zonal electricity prices and PA system load must be estimated. This relationship is called the elasticity of price with respect to demand. The basic equation for elasticity is shown in [Equation 2](#).

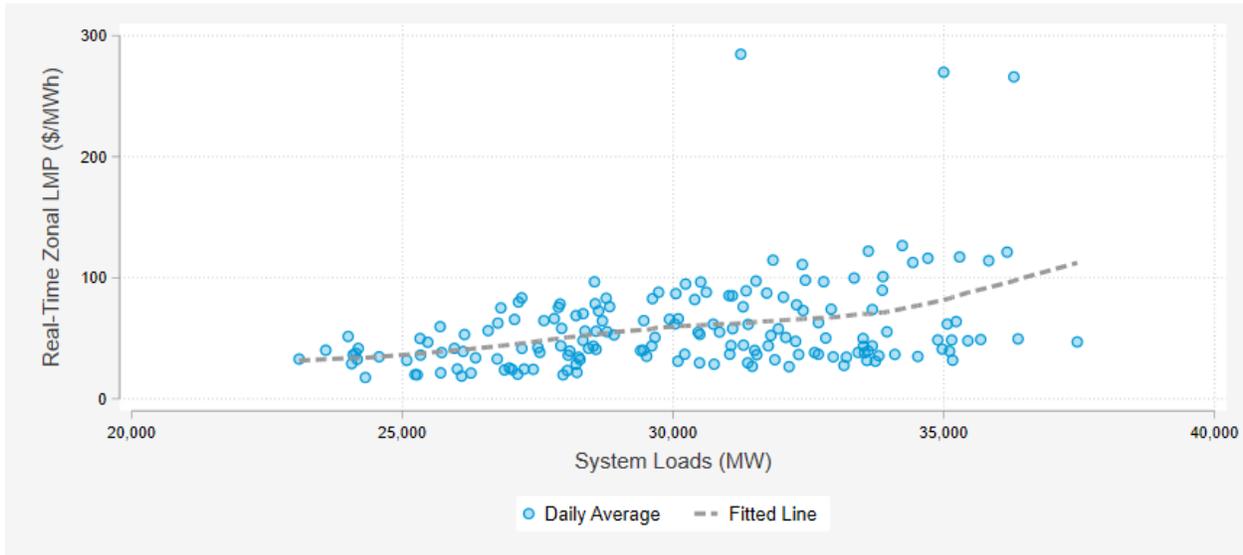
Equation 2: Elasticity Equation

$$\text{Elasticity} = \frac{\% \text{ change in price}}{\% \text{ change in quantity}}$$

The SWE estimated the elasticity of each load zone using real-time locational marginal prices (LMPs) as well as real-time system loads. The SWE team chose to use real-time hourly loads and real-time LMPs as they represent the system loads and prices experienced by the system, rather than using day-ahead estimations. The SWE team retrieved the zonal real-time LMPs and the real-time loads for each PA EDC/Rate District zone from 2021 – 2023 through Data Miner 2⁸. [Figure 7](#) below shows an example of the summer daily average real-time LMPs for the PECO zone versus statewide loads. Real-time LMP values tend to increase as system loads increase.

⁸ See Data Miner 2. <https://dataminer2.pjm.com/list>

Figure 7: 2021 – 2023 Summer Daily Average Zonal Real-Time LMPs vs. Zonal Loads: PECO



Equation 3 shows the model specification used to estimate the relationship between zonal prices and system loads. The model also includes natural gas prices as an explanatory variable. Since natural gas fuels a substantial portion of the energy generated in PA, its commodity price can have a large effect on zonal electric energy prices. The model uses the Henry Hub Natural Gas Spot Price⁹ for this purpose. The specification for this model allows for a non-linear relationship between system loads and zonal LMPs. The SWE team considered several models to describe the relationship between system loads and real-time LMPs and settled on a cubic function, which was used to estimate electric energy DRIPE in New England.¹⁰ This type of regression model can capture the steeper increases in prices when loads are higher. The generation sources on the margins at higher system loads tend to be much more expensive than further down the supply curve. Therefore, increases to system load tend to increase prices at a faster rate.

