Generation Interconnection
Feasibility Study Report

For

PJM Generation Interconnection Request Queue
Position Y2-050

Canton Central – Tidd 345 kV

March / 2013

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the IC. The IC may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the IC may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

General

IC(IC) proposes to install PJM Project #Y2-050, a 749 MW (710 MW capacity) natural gas fired 2x1 F class combined cycle plant. The primary point of interconnection is located approximately 17 miles from the Canton Central station on the Canton Central-Tidd 345 kV line (see Figure 2). The location of the generating facility is in Carroll County Ohio approximately 2.5 miles from proposed 345 kV switching station (see Figure 1). The secondary point of interconnection is on the South Canton – Sammis 345 kV line in ATSI territory.

The requested in service date is August 31, 2017.

A new in-line switching station for Option #1 will be located between AEP's Canton Central and Tidd 345 kV stations in Carroll County, Ohio. This new station is to consist of three 345 kV circuit breakers configured in a breaker and one half bus arrangement operated as a ring-bus (see Figure 2). The interconnection station will be expandable to accommodate future projects in the area. The station will also include 345 kV metering, SCADA, and associated equipment. Protection relays in the surrounding area will need to be reset to accommodate the addition of the new station.

IC is expected to obtain, at their cost, a station site for the AEP facilities. IC shall obtain all necessary permits. Ownership of the in-line facilities shall be transferred from IC to AEP upon successful completion of the work.

A 345 kV line extension is required to loop through the proposed station. For the cost estimate, the AEP switching station is assumed to be located immediately adjacent to the existing transmission lines. A supplemental line easement for the tap poles will be required. It is expected that IC will obtain the supplemental easement when the station property is purchased.

Direct Connection Cost Estimate

The following work is required to connect Project Y2-050 to the Canton Central – Tidd 345 kV line:

Table 1 - Direct Connect Cost estimate

Description	Total Cost
Station	
Install three (3) 345 kV circuit breakers, SCADA, 345 kV revenue metering, and associated equipment.	$12,500,000
Protection & Relaying	
Line protection and controls will need to be installed at the new 345 kV switching station. Estimated Cost	$600,000
Line protection and controls at the Canton Central 345 kV Substation will need to be upgraded to coordinate with the new 345 kV switching station	$300,000

Table 1 - Direct Connect Cost estimate	
Description	**Total Cost**
Station	
Line protection and controls at the Tidd 345 kV Substation will need to be upgraded to coordinate with the new 345 kV switching station	$300,000
Total (2013 Dollars)	**$13,700,000**

It is understood that the IC is responsible for all costs associated with this connection. The cost of IC generating plant and the costs for the line connecting the generating plant to IC switching station are not included in this report; these are assumed to be IC's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. It is the responsibility of the developer to contact the local service provider to determine if a local service agreement is required.

Revenue Metering and SCADA Requirements

For PJM: IC will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx

For AEP:

The IC will be required to comply with all AEP Revenue Metering Requirements for Generation ICs. The Revenue Metering Requirements may be found within the "Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System" document located at the following link:

http://www.pjm.com/~/media/planning/plan-standards/private-aep/aep-interconnection-requirements.ashx

Network Impacts

The Queue Project #Y2-050 was studied as a 749.0MW (Capacity710.0MW) injection as a tap of the Tidd-Canton Central 345 kV line in the AEP area. Project #Y2-050 was evaluated for compliance with reliability criteria for summer peak conditions in 2016.

Potential network impacts were as follows:

Table 2 – Contingency List for Option 1	
Contingency Name	**Description**
4743	CONTINGENCY '4743_C2' OPEN BRANCH FROM BUS 242946 TO BUS 253965 CKT 1 / 242946 05TIDD 345 253965 15COLLIE 345 1 OPEN BRANCH FROM BUS 242946 TO BUS 235707 CKT 1 / 242946 05TIDD 345 235707 WYLIE RIDGE 345 1 END
4743_C2	CONTINGENCY '4743_C2' OPEN BRANCH FROM BUS 242946 TO BUS 253965 CKT 1 / 242946 05TIDD 345 253965 15COLLIE 345 1 OPEN BRANCH FROM BUS 242946 TO BUS 235707 CKT 1 / 242946 05TIDD 345 235707 WYLIE RIDGE 345 1 END
4744_C2_05TIDD 345-CC2	CONTINGENCY '4744_C2_05TIDD 345-CC2' OPEN BRANCH FROM BUS 242946 TO BUS 235707 CKT 1 / 242946 05TIDD 345 235707 WYLIE RIDGE 345 1 OPEN BRANCH FROM BUS 242946 TO BUS 243129 CKT C / 242946 05TIDD 345 243129 05TIDD X 138 C OPEN BRANCH FROM BUS 243127 TO BUS 243129 CKT BP / 243127 05TIDD 138 243129 05TIDD X 138 BP OPEN BRANCH FROM BUS 243127 TO BUS 243129 CKT SR / 243127 05TIDD 138 243129 05TIDD X 138 SR END
5031_C2_05KAMMER 765-PP2	CONTINGENCY '5031_C2_05KAMMER 765-PP2' OPEN BRANCH FROM BUS 242920 TO BUS 242925 CKT 1 / 242920 05BELMON 765 242925 05KAMMER 765 1 OPEN BRANCH FROM BUS 242920 TO BUS 242516 CKT 1 / 242920 05BELMON 765 242516 05MOUNTN 765 1 OPEN BRANCH FROM BUS 242920 TO BUS 235102 CKT 1 / 242920 05BELMON 765 235102 BELMONT 500 1 OPEN BRANCH FROM BUS 242925 TO BUS 235117 CKT 1 / 242925 05KAMMER 765 235117 KAMMER 500 1 OPEN BRANCH FROM BUS 235111 TO BUS 235117 CKT 1 / 235111 502 JUNCTION 500 235117 KAMMER 500 1 END
761_B2	CONTINGENCY '761_B2' OPEN BRANCH FROM BUS 242946 TO BUS 253965 CKT 1 / 242946 05TIDD

