Network Upgrades Presentation

Awais Ghayas

PJM Interconnection Analysis

Transmission Expansion Advisory Committee January 9, 2024

Overview

- All study reports located at: https://pjm.com/planning.aspx

- Period between October 9, 2022 and September 6, 2023

- 151 System Impact Study reports issued
- $138.13 million net increase in total Network Upgrade costs
- $179.58 million in New Network Upgrades
- $41.45 million decrease for cancelled Network Upgrades

Network Upgrades

Network Upgrades – AEC

NUN	Description	Cost ($M)	Driver
n4783	To mitigate the (ACE) Cardiff 230/138 kV bus (from bus 227900 to bus 227934 Ckt 1) overload, will require substation reinforcements at Cardiff	$0.600	Z2-076
n6342	To mitigate the (ACE) Cardiff - New Freedom 230 kV line (from bus 227900 to bus 219100 ckt 1) overload, it will require increasing the emergency rating of the Cardiff to New Freedom 230 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators, and conductor. New Ratings: 796/932/932	$105.000	AE2-022
n8023	Upgrade relays at remote ends at South Millville-Newport 69 kV	$0.200	AE1-179
n8024	Modify Line #0762 AE1-179 South Millville-Newport 69 kV	$1.800	AE1-179
n8025	Install new communication equipment at new ring bus substation South Millville-Newport 69 kV	$0.200	AE1-179
n8040.1	Construct a new 138kV three-position ring bus substation for AE1-229	$8.710	AE1-229
n8040.2	Cut and loop in 1405 transmission line to the new 138 kV three-position ring bus substation, occupying two of those positions. The third position will accommodate the interconnection of the Customer Facility.	$0.245	AE1-229
n8040.3	Install a new lead line (no longer than 500 feet) from the Point of Interconnection to the new 138 kV ring bus substation.	$0.250	AE1-229
n8044.1	Construct a new 69kV ring bus for AE2-334 on the Clayton-Williamstown 69 kV	$8.710	AE2-334

Network Upgrades – AEC

NUN	Description	Cost ($M)	Driver
n8044.2	Cut in transmission line 0716 to the new 69 kV three-position ring bus substation, occupying two of those positions. The third position will accommodate interconnection of the Customer Facility	$0.245	AE2-334
n8044.3	Install protective relaying at the new 69kV three-position ring bus substation.	$0.250	AE2-334
n8222.1	Build new control house and all associated communications and relaying for reconfiguration at Cardiff 230kV substation.	$25.000	AE2-020
n8315	Install harmonic measurement equipment and collect data for a Harmonic Study. Provide data and report to Interconnection Customer and PJM.	$0.300	AE2-022

Network Upgrades – AEP

NUN	Description	Cost ($M)	Driver
n104.1	Construct a new three (3) circuit breaker 138 kV station, Snowhill, physically configured in a breaker and half bus arrangement but operated as a ring-bus	$6.535	AD2-071
n104.2	Connect Snowhill 138 kV Station to existing transmission circuit, update remote end protective relay settings	$0.813	AD2-071
n104.3	Replace Protective Relays at Strawton 138 kV Station	$0.199	AD2-071
n104.4	Install Two (2) Fiber-Optic Paths to facilitate relaying between Snowhill, Deer Creek, and Strawton 138 kV Stations	$0.240	AD2-071
n104.5	Replace Three (3) Structures, Six (6) spans of conductor along the Deer Creek - Makahoy 138 kV Circuit	$0.628	AD2-071
n5583	Install 138 kV Revenue Metering at the Ohio Central substation	$0.250	AC1-100
n5986	Settings changes will need to be reviewed. The estimated cost for relay setting review/revision for AD1-130 is $25,000	$0.025	AD1-130
n6032	AC1-173 Relay Settings - convert 2-terminal gen lead to 3-terminal gen lead	$0.060	AC1-173
n6033	AC1-173 Fiber system modifications	$0.010	AC1-173

Network Upgrades – AEP

NUN	Description	Cost ($M)	Driver
n6049	Expand existing bay and install one (1) 345kV circuit breaker, physical structures, protection and control equipment, communications equipment, and associated facilities at the Sullivan 345kV switching station.	$2.220	AC2-157
n6124.1	Reconductor/rebuild 2.78 miles of ACSR ~ 336/556 Six Wire conductor on the 05EDAN 1-05DANVL2 138 kV line	$4.275	AD1-076
n6124.2	Reconductor/rebuild 0.03 miles of ACSR ~ 1351.5 ~ 45/7 ~ DIPPER - Conductor Section 3 on the 05EDAN 1-05DANVL2 138 kV line	$0.036	AD1-076
n6124.3	Reconductor/rebuild 0.03 miles of ACSR ~ 1351.5 ~ 45/7 ~ DIPPER - Conductor Section 1 on the 05EDAN 1-05DANVL2 138 kV line	$0.036	AD1-076
n6329	Perform a sag study on the Pipe Creek - 05GRNTTA 138 kV line	$0.020	AD2-071
n6330	Perform a sag study on the AD2-071 Tap - Pipe Creek 138 kV line	$0.033	AD2-071
n7243.1	Install 138 kV revenue metering at the new interconnection sub along Madison - Tanners Creek 138kV Line	$0.250	AE2-297
n7243.2	Construct a new three (3) circuit breaker 138 kV switching station on the Madison - Tanners Creek 138kV Line	$6.000	AE2-297
n7243.3	Construct facilities to loop the existing Madison - Tanners Creek 138 kV line into the proposed 138kV Interconnection switching station	$1.000	AE2-297

Network Upgrades – AEP

NUN	Description	Cost ($M)	Driver
n7243.4	Modify relays and/or settings at the Madison 138 kV substation	$0.250	AE2-297
n7243.5	Modify relays and/or settings at the Tanners Creek 138 kV substation	$0.250	AE2-297
n7245.1	Construct 345 kV Revenue Metering at Bokes Creek	$0.427	AF1-227
n7245.2	Construct generator lead first span exiting the POI station, including the first structure outside the fence at Bokes Creek	$0.693	AF1-227
n7245.3	Install a three (3) circuit breaker 345 kV station physically configured and operated as a ring bus including associated protection and control equipment, 345 kV line risers and SCADA at Bokes Creek	$12.466	AF1-227
n7245.4	Install Two (2) Structures, Two (2) Spans of Conductor, Connect Bokes Creek 345 Station to existing Transmission Circuit, Update Remote End Protective Relay Settings at Bokes Creek	$1.901	AF1-227
n7245.6	Install two (2) Fiber-Optic Paths to the AEP Telecom Network to facilitate SCADA Connectivity at the Boke Creek Station. Includes Telecom Upgrades at the Marysville 345kV substation.	$0.184	AF1-227
n7287	Installation of gen tie line connecting Payne station to the IPP generator	$0.108	AD1-119
n7288	Construct Dual Fiber Telecom from Payne to the IPP station	$1.734	AD1-119