Equation 3: Regression Specification Relating Hourly Zonal Electric Energy Prices to System Demand

$$LMP_{Zone} = \beta_0 + \beta_1 Load_{system} + \beta_2 Load_{system}^2 + \beta_3 Load_{system}^3 + \beta_4 Henry\ Hub\ Spot\ Price_{Natural\ Gas}$$

The next step in estimating the elasticity of price with respect to demand is to calculate the equation for the slope of price relative to system demand. The equation for this slope is shown in Equation 4. This equation for slope can be calculated by taking the derivative of Equation 3 with respect to system loads. This equation is used to calculate the instantaneous slope of price for a zone given a level of system demand.

⁹ See Henry Hub Natural Gas Price. <https://www.eia.gov/dnav/ng/hist/rngwhhdm.htm>

¹⁰ See Avoided Energy Supply Components in New England: 2024 Report. <https://www.synapse-energy.com/sites/default/files/AESC%202024.pdf> (page 232)

Equation 4: Slope of Price with Respect to System Demand

$$\text{Slope of Price} = \beta_1 + 2 * \beta_2 \text{Load}_{\text{system}} + 3 * \beta_3 \text{Load}_{\text{system}}^2$$

Using Equation 4, the SWE team calculated the slopes of price relative to system demand for each observation in the 2021-2023 dataset. The final step to calculate the elasticity of price with respect to quantity for each zone in each hour of the sample is shown in Equation 5.

Equation 5: Calculation of Elasticity

$$\text{Elasticity} = \frac{\text{Slope of price relative to system demand}_{\text{zone}}}{\text{Hourly Real - Time LMP}_{\text{zone}}} \times \text{Hourly Load}_{\text{system}}$$

The SWE team then took a simple average of the hourly elasticities in the sample to get to a single elasticity value for each load zone. This elasticity represents the percentage change in zonal energy prices per 1% change in system loads. Table 5 shows the estimated elasticity for each PA EDC/Rate District.

Table 5: Estimated Elasticity by EDC/Rate District

EDC/Rate District	Elasticity
PECO	1.81
PPL	2.07
Duquesne Light	1.82
FE: Met-Ed	2.51
FE: Penelec	1.79
FE: Penn Power	1.79
FE: West Penn Power	1.89

- Along with the elasticity estimates, the SWE team needed information on future prices and sales to estimate electric energy DRIPE. PJM produces a forecast of net energy by load zone in each year, which the SWE team used as estimates for future sales.¹¹ The SWE team also needed to make assumptions about the percentage of the load in any given year that transacts through the PJM market. At any given time, a portion of future energy sales are already under contract and will therefore not benefit from energy DRIPE. The portion of energy sales under contract that does not benefit from energy DRIPE is typically referred to as hedged load. The SWE team did not have visibility into the percentage of sales that are hedged in any given year in the PJM marketplace, so instead the SWE team used the assumptions made in the Avoided Energy Supply Components in New England: 2024 Report¹² as a proxy for hedged loads in a similar marketplace. Table 6 shows the

¹¹ See PJM 2024 Load Forecast Report Data. <https://www.pjm.com/-/media/library/reports-notice/load-forecast/2024-load-report-data.ashx>

¹² See Avoided Energy Supply Components in New England: 2024 Report. <https://www.synapse-energy.com/sites/default/files/AESC%202024.pdf> (page 239)

hedged load assumptions used by year. Since measures can be installed in any year of the upcoming phase, Year 1 would correspond to the year of measure installation.

Table 6: Hedged Load Assumptions

Year	Non-Hedged Load
Year 1	38%
Year 2	59%
Year 3	74%
Year 4	68%

The SWE team also needed estimates of the future price of energy in each zone to calculate the final electric energy DRIPE benefits. The avoided energy costs from each EDC/Rate Districts’ Phase IV EE&C Plan were used for this purpose.