Table 2 – Contingency List for Option 1	
Contingency Name	**Description**
	345 253965 15COLLIE 345 1 END
AP_SB_363	CONTINGENCY 'AP_SB_363' / MITCHELL BREAKER FAILURE - TIE BREAKER FROM BUS 1-2 OPEN BRANCH FROM BUS 235124 TO BUS 235260 CKT 1 OPEN BRANCH FROM BUS 235124 TO BUS 235247 CKT 1 OPEN BRANCH FROM BUS 235124 TO BUS 235161 CKT 1 OPEN BUS 235572 OPEN BUS 235573 END
AP_SB_467	CONTINGENCY 'AP_SB_467' / HATFIELD500-RONCO500 STK BKR AT HATFIELD500 #8 OPEN BRANCH FROM BUS 235108 TO BUS 235774 CKT 1 OPEN BUS 235582 END
APS_B_G692	CONTINGENCY 'APS_B_G692' / 200011 KEYSTONE 500 235104 01CABOT 500 1 OPEN BRANCH FROM BUS 200011 TO BUS 235104 CKT 1 END
APS_B_G693	CONTINGENCY 'APS_B_G693' / 200011 KEYSTONE 500 235118 01SOBEND 500 1 OPEN BRANCH FROM BUS 200011 TO BUS 235118 CKT 1 END
B_LINE_SY_064	CONTINGENCY 'B_LINE_SY_064' /* LINE 01CABOT 500 TO 02CRNBRY 500 CK 1 DISCONNECT BRANCH FROM BUS 235104 TO BUS 239280 CKT 1 /* CABOT 500.00 02CRNBRY 500.00 END
B_LINE_SY_065	CONTINGENCY 'B_LINE_SY_065' /* LINE 02CRNBRY 500 TO 01WYLIER 500 CK 1 DISCONNECT BRANCH FROM BUS 239280 TO BUS 235703 CKT 1 /* 02CRNBRY 500.00 WYLIE RIDGE 500.00 END
B_LINE_TIE_027	CONTINGENCY 'B_LINE_TIE_027' /* 01WYLIE 345.00 - 05TIDD 345.00 LINE OUTAGE DISCONNECT BRANCH FROM BUS 235707 TO BUS 242946 CKT 1 /* WYLIE

Table 2 – Contingency List for Option 1	
Contingency Name	**Description**
	RIDGE 345.00 05TIDD 345.00 END
C2-BRK-ER126	CONTINGENCY 'C2-BRK-ER126' /* CRANBERRY 500KV, BKR FAILURE - BKR A DISCONNECT BRANCH FROM BUS 239280 TO BUS 235703 CKT 1 /* 02CRNBRY 500.00 01WYLIE R 500.00 DISCONNECT BRANCH FROM BUS 239280 TO BUS 239281 CKT 1 /* 02CRNBRY 500.00 02CRNBRY 138.00 END
C2-BRK-ER127	CONTINGENCY 'C2-BRK-ER127' /* CRANBERRY 500KV, BKR FAILURE - BKR B DISCONNECT BRANCH FROM BUS 239280 TO BUS 235703 CKT 1 /* 02CRNBRY 500.00 01WYLIE R 500.00 DISCONNECT BRANCH FROM BUS 239280 TO BUS 239281 CKT 2 /* 02CRNBRY 500.00 02CRNBRY 138.00 END
KEYSTONE_JACKMTN1_1	CONTINGENCY 'KEYSTONE_JACKMTN1_1' /* 500/500KV, AREA 225/225. DISCONNECT BRANCH FROM BUS 200011 TO BUS 200071 CKT 1 END
PJM20A_CONEMAGH-KEYSTONE	CONTINGENCY 'PJM20A_CONEMAGH-KEYSTONE' DISCONNECT BRANCH FROM BUS 200005 TO BUS 200011 CKT 1 /* CONEMAGH KEYSTONE 500 500 END
PJM3B1	CONTINGENCY 'PJM3B1' /* KEYSTONE BUS BREAKER 3 DISCONNECT BRANCH FROM BUS 200071 TO BUS 200011 CKT 1 /* JUNIATA KEYSTONE 500 500 /* BUS 200072 => 200071 (JACKMNT1) DISCONNECT BRANCH FROM BUS 200011 TO BUS 200810 TO BUS 200907 CKT 4/* KEYSTONE KEYSTONE 500 230 #4 END
PJM4	CONTINGENCY 'PJM4' /* KEYSTONE BREAKER 6 DISCONNECT BRANCH FROM BUS 200005 TO BUS 200011 CKT 1 /* CONEMAGH KEYSTONE 500 500 DISCONNECT BRANCH FROM BUS 200011 TO BUS 200810 TO BUS 200907 CKT 4/* KEYSTONE KEYSTONE 500 230 END

