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# **Designated Network Resource Service Request**

## **IBR Study**

**for OASIS 95150056 (DNR) "St. Marks Solar"**



**December 2021**

**Transmission Planning, Florida**

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## **1. Executive Summary**

As a member of the FRCC, DEF has been asked to conduct an Inverter Based Resource (IBR) study which includes other FRCC member entities' planned solar requests to assist them in assessing impacts to their system. The customer should note that this study may not follow DEF's interpretation of the Tariff and may not reflect request order in respect to this OASIS request thus impacts to DEF facilities were not considered in this study.

The System Impact for the Duke Energy Florida, LLC (DEF) Transmission System was studied for the Designated Network Resource (DNR) request referenced by OASIS number 95150056. This DNR requests a maximum of 75 MW yearly received from St. Marks Solar resource located in Wakulla County, Florida and delivered to DEF Load within DEF's Area beginning 01/01/2024 thru 01/01/2100. Although the requested start is 01/01/2024, current study work indicates that the NRIS study associated with this has an ISD of 09/03/2024. Therefore, this was the assumed ISD for this request. At the completion of this report, St. Marks Solar is still in its Large Generator Interconnection Procedures (LGIP) process under Q291 and working on the execution of a Large Generator Interconnection Agreement (LGIA) for 74.9 MW summer/winter.

The results of this IBR study did indicate that there are potentially impacted FRCC member entities. The customer will need contact these potentially impacted parties to confirm and resolve impacts to their system.

## **2. Point of Receipt, and Point of Delivery**

The Point of Receipt is the generator referred to as "St. Marks Solar", with the Point of Interconnection will be a new 230 kV terminal at DEF's existing St. Marks East 230/69 kV substation located in Wakulla County, Florida.

The Point of Delivery is City of DEF's Load, which is located in DEF's Balancing Area.

## **3. Model Development**

Power flow models were built using the Siemens PSS®E power system simulation program and were based on the FRCC 2021 (RIs2-RP) series cases, which were the most recent models available at the time of the study. The model years to be studied for power flow impacts will be 2024 Summer, and 2026 Summer. The study case models added the appropriate additional MW summer/winter output to each base case. Any sensitivity work performed was based on the FRCC 2021 (RIs2-RP) series cases.

This resource was studied as being dispatched against other DEF resources that would otherwise be serving DEF's Load.

## 4. Analyses Performed

Power flow analyses of the cases were performed using PowerGEM's TARA software (TARA) to determine the impact of the DNR on the Bulk Electric System (BES). The base and interconnection study cases were compared to determine if the DNR caused new overloads, voltage violations, or exacerbated existing thermal overloads. In addition, all 69 kV and above branch flows and bus voltages in the FRCC region were monitored.

The following contingencies were performed using the TARA AC Contingency Analysis Calculator:

- Selected TPL-001-4 Category P1, P2, P4, P5, P6 and P7 contingencies within the FRCC region as previously defined by FRCC transmission owners.

## 5. Screening Criteria

The following criteria were used for screening **thermal results**.

- Unrelated results from GSU transformers were excluded.
- Transmission system elements operated at less than 69 kV nominal voltage were excluded.
- System-intact overloads were screened at greater than 100 percent of rate A.
- Post-contingency overloads were screened at greater than 100 percent of rate A. An exception to using Rate A is the P6 contingencies, which were screened at Rate C.
- Post-contingency overloads that would be improved by the interconnection were excluded.
- Existing Post-contingency overloads were compared between the base and study cases, these overloads that increased were reviewed for significant impact.

The following criteria were used for screening **voltage results**.

- DEF and SECI buses were monitored for values outside of 0.90-1.05 p.u.
- FPL 69, 115, 138, and 230 kV buses were monitored for values outside of 0.95-1.07 p.u.
- FPL 500 kV buses were monitored for values outside of 0.95-1.10 p.u.
- TECO 69 kV buses were monitored for values outside of 0.925-1.05 p.u.
- TECO 138 and 230 kV buses were monitored for values outside of 0.95-1.06 p.u.
- FPL's Turkey Point bus voltage was monitored for values outside of 1.01 p.u. and 1.06 p.u.
- FPL's St. Lucie bus voltage was monitored for values outside of 1.00 p.u. and 1.06 p.u.
- All other monitored areas were monitored for values outside of 0.95-1.05 p.u.
- Generator buses and buses with nominal voltage below 69 kV were excluded from consideration.
- For P6 contingencies, buses were monitored for values outside of 0.88-1.10 p.u.
- Absolute change in bus voltage between base case and the interconnection case must have been greater than 0.02 p.u.

## **6. Study Results**

As a member of the FRCC, DEF has been asked to conduct an Inverter Based Resource (IBR) study which includes other FRCC member entities' planned solar requests to assist them in assessing impacts to their system. The customer should note that this study may not follow DEF's interpretation of the Tariff and may not reflect request order in respect to this OASIS request thus impacts to DEF facilities were not considered in this coordinated study.

The thermal and voltage analyses did indicate that there are potentially impacted FRCC member entity systems. The IBR study results identified as significant impacts are shown in the Appendices below. The customer will need contact these potentially impacted parties identified below to confirm and resolve impacts to their system to maintain firm service. FRCC member entities may wait to identify themselves as an impacted party when this request is presented at the FRCC. FRCC member entities may invoke their right to review any or all their facilities that are suspected to be impacted by this interconnection request, which could result in additional impacted transmission system facilities to any initially identified. The customer may utilize contact information located below.