- Finally, using the elasticity for each zone along with estimates of future energy costs and PJM estimates of future zonal load for 2027 – 2031, the SWE team estimated the electric energy DRIPE value on a \$/MWh basis for each zone. Table 7 shows the electric energy DRIPE estimate for each EDC/Rate District service territory for measures installed in PY18 (June 1, 2026, to May 31, 2027). Electric energy DRIPE values increase over the first three years for each EDC/Rate District as the amount of hedged energy decreases. This means that in each subsequent year, more energy can benefit from the lowered prices, and therefore the overall benefit increases. In the final year though, the benefit decreases as the market starts to move towards equilibrium and suppliers respond to the overall lower prices. The energy DRIPE estimates for Penn Power and West Penn Power use the ATSI and AP zones respectively as they do not have their own Locational Deliverability Area. The estimates of energy DRIPE shown in Table 7 include cross-zone benefits to the other PA EDC/Rate Districts. This means that the price benefits for all PA ratepayers are considered.

Table 7: Energy DRIPE Estimates PY18 (Nominal \$/MWh)

EDC/Rate District	Year 1	Year 2	Year 3	Year 4
PECO	\$14.65	\$24.23	\$31.97	\$30.62
PPL	\$14.72	\$24.39	\$32.25	\$30.98
Duquesne Light	\$14.69	\$24.28	\$32.00	\$30.64
FE: Met-Ed	\$13.86	\$22.45	\$29.02	\$27.27
FE: Penelec	\$14.79	\$24.53	\$32.47	\$31.20
FE: Penn Power	\$14.73	\$24.38	\$32.24	\$30.98
FE: West Penn Power	\$13.25	\$21.65	\$28.61	\$27.47

3.2 DISCUSSION AND SENSITIVITY ANALYSIS

Electric energy DRIPE benefits are assumed to last for four years just like the analogous capacity DRIPE benefits. The Avoided Energy Supply Components New England: 2024 Report calculates energy DRIPE over a ten-year horizon with the value gradually declining over time due to market

equilibrium changes. On the other hand, the Maryland EmPOWER program assumes that electric energy DRIPE benefits only last for four years. The SWE team chose to follow the more conservative approach to assume four years of benefits given the uncertainty associated with estimating the effects of these broad market dynamics.

To put the estimates of electric energy DRIPE in [Table 7](#) into context, [Table 8](#) shows the same sensitivity analysis performed for capacity DRIPE on the Non-Residential EE programs performed for electric energy DRIPE.

Table 8: Cost-Effectiveness Sensitivity Analysis – Non-Residential EE Programs – Electric Energy DRIPE

EDC/Rate District	TRC ratio w/o DRIPE	TRC ratio w/ DRIPE
PECO	0.88	1.06
PPL	2.31	2.63
Duquesne Light	2.49	2.93
FE: Met-Ed	1.34	1.55
FE: Penelec	1.41	1.65
FE: Penn Power	1.04	1.15
FE: West Penn Power	1.21	1.41

In each case, the TRC ratio increases with the inclusion of the electric energy DRIPE. The overall impact of electric energy DRIPE on each EDC/Rate District’s TRC ratio is higher than the inclusion of capacity DRIPE.

Both energy and capacity DRIPE represent real benefits to the PA EDC/Rate Districts from avoided energy and demand. Their inclusion in any cost-effectiveness tests provides a clearer picture of program impacts and cost-effectiveness. The SWE team recommends that the electric energy DRIPE values should be included in TRC tests during Phase V. [Section 4](#) contains tables with the recommended electric energy DRIPE values.

4

Section 4 Recommended DRIPE Values

This section details the recommended DRIPE values for both generation capacity and electric energy DRIPE. The DRIPE values are all calculated at the system level and presented in nominal dollars assuming a 2% inflation rate. For use in cost-effectiveness tests, any savings numbers calculated at the meter level should be scaled up for line losses.

There are limitations to the values shown below. For example, the capacity DRIPE estimates are all the same each year on a real dollar basis and only vary on a nominal basis. This is because the BRAs for generation capacity for Phase V years have not taken place as of the writing of this report; as a result, the SWE team used the average of the estimated values of generation capacity DRIPE from the three most recently completed BRA auctions (2022/2023, 2023/2024, and 2024/2025) as a proxy. The auctions for future years of capacity will have taken place by the time Phase V starts, but not before the publication of the 2026 TRC Test Tentative Order for Phase V. The electric energy DRIPE estimates for each EDC/Rate District also rely on past relationships between zonal energy prices and systems loads to hold several years into the future. Despite these limitations, the SWE believes that these estimates of DRIPE benefits are reasonable and should be included in Phase V TRC tests.