Network Upgrades – AEP

NUN	Description	Cost ($M)	Driver
n7355	Protection Setting Changes at East Lima, RP Mone, and Maddox Creek	$0.051	AC2-044
n7364	Modify line settings at Hardin Switch	$0.081	AD1-130
n7365	Modify remote end settings at Gunn Road	$0.017	AD1-130
n7366	Modify remote end settings at East Lima	$0.017	AD1-130
n7832	Install 69 kV Revenue Meter, generator lead transmission line span from the South Cumberland 69 kV station to the Point of Interconnection, including the first structure outside the South Cumberland 69 kV station, and extend dual fiber-optic from the Point of Interconnection to the South Cumberland 69 kV Station control house.	$0.772	AE1-227
n7833	Expand the South Cumberland 69 kV Station, including the addition of one (1) 69 kV circuit breaker, installation of associated protection and control equipment, 69 kV line risers, and supervisory control and data acquisition (SCADA) equipment.	$0.787	AE1-227
n7879	Marysville 345 kV Protection Settings Change	$0.024	AD2-092
n7880	Marysville 345 kV Protection Settings Change	$0.024	AD2-096
n7904	Construct a new three (3) circuit breaker AD2-179 138 kV station	$4.372	AD2-179

Network Upgrades – AEP

NUN	Description	Cost ($M)	Driver
n7905	Install 138kV Revenue Meter, Generator lead transmission line first span exiting the POI station, including the first structure outside the fence	$1.775	AD2-179
n7906	Claytor - Glen Lyn 138 kV #2 circuit T-Line New Station Cut-In & OPGW to Morgans Cut	$1.500	AD2-179
n7907	Upgrade line protections & controls at the Glen Lyn 138kV Station	$0.500	AD2-179
n7908	Replace the Claytor 138 kV Station remote end Circuit Breaker “A” line relays with a dual carrier system and implement required settings. Install breaker controls and a second line trap	$0.419	AD2-179
n7962	Install 138kV Revenue Meter, generator lead transmission line span from the Fostoria Central 138kV station to the Point of Interconnection, including the first four structures outside the Fostoria Central 138kV station, and extend dual fiber-optic from the Point of Interconnection to the Fostoria Central 138kV Station control house	$1.487	AD1-070
n7963	Expand the Fostoria Central 138kV Station, including the addition of one (1) 138kV circuit breaker, installation of associated protection and control equipment, 138kV line risers, and supervisory control and data acquisition (SCADA) equipment.	$0.846	AD1-070
n8038	Review area relay settings & modify generator lead protection and control scheme to 2-terminal, including fiber jumper and wiring changes at Losantville 345kV Substation	$0.061	AC2-090
n8045.1	Construct 3 breaker 138 kV Switching Station for AF1-158 interconnection	$6.488	AF1-158
n8045.2	Install two (2) new structures, four (4) spans of conductor to the Creek Walker 138 kV interconnection switching station, associated protection and control equipment, and fiber to interconnect to existing transmission circuit. Modify/replace relay settings	$0.823	AF1-158

Network Upgrades – AEP

NUN	Description	Cost ($M)	Driver
n8045.3	Replace Protective Relays at Edison 138 kV Station	$0.228	AF1-158
n8045.4	Install Two (2) Fiber-Optic Paths to facilitate relaying between Creek Walker and Edison 138 kV Stations	$0.640	AF1-158
n8060.1	Replace Existing Revenue Meter CTs at Hardin Switch 345 kV Station	$0.236	AD2-086
n8060.2	Update Protective Relay Settings at the Hardin, East Lima, and Gunn Road 345 kV Station	$0.116	AD2-086
n8064.1	Review protection relay settings at the Flatlick 765kV Station	$0.050	AF2-395
n8067.1	Update Protective Relay Settings at the Hardin, East Lima, and Gunn Road 345 kV Station	$0.116	AD2-091
n8068.1	Update Protective Relay Settings at the Hardin, East Lima, and Gunn Road 345 kV Station	$0.116	AE2-216
n8090.1	Install One (1) New 138 kV Circuit Breaker, One (1) New Box Bay, One (1) New Line Connection, Update Remote End Protective Relay Settings at the Valley 138 kV Station	$0.912	AD2-020
n8090.2	Install Six (6) Structures, Seven (7) Spans of Conductor in the existing Hartford - Valley 138 kV ROW	$1.115	AD2-020

Network Upgrades – AEP

NUN	Description	Cost ($M)	Driver
n8090.3	Expand the Valley 138 kV Station Yard, Fence, and Control House	$0.468	AD2-020
n8092	Replace Protective Relays, Wave trap & CCVT at Highland 69 kV Station	$0.526	AD2-031
n8104.1	Construct a new three (3) circuit breaker 138 kV station, Snowhill, physically configured in a breaker and half bus arrangement but operated as a ring-bus	$6.535	AD2-071
n8104.2	Connect Snowhill 138 kV Station to Existing Transmission Circuit, Update Remote End Protective Relay Settings	$0.813	AD2-071
n8104.3	Replace Protective Relays at Strawton 138 kV Station	$0.199	AD2-071
n8104.4	Install Two (2) Fiber-Optic Paths to facilitate relaying between Snowhill, Deer Creek, and Strawton 138 kV Stations	$0.240	AD2-071
n8120.1	Construct a new three (3) circuit breaker 230 kV station, Firefly 230 kV Station, physically configured and operated as a ring bus	$7.095	AD2-022
n8120.2	Transmission line Cut-In and Dead End Structure Installation at the new 230 kV station	$1.508	AD2-022
n8120.3	Remote End Tie Line Metering Removal at the new 230 kV station	$0.043	AD2-022

Network Upgrades – AEP

NUN	Description	Cost ($M)	Driver
n8120.4	Install 230 kV Duke Tie Line Meter Installation	$0.404	AD2-022
n8127.1	Oversight of Proposed Riverstone 138 kV Station	$0.467	AE1-108
n8127.2	Bremo-Scottsville 138 kV T-Line Cut-In and Fiber installation	$0.553	AE1-108
n8127.3	Upgrade line protection and controls at the Scottsville 138 kV Station	$0.037	AE1-108
n8127.4	Construct 138 kV Extension Line from Bremo-Scottsville 138 kV Circuit Tap to the proposed Riverstone 138 kV Station	$1.250	AE1-108
n8130.1	Install 138kV Revenue Meter, generator lead transmission line span from the new Rocky Ford 138kV station to the Point of Interconnection, and extend dual fiber-optic from the Point of Interconnection to the new 138kV Station control house	$0.984	AE1-146
n8130.2	Install new 138kV three-breaker ring bus station along the Ebersole-Fostoria Central #2 138kV line, installation of associated protection and control equipment, line risers, switches, jumpers, and supervisory control and data acquisition (SCADA) equipment	$6.161	AE1-146
n8130.3	Ebersole-Fostoria Central #2 138kV T-Line Cut In	$0.843	AE1-146
n8130.4	Replace protective relays at Ebersole and Fostoria Central 138kV stations	$0.384	AE1-146

