Transmission Expansion Advisory Committee (TEAC)

Recommendations to the PJM Board

PJM Staff Whitepaper
December 2017

EXECUTIVE SUMMARY

On October 18, 2017 the PJM Board of Managers approved changes to the Regional Transmission Expansion Plan (RTEP), totaling $1,019.41 million, primarily to resolve baseline reliability criteria violations.

Since that time PJM identified additional baseline reliability criteria violations within the planning horizon as part of the 2017 RTEP. Transmission upgrades have been identified to resolve these reliability criteria violations. The increase in the RTEP to include the upgrades to resolve the new baseline reliability criteria violations is $348.85 million. PJM has also identified a market efficiency upgrade to address capacity market congestion. The increase in the RTEP to include the market efficiency upgrade is $0.6 million.

PJM staff is, for the first time, recommended several interregional projects with MISO under the recently approved Targeted Market Efficiency Project (TMEP) type. PJM and MISO recommended five projects with a total estimated cost of $19.92 million and an estimated market efficiency benefit of $99.6 million. Four of the projects are in MISO. One project in the ATSI zone of PJM has an estimated cost of $1 million.

In addition, a number of previously approved baseline projects have been cancelled or the cost and scope has changed resulting in a net increase of $77.07 million. The net impact due to baseline reliability changes is an increase of $427.52 million.

PJM staff has also completed 252 new interconnection queue impact studies and 257 projects have withdrawn from the interconnection queue. The net impact of these changes to the interconnection queue is a net increase in the RTEP of $ 2,404.24 million.

The total change in the RTEP to include these baseline RTEP changes and interconnection queue changes is a net increase of $2,831.76 million.

With these changes, the RTEP will include over $35,110.50 million of transmission additions and upgrades since the first plan was approved by the Board in 2000.

The projects are summarized in the following paper and were presented for the Board Reliability Committee's consideration and for recommendation to the Board for approval.

Summary of Results

2017 Baseline Transmission Upgrades Changes and Additions

One aspect of the development of the Regional Transmission Expansion Plan is an evaluation of the "baseline" system, i.e. the transmission system without any of the generation interconnection requests included in the current planning cycle. This baseline analysis determines the compliance of the existing system with reliability criteria and standards. Transmission upgrades required to maintain a reliable system are identified and reviewed with stakeholders through the Transmission Expansion Advisory Committee (TEAC) and Subregional RTEP Committees. The cost of transmission upgrades to mitigate such baseline reliability criteria violations are the responsibility of the PJM load customers.

2017 RTEP Proposal Window #1

On July 11 of this year PJM opened a 45-day proposal window, which closed on August 25. This window solicited proposals for PJM reliability criteria violations based on forecast 2022 summer, winter and light load conditions. PJM reliability criteria violations included Baseline N-1 (thermal and voltage), Generation Deliverability, Common Mode Outage, N-1-1 (thermal and voltage), and Load Deliverability (thermal and voltage) violations. PJM staff identified potential reliability criteria violations associated with 190 flowgates (monitored transmission facility and contingency/outage pairs). Of the 190 flowgates, 150 flowgates were excluded from the proposal window. The exclusion were based on immediate need criteria (needs to resolve a violation within the next 3 years) and, for the first time, below the 200kV threshold criteria (per PJM OA 1.5.8(n)). The remaining 40 flowgates formed the substance of the proposal window.

A total of 51 proposals were received from 10 entities, including incumbent transmission owners and non-incumbent transmission developers. 29 of the proposals represented greenfield construction and 22 were transmission owner upgrades.

The locations of the violations associated with Proposal Window #1 are shown below in Figure 1, while Figure 2 identifies the location of the proposals that were submitted for Proposal Window #1.

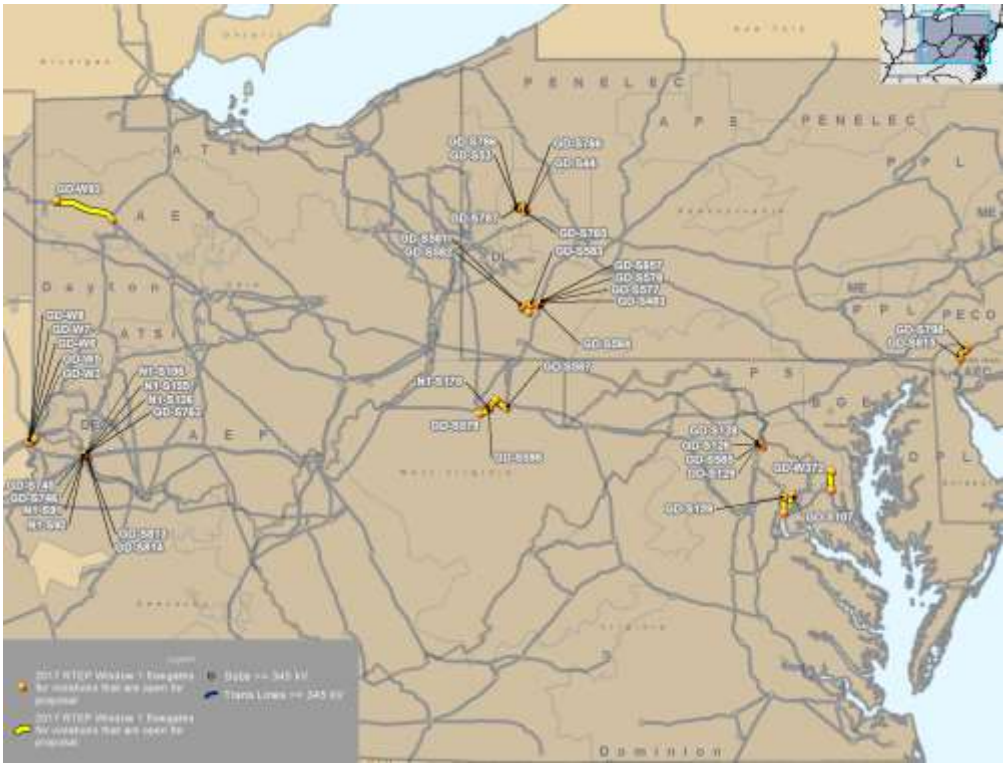

Figure 1. Location of violations for Proposal Window #1

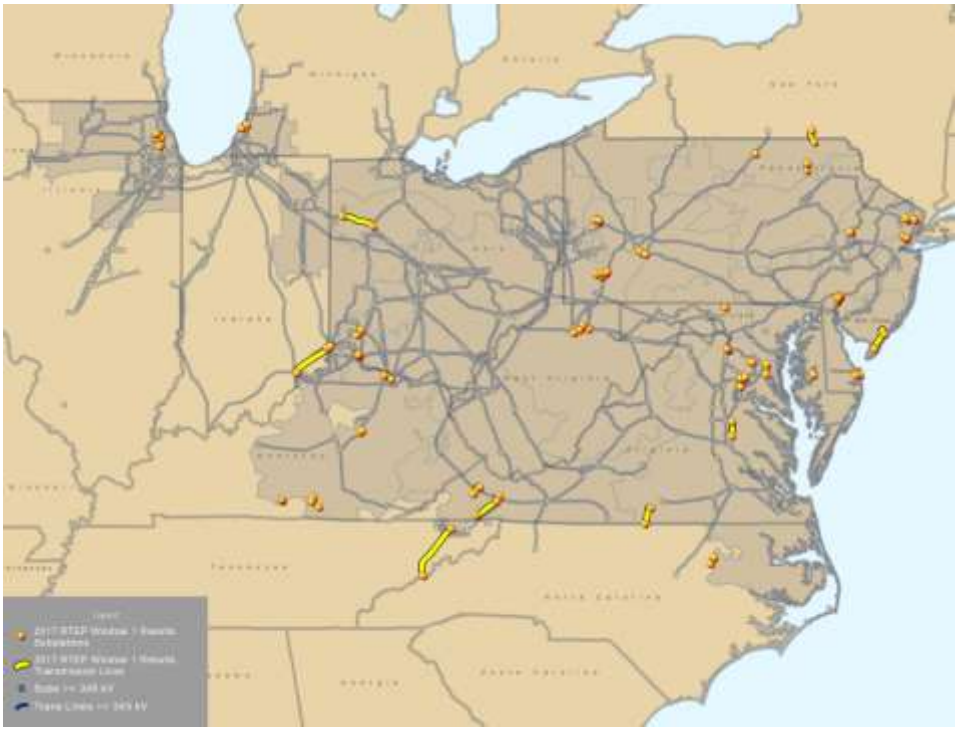

Figure 2. Location of submitted proposals for Window #1

PJM staff reviewed details of all proposals, including an evaluation of the effectiveness of each of the proposals, with stakeholders through the Transmission Expansion Advisory Committee (TEAC). PJM completed evaluation of most of the proposals, and is recommending eight projects at this time: four in the APS zone, two in the AEP zone and two in Dominion. Each of these projects is an upgrade submitted by the incumbent transmission owner. The work includes re-conductoring, upgrading terminal equipment, and reconfiguring existing lines.

The immediate need baseline reliability projects include transmission enhancements with a need date of 3 years or less. Due to the critical timing of immediate need projects, PJM did not have time to administer a proposal window to solicit alternative solutions from PJM stakeholders for the associated reliability drivers. The immediate need projects are being driven by several main categories of criteria drivers. The project drivers include short circuit issues to which the most efficient solution is typically a Transmission Owner upgrade of the associated breaker, new block load additions, Transmission Owner local criteria, generation deliverability issues in the Rochelle Municipal Utilities (a muni within the ComEd transmission zone) due to line rating updates, stability issues in the PPL and JCPL transmission zones, and a PJM operational performance issue.

Reliability Project Summary

A summary of the more significant baseline projects with estimated costs equal to or greater than $5 million are detailed below. A complete listing of all of the projects that are being recommended is included as Attachments A and B to this white paper. The projects with estimated costs less than $5 million include

transmission line cut in and re-conductoring, modifications to existing protection systems, new transmission switches, circuit breaker replacements, new circuit breakers, modification to transformer, and modifications to existing substation equipment.

Mid-Atlantic Region System Upgrades

- PSEG Transmission Zone
  - VFT – Warinanco - Aldene 230 kV Line Rebuild - $90.4M
  - Cedar Grove – Jackson Rd. 230 kV Line Re-conductor - $80M
- AE Transmission Zone
  - BL England – Middle Tap 138 kV Line Rebuild - $36.4M
- PenElec Transmission Zone
  - North Meshoppen 230/115 kV transformer #3 - $6.802M

Western Regional System Upgrades

- ComEd Transmission Zone
  - Schauff Road – Rock Falls 138kV Line Construction - $20.0M
- AEP Transmission Zone
  - Hazard – Wooten 161kV Line Rebuild - $16.48M
  - Sand Hill 138kV Ring Bus – $7.25M
- APS Transmission Zone
  - Convert the existing 6 wire Butler - Shanor Manor - Krendale 138 kV Line into two separate 138 kV lines, Reconductor the Yukon - Smithton - Shepler Hill Jct 138 kV Line with 795 ACSS Conductor, Reconductor the Charleroi –Allenport 138KV Line with 954 ACSR - $17.23M
  - Install new 230 / 138 kV transformer at Catoctin substation. Convert Ringgold-Catoctin 138 kV Line to 230 kV operation - $13.33M

Southern Region System Upgrades

- Dominion Transmission Zone
  - Fixed Series Capacitors on Line #547, 548 - $28.9M
  - Chesterfield - Locks & Chesterfield – Poe 230kV Lines Rebuild - $9.5M

Following is a more detailed description of the larger scope upgrades that are being recommended to the PJM Board for their consideration. A description of the criteria driving the need for the upgrade as well as the required in-service date is provided.

Baseline Project b2955 – VFT – Warinanco - Aldene 230 kV Line Rebuild

Generation Deliverability analysis identified a number of overloads on lines around Warinanco and Linden areas. Due to the immediacy of the need, the work will be allocated to the incumbent transmission operator. The recommended solution is the rebuild the VFT – Warinanco – Aldene 230kV line using a dual conductor construction to increase ampacity of the line. The estimated cost of the project is $90.4M and the project schedule is still being developed.

The map in Figure 3 shows the location of the recommended project.

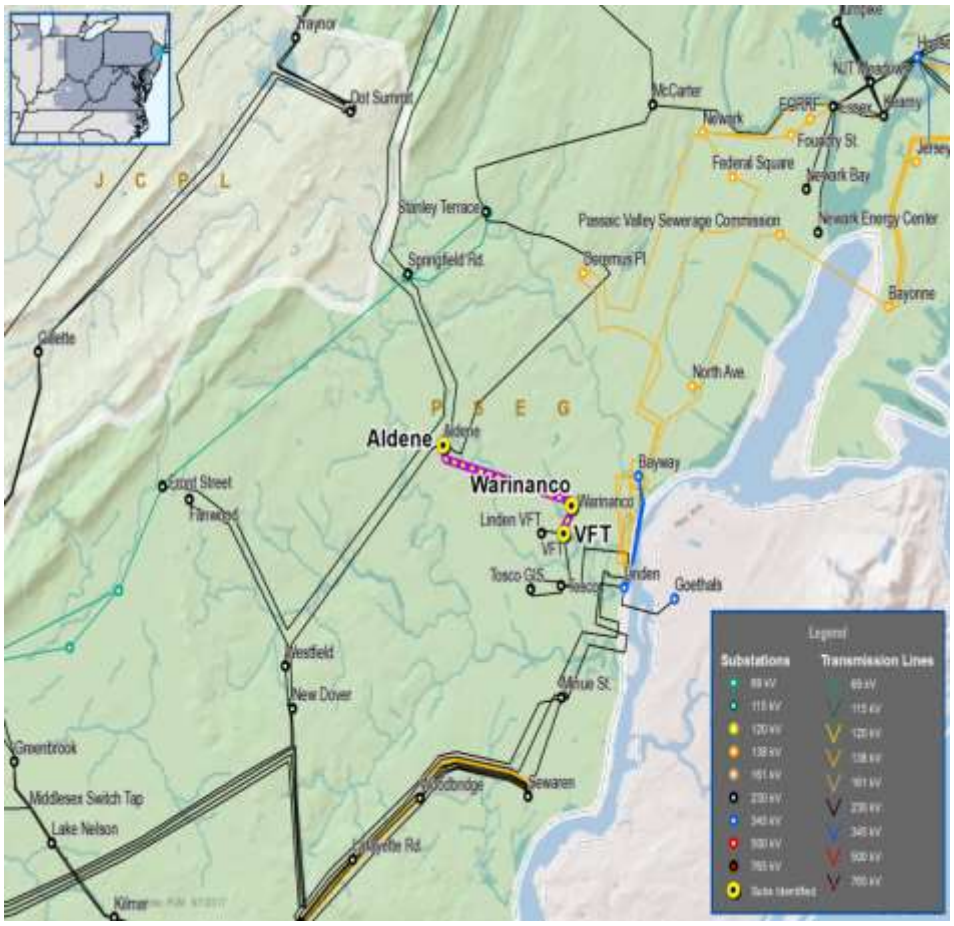

Figure 3. Location of PJM baseline b2955

Baseline Project b2956 – Cedar Grove – Jackson Rd. 230 kV Line Re-conductor

Generation deliverability analysis identified an overload of the Cedar Grove – Jackson Rd 230kV line. Flows on this line have increased due to the ending of the NYISO wheel agreement and the retirement of the Hudson generation station. The existing line is underground and conductor is a HPFF type conductor with an internal circulating cooling fluid. Due uncertainty of continued manufacturer support of the system replacement in kind is not preferred. Converting the line to overhead construction is prohibitive as obtaining ROW would be costly and time consuming. The recommended solution is to replace the existing HPFF cable with XLPE (solid dielectric) cables. The estimated cost is $80.0M and the required in-service date is June 2018.

The map in Figure 4 shows the location of the recommended project.

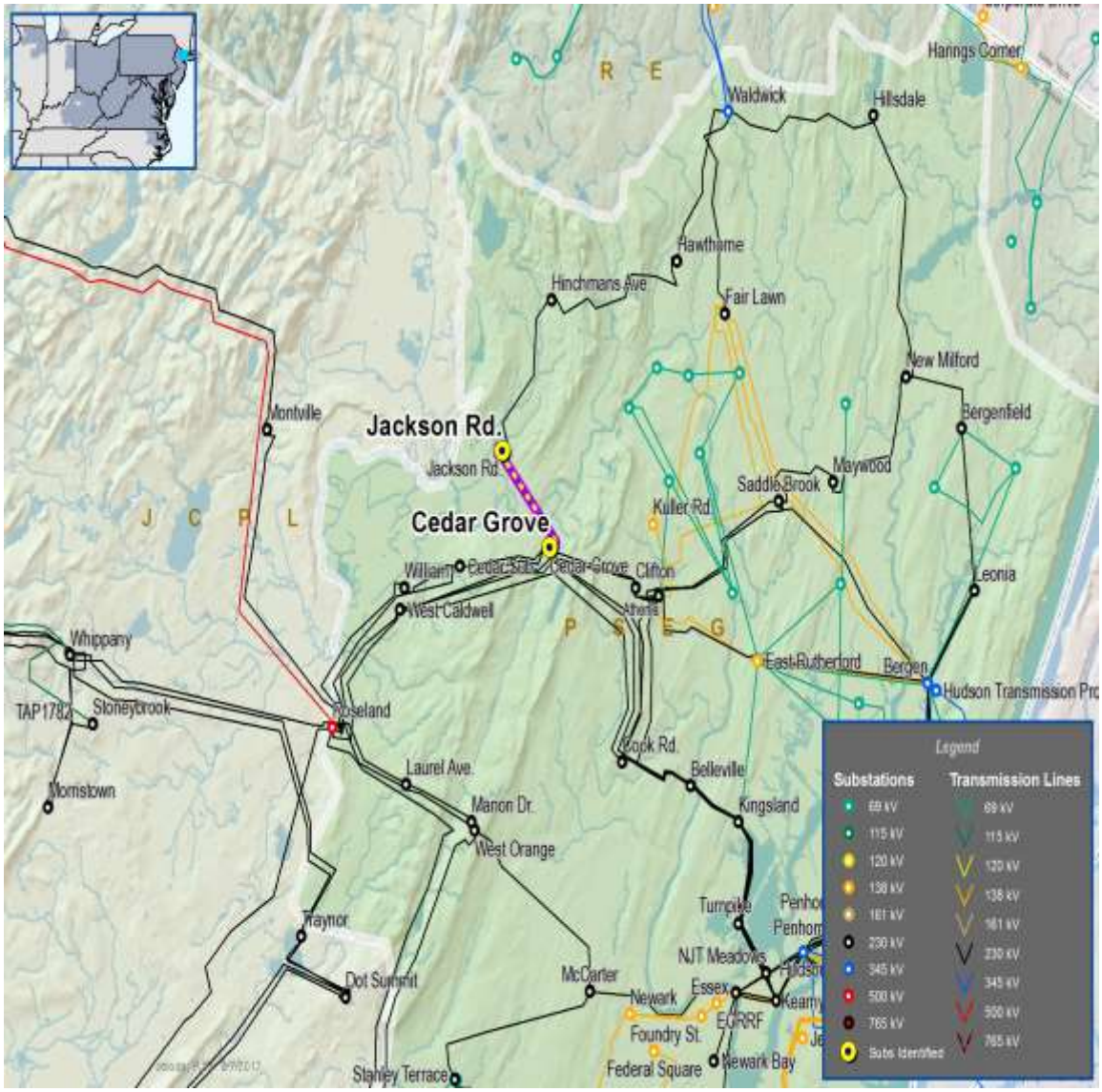

Figure 4. Location of PJM baseline b2956

Baseline Project b2945 – BL England – Middle Tap 138 kV Line Rebuild

The 2017 RTEP analysis identified generation deliverability and N-1-1 thermal criteria violations on the BL England – Middle Tap 138kV line. The recommended solution is to rebuild the entire 10.1 mi. of the line to increase the line rating. Since the BL England – Merion (1.9 mi) and the Merion – Corson (8.0 mi) 138kV lines share the lattice towers with the BL England – Middle Tap line, those lines will be re-conductored as part of this project. The total cost of the project is expected to be $36.4M and is required by June of 2022.

The map in Figure 5 shows the location of the recommended project.