4.1 ELECTRIC CAPACITY DRIPE ESTIMATES (SYSTEM LEVEL)

Table 9: Capacity DRIPE Estimates (Nominal \$/kW-year): PECO

Start Year	Year 1	Year 2	Year 3	Year 4
PY18	\$67.54	\$68.89	\$70.26	\$71.67
PY19	\$68.89	\$70.26	\$71.67	\$73.10
PY20	\$70.26	\$71.67	\$73.10	\$74.56
PY21	\$71.67	\$73.10	\$74.56	\$76.06
PY22	\$73.10	\$74.56	\$76.06	\$77.58

Table 10: Capacity DRIPE Estimates (Nominal \$/kW-year): PPL

Start Year	Year 1	Year 2	Year 3	Year 4
PY18	\$78.36	\$79.92	\$81.52	\$83.15
PY19	\$79.92	\$81.52	\$83.15	\$84.82
PY20	\$81.52	\$83.15	\$84.82	\$86.51
PY21	\$83.15	\$84.82	\$86.51	\$88.24
PY22	\$84.82	\$86.51	\$88.24	\$90.01

Table 11: Capacity DRIPE Estimates (Nominal \$/kW-year): Duquesne Light

Start Year	Year 1	Year 2	Year 3	Year 4
PY18	\$25.04	\$25.54	\$26.05	\$26.57
PY19	\$25.54	\$26.05	\$26.57	\$27.10
PY20	\$26.05	\$26.57	\$27.10	\$27.64
PY21	\$26.57	\$27.10	\$27.64	\$28.20
PY22	\$27.10	\$27.64	\$28.20	\$28.76

Table 12: Capacity DRIPE Estimates (Nominal \$/kW-year): FE: Met-Ed

Start Year	Year 1	Year 2	Year 3	Year 4
PY18	\$78.36	\$79.92	\$81.52	\$83.15
PY19	\$79.92	\$81.52	\$83.15	\$84.82
PY20	\$81.52	\$83.15	\$84.82	\$86.51
PY21	\$83.15	\$84.82	\$86.51	\$88.24
PY22	\$84.82	\$86.51	\$88.24	\$90.01

Table 13: Capacity DRIPE Estimates (Nominal \$/kW-year): FE: Penelec

Start Year	Year 1	Year 2	Year 3	Year 4
PY18	\$78.36	\$79.92	\$81.52	\$83.15
PY19	\$79.92	\$81.52	\$83.15	\$84.82
PY20	\$81.52	\$83.15	\$84.82	\$86.51
PY21	\$83.15	\$84.82	\$86.51	\$88.24
PY22	\$84.82	\$86.51	\$88.24	\$90.01

Table 14: Capacity DRIPE Estimates (Nominal \$/kW-year): FE: Penn Power

Start Year	Year 1	Year 2	Year 3	Year 4
PY18	\$14.65	\$14.94	\$15.24	\$15.54
PY19	\$14.94	\$15.24	\$15.54	\$15.85
PY20	\$15.24	\$15.54	\$15.85	\$16.17
PY21	\$15.54	\$15.85	\$16.17	\$16.49
PY22	\$15.85	\$16.17	\$16.49	\$16.82

Table 15: Capacity DRIPE Estimates (Nominal \$/kW-year): FE: West Penn Power

Start Year	Year 1	Year 2	Year 3	Year 4
PY18	\$25.04	\$25.54	\$26.05	\$26.57
PY19	\$25.54	\$26.05	\$26.57	\$27.10
PY20	\$26.05	\$26.57	\$27.10	\$27.64
PY21	\$26.57	\$27.10	\$27.64	\$28.20
PY22	\$27.10	\$27.64	\$28.20	\$28.76

