Provisional Interconnection Study Report for PI-2024-11

VERSION	DATE	DESCRIPTION
2	2/5/2025	Errata change to Introduction section correcting the request PI number and originally request COD
1	12/2/2024	Initial version

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1.0 Executive Summary

The PI-2024-11 project is a 199 MW Provisional Interconnection Service (PIS)[1] request for a 205.6 MW Battery Energy Storage System (BESS) Generating Facility with a Point of Interconnection (POI) at the Fort Saint Vrain 345 kV substation. The maximum output will be controlled via power plant controller not to exceed 199 MW. This PIS request is associated with Generation Interconnection Request 5RSC-2024-14 in the 5RSC cluster.

The total cost of the transmission system improvements required for PI-2024-11 to qualify for Provisional Interconnection Service is **$7.004 million** (Table 9 and Table 10).

The initial maximum permissible output of PI-2024-11 Generating Facility is 199 MW at the Point of Interconnection in Discharging mode at the POI and 205.6 MW in Grid Charging mode at the generator terminal. The maximum permissible output of the Generating Facility in the PLGIA[2] will be reviewed quarterly (or more often as needed) and updated, if there are changes to the system conditions assumed in this analysis, to determine the maximum permissible output.

Security: Based on 5RSC-2024-14 in the 5RSC selection of Energy Resource Interconnection Service (ERIS), the security associated with the Network Upgrades that might be identified at the conclusion of the 5RSC-2024-14 Large Generation Interconnection Procedure (LGIP) in the 5RSC cluster is $5 million.

The Interconnection Customer assumes all risk 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.

The 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.

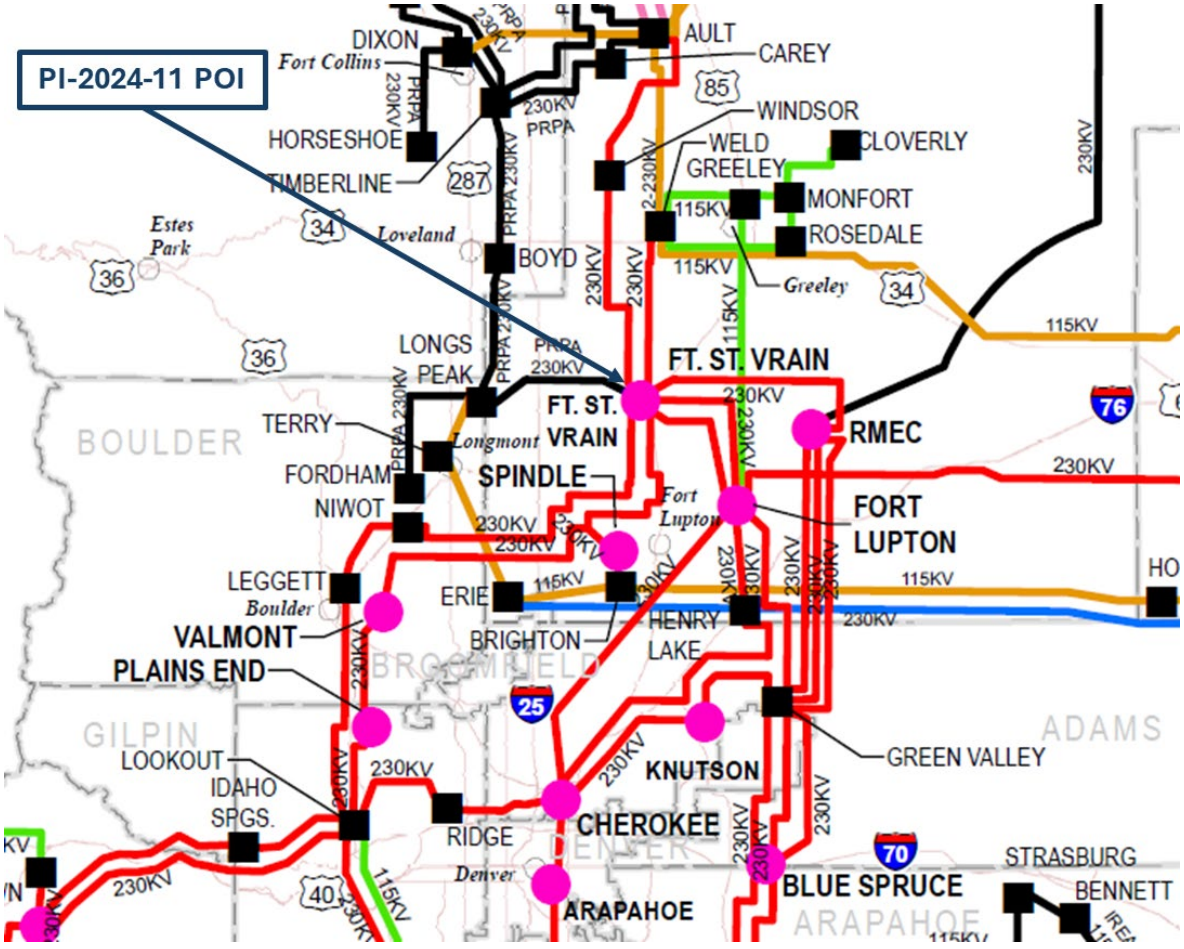
[3] **Large Generator Interconnection Agreement (LGIA)** shall mean the form of interconnection agreement applicable to an Interconnection Request pertaining to a Large Generating Facility that is included in the Transmission Provider's Tariff.

2.0 Introduction

PI-2024-11 is the 199 MW Provisional Interconnection Service[4] request for the 205.6 MW Battery Energy Storage System (BESS) located in Weld County, Colorado.

- The POI of this project is located at the Fort Saint Vrain 345 kV substation.
- The COD requested to be studied for PI-2024-11 was October 15, 2026.
- The requested COD is not attainable by PSCo. The new estimated COD is January 15, 2027.

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



[4] **Provisional Interconnection Service** 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.

Figure 1: Approximate Point of Interconnection of PI-2024-11

3.0 Study Scope

The purpose of this study is to determine the impacts to the PSCo Transmission System and Affected Systems from interconnecting PI-2024-11 for Provisional Interconnection Service. Consistent with the assumption in the study agreement, PI-2024-11 selected Energy Resource Interconnection Service (ERIS)[5].

The scope of this report includes voltage and reactive capability evaluation, steady state (thermal and voltage) analysis, transient stability analysis, short-circuit analysis, and cost estimates for Transmission Provider's Interconnection Facilities and Station Network Upgrades. The study also identifies the estimated Security[6] and Contingent Facilities associated with the Provisional Service.

3.1 Steady-State Criteria

The following Criteria are used for the reliability analysis of the PSCo system and Affected Systems:

P0—System Intact conditions:

Thermal Loading: <=100% of the normal facility rating

Voltage range: 0.95 to 1.05 per unit

P1 & P2-1—Single Contingencies:

Thermal Loading: <=100% Normal facility rating

Voltage range: 0.90 to 1.10 per unit

Voltage deviation: <=8% of pre-contingency voltage

P2 (except P2-1), P4, P5 & P7—Multiple Contingencies:

Thermal Loading: <=100% Emergency facility rating

Voltage range: 0.90 to 1.10 per unit

Voltage deviation: <=8% of pre-contingency voltage

[5] **Energy Resource Interconnection Service** shall mean an Interconnection Service that allows the Interconnection Customer to connect its Generating Facility to the Transmission Provider's Transmission system to be eligible to deliver the Generating Facility's electric output using the existing firm and non-firm capabilities of the Transmission Provider's Transmission System on an as available basis.

[6] **Security** estimates the risk associated with the Network Upgrades and Interconnection Facilities that could be identified in the corresponding LGIA.

3.2 Transient Stability Criteria

The transient voltage stability criteria are as follows:

a. Following fault clearing, the voltage shall recover to 80% of the pre-contingency voltage within 20 seconds of the initiating event for all P1 through P7 events for each applicable Bulk Electric System (BES) bus serving load.
b. Following fault clearing and voltage recovery above 80%, voltage at each applicable BES bus serving load shall neither dip below 70% of pre-contingency voltage for more than 30 cycles nor remain below 80% of pre-contingency voltage for more than two seconds, for all P1 through P7 events.
c. For Contingencies without a fault (P2.1 category event), voltage dips at each applicable BES bus serving load shall neither dip below 70% of pre-contingency voltage for more than 30 cycles nor remain below 80% of pre-contingency voltage for more than two seconds.

The transient angular stability criteria are as follows:

a. P1—No generating unit shall pull out of synchronism. A generator being disconnected from the system by fault clearing action or by a special Protection System is not considered an angular instability.
b. P2–P7—One or more generators may pull out of synchronism, provided the resulting apparent impedance swings shall not result in the tripping of any other generating facilities.
c. P1–P7—The relative rotor angle (power) oscillations are characterized by positive damping (i.e., amplitude reduction of successive peaks) > 5% within 30 seconds.

3.3 Breaker Duty Analysis Criteria

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 an Affected System may choose to perform additional breaker duty analysis to identify breaker duty violations on their system.

3.4 Study Methodology

For PSCo and non-PSCo owned facilities, thermal violations attributed to the request include all new facility overloads with a thermal loading >100% and increased by 1% or more from the benchmark case overload post the Generator Interconnection Request (GIR) addition.

The voltage violations assigned to the request include new voltage violations which resulted in a further variation of 0.01 per unit.

Since the request is for Provisional Interconnection Service, if thermal or voltage violations are seen, the maximum permissible Provisional Interconnection Service before violations is identified. For voltage violations caused by reactive power deficiency at the POI, voltage upgrades are identified.

The Provisional Interconnection Service request should meet the transient stability criteria stated in Section 3.2. If the addition of the GIR causes any violations, the maximum permissible Provisional Interconnection Service before violations is identified.

3.5 Contingency Analysis

The transmission system on which steady state contingency analysis is run includes the WECC designated area 70 and part of area 73, as applicable.

The transient stability analysis is performed for the following worst-case contingencies shown in Table 1.

Table 1 – Transient Stability Contingencies

Ref. No.	Fault Location	Fault Category	Outage(s)	Clearing Time (Cycles)
1	-	P0	Flat run	-
2	Ft. St. Vrain 345 kV	P1	PI-2024-11 generation and 'SS' load	4
3	Ft. St. Vrain 345 kV	P1	Ft. St. Vrain – Canal Crossing 345 kV ckt 1	4
4	Ft. St. Vrain 345 kV	P1	Ft. St. Vrain 230/345 kV transformer 'T8'	4
5	Canal Crossing 345 kV	P1	Canal Crossing – Missile Site 345 kV ckt 1	4
6	Canal Crossing 345 kV	P1	Canal Crossing – Pawnee 345 kV ckt 1	4
7	Canal Crossing 345 kV	P1	Canal Crossing – Goose Creek 345 kV ckt 1	4
8	Ft. St. Vrain 230 kV	P1	Ft. St. Vrain – Ft. St. Lupton 230 kV ckt 1	5
9	Ft. St. Vrain 230 kV	P1	Ft. St. Vrain – Spindle 230 kV ckt 1	5
10	Ft. St. Vrain 230 kV	P4	Ft. St. Vrain 22/230 kV transformer 'U1' Ft. St. Vrain 'ST' generation Ft. St. Vrain 'SS' load	17
11	Canal Crossing 345 kV	P4	Canal Crossing – Ft. St. Vrain 345 kV ckt 1 Canal Crossing – Pawnee 345 kV ckt 1	12
12	Canal Crossing 345 kV	P7	Canal Crossing – Ft. St. Vrain 345 kV ckt 1 Canal Crossing – Ft. St. Vrain 345 kV ckt 2	4

3.6 Study Area

The North study pocket includes WECC designated zone 706. As described in Section 3.11 of the BPM, this study pocket is comprised Northeast of Metro, North of Metro, and Northwest of Metro transmission systems. Below is the list of current generation comprising Pocket North:

- Northeast of Metro injecting at Keenesburg: Rocky Mountain Energy Center (RMEC) CC, Cedar Creek Wind, Blue Spruce
- North of Metro: Fort St Vrain, Fort Lupton, JM Shafer
- Northwest of Metro: Spindle, Valmont, Plains End

4.0 Base Case Modeling Assumptions

The 2029HS2a WECC case released on May 3, 2023, was selected as the Starting Case. The 2027 Heavy Summer Base Case was created from the Starting Case by including the following modeling changes.