Figure 5. Location of PJM baseline b2945

Baseline Project b2952 – North Meshoppen 230/115 kV transformer #3

The 2017 RTEP generation deliverability analysis revealed overloading of the North Meshoppen 230-115kV transformer #3 for two contingencies. The recommended solution is to replace the transformer with a higher capacity transformer. The solution also calls for removing an existing reactor which will no longer be needed and the installation of two circuit breakers to complete the station's ring bus, which will enhance reliability of the station. The project is expected to cost $6.8M and required to be in-service by June 2022.

The map in Figure 6 shows the location of the recommended project.

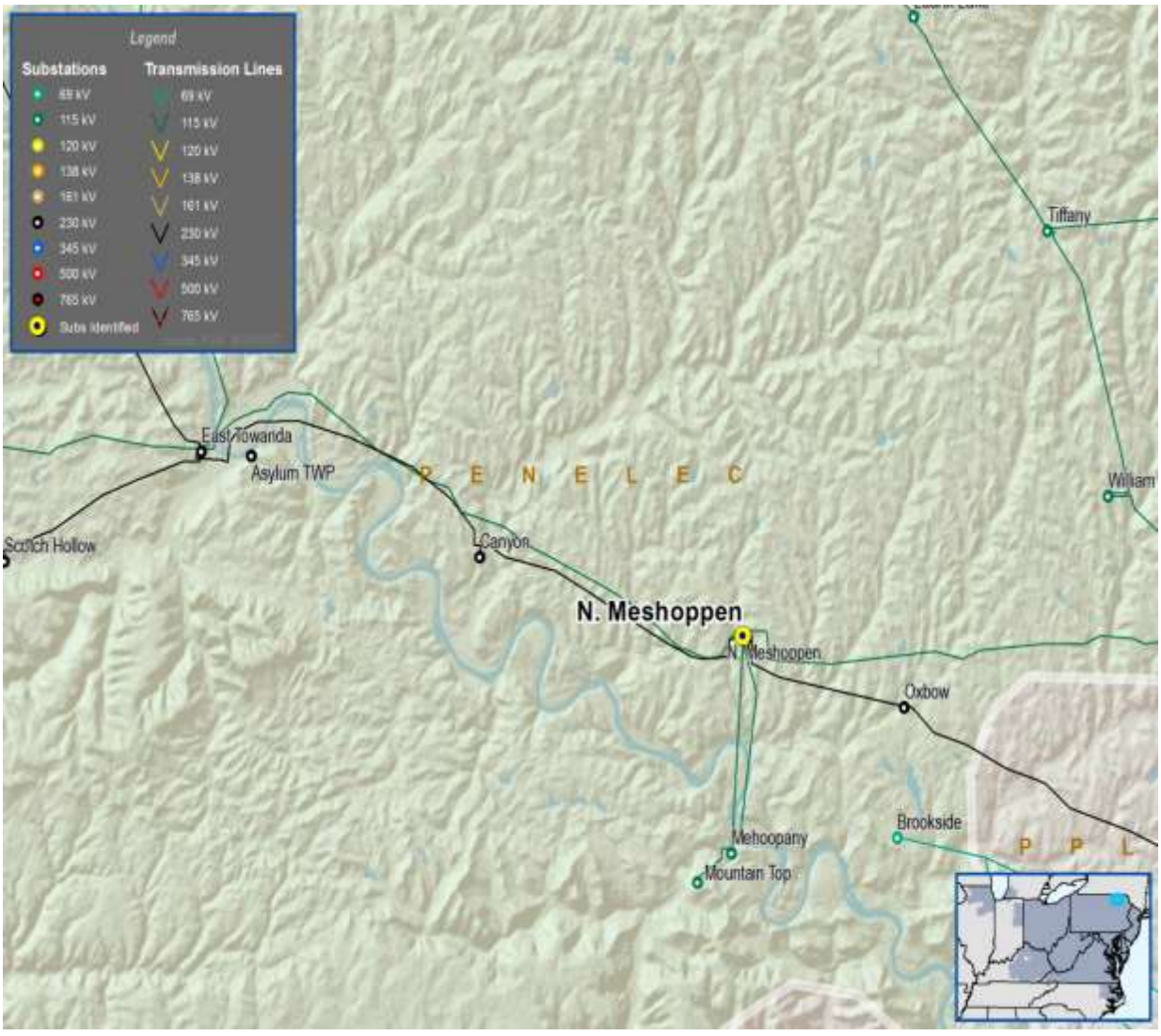

Figure 6. Location of PJM baseline b2952

Baseline Project b2959 – Schauff Road – Rock Falls 138kV Line Construction

Queue projects O-09 and O-29 are now active after being suspended for many years. Including these generators in the 2017 RTEP resulted in numerous base case and single contingency violations in the area of these projects. Due to the immediacy of the need, this work has been allocated to the incumbent transmission operator. The recommended solution builds a new 138kV line between Schauff Road and Rock Falls and a new breaker and half bay at the Schauff Road station. The project cost estimate is $20M and is required in-service by November 2019.

The map in Figure 7 shows the location of the recommended project.

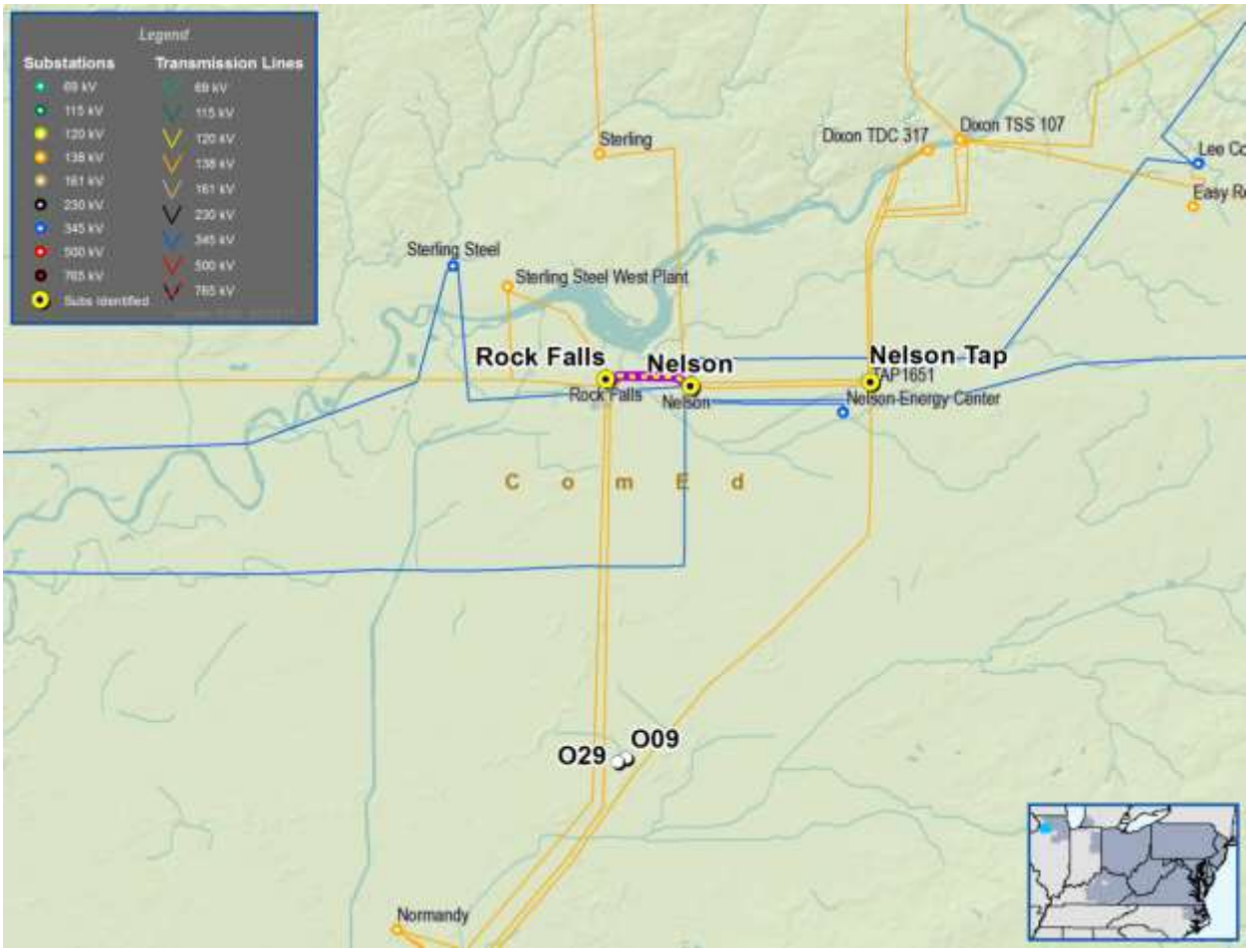

Figure 7. Location of PJM baseline b2959

Baseline Project b2761.3 – Hazard – Wooten 161kV Line Rebuild

Generation deliverability analysis revealed overloads of the Hazard – Wooten 161kV line under summer and winter peak loads. These overloads were identified in the 2016 RTEP study and included in Proposal Window #2. The approved action was to perform a sag study in the hope of increasing the operating temperature of the line. The sag study instead revealed that 40 of the 45 line structures needed be replaced meet clearance requirements at the higher temperature. The line also has 52 Category A open conditions. The line was originally built in 1943 so all of components of the line are aging and should be replaced. Therefore, at this time, the recommendation is to rebuild the line to current standards. The cost to rebuild the 6.5 mi. line is estimated at $16.5M and is expected to be in-service by June 2021.

The map in Figure 8 shows the location of the recommended project.

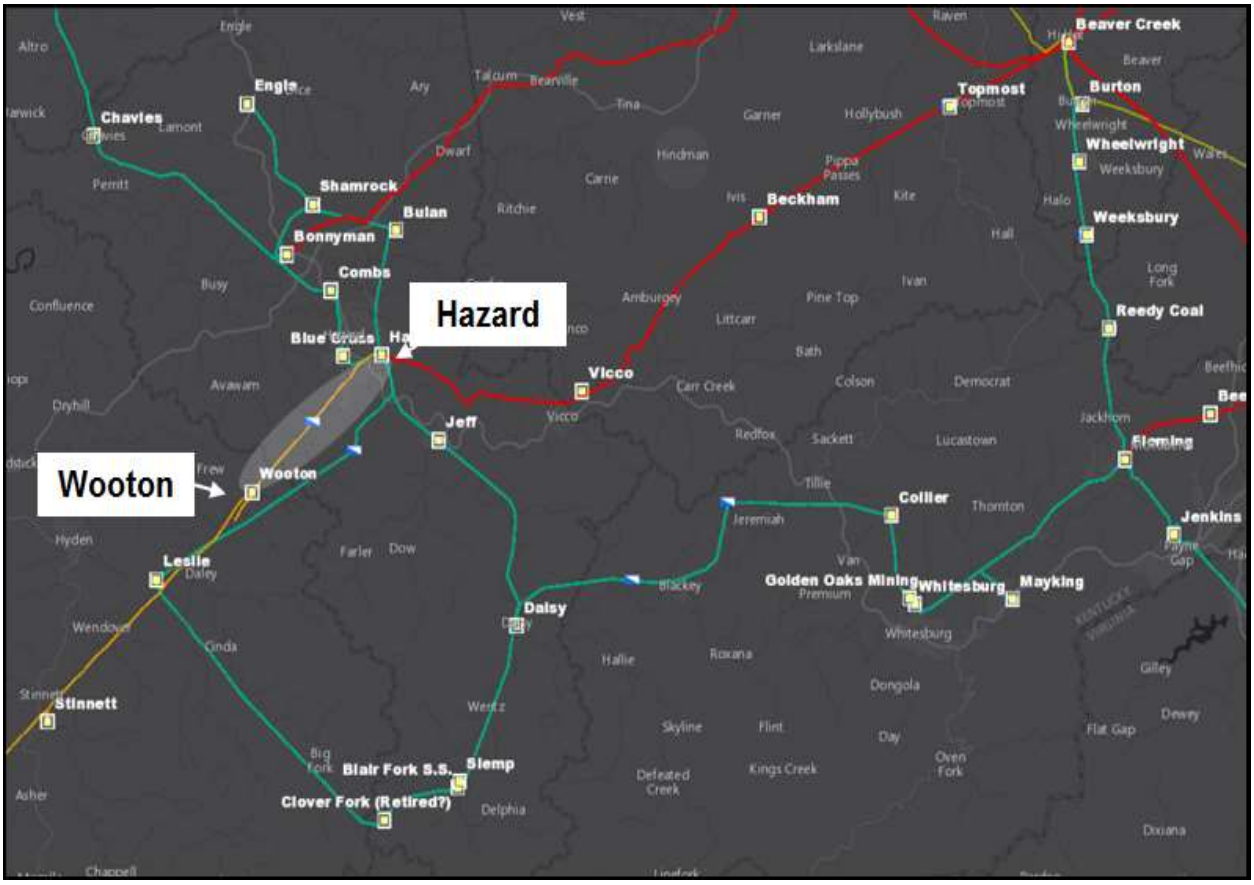

Figure 8. Location of PJM baseline b2761.3

Baseline Project b2958 – Sand Hill 138kV Ring Bus

Due to a planned demand increase of a large customer, local planning criteria identified a number of thermal, voltage and deliverability violations in the area of the Sand Hill station. The recommended solution is to break the nearby George Washington – Tidd 138kV line and terminate each end to the Sand Hill station. The total cost of the work is estimated to be $7.25M and is expected to be in-service by December 2018.

The map in Figure 9 shows the location of the recommended project.

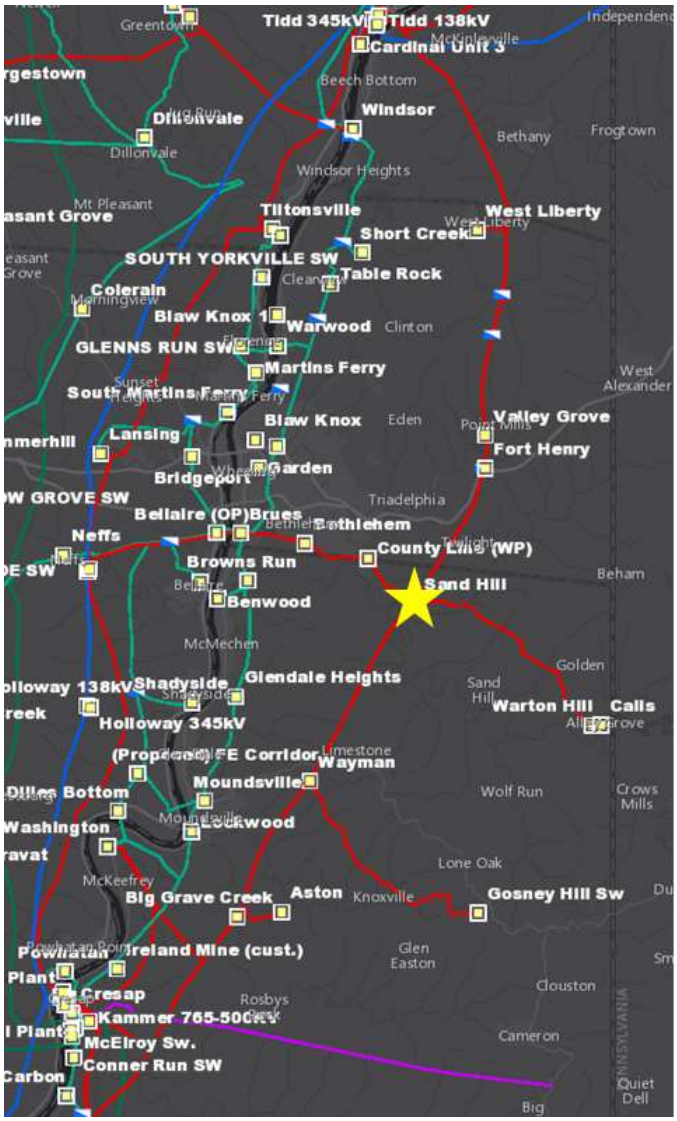

Figure 9. Location of PJM baseline b2958

Baseline Projects B2965, B2966, B2967 - Convert the existing 6 wire Butler - Shanor Manor - Krendale 138 kV Line into two separate 138 kV lines, Reconductor the Yukon - Smithton - Shepler Hill Jct 138 kV Line with 795 ACSS Conductor, Reconductor the Charleroi –Allenport 138KV Line with 954 ACS

Figure 10 shows the location of these 2017 Window #1 projects.

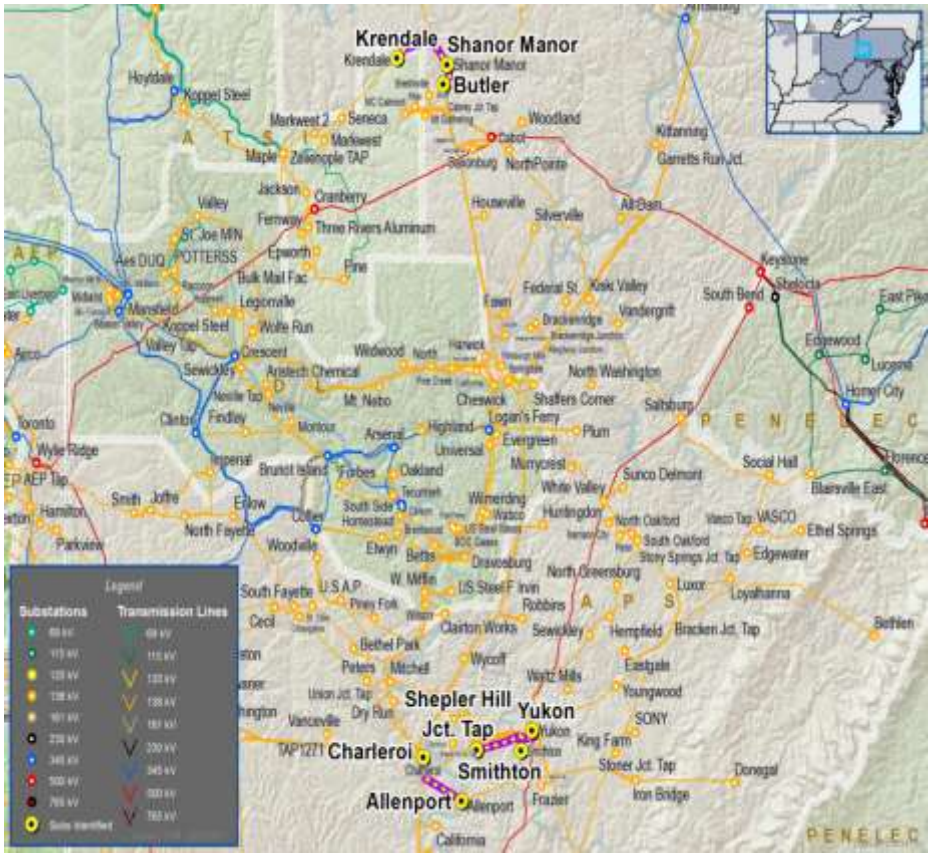

Figure 10. Location of PJM baseline b2965, b2966, and b2967

A number of generation deliverability violations (13) were identified in the south western Pennsylvania area of the APS and Duquesne transmission zones. Thermal overloads of the Butler – Shanor Manor – Krendale, Yukon – Smithon, and Smithon – Shepler Hill Jct Tap 138kV lines were identified for a variety of contingencies.

The recommended solutions will re-conductor two 138kV lines, Charleroi – Allenport and Yukon - Smithton - Shepler Hill Jct. The 6-wire Butler - Shanor Manor - Krendale 138 kV line will be separated into two 138kV lines. The costs for the each project will be $7.08M, $3.19M, and $6.96M, respectively, for a total cost of $17.23M.

Baseline Project b2970 - Install new 230 / 138 kV transformer at Catoctin substation. Convert Ringgold-Catoctin 138 kV Line to 230 kV operation.

Figure 11 shows the location of this 2017 Window #1 project.