Table 2 – Contingency List for Option 1	
Contingency Name	**Description**
PJM53	CONTINGENCY 'PJM53' /* CONEMAUGH BREAKER 2 DISCONNECT BRANCH FROM BUS 200005 TO BUS 200011 CKT 1 /* CONEMAGH C14_CLCT 500 500 DISCONNECT BRANCH FROM BUS 200005 TO BUS 200031 CKT 1 /* CONEMAGH CONEMAGH 500 22 REMOVE MACHINE H FROM BUS 200031 /* CONEMAUGH 2 REMOVE MACHINE L FROM BUS 200031 END

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

Table 3 below provides a summary of the impacts caused by Y2-050 on the AEP transmission system and other TO areas for generator deliverability:

Table 3 - Generator Deliverability Option 1											
	Contingency		Facility	Bus		Loading		Rating		MW	FG
#	Type	Name	Description	From	To	Initial	Final	Type	MVA	Cont.	App.
1	Non	Non	05TIDD-WYLIE RIDGE 345 kV line	242946	235707	75.95	85.95	NR	1166	116.65	2
2	N-1	PJM20A_CONEMAGH-KEYSTONE	KEYSTONE-JACKMTN1 500 kV line	200011	200071	92.46	92.81	ER	3723	80.49	3
3	N-1	B_LINE_TIE_027	05TIDD-15COLLIE 345 kV line	242946	253965	87.87	95.27	ER	1391	102.94	5
4	N-1	KEYSTONE_JACKMTN1_1	KEYSTONE-CONEM-GH 500 kV line	200011	200005	99.32	99.73	ER	3723	95.83	11
5	N-1	761_B2	05TIDD-WYLIE RIDGE 345 kV line	242946	235707	95.44	105.61	ER	1434	145.86	13
6	N-1	APS_B_G693	CABOT-KEYSTONE 500 kV line	235104	200011	97.47	98.17	ER	2598	114.54	15
7	N-1	APS_B_G693	CABOT-KEYSTONE 500 kV line	235104	200011	97.47	98.17	ER	2598	114.54	16

Multiple Facility Contingency

(Double Circuit Tower Line(DCTL), Line with Failed Breaker(LFFB) and Bus Fault(Bus) contingencies for the full energy output.)

Table 4 below provides a summary of the impacts caused by Y2-050 on the AEP transmission system and other TO areas for multiple facility contingency:

Table 4 - Y2-050 Multiple Facility Contingency Option 1

	Contingency		Facility	Bus		Loading		Rating		MW	FG
#	Type	Name	Description	From	To	Initial	Final	Type	MVA	Contrib.	App.
8	LFFB	AP_SB_467	SMITHTON 62-YUKON 138 kV line	235252	235277	73.08	73.98	ER	297	16.43	1
9	LFFB	AP_SB_467	SHEPLER H J-SMITHTON 62 138 kV line	235247	235252	78.38	79.27	ER	297	16.43	4
10	LFFB	PJM4	KEYSTONE-JACKMTN1 500 kV line	200011	200071	94.36	94.74	ER	3723	86.12	6
11	LFFB	4744_C2_05TIDD 345-CC2	05TIDD-15COLLIE 345 kV line	242946	253965	89.39	97.95	ER	1391	119.09	7
12	LFFB	4744_C2_05TIDD 345-CC2	05TIDD-15COLLIE 345 kV line	242946	253965	89.39	97.95	ER	1391	119.09	8
13	LFFB	PJM53	KEYSTONE-JACKMTN1 500 kV line	200011	200071	98.68	99.05	ER	3723	84.91	9
14	LFFB	AP_SB_363	DRY RUN-CHARLEROI 138 kV line	235169	235161	87.24	88.84	ER	243	24.08	10
15	LFFB	5031_C2_05KAMMER 765-PP2	05TIDD-WYLIE RIDGE 345 kV line	242946	235707	93.59	102.44	ER	1434	134.93	14

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

Table 5 below provides a summary of the impacts caused by Y1-070 on the ATSI transmission system and other TO areas for contribution to previously identified overloads:

Table 5 - Y2-050 Contribution to Previously Identified Overloads Option 1											
	Contingency		Facility Description	Bus		Loading		Rating		MW	FG
#	Type	Name		From	To	Initial	Final	Type	MVA	Contrib.	App.
16	LFFB	PJM3B1	KEYSTONE-CONEM-GH 500 kV line	200011	200005	100.91	101.34	ER	3723	102	12
17	N-1	B_LINE_SY_065	02HOYTDL-02CRNBRY 138 kV line	238813	239281	101.98	102.88	ER	309	17.39	17
18	LFFB	4743_C2	05TIDD-MAHANS LANE 138 kV line	243127	235363	109.19	110.59	ER	250	21.56	18
19	DCTL	4743	05TIDD-MAHANS LANE 138 kV line	243127	235363	109.19	110.59	ER	250	21.56	19
20	N-1	B_LINE_SY_064	02MAPLE-02SENECA 138 kV line	238942	239099	115.59	116.65	ER	350	22.82	20
21	DCTL	4743	05TILTON-WINDSOR 138 kV line	243131	235428	123.31	124.21	ER	284	15.89	21
22	N-1	B_LINE_SY_064	02SENECA-KRENDALE 138 kV line	239099	235205	119.66	120.75	ER	338	22.82	22
23	N-1	B_LINE_SY_065	02HOYTDL-02MAPLE 138 kV line	238813	238942	127.23	128.2	ER	309	18.51	23
24	N-1	B_LINE_SY_064	SHANOR MANOR-BUTLER 138 kV line	235246	235152	126.02	127.39	ER	352	29.67	24
25	N-1	B_LINE_SY_065	02SHNAGO-02MCDOWL 138 kV line	239107	238954	134.85	135.96	ER	153	10.54	25
26	N-1	B_LINE_SY_064	KRENDALE-SHANOR MANOR 138 kV line	235205	235246	129.15	130.51	ER	352	29.67	26
27	LFFB	C2-BRK-ER126	02SHNAGO-02MCDOWL 138 kV line	239107	238954	140.46	141.65	ER	153	11.29	27
28	LFFB	C2-BRK-ER127	02SHNAGO-02MCDOWL 138 kV line	239107	238954	140.46	141.65	ER	153	11.29	28

Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of the surrounding generation. Any potential problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which analyzes all overload conditions associated with the overloaded element(s) identified. As a result of the aggregate energy resources in the area, the following violations were identified.

Table 6 - Y2-050 Delivery of Energy Portion of Interconnection Request Option 1

	Contingency		Facility Description	Bus		Loading		Rating		MW	FG
#	Type	Name		From	To	Initial	Final	Type	MVA	Contrib.	App.
29	N-1	APS_B_G692	KARNS CITY-KISSINGER J 138 kV line	235197	235203	75.39	76.31	ER	256	14.63	N/A
30	N-1	B_LINE_SY_064	02MAPLE-02SENECA 138 kV line	238942	239099	104.32	105.43	ER	350	24.07	N/A
31	N-1	B_LINE_SY_064	02SENECA-KRENDALE 138 kV line	239099	235205	107.99	109.14	ER	338	24.07	N/A
32	N-1	B_LINE_SY_064	SHANOR MANOR-BUTLER 138 kV line	235246	235152	107.64	109.08	ER	352	31.3	N/A
33	N-1	B_LINE_SY_064	KRENDALE-SHANOR MANOR 138 kV line	235205	235246	110.77	112.21	ER	352	31.3	N/A

Short Circuit

(Summary of impacted circuit breakers)

No Breakers identified as overdutied

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. "Network Impacts", initially caused by the addition of this project generation)

Table 3a - Y2-050 Generator Deliverability Option 1				
#	**Contingency**	**Facility**	**Description**	**Cost**
1	Non	05TIDD-WYLIE RIDGE 345 kV line	The ACAR 2303.5 kcmil, 54/37 Conductor Section 1 is a limiting element. The 0.15 mile section of ACAR 2303.5 conductor will need to reconductored. The cost could be higher if the transmission line engineer determines that the line will have to be completely rebuilt.	$225,000
2	PJM20A_CONEMAGH-KEYSTONE	KEYSTONE-JACKMTN1 500 kV line	Existing baseline RTEP project b0284.3 replaces the wave trap at Keystone on the future Jacks Mountain terminal. With the trap replaced, the rating of the line is 4239 MVA. Upgrade b0284.3 is presently scheduled to be complete prior to the ISD for the Y2-050 project (Q3 - 2017) and will eliminate the violation.	Existing baseline
3	B_LINE_TIE_027	05TIDD-15COLLIE 345 kV line KEYSTONE-CONEM-GH 500 kV line	**AEP**: The Non-AEP Conductor is a limiting element. The ACAR 2303.5 kcmil 54/37 Conductor Section 1 is a limiting element. A sag check has been requested for the ACAR 2303.5 conductor section 1 to determine if the line section can be operated above its emergency rating of 1166 MVA as part of the generation retirement. Due date for the sag check is 6/1/2015. ACSR 954 kcmil 45/7 Rail Conductor Section 2 is a limiting element A sag check has been requested for the ACSR 954 conductor section 2 to determine if the line section can be operated above its emergency rating of 1409 MVA as part of the generation retirement. Due date for the sag check is 6/1/2015.	TBD pending results of the sag study.
			DLCO: To resolve the violations identified for the Collier-Tidd 345kV tie line, DLCO proposes to reconductor its portion of this tie line. The preliminary cost estimate to reconductor approximately 24 miles of this 345kV circuit is $38,821,000 in 2013 dollars. This project will require 2.5-3 years to complete from the date of receipt of a signed Interconnection Service Agreement (ISA).	$38,821,000
4	KEYSTONE_JACKMTN1_1	05TIDD-WYLIE RIDGE 345 kV line	Existing baseline RTEP projects b0285.1 and b0285.2 replace the wave trap at Keystone and Conemaugh respectively on the Keystone-	Existing baseline

Table 3a - Y2-050 Generator Deliverability Option 1				
			Conemaugh 500 kV line. The ISD for b0285.1 and b0285.2 is 6-1-2018. These projects may need accelerated to address the violation however both projects are tied to the Jacks Mountain project which is presently being evaluated by PJM and may be cancelled. This project will need to be studied without Jacks Mt, in the impact study, to evaluate the need for this upgrade. The new rating will be 4239 MVA with the traps replaced.	
5	761_B2	CABOT-KEYSTONE 500 kV line		Same as #1
6	APS_B_G693	CABOT-KEYSTONE 500 kV line	The upgrade is a Wave Trap and Meter. The upgrade will have no impact on the fault study analysis.	$145,800
7	APS_B_G693	05TIDD-WYLIE RIDGE 345 kV line		Same as #6
			Cost	**$39,191,800**