- Shortgrass to Goose Creek uprate to 1439 MVA – ISD TBD
- Poncha – San Luis Valley 115 kV L9811 uprate to 239 MVA – ISD 8/20/2025.
- Daniels Park-Prairie-Greenwood Uprate L5707 to 956 MVA – ISD 6/1/2026.
- Leetsdale-Monroe-Elati line 5283 uprate to 956 MVA – ISD 5/31/2026.
- Uprate Lines 6935/6936 69 kV from Alamosa - Mosca - San Luis Valley to 95 MVA – ISD 5/15/2026.
- Daniels Park-Prairie-Greenwood Uprate L5111 to 956 MVA – ISD 10/21/2026.
- NEW Harvest Mile to Smoky Hill 230 kV Line – ISD 5/14/2027.
- NEW Leetsdale to University Line 9338 – ISD 9/9/2026.
- Tollgate Load Shift – ISD 7/7/2026.
- NEW Arapahoe T6 230/115 kV, 272/319 MVA – ISD 2/10/2027.
- Cherokee-Federal Heights-Broomfield L9558 Line rebuild – ISD 11/18/2026.
- MidwayPS 230/115 T1 Transformer Replacement with 280 MVA – ISD 10/7/2026.
- Leetsdale-Harrison L9955 Uprate to 1900 A – ISD 11/16/2027.

Additionally, the following segments of the Colorado Power Pathway (CPP) were included in the Base Case:

- Segment #1: Fort St. Vrain – Canal Crossing 345 kV Double Circuit
- Segment #2: Canal Crossing – Goose Creek 345 kV Double Circuit
- Segment #3: Goose Creek – May Valley 345 kV Double Circuit

The Base Case model includes the existing PSCo generation resources and all Affected Systems' existing resources.

While the higher-queued Network Resource Interconnection Service (NRIS) requests were dispatched at 100%, the higher-queued ERIS requests were modeled offline.

4.1 Benchmark Case Modeling

The Benchmark Case was created from the Base Case described in Section 4.0 by changing the study pocket generation dispatch to reflect heavy generation in the North study pocket. This was accomplished by adopting the stressed generation dispatch given in Table 2.

Table 2 – Generation Dispatch Used to Create the North Pocket Benchmark Case (MW is Gross Capacity)

Generator Bus No.	Name	kV	ID	Pgen (MW)	Pmax (MW)
70188	FT_LUPTN_12	13.8	G1	41.31	45.90
70188	FT_LUPTN_12	13.8	G2	40.32	44.80
70409	ST.VRAIN	22	ST	286.02	317.80
70406	ST.VR_2	18	G2	147.33	163.70
70407	ST.VR_3	18	G3	140.40	156.00
70408	ST.VR_4	18	G4	156.22	173.58
70950	ST.VR_5	18	G5	140.85	156.50
70951	ST.VR_6	18	G6	139.05	154.50
70588	RMEC1	15	G1	132.39	147.10
70589	RMEC2	15	G2	140.49	156.10
70591	RMEC3	23	ST	288.72	320.80
70448	VALMNT6	13.8	G6	41.94	46.60
70557	VALMNT7	13.8	G7	36.63	40.70
70558	VALMNT8	13.8	G8	37.62	41.80
70487	JMSHAFR4	13.8	G5	29.70	33.00
70487	JMSHAFR4	13.8	G4	31.77	35.30
70490	JMSHAFR3	13.8	G3	34.02	37.80

Generator Bus No.	Name	kV	ID	Pgen (MW)	Pmax (MW)
70490	JMSHAFR3	13.8	ST	40.50	45.00
70493	JMSHAFR2	13.8	ST	42.48	47.20
70495	JMSHAFR1	13.8	G1	32.67	36.30
70495	JMSHAFR1	13.8	G2	31.50	35.00
700151	GI_2021_6	34.5	S1	203.30	203.30
70562	SPRUCE1	18	G1	122.85	136.50
70563	SPRUCE2	18	G2	121.95	135.50
70580	PLNENDG1_1	13.8	G0	4.86	5.40
70580	PLNENDG1_1	13.8	G1	4.86	5.40
70580	PLNENDG1_1	13.8	G2	4.86	5.40
70580	PLNENDG1_1	13.8	G3	4.86	5.40
70580	PLNENDG1_1	13.8	G4	4.86	5.40
70580	PLNENDG1_1	13.8	G5	4.86	5.40
70580	PLNENDG1_1	13.8	G6	4.86	5.40
70580	PLNENDG1_1	13.8	G7	4.86	5.40
70580	PLNENDG1_1	13.8	G8	4.86	5.40
70580	PLNENDG1_1	13.8	G9	4.86	5.40
70587	PLNENDG1_2	13.8	G0	4.86	5.40
70587	PLNENDG1_2	13.8	G1	4.86	5.40
70587	PLNENDG1_2	13.8	G2	4.86	5.40
70587	PLNENDG1_2	13.8	G3	4.86	5.40
70587	PLNENDG1_2	13.8	G4	4.86	5.40
70587	PLNENDG1_2	13.8	G5	4.86	5.40
70587	PLNENDG1_2	13.8	G6	4.86	5.40
70587	PLNENDG1_2	13.8	G7	4.86	5.40
70587	PLNENDG1_2	13.8	G8	4.86	5.40
70587	PLNENDG1_2	13.8	G9	4.86	5.40
70585	PLNENDG2_1	13.8	G1	7.29	8.10
70585	PLNENDG2_1	13.8	G2	7.29	8.10
70585	PLNENDG2_1	13.8	G3	7.29	8.10
70585	PLNENDG2_1	13.8	G4	7.29	8.10
70585	PLNENDG2_1	13.8	G5	7.29	8.10
70585	PLNENDG2_1	13.8	G6	7.29	8.10
70585	PLNENDG2_1	13.8	G7	7.29	8.10
70586	PLNENDG2_2	13.8	G1	7.29	8.10
70586	PLNENDG2_2	13.8	G2	7.29	8.10
70586	PLNENDG2_2	13.8	G3	7.29	8.10
70586	PLNENDG2_2	13.8	G4	7.29	8.10
70586	PLNENDG2_2	13.8	G5	7.29	8.10
70586	PLNENDG2_2	13.8	G6	7.29	8.10

Generator Bus No.	Name	kV	ID	Pgen (MW)	Pmax (MW)
70586	PLNENDG2_2	13.8	G7	7.29	8.10
70593	SPNDLE1	18	G1	128.76	143.07
70594	SPNDLE2	18	G2	126.53	140.59
70823	CEDARCK_1A	34.5	W1	176.00	220.00
70824	CEDARCK_1B	34.5	W2	64.00	80.00
70825	CEDAR2_W1	0.66	W1	100.00	125.00
70826	CEDAR2_W2	0.69	W2	80.64	100.80
70827	CEDAR2_W3	0.66	W3	20.00	25.00
Total (MW)				**3355.23**	**3766.64**

4.2 Grid Charging Benchmark Case Modeling

The Grid Charging Benchmark Case was created from the Base Case described in Section 4.0 by changing the study pocket generation dispatch to reflect a Grid Charging scenario. This was accomplished by adopting the stressed generation dispatch given in Table 3.

Table 3 – Generation Dispatch Used to Create the North Pocket Grid Charging Benchmark Case (MW is Gross Capacity)

Generator Bus No.	Name	kV	ID	Pgen (MW)	Pmax (MW)
70188	FT_LUPTN_12	13.80	G1	41.31	45.90
70188	FT_LUPTN_12	13.80	G2	40.32	44.80
70409	ST.VRAIN	22.00	ST	286.02	317.80
70406	ST.VR_2	18.00	G2	147.33	163.70
70407	ST.VR_3	18.00	G3	140.40	156.00
70408	ST.VR_4	18.00	G4	156.22	173.58
70950	ST.VR_5	18.00	G5	140.85	156.50
70951	ST.VR_6	18.00	G6	139.05	154.50
70588	RMEC1	15.00	G1	132.39	147.10
70589	RMEC2	15.00	G2	140.49	156.10
70591	RMEC3	23.00	ST	288.72	320.80
70448	VALMNT6	13.80	G6	41.94	46.60
70557	VALMNT7	13.80	G7	36.63	40.70
70558	VALMNT8	13.80	G8	37.62	41.80
70487	JMSHAFR4	13.80	G5	29.70	33.00
70487	JMSHAFR4	13.80	G4	31.77	35.30
70490	JMSHAFR3	13.80	G3	34.02	37.80
70490	JMSHAFR3	13.80	ST	40.50	45.00

Generator Bus No.	Name	kV	ID	Pgen (MW)	Pmax (MW)
70493	JMSHAFR2	13.80	ST	42.48	47.20
70495	JMSHAFR1	13.80	G1	32.67	36.30
70495	JMSHAFR1	13.80	G2	31.50	35.00
700151	GI_2021_6	34.50	S1	0.00	203.30
70562	SPRUCE1	18.00	G1	122.85	136.50
70563	SPRUCE2	18.00	G2	121.95	135.50
70580	PLNENDG1_1	13.80	G0	4.86	5.40
70580	PLNENDG1_1	13.80	G1	4.86	5.40
70580	PLNENDG1_1	13.80	G2	4.86	5.40
70580	PLNENDG1_1	13.80	G3	4.86	5.40
70580	PLNENDG1_1	13.80	G4	4.86	5.40
70580	PLNENDG1_1	13.80	G5	4.86	5.40
70580	PLNENDG1_1	13.80	G6	4.86	5.40
70580	PLNENDG1_1	13.80	G7	4.86	5.40
70580	PLNENDG1_1	13.80	G8	4.86	5.40
70580	PLNENDG1_1	13.80	G9	4.86	5.40
70587	PLNENDG1_2	13.80	G0	4.86	5.40
70587	PLNENDG1_2	13.80	G1	4.86	5.40
70587	PLNENDG1_2	13.80	G2	4.86	5.40
70587	PLNENDG1_2	13.80	G3	4.86	5.40
70587	PLNENDG1_2	13.80	G4	4.86	5.40
70587	PLNENDG1_2	13.80	G5	4.86	5.40
70587	PLNENDG1_2	13.80	G6	4.86	5.40
70587	PLNENDG1_2	13.80	G7	4.86	5.40
70587	PLNENDG1_2	13.80	G8	4.86	5.40
70587	PLNENDG1_2	13.80	G9	4.86	5.40
70585	PLNENDG2_1	13.80	G1	7.29	8.10
70585	PLNENDG2_1	13.80	G2	7.29	8.10
70585	PLNENDG2_1	13.80	G3	7.29	8.10
70585	PLNENDG2_1	13.80	G4	7.29	8.10
70585	PLNENDG2_1	13.80	G5	7.29	8.10
70585	PLNENDG2_1	13.80	G6	7.29	8.10
70585	PLNENDG2_1	13.80	G7	7.29	8.10
70586	PLNENDG2_2	13.80	G1	7.29	8.10
70586	PLNENDG2_2	13.80	G2	7.29	8.10
70586	PLNENDG2_2	13.80	G3	7.29	8.10
70586	PLNENDG2_2	13.80	G4	7.29	8.10
70586	PLNENDG2_2	13.80	G5	7.29	8.10
70586	PLNENDG2_2	13.80	G6	7.29	8.10
70586	PLNENDG2_2	13.80	G7	7.29	8.10