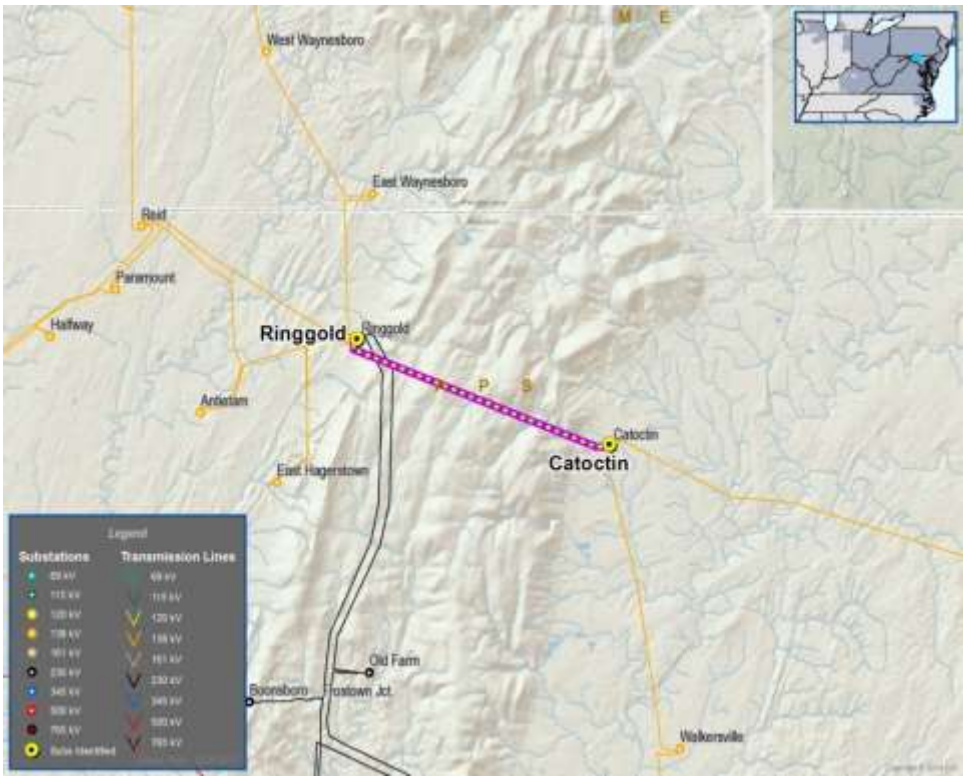

Figure 11. Location of PJM baseline b2970

The Ringgold 230/138kV transformers #3 and #4 are overloaded for multiple contingencies. The recommended solution is to install a new 230-138kV transformer at the Catoctin substation and convert the Ringgold-Catoctin line to 230kV operation. The total cost of the project is $13.3M.

Baseline Project b2960 – Fixed Series Capacitors on Line #547, 548

Series capacitors on the 500kV lines into Bath County (#547 and #548) have reached local criteria for end of life. The need for the capacitors has not ended. The capacitors are no longer manufactured and spare parts have become difficult to obtain. In addition the capacitor banks are the limiting element on the line. The recommended solution is to replace the capacitors with newer models with a higher current rating. Estimated project cost is $28.9M and the capacitors are expected to me in-service by April 2002.

The map in Figure 12 shows the location of the recommended project.

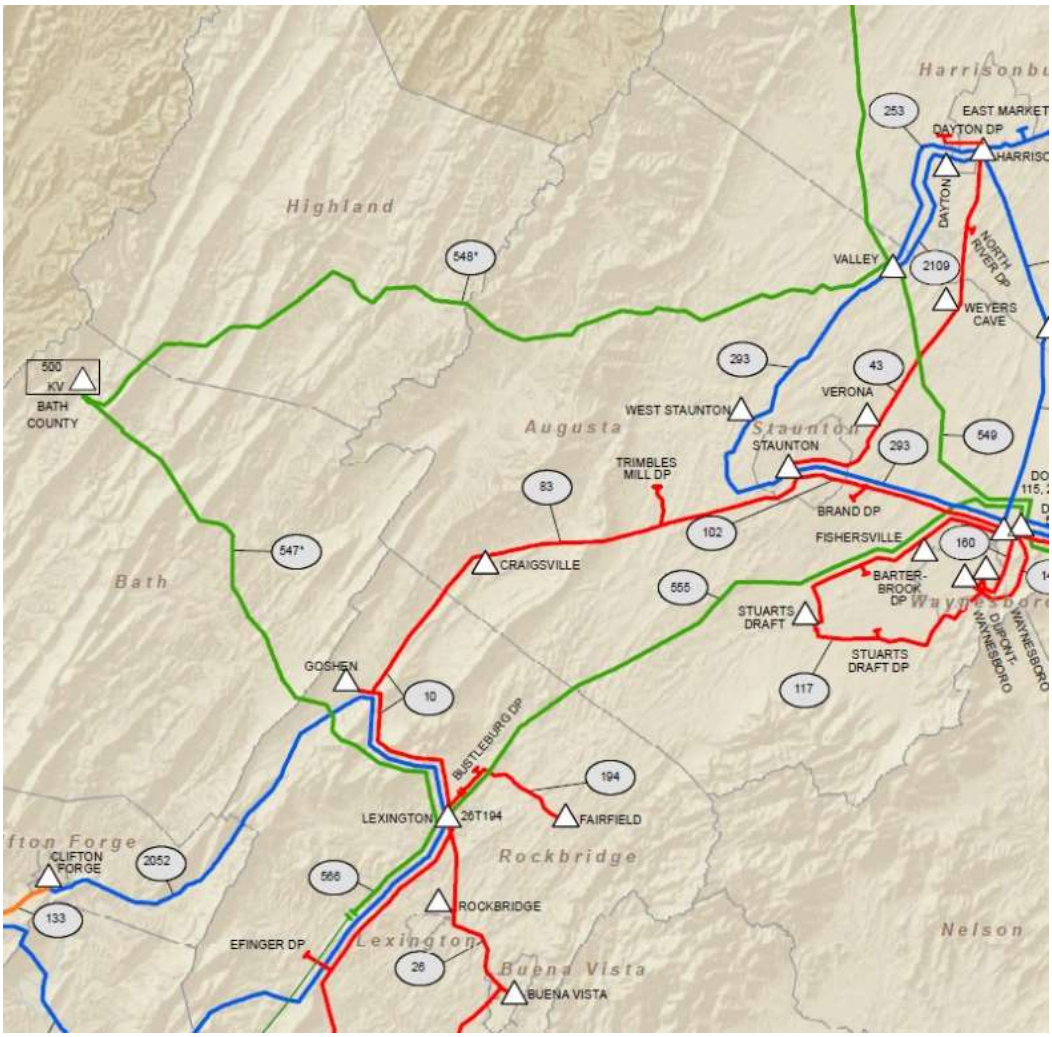

Figure 12. Location of PJM baseline b2960

Baseline Project b2961 – Chesterfield - Locks & Chesterfield – Poe 230kV Lines Rebuild

A 3 mi. section (between Chesterfield and Tyler) of these double circuited lines meets local owner end-of-life criteria. This section of line was built in 1962 using "corten" weathering steel. These structures have exhibited accelerated deterioration and are in poor condition. Loss of these lines would result in 140MW permanent load loss. The recommended solution is to rebuild the line to current standards. The proposed 2-636 ACSR conductor would increase the summer emergency rating of this section of line from 478MVA to 1047MVA. The project is estimated to cost $9.5M and should be in-service by the end of 2022.

The map in Figure 13 shows the location of the recommended project.

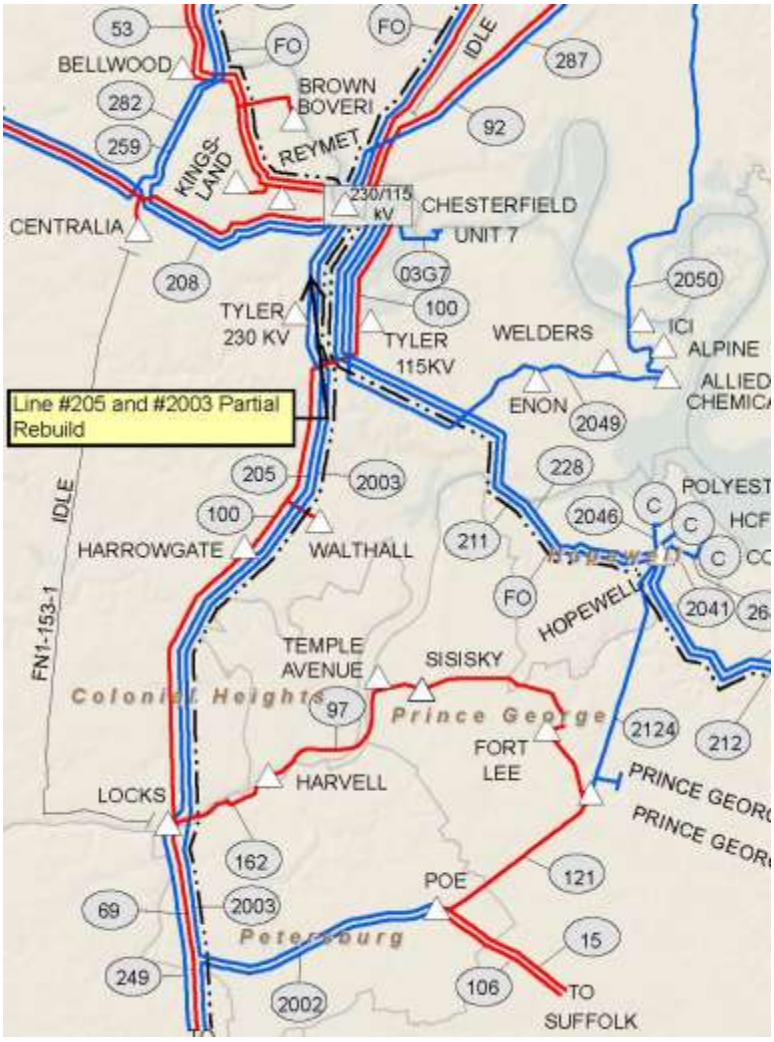

Figure 13. Location of PJM baseline b2961

PJM – MISO Interregional Targeted Market Efficiency Projects

PJM has conducted formal interregional planning with MISO under the Joint Operating Agreement (JOA) for many years. These activities include interconnection queue coordination, generation deactivation studies and other reliability assessments, as well as evaluation of future congestion between the RTOs. The first large joint interregional effort to examine congestion on the PJM/MISO interface was conducted in 2013 and 2014. No interregional projects were identified that satisfied the criteria specified in the JOA which limited potential interregional projects to large scope projects on the 345 kV and higher systems. A review of the actual historic congestion on the system showed that many of the constraints were on below 345 kV facilities and could be resolved with incremental upgrades to existing facilities. Since completing the study in 2014 PJM has worked closely with MISO and stakeholders to eliminate barriers in the JOA to addressing congestion along the seam.

In mid-2015, PJM and MISO began discussions of a new project type aimed at quickly addressing Market-to-Market (M2M) congestion on Reciprocally Coordinated Flowgates. Reciprocally Coordinated Flowgates are jointly controlled by PJM and MISO through coordinated dispatch to maintain flows within applicable limits. After the fact, the cost of this most efficient joint dispatch is settled between PJM and MISO based on each party's Firm Flow Entitlements and the actual use of the congested facilities.

Working with the Interregional Planning Stakeholder Advisory Committee (IPSAC), PJM and MISO developed criteria for a new project type which focus the study on developing low cost, short lead-time, high impact projects. The study is intended to be conducted annually, as part of a Coordinated System Plan study, as deemed needed by PJM and MISO, with stakeholder input. The resultant project type, called Targeted Market Efficiency Projects (TMEPs) are intended to complement, not replace, the longer term Market Efficiency Project (MEP) process.

Throughout 2016 PJM and MISO worked with stakeholders to develop and formalize the TMEP project type in the JOA. The TMEP project type can be summarized as follows:

- Limited to historically binding M2M flowgates
- Limited to M2M congestion that is not driven by temporary transmission outages
- Limited to M2M congestion that will not be remedied by already planned upgrades
- Projects must be in service by 3rd summer peak after project approval
- Projects over $20 million not eligible (must go through MEP process)
- Benefits based on relieving projected congestion equal to the average of 2 years of historical congestion (DA + Balancing/ECF[1])
- Four years' worth of projected benefits must completely cover project's installed capital cost
- Interregional cost allocation based on the assumed average two-year historical congestion relief in each RTO – Adjusted by M2M payments
- Each TMEP must be approved as an RTEP project in PJM and an MTEP project in MISO.

[1] Excess Congestion Fund, MISO term for Balancing Congestion

PJM and MISO filed changes to the JOA in December 2016 to formalize this new project type. On October 3, 2017 PJM and MISO received conditional approval from FERC for the requested changes pending a minor compliance filing which was filed on November 2, 2017.

In parallel with the development of the final JOA language, the RTOs worked with the IPSAC to complete the first iteration of the TMEP study. PJM and MISO initially identified fifty (50) M2M flowgates which had historically significant congestion (greater than $1 million). The 50 initial flowgates were trimmed down by eliminating congestion issues caused by outages or that would be mitigated by planned upgrades that were already included in the RTEP or MISO's MTEP. The RTOs then worked with the facility owners to identify the limiting equipment on these congested elements and determine the upgrades required to increase the facility rating. Potential feasible short term upgrades were identified for thirteen (13) facilities. PJM and MISO conducted market efficiency and power-flow based analyses to determine the efficacy of the thirteen potential upgrades in eliminating the identified congestion. If a potential upgrade produced more congestion (i.e. moved the constraint to a downstream facility) and significantly complicated the project, the proposal was referred to the long-term interregional MEP process.

As a result of this analysis, and considering the other TMEP criteria, the RTOs are recommending five (5) TMEPs for approval. These five upgrades have been discussed with the Interregional Planning Stakeholder Advisory Committee (i.e. IPSAC), PJM TEAC, and MISO PAC, and, are being recommended to both the PJM and MISO boards for approval.

PJM and MISO are jointly recommending the five projects shown in Table 1 and whose locations are shown in Figure 14. Location of five recommended TMEPs. The total estimated cost of these five projects is $19.92 million, with a TMEP benefit of $99.6 million, for an average B/C ratio of 5.0. Considering the interregional cost allocation, the total cost allocated to PJM for these projects will be $13.7 million.

The projects are being separately taken to the PJM and MISO Boards. MISO's board is expected to vote on this same package of TMEPs on December 5th. If approved by both RTO's Boards, the projects will be included in each regional plan. PJM will notify ATSI of their responsibility to construct project b2972. MISO will coordinate construction responsibility with NIPSCO for the remaining projects. The RTO's will use existing interregional billing mechanisms identified in the tariff to assess and collect costs for the interregional cost splits.

Table 1. Summary of five recommended TMEPs

Facility	Transmission Owner	TMEP Cost (Million $)	TMEP Benefit (Million $)	Benefit Allocation (%PJM/%MISO)
Burnham - Munster 345kV	CE - NIPS	6.7	32	88/12
Lallendorf - Monroe 345kV	ATSI - ITC	1	17	89/11
Michigan City – Bosserman 138kV	NIPS - AEP	6.0	29.6	90/10
Reynolds-Magnetation 138kV	NIPS	0.12	14.5	41/59

Roxana - Praxair 138kV	NIPS	6.1	6.5	24/76

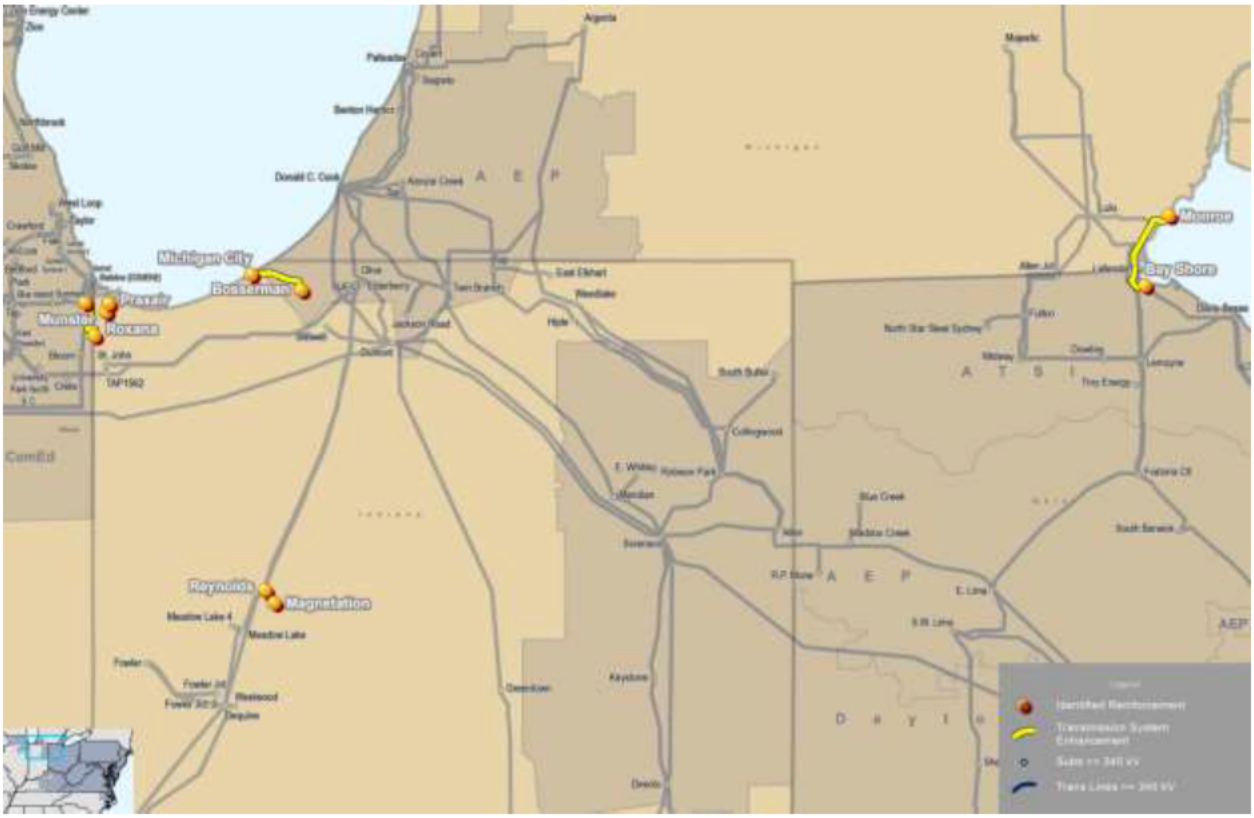

Figure 14. Location of five recommended TMEPs

Baseline Project b2971 – Reconfigure Munster 345kV (NIPSCO) as a ring bus and replace terminal equipment.

This project increases the rating on Burnham – Munster 345kV, to address historical M2M congestion on that facility.

The estimated cost is $6.7 million and the project will provide an estimated $32 million in congestion relief benefits in the first 4 years of operation. 88% of the cost ($5.9 million) will be allocated to PJM. The projected in service date is June 1, 2020. MISO will designate the local Transmission Owner, NIPSCO, to complete this work.

Baseline Project b2972 – Partial reconductor of Lallendorf – Monroe 345kV (ATSI – ITC)

This project replaces ATSI owned conductor on the span of the Lallendorf - Monroe 345kV (ATSI – ITC tie) line where it crosses the Muamee River. This increases the rating on Lallendorf - Monroe 345kV to address historical M2M congestion on that facility.

The estimated cost is $1 million and the project will provide an estimated $11.3 congestion relief benefit in the first 4 years of operation. 89% of the cost ($0.9 million) will be allocated to PJM. The projected in service date is November 1, 2019. PJM will designate the local Transmission Owner, ATSI, to complete this work.

Baseline Project b2973 – Reconductor the NIPSCO owned conductor on the Michigan City – Bosserman 138kV (NIPSCO – AEP tie) line

This project increases the rating on Michigan City – Bosserman 138kV, to address historical M2M congestion on that facility.

The estimated cost is $6.0 million and the project will provide an estimated $29.6 million congestion relief benefit in the first 4 years of operation. 90% of the cost ($5.4 million) will be allocated to PJM. The projected in service date is November 1, 2019. MISO will designate the local Transmission Owner, NIPSCO, to complete this work.

Baseline Project b2974 – Replace terminal equipment at the Reynolds 138kV station for the Reynolds – Magnetation 138kV (NIPSCO) circuit

This project increases the rating on Reynolds – Magnetation 138kV, to address historical M2M congestion on that facility.

The estimated cost is $120,000 and the project will provide an estimated $14.5 million congestion relief benefit in the first 4 years of operation. 41% of the cost ($49,000) will be allocated to PJM. The projected in service date is June 1, 2019. MISO will designate the local Transmission Owner, NIPSCO, to complete this work.

Baseline Project b2975 – Reconductor Roxana – Praxair 138kV (NIPSCO)

This project increases the rating on Roxana – Praxair 138kV, to address historical M2M congestion on that facility.

