PI-2025-4 Provisional Interconnection Study Report

Xcel Energy
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Table of Contents

List of Figures

List of Tables

1.0 Executive Summary

This Provisional Interconnection Service (PIS)[1] Study has been prepared in accordance with the Xcel Energy Open Access Transmission Tariff and the executed Provisional Interconnection Study Agreement between the Interconnection Customer (IC) and the Transmission Provider (TP) – Public Service Company of Colorado (PSCo). This PI request has been given the queue number as PI-2025-4 and it is associated with the DISIS GI-2024-04 Generation Interconnection Request (GIR).

The PI request is for a 100 MW Photovoltaic (PV) portion of a total 200 MW facility, with a Point of Interconnection (POI) at the Mirasol 230 kV switching station.

The total estimated cost of the PSCo transmission system improvements required for PI-2025-4 to qualify for Provisional Interconnection service is estimated to be **$7.039** million.

The maximum permissible output allowed for the Generating Facility is 100 MW. The output amount of the Generating Facility in the PLGIA[2] will be reviewed quarterly and updated if there are changes to the system conditions assumed in this analysis.

Security: PI-2025-4 is a request for Energy Resource Interconnection Service (ERIS). For ERIS requests, security shall estimate the risk associated with the Network Upgrades and the Interconnection Facilities and is assumed to be a minimum of $5 million.

The Interconnection Customer assumes all risks and liabilities with respect to changes between the PLGIA and the LGIA[3], including changes in output limits and Interconnection Facilities, Network Upgrades, Distribution Upgrades, and/or System Protection Facilities cost responsibility.

This Provisional Interconnection Service in and of itself does not convey transmission service.

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[1] **Provisional Interconnection Service (PIS)** shall mean an Interconnection Service provided by Transmission Provider associated with interconnecting the Interconnection Customer's Generating Facility to Transmission Provider's Transmission System and enabling that Transmission System to receive electric energy and capacity from the Generating Facility at the Point of Interconnection, pursuant to the terms of the Provisional Large Generator Interconnection Agreement and, if applicable, the Tariff.

[2] **Provisional Large Generator Interconnection Agreement (PLGIA)** shall mean the interconnection agreement for Provisional Interconnection Service established between Transmission Provider and/or the Transmission Owner and the Interconnection Customer. The pro forma agreement is provided in Appendix 8 and takes the form of the Large Generator Interconnection Agreement, modified for provisional purposes.

[3] **Large Generator Interconnection Agreement (LGIA)** shall mean the form of interconnection agreement applicable to an Interconnection Request pertaining to a Large Generating Facility that is included in the Transmission Provider's Tariff.

2.0 Introduction

This PI request is for a 100 MW Solar Photovoltaic (PV) Generating Facility located in Pueblo County, Colorado. This PI studied a 100 MW portion of a 200 MW facility. The study evaluated the impacts on the PSCo transmission system and Affected Systems by modeling the Generating Facility at the nameplate rating, adjusted for losses associated with the interconnection facilities.

- The POI of this project is at the Mirasol 230 kV switching station.
- The Commercial Operation Date (COD) to be studied for PI-2025-4 is 6/1/2028.

The geographical location of the transmission system near the POI is shown in Figure 1.

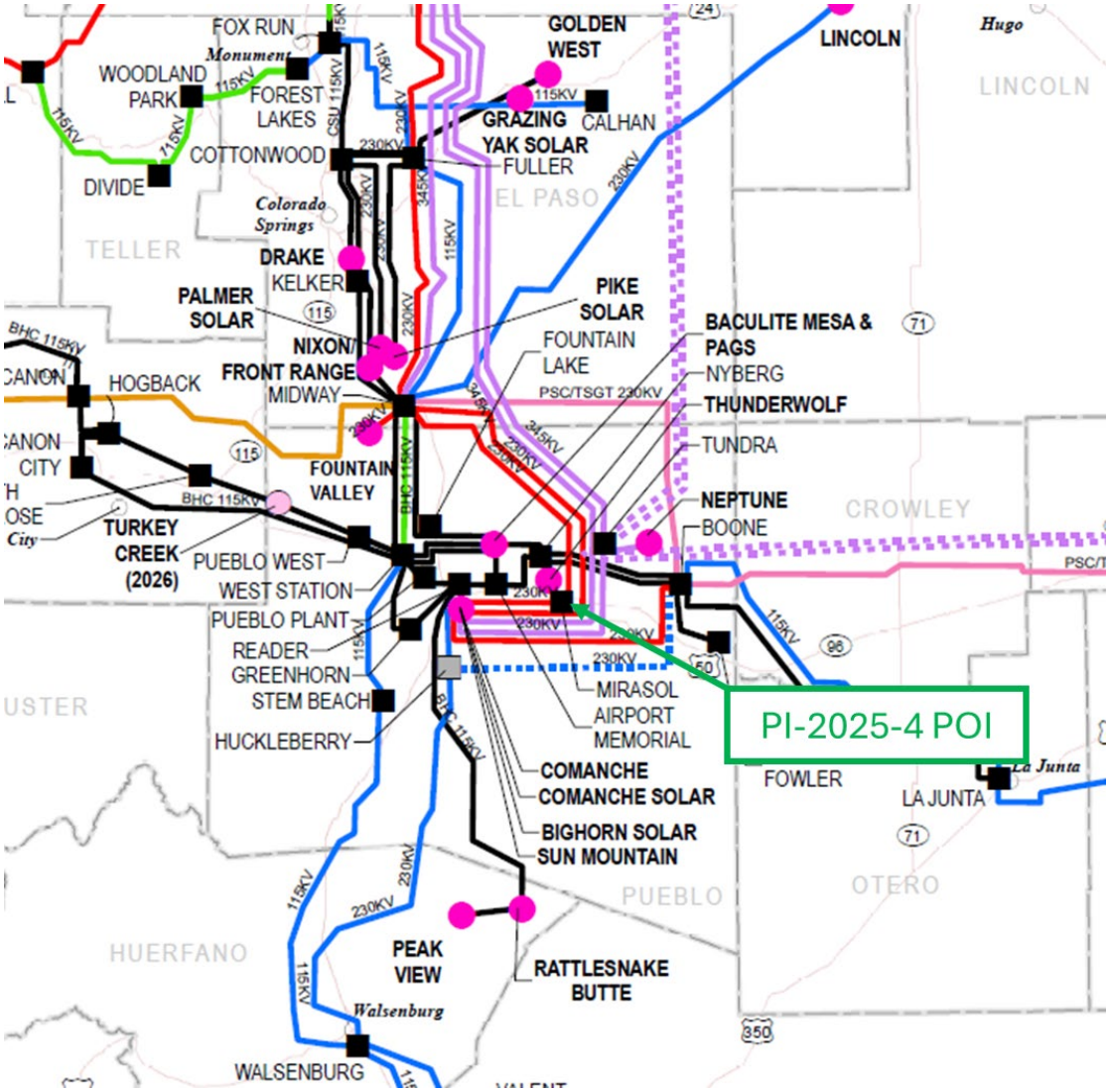


Figure 1: Point of Interconnection of PI-2025-4.

3.0 Study Scope

The Study Scope included Power Flow (thermal and voltage) analysis, Stability analysis, Voltage and Reactive Capability analysis, Short-Circuit analysis, and Cost Estimates for Interconnection Facilities and Station Network Upgrades. The study also identified the Contingent Facilities associated with the Provisional Interconnection service.

3.1 Power Flow and Stability Analysis Criteria

The Power Flow and Stability Analysis criteria used for this study follow the guidelines set forth in the TPL-001-WECC-CRT-4 under requirement WR1.

3.2 Short-Circuit Analysis Criteria (Breaker Duty)

Fault Current after PI addition should not exceed 100% of the Breaker Duty rating. PSCo can only perform breaker duty analysis on the PSCo Transmission System. Before the PI goes in-service the Affected Systems may choose to perform a breaker duty analysis to identify breaker duty violations on their system.

3.3 Benchmark Case Modeling

The Benchmark Case was created from the Base Case (2028HS) as described in Chapter 3 of the BPM, by modifying the study pocket generation dispatch to reflect heavy generation in the South study pocket. This study assesses a 100 MW portion of a 200 MW facility. The two 100 MW segments of this facility share the main plant transformer and the gen-tie line. Therefore, the Benchmark Case was created with the 200 MW facility but injecting 100 MW at the POI for the purposes of this study.

3.4 Study Case Modeling

The PI-2025-4 is a 100 MW net output at the Point of Interconnection with 100 MW (102.7 MW gross) Photovoltaic (PV) Generating Facility.

- Solar PV Machine model – Twenty-seven (27) GE Electric Flex 1566 inverters, each rated for 4.58 MVA.
- Length of Gen-Tie – approximately 1 mile.
- One (1) main step-up transformer, with winding voltages of 34.5/13.8/230.0 kV, and a rating of 135/180/225 MVA.

The Study Case was created from the Benchmark Case by turning on the PI-2025-4 generation, which corresponds to an additional 100 MW injected at the POI from the 200 MW facility. The additional 100 MW output at POI was balanced against PSCo generation outside of the South Colorado study pocket. The facility's diagram in PSLF is presented in Figure 2.

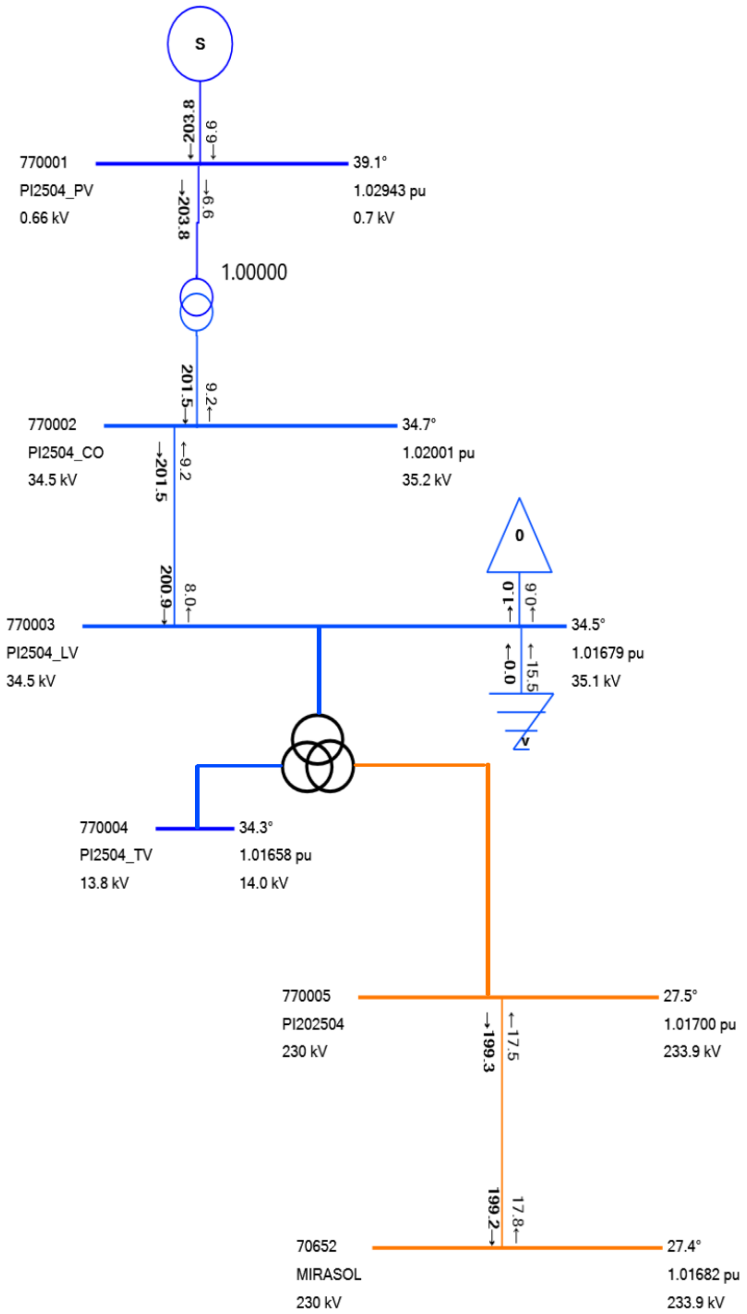


Figure 2: PSLF Model representation of PI-2025-4.

3.5 Short-Circuit Modeling

All connected generating facilities were assumed capable of producing maximum fault current. Accordingly, all generators were modeled at full capacity, regardless of whether NRIS or ERIS was requested. Generation was modeled as a separate generating resource in CAPE and included at full capacity in the short circuit study, independent of any operating limitations that would otherwise be imposed.

This PI-2025-4 assumes the use of twenty-seven (27) GE Flex 4.58 MW solar photovoltaic operating at +/-0.95 pf. Per the supplied interconnection data, each of the generators is connected to a collector transformer, 0.66/34.5kV, rated at 3.73 MVA. A 230/34.5/13.8kV main GSU transformer, rated at 135/180/225 MVA, steps the voltage up from the collector transformer voltage to the POI voltage. An equal amount of generation will be connected to the transformer from PI-2024-17. An approximately 1-mile-long generation tie line interconnects the project to the Mirasol 230kV substation.

3.6 Voltage and Reactive Power Capability Evaluation

Per Section 4.1.1.1 of the BPM, the following voltage regulation and reactive power capability requirements are applicable to non-synchronous generators:

- Xcel Energy's OATT requires all non-synchronous generator Interconnection Customers to provide dynamic reactive power within the power factor range of 0.95 leading to 0.95 lagging at the high side of the generator substation. Furthermore, Xcel Energy requires every Generating Facility to have dynamic voltage control capability to assist in maintaining the POI voltage schedule specified by the Transmission Operator.
- It is the responsibility of the Interconnection Customer to determine the type (switched shunt capacitors and/or switched shunt reactors, etc.), the size (Mvar), and the locations (on the Interconnection Customer's facility) of any additional static reactive power compensation needed within the generating plant in order to have adequate reactive capability to meet the +/- 0.95 power factor at the high side of the main step-up transformer.
- It is the responsibility of the Interconnection Customer to compensate their generation tie-line to ensure minimal reactive power flow under no load conditions.

All the summary tables representing the GIR's Voltage and Reactive Power Capability tests adhere to the following color formatting representing the different aspects of the tests:

- Values highlighted in red indicate a failed reactive power requirement.
- Voltages outside the range of 0.95 p.u. to 1.05 p.u. are highlighted in yellow to provide additional information.

The PI-2025-4 GIR is modeled as follows:

PV: Pmax = 102.7 MW, Pmin = 0.00 MW, Qmax = 68.9 Mvar, Qmin= -68.9 Mvar

The summary for the Voltage and Reactive Power Capability Evaluation for PI-2025-4 is:

- The GIR is capable of meeting ±0.95 pf at the high side of the main step-up transformer while maintaining a normal operating voltage at the POI.

- The GIR is capable of meeting ±0.95 pf at its terminals while meeting the interconnection service request.
- The reactive power exchange and voltage change across the gen-tie are acceptable under no load conditions.

The Voltage and Reactive Power Capability tests performed for PI-2025-4 are summarized in Table 1.

Table 1 – Reactive Capability Evaluation for PI-2025-4

Generator Terminals					High Side of Main Transformer				POI			
Pgen (MW)	Qgen (Mvar)	Qmax (Mvar)	Qmin (Mvar)	V (p.u.)	P (MW)	Q (Mvar)	V (p.u.)	PF	P (MW)	Q (Mvar)	V (p.u.)	PF
102.7	33.3	68.9	-68.9	1.049	100.0	33.0	1.021	0.9496	100.0	33.1	1.020	0.9493
102.7	-17.8	68.9	-68.9	1.004	100.0	-33.2	1.015	-0.9491	100.0	-33.1	1.016	-0.9493
0.0	1.3	68.9	-68.9	1.020	-1.0	1.4	1.032	-0.5812	-1.1	1.7	1.018	-0.5433

3.7 Power Flow Analysis Results

Contingency analysis was performed on the South Colorado study pocket Study Case.

- System intact contingency analysis showed no thermal or voltage violations attributable to PI-2025-4.
- Results of the single contingency analysis are shown in Table 2. Single contingency analysis showed no voltage violations attributable to PI-2025-4.
- Results of the multiple contingency analysis are shown in Table 3. Multiple contingency analysis showed no voltage violations attributable to PI-2025-4.

All single contingency overloads identified in Table 2 were alleviated through generation redispatch, as reflected in the Redispatch Study Case results presented in the last column of the table.

Multiple contingency overloads are mitigated using system adjustments, including generation redispatch (includes GIRs under study) and/or operator actions. None of the multiple contingency overloads are attributed to the study GIR.

Table 2 – South Colorado – Single Contingency Thermal Overloads

Ref. No.	Monitored Facility	Contingency Name	Area	Owner	Rate (MVA)	BM Case AC Loading (%)	Study Case		Redispatch Study Case	
							AC Loading (%)	Loading Diff. (%)	AC Loading (%)	Loading Diff. (%)
1	73391 CTTNWD N 115 73410 KETTLECK S 115 1 1	P21To: 73389 BRIARGATE S 115 73710 BRIARGATE N 115 1 1	73	CSU	162	151.8	153.5	1.7	135.0*	-16.8
2	73414 FOXRUN 115 73738 FLYHORSE N2 115 1 1	P21To: 72413 VOLLMERT 115 73481 FULLER 115 1 1	73	CSU	142	136.9	139.3	2.4	112.8*	-24.1
3	700139 GI_2020_10 230 70652 MIRASOL 230 1 1	P21To: 70286 MIDWAY_PS 230 70652 MIRASOL 230 1 1	70	PSCo	478	116.8	137.6	20.8	109.2*	-7.6
4	70139 DANIEL_PK 230 70323 PRAIRIE_3 230 2 1	70139 DANIEL_PK 230 70331 PRAIRIE_1 230 1 1	70	PSCo	478	136.1	137.6	1.5	109.7*	-26.3
5	73576 FLYHORSE S 115 73711 KETTLECK N 115 1 1	P21To: 72413 VOLLMERT 115 73481 FULLER 115 1 1	73	CSU	162	132.3	134.4	2.1	111.0*	-21.3
6	70550 W.CANON 115 71025 HOGBACK115 115 1 1	P21From: 73413 MIDWAYBR 230 73638 HAMBONE TAP 230 1 1	70	BHE	120	123.6	126.1	2.5	100.3*	-23.3
7	70394 SMELTER 115 70550 W.CANON 115 1 1	P21From: 73551 W CANON 230 79054 PONCHABR 230 1 1	70	BHE	73	117.1	119.9	2.9	90.0	-27.1
8	70139 DANIEL_PK 230 70331 PRAIRIE_1 230 1 1	P21To: 70139 DANIEL_PK 230 70323 PRAIRIE_3 230 2 1	70	PSCo	571	113.8	115.0	1.3	92.0	-21.8
9	73408 KELKER E 115 73422 TEMPLTON 115 1 1	73408 KELKER E 115 73420 ROCKISLD 115 1 1	73	CSU	131	111.4	112.4	1.0	101.5*	-9.9
10	70286 MIDWAY_PS 230 70652 MIRASOL 230 1 1	P21From: 70122 COMANCHE 230 700139 GI_2020_10 230 1 1	70	PSCo	796	97.4	110.1	12.7	92.6	-4.8
11	73710 BRIARGATE N 115 73711 KETTLECK N 115 1 1	P21To: 73391 CTTNWD N 115 73410 KETTLECK S 115 1 1	73	CSU	186	106.1	107.4	1.3	93.2	-13.0
12	70189 GREENWOOD_2 230 70323 PRAIRIE_3 230 1 1	70139 DANIEL_PK 230 70331 PRAIRIE_1 230 1 1	70	PSCo	572	104.9	106.2	1.3	83.1	-21.8

Ref. No.	Monitored Facility	Contingency Name	Area	Owner	Rate (MVA)	BM Case AC Loading (%)	Study Case		Redispatch Study Case	
							AC Loading (%)	Loading Diff. (%)	AC Loading (%)	Loading Diff. (%)
13	70339 PUEBPLNT 115 70352 READER 115 1 1	LoTC_102	70	BHE	160	102.3	104.7	2.4	90.6	-11.7
14	72413 VOLLMERT 115 73481 FULLER 115 1 1	P21To: 73576 FLYHORSE S 115 73711 KETTLECK N 115 1 1	73	TSGT	173	102.0	103.4	1.4	88.0	-14.0
15	70286 MIDWAY_PS 230 73477 FULLER 230 1 1	70286 MIDWAY_PS 230 73413 MIDWAYBR 230 1 1	70/73	PSCo	478	100.2	103.3	3.1	72.8	-27.5
16	70212 GREENWOOD_1 230 70331 PRAIRIE_1 230 2 1	P21To: 70139 DANIEL_PK 230 70323 PRAIRIE_3 230 2 1	70	PSCo	572	101.1	102.3	1.3	79.5	-21.6
17	70193 FTN_VLY 115 73412 MIDWAYBR 115 1 1	P21From: 70286 MIDWAY_PS 230 73413 MIDWAYBR 230 1 1	70/73	BHE	179	99.0	101.6	2.6	75.3	-23.7

*Re-dispatched Study Case loadings are considered resolved if they are less than Benchmark Case loadings.

