

Application of Transource Pennsylvania, LLC for approval of the Siting and Construction of the 230 kV Transmission Line Associated with the Independence Energy Connection - East and West Projects in portions of York and Franklin Counties, Pennsylvania  
Docket Nos. A-2017-2640195 & A-2017-2640200

Petition of Transource Pennsylvania, LLC for a finding that a building to shelter control equipment at the Rice Substation in Franklin County, Pennsylvania is reasonably necessary for the convenience or welfare of the public  
Docket No. P-2018-3001878

Petition of Transource Pennsylvania, LLC for a finding that a building to shelter control equipment at the Furnace Run Substation in York County, Pennsylvania is reasonably necessary for the convenience or welfare of the public  
Docket No. P-2018-3001883

Application of Transource Pennsylvania, LLC for approval to acquire a certain portion of the lands of various landowners in York and Franklin Counties, Pennsylvania for the siting and construction of the 230 kV Transmission Line associated with the Independence Energy Connection – East and West Projects as necessary or proper for the service, accommodation, convenience or safety of the public  
Docket Nos. A-2018-3001881, *et al.*

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**BEFORE THE  
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

Application of Transource Pennsylvania, LLC  
for approval of the Siting and Construction of the  
230 kV Transmission Line Associated with the  
Independence Energy Connection - East and West Projects  
in portions of York and Franklin Counties, Pennsylvania.

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East and West Projects as necessary or proper for the service,  
accommodation, convenience or safety of the public.

A-2018-3001881,  
*et al.*

**TRANSOURCE PENNSYLVANIA, LLC  
SUPPLEMENTAL TESTIMONY OF  
BRIAN D. WEBER  
IN SUPPORT OF AMENDED APPLICATION  
TRANSOURCE PA STATEMENT NO. AA-1**

Date: January 29, 2020

1     **I. INTRODUCTION**

2     **Q. Please state your name and business address.**

3     A. My name is Brian D. Weber, and my primary office is located at 1 Riverside Plaza in  
4       Columbus, Ohio 43215.

5  
6     **Q. Have you previously provided testimony in this proceeding?**

7     A. Yes. On November 27, 2018, I submitted written rebuttal testimony. In my rebuttal  
8       testimony, I adopted the written direct testimony of witness Peggy Simmons, which  
9       was filed with Transource Pennsylvania, LLC's ("Transource PA") Application for  
10      approval of the Siting and Construction of the 230 kV Transmission Line Associated  
11      with the Independence Energy Connection - East and West Projects in portions of York  
12      and Franklin Counties, Pennsylvania on December 27, 2017. On February 11, 2019, I  
13      submitted written rejoinder testimony. I also testified at the evidentiary hearings in this  
14      case.

15  
16    **Q. Please describe the purpose of your supplemental testimony.**

17    A. In my supplemental testimony, I will provide an overview of the Amended Application,  
18       which is being submitted by Transource PA and PPL Electric Utilities Corporation  
19       ("PPL Electric") to propose an alternative configuration of the East Portion of the  
20       Independence Energy Connection ("IEC") Project ("Alternative IEC East Portion"). I  
21       will describe the alternative configuration for the East Portion of the IEC Project and  
22       explain why Transource PA and PPL Electric are filing the Amended Application to  
23       propose the Alternative IEC East Portion. My testimony also addresses the following

1 topics: the continued need for the IEC Project with the Alternative IEC East Portion, a  
2 description of the Transource-owned facilities, updated project costs, project  
3 maintenance, and agency coordination.

4

5 **Q. Are you sponsoring any exhibits with your supplemental testimony?**

6 A. Yes. Attached as TPA Exhibit BDW-AA1 is a chart outlining the costs of the  
7 Alternative IEC East Portion of the IEC Project.

8

9 **II. AMENDED APPLICATION**

10 **Q. Please describe the Supplemental Attachments being filed with the Amended**  
11 **Application.**

12 A. The Supplemental Attachments to the Amended Application include the following:

- 13 • Supplemental Attachment 1: Commission Regulation Cross-Reference  
14 Matrix
- 15
- 16 • Supplemental Attachment 2: Necessity Statement
- 17 • Supplemental Attachment 3: Supplemental Siting Analysis
- 18 • Supplemental Attachment 4: Engineering Description
- 19 • Supplemental Attachment 5: List of Property Owners within the Right-of-  
20 Way
- 21
- 22 • Supplemental Attachment 6: Agency Requirements
- 23 • Supplemental Attachment 7: List of Governmental Agencies, Municipalities,  
24 and Other Public Entities Receiving the Amended Application
- 25
- 26 • Supplemental Attachment 8: List of Governmental Agencies, Municipalities,  
27 and Other Public Entities Contacted

- Supplemental Attachment 9: List of Public Locations where the Amended Application can be Viewed by the Public
- Supplemental Attachment 10: Design Criteria and Safety
- Supplemental Attachment 11: Vegetation Management
- Supplemental Attachment 12: Agency Coordination
- Supplemental Attachment 13: Public Notice Requirements

**Q. Please list Transource PA's other witnesses who are submitting testimony in support of the Amended Application and the topics they will address.**

A. Transource PA is submitting supplemental testimony in support of the Amended Application for the following witnesses:

- **Steven R. Herling** – Mr. Herling, former PJM Vice President of Planning and current Executive Consultant at PJM, will address PJM support for the Amended Application, provide an update on the benefits and cost analysis for the IEC Project, and address the ability of the Alternative IEC East Portion of the IEC Project to meet PJM's regional transmission planning needs.
- **Timothy J. Horger** – Mr. Horger, PJM's Director of Energy Market Operations will address PJM's recent market efficiency analyses of the IEC Project, including the Alternative IEC East Portion.

PPL Electric witness Mr. Grossman provides an overview of the PPL Electric witnesses submitting testimony in support of the Amended Application.

1     **Q.   Please provide a summary of why Transource PA and PPL Electric are filing the**  
2     **Amended Application to propose the Alterative IEC East Portion.**

3     A.   Transource PA has worked diligently throughout this regulatory process to address the  
4     concerns raised by parties and other stakeholders in Pennsylvania and Maryland<sup>1</sup> for  
5     the siting of the IEC Project.<sup>2</sup> Beginning with the initial siting process, Transource has  
6     worked collaboratively with interested parties to mitigate the environmental and  
7     socioeconomic impacts of the IEC Project. This collaboration did not stop with the  
8     filing of the Application, but rather has continued.

9             In September 2018, a party to the Maryland proceeding, the Power Plant Research  
10     Program (“PPRP”), asked Transource to evaluate a number of conceptual alternatives  
11     to the IEC East route that would utilize existing transmission infrastructure.  
12     Specifically, PPRP proposed that Transource and PJM evaluate the viability of a  
13     number of different configurations for the IEC East route using existing transmission  
14     corridors that currently contain transmission facilities owned and operated by PPL  
15     Electric in Pennsylvania and Baltimore Gas & Electric (“BGE”) in Maryland.  
16     Transource worked diligently to engage PJM in conducting detailed reliability and  
17     market efficiency studies to evaluate the configurations proposed by PPRP. Although  
18     PJM’s analysis indicated that certain NERC criteria reliability violations would result if

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<sup>1</sup>     On December 27, 2017, Transource also filed an Application before the Maryland Public Service Commission (“MD PSC”) requesting approval for the portion of the IEC Project located in portions of Harford and Washington Counties, Maryland. The Application was docketed at Case No. 9471.

<sup>2</sup>     The Alternative IEC East Portion is more fully described in Appendix A to the settlement agreements that were filed with Commission on October 17, 2019. The IEC Project is a major component of the broader project identified by PJM as “Project 9A.” Project 9A also includes upgrades at existing transmission facilities in Pennsylvania and Maryland, which are the responsibility of other incumbent entities. The upgrades to existing facilities, while not part of the IEC Project, are inter-dependent components of the solution approved by PJM, and are described in more detail in the testimony of Mr. Ali (Transource PA Statement No. 2), submitted with Transource PA’s December 27, 2017 Siting Application.

1 PPRP's initially proposed routes were used, Transource and PJM nevertheless  
2 determined that one of the conceptual alternatives could be modified to alleviate these  
3 NERC reliability violations. Specifically, Transource and PJM modified one of these  
4 conceptual alternatives by proposing to add a third transformer to Furnace Run Station.  
5 By doing so, this alternative to the IEC East route, which at the time was referred to as  
6 "Conceptual Alternative 3A," passed both the reliability tests as well as PJM's market  
7 efficiency tests.

8 Through discussions with the parties, Transource executed settlement agreements  
9 with PPL Electric, York County Planning Commission, and Citizens to Stop  
10 Transource York County, Maple Lawn Farms, Barron Shaw and Show Orchards (the  
11 latter four collectively, "York County Citizens") to propose Conceptual Alternative 3A  
12 or the "Alternative IEC East Portion" in an Amended Application. On October 17,  
13 2019, Transource filed the settlement agreements with the Pennsylvania Public Utility  
14 Commission ("PA PUC").<sup>3</sup>

15 The Amended Application presents the PA PUC with the Alternative IEC East  
16 Portion of the IEC Project. The Alternative IEC East Portion addresses the siting  
17 concerns raised by interested parties regarding the initially proposed route for the IEC  
18 East portion of the Project. Specifically, the Alternative IEC East Portion incorporates  
19 the use of existing transmission infrastructure and corridors, while still addressing the  
20 congestion that continues to persist. As explained in the supplemental testimony of Mr.  
21 Herling, PJM's most recent analysis shows that the benefit-to-cost ratio for the IEC

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<sup>3</sup> In the Maryland proceeding, Transource executed settlement agreements with BGE, PPRP, the Maryland Public Service Commission Technical Staff, and Harford County. These settlement agreements were filed with the MD PSC on October 17, 2018.

1 Project with the Alternative IEC East Portion has risen to a value of 1.66 using the  
2 Companies' updated cost estimates (up from an initial range of 1.39 – 1.52, as outlined  
3 in witness Horger's supplemental testimony submitted on May 14, 2019). *See*  
4 Transource PA Statement No. AA-2. This 1.66 figure is substantially above the  
5 required 1.25 ratio for market efficiency projects. As a result, the Amended  
6 Application provides for the construction of transmission enhancements that will  
7 provide hundreds of millions of dollars of benefits for customers in the PJM region and  
8 also addresses significant emerging reliability issues identified to occur in the near  
9 future.

10

11 **Q. Has the Alternative IEC East Portion proposed in the Amended Application**  
12 **changed from the Conceptual Alternative 3A previously studied?**

13 A. No. Transource PA has simply worked to verify the scope, cost and schedule to  
14 implement this alternative route.

15

16 **Q. What does Transource propose if the PA PUC or MD PSC does not approve the**  
17 **IEC Project as reconfigured by the Alternative East Portion?**

18 A. If the PA PUC or MD PSC does not approve the IEC Project as reconfigured by the  
19 Alternative East Portion and the proceedings continue, Transource PA reserves its right  
20 to pursue the IEC Project as initially proposed in Transource PA's Application.

21



**Alternative IEC East Portion**

**Q. Please describe the Alternative East Portion of the IEC Project.**

A. The Alternative East Portion of the IEC Project consists of cutting in the existing 230 kV circuits from Otter-Creek to Conastone and Manor to Graceton to the new Furnace Run substation and adding 230 kV circuits from Furnace Run to Conastone and Furnace Run to Graceton utilizing PPL Electric's existing towers and circuits to the extent possible. The Alternative East Portion also adds a 500 kV to 230 kV transformer and associated equipment at the Furnace Run substation. A detailed engineering description of the Alternative East Portion of the IEC Project is provided in Supplemental Attachment 4 to the Amended Application.

**Q. If the IEC Project with the Alternative East Portion is approved by the PA PUC and the MD PSC, what transmission facilities will Transource PA own or operate in Pennsylvania related to the IEC East portion of the Project?**

A. Transource PA will construct, own and operate the Furnace Run Substation. PPL Electric will construct, own and operate the reconfigured 230 kV lines that are located in Pennsylvania. Transource PA will also construct, own and operate all portions of the IEC West Project that are located in Pennsylvania. BGE will be responsible for a portion of the IEC Project located in Maryland.

**Q. Does Transource PA believe that the Alternative IEC East Portion of the IEC Project, as proposed in the Amended Application, will address PJM's regional transmission planning needs?**

1 A. Yes. As the PA PUC has previously heard from Transource witnesses Herling, Horgner,  
2 Ali, and Cawley, addressing congestion costs through market efficiency projects is  
3 necessary to ensure a properly-functioning—and fair—electricity market, upon which  
4 all customers in the PJM region benefit from and rely upon to provide reliable and  
5 economical supply. Transource, in conjunction with PPL Electric and PJM, have  
6 conducted substantial analysis of the Alternative IEC East Portion as proposed in the  
7 Amended Application, and have confirmed that this alternative would continue to meet  
8 PJM's regional transmission planning criteria. The Alternative IEC East Portion would  
9 still address the congestion on the AP South and related constraints within the needed  
10 timeframe. Additionally, the Alternative IEC East Portion would still also resolve the  
11 emerging reliability issues on the transmission system in southern Pennsylvania and  
12 northern Maryland that Project 9A has been projected to resolve, while passing the high  
13 bar of the benefit-to-cost ratio of 1.25 required by the PJM planning process.

14 As the PA PUC previously heard from these witnesses, the consequence of not  
15 approving the IEC Project would be that customers in the PJM region would continue  
16 to be plagued by economic congestion on the transmission system, as well as the  
17 adverse impact of emerging reliability violations.

18  
19 **Q. Has PJM approved the IEC Project with the Alternative East Portion as provided**  
20 **for in the Amended Application?**

21 A. Yes. As discussed in more detail by witness Herling, the PJM Board has approved the  
22 IEC Project with the Alternative IEC East Portion, subject to the PA PUC's and the  
23 MD PSC's approval of the Project, and subject to written confirmation from Transource

1 that the Scope of Work set forth in the Designated Entity Agreement will be revised to  
2 reflect the configuration of the IEC Project with the Alternative IEC East Portion.  
3 Based upon PJM's review of the Alternative IEC East Portion, the IEC Project, as  
4 provided for in the Amended Application, would continue to meet PJM's planning  
5 criteria. Upon approval of the IEC Project with the Alternative East Portion by the PA  
6 PUC and MD PSC, PJM would take necessary action to implement the IEC Project,  
7 through an amendment to Transource's Designated Entity Agreement and by  
8 designating BGE and PPL Electric as the local incumbent utilities responsible for  
9 constructing and operating each of those Companies' portions of the IEC Project.  
10

11 **Q. Can the IEC Project as proposed in the Amended Application be constructed in**  
12 **time to meet PJM's planning needs?**

13 A. Yes. Transource PA, PPL Electric and BGE anticipate beginning construction  
14 activities in the second quarter of 2020 in the event the PA PUC and MD PSC  
15 approvals are obtained by that time. The Companies have already begun working with  
16 PJM to coordinate and schedule outage time on the lines being upgraded to ensure that  
17 construction activities may proceed in a timely fashion. Transource PA and PPL  
18 Electric anticipate that construction will take approximately 20 months, therefore, PJM  
19 has not raised any concerns regarding a need to extend the in-service date for the  
20 Alternative IEC East Portion of the Project to February 2022. The IEC West Portion of  
21 the Project is expected to be in service in May 2021.  
22

1     **Q. Have the estimated costs of the Alternative IEC East Portion of the IEC East**  
2     **Project been verified?**

3     A. Yes. Since the time of the evidentiary hearing held in this matter, Transource, PPL  
4     Electric and BGE have worked cooperatively to verify the estimated costs for  
5     construction of the Alternative IEC East Portion of the IEC Project. The companies  
6     estimate the total cost for constructing this alternative to be approximately \$196  
7     million. *See* TPA Exhibit BDW-AA1.

8  
9     **Q. What is the status of negotiations with landowners to expand the existing right-of-**  
10    **way for the Alternative East Portion?**

11    A. As stated by PPL Electric witness Weseloh, no condemnation applications are necessary  
12    for the Alternative IEC East Portion because PPL Electric was able to acquire all  
13    necessary rights from landowners for the Furnace Run corridors prior to the submission  
14    of the Amended Application. *See* PPL Electric Statement No. AA-4.

15  
16                                    **IEC West Portion**

17    **Q. Does the Amended Application modify the West Portion of the IEC Project in any**  
18    **way?**

19    A. No. The West Portion of the IEC Project is not modified by the Amended Application,  
20    and the Amended Application provides for the West Portion of the IEC Project to be  
21    constructed as originally sited.

1     **Q. Has Transource PA reached agreements with additional landowners on the IEC**  
2     **West Route?**

3     A. Yes. As of January 24, 2020, Transource has successfully negotiated and secured  
4     additional Option to Purchase Easement agreements with 65% of landowners on the  
5     IEC West Portion.

6  
7     **III. CONCLUSION**

8     **Q. Please summarize why the PA PUC should approve the Amended Application.**

9     A. Transource is pleased to have worked with stakeholders in Maryland and Pennsylvania  
10    to reach a workable compromise to their concerns that not only maximizes the use of  
11    existing transmission infrastructure thereby reducing potential social and environmental  
12    impacts, but that also addresses the substantial market congestion and reliability issues  
13    that PJM is seeking to resolve. As a result of siting the Alternative IEC East Portion of  
14    the Project to be within existing transmission corridors, the IEC Project reduces its  
15    reliance on greenfield construction and reduces its environmental and socioeconomic  
16    footprint. With the IEC Project as modified by the Alternative IEC East Portion,  
17    Project 9A will deliver significant market efficiency benefits, while also achieving  
18    tangible reliability benefits.

19  
20    **Q. Does this conclude your supplemental testimony?**

21    A. Yes, it does.

### Alternative IEC East Portion Cost Summary

<b>Transource Costs</b>	\$125.9 M <sup>1</sup>
<ul style="list-style-type: none"> <li>• Furnace Run – Conastone 230kV double circuit line</li> <li>• Furnace Run Station as a 500kV GIS / 230kV station Air Insulated                             <ul style="list-style-type: none"> <li>○ 500kV GIS- Insulated                                     <ul style="list-style-type: none"> <li>▪ (8) 500kV circuit breakers</li> <li>▪ (3) 500/230kV transformers</li> </ul> </li> <li>○ 230kV                                     <ul style="list-style-type: none"> <li>▪ (14) circuit breakers to terminate 6 circuits</li> <li>▪ (3) 500/230kV transformers</li> </ul> </li> </ul> </li> </ul>	
<b>PPL Costs</b>	\$37 M <sup>2</sup>
<ul style="list-style-type: none"> <li>• Line upgrades                             <ul style="list-style-type: none"> <li>○ Add 2nd Circuit, Furnace Run – Conastone</li> <li>○ Add 2nd Circuit, Furnace Run – Graceton</li> </ul> </li> <li>• New Transmission                             <ul style="list-style-type: none"> <li>○ New double circuit, Furnace Run – Conastone 1 &amp; 2</li> <li>○ New double circuit, Furnace Run – Graceton 1 &amp; 2</li> <li>○ New single circuit, Furnace Run – Manor</li> <li>○ New single circuit, Furnace Run – Otter Creek</li> </ul> </li> </ul>	
<b>BGE Costs</b>	\$32.8 M <sup>3</sup>
<ul style="list-style-type: none"> <li>• Line upgrades                             <ul style="list-style-type: none"> <li>○ Add 2nd Circuit, Furnace Run – Conastone</li> <li>○ Rebuild Furnace Run – Manor</li> </ul> </li> <li>• Station upgrades                             <ul style="list-style-type: none"> <li>○ New circuit breaker Conastone</li> <li>○ New circuit breaker Graceton</li> </ul> </li> </ul>	
<b>Total</b>	\$195.7 M

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<sup>1</sup> Includes 2% contingency.

<sup>2</sup> Includes approximately \$3M contingency.

<sup>3</sup> Includes 10% contingency.

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PENNSYLVANIA PUBLIC UTILITY COMMISSION**

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**TRANSOURCE PENNSYLVANIA, LLC  
SUPPLEMENTAL TESTIMONY OF  
STEVEN R. HERLING  
IN SUPPORT OF AMENDED APPLICATION  
TRANSOURCE PA STATEMENT NO. AA-2**

Date: January 29, 2020

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**I. INTRODUCTION**

**Q. Please state your name and business address.**

A. My name is Steven R. Herling. I am the former Vice President of Planning for PJM Interconnection, LLC (“PJM”) and I am currently an Executive Consultant at PJM. My business address is 2750 Monroe Boulevard, Audubon, Pennsylvania 19403.

**Q. Have you previously provided testimony in this proceeding?**

A. Yes. I submitted rebuttal testimony on November 27, 2018 and rejoinder testimony on February 11, 2019. In my rebuttal testimony, I adopted portions of the direct testimony of Paul McGlynn. On May 14, 2019, I submitted supplemental testimony. I also testified at the evidentiary hearing held in this matter.

**Q. Please describe the purpose of your supplemental testimony.**

A. I am submitting testimony on behalf of Transource Pennsylvania, LLC (“Transource”) in support of the Amended Application. In my supplemental testimony, I will explain PJM’s intention to take necessary steps to implement the IEC Project, inclusive of the alternative routing of the eastern portion of the IEC Project (“Alternative IEC East Portion”), if approved by the Pennsylvania Public Utility Commission (“PA PUC”) and Maryland Public Service Commission (“MD PSC”) and explain PJM’s authority to do so. Also, I will confirm that the entire IEC Project, inclusive of the Alterantive IEC East Portion,<sup>1</sup> as described in the Amended Application would continue to meet PJM’s

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<sup>1</sup> The Alternative IEC East Portion is more fully described in Appendix A to the settlement agreements that were filed with Commission on October 17, 2019. The IEC Project is a major component of the broader project identified



1 long-term regional transmission planning needs which, among other issues, includes  
2 PJM's FERC mandate to address persistent economic congestion adversely impacting  
3 PJM's regional transmission system.  
4

5 **Q. Are you sponsoring any exhibits with your supplemental testimony?**

6 A. Yes. I am sponsoring the following exhibits:

- 7 • TPA Exhibit SRH-AA1: December 4, 2019 PJM Board Resolution
  - 8 • TPA Exhibit SRH-AA2: PJM Whitepaper, December 2019 Baseline Market
  - 9 Efficiency Recommendations (Dec. 3, 2019)
- 10

11 **II. PJM SUPPORTS THE IEC PROJECT INCLUSIVE OF THE ALTERNATIVE**  
12 **IEC EAST PORTION**  
13

14 **Q. Has PJM reviewed the Amended Application and its description of the Alternative**  
15 **IEC East Portion of the IEC Project?**

16 A. Yes. The Alternative IEC East Portion of the IEC Project is essentially the same  
17 configuration that was described and set forth in my May 14, 2019 supplemental  
18 testimony, Statement No. 7-SUPP. as "Conceptual Alternative 3A."  
19

20 **Q. Has the IEC Project inclusive of the Alternative IEC East Portion been presented**  
21 **to stakeholders and the PJM Board?**

22 A. Yes. In November 2019, the Alternative IEC East Portion of the IEC Project was  
23 presented during a Transmission Expansion Advisory Committee ("TEAC") meeting  
24 for informational purposes to inform stakeholders and market participants of the

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by PJM as "Project 9A." Project 9A also includes upgrades at existing transmission facilities in Pennsylvania and Maryland, which are the responsibility of other incumbent entities. The upgrades to existing facilities, while not part of the IEC Project, are inter-dependent components of the solution approved by PJM.

1 modifications. *See* TPA Ex. TJH-AA1. Thereafter, the IEC Project inclusive of the  
2 Alternative IEC East Portion was presented to the PJM Board for its consideration.  
3 The Alternative IEC East Portion of the IEC Project was also described in detail in a  
4 Whitepaper submitted by PJM to the PJM Board on December 3, 2019 (at pages 8-9)  
5 and is attached to my testimony as TPA Ex. SRH-AA2.

6  
7 **Q. What is PJM's position on the Alternative IEC East Portion of the IEC Project as**  
8 **presented in the Amended Application?**

9 A. The PJM Board reviewed and approved for inclusion in the Regional Transmission  
10 Expansion Plan ("RTEP") the IEC Project inclusive of the Alternative IEC East  
11 Portion, subject to the PA PUC's and MD PSC's approval, and subject to written  
12 confirmation from Transource that the Scope of Work set forth in the Designated Entity  
13 Agreement will be revised to reflect the configuration of the IEC Project with the  
14 Alternative IEC East Portion. *See* TPA Ex. SRH-AA1 (Dec. 4, 2019 PJM Board  
15 Resolution).

16  
17 **Q. If the Amended Application is approved by the PA PUC and MD PSC, would**  
18 **PJM take action to implement the Alternative IEC East Portion of the IEC**  
19 **Project?**

20 A. Yes. If the IEC Project with the Alternative East Portion is approved by the PA PUC  
21 and MD PSC, PJM will take the steps necessary to implement the project consistent  
22 with the state commission's orders.

1     **Q. Does PJM’s planning process allow for modifications to PJM-approved projects?**

2     A. Yes. PJM respects the states’ roles in the siting process. If a state regulatory authority,  
3     such as the PA PUC, requires an alternative route of a project, PJM will accommodate  
4     the alternative route so long as it comports with PJM’s RTEP process as set forth in  
5     Schedule 6 of the Amended and Restated Operating Agreement of PJM  
6     Interconnection, LLC and the *pro forma* designated entity agreement as set forth in  
7     PJM’s Open Access Transmission Tariff, Attachment KK. These documents  
8     contemplate the fact that projects approved through PJM’s RTEP process may need to  
9     be modified from time to time, including to comply with state regulatory approvals.  
10    For example, Schedule 6, § 1.7 of PJM’s Operating Agreement acknowledges that a  
11    designated entity’s obligation to construct PJM-approved upgrades is “[s]ubject to the  
12    requirements of applicable law, government regulations and approvals, including,  
13    without limitation, requirements to obtain necessary state or local siting, construction  
14    and operating permits.”

15         Further, under the terms of Transource’s Designated Entity Agreement with PJM (§  
16    4.3.0), modifications may be made to Transource’s scope of work where such a  
17    modification is directed by the PA PUC and accords with PJM’s planning process.  
18    More specifically, § 4.3.0 of the Designated Entity Agreement provides that “[t]he  
19    Scope of Work and Development Schedule, including the milestones therein, may be  
20    revised, as required, in accordance with Transmission Provider’s project modification  
21    process set forth in the PJM Manuals, or otherwise by Transmission Provider in  
22    writing.” Section 6.1.3.3 of PJM Manual 14C further contemplates a non-exhaustive  
23    list of “typical situations” under which the Designated Entity may initiate the project

1 modification process. This non-exhaustive list of scenarios includes where there is a  
2 “[s]ignificant routing change from what has been proposed”, or there are “[a]djustments  
3 to where a line terminates within a substation”, or there are “[s]ignificant electrical  
4 parameter changes[.]” The PA PUC may direct such modifications.

5 Indeed, Project 9A has already been modified several times to accommodate  
6 changes in the proposed conductors and changes to the in-service date. Those changes  
7 were memorialized as amendments to Transource’s Designated Entity Agreement.  
8 PJM also updated the modified specifications for Project 9A in PJM’s RTEP for  
9 planning and interconnection modeling purposes.

10  
11 **Q. If the PA PUC approves the IEC Project inclusive of the Alternative IEC East**  
12 **Portion, as proposed in the Amended Application, what action would PJM take to**  
13 **implement the Project?**

14 A. First, PJM would update the RTEP to reflect the modifications to the Project. PJM’s  
15 Operating Agreement provides that the Transmission Owner is required to be the  
16 Designated Entity for a project to be located on a Transmission Owner’s existing right  
17 of way if the project would alter the Transmission Owner’s use and control of its  
18 existing right of way under state law. *See* Schedule 6, Section 1.5.8(a)(iv). In addition,  
19 under the Consolidated Transmission Owners Agreement, the Transmission Owners in  
20 PJM have agreed to expand or modify their transmission facilities if directed to do so  
21 by PJM. Because portions of the Alternative IEC East Portion of the IEC Project  
22 would be constructed within PPL Electric’s and BGE’s existing right of way, if the PA  
23 PUC approves the IEC Project as proposed in the Amended Application, PJM would

1 direct the incumbent Transmission Owners (PPL Electric in Pennsylvania and BGE in  
2 Maryland) to construct the project facilities on their respective rights of way.

3 Lastly, if the IEC Project inclusive of the proposed Alternative IEC Portion is  
4 approved by the PA PUC and MD PSC, Transource's Designated Entity Agreement  
5 will be amended to reflect the alternative scope of Transource's work.

6

7 **Q. Does PJM have experience incorporating alternative configurations into PJM**  
8 **Board-approved projects as a result of state regulatory settlements?**

9 A. Yes, there are a number of examples of projects undergoing reconfigurations during  
10 state regulatory processes after they have been approved by PJM, which were then  
11 integrated into the RTEP under the project's alternative configuration. If a state  
12 regulatory authority, such as the PA PUC, requires an alternative configuration, PJM  
13 will accommodate the alternative configuration so long as it still addresses the needs  
14 for which the original project was approved and satisfies all other requirements set  
15 forth in the PJM governing documents. For example, in West Virginia, Transource  
16 West Virginia, LLC ("Transource WV") was the Designated Entity to construct new  
17 transmission lines and switching stations in West Virginia, referred to as the "Thorofare  
18 Project." During the course of the West Virginia Public Service Commission's review  
19 of the Thorofare Project, Transource WV reached a settlement with parties to the case  
20 that involved expanding the scope of the project and modifying the route of the new  
21 transmission lines. After the West Virginia Public Service Commission approved the  
22 settlement, PJM took necessary steps (similar to those described above) to update the  
23 RTEP to reflect the modifications to the project.

1 **III. THE PROJECT INCLUSIVE OF THE ALTERNATIVE IEC EAST PORTION**  
2 **CONTINUES TO RESULT IN AN OVERALL PROJECT THAT BENEFITS THE**  
3 **SYSTEM**  
4

5 **Q. Has PJM determined whether the Alternative IEC East Portion that is the subject**  
6 **of the Amended Application would continue to meet PJM's planning criteria**  
7 **needs?**

8 A. Yes. As I mentioned above, the Amended Application incorporates a version of the  
9 Alternative IEC East Portion that was previously studied and analyzed by PJM, then-  
10 known as "Conceptual Alternative 3A." The results of PJM's analysis of the IEC  
11 Project inclusive of the Alternative IEC East Portion, which were provided to PA PUC  
12 in my May 14, 2019 supplemental testimony and the May 14, 2019 supplemental  
13 testimony of witness Timothy Horger, demonstrated that the IEC Project inclusive of  
14 the Alternative IEC East Portion would continue to meet PJM's long-term planning  
15 needs by addressing the persistent congestion on the AP South reactive interface and  
16 related constraints. *See also* Supplemental Testimony of Timothy J. Horger, St. No.  
17 AA-3, at pp. 2-4.

18 In addition, on November 14, 2019, PJM published the results of its most recent  
19 evaluation of the IEC Project inclusive of the Alternative IEC East Portion. This  
20 analysis – performed in a manner consistent with all prior evaluations of the IEC  
21 Project and using PJM's most up-to-date market efficiency and reliability base case –  
22 concluded that the project has a benefit-to-cost ratio of up to 1.66, using the companies'  
23 cost estimates. *See* TPA Exhibit SRH-AA2.

1     **Q. As originally proposed, the IEC Project would prevent certain reliability problems**  
2     **from occurring elsewhere on the transmission system in PJM. Does the IEC**  
3     **Project inclusive of the Alternative East Portion as described in the Amended**  
4     **Application allow the IEC Project to continue to provide such reliability benefits?**

5     A. Yes. The IEC Project inclusive of the Alternative IEC East Portion as described in the  
6     Amended Application would also resolve the emerging reliability criteria violations  
7     that I identified on pages 20-22 of my rebuttal testimony. See Transource PA  
8     Statement No. 7-R, pp. 20-22. In the December 3, 2019 Whitepaper (TPA Ex. SRH-  
9     AA-2), PJM indicated to the PJM Board that “if Alternative Project 9A were to be  
10    removed from further consideration, PJM’s RTEP analysis has previously identified a  
11    number of reliability criteria violations starting in the 2023 study year,” including  
12    “conductor overloads on 500 kV transmission lines which, in PJM’s experience, are  
13    likely to be resolved only through the construction of additional greenfield  
14    transmission.” See TPA Ex. SRH-AA2 (PJM Whitepaper, December 2019 Baseline  
15    Market Efficiency recommendations (Dec. 3, 2019) at 7).

16  
17 **IV. CONCLUSION**

18  
19     **Q. Does this conclude your supplemental testimony?**

20     A. Yes.



Resolution for the Meeting of the PJM Board of Managers

December 4, 2019

IEC Project inclusive of the Alternative IEC East Portion (Alternative Project 9A)

WHEREAS, Amended and Restated Operating Agreement of PJM Interconnection, L.L.C., Schedule 6, section 1.6(a) provides that the PJM Board of Managers is responsible for approving changes to the Regional Transmission Expansion Plan (RTEP);

WHEREAS, in August 2016, the PJM Board of Managers approved for inclusion in the RTEP baseline project b2743/2752 known as the Independence Energy Connection (IEC) Project (Project 9A) submitted in the 2014/2015 RTEP Long-Term Proposal Window;

WHEREAS, re-evaluations of Project 9A reaffirm PJM's recommendation that Project 9A remain in the RTEP;

WHEREAS, in the ongoing siting proceedings in Pennsylvania and Maryland, several of the parties have filed a settlement that, if approved, would not alter the western segment of Project 9A as approved by the PJM Board of Managers, but offers an alternative configuration of the eastern portion of Project 9A (the Alternative IEC East Portion) – the IEC Project inclusive of the Alternative IEC East Portion is hereinafter referred to as Alternative Project 9A;

WHEREAS, PJM has demonstrated in its RTEP analyses that Alternative Project 9A exceeds the Benefit/Cost Ratio threshold of 1.25:1;

WHEREAS, the PJM Board of Managers has reviewed and considered (i) the RTEP materials developed by PJM in consultation with the Transmission Expansion Advisory Committee and (ii) PJM's recommendation that the PJM Board of Managers approve Alternative Project 9A subject to the Maryland Public Service Commission's and Pennsylvania Public Utility Commission's approval of the pending settlement; and

WHEREAS, the PJM Board of Managers has reviewed and considered the recommendation provided to the Board Reliability Committee of the PJM Board of Managers;

NOW, THEREFORE, BE IT RESOLVED, that the PJM Board of Managers hereby approves Alternative Project 9A subject to the Maryland Public Service Commission's and the Pennsylvania Public Utility Commission's approval of the Alternative Project 9A through their respective Certificate of Public Convenience and Necessity proceedings, and written confirmation from Transource Energy, LLC (for itself and on behalf of Transource Maryland, LLC and Transource Pennsylvania, LLC) that the Scope of Work set forth in the Designated Entity Agreement will be revised to reflect the configuration of Alternative Project 9A (which is the western segment of Project 9A as previously approved by the PJM Board of Managers with an alternative configuration of the eastern portion of Project 9A).





# December 2019 Baseline Market Efficiency Recommendations

**TEAC**

Dec. 3, 2019

For Public Use

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## Summary

PJM is making several baseline market efficiency recommendations based on two recent bodies of Regional Transmission Expansion Plan (RTEP) analyses that addressed the following:

1. 2018/2019 RTEP Long-Term Window Proposals
2. South-Central Pennsylvania and Northern Maryland (inclusive of the AP South Interface and related constraints) congestion relief

With respect to the first body of RTEP analyses, the 2018/2019 RTEP Long-Term Window yielded two market efficiency proposals evaluated by PJM that warrant recommendation to the PJM Board to alleviate congestion. The first recommendation is baseline project b3142, a PJM-MISO interregional project to rebuild the Michigan City-Trail Creek-Bosserman 138 kV transmission line. The second PJM recommendation is baseline project b3145 to rebuild the Hunterstown-Lincoln 115 kV line.

With respect to the second body of RTEP analyses – which includes additional RTEP analyses subsequent to the Transmission Expansion Advisory Committee's Nov. 14, 2019 review and comment – PJM has reviewed market efficiency projects that address congestion drivers in South-Central Pennsylvania and Northern Maryland.

More specifically, PJM's RTEP analyses reviewed:

- The Board-approved baseline project b2743/2752 known as the Independence Energy Connection (IEC) Project (Project 9A) submitted in the 2014/2015 RTEP Long-Term Proposal Window
- The Board-approved baseline project b2992 in the Bagley/Graceton area of BGE (Project 5E) submitted in the 2016/2017 RTEP Long-Term Proposal Window
- The baseline project b3145 to rebuild the Hunterstown-Lincoln 115 kV line (Project H-L), noted above, submitted in the 2018/2019 RTEP Long-Term Proposal Window, which PJM recommends to the Board for inclusion in the RTEP.

Additionally, in the ongoing siting proceedings in Pennsylvania and Maryland, several of the parties have filed a settlement that, if approved, would not alter the western segment of Project 9A as approved by the Board, but offers an alternative configuration of the eastern portion of Project 9A (the Alternative IEC East Portion). In light of this development, PJM's RTEP analyses have also considered:

- The IEC Project inclusive of the Alternative IEC East Portion, (Alternative Project 9A)
- Project 5E (which is already in the RTEP)
- Project H-L (which PJM is recommending to the Board for inclusion in the RTEP)

As discussed in greater detail below, PJM's analyses have determined that in the combinations set forth above, these projects exceed the benefit/cost ratio of 1.25, significantly reduce congestion in South-Central Pennsylvania and Northern Maryland, and solve reliability criteria violations identified in study year 2023 that PJM found to otherwise arise with certain of these projects removed from the base case.

Each of PJM's recommendations is now presented in more detail.

## 2018/2019 RTEP Long-Term Proposal Window Activity

PJM opened its third Long Term proposal window starting on November 2, 2018 through March 15, 2019 to solicit proposals addressing the identified congestion drivers shown in Table 1.

Market efficiency analysis is a part of the overall RTEP process to accomplish the following objectives:

1. Determine which reliability upgrades, if any, have an economic benefit if accelerated or modified.
2. Identify new transmission upgrades that may result in economic benefits.
3. Identify economic benefits associated with “hybrid” transmission upgrades. Hybrid transmission upgrades include proposed solutions, which encompass modifications to reliability-based enhancements already included in the RTEP that when modified would relieve one or more economic constraints. Such hybrid upgrades resolve reliability issues but are intentionally designed to provide economic benefits in addition to resolving reliability issues.

PJM conducts market efficiency analysis using market simulation tools of future annual periods for both the capacity market and energy market. Economic benefits of specific transmission projects are determined by comparing results of simulations that include each project with simulations that do not include the project. Projects are measured using two Tariff/Operating Agreement criteria. First, the project must address either an identified congestion driver or a capacity market constraint. Second, the project's total energy and capacity benefits must exceed costs (benefit to cost ratio) by at least 25 percent. Project energy benefits are measured by comparing the benefits in the form of net load payments and/or production costs with and without the proposed project for a 15-year study period. Projects affecting the capacity market derive additional capacity benefits in the form of net load capacity payments and/or capacity costs.

## Identified Congestion Drivers

PJM posted a list of identified congestion drivers – facilities and their simulated congestion levels -- as part of soliciting proposals during the 2018/2019 Long-Term Proposal Window, as shown in **Table 1**.

**Table 1. 2018/2019 Long-Term Window Congestion Drivers**

Constraint	Area	2023 Congestion Frequency (hours)	2023 Market Congestion (\$, million)	2026 Congestion Frequency (hours)	2026 Market Congestion (\$, million)
Hunterstown-Lincoln 115 kV Line	MetEd (PJM)	1,720	\$20.77	1,832	\$29.62
Monroe #1 and #2-Wayne 345 kV Lines	MISO	45	\$1.44	30	\$0.61
Marblehead North Bus #1 161/138 kV Transformer	MISO	195	\$1.41	138	\$1.18
Bosserman-Trail Creek 138 kV Line	AEP-MISO	66	\$1.47	89	\$1.69

Twelve parties submitted 34 proposals during the 2018/19 RTEP Long-Term Proposal Window that closed in March of 2019. Proposals ranged in cost from \$0.1 million to \$290.95 million and included transmission upgrades from

transmission owners and greenfield projects from incumbent transmission owners and non-incumbent entities, as summarized in **Table 2**.

**Table 2. Proposals by Type Submitted in the 2018/2019 Long Term Proposal Window**

Congestion Driver	Number of Proposals	Greenfield Proposals	TO Upgrade Proposals
Hunterstown-Lincoln 115 kV Line	22	19	3
Bosserman-Trail Creek 138 kV Line	5	4	1
Marblehead #1 161/138 kV Transformer	2	1	1
Monroe #1 and #2-Wayne 345 kV Lines	3	0	3
No PJM Driver	2	1	1
<b>Total</b>	<b>34</b>	<b>25</b>	<b>9</b>

PJM evaluated the proposals according to Schedule 6 of the Amended and Restated Operating Agreement of PJM Interconnection, L.L.C. (Operating Agreement). PJM is recommending for Board approval a market efficiency interregional solution to provide congestion relief on the Bosserman-Trail Creek line. PJM is also recommending for Board approval the Hunterstown-Lincoln 115 kV rebuild as part of a combination of transmission projects to address congestion in South-Central Pennsylvania and Northern Maryland. Because the proposals submitted to address congestion on the Marblehead transformer and the Monroe-Wayne transmission lines did not satisfy PJM criteria, PJM is not recommending any of those proposals to the Board for approval.

