Feasibility Study [redacted]

[redacted]

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Progress Energy

Bulk Transmission Planning, Florida

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These results are based on the current PEF GIS and transmission service requests which include requests preceding this GIS request. To the extent that one or more of these requests are modified or withdrawn, the results presented in this analysis may no longer be valid and may change materially. PEF will advise the customer of any changes associated with the preceding GIS requests that may require a re-study of this GIS request.

Feasibility Study for the [redacted] Power Station

Generation Description

The generation proposed by [redacted] is a gas fired, simple cycle peaking facility equipped with two 7FA combustion turbines. The facility's total net generating capability is 400 MW in summer seasons and 450 MW in winter seasons. The anticipated commercial operation date is June 1, 2014.

Interconnection Points Evaluated

Points of interconnection requested for study by the interconnection customer:

- Option A—Connection to PEF's Brookridge substation 230kV bus
- Option B—Connection to PEF's Hudson substation 230kV bus

Because the exact location of the generation site is not known, this feasibility study assumed that the transmission line between the generation site and the PEF 230kV bus will be single conductor 954 KCM ACSS/TW with a length of 2500 ft.

Model Development

Power Flow Models

All power flow models were based on the FRCC 2010 series revision 1C cases built for use in Siemens PSS/E power system simulation program. The model years studied for power flow analyses were 2014 summer and 2014/15 winter. The models that included the Invenergy plant interconnection utilized the base cases with the addition of the Invenergy source and associated transmission for the interconnection.

Each case studied modeled a stressed dispatch in which all generation located close to the point of interconnection under study was put in service at its maximum output. From these cases, generation was reduced south of the point of interconnection to stress the transmission system to the south. These cases are identified as STSO cases. Cases to stress the transmission system to the north were created by using the initial stressed cases and reducing generation in central Florida which creates flows to the north of the point of interconnection. These cases are identified as STNO cases.

Short Circuit Models

The short circuit model was based on the FRCC 2009 series revision 1 model of 2014.

Analyses Performed

ACCC **power flow analyses** of base cases and generator interconnection cases were performed to determine the impact of interconnecting the Invenergy generation on the transmission system in the area. The base cases and each of the interconnection option cases were compared to determine if the interconnection option created thermal overloads or voltage violations, or exacerbated existing thermal overloads or voltage violations. All single element contingencies (n-1) in the northern portions of the FRCC region except for elements operated at less than 100kV in FPL were run in ACCC. All branch flows and bus voltages were monitored in the FRCC region.

Short circuit analyses were performed using PSS/E activity ASCC. Three phase and single line-to-ground faults were applied at all buses within 5 buses of the Invenergy interconnection point. Fault analyses were performed with bus voltages initialized by a solved power flow case and all nearby generation in service.

Screening Criteria

The following criteria were used for screening thermal results.

- GSU transformers were excluded from consideration.
- Transmission system elements operated at less than 69 kV nominal voltage were excluded.
- System-intact overloads must be greater than 100 percent of rate A.
- Post-contingency overloads must be greater than 100 percent of rate B.
- Post-contingency overloads that are improved by the interconnection were excluded.
- In the interconnection cases, the post-contingency overloads must have been made worse than the base case by 3% or greater.

The following criteria were used for screening voltage results.

- Buses in PEF and SECI were monitored for values outside of the range 0.9 – 1.05 p.u.
- FPL 69, 115, 138, and 230 kV buses were monitored for values outside the range 0.95-1.07 p.u.
- FPL 500 kV buses were monitored for values outside the range 0.95-1.09 p.u.
- TECO 69 kV buses were monitored for values outside the range 0.925-1.05 p.u.
- TECO 138 and 230 kV buses were monitored for values outside the range 0.95-1.06 p.u.
- All other monitored areas were monitored for values outside of the range 0.95 – 1.05 p.u.
- Crystal River Plant 230 kV bus voltage must remain above 232.4kV, or 1.0104 p.u.
- Turkey Point bus voltage must remain between 1.01 p.u. and 1.06 p.u.
- St. Lucie bus voltage must remain between 1.00 p.u. and 1.06 p.u.
- Generator buses and buses with nominal voltage below 69 kV were excluded from consideration.
- Absolute change in bus voltage between base case and the transfer case must have been greater than 0.01 p.u.