Table 3 – South Colorado – Multiple Contingency Thermal Overloads

Ref. No.	Monitored Facility	Contingency Name	Area	Owner	Rate (MVA)	BM Case AC Loading (%)	Study Case AC Loading (%)	Loading Diff. (%)
1	70193 FTN_VLY 115 73412 MIDWAYBR 115 1 1	BF_094d	70/73	BHE	179	151.5	155.2	3.8
2	73414 FOXRUN 115 73738 FLYHORSE N2 115 1 1	P7_129	73	CSU	157	133.4	136.9	3.5
3	70286 MIDWAY_PS 230 73413 MIDWAYBR 230 1 1	P7_130	70/73	WAPA R. M.	637	131.2	135.7	4.5
4	70139 DANIEL_PK 230 70323 PRAIRIE_3 230 2 1	BF_064b	70	PSCo	478	133.1	134.3	1.2
5	70449 DESRTCOV 115 70456 W.STATON 115 1 1	BF_094d	70	BHE	221	130.9	134.0	3.1
6	73576 FLYHORSE S 115 73711 KETTLECK N 115 1 1	P7_129	73	CSU	180	127.2	130.2	3.0
7	70550 W.CANON 115 71025 HOGBACK115 115 1 1	BF_094d	70	BHE	120	124.2	126.9	2.7
8	70193 FTN_VLY 115 70449 DESRTCOV 115 1 1	BF_094d	70	BHE	221	123.3	126.3	3.0
9	70339 PUEBPLNT 115 70352 READER 115 1 1	P7_53	70	BHE	160	122.8	125.8	3.0
10	700139 GI_2020_10 230 70652 MIRASOL 230 1 1	BF_094c	70	PSCo	559	99.9	117.7	17.8
11	73391 CTTNWD N 115 73410 KETTLECK S 115 1 1	P7_129	73	CSU	180	113.7	115.7	2.1
12	70061 BOONE 230 700015 PI_2024_15 230 1 1	P7_53	70	PSCo	319	109.6	112.5	3.0
13	70286 MIDWAY_PS 230 700015 PI_2024_15 230 1 1	P7_53	70	PSCo	319	109.4	112.4	3.0

Ref. No.	Monitored Facility	Contingency Name	Area	Owner	Rate (MVA)	BM Case AC Loading (%)	Study Case AC Loading (%)	Loading Diff. (%)
14	70236 HYDEPARK 115 70339 PUEBPLNT 115 1 1	P7_53	70	BHE	159	108.0	111.0	3.0
15	70139 DANIEL_PK 230 73477 FULLER 230 1 1	BF_150c	70/73	PSCo	478	107.1	110.2	3.1
16	70653 TUNDRA 345 70654 COMANCHE 345 2 1	BF_140a	70	PSCo	1183	100.8	105.4	4.6
17	73412 MIDWAYBR 115 73416 RANCHO 115 1 1	P7_130	73	Tri-State G&T	119	102.8	104.3	1.5
18	70139 DANIEL_PK 230 70331 PRAIRIE_1 230 1 1	BF_045s	70	PSCo	629	101.2	102.3	1.2

3.8 Stability Analysis Results

The results of the transient stability analysis are summarized in Table 4. Ref. Nos. 7 and 9 resulted in unstable behavior. Faults at Midway 230 kV and at Comanche 230 kV buses were observed to present unstable behavior in both Study and Benchmark cases. The unstable result is observed independent of PI-2025-4 GIR's status and, therefore, the unstable result is not attributable to the Study Unit GIR. This stability issue had been observed previously and is currently under investigation by PSCo.

Apart from Ref. Nos. 7 and 9, all other contingencies presented the following:

- ✓ No machines lost synchronism with the system.
- ✓ No voltage drop violations were observed.
- ✓ Machine rotor angles displayed positive damping.

The stability plots for are shown in Appendix A in Section 8.0 of this report.

Table 4 – Transient Stability Analysis Results

Ref. No.	Contingency Name	Fault Category	Outage(s)	Clearing Time (Cycles)	Post-Fault Voltage Recovery	Angular Stability
1	Flat Run	P0	-	-	Stable	Stable
2	Gen PI-2025-4	P1	PI-2025-4 Unit	5	Stable	Stable
3	Midway - Mirasol 230 kV (LoTC_102)	P1	Midway - Mirasol 230 kV CKT 1	5	Stable	Stable
4	Mirasol - Thunderwolf 230 kV (LoTC_103)	P1	Mirasol - Thunderwolf 230 kV CKT 1 Thunderwolf Generators	5	Stable	Stable
5	Gens 3RSC-23-1	P1	3RSC-23-01 Units S1 and S2	5	Stable	Stable
6	Gen 3RSC-23-2	P1	3RSC-23-02 Unit B	5	Stable	Stable
7	Midway - Fuller 230 kV (LoTC_28)	P1	Midway - Fuller 230 kV CKT 1	5	Unstable	Unstable
8	Comanche - Mirasol 230 kV (LoTC_79)	P1	Comanche - Mirasol 230 kV CKT 1 GI-2020-10 Generators	5	Stable	Stable
9	Comanche - Huckleberry 230 kV (LoTC_76)	P1	Comanche - Huckleberry 230 kV CKT 1	5	Unstable	Unstable
10	Mirasol 230 kV BF (BF_096a)	P4	Comanche - Mirasol 230 kV CKT 1 Mirasol - Midway PS 230 kV CKT 1 GI-2020-10 Generators Thunderwolf Generators	17	Stable	Stable
11	Mirasol 230 kV P7 (P7_54)	P7	Comanche - Mirasol 230 kV CKT 1 Comanche - Huckleberry 230 kV CKT 1 Huckleberry - Walsenberg 230 kV CKT 1 GI-2020-10 Generators	5	Stable	Stable

3.9 Short-Circuit (Breaker Duty) Analysis Results

A study was completed to determine whether any over-dutied breakers resulted when several Provisional Interconnections (PIs) were added to the PSCo transmission system in the order of their Commercial Operation Date (COD). If the addition of the interconnection resulted in a requirement that one or more breakers be replaced in the PSCo transmission system, it was considered that that customer would not be able to connect under a Provisional Interconnection agreement and it was removed from the study.

Taken into consideration were any existing plans for breaker replacement by PSCo. Breakers that had already been assigned to projects were not considered as needing replacement by the interconnection customer.

No circuit breaker became over-dutied because of adding PI-2025-4. The fault currents at the POI for can be made available upon request by the Customer.

3.10 Affected Systems

No Affected Systems were identified.

4.0 Cost Estimates

The total estimated cost of the required Upgrades for PI-2025-4 to interconnect for Provisional Interconnection Service at the Mirasol 230 kV switching station **$7.039** million.

- **Cost of Transmission Provider's Interconnection Facilities (TPIF) is $2.922 million** (Table 5)
- **Cost of Station Network Upgrades is $4.117 million** (Table 6)
- **Cost of System Network Upgrades is $0**

The list of improvements required to accommodate the Provisional Interconnection of PI-2025-4 are given in Table 5, and Table 6.

Table 5 – Transmission Provider's Interconnection Facilities

Element	Description	Cost Est. (Million)
PSCo's Mirasol 230 kV switching station	Interconnection of GI-2024-04 (PI-2025-4) at the Mirasol 230 kV switching station. The new equipment includes: • (1) 230 kV single bay dead end structure • (1) 230 kV 3-phase arrester • (1) 230 kV 3000A disconnect switch • (1) 230 kV 3-phase CT for metering • (1) 230 kV 3-phase CCVT for metering • Associated electrical equipment, bus, wiring and grounding • Associated foundations and structures • Associated transmission line communications, fiber, relaying	$2.457
PSCo's Mirasol 230 kV switching station	Transmission Provider's dead-end structure at the Point of Change of Ownership (PCO) outside the switching station fence line and transmission line into new switching station from the PCO. Single span, dead end structure, 3 conductors, insulators, hardware, jumpers and labor.	$0.465
Total Cost Estimate for Interconnection Customer-Funded, PSCo-Owned Interconnection Facilities		**$2.922**

Table 6 – Station Network Upgrades

Element	Description	Cost Est. (Million)
PSCo's Mirasol 230 kV switching station	Interconnection of PI-2025-4 at the Mirasol 230 kV switching station. The new equipment includes: • (1) 230 kV single bay dead end structure • (1) 230 kV 3000 A circuit breaker • (5) 230 kV 3000 A disconnect switches • Associated electrical equipment, bus, wiring and grounding • Station controls and wiring • Associated foundations and structures	$3.733
PSCo's Mirasol 230 kV switching station	Install required communication in the EEE at the Mirasol 230 kV Switching Station	$0.284
PSCo's Mirasol 230 kV switching station	Siting and Land Rights permitting, no land purchase costs included	$0.100
Total Cost Estimate for PSCo-Funded, PSCo-Owned Interconnection Facilities		**$4.117**

The TPIF and Station Network Upgrades for PI-2025-4 and PI-2024-17 are considered shared facilities and for the same Interconnection Customer. If the Interconnection Customer for PI-2025-4 proceeds to execution of a PLGIA, the cash payments for TPIF and security for Station Network Upgrades will be collected for the shared interconnection facilities, not individually for each project under each PLGIA. The cash payments and security have been collected under PI-2024-17 and if one of the projects terminates its PLGIA, the entirety of TPIF cash payments and security for Station Network Upgrades will be maintained under the other PLGIA to support the project that remains to ensure construction continuity.

PSCo has developed cost estimates for Transmission Provider's Interconnection Facilities and Network/Infrastructure Upgrades required for the interconnection of PI-2025-4 for Provisional Interconnection Service. The estimated costs provided in this report are based upon the following assumptions:

- The estimated costs are in 2025 dollars with escalation and contingencies applied.
- Allowances for Funds Used During Construction (AFUDC) is not included.
- The estimated costs include all applicable labor and overheads associated with the siting, engineering, design, and construction of these new PSCo facilities.

- The estimated costs do not include the cost for any Customer owned equipment and associated design and engineering.
- Labor is estimated for straight time only—no overtime included.
- PSCo (or its Contractor) will perform all construction, wiring, testing, and commissioning for PSCo owned and maintained facilities.

The customer requirements include:

- Interconnection Customer will install two (2) redundant fiber optic circuits (one primary circuit with a redundant backup) into the Transmission Provider's switching station as part of its interconnection facilities construction scope.
- Power Quality Metering (PQM) will be required on the Customer's generation tie-line terminating into the POI.
- The Customer will be required to design, procure, install, own, operate and maintain a Remote Terminal Unit (RTU) at their Customer substation. PSCo will be provided with indications, readings and data from the RTU.
- The Interconnection Customer will comply with the most current version of the *Interconnection Guidelines for Transmission Interconnected Producer-Owned Generation Greater Than 20 MW*, as amended from time to time, and available at: Interconnection | Transmission | Corporate | Xcel Energy

4.1 Schedule

This section provides proposed milestones for the interconnection of PI-2025-4 to the Transmission Provider's Transmission System. The customer requested a back-feed date (In-Service Date for Transmission Provider Interconnection Facilities and Station Network Upgrades required for interconnection) for the Provisional Interconnection is October 1, 2027. This is attainable by the Transmission Provider, based upon the current schedule developed for this interconnection request. The Transmission Provider proposes the milestones provided below in Table 7.

Table 7 – Proposed Milestones for PI-2025-4

Milestone	Responsible Party	Estimated Completion Date
PLGIA Execution	Interconnection Customer and Transmission Provider	March 2025
In-Service Date for Transmission Provider Interconnection Facilities and Station Network Upgrades required for interconnection	Transmission Provider	October 1, 2027
In-Service Date & Energization of Interconnection Customer's Interconnection Facilities	Interconnection Customer	October 1, 2027
Initial Synchronization Date	Interconnection Customer	December 1, 2027
Begin trial operation & testing	Interconnection Customer and Transmission Provider	February 1, 2028
Commercial Operation Date	Interconnection Customer	June 1, 2028

Some schedule elements are outside of the Transmission Provider's control and could impact the overall schedule. The following schedule assumptions provide the basis for the schedule milestones:

- Construction permitting (if required) for new facilities will be completed within 12 months of PLGIA execution.
- The Transmission Provider is currently experiencing continued increases to material lead times which could impact the schedule milestones. The schedule milestones are based upon material lead times known at this time.
- Availability of line outages to interconnect new facilities to the transmission system.

5.0 Conclusion

The total estimated cost of the PSCo transmission system improvements required for PI-2025-4 to qualify for Provisional Interconnection Service would be **$7.039** million.

Based on the Power Flow and Stability analyses, the maximum permissible output allowed for the Generating Facility is 100 MW. The output amount of the Generating Facility in the PLGIA[4] will be reviewed quarterly and updated if there are changes to the system conditions assumed in this analysis.

The Short-Circuit analysis (breaker duty) on the PSCo transmission system found no over-dutied breakers attributed to this PI request.

Security: PI-2025-4 is a request for Energy Resource Interconnection Service (ERIS). For ERIS requests, security shall estimate the risk associated with the Network Upgrades and the Interconnection Facilities and is assumed to be a minimum of $5 million.

The Provisional Interconnection Service in and of itself does not convey transmission service.

[4] **Provisional Large Generator Interconnection Agreement (PLGIA)** shall mean the interconnection agreement for Provisional Interconnection Service established between Transmission Provider and/or the Transmission Owner and the Interconnection Customer. The pro forma agreement is provided in Appendix 8 and takes the form of the Large Generator Interconnection Agreement, modified for provisional purposes.

6.0 Contingent Facilities

The Contingent Facilities identified for PI-2025-4 include the overstressed breaker, TPIF and Station Network Upgrades identified in , Table 5 and Table 6, respectively.

7.0 Conceptual One-Line Diagram and General Arrangement for PI-2025-4

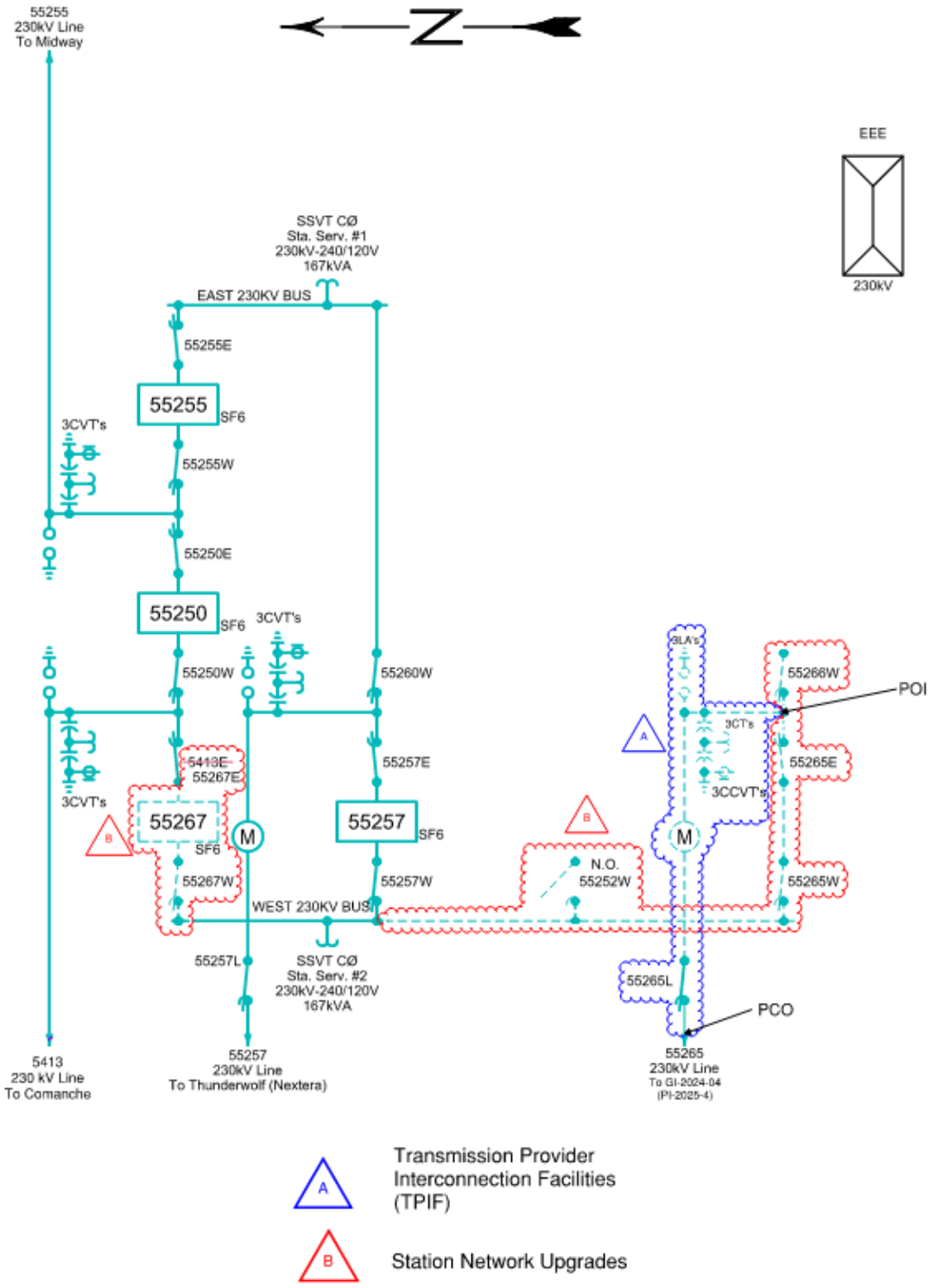


Figure 3: Preliminary One-Line of PI-2025-4 at the Mirasol 230 kV Switching Station