### **Recommendation: PJM-MISO Interregional Baseline Project b3142: Rebuild Michigan City-Trail Creek-Bosserman 138 kV Line**

PJM-MISO interregional baseline project b3142, a rebuild of the Michigan City-Trail Creek-Bosserman 138 kV Line, is the first interregional proposal submitted during the Long-Term Proposal Window that PJM is recommending to the Board for approval and inclusion in the RTEP.

PJM, working with MISO through the Interregional Planning Stakeholder Advisory Committee (IPSAC), completed a two-year Interregional Market Efficiency Project (IMEP) study in parallel with PJM's 2018/2019 Long-Term Proposal Window process. As part of the IMEP Study, PJM and MISO separately received project proposals that addressed at least one congestion driver identified in each region's respective planning process. Under the terms of the PJM/MISO Joint Operating Agreement, interregional proposals are separately submitted to, and evaluated by PJM and MISO, and subject to each RTO's respective regional processes.

As shown earlier in **Table 1**, The Bosserman-Trail Creek 138 kV line in Northern Indiana Public Service Company (NIPSCO) – in the MISO footprint – was identified as an interregional targeted congestion facility. Simulations performed in advance of the 2018/2019 Long Term proposal window identified over \$1.4 million in market congestion on this facility based on 2023 input assumptions and simulation results. PJM received a cluster of five proposals (four greenfield proposals and one upgrade proposal) from five entities to address the Bosserman-Trail Creek congestion. The proposed project cost estimates ranged from \$19 million to \$266 million.



### Solution Selection

The energy benefits associated with the proposed projects were determined using the methodologies specified in Schedule 6 of the Operating Agreement. PJM's annual energy benefits calculation for lower voltage facilities is weighted 100 percent to zones with a decrease in net load payments as a result of the proposed project. Change in net load payments comprises the change in gross load payments offset by the change in transmission rights credits. No capacity benefits were identified with these proposed projects.

PJM evaluated each of the five proposals, out of which two exceeded the 1.25 benefit-to-cost ratio and fully mitigated congestion: (1) proposal BT\_481 to rebuild the Michigan City-Trail Creek-Bosserman 138 kV line; and, (2) proposal BT\_129 to build a new Kuchar substation and new Kuchar-Luchtman 138 kV line. PJM conducted further analysis on these two proposals to determine how the projects addressed the identified congestion and to evaluate project constructability risk.

Based on the analysis performed, PJM selected proposal BT\_481 shown on **Map 1** – a rebuild of the Michigan City-Trail Creek-Bosserman 138 kV line – as the more efficient or cost effective solution to the identified congestion driver. Proposal BT\_481:

- Has a benefit-to-cost ratio of 2.63, which was the highest benefit-to-cost ratio across the proposals submitted for the Bosserman-Trail Creek constraint; cost estimates were from PJM's own constructability analysis
- Fully addresses the congestion driver
- Is an upgrade and has lower constructability risk compared to the four greenfield proposals, including BT\_129

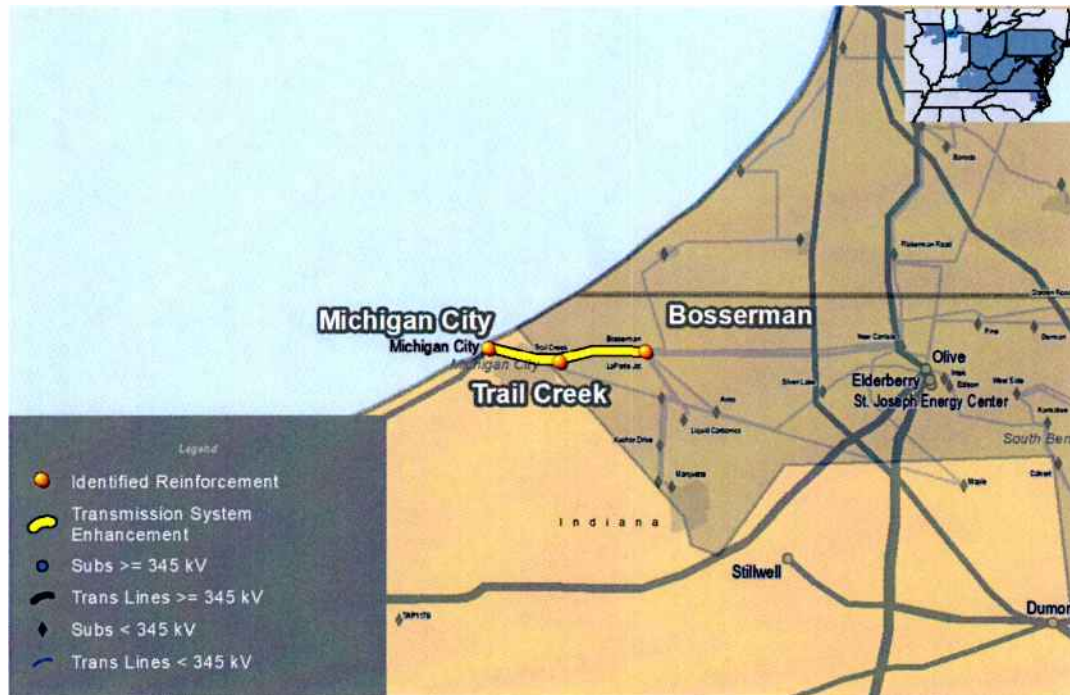
In addition to the market efficiency base case analysis for the recommended proposal BT\_481, PJM also performed sensitivity analysis on key input variables: natural gas prices, PJM load forecasts, generation expansions, and generator outage patterns. The benefit to cost ratio exceeded 1.25 in each instance. An RTEP process reliability analysis of the project did not identify any reliability criteria violations. PJM also conducted a constructability review of the components proposed by project BT\_481 and did not identify any significant issues.

In conclusion, PJM is recommending proposal BT\_481 to the PJM Board for provisional approval as an interregional baseline project, pending approval by the MISO Board as well. Both the PJM and MISO boards must approve the project in order for it to be included in each entity's regional transmission plan. BT\_481 project elements will be designated to NIPSCO, the proposing entity and transmission owner of the project elements in the MISO footprint:

- Reconductor Bosserman-Trail Creek 138 kV line
- Reconductor Michigan City-Trail Creek 138 kV line
- Michigan City Substation Upgrades
- Trail Creek Substation Upgrades

The estimated cost for the project is \$24.69 million (in service dollars) with a January 2023 in-service date required. Based on the PJM to MISO benefit ratio, 89.1 percent of the cost (\$22.00 million) will be allocated to PJM.

Map 1. Baseline Project b3142: Bosserman-Trail Creek-Michigan City 138 kV Proposal



### South-Central Pennsylvania and Northern Maryland Congestion

The following discussion relates to three projects addressing congestion in South-Central Pennsylvania and Northern Maryland, including congestion on the AP South Interface and related constraints. The first project (Project 9A) was submitted in the 2014/2015 RTEP Long-Term Proposal Window and approved by the PJM Board in August 2016. The second project (Project 5E) was submitted in the 2016/2017 RTEP Long-Term Proposal Window and approved by the PJM Board in April 2018. PJM is recommending the third project (Project H-L), which was submitted in the 2018/2019 RTEP Long-Term Proposal Window, for approval by the PJM Board. Because this combination of projects addresses interrelated congestion drivers, PJM has reviewed these projects to consider interactions among them given the dynamic nature of the market efficiency base case through changes in the 2014/2015, 2016/2017, and 2018/2019 RTEP Years, and in light of potential reliability criteria violations otherwise found to arise in 2023 in South-Central Pennsylvania and Northern Maryland with certain of these projects removed from the base case.

### Recommendation

PJM's RTEP analyses relative to the South-Central Pennsylvania and Northern Maryland congestion include a review of Project 9A, Project 5E, and Project H-L, as well as a review of Alternative Project 9A, Project 5E, and Project H-L.

As discussed in greater detail below, PJM's RTEP analyses have determined that in the combinations described, these projects exceed the benefit-to-cost ratio of 1.25, significantly reduce congestion, and solve reliability criteria violations identified in study year 2023 that otherwise were found to arise with certain of these projects removed from the base case.



As such, PJM recommends that:

- Project H-L be added to the RTEP
- Project 5E, as approved, remain in the RTEP
- Project 9A, as approved by the Board, continues to exceed the benefit-to-cost ratio and should remain in the RTEP
- Alternative Project 9A exceeds the benefit-to-cost ratio and, if approved by the Maryland and Pennsylvania Commissions through their respective CPCN application processes, Alternative Project 9A would be recommended for approval by the PJM Board of Managers as memorialized in a Board Resolution. Upon approval by both State Commissions, PJM would present Alternative Project 9A to the Board for final approval and inclusion in the RTEP.

Error! Reference source not found. summarizes PJM's RTEP analyses relating to the projects noted above. As is made clear below, the benefit-to-cost ratios exceeded the 1.25 threshold in the scenarios where PJM studied Project 9A, Project 5E, and Project H-L in the aggregate, and Alternative Project 9A, Project 5E, and Project H-L in the aggregate.

**Table 3. Summary of Recent RTEP Analyses**

RTEP Analyses <sup>1</sup>	Date Presented	Benefit to Cost Ratio
<b>Alternative Project 9A</b>	May 8, 2019	1.39 (using \$466.44M as cost est.) - 1.52 (using \$426.02M as cost est.)
<b>Re-evaluation of Project 9A</b>	Oct. 17, 2019	2.10
<b>Re-evaluation of Project 5E</b>	Nov. 14, 2019	1.11 <sup>2</sup>
<b>Project H-L</b>	Nov. 14, 2019	76.41
<b>Alternative Project 9A</b>	Nov. 14, 2019	1.60
<b>Re-evaluation of Project 5E (assuming Board approval of Project H-L)</b>	Nov. 14, 2019	1.80
<b>Project 9A + Project 5E + Project H-L</b>	To be presented at the December TEAC.	2.87, aggregate
<b>Alternative Project 9A + Project 5E + Project H-L</b>	To be presented at the December TEAC.	2.25 (using \$561.68M as cost est.) - 2.33 (using \$533.99M as cost est.), aggregate

The individual elements of each of the projects described above are shown schematically in **Figure 1**.

PJM conducted RTEP analyses of the two combinations noted in the last two rows of **Table 3**, above. PJM proceeded in this manner because the two combinations are comprised of:

<sup>1</sup> The market efficiency base case was updated in July 2019 and further revised in September 2019.

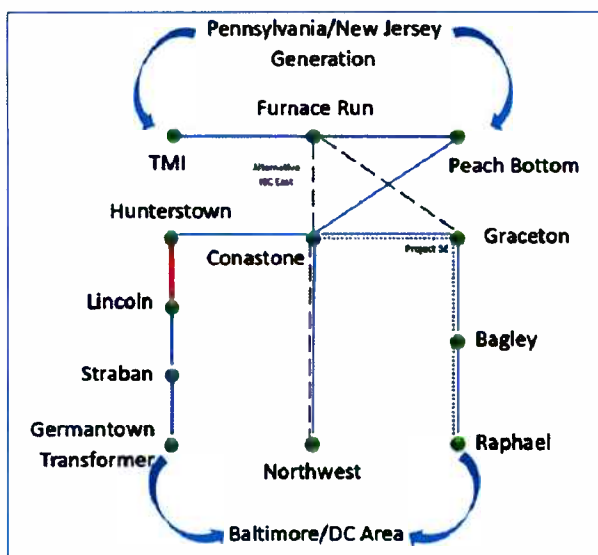
<sup>2</sup> For further discussion, see the section of this paper regarding Project 5E, below.

- Project 9A or Alternative Project 9A, a project that is nearing a decision in the state siting processes (and, notably, in the case of Alternative Project 9A, the siting processes might culminate in a Commission-approved settlement reflecting a compromise among certain parties to the proceeding)
- Project 5E, a project that is advanced in both its engineering and procurement phases
- Project H-L, which is a relatively modest upgrade

In the aggregate, PJM's RTEP analyses show that these combinations of projects exceed the benefit-to-cost ratio of 1.25, significantly reduce congestion, and solve reliability criteria violations identified in study year 2023 that otherwise were found to arise with certain of these projects removed from the base case.

It is important to note that if Project 9A or Alternative Project 9A were to be removed from further consideration, PJM's RTEP analysis has previously identified a number of reliability criteria violations starting in the 2023 study year. Some of these reliability criteria violations include conductor overloads on 500 kV transmission lines which, in PJM's experience, are likely to be resolved only through the construction of additional greenfield transmission. Should these combinations of projects inclusive of Project 9A or Alternative Project 9A be removed from the RTEP, resultant reliability criteria violations would be identified during the 2020 RTEP analysis, and potential solutions to such reliability criteria violations would not be identified to the Board until late 2020 or early 2021. Furthermore, removing these combinations of projects from the RTEP would fail to address the congestion that would be re-introduced into South-central Pennsylvania and Northern Maryland. Any proposal window to address this re-introduced congestion would not be held until 2021, with solutions not likely to be presented to the Board until late 2021. In light of this timing, and based on the likely need for greenfield transmission, PJM predicts that new CPCN applications for not-yet-identified reliability and market efficiency drivers would not be filed until 2022 or 2023. Conservatively assuming one to two years for state siting proceedings, reliability and market efficiency solutions likely could not be constructed sufficiently quickly to remediate reliability criteria violations, and further would leave customers subject to significant congestion for a number of years to come.

**Figure 1. South-Central Pennsylvania and Northern Maryland Congestion**



## Project 9A and Alternative Project 9A

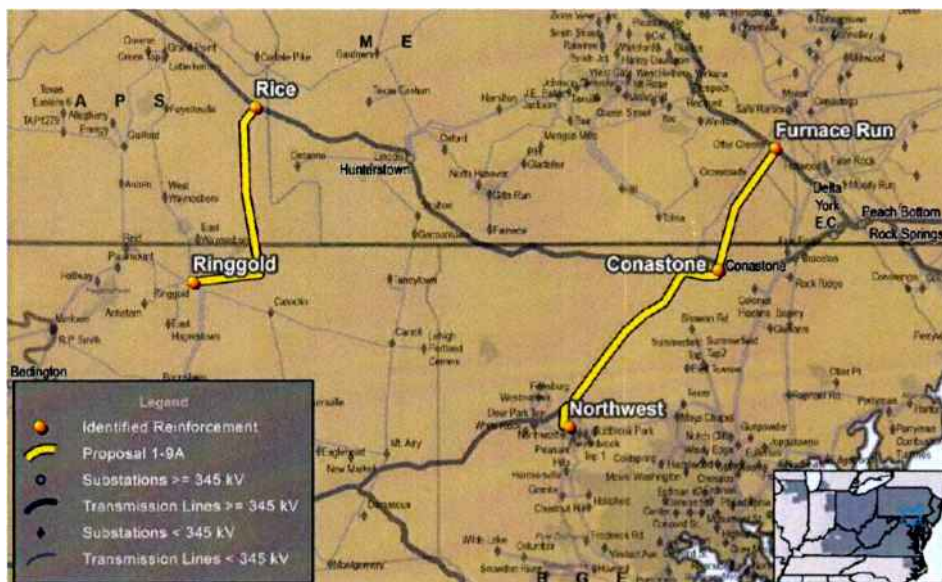
### Project 9A, as approved by the Board, continues to exceed the 1.25 Benefit-to-Cost Ratio

The PJM Board approved Project 9A in August 2016 to address persistent congestion in South-Central Pennsylvania and Northern Maryland. Project 9A includes a western component – the Rice-Ringgold 230 kV line – and an eastern component – the Furnace Run-Conastone-Northwest 230 kV line – shown on **Map 2**.

Five subsequent re-evaluations (Sept. 14, 2017; Feb. 8, 2018; Sept. 13, 2018; March 7, 2019; and Sept. 24, 2019) reaffirm PJM's recommendation that Project 9A be included in the RTEP, as discussed in detail in PJM's Nov. 15, 2018 white paper<sup>3</sup> and in testimony filed in the pending state siting proceedings. The below chart summarizes RTEP analyses of Project 9A from its presentation to the Board in August 2016 through the present, demonstrating that Project 9A continues to exceed the 1.25 benefit-to-cost ratio.

For the reasons discussed in this paper, Project 9A, as approved by the Board, continues to exceed the benefit to cost ratio and should remain in the RTEP.

**Map 2. Project 9A**



### Alternative Project 9A Exceeds the 1.25 Benefit-to-Cost Ratio and Reflects a Compromise Among Certain Parties in the Pending CPCN Proceedings in Maryland and Pennsylvania

Alternative Project 9A is the product of data requests, analysis and agreement among several of the parties<sup>4</sup> in the Maryland and Pennsylvania siting proceedings. Those parties have executed and filed a proposed settlement before the Maryland and Pennsylvania state Commissions seeking the approval of Alternative Project 9A (such approval

<sup>3</sup> <https://www.pjm.com/-/media/committees-groups/committees/teac/20181108/20181108-transource-white-paper.ashx>

<sup>4</sup> PJM is not a party to that proceeding, though PJM has run analysis, offered testimony and sponsored data requests in the matter.

being in the alternative to state Commission approval of Board-approved Project 9A). Discovery is ongoing and additional procedural orders are anticipated relating to Alternative Project 9A and the settlement.

Alternative Project 9A (as shown on Map 3) is comprised of the same western segment in Project 9A, as approved by the Board. Alternative Project 9A reflects modifications to the eastern segment of Board-approved Project 9A and involves less greenfield transmission than Project 9A because Alternative Project 9A uses a pre-existing right of way that requires expansion. In Maryland, the eastern segment of Alternative Project 9A would be constructed, owned and maintained by Baltimore Gas and Electric Company (BGE) within its existing utility rights-of-way. BGE would add a second 230 kV circuit on the existing Otter Creek-Conastone 230 kV line. BGE would also replace eight lattice structures that currently hold the single-circuit Manor-Graceton 230 kV line with approximately eight monopole structures, which would then carry a second 230 kV line. In Pennsylvania, PPL Electric Utilities Corporation (PPL) would construct, own and maintain the lines within PPL's expanded existing rights-of-way.

In the course of the state siting proceedings, PJM was asked to analyze Alternative Project 9A. Error! Reference source not found. summarizes the body of RTEP analyses PJM has conducted regarding Alternative Project 9A.

**Table 4. Summary of Recent RTEP Analyses Involving Alternative Project 9A**

<b>RTEP Analyses<sup>5</sup></b>	<b>Date Presented</b>	<b>Benefit-to-Cost Ratio</b>
<b>Alternative Project 9A</b>	May 8, 2019	1.39 (using \$466.44M as cost est.) - 1.52 (using \$426.02M as cost est.)
<b>Alternative Project 9A</b>	Nov. 14, 2019	1.60
<b>Alternative Project 9A6 + Project 5E + Project H-L</b>	To be presented at the December TEAC.	2.25 (using \$561.68M as cost est.) - 2.33 (using \$533.99M as cost est.), aggregate

PJM's RTEP analyses show that a combination of Alternative Project 9A, Project 5E, and Project H-L exceed the benefit-to-cost ratio of 1.25, significantly reduce congestion, and solve reliability criteria violations identified in study year 2023 that otherwise were found to arise with Alternative Project 9A removed from the base case.

For the reasons discussed in this paper, Alternative Project 9A exceeds the benefit-to-cost ratio and, if approved by the Maryland and Pennsylvania Commissions through their respective CPCN application processes, Alternative Project 9A would be recommended for approval by the PJM Board of Managers as memorialized in a Board

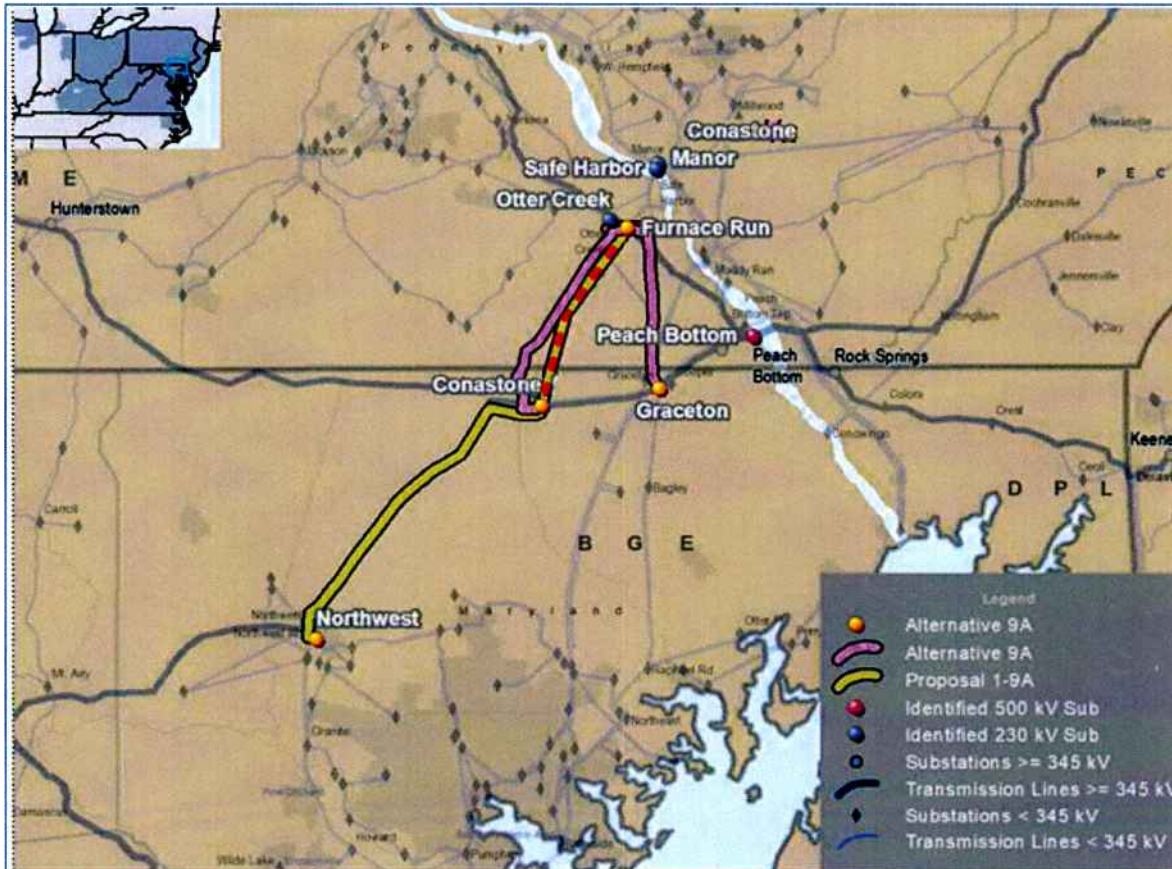
<sup>5</sup> The market efficiency base case was updated in July 2019 and further revised in September 2019.

<sup>6</sup> PJM has performed a constructability analysis of the western portion of Alternative Project 9A and used a cost for Alternative Project 9A's eastern segment that reflects a 25 percent sensitivity to the PPL and BGE elements (elements that have not been reviewed for constructability). Costs for the alternative configuration of the eastern portion would have to increase by a significant margin in order for the benefit-to-cost ratio for Alternative Project 9A to fall below the 1.25 threshold. At this stage of the CPCN proceedings and based on the significant margin that exists in the benefit-to-cost ratio, it is unnecessary to commission a partial constructability analysis of the alternative configuration of the eastern portion of Alternative Project 9A.



Resolution. Upon approval by both State Commissions, PJM would present Alternative Project 9A to the Board for final approval and inclusion in the RTEP

### Map 3. The Alternative Configuration of the Eastern Portion of Project 9A (the Alternative IEC East Portion)\*



\* Note: Dotted red line depicts originally proposed Furnace Run-Conastone 230 kV line now being rerouted.

### Project 5E, as Approved by the Board

In April 2018, the PJM Board approved baseline Project 5E with a benefit to cost ratio of 5.23 (calculated using an initial cost estimate of \$39.65 million). This market efficiency project would alleviate congestion on the Conastone-Graceton-Bagley 230 kV line in the BGE zone. Submitted by BGE, the project comprises reconductoring the Conastone-Graceton and Raphael Road-Northeast 230 kV lines together with adding bundled conductor to the Graceton-Bagley-Raphael Road double circuit lines, as shown on **Map 4**.

A re-evaluation of Project 5E in September 2018 yielded a benefit to cost ratio of 9.18, reaffirming the basis for PJM's recommendation that Project 5E be included in the RTEP.

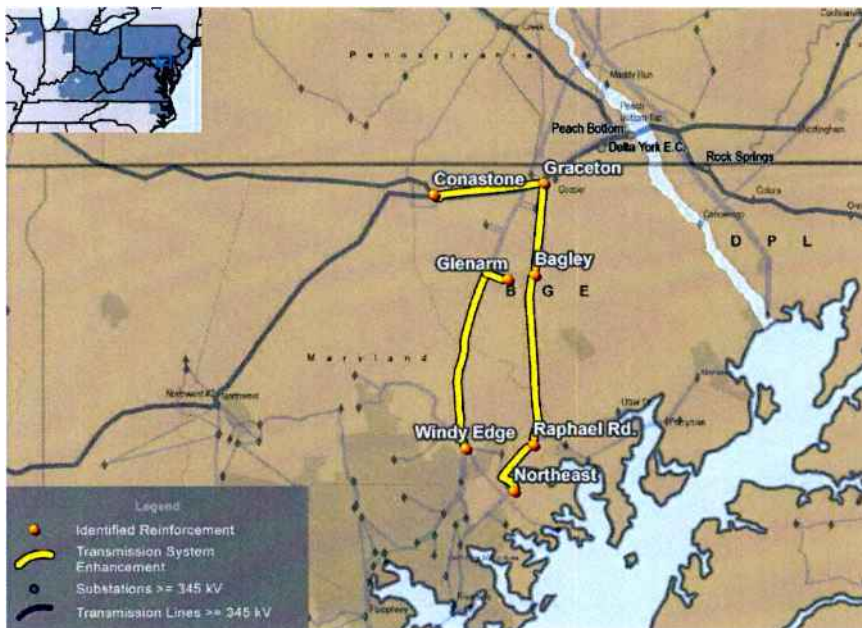
At present, the estimated cost for Project 5E is \$48,295,868 (2021 dollars). Error! Reference source not found. summarizes the recent body of RTEP analyses PJM has conducted regarding Project 5E.

Table 5. Summary of Recent RTEP Analyses Involving Project 5E

RTEP Analyses <sup>7</sup>	Date Presented	Benefit-to-Cost Ratio
Re-evaluation of Project 5E	Nov. 14, 2019	1.11 <sup>8</sup>
Re-evaluation of Project 5E (assuming Board approval of Project H-L)	Nov. 14, 2019	1.80
Project 9A + Project 5E + Project H-L	To be presented at the December TEAC.	2.87, aggregate
Alternative Project 9A + Project 5E + Project H-L	To be presented at the December TEAC.	2.25 (using \$561.68M as cost est.) - 2.33 (using \$533.99M as cost est.), aggregate

Although an initial re-evaluation of Project 5E indicated that the project no longer satisfied the benefit-to-cost criteria due to the continued evolution of the RTEP and increased cost estimates, PJM's RTEP analyses described above have studied the interaction of Project 5E, Project H-L and Project 9A or Alternative Project 9A. PJM's analyses indicate that it would not be accurate to conclude that Project 5E is no longer performing because the project combinations analyzed show that when Project 5E is studied in context, it no longer binds first and continues to exceed the 1.25 benefit-to-cost ratio threshold. For the reasons discussed above, PJM recommends that Project 5E remain in the RTEP.

Map 4. Project 5E


<sup>7</sup> The market efficiency base case was updated in July 2019 and further revised in September 2019.

<sup>8</sup> For further discussion, see the section of this paper regarding Project 5E, below.

## PJM's Recommendation of Project H-L

PJM opened a Long-Term Proposal Window on Nov. 2, 2018, that closed on March 15, 2019. For the reasons that follow, and because of the interactions between Project H-L, Project 5E and Project 9A or Alternative Project 9A, PJM recommends that the Board approve Project H-L and include it in the RTEP.

Project H-L consists of upgrades and changes to existing equipment designated to the incumbent transmission owner:

- Rebuild the Hunterstown to Lincoln 115kV line
- Upgrade substation equipment at Hunterstown Substation
- Upgrade substation equipment at Lincoln Substation

The estimated cost for proposal Project H-L is \$7.21 million, and the in-service date is June 2023.

As presented in Table 1 and on **Map 5**, PJM identified the Hunterstown-Lincoln 115 kV line as a targeted congestion facility. Simulations performed in advance of the 2018/2019 Long-Term Proposal Window identified over \$20.77 million in market congestion on this facility based on 2023 input assumptions and simulation results. The below serves as a description of the analysis that was conducted for this proposal window.

PJM received a cluster of 22 proposals (19 greenfield proposals and three upgrade proposals) from seven entities to address the Hunterstown-Lincoln congestion driver. The proposed project costs ranged from \$4.65 million to \$290.95 million.

PJM analyzed the proposals to determine which, if any, satisfied the 1.25 benefit-to-cost ratio criteria and provided the greatest degree of congestion relief. The energy benefits associated with the proposed projects were determined using the methodologies specified in Schedule 6 of the Operating Agreement. PJM's annual energy benefits calculation for lower voltage facilities is weighted 100 percent to zones with a decrease in net load payments as a result of the proposed project. Change in net load payments comprises the change in gross load payments offset by the change in transmission rights credits. No capacity benefits were identified with these proposed projects.

Of the proposals that did pass the benefit-to-cost ratio criteria in the base case, PJM selected the highest five benefit-to-cost ratio proposals for further evaluation. PJM then conducted market efficiency sensitivity analysis on those five proposals.

Of these five solutions, three proposals fully addressed the congestion driver. These three proposals included: (1) Project H-L (presented to stakeholders as HL\_622), which rebuilds the Hunterstown-Lincoln 115 kV line; (2) HL\_469, which installs a SmartValve<sup>9</sup> on the Hunterstown-Lincoln 115 kV line; and (3) HL\_960, which builds an additional Hunterstown-Lincoln 115kV line. PJM ultimately narrowed this list of three projects to two.

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<sup>9</sup> SmartValve, a Smart Wires Inc. product, acts as a variable impedance device that can vary the impedance on the line the device is installed on.



**Figure 2** shows a comparison of the top two proposals highlighting the challenges involved with the SmartValve proposal.

**Figure 2. Comparison of Proposals for Hunterstown-Lincoln 115 kV Line**

Criteria	HL_622 Upgrade Solution	HL_469 SmartValve™ Solution
Constructability Risk	Upgrade, no additional property needed	Greenfield, permitting risk related to new property for substation due to location near historically sensitive area
PJM Operations and Markets	No changes needed to real-time operations procedures and practices	At this time, real-time operations would not be able to fully utilize the dynamic capabilities of this device without additional changes
Additional Integration Cost with Operations and Markets	No additional costs	May require updating Day-Ahead, Real-Time, SCADA systems to support full operational range of this type of device
Industry experience	Established well known solution	Limited experience with SmartValve™ device
Additional System Capability/Flexibility	Yes/No	No/Yes

*\*SmartValve is a Trademark of Smart Wires Inc.*

Based on the analysis performed, PJM selected Project H-L (HL\_622), which rebuilds the Hunterstown-Lincoln 115 kV line as more efficient or cost effective solution because Project H-L:

- Has a benefit-to-cost ratio of 76.41
- Fully addresses the target congestion driver
- Is an upgrade and has less constructability risk
- Consistently delivers a high benefit-to-cost ratio, passes all sensitivity scenarios, and given the comparison criteria shown in **Figure 2**, was the preferred solution
- Did not cause any reliability issues under PJM's RTEP reliability analysis.

PJM's RTEP analyses described above have studied the interaction of Project 5E, Project H-L, and Project 9A or Alternative Project 9A. PJM's analyses indicate that Project H-L continues to play an important role in the mitigation of congestion in South-Central Pennsylvania and Northern Maryland as reflected in **0**. In conclusion, Project H-L shown in **Table 7** is being recommended to the Board for approval for inclusion in the RTEP. The local transmission owner/proposing entity, Mid-Atlantic Interstate Transmission (MAIT), would be designated to complete this work. Cost allocation for the project can be found in **Table 8**.



Table 6. Summary of Recent RTEP Analyses Involving Project H-L

RTEP Analyses <sup>10</sup>	Date Presented	Benefit to Cost Ratio
Project H-L	Nov. 14, 2019	76.41
Project 9A + Project 5E + Project H-L	To be presented at the December TEAC.	2.87, aggregate
Alternative Project 9A + Project 5E + Project H-L	To be presented at the December TEAC.	2.25 (using \$561.68M as cost est.) - 2.33 (using \$533.99M as cost est.), aggregate

Table 7. Identified Market Efficiency Projects

PJM Baseline ID	PJM Window Project ID	Project Description	Transmission Zone	Constraint Project Addresses	Project Cost (\$M)	In-Service Date	B/C Ratio
b3145	201819_1-622	Rebuild the Hunterstown - Lincoln 115 kV 962 line (~2.6 mi.). Upgrade limiting terminal equipment at Hunterstown and Lincoln.	MetEd	Hunterstown -Lincoln 115 kV	7.21	2023	76.41

Map 5. Project H-L

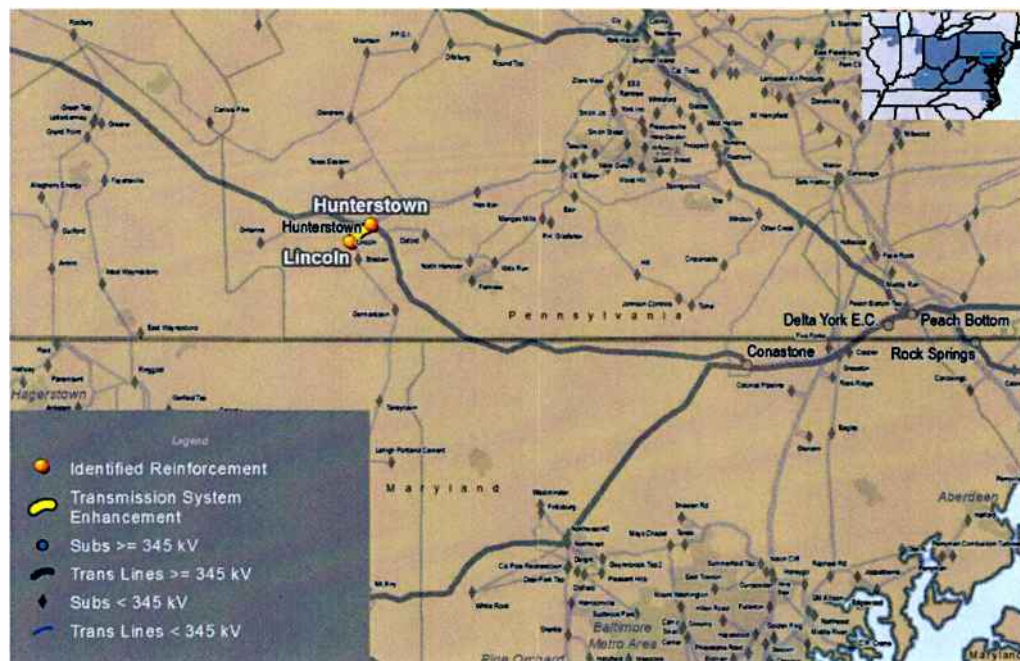

<sup>10</sup> The market efficiency base case was updated in July 2019 and further revised in September 2019.

Table 8. Cost Allocation Factors for Project H-L

b3145	Rebuild the Hunterstown - Lincoln 115 kV line (No.962) (~2.6 mi.). Upgrade limiting terminal equipment at Hunterstown and Lincoln.	\$7.21	ME	AEP (16.60%) APS (8.09%) BGE (2.74%) Dayton (2.00%) DEOK (0.35%) DL (1.31%) Dominion (52.77%) EKPC (1.54%) OVEC (0.06%) PEPCO (14.54%)	June 1, 2023
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**BEFORE THE  
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

Application of Transource Pennsylvania, LLC  
for approval of the Siting and Construction of the  
230 kV Transmission Line Associated with the  
Independence Energy Connection - East and West Projects  
in portions of York and Franklin Counties, Pennsylvania.

A-2017-2640195  
A-2017-2640200

Petition of Transource Pennsylvania, LLC  
for a finding that a building to shelter control equipment  
at the Rice Substation in Franklin County, Pennsylvania  
is reasonably necessary for the convenience or welfare of the public.

P-2018-3001878

Petition of Transource Pennsylvania, LLC  
for a finding that a building to shelter control equipment  
at the Furnace Run Substation in York County, Pennsylvania  
is reasonably necessary for the convenience or welfare of the public.

P-2018-3001883

Application of Transource Pennsylvania, LLC  
for approval to acquire a certain portion of the lands of  
various landowners in York and Franklin Counties, Pennsylvania  
for the siting and construction of the 230 kV Transmission Line  
associated with the Independence Energy Connection –  
East and West Projects as necessary or proper for the service,  
accommodation, convenience or safety of the public.

A-2018-3001881,  
*et al.*

**TRANSOURCE PENNSYLVANIA, LLC  
SUPPLEMENTAL TESTIMONY OF  
TIMOTHY J. HORGER  
IN SUPPORT OF AMENDED APPLICATION  
TRANSOURCE PA STATEMENT NO. AA-3**

Date: January 29, 2020

1 **I. INTRODUCTION**

2 **Q. Please state your name and business address.**

3 A. My name is Timothy J. Horger. I am the Director of Energy Market Operations at PJM  
4 Interconnection, LLC ("PJM"). My business address is 2750 Monroe Boulevard,  
5 Audubon, Pennsylvania 19403.  
6

7 **Q. Have you previously provided testimony in this proceeding?**

8 A. Yes. I submitted rebuttal testimony on November 27, 2018 and rejoinder testimony on  
9 February 11, 2019. In my rebuttal testimony, I adopted as my own sections of Mr. Paul  
10 McGlynn's Direct Testimony. I submitted supplemental testimony on May 14, 2019. I  
11 also testified at the evidentiary hearing held in this matter.  
12

13 **Q. Please describe the purpose of your Supplemental Testimony.**

14 A. I am submitting testimony on behalf of Transource Pennsylvania, LLC ("Transource  
15 PA") in support of the Amended Application. In my supplemental testimony, I will  
16 explain PJM's analysis of the Independence Energy Connection Project ("IEC Project"),  
17 with the alternative routing of the eastern portion of the IEC Project ("Alternative IEC  
18 East Portion"),<sup>1</sup> as described in the Amended Application. PJM has undertaken  
19 additional analysis of the IEC Project inclusive of the Alternative IEC East Portion and  
20 the PJM Board of Managers has approved the IEC Project inclusive of the Alternative  
21 IEC East Portion for inclusion in the Regional Transmission Expansion Plan if the

---

<sup>1</sup> The Alternative IEC East Portion is more fully described in Appendix A to the settlement agreements that were filed with Commission on October 17, 2019. The IEC Project is a major component of the broader project identified by PJM as "Project 9A." Project 9A also includes upgrades at existing transmission facilities in Pennsylvania and Maryland, which are the responsibility of other incumbent entities. The upgrades to existing facilities, while not part of the IEC Project, are inter-dependent components of the solution approved by PJM.

1 Pennsylvania Public Utility Commission and Maryland Public Service Commission grant  
2 the necessary approvals for the IEC Project inclusive of the Alternative IEC East Portion.  
3

4 **Q. Are you sponsoring any exhibits with your Supplemental Testimony?**

5 A. Yes. Attached to my testimony are:

- 6 • TPA Exhibit TJH-AA1: slides presented at the November 14, 2019 PJM TEAC  
7 meeting
- 8 • TPA Exhibit TJH-AA2: slides presented at the December 12, 2019 PJM TEAC  
9 meeting
- 10 • TPA Exhibit TJH-AA3: market efficiency analyses/workpapers  
11

12 **II. ANALYSIS PERFORMED BY PJM REGARDING THE IEC PROJECT**  
13 **INCLUSIVE OF THE ALTERNATIVE IEC EAST PORTION**

14 **Q. Since the time of your May 14, 2019 supplemental testimony and the evidentiary**  
15 **hearing, has PJM conducted any updated market efficiency analyses on the IEC**  
16 **Project inclusive of the Alternative IEC East Portion that is the subject of the**  
17 **Amended Application?**

18 A. Yes. In July 2019, and unrelated to Project 9A, PJM's market planning group completed  
19 a "mid-cycle" update to PJM's market efficiency "base case." The market efficiency  
20 base case is the tool PJM's market planning group uses to evaluate whether a proposed  
21 market efficiency project will provide benefits, based on a number of planning  
22 assumptions. To confirm that the IEC Project inclusive of the Alternative IEC East  
23 Portion continues to meet PJM's market efficiency planning needs, PJM conducted  
24 another analysis of the IEC Project inclusive of the Alternative IEC East Portion using

1 the updated mid-cycle base case. *See* TPA Ex. SRH-AA-2 (PJM December 3, 2019  
2 Whitepaper) at 9 n.5. The IEC Project inclusive of the Alternative IEC East Portion  
3 continues to exceed the benefit-to-cost ratio of 1.25 required for approval of a market  
4 efficiency project.