The estimated cost is $6.1 million and the project will provide an estimated $6.5 million congestion relief benefits in the first 4 years of operation. 24% of the cost ($1.5 million) will be allocated to PJM. The projected in service date is June 1, 2020. MISO will designate the local Transmission Owner, NIPSCO, to complete this work.

Baseline Market Efficiency Project

2016/17 RTEP Long Term Proposal Window Addendum 1A

PJM opened an additional proposal window to solicit proposals to address facilities expected to limit capacity imports into the DEOK LDA in RPM. Following the 2020/21 RPM Base Residual Auction (BRA) in May of 2017, imports into the DEOK LDA were limited by the Tanners Creek - Dearborn 345kV line. The Addendum Window 1A was opened from September 14, 2017 through September 28, 2017.

PJM staff solicited proposals to address constraints on the Tanners Creek – Dearborn 345 kV line. Three proposals were submitted to address DEOK LDA capacity market constraints. Proposals submitted ranged in costs from $0.6 to $12.7 million and included two Transmission Owner upgrades and one Greenfield project from a non-incumbent entity.

PJM staff conducted an extensive analysis on the proposals to determine which projects satisfy the Market Efficiency criteria of having a Benefit/Cost ratio >1.25, and are economically justified.

The capacity benefits associated with the proposed projects were determined using the methodologies specified in Schedule 6 of the PJM Operating Agreement. PJM's annual capacity benefits calculation for lower voltage facilities is weighted 100 percent to zones with a decrease in net load capacity payments as a result of the proposed project. Change in net load capacity payments comprises the change in gross capacity payments offset by the change in capacity transfer rights.

PJM determined the impact of each of the three proposed projects on the DEOK LDA Capacity Emergency Transfer Limit (CETL). By increasing the capability of the LDA's limiting element the DEOK zone and other LDAs may be able to satisfy capacity requirements at a lower overall cost. PJM simulated the RPM process for multiple study years with the updated CETL values and measured each projects capacity benefits over a 15 year period.

The total Market Efficiency benefit of a project is the summation of the energy market benefits and the capacity market benefits. The energy market benefits were derived from production cost simulations and the capacity benefits were derived from capacity market simulations.

The project shown in Table 2 provides the highest total benefits, satisfies the B/C ratio of 1.25 and is being recommended to the Board for approval for inclusion into the RTEP. This project is an upgrade to existing equipment and will be designated to the incumbent transmission owner.

Table 2. Recommended Market Efficiency RPM Project

PJM Baseline ID	PJM Window Project ID	Project Description	Transmission Zone	Constraint Project Addresses	Project Cost ($M)	In Service Date	B/C Ratio
b2976	201617_1A-2A	Upgrade terminal equipment at Tanners Creek 345kV station Upgrade 345kV Bus and Risers at Tanners Creek for the Dearborn circuit.	AEP	Tanners Creek - Dearborn 345 kV, RPM Benefits	$0.6	2021	151.61

The recommended project will provide estimated average annual savings of $8.2 million in load energy and capacity payments.

The map in Figure 15 shows the location of the recommended project.

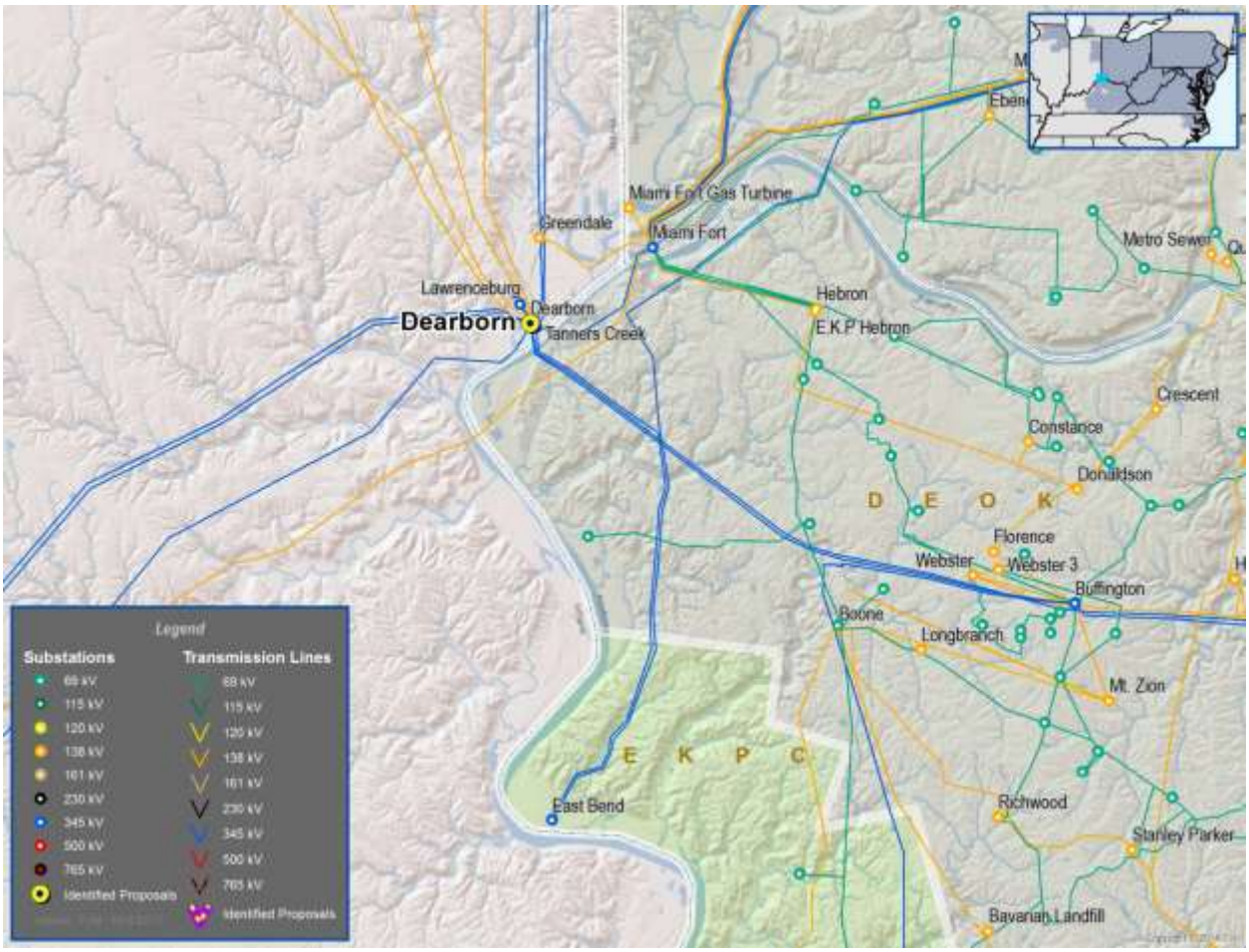

Figure 15. Location of Proposal 201717_1A-2A (PJM Baseline B2976)

Interconnection Queue Projects

Throughout 2017 PJM has continued to study new service customer requests that are submitted into our interconnection queue. These studies evaluate the impact of the interconnection request and include an evaluation of new generation interconnections, increases in generation at existing stations, long-term firm transmission service requests and merchant transmission interconnection requests.

These studies were last reviewed with the Reliability Committee of the Board in December of 2016. Since that time PJM has completed 252 interconnection System Impact Studies and 257 interconnection projects have withdrawn. The changes associated with the new and withdrawn projects resulted in a net increase in the RTEP of $2,404.24 million for the network upgrades. Figure 16 below shows the location of the new units associated with the completed interconnection System Impact Studies along with the fuel type and relative size. A listing of the projects with recently completed impact studies is provided in Attachment C to this white paper. A listing of the network upgrades associated with these projects is shown in Attachment D to this report. The cost for the network upgrades associated with these interconnection projects is the responsibility of the developer.

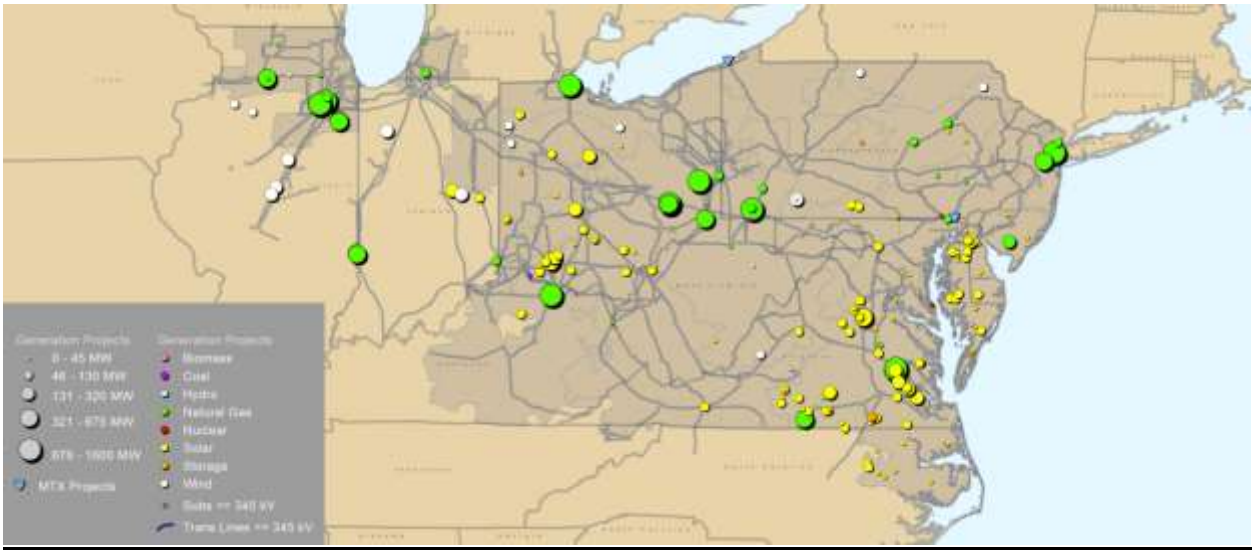

Figure 16. Completed Interconnection System Impact Studies

Summary of Interconnection Queue Activity (MW)

The following Table 3 shows the status of all of the generation projects in the Interconnection Queues.

Table 3. Status of Generation Interconnection Queues

Status of Generation Interconnection Queues

Queue	Active	Suspended	Under Construction	In-Service*	Withdrawn	Total MW Request**
A-U2	0	738	1,321	30,576	190,452	223,087
U3	100	0	7	141	2,126	2,374
U4	100	52	0	76	2,442	2,670
V1	40	33	0	46	2,072	2,191
V2	20	2	6	889	2,497	3,414
V3	26	39	8	863	1,395	2,331
V4	0	28	0	732	1,726	2,487
W1	0	5	53	194	3,514	3,765
W2	10	9	4	186	1,778	1,987
W3	0	403	43	463	2,683	3,591
W4	0	260	80	933	2,721	3,993
X1	195	356	21	955	2,011	3,538
X2	0	585	1,092	2,154	4,121	7,952
X3	0	751	9	43	5,627	6,430
X4	0	0	1,998	772	2,025	4,794
Y1	9	0	1,412	880	4,630	6,931
Y2	697	247	1,098	241	7,977	10,260
Y3	90	20	1,072	295	3,886	5,363
Z1	693	40	2,639	343	3,812	7,528
Z2	74	145	2,326	218	2,252	5,015
AA1	1,963	88	2,796	174	4,880	9,900
AA2	4,791	1,624	858	220	6,660	14,152
AB1	10,340	68	848	45	6,188	17,489
AB2	8,520	11	137	7	3,285	11,961
AC1	12,348	16	98	4	2,418	14,884
AC2	3,907	0	0	0	3,232	7,139
AD1	3,521	0	0	0	25	3,546
TOTAL	0	738	1,321	30,576	190,452	223,087

* In-service MW can and do change to account for units that are phased into commercial operation
**Total MW Requests can change due to MW reduction in certain phases of the study process
Data Valid as of:
9/30/2017

Changes to Previously Approved Projects

As further described below, cost and scope of previously approved RTEP baseline projects have changed, resulting in a net increase of $79.72M. Three projects, totaling $2.65M, are being cancelled as they are no longer needed to satisfy reliability criteria. The net change in the RTEP to incorporate these changes to previously approved projects is $77.07 million.

Baseline Project b2361 – New Idylwood to Tysons 230kV line and new Tyson GIS substation

An N-1-1 analysis of the 2013 base case revealed a loss of more than 300MW load. The approved solution was to build 2.4 miles of new OH 230kV line from Idylwood to the Dulles Toll Road in the ROW with Idlywood – CIA line and build 2.1 miles of new OH 230kV line from the Dulles Toll Road to a new Scott's Run substation. The section from the Dulles Toll Road to Scott's Run would be in new ROW. The approved cost this project was $32.0M.

A number of drivers have caused the scope to change and the project cost to increase. The incumbent transmission owner has been unable to find a suitable site for the Scott's Run station in Fairfax County. The existing ROW between Idylwood and the Dulles Toll Road is very narrow. Siting a second line the ROW is not viable and expansion of the ROW very difficult due high population density along the path. The new ROW required for overhead construction between the Dulles Toll Road and the Scott's Run station is very difficult to acquire due to high population density and the close proximity of the highway and commuter rail lines.

The modified solution recommended build 4.5 miles of new underground 230kV line from Idylwood to the Tysons station. Due to lack of land available adjacent to the Tysons station, the station will be converted to GIS and rebuilt within the existing footprint. The revised construction estimate is $111.7M and the revised in-service date is June 2022.

The maps in Figure 17 show the location of the recommended project with scope and cost changes, while the map in Figure 18 shows the alternatives to the recommended project.

COLOR	VOLTAGE	TRANSMISSION LINE NUMBER
	500 KV.	500 thru 599
	230 KV.	200 thru 299 & 2000 thru 2099
	115 KV.	1 thru 199
	138 KV.	AS NOTED
	69 KV.	AS NOTED

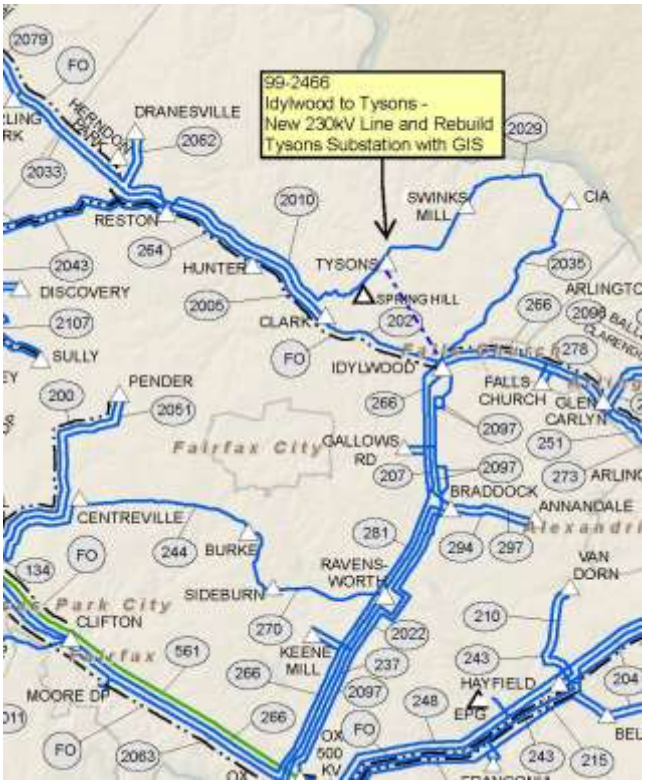

Figure 17. Location of PJM baseline b2361

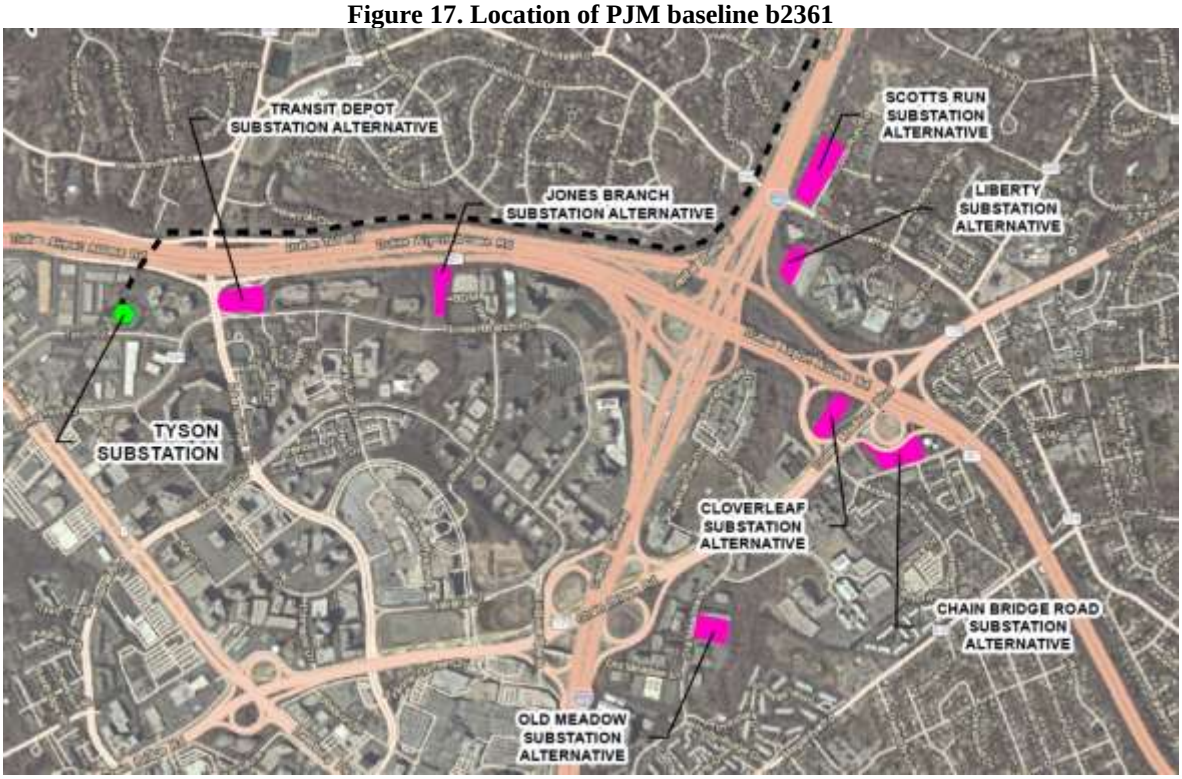

Figure 18. Location of PJM baseline b2361 Alternatives

Review by the Transmission Expansion Advisory Committee (TEAC)

The need for the projects was reviewed with stakeholders at several meetings throughout 2017, most recently at the November and October 2017 TEAC and Sub Regional RTEP Committee meetings. Written comments were requested to be submitted to PJM. As of the writing of this report there have been no comments received on the projects presented to the TEAC.

Cost Allocation

Cost allocations for the projects are calculated in accordance with the Schedule 12 of the OATT. Baseline reliability project allocations are calculated using a distribution factor methodology that allocates the cost to the load zones that contribute to the loading on the new facility. Baseline projects required exclusively to address local transmission owner FERC Form 715 planning criteria are allocated to the local transmission owner zone. As described above, the market efficiency project is allocated to the zone that benefit from the project. The allocations will be filed at the FERC 30 days following approval by the Board.

Board Approval

The PJM Board Reliability Committee was requested to endorse the new baseline reliability projects and associated cost allocations, and recommend to the Board, approval of the baseline upgrades to the 2017 RTEP.

The baseline upgrades will be incorporated into the published RTEP after approval by the PJM Board. The RTEP will be published on the PJM Website.

