Number 3 Substation Energization Procedure

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Revision	Date	Prepared By	Revision Notes
Draft	7-15	P. Bedgood	
REV 0	7-19	P. Bedgood	typos

1. Purpose and Scope

1.1. This procedure describes each step involved in energizing the Number 3 Substation. This document provides information necessary to:

- Safely energize and document initial energization of the substation
- Plan and manage safe working conditions covered by this procedure.
- Provide LOTO description of the isolation points associated with substation equipment.
- Provide switching order of the substation/ equipment energization.

1.2. Every member of the energization team has the right and obligation to **STOP** the evolution of this energization procedure if any unsafe act or condition is identified.

1.3. A summary of the equipment and switches to be energized or operated include:

1.3.1. Substation equipment - Number 3

- 1 115 kV CVT – **CVT 115-1**
- 1 115kV motor operated disconnect – **SW33**
- 1 115kV breaker – **R30**
- 1 115 kV main power transformer – **TRANSF #1**
- 1 38kV 3000A disconnect – **SW 35-1**
- 2 120/240v station service disconnect – **SSD-1, SSD-2**
- 1 50kV station service transformer – **SS1**
- 2 voltage transformer– **VT 35-1, VT 35-CBA**
- 10 34.5kV 1200A disconnect switch – **SW 35-B1, SW 35-B2, SW 35-B3, SW 35-F1, SW 35-F2A, SW 35-F2B, SW 35-F3A, SW 35-F3B, SW 35-CB1B, SW 35-CB1F**
- 4 34.5kV 1200A breaker – **PCB 35-1, PCB 35-2, PCB 35-3, PCB 35-CB1**
- 1 CAP switch disconnect – **89D1**
- 1 CAP bank – **CSA**
- 1 CAP grounding switch – **89G1**

This procedure assumes that all work required for safe energization, has been completed, documented, and verified.

1.4. This procedure must be performed after the substation commissioning has been completed and results reviewed.

2. Energization Contact Information

Contact Name	Company	Role	Phone	Email
Emergency Dispatch			**911**	
Paul Bedgood	RES	HV Manager	(954) 670-4353	Paul.bedgood@res-group.com
Tyler Hankins	RES	Ops Manager	(217) 414-0845	Tyler.hankins@res-group.com
Paul Bedgood	RES	EC	(954) 670-4353	Paul.bedgood@res-group.com
TBD	RES	Switchman		
		Testing		
	RES	Safety		
	INVENERGY	Site Manager		
	EOR	Engineer		
	INVENERGY	Construction Manager		
	INVENERGY	Site Supervisor		
	INVENERGY	INVENERGY Engineer		
	INVENERGY	O&M Site Manager		
	INVENERGY	INVENERGY Dispatch		
	POI			

3. General Information and Responsibilities

3.1. All personnel performing work under this procedure shall have read and be fully knowledgeable of its contents and concepts.

3.2. Any concerns regarding this procedure shall be sent at once to the RES Management to be addresses and reissued.

3.3. Part of this procedure is to develop an actual sequence which will be used for energization and substantial completion of electrical systems.

3.4. All equipment must have agreed upon 'name' or address per local labeling prior to Energization

3.5. Any additional person(s) involved, not signed in above, need to be instructed directly from one of the above signed personnel and receive a copy of all pertinent materials. Because collectively we are responsible to provide instruction to all our employees on this procedure and stress the significance of safety.

3.6. Access to associated substation equipment shall be restricted during this energization procedure.

3.7. Supervisors are responsible to provide instruction to all their employees on their individual Lock-out/Tag-out (**LOTO**) procedures and this procedure for those with significant involvement.

Confirmed by INVENERGY:_____
Signature/Initials:_____

4. Pre-Energization Requirements

4.1. Energization Notifications

4.1.1. **48 Hours Prior** – Energization notification will be issued by the Project Team to the following personnel 48 hours before energization:

- Landowners (by Owner)
- Project Personnel
- Interconnecting Utilities
- Local Emergency Services
- Other Parties (as required)

4.1.2. **24 Hours Prior** – Energization notification will be issued by the Project Team to each contractor's "Single Point of Contact" 24 hours in advance of the schedule energization time.

4.1.3. Each contractor's "Single Point of Contact" shall notify all their personnel prior to the substation energization.

4.2. Pre-Energization Equipment Status

Pre-Energization checks shall be verified by the EC and Switchman. Everyone will initial after each step has been verified. Verify Closed/Energized equipment at HMI in Control Building.