5  
6 **Q. What were the results of this updated analysis?**

7 A. The updated analysis shows that the IEC Project inclusive of the Alternative IEC East  
8 Portion continues to provide substantial market efficiency benefits. PJM determined that  
9 the IEC Project inclusive of the Alternative IEC East Portion is now projected to have a  
10 benefit-to-cost ratio up to 1.66 based on the companies' cost assumptions, representing an  
11 increase in the range PJM had calculated in May 2019.

12  
13 **Q. Did PJM conduct any sensitivity analyses?**

14 A. Yes. The capital cost figures that were used to calculate the 1.66 benefit-to-cost ratio  
15 were figures provided by Transource, PPL Electric, and BGE. PJM reached out  
16 independently to each transmission owner, each of which confirmed that their costs were  
17 the most up-to-date estimates. Nevertheless, PJM also calculated a benefit-to-cost ratio  
18 assuming a 25 percent adder to PPL Electric's and BGE's cost estimates. Even assuming  
19 this adder, the benefit to cost ratio for the IEC Project with the proposed Alternative IEC  
20 East Portion would be 1.60.

21 Additionally, PJM also conducted a market efficiency sensitivity analysis  
22 assuming a 1 percent load decrease in addition to the lower load assumptions already  
23 incorporated into the updated mid-cycle base case. Again, even assuming this sensitivity,

the benefit to cost ratio for the IEC Project with the proposed Alternative IEC East Portion would range from 1.46 (including the 25 percent cost adder) to 1.52. The full range of sensitivities performed by PJM are set forth in the below chart:<sup>2</sup>

<b>Updated Mid-Cycle Base Case</b>	<b>NPV \$(M) BGE/PPL Validated Costs</b>	<b>NPV \$(M) Including 25% Cost Adder</b>
Total Cost for Project 9A as modified by Settlement	\$478.48	\$496.17
B/C Ratio for Project 9A as modified by Settlement	1.66	1.60

<b>Sensitivity Case – 1% Load Decrease (Peak and Energy)</b>	<b>Present \$ (M) BGE/PPL Validated Costs</b>	<b>Present \$ (M) Including 25% Cost Adder</b>
Total Cost for Project 9A as modified by Settlement	\$478.48	\$496.17
B/C Ratio for Project 9A as modified by Settlement	1.52	1.46

**Q. Does the IEC Project inclusive of the Alternative IEC East Portion provide projected market efficiency benefits?**

**A.** Yes. After having now conducted multiple market efficiency analyses of the IEC Project inclusive of the Alternative IEC East Portion resulting in benefit-to-cost ratios exceeding the 1.25 threshold, the Project as proposed in the Amended Application would result in a project that continues to provide customers with substantial benefits. *See* TPA Ex. SRH-AA-2 (PJM December 3, 2019 Whitepaper) at 5-6, 8-9. PJM's costs and load forecast sensitivity analyses also demonstrate that the IEC Project inclusive of the Alternative IEC East Portion would continue to exceed PJM's benefit-to-cost threshold of 1.25. *See id.* Therefore, just as Project 9A as originally configured would provide substantial market

<sup>2</sup> *See also* TPA Ex. TJH-AA-3.

1 efficiency benefits, so too does the IEC Project inclusive of the Alternative IEC East  
2 Portion.

3 **III. CONCLUSION**

4 **Q. Does this conclude your Supplemental Testimony at this time?**

5 **A. Yes.**





# Market Efficiency Update

Nick Dumitriu  
Sr. Lead Engineer, Market Simulation  
Transmission Expansion Advisory Committee  
November 14, 2019



## 2018/19 Market Efficiency Window



## 2018/19 Market Efficiency Window Interregional Analysis



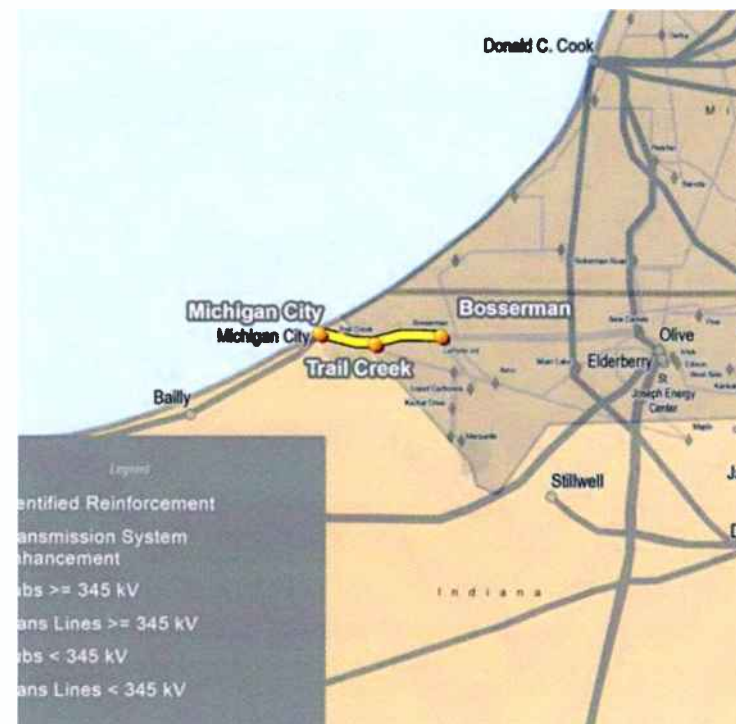
## Conclusion of Interregional Market Efficiency Analysis

- Analysis is complete, concluding 2019 PJM-MISO Coordinated System Plan
- Three drivers identified:
  - Marblehead N 161/138kV Transformer
    - No proposed project met B/C criteria in either region
  - Monroe – Wayne 345kV
    - No proposed project effectively resolved congestion
  - Bosserman – Trail Creek 138kV
    - Rebuilding Michigan City to Trail Creek to Bosserman 138kV to be recommended in both regional processes



## Bosserman –Trail Creek 138 kV

- PJM selected BT\_481, rebuilding Michigan City to Trail Creek to Bosserman 138 kV lines
- Results presented at Oct 2019 TEAC:
  - Highest B/C ratio
  - Robustly addresses congestion on identified issue
  - Passed reliability no-harm test
  - Passed all PROMOD sensitivity scenarios
- Recommended as Interregional Market Efficiency project in both PJM and MISO regional processes
- Interregional Cost allocation
  - PJM 89.1% MISO 10.9%





# Bosserman-Trail Creek Proposal Final Results

Proposal ID	BT_481
Proposal Description	Rebuild Michigan City-Trail Creek-Bosserman 138 kV (10.7mi)
Project Type	Upgrade
B/C Ratio Metric	Lower Voltage
In-Service Cost (\$MM)*	\$24.69
Cost Containment	No
In-Service Month	Jan 2023
% Cong Driver Mitigated	100%
2023 Shifted Cong (\$MM)	\$0.04
PJM Benefit Metric (\$MM)	69.16
PJM Base Case B/C Ratio	2.63
PJM Interregional Cost Allocation %**	89.1 %

\* Costs based on PJM's Independent Cost/Constructability Review

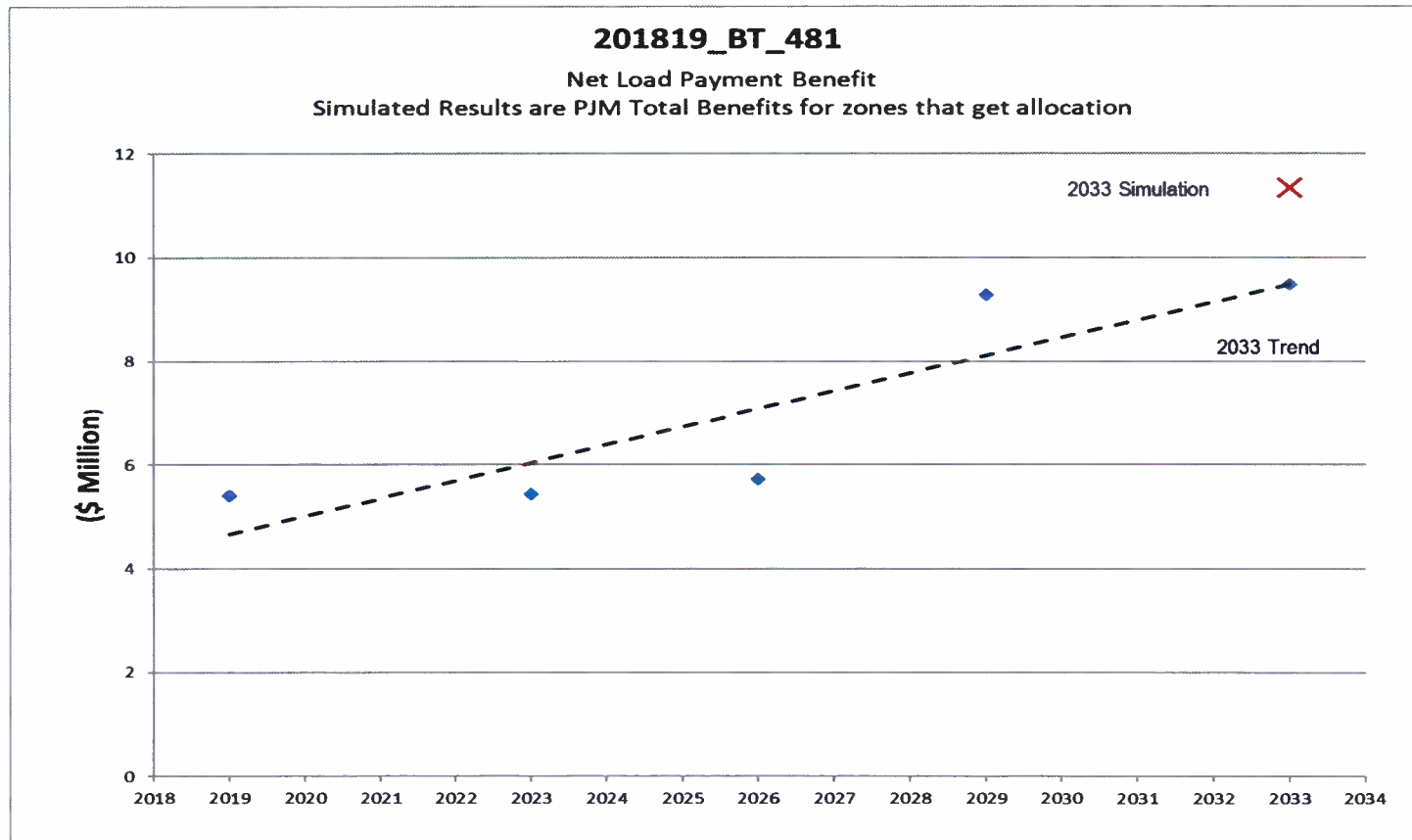
\*\* Cost split based on September 20 IPSAC Presentation :

<https://www.pjm.com/-/media/committees-groups/stakeholder-meetings/ipsac/20190920/20190920-ipsac-presentation.ashx>



TPA Ex. TJH-AA1  
Trend for Net Load Benefits of Proposal BT\_481

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## Interregional Market Efficiency Analysis Next Steps

- Recommend BT\_481 for provisional\* approval at the December Board meeting
- Continue to coordinate with MISO

*\*Dependent on MISO Board approval of same project*





## 2018/19 Market Efficiency Window Hunterstown – Lincoln Proposals



## Status Update: Hunterstown – Lincoln

- Preliminary results first presented at [July 2019 TEAC](#)
  - Calculated preliminary benefits and determined preliminary B/C ratios for all 22 proposals
- Top 5 proposals analysis completed
  - Cost/Constructability review completed
  - PROMOD base and sensitivity runs completed (see Appendix B)
- Three lower cost proposals fully relieve congestion on the driver with minimal shift in congestion
  - HL\_622: Rebuild the Hunterstown-Lincoln 115 kV line
  - HL\_469: Install SmartValve\* power flow control series devices
  - HL\_960: Build new Hunterstown-Lincoln 115 kV line

*\*SmartValve is a Trademark of Smart Wires Inc.*



# Hunterstown-Lincoln Proposal Top5 Results

Proposal ID	HL_622	HL_469**	HL_007	BT_293	HL_960
<b>Proposal Description</b>	Rebuild the Hunterstown-Lincoln 115 kV line.	Install SmartValve™** power flow control 5% series reactance device in series with the Lincoln Tap-Hunterstown 115 kV line.	Build a 115 kV ring bus at the Lincoln tap.	Build Meade 115 kV substation.	Build new Hunterstown-Lincoln 115 kV line.
<b>Project Type</b>	Upgrade	Greenfield	Greenfield	Greenfield	Greenfield
<b>Proposer Cost (\$MM)</b>	\$7.21	\$4.65	\$7.58	\$8.95	\$10.13
<b>PJM/Independent Cost (\$MM)*</b>	\$6.20	\$7.15	\$8.26	\$8.40	\$11.92
<b>Cost Containment</b>	No	No	No	No	Yes
<b>In-Service Year</b>	2023	2022	2023	2023	2021
<b>% Cong Driver Mitigated</b>	100%	100%	86%	86%	100%
<b>2023 Shifted Cong (\$MM)</b>	\$1.77	\$2.03	\$1.35	\$1.35	\$1.89
<b>15-Yr NPV NLP Benefit (\$MM)</b>	\$586	\$552	\$428	\$428	\$563
<b>PJM Cost Used (\$MM)</b>	\$7.21	\$7.15	\$8.26	\$8.40	\$11.92
<b>B/C Ratio</b>	76.41	72.61	48.78	47.97	44.39

\*Costs based on PJM's Independent Cost/Constructability Review

\*\*SmartValve is a Trademark of Smart Wires Inc.



## SmartValve™ vs. Reconductoring Proposal

Criteria	HL_622 Upgrade Solution	HL_469 SmartValve™* Solution
Constructability Risk	Upgrade, no additional property needed	Greenfield, permitting risk related to new property for substation due to location near historically sensitive area
PJM Operations and Markets	No changes needed to real-time operations procedures and practices	At this time, real-time operations would not be able to fully utilize the dynamic capabilities of this device without additional changes
Additional Integration Cost with Operations and Markets	No additional costs	May require updating Day-Ahead, Real-Time, SCADA systems to support full operational range of this type of device
Industry experience	Established well known solution	Limited experience with SmartValve™ device
Additional System Capability/Flexibility**	Yes/No	No/Yes

\*SmartValve is a Trademark of Smart Wires Inc

\*\*Capability in terms of line ratings increase / Flexibility in terms of dynamic flow control



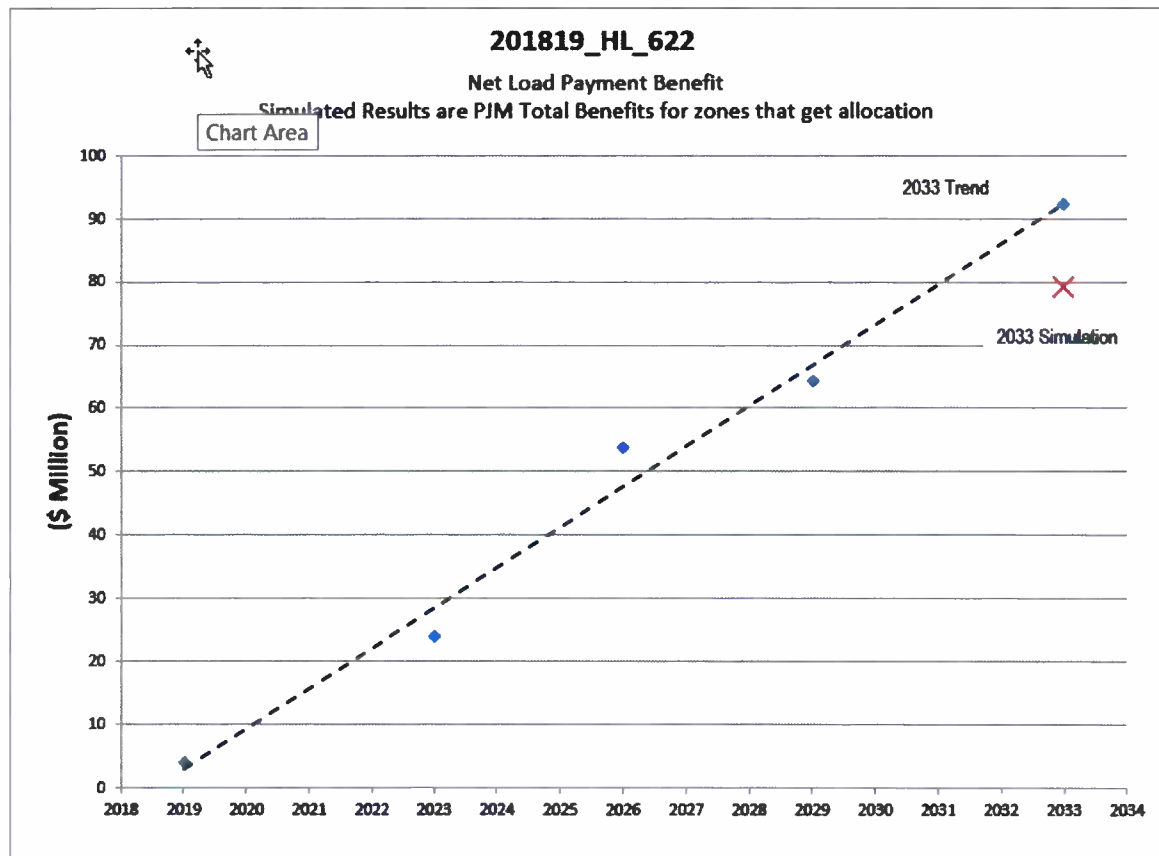
## Hunterstown – Lincoln Conclusion and Next Steps

- Completed comprehensive analysis considering both economic benefits and operational challenges of proposals
- HL\_622, rebuild the Hunterstown-Lincoln 115 kV line, will be recommended to the PJM Board for RTEP inclusion
  - High B/C Ratio: 76.41
  - Low Cost: \$7.21 million
  - Fully addresses target congestion driver Hunterstown – Lincoln 115 kV
  - Passes all PROMOD sensitivity scenarios
  - Reliability Analysis has been completed and no reliability violation identified
- PJM staff will recommend proposal HL\_622 to the PJM Board
  - Proposal will be presented at the December Board meeting
  - Timeline supports RTEP model build



TPA Ex. TJH-AA1  
Trend for Net Load Benefits of Proposal HL\_622

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## 2019 Annual Reevaluation of Market Efficiency Projects



## Reevaluation Overview

- Applies to Market Efficiency projects approved during the 2014/15 and 2016/17 RTEP Windows
- Using the most recent Market Efficiency case available:
  - Base case version 2019-07-26 (posted on 08/02/2019)
  - With First Energy generator deactivations withdrawn
- Projects already in-service, under construction or cancelled are no longer required to be reevaluated.
- Projects must continue to meet the B/C criterion of 1.25
- Reevaluation Process to be completed by December 2019



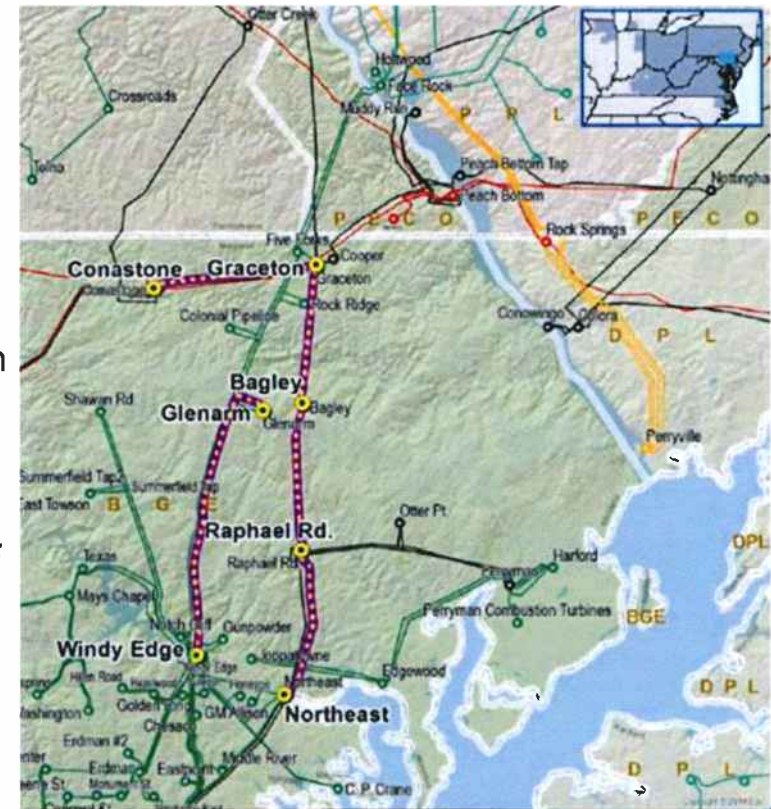


## 5E (b2992) Reevaluation Analysis Overview



## Background and History

- History
  - Project 5E (B2992) approved during 2016/17 Window:
    - B/C Ratio: 5.93 (Cost: \$39.65 mill)
  - Reevaluation Nov 2019
    - Updated Cost: \$48.3 mill
    - B/C Ratio: **1.11**
    - B/C Ratio: **1.80** (with Hunterstown – Lincoln congestion relieved)
- In the current Market Efficiency Base Case, benefits of 5E (b2992) are decreased because of Hunterstown – Lincoln 115 kV congestion
  - Once Hunterstown – Lincoln 115 kV congestion relieved, 5E (b2992) delivers expected benefits

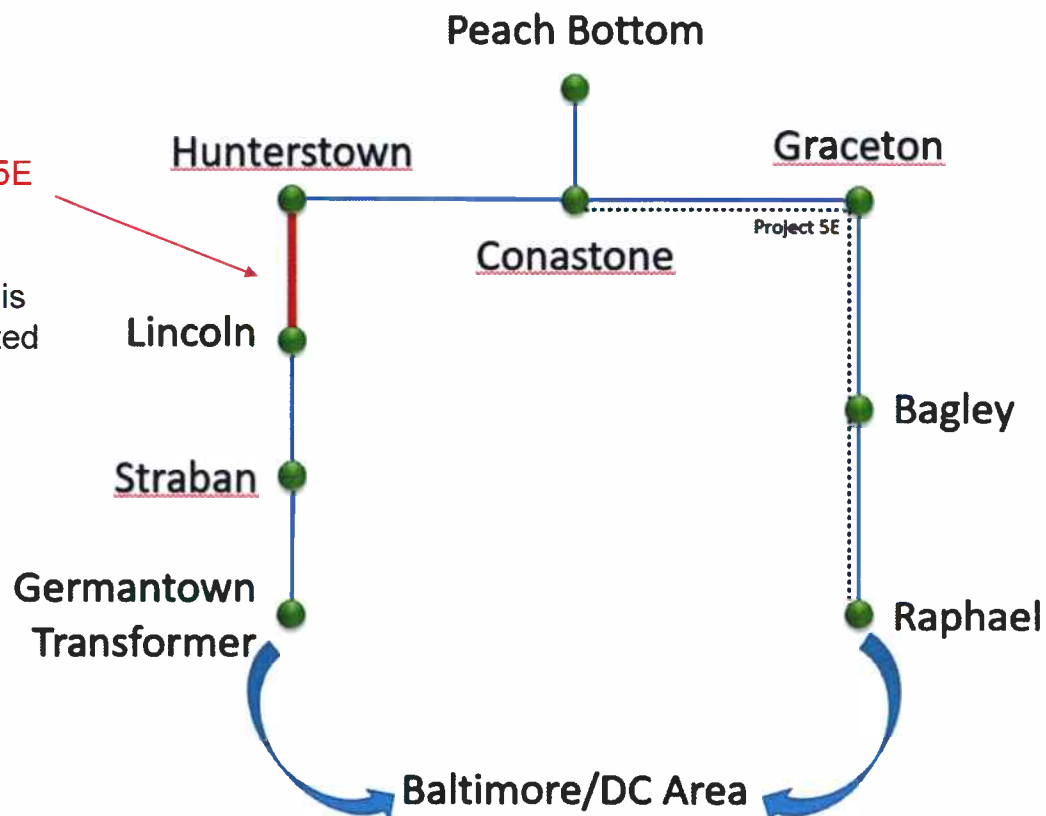




# Hunterstown – Lincoln 115kV Congestion Decreases 5E Benefits

Hunterstown – Lincoln congestion prevents 5E (b2992) benefits to be realized.

If Hunterstown – Lincoln 115 kV congestion is relieved, then 5E (b2992) delivers the expected benefits.





## 5E Cost Update Details

- Construction Status
  - Design and engineering - 95% complete
  - Construction scheduled to begin March 2020, with an expected 6/1/2021 in-service date
- Cost Update

Baseline #	Costs (Direct & Indirect)*	
<b>b2992.1</b>	Reconductor Conastone-Graceton 2323/2324 Circuits	\$18,487,474
<b>b2992.2</b>	Bundle Conductor Graceton-Bagley-Raphael Road 2305/2313 Circuits	\$20,306,088
<b>b2992.3</b>	Remove Windy Edge - Glenarm 110512 Substation Limitations	\$237,592
<b>b2992.4</b>	Reconductor Raphael Road - Northeast 2315/2337 Circuits	\$9,264,714
	<b>Total In-Service Cost</b>	<b>\$48,295,868</b>

*\* A 2.5% inflation rate was used to escalate costs to in-service date*



## Reevaluation Status and Next Steps

- Reevaluation of 201617\_1-5E (b2992.1-4) project completed
  - PJM Staff will recommend keeping 5E (b2992) in the RTEP pending approval by the PJM Board of HL\_622, reconductoring of Hunterstown – Lincoln 115 kV.
- Reevaluation of projects b2697, b2976, b2931 completed
  - All projects pass the 1.25 threshold
  - Results included in Appendix C
- This concludes the 2019 Reevaluation process



## Alternative IEC East Portion of the IEC Project (Transource 9A)



## Background and History

- IEC Project (Transource 9A) Details
  - <https://www.transourceenergyprojects.com/IndependenceEnergyConnection/>
  - PJM Baseline # b2743, b2752
- Original application
  - In December 2017, Transource filed CPCN applications to build the IEC Project (Transource 9A) before the Maryland Public Service Commission (MD Commission) and Pennsylvania Public Utility Commission (PA Commission).
- Proposed Alternatives
  - In the course of the regulatory proceedings, alternative reconfigurations of the IEC Project (Transource 9A) were introduced by various parties.
  - PJM analyzed these alternative routes to assess reliability and market efficiency impacts.
  - In addition to the IEC Project (Transource 9A), an Alternative IEC East Portion of the IEC Project has been filed as part of a proposed settlement in the pending proceedings before the MD and PA Commissions





# IEC Project inclusive of the Alternative IEC East Portion Analysis and Next Steps

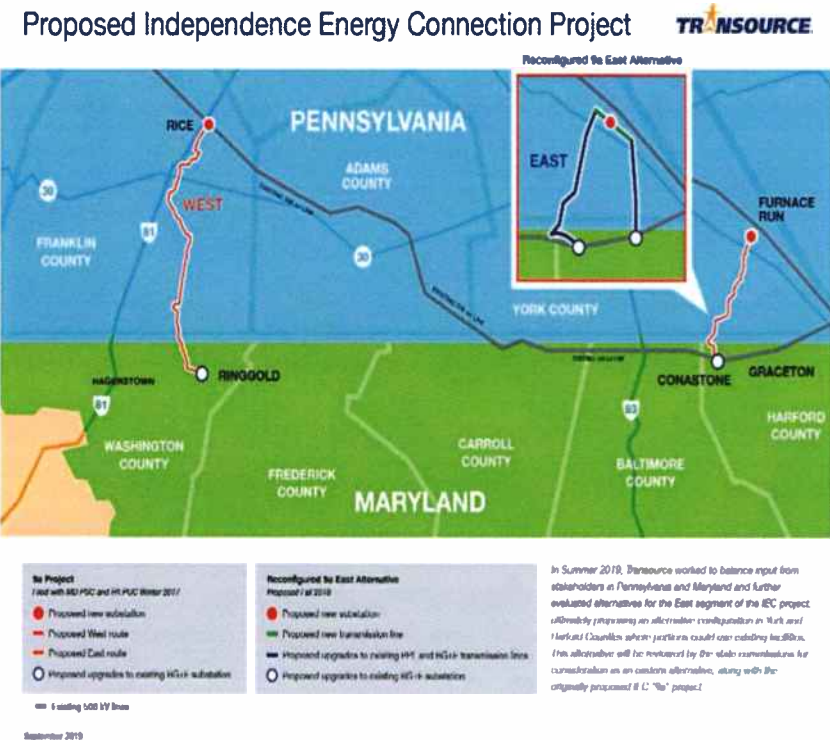
- PJM assessed the IEC Project (Transource 9A) inclusive of the Alternative IEC East Portion:

- In Service Cost: \$496.17 million
- Benefits: \$844.81 million
- B/C Ratio: 1.60
- Satisfies all PJM Reliability criteria

- PJM staff will present the IEC Project (Transource 9A) inclusive of the Alternative IEC East Portion at the December Board meeting

- Request approval conditioned upon MD Commission approval and PA Commission approval

Note: Map from <https://www.transourceenergyprojects.com/IndependenceEnergyConnection/>







## Appendix A

### Bosserman – Trail Creek Sensitivities



TPA Ex. TJH-AA1  
**B/C Ratio Sensitivities: Bosserman – Trail Creek**

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Sensitivity	BT_481	BT_129
Project Cost (\$MM)	24.69	29.51
Base Case	2.63	1.91
FSA Included	5.13	4.4
High Load	3.12	3.19
Low Load	3.73	2.78
High Gas	3.62	3.03
Low Gas	2.26	1.96
Outage Library 1	4.62	3.78
Outage Library 2	3.87	3.38
Outage Library 3	4.21	3.25
Outage Library 4	4.62	3.94
Outage Library 5	3.62	3.50
FE Reactivations	4.62	3.95

Note: B/C ratios computed using Independent Cost / Constructability Review



## Appendix B

### Hunterstown – Lincoln 115 kV Top5 Proposals Sensitivities



TRA Ex. T-1H-AA1

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## B/C Ratio Sensitivities: Hunterstown - Lincoln

Sensitivity	HL_622	HL_469	HL_007	HL_293	HL_960
Project Cost (\$MM)	7.21	7.15	8.26	8.4	11.92
Base Case	76.41	72.61	48.78	47.97	44.39
FSA Included	8.87	10.34	6.23	6.12	5.81
High Load	85.23	82.35	61.85	60.82	50.73
Low Load	74.61	75.94	58.09	57.12	42.63
High Gas	65.13	63.37	45.99	45.23	36.05
Low Gas	74.58	74.06	50.15	49.31	44.10
Outage Library 1	75.96	77.16	51.80	50.94	47.26
Outage Library 2	81.62	81.75	59.40	58.41	49.56
Outage Library 3	68.25	67.00	47.22	46.43	40.96
Outage Library 4	86.68	85.71	60.21	59.21	50.96
Outage Library 5	76.48	76.33	53.31	52.42	45.54
FE Reactivations	59.45	60.03	41.92	41.23	35.56



# Appendix C

## 2019 Reevaluation Results

### Proposals b2697, b2976, b2931



## Reevaluation Results b2697, b2976, b2931

- Overview
  - Projects with capital cost under \$20 million are reevaluated using the original benefits\* and updated capital costs.
  - Capital costs updated as of 11/13/2019
- 2019 Reevaluation B/C ratios for b2697, b2976, b2931

PJM Window Project ID	Baseline#	Type	Area	Constraint	Initial TEAC Date	Initial Capital Cost (\$ million)	Initial B/C Ratio	Current Status	Projected ISD	Updated Capital Cost	2019 Reevaluation B/C Ratio
201415_1-4I	b2697.1-2	Upgrade	AEP	Fieldale to Thornton 138 kV	9/10/2015	\$0.75	101.19	EP	1/1/2019 1:06 2: 12/31/2019	\$2.70	28.11
201617_1A_RP M_DEOK	b2976	Upgrade	DEOK	Tanners Creek to Dearborn 345 kV	11/2/2017	\$0.60	151.61	EP	6/1/2021	\$0.30	303.22
201617_1-3B	b2931	Upgrade	COMED	Pontiac to Brokaw 345 kV	8/10/2017	\$5.62	13.45	EP	6/1/2021	\$5.62	13.45

EP – Engineering Procurement

\*Original benefits are the benefits that were determined when the projects were initially approved



## Revision History

- V1 – 11/11/2019 – Original slides posted
- V2 - 11/13/2019
  - Slide 12: Added clarifying note:
    - \*\*Capability in terms of line ratings increase / Flexibility in terms of dynamic flow control
  - Slide 21: Added
    - Reevaluation of projects b2697, b2976, b2931 completed
      - All projects pass the 1.25 threshold
      - Results included in Appendix C
    - This concludes the 2019 Reevaluation process
  - Added slides 29,30
    - Appendix C - Reevaluation Results b2697, b2976, b2931
- V3 - 11/26/2019 – Corrected typo for MISO Cost Allocation on slide #5



# Market Efficiency Update

Nick Dumitriu  
Sr. Lead Engineer, Market Simulation  
Transmission Expansion Advisory Committee  
December 12, 2019





## 2018/19 Market Efficiency Window



## Conclusion of 2018/19 Long-Term Window

- Four drivers identified:
  - Hunterstown – Lincoln 115 kV
    - HL\_622, baseline b3145, rebuild the Hunterstown-Lincoln 115 kV line, was approved by the PJM Board of Managers for inclusion in the RTEP
  - Marblehead N 161/138kV Transformer
    - No proposed project met B/C criteria in either region
  - Monroe – Wayne 345kV
    - No proposed project effectively resolved congestion
  - Bosserman – Trail Creek 138kV
    - BT\_481, baseline b3142, rebuilding Michigan City to Trail Creek to Bosserman 138kV lines, received provisional approval by the PJM Board of Managers, pending approval by the MISO Board as well
- Analysis is completed, concluding the 2018/19 Market Efficiency Cycle



# Congestion Relief in South-Central Pennsylvania and Northern Maryland



## Background: PJM's RTEP Analyses

- Following the November TEAC, PJM performed additional RTEP analyses
- RTEP analyses included:
  - Project 9A + Project 5E + and Project H-L
  - Alternative Project 9A + Project 5E + Project H-L
- PJM's RTEP analyses have determined that in the combinations described:
  - projects exceed the benefit/cost ratio of 1.25
  - significantly reduce congestion; and
  - solve reliability criteria violations identified in study year 2023



## Combination of projects addresses interrelated congestion drivers

- **2014/2015 Long-Term Window:** PJM Board approved baseline project b2743/2752 in Aug 2016
  - Transource Independence Energy Connection (IEC) Project (Project 9A)
  - Pending CPCN proceedings in Maryland and Pennsylvania
  - Proposed settlement: if approved by states, western part of Project 9A stays the same, but there would be an alternative configuration to a portion of the eastern part of Project 9A (the Alternative IEC East Portion)
- **2016/2017 RTEP Long-Term Window:** PJM Board approved baseline project b2992 in Apr 2018
  - Conastone/Graceton/Bagley/Raphael upgrades in BGE (Project 5E)
- **2018/2019 RTEP Long-Term Window:** PJM Board approved baseline project b3145 in Dec 2019
  - Rebuild Hunterstown-Lincoln 115 kV line (Project H-L)



# Summary of Recent RTEP Analyses

RTEP Analyses	Date Presented	Benefit to Cost Ratio
Alternative Project 9A	5/8/2019	1.39 - 1.52
Re-evaluation of Project 9A	10/17/2019	2.10
Re-evaluation of Project 5E	11/14/2019	1.11
Project H-L	11/14/2019	76.41
Alternative Project 9A	11/14/2019	1.60
Re-evaluation of Project 5E (including Project H-L)	11/14/2019	1.80
Project 9A + Project 5E + Project H-L	12/12/2019	2.87
Alternative Project 9A + Project 5E + Project H-L	12/12/2019	2.25 - 2.33

New Analysis  
Performed after  
November TEAC





- Baseline project b3145 (Project H-L) included in the RTEP
  - rebuild Hunterstown-Lincoln 115 kV line
  - Board approved in December 2019
- Baseline project b2992 (Project 5E) remains in the RTEP
  - Conastone/Graceton/Bagley/Raphael 230 kV upgrades
  - Board approved in April 2018
- Transource Project 9A (b2743.2-8, b2752.1-9)
  - Project 9A – exceeds 1.25 B/C ratio and remain in RTEP
  - Alternative Project 9A - exceeds 1.25 B/C ratio
    - PJM Board of Managers approved Alternative Project 9A subject to the Maryland Public Service Commission's and the Pennsylvania Public Utility Commission's approval of the Alternative Project 9A through their respective Certificate of Public Convenience and Necessity proceedings



# Questions?







- V1 – 12/09/2019 – Original slides posted

**Instructions**

---

- 1 - Add simulation data to "Sim.Results" tab using the format in the example
- 2 - Update "Project Details" table within the "Setup" tab. Each Project (4 years) is assigned a group. The Base (Comparison group), Cost, ISD should be added
- 3 - Results displayed on BC\_CA (Benefit Cost - Cost Allocation) Results tab. Use Cell "D4" to switch from one project to another.
- 4 - All formulas will automatically update

## Reporting Data Inputs

<u>Reporting Variable</u>	<u>Description</u>	<u>Report Agent</u>	<u>Calculation Granularity</u>	<u>Variable (TPL)</u>	<u>Promod Txt Files</u>	<u>Calculation Granularity</u>	<u>Variable</u>
Total Demand Cost	$MW_{bus} LMP_{bus}$	Promod Report Agent	Monthly/Hourly	Demand >> Bus Level Demand Costs	*.BUS	Hourly	DEMND CST
Generator Production Cost	Fuel + O&M + Emissions	Promod Report Agent	Monthly/Hourly	Generating Units >> Costs >> Total Variable Production Costs By Unit	*.UNT	Hourly	UCST
Merchant Transaction Value	$FWR \text{ on Line } \times LMP_{pjm}$	Promod Report Agent	Hourly	LMP >> Locational Marginal Price (\$/MWH) FWR >> Constant (Input)	*.BUS	Hourly	MBC
Hourly Interchange	PJM generation - PJM Load - PJM Losses	Promod Report Agent	Hourly	LMP >> Locational Marginal Price (\$/MWH)	*.TRN	Hourly	Tariffs

## Spreadsheet Tabs

## Tab

Sim.Results  
Setup  
BC\_CA Results  
NLP Analysis  
PRDCst Analysis

## Purpose

Enter results from simulation. Format and layout must be preserved for spreadsheet to update appropriately  
Only the "Project Details" table should be updated  
Results based on "NLP Analysis" and "PRDCst Analysis" calculations. No changes should be made to this sheet, except the Project Group Selection (Cell "D4").  
Net Load Payment Analysis. Calculates trend-line for each zone, and determines the in-between year calculated net load payment benefits  
Adjusted Production Cost Analysis Payment Analysis. Calculates trend-line for each zone, and determines the in-between year calculated net load payment benefits

**Benefit Cost Test**

<b>Project</b>	<b>Sensitivity</b>	<b>Case</b>	<b>Basecase</b>
CA3		201819ME PJM Base CA3 S2 v2019-07-26	201819ME PJM Base Remove All S2 v2019-07-26

Project Group **B**

Criteria	Benefits Allocation		Benefits Dollars (\$Millions)		Weighted Benefits Dollars (\$Millions)		Project Result			
	NLP	APC	NLP	APC	NLP	APC	Benefits (\$Millions)	B/C	Pass	Breakeven (\$Millions)
< 500 kV	100%	0%	\$844.8	\$149.86	\$844.81	\$0.00	\$844.81	66	TRUE	\$635.58
345-kV DC and >= 500 kV	50%	50%	\$844.8	\$149.86	\$422.40	\$74.93	\$497.33	0.98	FALSE	\$374.17

Cost Variables	
Project Capital Cost	\$478.48
Annual Revenue Requirement (\$/Yr)	\$56.75
Present Value of Payments	\$508.79

### Cost Allocation:

ZONE	2019 NSPL (MW)	NLP %	< 500 kV	345-kV DC and >= 500 kV
345-kV DC and >= 500 kV	50%	50%		
Total:	161361.5			
AECO	2591.3	0.00%	\$0.00	\$4.09
AEP	22739.0	9.92%	\$50.50	\$61.10
APS	9342.2	7.13%	\$36.29	\$32.87
BGE	6626.5	12.65%	\$64.35	\$42.62
COMED	21349.4	0.00%	\$0.00	\$33.66
DAY	3337.2	1.11%	\$5.66	\$8.09
DEOK	5194.9	0.00%	\$0.00	\$8.19
DOM	21232.0	48.08%	\$244.62	\$155.78
DPL	4002.3	0.00%	\$0.00	\$6.31
DUQ	2795.1	0.00%	\$0.00	\$4.41
EKPC	3430.8	0.84%	\$4.25	\$7.53
FE-ATSI	12824.5	0.00%	\$0.00	\$20.22
JCPL	5976.5	0.00%	\$0.00	\$9.42
METED	3027.8	0.00%	\$0.00	\$4.77
NEPTHVDC	660.0	0.00%	\$0.00	\$1.04
OVEC	140.5	0.04%	\$0.19	\$0.32
PECO	8607.9	0.00%	\$0.00	\$13.57
PENELEC	2997.2	0.00%	\$0.00	\$4.73
PEPCO	6412.0	20.23%	\$102.93	\$61.58
PLGRP	7681.3	0.00%	\$0.00	\$12.11
PSEG	9978.3	0.00%	\$0.00	\$15.73
RECO	414.8	0.00%	\$0.00	\$0.65