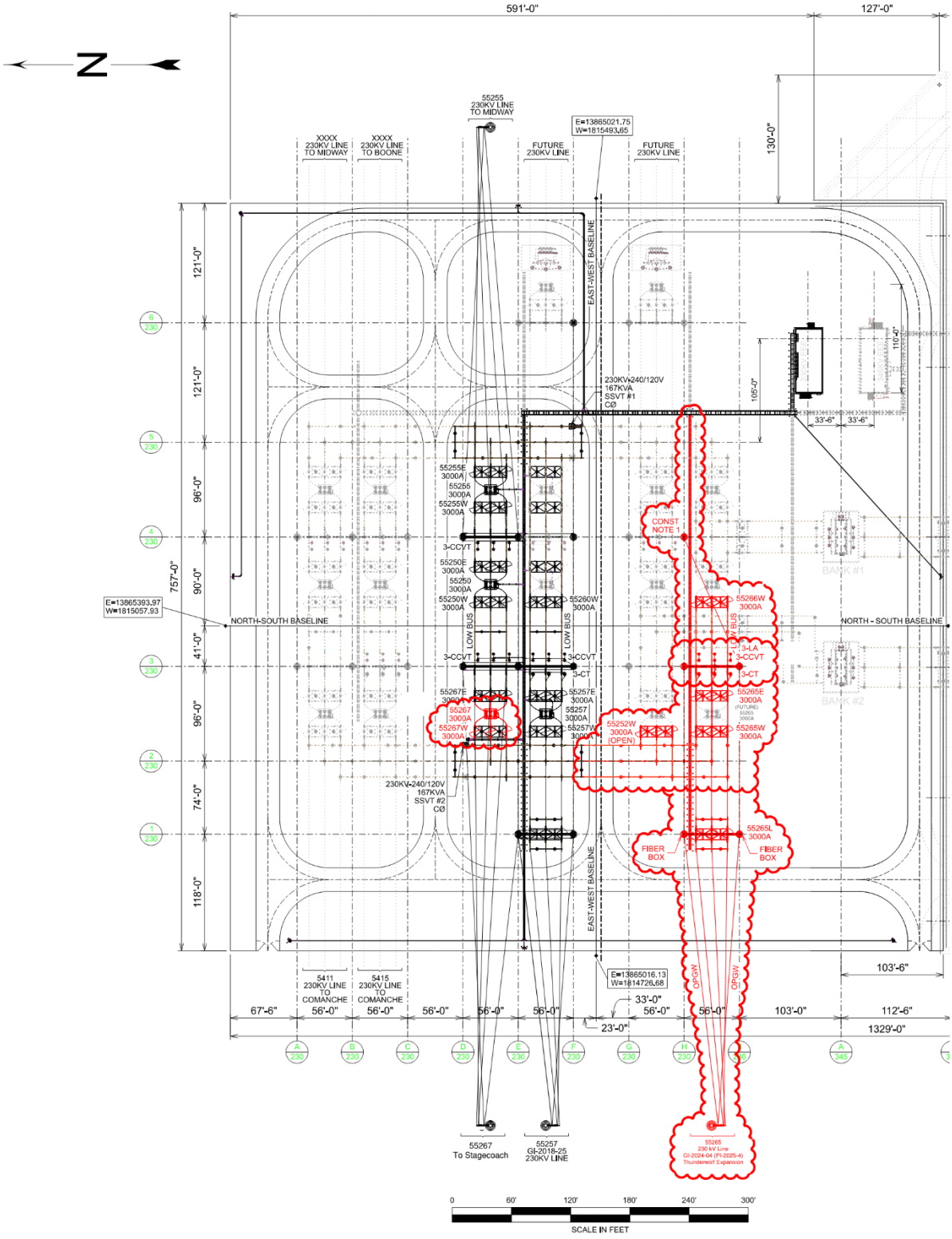
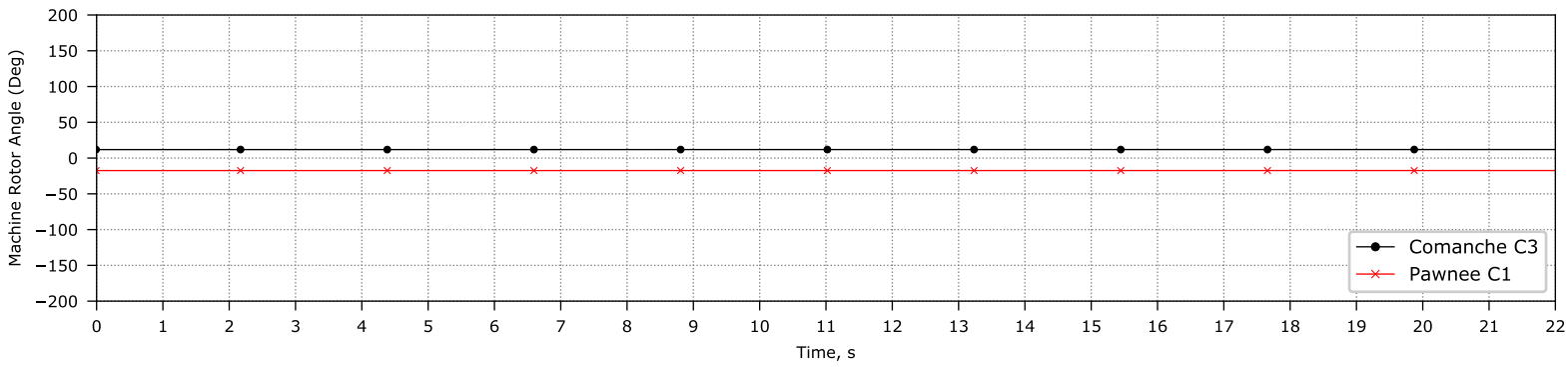


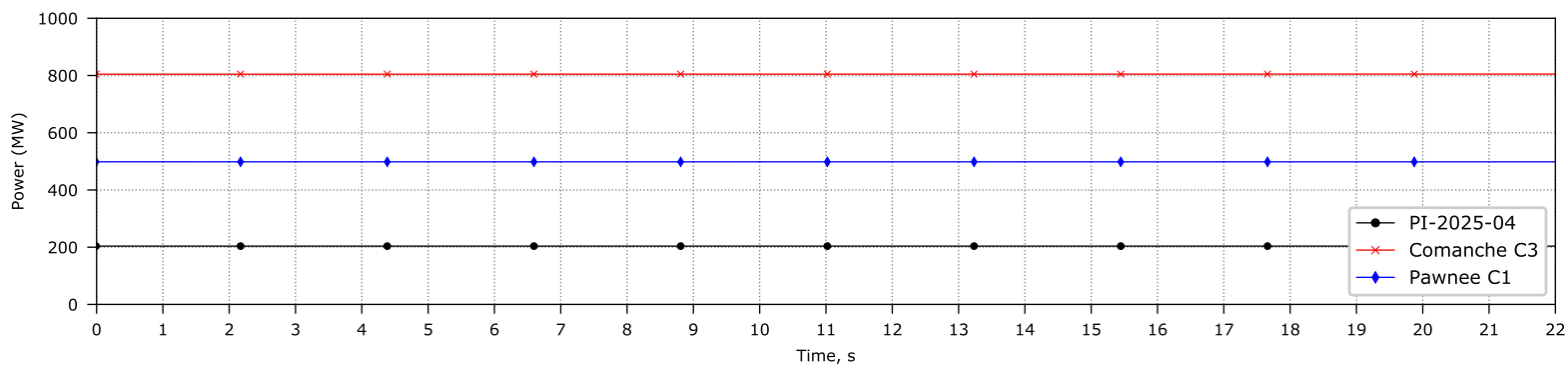
Figure 4: Preliminary General Arrangement of PI-2025-4 at the Mirasol 230 kV Switching Station

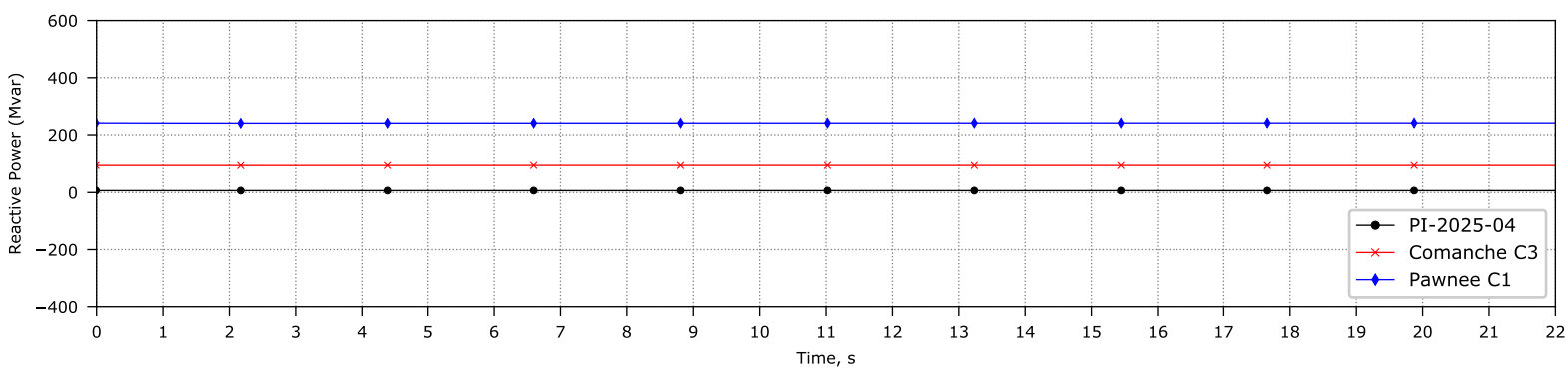
8.0 Appendices

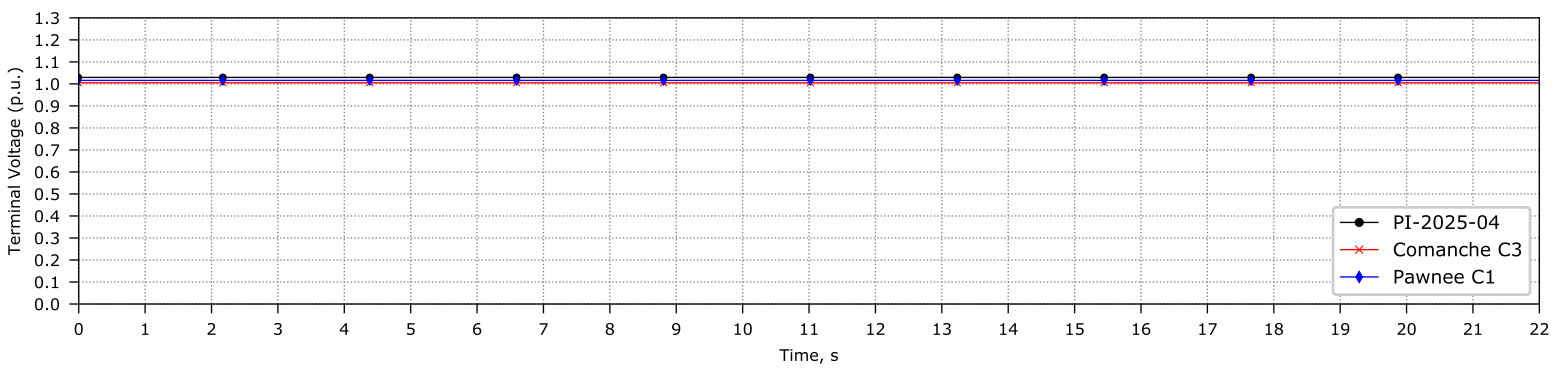
Appendix A: Stability Plots	PI-2025-4_Study_Transient Stability Plots

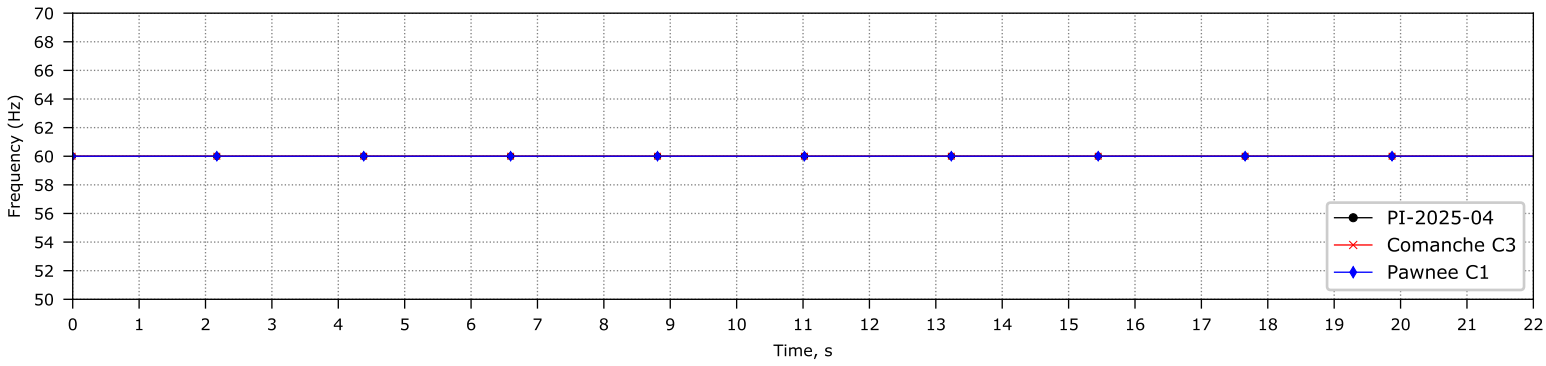
Flat Run

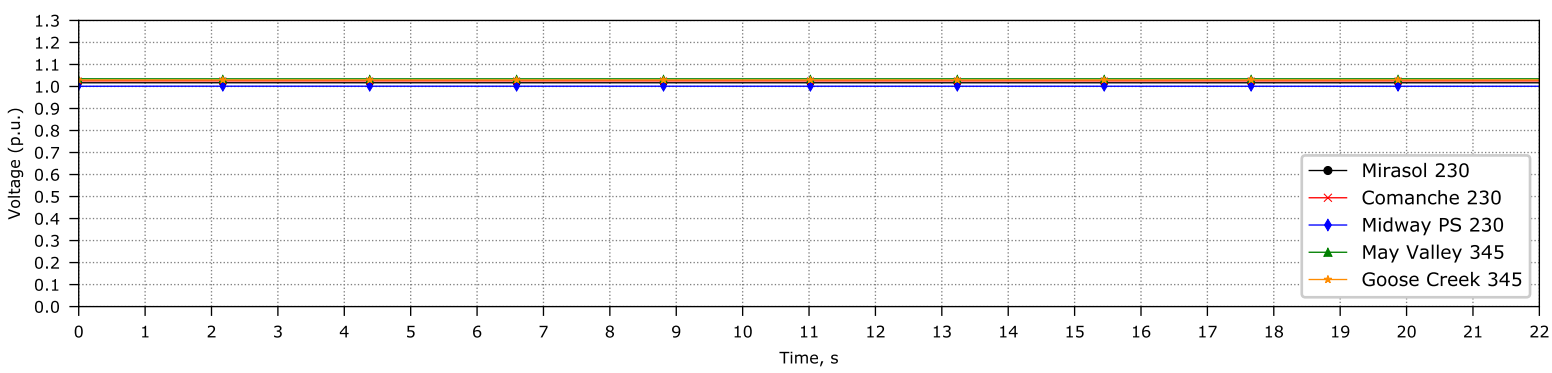

Machine Rotor Angle (Deg)
Time, s
Comanche C3
Pawnee C1


Power (MW)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

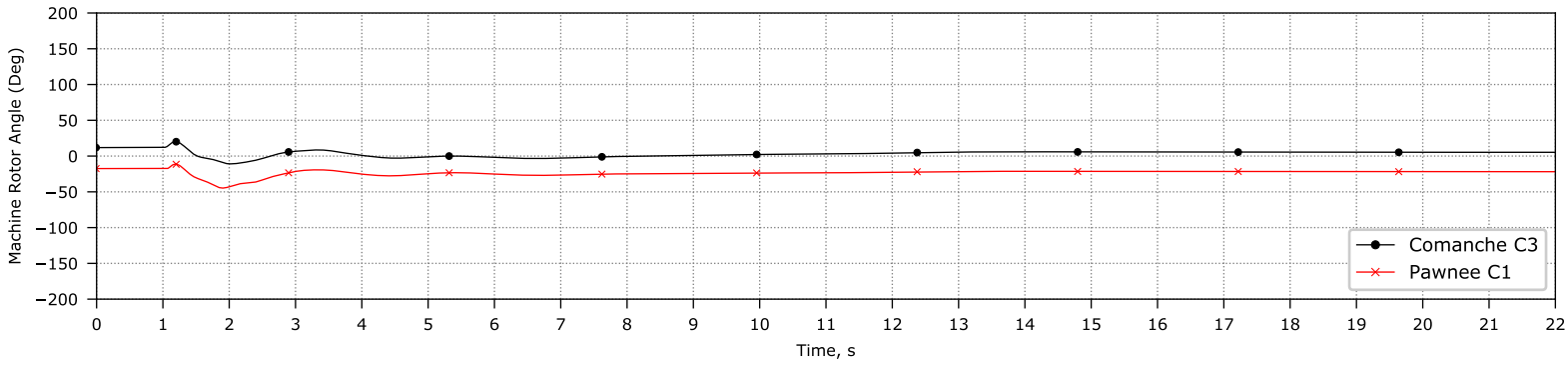

Reactive Power (Mvar)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

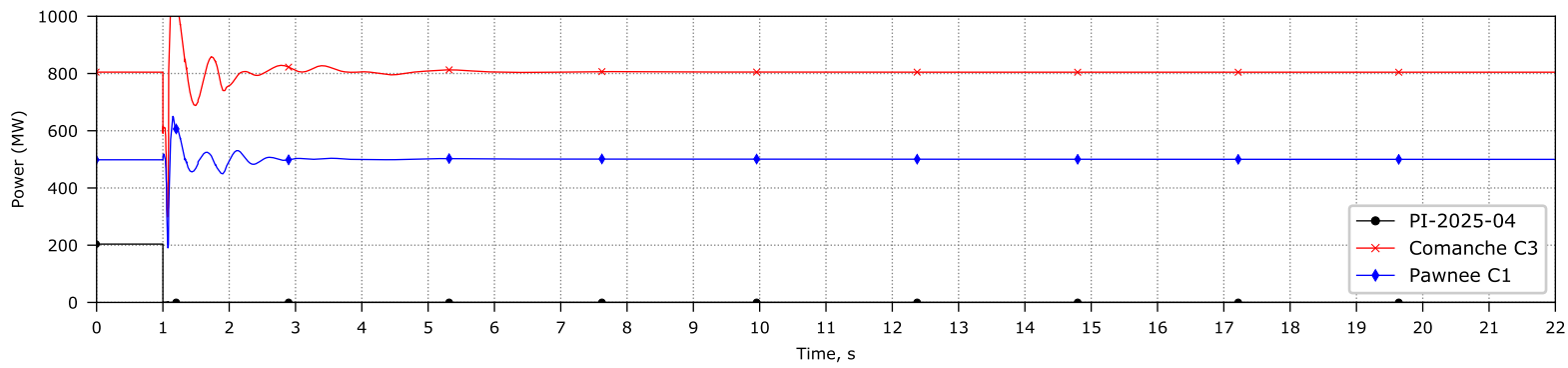

Terminal Voltage (p.u.)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

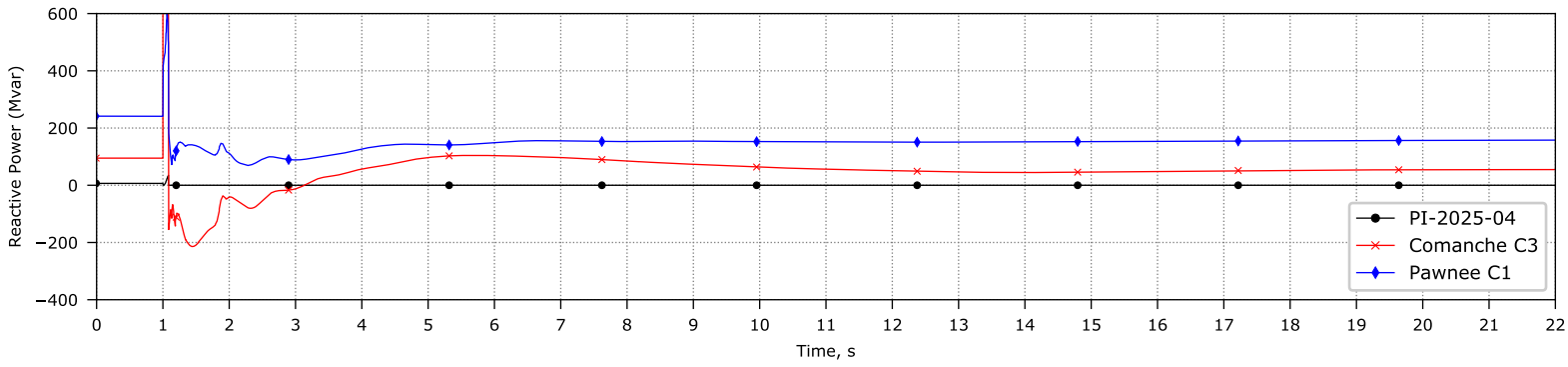

Frequency (Hz)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

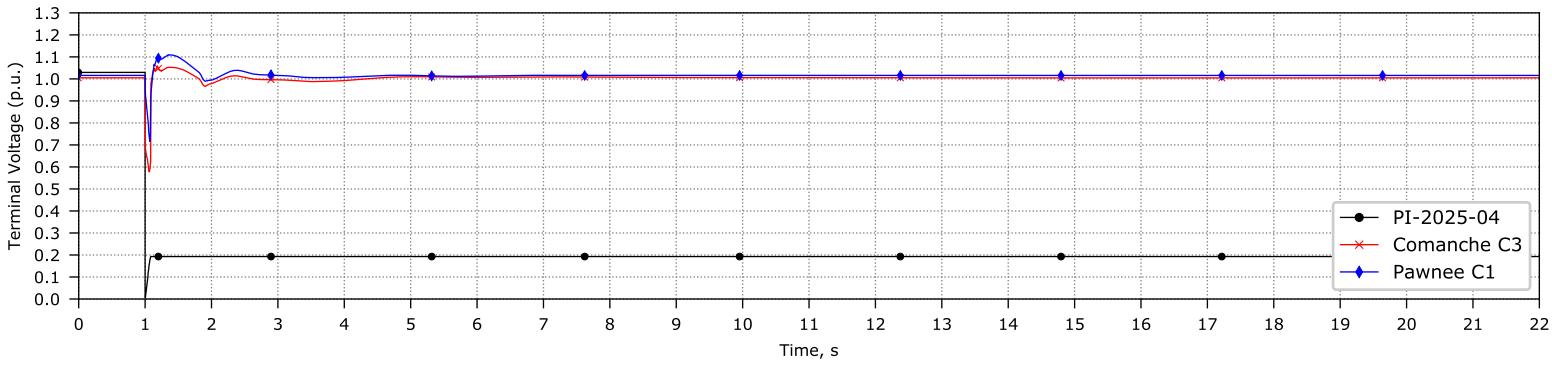

Voltage (p.u.)
Time, s
Mirasol 230
Comanche 230
Midway PS 230
May Valley 345
Goose Creek 345

