

**PJM Generator Interconnection  
Y2-077 Hopewell 230 kV  
30 MW Capacity  
Feasibility Study Report**

*February 2013  
DMS #740196v1*

## **Introduction**

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, §36.2, as well as the Feasibility Study Agreement between Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Virginia Electric and Power Company.

## **Preface**

The intent of this Feasibility Study is to determine a plan, with preliminary cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by IC. As a requirement for interconnection, IC may be responsible for the cost of constructing Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM and the underlying system. All facilities required for interconnection of a generation interconnection project must be designed to meet ITO technical specifications.

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. IC is responsible for its right of way, real estate, and construction permit issues.

## **General**

The queue project Y2-077 was studied as a 30 MW Capacity injection to the ITO Hopewell Substation. Project Y2-077 was evaluated for compliance with reliability criteria for summer peak conditions in 2016. Potential network impacts were as follows:

**Network Impacts (Primary Option):**

**Impactful Contingencies**

*(The following contingencies resulted in overloads identified below)*

Contingency ID	Contingency Description
208&259	CONTINGENCY '208&259' /* LN 208 & 259 OPEN BRANCH FROM BUS 314338 TO BUS 314309 CKT 1 /* 208 CHESTERFIELD OPEN BRANCH FROM BUS 314309 TO BUS 314286 CKT 1 /* 208 OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /* 259 BASIN END
LN 259	CONTINGENCY 'LN 259' /* OPEN BRANCH FROM BUS 314276 TO BUS 314287 CKT 1 /*BASIN CHESTERFIELD END

**Generator Deliverability**

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

None.

**Multiple Facility Contingency**

*(Double Circuit Tower Line Contingencies only with full energy output. Stuck Breaker and Bus Fault contingencies will be applied during the Impact Study)*

None.

**Contribution to Previously Identified Overloads**

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

Y2-077 Contribution to Previously Identified Overloads													
Overload Number	Contingency		Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading		Rating		MW Contribution
	Type	Name			From	To			Initial	Final	Type	MVA	
1	N-1	LN 259	PJM	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	105.31	106.33	ER	399	4.08
2	N-1	LN 259	PJM	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	105.47	106.49	ER	399	4.08
3	DCTL	208&259	PJM	6MESSER-6CHARCTY 230 kV line	314228	314225	1	DC	118.06	119.2	ER	399	4.54
4	DCTL	208&259	PJM	6CHSTF B-6MESSER 230 kV line	314287	314228	1	DC	118.22	119.36	ER	399	4.54

**Mitigation:** This addresses 2-5: To up-rate line 217 from Lakeside to Chesterfield, which is 21.2 miles, to a capability of at least 476 MVA will require a re-sagging the existing conductor to allow a higher operating temperature. The estimated cost is \$6.5M and will take 18-24 months to complete. Cost allocations, if any, for this project to this upgrade will be determined at the System Impact Study.

**Short Circuit**

*(Report Overdutied breakers here)*

There is no impact to breaker interrupting capabilities.

**Steady-State Voltage Requirements**

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

Not required; existing facility already evaluated.

**Stability and Reactive Power Requirement**

*(Results of the dynamic studies should be inserted here)*

Not required; existing unit and energy portion already evaluated.

## ITO Analysis

ITO assessed the impact of the proposed queue project, Y2-077, interconnection as a 30 MW injection into the ITO transmission system. The system was assessed using the summer 2016 RTEP case provided to ITO by PJM. This 30 MW Capacity injection occurred at the Hopewell 230 kV substation bus.

This analysis did include the impacts of the generation Capacity for all higher order queue generators within the ITO transmission system. When performing a generation analysis, ITO's main analysis is load flow study results under single contingency, both normal and stressed system conditions, and import & export system conditions. One ITO criterion considers a transmission facility overloaded if it exceeds 94% of its emergency rating under normal and stressed system conditions. For import & export studies, ITO criterion considers a transmission facility overloaded if it exceeded 100% of its emergency rating. A full listing of ITO's planning criteria and interconnection requirements can be found in the ITO "Facility Connection Requirements," publicly available at: <http://www.dom.com>.

The results of these studies evaluate the system under a limited set of operating conditions and do not guarantee the full delivery of the Capacity and associated energy of this proposed generation facility under all operating conditions. NERC planning and operating reliability criteria allow for the re-dispatch of generating units to resolve projected and actual deficiencies in real time and planning studies. Specifically, NERC Category C contingency conditions: bus fault, tower line, N-1-1, and stuck breaker scenarios, allow for re-dispatch of generating units to resolve potential reliability deficiencies. For ITO planning criteria the re-dispatch of generating units for these contingency conditions is allowed as long as the projected loading does not exceed 100% of a facility load dump rating.