### **Potentially Affected Third-Party List**

- FPL, GULF

## N-1 Thermal Rate A Results

## N-1 Thermal Rate B Results

## N-1 Thermal Rate C Results

Contingency	Monitored Facility	kVs	Areas	areas Name	Zones	Rate A (MVA)	Rate B (MVA)	Rate C (MVA)	Rate A %	Rate B %	Rate C %	Rate A Diff	Rate B Diff	Rate C Diff	Rate A %	Rate B %	Rate C %	Rate A %	Rate B %	Rate C %	Rate A %	Rate B %	Rate C %	Rate A Diff	Rate B Diff	Rate C Diff	Rate A Max	Rate B Max	Rate C Max	Rate Alt Max			
P2-2:PFPL-CFLAU-1850	12355 MACEDON SW	115	50010-FPL-Q421	PO1	115 1	115	30/1	SOCO/PL	701/5	207	207	207	-	-	-	99.87	99.87	99.87	100.98	100.98	100.98	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW				
P2-2:PFPL-CFLAU-1850-117	12355 MACEDON SW	115	50010-FPL-Q421	PO1	115 1	115	30/1	SOCO/PL	701/5	207	207	207	-	-	-	99.87	99.87	99.87	100.98	100.98	100.98	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW				
P2-3:PLC-CFLAU-1850-344	12355 MACEDON SW	115	50010-FPL-Q421	PO1	115 1	115	30/1	SOCO/PL	701/5	207	207	207	-	-	-	99.87	99.87	99.87	100.98	100.98	100.98	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW				
P1-2_Branch DEF-330-3161-FL GAS TRNS-230-3167-PERRY-230-1	3101 BAKER TP	115	3143 KILLEARN TP1	TP1	115 1	115	2	DEF	84	98	43.71	37.47	36	55.32	47.42	45.56	-	-	-	109.28	93.67	90	122.15	104.7	100.59	NEW	NEW	NEW	12.87	10.59	10.59		
P2-3:DEF-5482_5485_5487:FLGT	3101 BAKER TP	115	3143 KILLEARN TP1	TP1	115 1	115	2	DEF	84	98	102	45.91	39.35	37.81	57.52	49.3	47.37	-	-	-	111.59	95.65	91.9	124.42	106.64	102.46	NEW	NEW	NEW	12.83	10.64	10.64	
P7:DEF-*STME-FLGT-PRRY	3101 BAKER TP	115	3143 KILLEARN TP1	TP1	115 1	115	2	DEF	84	98	102	45.91	39.35	37.81	57.52	49.3	47.37	-	-	-	111.59	95.65	91.9	124.42	106.64	102.46	NEW	NEW	NEW	12.83	10.64	10.64	
P2-3:DEF-3151:PRRY	3101 BAKER TP	115	3143 KILLEARN TP1	TP1	115 1	115	2	DEF	84	98	102	45.91	39.35	37.81	57.04	48.89	46.97	-	-	-	112.31	96.27	92.49	123.95	106.24	102.07	11.64	NEW	NEW	NEW	12.83	10.64	10.64
P1-2_Branch DEF-330-3161-FL GAS TRNS-230-3172-ST MARKS E-230-1	3101 BAKER TP	115	3143 KILLEARN TP1	TP1	115 1	115	2	DEF	84	98	102	47.84	41.01	39.4	59.53	51.03	49.03	-	-	-	114.67	98.29	94.44	126.19	108.16	103.92	11.52	NEW	NEW	NEW	12.52	10.72	10.72
P2-3:DEF-8492-STME	3101 BAKER TP	115	3143 KILLEARN TP1	TP1	115 1	115	2	DEF	84	98	102	47.85	41.01	39.4	59.18	50.73	48.74	-	-	-	114.62	98.25	94.4	125.93	107.94	103.71	11.31	NEW	NEW	NEW	12.52	10.72	10.72

## N-1 Voltage Results

Contingency	Monitored Facility	kVs	Areas	reas Nam	Names	Min Volt	Max Volt	Volt	Volt	Volt Diff	Volt	Volt	Volt Diff	Volt Max	Dif
T-P2-1:DEF:115:BRDW-DFTN:(3104-3105-1)	2997 MICOUSCO CAP 115	115	2	DEF	84	0.9	1.05	1.0137	1.0675	NEW	1.017	1.0193	-	NEW	
T-P2-1:DEF:115:BRDW-DFTN:(3104-3105-1)	3101 BAKER TP 115	115	2	DEF	84	0.9	1.05	1.0113	1.0934	NEW	1.0146	1.0163	-	NEW	
T-P2-1:DEF:115:BRDW-DFTN:(3104-3105-1)	3104 BRADFV W CAP 115	115	2	DEF	84	0.9	1.05	1.0114	1.1103	NEW	1.0146	1.0164	-	NEW	
T-P2-1:DEF:115:BRDW-DFTN:(3104-3105-1)	3115 LLOYD TP 115	115	2	DEF	84	0.9	1.05	1.0207	1.0553	NEW	1.0241	1.0165	-	NEW	
T-P2-1:DEF:115:BRDW-DFTN:(3104-3105-1)	3119 MICOUSCO TP 115	115	2	DEF	84	0.9	1.05	1.0139	1.0677	NEW	1.0173	1.0191	-	NEW	
T-P2-1:DEF:115:BRDW-DFTN:(3104-3105-1)	3143 KILLEARN TP1 115	115	2	DEF	84	0.9	1.05	1.0114	1.1059	NEW	1.0146	1.0164	-	NEW	
T-P2-1:DEF:115:BRDW-DFTN:(3104-3105-1)	6998 BUCK LK 115	115	2	DEF	307	0.9	1.05	1.0024	1.0572	NEW	1.0061	1.0083	-	NEW	
T-P2-1:DEF:115:BRDW-DFTN:(3104-3105-1)	7014 MICOSSC 115	115	2	DEF	307	0.9	1.05	1.0137	1.0675	NEW	1.017	1.0193	-	NEW	
T-P2-1:DEF:115:BRDW-DFTN:(3104-3105-1)	7030 BAKER 115	115	2	DEF	307	0.9	1.05	1.0113	1.0934	NEW	1.0145	1.0163	-	NEW	
T-P2-1:DEF:115:BRDW-DFTN:(3104-3105-1)	7051 LLOYD 115	115	2	DEF	308	0.9	1.05	1.0207	1.0553	NEW	1.0241	1.0164	-	NEW	
P5:FPL-138:MIAMI-RIVERSEDE	806 CCG DIST2 138	138	1	FPL	1	0.95	1.07	0.9522	0.9522	0.9522	0.9519	0.9499	NEW	NEW	
T-P2-1:FPL:230:OrangeRiver_Terry_(609-351-1)	283 AGRADA 69	69	1	FPL	4	0.95	1.07	0.9538	0.9539	0.9539	0.9519	0.946	NEW	NEW	
P2-3:FPL:ARMFLIE:227-248	5323 KEY KDS1 69	69	7	KEY	221	0.95	1.051	0.9935	0.9935	0.9935	0.7168	0.6853	0.0315	0.0315	
P2-3:FPL:ARMFLIE:227-248	5324 KEY KWD 69	69	7	KEY	221	0.95	1.051	0.987	0.987	0.987	0.7081	0.6766	0.0315	0.0315	
P2-3:FPL:ARMFLIE:227-248	5325 KEY WSS 69	69	7	KEY	221	0.95	1.051	0.988	0.988	0.988	0.7086	0.6771	0.0315	0.0315	
P2-3:FPL:ARMFLIE:227-248	5320 KEY CT 69	69	7	KEY	221	0.95	1.051	1	1	1	0.7268	0.6954	0.0314	0.0314	
P2-3:FPL:ARMFLIE:227-248	5322 KEY SIPS 69	69	7	KEY	221	0.95	1.051	1	1	1	0.7268	0.6954	0.0314	0.0314	
P2-3:FPL:ARMFLIE:227-248	5326 KEY TSS 69	69	7	KEY	221	0.95	1.051	0.9865	0.9865	0.9865	0.7085	0.6771	0.0314	0.0314	
P2-3:FPL:ARMFLIE:227-248	5328 KEY KDS2 69	69	7	KEY	221	0.95	1.051	0.9877	0.9877	0.9877	0.7114	0.6802	0.0312	0.0312	
P2-3:FPL:ARMFLIE:227-248	5330 KEY SSS 69	69	7	KEY	221	0.95	1.051	0.9959	0.9959	0.9959	0.7229	0.6917	0.0312	0.0312	
P2-3:FPL:ARMFLIE:227-248	5321 KEY SIS 69	69	7	KEY	221	0.95	1.051	0.99	0.99	0.99	0.7184	0.6874	0.031	0.031	
P2-3:FPL:ARMFLIE:227-248	5305 KEY SISZ 138	138	7	KEY	221	0.95	1.051	0.9883	0.9883	0.9883	0.7174	0.6866	0.0308	0.0308	
P2-3:FPL:ARMFLIE:227-248	5303 KEY SIS1 138	138	7	KEY	221	0.95	1.051	0.9819	0.9819	0.9819	0.7145	0.6843	0.0302	0.0302	
P2-3:FPL:ARMFLIE:227-248	5302 KEY BCS 138	138	7	KEY	221	0.95	1.051	0.9801	0.9801	0.9801	0.7148	0.6848	0.03	0.03	
P2-3:FPL:ARMFLIE:227-248	5304 KEY CKS 138	138	7	KEY	221	0.95	1.051	0.969	0.969	0.969	0.7133	0.6845	0.0288	0.0288	
P2-3:FPL:ARMFLIE:227-248	5339 KEY BPS1 13.8	13.8	7	KEY	221	0.9	1.1	0.9835	0.9835	0.9835	0.7673	0.7393	0.028	0.028	
P2-3:FPL:ARMFLIE:227-248	5301 BIGPINE 138	138	7	KEY	221	0.95	1.051	0.9586	0.9586	0.9586	0.7217	0.6948	0.0269	0.0269	
P2-3:FPL:ARMFLIE:227-248	873 MARATHON 138	138	1	FPL	7	0.95	1.07	0.9298	0.9298	0.9298	0.7249	0.702	0.0229	0.0229	
P2-3:FPL:ARMFLIE:227-248	877 CRAWLEY 138	138	1	FPL	7	0.95	1.07	0.9154	0.9154	0.9154	0.7286	0.7078	0.0208	0.0208	
P2-3:FPL:ARMFLIE:227-248	879 ISLMRDASCAP 138	138	1	FPL	7	0.95	1.07	0.9692	0.9692	0.9692	0.7761	0.7559	0.0202	0.0202	