**Benefit Cost Test**

Project

Sensitivity

Case

Basecase

CA3

201819ME PJM Base CA3 S2 v2019-07-26

201819ME PJM Base Remove All S2 v2019-07-26

Project Group **B**

Criteria	Benefits Allocation		Benefits Dollars (\$Millions)		Weighted Benefits Dollars (\$Millions)		Project Result			
	NLP	APC	NLP	APC	NLP	APC	Benefits (\$Millions)	B/C	Pass	Breakeven (\$Millions)
< 500 kV	100%	0%	\$844.8	\$149.86	\$844.81	\$0.00	\$844.81	1.60	TRUE	\$635.58
345-kV DC and >= 500 kV	50%	50%	\$844.8	\$149.86	\$422.40	\$74.93	\$497.33	0.94	FALSE	\$374.17

**Cost Variables**

Project Capital Cost	\$496.17
Annual Revenue Requirement (\$/Yr)	\$58.85
Present Value of Payments	\$527.60

**Cost Allocation:**

<u>ZONE</u>	2019 NSPL (MW)	NLP %	< 500 kV	345-kV DC and >= 500 kV
345-kV DC and >= 500 kV	50%	50%		
Total:	161361.5			
AECO	2591.3	0.00%	\$0.00	\$4.24
AEP	22739.0	9.92%	\$52.36	\$63.36
APS	9342.2	7.13%	\$37.63	\$34.09
BGE	6626.5	12.65%	\$66.73	\$44.20
COMED	21349.4	0.00%	\$0.00	\$34.90
DAY	3337.2	1.11%	\$5.87	\$8.39
DEOK	5194.9	0.00%	\$0.00	\$8.49
DOM	21232.0	48.08%	\$253.66	\$161.54
DPL	4002.3	0.00%	\$0.00	\$6.54
DUQ	2795.1	0.00%	\$0.00	\$4.57
EKPC	3430.8	0.84%	\$4.41	\$7.81
FE-ATSI	12824.5	0.00%	\$0.00	\$20.97
JCPL	5976.5	0.00%	\$0.00	\$9.77
METED	3027.8	0.00%	\$0.00	\$4.95
NEPETHVDC	660.0	0.00%	\$0.00	\$1.08
OVEC	140.5	0.04%	\$0.20	\$0.33
PECO	8607.9	0.00%	\$0.00	\$14.07
PENELEC	2997.2	0.00%	\$0.00	\$4.90
PEPCO	6412.0	20.23%	\$106.74	\$63.85
PLGRP	7681.3	0.00%	\$0.00	\$12.56
PSEG	9978.3	0.00%	\$0.00	\$16.31
RECO	414.8	0.00%	\$0.00	\$0.68

Project Alias	Project Group-Year-Zone	Base Group-Year-Zone	Demand Zone	Load Payment	ARR Valuation	Net Load Payment	Production Cost	Interchange Value	Adjusted Production Cost
201819ME PJM Base Remove All S2 v2	A2019AECO	A2019AECO	AECO	241196076.6	-275694.19	241471770.8	136830663.3	-29785295.86	107045367.5
201819ME PJM Base Remove All S2 v2	A2019AEP	A2019AEP	AEP	3257455472	-18096837.08	3275552309	3105185128	-29785295.86	3075399833
201819ME PJM Base Remove All S2 v2	A2019APS	A2019APS	APS	1253636083	20270759.34	1233365324	1388763557	-29785295.86	1358978262
201819ME PJM Base Remove All S2 v2	A2019BGE	A2019BGE	BGE	859057000.8	1585284.72	857471716.1	223115733.7	-29785295.86	193330437.9
201819ME PJM Base Remove All S2 v2	A2019COMED	A2019COMED	COMED	2477209558	3255963.74	2473953594	1614465709	-29785295.86	1584680413
201819ME PJM Base Remove All S2 v2	A2019DAY	A2019DAY	DAY	444860117	142259.62	444717857.4	44405696.48	-29785295.86	14620400.62
201819ME PJM Base Remove All S2 v2	A2019DEOK	A2019DEOK	DEOK	675080093.8	6105089.92	668975003.9	496914497.5	-29785295.86	467129201.6
201819ME PJM Base Remove All S2 v2	A2019DOM	A2019DOM	DOM	2520882262	11166396.58	2509715866	1485163933	-29785295.86	1455378637
201819ME PJM Base Remove All S2 v2	A2019DPL	A2019DPL	DPL	467071069.3	-383285.85	467454355.1	124443490.9	-29785295.86	94658195.07
201819ME PJM Base Remove All S2 v2	A2019DUQ	A2019DUQ	DUQ	350777619.7	319701.33	350457918.4	106087392.2	-29785295.86	76302096.34
201819ME PJM Base Remove All S2 v2	A2019EKPC	A2019EKPC	EKPC	273205001.1	83736.2	273121264.9	222091528	-29785295.86	192306232.1
201819ME PJM Base Remove All S2 v2	A2019FE-ATSI	A2019FE-ATSI	FE-ATSI	1703693408	5226728.29	1698466680	1010110025	-29785295.86	980324729.2
201819ME PJM Base Remove All S2 v2	A2019JCPL	A2019JCPL	JCPL	548955031.2	-270861.77	549225893	140804804.9	-29785295.86	111019509.1
201819ME PJM Base Remove All S2 v2	A2019METED	A2019METED	METED	384337234.3	1484367.24	382852867	355612458	-29785295.86	325827162.1
201819ME PJM Base Remove All S2 v2	A2019NEPTHVDC	A2019NEPTHVDC	NEPTHVDC	140912121.3	0	140912121.3	0	-29785295.86	-29785295.86
201819ME PJM Base Remove All S2 v2	A2019OVEC	A2019OVEC	OVEC	13583004.44	0	13583004.44	288478983.5	-29785295.86	258693687.7
201819ME PJM Base Remove All S2 v2	A2019PECO	A2019PECO	PECO	1016367575	-70085.26	1016437660	953842440.1	-29785295.86	924057144.3
201819ME PJM Base Remove All S2 v2	A2019PENELEC	A2019PENELEC	PENELEC	427554818.2	572787.77	426982030.4	1084981709	-29785295.86	1055196413
201819ME PJM Base Remove All S2 v2	A2019PEPCO	A2019PEPCO	PEPCO	829567536.8	6544255.28	823023281.5	215592708	-29785295.86	185807412.1
201819ME PJM Base Remove All S2 v2	A2019PLGRP	A2019PLGRP	PLGRP	1002630099	1845135.16	1000984964	1230988040	-29785295.86	1201202744
201819ME PJM Base Remove All S2 v2	A2019PSEG	A2019PSEG	PSEG	1084299946	-2912886.17	1067212832	975474338.7	-29785295.86	945689042.8
201819ME PJM Base Remove All S2 v2	A2019RECO	A2019RECO	RECO	37832193.84	108111.11	37724082.72	0	-29785295.86	-29785295.86
201819ME PJM Base Remove All S2 v2	A2019zPJMIMP	A2019zPJMIMP	zPJMIMP	0	0	0	216177954.7	-29785295.86	186392658.8
201819ME PJM Base Remove All S2 v2	A2023AECO	A2023AECO	AECO	312122640.8	-234286.84	312356927.5	163865358.1	-42950569.4	120914788.7
201819ME PJM Base Remove All S2 v2	A2023AEP	A2023AEP	AEP	4139967985	-23410701.51	4163378686	3665154596	-42950569.4	3622204027
201819ME PJM Base Remove All S2 v2	A2023APS	A2023APS	APS	1643446996	16992314.64	1626454682	1682255019	-42950569.4	1639304450
201819ME PJM Base Remove All S2 v2	A2023BGE	A2023BGE	BGE	1086040842	2757677.02	1083283165	330467062.9	-42950569.4	287516493.5
201819ME PJM Base Remove All S2 v2	A2023COMED	A2023COMED	COMED	3104438256	2727956.36	3101710300	1959017376	-42950569.4	1916068807
201819ME PJM Base Remove All S2 v2	A2023DAY	A2023DAY	DAY	560601692.8	22996.36	560578696.4	69352356.56	-42950569.4	26401787.16
201819ME PJM Base Remove All S2 v2	A2023DEOK	A2023DEOK	DEOK	853337848.9	3013182.34	850324666.5	607314437.3	-42950569.4	564363867.9
201819ME PJM Base Remove All S2 v2	A2023DOM	A2023DOM	DOM	3343739727	11353912.24	3332385815	2012464103	-42950569.4	1969513534
201819ME PJM Base Remove All S2 v2	A2023DPL	A2023DPL	DPL	618709361.2	393497.15	618315864	74178977.3	-42950569.4	31228407.9
201819ME PJM Base Remove All S2 v2	A2023DUQ	A2023DUQ	DUQ	439991338.2	-551475.48	440542813.7	182469100.5	-42950569.4	139518531.1
201819ME PJM Base Remove All S2 v2	A2023EKPC	A2023EKPC	EKPC	344259923	-24739.85	344264662.9	299838497.7	-42950569.4	256887928.3
201819ME PJM Base Remove All S2 v2	A2023FE-ATSI	A2023FE-ATSI	FE-ATSI	2148752542	863626.69	2147888915	1344418721	-42950569.4	1301468152
201819ME PJM Base Remove All S2 v2	A2023JCPL	A2023JCPL	JCPL	717775437.1	628103.62	717147333.5	122506985.3	-42950569.4	79556415.89
201819ME PJM Base Remove All S2 v2	A2023METED	A2023METED	METED	509760623.8	863118.39	508897505.4	355851349.9	-42950569.4	312900780.5
201819ME PJM Base Remove All S2 v2	A2023NEPTHVDC	A2023NEPTHVDC	NEPTHVDC	187461015.5	0	187461015.5	0	-42950569.4	-42950569.4
201819ME PJM Base Remove All S2 v2	A2023OVEC	A2023OVEC	OVEC	16943122.75	0	16943122.75	363664621.7	-42950569.4	320714052.3
201819ME PJM Base Remove All S2 v2	A2023PECO	A2023PECO	PECO	1360827706	-586468.72	1361414175	983647780.6	-42950569.4	940697211.2
201819ME PJM Base Remove All S2 v2	A2023PENELEC	A2023PENELEC	PENELEC	542425550.9	-786535.8	543212086.7	1453606332	-42950569.4	1410655762
201819ME PJM Base Remove All S2 v2	A2023PEPCO	A2023PEPCO	PEPCO	1041162673	5276137.31	1035886536	269558059.5	-42950569.4	226607490.1
201819ME PJM Base Remove All S2 v2	A2023PLGRP	A2023PLGRP	PLGRP	1329646208	3323567.8	1326322640	1471094679	-42950569.4	1428144110
201819ME PJM Base Remove All S2 v2	A2023PSEG	A2023PSEG	PSEG	1395410596	-1461716.95	1396872313	1036325104	-42950569.4	993374535
201819ME PJM Base Remove All S2 v2	A2023RECO	A2023RECO	RECO	48517050.65	42975.24	48474075.4	0	-42950569.4	-42950569.4
201819ME PJM Base Remove All S2 v2	A2023zPJMIMP	A2023zPJMIMP	zPJMIMP	0	0	0	240755607.2	-42950569.4	197805037.8
201819ME PJM Base Remove All S2 v2	A2026AECO	A2026AECO	AECO	344436744.3	-418418.79	344855163	202223348.6	-56061101.45	146162247.1
201819ME PJM Base Remove All S2 v2	A2026AEP	A2026AEP	AEP	4775808874	-27633875.22	4803442750	4109978732	-56061101.45	4053917631
201819ME PJM Base Remove All S2 v2	A2026APS	A2026APS	APS	1892785286	22379135.49	1870406150	1870488010	-56061101.45	1814426908

201819ME PJM Base Remove All S2 v2	A2026BGE	A2026BGE	BGE	1222990110	2562680.47	1220427430	357356250.2	-56061101.45	301295148.7
201819ME PJM Base Remove All S2 v2	A2026COMED	A2026COMED	COMED	3585113001	4078021.76	3581034979	2181727609	-56061101.45	2125666508
201819ME PJM Base Remove All S2 v2	A2026DAY	A2026DAY	DAY	644948292.1	59574.45	644888717.7	83949488.6	-56061101.45	27888387.15
201819ME PJM Base Remove All S2 v2	A2026DEOK	A2026DEOK	DEOK	985228269.1	6111943.17	979116325.9	674142768.1	-56061101.45	618081866.7
201819ME PJM Base Remove All S2 v2	A2026DOM	A2026DOM	DOM	3870276708	11993654.82	3858283054	2362749065	-56061101.45	2306687963
201819ME PJM Base Remove All S2 v2	A2026DPL	A2026DPL	DPL	695298781.9	1349276.12	693949505.8	75827326.91	-56061101.45	19766225.46
201819ME PJM Base Remove All S2 v2	A2026DUQ	A2026DUQ	DUQ	498225047.2	-123039.77	498348087	207139612.3	-56061101.45	151078510.9
201819ME PJM Base Remove All S2 v2	A2026EKPC	A2026EKPC	EKPC	395125608.4	-12430.96	395138039.3	332493439.3	-56061101.45	276432337.9
201819ME PJM Base Remove All S2 v2	A2026FE-ATSI	A2026FE-ATSI	FE-ATSI	2447698285	4743041.47	2442955243	1537840350	-56061101.45	1481779249
201819ME PJM Base Remove All S2 v2	A2026JCPL	A2026JCPL	JCPL	794739250.4	368108.72	794371141.7	138601059.2	-56061101.45	82539957.7
201819ME PJM Base Remove All S2 v2	A2026METED	A2026METED	METED	576092194.1	1486412.61	574605781.5	409132213.4	-56061101.45	353071111.9
201819ME PJM Base Remove All S2 v2	A2026NEPTHVDC	A2026NEPTHVDC	NEPTHVDC	207435501.1	0	207435501.1	0	-56061101.45	-56061101.45
201819ME PJM Base Remove All S2 v2	A2026OVEC	A2026OVEC	OVEC	19184709.57	0	19184709.57	400855036.3	-56061101.45	344793934.9
201819ME PJM Base Remove All S2 v2	A2026PECO	A2026PECO	PECO	1526204703	-1441709.11	1527646412	1101758044	-56061101.45	1045696943
201819ME PJM Base Remove All S2 v2	A2026PENELEC	A2026PENELEC	PENELEC	610656789.5	352221.52	610304568	1621767074	-56061101.45	1565705972
201819ME PJM Base Remove All S2 v2	A2026PEPCO	A2026PEPCO	PEPCO	1181498207	6378739.47	1175119468	299792100.6	-56061101.45	243730999.1
201819ME PJM Base Remove All S2 v2	A2026PLGRP	A2026PLGRP	PLGRP	1485077168	3516013.55	1481561155	1683488159	-56061101.45	1627427058
201819ME PJM Base Remove All S2 v2	A2026PSEG	A2026PSEG	PSEG	1543614631	-3823032.47	1547437663	1179786100	-56061101.45	1123724998
201819ME PJM Base Remove All S2 v2	A2026RECO	A2026RECO	RECO	54516201.57	105780.41	54410421.17	0	-56061101.45	-56061101.45
201819ME PJM Base Remove All S2 v2	A2026zPJMIMP	A2026zPJMIMP	zPJMIMP	0	0	0	265911026.2	-56061101.45	209849924.8
201819ME PJM Base Remove All S2 v2	A2029AEAO	A2029AEAO	AEAO	382779050.2	-517597.77	383296648	240718969.1	-66041269.92	174677699.2
201819ME PJM Base Remove All S2 v2	A2029AEP	A2029AEP	AEP	5460056942	-33423029.27	5493479971	4682634697	-66041269.92	4616593428
201819ME PJM Base Remove All S2 v2	A2029APS	A2029APS	APS	2158413043	24390003.9	2134023039	2087380762	-66041269.92	2021339493
201819ME PJM Base Remove All S2 v2	A2029BGE	A2029BGE	BGE	1375886283	3293932.45	1372592350	394207279	-66041269.92	328166009.1
201819ME PJM Base Remove All S2 v2	A2029COMED	A2029COMED	COMED	4105758566	5925230.46	4099833336	2397760626	-66041269.92	2331719356
201819ME PJM Base Remove All S2 v2	A2029DAY	A2029DAY	DAY	734284627.4	46154.3	734238473.1	112476508.9	-66041269.92	46435238.99
201819ME PJM Base Remove All S2 v2	A2029DEOK	A2029DEOK	DEOK	1126430593	7716652.92	1118713940	744798241.9	-66041269.92	678756971.9
201819ME PJM Base Remove All S2 v2	A2029DOM	A2029DOM	DOM	4442677825	12484330.52	4430193494	2747178674	-66041269.92	2681137404
201819ME PJM Base Remove All S2 v2	A2029DPL	A2029DPL	DPL	784473565.5	-195853.13	784669418.6	89044892.11	-66041269.92	23003622.19
201819ME PJM Base Remove All S2 v2	A2029DUQ	A2029DUQ	DUQ	560123490.9	-189552.56	560313043.5	232829333.8	-66041269.92	166788063.9
201819ME PJM Base Remove All S2 v2	A2029EKPC	A2029EKPC	EKPC	447976376.7	76196.35	447900180.3	374811708.4	-66041269.92	308770438.5
201819ME PJM Base Remove All S2 v2	A2029FE-ATSI	A2029FE-ATSI	FE-ATSI	2765836693	5747751.7	2760088942	1722829160	-66041269.92	1656787890
201819ME PJM Base Remove All S2 v2	A2029JCPL	A2029JCPL	JCPL	889112237.4	275815.91	888836421.5	164147260.1	-66041269.92	98105990.18
201819ME PJM Base Remove All S2 v2	A2029METED	A2029METED	METED	657233295.2	1976278.99	655257016.2	478778662.5	-66041269.92	412737392.6
201819ME PJM Base Remove All S2 v2	A2029NEPTHVDC	A2029NEPTHVDC	NEPTHVDC	230412458.1	0	230412458.1	0	-66041269.92	-66041269.92
201819ME PJM Base Remove All S2 v2	A2029OVEC	A2029OVEC	OVEC	21500555.94	0	21500555.94	440822391	-66041269.92	374781121.1
201819ME PJM Base Remove All S2 v2	A2029PECO	A2029PECO	PECO	1729191484	-1315518.79	1730507003	1225535195	-66041269.92	1159493925
201819ME PJM Base Remove All S2 v2	A2029PENELEC	A2029PENELEC	PENELEC	681775147.1	167680.02	681607467	1800132419	-66041269.92	1734091149
201819ME PJM Base Remove All S2 v2	A2029PEPCO	A2029PEPCO	PEPCO	1331238740	7154379.49	1324084360	359025599	-66041269.92	292984329.1
201819ME PJM Base Remove All S2 v2	A2029PLGRP	A2029PLGRP	PLGRP	1673795313	4470115.18	1669325198	1914631745	-66041269.92	1848590475
201819ME PJM Base Remove All S2 v2	A2029PSEG	A2029PSEG	PSEG	1720000308	-4883634.23	1724883943	1317943736	-66041269.92	1251902466
201819ME PJM Base Remove All S2 v2	A2029RECO	A2029RECO	RECO	60463008.76	125525.22	60337483.52	0	-66041269.92	-66041269.92
201819ME PJM Base Remove All S2 v2	A2029zPJMIMP	A2029zPJMIMP	zPJMIMP	0	0	0	298613985.1	-66041269.92	232572715.2
201819ME PJM Base CA3 S2 v2019-07	B2019AEAO	A2019AEAO	AEAO	244925918.7	-113246.57	245039165.3	149622651.7	-31872785.09	117749866.6
201819ME PJM Base CA3 S2 v2019-07	B2019AEP	A2019AEP	AEP	3253743591	-19377463	3273121054	3091269972	-31872785.09	3059397187
201819ME PJM Base CA3 S2 v2019-07	B2019APS	A2019APS	APS	1234866642	3683898.83	1231182743	1376351428	-31872785.09	1344478643
201819ME PJM Base CA3 S2 v2019-07	B2019BGE	A2019BGE	BGE	855461813.3	3918961.79	851542851.5	220254259.3	-31872785.09	188381474.2
201819ME PJM Base CA3 S2 v2019-07	B2019COMED	A2019COMED	COMED	2481329109	2998415.6	2478330693	1613649356	-31872785.09	1581776570
201819ME PJM Base CA3 S2 v2019-07	B2019DAY	A2019DAY	DAY	444670080.5	39877.5	444630203	42239230.06	-31872785.09	10366444.97

201819ME PJM Base CA3 S2 v2019-07	B2019DEOK	A2019DEOK	DEOK	674769389.5	2747089.98	672022299.5	496369820.6	-31872785.09	464497035.5
201819ME PJM Base CA3 S2 v2019-07	B2019DOM	A2019DOM	DOM	2482118245	3227878.71	2478890366	1358983308	-31872785.09	1327110523
201819ME PJM Base CA3 S2 v2019-07	B2019DPL	A2019DPL	DPL	474291055.1	-48889.12	474339944.2	155544011	-31872785.09	123671225.9
201819ME PJM Base CA3 S2 v2019-07	B2019DUQ	A2019DUQ	DUQ	351061973.9	75701.23	350986272.7	108397020.8	-31872785.09	76524235.67
201819ME PJM Base CA3 S2 v2019-07	B2019EKPC	A2019EKPC	EKPC	273139882.5	119096.49	273020786	221342388.8	-31872785.09	189469603.7
201819ME PJM Base CA3 S2 v2019-07	B2019FE-ATSI	A2019FE-ATSI	FE-ATSI	1705398724	1989735.03	1703408989	1002338082	-31872785.09	970465297.1
201819ME PJM Base CA3 S2 v2019-07	B2019JCPL	A2019JCPL	JCPL	557876602.5	-203524.76	558080127.3	149900806.3	-31872785.09	118028021.2
201819ME PJM Base CA3 S2 v2019-07	B2019METED	A2019METED	METED	389038494.1	241020.72	388797473.4	367476310.2	-31872785.09	335603525.1
201819ME PJM Base CA3 S2 v2019-07	B2019NEPTHVDC	A2019NEPTHVDC	NEPTHVDC	142962754.4	0	142962754.4	0	-31872785.09	-31872785.09
201819ME PJM Base CA3 S2 v2019-07	B2019OVEC	A2019OVEC	OVEC	13572006.34	0	13572006.34	286257343.1	-31872785.09	254384558
201819ME PJM Base CA3 S2 v2019-07	B2019PECO	A2019PECO	PECO	1033076691	828727.89	1032247963	1013448363	-31872785.09	981575577.7
201819ME PJM Base CA3 S2 v2019-07	B2019PENELEC	A2019PENELEC	PENELEC	430921242.7	-353520.35	431274763	1106205704	-31872785.09	1074332919
201819ME PJM Base CA3 S2 v2019-07	B2019PEPCO	A2019PEPCO	PEPCO	814453586.6	3355201.61	811098384.9	180139667.9	-31872785.09	148266882.8
201819ME PJM Base CA3 S2 v2019-07	B2019PLGRP	A2019PLGRP	PLGRP	1017567631	189685.61	1017377945	1284313750	-31872785.09	1252440965
201819ME PJM Base CA3 S2 v2019-07	B2019PSEG	A2019PSEG	PSEG	1080829469	-1236088.06	1082065557	1009287966	-31872785.09	977415180.8
201819ME PJM Base CA3 S2 v2019-07	B2019RECO	A2019RECO	RECO	38003341.61	62652.39	37940689.22	0	-31872785.09	-31872785.09
201819ME PJM Base CA3 S2 v2019-07	B2019zPJMIMP	A2019zPJMIMP	zPJMIMP	0	0	0	215977626.8	-31872785.09	184104841.8
201819ME PJM Base CA3 S2 v2019-07	B2023AECO	A2023AECO	AECO	315298740.5	-68839.44	315367579.9	173597228.9	-44476686.9	129120542
201819ME PJM Base CA3 S2 v2019-07	B2023AEP	A2023AEP	AEP	4133998862	-24686515.29	4158685378	3660912267	-44476686.9	3616435580
201819ME PJM Base CA3 S2 v2019-07	B2023APS	A2023APS	APS	1624040615	797361.28	1623243253	1678606510	-44476686.9	1634129823
201819ME PJM Base CA3 S2 v2019-07	B2023BGE	A2023BGE	BGE	1080442237	3096152.59	1077346084	326844450.9	-44476686.9	282367764
201819ME PJM Base CA3 S2 v2019-07	B2023COMED	A2023COMED	COMED	3108258769	2785942.13	3105472827	1958244749	-44476686.9	1913768062
201819ME PJM Base CA3 S2 v2019-07	B2023DAY	A2023DAY	DAY	560023254.7	-68465.14	560091719.9	69187701.59	-44476686.9	24711014.69
201819ME PJM Base CA3 S2 v2019-07	B2023DEOK	A2023DEOK	DEOK	852314004.1	633597.99	851680406.1	607074608	-44476686.9	562597921.1
201819ME PJM Base CA3 S2 v2019-07	B2023DOM	A2023DOM	DOM	3305325347	5154675.49	3300170672	1925873640	-44476686.9	1881396953
201819ME PJM Base CA3 S2 v2019-07	B2023DPL	A2023DPL	DPL	624557432.2	639885.55	623917546.7	84180686.57	-44476686.9	39703999.67
201819ME PJM Base CA3 S2 v2019-07	B2023DUQ	A2023DUQ	DUQ	440200260.3	-644797.5	440845057.8	182630938.4	-44476686.9	138154251.5
201819ME PJM Base CA3 S2 v2019-07	B2023EKPC	A2023EKPC	EKPC	343809868.9	-19247.81	343829116.7	298839982.2	-44476686.9	254363295.3
201819ME PJM Base CA3 S2 v2019-07	B2023FE-ATSI	A2023FE-ATSI	FE-ATSI	2149945651	-1189109.12	2151134760	1348012611	-44476686.9	1303535924
201819ME PJM Base CA3 S2 v2019-07	B2023JCPL	A2023JCPL	JCPL	725074052.7	485128.78	724588923.9	127425240.6	-44476686.9	82948553.74
201819ME PJM Base CA3 S2 v2019-07	B2023METED	A2023METED	METED	514663507.7	-359519.7	515023027.4	377031096.2	-44476686.9	332554409.3
201819ME PJM Base CA3 S2 v2019-07	B2023NEPTHVDC	A2023NEPTHVDC	NEPTHVDC	188469995.8	0	188469995.8	0	-44476686.9	-44476686.9
201819ME PJM Base CA3 S2 v2019-07	B2023OVEC	A2023OVEC	OVEC	16923315.49	0	16923315.49	363531047.6	-44476686.9	319054360.7
201819ME PJM Base CA3 S2 v2019-07	B2023PECO	A2023PECO	PECO	1374804213	151645.11	1374652568	1019453138	-44476686.9	974976451.5
201819ME PJM Base CA3 S2 v2019-07	B2023PENELEC	A2023PENELEC	PENELEC	545724868.2	-1753204.29	547478072.5	1458092431	-44476686.9	1413615744
201819ME PJM Base CA3 S2 v2019-07	B2023PEPCO	A2023PEPCO	PEPCO	1027966660	2936864.45	1025029796	236973178.4	-44476686.9	192496491.5
201819ME PJM Base CA3 S2 v2019-07	B2023PLGRP	A2023PLGRP	PLGRP	1343689899	1816811.42	1341873087	1520302436	-44476686.9	1475825749
201819ME PJM Base CA3 S2 v2019-07	B2023PSEG	A2023PSEG	PSEG	1409828223	171854	14098656369	1052446196	-44476686.9	1007969509
201819ME PJM Base CA3 S2 v2019-07	B2023RECO	A2023RECO	RECO	48844125.76	22834.35	48821291.42	0	-44476686.9	-44476686.9
201819ME PJM Base CA3 S2 v2019-07	B2023zPJMIMP	A2023zPJMIMP	zPJMIMP	0	0	0	240680508.6	-44476686.9	196203821.7
201819ME PJM Base CA3 S2 v2019-07	B2026AECO	A2026AECO	AECO	347985539.3	-206179.57	348191718.9	212122782.3	-58234980.14	153887802.1
201819ME PJM Base CA3 S2 v2019-07	B2026AEP	A2026AEP	AEP	4763935292	-29251987.65	4793187279	4097660931	-58234980.14	4039425950
201819ME PJM Base CA3 S2 v2019-07	B2026APS	A2026APS	APS	1865251851	1378122.53	1863873729	1864010987	-58234980.14	1805776007
201819ME PJM Base CA3 S2 v2019-07	B2026BGE	A2026BGE	BGE	1210734788	1670316.01	1209064471	346832351.9	-58234980.14	288597371.8
201819ME PJM Base CA3 S2 v2019-07	B2026COMED	A2026COMED	COMED	3587031874	4352572.73	3582679302	2175897711	-58234980.14	2117662731
201819ME PJM Base CA3 S2 v2019-07	B2026DAY	A2026DAY	DAY	643693501.6	-51201.51	643744703.1	81829441	-58234980.14	23594460.86
201819ME PJM Base CA3 S2 v2019-07	B2026DEOK	A2026DEOK	DEOK	983133459.6	3322320.69	979811138.8	673726032	-58234980.14	615491051.9
201819ME PJM Base CA3 S2 v2019-07	B2026DOM	A2026DOM	DOM	3819637815	6602264.14	3813035551	2257460575	-58234980.14	2199225595
201819ME PJM Base CA3 S2 v2019-07	B2026DPL	A2026DPL	DPL	701269420	1400447.9	699868972.1	90062602.07	-58234980.14	31827621.93



201819ME PJM Base CA3 S2 v2019-07	B2026DUQ	A2026DUQ	DUQ	498067345.3	-162794.22	498230139.5	206863945	-58234980.14	148628964.8
201819ME PJM Base CA3 S2 v2019-07	B2026EKPC	A2026EKPC	EKPC	394258990.8	2139.96	394256850.8	331882777.4	-58234980.14	273647797.3
201819ME PJM Base CA3 S2 v2019-07	B2026FE-ATSI	A2026FE-ATSI	FE-ATSI	2447143990	2489197.09	2444654793	1538752323	-58234980.14	1480517343
201819ME PJM Base CA3 S2 v2019-07	B2026JCPL	A2026JCPL	JCPL	803382130.6	129090.65	803253040	156077430.6	-58234980.14	97842450.43
201819ME PJM Base CA3 S2 v2019-07	B2026METED	A2026METED	METED	581143353.1	-98948.19	581242301.3	450087539.4	-58234980.14	391852559.2
201819ME PJM Base CA3 S2 v2019-07	B2026NEPTHVDC	A2026NEPTHVDC	NEPTHVDC	208942011.3	0	208942011.3	0	-58234980.14	-58234980.14
201819ME PJM Base CA3 S2 v2019-07	B2026OVEC	A2026OVEC	OVEC	19145729.37	0	19145729.37	400778597.6	-58234980.14	342543617.5
201819ME PJM Base CA3 S2 v2019-07	B2026PECO	A2026PECO	PECO	1541395073	-657170.21	1542052243	1148625726	-58234980.14	1090390746
201819ME PJM Base CA3 S2 v2019-07	B2026PENELEC	A2026PENELEC	PENELEC	614285109.5	-873136.3	615158245.8	1624464534	-58234980.14	1566229554
201819ME PJM Base CA3 S2 v2019-07	B2026PEPCO	A2026PEPCO	PEPCO	1159525626	2717301.3	1156808324	264949228.7	-58234980.14	206714248.5
201819ME PJM Base CA3 S2 v2019-07	B2026PLGRP	A2026PLGRP	PLGRP	1499792611	1383304.7	1498409306	1743507741	-58234980.14	1685272761
201819ME PJM Base CA3 S2 v2019-07	B2026PSEG	A2026PSEG	PSEG	1559454539	-1914459.82	1561368999	1202390409	-58234980.14	1144155429
201819ME PJM Base CA3 S2 v2019-07	B2026RECO	A2026RECO	RECO	54888984.88	89901.04	54799083.83	0	-58234980.14	-58234980.14
201819ME PJM Base CA3 S2 v2019-07	B2026zPJMIMP	A2026zPJMIMP	zPJMIMP	0	0	0	265892155.4	-58234980.14	207657175.2
201819ME PJM Base CA3 S2 v2019-07	B2029AECO	A2029AECO	AECO	387090100.8	-287333.11	387377433.9	251073629.1	-68471910.16	182601718.9
201819ME PJM Base CA3 S2 v2019-07	B2029AEP	A2029AEP	AEP	5451196166	-34898514.03	5486094680	4668170444	-68471910.16	4599698534
201819ME PJM Base CA3 S2 v2019-07	B2029APS	A2029APS	APS	2128818193	1064765	2127753428	2083457639	-68471910.16	2014985729
201819ME PJM Base CA3 S2 v2019-07	B2029BGE	A2029BGE	BGE	1362334362	1851333.67	1360483028	375223334.6	-68471910.16	306751424.4
201819ME PJM Base CA3 S2 v2019-07	B2029COMED	A2029COMED	COMED	4108119257	5959112.9	4102160144	2399998123	-68471910.16	2331526213
201819ME PJM Base CA3 S2 v2019-07	B2029DAY	A2029DAY	DAY	733417514.8	-55090.3	733472605.1	111325204.8	-68471910.16	42853294.6
201819ME PJM Base CA3 S2 v2019-07	B2029DEOK	A2029DEOK	DEOK	1125021562	4473371.57	1120548190	744049987.2	-68471910.16	675578077
201819ME PJM Base CA3 S2 v2019-07	B2029DOM	A2029DOM	DOM	4394104856	8053647.15	4386051209	2624853386	-68471910.16	2556381476
201819ME PJM Base CA3 S2 v2019-07	B2029DPL	A2029DPL	DPL	792436467.5	20491.79	792415975.7	105524575.1	-68471910.16	37052664.94
201819ME PJM Base CA3 S2 v2019-07	B2029DUQ	A2029DUQ	DUQ	560426981	-283262.42	560710243.4	232986540.2	-68471910.16	164514630.1
201819ME PJM Base CA3 S2 v2019-07	B2029EKPC	A2029EKPC	EKPC	447478680.3	115640.05	447363040.2	374476141	-68471910.16	306004230.8
201819ME PJM Base CA3 S2 v2019-07	B2029FE-ATSI	A2029FE-ATSI	FE-ATSI	2767439639	2989128.13	2764450510	1722737336	-68471910.16	1654265426
201819ME PJM Base CA3 S2 v2019-07	B2029JCPL	A2029JCPL	JCPL	899726162.6	83703.39	899642459.2	182617038.7	-68471910.16	114145128.5
201819ME PJM Base CA3 S2 v2019-07	B2029METED	A2029METED	METED	663361862.4	117022.38	663244840.1	518902853.2	-68471910.16	450430943
201819ME PJM Base CA3 S2 v2019-07	B2029NEPTHVDC	A2029NEPTHVDC	NEPTHVDC	232637167.5	0	232637167.5	0	-68471910.16	-68471910.16
201819ME PJM Base CA3 S2 v2019-07	B2029OVEC	A2029OVEC	OVEC	21473718.13	0	21473718.13	440832046.3	-68471910.16	372360136.2
201819ME PJM Base CA3 S2 v2019-07	B2029PECO	A2029PECO	PECO	1748824760	-58410.52	1748883170	1288433111	-68471910.16	1219961201
201819ME PJM Base CA3 S2 v2019-07	B2029PENELEC	A2029PENELEC	PENELEC	686632541.9	-1168237.86	687800779.8	1805388021	-68471910.16	1736916111
201819ME PJM Base CA3 S2 v2019-07	B2029PEPCO	A2029PEPCO	PEPCO	1307081587	2787331.48	1304294255	309870402.1	-68471910.16	241398491.9
201819ME PJM Base CA3 S2 v2019-07	B2029PLGRP	A2029PLGRP	PLGRP	1691583595	2074310.31	1689509284	1981056485	-68471910.16	1912584574
201819ME PJM Base CA3 S2 v2019-07	B2029PSEG	A2029PSEG	PSEG	1739602729	-2780950.22	1742383679	1340938890	-68471910.16	1272466980
201819ME PJM Base CA3 S2 v2019-07	B2029RECO	A2029RECO	RECO	60912877.84	103882.04	60808995.8	0	-68471910.16	-68471910.16
201819ME PJM Base CA3 S2 v2019-07	B2029zPJMIMP	A2029zPJMIMP	zPJMIMP	0	0	0	298441560.7	-68471910.16	229969650.5

Years from Sim	Year
Start_yr	2019
Rtep Yr	2023
Rtep Yr+3	2026
Rtep Yr+6	2029

Project Details			
Group	Base Group	ISD	Cost
A	A		
B	A	2023	300
C	A		
D	A		
E	A		
F	A		
G	A		
H	A		

ME Tool Py Field	Zone
Project Alias	AECO
Project Group-Year-Zone	AEP
Base Group-Year-Zone	APS
Demand Zone	BGE
Load Payment	COMED
ARR Valuation	DAY
Net Load Payment	DEOK
Production Cost	DOM
Interchange Value	DPL
Adjusted Production Cost	DUQ
	EKPC
	FE-ATSI
	JCPL
	METED
	NEPTHVDC
	OVEC
	PECO
	PENELEC
	PEPCO
	PLGRP
	PSEG
	RECO
	ZPJMIMP

Project RTEP Year	WACC	FCR	Inflation Assumption	Number of Periods	Pass Criteria
2023	7.25%	11.86%	2.25%	15	1.25

## Net Load Payment Benefits From Simulation

Do not modify ----&gt; Project Group

Do not modify ----&gt; Base Group

ISD

Project RTEP Year

Variable	ME Tool Column	Zone	2019	2020	2021	2022	2023	2024
Net Load Payment	7	AECO	\$ 3,567,395	\$ 3,428,209	\$ 3,289,023	\$ 3,149,838	\$ 3,010,652	\$ 3,119,287
Net Load Payment	7	AEP	\$ (2,431,255)	\$ (2,996,769)	\$ (3,562,282)	\$ (4,127,795)	\$ (4,693,309)	\$ (6,547,363)
Net Load Payment	7	APS	\$ (2,182,581)	\$ (2,439,793)	\$ (2,697,005)	\$ (2,954,216)	\$ (3,211,428)	\$ (4,318,426)
Net Load Payment	7	BGE	\$ (5,928,865)	\$ (5,930,919)	\$ (5,932,973)	\$ (5,935,027)	\$ (5,937,081)	\$ (7,745,707)
Net Load Payment	7	COMED	\$ 4,377,099	\$ 4,223,456	\$ 4,069,813	\$ 3,916,170	\$ 3,762,527	\$ 3,056,459
Net Load Payment	7	DAY	\$ (87,654)	\$ (187,485)	\$ (287,315)	\$ (387,146)	\$ (486,977)	\$ (705,989)
Net Load Payment	7	DEOK	\$ 3,047,296	\$ 2,624,407	\$ 2,201,518	\$ 1,778,629	\$ 1,355,740	\$ 1,135,431
Net Load Payment	7	DOM	\$ (30,825,499)	\$ (31,172,910)	\$ (31,520,321)	\$ (31,867,732)	\$ (32,215,143)	\$ (36,559,263)
Net Load Payment	7	DPL	\$ 6,885,589	\$ 6,564,612	\$ 6,243,636	\$ 5,922,659	\$ 5,601,683	\$ 5,707,611
Net Load Payment	7	DUQ	\$ 528,354	\$ 471,827	\$ 415,299	\$ 358,772	\$ 302,244	\$ 162,180
Net Load Payment	7	EKPC	\$ (100,479)	\$ (189,246)	\$ (278,013)	\$ (366,779)	\$ (455,546)	\$ (597,427)
Net Load Payment	7	FE-ATSI	\$ 4,942,309	\$ 4,518,193	\$ 4,094,077	\$ 3,669,961	\$ 3,245,845	\$ 2,730,413
Net Load Payment	7	JCPL	\$ 8,854,234	\$ 8,501,073	\$ 8,147,912	\$ 7,794,751	\$ 7,441,590	\$ 7,921,693
Net Load Payment	7	METED	\$ 5,944,606	\$ 5,989,835	\$ 6,035,064	\$ 6,080,293	\$ 6,125,522	\$ 6,295,855
Net Load Payment	7	NEPETHVDC	\$ 2,050,633	\$ 1,790,220	\$ 1,529,807	\$ 1,269,394	\$ 1,008,980	\$ 1,174,824
Net Load Payment	7	OVEC	\$ (10,998)	\$ (13,200)	\$ (15,403)	\$ (17,605)	\$ (19,807)	\$ (26,198)
Net Load Payment	7	PECO	\$ 15,810,303	\$ 15,167,326	\$ 14,524,348	\$ 13,881,371	\$ 13,238,393	\$ 13,627,539
Net Load Payment	7	PENELEC	\$ 4,292,733	\$ 4,286,046	\$ 4,279,359	\$ 4,272,672	\$ 4,265,986	\$ 4,461,883
Net Load Payment	7	PEPCO	\$ (11,924,897)	\$ (11,657,858)	\$ (11,390,818)	\$ (11,123,779)	\$ (10,856,740)	\$ (13,341,541)
Net Load Payment	7	PLGRP	\$ 16,392,982	\$ 16,182,348	\$ 15,971,715	\$ 15,761,081	\$ 15,550,447	\$ 15,983,015
Net Load Payment	7	PSEG	\$ 14,852,724	\$ 14,335,558	\$ 13,818,391	\$ 13,301,224	\$ 12,784,057	\$ 13,166,483
Net Load Payment	7	RECO	\$ 216,607	\$ 249,259	\$ 281,911	\$ 314,564	\$ 347,216	\$ 361,032
Net Load Payment	7	zPJMIMP	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