Table 4a - Y2-050 Multiple Facility Contingency Option 1				
#	**Contingency**	**Facility**	**Description**	**Cost**
8	AP_SB_467	SMITHTON 62-YUKON 138 kV line	The SMITHTON 62-YUKON 138 kV line: This is an existing baseline RTEP project b2169. The estimated upgrade cost and ISD in the PJM database is $60,000 and 6-1-2017 respectively. Upgrade b2169 is presently scheduled to be complete prior to the ISD for the Y2-050 project (Q3 - 2017) and will eliminate the violations identified below. New Rating will be 332 MVA.	Existing Baseline
9	AP_SB_467	SHEPLER H J-SMITHTON 62 138 kV line	The SHEPLER H J-SMITHTON 62 138 kV line: This is an existing baseline RTEP project b2170. The estimated upgrade cost and ISD in the PJM database is $120,000 and 6-1-2017 respectively. Upgrade b2170 is presently scheduled to be complete prior to the ISD for the Y2-050 project (Q3 - 2017) and will eliminate the violations identified below. New Rating will be 376 MVA.	Existing Baseline
10	PJM4	KEYSTONE-JACKMTN1 500 kV line	The KEYSTONE-JACKMTN1 500 kV line: Existing baseline RTEP project b0284.3 replaces the wave trap at Keystone on the future Jacks Mountain terminal. With the trap replaced, the rating of the line is 4239 MVA. Upgrade b0284.3 is presently scheduled to be complete prior to the ISD for the Y2-050 project (Q3 - 2017) and will eliminate the violations identified below.	Existing Baseline

Table 4a - Y2-050 Multiple Facility Contingency Option 1				
#	**Contingency**	**Facility**	**Description**	**Cost**
11	4744_C2_05TIDD 345-CC2	05TIDD-15COLLIE 345 kV line	The 05TIDD-15COLLIE 345 kV line **AEP**: The Non-AEP Conductor is a limiting element. The ACAR 2303.5 kcmil 54/37 Conductor Section 1 is a limiting element. A sag check has been requested for the ACAR 2303.5 conductor section 1 to determine if the line section can be operated above its emergency rating of 1166 MVA as part of the generation retirement. Due date for the sag check is 6/1/2015. ACSR 954 kcmil 45/7 Rail Conductor Section 2 is a limiting element. A sag check has been requested for the ACSR 954 conductor section 2 to determine if the line section can be operated above its emergency rating of 1409 MVA as part of the generation retirement. Due date for the sag check is 6/1/2015. **DLCO:** To resolve the violations identified for the Collier-Tidd 345kV tie line, DLCO proposes to reconductor its portion of this tie line. The preliminary cost estimate to reconductor approximately 24 miles of this 345kV circuit is $38,821,000 in 2013 dollars. This project will require 2.5-3 years to complete from the date of receipt of a signed Interconnection Service Agreement (ISA).	
12	4744_C2_05TIDD 345-CC2	05TIDD-15COLLIE 345 kV line		Same as #3
13	PJM53	KEYSTONE-JACKMTN1 500 kV line	The KEYSTONE-JACKMTN1 500 kV line: Existing baseline RTEP project b0284.3 replaces the wave trap at Keystone on the future Jacks Mountain terminal. With the trap replaced, the rating of the line is 4239 MVA. Upgrade b0284.3 is presently scheduled to be complete prior to the ISD for the Y2-050 project (Q3 - 2017) and will eliminate the violations identified below.	Existing Baseline
14	AP_SB_363	DRY RUN-CHARLEROI 138 kV line	The DRY RUN-CHARLEROI 138 kV line: The violation is crossed out because the rating is incorrect in the case, with the actual rating of 332 MVA there is no violation.	N/A
15	5031_C2_05KAMMER 765-PP2	05TIDD-WYLIE RIDGE 345 kV line	The 05TIDD-WYLIE RIDGE 345 kV line: The violation is crossed out because this is no longer a valid contingency.	N/A
			Cost	N/A

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

Table 5a - Y2-050 Contribution to Previously Identified Overloads Option 1

#	Contingency	Facility	Description	Cost
16	PJM3B1	KEYSTONE-CONEM-GH 500 kV line	The KEYSTONE-CONEM-GH 500 kV line: Existing baseline RTEP projects b0285.1 and b0285.2 replace the wave trap at Keystone and Conemaugh respectively on the Keystone-Conemaugh 500 kV line. The ISD for b0285.1 and b0285.2 is 6-1-2018. These projects may need accelerated to address the violation however both projects are tied to the Jacks Mountain project which is presently being evaluated by PJM and may be cancelled. This project will need to be studied without Jacks Mt, in the impact study, to evaluate the need for this upgrade. The new rating will be 4239 MVA with the traps replaced.	Existing Baseline
17	B_LINE_SY_065	02HOYTDL-02CRNBRY 138 kV line	The 02HOYTDL-02CRNBRY 138 kV line: Reconductor the Cranberry – Hoytdale 138 kV line.	$22,601,000
18	4743_C2	05TIDD-MAHANS LANE 138 kV line	**AEP**: The Sub cond. 500 MCM CU 37 Str. Tidd Switch to Line Riser Section is a limiting element. Replace the Tidd Switch to Line Riser Section. Estimated Cost (2013 Dollars): $50,000.	$50,000
19	4743	05TIDD-MAHANS LANE 138 kV line	The Tidd Relay Thermal Limit is a limiting element. An engineering study will need to be conducted to determine if the relay thermal limit settings can be adjusted to mitigate the overload. A new relay package will be required if the relay thermal settings cannot be adjusted. Estimated Cost (2013 Dollars) for the relay package: $300,000.	$300,000
			The ACSR 556.5 kcmil 26/7 conductor section 1 is a limiting element. A sag check has been requested for the ACSR 556.5 conductor section 1 to determine if the line section can be operated above its emergency rating of 205 MVA as part of the generation retirement. The new summer emergency rating is 284 MVA. The new rating is not sufficient to mitigate this overload. AEP will have to rebuilt AEP's portion of the 05TIDD – MAHANS LANE 138 kV line	$7,836,000