# P6 Thermal results

Contingency	2nd Contingency	Monitored Facility	kVs	Areas	reas Name	Zones	Rate Cont (MVA)	05-0291IBR EdBsp_24 s_Base		06-0291IBR EdBsp_24 s_Study		07-0291IBR EdBsp_26 s_Base		08-0291IBR EdBsp_26 s_Study		Rate Cont Diff	AC % / PU	Rate Cont Diff	Row Summary						
								AC % / PU	AC % / PU	AC % / PU	AC % / PU	Rate Cont Diff	AC % / PU	AC % / PU	AC % / PU	AC % / PU									
P1-2:DEF:115:SWTR-HOGN	P1-2, Branch:FPL:230:463-DUVAL-230-1830-CLAUDE-230-1	509 SANDERTP	115	50010 FPL-Q421_POI	115 1	115	1	FPL	5	207			99.54	100.12	NEW	NEW									
P1-2:FPL:115:Bearcat_Hogan	P1-2, Branch:FPL:230:463-DUVAL-230-1830-CLAUDE-230-1	509 SANDERTP	115	1368 TIMBER	115 1	115	1	FPL	5	192			99.43	100.06	NEW	NEW									
P1-2:FPL:115:Hogan_Swanne	P1-2, Branch:FPL:230:463-DUVAL-230-1830-CLAUDE-230-1	509 SANDERTP	115	50010 FPL-Q421_POI	115 1	115	1	FPL	5	207			99.54	100.12	NEW	NEW									
P1-2, Branch:FPL:230:1000-SKYLIGHT-230-1006-SUNSHINE-230-1	P1-2, Branch:FPL:138:152-LAUDRDLI-138-1197-DEC-ST-138-1	535 CORBETT	230	1312 WCE1-CL2	230 1	230	1	FPL	3	1269					115.38	NEW	NEW								
P1-2, Branch:FPL:230:1176-HERITAGE-230-1826-FPL-Q286_PO-230-1	P1-2, Branch:FPL:138:152-LAUDRDLI-138-1197-DEC-ST-138-1	535 CORBETT	230	1312 WCE1-CL2	230 1	230	1	FPL	3	1269					115.41	NEW	NEW								
P1-2, Branch:FPL:230:1186-ELDORA-230-1826-FPL-Q286_PO-230-1	P1-2, Branch:FPL:138:152-LAUDRDLI-138-1197-DEC-ST-138-1	F-P2-1:FPL:115:Bearcat_Hogan:(1369-855-1)	509 SANDERTP	115	1368 TIMBER	115 1	115	1	FPL	5	192			99.42	100.05	NEW	NEW								
P1-2, Branch:FPL:230:463-DUVAL-230-1830-CLAUDE-230-1	P1-2, Branch:FPL:230:463-DUVAL-230-1830-CLAUDE-230-1	F-P2-1:FPL:115:Hogan_Swanne:(1370-368-1)	509 SANDERTP	115	50010 FPL-Q421_POI	115 1	115	1	FPL	5	207			99.47	100.05	NEW	NEW								
P1-2, Branch:FPL:230:463-DUVAL-230-1830-CLAUDE-230-1	T-P2-1:DEF:115:SWTR-HOGN:(368-1370-1)	509 SANDERTP	115	50010 FPL-Q421_POI	115 1	115	1	FPL	5	207			99.47	100.05	NEW	NEW									
10024 N TIFTON 500 12501S_NTIF_RC 500 1	11885 W VALDOSTA 230 12505 SPAIN 230 1	3101 BAKER TP	115	3119 MICCOSUKE TP	115 1	115	2	DEF	84	102			96.86	100.33	NEW	NEW									
10024 N TIFTON 500 12501S_NTIF_RC 500 1	12505 SPAIN 230 12595 DAISY 230 1	3101 BAKER TP	115	3119 MICCOSUKE TP	115 1	115	2	DEF	84	102			97.93	101.47	NEW	NEW									
10219 THOMASVL B1 230 12545 THOMASVL B2 230 1	12500 RACCOON CK 500 14600 FARLEY 8 500 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102			97.09	101.04	NEW	NEW									
11885 W VALDOSTA 230 12505 SPAIN 230 1	10024 N TIFTON 500 12501S_NTIF_RC 500 1	3101 BAKER TP	115	3119 MICCOSUKE TP	115 1	115	2	DEF	84	102			96.86	100.33	NEW	NEW									
11885 W VALDOSTA 230 12505 SPAIN 230 1	12500 RACCOON CK 500 12505 SPAIN 230 1	3101 BAKER TP	115	3119 MICCOSUKE TP	115 1	115	2	DEF	84	102			96.9	100.38	NEW	NEW									
11885 W VALDOSTA 230 12505 SPAIN 230 1	12500 RACCOON CK 500 12505 SPAIN 230 1	3101 BAKER TP	115	3119 MICCOSUKE TP	115 1	115	2	DEF	84	102			99.02	102.47	NEW	NEW									
12500 RACCOON CK 500 12501S_NTIF_RC 500 1	11885 W VALDOSTA 230 12505 SPAIN 230 1	3101 BAKER TP	115	3119 MICCOSUKE TP	115 1	115	2	DEF	84	102			96.9	100.38	NEW	NEW									
12500 RACCOON CK 500 12501S_NTIF_RC 500 1	12505 SPAIN 230 12595 DAISY 230 1	3101 BAKER TP	115	3119 MICCOSUKE TP	115 1	115	2	DEF	84	102			97.98	101.53	NEW	NEW									
12500 RACCOON CK 500 14600 FARLEY 8 500 1	10219 THOMASVL B1 230 12545 THOMASVL B2 230 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102			97.1	101.15	NEW	NEW									
12500 RACCOON CK 500 14600 FARLEY 8 500 1	11885 W VALDOSTA 230 12505 SPAIN 230 1	3101 BAKER TP	115	3119 MICCOSUKE TP	115 1	115	2	DEF	84	102			98.95	102.5	NEW	NEW									
12500 RACCOON CK 500 14600 FARLEY 8 500 1	12505 SPAIN 230 12595 DAISY 230 1	3101 BAKER TP	115	3119 MICCOSUKE TP	115 1	115	2	DEF	84	102			99.92	103.52	NEW	NEW									
12500 RACCOON CK 500 14600 FARLEY 8 500 1	14512 SNOWDN8 500 14600 FARLEY 8 500 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102			99.37	103	NEW	NEW									
12505 SPAIN 230 12595 DAISY 230 1	10024 N TIFTON 500 12501S_NTIF_RC 500 1	3101 BAKER TP	115	3119 MICCOSUKE TP	115 1	115	2	DEF	84	102			97.87	101.58	NEW	NEW									