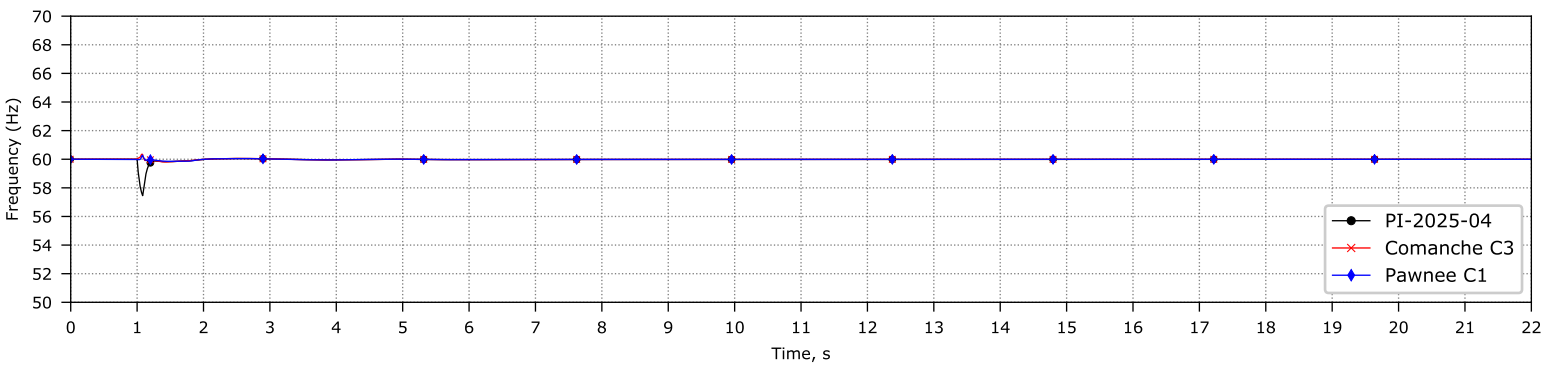
Gen PI_2025_4

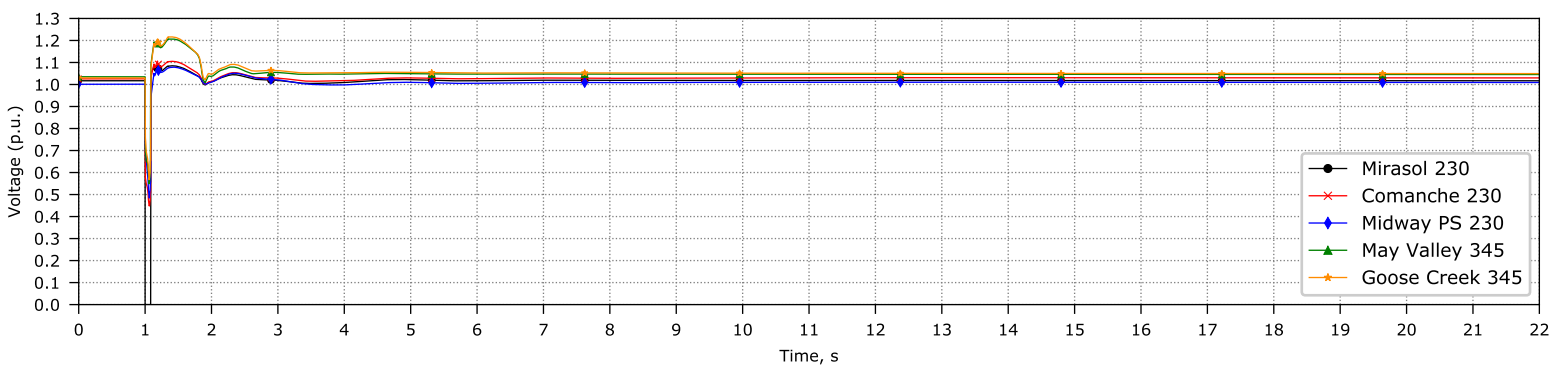

Machine Rotor Angle (Deg)
Time, s
Comanche C3
Pawnee C1


Power (MW)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

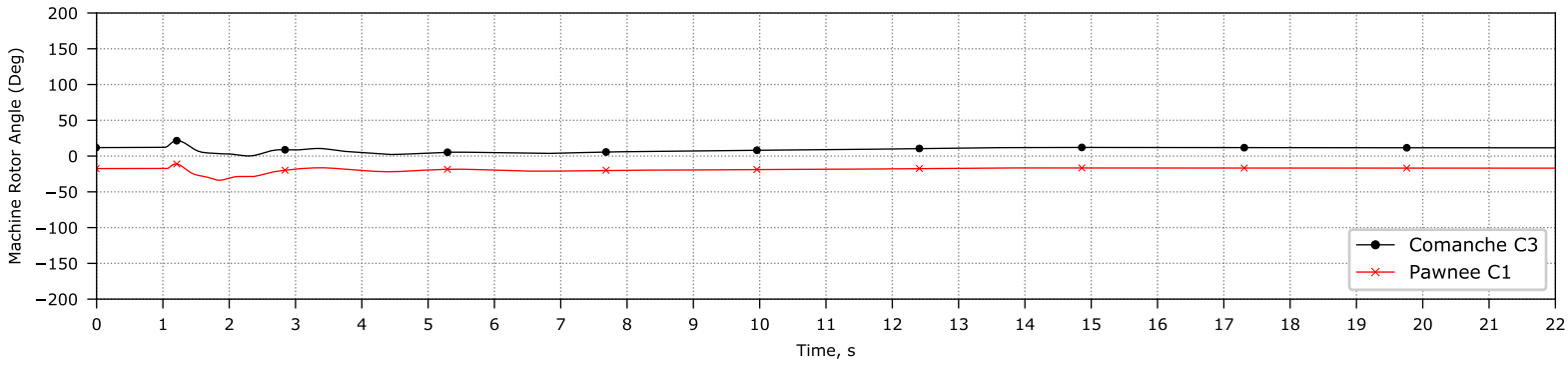

Reactive Power (Mvar)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

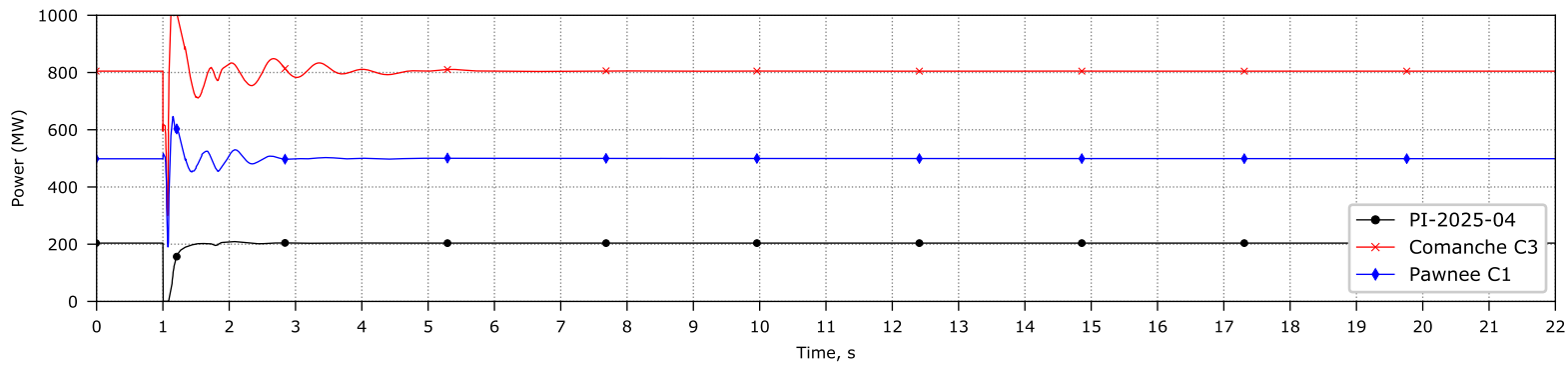

Terminal Voltage (p.u.)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

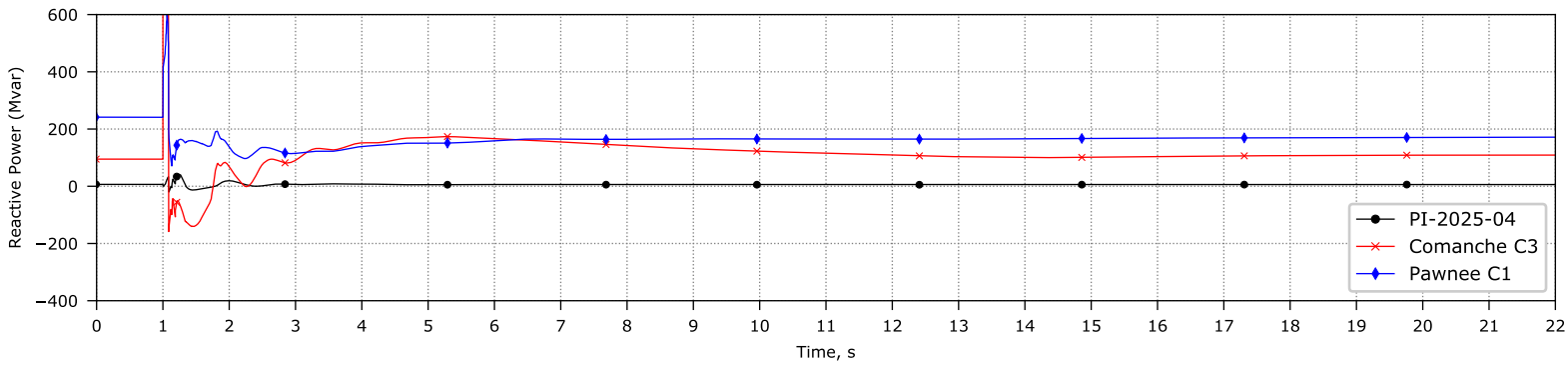

Frequency (Hz)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

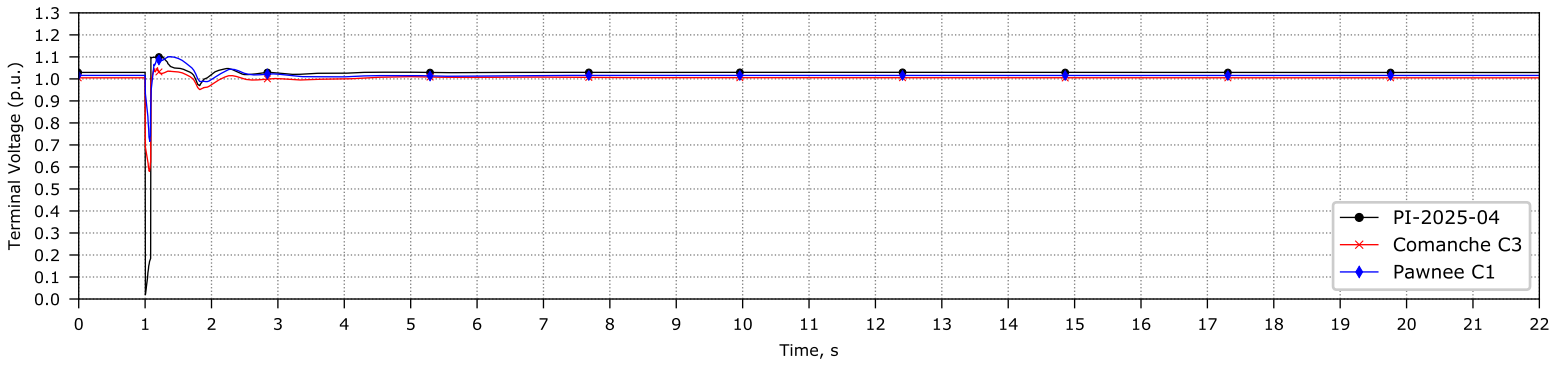

Voltage (p.u.)
Time, s
Mirasol 230
Comanche 230
Midway PS 230
May Valley 345
Goose Creek 345