Generator Bus No.	Name	kV	ID	Pgen (MW)	Pmax (MW)
70593	SPNDLE1	18.00	G1	128.76	143.07
70594	SPNDLE2	18.00	G2	126.53	140.59
70823	CEDARCK_1A	34.50	W1	46.20	220.00
70824	CEDARCK_1B	34.50	W2	16.80	80.00
70825	CEDAR2_W1	0.66	W1	26.25	125.00
70826	CEDAR2_W2	0.69	W2	21.17	100.80
70827	CEDAR2_W3	0.66	W3	5.25	25.00
Total (MW)				**2826.95**	**3766.64**

4.3 Study Case Modeling

A Study Case was created from the Benchmark Case by turning on the PI-2024-11 BESS. The additional 205.6 MW output from PI-2024-11 at the generating terminal or 199 MW at the Point of Interconnection was balanced against PSCo generation outside of the North study pocket.

A Grid Charging Study Case was created from the Grid Charging Benchmark Case by adding the PI-2024-11 BESS modeled as a load (205.6 MW).

4.4 Short-Circuit Modeling

This request is for the Interconnection of 205.6 MW Battery Energy Storage System (BESS) (PI-2024-11) to the Fort Saint Vrain 345 kV substation. The output will not exceed 199 MW at the POI.

This project assumes the use of sixty-four (64) Power Electronics FREEMAQ PCSM 660 V FP4200M solar generators for PI-2024-11. Each of the BESS generators is connected to a collector transformer, 0.66/34.5 kV, rated at 4.2 MVA. One 230/34.5/13.8 kV main GSU transformer rated at 165/220/275 MVA steps the voltage up from the collector transformer voltage to the POI voltage. An approximately 2.5-mile-long generation tie line interconnects the project to the Fort Saint Vrain 345 kV substation.

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

5.0 Provisional Interconnection Service Analysis

5.1 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.

Per Section 4.1.1.2 in the BPM, the following voltage regulation and reactive power capability requirements are applicable to synchronous generators:

- Xcel Energy's OATT requires all synchronous Generator Interconnection Customers to provide dynamic reactive power within the power factor range of 0.95 leading to 0.95 lagging at the POI.
- The reactive power analysis performed in this report is an indicator of the reactive power requirements at the POI and the capability of the generator to meet those requirements. The Interconnection Customer is required to demonstrate to the satisfaction of PSCo Transmission Operations prior to the commercial in-service date of the generating plant that it can safely and reliably operate within the required power factor and the regulating voltage of the POI.

Per Section 4.4.1 in the BPM, the following steps shall be followed to perform the reactive power capability evaluation for synchronous generators:

a. The reactive power evaluation of the Synchronous generators is done by dispatching the generator at Pmax and changing the POI voltage till Qmax and Qmin are reached.
b. This step is repeated for Pmin.
c. The POI voltage and power factor for the two evaluations are noted. If the POI power factor of 0.95 is reached and the POI voltage stays under the voltage guidance values noted (1-1.04 p.u. for the 230 kV system, 1-1.05 for the 345 kV system and 1-1.03 for 115 kV system), the GIR is considered to meet reactive power requirements. If not, additional dynamic reactive support would be identified.

All proposed reactive devices in customer provided models are switched favorably to provide appropriate reactive compensation in each test, therefore identified deficiencies are in addition to any proposed reactive compensation.

All summary tables representing GIRs' 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 of 0.95 – 1.05 p.u. are highlighted in yellow to provide additional information.

The PI-2024-11 GIR is modeled as follows:

Generator gross capacity: Pmax = 205.63 MW, Pmin = -205.63 MW, Qmax = 173.11 Mvar, Qmin = -173.11 Mvar

The summary for the Voltage and Reactive Power Capability Evaluation for PI-2024-11 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-2024-11 are summarized in Table 4. Please note the terminal voltage of the GIR unit exceeded the upper limit of 1.05 p.u. during the 0.95 lagging power factor assessment.

Table 4 – Reactive Capability Evaluation for PI-2024-11

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
205.5	103.9	173.1	-173.1	1.058	199.0	65.8	1.032	0.9494	198.8	65.2	1.029	0.9502
205.5	-30.6	173.1	-173.1	0.987	199.1	-66.1	1.020	0.9491	198.9	-66.8	1.021	-0.9480
0.0	0.1	173.1	-173.1	1.026	-5.0	0.1	1.026	-0.9998	-5.0	0.6	1.026	-0.9929

5.2 Steady-State Analysis

Contingency analysis was performed on the North study pocket using the Study Case and the Grid Discharging Study Case models. The results obtained with the Study Case model for Discharging scenario are summarized below:

- System Intact analysis showed no thermal or voltage violations attributable to PI-2024-11.
- Single Contingency analysis showed the following thermal violation attributable to PI-2024-11 in Table 5.
    - All single contingency violations were alleviated through generation redispatch as shown in column “Re-dispatched Case Loading (%)” of Table 5.
- Single Contingency showed no voltage violations attributable to PI-2024-11.
- Multiple Contingency analysis showed the following thermal violations attributable to PI-2024-11 in Table 6. Per TPL-001-5, multiple contingency violations 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. Multiple Contingency analysis showed no voltage violations attributed to the Study GIR.

The results obtained with the Grid Charging Study Case model for Grid Charging scenario are summarized below:

- System Intact analysis showed no thermal or voltage violations attributed to PI-2024-11.
- Single Contingency analysis showed no thermal or voltage violations attributed to PI-2024-11.
- Multiple Contingency analysis showed the following thermal violations attributable to PI-2024-11 in Table 7. Per TPL-001-5, multiple contingency violations 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. Multiple Contingency analysis showed no voltage violations attributed to the Study GIR.

Table 5 – Single Contingency Overloads for Discharging Scenario

Ref. No.	Monitored Facility	Contingency Name	kVs	Areas	Rate Cont (MVA)	Benchmark Case Loading (%)	Study Case Loading (%)	Loading Difference (%)	Re-dispatched Case Loading (%)
1	GI_2021_6 (700155) – Sky Ranch (70392) 230 kV ckt 1	Green Valley - Spruce (#5270)	230	70	484	97.74	101.07	3.33	96.40

Table 6 – Multiple Contingency Overloads for Discharging Scenario

Ref. No.	Monitored Facility	Contingency Name	kVs	Areas	Rate Cont (MVA)	Benchmark Case Loading (%)	Study Case Loading (%)	Loading Difference (%)
1	Ft St Vrain (70410) - Long Peak (78105) 230 kV ckt 1	Ft St Vrain - Ault/Fordham #5308	230	70	476	100.09	101.80	1.71
2	Green Valley (70048) - Spruce (70528) 230 kV ckt 1	Lines: 5525 5277 5759 5275	230	70	717	104.37	107.39	3.02
3	Green Valley (70048) - Keenesburg (70820) 230 kV ckt 2	Lines: 5279 5271	230	70	717	105.98	108.52	2.54
4	Green Valley (70048) - Keenesburg (70820) 230 kV ckt 1	Lines: 5271 5961	230	70	717	105.98	108.52	2.54
5	Green Valley (70048) - RMEC (70590) 230 kV ckt 1	Lines: 5279 5961	230	70	717	99.75	102.04	2.29
6	Clark (70112) - Jordan (70241) 230 kV ckt 1	Lines: 5167 5285	230	70	364	102.06	104.30	2.24

Table 7 – Multiple Contingency Overloads for Grid Charging Scenario

Ref. No.	Monitored Facility	Contingency Name	kVs	Areas	Rate Cont (MVA)	Benchmark Case Loading (%)	Study Case Loading (%)	Loading Difference (%)
1	Goose Creek (70918) - Shortgrass (70630) 345 kV ckt 1	Lines: May Valley - Sandstone	345	70	1439	98.42	100.14	1.72

5.3 Transient Stability Results

The following results were obtained for the disturbances analysed:

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

The results of the contingency analysis are shown in Table 8. The transient stability plots are shown in Appendix A in Section 10.0 of this report.

Table 8 – Transient Stability Analysis Results

Ref. No.	Fault Location	Fault Category	Outage(s)	Clearing Time (Cycles)	Discharging		Grid Charging	
					Post-Fault Voltage Recovery	Angular Stability	Post-Fault Voltage Recovery	Angular Stability
1	-	P0	Flat Run	-	Stable	Stable	Stable	Stable
2	Ft. St. Vrain 345 kV	P1	PI-2024-11 generation and 'SS' load	4	Stable	Stable	Stable	Stable
3	Ft. St. Vrain 345 kV	P1	Ft. St. Vrain – Canal Crossing 345 kV ckt 1	4	Stable	Stable	Stable	Stable
4	Ft. St. Vrain 345 kV	P1	Ft. St. Vrain 230/345 kV transformer 'T8'	4	Stable	Stable	Stable	Stable
5	Canal Crossing 345 kV	P1	Canal Crossing – Missile Site 345 kV ckt 1	4	Stable	Stable	Stable	Stable
6	Canal Crossing 345 kV	P1	Canal Crossing – Pawnee 345 kV ckt 1	4	Stable	Stable	Stable	Stable
7	Canal Crossing 345 kV	P1	Canal Crossing – Goose Creek 345 kV ckt 1	4	Stable	Stable	Stable	Stable
8	Ft. St. Vrain 230 kV	P1	Ft. St. Vrain – Ft. Lupton 230 kV ckt 1	5	Stable	Stable	Stable	Stable
9	Ft. St. Vrain 230 kV	P1	Ft. St. Vrain – Spindle 230 kV ckt 1	5	Stable	Stable	Stable	Stable
10	Ft. St. Vrain 230 kV	P4	Ft. St. Vrain 22/230 kV transformer 'U1' Ft. St. Vrain 'ST' generation Ft. St. Vrain 'SS' load	17	Stable	Stable	Stable	Stable
11	Canal Crossing 345 kV	P4	Canal Crossing – Ft. St. Vrain 345 kV ckt 1 Canal Crossing – Pawnee 345 kV ckt 1	12	Stable	Stable	Stable	Stable
12	Canal Crossing 345 kV	P7	Canal Crossing – Ft. St. Vrain 345 kV ckt 1 Canal Crossing – Ft. St. Vrain 345 kV ckt 2	4	Stable	Stable	Stable	Stable

5.4 Short-Circuit and Breaker Duty Analysis Results

A study was completed to determine whether any overstressed breakers resulted when several Provisional Interconnection Service requests were added to the PSCo Transmission System in the order of their estimated Commercial Operation Dates (CODs). 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.