12505 SPAIN 230 12595 DAISY 230 1	12500 RACCOON CK 500 12501S_NTIF_RC 500 1	3101 BAKER TP	115	3119 MICCOSUKE TP	115 1	115	2	DEF	84	102			97.92	101.63	NEW	NEW									
12505 SPAIN 230 12595 DAISY 230 1	12500 RACCOON CK 500 14600 FARLEY 8 500 1	3101 BAKER TP	115	3119 MICCOSUKE TP	115 1	115	2	DEF	84	102			99.92	103.5	NEW	NEW									
14512 SNOWDN8 500 14600 FARLEY 8 500 1	12500 RACCOON CK 500 14600 FARLEY 8 500 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102			99.31	102.95	NEW	NEW									
397765 LAGUNA B6 500 397836 L SMITH 6 230 1	397765 LAGUNA B6 230 397836 L SMITH 6 230 2	397800 LONG BEACH	115	397802 HOLIDAY	115 1	115	348	GULF	802	155	99.76	100.62	NEW	97.3	98.19	-	NEW								
397765 LAGUNA B6 230 397836 L SMITH 6 230 1	P1-2, Branch:GULF:230:397765-LAGUNA B6-230-397836-L SMITH 6-230-2	397800 LONG BEACH	115	397802 HOLIDAY	115 1	115	348	GULF	802	155	99.76	100.62	NEW	97.3	98.19	-	NEW								
P1-2:GPC:115:FlowerCreek_Callaway	P1-2:GPC:115:FlowerCreek_Callaway	397860 CALLAWAY6 230 397861 CALLAWAY3 115 1	397855 REDWOOD1	115	397865 WEWRAWD	115 1	115	348	GULF	802	121			99.63	100.42	NEW	NEW								
P1-2:GPC:115:FlowerCreek_Callaway	P1-2:GPC:115:FlowerCreek_Callaway	397765 LAGUNA B6 230 397836 L SMITH 6 230 1	397855 REDWOOD1	115	397865 WEWRAWD	115 1	115	348	GULF	802	121			99.63	100.42	NEW	NEW								
P1-2:Branch:GULF:230:397765-LAGUNA B6-230-397836-L SMITH 6-230-1	P1-2:Branch:GULF:230:397765-LAGUNA B6-230-397836-L SMITH 6-230-2	397800 LONG BEACH	115	397802 HOLIDAY	115 1	115	348	GULF	802	155	99.76	100.62	NEW	97.3	98.19	-	NEW								
11878 N TIFTON B2 230 12587 COOK 230 1	P1-2, Branch:FPL:230:463-DUVAL-230-1830-CLAUDE-230-1	12355 MACEDON SW	115	50010 FPL-Q421_POI	115 1	115	30/1	SOCO/FPL	701/5	207					108.38	NEW	NEW								
11878 N TIFTON B2 230 12587 COOK 230 1	P1-2, Branch:FPL:230:463-DUVAL-230-1830-CLAUDE-230-1	12355 MACEDON SW	115	50010 FPL-Q421_POI	115 1	115	30/1	SOCO/FPL	701/5	207					112.49	NEW	NEW								
10218 S BAINBRDGE 230 12545 THOMASVL B2 230 1	P1-2, Branch:FPL:230:463-DUVAL-230-1830-CLAUDE-230-1	12355 MACEDON SW	115	50010 FPL-Q421_POI	115 1	115	30/1	SOCO/FPL	701/5	207					101.82	105.34	3.52	3.52							
10218 S BAINBRDGE 230 12545 THOMASVL B2 230 1	12500 RACCOON CK 500 14600 FARLEY 8 500 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102					101.87	105.39	3.52	3.52							
10218 S BAINBRDGE 230 12545 THOMASVL B2 230 1	10218 S BAINBRDGE 230 12545 THOMASVL B2 230 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102					102.67	106.72	4.05	4.05							
10218 S BAINBRDGE 230 12545 THOMASVL B2 230 1	10218 S BAINBRDGE 230 12545 THOMASVL B2 230 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102					102.67	106.72	4.05	4.05							
10218 S BAINBRDGE 230 12545 THOMASVL B2 230 1	102024 N TIFTON 500 12501S_NTIF_RC 500 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102					102.87	106.58	3.71	3.71							
102024 N TIFTON 500 12501S_NTIF_RC 500 1	102024 N TIFTON 500 12501S_NTIF_RC 500 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102					102.92	106.63	3.71	3.71							
102024 N TIFTON 500 12501S_NTIF_RC 500 1	12500 RACCOON CK 500 14600 FARLEY 8 500 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102					104.92	108.55	3.63	3.63							
102024 N TIFTON 500 12501S_NTIF_RC 500 1	12505 SPAIN 230 12595 DAISY 230 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102					104.93	108.53	3.6	3.6							
102024 N TIFTON 500 12501S_NTIF_RC 500 1	12505 SPAIN 230 12595 DAISY 230 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102					102.93	106.5	3.57	3.57							
102024 N TIFTON 500 12501S_NTIF_RC 500 1	12505 SPAIN 230 12595 DAISY 230 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102					102.98	106.55	3.57	3.57							
102024 N TIFTON 500 12501S_NTIF_RC 500 1	11885 W VALDOSTA 230 12505 SPAIN 230 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102					103.95	107.52	3.57	3.57							
102024 N TIFTON 500 12501S_NTIF_RC 500 1	11885 W VALDOSTA 230 12505 SPAIN 230 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84	102					101.82	105.34	3.52	3.52							
102024 N TIFTON 500 12501S_NTIF_RC 500 1	11885 W VALDOSTA 230 12505 SPAIN 230 1	3101 BAKER TP	115	3143 KILLEARN TP1	115 1	115	2	DEF	84																