As part of its generation impact analysis ITO routinely evaluates the impact that a proposed new generation resource will have under maximum generation conditions, stress system conditions and import & export system conditions. The results of these studies are discussed in more detail below.

1. The first being when local generation including the proposed Y2-077 Facility is operated at their maximum capability. The result of this study is shown below.

No problems identified.

- The second being a stressed system condition where the largest generator in the area is unavailable. With the Y2-077 generator geographically located in Southside Virginia, Yorktown Unit #3 is considered the most critical generating unit in the area. The impact of Y2-077 was studied with the outage of Yorktown Unit #3. The result of this study is shown below.

No problems identified.

- The third being import and export conditions into and out of the ITO System. Any new facility that is interconnected with the ITO System should not significantly decrement First Contingency Incremental Transfer Capability between utilities. The results of these studies can be found in Tables A and B.

Table A: Import Study Results			
Area	Summer 2016	Summer 2016 with Y2-077	Limiting Element
AEP	2000+	2000+	None
APS	2000+	2000+	None
CPL	2000+	2000+	None
PJM	2000+	2000+	None

Table B: Export Study Results			
Area	Summer 2016	Summer 2016 with Y2-077	Limiting Element
AEP	2000+	2000+	None
APS	2000+	2000+	None
CPL	2000+	2000+	None
PJM	2000+	2000+	None

ITO planning criteria indicate a need to have at least 2000 MW of import and export capability with each interface area. The results of these import and export studies are indicate that the proposed generation facility will not impact ITO import or export capability.

### **Attachment Facilities**

Existing facilities are sufficient.

### **Direct Connection Network Upgrades**

Existing facilities are sufficient.

**Overload 1**

Bus Number	Bus Name	Full Contribution
315094	1CHESPK1	5.02
315095	1CHESPK2	5.02
315096	1CHESPK3	6.72
315097	1CHESPK4	9.47
315065	1CHESTF6	4.53
315139	1GASTONA	0.18
315141	1GASTONB	0.18
315119	1GRAVEL3	0.16
315120	1GRAVEL4	0.16
315121	1GRAVEL5	0.16
315122	1GRAVEL6	0.16
315117	1GRAVELC	0.05
315074	1HOPCGN1	0.15
315075	1HOPCGN2	0.15
315077	1HOPHCF1	0.24
315078	1HOPHCF2	0.24
315079	1HOPHCF3	0.24
315080	1HOPHCF4	0.37
315076	1HOPPOLC	0.2
315126	1ROARAP2	0.08
315128	1ROARAP4	0.07
315134	1ROAVALA	0.26
315135	1ROAVALB	0.07
315136	1ROSEMG1	0.13
315138	1ROSEMG2	0.06
315137	1ROSEMS1	0.08
315115	1SHAMPT1	0.08
315073	1STONECA	5.23
315116	1SURRY 1	1.52
314314	3LOCKS	0.04
314539	3UNCAMP	0.71
315419	Q-070	0.02
LTF	V3-012	6.02
900671	V4-068 C	.
907311	X1-080 1	10.98
907321	X1-080 2	10.98
LTF	X2-042	2.41
910753	X3-032 1	1.63
910752	X3-032 2	1.63
LTF	X3-097	3.29
LTF	X3-098	3.12
LTF	X4-041	3.08
LTF	Y1-004	7.53
LTF	Y1-007	5.23
913321	Y1-048 OP1	-1.2
913371	Y1-060 C	0.41
913411	Y1-066	-0.16
LTF	Y2-007	3.17
LTF	Y2-008	2.42
LTF	Y2-033	3.93
LTF	Y2-034	8.2
LTF	Y2-035	4.4
LTF	Y2-036	4.4
LTF	Y2-068	16.52
914241	Y2-074	1.09
914261	Y2-077	4.08