Network Upgrades – AEP

NUN	Description	Cost ($M)	Driver
n8130.5	Install two (2) Fiber-Optic Paths to facilitate relaying between Rocky Ford, Ebersole, and Fostoria Central 138 kV stations	$0.240	AE1-146
n8150	Expand the Circleville 138 kV Station, including the addition of one (1) 138 kV circuit breaker, installation of associated protection and control equipment, line risers, switches, jumpers, a 16' x 12' expansion DICM, and supervisory control and data acquisition (SCADA) equipment.	$1.551	AC2-029
n8169.1	Construct Millikan 138 kV Station. associated line protection and control equipment, line risers, switches, jumpers, and SCADA at the Millikan 138 kV Station	$6.490	AE1-170
n8169.2	Install Two (2) Structures, Two (2) Spans of Conductor, Connect Millikan 138 kV Station to Existing Transmission Circuit, Update Remote End Protective Relay Settings	$0.757	AE1-170
n8169.3	Install Two (2) Fiber-Optic Paths to facilitate relaying between Millikan, Kenzie Creek, and Colby Tap 138 kV Stations	$0.205	AE1-170
n8170.1	Construct Fritts 138 kV three breaker Station, associated line protection and control equipment, line risers, switches, jumpers, and SCADA at the proposed Fritts 138 kV Station	$5.526	AE1-207
n8170.2	Install Two (2) Structures, Two (2) Spans of Conductor, Connect Fritts 138 kV Station to Existing Transmission Circuit, Update Remote End Protective Relay Settings at Deer Creek 138 kV Station	$0.645	AE1-207
n8170.3	Install Two (2) Fiber-Optic Paths to facilitate ICON relaying between Fritts and Gaston 138 kV Stations	$0.290	AE1-207
n8170.4	Replace Protective Relays at Gaston 138 kV Station	$0.278	AE1-207

Network Upgrades – AEP

NUN	Description	Cost ($M)	Driver
n8176.1	Install one (1) new 345 kV circuit breaker & associated equipment, update protective relay settings, and install jumpers for Sorenson & Tanners Creek 345 kV line re-terminations	$2.181	AE1-209
n8176.2	Re-terminate the Desoto – Tanners Creek and Desoto – Sorenson 345 kV circuits in the Desoto 345 kV "B" string	$0.499	AE1-209
n8177.1	Install new 138 kV three-breaker ring bus station along the East Leipsic - Richland 138 kV line. Install a Drop-In Control Module (DICM) and other associated line protection and control equipment, line risers, switches, jumpers, and supervisory control and data acquisition (SCADA) equipment	$5.898	AE2-072
n8177.2	Perform final connection of the East Leipsic - Richland 138 kV to the Lammer 138 kV Station, and update protective relay settings at East Leipsic 138 kV Station	$0.695	AE2-072
n8177.3	Install one (1) Fiber-Optic path to facilitate relaying between Lammer, East Leipsic, and Yellow Creek 138 kV Stations.	$0.767	AE2-072
n8178.1	Install new 138 kV three-breaker ring bus station along the Axton - Danville #1 138 kV line. Install a Drop-In Control Module (DICM) and other associated line protection and control equipment, line risers, switches, jumpers, and supervisory control and data acquisition (SCADA) equipment.	$4.701	AE2-140
n8178.2	Perform final connection of the Axton - Danville #1 138 kV line to the Lendlease 138 kV Station, update remote end protective relay settings.	$1.256	AE2-140
n8178.3	Install one (1) Fiber-Optic path to facilitate relaying between Lendlease and Axton 138 kV Stations	$0.764	AE2-140
n8178.4	Replace protective relays at Axton 138 kV	$0.243	AE2-140

Network Upgrades – AEP

NUN	Description	Cost ($M)	Driver
n8178.5	Extend two (2) new fiber-optic connections from the AE2-140 proposed Lendlease 138 kV Station into AEP's existing fiber-optic network to facilitate SCADA network connectivity	$0.184	AE2-140
n8179	Install one (1) new 138 kV circuit breaker & associated equipment, and update protective relay settings at the Cole 345 kV Station	$1.556	AE2-214
n8186	Update Protective Relay Settings at Fritts 138 kV Station	$0.047	AE2-172
n8200.1	Construct a new three (3) circuit breaker 69 kV station physically configured and operated as a ring bus	$3.776	AE2-047
n8200.2	Install Three (3) Dead End Structures, Four (4) Spans of Conductor, Connect POI station to Existing Transmission Circuit, Update Remote End Relay Settings	$1.286	AE2-047
n8212.1	Expand the Stockton 138 kV Station into a 4-breaker ring-bus arrangement	$7.145	AE2-166
n8212.2	Axton - Martinsville Transmission Line Work, Martinsville Remote End Settings	$0.455	AE2-166
n8212.3	Install a new ICON at the Axton 138 kV Station with connectivity to the Stockton 138 kV Station. Replace the existing relays at the Axton 138 kV Station	$0.254	AE2-166
n8212.4	Install Stockton 138kV Circuit Switcher	$0.201	AE2-166

Network Upgrades – AEP

NUN	Description	Cost ($M)	Driver
n8215.1	Construct New Three Breaker 138 kV Station In A Breaker and a Half Configuration	$6.467	AE2-219
n8215.2	Install Two (2) Structures, Two (2) Spans of Conductor, Connect Proposed 138 kV Station to Existing Transmission Circuit, Update Remote End Protective Relay Settings at Bluff Point 138 kV Station	$0.882	AE2-219
n8215.3	Install Two (2) Fiber-Optic Paths to Facilitate Relaying Between The Randolph and Proposed138 kV Stations.	$1.196	AE2-219
n8215.4	Replace Protective Relays, Install ICON at Randolph 138 kV Station	$0.188	AE2-219
n8232	Install Diverse UG/ADSS Fiber-Optic Cable Path	$0.367	AD2-179
n8233	Morgans Cut Station Circuit Breaker Addition and associated work	$1.261	AD2-179
n8434.2	Install one new bay box, expand the control house, and reterminate the existing 138/12 kV transformer. Install associated line protection and control equipment, line risers, switches, jumpers, and SCADA.	$0.766	AE1-245

Network Upgrades – APS

NUN	Description	Cost ($M)	Driver
n4655	Reconfigure the Albright 138 kV substation to a breaker and a half configuration	$20.700	AD2-180
n5987	Install new 115kV three-breaker ring bus substation	$3.876	AD1-020
n5988	Loop the 962 (Hunterstown-Lincoln) 115kV circuit into substation	$0.467	AD1-020
n5989	Revenue metering - engineering oversight of specification and design of new revenue metering that will be installed by power producer (interconnection customer) at their location (AD1-020) and connected to the new ring bus station on the Hunterstown - Lincoln line. Coordinate FE MV90 access to the new meter.	$0.002	AD1-020
n5990	Replace one (1) existing shield wire with optical ground wire (OPGW) on the Hunterstown-Lincoln 115kV circuit between the proposed AD1-020 ring bus and Lincoln substation, approximately 1.6 miles.	$0.497	AD1-020
n5991	Replace one (1) existing shield wire with OPGW on the Hunterstown-Lincoln 115kV circuit between the proposed AD1-020 ring bus and Hunterstown substation, approximately 1.0 miles.	$0.321	AD1-020
n5992	Install new line relaying and capacitor-voltage transformers (CVT) for the AD1-020 Interconnection at Hunterstown substation.	$0.259	AD1-020
n5993	Install new line relaying and capacitor- voltage transformers (CVT) for the AD1-020 Interconnection at Lincoln substation.	$0.259	AD1-020
n5994	Estimated MPLS router at new AD1-020 Interconnection Substation to support new RTU	$0.150	AD1-020