The following screening criteria were used for screening the ASCC short circuit results.

- Three phase and single line-to-ground fault current had to increase by 3% over the base case fault current.
- Breaker interrupting capabilities were reviewed at buses that increased by 3% or more.

Study Results for Option A, Brookridge 230kV

Required Upgrades

Thermal

Option A will require the following transmission system upgrades on the PEF system.

- Georgia Pacific-Chiefland Tap 69kV line must be rebuilt, 4.7 miles
- Brooksville-Springwood Tap 115kV line must be rebuilt, 4.1 miles

CASE	CONTINGENCY	ELEMENT	BASE POST CONTIN-GENCY MW	BASE POST CONTIN-GENCY %	BKRG POST CONTIN-GENCY MW	BKRG POST CONTIN-GENCY %	% DIFF
14W STNO	NEWBERRY-BRONSON 230KV CIR 1	GA PACIF-CHFLAND1TP 69KV CIR 1	97.7	94.8	106.9	103.6	8.80
14S STNO	BROOKSVLW-TANGERTP 115KV CIR 1	BROOKSVL- SPRINGWDTP 115KV CIR 1	145.6	94.6	160.7	104.3	9.70
14W STNO	BROOKSVLW-TANGERTP 115KV CIR 1	BROOKSVL- SPRINGWDTP 115KV CIR 1	167.8	98.6	185.9	109.2	10.60

Voltage

No voltage violations were identified on the PEF system that were caused by the interconnection of the Invenergy facility using option A.

Short Circuit

Short circuit analyses showed that six PEF buses were impacted by greater than 3% as a result of the interconnection of the Invenergy Plant using option A, but none of these buses should require breaker replacements based on this review.

Third Party Impacts

Two potential third party thermal impacts were identified as a result of interconnecting the Invenergy facility using option A. These impacts were overloads of the Juneau-Gannon 230kV transmission line and the Polk Plant-Pebbledale 230kV transmission line, both of which are owned by Tampa Electric Company. These third party impacts will be further evaluated in a system impact study and may have to be resolved through collaboration between the requesting customer and Tampa Electric Company, if PEF is unable to obtain a resolution from Tampa Electric Company during the system impact study.

CASE	CONTINGENCY	ELEMENT	BASE POST CONTIN-GENCY MW	BASE POST CONTIN-GENCY %	BKRG POST CONTIN-GENCY MW	BKRG POST CONTIN-GENCY %	% DIFF
14S STSO	DAVIS RD-CHAPMAN 230KV CIR 1	JUNEAU-GANNON 230KV CIR 1	737	99.9	760	103.1	3.20
14S STNO	POLKPLNT-PEBBLDLE682 230KV CIR 1	POLKPLNT-PEBB 230KV CIR 2	729.6	98.2	759.9	102.2	4.00

There were no third party voltage impacts identified.

Seven third-party buses had short circuit impacts greater than 3% as a result of the interconnection of the Invenergy Plant using option A. Coordination with the owners of those buses will be necessary as part of a system impact study to determine if those buses will require upgrades.

Costs

Based on this feasibility study, the cost to interconnect the [redacted] facility at PEF's Brookridge 230kV substation will cost approximately $8.8M, and facilities identified will require between 36-48 months to construct.

All costs and time to construct references in this feasibility report are non-binding good faith estimates. These estimates do not include any costs or time to construct facilities associated with resolving third party impacts or other potential system upgrades that may be identified in the system impact study. These estimates are planning estimates, and details specific to this project discovered in the system impact study and facilities study may significantly change the estimate.

Study Results for Option B, Hudson 230kV

Required Upgrades

Thermal

Option B will require the following transmission system upgrades on the PEF system.