## P6 Voltage Results

# **Designated Network Resource Service Request**

## **System Impact Study**

**for OASIS 95150056 (DNR) "St. Marks Solar"**



**January 2022**

**Transmission Planning, Florida**

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## **1. Executive Summary**

The System Impact for the Duke Energy Florida, LLC (DEF) Transmission System was studied for the Designated Network Resource (DNR) request referenced by OASIS number 95150056. This DNR requests a maximum of 75 MW yearly received from St. Marks Solar resource located in Wakulla County, Florida and delivered to DEF Load within DEF's Area beginning 01/01/2024 thru 01/01/2100. Although the requested start is 01/01/2024, current study work indicates that the NRIS study associated with this has an ISD of 09/03/2024. Therefore, this was the assumed ISD for this request. At the completion of this report, St. Marks Solar is still in its Large Generator Interconnection Procedures (LGIP) process under Q291 and working on the execution of a Large Generator Interconnection Agreement (LGIA) for 74.9 MW summer/winter.

The Third-party results of this study did indicate that there are potentially impacted Third-Party systems. Third-parties screened in the results and other FRCC members may wait to identify themselves as an impacted party when this request is presented in subsequent FRCC-TTS coordination study. The customer will need to work with parties who identify themselves as impacted, to resolve impacts to their system to maintain firm service.

This study confirms that this unit can be reliably integrated in DEF's system and designated as a Network Resource for the period under study.

## **2. Point of Receipt, and Point of Delivery**

The Point of Receipt is the generator referred to as "St. Marks Solar", with the Point of Interconnection will be a new 230 kV terminal at DEF's existing St. Marks East 230/69 kV substation located in Wakulla County, Florida.

The Point of Delivery is City of DEF's Load, which is located in DEF's Balancing Area.

## **3. Model Development**

Power flow models were built using the Siemens PSS<sup>®</sup>E power system simulation program and were based on the FRCC 2021 (RIs2-RP) series cases, which were the most recent models available at the time of the study. The model years to be studied for power flow impacts will be 2024 Summer, and 2026 Summer. The study case models added the appropriate additional MW summer/winter output to each base case. Any sensitivity work performed was based on the FRCC 2021 (RIs2-RP) series cases.

This resource was studied as being dispatched against other DEF resources that would otherwise be serving DEF's Load.

## 4. Analyses Performed

Power flow analyses of the cases were performed using PowerGEM's TARA software (TARA) to determine the impact of the DNR on the Bulk Electric System (BES). The base and interconnection study cases were compared to determine if the DNR caused new overloads, voltage violations, or exacerbated existing thermal overloads. In addition, all 69 kV and above branch flows and bus voltages in the FRCC region were monitored.

The following contingencies were performed using the TARA AC Contingency Analysis Calculator:

- Selected TPL-001-4 Category P1, P2, P4, P5, P6 and P7 contingencies within the FRCC region as previously defined by FRCC transmission owners.

## 5. Screening Criteria

The following criteria were used for screening **thermal results**.

- Unrelated results from GSU transformers were excluded.
- Transmission system elements operated at less than 69 kV nominal voltage were excluded.
- System-intact overloads were screened at greater than 100 percent of rate A.
- Post-contingency overloads were screened at greater than 100 percent of rate A. An exception to using Rate A is the P6 contingencies, which were screened at Rate C.
- Post-contingency overloads that would be improved by the interconnection were excluded.
- Existing Post-contingency overloads were compared between the base and study cases, these overloads that increased were reviewed for significant impact.