Network Upgrades – APS

NUN	Description	Cost ($M)	Driver
n6894	New Sulphur City 138 kV Substation: Design, install and test/commission MPLS equipment to provide SCADA transport.	$0.250	AD2-180
n7009	At new AE1-101 138 kV Switchyard: Install line exit take-off structure, foundations, disconnect switch and associated equipment at ring bus substation	$0.642	AE1-101
n7024	At new AD1-068 138 kV Switchyard: Install line exit take-off structure, foundations, disconnect switch and associated equipment at ring bus substation	$0.681	AE1-101
n7025	Construct a new 3-breaker Ring Bus on the 138 kV line between Albright and Garrett	$6.932	AE1-101
n7026	Loop the Albright-Garrett 138kV line to create the interconnection for AD1-068 3 breaker ring bus (Afton Substation), approximately 6.4 miles from Albright substation	$0.616	AE1-101
n7027	Albright: Replace wave trap and line tuner. Add anti-islanding relaying. Change carrier frequency and adjust relay settings. Change line name	$0.310	AE1-101
n7028	Garrett: Replace wave trap and line tuner. Add anti-islanding & replace line relaying. Change carrier frequency and adjust relay settings.	$0.394	AE1-101
n7164.2	Replace relaying (RT, WT, MT, ZR, OR) at Karns City substation.	$0.456	AF1-086
n7272	Install a 600A gang operated switch on a new pole to tap the McConnellsburg – Mercersburg 34.5kV line.	$0.037	AD1-061

Network Upgrades – APS

NUN	Description	Cost ($M)	Driver
n7273	Provide 34.5 kV Meter Package at LSBP solar facility connection.	$0.008	AD1-061
n7278	Project Management, Environmental, Forestry, Real Estate and Right of Way.	$0.060	AD1-061
n7301	New 3-bkr 138kV Ring Bus for AD2-157 Interconnect at Bubbling Springs: Transmission Owner will design, furnish and construct the new 138 kV line terminal and take-off structure. This work will include, but not be limited to, installation of a 138 kV line exit take-off structure, foundations, disconnect switch and associated equipment to accommodate the termination of the 138 kV generator lead line.	$0.581	AD2-133
n7302	New 3-bkr 138kV Ring Bus for AD2-157 Interconnect at Bubbling Springs: A new three breaker ring bus substation, Bubbling Springs 138 kV, will be constructed along the Gore-Hampshire 138 kV line to interconnect the AD2-157 solar project with the Potomac Edison transmission system. The POI will be at the TO-owned dead-end structure inside the substation yard where the generator lead line terminates.	$5.228	AD2-133
n7305	Install fiber from AD2-157 to Gore for communication transport.	$0.295	AD2-133
n7306	Estimated SCADA work at Gore, French Mill, and Meadow Brook substations to support updated relay settings. Estimated in-sub fiber run to customer built fiber to support communications to AD2-157 substation.	$0.108	AD2-133
n7337	Bedington: Direct injection into Bedington substation to interconnect queue project AE2-333. This includes Project Management.	$1.072	AE2-333
n7338	Estimated (1) in-sub fiber run from Bedington control house to developer built fiber run to support communications to AE2-333. SCADA work at Bedington to support breaker and relay installations.	$0.057	AE2-333

Network Upgrades – ATSI

NUN	Description	Cost ($M)	Driver
n5865	Install attachment facility line, line disconnect switch, and associated hardware to accept the Interconnection Customer generator lead line terminating at the AD2-163 Interconnection switching station. Install Customer-owned revenue metering at the AD2-163 facility.	$0.500	AD2-163
n5866	138 kV Three Breaker Ring Bus Generation Interconnection at AD2-163 Interconnection SS	$11.160	AD2-163
n6712	AC2-195 ADSS fiber: From the new AC2-195 interconnection substation to the anticipated ADSS cable near the intersection of Marion Williamsport Road and N Main Street proposed for PJM queue position AB2-131. The assumed route is a combination of aerial ADSS (0.87 miles) and underground bore (0.14 miles).	$0.165	AC2-195
n8177.4	Update protective relays settings at Richland 138 kV Station	$0.000	AE2-072

Network Upgrades – ComEd

NUN	Description	Cost ($M)	Driver
n6280	Upgrade will be to mitigate sag on ComEd portion of line. A preliminary estimate is $4.5M with an estimated construction timeline of 24 months.	$2.470	AE1-163
n6679	Install AC1-033 New line section for interconnection at Kewanee	$4.000	AC1-033
n7033	Reconductor the AD2-066 Tap - Mazon 138 kV line	$32.200	AD2-066
n7383	Relaying upgrades at TSS 100 Shady Oaks Substation including: Install a SEL-411L as Current Differential Line protection on L94701 and make the existing primary relay, SEL-311L, the secondary relay. Modify L16901 CB and L13901 CB tripping to accommodate new topology. Install load rejection logic such that transfer trip is initiated on both primary and secondary relaying to TSS 946 GSG-6 Wind Farm if L94701 CBs are open at TSS 100 Shady Oaks.	$0.410	AD2-134
n8010	ComEd will be responsible to perform design, procurement, and construction to revise remote terminal.	$0.318	AC1-053
n8011	ComEd will be responsible to perform design, procurement, and construction to revise remote terminal to TSS 987 Beason instead of TSS 188 Mount Pulaski.	$0.313	AC1-053
n8012	ComEd will be responsible for performing design, procurement and construction to build L18806 and L98704 from the cut-in location to TSS 987 Beason. New conductor will match existing conductor rating.	$5.562	AC1-053
n8013	Engineering and Construction Oversight for TSS 987 Beason performed by IC	$1.321	AC1-053
n8073	Install relaying at Kewanee for the new bay position. Conduct a detailed review of the IC relay settings	$0.603	AC1-033

Network Upgrades – ComEd

NUN	Description	Cost ($M)	Driver
n8133.1	Relay settings need to be updated at TSS 951 Aurora Energy Center L95102. Connect new meters into the SCADA system at TSS 951 Aurora Energy Center	$0.292	AG1-513
n8133.2	Relay settings need to be updated at TSS 144 Wayne L14403.	$0.233	AG1-513
n8133.3	Relay settings need to be updated at TSS 111 Electric Junction L11103.	$0.222	AG1-513
n8143	Perform design, procurement and construction to expand 138kV ESS H-445 Twombly Road substation	$12.300	AD1-013
n8189.1	Construct the new 345 kV TSS 918 Dana substation with three 345kV circuit breakers arranged in breaker-and-a-half configuration	$31.267	AD2-038
n8189.2	Upgrade existing System 1 and System 2 line protection for 345kV L0303	$0.590	AD2-038
n8189.3	Upgrade existing System 1 and System 2 line protection for 345kV L91815, formerly L0303.	$0.382	AD2-038
n8189.4	Transmission Line Cut-in: install new line facilities required to connect 345kV L0303 and 345kV L91815 into TSS 918 Dana Substation	$9.785	AD2-038
n8189.5	Install diverse fiber paths from TSS 918 Dana to TSS 908 Mole Creek and from TSS 918 Dana to TSS 98 Nevada.	$4.548	AD2-038

Network Upgrades – ComEd

NUN	Description	Cost ($M)	Driver
n8189.6	Install one fiber cable to Station 3 Powerton.	$30.582	AD2-038
n8195.1	Oversight for self build of TSS 905 Essex Construction	$3.458	AD1-100
n8195.2	Transmission Line (L2002, L11212) Cut-in Tap into TSS 905 Essex	$20.142	AD1-100
n8195.3	Design, procurement, and construction to upgrade existing System 1 and System 2-line protection for 345kV L90505	$0.834	AD1-100
n8195.4	Design, procurement, and construction to upgrade existing System 1 and System 2-line protection for 345kV L2002	$0.834	AD1-100
n8195.5	Design, procurement, and construction to upgrade existing System 1 and System 2-line protection for 345kV L90506	$0.834	AD1-100
n8195.6	Design, procurement, and construction to install a new fiber path between TSS 905 Essex and STA. 20 Braidwood.	$3.141	AD1-100
n8195.7	Design, procurement, and construction to install a new fiber path between TSS 905 Essex and TSS 86 Davis Creek	$8.833	AD1-100
n8195.8	Design, procurement, and construction to install a new fiber path between TSS 905 Essex and TSS 93 Loretto	$10.813	AD1-100