[illegible]

-18,287,561	-21,669,753	-25,051,946	-28,434,138	-31,816,330	-35,198,522	-38,580,714	-41,962,907	-45,345,099	-48,727,291
B2034	B2035	B2036	B2037	B2038	B2039	B2040	B2041	B2042	B2043
A2034	A2035	A2036	A2037	A2038	A2039	A2040	A2041	A2042	A2043
2029	2029	2029	2029	2029	2029	2029	2029	2029	2029
4	4	4	4	4	4	4	4	4	4
0	0	0	0	0	0	0	0	0	0
2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
\$ 3,985,113	\$ 4,034,986	\$ 4,084,860	\$ 4,134,733	\$ 4,184,606	\$ 4,234,480	\$ 4,284,353	\$ 4,334,227	\$ 4,384,100	\$ 4,433,973
\$ (12,316,731)	\$ (12,944,978)	\$ (13,573,224)	\$ (14,201,470)	\$ (14,829,716)	\$ (15,457,962)	\$ (16,086,209)	\$ (16,714,455)	\$ (17,342,701)	\$ (17,970,947)
\$ (9,132,767)	\$ (9,602,896)	\$ (10,073,025)	\$ (10,543,154)	\$ (11,013,283)	\$ (11,483,412)	\$ (11,953,541)	\$ (12,423,670)	\$ (12,893,799)	\$ (13,363,928)
\$ (15,754,220)	\$ (16,463,929)	\$ (17,173,638)	\$ (17,883,347)	\$ (18,593,056)	\$ (19,302,765)	\$ (20,012,474)	\$ (20,722,183)	\$ (21,431,892)	\$ (22,141,601)
\$ 578,521	\$ 327,324	\$ 76,127	\$ (175,070)	\$ (426,267)	\$ (677,463)	\$ (928,660)	\$ (1,179,857)	\$ (1,431,054)	\$ (1,682,251)
\$ (1,435,141)	\$ (1,518,629)	\$ (1,602,118)	\$ (1,685,606)	\$ (1,769,094)	\$ (1,852,583)	\$ (1,936,071)	\$ (2,019,560)	\$ (2,103,048)	\$ (2,186,537)
\$ 350,329	\$ 208,515	\$ 66,700	\$ (75,115)	\$ (216,930)	\$ (358,745)	\$ (500,560)	\$ (642,375)	\$ (784,190)	\$ (926,005)
\$ (53,557,339)	\$ (55,141,927)	\$ (56,726,514)	\$ (58,311,102)	\$ (59,895,690)	\$ (61,480,278)	\$ (63,064,866)	\$ (64,649,454)	\$ (66,234,041)	\$ (67,818,629)
\$ 7,251,323	\$ 7,324,451	\$ 7,397,579	\$ 7,470,708	\$ 7,543,836	\$ 7,616,964	\$ 7,690,092	\$ 7,763,220	\$ 7,836,348	\$ 7,909,476
\$ 15,437	\$ (11,437)	\$ (38,312)	\$ (65,186)	\$ (92,060)	\$ (118,935)	\$ (145,809)	\$ (172,684)	\$ (199,558)	\$ (226,432)
\$ (1,027,220)	\$ (1,081,952)	\$ (1,136,683)	\$ (1,191,415)	\$ (1,246,146)	\$ (1,300,878)	\$ (1,355,609)	\$ (1,410,341)	\$ (1,465,072)	\$ (1,519,803)
\$ 2,438,127	\$ 2,322,825	\$ 2,207,524	\$ 2,092,222	\$ 1,976,920	\$ 1,861,619	\$ 1,746,317	\$ 1,631,015	\$ 1,515,714	\$ 1,400,412
\$ 10,970,032	\$ 11,172,503	\$ 11,374,974	\$ 11,577,445	\$ 11,779,915	\$ 11,982,386	\$ 12,184,857	\$ 12,387,328	\$ 12,589,799	\$ 12,792,270
\$ 8,577,314	\$ 8,772,565	\$ 8,967,816	\$ 9,163,067	\$ 9,358,318	\$ 9,553,569	\$ 9,748,820	\$ 9,944,071	\$ 10,139,322	\$ 10,334,573
\$ 1,907,260	\$ 1,928,752	\$ 1,950,245	\$ 1,971,737	\$ 1,993,230	\$ 2,014,722	\$ 2,036,215	\$ 2,057,707	\$ 2,079,200	\$ 2,100,692
\$ (44,314)	\$ (46,382)	\$ (48,449)	\$ (50,517)	\$ (52,584)	\$ (54,652)	\$ (56,719)	\$ (58,787)	\$ (60,854)	\$ (62,922)
\$ 17,762,933	\$ 17,999,370	\$ 18,235,807	\$ 18,472,244	\$ 18,708,680	\$ 18,945,117	\$ 19,181,554	\$ 19,417,991	\$ 19,654,428	\$ 19,890,865
\$ 6,689,879	\$ 6,873,310	\$ 7,056,741	\$ 7,240,172	\$ 7,423,602	\$ 7,607,033	\$ 7,790,464	\$ 7,973,895	\$ 8,157,326	\$ 8,340,757
\$ (24,101,835)	\$ (25,012,718)	\$ (25,923,601)	\$ (26,834,485)	\$ (27,745,368)	\$ (28,656,252)	\$ (29,567,135)	\$ (30,478,018)	\$ (31,388,902)	\$ (32,299,785)
\$ 20,780,178	\$ 21,142,871	\$ 21,505,564	\$ 21,868,258	\$ 22,230,951	\$ 22,593,645	\$ 22,956,338	\$ 23,319,031	\$ 23,681,725	\$ 24,044,418
\$ 17,179,392	\$ 17,426,821	\$ 17,674,249	\$ 17,921,678	\$ 18,169,106	\$ 18,416,535	\$ 18,663,963	\$ 18,911,392	\$ 19,158,820	\$ 19,406,249
\$ 596,168	\$ 620,801	\$ 645,433	\$ 670,066	\$ 694,699	\$ 719,331	\$ 743,964	\$ 768,597	\$ 793,229	\$ 817,862
\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

-52,109,483  
B2044  
A2044  
2029  
4  
0

**PJM NPV**  
**-\$844,806,909**

**TRENDING A**

<u>2044</u>	<u>ZONE</u>	<u>NLP NPV (\$)</u>	<u>Positive Benefit</u>	<u>%</u>	<u>Yr1-Yr2 Slope</u>	<u>Yr2-Yr3 Slope</u>	<u>Yr3-Yr4 Slope</u>	<u>2019</u>
\$ 4,483,847	AECO	\$32,484,390	FALSE	0%	-139185.52	108634.46	248076.68	3,567,394.5
\$ (18,599,193)	AEP	(\$83,844,189)	TRUE	10%	-565513.36	-1854053.90	956726.55	-2,431,255.2
\$ (13,834,056)	APS	(\$60,259,292)	TRUE	7%	-257211.98	-1106997.68	87603.39	-2,182,580.5
\$ (22,851,310)	BGE	(\$106,852,669)	TRUE	13%	-2054.04	-1808625.94	-248787.99	-5,928,864.6
\$ (1,933,447)	COMED	\$16,321,287	FALSE	0%	-153643.02	-706068.14	227495.27	4,377,099.1
\$ (2,270,025)	DAY	(\$9,392,909)	TRUE	1%	-99830.52	-219012.68	126048.86	-87,654.4
\$ (1,067,819)	DEOK	\$8,068,937	FALSE	0%	-422889.00	-220308.88	379812.43	3,047,295.6
\$ (69,403,217)	DOM	(\$406,173,109)	TRUE	48%	-347410.94	-4344119.80	368405.81	-30,825,499.4
\$ 7,982,605	DPL	\$59,451,722	FALSE	0%	-320976.62	105927.88	609030.27	6,885,589.1
\$ (253,307)	DUQ	\$921,199	FALSE	0%	-56527.54	-140063.85	171715.77	528,354.3
\$ (1,574,535)	EKPC	(\$7,057,159)	TRUE	1%	-88766.82	-141880.74	114682.79	-100,478.9
\$ 1,285,110	FE-ATSI	\$24,453,562	FALSE	0%	-424116.15	-515431.70	887339.80	4,942,309.1
\$ 12,994,741	JCPL	\$86,471,109	FALSE	0%	-353160.96	480102.63	641379.81	8,854,234.3
\$ 10,529,823	METED	\$66,748,001	FALSE	0%	45228.93	170332.58	450434.69	5,944,606.4
\$ 2,122,185	NEPTHVDC	\$14,928,337	FALSE	0%	-260413.20	165843.30	239399.72	2,050,633.1
\$ (64,989)	OVEC	(\$312,551)	TRUE	0%	-2202.29	-6390.98	4047.46	-10,998.1
\$ 20,127,302	PECO	\$143,605,841	FALSE	0%	-642977.40	389145.78	1323445.64	15,810,303.0
\$ 8,524,188	PENELEC	\$50,269,773	FALSE	0%	-6686.72	195897.35	446544.98	4,292,732.6
\$ (33,210,669)	PEPCO	(\$170,915,031)	TRUE	20%	267039.11	-2484800.98	-492987.30	-11,924,896.6
\$ 24,407,112	PLGRP	\$166,142,625	FALSE	0%	-210633.51	432567.92	1111978.51	16,392,981.5
\$ 19,653,678	PSEG	\$138,441,230	FALSE	0%	-517166.93	382426.37	1189467.02	14,852,724.5
\$ 842,495	RECO	\$4,191,912	FALSE	0%	32652.38	13815.55	27616.54	216,606.5
\$ -	zPJMIMP	\$0	FALSE	0%	0.00	0.00	0.00	0.0

<b>NALYSIS</b>
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2	3	4	y = m*x + b	
2023	2026	2029	Slope	Intercept
3,010,652.4	3,336,555.8	4,080,785.9	49,873.4	-97,457,390.4
-4,693,308.6	-10,255,470.3	-7,385,290.7	-628,246.2	1,265,535,994.1
-3,211,428.5	-6,532,421.5	-6,269,611.3	-470,128.9	947,109,441.0
-5,937,080.7	-11,362,958.5	-12,109,322.5	-709,709.0	1,427,793,944.3
3,762,527.1	1,644,322.6	2,326,808.4	-251,196.8	511,512,802.6
-486,976.5	-1,144,014.6	-765,868.0	-83,488.4	168,380,342.4
1,355,739.6	694,812.9	1,834,250.2	-141,814.9	288,801,810.4
-32,215,143.1	-45,247,502.5	-44,142,285.1	-1,584,587.8	3,169,494,287.7
5,601,682.6	5,919,466.3	7,746,557.1	73,128.1	-141,491,323.0
302,244.1	-117,947.4	397,199.9	-26,874.4	54,677,977.9
-455,546.2	-881,188.5	-537,140.1	-54,731.5	110,296,588.3
3,245,844.5	1,699,549.4	4,361,568.8	-115,301.6	236,961,676.5
7,441,590.4	8,881,898.3	10,806,037.7	202,470.9	-400,855,838.1
6,125,522.1	6,636,519.8	7,987,823.9	195,250.9	-388,563,030.3
1,008,980.3	1,506,510.2	2,224,709.4	21,492.5	-41,808,439.7
-19,807.3	-38,980.2	-26,837.8	-2,067.5	4,160,989.3
13,238,393.4	14,405,830.7	18,376,167.7	236,436.9	-463,149,622.8
4,265,985.7	4,853,677.8	6,193,312.7	183,430.9	-366,408,623.4
-10,856,740.2	-18,311,143.1	-19,790,105.1	-910,883.4	1,828,635,034.2
15,550,447.5	16,848,151.2	20,184,086.8	362,693.4	-716,938,228.9
12,784,056.8	13,931,335.9	17,499,736.9	247,428.6	-486,090,300.6
347,216.0	388,662.7	471,512.3	24,632.7	-49,506,688.5
0.0	0.0	0.0	0.0	0.0



## Adjusted Production Cost Benefits From Simulation

Do not modify ----&gt; Project Group

Do not modify ----&gt; Base Group

		<b>B</b>	PJM APC Benefit	-18,173,979	-16,872,030	-15,570,080	-14,268,131	-12,966,181	-13,020,855
		<b>A</b>	Project Grp	B2019	B2020	B2021	B2022	B2023	B2024
			BaseGrp	A2019	A2020	A2021	A2022	A2023	A2024
			Intercept Year	2019	2019	2019	2019	2023	2023
ISD	2023		slope/intercept	1	1	1	1	2	2
Project RTEP Year	2023		Model Year	1	0	0	0	2	0
Variable	ME_Tool Column	Zone	2019	2020	2021	2022	2023	2024	
Adjusted Production Cost	10	AECO	#####	#####	\$9,455,126.180	\$8,830,439.705	\$8,205,753.230	\$8,045,687.153	
Adjusted Production Cost	10	AEP	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	APS	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	BGE	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	COMED	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	DAY	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	DEOK	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	DOM	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	DPL	#####	#####	#####	#####	\$8,475,591.770	\$9,670,860.003	
Adjusted Production Cost	10	DUQ	#####	\$ (174,465.405)	\$ (571,070.140)	\$ (967,674.875)	#####	#####	
Adjusted Production Cost	10	EKPC	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	FE-ATSI	#####	#####	#####	\$ (914,028.785)	\$2,067,772.320	\$ 957,879.517	
Adjusted Production Cost	10	JCPL	#####	\$6,104,418.553	\$5,200,324.985	\$4,296,231.418	\$3,392,137.850	\$7,362,256.143	
Adjusted Production Cost	10	METED	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	NEPTHVDC	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	OVEC	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	PECO	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	PENELEC	#####	#####	#####	\$7,004,112.998	\$2,959,982.080	\$2,147,848.690	
Adjusted Production Cost	10	PEPCO	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	PLGRP	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	PSEG	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	RECO	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	zPJMIMP	#####	#####	#####	#####	#####	#####	



-13,075,528	-13,130,202	-16,036,742	-18,943,283	-21,849,823	-18,120,449	-18,397,040	-18,673,632	-18,950,224
B2025	B2026	B2027	B2028	B2029	B2030	B2031	B2032	B2033
A2025	A2026	A2027	A2028	A2029	A2030	A2031	A2032	A2033
2023	2026	2026	2026	2029	2029	2029	2029	2029
2	3	3	3	4	4	4	4	4
0	3	0	0	4	0	0	0	0
<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>	<b>2030</b>	<b>2031</b>	<b>2032</b>	<b>2033</b>
\$7,885,621.077	\$ 7,725,555.000	\$ 7,791,709.910	\$ 7,857,864.820	\$ 7,924,019.730	\$ 7,033,422.841	\$ 6,754,025.635	\$ 6,474,628.430	\$ 6,195,231.224
#####	#####	#####	#####	#####	#####	#####	#####	#####
#####	\$(8,650,901.530)	\$(7,885,188.887)	\$(7,119,476.243)	\$(6,353,763.600)	\$(4,755,334.892)	\$(4,074,570.942)	\$(3,393,806.991)	\$(2,713,043.041)
#####	#####	#####	#####	#####	#####	#####	#####	#####
#####	\$(8,003,776.850)	\$(5,400,232.360)	\$(2,796,687.870)	\$(193,143.380)	\$(3,014,374.638)	\$(2,956,026.444)	\$(2,897,678.250)	\$(2,839,330.056)
#####	\$(4,293,926.290)	\$(4,056,598.990)	\$(3,819,271.690)	\$(3,581,944.390)	\$(3,463,748.351)	\$(3,465,243.768)	\$(3,466,739.186)	\$(3,468,234.603)
#####	\$(2,590,614.810)	\$(2,786,708.173)	\$(2,982,801.537)	\$(3,178,894.900)	\$(2,920,725.218)	\$(2,986,606.884)	\$(3,052,488.549)	\$(3,118,370.214)
#####	#####	#####	#####	#####	#####	#####	#####	#####
#####	\$12,061,396.470	\$12,723,945.230	\$13,386,493.990	\$14,049,042.750	\$ 8,015,438.479	\$ 6,644,251.179	\$ 5,273,063.879	\$ 3,901,876.578
#####	\$(2,449,546.060)	\$(2,390,841.987)	\$(2,332,137.913)	\$(2,273,433.840)	\$(2,993,983.978)	\$(3,259,671.618)	\$(3,525,359.259)	\$(3,791,046.899)
#####	\$(2,784,540.590)	\$(2,778,429.610)	\$(2,772,318.630)	\$(2,766,207.650)	\$(2,724,257.498)	\$(2,723,606.208)	\$(2,722,954.918)	\$(2,722,303.628)
\$ (152,013.287)	\$(1,261,906.090)	\$(1,682,092.097)	\$(2,102,278.103)	\$(2,522,464.110)	\$ 780,453.910	\$ 1,419,490.676	\$ 2,058,527.442	\$ 2,697,564.209
#####	\$15,302,492.730	\$15,548,041.273	\$15,793,589.817	\$16,039,138.360	\$16,939,677.098	\$18,070,826.113	\$19,201,975.128	\$20,333,124.142
#####	\$38,781,447.320	\$38,418,815.040	\$38,056,182.760	\$37,693,550.480	\$44,437,142.321	\$47,560,776.221	\$50,684,410.121	\$53,808,044.021
#####	\$(2,173,878.690)	\$(2,259,465.873)	\$(2,345,053.057)	\$(2,430,640.240)	\$(2,315,288.770)	\$(2,360,637.876)	\$(2,405,986.981)	\$(2,451,336.086)
#####	\$(2,250,317.360)	\$(2,307,206.560)	\$(2,364,095.760)	\$(2,420,984.960)	\$(1,687,539.298)	\$(1,518,410.327)	\$(1,349,281.356)	\$(1,180,152.385)
#####	\$44,693,803.270	\$49,951,627.333	\$55,209,451.397	\$60,467,275.460	\$51,404,512.010	\$51,781,003.124	\$52,157,494.238	\$52,533,985.351
\$1,335,715.300	\$ 523,581.910	\$ 1,290,708.677	\$ 2,057,835.443	\$ 2,824,962.210	\$(3,073,131.331)	\$(4,713,894.691)	\$(6,354,658.051)	\$(7,995,421.411)
#####	#####	#####	#####	#####	#####	#####	#####	#####
#####	\$57,845,703.480	\$59,895,168.797	\$61,944,634.113	\$63,994,099.430	\$63,234,585.315	\$64,633,658.263	\$66,032,731.211	\$67,431,804.159
#####	\$20,430,430.480	\$20,475,124.873	\$20,519,819.267	\$20,564,513.660	\$16,433,860.068	\$15,495,572.410	\$14,557,284.753	\$13,618,997.095
#####	\$(2,173,878.690)	\$(2,259,465.873)	\$(2,345,053.057)	\$(2,430,640.240)	\$(2,315,288.770)	\$(2,360,637.876)	\$(2,405,986.981)	\$(2,451,336.086)
#####	\$(2,192,749.550)	\$(2,329,521.253)	\$(2,466,292.957)	\$(2,603,064.660)	\$(2,401,139.270)	\$(2,441,126.651)	\$(2,481,114.031)	\$(2,521,101.412)

-19,226,815	-19,503,407	-19,779,999	-20,056,590	-20,333,182	-20,609,774	-20,886,365	-21,162,957	-21,439,549
B2034	B2035	B2036	B2037	B2038	B2039	B2040	B2041	B2042
A2034	A2035	A2036	A2037	A2038	A2039	A2040	A2041	A2042
2029	2029	2029	2029	2029	2029	2029	2029	2029
4	4	4	4	4	4	4	4	4
0	0	0	0	0	0	0	0	0
<u>2034</u>	<u>2035</u>	<u>2036</u>	<u>2037</u>	<u>2038</u>	<u>2039</u>	<u>2040</u>	<u>2041</u>	<u>2042</u>
\$ 5,915,834.019	\$ 5,636,436.813	\$ 5,357,039.608	\$ 5,077,642.402	\$ 4,798,245.197	\$ 4,518,847.991	\$ 4,239,450.785	\$ 3,960,053.580	\$ 3,680,656.374
#####	#####	#####	#####	#####	#####	#####	#####	#####
\$(2,032,279.091)	\$(1,351,515.140)	\$(670,751.190)	\$ 10,012.761	\$ 690,776.711	\$ 1,371,540.662	\$ 2,052,304.612	\$ 2,733,068.563	\$ 3,413,832.513
#####	#####	#####	#####	#####	#####	#####	#####	#####
\$(2,780,981.863)	\$(2,722,633.669)	\$(2,664,285.475)	\$(2,605,937.281)	\$(2,547,589.087)	\$(2,489,240.893)	\$(2,430,892.700)	\$(2,372,544.506)	\$(2,314,196.312)
\$(3,469,730.021)	\$(3,471,225.438)	\$(3,472,720.856)	\$(3,474,216.274)	\$(3,475,711.691)	\$(3,477,207.109)	\$(3,478,702.526)	\$(3,480,197.944)	\$(3,481,693.361)
\$(3,184,251.880)	\$(3,250,133.545)	\$(3,316,015.210)	\$(3,381,896.876)	\$(3,447,778.541)	\$(3,513,660.206)	\$(3,579,541.872)	\$(3,645,423.537)	\$(3,711,305.202)
#####	#####	#####	#####	#####	#####	#####	#####	#####
\$ 2,530,689.278	\$ 1,159,501.978	\$ (211,685.322)	\$(1,582,872.622)	\$(2,954,059.923)	\$(4,325,247.223)	\$(5,696,434.523)	\$(7,067,621.823)	\$(8,438,809.123)
\$(4,056,734.539)	\$(4,322,422.180)	\$(4,588,109.820)	\$(4,853,797.461)	\$(5,119,485.101)	\$(5,385,172.742)	\$(5,650,860.382)	\$(5,916,548.023)	\$(6,182,235.663)
\$(2,721,652.338)	\$(2,721,001.048)	\$(2,720,349.758)	\$(2,719,698.468)	\$(2,719,047.178)	\$(2,718,395.888)	\$(2,717,744.598)	\$(2,717,093.308)	\$(2,716,442.018)
\$ 3,336,600.975	\$ 3,975,637.741	\$ 4,614,674.507	\$ 5,253,711.273	\$ 5,892,748.039	\$ 6,531,784.805	\$ 7,170,821.571	\$ 7,809,858.337	\$ 8,448,895.104
\$21,464,273.157	\$22,595,422.171	\$23,726,571.186	\$24,857,720.200	\$25,988,869.215	\$27,120,018.229	\$28,251,167.244	\$29,382,316.258	\$30,513,465.273
\$56,931,677.920	\$60,055,311.820	\$63,178,945.720	\$66,302,579.620	\$69,426,213.519	\$72,549,847.419	\$75,673,481.319	\$78,797,115.219	\$81,920,749.118
\$(2,496,685.192)	\$(2,542,034.297)	\$(2,587,383.402)	\$(2,632,732.508)	\$(2,678,081.613)	\$(2,723,430.718)	\$(2,768,779.823)	\$(2,814,128.929)	\$(2,859,478.034)
\$(1,011,023.413)	\$(841,894.442)	\$(672,765.471)	\$(503,636.500)	\$(334,507.529)	\$(165,378.557)	\$ 3,750.414	\$ 172,879.385	\$ 342,008.356
\$52,910,476.465	\$53,286,967.579	\$53,663,458.693	\$54,039,949.807	\$54,416,440.921	\$54,792,932.035	\$55,169,423.149	\$55,545,914.263	\$55,922,405.376
\$(9,636,184.770)	#####	#####	#####	#####	#####	#####	#####	#####
#####	#####	#####	#####	#####	#####	#####	#####	#####
\$68,830,877.107	\$70,229,950.054	\$71,629,023.002	\$73,028,095.950	\$74,427,168.898	\$75,826,241.846	\$77,225,314.794	\$78,624,387.742	\$80,023,460.689
\$12,680,709.437	\$11,742,421.780	\$10,804,134.122	\$ 9,865,846.464	\$ 8,927,558.806	\$ 7,989,271.149	\$ 7,050,983.491	\$ 6,112,695.833	\$ 5,174,408.176
\$(2,496,685.192)	\$(2,542,034.297)	\$(2,587,383.402)	\$(2,632,732.508)	\$(2,678,081.613)	\$(2,723,430.718)	\$(2,768,779.823)	\$(2,814,128.929)	\$(2,859,478.034)
\$(2,561,088.793)	\$(2,601,076.174)	\$(2,641,063.555)	\$(2,681,050.935)	\$(2,721,038.316)	\$(2,761,025.697)	\$(2,801,013.078)	\$(2,841,000.459)	\$(2,880,987.840)

-21,716,141	-21,992,732
B2043	B2044
A2043	A2044
2029	2029
4	4
0	0

PJM NPV
-\$149,862,649

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2043	2044	ZONE	APC NPV (\$)	Positive Benefit	%	Yr1-Yr2 Slope	Yr2-Yr3 Slope
\$ 3,401,259.169	\$ 3,121,861.963	AECO	\$64,696,128	TRUE	-43%	-624686.48	-160066.08
#####	#####	AEP	(\$121,575,681)	TRUE	81%	2558549.67	-2907744.35
\$ 4,094,596.464	\$ 4,775,360.414	APS	(\$46,568,181)	TRUE	31%	2331247.98	-1158758.28
#####	#####	BGE	(\$159,448,018)	TRUE	106%	-49941.46	-2516349.15
\$(2,255,848.118)	\$(2,197,499.924)	COMED	(\$32,811,365)	TRUE	22%	151274.64	-1901677.58
\$(3,483,188.779)	\$(3,484,684.196)	DAY	(\$29,953,045)	TRUE	20%	640795.80	-867717.94
\$(3,777,186.868)	\$(3,843,068.533)	DEOK	(\$24,457,846)	TRUE	16%	216554.84	-274889.35
#####	#####	DOM	(\$966,523,538)	TRUE	645%	10037883.37	-6448595.83
\$(9,809,996.423)	#####	DPL	\$74,073,561	TRUE	-49%	-5134359.77	1195268.23
\$(6,447,923.304)	\$(6,713,610.944)	DUQ	(\$24,791,606)	TRUE	17%	-396604.74	-361755.48
\$(2,715,790.728)	\$(2,715,139.438)	EKPC	(\$24,253,114)	TRUE	16%	77998.86	-86635.87
\$ 9,087,931.870	\$ 9,726,968.636	FE-ATSI	\$7,656,750	TRUE	-5%	2981801.10	-1109892.80
\$31,644,614.287	\$32,775,763.302	JCPL	\$135,698,130	TRUE	-91%	-904093.57	3970118.29
\$85,044,383.018	\$88,168,016.918	METED	\$368,185,882	TRUE	-246%	2469316.47	6375939.50
\$(2,904,827.139)	\$(2,950,176.245)	NEPTHVDC	(\$19,693,657)	TRUE	13%	140342.93	-215920.40
\$ 511,137.327	\$ 680,266.298	OVEC	(\$15,382,942)	TRUE	10%	662359.52	-196875.27
\$56,298,896.490	\$56,675,387.604	PECO	\$431,024,629	TRUE	-288%	-5809798.27	3471520.99
#####	#####	PENELEC	(\$19,670,260)	TRUE	13%	-4044130.92	-812133.39
#####	#####	PEPCO	(\$397,683,005)	TRUE	265%	857382.67	-968583.99
\$81,422,533.637	\$82,821,606.585	PLGRP	\$543,838,564	TRUE	-363%	-889145.34	3388021.29
\$ 4,236,120.518	\$ 3,297,832.860	PSEG	\$147,811,880	TRUE	-99%	-4282790.96	1945152.09
\$(2,904,827.139)	\$(2,950,176.245)	RECO	(\$19,693,657)	TRUE	13%	140342.93	-215920.40
\$(2,920,975.220)	\$(2,960,962.601)	zPJMIMP	(\$20,342,257)	TRUE	14%	171650.27	-197177.84

## TRENDING ANALYSIS

Yr3-Yr4 Slope	1	2	3	4	y = m*x + b	
	2019	2023	2026	2029	Slope	Intercept
66154.91	10,704,499	8,205,753	7,725,555	7,924,020	-279,397	574,209,750
-801071.05	-16,002,646	-5,768,447	-14,491,680	-16,894,894	-262,771	518,625,593
765712.64	-14,499,619	-5,174,627	-8,650,902	-6,353,764	680,764	-1,386,706,154
-2905602.57	-4,948,964	-5,148,730	-12,697,777	-21,414,585	-1,671,642	3,372,769,401
2603544.49	-2,903,843	-2,298,744	-8,003,777	-193,143	58,348	-121,461,208
237327.30	-4,253,956	-1,690,772	-4,293,926	-3,581,944	-1,495	-428,051
-196093.36	-2,632,166	-1,765,947	-2,590,615	-3,178,895	-65,882	130,819,055
-5764519.90	-128,268,114	-88,116,581	-107,462,368	-124,755,928	53,032	-219,501,565
662548.76	29,013,031	8,475,592	12,061,396	14,049,043	-1,371,187	2,791,525,658
58704.07	222,139	-1,364,280	-2,449,546	-2,273,434	-265,688	536,351,926
6110.98	-2,836,628	-2,524,633	-2,784,541	-2,766,208	651	-4,046,376
-420186.01	-9,859,432	2,067,772	-1,261,906	-2,522,464	639,037	-1,296,464,181
245548.54	7,008,512	3,392,138	15,302,493	16,039,138	1,131,149	-2,279,292,822
-362632.28	9,776,363	19,653,629	38,781,447	37,693,550	3,123,634	-6,296,539,674
-85587.18	-2,087,489	-1,526,118	-2,173,879	-2,430,640	-45,349	89,743,395
-56889.20	-4,309,130	-1,659,692	-2,250,317	-2,420,985	169,129	-345,019,351
5257824.06	57,518,433	34,279,240	44,693,803	60,467,275	376,491	-712,872,449
767126.77	19,136,506	2,959,982	523,582	2,824,962	-1,640,763	3,327,676,489
-4856362.19	-37,540,529	-34,110,999	-37,016,751	-51,585,837	-1,280,101	2,551,180,295
2049465.32	51,238,221	47,681,640	57,845,703	63,994,099	1,399,073	-2,776,883,499
44694.39	31,726,138	14,594,974	20,430,430	20,564,514	-938,288	1,921,157,805
-85587.18	-2,087,489	-1,526,118	-2,173,879	-2,430,640	-45,349	89,743,395
-136771.70	-2,287,817	-1,601,216	-2,192,750	-2,603,065	-39,987	78,773,244

**Instructions**

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- 1 - Add simulation data to "Sim.Results" tab using the format in the example
- 2 - Update "Project Details" table within the "Setup" tab. Each Project (4 years) is assigned a group. The Base (Comparison group), Cost, ISD should be added
- 3 - Results displayed on BC\_CA (Benefit Cost - Cost Allocation) Results tab. Use Cell "D4" to switch from one project to another.
- 4 - All formulas will automatically update

## Reporting Data Inputs

Reporting Variable	Description	Report Agent	Calculation Granularity	Variable (TPL)	Promod Txt Files	Calculation Granularity	Variable
Total Demand Cost	$MW_{Bus} LMP_{Bus}$	Promod Report Agent	Monthly/Hourly	Demand >> Bus Level Demand Costs	*.BUS	Hourly	DEMND CST
Generator Production Cost	Fuel + O&M + Emissions	Promod Report Agent	Monthly/Hourly	Generating Units >> Costs >> Total Variable Production Costs By Unit	*.UNT	Hourly	UCST
Merchant Transaction Value	$FWR \text{ on Line } \times LMP_{PJM}$	Promod Report Agent	Hourly	LMP >> Locational Marginal Price (\$/MWH) FWR >> Constant (Input)	*.BUS	Hourly	MBC
Hourly Interchange	PJM generation - PJM Load - PJM Losses	Promod Report Agent	Hourly	LMP >> Locational Marginal Price (\$/MWH)	*.TRN	Hourly	Tariffs

## Spreadsheet Tabs

## Tab

Sim.Results

Setup

BC\_CA Results

NLP Analysis

PRDCst Analysis

## Purpose

Enter results from simulation. Format and layout must be preserved for spreadsheet to update appropriately

Only the "Project Details" table should be updated

Results based on "NLP Analysis" and "PRDCst Analysis" calculations. No changes should be made to this sheet, except the Project Group Selection (Cell "D4").

Net Load Payment Analysis. Calculates trend-line for each zone, and determines the in-between year calculated net load payment benefits

Adjusted Production Cost Analysis Payment Analysis. Calculates trend-line for each zone, and determines the in-between year calculated net load payment benefits

**Benefit Cost Test**

Project

CA3

Sensitivity

Case

Basecase

201819ME PJM Base CA3 S2 1%LD v2019-07-26 201819ME PJM Base Remove All S2 1%LD v2019-07-26

Project Group **B**

Criteria	Benefits Allocation		Benefits Dollars (\$Millions)		Weighted Benefits Dollars (\$Millions)		Project Result			
	NLP	APC	NLP	APC	NLP	APC	Benefits (\$Millions)	B/C	Pass	Breakeven (\$Millions)
< 500 kV	100%	0%	\$771.2	\$157.95	\$771.23	\$0.00	\$771.23	.52	TRUE	\$580.22
345-kV DC and >= 500 kV	50%	50%	\$771.2	\$157.95	\$385.61	\$78.97	\$464.59	0.91	FALSE	\$349.53

**Cost Variables**

Project Capital Cost	\$478.48
Annual Revenue Requirement (\$/Yr)	\$56.75
Present Value of Payments	\$508.79

**Cost Allocation:**

<u>ZONE</u>	2019 NSPL (MW)	NLP %	< 500 kV	345-kV DC and >= 500 kV
345-kV DC and >= 500 kV	50%	50%		
Total:	161361.5			
AECO	2591.3	0.00%	\$0.00	\$4.09
AEP	22739.0	8.87%	\$45.15	\$58.42
APS	9342.2	6.19%	\$31.50	\$30.48
BGE	6626.5	12.77%	\$64.98	\$42.94
COMED	21349.4	0.00%	\$0.00	\$33.66
DAY	3337.2	0.92%	\$4.67	\$7.60
DEOK	5194.9	0.00%	\$0.00	\$8.19
DOM	21232.0	49.77%	\$253.23	\$160.09
DPL	4002.3	0.00%	\$0.00	\$6.31
DUQ	2795.1	0.00%	\$0.00	\$4.41
EKPC	3430.8	0.72%	\$3.66	\$7.24
FE-ATSI	12824.5	0.00%	\$0.00	\$20.22
JCPL	5976.5	0.00%	\$0.00	\$9.42
METED	3027.8	0.00%	\$0.00	\$4.77
NEPETHVDC	660.0	0.00%	\$0.00	\$1.04
OVEC	140.5	0.03%	\$0.17	\$0.31
PECO	8607.9	0.00%	\$0.00	\$13.57
PENELEC	2997.2	0.00%	\$0.00	\$4.73
PEPCO	6412.0	20.72%	\$105.43	\$62.82
PLGRP	7681.3	0.00%	\$0.00	\$12.11
PSEG	9978.3	0.00%	\$0.00	\$15.73
RECO	414.8	0.00%	\$0.00	\$0.65

**Benefit Cost Test**

Project

Sensitivity

Case

Basecase

CA3

201819ME PJM Base CA3 S2 1%LD v2019-07-26 201819ME PJM Base Remove All S2 1%LD v2019-07-26

Project Group **B**

Criteria	Benefits Allocation		Benefits Dollars (\$Millions)		Weighted Benefits Dollars (\$Millions)		Project Result			
	NLP	APC	NLP	APC	NLP	APC	Benefits (\$Millions)	B/C	Pass	Breakeven (\$Millions)
< 500 kV	100%	0%	\$771.2	\$157.95	\$771.23	\$0.00	\$771.23	1.46	TRUE	\$580.22
345-kV DC and >= 500 kV	50%	50%	\$771.2	\$157.95	\$385.61	\$78.97	\$464.59	0.88	FALSE	\$349.53

Cost Variables	
Project Capital Cost	\$106.17
Annual Revenue Requirement (\$/Yr)	\$58.85
Present Value of Payments	\$527.60

**Cost Allocation:**

<u>ZONE</u>	2019 NSPL (MW)	NLP %	< 500 kV	345-kV DC and >= 500 kV
345-kV DC and >= 500 kV	50%	50%		
<b>Total:</b>	<b>161361.5</b>			
AECO	2591.3	0.00%	\$0.00	\$4.24
AEP	22739.0	8.87%	\$46.82	\$60.58
APS	9342.2	6.19%	\$32.67	\$31.61
BGE	6626.5	12.77%	\$67.38	\$44.52
COMED	21349.4	0.00%	\$0.00	\$34.90
DAY	3337.2	0.92%	\$4.84	\$7.88
DEOK	5194.9	0.00%	\$0.00	\$8.49
DOM	21232.0	49.77%	\$262.60	\$166.01
DPL	4002.3	0.00%	\$0.00	\$6.54
DUQ	2795.1	0.00%	\$0.00	\$4.57
EKPC	3430.8	0.72%	\$3.80	\$7.51
FE-ATSI	12824.5	0.00%	\$0.00	\$20.97
JCPL	5976.5	0.00%	\$0.00	\$9.77
METED	3027.8	0.00%	\$0.00	\$4.95
NEPTHVDC	660.0	0.00%	\$0.00	\$1.08
OVEC	140.5	0.03%	\$0.18	\$0.32
PECO	8607.9	0.00%	\$0.00	\$14.07
PENELEC	2997.2	0.00%	\$0.00	\$4.90
PEPCO	6412.0	20.72%	\$109.32	\$65.14
PLGRP	7681.3	0.00%	\$0.00	\$12.56
PSEG	9978.3	0.00%	\$0.00	\$16.31
RECO	414.8	0.00%	\$0.00	\$0.68