The Short Circuit study on the PSCo Transmission System did not identify any circuit breakers that became over-dutied because of adding the PI-2024-11. The fault currents at the POI for can be made available upon request by the Customer.

5.5 Affected Systems

The study did not identify any impacts to Affected Systems.

5.6 Summary of Provisional Interconnection Analysis

The maximum permissible output of the Provisional Interconnection Service without requiring any additional system Network Upgrades is 199 MW in Discharging mode at the POI and 205.6 MW in Grid Charging mode at the generator terminal.

During the 0.95 lagging power factor test, as shown in Section 5.1, the generating facility POI reaches 1.058 p.u. voltage. This over-voltage will need to be corrected by the generator owner.

6.0 Cost Estimates

The total estimated cost of the required upgrades for PI-2024-11 to interconnect for Provisional Interconnection Service at the Fort Saint Vrain 345 kV substation is **$7.004 million**. Note the cost estimates for any Network Upgrades on Affected Systems is not provided by PSCo.

- **Cost of Transmission Provider's Interconnection Facilities (TPIF) is $3.489 million** (Table 9)
- **Cost of Station Network Upgrades is $3.515 million** (Table 10)
- **Cost of System Network Upgrades is $0**

The list of improvements required to accommodate the Provisional Interconnection of PI-2024-11 are given in Table 9, and Table 10.

Table 9 – Transmission Provider's Interconnection Facilities

Element	Description	Cost Est. (Million)
PSCo's Ft St Vrain 345 kV substation	Interconnection of 5RSC-2024-14 (PI-2024-11) at the Fort Saint Vrain 345 kV substation. The new equipment includes: • (2) 345 kV single bay dead end structures • (1) 345 kV 3-phase arrester • (1) 345 kV 3000 A disconnect switch • (1) 345 kV 3-phase CT for metering • (3) 345 kV CVT's • Associated electrical equipment, bus, wiring and grounding • Associated foundations and structures • Associated transmission line communications, fiber, relaying	$3.239
PSCo's Ft St Vrain 345 kV substation	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.	$0.250
Total Cost Estimate for Interconnection Customer-Funded, PSCo-Owned Interconnection Facilities		**$3.489**

Table 10 – Station Network Upgrades

Element	Description	Cost Est. (Million)
PSCo's Ft St Vrain 345 kV substation	Interconnection of 5RSC-2024-14 (PI-2024-11) at the Fort Saint Vrain 345 kV substation. The new equipment includes: • (1) 345 kV 3000 A circuit breaker • (2) 345 kV 3000 A disconnect switches • Associated electrical equipment, bus, wiring and grounding • Station controls and wiring • Associated foundations and structures	$2.995
PSCo's Ft St Vrain 345 kV substation	Install required communication equipment in the EEE at the Fort Saint Vrain 345 kV substation	$0.470
PSCo's Ft St Vrain 345 kV substation	Siting and Land Rights permitting, no land purchase costs included	$0.050
Total Cost Estimate for PSCo-Funded, PSCo-Owned Interconnection Facilities		**$3.515**

PSCo has developed cost estimates for Transmission Provider's Interconnection Facilities and Network/Infrastructure Upgrades required for the interconnection of PI-2024-11 for Provisional Interconnection Service. The estimated costs provided in this report are based upon the following assumptions:

- The estimated costs are in 2024 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:

- Customer will install two (2) redundant fiber optic circuits (one primary circuit with a redundant backup) into the Transmission Provider's substation 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 Load Frequency/Automated Generation Control (LF/AGC) RTU at their Customer substation. PSCo will be provided with indications, readings, and data from the LF/AGC RTU.
- The Interconnection Customer will comply with the Interconnection Guidelines for Transmission Interconnected Producer-Owned Generation Greater Than 20 MW, as amended from time to time, and available at: XEL-POL-Transmission Interconnection Guideline Greater 20MW (https://corporate.my.xcelenergy.com/s/transmission/interconnection)

6.1 Schedule

This section provides proposed milestones for the interconnection of PI-2024-11 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 of March 19, 2026. This is not 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 11.

Table 11 – Proposed Milestones for PI-2024-11

Milestone	Responsible Party	Estimated Completion Date
LGIA 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	June 29, 2026
In-Service Date & Energization of Interconnection Customer's Interconnection Facilities	Interconnection Customer	June 29, 2026
Initial Synchronization Date	Interconnection Customer	July 6, 2026
Begin trial operation & testing (90% of IC facilities available for testing)	Interconnection Customer and Transmission Provider	July 20, 2026
Commercial Operation Date	Interconnection Customer	January 15, 2027

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 LGIA 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.
- A Certificate of Public Convenience and Necessity (CPCN) may be required for the construction of the Interconnection Facilities and Station Network Upgrades. The expected time to obtain a CPCN approval is 18 months, which could impact the start of construction for the interconnection facilities.

7.0 Summary of Provisional Interconnection Service Analysis

The total estimated cost of the PSCo transmission system improvements required for PI-2024-11 to qualify for Provisional Interconnection Service is **$7.004 million.**

The initial maximum permissible output of PI-2024-11 Generating Facility is 199 MW in Discharging at the POI and 205.6 MW in Grid Charging mode at the generator terminal. The maximum permissible output of the Generating Facility in the PLGIA will be reviewed quarterly (or more often as needed) and updated if there are changes to system conditions compared to the system conditions previously used to determine the maximum permissible output.

Security: Based on 5RSC-2024-14 in the 5RSC selection of Energy Resource Interconnection Service (ERIS), the security associated with the Network Upgrades that might be identified at the conclusion of the 5RSC-2024-14 Large Generation Interconnection Procedure (LGIP) in the 5RSC cluster is $5 million.

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

8.0 Contingent Facilities

The Contingent Facilities identified for PI-2024-11 include the TPIF and Station Network Upgrades identified in Table 9, and Table 10, respectively.

9.0 Preliminary One-Line Diagram and General Arrangement for PI-2024-11

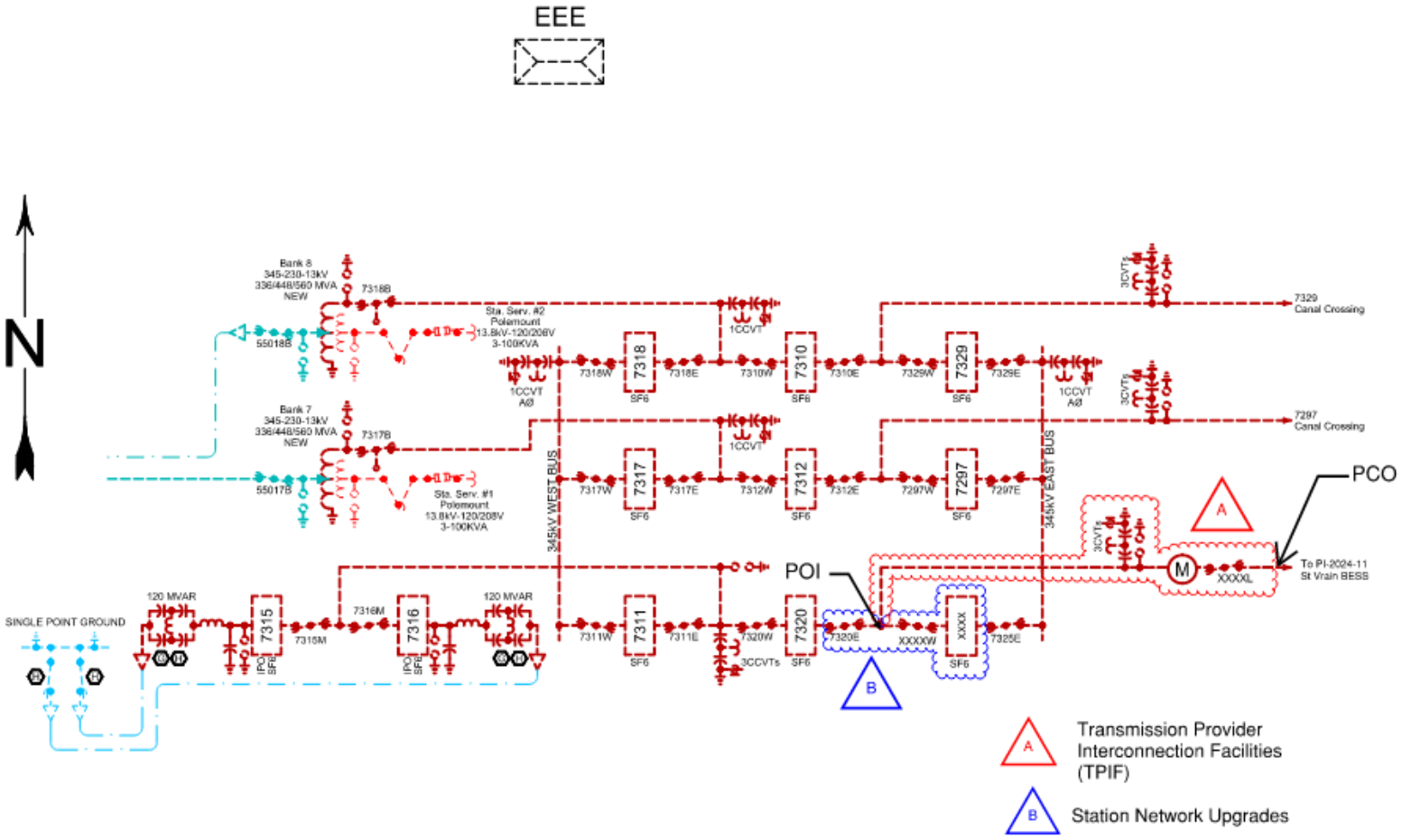


Figure 2: Preliminary One-Line for PI-2024-11 at the Fort St Vrain 345 kV substation