Network Upgrades – ComEd

NUN	Description	Cost ($M)	Driver
n8214.1	The L7423 138kV line will be cut and looped into the new TSS 922 Kentville Rd interconnection substation	$1.910	AD1-031
n8214.2	Install dual 87L/SEL-411L current differential scheme via direct fiber. Upgrade L7423 CB from 25/SEL-279H and 50/2BF SEL-251C to 50BF/25/79 SEL-451. Install SEL-3350 RTAC with redundant RST-2228 Switch Architecture (Master, Master Aux A/B, Aux A/B switches) Install SEL-3620 Port Servers as needed for IED that must be connected serially over the available 3350 RTAC ports. Remove any PLC equipment on L7423 including wave trap, line tuner etc.	$1.910	AD1-031
n8214.3	A new breaker and a half substation, 138kV TSS 922 Kentville Rd, will be constructed approximately 0.13 miles south of existing TSS74 Kewanee, which will interconnect via existing 138kV L7423	$20.328	AD1-031
n8214.4	Relaying coordination and oversight at Edwards	$0.027	AD1-031
n8214.5	138kV L. 7423 will require two Single Mode Fiber paths from TSS 74 Kewanee to TSS 922 Kentville Rd, approximately 0.4 miles. These will be used for 138kV L7423 System 1 and System 2 relay scheme using direct-on-fiber connections. At least one of these two Fiber paths will need to be built per ESP 5.8.1 and 5.8.2 to determine the Fiber count and construction. The second Single Mode Fiber path will require a minimum of 48 Fibers. Both of these cables will be owned and maintained by ComEd. These fibers must be built in physically diverse paths from each other. Fiber paths are assumed to be installed underground for an approximate distance of 1000’ per fiber path. Fiber count and construction for this fiber path will be determined by ComEd standards.	$1.098	AD1-031
n8223	Expansion of Existing TSS 86 Davis Creek Substation	$0.682	AD2-047
n8329.1	Build a new ring bus 3 Breaker and a half configuration	$20.677	AD2-066

Network Upgrades – ComEd

NUN	Description	Cost ($M)	Driver
n8329.2	Cut and loop L7713 138kV line to new sub	$4.073	AD2-066
n8329.4	Relay settings shall be modified based on the new line topology.	$0.488	AD2-066
n8329.5	Installation of Fiber Cable in Existing ROW	$2.648	AD2-066
n8333	Mitigate overvoltage condition at fault clearing at AD1-031	$0.000	AD1-031
n8362.1	New 345 kV, TSS 964 Clear Creek Substation to accommodate AD2-100 and AD2-131 .	$32.000	AD2-100
n8362.2	Modify the kincaid - pana 345 kV transmission line to tie in the interconnection substation	$6.500	AD2-100
n8362.3	Relay and fiber upgrades to STA 21 Kincaid	$0.800	AD2-100
n8362.4	ComEd coordination with Ameren for relay and fiber upgrades to Ameren's Pana substation.	$0.700	AD2-100
n8362.5	Install two physically diverse 48-count single-mode fiber cables per ComEd standards from TSS 964 Clear Creek Substation to STA 21 Kincaid	$107.800	AD2-100

Network Upgrades – ComEd

NUN	Description	Cost ($M)	Driver
n8362.6	Install two physically diverse 48-count single-mode fiber cables per ComEd standards from TSS 964 Clear Creek Substation to Ameren's Pana substation	$41.300	AD2-100
n8372.1	Transmission Line (L0303) Cut-in Tap into TSS 915 Dee Mac Road	$11.117	AE1-163
n8372.2	Upgrade existing System 1 and System 2 line protection for existing L9150	$0.377	AE1-163
n8372.3	Install one (1) 48-count Single Mode fiber cable and upgrade existing System 1 and System 2 line protection for existing L0303	$0.608	AE1-163
n8372.4	Fiber Installation – Between TSS915 Dee Mac Rd and Existing ComEd Facilities	$0.170	AE1-163

Network Upgrades – Dayton

NUN	Description	Cost ($M)	Driver
n6950	Tap the Martinsville-Wilmington 69 kV line and install a three-way phase switch to interconnect the AD2-031 project. (One switch covering the generator lead line is considered an Attachment Facility).	$0.219	AD2-031
n6951	Tap the Martinsville-Wilmington 69 kV line and install a three-way phase switch to interconnect the AD2-031 project (Two network switches of the three-way switch are considered Direct Connection Facilities).	$0.450	AD2-031
n6952	Install a new 69kV breaker at Martinsville Substation. This will include the installation of all physical structures, P&C equipment, communications equipment, metering equipment, and associated facilities.	$1.610	AD2-031
n6953	Protection System changes at Wilmington Substation	$0.010	AD2-031
n7375	Tap the Martinsville-Wilmington 69 kV line and install a three-way phase switch to interconnect the AD2-031 project (Two network switches of the three-way switch are considered Direct Connection Facilities).	$0.450	AD2-031
n7376	Install a new 69kV breaker at Martinsville Substation. This will include the installation of all physical structures, P&C equipment, communications equipment, metering equipment, and associated facilities.	$1.610	AD2-031
n7377	Protection System changes at Wilmington Substation	$0.010	AD2-031
n8048.1	Robinson Relaying: Upgrade the line relaying equipment at Robinson Substation to prevent islanding	$0.644	AC1-068
n8048.2	Washington C.H. Relaying: Upgrade the line relaying equipment at Washington Courthouse Substation to prevent islanding	$0.396	AC1-068

Network Upgrades – Dayton

NUN	Description	Cost ($M)	Driver
n8058	Modify Relay Settings	$0.015	AE2-315
n8099	Fiber Installation to Wilmington and Martinsville Tap	$0.850	AD2-031
n8135	Review relay settings and change the carrier frequency at the Greene 345 kV Station.	$0.015	AE2-148
n8136	Review relay settings and change the carrier frequency at the Madison 345 kV Station.	$0.015	AE2-148

Network Upgrades – DEOK

NUN	Description	Cost ($M)	Driver
n7842	Revenue Metering Installation Oversight at AE2-318 station	$0.186	AE2-318
n7843	New 138 kV Station Oversight for AE2-318 interconnection	$0.214	AE2-318
n7844	Ford-Cedarville 138 kV T-Line Loop In/Out	$1.174	AE2-318
n7845	Perform remote protection and communication work at Ford and Cedarville substations to accommodate the interconnection switching substation.	$0.716	AE2-318
n7846	Distribution Line Extension for Station Power at AE2-318	$0.191	AE2-318