The following criteria were used for screening **voltage results**.

- DEF and SECI buses were monitored for values outside of 0.90-1.05 p.u.
- FPL 69, 115, 138, and 230 kV buses were monitored for values outside of 0.95-1.07 p.u.
- FPL 500 kV buses were monitored for values outside of 0.95-1.10 p.u.
- TECO 69 kV buses were monitored for values outside of 0.925-1.05 p.u.
- TECO 138 and 230 kV buses were monitored for values outside of 0.95-1.06 p.u.
- FPL's Turkey Point bus voltage was monitored for values outside of 1.01 p.u. and 1.06 p.u.
- FPL's St. Lucie bus voltage was monitored for values outside of 1.00 p.u. and 1.06 p.u.
- All other monitored areas were monitored for values outside of 0.95-1.05 p.u.
- Generator buses and buses with nominal voltage below 69 kV were excluded from consideration.
- For P6 contingencies, buses were monitored for values outside of 0.88-1.10 p.u.
- Absolute change in bus voltage between base case and the interconnection case must have been greater than 0.02 p.u.

## **6. Study Results**

### **6.1. Thermal Results**

The evaluation of thermal results did not identify any network upgrades of DEF's transmission system required to accommodate the 75 MW DNR. The FPL/GULF bi-directional transfers have known constraints related to line sections associated with the Baker Substation which are not attributable to this resource under study. These constraints are planned to be resolved. Due to the inclusion of these transfers in the Sensitivity cases extensive results regarding the line sections have been paired down to show the worst overloads. These and other results identified as significant impacts can be found in the Appendices below.

### **6.2. Voltage Results**

The evaluation of voltage results did not identify impacted facilities on DEF's transmission system required to accommodate the 75 MW DNR. The results identified as significant impacts can be found in the Appendices below.

### **6.3. Third-Party impacts**

The thermal and voltage analysis did indicate that there are potentially impacted Third-Party systems. The results identified as significant impacts are shown in the Appendices below. Third-parties screened in the results and other FRCC members may wait to identify themselves as an impacted party when this request is presented in subsequent FRCC-TTS coordination study. The customer will need to work with parties who identify themselves as impacted, to resolve impacts to their system to maintain firm service.

The customer should contact any Third-Parties identified below to initiate an affected system study pertaining to the impacted transmission system facilities identified in this study. Third-Parties may invoke their right to review any or all their facilities that are suspected to be impacted by this interconnection request, which could result in additional impacted transmission system facilities to any initially identified. The customer may utilize contact information located in the Appendices below.

#### **Potentially Affected Third-Party List**

- FPL, GULF, SOCO, TAL

## N-1 Thermal Rate A Results

## N-1 Thermal Rate B Results

Contingency	Monitored Facility	kV/s	Areas	areas Nam/s	Zones	Rate A (MVA)	Rate B (MVA)	Rate C (MVA)	Rate A %	Rate B %	Rate C %	Rate A %	Rate B %	Rate C %	Rate A Diff	Rate B Diff	Rate C Diff	Rate A %	Rate B %	Rate C %	Rate A Diff	Rate B Diff	Rate C Diff	Rate A Max	Rate B Max	Rate C Max	Rate All Max	Diff	Diff	Diff	Diff	
P2-3:FPL:MARFHLL:227-248	873 MARATHON	138	5301 BIGHINE	138 1	138	1/7	FPL/KEY	7/221	193	221	221	95.35	83.27	83.27	9999	9999	9999	NEW	NEW	NEW	9999	9999	9999	9999	9999	=	=	=	NEW	NEW	NEW	NEW
P2-3:FPL:MARFHLL:227-248	873 MARATHON	138	877 CRAWLEY	138 1	138	1	FPL	7	221	221	221	100.25	100.25	100.25	9999	9999	9999	9988.75	9988.75	9988.75	9999	9999	9999	9999	9999	=	=	=	9898.75	9988.75	9988.75	9988.75
P2-3:FPL:MARFHLL:227-248	872 ISLMRADA	138	877 CRAWLEY	138 1	138	1	FPL	7	221	221	221	109.9	109.9	109.9	9999	9999	9999	9889.1	9889.1	9889.1	9999	9999	9999	9999	9999	=	=	=	9889.1	9889.1	9889.1	9889.1
P2-3:FPL:MARFHLL:227-248	872 ISLMRADA	138	879 ISLMDRASCAP	138 1	138	1	FPL	7	241	241	241	111.95	111.95	111.95	9999	9999	9999	9987.05	9987.05	9987.05	9999	9999	9999	9999	9999	=	=	=	9887.05	9887.05	9887.05	9887.05
P2-3:FPL:MARFHLL:227-248	871 TAVERNIER	138	879 ISLMDRASCAP	138 1	138	1	FPL	7	241	241	241	112.01	112.01	112.01	9999	9999	9999	9986.99	9986.99	9986.99	9999	9999	9999	9999	9999	=	=	=	9886.99	9986.99	9986.99	9986.99
P2-3:FPL:MARFHLL:227-248	870 KEYLARGO	138	871 TAVERNIER	138 1	138	1	FPL	7	241	241	241	127.8	127.8	127.8	9999	9999	9999	9987.12	9987.12	9987.12	9999	9999	9999	9999	9999	=	=	=	9871.2	9987.12	9987.12	9987.12
P2-3:FPL:MARFHLL:227-248	101 WIFISHCK	138	870 KEYLARGO	138 1	138	1	FPL	7	241	241	241	142.54	142.54	142.54	9999	9999	9999	9856.46	9856.46	9856.46	9999	9999	9999	9999	9999	=	=	=	9856.46	9985.46	9985.46	9985.46
P2-3:FPL:MARFHLL:227-248	100 WIFISHCK	138	227 FARMLIFE	138 1	138	1	FPL	7/1	243	243	243	158.38	158.38	158.38	9999	9999	9999	9840.62	9840.62	9840.62	9999	9999	9999	9999	9999	=	=	=	9840.62	99840.62	99840.62	99840.62
P2-3:FPL:MARFHLL:227-248	101 WIFISHCK	138	227 FARMLIFE	138 1	138	1	FPL	7/1	243	243	243	158.38	158.38	158.38	9999	9999	9999	9840.62	9840.62	9840.62	9999	9999	9999	9999	9999	=	=	=	9840.62	99840.62	99840.62	99840.62