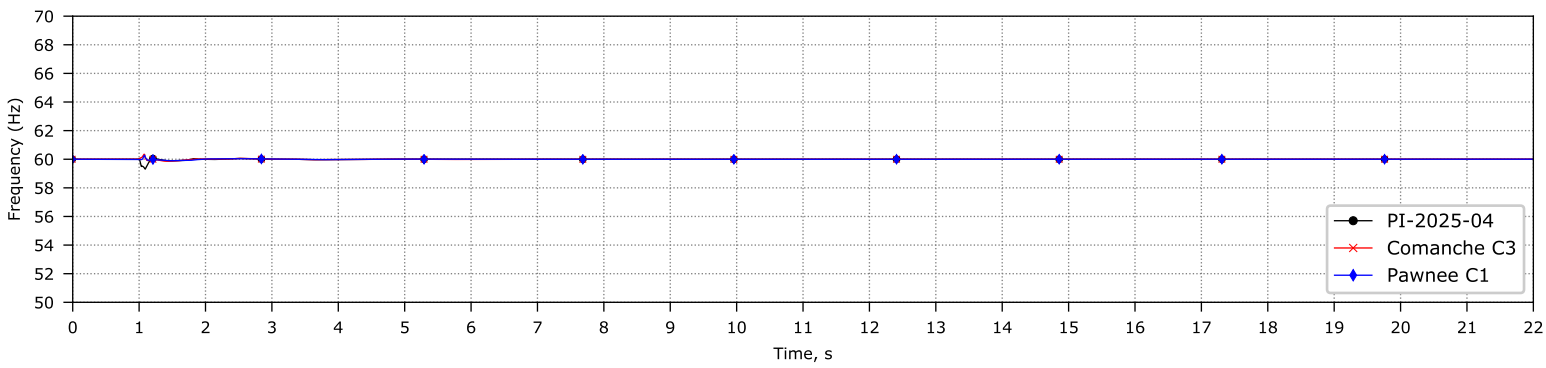
Midway - Mirasol 230 kV

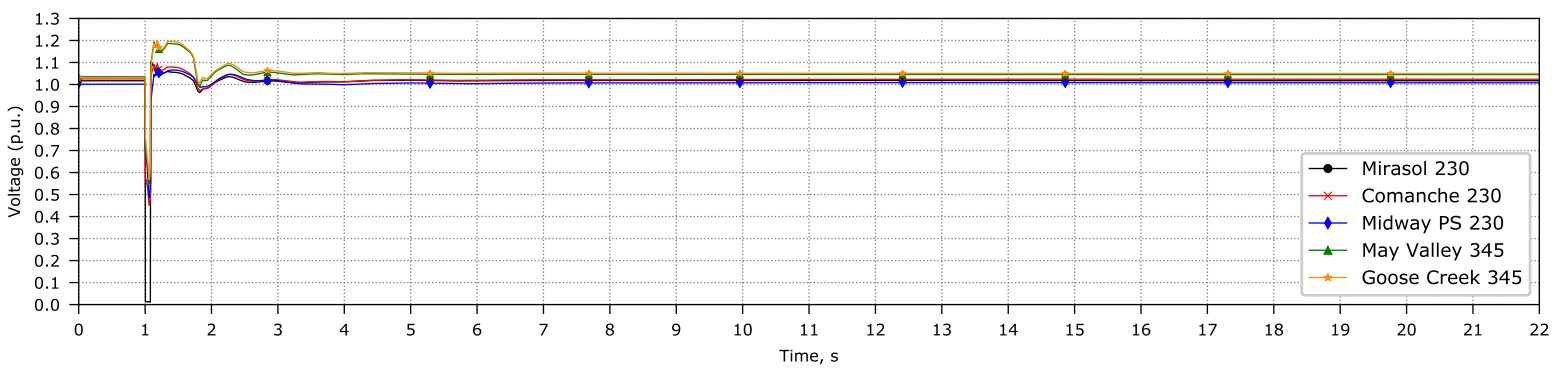




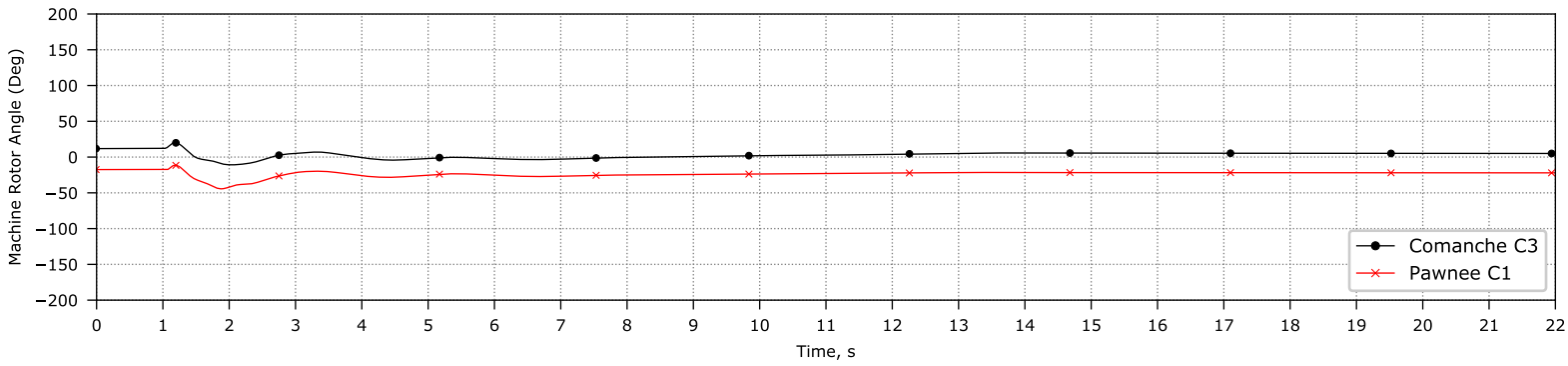


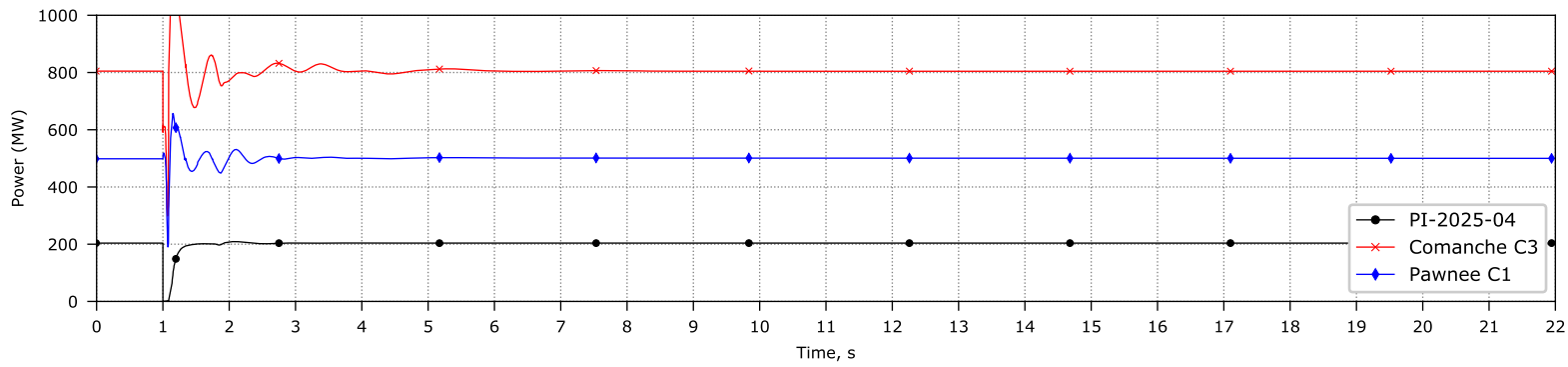


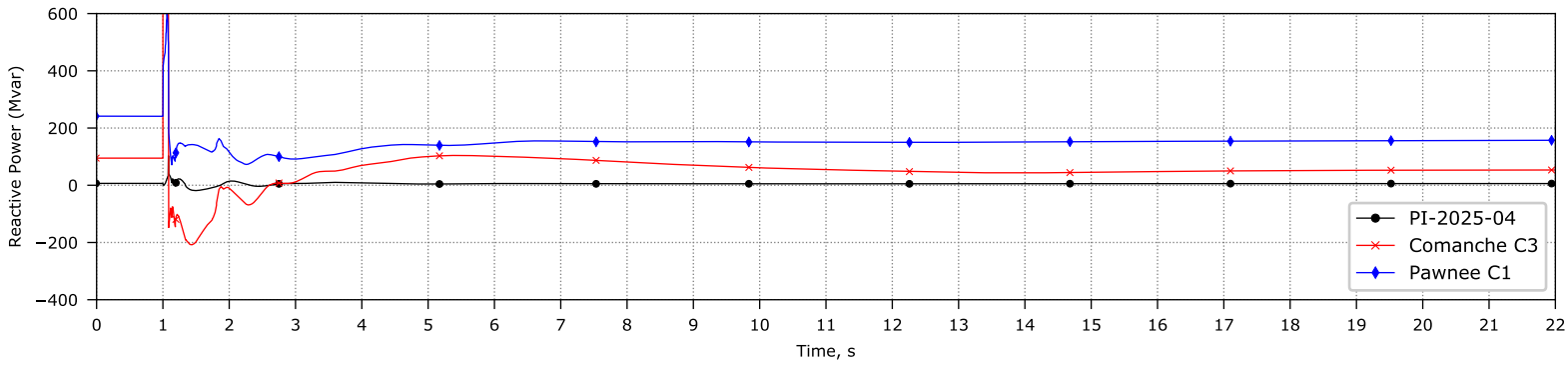


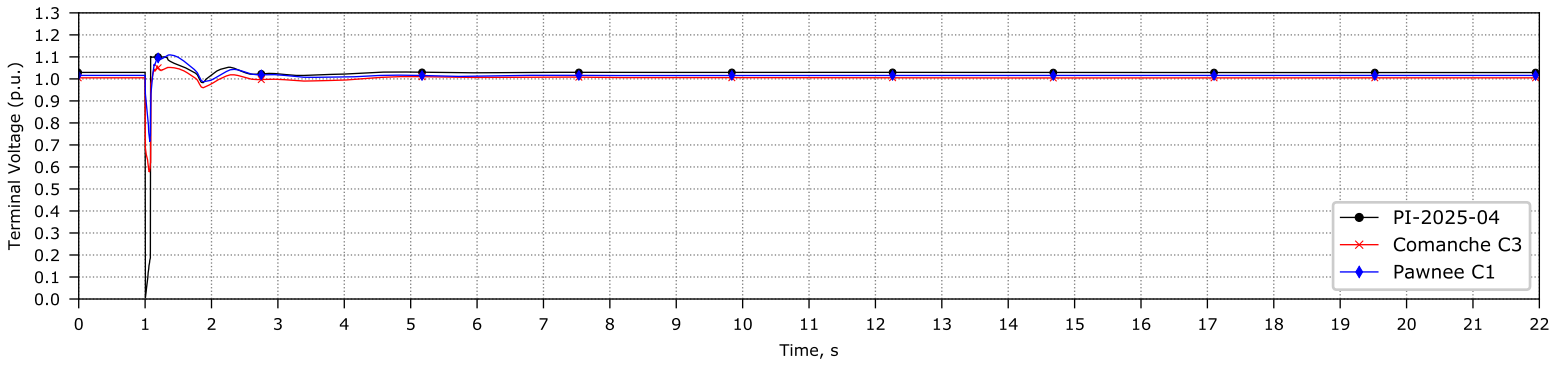


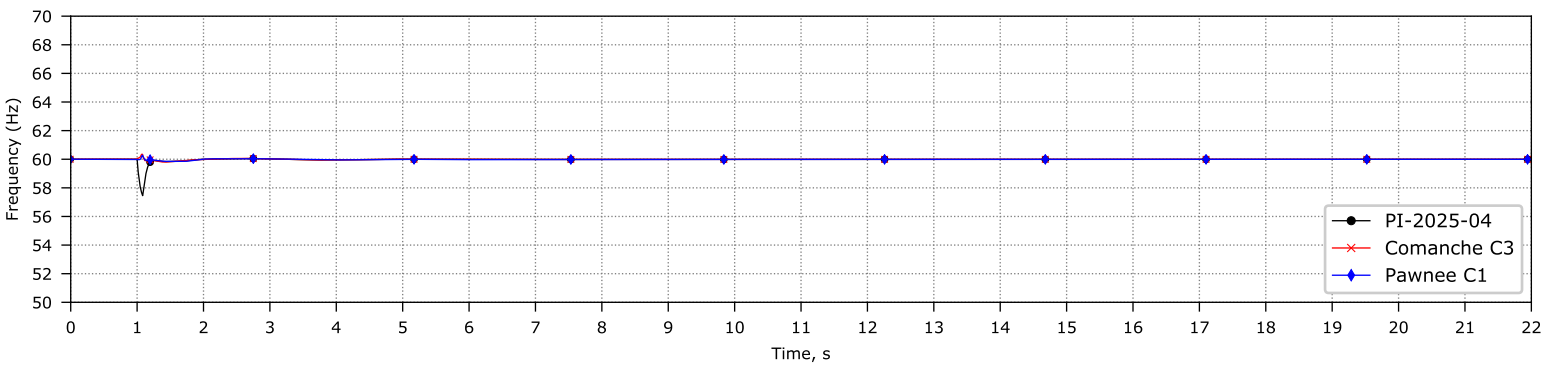
Mirasol - Thunderwolf 230 kV

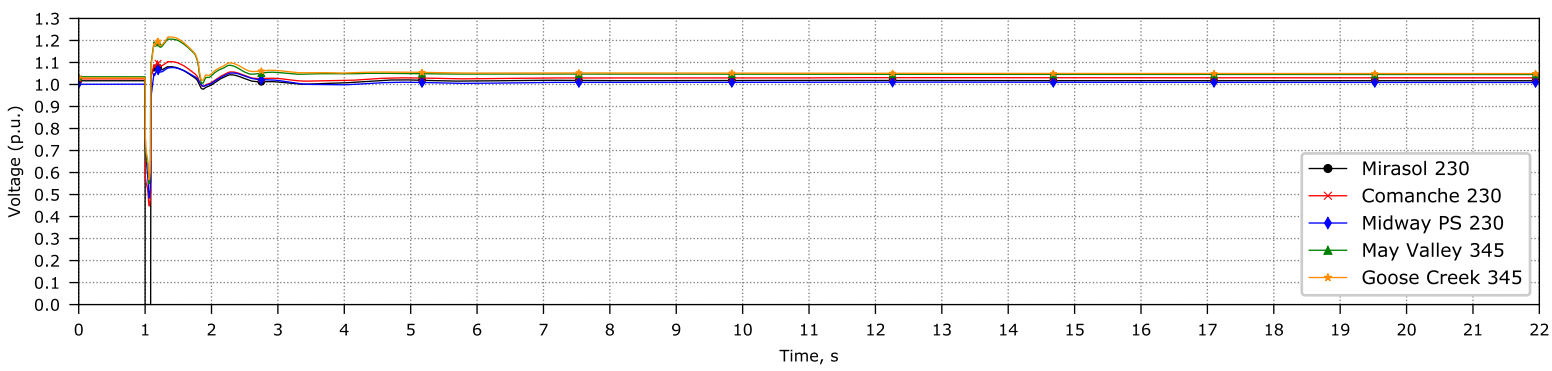




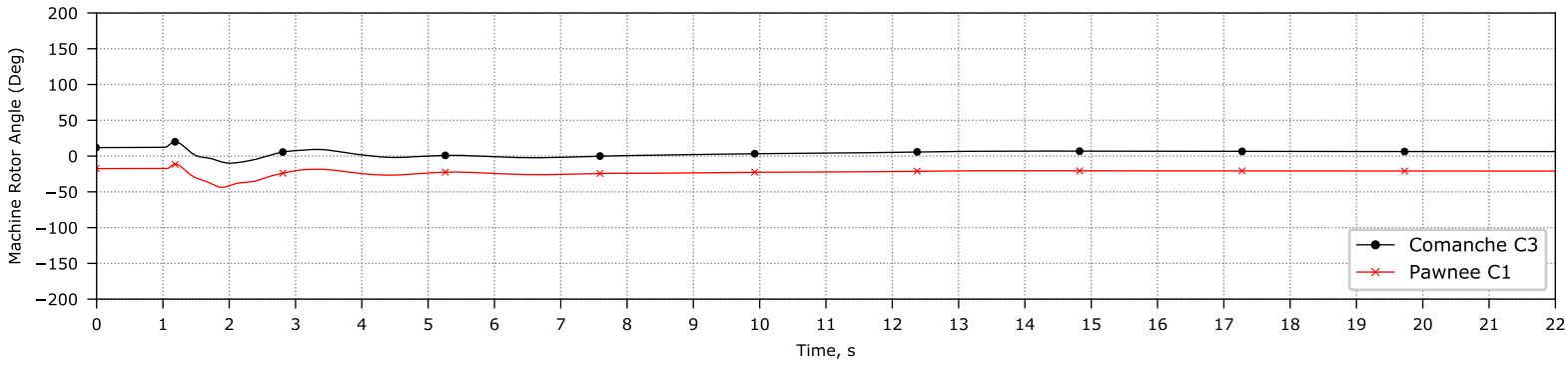


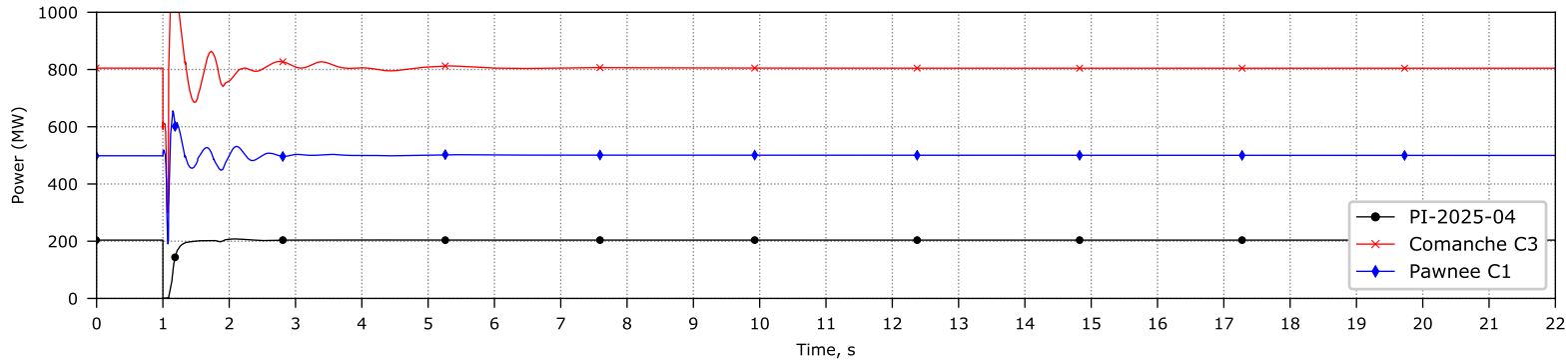


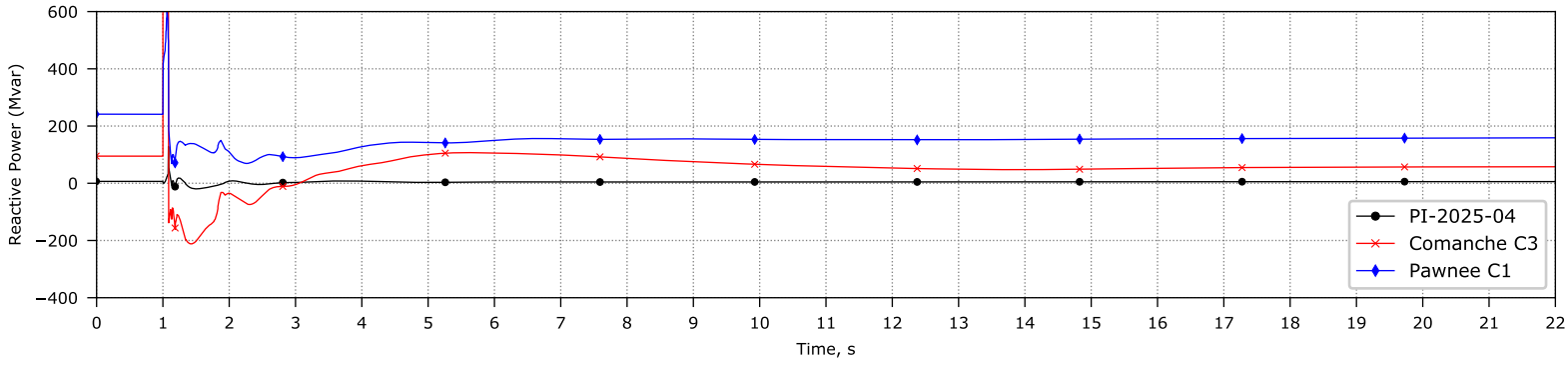


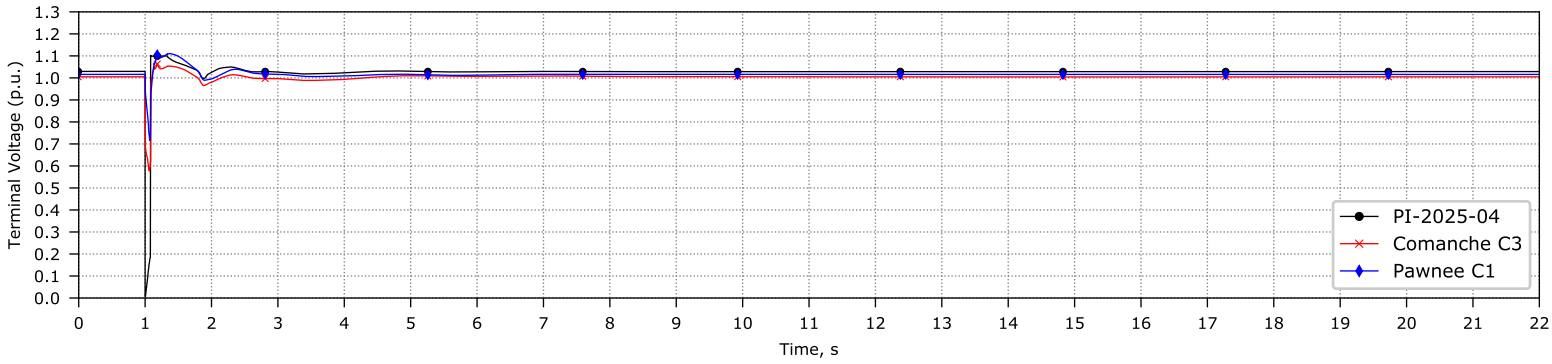


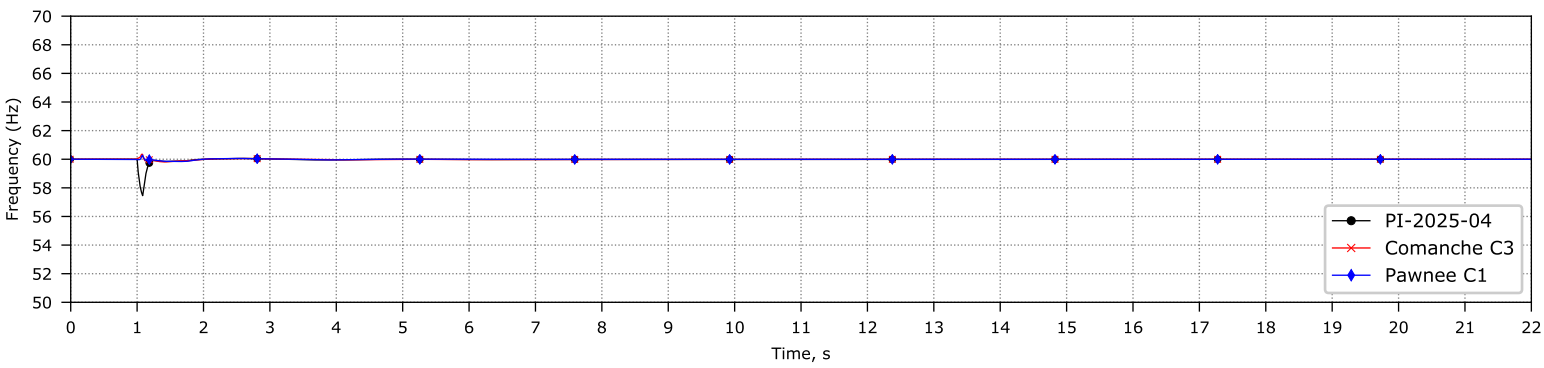
Gen 3RSC_23_1

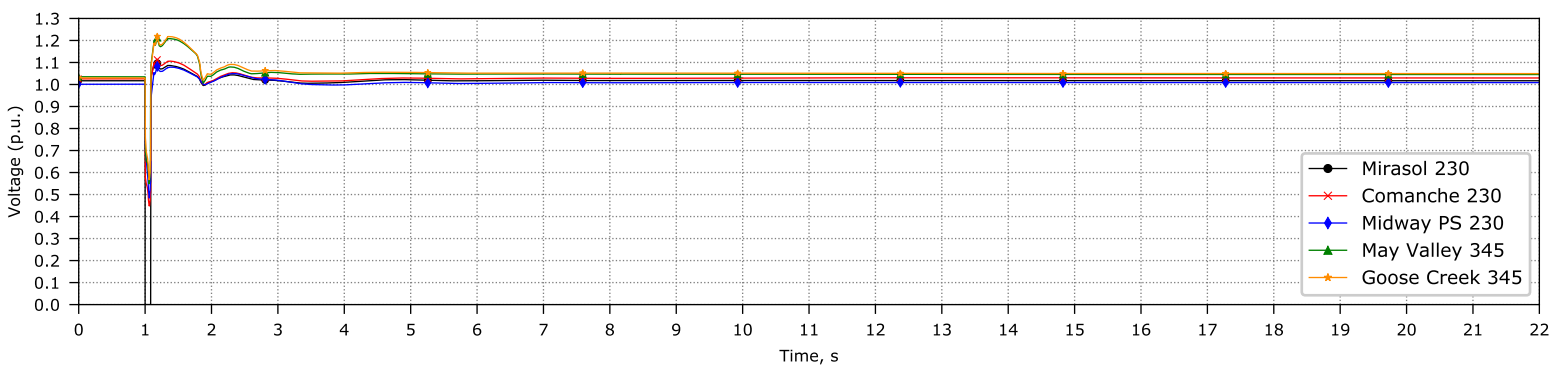

Machine Rotor Angle (Deg)
Time, s
Comanche C3
Pawnee C1


Power (MW)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

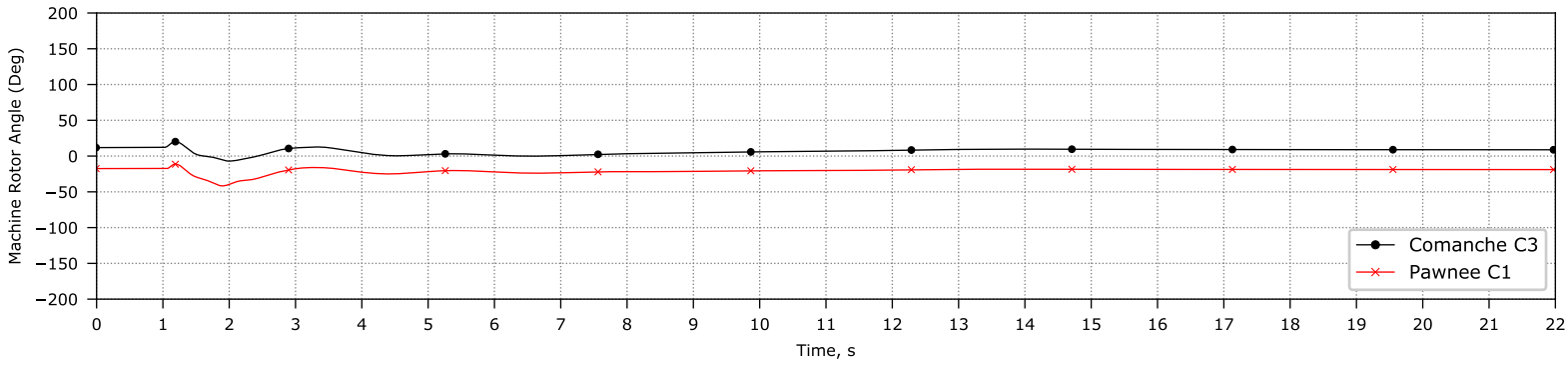

Reactive Power (Mvar)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

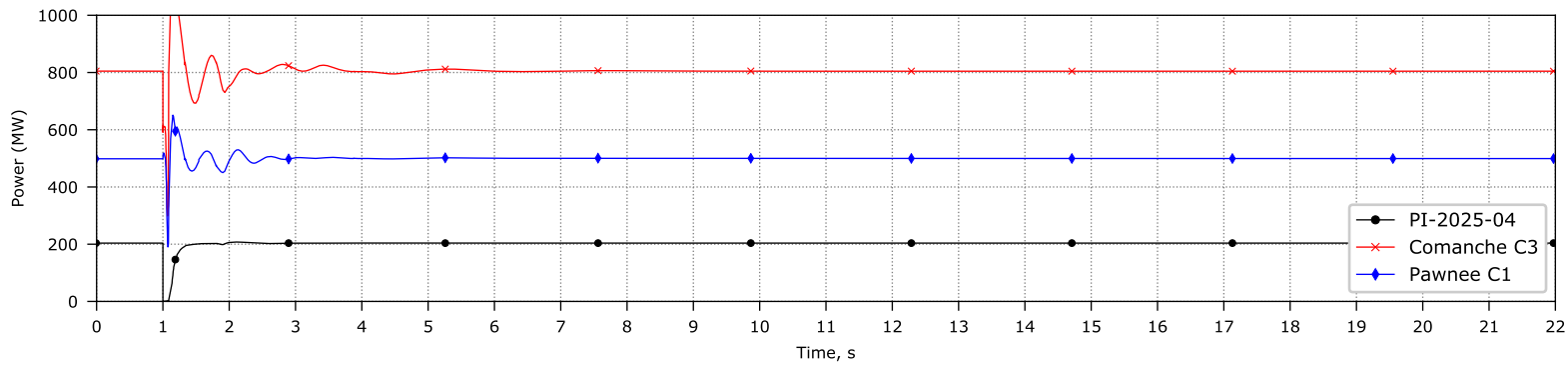