Network Upgrades – Dominion

NUN	Description	Cost ($M)	Driver
n6236	Build new structures to cut and loop the line into AC1-043 115 kV switching station	$1.430	AC1-043
n6287.2	Add two breakers in the Trowbridge 230 kV Substation to accommodate AD1-074/75/76	$4.000	AD1-074
n6314	Rebuild Shawboro – Elizabeth City 230 kV line #2021	$15.420	AD1-057
n6378	Rebuild 6.42 miles of 115 kV Line 91 from AE2-092 Tap to Sherwood with 2-636 ACSR.	$16.050	AE2-092
n6385	Replace 230/115 kV transformer TX #1 at New Road substation	$4.900	AE2-019
n6437	Rebuild 20.57 miles of 230 kV Line 2034 from Cashie to Earleys with 2-636 ACSR.	$30.855	AE2-034
n6786	Build a three breaker 115 kV substation at the existing Kings Dominion DP substation	$5.300	AD1-105
n6787	Build new structures to cut and loop the transmission line into the new Kings Dominion 115 kV ring bus substation	$0.500	AD1-105
n6788	Modify protection and communication work to support interconnection of the new Kings Dominion DP three breaker ring bus substation	$0.200	AD1-105

Network Upgrades – Dominion

NUN	Description	Cost ($M)	Driver
n7180	Rebuild 7.2 miles of 230 kV Line 235 from Prince EDW to Farmville with 2-636 ACSR.	$10.800	AF1-042
n7181	Rebuild 5.7 miles of 230 kV Line 235 from Briery to Prince EDW with 2-636 ACSR.	$8.550	AF1-042
n7586	Rebuild 7.62 miles of 230 kV Line 2104 from Cranes Corner to Stafford with 2-795 ACSR 150 C.	$11.430	AE1-191
n7854.1	Re-arrange line #65 to loop into and out of the new three breaker AE1-155 115 kV switching station Line 65 is an existing 115kV line that runs from Northern Neck substation to Harmony Village substation. AE1-155 provides for the construction of a new substation located in the existing Line 65 right-of-way between existing structures 65/498 and 65/499 in Farnham, VA.	$1.067	AE1-155
n7854.2	Build a three breaker AE1-155 115 kV switching station. The facilities identified provides for the initial construction of a new 115 kV three breaker ring substation between structures 65/498 and 65/499.	$5.414	AE1-155
n7854.3	Remote protection and communication work. Additional work is required at Northern Neck, Rappahannock, and Harmony Village substations. Drawing work, relay resets, and field support necessary to change the line 65 destinations at Garner DP, Lancaster, Ocran & White Stone substations will also be completed.	$0.318	AE1-155
n7954	Install a new 115kV overhead transmission line from Endless Caverns Substation	$1.423	AF1-028
n7955	Additional Work to be required at Endless Caverns includes adding a new 115kV bay, relocating Bus No. 3 Cap Bank, relocating 115kV line 118, and relocating Transformer No. 5 tap position. Control Enclosure CE1 will be expanded to the North by 10’ to allow room for new relaying panels to be installed with project and battery and charger replaced as well.	$3.378	AF1-028

Network Upgrades – Dominion

NUN	Description	Cost ($M)	Driver
n7972	Split Line #65 between Northern Neck Substation and Rappahannock Substation. Rappahannock Substation The AD2-074/AF1-042 substation will be built in line with line 65 approximately halfway between existing structures 65/541 and 65/542. This location is approximately 5.4 miles to the southeast of Garner DP. The final location of the substation is subject to change but shall remain within the same vicinity.	$0.969	AF1-042
n7973	Build a three breaker AD2-074/AF1-042 115 kV switching station. The objective of this project is to build a 115kV, 3-breaker ring bus to support the new solar farm built by Waller Solar I, LLC. The site is located along Dominion Energy's existing 115kV, 65 Line from Northern Neck Substation to Rappahannock Substation. The cut line will consume two of the positions in the ring bus. The third position will be for the 115kV feed from Waller Solar I, LLC collector station for the new solar farm.	$5.442	AF1-042
n7974	Remote protection and communication work. Additional work to be required at Harmony Village, Rappahannock, Northern Neck and Garner DP, Lancaster, Ocran & White Stone substations.	$0.318	AF1-042
n8049	Build a new 115 kV Solar Farm to interconnect into the Suffolk Station Project AE2-104 provides for the construction of one new 115kV interconnect into Suffolk Substation. The objective of this project is to add one new line position and one new 115kV breaker installed at Suffolk Substation to support the new 49MW solar farm built by Switchgrass Solar I, LLC. Additional modifications will be required to accommodate this additional infrastructure.	$3.349	AE2-104
n8070.1	Re-arrange line #2034 to loop into and out of the new three breaker AD1-022/023 230 kV switching station	$1.423	AD1-022
n8070.2	Remote protection and communication work. Additional protection and communication work to be required at Cashie, Earleys, and Trowbridge 230 kV substations.	$3.378	AD1-022

Network Upgrades – Dominion

NUN	Description	Cost ($M)	Driver
n8082	The Colonial Trail substation was built with four 230 kV circuit breakers in a ring breaker configuration with an ability to expand to a six breaker ring configuration. The previous projects (AB2-134 and AC1-216) have connected two solar generation to this substation. This project (AD1-025) will install a fifth 230kV circuit breaker to accommodate a third generator interconnection point.	$0.558	AD1-025
n8103.1	Build a three breaker AE1-103 115 kV switching station. The objective of this project is to build a 115 kV, 3-breaker ring bus to support the new 40 MW solar farm built by Aquasan Network Inc. The site is located along Dominion Energy's existing 115 kV Line 68 from Holland Substation to Union Camp Substation. The cut line will consume two of the positions in the ring bus. The third position will be for the 115 kV feed from Aquasan Network Inc. collector station for the new 40 MW solar farm.	$5.941	AE1-103
n8103.2	Remote protection and communication work	$0.342	AE1-103
n8103.3	Re-arrange line #68 to loop into and out of the new three breaker AE1-103 115 kV switching station Project AE1-103 will tap into Dominion's Line #68 between Holland and Union Camp substations. The new substation will be located off the main line between structures 68/98 and 68/99 in Isle of Wight County, Virginia.	$2.396	AE1-103
n8109.1	Build a three breaker 115 kV switching station.	$5.456	AD2-033
n8109.2	Re-arrange line #98 to loop into and out of the new three breaker 115 kV switching station	$1.802	AD2-033
n8109.3	Remote station work- Lunenburg 115 kV Substation	$0.139	AD2-033
n8109.4	Remote station work- Butcher Creek 115 kV Substation	$0.017	AD2-033

Network Upgrades – Dominion

NUN	Description	Cost ($M)	Driver
n8116.1	Install one new 230kV interconnect at Harmony Village Station	$3.828	AE2-041
n8116.2	Relocate existing 230kV Lanexa Line 2016	$2.608	AE2-041
n8116.3	Remote station work- Lanexa 230kV Substation	$0.093	AE2-041
n8117.1	Build a three breaker AE2-27 115 kV switching station. The objective of this project is to build a 115kV, 3-breaker ring bus to support the new 120MWSolar Farm built by Torch Clean Energy. The site is located along Dominion Energy's existing 115kV, 100 Line from Locks Substation to Chesterfield 115kV Substation. The cut line will consume two of the positions in the ring bus. The third position will be for the 115kV feed from Torch Clean Energy Collector Station for the new 120MW Solar Farm.	$6.792	AE2-027
n8117.2	Remote protection and communication work	$1.399	AE2-027
n8117.3	Re-arrange line #100 to loop into and out of the new three breaker AE2-027 115 kV switching station The following estimate is for the construction of a new substation connection on transmission line 100 between Harrowgate Substation and Locks Substation. The line connection will require the installation of two (2) backbone structures, two (2) static pole structures, and two (2) DDE H-frame structures.	$0.683	AE2-027
n8123.1	AE2-019 provides for the initial construction of one new 230kV interconnect into New Road Substation. To facilitate the addition of the attachment facility for the new 230kV line, the 230kV Bus #1 will need partially relocated at the point of interconnect. Also, to keep the station design standard, with the addition of the interconnect, a 230kV Motor Operated disconnect switch will need added on the high side of Transformer No. 1. In addition to the MOAB, three phase CCVTs on 115kV Bus #1, a single phase CCVT on 230kV Bus #1, and a single phase CCVT on 230kV Bus #2 will be installed.	$2.554	AE2-019
n8123.2	Remote protection and communication work	$0.078	AE2-019