## N-1 Thermal Rate C Results

## N-1 Voltage Results

Contingency	Monitored Facility	kVs	Areas	Area Name	Zones	Min Volt	Max Volt	Limit	Volt	Volt	Volt Diff	Volt	Volt	Volt Diff	Volt Max	
P2-2:DEF:115:BRDW_1	2997 MICOSUE CAP 115	115	2	DEF	84	0.9	1.05	1.011	1.0684	NEW	1.0214	1.0208	-	NEW		
P2-2:DEF:115:BRDW_1	3101 BAKER TP 115	115	2	DEF	84	0.9	1.05	1.0066	1.0943	NEW	1.0185	1.0179	-	NEW		
P2-2:DEF:115:BRDW_1	3104 BRADY W CAP 115	115	2	DEF	84	0.9	1.05	1.0087	1.1112	NEW	1.0186	1.018	-	NEW		
P2-2:DEF:115:BRDW_1	3115 LLOYD TP 115	115	2	DEF	84	0.9	1.05	1.018	1.0661	NEW	1.0186	1.018	-	NEW		
P2-2:DEF:115:BRDW_1	3119 MICOSUE TP 115	115	2	DEF	84	0.9	1.05	1.0112	1.0686	NEW	1.0213	1.0206	-	NEW		
P2-2:DEF:115:BRDW_1	3143 KILLEARN TP1 115	115	2	DEF	84	0.9	1.05	1.0087	1.1068	NEW	1.0186	1.018	-	NEW		
P2-2:DEF:115:BRDW_1	6998 BUCK LK 115	115	2	DEF	307	0.9	1.05	1.0001	1.058	NEW	1.0105	1.0099	-	NEW		
P2-2:DEF:115:BRDW_1	7014 MICOSK 115	115	2	DEF	307	0.9	1.05	1.011	1.0684	NEW	1.0214	1.0208	-	NEW		
P2-2:DEF:115:BRDW_1	7051 LLOYD 115	115	2	DEF	308	0.9	1.05	1.018	1.0561	NEW	1.0186	1.018	-	NEW		
P2-3:DEF:1774_1776:BRDW	2997 MICOSUE CAP 115	115	2	DEF	84	0.9	1.05	1.011	1.0684	NEW	1.0214	1.0208	-	NEW		
P2-3:DEF:1774_1776:BRDW	3101 BAKER TP 115	115	2	DEF	84	0.9	1.05	1.0086	1.0943	NEW	1.0185	1.0179	-	NEW		
P2-3:DEF:1774_1776:BRDW	3104 BRADY W CAP 115	115	2	DEF	84	0.9	1.05	1.0087	1.1112	NEW	1.0186	1.018	-	NEW		
P2-3:DEF:1774_1776:BRDW	3115 LLOYD TP 115	115	2	DEF	84	0.9	1.05	1.018	1.0661	NEW	1.0186	1.018	-	NEW		
P2-3:DEF:1774_1776:BRDW	3119 MICOSUE TP 115	115	2	DEF	84	0.9	1.05	1.0112	1.0686	NEW	1.0213	1.0206	-	NEW		
P2-3:DEF:1774_1776:BRDW	3143 KILLEARN TP1 115	115	2	DEF	84	0.9	1.05	1.0087	1.1068	NEW	1.0186	1.018	-	NEW		
P2-3:DEF:1774_1776:BRDW	6998 BUCK LK 115	115	2	DEF	307	0.9	1.05	1.0001	1.058	NEW	1.0105	1.0099	-	NEW		
P2-3:DEF:1774_1776:BRDW	7014 MICOSK 115	115	2	DEF	307	0.9	1.05	1.011	1.0684	NEW	1.0214	1.0208	-	NEW		
P2-3:DEF:1774_1776:BRDW	7030 BAKER 115	115	2	DEF	307	0.9	1.05	1.0086	1.0943	NEW	1.0185	1.0179	-	NEW		
P2-3:DEF:1774_1776:BRDW	7051 LLOYD 115	115	2	DEF	308	0.9	1.05	1.018	1.0561	NEW	1.0186	1.018	-	NEW		
P2-3:DEF:1774_1776:BRDW	2997 MICOSUE CAP 115	115	2	DEF	84	0.9	1.05	1.011	1.0684	NEW	1.0214	1.0208	-	NEW		
P2-3:DEF:1775:BRDW	3101 BAKER TP 115	115	2	DEF	84	0.9	1.05	1.0086	1.0943	NEW	1.0185	1.0179	-	NEW		
P2-3:DEF:1775:BRDW	3104 BRADY W CAP 115	115	2	DEF	84	0.9	1.05	1.0087	1.1112	NEW	1.0186	1.018	-	NEW		
P2-3:DEF:1775:BRDW	3115 LLOYD TP 115	115	2	DEF	84	0.9	1.05	1.018	1.0561	NEW	1.0186	1.018	-	NEW		
P2-3:DEF:1775:BRDW	3119 MICOSUE TP 115	115	2	DEF	84	0.9	1.05	1.0112	1.0686	NEW	1.0213	1.0206	-	NEW		
P2-3:DEF:1775:BRDW	3143 KILLEARN TP1 115	115	2	DEF	84	0.9	1.05	1.0087	1.1068	NEW	1.0186	1.018	-	NEW		
P2-3:DEF:1775:BRDW	6998 BUCK LK 115	115	2	DEF	307	0.9	1.05	1.0001	1.058	NEW	1.0105	1.0099	-	NEW		
P2-3:DEF:1775:BRDW	7014 MICOSK 115	115	2	DEF	307	0.9	1.05	1.011	1.0684	NEW	1.0214	1.0208	-	NEW		
P2-3:DEF:1775:BRDW	7030 BAKER 115	115	2	DEF	307	0.9	1.05	1.0086	1.0943	NEW	1.0185	1.0179	-	NEW		
P2-3:DEF:1775:BRDW	7051 LLOYD 115	115	2	DEF	308	0.9	1.05	1.018	1.0561	NEW	1.0186	1.018	-	NEW		
T-P2-2:DEF:115:BRDW-DFTN:(1104:3105-1)	2997 MICOSUE CAP 115	115	2	DEF	84	0.9	1.05	1.0167	1.064	0.0023	1.0213	1.0657	NEW	NEW		
T-P2-2:DEF:115:BRDW-DFTN:(1104:3105-1)	3101 BAKER TP 115	115	2	DEF	84	0.9	1.05	1.0875	1.0898	0.0023	1.0184	1.0914	NEW	NEW		