Terminal Voltage (p.u.)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

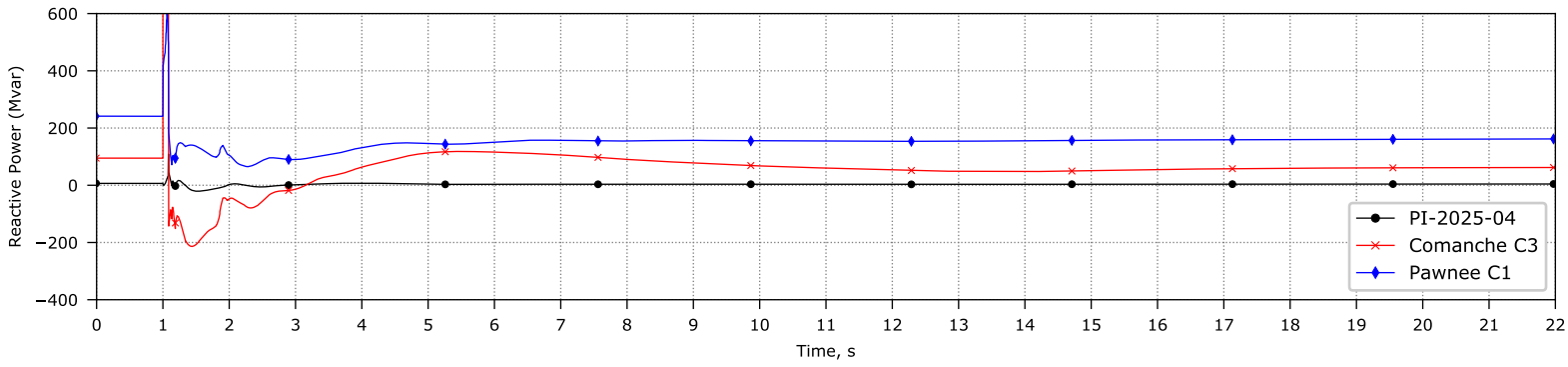

Frequency (Hz)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

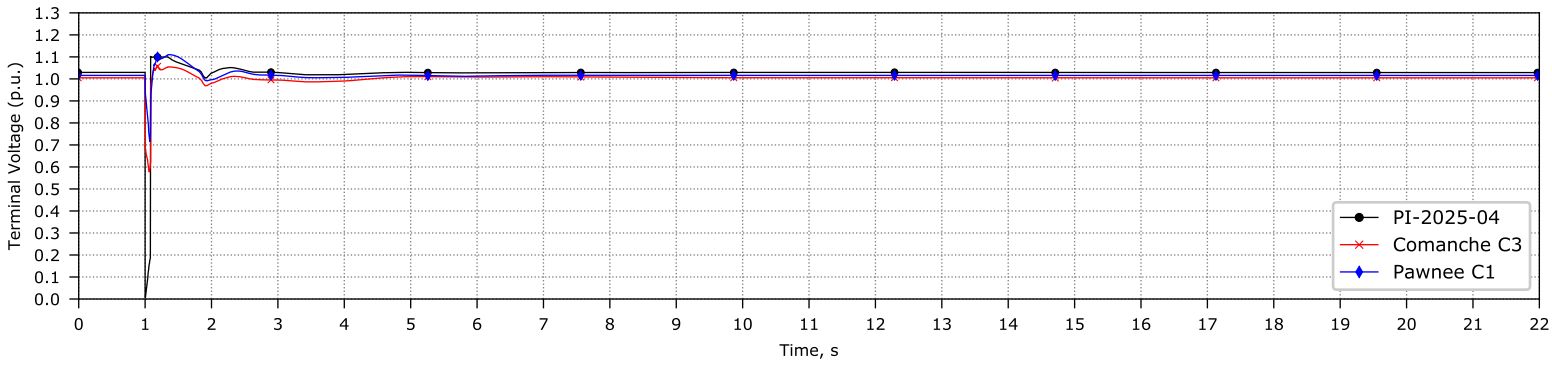

Voltage (p.u.)
Time, s
Mirasol 230
Comanche 230
Midway PS 230
May Valley 345
Goose Creek 345

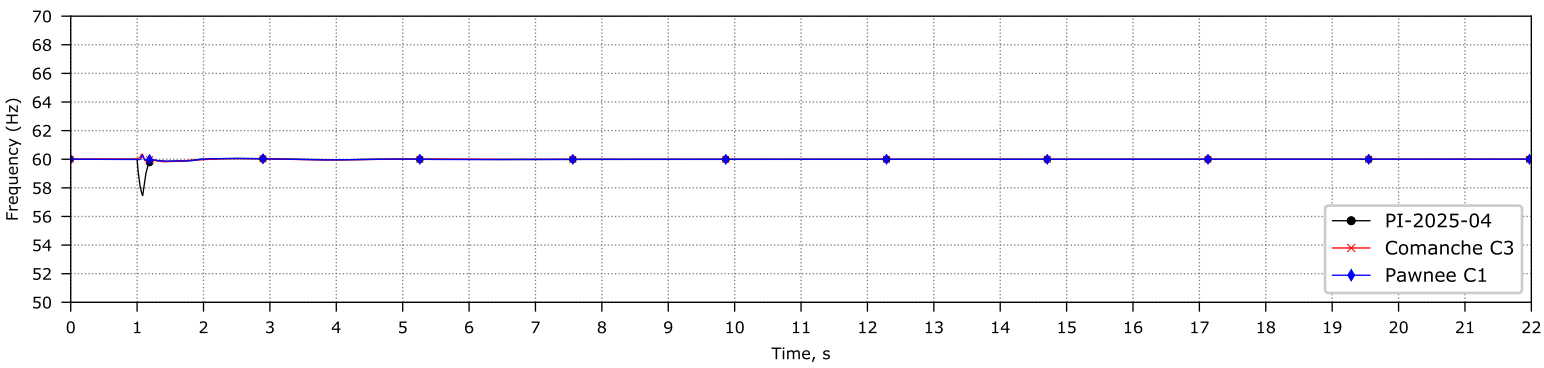
Gen 3RSC_23_2

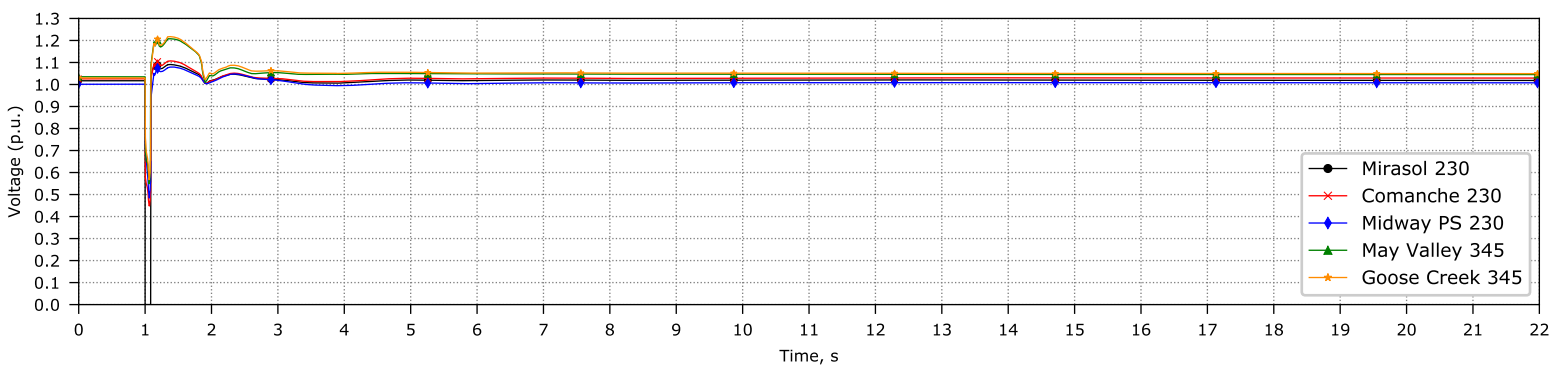

Machine Rotor Angle (Deg)
Time, s
Comanche C3
Pawnee C1


Power (MW)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

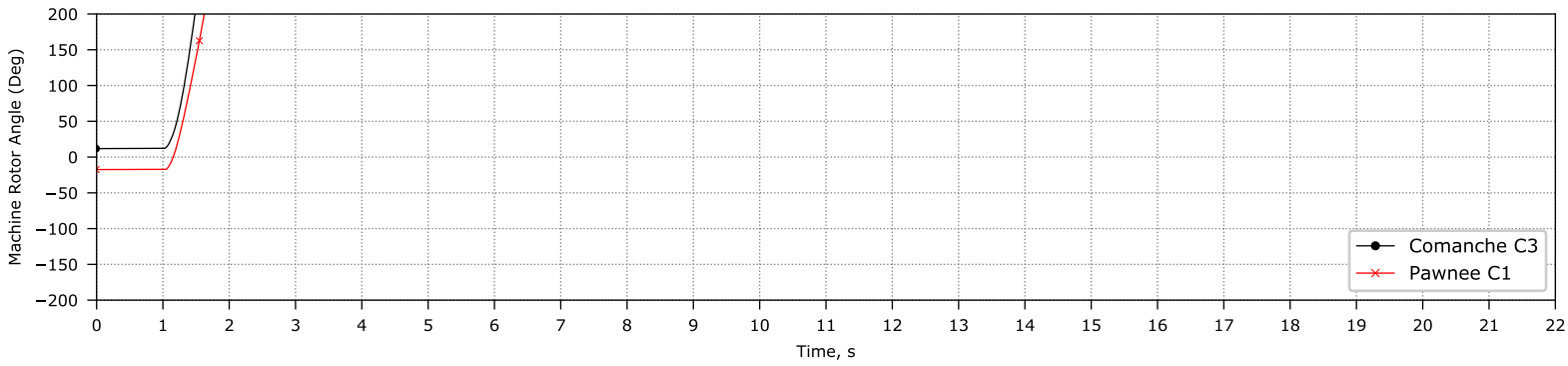

Reactive Power (Mvar)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

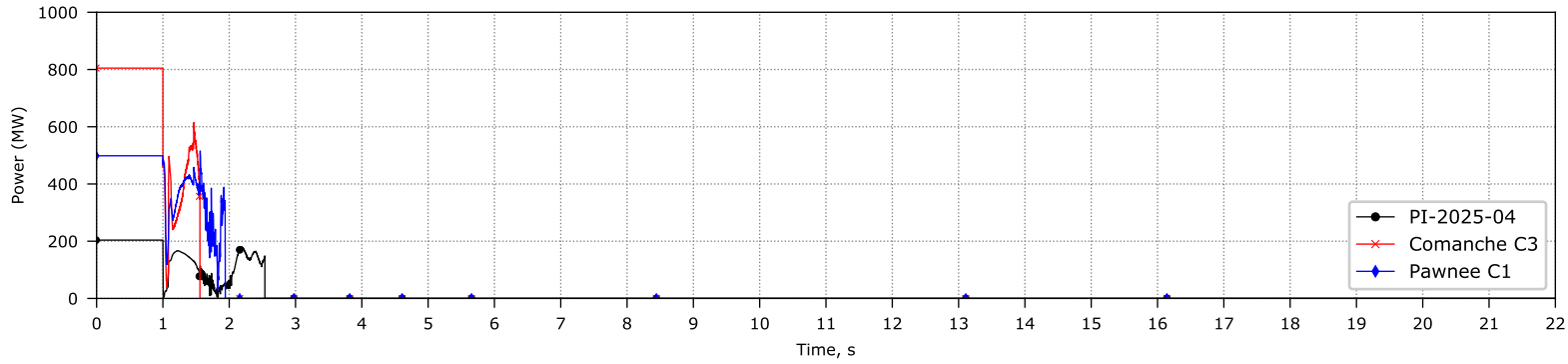

Terminal Voltage (p.u.)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

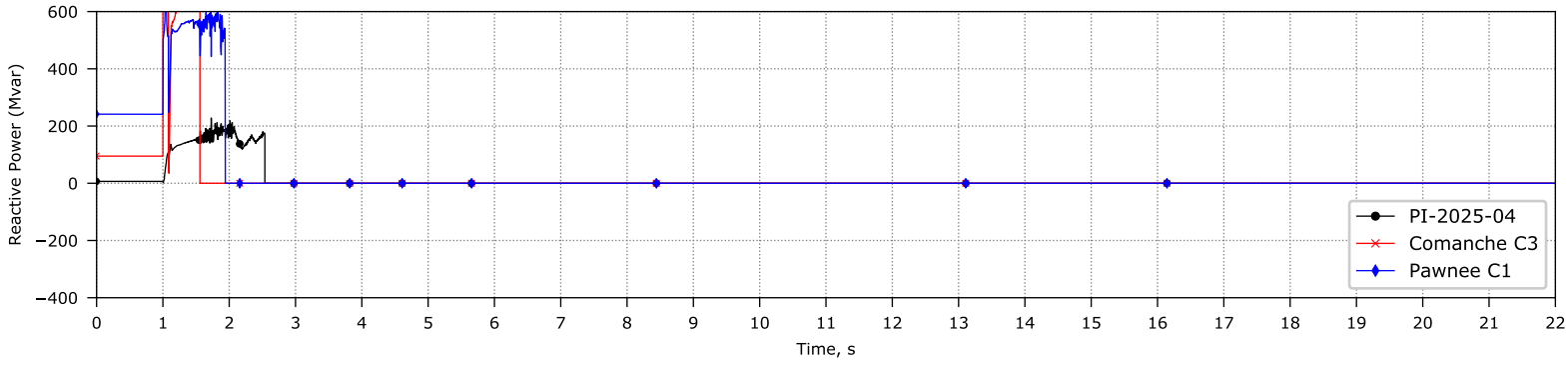

Frequency (Hz)
Time, s
PI-2025-04
Comanche C3
Pawnee C1

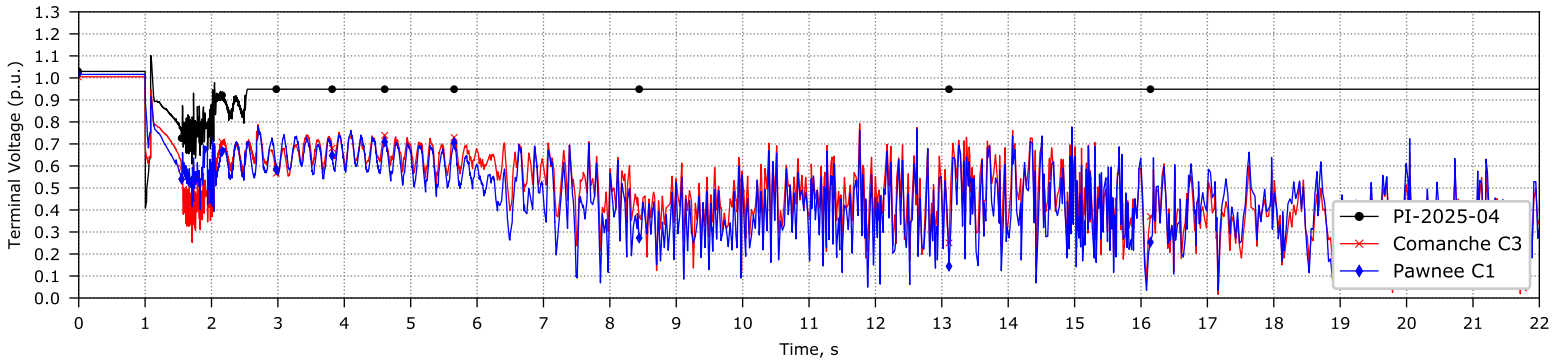

Voltage (p.u.)
Time, s
Mirasol 230
Comanche 230
Midway PS 230
May Valley 345
Goose Creek 345