Upgrade ID	Description	Cost Estimate ($M)	Trans Owner	Cost Responsibility	Required IS Date
b2752.8	Replace the Conaston 230kV '2322 B5' breaker with a 63kA breaker	$0.54	BGE	BGE	6/1/2020
b2752.9	Replace the Conaston 230kV '2322 B6' breaker with a 63kA breaker	$0.54	BGE	BGE	6/1/2020
b2761.3	Rebuild the Hazard – Wooton 161 kV line utilizing 795 26/7 ACSR conductor (300 MVA rating).	$16.48	AEP	AEP	6/1/2021
b2838	Build a new 230/69 kV substation by tapping the Montour - Susquehanna 230 kV double circuits and Berwick - Hunlock & Berwick - Colombia 69 kV circuits	$57.00	PPL	PPL	6/1/2017
b2945.1	Rebuild the BL England – Middle Tap 138kV line to 2000A on double circuited steel poles and new foundations	$22.64	AEC	AEC	6/1/2022
b2945.2	Re-conductor BL England – Merion 138kV (1.9miles) line	$3.92	AEC	AEC	6/1/2022
b2945.3	Re-conductor Merion – Corson 138kV (8miles) line	$9.85	AEC	AEC	6/1/2022
b2946	Convert existing Preston 69 kV Substation to DPL's current design standard of a 3-breaker ring bus.	$2.64	DPL	DPL	6/1/2022
b2947.1	Upgrade terminal equipment at DPL's Naamans Substation (Darley-Naamans 69 kV)	$0.15	DPL	DPL	6/1/2022
b2947.2	Re-conductor 0.11 mile section of Darley-Naamans 69 kV circuit	$0.20	DPL	DPL	6/1/2022
b2948	Upgrade terminal equipment at DPL's Silverside Road Substation (Dupont Edge Moor –Silver R. 69 kV)	$0.15	DPL	DPL	6/1/2022
b2950	Upgrade limiting 115 kV switches on the 115 kV side of the 230/115 kV Northwood substation and adjust setting on limiting ZR relay	$0.10	ME	ME	6/1/2022
b2951	Seward, Blairsville East, Sheltocta work	$1.49	PENELEC	PENELEC	6/1/2022
b2951.1	Upgrade Florence 115kV line terminal equipment at Seward SS	$0.00	PENELEC	PENELEC	6/1/2022
b2951.2	Replace Blairsville East/Seward 115kV line tuner, coax, line relaying and carrier set at Shelocta SS	$0.00	PENELEC	PENELEC	6/1/2022
b2951.3	Replace Seward/Shelocta 115kV line CVT, tuner, coax, and line relaying at Blairsville East SS	$0.00	PENELEC	PENELEC	6/1/2022

Upgrade ID	Description	Cost Estimate ($M)	Trans Owner	Cost Responsibility	Required IS Date
b2952	Replace the North Meshoppen #3 230/115kV transformer eliminating the old reactor and installing two breakers to complete a 230kV ring bus at North Meshoppen	$6.80	PENELEC	PENELEC	6/1/2022
b2953	Replace the Keystone 500kV breaker "NO.14 Cabot" with 50kA breaker	$1.24	PENELEC	PENELEC	6/1/2020
b2954	Replace the Keystone 500kV breaker "NO.16 Cabot" with 50kA breaker	$1.24	PENELEC	PENELEC	6/1/2020
b2958.1	Cut George Washington – Tidd 138kV circuit into Sand Hill and reconfigure Brues & Warton Hill line entrances.	$2.19	AEP	AEP	7/1/2017
b2958.2	Add 2 138kV 3000 A 40 kA breakers, disconnect switches, and update relaying at Sand Hill station.	$5.06	AEP	AEP	7/1/2017
b2959	Install a new 138kV circuit 18702 from Schauff Road to Rock Falls and install a fourth breaker and a half run at Schauff Road.	$20.00	ComEd	ComEd	11/1/2019
b2960	Replace fixed series capacitors on 500kV Line #547 at Lexington and on 500kV Line #548 at Valley	$28.90	Dominion	Dominion	4/1/2020
b2961	Rebuild approximately 3 miles of Line #205 & Line #2003 from Chesterfield to Locks & Poe respectively.	$9.50	Dominion	Dominion	12/31/2022
b2962	Split Line #227 (Brambleton – Beaumeade 230 kV)and terminate into existing Belmont substation	$3.05	Dominion	Dominion	6/1/2022
b2963	Reconductor the Woodbridge to Occoquan 230kV line segment of Line 2001 with 1047 MVA conductor and replace line terminal equipment at Possum Point, Woodbridge, and Occoquan	$4.49	Dominion	Dominion	6/1/2022
b2964.1	Replace terminal equipments at Pruntytown and Glen Falls 138 kV station.	$0.26	APS	APS	6/1/2022
b2964.2	Reconductor approximately 8.3 miles of the McAlpin - White Hall Junction 138 kV circuit	$3.79	APS	APS	6/1/2022
b2965	Reconductor the Charleroi – Allenport 138KV Line with 954 ACSR Conductor, Replace Breaker Risers at Charleroi and Allenport	$7.08	APS	DL	6/1/2022
b2966	Reconductor the Yukon - Smithton - Shepler Hill Jct 138 kV Line with 795 ACSS Conductor, Replace Line Disconnect Switch at Yukon	$3.19	APS	APS	6/1/2022

Upgrade ID	Description	Cost Estimate ($M)	Trans Owner	Cost Responsibility	Required IS Date
b2967	Convert the existing 6 wire Butler - Shanor Manor - Krendale 138 kV Line into two separate 138 kV lines. New lines will be Butler - Keisters and Butler - Shanor Manor - Krendale 138 kV	$6.96	APS	APS	6/1/2022
b2968	Upgrade existing 345kV terminal equipment at Tanner Creek station	$1.20	AEP	AEP	6/1/2022
b2969	Replace terminal equipment on Maddox Creek - East Lima 345kV circuit	$1.48	AEP	AEP	6/1/2022
b2970	Ringgold - Catoctin Solution	$13.33	APS	APS	6/1/2020
b2970.1	Install two new 230 kV positions at Ringgold for 230/138 kV transformers.	$0.00	APS	APS	6/1/2020
b2970.2	Install new 230 kV position for Ringgold – Catoctin 230 kV line.	$0.00	APS	APS	6/1/2020
b2970.3	Install one new 230 kV breaker at Catoctin substation.	$0.00	APS	APS	6/1/2020
b2970.4	Install new 230 / 138 kV transformer at Catoctin substation. Convert Ringgold-Catoctin 138 kV Line to 230 kV operation.	$0.00	APS	APS	6/1/2020
b2976	Upgrade terminal equipment at Tanners Creek 345kV station. Upgrade 345kV Bus and Risers at Tanners Creek for the Dearborn circuit.	$0.60	AEP	DEOK	6/1/2021

Upgrade ID	Description	Cost Estimate ($M)	Trans Owner	Cost Responsibility	Required IS Date
b2955	Wreck and re-build the VFT – Warinanco – Aldene 230 kV circuit with paired conductor.	$90.40	PSEG	ECP (1.02%) / JCPL (89.15%) / NEPTUNE (5.91%) / HTP (3.92%)	6/1/2018
b2956	Replace existing cable on Cedar Grove-Jackson Rd. with 5000kcmil XLPE cable.	$80.00	PSEG	JCPL (42.91%) / NEPTUNE (4.56%) / HTP (2.07%) / PSEG (48.51%) / RE (1.95%)	6/1/2018
b2971	Reconfigure Munster 345kV as ring bus	$7.00	NIPSCO	MISO (12.00%) / AEC (0.97%) / AEP (16.65%) / APS (4.94%) / ATSI (7.77%) / BGE (5.20%) / DAY (1.85%) / DEOK (2.29%) / Dominion (15.20%) / DPL (1.75%) / DLCO (1.43%) / EKPC (0.60%) / JCPL (2.16%) / ME (1.72%) / PECO (4.32%) / PENELEC (4.98%) / PEPCO (5.80%) / PPL (4.74%) / PSEG (5.08%) / RE (0.15%) / NEPTUNE (0.33%) / ECP (0.05%) / HTP (0.01%)	6/1/2020
b2972	Reconductor limiting span of Lallendorf - Monroe 345kV (crossing of Maumee river)	$1.00	ATSI	MISO (11.00%) / AEP (5.38%) / APS (4.27%) / ATSI (66.48%) / DAY (2.71%) / Dominion (5.31%) / DLCO (4.84%)	11/1/2019
b2973	Reconductor Michigan City - Bosserman 138kV	$4.60	NIPSCO	MISO (10.00%) / AEC (0.93%) / AEP (26.02%) / APS (4.19%) / ATSI (5.95%) / BGE (4.38%) / DAY (1.59%) / DEOK (2.30%) / Dominion (14.70%) / DPL (1.53%) / DLCO (1.26%) / EKPC (0.98%) / JCPL (1.92%) / ME (1.39%) / PECO (4.19%) / PENELEC (4.34%) / PEPCO (5.05%) / PPL (4.03%) / PSEG (4.48%) / RE (0.12%) / NEPTUNE (0.56%) / ECP (0.08%) / HTP (0.02%)	12/1/2019

Upgrade ID	Description	Cost Estimate ($M)	Trans Owner	Cost Responsibility	Required IS Date
b2974	Replace terminal equipment at Reynolds on the Reynolds - Magnetation 138kV	$0.15	NIPSCO	MISO (59.00%) / AEC (0.01%) / AEP (40.28%) / APS (0.13%) / ATSI (0.05%) / BGE (0.08%) / DAY (0.03%) / DPL (0.01%) / ME (0.04%) / PENELEC (0.06%) / PPL (0.21%) / PSEG (0.03%) NEPTUNE (0.04%) / HTP (0.04%)	6/1/2019
b2975	Reconductor Roxana - Praxair 138kV	$4.50	NIPSCO	MISO (76.00%) / AEC (0.28%) / AEP (4.51%) / APS (1.31%) / ATSI (1.91%) / BGE (1.40%) / DAY (0.49%) / DEOK (0.70%) / Dominion (4.35%) / DPL (0.46%) / DLCO (0.38%) / EKPC (0.27%) / JCPL (0.57%) / ME (0.43%) / PECO (1.25%) / PENELEC (1.34%) / PEPCO (1.53%) / PPL (1.23%) / PSEG (1.41%) / RE (0.04%) / NEPTUNE (0.14%) / ECP (0.01%) / HTP (0.01%)	6/1/2020

Queue Position	Path Name	Request Type	TO
AB2-019	Erie West 345kV	Merch. Trans.	PENELEC
AB2-021	Keeney-Rock Springs 500kV	Merch. Trans.	DPL

Queue Position	Path Name	Request Type	MWs
AB1-100	NYIS-PJM	Long-Term Firm	480
AB2-005	TVA-PJM	Long-Term Firm	148
AB2-007	NYISJK-PJM-NYISABC	Long-Term Firm	1000
AB2-013	AMIL-PJM	Long-Term Firm	150
AB2-075	DUK-PJM	Long-Term Firm	42
AB2-076	DUK-PJM	Long-Term Firm	51
AC1-002	AMIL-PJM	Long-Term Firm	550
AC1-004	AMIL-PJM	Long-Term Firm	300
AC1-056	PJM-AMIL	Long-Term Firm	100
AC1-057	PJM-MECS	Long-Term Firm	200
AC1-126	PJM-CPLE	Long-Term Firm	25
AC1-127	PJM-CPLE	Long-Term Firm	25
AC1-128	PJM-CPLE	Long-Term Firm	25
AC1-129	PJM-CPLE	Long-Term Firm	25
AC1-131	PJM-CPLE	Long-Term Firm	50
AC1-132	PJM-CPLE	Long-Term Firm	50
AC1-133	PJM-CPLE	Long-Term Firm	100
AD1-021	PJM-LINDENVFT	Long-Term Firm	330

Transmission Owner	Queue Position	Fuel Type	MW Capacity (FTIR/FTWR)	MW Energy (nFTIR/nFTWR)
AEP	AB1-087	Natural Gas	550	575
AEP	AB1-088	Natural Gas	550	575
AEP	AB2-016	Wind	13	100
AEP	AB2-028	Wind	26	200
AEP	AB2-065	Wind	16	124.2
AEP	AB2-067	Natural Gas	1100	1100
AEP	AB2-083	Solar	27.2	40
AEP	AB2-085	Solar	54.4	80
AEP	AB2-093	Natural Gas	485	485
AEP	AB2-103	Solar	27.2	40
AEC	AB2-049	Solar	3.8	10
AEC	AB2-102	Natural Gas	225	230

Transmission Owner	Queue Position	Fuel Type	MW Capacity (FTIR/FTWR)	MW Energy (nFTIR/nFTWR)
AEC	AB2-122	Solar	0.7	1.9
AEP	AB2-109	Hydro	4	12.5
AEP	AB2-145	Natural Gas	572	572
AEP	AB2-170	Solar	49.4	130
AEP	AC1-001	Solar	54.4	80
AEP	AC1-012	Solar	0	5
AEP	AC1-038	Natural Gas	13	13
AEP	AC1-040	Solar	57	150
AEP	AC1-044	Natural Gas	550	550
AEP	AC1-051	Wind	7.8	60
AEP	AC1-072	Natural Gas	20	20
AEP	AB2-109	Hydro	4	12.5
AEP	AB2-145	Natural Gas	572	572
AEP	AB2-170	Solar	49.4	130
AEP	AC1-001	Solar	54.4	80
AEP	AC1-012	Solar	0	5
AEP	AC1-038	Natural Gas	13	13
AEP	AC1-040	Solar	57	150
AEP	AC1-044	Natural Gas	550	550
AEP	AC1-051	Wind	7.8	60
AEP	AC1-072	Natural Gas	20	20
AEP	AC1-082	Solar	29	48
AEP	AC1-083	Solar	38	100
AEP	AC1-088	Storage	20	20
AEP	AC1-089	Solar	57	150
AEP	AC1-100	Natural Gas	27.4	100
AEP	AC1-101	Solar	19	50
AEP	AC1-102	Solar	19	50
AEP	AC1-103	Natural Gas	1026	1050
AEP	AC1-122	Solar	40.7	60
AEP	AC1-123	Solar	13.7	20
AEP	AC1-141	Natural Gas	91	91
AEP	AC1-144	Solar	57.2	85
AEP	AC1-152	Natural Gas	50	50
AEP	AC1-167	Solar	33.6	49.9
AEP	AC1-172	Natural Gas	50	50
AEP	AC1-173	Wind	9.9	75.9
AEP	AC1-174	Solar	38	100
AEP	AC1-175	Solar	38	100

Transmission Owner	Queue Position	Fuel Type	MW Capacity (FTIR/FTWR)	MW Energy (nFTIR/nFTWR)
AEP	AC1-176	Wind	7.6	58.7
AEP	AC1-188	Solar	46.6	70
AEP	AC1-194	Solar	47.5	125
AEP	AC1-210	Solar	31	45
AEP	AC2-038	Solar	12	20
AEP	AC2-080	Wind	26	200
AEP	AC2-123	Solar	44.6	75
APS	AB2-041	Wind	3.7	20
APS	AB2-104	Natural Gas	65	65
APS	AB2-129	Solar	30.4	80
APS	AC1-003	Natural Gas	80	80
APS	AC1-021	Natural Gas	0	110
APS	AC1-025	Storage	0	1.5
APS	AC1-055	Natural Gas	30	30
APS	AC1-073	Wind; Storage	5.8	16.3
APS	AC1-097	Natural Gas	1040	1140
APS	AC1-139	Solar	38.8	102
APS	AC1-140	Coal	10	10
APS	AC1-187	Wind	15	117
APS	AC1-211	Solar	48.1	70
APS	AC1-217	Solar	37.8	55
APS	AC2-142	Natural Gas	129.7	129.7
ATSI	AB1-107	Natural Gas	860	955
ATSI	AB2-131	Solar	57	150
ATSI	AC1-078	Solar	66	176
BGE	AC1-008	Nuclear	19.2	19.2
ComEd	AB1-089	Natural Gas	550	575
ComEd	AB1-090	Natural Gas	550	575
ComEd	AB1-091	Natural Gas	550	575
ComEd	AB1-122	Natural Gas	1150	1150
ComEd	AB2-047	Wind	32.5	250
ComEd	AB2-070	Wind	26	200
ComEd	AB2-096	Natural Gas	350	350
ComEd	AB2-132	Wind; Storage	2.2	2.5
ComEd	AB2-173	Natural Gas	28	16
ComEd	AB2-191	Wind	10.6	20
ComEd	AC1-033	Wind	13.1	100.8
ComEd	AC1-053	Wind	26	200
ComEd	AC1-067	Natural Gas	1092	1254

Transmission Owner	Queue Position	Fuel Type	MW Capacity (FTIR/FTWR)	MW Energy (nFTIR/nFTWR)
ComEd	AC1-109	Natural Gas	30	30
ComEd	AC1-110	Natural Gas	30	30
ComEd	AC1-111	Natural Gas	36	36
ComEd	AC1-113	Natural Gas	20	20
ComEd	AC1-114	Natural Gas	20	20
ComEd	AC1-142A	Natural Gas	64	64
ComEd	AC1-204	Natural Gas	1115.9	1200.9
ComEd	AC1-214	Wind	19	79.4
Dayton	AB1-169	Natural Gas	1100	1150
Dayton	AC1-068	Solar	34	49.9
Dayton	AC1-069	Solar	34	49.9
Dayton	AC1-085	Solar	152	400
Dayton	AC1-165	Solar	33.6	49.9
Dayton	AC1-166	Solar	33.6	49.9
Dayton	AC1-212	Storage	17	19.9
Dayton	AC2-020	Solar	7.6	20
Dayton	AC2-067	Solar	18.9	49.9
Dayton	AC2-068	Solar	7.6	20
Dayton	AC2-164	Solar	14.4	0
DEOK	AC1-182	Coal	20	20
DEOK	AC2-066	Solar	28.5	75
DEOK	AC2-085	Solar	10.8	20
DEOK	AC2-088	Solar	38.4	70
Dominion	AB2-015	Solar	50	91
Dominion	AB2-022	Solar	13	20
Dominion	AB2-031	Solar	13.4	20
Dominion	AB2-035	Solar	2.1	3
Dominion	AB2-040	Solar	44	80
Dominion	AB2-043	Solar	18.9	49.9
Dominion	AB2-050	Natural Gas	20	20
Dominion	AB2-051	Natural Gas	765.5	884.5
Dominion	AB2-059	Solar	66	100
Dominion	AB2-060	Solar	54.4	80
Dominion	AB2-062	Solar	0	20
Dominion	AB2-068	Natural Gas	1060	1060
Dominion	AB2-072	Solar	13.6	20
Dominion	AB2-077	Solar	12	20
Dominion	AB2-078	Solar	12	20
Dominion	AB2-079	Solar	12	20

Transmission Owner	Queue Position	Fuel Type	MW Capacity (FTIR/FTWR)	MW Energy (nFTIR/nFTWR)
Dominion	AB2-087	Solar	3.4	5
Dominion	AB2-088	Solar	2.7	4
Dominion	AB2-089	Solar	13.2	20
Dominion	AB2-090	Solar	23.8	36
Dominion	AB2-098	Solar	3.5	5
Dominion	AB2-099	Solar	3.5	5
Dominion	AB2-100	Solar	67	100
Dominion	AB2-134	Solar	71.8	142.4
Dominion	AB2-158	Solar	61	88.2
Dominion	AB2-160	Solar	30.4	80
Dominion	AB2-161	Solar	19	50
Dominion	AB2-169	Solar	39	74
Dominion	AB2-174	Solar	42	80
Dominion	AB2-176	Solar	9.8	14
Dominion	AB2-186	Solar	3.5	5
Dominion	AB2-188	Solar	14	20
Dominion	AB2-190	Solar	112	160
Dominion	AC1-034	Solar	42.75	75
Dominion	AC1-036	Solar	5.7	15
Dominion	AC1-042	Solar	15.96	42
Dominion	AC1-043	Solar	38	100
Dominion	AC1-054	Solar	44.5	65
Dominion	AC1-065	Solar	19	50
Dominion	AC1-070	Solar	13.3	20
Dominion	AC1-075	Solar	38.3	60
Dominion	AC1-076	Solar	23.8	62.5
Dominion	AC1-080	Solar	12.8	20
Dominion	AC1-086	Solar	123.7	180
Dominion	AC1-098	Solar	37.6	60
Dominion	AC1-099	Solar	12.6	20
Dominion	AC1-105	Solar	34.5	51
Dominion	AC1-107	Natural Gas	1600	1600
Dominion	AC1-115	Solar	5.7	14.9
Dominion	AC1-120	Solar	39.6	60
Dominion	AC1-121	Solar	13.6	20
Dominion	AC1-134	Natural Gas	50	0
Dominion	AC1-143	Solar	41.2	60
Dominion	AC1-145	Solar	19	50
Dominion	AC1-158	Solar	347.5	500