**Overload 2**

Bus Number	Bus Name	Full Contribution
315094	1CHESPK1	5.02
315095	1CHESPK2	5.02
315096	1CHESPK3	6.72
315097	1CHESPK4	9.47
315065	1CHESTF6	4.53
315139	1GASTONA	0.18
315141	1GASTONB	0.18
315119	1GRAVEL3	0.16
315120	1GRAVEL4	0.16
315121	1GRAVEL5	0.16
315122	1GRAVEL6	0.16
315117	1GRAVELC	0.05
315074	1HOPCGN1	0.15
315075	1HOPCGN2	0.15
315077	1HOPHCF1	0.24
315078	1HOPHCF2	0.24
315079	1HOPHCF3	0.24
315080	1HOPHCF4	0.37
315076	1HOPPOLC	0.2
315126	1ROARAP2	0.08
315128	1ROARAP4	0.07
315134	1ROAVALA	0.26
315135	1ROAVALB	0.07
315136	1ROSEMG1	0.13
315138	1ROSEMG2	0.06
315137	1ROSEMS1	0.08
315115	1SHAMPT1	0.08
315073	1STONECA	5.23
315116	1SURRY 1	1.52
314314	3LOCKS	0.04
314539	3UNCAMP	0.71
315419	Q-070	0.02
LTF	V3-012	6.02
900671	V4-068 C	.
907311	X1-080 1	10.98
907321	X1-080 2	10.98
LTF	X2-042	2.41
910753	X3-032 1	1.63
910752	X3-032 2	1.63
LTF	X3-097	3.29
LTF	X3-098	3.12
LTF	X4-041	3.08
LTF	Y1-004	7.53
LTF	Y1-007	5.23
913321	Y1-048 OP1	-1.2
913371	Y1-060 C	0.41
913411	Y1-066	-0.16
LTF	Y2-007	3.17
LTF	Y2-008	2.42
LTF	Y2-033	3.93
LTF	Y2-034	8.2
LTF	Y2-035	4.4
LTF	Y2-036	4.4
LTF	Y2-068	16.52
914241	Y2-074	1.09
914261	Y2-077	4.08

**Overload 3**

Bus Number	Bus Name	Full Contribution
315094	1CHESPK1	5.53
315095	1CHESPK2	5.53
315096	1CHESPK3	7.4
315097	1CHESPK4	10.43
315065	1CHESTF6	4.64
315074	1HOPCGN1	0.17
315075	1HOPCGN2	0.17
315077	1HOPHCF1	0.26
315078	1HOPHCF2	0.26
315079	1HOPHCF3	0.26
315080	1HOPHCF4	0.41
315076	1HOPPOLC	0.23
315073	1STONECA	5.82
314572	3EMPORIA	0.21
314704	3LAWRENC	0.82
314314	3LOCKS	0.05
314539	3UNCAMP	0.76
314541	3WATKINS	0.22
292791	U1-032 E	3.03
LTF	V3-012	6.15
900672	V4-068 E	0.1
907092	X1-038 E	1.91
907311	X1-080 1	11.53
907321	X1-080 2	11.53
LTF	X2-042	2.36
910753	X3-032 1	1.71
910752	X3-032 2	1.71
LTF	X3-097	3.29
LTF	X3-098	3.12
LTF	X4-041	3.08
LTF	Y1-004	7.7
LTF	Y1-007	5.35
913291	Y1-043 C OP1	1.01
913292	Y1-043 E OP1	6.76
913321	Y1-048 OP1	-1.29
913371	Y1-060 C	0.44
913372	Y1-060 E	0.44
913411	Y1-066	-0.18
LTF	Y2-007	3.17
LTF	Y2-008	2.38
LTF	Y2-033	4.03
LTF	Y2-034	8.51
LTF	Y2-035	4.56
LTF	Y2-036	4.56
LTF	Y2-068	16.51
914241	Y2-074	1.21
914261	Y2-077	4.54

**Overload 4**

Bus Number	Bus Name	Full Contribution
315094	1CHESPK1	5.53
315095	1CHESPK2	5.53
315096	1CHESPK3	7.4
315097	1CHESPK4	10.43
315065	1CHESTF6	4.64
315074	1HOPCGN1	0.17
315075	1HOPCGN2	0.17
315077	1HOPHCF1	0.26
315078	1HOPHCF2	0.26
315079	1HOPHCF3	0.26
315080	1HOPHCF4	0.41
315076	1HOPPOLC	0.23
315073	1STONECA	5.82
314572	3EMPORIA	0.21
314704	3LAWRENC	0.82
314314	3LOCKS	0.05
314539	3UNCAMP	0.76
314541	3WATKINS	0.22
292791	U1-032 E	3.03
LTF	V3-012	6.15
900672	V4-068 E	0.1
907092	X1-038 E	1.91
907311	X1-080 1	11.53
907321	X1-080 2	11.53
LTF	X2-042	2.36
910753	X3-032 1	1.71
910752	X3-032 2	1.71
LTF	X3-097	3.29
LTF	X3-098	3.12
LTF	X4-041	3.08
LTF	Y1-004	7.7
LTF	Y1-007	5.35
913291	Y1-043 C OP1	1.01
913292	Y1-043 E OP1	6.76
913321	Y1-048 OP1	-1.29
913371	Y1-060 C	0.44
913372	Y1-060 E	0.44
913411	Y1-066	-0.18
LTF	Y2-007	3.17
LTF	Y2-008	2.38
LTF	Y2-033	4.03
LTF	Y2-034	8.51
LTF	Y2-035	4.56
LTF	Y2-036	4.56
LTF	Y2-068	16.51
914241	Y2-074	1.21
914261	Y2-077	4.54