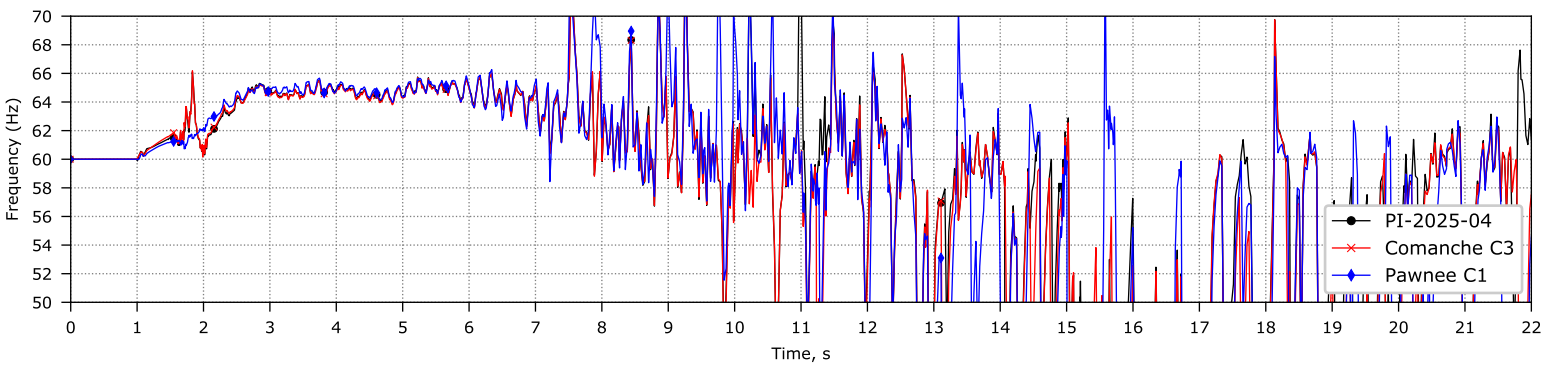
Midway - Fuller 230 kV

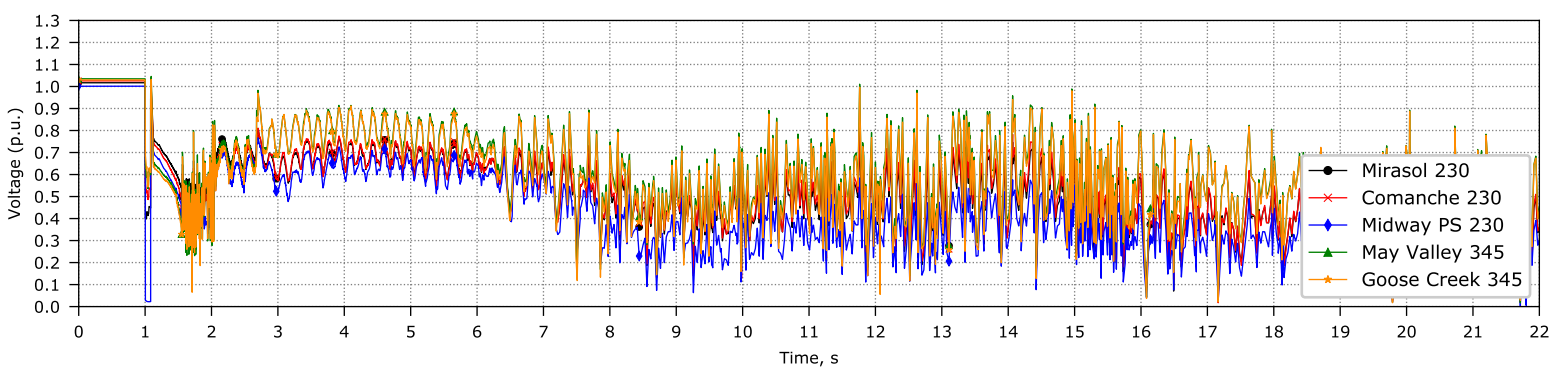




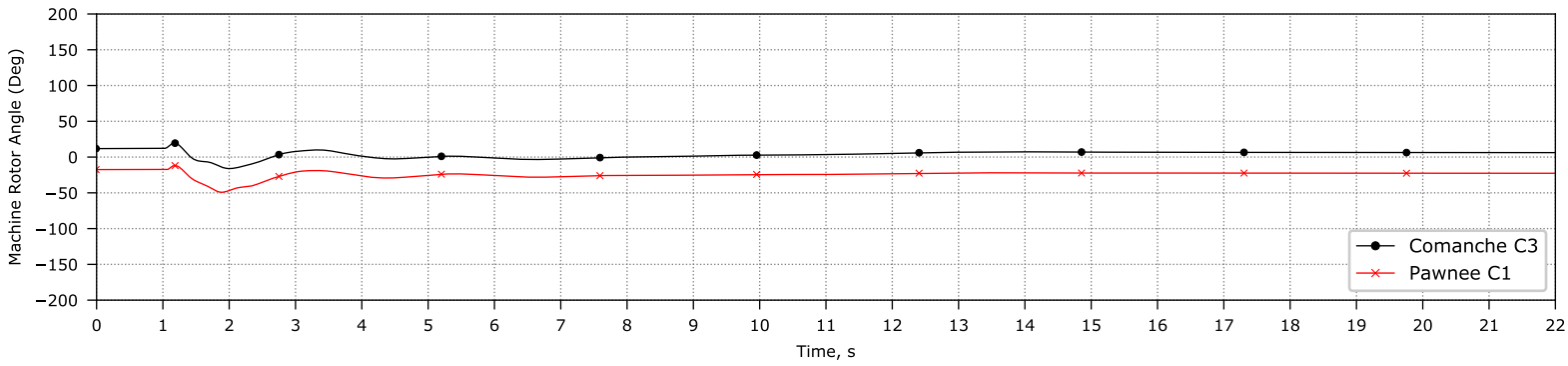


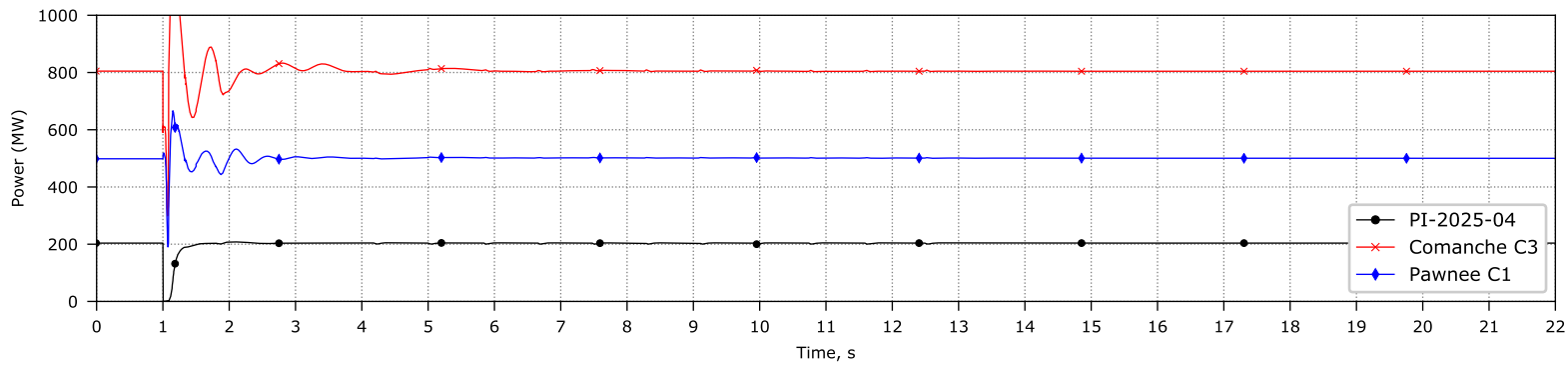


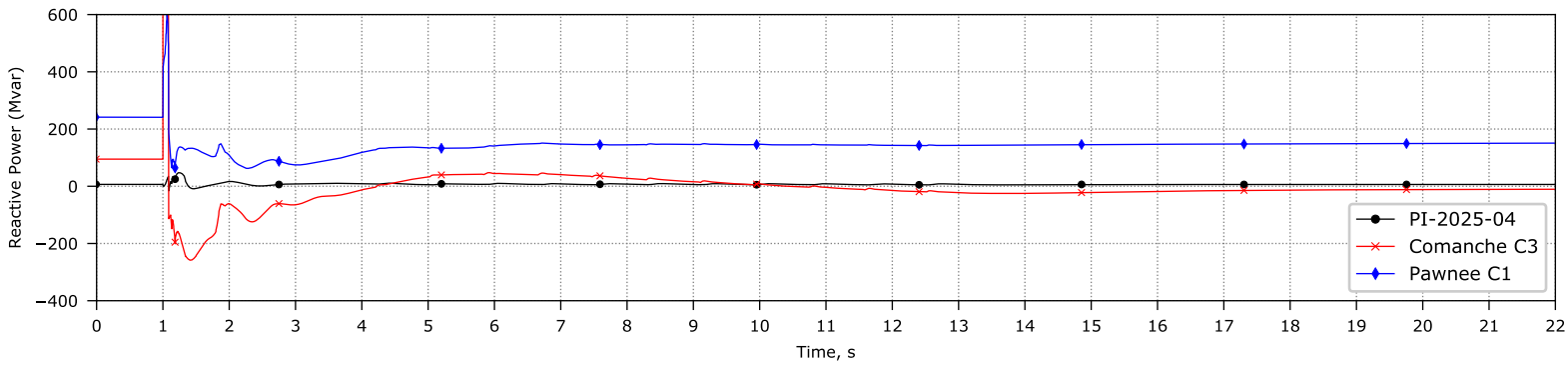


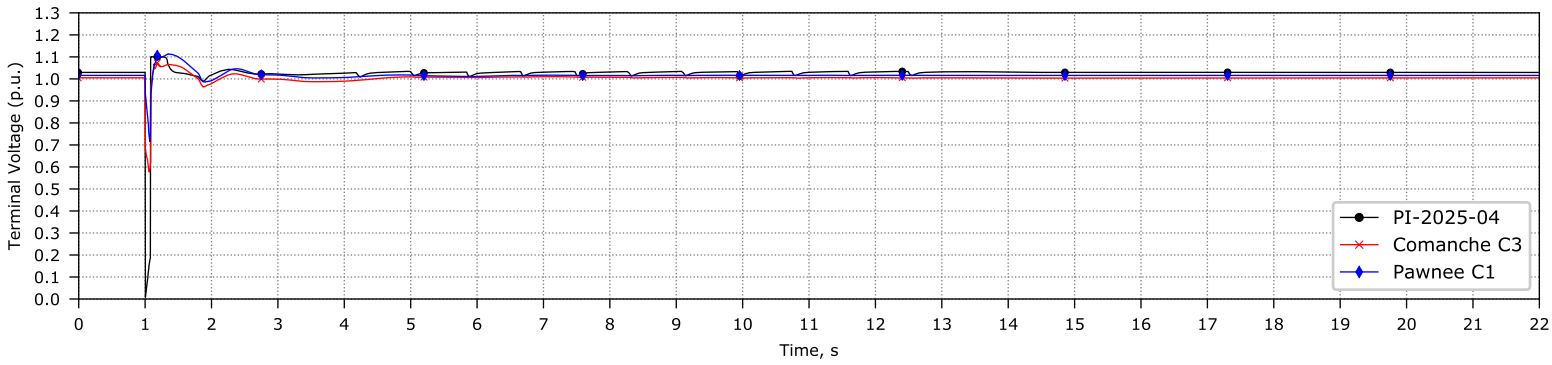


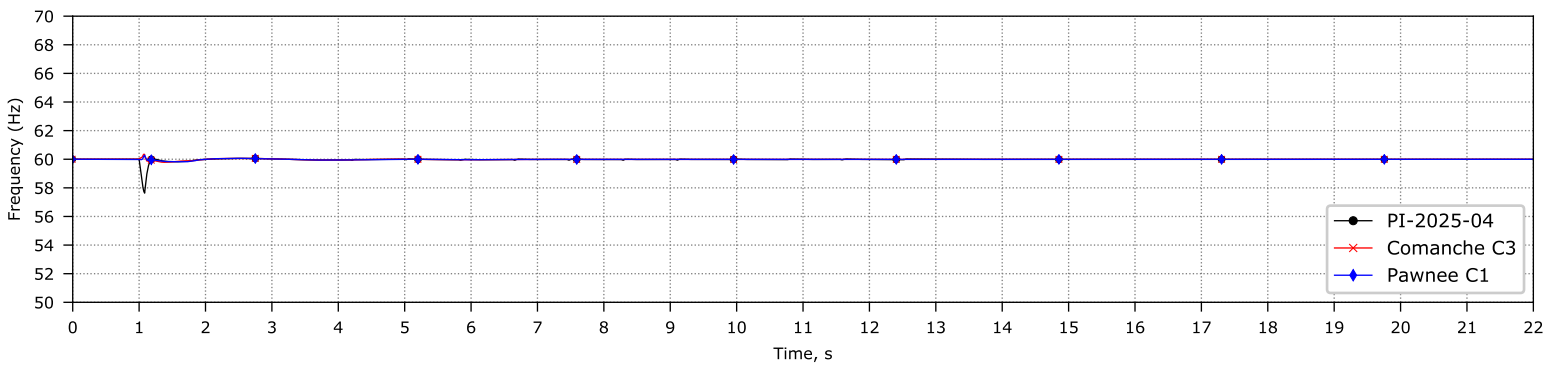
Comanche - Mirasol 230 kV

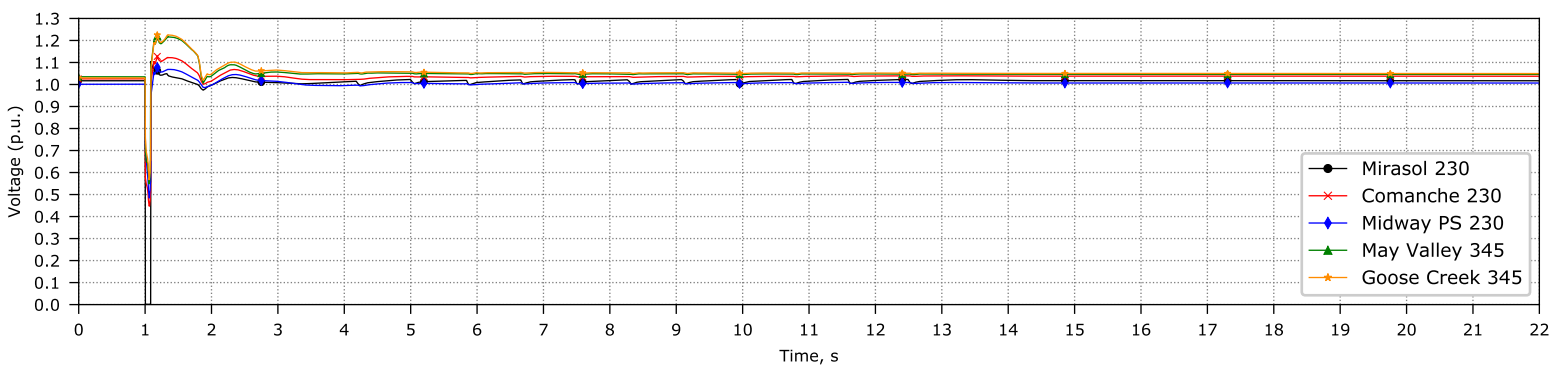




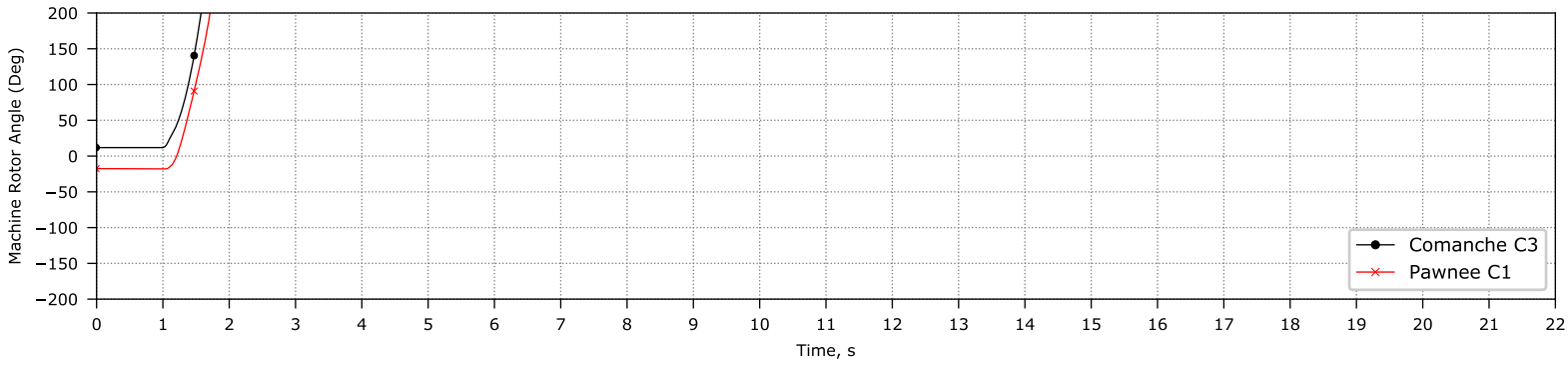


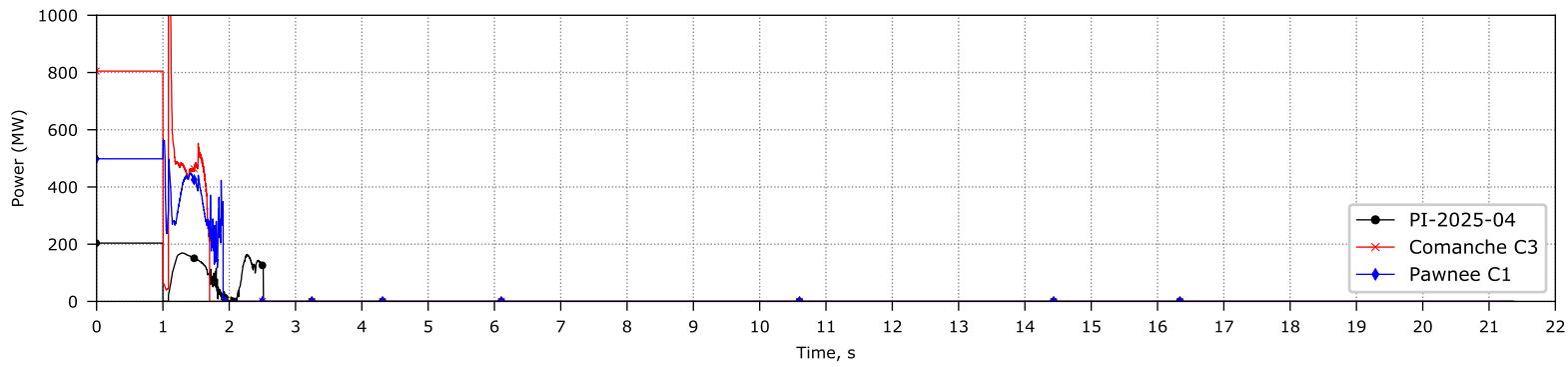