Device ID	Position/Description	INVENERGY	RES
POI Substation			
POI Switch	**OPEN**		
Breaker #	**OPEN**		
115kV T-Line	De-Energized to Substation		
Number 3 Substation			
COMPLETION CERT SIGNED	**Complete, punch list signed off PER energization critical**		
SW33	**OPEN** confirmed **OPEN, LOTO** applied		
CCVT 115-1	Potential grounding switch **OPEN**, Fuses in junction box Open, Confirm continuity of fuses		
R30	**OPEN**, indicator showing **OPEN**, spring charged, confirm SF6 levels are in operating range, confirm shorting pins are removed for CT's with connected burden and shorted for CT's without burden for all CT circuits. Verify 120VAC is ON. **LOTO applied**		
TRANSF #1	Main tank and LTC oil level ok, Radiator valves open, Stage 1&2 fans in auto and circuit breakers ON. Confirm shorting pins are removed for all CT's with connected burden and shorted for CT's without burden. Verify all alarms are reset and no alarms are present. Verify 120VAC is ON Confirm On Load Tap Changer (OLTC) is in **NEUTRAL** position and control is set to **MANUAL**		

Device ID	Position/Description	INVENERGY	RES
SW 35-1			
SM-5 (Fused Cutout)	**OPEN confirmed OPENED Fuse Barrell REMOVED, continuity of fuse verified.**		
SS1 (Station Service TX)	Confirm transformer terminations are complete		
SSD-1 (Disconnect switch)	Confirm terminations complete**, OPEN confirmed OPENED, LOTO applied (disconnect locked in the open position and tagged)**		
SSD-2 (Disconnect switch)	Confirm terminations complete**, OPEN confirmed OPENED, LOTO applied (disconnect temporarily wired to generator)**		
ATS	**Energized,** on temporary In Automatic mode.		
VT-35-1	Fuses in junction box Open, Confirm continuity of fuses		
SW 35-B1	**CLOSED confirmed CLOSED**		
SW 35-B2	**CLOSED confirmed CLOSED**		
SW 35-B3	**CLOSED confirmed CLOSED**		
SW 35-CB1B	**CLOSED confirmed CLOSED**		
PCB 35-1	**OPEN**, indicator showing **OPEN**, spring charged, confirm shorting pins are removed for CT's with connected burden and shorted for CT's without burden for all CT circuits. Verify 120VAC is ON. **LOTO applied**		
PCB 35-2	**OPEN**, indicator showing **OPEN**, spring charged, confirm shorting pins are removed for CT's with connected burden and shorted for CT's without burden for all CT circuits. Verify 120VAC is ON. **LOTO applied**		
PCB 35-3	**OPEN**, indicator showing **OPEN**, spring charged, confirm shorting pins are removed for CT's with connected burden and shorted for CT's without burden for all CT circuits. Verify 120VAC is ON. **LOTO applied**		
PCB 35-CB1	**OPEN**, indicator showing **OPEN**, spring charged, confirm shorting pins are removed for CT's with connected burden and shorted for CT's without burden for all CT circuits. Verify 120VAC is ON. **LOTO applied**		
SW 35-F1	**OPEN** confirmed **OPEN, LOTO** applied		
SW 35-F2A	**OPEN** confirmed **OPEN, LOTO** applied		
SW 35-F2B	**OPEN** confirmed **OPEN, LOTO** applied		
SW 35-F3A	**OPEN** confirmed **OPEN, LOTO** applied		
SW 35-F3B	**OPEN** confirmed **OPEN, LOTO** applied		
SW 35-CB1B	**OPEN** confirmed **OPEN, LOTO** applied		
SW 35-CB1F	**OPEN** confirmed **OPEN, LOTO** applied		

Device ID	Position/Description	INVENERGY	RES
	CAP BANKS		
89D1	**OPEN** confirmed **OPEN, LOTO** applied		
CSA	**OPEN, Indicator showing OPEN, spring charged, LOTO applied, verify 120VAC is on.**		
89G1	**CLOSED confirmed CLOSED, LOTO APPLIED**		

4.3. Additional Pre-Energization Requirements

4.3.1. All labeling is installed for equipment.

	Responsibility	Initials	Date
Completed	Switchman		
Step Verified	INVENERGY		

4.3.2. Substation punch list shall be reviewed and critical all items affecting energization and continuous operation have been corrected and accepted.