Project Alias	Project Group-Year-Zone	Base Group-Year-Zone	Demand Zone	Load Payment	ARR Valuation	Net Load Payment	Production Cost	Interchange Value	Adjusted Production Cost
201819ME PJM Base Remove All S2 19	A2019AECO	A2019AECO	AECO	237638162.9	-262035.75	237900198.7	134781623.5	-30743208.57	104038415
201819ME PJM Base Remove All S2 19	A2019AEP	A2019AEP	AEP	3210747552	-17997992.07	3228745544	3080508303	-30743208.57	3049765095
201819ME PJM Base Remove All S2 19	A2019APS	A2019APS	APS	1235311362	20161345.44	1215150017	1381215002	-30743208.57	1350471793
201819ME PJM Base Remove All S2 19	A2019BGE	A2019BGE	BGE	846030021.4	1477039.56	844552981.8	220737256.4	-30743208.57	189994047.8
201819ME PJM Base Remove All S2 19	A2019COMED	A2019COMED	COMED	2441556747	3141368.08	2438415379	1604067215	-30743208.57	1573324006
201819ME PJM Base Remove All S2 19	A2019DAY	A2019DAY	DAY	438386053.4	141118.84	438244934.6	40597163.84	-30743208.57	9853955.27
201819ME PJM Base Remove All S2 19	A2019DEOK	A2019DEOK	DEOK	665371101.3	6138058.47	659233042.9	494815605.6	-30743208.57	464072397.1
201819ME PJM Base Remove All S2 19	A2019DOM	A2019DOM	DOM	2484159168	11093496.15	2473065671	1457886130	-30743208.57	1427142922
201819ME PJM Base Remove All S2 19	A2019DPL	A2019DPL	DPL	460223353.7	-206296.4	460429650.1	116362253	-30743208.57	85619044.45
201819ME PJM Base Remove All S2 19	A2019DUQ	A2019DUQ	DUQ	345751085.4	324770.65	345426314.7	104353459.7	-30743208.57	73610251.14
201819ME PJM Base Remove All S2 19	A2019EKPC	A2019EKPC	EKPC	269278078.1	89690.68	269188387.4	217599159.5	-30743208.57	186855950.9
201819ME PJM Base Remove All S2 19	A2019FE-ATSI	A2019FE-ATSI	FE-ATSI	1679072913	5288647.66	1673784266	994190609.6	-30743208.57	963447401
201819ME PJM Base Remove All S2 19	A2019JCPL	A2019JCPL	JCPL	540913464.5	-219953.03	541133417.5	137598331.9	-30743208.57	106855123.4
201819ME PJM Base Remove All S2 19	A2019METED	A2019METED	METED	378533982.4	1441191.07	377092791.3	350057202.9	-30743208.57	319313994.3
201819ME PJM Base Remove All S2 19	A2019NEPTHVDC	A2019NEPTHVDC	NEPTHVDC	140394631.9	0	140394631.9	0	-30743208.57	-30743208.57
201819ME PJM Base Remove All S2 19	A2019OVEC	A2019OVEC	OVEC	13388329.28	0	13388329.28	284675542.3	-30743208.57	253932333.7
201819ME PJM Base Remove All S2 19	A2019PECO	A2019PECO	PECO	1000970243	-472151.55	1001442394	944658302.5	-30743208.57	913915093.9
201819ME PJM Base Remove All S2 19	A2019PENELEC	A2019PENELEC	PENELEC	421524222.1	610130.65	420914091.5	1077401874	-30743208.57	1046658665
201819ME PJM Base Remove All S2 19	A2019PEPCO	A2019PEPCO	PEPCO	817154827	6497832.01	810656995.1	206013726.5	-30743208.57	175270517.9
201819ME PJM Base Remove All S2 19	A2019PLGRP	A2019PLGRP	PLGRP	987794658.4	1618728.07	986175930.3	1217343437	-30743208.57	1186600228
201819ME PJM Base Remove All S2 19	A2019PSEG	A2019PSEG	PSEG	1049006843	-2777559.64	1051784403	967484928.3	-30743208.57	936741719.8
201819ME PJM Base Remove All S2 19	A2019RECO	A2019RECO	RECO	37292034.87	108105.92	37183928.94	0	-30743208.57	-30743208.57
201819ME PJM Base Remove All S2 19	A2019zPJMIMP	A2019zPJMIMP	zPJMIMP	0	0	0	215070375.2	-30743208.57	184327166.6
201819ME PJM Base Remove All S2 19	A2023AECO	A2023AECO	AECO	307858864.4	-214804.96	308073669.3	159434440.7	-44390149.46	115044291.3
201819ME PJM Base Remove All S2 19	A2023AEP	A2023AEP	AEP	4081366428	-23679738.6	4105046167	3629567745	-44390149.46	3585177595
201819ME PJM Base Remove All S2 19	A2023APS	A2023APS	APS	1619157094	15417261.29	1603739833	1677313882	-44390149.46	1632923732
201819ME PJM Base Remove All S2 19	A2023BGE	A2023BGE	BGE	1069821277	2418173.63	1067403104	325710509.1	-44390149.46	281320359.6
201819ME PJM Base Remove All S2 19	A2023COMED	A2023COMED	COMED	3061147468	3011699.27	3058135768	1951283263	-44390149.46	1906893113
201819ME PJM Base Remove All S2 19	A2023DAY	A2023DAY	DAY	552464285.2	-8754.33	552473039.5	67804374	-44390149.46	23414224.54
201819ME PJM Base Remove All S2 19	A2023DEOK	A2023DEOK	DEOK	841064234.4	2757201.01	838307033.4	604956038.7	-44390149.46	560565889.2
201819ME PJM Base Remove All S2 19	A2023DOM	A2023DOM	DOM	3293449225	10232044.52	3283217180	1960602450	-44390149.46	1916212300
201819ME PJM Base Remove All S2 19	A2023DPL	A2023DPL	DPL	610109045.2	415321.5	609693723.8	69984789.35	-44390149.46	25594639.89
201819ME PJM Base Remove All S2 19	A2023DUQ	A2023DUQ	DUQ	433776118.8	-536620.08	434312738.9	180946580	-44390149.46	136556430.5
201819ME PJM Base Remove All S2 19	A2023EKPC	A2023EKPC	EKPC	339654365.1	-22897.79	339677262.9	296703054.9	-44390149.46	252312905.4
201819ME PJM Base Remove All S2 19	A2023FE-ATSI	A2023FE-ATSI	FE-ATSI	2118202478	863829.84	2117338648	1334112310	-44390149.46	1289722161
201819ME PJM Base Remove All S2 19	A2023JCPL	A2023JCPL	JCPL	707709670.7	673304.81	707036365.9	115049993.4	-44390149.46	70659843.92
201819ME PJM Base Remove All S2 19	A2023METED	A2023METED	METED	502605673.6	689334.56	501916339.1	347415348.8	-44390149.46	303025199.4
201819ME PJM Base Remove All S2 19	A2023NEPTHVDC	A2023NEPTHVDC	NEPTHVDC	186470655.5	0	186470655.5	0	-44390149.46	-44390149.46
201819ME PJM Base Remove All S2 19	A2023OVEC	A2023OVEC	OVEC	16713925.78	0	16713925.78	362553362.2	-44390149.46	318163212.7
201819ME PJM Base Remove All S2 19	A2023PECO	A2023PECO	PECO	1342186624	-705904.58	1342892528	970301644.9	-44390149.46	925911495.5
201819ME PJM Base Remove All S2 19	A2023PENELEC	A2023PENELEC	PENELEC	535467872.3	-797520.04	536265392.3	1449060355	-44390149.46	1404670206
201819ME PJM Base Remove All S2 19	A2023PEPCO	A2023PEPCO	PEPCO	1025327156	4929294	1020397862	256850035.1	-44390149.46	212458885.6
201819ME PJM Base Remove All S2 19	A2023PLGRP	A2023PLGRP	PLGRP	1311985916	3211251.71	1308774665	1446824601	-44390149.46	1402434452
201819ME PJM Base Remove All S2 19	A2023PSEG	A2023PSEG	PSEG	1376959776	-1263196.24	1378222972	1025140350	-44390149.46	980750201
201819ME PJM Base Remove All S2 19	A2023RECO	A2023RECO	RECO	47908986.33	42688.2	47866298.14	0	-44390149.46	-44390149.46
201819ME PJM Base Remove All S2 19	A2023zPJMIMP	A2023zPJMIMP	zPJMIMP	0	0	0	240064348.2	-44390149.46	195674198.8
201819ME PJM Base Remove All S2 19	A2026AECO	A2026AECO	AECO	339616824.6	-396764.35	340013589	198754531.2	-57681787.54	141072743.7
201819ME PJM Base Remove All S2 19	A2026AEP	A2026AEP	AEP	4704146078	-28019779.4	4732165858	4063195409	-57681787.54	4005513622
201819ME PJM Base Remove All S2 19	A2026APS	A2026APS	APS	1863314883	21106652.36	1842208230	1862677028	-57681787.54	1804995240

201819ME PJM Base Remove All S2 19	A2026BGE	A2026BGE	BGE	1204756555	2473179.46	1202283375	350228982	-57681787.54	292547194.5
201819ME PJM Base Remove All S2 19	A2026COMED	A2026COMED	COMED	3533424275	4749863.09	3528674412	2168238064	-57681787.54	2110556277
201819ME PJM Base Remove All S2 19	A2026DAY	A2026DAY	DAY	635046981.2	24205.79	635022775.4	78090464.02	-57681787.54	20408676.48
201819ME PJM Base Remove All S2 19	A2026DEOK	A2026DEOK	DEOK	970224744.1	5880571.6	964344172.5	671983187.4	-57681787.54	614301399.8
201819ME PJM Base Remove All S2 19	A2026DOM	A2026DOM	DOM	3809349922	10955378.5	3798394543	2312417292	-57681787.54	2254735504
201819ME PJM Base Remove All S2 19	A2026DPL	A2026DPL	DPL	685118339.4	1097199.48	684021139.9	71066702.56	-57681787.54	13384915.02
201819ME PJM Base Remove All S2 19	A2026DUQ	A2026DUQ	DUQ	490650086.9	-150692.12	490800779	205769655.6	-57681787.54	148087868.1
201819ME PJM Base Remove All S2 19	A2026EKPC	A2026EKPC	EKPC	389268180.3	-13611.84	389281792.1	331244399.4	-57681787.54	273562611.9
201819ME PJM Base Remove All S2 19	A2026FE-ATSI	A2026FE-ATSI	FE-ATSI	2409919566	4611639.04	2405307927	1522893761	-57681787.54	1465211974
201819ME PJM Base Remove All S2 19	A2026JCPL	A2026JCPL	JCPL	783667620.6	376578.04	783291042.6	133360212.6	-57681787.54	75678425.05
201819ME PJM Base Remove All S2 19	A2026METED	A2026METED	METED	567957225.9	1392827.74	566564398.2	401899587	-57681787.54	344217799.4
201819ME PJM Base Remove All S2 19	A2026NEPTHVDC	A2026NEPTHVDC	NEPTHVDC	206777355.8	0	206777355.8	0	-57681787.54	-57681787.54
201819ME PJM Base Remove All S2 19	A2026OVEC	A2026OVEC	OVEC	18908141.84	0	18908141.84	401028900.4	-57681787.54	343347112.8
201819ME PJM Base Remove All S2 19	A2026PECO	A2026PECO	PECO	1505175760	-1341474.74	1506517235	1085191329	-57681787.54	1027509541
201819ME PJM Base Remove All S2 19	A2026PENELEC	A2026PENELEC	PENELEC	601829496.4	290068.42	601539428	1615759585	-57681787.54	1558077798
201819ME PJM Base Remove All S2 19	A2026PEPCO	A2026PEPCO	PEPCO	1163253355	6172616.83	1157080738	288215077.3	-57681787.54	230533289.7
201819ME PJM Base Remove All S2 19	A2026PLGRP	A2026PLGRP	PLGRP	1464735248	3281456.25	1461453792	1656816587	-57681787.54	1599134799
201819ME PJM Base Remove All S2 19	A2026PSEG	A2026PSEG	PSEG	1522565679	-3628685.73	1526194365	1168143397	-57681787.54	1110461610
201819ME PJM Base Remove All S2 19	A2026RECO	A2026RECO	RECO	53707091.25	100278.44	53606812.83	0	-57681787.54	-57681787.54
201819ME PJM Base Remove All S2 19	A2026zPJMIMP	A2026zPJMIMP	zPJMIMP	0	0	0	265275671.3	-57681787.54	207593883.7
201819ME PJM Base Remove All S2 19	A2029AEEO	A2029AEEO	AEEO	377163832.1	-509067.22	377672899.3	237128502.5	-68132891.01	168995611.5
201819ME PJM Base Remove All S2 19	A2029AEP	A2029AEP	AEP	5380098933	-32904658.75	5413003592	4630283206	-68132891.01	4562150315
201819ME PJM Base Remove All S2 19	A2029APS	A2029APS	APS	2126530920	24852642.84	2101678277	2076484051	-68132891.01	2008351160
201819ME PJM Base Remove All S2 19	A2029BGE	A2029BGE	BGE	1355968449	3266712.7	1352701736	384285046.2	-68132891.01	316152155.2
201819ME PJM Base Remove All S2 19	A2029COMED	A2029COMED	COMED	4044458646	5946383.64	4038512262	2395041826	-68132891.01	2326908935
201819ME PJM Base Remove All S2 19	A2029DAY	A2029DAY	DAY	723364599.3	64029.16	723300570.1	101220645.1	-68132891.01	33087754.04
201819ME PJM Base Remove All S2 19	A2029DEOK	A2029DEOK	DEOK	1109824542	7650626	1102173916	741096237	-68132891.01	672963346
201819ME PJM Base Remove All S2 19	A2029DOM	A2029DOM	DOM	4378540905	12390137.72	4366150767	2685904997	-68132891.01	2617772106
201819ME PJM Base Remove All S2 19	A2029DPL	A2029DPL	DPL	772900721.1	-203293.48	773104014.6	83070641.99	-68132891.01	14937750.98
201819ME PJM Base Remove All S2 19	A2029DUQ	A2029DUQ	DUQ	551670809.6	-172433.38	551843243	231546666.8	-68132891.01	163413775.8
201819ME PJM Base Remove All S2 19	A2029EKPC	A2029EKPC	EKPC	441623164.7	71667.29	441551497.4	373322089.3	-68132891.01	305189198.3
201819ME PJM Base Remove All S2 19	A2029FE-ATSI	A2029FE-ATSI	FE-ATSI	2724052877	5565563.54	2718486314	1711058679	-68132891.01	1642925788
201819ME PJM Base Remove All S2 19	A2029JCPL	A2029JCPL	JCPL	875945875.7	294867.03	875651008.7	159088949.1	-68132891.01	90856058.12
201819ME PJM Base Remove All S2 19	A2029METED	A2029METED	METED	647364364.5	1937634.73	645426729.8	472046529.3	-68132891.01	403913638.3
201819ME PJM Base Remove All S2 19	A2029NEPTHVDC	A2029NEPTHVDC	NEPTHVDC	229360716	0	229360716	0	-68132891.01	-68132891.01
201819ME PJM Base Remove All S2 19	A2029OVEC	A2029OVEC	OVEC	21193880.75	0	21193880.75	441104460.4	-68132891.01	372971569.4
201819ME PJM Base Remove All S2 19	A2029PECO	A2029PECO	PECO	1703917701	-1318762.04	1705236463	1206257822	-68132891.01	1138124931
201819ME PJM Base Remove All S2 19	A2029PENELEC	A2029PENELEC	PENELEC	671485406.1	128237.33	671357168.7	1793849021	-68132891.01	1725716130
201819ME PJM Base Remove All S2 19	A2029PEPCO	A2029PEPCO	PEPCO	1312149427	7232727.47	1304916700	337284458.3	-68132891.01	269151567.3
201819ME PJM Base Remove All S2 19	A2029PLGRP	A2029PLGRP	PLGRP	1649294060	4363627.38	1644930433	1881882304	-68132891.01	1813749413
201819ME PJM Base Remove All S2 19	A2029PSEG	A2029PSEG	PSEG	1694851244	-4847551.58	1699698796	1308509232	-68132891.01	1240376341
201819ME PJM Base Remove All S2 19	A2029RECO	A2029RECO	RECO	59563054.33	126406.87	59436647.47	0	-68132891.01	-68132891.01
201819ME PJM Base Remove All S2 19	A2029zPJMIMP	A2029zPJMIMP	zPJMIMP	0	0	0	298428577.7	-68132891.01	230295686.7
201819ME PJM Base CA3 S2 1%LD v2C	B2019AEEO	A2019AEEO	AEEO	241426686.5	-110721.76	241537408.2	146511426.5	-32653688.94	113857737.6
201819ME PJM Base CA3 S2 1%LD v2C	B2019AEP	A2019AEP	AEP	3206497539	-19288349.96	3225785889	3062714276	-32653688.94	3030060587
201819ME PJM Base CA3 S2 1%LD v2C	B2019APS	A2019APS	APS	1216787332	4004828.54	1212782503	1370368855	-32653688.94	1337715166
201819ME PJM Base CA3 S2 1%LD v2C	B2019BGE	A2019BGE	BGE	842860414.4	3974372.27	838886042.1	218594403.9	-32653688.94	185940715
201819ME PJM Base CA3 S2 1%LD v2C	B2019COMED	A2019COMED	COMED	2445103702	2897328.8	2442206373	1603361006	-32653688.94	1570707317
201819ME PJM Base CA3 S2 1%LD v2C	B2019DAY	A2019DAY	DAY	438087643.1	36795.02	438050848.1	39079003.51	-32653688.94	6425314.57

201819ME PJM Base CA3 S2 1%LD v2C	B2019DEOK	A2019DEOK	DEOK	664918434.4	2736215.41	662182219	495263371.5	-32653688.94	462609682.6
201819ME PJM Base CA3 S2 1%LD v2C	B2019DOM	A2019DOM	DOM	2447228910	3588007.05	2443640903	1324640065	-32653688.94	1291986376
201819ME PJM Base CA3 S2 1%LD v2C	B2019DPL	A2019DPL	DPL	467611548.3	140229.76	467471318.5	149379025.5	-32653688.94	116725336.5
201819ME PJM Base CA3 S2 1%LD v2C	B2019DUQ	A2019DUQ	DUQ	345985863.3	51708.8	345934154.5	103308048.1	-32653688.94	70654359.13
201819ME PJM Base CA3 S2 1%LD v2C	B2019EKPC	A2019EKPC	EKPC	269172215.3	123118.27	269049097	216577798.8	-32653688.94	183924109.8
201819ME PJM Base CA3 S2 1%LD v2C	B2019FE-ATSI	A2019FE-ATSI	FE-ATSI	1680099954	1952536.86	1678147417	991817654	-32653688.94	959163965.1
201819ME PJM Base CA3 S2 1%LD v2C	B2019JCPL	A2019JCPL	JCPL	549797740.6	-186946.71	549984687.3	146247940.9	-32653688.94	113594252
201819ME PJM Base CA3 S2 1%LD v2C	B2019METED	A2019METED	METED	383470396.9	236415.3	383233981.6	361015370.7	-32653688.94	328361681.7
201819ME PJM Base CA3 S2 1%LD v2C	B2019NEPTHVDC	A2019NEPTHVDC	NEPTHVDC	142487332.9	0	142487332.9	0	-32653688.94	-32653688.94
201819ME PJM Base CA3 S2 1%LD v2C	B2019OVEC	A2019OVEC	OVEC	13377629.24	0	13377629.24	281719238.6	-32653688.94	249065549.7
201819ME PJM Base CA3 S2 1%LD v2C	B2019PECO	A2019PECO	PECO	1017870557	423323.17	1017447234	1002731682	-32653688.94	970077993.4
201819ME PJM Base CA3 S2 1%LD v2C	B2019PENELEC	A2019PENELEC	PENELEC	424642446.4	-387568.78	425030015.2	1100302499	-32653688.94	1067648810
201819ME PJM Base CA3 S2 1%LD v2C	B2019PEPCO	A2019PEPCO	PEPCO	802542640.4	3420800.07	799121840.3	172599530.8	-32653688.94	139945841.9
201819ME PJM Base CA3 S2 1%LD v2C	B2019PLGRP	A2019PLGRP	PLGRP	1002940270	142201.41	1002798068	1271189283	-32653688.94	1238535594
201819ME PJM Base CA3 S2 1%LD v2C	B2019PSEG	A2019PSEG	PSEG	1065560852	-1171875.79	1066732727	1000078236	-32653688.94	967424547.4
201819ME PJM Base CA3 S2 1%LD v2C	B2019RECO	A2019RECO	RECO	37460225.42	62069.93	37398155.51	0	-32653688.94	-32653688.94
201819ME PJM Base CA3 S2 1%LD v2C	B2019zPJMIMP	A2019zPJMIMP	zPJMIMP	0	0	0	214778489.5	-32653688.94	182124800.5
201819ME PJM Base CA3 S2 1%LD v2C	B2023AECO	A2023AECO	AECO	310664788.9	-62321.75	310727110.7	167689393.9	-45866617.13	121822776.8
201819ME PJM Base CA3 S2 1%LD v2C	B2023AEP	A2023AEP	AEP	4076234550	-24726599.54	4100961150	3622494670	-45866617.13	3576628053
201819ME PJM Base CA3 S2 1%LD v2C	B2023APS	A2023APS	APS	1601020097	210765.96	1600809331	1673554889	-45866617.13	1627688272
201819ME PJM Base CA3 S2 1%LD v2C	B2023BGE	A2023BGE	BGE	1065601711	3048186.53	1062553525	320658764.3	-45866617.13	274792142.7
201819ME PJM Base CA3 S2 1%LD v2C	B2023COMED	A2023COMED	COMED	3063523707	2905354.32	3060618352	1950980745	-45866617.13	1905114128
201819ME PJM Base CA3 S2 1%LD v2C	B2023DAY	A2023DAY	DAY	551978988.2	-83786.37	552062774.6	67645938.72	-45866617.13	21779321.59
201819ME PJM Base CA3 S2 1%LD v2C	B2023DEOK	A2023DEOK	DEOK	840182892	707471.14	839475420.8	604898539.5	-45866617.13	559031922.3
201819ME PJM Base CA3 S2 1%LD v2C	B2023DOM	A2023DOM	DOM	3258865000	4300597.86	3254564402	1865420630	-45866617.13	1819554013
201819ME PJM Base CA3 S2 1%LD v2C	B2023DPL	A2023DPL	DPL	615281143.4	649344.96	614631798.5	78841190.72	-45866617.13	32974573.59
201819ME PJM Base CA3 S2 1%LD v2C	B2023DUQ	A2023DUQ	DUQ	433998979.7	-574087.27	434573067	181296181.4	-45866617.13	135429564.3
201819ME PJM Base CA3 S2 1%LD v2C	B2023EKPC	A2023EKPC	EKPC	339340543.1	-1748.64	339342291.7	296136336.1	-45866617.13	250269719
201819ME PJM Base CA3 S2 1%LD v2C	B2023FE-ATSI	A2023FE-ATSI	FE-ATSI	2119188910	-826263.19	2120015174	1335078338	-45866617.13	1289211721
201819ME PJM Base CA3 S2 1%LD v2C	B2023JCPL	A2023JCPL	JCPL	714582306.3	459530.56	714122775.7	124203741.7	-45866617.13	78337124.55
201819ME PJM Base CA3 S2 1%LD v2C	B2023METED	A2023METED	METED	507055695.8	-427864.6	507483560.4	371160334.6	-45866617.13	325293717.4
201819ME PJM Base CA3 S2 1%LD v2C	B2023NEPTHVDC	A2023NEPTHVDC	NEPTHVDC	187969436.2	0	187969436.2	0	-45866617.13	-45866617.13
201819ME PJM Base CA3 S2 1%LD v2C	B2023OVEC	A2023OVEC	OVEC	16696154.84	0	16696154.84	362393921	-45866617.13	316527303.9
201819ME PJM Base CA3 S2 1%LD v2C	B2023PECO	A2023PECO	PECO	1354385693	10034.88	1354375659	1003322516	-45866617.13	957455899.2
201819ME PJM Base CA3 S2 1%LD v2C	B2023PENELEC	A2023PENELEC	PENELEC	538092108	-1740195.65	539832303.7	1452447138	-45866617.13	1406580520
201819ME PJM Base CA3 S2 1%LD v2C	B2023PEPCO	A2023PEPCO	PEPCO	1014039784	2982715.67	1011057068	227978299.2	-45866617.13	182111682.1
201819ME PJM Base CA3 S2 1%LD v2C	B2023PLGRP	A2023PLGRP	PLGRP	1324082405	1624895.26	1322457510	1504875797	-45866617.13	1459009180
201819ME PJM Base CA3 S2 1%LD v2C	B2023PSEG	A2023PSEG	PSEG	1389148521	162155.96	1388986365	1041713012	-45866617.13	995846395.2
201819ME PJM Base CA3 S2 1%LD v2C	B2023RECO	A2023RECO	RECO	48156473.3	27577.86	48128895.46	0	-45866617.13	-45866617.13
201819ME PJM Base CA3 S2 1%LD v2C	B2023zPJMIMP	A2023zPJMIMP	zPJMIMP	0	0	0	240088000.8	-45866617.13	194221383.6
201819ME PJM Base CA3 S2 1%LD v2C	B2026AECO	A2026AECO	AECO	343019768.1	-195791.02	343215559.1	208694908.2	-59875743.91	148819164.3
201819ME PJM Base CA3 S2 1%LD v2C	B2026AEP	A2026AEP	AEP	4694534143	-29678409.88	4724212553	4049650942	-59875743.91	3989775198
201819ME PJM Base CA3 S2 1%LD v2C	B2026APS	A2026APS	APS	1837581563	783220.42	1836798342	1857003870	-59875743.91	1797128126
201819ME PJM Base CA3 S2 1%LD v2C	B2026BGE	A2026BGE	BGE	1193317755	1738926.25	1191578829	342189150.1	-59875743.91	282313406.2
201819ME PJM Base CA3 S2 1%LD v2C	B2026COMED	A2026COMED	COMED	353569392	4858087.58	3530811304	2168353909	-59875743.91	2108478165
201819ME PJM Base CA3 S2 1%LD v2C	B2026DAY	A2026DAY	DAY	634128159.4	-72891.72	634201051.1	75965610.41	-59875743.91	16089866.5
201819ME PJM Base CA3 S2 1%LD v2C	B2026DEOK	A2026DEOK	DEOK	968752798.7	3239939.67	965512859	671243434.1	-59875743.91	611367690.2
201819ME PJM Base CA3 S2 1%LD v2C	B2026DOM	A2026DOM	DOM	3761321469	5002924.11	3756318545	2202248022	-59875743.91	2142372278
201819ME PJM Base CA3 S2 1%LD v2C	B2026DPL	A2026DPL	DPL	691204570.4	1361439.48	689843130.9	84716306.23	-59875743.91	24840562.32

201819ME PJM Base CA3 S2 1%LD v2C	B2026DUQ	A2026DUQ	DUQ	490663446.1	-195148.68	490858594.8	205782101.4	-59875743.91	145906357.4
201819ME PJM Base CA3 S2 1%LD v2C	B2026EKPC	A2026EKPC	EKPC	388700353.4	16774.53	388683578.9	330520760.1	-59875743.91	270645016.2
201819ME PJM Base CA3 S2 1%LD v2C	B2026FE-ATSI	A2026FE-ATSI	FE-ATSI	2410151589	2456900.1	2407694689	1522099969	-59875743.91	1462224225
201819ME PJM Base CA3 S2 1%LD v2C	B2026JCPL	A2026JCPL	JCPL	791865912.7	144800.58	791721112.1	151438174.5	-59875743.91	91562430.57
201819ME PJM Base CA3 S2 1%LD v2C	B2026METED	A2026METED	METED	572916850.9	-147105.61	573083956.5	442033693.1	-59875743.91	382157949.2
201819ME PJM Base CA3 S2 1%LD v2C	B2026NEPETHVDC	A2026NEPETHVDC	NEPETHVDC	208241593.3	0	208241593.3	0	-59875743.91	-59875743.91
201819ME PJM Base CA3 S2 1%LD v2C	B2026OVEC	A2026OVEC	OVEC	18875810.93	0	18875810.93	400974190.6	-59875743.91	341098446.7
201819ME PJM Base CA3 S2 1%LD v2C	B2026PECO	A2026PECO	PECO	1519733356	-600367.77	1520333724	1131883090	-59875743.91	1072007346
201819ME PJM Base CA3 S2 1%LD v2C	B2026PENELEC	A2026PENELEC	PENELEC	605355451.6	-928284.96	606283736.6	1617989344	-59875743.91	1558113600
201819ME PJM Base CA3 S2 1%LD v2C	B2026PEPCO	A2026PEPCO	PEPCO	1142659540	2605159.79	1140054380	251348937.9	-59875743.91	191473193.9
201819ME PJM Base CA3 S2 1%LD v2C	B2026PLGRP	A2026PLGRP	PLGRP	1479062397	1327500.99	1477734896	1719596542	-59875743.91	1659720798
201819ME PJM Base CA3 S2 1%LD v2C	B2026PSEG	A2026PSEG	PSEG	1537517412	-1789827.62	1539307239	1189701289	-59875743.91	1129825545
201819ME PJM Base CA3 S2 1%LD v2C	B2026RECO	A2026RECO	RECO	54059024.5	84935.11	53974089.41	0	-59875743.91	-59875743.91
201819ME PJM Base CA3 S2 1%LD v2C	B2026zPJMIMP	A2026zPJMIMP	zPJMIMP	0	0	0	265290414.1	-59875743.91	205414670.2
201819ME PJM Base CA3 S2 1%LD v2C	B2029AECO	A2029AECO	AECO	381812635	-274702.99	382087338	246769672.2	-70540200.3	176229471.9
201819ME PJM Base CA3 S2 1%LD v2C	B2029AEP	A2029AEP	AEP	5371813972	-34482469.79	5406296441	4621150847	-70540200.3	4550610647
201819ME PJM Base CA3 S2 1%LD v2C	B2029APS	A2029APS	APS	2097684099	904606.26	2096779493	2071501041	-70540200.3	2000960841
201819ME PJM Base CA3 S2 1%LD v2C	B2029BGE	A2029BGE	BGE	1343345149	1944132.67	1341401017	365525233.5	-70540200.3	294985033.2
201819ME PJM Base CA3 S2 1%LD v2C	B2029COMED	A2029COMED	COMED	4048311277	5991832.68	4042319444	2396496778	-70540200.3	2325956578
201819ME PJM Base CA3 S2 1%LD v2C	B2029DAY	A2029DAY	DAY	722599600.7	-50660.43	722650261.1	99704617.85	-70540200.3	29164417.55
201819ME PJM Base CA3 S2 1%LD v2C	B2029DEOK	A2029DEOK	DEOK	1108486228	4223498.16	1104262730	740774012.4	-70540200.3	670233812.1
201819ME PJM Base CA3 S2 1%LD v2C	B2029DOM	A2029DOM	DOM	4330207843	7182427.82	4323025416	2555742141	-70540200.3	2485201941
201819ME PJM Base CA3 S2 1%LD v2C	B2029DPL	A2029DPL	DPL	781370003.9	-19183.92	781389187.8	98399296.98	-70540200.3	27859096.68
201819ME PJM Base CA3 S2 1%LD v2C	B2029DUQ	A2029DUQ	DUQ	552167507.8	-272857.72	552440365.6	231806796.7	-70540200.3	161266596.4
201819ME PJM Base CA3 S2 1%LD v2C	B2029EKPC	A2029EKPC	EKPC	441125175.7	111163.2	441014012.5	373143173.1	-70540200.3	302602972.8
201819ME PJM Base CA3 S2 1%LD v2C	B2029FE-ATSI	A2029FE-ATSI	FE-ATSI	2726616341	2611444.65	2724004896	1712077450	-70540200.3	1641537249
201819ME PJM Base CA3 S2 1%LD v2C	B2029JCPL	A2029JCPL	JCPL	887164040.8	79101.53	887084939.3	176165018.9	-70540200.3	105624818.6
201819ME PJM Base CA3 S2 1%LD v2C	B2029METED	A2029METED	METED	654176240.4	60427.43	654115812.9	513304495.6	-70540200.3	442764295.3
201819ME PJM Base CA3 S2 1%LD v2C	B2029NEPETHVDC	A2029NEPETHVDC	NEPETHVDC	231655208.4	0	231655208.4	0	-70540200.3	-70540200.3
201819ME PJM Base CA3 S2 1%LD v2C	B2029OVEC	A2029OVEC	OVEC	21170870.42	0	21170870.42	441108198.3	-70540200.3	370567998
201819ME PJM Base CA3 S2 1%LD v2C	B2029PECO	A2029PECO	PECO	1724862211	-233663.41	1725095874	1262575937	-70540200.3	1192035737
201819ME PJM Base CA3 S2 1%LD v2C	B2029PENELEC	A2029PENELEC	PENELEC	676650350.1	-1270527.12	677920877.3	1799511136	-70540200.3	1728970936
201819ME PJM Base CA3 S2 1%LD v2C	B2029PEPCO	A2029PEPCO	PEPCO	1288624063	2777104.83	1285846958	291831800.4	-70540200.3	221291600.1
201819ME PJM Base CA3 S2 1%LD v2C	B2029PLGRP	A2029PLGRP	PLGRP	1668759123	1966203.82	1666792920	1953765977	-70540200.3	1883225777
201819ME PJM Base CA3 S2 1%LD v2C	B2029PSEG	A2029PSEG	PSEG	1716024957	-2646557.58	1718671514	1331474665	-70540200.3	1260934465
201819ME PJM Base CA3 S2 1%LD v2C	B2029RECO	A2029RECO	RECO	60023877.82	98369.16	59925508.68	0	-70540200.3	-70540200.3
201819ME PJM Base CA3 S2 1%LD v2C	B2029zPJMIMP	A2029zPJMIMP	zPJMIMP	0	0	0	298207183.8	-70540200.3	227666983.5

Years from Sim	Year
Start_yr	2019
Rtep Yr	2023
Rtep Yr+3	2026
Rtep Yr+6	2029

Project Details			
Group	Base Group	ISD	Cost
A	A		
B	A	2023	466.44
C	A		
D	A		
E	A		
F	A		
G	A		
H	A		

ME ToolPy Field	Zone
Project Alias	AECO
Project Group-Year-Zone	AEP
Base Group-Year-Zone	APS
Demand Zone	BGE
Load Payment	COMED
ARR Valuation	DAY
Net Load Payment	DEOK
Production Cost	DOM
Interchange Value	DPL
Adjusted Production Cost	DUQ
	EKPC
	FE-ATSI
	JCPL
	METED
	NEPTHVDC
	OVEC
	PECO
	PENELEC
	PEPCO
	PLGRP
	PSEG
	RECO
	ZPJMIMP

Project RTEP Year	WACC	FCR	Inflation Assumption	Number of Periods	Pass Criteria
2023	7.25%	11.86%	2.25%	15	1.25

## Net Load Payment Benefits From Simulation

Do not modify --- &gt; Project Group

Do not modify --- &gt; Base Group

ISD

Project RTEP Year

Variable	ME Tool Column	Zone	2019	2020	2021	2022	2023	2024
Net Load Payment	7	AECO	\$ 3,637,210	\$ 3,391,267	\$ 3,145,325	\$ 2,899,383	\$ 2,653,441	\$ 2,836,284
Net Load Payment	7	AEP	\$ (2,959,655)	\$ (3,240,995)	\$ (3,522,336)	\$ (3,803,676)	\$ (4,085,017)	\$ (5,374,446)
Net Load Payment	7	APS	\$ (2,367,514)	\$ (2,508,261)	\$ (2,649,008)	\$ (2,789,755)	\$ (2,930,502)	\$ (3,756,964)
Net Load Payment	7	BGE	\$ (5,666,940)	\$ (5,462,600)	\$ (5,258,259)	\$ (5,053,919)	\$ (4,849,579)	\$ (6,801,235)
Net Load Payment	7	COMED	\$ 3,790,994	\$ 3,463,891	\$ 3,136,789	\$ 2,809,686	\$ 2,482,584	\$ 2,367,353
Net Load Payment	7	DAY	\$ (194,086)	\$ (248,131)	\$ (302,176)	\$ (356,220)	\$ (410,265)	\$ (547,418)
Net Load Payment	7	DEOK	\$ 2,949,176	\$ 2,503,979	\$ 2,058,782	\$ 1,613,585	\$ 1,168,387	\$ 1,168,487
Net Load Payment	7	DOM	\$ (29,424,768)	\$ (29,231,771)	\$ (29,038,773)	\$ (28,845,776)	\$ (28,652,779)	\$ (33,127,185)
Net Load Payment	7	DPL	\$ 7,041,668	\$ 6,515,770	\$ 5,989,872	\$ 5,463,973	\$ 4,938,075	\$ 5,232,713
Net Load Payment	7	DUQ	\$ 507,840	\$ 445,962	\$ 384,084	\$ 322,206	\$ 260,328	\$ 192,824
Net Load Payment	7	EKPC	\$ (139,290)	\$ (188,211)	\$ (237,131)	\$ (286,051)	\$ (334,971)	\$ (422,718)
Net Load Payment	7	FE-ATSI	\$ 4,363,151	\$ 3,941,495	\$ 3,519,839	\$ 3,098,182	\$ 2,676,526	\$ 2,579,938
Net Load Payment	7	JCPL	\$ 8,851,270	\$ 8,410,055	\$ 7,968,840	\$ 7,527,625	\$ 7,086,410	\$ 7,534,296
Net Load Payment	7	METED	\$ 6,141,190	\$ 5,997,698	\$ 5,854,206	\$ 5,710,714	\$ 5,567,221	\$ 5,878,000
Net Load Payment	7	NEPTHVDC	\$ 2,092,701	\$ 1,944,221	\$ 1,795,741	\$ 1,647,261	\$ 1,498,781	\$ 1,487,266
Net Load Payment	7	OVEC	\$ (10,700)	\$ (12,468)	\$ (14,235)	\$ (16,003)	\$ (17,771)	\$ (22,624)
Net Load Payment	7	PECO	\$ 16,004,839	\$ 14,874,412	\$ 13,743,985	\$ 12,613,557	\$ 11,483,130	\$ 12,260,916
Net Load Payment	7	PENELEC	\$ 4,115,924	\$ 3,978,671	\$ 3,841,418	\$ 3,704,164	\$ 3,566,911	\$ 3,959,377
Net Load Payment	7	PEPCO	\$ (11,535,155)	\$ (10,986,564)	\$ (10,437,974)	\$ (9,889,384)	\$ (9,340,793)	\$ (11,902,648)
Net Load Payment	7	PLGRP	\$ 16,622,138	\$ 15,887,315	\$ 15,152,492	\$ 14,417,668	\$ 13,682,845	\$ 14,548,931
Net Load Payment	7	PSEG	\$ 14,948,325	\$ 13,902,092	\$ 12,855,859	\$ 11,809,626	\$ 10,763,393	\$ 11,546,553
Net Load Payment	7	RECO	\$ 214,227	\$ 226,319	\$ 238,412	\$ 250,505	\$ 262,597	\$ 297,490
Net Load Payment	7	zPJMIMP	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

[illegible]



2,198,103	375,277	-1,447,549	-3,270,375	-5,093,201	-6,916,027	-8,738,853	-10,561,679	-12,384,505	-14,207,330
B2034	B2035	B2036	B2037	B2038	B2039	B2040	B2041	B2042	B2043
A2034	A2035	A2036	A2037	A2038	A2039	A2040	A2041	A2042	A2043
2029	2029	2029	2029	2029	2029	2029	2029	2029	2029
4	4	4	4	4	4	4	4	4	4
0	0	0	0	0	0	0	0	0	0
<u>2034</u>	<u>2035</u>	<u>2036</u>	<u>2037</u>	<u>2038</u>	<u>2039</u>	<u>2040</u>	<u>2041</u>	<u>2042</u>	<u>2043</u>
\$ 4,217,565	\$ 4,293,545	\$ 4,369,524	\$ 4,445,504	\$ 4,521,484	\$ 4,597,463	\$ 4,673,443	\$ 4,749,422	\$ 4,825,402	\$ 4,901,381
\$ (9,901,984)	\$ (10,361,030)	\$ (10,820,077)	\$ (11,279,123)	\$ (11,738,169)	\$ (12,197,216)	\$ (12,656,262)	\$ (13,115,308)	\$ (13,574,355)	\$ (14,033,401)
\$ (6,865,665)	\$ (7,169,664)	\$ (7,473,663)	\$ (7,777,662)	\$ (8,081,662)	\$ (8,385,661)	\$ (8,689,660)	\$ (8,993,659)	\$ (9,297,659)	\$ (9,601,658)
\$ (14,647,892)	\$ (15,316,348)	\$ (15,984,804)	\$ (16,653,260)	\$ (17,321,716)	\$ (17,990,172)	\$ (18,658,628)	\$ (19,327,084)	\$ (19,995,540)	\$ (20,663,996)
\$ 2,843,872	\$ 2,822,278	\$ 2,800,684	\$ 2,779,090	\$ 2,757,496	\$ 2,735,902	\$ 2,714,309	\$ 2,692,715	\$ 2,671,121	\$ 2,649,527
\$ (1,052,488)	\$ (1,107,195)	\$ (1,161,902)	\$ (1,216,609)	\$ (1,271,315)	\$ (1,326,022)	\$ (1,380,729)	\$ (1,435,436)	\$ (1,490,143)	\$ (1,544,850)
\$ 957,524	\$ 866,628	\$ 775,731	\$ 684,835	\$ 593,938	\$ 503,041	\$ 412,145	\$ 321,248	\$ 230,352	\$ 139,455
\$ (51,523,442)	\$ (53,134,079)	\$ (54,744,717)	\$ (56,355,355)	\$ (57,965,992)	\$ (59,576,630)	\$ (61,187,268)	\$ (62,797,905)	\$ (64,408,543)	\$ (66,019,181)
\$ 7,661,756	\$ 7,778,682	\$ 7,895,609	\$ 8,012,535	\$ 8,129,461	\$ 8,246,387	\$ 8,363,313	\$ 8,480,239	\$ 8,597,165	\$ 8,714,091
\$ 346,150	\$ 345,162	\$ 344,175	\$ 343,187	\$ 342,200	\$ 341,213	\$ 340,225	\$ 339,238	\$ 338,250	\$ 337,263
\$ (838,780)	\$ (883,528)	\$ (928,276)	\$ (973,023)	\$ (1,017,771)	\$ (1,062,519)	\$ (1,107,267)	\$ (1,152,014)	\$ (1,196,762)	\$ (1,241,510)
\$ 4,473,141	\$ 4,548,719	\$ 4,624,297	\$ 4,699,875	\$ 4,775,454	\$ 4,851,032	\$ 4,926,610	\$ 5,002,188	\$ 5,077,766	\$ 5,153,344
\$ 11,396,666	\$ 11,647,563	\$ 11,898,460	\$ 12,149,357	\$ 12,400,254	\$ 12,651,152	\$ 12,902,049	\$ 13,152,946	\$ 13,403,843	\$ 13,654,740
\$ 9,118,952	\$ 9,364,561	\$ 9,610,170	\$ 9,855,779	\$ 10,101,388	\$ 10,346,997	\$ 10,592,606	\$ 10,838,215	\$ 11,083,824	\$ 11,329,433
\$ 1,944,598	\$ 1,955,577	\$ 1,966,556	\$ 1,977,535	\$ 1,988,514	\$ 1,999,493	\$ 2,010,472	\$ 2,021,451	\$ 2,032,430	\$ 2,043,409
\$ (36,533)	\$ (38,131)	\$ (39,729)	\$ (41,327)	\$ (42,925)	\$ (44,523)	\$ (46,121)	\$ (47,719)	\$ (49,317)	\$ (50,915)
\$ 18,876,072	\$ 19,243,775	\$ 19,611,478	\$ 19,979,181	\$ 20,346,884	\$ 20,714,586	\$ 21,082,289	\$ 21,449,992	\$ 21,817,695	\$ 22,185,398
\$ 7,136,315	\$ 7,381,299	\$ 7,626,284	\$ 7,871,269	\$ 8,116,254	\$ 8,361,239	\$ 8,606,223	\$ 8,851,208	\$ 9,096,193	\$ 9,341,178
\$ (22,816,217)	\$ (23,695,520)	\$ (24,574,823)	\$ (25,454,126)	\$ (26,333,430)	\$ (27,212,733)	\$ (28,092,036)	\$ (28,971,339)	\$ (29,850,642)	\$ (30,729,945)
\$ 22,092,918	\$ 22,603,766	\$ 23,114,615	\$ 23,625,464	\$ 24,136,312	\$ 24,647,161	\$ 25,158,010	\$ 25,668,858	\$ 26,179,707	\$ 26,690,556
\$ 18,213,094	\$ 18,599,121	\$ 18,985,149	\$ 19,371,176	\$ 19,757,203	\$ 20,143,231	\$ 20,529,258	\$ 20,915,285	\$ 21,301,313	\$ 21,687,340
\$ 602,481	\$ 630,095	\$ 657,710	\$ 685,324	\$ 712,938	\$ 740,553	\$ 768,167	\$ 795,782	\$ 823,396	\$ 851,010
\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -



-16,030,156  
B2044  
A2044  
2029  
4  
0

**PJM NPV**  
**-\$771,225,376**

**TRENDING A**

<u>2044</u>	<u>ZONE</u>	<u>NLP NPV (\$)</u>	<u>Positive Benefit</u>	<u>%</u>	<u>Yr1-Yr2 Slope</u>	<u>Yr2-Yr3 Slope</u>	<u>Yr3-Yr4 Slope</u>	<u>2019</u>
\$ 4,977,361	AECO	\$32,730,915	FALSE	0%	-245942.05	182842.94	404156.17	3,637,209.5
\$ (14,492,448)	AEP	(\$68,432,741)	TRUE	9%	-281340.49	-1289429.44	415384.92	-2,959,654.8
\$ (9,905,657)	APS	(\$47,749,528)	TRUE	6%	-140747.16	-826461.96	170367.75	-2,367,513.6
\$ (21,332,452)	BGE	(\$98,498,143)	TRUE	13%	204340.19	-1951655.73	-198724.47	-5,666,939.7
\$ 2,627,933	COMED	\$24,551,677	FALSE	0%	-327102.46	-115230.45	556763.31	3,790,993.7
\$ (1,599,556)	DAY	(\$7,078,307)	TRUE	1%	-54044.60	-137153.14	57138.44	-194,086.5
\$ 48,558	DEOK	\$11,180,602	FALSE	0%	-445197.16	99.67	306709.35	2,949,176.1
\$ (67,629,818)	DOM	(\$383,851,403)	TRUE	50%	192997.36	-4474406.66	-349784.37	-29,424,768.0
\$ 8,831,017	DPL	\$60,089,493	FALSE	0%	-525898.42	294638.74	821060.75	7,041,668.4
\$ 336,276	DUQ	\$2,620,405	FALSE	0%	-61877.92	-67504.12	179768.93	507,839.8
\$ (1,286,257)	EKPC	(\$5,547,548)	TRUE	1%	-48920.18	-87747.34	20242.75	-139,290.4
\$ 5,228,922	FE-ATSI	\$33,264,355	FALSE	0%	-421656.40	-96588.01	1043940.28	4,363,151.3
\$ 13,905,637	JCPL	\$87,011,421	FALSE	0%	-441214.98	447886.57	1001287.03	8,851,269.8
\$ 11,575,042	METED	\$68,147,526	FALSE	0%	-143492.22	310779.00	729841.59	6,141,190.3
\$ 2,054,387	NEPTHVDC	\$15,963,053	FALSE	0%	-148480.09	-11514.39	276751.64	2,092,701.0
\$ (52,513)	OVEC	(\$262,157)	TRUE	0%	-1767.73	-4853.32	3106.86	-10,700.0
\$ 22,553,101	PECO	\$144,665,334	FALSE	0%	-1130427.30	777786.27	2014307.35	16,004,839.4
\$ 9,586,162	PENELEC	\$50,675,777	FALSE	0%	-137253.09	392465.74	606466.63	4,115,923.8
\$ (31,609,248)	PEPCO	(\$159,805,549)	TRUE	21%	548590.35	-2561854.79	-681127.99	-11,535,154.8
\$ 27,201,404	PLGRP	\$167,973,753	FALSE	0%	-734823.18	866086.28	1860460.89	16,622,137.9
\$ 22,073,367	PSEG	\$138,182,519	FALSE	0%	-1046232.99	783160.52	1953281.36	14,948,324.7
\$ 878,625	RECO	\$4,028,283	FALSE	0%	12092.69	34893.09	40528.21	214,226.6
\$ -	zPJMIMP	\$0	FALSE	0%	0.00	0.00	0.00	0.0

**NALYSIS**

2	3	4	y = m*x + b	
2023	2026	2029	Slope	Intercept
2,653,441.3	3,201,970.1	4,414,438.7	75,979.5	-150,324,815.0
-4,085,016.7	-7,953,305.0	-6,707,150.3	-459,046.4	923,798,346.8
-2,930,502.2	-5,409,888.1	-4,898,784.8	-303,999.2	611,468,777.0
-4,849,579.0	-10,704,546.1	-11,300,719.6	-668,456.0	1,344,991,631.5
2,482,583.8	2,136,892.5	3,807,182.4	-21,593.9	46,765,947.6
-410,264.9	-821,724.3	-650,309.0	-54,706.9	110,221,249.7
1,168,387.5	1,168,686.5	2,088,814.5	-90,896.6	185,841,195.7
-28,652,778.6	-42,075,998.6	-43,125,351.7	-1,610,637.7	3,224,513,586.8
4,938,074.7	5,821,990.9	8,285,173.2	116,926.1	-230,165,940.8
260,328.1	57,815.7	597,122.5	-987.4	2,354,492.0
-334,971.1	-598,213.1	-537,484.9	-44,747.7	90,178,088.0
2,676,525.7	2,386,761.7	5,518,582.5	75,578.1	-149,252,616.5
7,086,409.8	8,430,069.5	11,433,930.6	250,897.1	-498,927,943.8
5,567,221.4	6,499,558.4	8,689,083.1	245,609.1	-490,449,892.6
1,498,780.7	1,464,237.5	2,294,492.4	10,979.0	-20,386,619.2
-17,770.9	-32,330.9	-23,010.3	-1,598.0	3,213,753.2
11,483,130.2	13,816,489.0	19,859,411.0	367,703.0	-729,031,811.6
3,566,911.4	4,744,308.6	6,563,708.5	244,984.8	-491,162,721.6
-9,340,793.3	-17,026,357.7	-19,069,741.7	-879,303.1	1,765,686,293.1
13,682,845.2	16,281,104.0	21,862,486.7	510,848.6	-1,016,973,230.4
10,763,392.8	13,112,874.3	18,972,718.4	386,027.3	-766,966,511.7
262,597.3	367,276.6	488,861.2	27,614.4	-55,565,216.9
0.0	0.0	0.0	0.0	0.0

## Adjusted Production Cost Benefits From Simulation

Do not modify --- &gt; Project Group

Do not modify --- &gt; Base Group

Project Group		B	PJM APC Benefit	-19,081,346	-17,500,973	-15,920,600	-14,340,227	-12,759,854	-13,168,624
Base Group		A	Project Grp	B2019	B2020	B2021	B2022	B2023	B2024
			BaseGrp	A2019	A2020	A2021	A2022	A2023	A2024
			Intercept Year	2019	2019	2019	2019	2023	2023
ISD	2023		slope/intercept	1	1	1	1	2	2
Project RTEP Year	2023		Model Year	1	0	0	0	2	0
Variable	ME_Tool Column	Zone	2019	2020	2021	2022	2023	2024	
Adjusted Production Cost	10	AECO	#####	\$9,059,113.335	\$8,298,904.060	\$7,538,694.785	\$6,778,485.510	\$7,101,130.553	
Adjusted Production Cost	10	AEP	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	APS	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	BGE	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	COMED	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	DAY	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	DEOK	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	DOM	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	DPL	#####	#####	#####	#####	\$7,379,933.700	\$8,738,504.900	
Adjusted Production Cost	10	DUQ	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	EKPC	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	FE-ATSI	#####	#####	#####	#####	\$ (510,439.430)	#####	
Adjusted Production Cost	10	JCPL	#####	\$6,973,666.600	\$7,208,204.610	\$7,442,742.620	\$7,677,280.630	#####	
Adjusted Production Cost	10	METED	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	NEPTHVDC	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	OVEC	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	PECO	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	PENELEC	#####	#####	#####	\$6,680,272.138	\$1,910,314.630	\$1,285,477.230	
Adjusted Production Cost	10	PEPCO	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	PLGRP	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	PSEG	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	RECO	#####	#####	#####	#####	#####	#####	
Adjusted Production Cost	10	zPJMIMP	#####	#####	#####	#####	#####	#####	

-13,577,394	-13,986,163	-17,066,303	-20,146,443	-23,226,582	-19,224,805	-19,565,904	-19,907,003	-20,248,102
B2025	B2026	B2027	B2028	B2029	B2030	B2031	B2032	B2033
A2025	A2026	A2027	A2028	A2029	A2030	A2031	A2032	A2033
2023	2026	2026	2026	2029	2029	2029	2029	2029
2	3	3	3	4	4	4	4	4
0	3	0	0	4	0	0	0	0
<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>	<b>2030</b>	<b>2031</b>	<b>2032</b>	<b>2033</b>
\$7,423,775.597	\$ 7,746,420.640	\$ 7,575,567.223	\$ 7,404,713.807	\$ 7,233,860.390	\$ 6,622,960.711	\$ 6,401,819.568	\$ 6,180,678.424	\$ 5,959,537.280
#####	#####	#####	#####	#####	#####	\$(9,964,962.591)	\$(9,384,507.357)	\$(8,804,052.123)
#####	\$(7,867,114.680)	\$(7,708,182.650)	\$(7,549,250.620)	\$(7,390,318.590)	\$(5,724,076.159)	\$(5,273,936.300)	\$(4,823,796.441)	\$(4,373,656.582)
#####	#####	#####	#####	#####	#####	#####	#####	#####
#####	\$(2,078,111.570)	\$(1,702,860.130)	\$(1,327,608.690)	\$(952,357.250)	\$(1,037,257.009)	\$(894,773.715)	\$(752,290.422)	\$(609,807.128)
#####	\$(4,318,809.980)	\$(4,186,985.483)	\$(4,055,160.987)	\$(3,923,336.490)	\$(3,972,289.146)	\$(4,084,613.775)	\$(4,196,938.404)	\$(4,309,263.033)
#####	\$(2,933,709.680)	\$(2,865,651.087)	\$(2,797,592.493)	\$(2,729,533.900)	\$(3,057,945.029)	\$(3,213,243.079)	\$(3,368,541.129)	\$(3,523,839.178)
#####	#####	#####	#####	#####	#####	#####	#####	#####
#####	\$11,455,647.300	\$11,944,213.433	\$12,432,779.567	\$12,921,345.700	\$ 6,147,261.126	\$ 4,483,166.592	\$ 2,819,072.057	\$ 1,154,977.523
#####	\$(2,181,510.610)	\$(2,170,066.897)	\$(2,158,623.183)	\$(2,147,179.470)	\$(1,797,217.309)	\$(1,744,061.696)	\$(1,690,906.083)	\$(1,637,750.470)
#####	\$(2,917,595.660)	\$(2,807,138.937)	\$(2,696,682.213)	\$(2,586,225.490)	\$(2,561,342.015)	\$(2,551,190.681)	\$(2,541,039.347)	\$(2,530,888.014)
#####	\$(2,987,748.770)	\$(2,454,678.710)	\$(1,921,608.650)	\$(1,388,538.590)	\$(1,105,575.880)	\$(899,147.220)	\$(692,718.561)	\$(486,289.901)
#####	\$15,884,005.520	\$15,478,923.853	\$15,073,842.187	\$14,668,760.520	\$16,755,634.973	\$17,714,476.914	\$18,673,318.854	\$19,632,160.795
#####	\$37,940,149.730	\$38,243,652.133	\$38,547,154.537	\$38,850,656.940	\$45,468,749.152	\$48,676,052.824	\$51,883,356.496	\$55,090,660.168
#####	\$(2,193,956.370)	\$(2,265,074.010)	\$(2,336,191.650)	\$(2,407,309.290)	\$(2,353,977.323)	\$(2,416,051.044)	\$(2,478,124.766)	\$(2,540,198.487)
#####	\$(2,248,666.120)	\$(2,300,301.200)	\$(2,351,936.280)	\$(2,403,571.360)	\$(1,502,898.934)	\$(1,279,275.689)	\$(1,055,652.445)	\$(832,029.201)
#####	\$44,497,804.670	\$47,635,471.913	\$50,773,139.157	\$53,910,806.400	\$46,493,455.802	\$46,487,277.930	\$46,481,100.057	\$46,474,922.185
\$ 660,639.830	\$ 35,802.430	\$ 1,108,803.593	\$ 2,181,804.757	\$ 3,254,805.920	\$(3,646,082.034)	\$(5,418,925.329)	\$(7,191,768.623)	\$(8,964,611.918)
#####	#####	#####	#####	#####	#####	#####	#####	#####
#####	\$60,585,998.460	\$63,549,453.490	\$66,512,908.520	\$69,476,363.550	\$69,374,439.674	\$71,066,844.143	\$72,759,248.612	\$74,451,653.080
#####	\$19,363,935.220	\$19,761,998.230	\$20,160,061.240	\$20,558,124.250	\$16,340,368.244	\$15,456,037.445	\$14,571,706.646	\$13,687,375.846
#####	\$(2,193,956.370)	\$(2,265,074.010)	\$(2,336,191.650)	\$(2,407,309.290)	\$(2,353,977.323)	\$(2,416,051.044)	\$(2,478,124.766)	\$(2,540,198.487)
#####	\$(2,179,213.520)	\$(2,329,043.407)	\$(2,478,873.293)	\$(2,628,703.180)	\$(2,422,601.099)	\$(2,475,962.251)	\$(2,529,323.403)	\$(2,582,684.554)



-20,589,201	-20,930,300	-21,271,399	-21,612,498	-21,953,597	-22,294,696	-22,635,795	-22,976,894	-23,317,993
B2034	B2035	B2036	B2037	B2038	B2039	B2040	B2041	B2042
A2034	A2035	A2036	A2037	A2038	A2039	A2040	A2041	A2042
2029	2029	2029	2029	2029	2029	2029	2029	2029
4	4	4	4	4	4	4	4	4
0	0	0	0	0	0	0	0	0
<u>2034</u>	<u>2035</u>	<u>2036</u>	<u>2037</u>	<u>2038</u>	<u>2039</u>	<u>2040</u>	<u>2041</u>	<u>2042</u>
\$ 5,738,396.136	\$ 5,517,254.993	\$ 5,296,113.849	\$ 5,074,972.705	\$ 4,853,831.562	\$ 4,632,690.418	\$ 4,411,549.274	\$ 4,190,408.131	\$ 3,969,266.987
\$ (8,223,596.889)	\$ (7,643,141.655)	\$ (7,062,686.421)	\$ (6,482,231.187)	\$ (5,901,775.953)	\$ (5,321,320.719)	\$ (4,740,865.485)	\$ (4,160,410.251)	\$ (3,579,955.017)
\$ (3,923,516.723)	\$ (3,473,376.864)	\$ (3,023,237.005)	\$ (2,573,097.146)	\$ (2,122,957.287)	\$ (1,672,817.428)	\$ (1,222,677.569)	\$ (772,537.710)	\$ (322,397.851)
#####	#####	#####	#####	#####	#####	#####	#####	#####
\$ (467,323.834)	\$ (324,840.541)	\$ (182,357.247)	\$ (39,873.953)	\$ 102,609.340	\$ 245,092.634	\$ 387,575.928	\$ 530,059.221	\$ 672,542.515
\$ (4,421,587.661)	\$ (4,533,912.290)	\$ (4,646,236.919)	\$ (4,758,561.548)	\$ (4,870,886.177)	\$ (4,983,210.806)	\$ (5,095,535.435)	\$ (5,207,860.063)	\$ (5,320,184.692)
\$ (3,679,137.228)	\$ (3,834,435.278)	\$ (3,989,733.328)	\$ (4,145,031.378)	\$ (4,300,329.427)	\$ (4,455,627.477)	\$ (4,610,925.527)	\$ (4,766,223.577)	\$ (4,921,521.627)
#####	#####	#####	#####	#####	#####	#####	#####	#####
\$ (509,117.011)	\$ (2,173,211.545)	\$ (3,837,306.079)	\$ (5,501,400.614)	\$ (7,165,495.148)	\$ (8,829,589.682)	#####	#####	#####
\$ (1,584,594.857)	\$ (1,531,439.245)	\$ (1,478,283.632)	\$ (1,425,128.019)	\$ (1,371,972.406)	\$ (1,318,816.793)	\$ (1,265,661.180)	\$ (1,212,505.568)	\$ (1,159,349.955)
\$ (2,520,736.680)	\$ (2,510,585.347)	\$ (2,500,434.013)	\$ (2,490,282.680)	\$ (2,480,131.346)	\$ (2,469,980.012)	\$ (2,459,828.679)	\$ (2,449,677.345)	\$ (2,439,526.012)
\$ (279,861.242)	\$ (73,432.582)	\$ 132,996.078	\$ 339,424.737	\$ 545,853.397	\$ 752,282.056	\$ 958,710.716	\$ 1,165,139.376	\$ 1,371,568.035
\$20,591,002.735	\$21,549,844.676	\$22,508,686.616	\$23,467,528.557	\$24,426,370.498	\$25,385,212.438	\$26,344,054.379	\$27,302,896.319	\$28,261,738.260
\$58,297,963.840	\$61,505,267.512	\$64,712,571.184	\$67,919,874.856	\$71,127,178.528	\$74,334,482.200	\$77,541,785.872	\$80,749,089.544	\$83,956,393.216
\$ (2,602,272.208)	\$ (2,664,345.930)	\$ (2,726,419.651)	\$ (2,788,493.372)	\$ (2,850,567.094)	\$ (2,912,640.815)	\$ (2,974,714.537)	\$ (3,036,788.258)	\$ (3,098,861.979)
\$ (608,405.957)	\$ (384,782.713)	\$ (161,159.469)	\$ 62,463.775	\$ 286,087.020	\$ 509,710.264	\$ 733,333.508	\$ 956,956.752	\$ 1,180,579.996
\$46,468,744.313	\$46,462,566.440	\$46,456,388.568	\$46,450,210.696	\$46,444,032.824	\$46,437,854.951	\$46,431,677.079	\$46,425,499.207	\$46,419,321.334
#####	#####	#####	#####	#####	#####	#####	#####	#####
#####	#####	#####	#####	#####	#####	#####	#####	#####
\$76,144,057.549	\$77,836,462.018	\$79,528,866.487	\$81,221,270.956	\$82,913,675.425	\$84,606,079.894	\$86,298,484.363	\$87,990,888.832	\$89,683,293.301
\$12,803,045.047	\$11,918,714.248	\$11,034,383.449	\$10,150,052.649	\$ 9,265,721.850	\$ 8,381,391.051	\$ 7,497,060.252	\$ 6,612,729.452	\$ 5,728,398.653
\$ (2,602,272.208)	\$ (2,664,345.930)	\$ (2,726,419.651)	\$ (2,788,493.372)	\$ (2,850,567.094)	\$ (2,912,640.815)	\$ (2,974,714.537)	\$ (3,036,788.258)	\$ (3,098,861.979)
\$ (2,636,045.706)	\$ (2,689,406.858)	\$ (2,742,768.009)	\$ (2,796,129.161)	\$ (2,849,490.313)	\$ (2,902,851.464)	\$ (2,956,212.616)	\$ (3,009,573.768)	\$ (3,062,934.919)

PJM NPV
-\$157,945,981

--

-23,659,092	-24,000,191
B2043	B2044
A2043	A2044
2029	2029
4	4
0	0

2043	2044	ZONE	APC NPV (\$)	Positive Benefit	%	Yr1-Yr2 Slope	Yr2-Yr3 Slope
\$ 3,748,125.843	\$ 3,526,984.699	AECO	\$60,487,082	TRUE	-38%	-760209.27	322645.04
\$(2,999,499.783)	\$(2,419,044.549)	AEP	\$(97,490,679)	TRUE	62%	2788741.27	-2396293.81
\$ 127,742.008	\$ 577,881.867	APS	\$(52,355,310)	TRUE	33%	1880291.86	-877218.11
#####	#####	BGE	\$(152,489,862)	TRUE	97%	-618719.91	-1235191.93
\$ 815,025.808	\$ 957,509.102	COMED	\$(11,262,228)	TRUE	7%	209426.11	-99708.77
\$(5,432,509.321)	\$(5,544,833.950)	DAY	\$(33,450,186)	TRUE	21%	448434.44	-894635.68
\$(5,076,819.677)	\$(5,232,117.726)	DEOK	\$(25,759,852)	TRUE	16%	-17813.10	-466580.93
#####	#####	DOM	\$(1,027,760,521)	TRUE	651%	9624564.51	-5234979.69
#####	#####	DPL	\$59,197,881	TRUE	-37%	-5931589.60	1358571.20
\$(1,106,194.342)	\$(1,053,038.729)	DUQ	\$(15,639,288)	TRUE	10%	457256.44	-351548.12
\$(2,429,374.678)	\$(2,419,223.345)	EKPC	\$(22,768,215)	TRUE	14%	222163.67	-291469.74
\$ 1,577,996.695	\$ 1,784,425.354	FE-ATSI	\$(11,152,800)	TRUE	7%	943249.12	-825769.78
\$29,220,580.200	\$30,179,422.141	JCPL	\$140,272,427	TRUE	-89%	234538.01	2735574.96
\$87,163,696.888	\$90,371,000.560	METED	\$377,107,803	TRUE	-239%	3305207.67	5223877.22
\$(3,160,935.701)	\$(3,223,009.422)	NEPHTVDC	\$(19,950,965)	TRUE	13%	108503.18	-239162.90
\$ 1,404,203.240	\$ 1,627,826.485	OVEC	\$(14,026,545)	TRUE	9%	807718.81	-204252.43
\$46,413,143.462	\$46,406,965.590	PECO	\$395,136,099	TRUE	-250%	-6154623.96	4317800.33
#####	#####	PENELEC	\$(25,673,879)	TRUE	16%	-4769957.51	-624837.40
#####	#####	PEPCO	\$(385,197,906)	TRUE	244%	1244118.13	-2903964.08
\$91,375,697.769	\$93,068,102.238	PLGRP	\$598,546,647	TRUE	-379%	1159840.71	1337090.03
\$ 4,844,067.854	\$ 3,959,737.054	PSEG	\$146,544,869	TRUE	-93%	-3896658.37	1422580.34
\$(3,160,935.701)	\$(3,223,009.422)	RECO	\$(19,950,965)	TRUE	13%	108503.18	-239162.90
\$(3,116,296.071)	\$(3,169,657.222)	zPJMIMP	\$(20,309,592)	TRUE	13%	187387.72	-242132.79

## TRENDING ANALYSIS

Yr3-Yr4 Slope	1	2	3	4	y = m*x + b	
	2019	2023	2026	2029	Slope	Intercept
-170853.42	9,819,323	6,778,486	7,746,421	7,233,860	-221,141	455,539,482
1399585.03	-19,704,507	-8,549,542	-15,738,424	-11,539,669	580,455	-1,188,869,543
158932.03	-12,756,628	-5,235,460	-7,867,115	-7,390,319	450,140	-919,507,990
-3644444.60	-4,053,333	-6,528,212	-10,233,788	-21,167,122	-1,625,803	3,280,535,440
375251.44	-2,616,690	-1,778,985	-2,078,112	-952,357	142,483	-290,278,343
131824.50	-3,428,641	-1,634,903	-4,318,810	-3,923,336	-112,325	224,046,707
68058.59	-1,462,715	-1,533,967	-2,933,710	-2,729,534	-155,298	312,197,096
-6735646.25	-135,156,545	-96,658,287	-112,363,226	-132,570,165	73,987	-268,955,372
488566.13	31,106,292	7,379,934	11,455,647	12,921,346	-1,664,095	3,384,259,166
11443.71	-2,955,892	-1,126,866	-2,181,511	-2,147,179	53,156	-109,703,111
110456.72	-2,931,841	-2,043,186	-2,917,596	-2,586,225	10,151	-23,168,549
533070.06	-4,283,436	-510,439	-2,987,749	-1,388,539	206,429	-420,155,755
-405081.67	6,739,129	7,677,281	15,884,006	14,668,761	958,842	-1,929,693,504
303502.40	9,047,687	22,268,518	37,940,150	38,850,657	3,207,304	-6,465,357,705
-71117.64	-1,910,480	-1,476,468	-2,193,956	-2,407,309	-62,074	123,655,677
-51635.08	-4,866,784	-1,635,909	-2,248,666	-2,403,571	223,623	-455,458,085
3137667.24	56,162,900	31,544,404	44,497,805	53,910,806	-6,178	59,034,537
1073001.16	20,990,145	1,910,315	35,802	3,254,806	-1,772,843	3,595,225,806
-2933290.47	-35,324,676	-30,348,204	-39,060,096	-47,859,967	-1,320,552	2,634,978,637
2963455.03	51,935,366	56,574,728	60,585,998	69,476,364	1,692,404	-3,366,206,632
398063.01	30,682,828	15,096,194	19,363,935	20,558,124	-884,331	1,811,531,891
-71117.64	-1,910,480	-1,476,468	-2,193,956	-2,407,309	-62,074	123,655,677
-149829.89	-2,202,366	-1,452,815	-2,179,214	-2,628,703	-53,361	105,900,537

**BEFORE THE  
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

Application of Transource Pennsylvania, LLC  
for approval of the Siting and Construction of the  
230 kV Transmission Line Associated with the  
Independence Energy Connection - East and West Projects  
in portions of York and Franklin Counties, Pennsylvania.

A-2017-2640195  
A-2017-2640200

Petition of Transource Pennsylvania, LLC  
for a finding that a building to shelter control equipment  
at the Rice Substation in Franklin County, Pennsylvania  
is reasonably necessary for the convenience or welfare of the public.

P-2018-3001878

Petition of Transource Pennsylvania, LLC  
for a finding that a building to shelter control equipment  
at the Furnace Run Substation in York County, Pennsylvania  
is reasonably necessary for the convenience or welfare of the public.

P-2018-3001883

Application of Transource Pennsylvania, LLC  
for approval to acquire a certain portion of the lands of  
various landowners in York and Franklin Counties, Pennsylvania  
for the siting and construction of the 230 kV Transmission Line  
associated with the Independence Energy Connection –  
East and West Projects as necessary or proper for the service,  
accommodation, convenience or safety of the public.

A-2018-3001881,  
*et al.*

**PPL ELECTRIC UTILITIES CORPORATION**

**SUPPLEMENTAL TESTIMONY OF**

**DOUGLAS J. GROSSMAN, P.E.**

**IN SUPPORT OF AMENDED APPLICATION**

**PPL ELECTRIC STATEMENT NO. AA-1**

Date: January 29, 2020



1   **Q.     Please state your name and business address.**

2   A.     My name is Douglas J. Grossman. My business address is Two North Ninth Street,  
3           Allentown, PA 18101.

4  
5   **Q.     By whom are you employed and in what capacity?**

6   A.     I am employed by PPL Electric Utilities Corporation (“PPL Electric”) as the  
7           Transmission Siting Supervisor. In that position, I am responsible for supervising siting  
8           projects that identify and select high voltage transmission line routes and substation  
9           locations. I am also responsible for supervising the preparation of Applications and  
10          Attachments for approval by the Pennsylvania Public Utility Commission (“PUC” or  
11          “Commission”).

12  
13   **Q.     What is your educational background?**

14   A.     I have a Bachelor of Science degree in Civil Engineering from Clarkson University.

15  
16   **Q.     Do you hold any professional licenses?**

17   A.     Yes. I have been a Licensed Professional Engineer in the Commonwealth of  
18          Pennsylvania since 2001. My License Number is PE-055803E.

19  
20   **Q.     Describe your experience and employment history with PPL Electric.**

21   A.     I have been employed by PPL Electric for approximately 10 years. I have been in my  
22          current position since January 2017. In this position I am responsible for supervising  
23          siting projects that identify and select high voltage transmission line routes and substation

1 locations. Prior to this position I held various titles including Siting and Permitting  
2 Supervisor, Senior Right of Way Specialist and Senior Siting Specialist.

3  
4 **Q. Have you participated in other transmission line siting projects for PPL Electric?**

5 A. Yes. I have worked on more than 75 projects involving transmission lines.

6  
7 **Q. What are your responsibilities in connection with the proposed project to site and**  
8 **construct transmission lines associated with the Alternative IEC East Portion of the**  
9 **IEC Project (the “Project”)?**

10 A. My responsibilities are to provide overall management direction for the siting of the  
11 Project. In this capacity, I have been the lead contact between PPL Electric and  
12 Transource Pennsylvania, LLC (“Transource PA”) in the joint siting process, supervised  
13 the acquisition of contract resources, public outreach, and support of right-of-way  
14 negotiations.

15  
16 **Q. What is the purpose of your direct testimony in this proceeding?**

17 A. My testimony addresses several subjects. First, I will provide a digest of the testimony  
18 and exhibits filed by PPL Electric in support of the Amended Application for Approval of  
19 the Siting and Construction of Transmission Lines Associated with the Alternative IEC  
20 East Portion of the IEC Project in York County, Pennsylvania. Second, I will provide a  
21 brief overview of the Project. Third, I will describe the process employed by PPL  
22 Electric in working with Transource PA in preparing and filing the Amended  
23 Application. Fourth, I will provide an overview of the siting process used for this

Project. Fifth, I will explain PPL Electric's corporate policy on measures to mitigate the impacts of transmission lines. Finally, I will describe PPL Electric's public outreach efforts for this Project.

**I. DIGEST TO THE TESTIMONY AND EXHIBITS**

**Q. Please describe the relief sought in the Joint Amended Application filed by PPL Electric and Transource PA in this proceeding.**

A. Through the Amended Application, PPL Electric and Transource PA seek approval from the PUC to site and construct transmission lines associated with the Alternative IEC East Portion. The Amended Application provides, among other things, an overview of the Project, an explanation of the need for the Project, a summary of the process of selecting the route for the transmission line associated with the Project and a description of the design of the transmission line.

**Q. Please describe the Attachments filed with the Amended Application.**

A. The Attachments to the Amended Application include the following:

- Supplemental Attachment 1: Commission Regulation Cross-Reference Matrix
- Supplemental Attachment 2: Necessity Statement
- Supplemental Attachment 3: Supplemental Siting Analysis
- Supplemental Attachment 4: Engineering Description
- Supplemental Attachment 5: List of Property Owners within the Right-of-Way
- Supplemental Attachment 6: Agency Requirements

- Supplemental Attachment 7: List of Governmental Agencies, Municipalities, and Other Public Entities Receiving the Amended Application
- Supplemental Attachment 8: List of Governmental Agencies, Municipalities, and Other Public Entities Contacted
- Supplemental Attachment 9: List of Public Locations where the Amended Application can be Viewed by the Public
- Supplemental Attachment 10: Design Criteria and Safety
- Supplemental Attachment 11: Vegetation Management
- Supplemental Attachment 12: Agency Coordination
- Supplemental Attachment 13: Public Notice Requirements

**Q. Are you responsible for the oversight and preparation of any of the attachments or exhibits filed with the Amended Application?**

A. Yes. I am responsible for coordinating with Transource PA and the preparation PPL Electric's portion of the Amended Application and supporting attachments. In addition, I am directly responsible for overseeing the preparation of the following portions of the Amended Application:

- Supplemental Attachment 1 PUC Regulation Cross-Reference Matrix
- Supplemental Attachment 7 List of Governmental Agencies, Municipalities and Other Public Entities Receiving the Amended Application
- Supplemental Attachment 8 List of Government Agencies, Municipalities and Other Public Entities Contacted
- Supplemental Attachment 9 List of Public Locations where Amended Application can be Viewed

**Q. Please describe the testimony submitted with the Amended Application.**

A. PPL Electric and Transource PA are submitting a total of eight statements, including this one, in support of the Amended Application. These Statements provide additional explanation of the matters addressed in the Amended Application and identify the witness who is sponsoring each portion of the Amended Application. PPL Electric's statements are identified below.

PPL Electric St. No. AA-1: Douglas J. Grossman, Transmission Siting Supervisor for PPL Electric – Provides an overview of the Project; describes the process employed by PPL Electric in developing, preparing and filing this Amended Application; provides an overview of the siting process used for this Project; explains the decision making process within PPL Electric for selecting the transmission line route; explains PPL Electric's corporate policy on measures to mitigate the impact of a transmission line; and describes the public outreach program employed by PPL Electric for this Project.

PPL Electric St. No. AA-2: Matt Baranoski, Support Engineer for PPL Electric – Addresses the cost of the Project and the proposed Project schedule.

PPL Electric St. No. AA-3: Kyle Swarzentruher, Senior Engineer for PPL Electric – Explains the major design features of the Project; describes the safety features incorporated into the design of the proposal; explains PPL Electric's Magnetic Field Management Program and how it has been incorporated into the design of the Project; and describes PPL Electric's existing system and how this Project will be added to existing facilities.

PPL Electric St. No. AA-4: Austin Weseloh, Transmission Right-of-Way and Real Estate Supervisor for PPL Electric – Describes PPL Electric's policies regarding dealings with owners of land over which PPL Electric needs to construct electric utility facilities; summarizes the existing right-of-way for the proposed Project; and identifies additional or expanded rights-of-way needed.

PPL Electric St. No. AA-5: Barry Baker – Mr. Baker is Associate Vice-President and Department Manager for the Natural Resources Department at AECOM and Technical Lead in the AECOM U.S. Transmission & Distribution and Impact Assessment & Permitting practices. Mr. Baker conducted the initial siting analysis for the IEC Project and will provide information regarding the siting analysis for the Alternative East Portion of the IEC Project.

1  
2 **II. SUMMARY OF THE PROJECT**

3 **Q. Please summarize the Project.**

4 A. The proposed Project involves siting and constructing transmission lines associated with  
5 the Alternative IEC East project that was agreed to in various settlement in this  
6 proceeding.

7 PPL's total estimated cost for PPL's portion of the Project is approximately  
8 \$37.84 million.<sup>1</sup> Construction is scheduled as soon as practical following Commission  
9 approval. The engineering and design of the Project are further explained in  
10 Supplemental Attachment 4 to the Amended Application and PPL Electric Statement No.  
11 AA-3.

12  
13 **Q. Please describe the major tasks PPL Electric must undertake to construct this**  
14 **Project.**

15 A. PPL Electric must: 1) obtain PUC approval, and applicable state, county, and local  
16 permits; 2) complete engineering; 3) procure materials; and 4) install erosion and  
17 sedimentation controls.

18  
19 **Q. Please summarize the principal permits and approvals required for this project.**

---

<sup>1</sup> The estimated cost for the proposed Project is an order-of-magnitude estimate developed using averages of recent costs for similar projects and without an in-depth analysis of field investigation. The estimated cost is subject to change as the constructability of the project, sequence of construction, and other factors that may affect cost are identified and analyzed as the project progresses.

1 A. Supplemental Attachment 6 lists the local, state and federal agency requirements for  
2 permits, approvals or documentation. Specific permits and approvals will be obtained  
3 once engineering is complete and appropriate permits are identified.  
4

5 **III. PREPARATION OF THE AMENDED APPLICATION**

6 **Q. Please describe the process employed by PPL Electric in preparing the Amended**  
7 **Application.**

8 A. The Amended Application, in its broadest sense, is designed to show that the Alternative  
9 IEC East Portion route, as agreed to by the Settling Parties, is in the public interest and  
10 should be approved by the PUC. The need for the Alternative IEC East Portion is  
11 explained in Supplemental Attachment 2 to the Amended Application and Transource PA  
12 Statement No. AA-1. The PPL Electric siting process and environmental assessment and  
13 mitigation are described Supplemental Attachment 3 to the Amended Application and  
14 PPL Electric Statement No. AA-5.

15 The process to prepare this Amended Application was a joint effort between PPL  
16 Electric and Transource PA. The Amended Application is consistent with requirements  
17 put forth in the Settlement Agreements between Transource PA and PPL Electric, York  
18 County Planning Commission, and Citizens to Stop Transource York County, Maple  
19 Lawn Farms, Barron Shaw and Shaw Orchards (the latter four collectively, “York County  
20 Citizens”)

21 PPL Electric has maintained close involvement in all aspects of this Project  
22 throughout the period prior to the filing of this Amended Application, and it will continue  
23 to do so through engineering, construction, and Project commissioning. Where outside

1 assistance is used, one or more PPL Electric employees are assigned for oversight and  
2 decision making purposes.

3  
4 **IV. OVERVIEW OF THE SITING PROCESS**

5 **Q. Please summarize PPL Electric's experience and expertise in planning and**  
6 **constructing high voltage transmission line projects.**

7 A. PPL Electric's experience and expertise in planning and constructing high voltage  
8 transmission line projects goes back many decades. During the 1920s, PPL Electric was  
9 one of three utilities that formed the PA-NJ interconnection by linking 230 kV  
10 transmission systems together and establishing an economic generation dispatch protocol  
11 among the companies. In the 1960s, the Company entered a joint venture with partner  
12 utilities that were members of the PJM power pool to construct mine-mouth generation  
13 units in western Pennsylvania and transmit that generation to Maryland, Delaware and  
14 eastern Pennsylvania and New Jersey through more than 600 miles of 500 kV  
15 transmission lines. In the early 1980s, PPL Electric reinforced its backbone transmission  
16 system by establishing over 100 miles of new 500 kV transmission facilities and three  
17 new 500 kV Substations and significantly upgrading three existing 500 kV Substations.  
18 Today, PPL Electric owns and maintains approximately 447 miles of 500 kV and 1292  
19 miles of 230 kV high voltage transmission line.

20 PPL Electric has extensive experience and, through the combination of internal  
21 and contract resources, the expertise to plan, design, and construct high voltage  
22 transmission line projects. The Company maintains a staff of planning and design  
23 engineers for high voltage transmission projects and, from time to time, supplements that



1 staff with contract resources. PPL Electric has in-house construction resources capable  
2 of building high voltage projects. For very large projects, such as the project proposed  
3 here, PPL Electric uses a combination of internal PPL Electric resources as well as  
4 contract resources to build facilities in an efficient and timely manner.

5  
6 **Q. What was your role on the siting team?**

7 A. My principal responsibility was to oversee the Siting Team in pursuing the Alternative  
8 IEC East project including providing oversight for the public outreach undertaken on this  
9 project and provide assistance to the Real Estate Team.

10  
11 **VI. MEASURES TO MITIGATE THE IMPACTS OF TRANSMISSION LINES**

12 **Q, Please explain how PPL Electric will oversee the siting and construction of**  
13 **transmission lines associated with the Alternative IEC East project, if approved by**  
14 **the Commission.**

15 A. We plan to assemble a team of experts in design and construction of overhead  
16 transmission lines. The Project's success will be defined in terms of compliance to  
17 schedule, economy in cost, and adherence to quality. Construction sequences will be  
18 established to assure assets can be placed in service as soon as possible. Outages will be  
19 coordinated, planned, and scheduled to maintain system integrity during the construction  
20 phase. PPL Electric understands the impact of construction activity on the local  
21 community and significant efforts will be made to keep local area residents and their  
22 representatives aware of Project activities.

1   **Q.     Please explain PPL Electric’s corporate policy on measures to mitigate the impacts**  
2       **of transmission lines.**

3   A.    PPL Electric strives to minimize the impacts of transmission lines upon property owners  
4       and the environment. Mitigation efforts actually begin in the siting stage where sensitive  
5       areas are avoided to the extent practical. When avoidance is not practical, PPL Electric  
6       will implement mitigation strategies as explained in more detail below.

7  
8   **Q.     Please describe PPL Electric’s vegetation management program.**

9   A.    PPL Electric’s vegetation management program is outlined in the “Specifications for  
10       Transmission Vegetation Management LA-79827.” A copy of this vegetation  
11       management program is provided as Supplemental Attachment 12 to the Amended  
12       Application. In summary, for the initial clearing of the expanded right-of-way, PPL  
13       Electric initially removes all vegetation except for grasses and herbaceous or non-woody  
14       plants within the right-of-way. After the initial clearing of the right-of-way, compatible  
15       species are then allowed to grow back through selective application of herbicides. PPL  
16       Electric then maintains the right-of-way by selectively removing only non-compatible  
17       species. Selective clearing allows compatible species of vegetation that would not grow  
18       tall enough to threaten the reliable operation of the transmission line to remain within the  
19       right-of-way.

20           Additionally, PPL Electric does not use any aerial herbicide application  
21       techniques. Herbicides are applied at ground level by trained professionals. Only those  
22       species that require control are treated. PPL Electric will not apply herbicides in the  
23       following areas or situations: pastures within 50 feet of any body of water, except that

1 PPL Electric will use herbicides approved for watershed/aquatic use for stump  
2 treatments; within any actively maintained orchard or cultivated planting; near  
3 susceptible crops or other non-target vegetation where drift, runoff, or vapors can cause  
4 injury; where weather conditions create excessive drift; on rights-of-way under  
5 jurisdiction of the Pennsylvania Department of Conservation and Natural Resources,  
6 Pennsylvania Game Commission, Pennsylvania Fish and Boat Commission, and the  
7 National Park Service unless prior approval is granted by the Department or Commission;  
8 on watershed properties, or in the vicinity of springs, irrigation ditches, or other potable  
9 water sources, unless prior approval is granted by the property owner for use of a  
10 watershed/aquatic approved herbicide; or in gullies or ravines where tree clearing is  
11 minimal. Finally, all herbicides used by PPL Electric have been approved by the United  
12 States Environmental Protection Agency.

13  
14 **Q. Will these same vegetation management practices be applied to the siting and**  
15 **construction of transmission lines associated with the Alternative IEC East Portion?**

16 A. Yes. The project includes a combination of existing right-of-way and right-of-way that  
17 was expanded to meet project requirements. In areas where vegetation management is  
18 required to complete the project, PPL Electric will apply its “Specifications for  
19 Transmission Vegetation Management LA-79827” to mitigate any impacts.