Table 5a - Y2-050 Contribution to Previously Identified Overloads Option 1				
#	**Contingency**	**Facility**	**Description**	**Cost**
			which is approximately 6.53 miles of ACSR 556.5. Estimated Cost (2013 Dollars): $7,836,000.	
20	B_LINE_SY_064	02MAPLE-02SENECA 138 kV line	Build new Maple-Krendale 138kV line. Requires new line exits at Maple and Krendale substations.	$20,700,400
21	4743	05TILTON-WINDSOR 138 kV line	The 05TILTON-WINDSOR 138 kV line: The ACSR 556.5 kcmil 26/7 Dove Conductor Section 1 is a limiting element. A sag check will be required for the ACSR 556.5 kcmil 26/7 Dove Conductor Section 1 to determine if the line section can be operated above its emergency rating of 284 MVA. A study scheduled to be completed by 12/31/2012 could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 4.92 mile section of line would need to be rebuilt.	$5,904,000
22	B_LINE_SY_064	02SENECA-KRENDALE 138 kV line	The 02SENECA-KRENDALE 138 kV line: Build new Maple-Krendale 138kV line. Requires new line exits at Maple and Krendale substations.	Same as #20
23	B_LINE_SY_065	02HOYTDL-02MAPLE 138 kV line	The 02HOYTDL-02MAPLE 138 kV line: Perform terminal upgrades at both Maple and Hoytdale substations.	$333,880
24	B_LINE_SY_064	SHANOR MANOR-BUTLER 138 kV line	The SHANOR MANOR-BUTLER 138 kV line (from bus 235246 to bus 235152 ckt 1) loads from 126.02% to 127.39% (**DC power flow**) of its emergency rating (352 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('B_LINE_SY_064'). This project contributes approximately 29.67 MW to the thermal violation.	Same as #20
25	B_LINE_SY_065	02SHNAGO-02MCDOWL 138 kV line	The 02SHNAGO-02MCDOWL 138 kV line: Perform terminal upgrades at both McDowell and Shenango substations.	Same as #23
26	B_LINE_SY_064	02SHNAGO-02MCDOWL 138 kV line	The KRENDALE-SHANOR MANOR 138 kV line (from bus 235205 to bus 235246 ckt 1) loads from 129.15% to 130.51% (**DC power flow**) of its emergency rating (352 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('B_LINE_SY_064'). This project contributes approximately 29.67 MW to the thermal violation. APS- this violation also occurs in Y2-095, a request was sent on 2/8/13.	Same as #20

Table 5a - Y2-050 Contribution to Previously Identified Overloads Option 1				
#	**Contingency**	**Facility**	**Description**	**Cost**
27	C2-BRK-ER126	02SHNAGO-02MCDOWL 138 kV line		Same as #25
28	C2-BRK-ER127	KRENDALE-SHANOR MANOR 138 kV line		Same as #25
			Cost	**$57,725,280**

Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of the surrounding generation. Any potential problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which analyzes all overload conditions associated with the overloaded element(s) identified. As a result of the aggregate energy resources in the area, the following violations were identified.

Table 6a - Y2-050 Delivery of Energy Portion of Interconnection Request				
#	**Contingency**	**Facility**	**Description**	**Cost**
29	APS_B_G692	KARNS CITY-KISSINGER J 138 kV line	The KARNS CITY-KISSINGER J 138 kV line (from bus 235197 to bus 235203 ckt 1) loads from 75.39% to 76.31% (DC power flow) of its emergency rating (256 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('APS_B_G692'). This project contributes approximately 14.63 MW to the thermal violation.	**N/A**
30	B_LINE_SY_064	02MAPLE-02SENECA 138 kV line	The 02MAPLE-02SENECA 138 kV line (from bus 238942 to bus 239099 ckt 1) loads from 104.32% to 105.43% (DC power flow) of its emergency rating (350 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('B_LINE_SY_064'). This project	**N/A**

Table 6a - Y2-050 Delivery of Energy Portion of Interconnection Request				
#	**Contingency**	**Facility**	**Description**	**Cost**
			contributes approximately 24.07 MW to the thermal violation.	
31	B_LINE_SY_064	02SENECA-KRENDALE 138 kV line	The 02SENECA-KRENDALE 138 kV line (from bus 239099 to bus 235205 ckt 1) loads from 107.99% to 109.14% (DC power flow) of its emergency rating (338 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('B_LINE_SY_064'). This project contributes approximately 24.07 MW to the thermal violation.	**N/A**
32	B_LINE_SY_064	SHANOR MANOR-BUTLER 138 kV line	The SHANOR MANOR-BUTLER 138 kV line (from bus 235246 to bus 235152 ckt 1) loads from 107.64% to 109.08% (DC power flow) of its emergency rating (352 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('B_LINE_SY_064'). This project contributes approximately 31.3 MW to the thermal violation.	**N/A**
33	B_LINE_SY_064	KRENDALE-SHANOR MANOR 138 kV line	The KRENDALE-SHANOR MANOR 138 kV line (from bus 235205 to bus 235246 ckt 1) loads from 110.77% to 112.21% (DC power flow) of its emergency rating (352 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('B_LINE_SY_064'). This project contributes approximately 31.3 MW to the thermal violation.	**N/A**
			Cost	**N/A**

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

To be determined

Light Load Reliability Analysis

*(Summary of any reinforcements required to mitigate system reliability issues during light load periods. This light load study was evaluated for compliance with reliability criteria for **Light Load conditions** in 2014.)*

Not required.