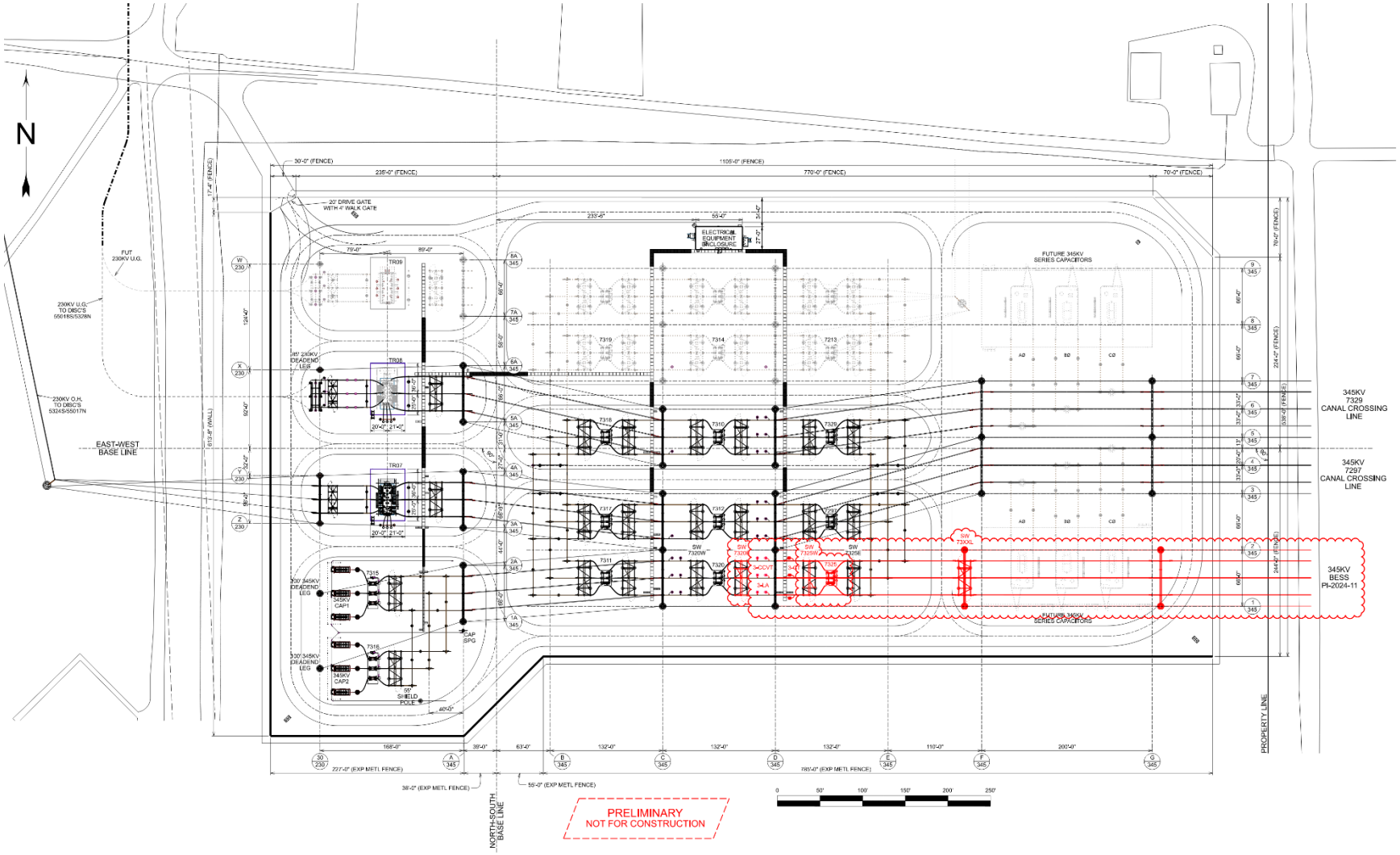
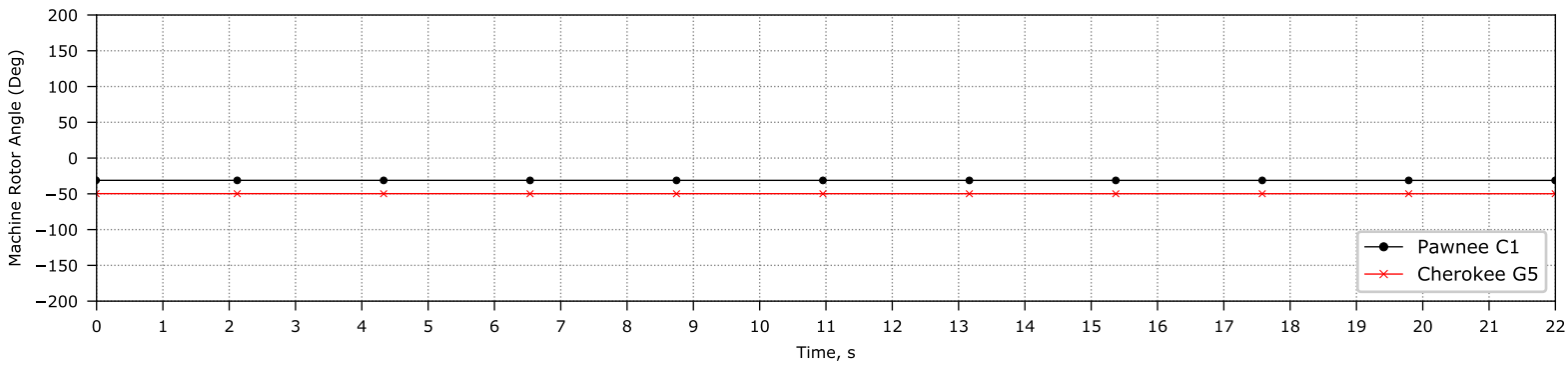


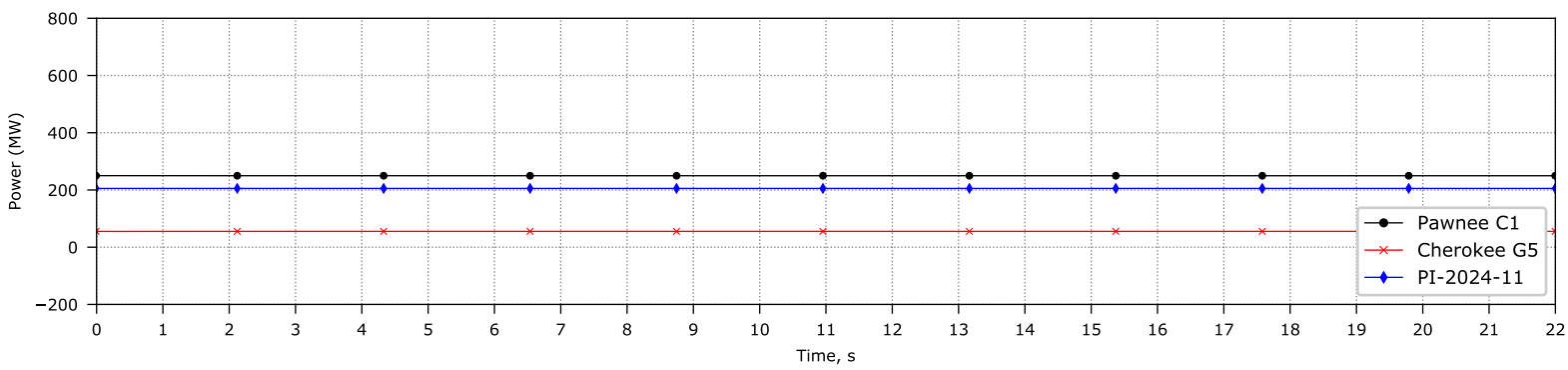
Figure 3: Preliminary General Arrangement for PI-2024-11 at the Fort St Vrain 345 kV substation

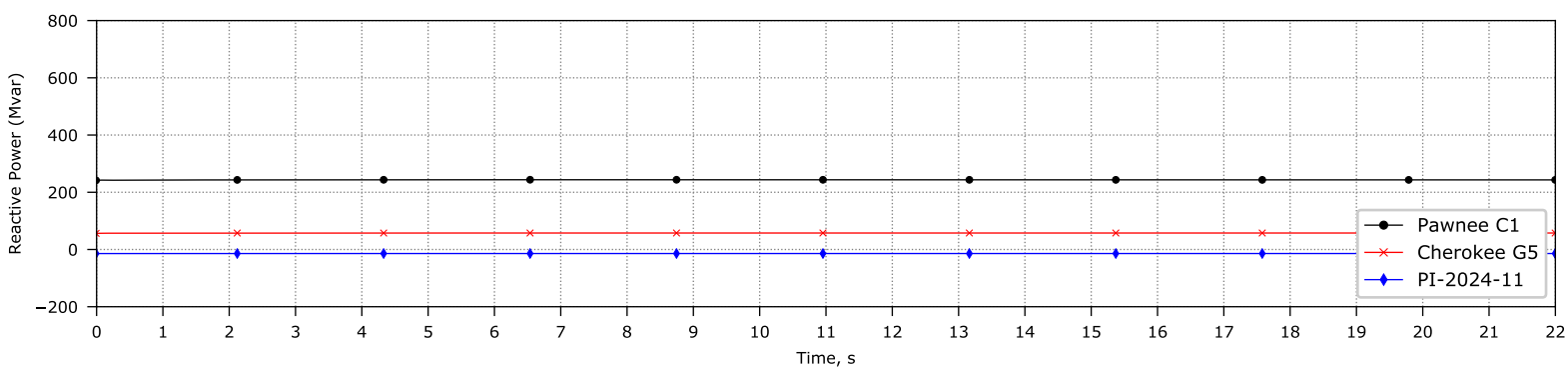
10.0 Appendices

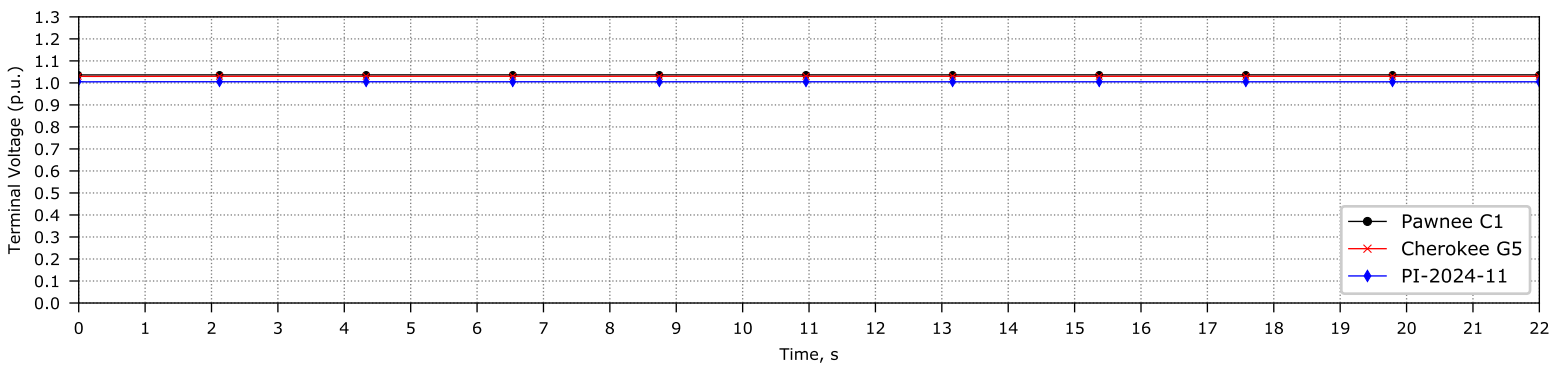
Appendix A: Transient Stability Plots for Discharging Scenario	PI-2024-11 Discharging - Transi
Appendix B: Transient Stability Plots for Grid Charging Scenario	PI-2024-11 Grid Charging - Transien