T-P2-2:DEF:115:BRDW-DFTN:(1104:3105-1)	3104 BRADY W CAP 115	115	2	DEF	84	0.9	1.05	1.1042	1.1067	0.0025	1.0185	1.1083	NEW	NEW		
T-P2-2:DEF:115:BRDW-DFTN:(1104:3105-1)	3115 LLOYD TP 115	115	2	DEF	84	0.9	1.05	1.0497	1.0519	NEW	1.0185	1.0536	NEW	NEW		
T-P2-2:DEF:115:BRDW-DFTN:(1104:3105-1)	3119 MICOSUE TP 115	115	2	DEF	84	0.9	1.05	1.062	1.0643	0.0023	1.0211	1.0659	NEW	NEW		
T-P2-2:DEF:115:BRDW-DFTN:(1104:3105-1)	3143 KILLEARN TP1 115	115	2	DEF	84	0.9	1.05	1.0999	1.1023	0.0024	1.0185	1.1039	NEW	NEW		
T-P2-2:DEF:115:BRDW-DFTN:(1104:3105-1)	6998 BUCK LK 115	115	2	DEF	307	0.9	1.05	1.0513	1.0537	0.0024	1.0104	1.0552	NEW	NEW		
T-P2-2:DEF:115:BRDW-DFTN:(1104:3105-1)	7014 MICOSK 115	115	2	DEF	307	0.9	1.05	1.0617	1.064	0.0023	1.0213	1.0657	NEW	NEW		
T-P2-2:DEF:115:BRDW-DFTN:(1104:3105-1)	7030 BAKER 115	115	2	DEF	307	0.9	1.05	1.0875	1.0898	0.0023	1.0184	1.0914	NEW	NEW		
T-P2-2:DEF:115:BRDW-DFTN:(1104:3105-1)	7051 LLOYD 115	115	2	DEF	308	0.9	1.05	1.0497	1.0519	NEW	1.0185	1.0536	NEW	NEW		
P2-2:FPL:GHOS_1372_1	283 ARCADIA 69	69	1	FPL	4	0.95	1.07	0.955	0.955	-	0.95	0.9499	NEW	NEW		
P2-3:FPL:GHOS_1372_004	283 ARCADIA 69	69	1	FPL	4	0.95	1.07	0.955	0.955	-	0.95	0.9499	NEW	NEW		
P2-3:FPL:LAUD-0152-283	43 FULDOR 138	138	1	FPL	1	0.95	1.07	0.9544	0.9544	-	0.9501	0.9499	NEW	NEW		
P7-FPL:FLAMINGO-GRATIGNY_GARDEN-GRATIGNY	526 FLAMINGO 138	138	1	FPL	2	0.95	1.07	0.95	0.9499	NEW	0.9521	0.952	-	NEW		
P2-3:FPL:FLAMINGO-GRATIGNY_GARDEN-GRATIGNY	5323 KEY KDS1 69	69	7	KEY	221	0.95	1.051	0.7149	0.7375	0.0226	0.7374	0.7373	0.0001	0.0226		
P2-3:FPL:FLAMINGO-GRATIGNY_GARDEN-GRATIGNY	5320 KEY CT 69	69	7	KEY	221	0.95	1.051	0.7248	0.7474	0.0226	0.7473	0.7473	=	0.0226		
P2-3:FPL:FLAMINGO-GRATIGNY_GARDEN-GRATIGNY	5322 KEY SIPS 69	69	7	KEY	221	0.95	1.051	0.7248	0.7474	0.0226	0.7473	0.7473	=	0.0226		
P2-3:FPL:FLAMINGO-GRATIGNY_GARDEN-GRATIGNY	5324 KEY KWD 69	69	7	KEY	221	0.95	1.051	0.7063	0.7288	0.0225	0.7287	0.7286	1E-04	0.0225		
P2-3:FPL:FLAMINGO-GRATIGNY_GARDEN-GRATIGNY	5325 KEY VSS 69	69	7	KEY	221	0.95	1.051	0.7068	0.7293	0.0225	0.7294	0.7292	=	0.0225		
P2-3:FPL:FLAMINGO-GRATIGNY_GARDEN-GRATIGNY	5326 KEY TSS 69	69	7	KEY	221	0.95	1.051	0.7067	0.7292	0.0225	0.729	0.729	=	0.0225		
P2-3:FPL:FLAMINGO-GRATIGNY_GARDEN-GRATIGNY	5328 KEY KDS2 69	69	7	KEY	221	0.95	1.051	0.7096	0.7321	0.0225	0.7319	0.7318	1E-04	0.0225		
P2-3:FPL:FLAMINGO-GRATIGNY_GARDEN-GRATIGNY	5321 KEY SIS 69	69	7	KEY	221	0.95	1.051	0.7167	0.7391	0.0224	0.7388	0.7387	1E-04	0.0224		
P2-3:FPL:FLAMINGO-GRATIGNY_GARDEN-GRATIGNY	5305 KEY SIS2 138	138	7	KEY	221	0.95	1.051	0.7158	0.738	0.0222	0.7376	0.7375	1E-04	0.0222		
P2-3:FPL:FLAMINGO-GRATIGNY_GARDEN-GRATIGNY	5303 KEY SIS1 138	138	7	KEY	221	0.95	1.051	0.7131	0.7351	0.022	0.7344	0.7343	0.0001	0.022		
P2-3:FPL:FLAMINGO-GRATIGNY_GARDEN-GRATIGNY	5302 KEY BCS 138	138	7	KEY	221	0.95	1.051	0.7135	0.7354	0.0219	0.7345	0.7345	=	0.0219		
P2-3:FPL:FLAMINGO-GRATIGNY_GARDEN-GRATIGNY	5304 KEY CKS 138	138	7	KEY	221	0.95	1.051	0.7125	0.7338	0.0213	0.7325	0.7324	1E-04	0.0213		
P2-3:FPL:FLAMINGO-GRATIGNY_GARDEN-GRATIGNY	5301 BIGPINS 138	138	7	KEY	221	0.95	1.051	0.7214	0.7418	0.0204	0.7398	0.7398	=	0.0204		

# P6 Thermal results

## P6 Voltage Results

## N-1 Thermal Rate A Results

## N-1 Thermal Rate B Results

## N-1 Thermal Rate C Results

## N-1 Voltage Results