Stability and Reactive Power Requirement
(Results of the dynamic studies should be inserted here)

The analysis will be done in the Impact Study

Schedule

The standard time required for construction is 18 months after signing an interconnection agreement.

Option 2 South Canton – Sammis 345 kV Sensitivity Analysis

Contingencies:

Option 2 South Canton – Sammis 345 kV	
Contingency Name	**Description**
378	CONTINGENCY '378' /KEYSTONE-01CABOT WITH STUCK BREAKER KEYSTONE 14 OPEN BRANCH FROM BUS 200011 TO BUS 235104 CKT 1 OPEN BRANCH FROM BUS 200011 TO BUS 200810 TO BUS 200906 CKT 3 END
AP_SB_363	CONTINGENCY 'AP_SB_363' / MITCHELL BREAKER FAILURE - TIE BREAKER FROM BUS 1-2 OPEN BRANCH FROM BUS 235124 TO BUS 235260 CKT 1 OPEN BRANCH FROM BUS 235124 TO BUS 235247 CKT 1 OPEN BRANCH FROM BUS 235124 TO BUS 235161 CKT 1 OPEN BUS 235572 OPEN BUS 235573 END
AP_SB_467	CONTINGENCY 'AP_SB_467' / HATFIELD500-RONCO500 STK BKR AT HATFIELD500 #8 OPEN BRANCH FROM BUS 235108 TO BUS 235774 CKT 1 OPEN BUS 235582 END
APS_B_G693	CONTINGENCY 'APS_B_G693' / 200011 KEYSTONE 500 235118 01SOBEND 500 1 OPEN BRANCH FROM BUS 200011 TO BUS 235118 CKT 1 END
B_LINE_SY_064	CONTINGENCY 'B_LINE_SY_064' /* LINE 01CABOT 500 TO 02CRNBRY 500 CK 1 DISCONNECT BRANCH FROM BUS 235104 TO BUS 239280 CKT 1 /* CABOT 500.00 02CRNBRY 500.00 END
B_LINE_SY_065	CONTINGENCY 'B_LINE_SY_065' /* LINE 02CRNBRY 500 TO 01WYLIER 500 CK 1 DISCONNECT BRANCH FROM BUS 239280 TO BUS 235703 CKT 1 /* 02CRNBRY 500.00 WYLIE RIDGE 500.00 END

Option 2 South Canton – Sammis 345 kV	
Contingency Name	**Description**
C2-BRK-ER126	CONTINGENCY 'C2-BRK-ER126' /* CRANBERRY 500KV, BKR FAILURE - BKR A DISCONNECT BRANCH FROM BUS 239280 TO BUS 235703 CKT 1 /* 02CRNBRY 500.00 01WYLIE R 500.00 DISCONNECT BRANCH FROM BUS 239280 TO BUS 239281 CKT 1 /* 02CRNBRY 500.00 02CRNBRY 138.00 END
C2-BRK-ER127	CONTINGENCY 'C2-BRK-ER127' /* CRANBERRY 500KV, BKR FAILURE - BKR B DISCONNECT BRANCH FROM BUS 239280 TO BUS 235703 CKT 1 /* 02CRNBRY 500.00 01WYLIE R 500.00 DISCONNECT BRANCH FROM BUS 239280 TO BUS 239281 CKT 2 /* 02CRNBRY 500.00 02CRNBRY 138.00 END
KEYSTONE_JACKMTN1_1	CONTINGENCY 'KEYSTONE_JACKMTN1_1' /* 500/500KV, AREA 225/225. DISCONNECT BRANCH FROM BUS 200011 TO BUS 200071 CKT 1 END
PJM20A_CONEMAGH-KEYSTONE	CONTINGENCY 'PJM20A_CONEMAGH-KEYSTONE' DISCONNECT BRANCH FROM BUS 200005 TO BUS 200011 CKT 1 /* CONEMAGH KEYSTONE 500 500 END
PJM3B1	CONTINGENCY 'PJM3B1' /* KEYSTONE BUS BREAKER 3 DISCONNECT BRANCH FROM BUS 200071 TO BUS 200011 CKT 1 /* JUNIATA KEYSTONE 500 500 /* BUS 200072 => 200071 (JACKMNT1) DISCONNECT BRANCH FROM BUS 200011 TO BUS 200810 TO BUS 200907 CKT 4/* KEYSTONE KEYSTONE 500 230 #4 END
PJM4	CONTINGENCY 'PJM4' /* KEYSTONE BREAKER 6 DISCONNECT BRANCH FROM BUS 200005 TO BUS 200011 CKT 1 /* CONEMAGH KEYSTONE 500 500 DISCONNECT BRANCH FROM BUS 200011 TO BUS 200810 TO BUS 200907 CKT 4/* KEYSTONE KEYSTONE 500 230 END