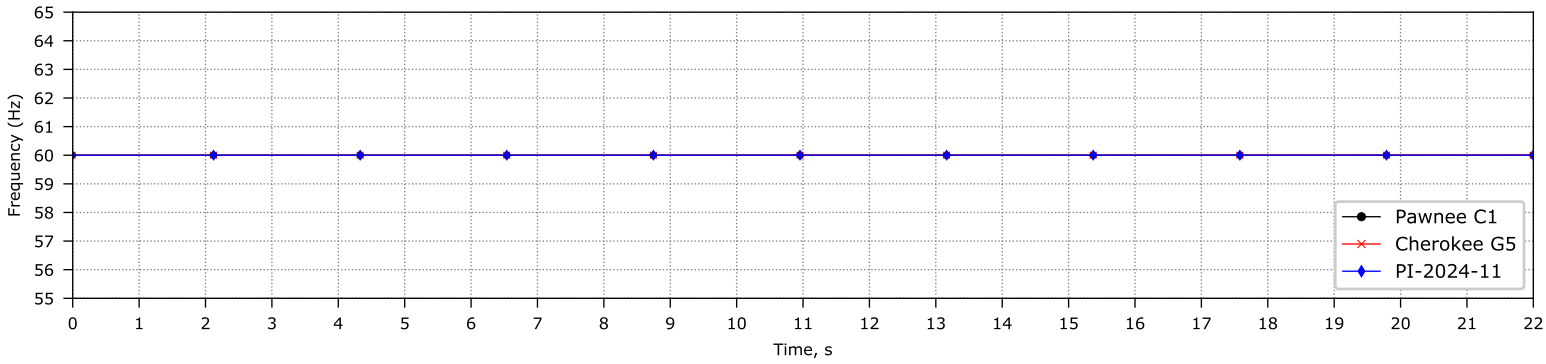
Flat Run

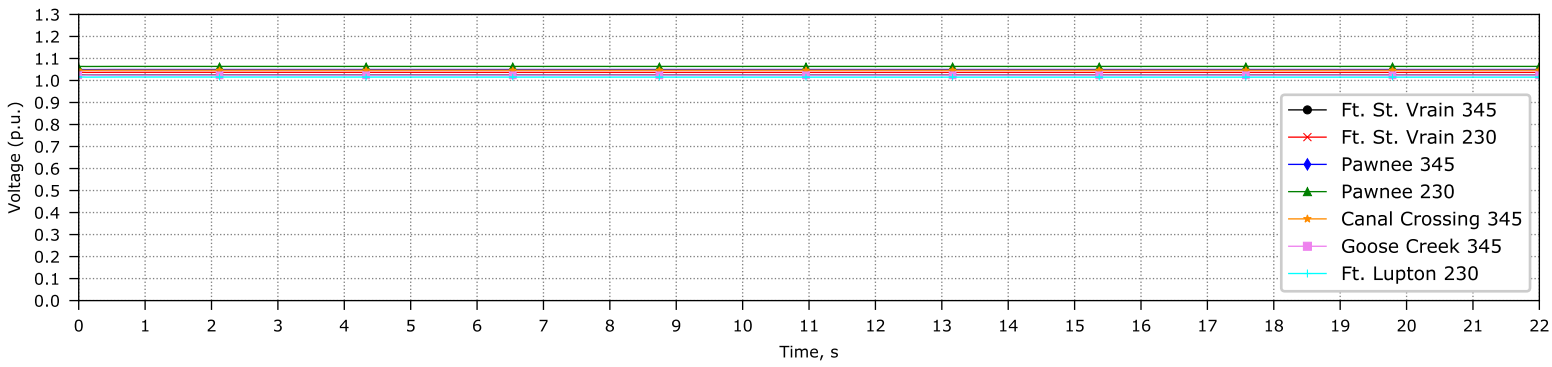

Machine Rotor Angle (Deg)
Time, s
Pawnee C1
Cherokee G5


Power (MW)
Time, s
Pawnee C1
Cherokee G5
PI-2024-11

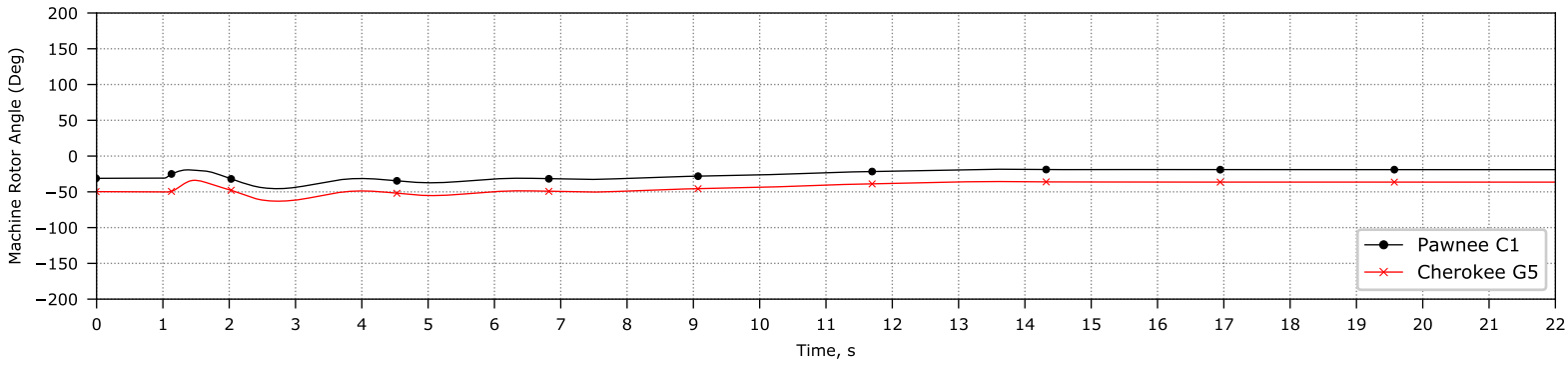

Reactive Power (Mvar)
Time, s
Pawnee C1
Cherokee G5
PI-2024-11

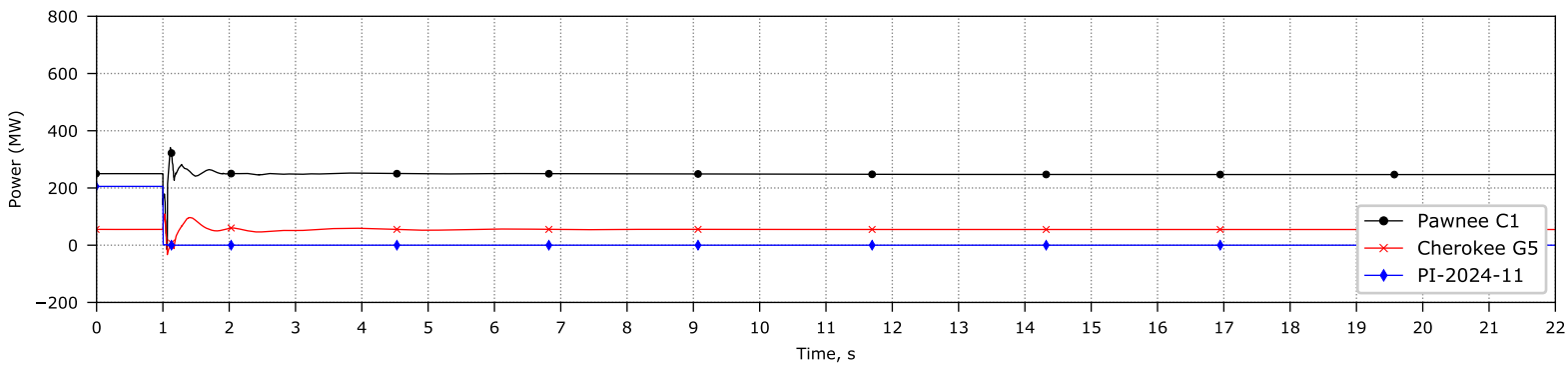

Terminal Voltage (p.u.)
Time, s
Pawnee C1
Cherokee G5
PI-2024-11

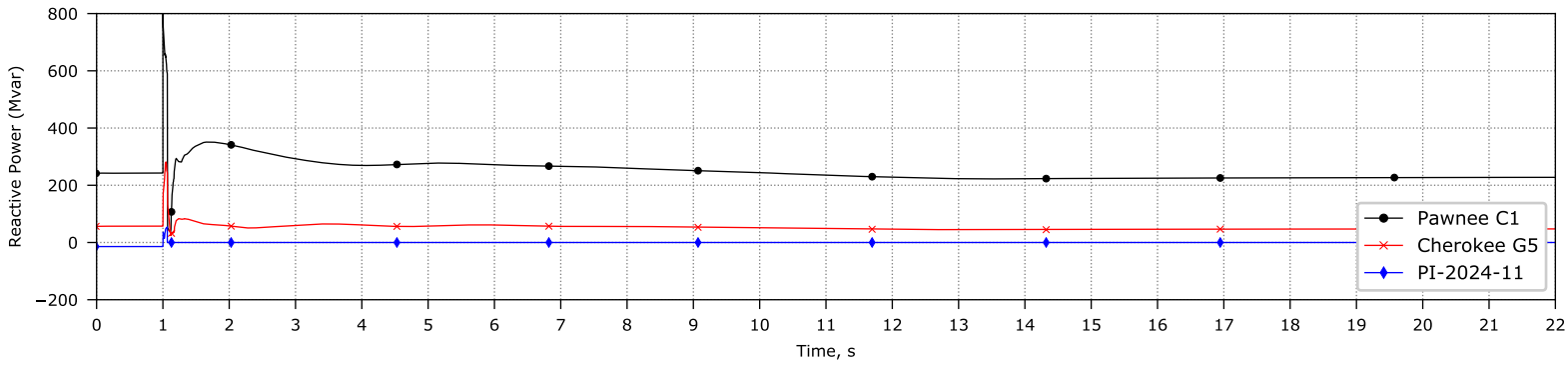

Frequency (Hz)
Time, s
Pawnee C1
Cherokee G5
PI-2024-11

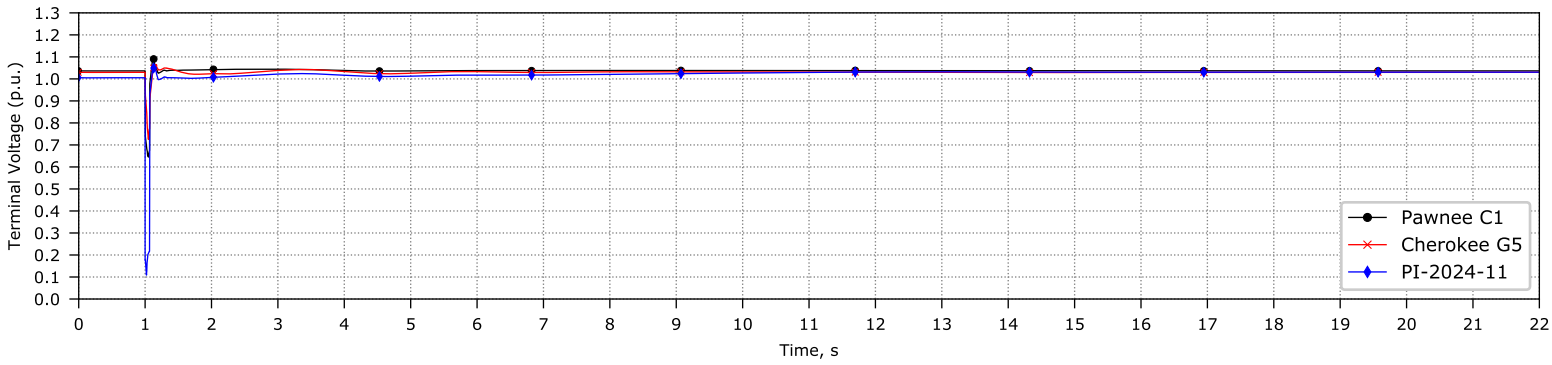

Voltage (p.u.)
Time, s
Ft. St. Vrain 345
Ft. St. Vrain 230
Pawnee 345
Pawnee 230
Canal Crossing 345
Goose Creek 345
Ft. Lupton 230