Network Upgrades – Dominion

NUN	Description	Cost ($M)	Driver
n8167.1	Re-arrange line #2056 to loop into and out of the new three breaker AD1-056/AD1-057 230 kV switching station	$1.708	AD1-057
n8167.2	Build a three breaker AD1-056/AD1-057 230 kV switching station	$7.191	AD1-057
n8167.3	Remote protection and communication work at Hathaway 230 kV and Hornertown 230 kV substations	$0.067	AD1-057
n8190	Re-arrange lines 167, 168, and 2126 and reroute lines 25 and 1020 at Trowbridge substation and route developer transmission line into Trowbridge substation	$3.168	AD1-074
n8226.1	Re-arrange line #15 to loop into and out of the new three breaker AE1-149 115 kV switching station	$1.381	AE1-149
n8226.2	Build a three breaker AE1-149 115 kV switching station	$7.045	AE1-149
n8226.3	Remote protection and communication work at AE1-149 station	$0.637	AE1-149
n8258.1	Re-arrange line #91 to loop into and out of the new three breaker AE2-092 230 kV switching station	$2.510	AE2-092
n8258.2	Remote protection and communication work at AE2-092 station	$0.586	AE2-092
n8258.3	Build a three breaker AE2-092 230 kV switching station	$1.062	AE2-092

Network Upgrades – DPL

NUN	Description	Cost ($M)	Driver
n6023	Rebuild of the AB2-135 TAP - Church 69kV circuit, including the installation of new poles and a new disconnect switch	$6.600	AB2-135
n6070	Reinforcements to increase the emergency rating of the Delco Tap to Mickleton 230 kV line require the replacement of substation equipment, including substation bus at Mickleton Substation. The estimate to perform this work is $905,000 and will take 18 months to complete.	$0.905	AB2-153
n6472	Construct a new 230 kV substation with a three-position ring bus	$16.466	AB2-037
n7348	Cut and loop in Line 23009 to new 230 kV three-position ring bus substation, occupying two of those positions. The third position will accommodate interconnection of the Customer Facility.	$2.730	AB2-037
n7423	Install harmonic measurement equipment and provide harmonic measurement data to IC for the completion of a 12-month Harmonic Study for the interconnection of AE1-104	$0.000	AE1-104
n7502	Convert Hebron 69 kV substation to a five (5) position ring bus. The ring bus will consist of positions for a new terminal and take-off tower for Line 6708, a new terminal and takeoff tower for Line 6775, an existing terminal for Transformer T2, a new terminal for Transformer T1, and a new terminal for AC2-023	$4.840	AC2-023
n7503	Convert Hebron 69 kV substation to a five (5) position ring bus. The ring bus will consist of positions for a new terminal and take-off tower for Line 6708, a new terminal and takeoff tower for Line 6775, an existing terminal for Transformer T2, a new terminal for Transformer T1, and a new terminal for AC2-023	$4.840	AC2-023
n8042.1	Convert the East New Market 69 kV substation from a four (4) position line bus to a six (6) position ring bus.	$11.340	AC1-190
n8042.2	Modify lines 6715 and 6719 to align with their new takeoff positions at East New Market 69 kV substation.	$1.260	AC1-190

Network Upgrades – DPL

NUN	Description	Cost ($M)	Driver
n8051	Cut and loop in 13712 transmission line to the AE2-093, 138 kV three-position ring bus substation, occupying two of those positions.	$6.217	AE2-093
n8342	Install harmonic measurement equipment and collect data for a harmonic study. Provide data and report to Interconnection Customer and PJM.	$0.400	AF1-007

Network Upgrades – DUKE

NUN	Description	Cost ($M)	Driver
n8120.5	Roxboro (DEP) 230 kV Station - Update relay settings, engineering drawings, equipment labels.	$0.116	AD2-022

Network Upgrades – EKPC

NUN	Description	Cost ($M)	Driver
n6496	Increase the maximum operating temperature of the Summershade-Edm. JB Galloway Jct 69kV line section 266 MCM conductor to 212F (~7.9 miles)	$0.525	AE2-071
n8202	Increase the maximum operating temperature of the 266 MCM ACSR conductor in the McKinney Corner Tap-Knob Lick 69 kV line section to 212 degrees F (12.53 miles)	$0.720	AF1-203

Network Upgrades – FE

NUN	Description	Cost ($M)	Driver
n8061.1	Install fiber from Bartonville substation to backbone for relaying communications transport	$0.250	AE2-230
n8061.2	Loop the Bartonville-Meadow Brook 138kV into the new Long Creek Substation	$1.205	AE2-230
n8061.3	New structure installation per the Bartonville-Meadow Brook 138kV Line estimate	$0.515	AE2-230
n8061.4	Retune single frequency line trap and replace line tuner on Stephenson line	$0.232	AE2-230
n8061.5	Retune single frequency line trap and replace line tuner for Bartonville and Stonewall lines	$0.493	AE2-230
n8061.6	Replace line relaying, modify nameplates and drawings for line name change	$0.358	AE2-230
n8061.7	Replace line relying, retune single frequency line trap and replace line tuner on Stephenson line	$0.529	AE2-230
n8061.8	Interconnection Customer will construct a new three-breaker ring bus substation along the Bartonville - Meadow Brook 138 kV transmission line, to electrically interconnect the Customer Facility with the Transmission System.	$0.672	AE2-230

Network Upgrades – JCPL

NUN	Description	Cost ($M)	Driver
n6145	Construct a 34.5 line tap/connection and 2-34.5kV load-break switches with SCADA control at tap location, including 1 span of 34.5kV line to the point of interconnection at Gilbert-Morris Park (A27) 34.5kV Generation Interconnection. (One (1) 34.5 kV switch on the generator lead line and the span of 34.5 kV circuit are considered Attachment Facilities)	$0.073	AE1-243
n6146	Construct a 34.5 line tap/connection and 2-34.5kV load-break air switches with SCADA control at tap location, including 1 span of 34.5kV line to the point of interconnection at Gilbert-Morris Park (A27) 34.5kV Generation Interconnection. (The one (1) switch on the main circuit next to the tap is considered a Non-Direct Connection cost) Estimated installation of 700 MHz radio system (70% penetration of FE territory) to support the (3) SCADA switch replacements. Assumed SCADA work is included in this cost. Provide and install 34.5 kV instrument transformer package and bi-directional 4G cell meter at AE1-243 site (new battery facility.)	$0.817	AE1-243
n6147	Gilbert Substation- revise remote relay and metering settings on the Morris Park 34.5 kV terminal	$0.042	AE1-243
n6148	Morris Park Substation- revise remote relay and metering settings on the Gilbert 34.5 kV terminal	$0.042	AE1-243
n6587	Reconductor the Oyster Creek - Cedar 230 kV line (JCP&L portion only ~0.1 miles. AE portion ~14 miles) Upgrade terminal equipment at Oyster Creek Additionally, AE would need to replace their section of the limiting conductor and provide estimates for their replacement.	$2.820	AE1-020
n6728	To mitigate the (ACE) Cedar Oyster Creek 230 kV line (from bus 227955 to bus 206302 ckt 1) overload, it will require increasing the emergency rating of the Cedar to Oyster Creek 230 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators, and conductor. In addition, various terminal reinforcements are required at Cedar.	$27.000	AE1-020