20  
21 **Q. What is PPL Electric’s approach to mitigation of impacts on bodies of water and**  
22 **wetlands?**

1 A Impacts from soil erosion and sedimentation and crossings of jurisdictional waters and  
2 wetlands are mitigated through the acquisition of and compliance with all required  
3 permits and plans. Initially, all wetlands and waters are identified, delineated, surveyed  
4 and added to construction plans. Structure and access road locations are located outside  
5 these sensitive areas as much as practical. In locations where avoidance is not practical,  
6 all required permits are obtained, and PPL Electric adheres to their terms and conditions  
7 during construction.

8 The placement of conditions on a permit by the U.S. Army Corps of Engineers,  
9 the Department of Environmental Protection or similar agencies is a principal tool for  
10 protecting the environment. The placement of conditions on a permit indicates that the  
11 agency has thoroughly reviewed the permit application and that, so long as conditions are  
12 followed, there will be no harm to the environment that is unlawful under the applicable  
13 statutes.

14  
15 **Q. What is PPL Electric's policy regarding electric and magnetic fields?**

16 A. PPL Electric has instituted a Magnetic Field Management Program for new and rebuilt  
17 transmission lines. The implementation of this policy with respect to the proposed siting  
18 and construction of transmission lines associated with the Alternative IEC East Portion is  
19 discussed in PPL Electric Statement No. AA-3.

20  
21 **Q. Does PPL Electric consider impacts on individual property owners?**

22 A. Yes. PPL Electric works with property owners to locate the line to minimize the impact  
23 on their existing and future land use plans wherever practical. For the portion of the

1 project that utilized expanded right-of-way, PPL Electric shifted the proposed centerline,  
2 where practical, to increase the distance from the centerline and edge of right-of-way to  
3 residential structures.

4  
5 **Q. Does this conclude your testimony at this time?**

6 A. Yes, it does. I reserve the right to supplement my testimony as additional issues arise  
7 during the course of this proceeding.

**BEFORE THE  
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

Application of Transource Pennsylvania, LLC  
for approval of the Siting and Construction of the  
230 kV Transmission Line Associated with the  
Independence Energy Connection - East and West Projects  
in portions of York and Franklin Counties, Pennsylvania.

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Petition of Transource Pennsylvania, LLC  
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various landowners in York and Franklin Counties, Pennsylvania  
for the siting and construction of the 230 kV Transmission Line  
associated with the Independence Energy Connection –  
East and West Projects as necessary or proper for the service,  
accommodation, convenience or safety of the public.

A-2018-3001881,  
*et al.*

**PPL ELECTRIC UTILITIES CORPORATION**

**SUPPLEMENTAL TESTIMONY OF**

**MATTHEW BARANOSKI**

**IN SUPPORT OF AMENDED APPLICATION**

**PPL ELECTRIC STATEMENT NO. AA-2**

Date: January 29, 2020

1   **Q.     Please state your name and business address.**

2   A.     My name is Matthew Baranoski. My business address is Two North Ninth Street,  
3           Allentown, PA 18101.

4  
5   **Q.     By whom are you employed and in what capacity?**

6   A.     I am employed by PPL Electric Utilities Corporation (“PPL Electric”) as a Support  
7           Engineer. In that position, I am responsible for general oversight and project  
8           management during the project development phase. The project development phase is  
9           responsible for completing sufficient preliminary engineering and planning activities to  
10          finalize technical scope to reduce risk on transmission projects.

11  
12   **Q.     What is your educational background?**

13   A.     I have a Bachelor of Science degree in Electrical Engineering from The Pennsylvania  
14          State University and a Master of Business Administration from Temple University.

15  
16   **Q.     Do you hold any professional licenses?**

17   A.     I hold an Engineer in Training (EIT) certification in the state of Pennsylvania which was  
18          obtained in 2017.

19  
20   **Q.     Describe your experience and employment history with PPL Electric.**

21   A.     I have been employed by PPL Electric for approximately 3 years. I have been in my  
22          current position since May of 2019. In this position I am responsible for general

oversight and project management for the preliminary engineering and planning activities on transmission projects.

**Q. Have you participated in other transmission line siting projects for PPL Electric?**

A. Yes. I have worked on more than 5 projects involving transmission lines of which involved siting activities.

**Q. What are your responsibilities in connection with the proposed siting and construction of transmission lines associated with the Alternative IEC East Portion of the IEC Project (the "Project")?**

A. My responsibilities are to oversee the preliminary engineering and project planning activities for the siting and construction of transmission lines associated with the Alternative IEC East Portion.

**Q. What is the purpose of your direct testimony in this proceeding?**

A. My testimony addresses cost of the proposed Project.

**Q. Are you responsible for the oversight and preparation of any of the attachments or exhibits filed with the Amended Application?**

A. I am not responsible for any of the attachments or exhibits filed with the Amended Application.

**I. SUMMARY OF THE PROJECT**

**Q. Please summarize the Project.**



1 A. The proposed Project involves the siting and construction of transmission lines associated  
2 with the Alternative IEC East Portion.

3 The total estimated cost to PPL Electric of this Project is approximately \$37.84  
4 million.<sup>1</sup>

5  
6 **Q. Please give a breakdown of the total estimated cost to PPL Electric of the proposed**  
7 **plan to site and construct transmission lines associated with the Alternative IEC**  
8 **East Portion.**

9 A.

Project Section	Description	Total Estimated Costs
Furnace Run - Conastone	Add 2nd Circuit	\$ 6,927,989
Furnace Run - Conastone	New D/C	\$ 5,683,243
Furnace Run - Otter Creek	New S/C	\$ 4,132,557
Furnace Run - Manor	New S/C	\$ 5,653,949
Furnace Run - Graceton 1 & 2	New D/C	\$ 7,836,770
Furnace Run - Graceton 1 & 2	Add 2nd Circuit	\$ 6,191,176
Row Acquisition	Expand ROW	\$ 1,410,360
<b>Total</b>		<b>\$ 37,836,044</b>

10  
11 **Q. Does this conclude your testimony at this time?**

12 A. Yes, it does. I reserve the right to supplement my testimony as additional issues arise  
13 during the course of this proceeding.

---

<sup>1</sup> The estimated cost for the proposed Project is an order-of-magnitude estimate developed using averages of recent costs for similar projects and without an in-depth analysis of field investigation. The estimated cost is subject to change as the constructability of the project, sequence of construction, and other factors that may affect cost are identified and analyzed as the project progresses.

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East and West Projects as necessary or proper for the service,  
accommodation, convenience or safety of the public.

A-2018-3001881,  
*et al.*

**PPL ELECTRIC UTILITIES CORPORATION**

**SUPPLEMENTAL TESTIMONY OF**

**KYLE SWARTZENTRUBER**

**IN SUPPORT OF AMENDED APPLICATION**

**PPL ELECTRIC STATEMENT NO. AA-3**

Date: January 29, 2020

1   **Q.     Please state your name and business address.**

2   A.     My name is Kyle Swartzentruber, and my business address is Two North Ninth Street,  
3           Allentown, Pennsylvania 18101.

4  
5   **Q.     By whom are you employed and in what capacity?**

6   A.     I am employed by PPL Electric Utilities Corporation (“PPL Electric”) as a Senior  
7           Engineer. In this position, I engineer and oversee the construction of high voltage  
8           electrical lines ranging from 69kV-500kV. Our group is also responsible for any item of  
9           concern on the Transmission system ranging from significant operating events to  
10          property owner and customer requests. I have been employed by PPL Electric since May  
11          of 2011.

12  
13   **Q.     Please provide a summary of your education and professional work experience.**

14   A.     I attended The Pennsylvania State University where I received a BS in Mechanical  
15           Engineering Technology graduating in May of 2008. After graduating college, I began  
16           work as a Reliability Test Engineer for Mack Trucks Inc. from 2008-2010 when the  
17           facility was closed.

18           From the spring of 2010 to the fall of 2010, I worked as a design engineer and drafter for  
19           East Penn Manufacturing performing machine design and drafting to facilitate  
20           manufacturing of large stationary batteries.

21           From the Fall of 2010 to the spring of 2011, I worked for Ingersoll Rand designing Air  
22           Drying system for industrial manufacturing applications. I have been employed by PPL  
23           Electric since May of 2011.

1   **Q.    What are your responsibilities in connection with the proposal to site and construct**  
2       **transmission lines associated with the Alternative IEC East Portion of the IEC**  
3       **Project?**

4    A.    In my role as a Senior Engineer, I am responsible for the transmission design and  
5       engineering portion of the proposal to site and construct transmission lines associated  
6       with the Alternative IEC East Portion of the IEC Project (the “Project”).  
7

8   **Q.    What is the purpose of your direct testimony in this proceeding?**

9    A.    My testimony addresses several issues. First, I will explain the major design features of  
10       the proposal to site and construct transmission lines associated with the Alternative IEC  
11       East Portion. Second, I will explain the safety features incorporated into the design of the  
12       proposal to site and construct transmission lines associated with the Alternative IEC East  
13       project. Third, I will explain PPL Electric’s Magnetic Field Management Program and  
14       how it has been incorporated into the design of the proposal to site and construct  
15       transmission lines associated with the Alternative IEC East Portion. Finally, I will  
16       explain PPL Electric’s existing system and how this project will be added to existing  
17       facilities.  
18

19   **Q.    Please describe the portions of the Amended Application that you are sponsoring.**

20   A.    I am sponsoring Supplemental Attachment 4, the Engineering Description, and  
21       Supplemental Attachment 10, PPL Electric’s Design and Safety Practices, which includes  
22       the Company’s Magnetic Field Management Program.  
23

1   **Q.    Please provide an overview of the proposed project to site and construct**  
2   **transmission lines associated with the Alternative IEC East Portion.**

3   A.    The proposed Project involves rerouting the existing Manor-Graceton 230 kV line from  
4   both Manor and Graceton to terminate in Transource PA's Furnace Run Substation,  
5   creating a Furnace Run-Manor 230 kV line and a Furnace Run – Graceton #1 230kV line.  
6   In addition, PPL Electric will construct a new Furnace Run - Graceton #2 230kV circuit  
7   in Pennsylvania by: (1) constructing a new 230kV line from Transource PA's Furnace  
8   Run station to the intersection of the current PPL Electric Manor-Graceton 230kV line;  
9   (2) adding a new line, consisting of new arms, conductors and necessary hardware, to the  
10   open positons on the existing towers on the current Manor –Graceton 230kV line from  
11   the Manor – Graceton 230kV intersection point south to the state line; and (3) using  
12   conductors for the new Furnace Run-Manor, Furnace Run - Graceton #1 and Furnace  
13   Run – Graceton #2 230kV lines that are similar to those used by PPL Electric when it  
14   rebuilt the Conastone-Otter Creek and Graceton Manor 230 kV lines. PPL Electric will  
15   reroute the Conastone-Otter Creek 230 kV line from both Otter Creek and Conastone to  
16   terminate in Transource PA's Furnace Run Substation, creating a Furnace Run-Otter  
17   Creek 230 kV line and a Furnace – Run Conastone #1 230kV circuit. Lastly, PPL  
18   Electric will construct a new Furnace Run-Conastone #2 230 kV line in Pennsylvania by:  
19   (1) constructing a new 230kV line from Transource PA's Furnace Run station to the  
20   intersection of the current Otter Creek - Conastone 230kV line; (2) adding a new line,  
21   consisting of new arms, conductors and necessary hardware, to the open positons on the  
22   existing towers on the current Otter Creek – Conastone 230kV line from the Otter Creek  
23   – Conastone 230kV intersection point south to the Conastone Substation; and (3) using

conductors for the new Furnace Run – Otter creek, Furnace Run-Conastone #1 and Furnace Run – Conastone #2 230kV lines that are similar to those used by PPL Electric when it rebuilt the Conastone-Otter Creek and Graceton-Manor 230 kV lines. Transource PA will modify the initial Furnace Run station configuration to accommodate the addition of a third 500/230kV transformer and terminate the six 230kV lines in the station.

**Q. Please describe the engineering configuration of the existing facilities.**

A. The existing PPL facilities, the Manor-Graceton line and the Otter Creek-Conastone line, are both single circuit 230kV steel monopole lines that were designed and constructed for future double circuit.

**Q. Please describe the process used to determine whether PPL Electric's existing facilities could accommodate the Alternative IEC East Portion.**

A. Engineering evaluated the capacity of the existing structures and determined that an additional circuit can be added as the structures were designed with the capacity of a future second circuit.

**Q. Please describe the design voltage for the existing lines.**

A. The existing lines being re-routed into the Furnace Run Substation are presently operated and designed for 230kV.

1 **Q. Please describe the conductors to be used for the Furnace Run-Graceton #1,**  
2 **Furnace Run-Graceton #2, Otter Creek,-Furnace Run Furnace Run-Conastone #1,**  
3 **and Furnace Run-Conastone #2 230 kV lines?**

4 A. Based on preliminary engineering the conductors will be Lapwing 1590 ASCR 45/7  
5 stranding, or they will provide a minimum ampacity of the above-mentioned conductor.  
6

7 **Q. Will the proposed rerouting of the Manor-Graceton 230 kV line and proposed**  
8 **rerouting of the Conastone-Otter Creek 230 kV line include overhead ground**  
9 **wires?**

10 A. Yes. The proposed Project will include the installation of 0.752 diameter OPGW acting  
11 as overhead shield wire.  
12

13 **Q. Please describe the principal types of structures that will be used for the proposed**  
14 **siting and construction of transmission lines associated with the Alternative IEC**  
15 **East Portion.**

16 A. Diagrams of structures similar to the ones that will be installed for this proposed Project  
17 are included in Supplemental Attachment 4 to the Amended Application.  
18

19 **Q. For the portion of the Project that will require new structures, will the new**  
20 **structures be placed in a pole-for-pole configuration with the existing structures?**

21 A. No. There are existing 69kV structures however the new circuits to the Furnace Run  
22 Substation will not follow a pole for pole configuration. The new facilities to Furnace  
23 Run will be a single and a double circuit 230kV line. The existing 69kV line are a double

1 circuit line. However, the new structures will generally follow the existing transmission  
2 line corridor.

3  
4 **Q. Please explain the safety features incorporated into the design of the proposed siting**  
5 **and construction of transmission lines associated with the Alternative IEC East**  
6 **Portion.**

7 A. The proposed Project will be designed and built to meet or exceed all applicable National  
8 Electrical Safety Code (“NESC”) minimum standards. The NESC is a set of guidelines  
9 to safeguard people during the installation, operation, and maintenance of electric power  
10 lines. The NESC contains the basic provisions considered necessary for the safety of  
11 employees and the public.

12 In addition to the safety features incorporated by designing the line in accordance  
13 with the NESC; PPL Electric has additional more stringent design standards. PPL  
14 Electric’s design loading conditions for structures, wires, and clearances exceed NESC  
15 standards. Relay protection systems are also employed to automatically de-energize the  
16 line in the unlikely event of a failure on the line in which the line contacts the ground or a  
17 grounded object. The line is also designed for conductor-to-conductor clearances and  
18 conductor-to-ground clearances which support live-line maintenance and inspections.  
19 Work procedures and tooling have been developed to allow work to be performed in a  
20 safe manner on energized facilities. Personnel are furnished with appropriate Personal  
21 Protective Equipment for the performance of construction or maintenance activities in a  
22 safe manner.



1   **Q.     Please explain PPL Electric’s Magnetic Field Management Program and how it will**  
2       **be incorporated into the design of the proposed siting and construction of**  
3       **transmission lines associated with the Alternative IEC East project.**

4   A.    Before describing PPL Electric’s Magnetic Field Management Program, I note that, in  
5       conjunction with seeking Commission approval for the siting and construction of the  
6       Susquehanna-Roseland 500 kV Transmission Line, Docket Number A-2009-2082652,  
7       PPL Electric presented extensive independent expert testimony on Electric and Magnetic  
8       Field (“EMF”) issues. Based on this extensive evidence, the Commission adopted the  
9       Administrative Law Judge’s finding that there is no reliable scientific basis to conclude  
10      that exposure to EMFs from electric power lines causes or contributes to adverse health  
11      effects in people. *See Application of PPL Electric Utilities Corporation Filed Pursuant*  
12      *to 52 Pa. Code Chapter 57, Subchapter G, for Approval of the Siting and Construction of*  
13      *the Pennsylvania Portion of The Proposed Susquehanna-Roseland 500-kV Transmission*  
14      *Line in Portions of Lackawanna, Luzerne, Monroe, Pike and Wayne Counties,*  
15      *Pennsylvania*, Docket Number A-2009-2082652, 2010 Pa. PUC LEXIS 434 at \*167-80  
16      (February 12, 2010), *affirmed sub nom., Environmental Conservation Council v. Public*  
17      *Utility Commission*, 25 A.3d 440 (Pa. Cmwlth. 2011).

18           Notwithstanding the foregoing, PPL Electric has adopted a program to mitigate  
19      the potential impacts from EMFs. PPL Electric’s Magnetic Field Management Program  
20      was first developed in the early 1990s to implement a policy decision to design new and  
21      rebuilt transmission lines to reduce magnetic fields when that can be done at no or low  
22      additional cost and is consistent with meeting the functional requirements of the line. A

1 copy of the current PPL Electric's Magnetic Field Management Program is found as  
2 Attachment 10 to the Siting Application.

3 PPL Electric's Magnetic Field Management Program is applied to new and  
4 reconstructed transmission line projects. In order to lower magnetic field exposures, the  
5 program generally prescribes the use of a line design that provides ground clearances of  
6 five feet higher than the required minimum NESC ground clearance and reverses phasing  
7 of new double circuit lines where it is feasible to do so at low or no cost. The  
8 implementation of additional modifications will be considered, provided those  
9 modifications can be made at low or no cost and will not interfere with the operation of  
10 the line.

11 Consistent with its Magnetic Field Management Program, PPL Electric will  
12 design the new transmission lines for ground clearances that are a minimum of 25.5 feet.  
13

14 **Q. Does this complete your direct testimony?**

15 A. Yes, it does. I reserve the right to supplement my testimony as additional issues arise  
16 during the course of this proceeding.

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East and West Projects as necessary or proper for the service,  
accommodation, convenience or safety of the public.

A-2018-3001881,  
*et al.*

**PPL ELECTRIC UTILITIES CORPORATION**

**SUPPLEMENTAL TESTIMONY OF**

**AUSTIN K. WESELOH**

**IN SUPPORT OF AMENDED APPLICATION**

**PPL ELECTRIC STATEMENT NO. AA-4**

Date: January 29, 2020

1   **I. INTRODUCTION**

2   **Q. Please state your name and business address.**

3   A. My name is Austin K. Weseloh. My business address is Two North Ninth Street,  
4       Allentown, PA 18101.

5  
6   **Q. By whom are you employed and in what capacity?**

7   A. I am employed by PPL Electric Utilities Corporation ("PPL Electric") as the  
8       Transmission Right of Way and Real Estate Supervisor. In this position, my primary  
9       responsibility is to supervise all Transmission Right of Way and Real Estate assets for  
10      PPL Electric.

11  
12   **Q. What is your educational background?**

13   A. I attended 3 years at University of Pittsburgh majoring in Economics, and I am working  
14      to complete the remaining required classes to attain my Bachelors of Art.

15  
16   **Q. Are you a member of any professional organizations?**

17   A. Yes. I am currently a member of the International Right of Way Association ("IRWA")  
18      where I am taking classes to attain the Senior Right of Way Agent ("SRWA")  
19      certification. This is the highest designation of Senior Right of Way Professional  
20      ("SR/WA"). The certification requires course work consisting of both core courses and  
21      elective courses. The certification requires satisfactory completion of the certification  
22      test administered by the IRWA.

23  
24   **Q. Please summarize your employment history.**

1 A. I have been employed by PPL Electric in my current position as Transmission Right of  
2 Way and Real Estate Supervisor for approximately 2 years. Prior to that, I was a Senior  
3 Right of Way Specialist at PPL Electric for three and a half years.

4 • From 2012 through 2013, I worked as a Right-of-Way Agent for Doyle Land  
5 Services negotiating the acquisition of right-of-way grants, access roads, property  
6 damages and real estate contracts to add a 60 mile pipe adjacent to an existing  
7 right-of-way in Pennsylvania.

8 • From 2011 through 2012, I worked as a Right-of-Way Agent for Meridian Land  
9 Group negotiating the acquisition of right-of-way grants, access roads and  
10 property damages for 75 miles of new pipeline right-of-way to connect 69 new  
11 natural gas wells in North East Pennsylvania.

12 • From 2010 through 2011, I worked as a Right-of-Way Agent for Miller Land  
13 Professionals reviewing title for potential natural gas leases and rights-of-way in  
14 Bradford and Susquehanna Counties, Pennsylvania.

15 • From 2004 through 2010, I worked for LTS Builders and Realty Company  
16 purchasing land for new home construction. My duties included negotiating for  
17 individual lots as well as large tracts to be subdivided into developments.

18  
19 **Q. What are your responsibilities in connection with the proposed project to site and**  
20 **construct the transmission lines associated with the Alternative IEC East Portion of**  
21 **the IEC Project (the “Project”)?**

22 A. My colleagues and I are responsible to work with the affected landowners and negotiate  
23 to obtain the easements which PPL Electric is seeking to acquire to build the Alternative

1 IEC East project. The project team reviews and identifies any areas where PPL Electric  
2 will require new or widened rights-of-way for the Project.

3 In the areas where PPL Electric needs to acquire additional or expanded  
4 transmission line rights-of-way, we attempt to negotiate with the landowners to acquire  
5 the needed land rights through voluntary transactions. We also deliver to all property  
6 owners affected by the Project, literature including, but not limited to, an electromagnetic  
7 field ("EMF") brochure, compatible right-of-way uses, existing right-of-way  
8 documentation, pictures of typical transmission line structures, and other information to  
9 help them fully understand the project.

10  
11 **Q. Do you meet with property owners?**

12 A. Yes. The Right-of-Way Agents meet with property owners to answer questions, address  
13 concerns, and/or resolve issues. The Right-of-Way Agent provides the property owners  
14 with information on how they can contact PPL Electric at any time, answer questions or  
15 address any issues or concerns. The Right-of-Way Agent is a direct link for the property  
16 owner to communicate with PPL Electric.

17  
18 **Q. What is the purpose of your direct testimony in this proceeding?**

19 A. First, I will identify the portions of the Amended Application that I am sponsoring.  
20 Second, I will describe PPL Electric's policies regarding dealings with owners of land  
21 over which PPL Electric needs to construct electric utility facilities. Third, I will  
22 summarize the existing right-of-way for the proposal to site and construct the

transmission lines associated with the Alternative IEC East Portion and identify the additional or expanded rights-of-way needed for the Project.

**Q. Please describe the portions of the Amended Application that you are sponsoring.**

A. I am responsible for Supplemental Attachment 5, which provides a list of property owners that will be traversed by the proposed Project. I also am responsible for Supplemental Attachment 13, which provides the packets of information that PPL Electric delivered to property owners that are or will be along the right-of-way and easement for the siting and construction of the transmission lines associated with the Alternative IEC East Portion.

## **II. PPL ELECTRIC POLICIES REGARDING OWNERS OF LAND**

**Q. Please explain PPL Electric's policy regarding dealings with owners of land over which PPL Electric needs to construct electric utility facilities.**

A. PPL Electric has adopted Internal Practices for Dealing with the Public on Power Line Projects, which is included in Supplemental Attachment 13 to the Amended Application. PPL Corporation has a long-standing commitment to conducting business in an honest and ethical manner. Consistent with the expectations laid out in the PPL Standards of Conduct PPL Electric's employees, contractors and agents who interact with members of the public in activities such as negotiating real estate transactions, access roads, crop damages among other things, to act with honesty and integrity while treating people courteously and in a professional manner at all times.

1    **Q.     Did PPL Electric provide information to property owners that PPL Electric needed**  
2       **acquire additional rights-of-way?**

3    A.    Yes. During the initial contact with landowners regarding transmission line projects, PPL  
4       Electric provides packets of information to fully notify landowners that PPL Electric  
5       plans to negotiate to acquire rights-of-way and easements across their land. This packet  
6       of information discloses information to the owner concerning the name of the proposed  
7       project and the voltage at which the line will operate and informs them of their legal  
8       rights and PPL Electric's legal rights with regard to the project.

9               This information includes the two notices which are required by the Pennsylvania  
10       Public Utility Commission ("Commission") in its regulations at 52 Pa. Code § 57.91.  
11       The first notice references PPL Electric's power of eminent domain, that is, the power to  
12       condemn land rights to construct facilities necessary for providing electric utility services  
13       to the public. The second notice provides information related to the right-of-way  
14       maintenance practices for the subject transmission lines. We also provide information  
15       that pertains to electric and magnetic fields, a glossary of commonly used real estate  
16       terms and a listing of the trees and shrubs that are considered a permitted use within the  
17       easement area by PPL Electric.

18              The information and notices provided for the siting and construction of the  
19       transmission lines associated with the Alternative IEC East project are included in  
20       Supplemental Attachment 13 to the Amended Application.



1   **Q.    What does PPL Electric do after providing the information and notices to**  
2       **landowners?**

3    A.    Pursuant to 52 Pa. Code § 57.91(a), PPL Electric waits at least fifteen days after the  
4       landowner receives the notices provided in Supplemental Attachment 13 to the Amended  
5       Application before discussing compensation for the rights-of-way. We then contact the  
6       property owner(s) via telephone or in person to schedule a convenient time to meet so  
7       that we may explain the details of the Project and answer any questions the property  
8       owner(s) may have. For any new, additional, or expanded rights-of-way or easements we  
9       usually make a monetary offer to the property owner(s) at the meeting. The amount of  
10      the offer is based on the fair market value of the interests in the real estate which PPL  
11      Electric wishes to acquire.

12  
13   **Q.    When negotiating with landowners, how do you determine the value of the land**  
14       **rights which PPL Electric proposes to acquire?**

15    A.    When determining fair compensation to the property owner for the rights which PPL  
16       Electric proposes to acquire, we follow a process. First, PPL Electric hires an outside  
17       appraiser to conduct a market study of recent, nearby comparable land sales and current  
18       listings. This information is used as a basis for determining the value of land on a per  
19       acre basis in the transmission line project area. These comparable values are reviewed  
20       and analyzed with special attention given to the acreage amounts, type of land, zoning  
21       classification, and other price determining factors such as topography, views, on-site  
22       utilities, etc. The current use and potential future use of the parcel along with the location

of the proposed easement area on the property are also important factors in determining the amount of monetary compensation for the right-of-way.

### **III. DESCRIPTION OF RIGHT-OF-WAY**

#### **Q. Please describe the right-of-way for the existing facilities.**

A. The existing right-of-way for the project extends approximately 4 miles between the Manor -Graceton and the Otter Creek – Conastone 230 kV transmission lines. The existing right-of-way traverses York County through the municipalities listed in Supplemental Attachment 8. The existing right-of-way varies in width from undefined centerline rights to a 300 foot corridor owned by PPL Electric in fee simple. In some areas, PPL Electric also has tree clearing/tree trimming rights in place to prevent encroachments and minimize the potential impacts of danger trees.

#### **Q. Will the proposed project to site and construct the transmission lines associated with the Alternative IEC East Portion require expansion of the existing right-of-way?**

A. Not with respect to the Manor – Graceton and Otter Creek – Conastone lines to install the second circuit. However, PPL Electric was required to acquire additional easement rights to define the Furnace Run 230 kV right-of-way to 225 feet in width. I note that no condemnation applications are necessary for the Alternative IEC East Portion because PPL Electric was able to acquire all necessary rights from landowners for the Furnace Run segments of the Alternative IEC East Portion prior to the submission of the Amended Application.

1    **Q.     Does PPL Electric have sufficient rights to site and construct the transmission lines**  
2       **associated with the Alternative IEC East Portion?**

3    A.     Yes, PPL Electric has all the required right of way on both the Manor – Graceton and  
4       Otter Creek – Conastone lines to install the second circuit and has purchased the  
5       necessary easements for the Furnace Run line.

6  
7  
8    **Q.     Please explain PPL Electric’s policy regarding the land owner’s use of the right-of-**  
9       **way area.**

10   A.     PPL Electric has established encroachment guidelines that define permitted and non-  
11       permitted uses within its existing transmission line rights-of-way. In the most general  
12       terms, no building, structure, or explosive material may occupy PPL Electric’s rights-of-  
13       way. There are, however, numerous compatible uses of these rights-of-way that do not  
14       interfere with the safe and reliable operation and maintenance of our facilities. Uses such  
15       as farming and gardening, or other passive uses, require no review or approvals by PPL  
16       Electric. Development of properties which includes extensive grading and installation of  
17       parking, utilities, roadways and other infrastructure, requires review and approval by PPL  
18       Electric. These development changes are usually compatible, provided the design and  
19       work performed in the area does not interfere with the safe and reliable operation and  
20       maintenance of our facilities.

21  
22   **Q.     Does this complete your direct testimony?**

1     A.     Yes, it does. I reserve the right to supplement my testimony as additional issues arise  
2           during the course of this proceeding.

**BEFORE THE  
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

Application of Transource Pennsylvania, LLC  
for approval of the Siting and Construction of the  
230 kV Transmission Line Associated with the  
Independence Energy Connection - East and West Projects  
in portions of York and Franklin Counties, Pennsylvania.

A-2017-2640195  
A-2017-2640200

Petition of Transource Pennsylvania, LLC  
for a finding that a building to shelter control equipment  
at the Rice Substation in Franklin County, Pennsylvania  
is reasonably necessary for the convenience or welfare of the public.

P-2018-3001878

Petition of Transource Pennsylvania, LLC  
for a finding that a building to shelter control equipment  
at the Furnace Run Substation in York County, Pennsylvania  
is reasonably necessary for the convenience or welfare of the public.

P-2018-3001883

Application of Transource Pennsylvania, LLC  
for approval to acquire a certain portion of the lands of  
various landowners in York and Franklin Counties, Pennsylvania  
for the siting and construction of the 230 kV Transmission Line  
associated with the Independence Energy Connection –  
East and West Projects as necessary or proper for the service,  
accommodation, convenience or safety of the public.

A-2018-3001881,  
*et al.*

**PPL ELECTRIC UTILITIES CORPORATION  
SUPPLEMENTAL TESTIMONY OF  
BARRY A. BAKER  
IN SUPPORT OF AMENDED APPLICATION  
PPL ELECTRIC STATEMENT NO. AA-5**

Date: January 29, 2020

1   **I.   INTRODUCTION**

2   **Q.   Please state your name and business address.**

3   A.   My name is Barry Alan Baker. My business address is 625 West Ridge Pike, Suite E-  
4       100, Conshohocken, PA 19428

5  
6   **Q.   By whom are you employed and in what capacity?**

7   A.   I am employed by AECOM Corporation as a Vice-President and Department Manager  
8       for the Pennsylvania Impact Assessment & Permitting (IAP) Department and also serve  
9       as the AECOM co-Regional Practice lead in the Northeast U.S.

10  
11   **Q.   What are your principal responsibilities in these positions?**

12   A.   In these roles I am a Certified Project Manager and manage projects for siting and  
13       permitting of new transmission lines, power plants, and other facilities. I manage  
14       Departments of approximately two hundred (200) individuals responsible for  
15       environmental, cultural resources, and information technology services. Additionally, I  
16       serve as a technical lead for transmission and distribution services on the east coast of the  
17       U.S.

18  
19   **Q.   Please provide a summary of your education and professional work experience.**

20   A.   I received a Bachelor of Science with Honors degree in Environmental Science from the  
21       University of East Anglia in Norwich, England in 1996. A key focus was on the use of  
22       GIS and computer applications for environmental problem solving. My additional  
23       continuing education relevant to my current position includes the following courses and  
24       programs:

- Approximately 50 Project Management Classes necessary for formal certification.
- Creating and Integrating Data for Natural Resource Applications (ESRI).
- Geoprocessing with ArcGIS Desktop (ESRI).
- Spatial Hydrology Using ArcView (ESRI).
- Introduction to ArcIMS (ESRI).
- System Architecture Design for GIS (ESRI).

I have been employed by AECOM for the last fourteen years in the roles previously discussed. In these positions I have been responsible for siting studies both as a Project Manager and as a technical lead for transmission line siting as well as new power development throughout the Northeast and mid-Atlantic regions of the U.S., including: PA, NJ, MD, NY, CT, OH, IL, VA, DE, and MA. I also manage the Pennsylvania Impact Assessment & Permitting Department where I am responsible for a team of biologists, ecologists, and GIS specialists. Prior to joining AECOM, I held GIS and environmental development positions for other environmental and government consultants.

**Q. Have you previously testified in public utility commission proceedings?**

A. Yes, I have provided siting testimony before the Pennsylvania Public Utility Commission (Commission or PAPUC) for PPL Electric Utilities Corporation (PPL Electric) and FirstEnergy Service Company, as well as for Transource PA, LLC (Transource PA) specifically for the portions of the Independence Energy Connection Project (IEC Project) located in Pennsylvania. I also testified before the Maryland Public Service

Commission (MDPSC) for Transource MD, LLC specifically for the portions of the IEC Project in Maryland. Additionally, I have provided siting testimony before the New Jersey Board of Public Utilities.

**Q. What is the purpose of your direct testimony in this proceeding?**

A. My testimony provides a summary of the Supplemental Siting Study and explains the selection of the Alternative IEC East Portion as the Proposed Route for the IEC East Project, which is described below.

**Q. Were any portions of the siting application prepared by you or under your supervision?**

A. Yes. I am sponsoring certain attachments to the Amended Application. Specifically, I am responsible for portions of the following attachments to the Siting Application:

- Supplemental Attachment 1 PAPUC Cross-Reference
- Supplemental Attachment 3 Supplemental Siting Study
- Supplemental Attachment 5 Landowner Addresses
- Supplemental Attachment 6 Permit Matrix
- Supplemental Attachment 7 Entities Receiving Application
- Supplemental Attachment 8 Government Agencies Contacted
- Supplemental Attachment 9 Public Locations
- Supplemental Attachment 12 Agency Coordination

I was integrally involved in preparing these attachments to the Siting Application and provided oversight to AECOM technical staff that also were involved with their



1 preparation. I also provided review for the complete Siting Application prior to assembly  
2 and submission to the Commission.

3  
4 **Q. What are your responsibilities in connection with the Supplemental Siting Study?**

5 A. PPL Electric retained AECOM to prepare a Supplemental Siting Study that  
6 comparatively evaluated the original Transource PA IEC East Proposed Route with the  
7 Alternative IEC East Route. I led the team that conducted the Supplemental Siting Study  
8 for this Project and was integrally involved in preparing various attachments to the  
9 Application, most notably Attachment 3 – Supplemental Siting Study. In this capacity, I  
10 reviewed and provided oversight on all items prepared, coordinated and managed all  
11 team members, technical experts and writers, and helped assemble the document  
12 submitted to the Commission.

13  
14 **Q. Please describe the purpose of the Supplemental Siting Study.**

15 A. The purpose of the Supplemental Siting Study is to compare the original IEC East  
16 Proposed Route with the Alternative IEC East Route. The comparison allows for the  
17 assessment of potential impacts to the human/built environment, natural environment,  
18 and engineering variables associated with constructing the two Alternative Routes.  
19 Following this comparison and evaluation, a Proposed Route can be identified for  
20 construction that meets the need for the IEC East Project while minimizing potential  
21 impacts to the surrounding environments. A complete copy of the Supplemental Siting  
22 Study, along with supporting materials and maps, is provided as Attachment 3 to the  
23 Siting Application.

1  
2 **Q. Was the same methodology and analysis used for the Supplemental Siting Study as**  
3 **that described in the original Transource IEC East Project application and siting**  
4 **study?**

5 A. Yes.

6  
7 **Q. Was public outreach conducted during this process?**

8 A. Yes. PPL Electric and Transource PA held a public open house meeting on January 14,  
9 2020 in the project area. The meeting was held to inform the general public and relevant  
10 landowners of the current project status; address any questions and concerns the public  
11 may have; and discuss the timing and construction activities to be conducted for the  
12 development of the Alternative IEC East Route, with specific focus on the Furnace Run  
13 230 kV Transmission Line section. Landowners within 500 feet of the Alternative IEC  
14 East Route alignment were mailed invitation letters to the open house and advertisements  
15 for the event were also placed in local newspapers.

16  
17 **II. PROPOSED ROUTE**

18 **Q. How does the Alternative IEC East Portion compare to the originally proposed**  
19 **route for the IEC East Project?**

20 A. The Alternative IEC East Portion will utilize existing infrastructure and/or rights-of-way,  
21 affect fewer new landowners and parcels, and impact fewer natural resources than the  
22 route originally proposed for the IEC East Project.

23 The entire alignment for the Alternative IEC East Portion consists of parcels that  
24 currently have ROW agreements in place or are owned in fee by PPL Electric, and it uses

1 existing infrastructure for majority of the length of the line. Furthermore, the addition of  
2 a second circuit onto the existing PPL Electric transmission lines that compose the  
3 majority of the Alternative IEC East Portion have been previously approved by the  
4 PAPUC.

5 The 4-mile Furnace Run 230 kV Transmission Line corridor portion of the  
6 Alternative IEC East Portion is the only section that will require widening of existing  
7 ROWs. Some of the parcels crossed are owned in fee by PPL Electric that will not  
8 require any ROW widening. The Furnace Run 230 kV Transmission Line section  
9 contains fewer landowners and parcel crossings relative to the original IEC East Proposed  
10 Route. Effectively, the Alternative IEC East Portion will minimize requirements for new  
11 ROW acquisition and potential impacts to new property owners.

12 Environmentally, only four streams are present along the Furnace Run 230 kV  
13 Transmission Line corridor that will require clearing of the riparian areas compared to the  
14 eleven streams located along the original IEC East Proposed Route. In terms of wetlands,  
15 the Furnace Run 230 kV Transmission Line corridor would potentially cross 0.7 acre of  
16 forested wetland that would require clearing, which is similar to the forested wetland area  
17 (0.7 acre) that would be crossed by the IEC East Proposed Route. Forest clearing for the  
18 Alternative IEC East Portion will only occur along the Furnace Run 230 kV  
19 Transmission Line corridor portion. This option will involve less tree clearing (19.3  
20 acres) relative to the IEC East Proposed Route (51.7 acres), which reduces the forest  
21 fragmentation effects and potential impacts to threatened and endangered (T&E) species  
22 that use forest habitats such as T&E bat species. As such, the Alternative IEC East

Portion will result in less overall environmental impacts relative to the original IEC East Proposed Route.

From an engineering perspective, the Alternative IEC East Portion already spans Muddy Creek in defined ROW areas and will minimize the construction challenges associated with steep slopes in these areas as only new arms and wires will be added to the existing towers. The Alternative IEC East Portion was also selected as the Proposed Route because access to the existing PPL Electric transmission lines was previously identified and coordinated with landowners when these lines were rebuilt in 2012-2014. Coordination for access to the Furnace Run 230 kV Transmission Line section will be considerably less challenging than the coordination that will be required for defining and obtaining permission for the numerous new access roads that would be necessary for the IEC East Proposed Route.

Overall the Alternative IEC East Portion is anticipated to have less total impact when compared to the original Proposed Route for the IEC East Project.

### **III. COMPLIANCE WITH POTENTIAL PERMIT AND MITIGATION REQUIREMENTS**

**Q. Please summarize PPL Electric's efforts to minimize the anticipated impacts and potential permit and mitigation requirements of the Proposed Route for the IEC-East Project.**

A. Efforts were made during this process to minimize impacts on existing and future land uses, as well as avoid sensitive natural resources such as wetlands and streams. Where potential impacts are unavoidable, best management practices will be employed and PPL Electric will obtain and comply with any necessary permits.

1           As part of the permitting process, any required waterway, wetland, or floodplain  
2           encroachment permits will be obtained from the applicable jurisdictional state and federal  
3           agencies prior to construction and PPL Electric will comply with all special conditions  
4           placed on the permits. In addition, to address water quality standards within watersheds  
5           along the IEC East Project corridor, PPL Electric will comply with the regulations of the  
6           National Pollutant Discharge and Elimination System permit program, obtain the  
7           required soil erosion and sedimentation control permits, and follows the specified  
8           conditions required for the permit.

9           PPL Electric has initiated the T&E species review process through the  
10          Pennsylvania Natural Diversity Inventory (PNDI) on-line system to determine if any state  
11          or federally listed species of concern may be located in the Furnace Run 230 kV  
12          Transmission Line project area. The PNDI receipt noted that there is a potential for a  
13          U.S. Fish and Wildlife Service (USFWS) listed species to be present. Coordination with  
14          USFWS will be conducted to determine if any surveys or avoidance measures are  
15          required for the project. No other potential species impacts were identified, and no  
16          additional coordination is required from Pennsylvania state agencies.

17          Additional discussion of PPL Electric's efforts to minimize the anticipated  
18          impacts and potential permit and mitigation requirements of the proposed IEC East  
19          Project is provided in Section 4.2 of Attachment 3 (Supplemental Siting Study) to the  
20          Amended Application. This section addresses potential impacts to land use, natural  
21          features, threatened and endangered species; cultural resources, and community features  
22          and conserved lands, as well as addresses anticipated agency requirements and permits  
23          and reviews consistency with county comprehensive plans and municipal zoning.

1

2   **Q.     Does this conclude your testimony at this time?**

3   A.     Yes. I reserve the right to supplement my testimony as additional issues arise during the  
4           course of this proceeding.