Transmission Owner	Queue Position	Fuel Type	MW Capacity (FTIR/FTWR)	MW Energy (nFTIR/nFTWR)
Dominion	AC1-161	Solar	168.2	240
Dominion	AC1-162	Solar	168.9	240
Dominion	AC1-163	Solar	11.54	16.94
Dominion	AC1-164	Solar	220.8	320
Dominion	AC1-189	Solar	53.4	80
Dominion	AC1-191	Solar	53.4	80
Dominion	AC1-206	Storage; Solar	57.72	85
Dominion	AC1-208	Solar	55.4	80
Dominion	AC1-216	Solar	54.8	97.9
Dominion	AC1-221	Solar	14.6	29.2
Dominion	AC1-222	Solar	22.9	44.7
Dominion	AC1-227	Wind	12	96.6
DPL	AB2-030	Storage	0	4
DPL	AB2-032	Solar	13.6	20
DPL	AB2-036	Solar	34.9	92
DPL	AB2-037	Solar	76.7	202
DPL	AB2-063	Solar	7.6	20
DPL	AB2-084	Solar	3.8	10
DPL	AB2-120	Solar	38	100
DPL	AB2-130	Solar	32.3	85
DPL	AB2-133	Solar	24.6	55.8
DPL	AB2-135	Solar	29.9	64
DPL	AB2-136	Solar	24.8	51.1
DPL	AB2-153	Solar	7.6	20
DPL	AB2-166	Solar	2	5.5
DPL	AB2-168	Solar	3.8	10
DPL	AB2-172	Solar	19	50
DPL	AB2-179	Solar	37.6	50
DPL	AB2-180	Solar	14	20
DPL	AB2-185	Solar	14	20
DPL	AC1-009	Solar	7.6	20
DPL	AC1-041	Solar	1.9	5
DPL	AC1-049	Solar	1.5	4
DPL	AC1-050	Solar	1.9	5
DPL	AC1-052	Solar	6.4	9
DPL	AC1-091	Solar	7.5	19.8
DPL	AC1-092	Solar	7.5	19.8
DPL	AC1-093	Solar	7.1	18.8
DPL	AC1-094	Solar	6	15.9

Transmission Owner	Queue Position	Fuel Type	MW Capacity (FTIR/FTWR)	MW Energy (nFTIR/nFTWR)
DPL	AC1-095	Solar	3.8	9.9
DPL	AC1-154	Solar	1.2	3.2
DPL	AC1-177	Biomass	4	4
DPL	AC1-190	Solar	35	50
DPL	AC1-213	Solar	3.2	5.3
DPL	AC1-220	Solar	15.5	26.5
DPL	AC1-228	Solar	1.1	3
DPL	AC1-229	Solar	3.8	10
DPL	AC2-018	Natural Gas	8	60
DPL	AC2-187	Solar	7.6	20
EKPC	AC1-074	Solar	56	80
ME	AB2-112	Natural Gas	35	35
ME	AC1-035	Natural Gas	30	30
ME	AC1-048	Solar	13.3	35
ME	AC2-053	Solar	7.6	20
ODEC	AB2-033	Solar	7.16	10
PECO	AB2-175	Nuclear	44	44
PENELEC	AC1-108	Natural Gas	100	50
PENELEC	AC1-186	Wind	17.9	138
PEPCO	AB2-157	Solar	0.8	2.5
PPL	AB2-074	Natural Gas	50	113
PPL	AC1-071	Wind	8.74	67.25
PPL	AC1-087	Solar	3.8	10
PPL	AC1-151	Solar	7.6	20
PPL	AC2-092	Natural Gas	65	55
PSEG	AB2-055	Natural Gas	1041.4	1041.4
PSEG	AB2-082	Natural Gas	671	675
PSEG	AB2-092	Natural Gas	51.1	51.1
SMECO	AC2-101	Solar	12.35	32.5

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n2115	Construct a new switching station (U4-028), including four 138 kV circuit breakers, relays, 138 kV revenue metering, SCADA, and associated equipment	ComEd	5.86	12/31/2018
n3666	Construct a new Iron Ridge 138kV Switching Station	AEP	5.4077	10/31/2019
n3666.1	Install ADSS Fiber at the new Iron Ridge 138kV substation	AEP	0.0546	10/31/2019
n3666.2	Construct Jubal Early – Austinville 138kV T-Line Cut In	AEP	1.8549	10/31/2019
n3666.3	Install 138 kV Revenue Metering at the new Iron Ridge 138kV substation	AEP	0.2006	10/31/2019
n4317.1	Install one 345 kV breaker at the Leroy Center 345 kV substation	PENELEC	1.193	12/31/2017
n4317.3	Build a new Leroy Center - Erie West 345 kV line	PENELEC	194.574	12/31/2017
n4318	Re-conductor Leroy Center - Spruce 138 kV line	PENELEC	8.8986	12/31/2017
n4319	Install a 50 MVAR capacitor bank at the Ashtabula 138 kV substation	PENELEC	1.0233	12/31/2017
n4320.1	Replace the line side disconnect risers and connectors, and revise relay settings as necessary, on the Butler line terminal at the Karns City 138 kV substation	PENELEC	0.0132	12/31/2017
n4320.2	Re-conductor the Karns City 138 kV line terminal at the Butler 138 kV substation including Wave Trap, line and bus side disconnects	PENELEC	0.0855	12/31/2017
n4320.3	Re-conductor 15.6 miles of Butler - Karns City 138 kV line	PENELEC	12.8429	12/31/2017
n4347.1	Replace 25kA E. Towanda 230kV Hillside breaker with 50kA	AEP	0.45	4/29/2019
n4347.2	Replace 25kA E. Towanda 230kV Moshannon breaker with 50kA	ComEd	0.45	4/29/2019
n4713.1	Sturgis - Howe 69kV T-Line Removal for the rebuild of the 2.83 miles of existing Howe – Sturgis 69 kV line (AEP Portion)	AEP	0.266	7/1/2019
n4713.2	Right Of Way for the rebuild of the 2.83 miles of existing Howe – Sturgis 69 kV line (AEP Portion)	AEP	2.382	7/1/2019
n4734	Upgrade 345kV switches at TSS 155 for L15502, upgrade station conductor and adjust CT ratios at the two station terminals	ComEd	0.35	6/1/2020

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n4742.1	Greentown - Dumont 765kV T-Line Circuit Cut-In for the new 765 kV switching Station	AEP	3.06	7/1/2019
n4742.2	Install 765 kV Metering at the new substation	AEP	1.284	7/1/2019
n4742.4	Install Telecommunications - Fiber Optic for the new substation	AEP	0.226	7/1/2019
N4747	Engineering Oversight to Construct New Interconnection Substation	AEP	1.02	10/1/2018
n4748	Transmission cut in work for TSS 971 Garden Prairie Road	AEP	1.635	10/1/2018
n4749	Upgrade relaying and communications equipment to coordinate with cut in of TSS 971 Garden Prairie Road	AEP	0.495	10/1/2018
n4750	Upgrade relaying and communications equipment to coordinate with cut in of TSS 971 Garden Prairie Road	AEP	0.495	10/1/2018
n4751	Engineering Oversight to Construct New Interconnection Substation	ComEd	1.12	10/1/2018
n4752	Transmission cut in work for TSS 96 King Creek	ComEd	1.435	10/1/2018
n4753	Upgrade relaying and communication equipment to coordinate with cut in of TSS 96 King Creek	ComEd	0.337	10/1/2018
n4754	Upgrade relaying and communication equipment to coordinate with cut in of TSS 96 King Creek	AEP	0.446	10/1/2018
n4755	Upgrade relaying and communication equipment to coordinate with cut in of TSS 96 King Creek	AEP	0.341	10/1/2018
n4773	Install three 345 kV breakers at Losantville substation to accommodate the connection for V3-007	AEP	2.6061	10/31/2017
n4774	Install 345 kV metering on the new line exit for the V3-007 connection	AEP	0.3477	10/31/2017
n4789	Description, cost, driver Changed on 10/18/17 per Ed	AEP	0.025	6/1/2019
n4790	Rebuild 9 miles of the AEP portion of the Stillwell – Dumont 345 kV line and upgrade necessary Dumont terminal equipment	AEP	20	6/1/2019
n4797	Add new 138 kV breaker and electrically re-route high side of Transformer #2 to the 138 kV East Bus at West Fremont substation	ComEd	0.5509	12/31/2018
n5008	Reconfigure the Kewanee 138 kV bus by	AEP	7.5	12/1/2016

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
	swapping the Bishop Hill & Edwards line terminals			
n5015	Replace disconnect switch, rebuild line & replace conductor for Church - New Meredith 69kV line	DPL	11.3	12/31/2022
n5019	Replace bushing for Easton 138/69kV transformer	DPL	0.08	12/31/2022
n5045	Construct a new switching station (Saxony) connecting to the East Leipsic – Richlands 138 kV line, including four (4) 138 kV circuit breakers, relays, SCADA, and associated equipment	AEP	4.29	12/1/2017
n5046	Install Saxony 138kV Primary and back-up 138 kV revenue metering	AEP	0.19	12/1/2017
n5047	Upgrade relaying at Yellow Creek substation	AEP	0.25	12/1/2017
n5048	Construct Saxony 138kV Line extension	AEP	7.24	12/1/2017
n5049	Relocate from its existing position, the portion of the existing East Leipsic - Richlands 138kV circuit that shares the 6 miles of double circuit towers with the E. Lima – E. Leipsic 138 kV circuit	AEP	0.83	12/1/2017
n5050	Upgrade relaying at East Lima 138 kV substation	AEP	0.12	12/1/2017
n5051	Upgrade relaying at East Leipsic 138 kV substation	AEP	0.38	12/1/2017
n5052	Upgrade relaying at Richland 138 kV substation	AEP	0.25	12/1/2017
n5053	Construct a new 138kV T-Line from Saxony to the existing East Leipsic – Richland line	AEP	0.15	12/1/2017
n5054	Relocate the existing East Leipsic-Yellow Creek T-Line exit at East Leipsic Station	ATSI	0.3	12/1/2017
n5055	Reconfigure the East Leipsic-East Lima 138kV circuit to provide a loop to East Leipsic and an extension to Yellow Creek	ATSI	0.11	12/1/2017
n5064	Re-conductor AEP end of Stillwell – Dumont 345 kV line with 1272 dual ACSR and upgrade the Dumont risers	AEP	2	5/1/2018
n5065	Re-conductor or rebuild the Eugene – Dequine 345 kV line and replace the Dequine riser	AEP	88.3	5/1/2018
n5067	Upgrade the line terminal equipment on the 115 kV to Mainesburg at the Mansfield substation	PENELEC	0.08	9/1/2019

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n5068	Replace Wave Trap on the 230 kV Hillside line exit	PENELEC	0.0085	9/1/2019
n5069	Replace South Homer City Transformer	PENELEC	14.7947	9/1/2019
n5086	Update relay settings on 345kV Mainesburg line terminal at Homer City substation	PENELEC	0.1073	9/1/2019
n5087	Update relay settings and re-tune carrier equipment on 345kV Homer City line terminal at Mainesburg substation	PENELEC	0.1073	9/1/2019
n5093	Construct new 69kV line along the Blooming Grove - West Damascus 69kV like to the AB2-012 Point of Interconnection	PPL	1.9	6/1/2018
n5094	Install new protection equipment in the existing Blooming Grove substation to support the AB2-012 connection	PPL	0.158	6/1/2018
n5095	Install new protection equipment in the existing Paupack substation to support the AB2-012 connection	PPL	0.158	6/1/2018
n5104	Adjust Remote Relay and Metering Settings at Tidd and Wylie Ridge substations	APS	0.1525	6/1/2020
n5105	Replace the two existing Wave Traps and potential transformers at the Rock Springs 500kV substation to increase their emergency rating from 2905 to 3014 MVA	DPL	0.42	6/1/2018
n5106	Rebuild the portions of 345 kV lines between the Benton Harbor and Segreto 345 kV substations	AEP	19	10/1/2016
n5108	Replace the Wayne Junction and Sexton Junction 25 kV circuit breakers at Franklin Substation	APS	0.71	10/31/2019
n5109	Expand the proposed in-line switching station identified as an attachment facility for PJM project W4-004 & W4-008. Add three (3) 138 kV circuit breakers. The expanded switching station will have a configuration of a breaker and one half bus arrangement. Associated disconnect switches, bus work, SCADA and 138 kV revenue metering will also be required	AEP	3.45	6/1/2019
n5110	Bring the Tanners Creek – Pendleton 138 kV circuit into the proposed W4-004 & W4-008 138 kV switching station which will require adding an additional string and three (3) new 138 kV circuit breakers, associated disconnect switches, bus work, SCADA and	AEP	3.45	6/1/2019

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
	138 kV revenue metering			
n5111	Install line protection and controls at the newly expanded 138 kV switching station	AEP	0.25	6/1/2019
n5112	Update relay settings at Madison 138 kV substation	AEP	0.05	6/1/2019
n5113	Update relay settings at Tanners Creek 138 kV substation	AEP	0.05	6/1/2019
n5114	Update line protection and controls at Pendleton 138 kV substation	AEP	0.2	6/1/2019
n5115	Build a new 230 kV line terminal at the Indian River 230 kV North Substation. The new terminal will be designed and constructed off an existing breaker and a half leg with Indian River AT22	DPL	1.3	3/1/2020
n5116	Build a new 230 kV line terminal at the Indian River 230 kV North Substation. This project will require the expansion of the substation to the northwest, the extension of the end buses, and the construction of a new breaker and a half leg to add one new terminal position	DPL	3.9	3/1/2020
n5117	Increase the emergency rating of the Milford to Steele 230 kV line by rebuilding the circuit, including the replacement of poles	DPL	43.9	3/1/2020
n5118	Reconfigure Price 69 kV Substation to be a 4 position ring bus (with provisions to add a 5th position). This will include adding 3 new 69 kV circuit breakers, disconnect switches, CVTs, line relays, breaker relays, and associated bus equipment and support	DPL	3.4	7/1/2017
n5119	Build a new 138 kV substation with a 3 position ring bus (with provisions to add a 4th position for PJM Queue Project AB2-032)	DPL	4.6	11/1/2017
n5128	Adjust remote end relaying and metering settings at Potter and Niles Valley 115kV Substations	PENELEC	0.0127	12/1/2017
n5130	Adjust remote end relaying and metering settings at Highland, Mansfield, and Sammis 345kV Substations	ATSI	0.0133	5/1/2018
n5133	Build new 69kV transmission line from the Bear Creek tap to the Point of	PPL	0.754	12/31/2016

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
	Interconnection			
n5134	Modify existing protection and communication to accommodate the new AB1-182 interconnection	PPL	0.25	12/31/2016
n5136	Replace the Beatty road line riser section (sub cond 2-1024.5 ACAR) to increase the ratings on the Adkins – Beatty 345 kV line	Dayton	0.1	6/1/2017
n5144	Upgrade L10805 Kendall - Lockport 345 kV line conductor	ComEd	18.2	6/30/2019
n5145	Reconfigure Wilton 765kV bus thereby allowing for 765kV L11216 (currently on Bus 6) to be relocated to Bus 8. Along with this line relocation, installation of 2-765kV BT CB's (6-8 & 8-2)	ComEd	11	6/30/2019
n5146	Install line riser and connection hardware to accept the Interconnection Customer 2156 ACSS Bluebird conductor terminating at Gilbert 230kV substation	JCPL	1.45	6/1/2020
n5147	Build new 0.05 mile interconnection of AB1-154 to accommodate reconstruction of the Gilbert 230kV yard as breaker and a half configuration	JCPL	0.943	6/1/2020
n5148	Install two line terminal breakers, risers, necessary disconnects and controls for the AB1-154 terminal at Gilbert 230kV substation	JCPL	5.171	6/1/2020
n5149	Install fiber optic cable from Gilbert 230kV to the AB1-154 generator	JCPL	0.0197	6/1/2020
n5150	Reconstruct Gilbert 230kV yard as a breaker and a half layout	JCPL	12.155	6/1/2020
n5150.1	Replace Gilbert 230 kV breaker A13 with a 63 kA breaker. Note: the cost of the replacement is lumped in the n5150 Network upgrade	JCPL	0	6/1/2020
n5150.2	Replace Gilbert 230 kV breaker PV with a 63 kA breaker. Note: the cost of the replacement is lumped in the n5150 Network upgrade	JCPL	0	6/1/2020
n5150.3	Replace Gilbert 230 kV breaker C11 with a 63 kA breaker. Note: the cost of the replacement is lumped in the n5150 Network upgrade	JCPL	0	6/1/2020

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n5150.4	Replace Gilbert 230 kV breaker 13P with a 63 kA breaker. Note: the cost of the replacement is lumped in the n5150 Network upgrade	JCPL	0	6/1/2020
n5150.5	Replace Gilbert 230 kV breaker VC with a 63 kA breaker. Note: the cost of the replacement is lumped in the n5150 Network upgrade	JCPL	0	6/1/2020
n5150.6	Replace Gilbert 230 kV breaker 1216 with a 63 kA breaker. Note: the cost of the replacement is lumped in the n5150 Network upgrade. Note: the cost of the replacement is lumped in the n5150 Network upgrade	JCPL	0	6/1/2020
n5151	Reconfigure the existing Gilbert - Martins Creek 230kV line (P2016) transmission exit from Gilbert to accommodate the Gilbert substation rebuild	JCPL	0.898	6/1/2020
n5152	Reconfigure the existing Gilbert - Glen Gardner 230kV line (V1036) transmission exit from Gilbert to accommodate the Gilbert substation rebuild	JCPL	0.931	6/1/2020
n5153	Reconfigure the existing Gilbert - Morristown 230kV line (V1036) transmission exit from Gilbert to accommodate the Gilbert substation rebuild	JCPL	0.918	6/1/2020
n5154	Reconfigure the existing Gilbert - PPL Springfield 230kV line (A1015) transmission exit from Gilbert to accommodate the Gilbert substation rebuild	JCPL	1.42	6/1/2020
n5155	Rebuild existing Gilbert - Bank 16 230kV transmission line at Gilbert to accommodate the Gilbert substation rebuild	JCPL	1.131	6/1/2020
n5156	Rebuild existing Gilbert - Bank 13 230kV transmission line at Gilbert to accommodate the Gilbert substation rebuild	JCPL	0.752	6/1/2020
n5157	Reconfigure the existing Gilbert – Flanders – Gilbert – Pequest River 115kV transmission line near the Gilbert substation to accommodate the Gilbert substation rebuild	JCPL	0.76	6/1/2020
n5158	Reconfigure the existing Gilbert JC - Raubsville ME 34.5kV transmission line near the Gilbert substation to accommodate the Gilbert substation rebuild	JCPL	0.417	6/1/2020

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n5159	Reconfigure the existing Gilbert - Bank 11 34.5kV transmission line near the Gilbert substation to accommodate the Gilbert substation rebuild	JCPL	0.245	6/1/2020
n5160	Upgrade Gilbert - Morris Park relaying at Morris Park substation	JCPL	0.465	6/1/2020
n5161	Upgrade Gilbert - Morristown relaying at Morristown substation	JCPL	0.352	6/1/2020
n5162	Upgrade Gilbert - Glen Gardener relaying at Glen Gardener substation	JCPL	0.449	6/1/2020
n5163	Upgrade Gilbert-Springfield relaying at Springfield substation	JCPL	0.479	6/1/2020
n5164	Install fiber optic cable from Gilbert transformer 11 low side to Gilbert, from Gilbert 230kV to the Bank 13, and from Gilbert 230kV to the CT9	JCPL	0.0814	6/1/2020
n5165	Re-conductor 11.9 miles of Gilbert - Springfield 230kV circuit replacing 1590 ACSR with 1590 ACSS	JCPL	15.325	6/1/2020
n5166	Re-conductor approximately 1700 feet of transmission three-phase 1590 ACSR with 1590 ACSS. Re-conductor approximately 50 feet of substation deadend downcomer three-phase 1590 ACSR with 1590 ACSS	JCPL	0.5	6/1/2020
n5170	Tap Juniata - Alburtis 500 kV line to create a new DAUP 500kV station, and build 500kV line from Sunberry 500kV station to the new DAUP 500kV station	PPL	200	9/30/2019
n5171.1	Replace Gang operated circuit breaker at Kewanee TSS 138 kV bus 2 (circuit 7411) with Independent Pole Operated breaker	ComEd	0.126	12/31/2018
n5171.2	Replace Gang operated circuit breaker at Kewanee TSS 138 kV bus 1 with Independent Pole Operated breaker	ComEd	0.126	12/31/2018
n5171.3	Replace Gang operated circuit breaker at Kewanee TSS 138 kV bus 1 (circuit 7423) with Independent Pole Operated breaker	ComEd	0.126	12/31/2018
n5171.4	Replace Gang operated circuit breaker at Kewanee TSS 138 kV bus 1 (circuit 7421) with Independent Pole Operated breaker	ComEd	0.126	12/31/2018
n5171.5	Replace Gang operated circuit breaker at Kewanee TSS 138 kV bus 2 (circuit 6101) with Independent Pole Operated breaker	ComEd	0.126	12/31/2018