- Georgia Pacific-Chiefland Tap 69kV line must be rebuilt, 4.7 miles
- Brooksville-Springwood Tap 115kV line must be rebuilt, 4.1 miles
- Brooksville 115/69kV transformer 4 will have to be replaced
- Hudson substation will require the addition of an additional 230/115kV transformer

CASE	CONTINGENCY	ELEMENT	BASE POST CONTIN-GENCY MW	BASE POST CONTIN-GENCY %	HUDSON POST CONTIN-GENCY MW	HUDSON POST CONTIN-GENCY %	% DIFF
14W STNO	NEWBERRY-BRONSON 230KV CIR 1	GA PACIF-CHFLAND1TP 69KV CIR 1	97.7	94.8	105.9	102.6	7.8
14S STNO	BROOKSVILLE 115/69 TRF 1	BROOKSVILLE 115/69 TRF 2	104.2	93	115.9	103.5	10.5
14S STNO	BROOKSVLW-TANGERTP 115KV CIR 1	BROOKSVL- SPRINGWDTP 115KV CIR 1	145.6	94.6	157.9	102.7	8.1
14W STNO	BROOKSVLW-TANGERTP 115KV CIR 1	BROOKSVL- SPRINGWDTP 115KV CIR 1	167.8	98.6	183.5	108.3	9.7
14W STNO	HUDSON 230/115 TRF 2	HUDSON 230/115 TRF 1			295.8	105.6	>13.6%
14W STSO	HUDSON 230/115 TRF 2	HUDSON 230/115 TRF 1			297.4	106.2	>14.2%

Voltage

No voltage violations were identified on the PEF system that were caused by the interconnection of the Invenergy facility using option B.

Short Circuit

Short circuit analyses showed that four PEF buses were impacted by greater than 3% as a result of the interconnection of the Invenergy Plant using option B, but none of these buses should require breaker replacements based on this review.

Third Party Impacts

One potential third party thermal impact was identified as a result of interconnecting the Invenergy facility using option B. This impact was an overload of the Polk Plant-Pebbledale 230kV transmission line owned by Tampa Electric Company. These third party impacts will be further evaluated in a system impact study and may have to be resolved through collaboration between the requesting customer and Tampa Electric Company, if PEF is unable to obtain a resolution from Tampa Electric Company during the system impact study.

CASE	CONTINGENCY	ELEMENT	BASE POST CONTIN-GENCY MW	BASE POST CONTIN-GENCY %	HUDSON POST CONTIN-GENCY MW	HUDSON POST CONTIN-GENCY %	% DIFF
14S STNO	POLKPLNT-PEBBLDLE682 230KV CIR 1	POLKPLNT-PEBB 230KV CIR 2	729.6	98.2	761.4	102.4	4.2

There were no third party voltage impacts identified.

Nine third-party buses had short circuit impacts greater than 3% as a result of the interconnection of the Invenergy Plant using option B. Coordination with the owners of those buses will be necessary as part of a system impact study to determine if those buses will require upgrades.

Costs

Based on this feasibility study, the cost to interconnect the Invenergy facility at PEF's Hudson 230kV substation will cost approximately $23.9M, and facilities identified will require between 36-48 months to construct.

All costs and time to construct references in this feasibility report are non-binding good faith estimates. These estimates do not include any costs or time to construct facilities associated with resolving third party impacts or other potential system upgrades that may be identified in the system impact study. These estimates are planning estimates, and details specific to this project discovered in the system impact study and facilities study may significantly change the estimate.

Considerations for Additional Study

This feasibility study is performed in accordance with the PEF OATT to determine whether interconnection of the proposed generation at one of the specified points is feasible. Further analyses will need to be performed in the system impact study which may identify other system upgrades needed to reliably interconnect the proposed facility. The system impact study will include additional contingency analyses not performed in the feasibility study, system stability analyses, PV analyses, and short circuit analyses.

The contingency analyses will examine how the transmission system is impacted by the proposed generation when there are single element (n-1) contingencies as performed in this feasibility study, but additional contingencies such as multiple element contingencies (n-2), breaker failure contingencies, generation outages, and extreme contingencies are examined as well.

System stability analyses will examine how the transmission system responds to disturbances and whether the proposed generation will adversely affect the stability of the transmission system.

PV analyses are used to determine how the import and export capability of the State of Florida is affected by the interconnection of the proposed generation. Import and export capability is a critical consideration given the peninsular geography of the State of Florida. These analyses will determine whether the proposed generation has adversely affected this transfer capability.

The short circuit analyses will include any additional system upgrades identified in system impact study.

The impact of the proposed interconnecting facility will be analyzed using various system conditions. Such conditions may include, but are not limited to, peak load cases, light load cases, high Florida import cases, high Florida export cases, stressed generation dispatch, including any relevant prior queued generation or other conditions considered to present risk to the reliability of the transmission system.