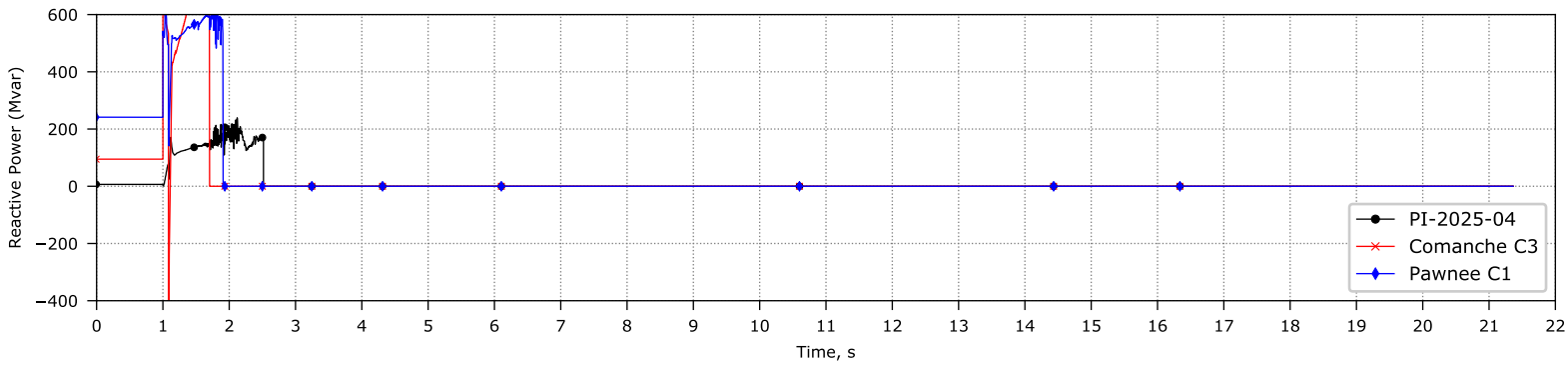


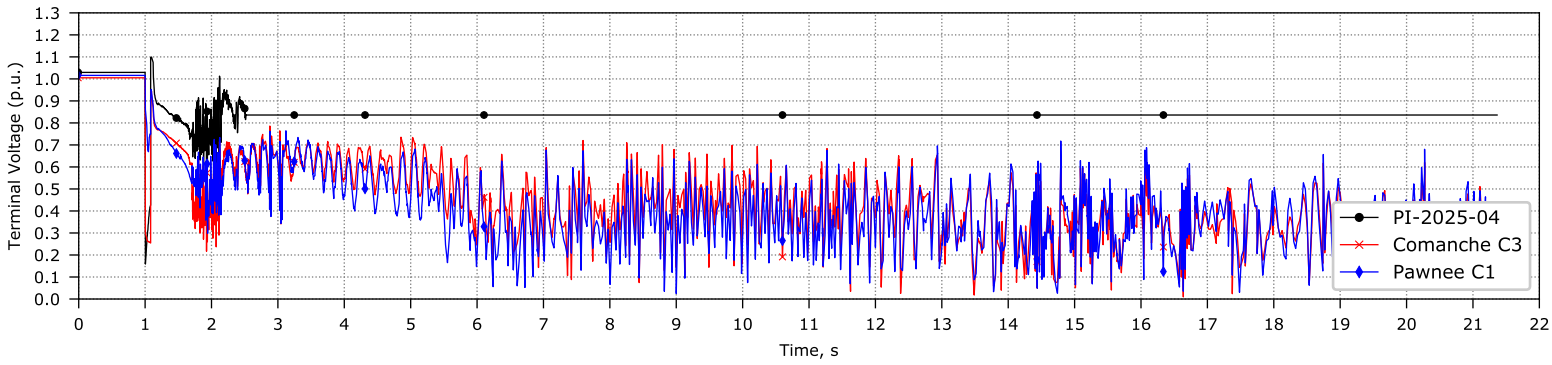


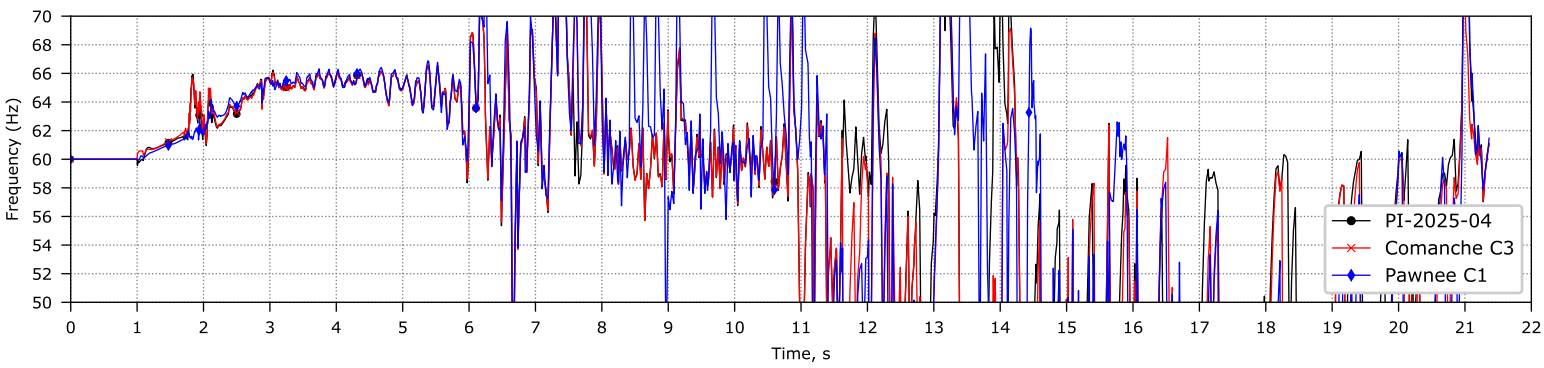
Comanche - Huckleberry 230 kV

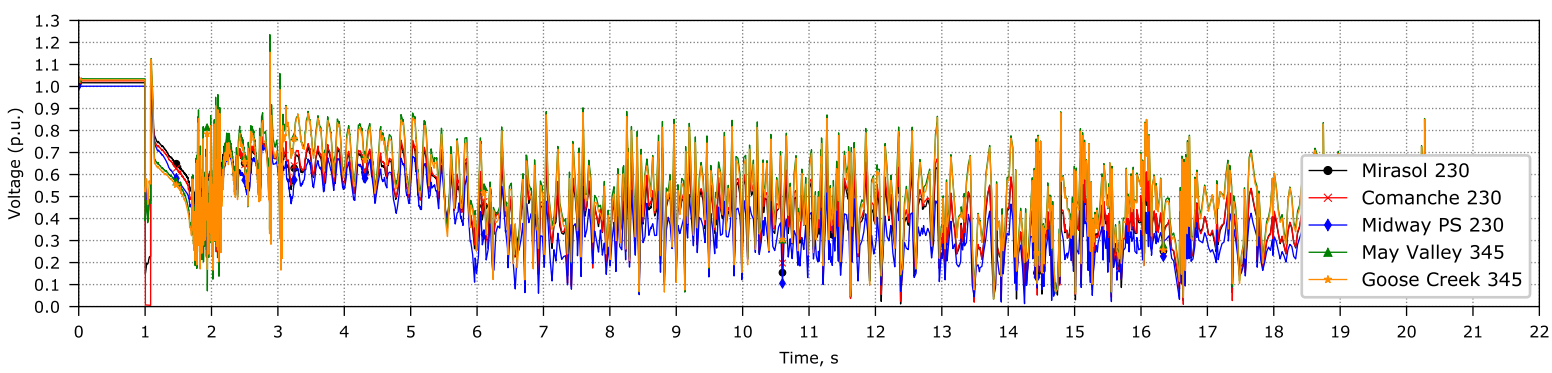




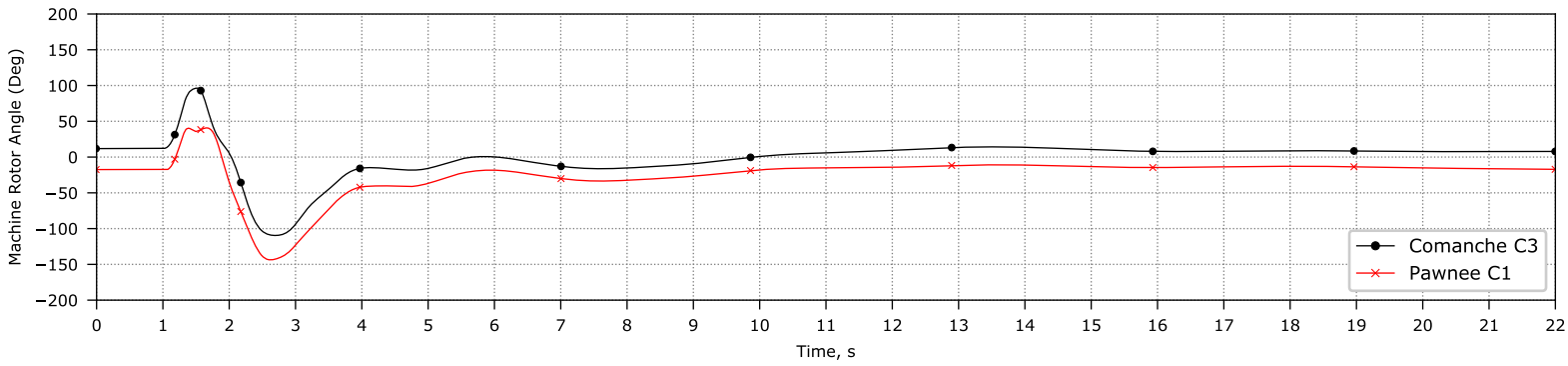


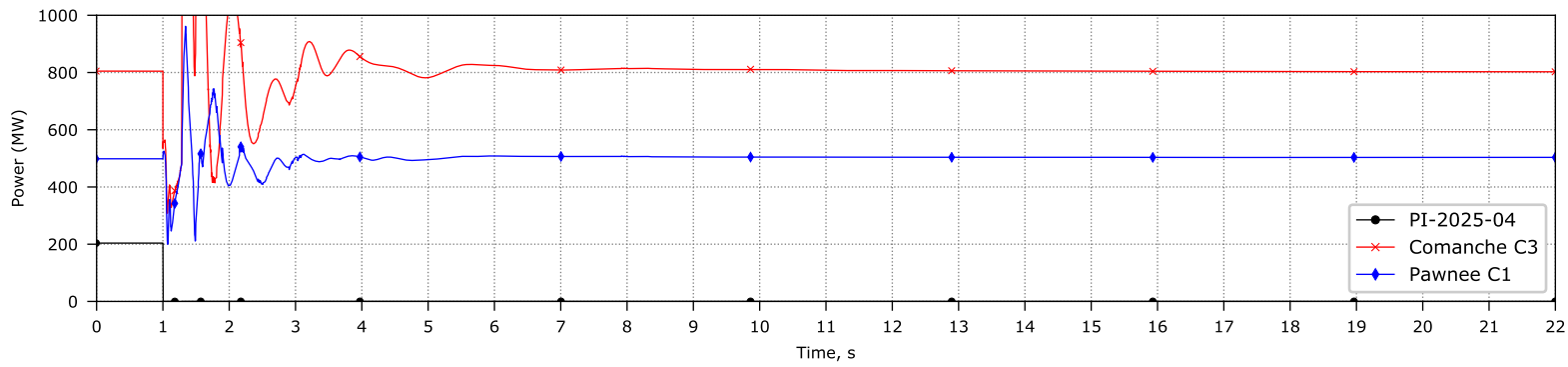


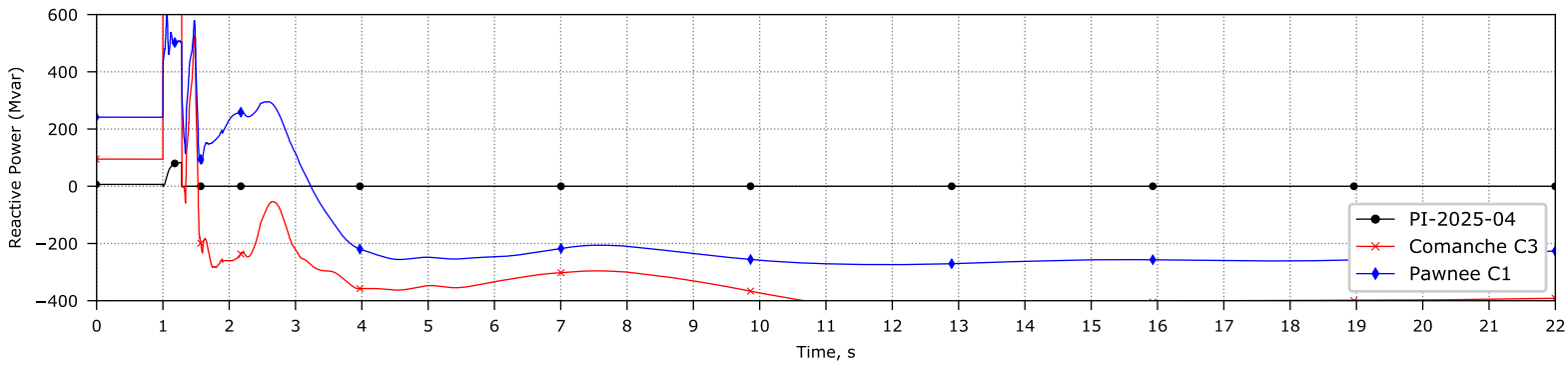


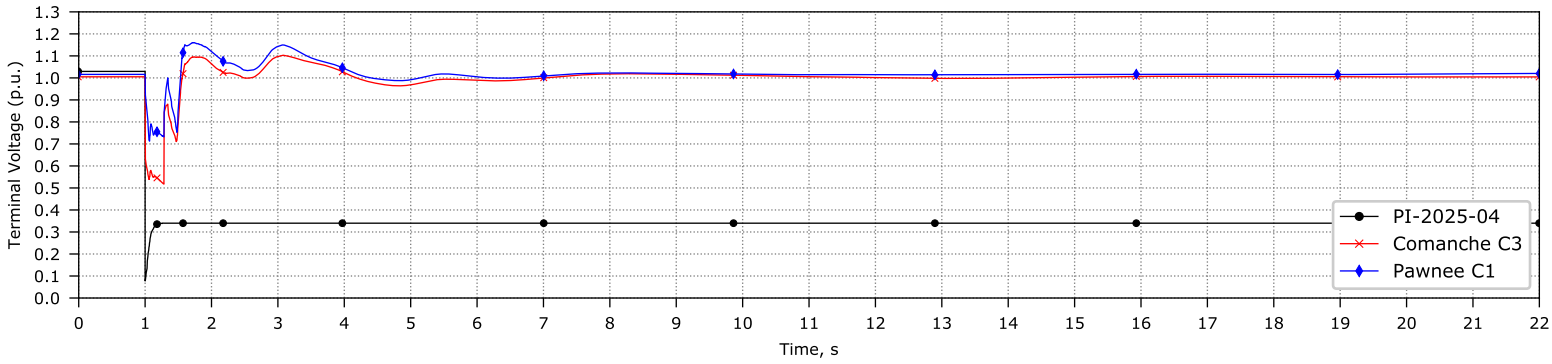


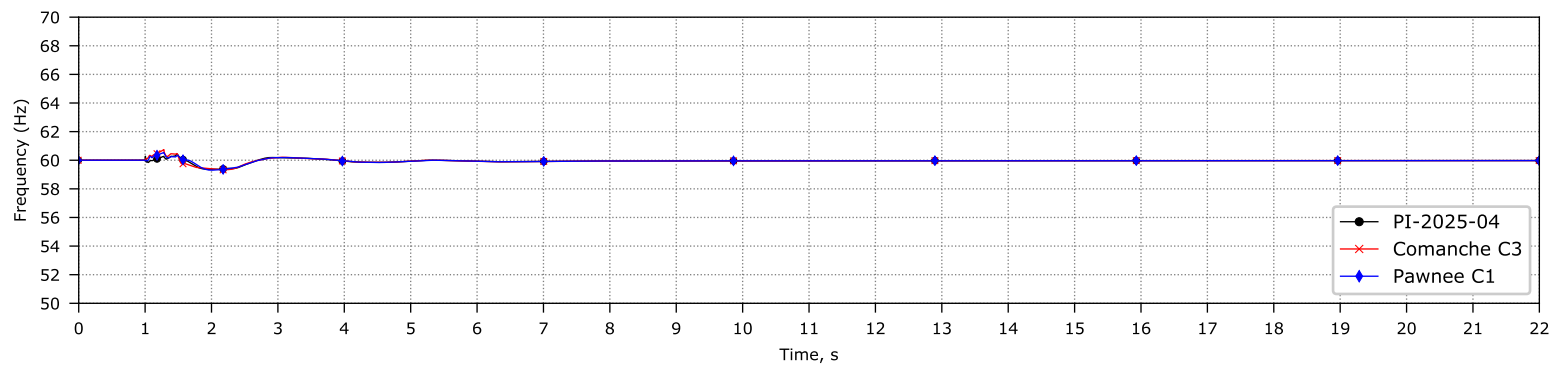
Mirasol 230 kV BF

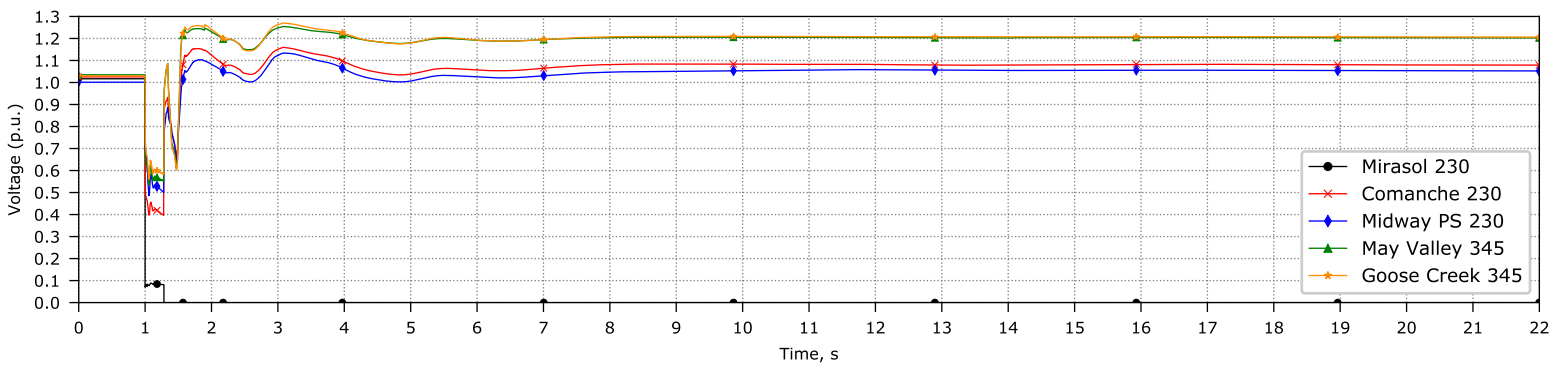












Mirasol 230 kV P7