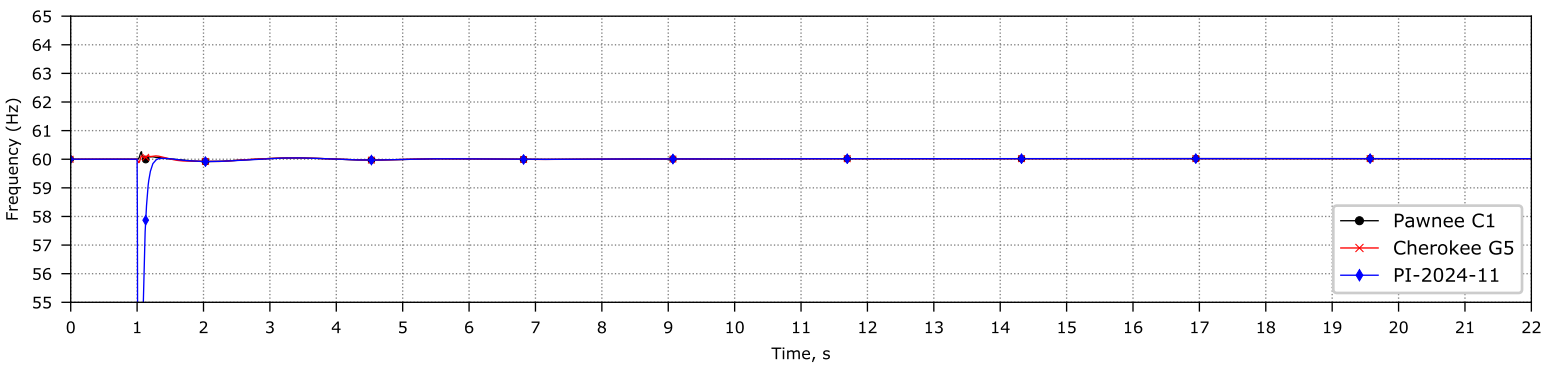
PI-2024-11_Gen

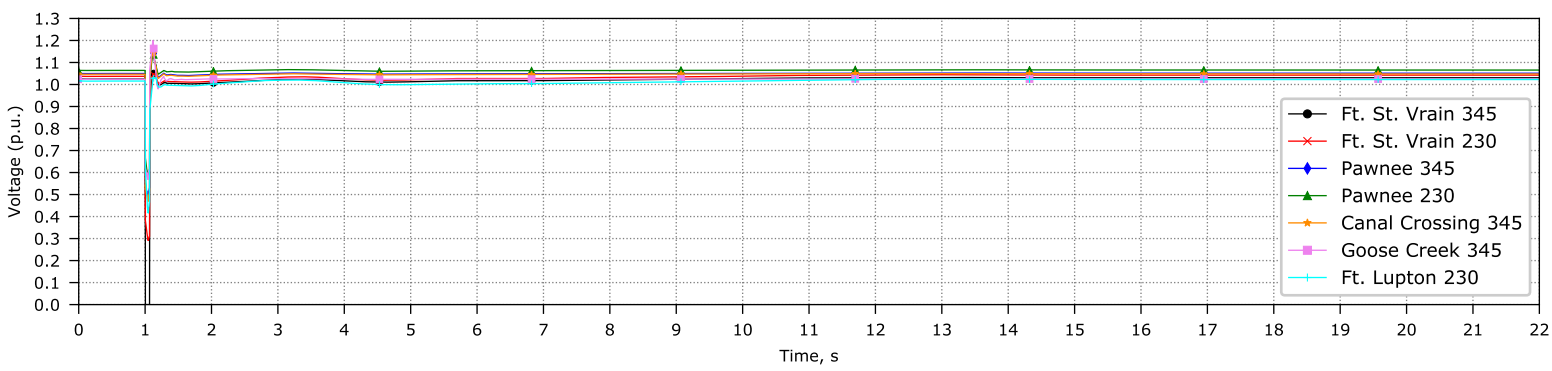




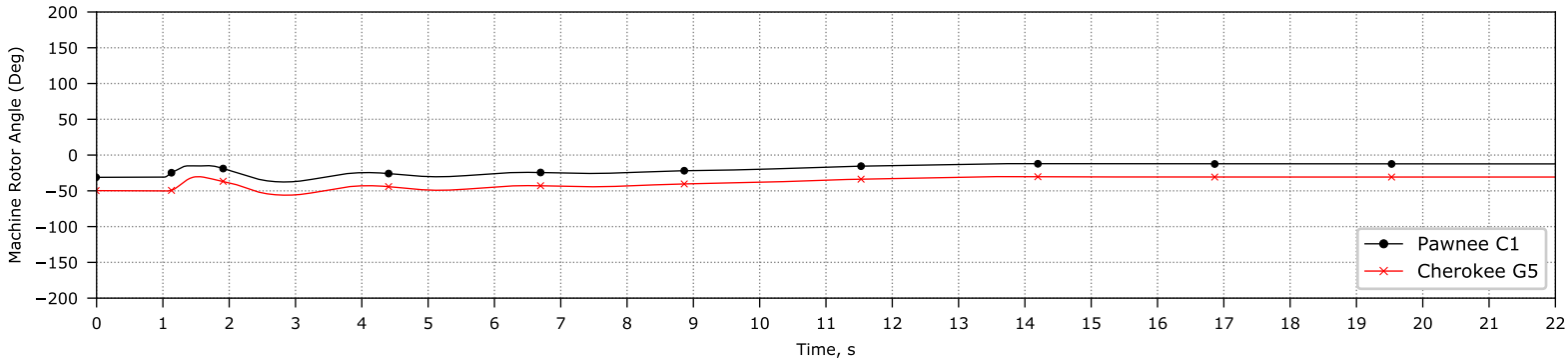


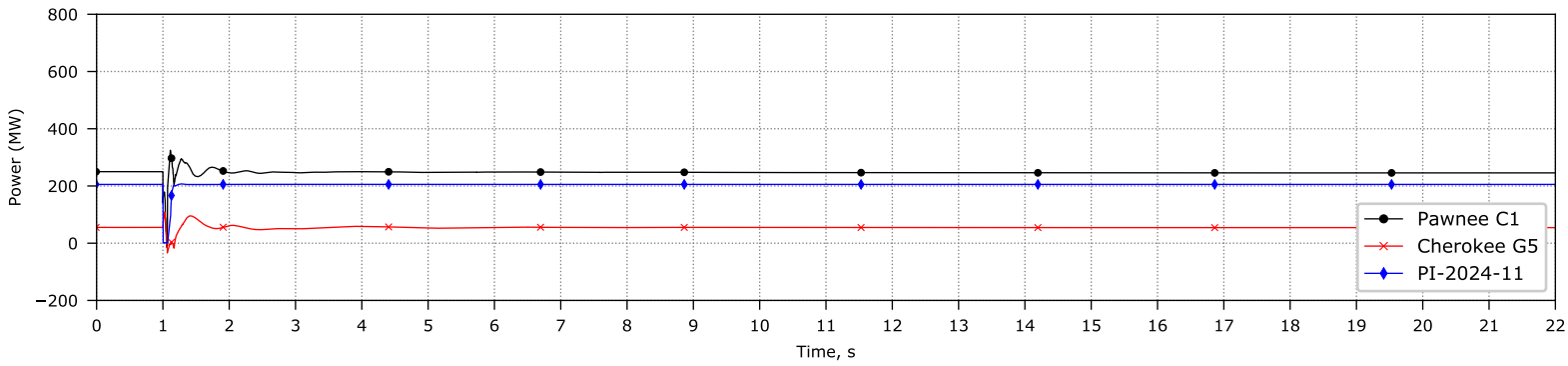


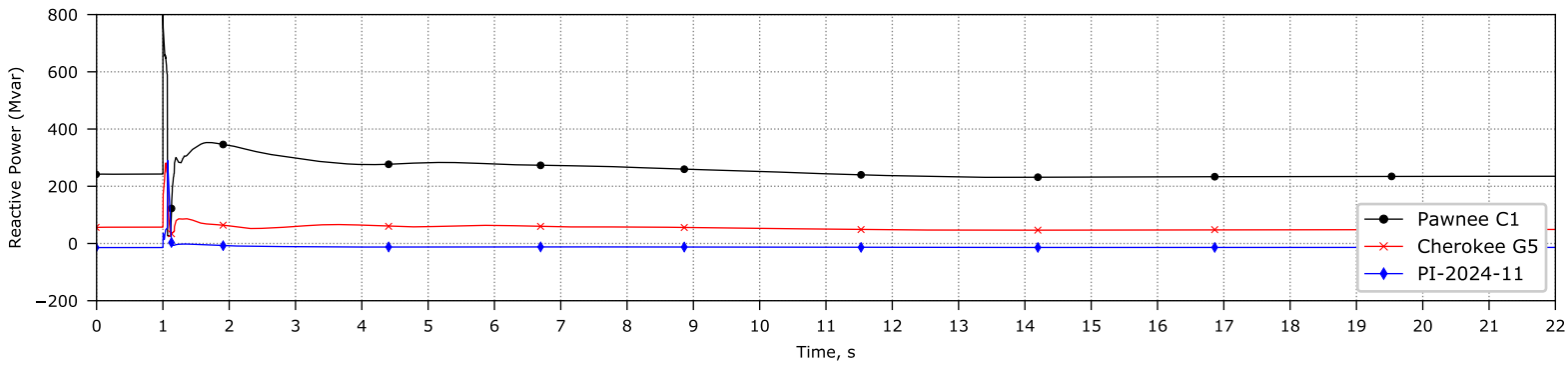


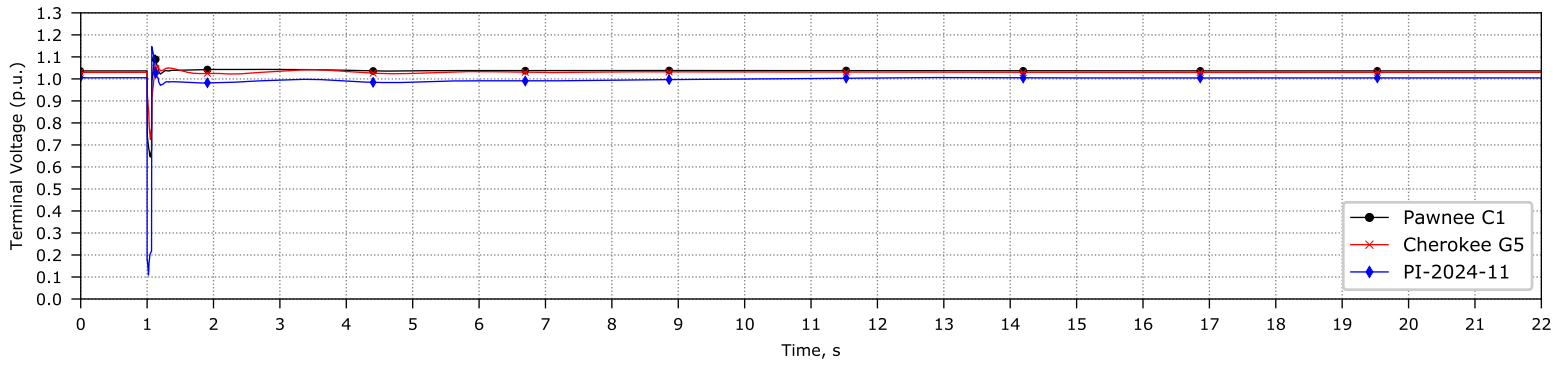