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n5171.6	Replace Gang operated circuit breaker at Kewanee TSS 138 kV bus 1 (circuit 7413) with Independent Pole Operated breaker	ComEd	0.126	12/31/2018
n5173	Replace dual primary relaying at U4-027 138 kV substation	ComEd	1	12/31/2018
n5174	Install new 230kV series reactor and required associated substation equipment at Erie East substation	PPL	10	1/31/2019
n5175	Upgrade substation equipment to add a fourth ring bus position at Mackeys substation	Dominion	1.5	11/15/2017
n5178.1	Replacement of 345kV breaker at Sta 6 Byron BT5-6 with 2-cycle IPO breaker	ComEd	3	6/1/2019
n5178.2	Replacement of 345kV breaker at Sta 6 Byron BT4-5 with 2-cycle IPO breaker	ComEd	3	6/1/2019
n5178.3	Replacement of 345kV breaker at Sta 6 Byron BT11-12 with 2-cycle IPO breaker	ComEd	3	6/1/2019
n5178.4	Replacement of 345kV breaker at Sta 6 Byron BT12-13 with 2-cycle IPO breaker	ComEd	3	6/1/2019
n5179	Installation of about 50 miles of 345kV line from AB1-089/AB1-090 to Wayne	ComEd	100	6/1/2019
n5179.1	Installation of 2-345kV breakers at Wayne and 3-345kV breakers at AB1-089/AB1-090 terminal station	ComEd	15	6/1/2019
n5191	Build a three breaker ring bus at Occoneechee 115kV substation	Dominion	5.56544	1/1/2019
n5192	Install transmission structures on the Carolina – Jackson DP 115 kV line to split the existing line and connect new substation	Dominion	0.49715	1/1/2019
n5193	Upgrade relaying on the Carolina – Earleys 115 kV line to accommodate new generation and interconnection substation	Dominion	0.10288	1/1/2019
n5194.1	Replace 345kV Circuit Breaker with a 80kA Breaker B5213(GEN B) at Sammis substation	ATSI	0.765	10/20/2017
n5194.10	Replace 345kV Circuit Breaker with a 80kA Breaker HIL-W.B(B280) at Sammis substation	ATSI	0.765	10/20/2017
n5194.11	Replace 345kV Circuit Breaker with a 80kA Breaker HL-GEN3(B278) at Sammis substation	ATSI	0.765	10/20/2017
n5194.12	Replace 345kV Circuit Breaker with a 80kA Breaker S.CAN-W(B290) at Sammis substation	ATSI	0.765	10/20/2017
n5194.13	Replace 345kV Circuit Breaker with a 80kA Breaker SN-GEN5(B287) at Sammis	ATSI	0.765	10/20/2017

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
	substation			
n5194.14	Replace 345kV Circuit Breaker with a 80kA Breaker SR-W.BUS(B17) at Sammis substation	ATSI	0.765	10/20/2017
n5194.15	Replace 345kV Circuit Breaker with a 80kA Breaker STRGEN.4(B14) at Sammis substation	ATSI	0.765	10/20/2017
n5194.16	Replace 345kV Circuit Breaker with a 80kA Breaker TR-GEN6(B295) at Sammis substation	ATSI	0.765	10/20/2017
n5194.17	Replace 345kV Circuit Breaker with a 80kA Breaker TRW.BUS(B298) at Sammis substation	ATSI	0.765	10/20/2017
n5194.2	Replace 345kV Circuit Breaker with a 80kA BreakerB5218(GEN B) at Sammis substation	ATSI	0.765	10/20/2017
n5194.3	Replace 345kV Circuit Breaker with a 80kA Breaker BVR VLY(B456) at Sammis substation	ATSI	0.765	10/20/2017
n5194.4	Replace 345kV Circuit Breaker with a 80kA Breaker BVR VLY(B459) at Sammis substation	ATSI	0.765	10/20/2017
n5194.5	Replace 345kV Circuit Breaker with a 80kA Breaker GEN.3-E(B279) at Sammis substation	ATSI	0.765	10/20/2017
n5194.6	Replace 345kV Circuit Breaker with a 80kA Breaker GEN.4-E.(B11) at Sammis substation	ATSI	0.765	10/20/2017
n5194.7	Replace 345kV Circuit Breaker with a 80kA Breaker GEN.5-E(B284) at Sammis substation	ATSI	0.765	10/20/2017
n5194.8	Replace 345kV Circuit Breaker with a 80kA Breaker GEN.6-E.B(B5) at Sammis substation	ATSI	0.765	10/20/2017
n5194.9	Replace 345kV Circuit Breaker with a 80kA Breaker GEN.7-E(B453) at Sammis substation	ATSI	0.765	10/20/2017
n5195	Replace 138kV Circuit Breakers B16, B6, and B65 at Evergreen substation	ATSI	0.76	10/20/2017
n5196	Install a new AB1-105 Interconnection substation, 345kV 3-breaker ring bus along the Hannah-Highland line	ATSI	8.7236	10/20/2017
n5197	Loop the Hanna-Highland 345kV circuit into the new 345kV ring bus approximately 1.3 circuit miles southwest of Highland substation to create a new circuit from Highland substation to the new ring bus	ATSI	0.6839	10/20/2017
n5198	Loop the Hanna-Highland 345kV circuit into the new 345kV ring bus approximately 1.3 circuit miles southwest of Highland substation to create a new circuit from Hanna substation to the new ring bus	ATSI	0.6709	10/20/2017

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n5199	Install new line relaying for future AB1-105 Interconnect line exit at Highland substation	ATSI	0.1609	10/20/2017
n5200	Install new communications equipment at existing Hanna substation for the future AB1-105 Interconnect and install new line relaying panel	ATSI	0.2241	10/20/2017
n5201	Install Fiber Optic Cable from the AB1-105 Interconnection to the Highland substations and back, approximately 2.9 miles each way	ATSI	0.5055	10/20/2017
n5205	Loop existing Harrison-Wylie Ridge 500 kV transmission line into proposed Strope Road substation, approximately one span (at Strope Road Loop, Harrison-Wylie Ridge 500 kV line).	APS	2.3293	7/1/2019
n5206	Replace 6 345 kV breakers with 3000A, 63 kA breakers at Wylie Ridge substation. Estimate assumes foundations, risers, and control cables will be replaced. Rewire 345 kV line transducers	APS	4.6006	7/1/2019
n5207	Upgrade line relaying on 500 kV Strope Road (former Harrison line) at Wylie Ridge Substation	APS	0.4181	7/1/2019
n5208	Upgrade line relaying on 500 kV Strope Road (former Wylie Ridge) line at Harrison Substation	APS	0.4181	7/1/2019
n5209	Install Relay for breaker failure lockout trip at South Justice substation	Dominion	0.04858	6/1/2018
n5210.1	Tap the existing new Orchard – Cardiff 230kV line to install a 230kV 4 position ring bus at Minotola substation, with 4-230 kV breakers	AEC	11.2	6/1/2020
n5210.2	Install 1-138kV breaker and 1-230/138kV transformer at Minotola Substation	AEC	5.284	6/1/2020
n5210.3	Install 1-138kV breaker and 1-230/138kV transformer at Minotola Substation	AEC	5.284	6/1/2020
n5211	Install new 345 kV bay including 2 circuit breakers at Stuart 345 kV substation	Dayton	2.5	6/1/2020
n5212	Add three new 500 kV breakers and associated equipment to the existing Chickahominy 500 kV substation	Dominion	6.5	3/31/2020
n5215	Adjust remote end relaying and metering settings at Greencastle 34.5 kV substation	APS	0.0127	9/30/2017
n5216	Modify relay settings for AC1-039 interconnection at Catoctin substation	APS	0.0068	10/31/2018

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n5217	Modify relay settings for AC1-039 interconnection at Monocacy substation	APS	0.0068	10/31/2018
n5218	Adjust remote end relaying and metering settings at North Longview 500 kV substation	APS	0.0127	12/31/2017
n5226	Tap the Morris Park '27051' 12 kV distribution circuit to the AC1-018 POI with a new tap pole and 100K fuses. Install metering CTs and PTs.	JCPL	0.0865	7/1/2019
n5231	Tap the Englishtown-Monroe (H-34) 34.5 kV line to the AC1-207 POI through one (1) new SCADA-controlled switch	JCPL	0.1116	7/2/2018
n5232	Install two (2) new SCADA-controlled switches on new poles in the Englishtown - Monroe (H-34) 34.5 kV line on either side of the tap point to the AC1-207 Customer	JCPL	0.223	7/2/2018
n5233	Adjust remote relay settings on the H-34 terminal at Englishtown Substation	JCPL	0.0163	7/2/2018
n5234	Adjust remote relay settings on the H-34 terminal at Monroe Substation	JCPL	0.0163	7/2/2018
n5235	Install Line Terminal for Attachment Line for AA2-077 at Penrose substation	PECO	1.5	5/1/2018
n5236	Modify relays for AA2-077 at Penrose substation	PECO	0.25	5/1/2018
n5237	Replace #115 Circuit Breaker at Grays Ferry substation	PECO	0.5	5/1/2018
n5238	Replace 138kV Circuit Breaker B16 at Crossland Substation	ATSI	0.2085	3/30/2020
n5239	Adjust remote end relaying and metering settings at Yukon and Hatfield substations	APS	0.0127	1/1/2019
n5240	Perform a sag study on the Twin – Argenta 345 kV line to determine if the line section can be operated above its emergency rating of 1409 MVA	AEP	0.2	6/1/2020
n5241	Replace (78-B-1-J) 138kV overdutied breakers, bus work, and ground grid with 145kV 80kA breakers at Bayshore substation	ATSI	0.8586	10/20/2017
n5242	Replace (78-B-1-K) 138kV overdutied breakers, bus work, and ground grid with 145kV 80kA breakers at Bayshore substation	ATSI	0.8586	10/20/2017
n5243	Replace (78-B-13103) 138kV overdutied breakers, bus work, and ground grid with 145kV 80kA breakers at Bayshore substation	ATSI	0.8586	10/20/2017

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n5244	Replace (78-B-13104) 138kV overdutied breakers, bus work, and ground grid with 145kV 80kA breakers at Bayshore substation	ATSI	0.8586	10/20/2017
n5245	Replace (78-B-13252) 138kV overdutied breakers, bus work, and ground grid with 145kV 80kA breakers at Bayshore substation	ATSI	0.8586	10/20/2017
n5246	Replace (78-B-13253) 138kV overdutied breakers, bus work, and ground grid with 145kV 80kA breakers at Bayshore substation	ATSI	0.8586	10/20/2017
n5247	Replace (78-B-13254) 138kV overdutied breakers, bus work, and ground grid with 145kV 80kA breakers at Bayshore substation	ATSI	0.8586	10/20/2017
n5248	Replace (78-B-1-J) 138kV overdutied breakers, bus work, and ground grid with 145kV 80kA breakers at Bayshore substation	ATSI	0.8586	10/20/2017
n5249	Replace (78-B-2-K) 138kV overdutied breakers, bus work, and ground grid with 145kV 80kA breakers at Bayshore substation	ATSI	0.8586	10/20/2017
n5250	Install a line tap from Catoctin – Monocacy 34.5 kV line to the Point of Interconnection including the installation of two (2) fully rated load-breaker air switches at the tap point and meter equipment inside the Interconnection Customer facilities	APS	0.12	10/31/2018
n5251	Re-conductor 0.8 miles of the Casey - Breed 345 kV line	AEP	0.0007	7/1/2017
n5252	Mitigate the sag on the Wilton - Dumont 765 kV line L11215 to achieve an ALDR that exceeds 6166 MVA	ComEd	9	6/1/2020
n5253	Re-conductor the ComEd portion of Crete - St John 345 kV line	ComEd	18	6/1/2020
n5254	Re-conductor the Lee County - Byron 345 kV line	ComEd	6	10/1/2017
n5255	Adjust Remote Relay and Metering Settings at the Wylie Ridge 345 kV substation	APS	0.0061	6/1/2020
n5257	Install new transmission structures, as well as 2 switches and one Wave Trap at the new Meherrin substation	Dominion	0.7	3/31/2018
n5258	Install 138kV three breaker ring bus connector station for new customer generation addition along the Galion-Roberts South 138kV line	ATSI	5.148	6/1/2019

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n5259	Loop the Galion-Roberts South 138kV circuit into the proposed 3-breaker ring bus near tower #3801 at Galion-Roberts South 138kV Loop	ATSI	0.489	6/1/2019
n5260	Upgrade line relaying for Roberts 138kV line exit and rename for new AB2-131 PJM station at Galion substation	ATSI	0.178	6/1/2019
n5261	Upgrade line relaying for Galion 138kV line exit and rename for new AB2-131 PJM station at Roberts substation	ATSI	0.178	6/1/2019
n5262	Install new ADSS fiber build from the proposed ring bus to both Galion and Roberts substations	ATSI	2.618	6/1/2019
n5263	Rebuild Linden - Tosco 3 230 kV line with paired 795 ACSS	PSEG	13.65	6/1/2021
n5264	Rebuild TOSCO_2 - VFT 2 230 kV line with paired 1033 ACSS	PSEG	7.5	6/1/2021
n5265	Rebuild VFT 1 - WARINICO_1 230 kV line with paired 795 ACSS	PSEG	38.925	6/1/2021
n5266	Install a new GIS Breaker on the spare bay position and associated GIS / AIS bus work, UG cable, relaying, metering at the Bayonne 345kV substation	PSEG	18.9	6/1/2021
n5268	Rebuild SEWAREN-MINUEST_R 230 kV line with paired 795 ACSS	PSEG	30.844	6/1/2019
n5269	Wreck & Rebuild MINUEST_R - LINDEN 230 kV line with paired 795 ACSS	PSEG	34.781	6/1/2019
n5270	Rebuild WARINICO_2 - ALDENE_4 230 kV line with 1590 ACSS	PSEG	8.594	6/1/2019
n5271	Rebuild METUCHEN - NEWDOVR_H 230 kV line with paired 795 ACSS	PSEG	51.858	6/1/2019
n5272	Rebuild NEWDOVR_H - FANWOOD_1 230 kV line with paired 795 ACSS	PSEG	47.869	6/1/2019
n5273	Expand the existing substation yard and Install a new breaker position and associated fencing, ground grid, dead end structures, bus work, switches, relaying, and metering at the Metuchen 230 KV substation	PSEG	10.349	6/1/2019
n5286	Construct a 138kV three breaker ring bus at AB1-107 GT-1 substation, interconnect	ATSI	5.217	10/20/2017

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
	substation on the Bayshore-GM Powertrain line			
n5287	Loop the Oregon Generation facility GT-1 to the Bayshore - GM Powertrain 138kV line at Bayshore - GM Powertrain 138kV - Loop to Interconnection Station for Oregon Gen GT-1_AB1-107	ATSI	2.26	10/20/2017
n5288	Provide a single span tap from Lallendorf substation ring bus to Oregon Generation facility Steam Turbine at Lallendorf Tap for Oregon Gen Steam Turbine_AB1-107	ATSI	0.34	10/20/2017
n5289	Replace line relaying on the Bayshore (AB1-1007 GT-1) 138kV Line at the GM Powertrain substation	ATSI	0.208	10/20/2017
n5290	Upgrade 138kV line relaying to GM Powertrain (AB1-107 GT-1) 138kV Line at Bayshore substation	ATSI	0.203	10/20/2017
n5291	Interconnection (GT-1) to Bayshore and GM Powertrain substations. Install Fiber Optic Cable from Interconnection (GT-1) to Bayshore substations and back, approximately 1.8 miles. Install Fiber Optic Cable from Interconnection (GT-1) to GM Powertrain substations	ATSI	1.048	10/20/2017
n5292	Install a 345kV Breaker and Line terminal for the AB1-107 ST, GT2 Interconnection at Lallendorf substation	ATSI	1.699	10/20/2017
n5293	Install new relaying on Ottawa line at Greenfield substation	ATSI	0.245	10/20/2017
n5294	Install new breaker bay and line exit to Greenfield at Ottawa substation	ATSI	1.58	10/20/2017
n5295	Engineering and Construction Oversight at TSS 92 McLean substation	ComEd	1.36	12/1/2018
n5296	Transmission Line Cut In and Turning Structures at TSS 92 McLean substation	ComEd	3.2	12/1/2018
n5297	Upgrade Relay, Protection, and Communication equipment at TSS80 Pontiac substation	ComEd	0.22	12/1/2018
n5298	Upgrade Relay, Protection, and	ComEd	0.025	12/1/2018

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
	Communication equipment at RP4 Brokaw substation			
n5299	Build a new 138 kV terminal off of the new 138 kV substation created for PJM Queue Project AB1-141	DPL	1	11/1/2017
n5300	Rebuild a small section of the Middletown Tap – Mt. Pleasant 138 kV circuit, install new poles, and re-mount the 138 kV disconnect switches	DPL	0.0008	11/1/2017
n5301	Rebuild a small section of the Townsend - Middletown Tap 138 kV circuit, install new poles, and re-mount the 138 kV disconnect switches	DPL	0.0008	11/1/2017
n5302	Mitigate sag limits on the Wayne – Tollway ; B 345 kV line	ComEd	3	6/1/2018
n5303	Rebuild/Re-conductor 40.61 miles of the AEP owned section of the Olive - University Park 345 kV ACSR/PE 1414 62/19 line section 1 and replace Olive switches and riser	ComEd	82.6	6/1/2020
n5304	Re-conductor 0.08 miles of the ACSR 1590 (54/19) Falcon conductor section 2, replace the George Washington Wave Trap (2000 A) and replace the Kammer Wave Trap (2000 A)	AEP	0.3	2/15/2020
n5305	Replace (78-B-3-J) 138kV overdutied breakers, bus work, and ground grid with 145kV 80kA breakers at Bayshore substation	ATSI	0.8586	10/20/2017
n5306	Replace (78-B-3-K) 138kV overdutied breakers, bus work, and ground grid with 145kV 80kA breakers at Bayshore substation	ATSI	0.8586	10/20/2017
n5307	Replace (78-B-J_L) 138kV overdutied breakers, bus work, and ground grid with 145kV 80kA breakers at Bayshore substation	ATSI	0.8586	10/20/2017
n5308	Replace (78-B-13251) 138kV overdutied breakers, bus work, and ground grid with 145kV 80kA breakers at Bayshore	ATSI	0.8586	10/20/2017

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
	substation			
n5309	Replace (78-B-13261) 138kV overdutied breakers, bus work, and ground grid with 145kV 80kA breakers at Bayshore substation	ATSI	0.8586	10/20/2017
n5310.1	Replace Wave Trap at the Twin Branch substation	AEP	0.4	12/1/2016
n5310.2	Replace substation structure at Argenta substation to accommodate larger wire	AEP	0.5	12/1/2016
n5311	Rebuild or Re-conductor approximately 30 miles of the Cook – T-094 (Segreto) 345 kV line	AEP	60	12/1/2016
n5312.1	Replace the Benton 345 kV H Wave Trap	AEP	0.4	6/1/2018
n5312.2	Replace the Benton 345 kV H Line Riser	AEP	0.2	6/1/2018
n5313	Upgrade the Monroe – Lallendorf 345 kV line span over the Maumee River	ATSI	1	6/1/2018
n5315	Re-conductor the Cherry Valley – Garden Prairie 345 kV line and upgrade terminal equipment at both ends	ComEd	50	6/1/2019
n5316	Re-conductor the Cordova - Nelson 345 kV line and replace station conductor at Cordova	ComEd	20.2	9/1/2015
n5317	Re-conductor the E. Frankfort – Crete 345 kV line	ComEd	10	7/1/2019
n5318	Re-conductor the Garden Prairie – Silver Lake 345 kV line and station conductor at both terminals	ComEd	50	6/1/2019
n5319	Re-conductor the Nelson – Lee County 345 kV line and upgrade station conductor, 2-345kV Bus Tie Circuit Breakers, and disconnect switches at Nelson	ComEd	15	1/9/2017
n5320	Re-conductor the Pontiac - Dresden 345 kV line	ComEd	22	9/1/2017
n5321	Re-conductor the Quad Cities – ESS H471 345 kV line and upgrade station conductor at Sterling Steel and Quad Cities	ComEd	20.2	9/1/2015
n5322	Re-conductor the ESS H471 - Nelson 345	ComEd	20.2	7/1/2019