	Responsibility	Initials	Date
Completed	Switchman		
Step Verified	INVENERGY		

4.3.3. Verify all equipment tests are complete and satisfactory.

	Responsibility	Initials	Date
Completed	Switchman		
Step Verified	INVENERGY		

4.3.4. Verify that there are no standing trips or alarms (except under voltage and/or under frequency) on any relay devices. (if necessary)

	Responsibility	Initials	Date
Completed	Switchman		
Step Verified	INVENERGY		

4.3.5. The EC Shall conduct an on-site pre-energization briefing. Specific items to be discussed are:

- Review the job hazard analysis (JHA)
- Review personnel assignments
- Review safety precautions, safety equipment, Zone of Protection (ZOP)
- Identify energization muster area (Outside of Substation area)
- Review reporting protocols and communication methods.
- Review energization procedure.

5. **Energization Preparation Procedure**

5.1. Verify equipment being energized is properly labeled, secured, and grounded. The area is clean and is free of debris, material, and construction equipment.

5.2. Ensure all lockout relays and control switches are reset IF applicable.

5.3. Verify remote capabilities have been tested with owners control center.

5.4. Punchlist has been completed

5.5. Grounds have been removed from the line side of Main Power Transformer.

5.6. All electrical equipment in the field has been placed in LOTO per the pre-energization requirements.

5.7. Ensure Collection Contractor has placed the necessary LOTO on equipment.

5.8. Ensure that Site Notifications have been announced for circuit to be energized. If applicable.

	Responsibility	Initials	Date
Completed	Switchman		
Step Verified	INVENERGY		

6. Energization Procedure

Date/Time Begin: _____

Step	Device ID	Operation	INVENERGY	RES	Time
		EC TO CONFIRM ALL NON-CRITICAL PERSONNEL ARE CLEAR FROM SUBSTATION			
1	**SW33**	**REMOVE LOTO** and **CLOSE** check **CLOSED**			
2	**POI**	This step will energize the T-line from POI to R30. EC to contact Utility to **CLOSE ALL** necessary switches & breakers to energize up to **OPEN** breaker **R30**. (soak T-line for 15 minutes before proceeding to Step #3)			
3	**CCVT 115-1**	Verify Voltage and Rotation at fuse panel for **CCVT 115-1**. Record readings on Table 1 below.			
4	**CCVT 115-1**	If voltages are as expected, install fuses in fuse holder			
5		**Testing Commissioner to review voltages and phase angles on relays per testing plan. Any issues will generate an ALL STOP and discuss with engineering how to proceed.**			
6	**R30 (yard)**	**REMOVE LOTO**, place in **REMOTE**			
7	**R30 (house)**	**This step will energize TRANSF #1.** From **Control House**, place/verify in **LOCAL, CLOSE** check **CLOSED R30**, Place in **REMOTE** and verify remote capabilities have been tested			
		Begin soak			

Once 12-hour soak is complete, resume Energization Plan

6.1. The EC shall conduct an on-site pre-energization briefing. Specific items to be discussed are:

6.1.1. Review the job hazard analysis (JHA)

6.1.2. Review personnel assignments

6.1.3. Review safety precautions, safety equipment, Zone of Protection (ZOP)

6.1.4. Identify energization muster area, (Outside of the Substation area)

6.1.5. Review reporting protocols and communication methods

6.1.6. Review energization procedure

6.2. EC to confirm all non-critical personnel are clear from the Substation

Step	Device ID	Operation	INVENERGY	RES	Time
8	**R30 (house)**	This step will de-energize **T1**. From **Control House**, place/verify in **LOCAL, OPEN** check **OPEN R30**, **apply LOTO**.			
9	**SW 35-1**	**REMOVE LOTO** and **CLOSE** check **CLOSED**			
10	**SM-5**	**REMOVE LOTO** and **CLOSE** check **CLOSED**			
11	**SW 35-B1**	**REMOVE LOTO** and **CLOSE** check **CLOSED**			
12	**SW 35-B2**	**REMOVE LOTO** and **CLOSE** check **CLOSED**			
13	**SW 35-B3**	**REMOVE LOTO** and **CLOSE** check **CLOSED**			
14	**SW 35-CB1B**	**REMOVE LOTO** and **CLOSE** check **CLOSED**			
15	**R30 (house)**	This step will energize **TRANSF #1** and low side buss. From **Control House**, place/verify in **LOCAL, CLOSE** check **CLOSED R30**, Place in **REMOTE**.			
16	**VT 35-1**	Verify Voltage and Rotation at fuse panel for VT 35-1. Record readings on Table 2 below.			
17	**VT 35-1**	If voltages are as expected, install fuses in fuse holder			
18	**OLTC**	Place **OLTC** control in **MANUAL** and **LOWER** the OLTC position by 2-3 taps to raise the lower side buss			
19	**OLTC**	Place **OLTC** control in Auto and confirm tap position raises to bring the 34.5KV buss back to nominal voltage. IF OLTC is not returning to nominal voltage, immediately switch OLTC to manual and consult with engineering			
20	**OLTC**	Place **OLTC** control in **MANUAL** and **RAISE** the OLTC position by 2-3 taps to lower the low side buss voltage.			
21	**OLTC**	Place **OLTC** control in **Auto** and confirm tap position raises to bring the 34.5KV buss back to nominal voltage. Place in **AUTO**. IF OLTC is not returning to nominal voltage, immediately switch OLTC to manual and consult with engineering.			
22					
23	**SSD-1**	Check Voltage and record in Table 3 below. If voltage is as expected, **REMOVE LOTO** and **CLOSE** check **CLOSED**			
24	**ATS**	Verify correct operation of **ATS**.			