4.2 ELECTRIC ENERGY DRIPE ESTIMATES (SYSTEM LEVEL)

Table 16: Energy DRIPE Estimates (Nominal \$/MWh): PECO

Start Year	Year 1	Year 2	Year 3	Year 4
PY18	\$14.65	\$24.23	\$31.97	\$30.62
PY19	\$15.77	\$25.77	\$33.68	\$32.26
PY20	\$16.77	\$27.15	\$35.49	\$34.13
PY21	\$17.67	\$28.60	\$37.55	\$35.25
PY22	\$18.61	\$30.26	\$38.77	\$36.41

Table 17: Energy DRIPE Estimates (Nominal \$/MWh): PPL

Start Year	Year 1	Year 2	Year 3	Year 4
PY18	\$14.72	\$24.39	\$32.25	\$30.98
PY19	\$15.87	\$25.99	\$34.08	\$32.75
PY20	\$16.92	\$27.46	\$36.02	\$34.78
PY21	\$17.88	\$29.03	\$38.26	\$36.06
PY22	\$18.90	\$30.83	\$39.67	\$37.42

Table 18: Energy DRIPE Estimates (Nominal \$/MWh): Duquesne Light

Start Year	Year 1	Year 2	Year 3	Year 4
PY18	\$14.69	\$24.28	\$32.00	\$30.64
PY19	\$15.81	\$25.79	\$33.70	\$32.26
PY20	\$16.78	\$27.16	\$35.48	\$34.12
PY21	\$17.68	\$28.60	\$37.53	\$35.17
PY22	\$18.61	\$30.25	\$38.69	\$36.28

Table 19: Energy DRIPE Estimates (Nominal \$/MWh): FE: Met-Ed

Start Year	Year 1	Year 2	Year 3	Year 4
PY18	\$13.86	\$22.45	\$29.02	\$27.27
PY19	\$14.61	\$23.39	\$29.99	\$28.16
PY20	\$15.22	\$24.17	\$30.98	\$29.17
PY21	\$15.73	\$24.96	\$32.09	\$29.48
PY22	\$16.25	\$25.86	\$32.43	\$29.72

Table 20: Energy DRIPE Estimates (Nominal \$/MWh): FE: Penelec

Start Year	Year 1	Year 2	Year 3	Year 4
PY18	\$14.79	\$24.53	\$32.47	\$31.20
PY19	\$15.96	\$26.17	\$34.32	\$32.97
PY20	\$17.03	\$27.66	\$36.27	\$34.99
PY21	\$18.00	\$29.23	\$38.49	\$36.25
PY22	\$19.03	\$31.02	\$39.88	\$37.58

Table 21: Energy DRIPE Estimates (Nominal \$/MWh): FE: Penn Power

Start Year	Year 1	Year 2	Year 3	Year 4
PY18	\$14.73	\$24.38	\$32.24	\$30.98
PY19	\$15.87	\$25.98	\$34.08	\$32.77
PY20	\$16.91	\$27.46	\$36.05	\$34.83
PY21	\$17.87	\$29.05	\$38.31	\$36.14
PY22	\$18.91	\$30.88	\$39.75	\$37.50

Table 22: Energy DRIPE Estimates (Nominal \$/MWh): FE: West Penn Power

Start Year	Year 1	Year 2	Year 3	Year 4
PY18	\$13.25	\$21.65	\$28.61	\$27.47
PY19	\$14.09	\$23.06	\$30.21	\$29.06
PY20	\$15.01	\$24.35	\$31.97	\$30.90
PY21	\$15.85	\$25.76	\$34.00	\$32.09
PY22	\$16.77	\$27.40	\$35.31	\$33.36

Appendix A Supporting Tables

Table 23: Transmission Zone/Region of each PA EDC/Rate District

PJM Locational Deliverability Area	Short Name or Acronym	Regions / Areas			
		RTO	ATSI	Mid-Atlantic (MAAC)	East Mid-Atlantic (EMAAC)
Allegheny Power	APS or AP or FE South (includes West Penn Power)	X			
American Transmission Service Inc (FE)	ATSI (includes Penn Power)	X	X		
Duquesne Light	DUQ or DLCO	X			
Metropolitan Edison	Met Ed or ME	X		X	
PECO Energy	PECO or PE	X		X	X
Pennsylvania Electric	PENELEC or PN	X		X	
PPL Electric Utilities	PPL or PL	X		X	