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
	kV line and upgrade station conductor			
n5323	Re-conductor the Lee County – Byron 345 kV line, upgrade station conductor, and replace bus disconnect switches at Byron	ComEd	6.5	9/1/2018
n5324	Re-conductor the AB1-122 Tap – Dresden 345 kV line	ComEd	20	6/1/2020
n5325	Upgrade remote-end protection, communications & metering equipment at Tidd 345kV substation	APS	0.45	6/1/2020
n5326	Build a 2nd Nelson - Electric Junction 345 kV line	ComEd	300	9/15/2018
n5327	Construct a new nine (9) circuit breaker 138 kV switching station physically configured in a breaker and half bus arrangement at or near the existing Ormet 138 kV station site	AEP	13	2/15/2020
n5328	Install associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering at the new switching station	AEP	2	2/15/2020
n5329	Install revenue metering at the new switching station	AEP	0.15	2/15/2020
n5330	Retire existing Ormet 138 kV Substation	AEP	2	2/15/2020
n5331	Upgrade line protection and controls at the Kammer 138 kV substation to coordinate with the new 138 kV switching station	AEP	0.5	2/15/2020
n5332	Install Primary and Backup RFL Relays on the 372 34.5 kV Circuit at the North Wales substation	PECO	0.35	6/1/2019
n5333	Replace relaying on the Coneville 46kV line terminal at Potter Substation and install anti-islanding scheme including fiber communication cable	APS	0.1489	9/30/2019
n5334	Modify remote end relaying to reflect the added 40 MW of Energy at Elderberry 345 kV substation	AEP	0.025	6/1/2018
n5335	Re-conductor Cherry Valley - Garden PR 345 kV line	AEP	25	6/1/2021

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n5336	Re-conductor Garden PR - Silver Lake 345 kV line	AEP	25	6/1/2021
n5337	Rebuild 8.3 miles of Burroak – Plymouth 138 kV line	AEP	10.4	6/1/2021
n5338	Replace Circuit Breaker 7-8 and Circuit Breaker 8-9 at Nelson 345 kV substation	AEP	6	6/1/2021
n5339	Rebuild Eugene - Cayuga complete line with steel structures and larger conductor -(2)1272ACSR45X7: 3028A rating @ 100C	AEP	18.6	6/1/2021
n5340	Six Wire the Kyger - Sporn 345 kV No 1 and No 2 Circuits together	AEP	0.3	6/1/2021
n5341	Mitigate sag limits on 345 kV line 11212 from Loretto - Wilton Center	AEP	30	6/1/2021
n5342	Re-conductor of Michigan City - Bosserman 138 kV line to 397 ACSS. Michigan City to Laporte is now Michigan City to Bosserman	AEP	0.5	6/1/2021
n5343	Rebuild 24 miles of 138 kV line from Monticello – Winamac	AEP	3	6/1/2021
n5344	Replace two MODs at Electric Junction	AEP	5	6/1/2021
n5345	Replace terminal equipment at Pierce-Foster 345 kV line	AEP	0.25	6/1/2021
n5346	Mitigate sag on the Pontiac – Loretto 345 kV line	AEP	12	6/1/2021
n5347	Replace line riser at Muskingum 345 kV substation	AEP	0.2	6/1/2021
n5348	Re-conductor Lee - Byron 345 kV line	AEP	0.4	6/1/2021
n5349	Upgrade station conductor at ESS H471 on L0404	AEP	57.5	6/1/2021
n5350.1	Replace the Wave Trap (3000A) at Eugene substation	AEP	0.4	6/1/2021
n5350.2	Build a new 345 kV line from Bunsonville – Eugene substations	AEP	57.5	6/1/2021
n5351	Install substation relay for transfer trip from Carolina and Palmer Springs substations	Dominion	0.1791	8/31/2018
n5352	Construct a new three (3) circuit breaker 765 kV switching station physically configured in a breaker and half bus	AEP	25	6/1/2020

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
	arrangement but operated as a ring-bus to accommodate the interconnection on the Kammer – Vassell 765 kV circuit			
n5352	Construct a new three (3) circuit breaker 765 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus to accommodate the interconnection on the Kammer – Vassell 765 kV circuit	AEP	25	6/1/2020
n5353	Install 765 kV Revenue Metering at the new 765 kV switching station	AEP	0.465	6/1/2020
n5353	Install 765 kV Revenue Metering at the new 765 kV switching station	AEP	0.465	6/1/2020
n5354	Install line protection and controls at the new 765 kV switching station	AEP	1	6/1/2020
n5354	Install line protection and controls at the new 765 kV switching station	AEP	1	6/1/2020
n5355	Kammer – Vassell 765 kV T-Line Cut In for the new 765 kV switching Station	AEP	3.1	6/1/2020
n5355	Kammer – Vassell 765 kV T-Line Cut In for the new 765 kV switching Station	AEP	3.1	6/1/2020
n5356	Upgrade line protection and controls at the Kammer 138 kV substation to coordinate with the new 138 kV switching station	AEP	0.6	6/1/2020
n5357	Upgrade line protection and controls at the Vassell 765 kV substation to coordinate with the new 765 kV switching station	AEP	0.6	6/1/2020
n5358	Re-conductor 28 miles of 345kV Wempletown - Byron line and upgrade Substation Conductor at both Wempletown and Byron substations	ComEd	56.1	6/1/2016
n5359	Re-conductor 40.5 miles of 345kV Silver lake – Garden Prairie (U3-021) line and upgrade Substation Conductor at Silver Lake substation	ComEd	54.1	6/1/2016
n5360	Re-conductor 13.8 miles of 345kV Cherry Valley – Garden Prairie (U3-021) line	ComEd	27	6/1/2016

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n5361	Re-conductor 2.8 miles of 138kV of Nelson - Rock Falls; and upgrade Substation Conductor at Nelson substation	ComEd	2.9	6/1/2016
n5362	Re-conductor 40 miles of 345kV Nelson - Cordova line	ComEd	80	6/1/2016
n5363	Upgrade substation conductor at Nelson substation	ComEd	0.1	6/1/2016
n5364	Upgrade substation conductor at Electric junction substation	ComEd	0.1	6/1/2016
n5365	Re-conductor 10.4 miles of 138kV Rock Falls line	ComEd	10.4	6/1/2016
n5366	Re-conductor 0.045 miles of 138kV Kickapoo - LaSalle County line; and upgrade Substation Conductor at LaSalle County substation	ComEd	0.145	6/1/2016
n5367	Perform sag study on the Byron to Cherry Valley 345 kV line	ComEd	0.15	6/1/2016
n5368	Re-conductor 26.9 miles of 138 kV Normandy to Kewannee line	ComEd	26.9	6/1/2016
n5369	Re-conductor 5.4 miles of 138kV Normandy line	ComEd	5.4	6/1/2016
n5370	Re-conductor 13.6 miles of 345kV Electric Junction to Lombard line	ComEd	27.2	6/1/2016
n5371	Re-conductor 6.7 miles of 345kV Byron to Cherry Valley line	ComEd	13.4	6/1/2016
n5372	Upgrade the substation Conductor at Lasalle County 345 kV substation	ComEd	0.1	6/1/2016
n5373	Re-conductor 1 mile of 138kV Plano - Plano West Line; and upgrade Substation Conductor at Plano substation	ComEd	1.1	6/1/2016
n5374	Install 138kV Circuit Breaker at Cherry valley substation	ComEd	1.5	6/1/2016
n5375	Replace Wave Trap at Belvidere substation	ComEd	0.1	6/1/2016
n5376	Perform Sag study on the Marengo to Pleasant Valley line and update the Station Conductor at Pleasant Valley substation	ComEd	4.5	6/1/2016
n5377	Replace 138kV Circuit Breaker at Cherry	ComEd	1.5	6/1/2016

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
	Valley substation			
n5378	Replace (2) Circuit Switches on the Belvidere to Marengo line (one at Belvidere substation and one at Marengo substation)	ComEd	0.2	6/1/2016
n5379	Replace Wave Trap at Belvidere substation on the Belvidere – B465 line 15624	ComEd	0.1	6/1/2016
n5380	Re-conductor 4 miles of 138kV Belvidere to Alpine line	ComEd	4	6/1/2016
n5381	Upgrade relaying at the Waterman 138 kV substation	ComEd	0.1	6/1/2016
n5382	Upgrade station conductor at the Waterman substation	ComEd	0.1	6/1/2016
n5383	Replace 345kV Bus Tie Breaker 1-2 at H471 substation	ComEd	2	6/1/2016
n5384	Reconductor 8.8 miles of 138kV West Plano to Sandwich line	ComEd	8.8	6/1/2016
n5385	Re-conductor 12.5 miles of 138kV Nelson to O-029 line	ComEd	12.5	6/1/2016
n5386	Replace the Disconnect Switches on the Nelson to Rock Fall line at Rock Fall substation	ComEd	0.05	6/1/2016
n5387	Re-conductor 7.9 miles of 345kV line from Nelson to ESSH471 substations	ComEd	15.8	6/1/2016
n5388	Replace (2) Disconnects at Nelson – Electric Junction line at Nelson substation	ComEd	0.1	6/1/2016
n5389	Replace (2) Disconnects on the Nelson – Electric Junction line at Electric-junction substation	ComEd	0.1	6/1/2016
n5390	Re-conductor 11 miles of line from GardenPL - ESSH71 line	ComEd	11	6/1/2016
n5391	Replace 345kV bus tie breaker 4-7 at Cherry Valley substation	ComEd	2	6/1/2016
n5392	Re-conductor 19.472 miles of 345kV line from Byron – Lee County Energy Center and upgrade Substation Conductor at Byron substation	ComEd	39.044	6/1/2016
n5393	Re-conductor 5.4 miles of 138kV line from O-029 to Normandy substation	ComEd	5.4	6/1/2016

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n5394	Re-conductor 17.9 miles of 138kV line from Normandy to Annawan (U4-027) substation	ComEd	17.9	6/1/2016
n5395	Replace Wave Trap at Kewannee substation	ComEd	0.1	6/1/2016
n5396	Re-conductor 6.7 miles of 138kV line from Byron to Cherry Valley substations	ComEd	13.4	6/1/2016
n5397	Replace TR. 81 138kV Circuit Breaker at Cherry Valley substation	ComEd	1.5	6/1/2016
n5398	Install an additional (fourth) Auto transformer 300 MVA at Nelson substation	ComEd	15	6/1/2016
n5399	Replace TR. 84 138kV Circuit Breaker at Nelson substation	ComEd	1.5	6/1/2016
n5400	Replace two (2) Wave Traps at Quadcities substation	ComEd	0.2	6/1/2016
n5401	Install 138 kV rated breaker, breaker disconnects, and 138 kV bus including equipment and structures necessary for the installation and operation at the Hillcrest substation	APS	1.6825	10/31/2018
n5402	Re-conductor the Everts Drive – South Troy 115 kV Line with high temperature conductor	PENELEC	5.9112	6/1/2020
n5403	Re-conductor ~8.8 miles of the Everts Drive – Mainesburg 115 kV Line with 795 ACSS conductor	PENELEC	17.5237	6/1/2020
n5404	Update relay settings on the Homer City 345kV Line at Mainesburg substation	PENELEC	0.0552	6/1/2020
n5405	Modify relaying at East Palmerton 230-69kV Substation	PPL	0.141	12/1/2020
n5406	Modify relaying at Acahela 230-69kV Substation	PPL	0.141	12/1/2020
n5407	Build one span of 230 kV attachment line between the AB2-158 generation station and the new AB2-158 switching substation (Desper Substation)	Dominion	1.2	10/1/2018
n5408	Install metering and associated protection equipment at AB2-158 generation substation	Dominion	0.6	10/1/2018

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n5409	Build the new AB2-158 Switching substation (interconnection substation)	Dominion	6.3	10/1/2018
n5410	Install Transmission structure in line with South Anna - Louisa 230 kV transmission line to allow the proposed interconnection switching station to be interconnected with the transmission system	Dominion	1	10/1/2018
n5413	Install a 69 kV Circuit Breaker, SCADA, bus work, metering, and disconnect switches at South Cumberland 69 kV Substation	AEP	1.25	8/31/2017
n5414	Install line protection and controls at South Cumberland 69 kV Substation	AEP	0.25	8/31/2017
n5415	Install a 345 kV Circuit Breaker, SCADA, bus work, metering, and disconnect switches at Maddox Creek 345 kV Substation	AEP	2.5	12/31/2019
n5416	Install line protection and controls at Maddox Creek 345 kV Substation	AEP	0.65	12/31/2019
n5417	Construct a new three (3) circuit breaker 345 kV switching station along the Desoto – Fall Creek 345 kV Line	AEP	5.55	10/31/2018
n5418	Upgrade Line Relaying on the Desoto – Fall Creek 345 kV Line	AEP	0.3	10/31/2018
n5418	Upgrade Line Relaying on the Desoto – Fall Creek 345 kV Line	AEP	0.3	10/31/2018
n5419	Upgrade Line Relaying on the Desoto – Fall Creek 345 kV Line	AEP	0.3	10/31/2018
n5419	Upgrade Line Relaying on the Desoto – Fall Creek 345 kV Line	AEP	0.3	10/31/2018
n5420	Install a 138 kV Circuit Breaker, SCADA, bus work, metering, and disconnect switches at Delano 138 kV Substation	AEP	0.65	10/31/2017
n5421	Install line protection and controls at Delano 138 kV Substation	AEP	0.3	10/31/2017
n5422	Install a 138 kV Circuit Breaker, SCADA, bus work, metering, and disconnect switches at Adams 138 kV substation	AEP	0.65	10/31/2017
n5423	Install line protection and controls at the Adams 138 kV substation	AEP	0.2	10/31/2017

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n5424	Install a 138 kV Circuit Breaker, SCADA, bus work, metering, and disconnect switches at the Seaman 138 kV substation	AEP	0.55	10/31/2017
n5425	Install line protection and controls at the Seaman 138 kV substation	AEP	0.2	10/31/2017
n5426	Upgrade Line Relaying on the RP Mone – Maddox Creek 345 kV Line	AEP	0.025	12/31/2019
n5427	Upgrade Line Relaying on the East Lima – Maddox Creek 345 kV Line	AEP	0.025	12/31/2019
n5428	Install a 345 kV Circuit Breaker, SCADA, bus work, metering, and disconnect switches at the Hardin Switch 345 kV substation	AEP	2	12/31/2018
n5429	Install line protection and controls at the Hardin Switch 345 kV substation	AEP	0.25	12/31/2018
n5430	Upgrade Line Relaying on the East Lima – Marysville 345 kV Line	AEP	0.025	12/31/2018
n5431	Upgrade Line Relaying on the East Lima – Marysville 345 kV Line	AEP	0.025	12/31/2018
n5432	Install 1 SCADA-controlled MOAB switch on the tap to the AC2-134 Customer	JCPL	0.1562	12/31/2018
n5433	Install 2 SCADA-controlled MOAB switches on the Franklin-Sussex 34.5 kV line on either side of the tap to the AC2-134 customer	JCPL	0.2343	12/31/2018
n5434	Adjust Remote Relay and Metering Settings at Franklin Substation	JCPL	0.008	12/31/2018
n5435	Adjust Remote Relay and Metering Settings at Branchville Substation	JCPL	0.008	12/31/2018
n5436	Install 1 SCADA-controlled MOAB switch on the tap to the AC2-143 Customer	JCPL	0.2092	3/1/2019
n5437	Install 1 SCADA-controlled MOAB switch on the D82 34.5 kV line (Wyckoff Street - Englishtown) adjacent to the tap to the AC2-143 customer	JCPL	0.2023	3/1/2019
n5438	Revise relay settings on D82 line terminal at Wychoff Street substation	JCPL	0.0335	3/1/2019
n5439	Revise relay settings on D82 line terminal at Englishtown substation	JCPL	0.0335	3/1/2019
n5440	Revise relay settings on D82 line terminal	JCPL	0.0335	3/1/2019

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
	at Monroe substation			
n5442	Rebuild Line #23033 from Cartanza - Mil 230 kV substations	DPL	39.75	6/1/2016
n5443	Replace auto transformer 2 from Church - Church 69 substation	DPL	2.75	6/1/2016
n5444	Replace disconnect switch, rebuild line 6704-1 from Church 69 – N. Meredth and replace conductor on 6701-1 line	DPL	11.3	6/1/2016
n5445	Replace bushing on Auto transformer 1 at Easton 138 kV substation	DPL	0.08	6/1/2016
n5446	Rebuild Line #22085 from Edgemr5 - Linwood with dual 1590 ACSR	DPL	38.25	6/1/2016
n5447	Rebuild line #13773 from Farm view - MILF_138 with 954 ACSR 125 C	DPL	2.7715	6/1/2016
n5448	Rebuild line #13703 from INDRV 2&3 - NELSON and replace substation bus	DPL	31.53	6/1/2016
n5449	Re-conductor C & D canal crossing from Keen - Steele 23001 line	DPL	0.32	6/1/2016
n5450	Replace relays on Keen - Steele 230 KV line	DPL	0.5	6/1/2016
n5451	Rebuild 69 kV line 6705_1 from Laurel - AA1-142 Tap with 954 ACSR	DPL	10.91	6/1/2016
n5452	Rebuild 69 kV line 6705_1 from Sharptown - AA1-142 Tap with 954 ACSR	DPL	10.91	6/1/2016
n5453	Rebuild 230 kV line #23076 from Milford - Steele with 1590 ACSR 125 C	DPL	43.965	6/1/2016
n5454	Rebuild 138 kV line 13707 from Nelson - Vienna with 1590 ACSR	DPL	17.473	6/1/2016
n5455	Rebuild Line 6705 _2 from Sharptown - Vienna 69 kV with 1590 ASCR and upgrade all substation equipment to 2000 A	DPL	12.4698	6/1/2016
n5456	Replace a 1200 Amp Wave Trap at Robinson substation on the Holland - Robinson 69 kV line	Dayton	0.04	12/1/2019
n5457	Re-conductor/rebuild the AEP portion of the Adkins-Beatty 345 kV line	Dayton	26	12/1/2019
n5458	Install circuit breaker to create a new line terminal at Riders Creek substation	Dominion	2.4689	11/15/2019

Upgrade ID	Description	Transmission Owner	Cost Estimate ($M)	Required IS Date
n5459	Install Wave Trap and a line CCVT for power Line Carrier communication on the Riders Creek – Mackeys 115 kV line	Dominion	0.1933	11/15/2019
n5460	Wreck and rebuild the Penniman - Waller 230 kV line	Dominion	13	6/1/2020
n5461	Wreck and rebuild the Kings Mill - Penniman 230 kV line	Dominion	6.8	6/1/2020
n5462	Install a third Chesapeake 230/115 kV transformer	Dominion	7	6/1/2020
n5463	Wreck and rebuild 11 miles of Chesapeake-Greenwich 230 kV line	Dominion	21.2	6/1/2020
n5464	Replace Wave Traps at both Chickahominy and Elmont 500 kV substations	Dominion	0.5	6/1/2020
n5465	Wreck and rebuild the Skiff Creek-Kings Mill 230 kV line	Dominion	8.4	6/1/2020
n5466	Replace Wave Traps at both Chickahominy and Surry 500 kV substations	Dominion	1	6/1/2020
n5468	Install transfer trip transmitters for anti-islanding scheme on the Trowbridge – Mackeys – Winfall 230 kV line	Dominion	0.0567	12/31/2018
n5470	Perform a sag study on the Banister - East Danville 138 kV line	AEP	0.015	10/21/2017
n5471	Perform a sag study on the AC1-083 TAP - Bearskin 138 kV line	AEP	0.015	10/21/2017
n5472	Perform a sag study on the Wildcat - Hillsboro 138 kV line	AEP	0.04	10/1/2020
n5473	Re-conductor the Nottingham - Yager 138 kV line	AEP	30.4495	10/21/2020
n5474	Replace the Wave Traps at the East Lima and Haviland substations	AEP	0.1	10/21/2020