Step	Device ID	Operation	INVENERGY	RES	Time
		CAP BANK section to be completed when CAPs are needed and approved to energize			
	SW 35-CB1F	**REMOVE LOTO** and **CLOSE** check **CLOSED**			
	89D1	**REMOVE LOTO** and **CLOSE** check **CLOSED**			
	89G1	**REMOVE LOTO** and **CLOSE** check **CLOSED**			
	PCB 35-CB1 (yard)	**REMOVE LOTO**, place in **REMOTE**			
	PCB 35-CB1 (house)	**This step will energize CSA.** From **Control House**, place/verify in **LOCAL, CLOSE** check **CLOSED PCB 35-CB1**, Place in **REMOTE** and verify remote capabilities have been tested			

6.3. Table 1

Location:	Voltage Transformer: **CVT 115-1**					
Phase Rotation:	Expected:			Actual:		
Voltage Readings:						
Expected: (115V)	AX1-AX3	BX1-BX3	CX1-CX3	AY1-AY3	BY1-BY3	CY1-CY3
Actual:						
Expected: (69V)	AX2-AX3	BX2-BX3	CX2-CX3	AY2-AY3	BY2-BY3	CY2-CY3
Actual:						

6.4. Table 2 **VT 35-1**

Expected (115V)	L1 – L2	Expected (67V)	L1 – N	L2 – N
Actual		Actual		

6.5. Table 3 **SS1**

Expected (240V)	L1 – L2	Expected (120V)	L1 – N	L2 – N
Actual		Actual		

7. As Left Conditions

Number 3 Substation				
	CLOSED			
CCVT 115-1	Energized, fuses installed			
SW33	**CLOSED**			
R30	**CLOSED**			
TRANSF #1	Energized Confirm Load Tap Changer (OLTC) is in **NEUTRAL** position and control is set to **AUTOMATIC**			
SW 35-1	**CLOSED**			
VT 35-1	Energized, fuses installed			
SW-5	**CLOSED**			
SSD-1	**CLOSED**			
ATS	Energized on primary (SST1), in **AUTOMATIC**			
SW 35-B1	**CLOSED**			
SW 35-B2	**CLOSED**			
SW 35-B3	**CLOSED**			
SW 35-CB1B	**CLOSED**			
PCB 35-1	**OPEN**, LOTO installed, placed in **LOCAL**			
PCB 35-2	**OPEN**, LOTO installed, placed in **LOCAL**			
PCB 35-3	**OPEN**, LOTO installed, placed in **LOCAL**			
PCB 35-CB1	**OPEN**, LOTO installed, placed in **LOCAL**			
SW 35-F1	**OPEN**, LOTO installed			
SW 35-F2A	**OPEN**, LOTO installed			
SW 35-F2B	**OPEN**, LOTO installed			
SW 35-F3A	**OPEN**, LOTO installed			
SW 35-F3B	**OPEN**, LOTO installed			
CAP BANK (pending completion of CAP Bank energization)				
SW 35-CB1F	**OPEN**, LOTO installed			
89D1	**OPEN**, LOTO installed			
89G1	**CLOSED LOTO installed**			

END OF ENERGIZATION PROCEDURE

8. Acknowledgement of Energization

By signing this document, you are verifying all steps in this procedure were followed correctly and in order and all systems have functioned according to their specifications.

Substation Energization Completion X Energization Coordinator Signature	Time & Date
Substation Energization Completion X Switchman Signature	Time & Date
Substation Energization Completion X Site Manager Signature	Time & Date