Option 2 South Canton – Sammis 345 kV	
Contingency Name	**Description**
PJM53	CONTINGENCY 'PJM53' /* CONEMAUGH BREAKER 2 DISCONNECT BRANCH FROM BUS 200005 TO BUS 200011 CKT 1 /* CONEMAGH C14_CLCT 500 500 DISCONNECT BRANCH FROM BUS 200005 TO BUS 200031 CKT 1 /* CONEMAGH CONEMAGH 500 22 REMOVE MACHINE H FROM BUS 200031 /* CONEMAUGH 2 REMOVE MACHINE L FROM BUS 200031 END

Load Flow Results:

Option 2											
Y2-050 Generator Deliverability Option 2 South Canton – Sammis 345 kV											
	Contingency		**Facility Description**	**Bus**		**Loading**		**Rating**		**MW Cont.**	**FG App.**
#	**Type**	**Name**		**From**	**To**	**Initial**	**Final**	**Type**	**MVA**		
1	N-1	PJM20A_CONEMAGH-KEYSTONE	KEYSTONE-JACKMTN1 500 kV line	200011	200071	92.46	92.81	ER	3723	80.49	3
2	N-1	KEYSTONE_JACKMTN1_1	KEYSTONE-CONEM-GH 500 kV line	200011	200005	99.32	99.73	ER	3723	95.83	8
3	N-1	APS_B_G693	CABOT-KEYSTONE 500 kV line	235104	200011	97.47	98.21	ER	2598	120.58	10

Y2-050 Multiple Facility Contingency Option 2 South Canton – Sammis 345 kV											
	Contingency		**Facility Description**	**Bus**		**Loading**		**Rating**		**MW Cont.**	**FG App.**
#	**Type**	**Name**		**From**	**To**	**Initial**	**Final**	**Type**	**MVA**		
4	LFFB	AP_SB_467	SMITHTON 62-YUKON 138 kV line	235252	235277	73.09	73.91	ER	297	15.05	1
5	LFFB	378	KARNS CITY-KISSINGER J 138 kV line	235197	235203	76.65	77.67	ER	256	16.02	2
6	LFFB	AP_SB_467	SHEPLER H J-SMITHTON 62 138 kV line	235247	235252	78.41	79.23	ER	297	15.05	4
7	LFFB	PJM4	KEYSTONE-JACKMTN1 500 kV line	200011	200071	94.36	94.74	ER	3723	86.12	5
8	LFFB	PJM53	KEYSTONE-JACKMTN1 500 kV line	200011	200071	98.69	99.05	ER	3723	84.91	6
9	LFFB	AP_SB_363	DRY RUN-CHARLEROI 138 kV line	235169	235161	87.24	88.8	ER	243	23.39	7

Y2-050 Contribution to Previously Identified Overloads Option 2											
	Contingency		Facility Description	Bus		Loading		Rating		MW Cont.	FG App.
#	Type	Name		From	To	Initial	Final	Type	MVA		
10	LFFB	PJM3B1	KEYSTONE-CONEM-GH 500 kV line	200011	200005	100.91	101.34	ER	3723	102	9
11	N-1	B_LINE_SY_065	02HOYTDL-02CRNBRY 138 kV line	238813	239281	101.98	102.99	ER	309	19.33	11
12	N-1	B_LINE_SY_064	02MAPLE-02SENECA 138 kV line	238942	239099	115.6	116.76	ER	350	25.21	12
13	N-1	B_LINE_SY_064	02SENECA-KRENDALE 138 kV line	239099	235205	119.67	120.87	ER	338	25.21	13
14	N-1	B_LINE_SY_065	02HOYTDL-02MAPLE 138 kV line	238813	238942	127.23	128.31	ER	309	20.59	14
15	N-1	B_LINE_SY_064	SHANOR MANOR-BUTLER 138 kV line	235246	235152	126.02	127.54	ER	352	32.93	15
16	N-1	B_LINE_SY_065	02SHNAGO-02MCDOWL 138 kV line	239107	238954	134.85	136.1	ER	153	11.83	16
17	N-1	B_LINE_SY_064	KRENDALE-SHANOR MANOR 138 kV line	235205	235246	129.15	130.66	ER	352	32.93	17
18	LFFB	C2-BRK-ER127	02SHNAGO-02MCDOWL 138 kV line	239107	238954	140.46	141.8	ER	153	12.67	18
19	LFFB	C2-BRK-ER126	02SHNAGO-02MCDOWL 138 kV line	239107	238954	140.46	141.8	ER	153	12.67	19

Y2-050 Delivery of Energy Portion of Interconnection Request Option 2											
	Contingency		Facility Description	Bus		Loading		Rating		MW Cont.	FG App.
#	Type	Name		From	To	Initial	Final	Type	MVA		
20	N-1	B_LINE_SY_064	02MAPLE-02SENECA 138 kV line	238942	239099	104.32	105.55	ER	350	26.6	
21	N-1	B_LINE_SY_064	02SENECA-KRENDALE 138 kV line	239099	235205	107.99	109.27	ER	338	26.6	
22	N-1	B_LINE_SY_064	SHANOR MANOR-BUTLER 138 kV line	235246	235152	107.64	109.24	ER	352	34.74	
23	N-1	B_LINE_SY_064	KRENDALE-SHANOR MANOR 138 kV line	235205	235246	110.77	112.36	ER	352	34.74	