Network Upgrades – JCPL

NUN	Description	Cost ($M)	Driver
n7262	At Farmingdale 34.5 kV: Appropriate terminal equipment upgrades required to accommodate higher generation output.	$0.010	AG1-563
n7263	At Bennett 34.5 kV: Appropriate terminal equipment upgrades required to accommodate higher generation output.	$0.010	AG1-563
n7264	Review of relay settings/ protection settings at X4-031 34.5 kV required.	$0.020	AG1-563
n8043.1	Oyster Creek Substation: Install (2) new 230kV breakers at Oyster Creek 230 kV substation for (1) new POI connection to AE1-020 (AE2-000)	$5.772	AE1-020
n8043.2	Manitou Substation: Relay settings changes	$0.117	AE1-020
n8442.3	Review relay settings at Chester substation	$0.085	AG1-191
n8442.4	Review relay settings at Pohatcong Mountain	$0.085	AG1-191

Network Upgrades – MAIT

NUN	Description	Cost ($M)	Driver
n6922	Install new line position for AF1-287 generator interconnection at Edinboro South	$0.784	AF1-287
n6923	Primary POI is to connect directly to the Edinboro South #1 34.5kV bus and 34.5KV GOAB to interconnect queue project AF1-287. Install 34.5 kV metering in customer's facilities. The customer is responsible to build their own line from their site to Penelec's existing facilities.	$0.072	AF1-287
n6924	Nameplates and customer drawing review at AF1-287 sub.	$0.053	AF1-287
n7084	At new AE1-071 115 kV Switchyard: Install line exit take-off structure, foundations, disconnect switch and associated equipment at ring bus substation	$0.691	AE1-071
n7261.2	AE1-185 Project Management: Project Management, Commissioning, Environmental, Forestry, Real Estate, and Right of Way.	$0.183	AE1-185
n7359	Loop the Jackson-TMI 230 kV line into the new AE2-211 ring bus substation.	$0.777	AE2-212
n7360	Modify Relay Settings at Jackson	$0.062	AE2-212
n7361	Modify Relay Settings at Three Mile Island	$0.062	AE2-212

Network Upgrades – MISO

NUN	Description	Cost ($M)	Driver
n8329.3	Relay settings shall be modified based on the new line topology.	$0.035	AD2-066

Network Upgrades – PENELEC

NUN	Description	Cost ($M)	Driver
n7529	AE2-224 Interconnection Sub: Construct a new 230 kV three breaker ring bus looping in the Bear Rock – Johnstown 230 kV line to provide interconnection facilities for AE2-224.	$1.031	AE2-224
n7530	AE2-224 Sub: Design, install and test/commission MPLS Equipment for SCADA transport.	$0.219	AE2-224
n7531	Bear Rock-Johnstown 230 kV Line Loop: Loop the Bear Rock- Johnstown 230kV into the new AE2-224 Interconnection Substation.	$0.969	AE2-224
n7532	Johnstown Substation: Upgrade Line terminal	$0.429	AE2-224
n7533	Lewistown Substation: Upgrade Line terminal	$0.219	AE2-224
n7534	Raystown Substation: Upgrade Line terminal	$0.367	AE2-224
n7535	Altoona Substation: Nameplates, Drawings, relay settings and relay upgrade	$0.728	AE2-224
n7536	Bear Rock Substation: Upgrade Line terminal	$0.454	AE2-224

Network Upgrades – PPL

NUN	Description	Cost ($M)	Driver
n7882	69 kV Tap line, MOLBAB Switch, Poles, structure, and foundations.	$0.597	AE2-059
n7883	Complete MILT-MVIL line modifications to tie in the new AE2-059 Attachment Facilities. This includes connecting the conductors and OPGW from the MILT-MVIL line to the new tap structure.	$0.066	AE2-059
n7884	Short Circuit Study, Review IC Engineering Package, and Remote End Work at the Milton 69 kV Substation	$0.116	AE2-059
n8131.1	Complete DANV-COLU 2 line modifications to tie in the new AE2-110 Attachment Facilities. This includes connecting the conductors and OPGW from the MILT-MVIL line to the new tap structure. Install (1) MOLBAB just north of the AE2-110 tap point.	$0.278	AE2-110
n8131.2	Re-arrange line #2199 to loop into and out of the new three breaker AE1-153 230 kV switching station. Project AE1-153 will tap into Dominion's Line #2199 between Remington and Gordonsville substations between transmission structures 2199/144 and 2199/145. The transmission line shall connect to the substation within the existing line right-of-way. Installation of the substation shall require the line to be renumbered from the new substation to Remington substation. The existing line segment between the new substation to Gordonsville substation shall remain Line 2199.	$0.138	AE2-110
n8165.1	Modifications to the Acahela - Jackson 69 kV line to tie in the AE2-175 Attachment Facilities	$0.097	AE2-175
n8165.2	Relay modifications and remote end work Acahela 69 kV	$0.138	AE2-175
n8165.3	Relay modifications and remote end work Jackson 69 kV	$0.138	AE2-175

Network Upgrades – PPL

NUN	Description	Cost ($M)	Driver
n8181.1	Complete COLU-SCOT line modifications to tie in the new AE2-241 Attachment Facilities. This includes replacing existing structure (grid # 34537N30614) with a new high pole of a high-low tap structure with a foundation and reframe/modify existing structures on each side of the new tap structure if required.	$0.054	AE2-241
n8181.2	Relay modifications and remote end work at Columbia 69 kV	$0.105	AE2-241
n8341.1	Modifications to the Mifflintown Tap 69 kV line to tie in the AF2-361 Attachment Facilities	$0.096	AF2-361
n8341.2	Relay Modifications Scope of Work at Juniata Substation	$0.238	AF2-361
n8341.3	Relay Modifications Scope of Work at Dauphin Substation	$0.238	AF2-361
n8351.1	Modifications to the Millville Tap 69 kV line to tie in the AF1-226 Attachment Facilities	$0.280	AF1-226
n8351.2	Relay Modification Work for IC and remote end	$0.140	AF1-226

Network Upgrades – PSEG

NUN	Description	Cost ($M)	Driver
n6233	Replacement of (2) poles and associated PSE&G standard conductor Installation of (2) new poles as H-frame for STATCOM equipment Installation and commissioning of STATCOM equipment. Relocation of branch recloser to new poles	$0.401	AE2-064
n8310	Replacement of the equipment for the 2310 line termination at New Freedom Switching Station including A-frame structure, line disconnect switch, relays, and associated equipment.	$2.730	AE2-022

Contact

Facilitator:
Paul McGlynn,
Paul.Mcglynn@pjm.com

Secretary:
Tarik Bensala,
Tarik Bensala@pjm.com

SME/Presenter:
Awais Ghayas,
Awais.Ghayas@pjm.com

Network Upgrades Update

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

Revision History

Version No.	Date	Description
1	Jan 4th, 2024	• Original slides posted

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