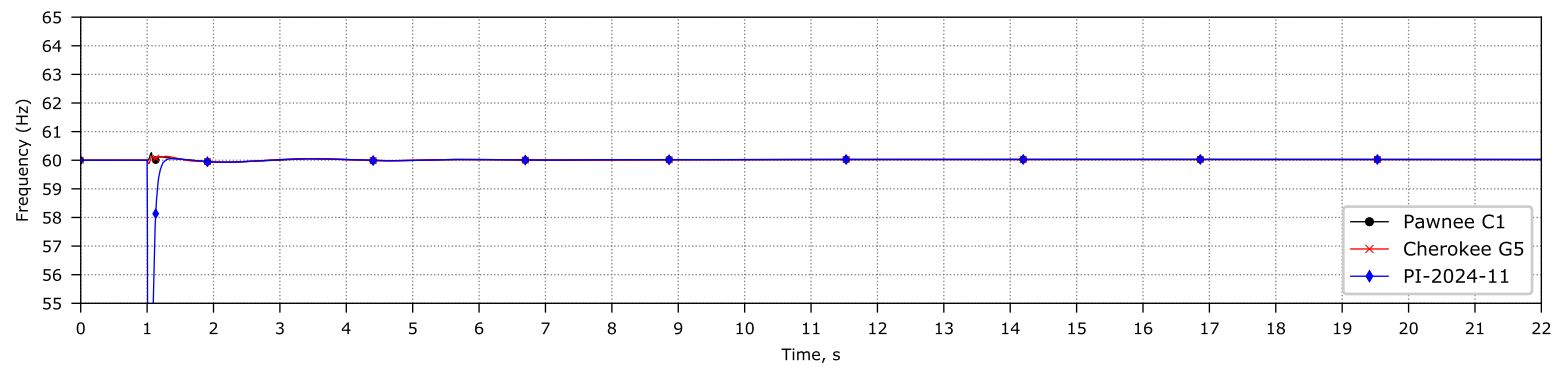
Ft-St-Vrain_Canal-Crossing_345kV

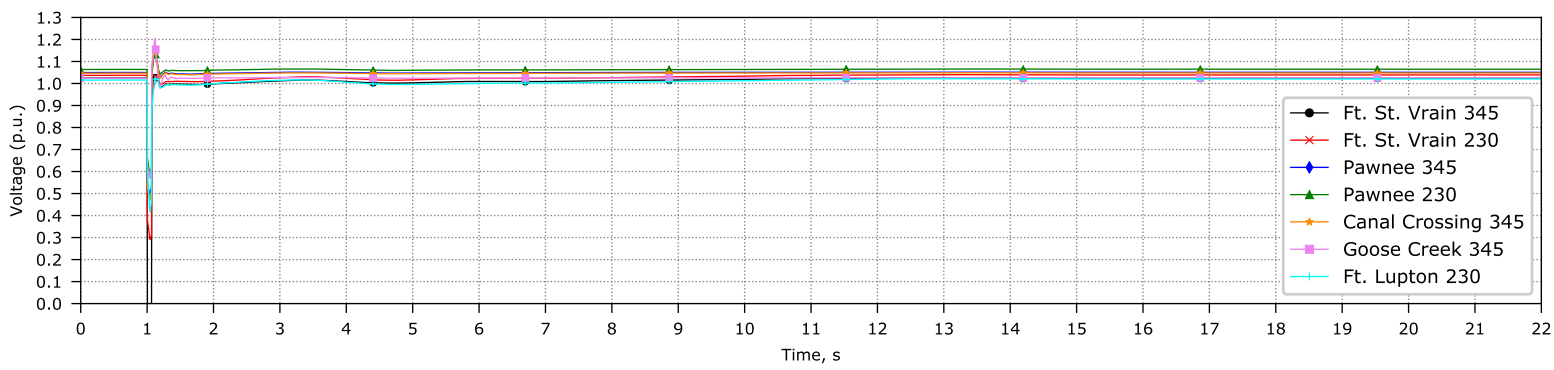




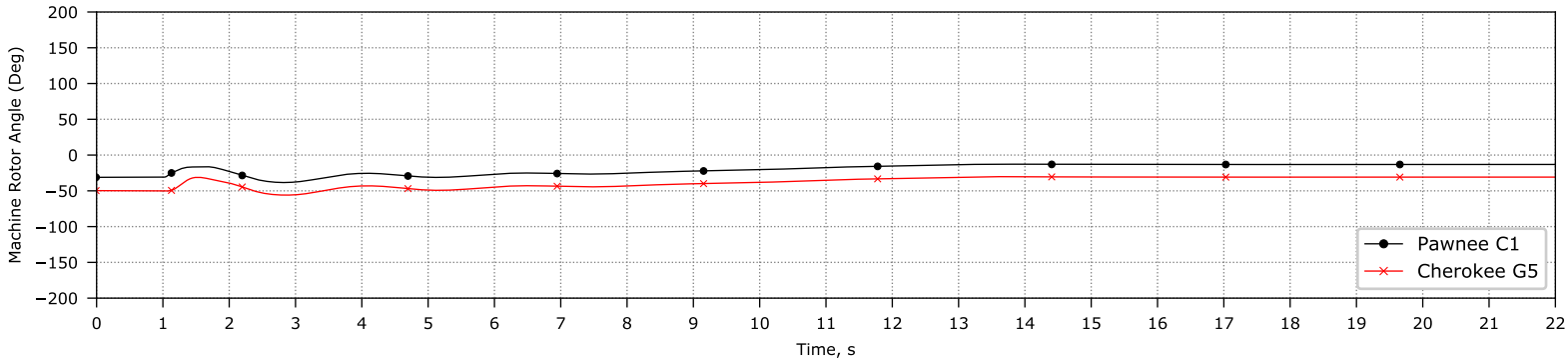


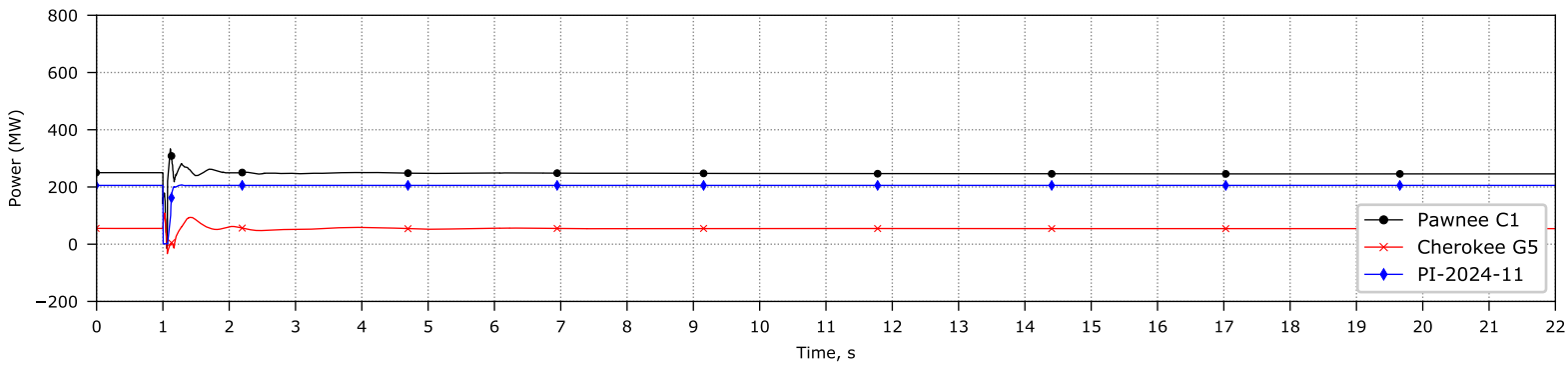


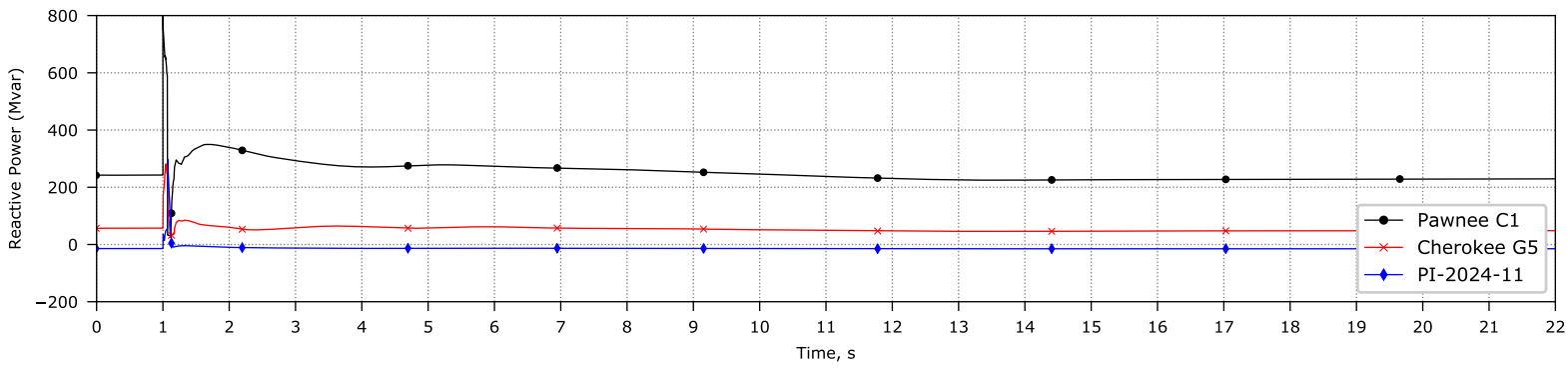


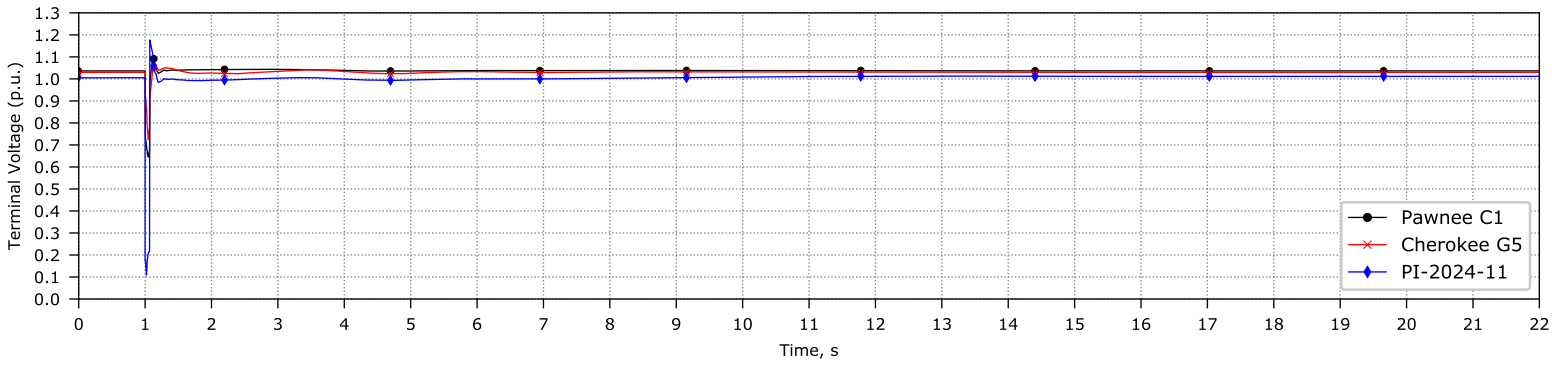


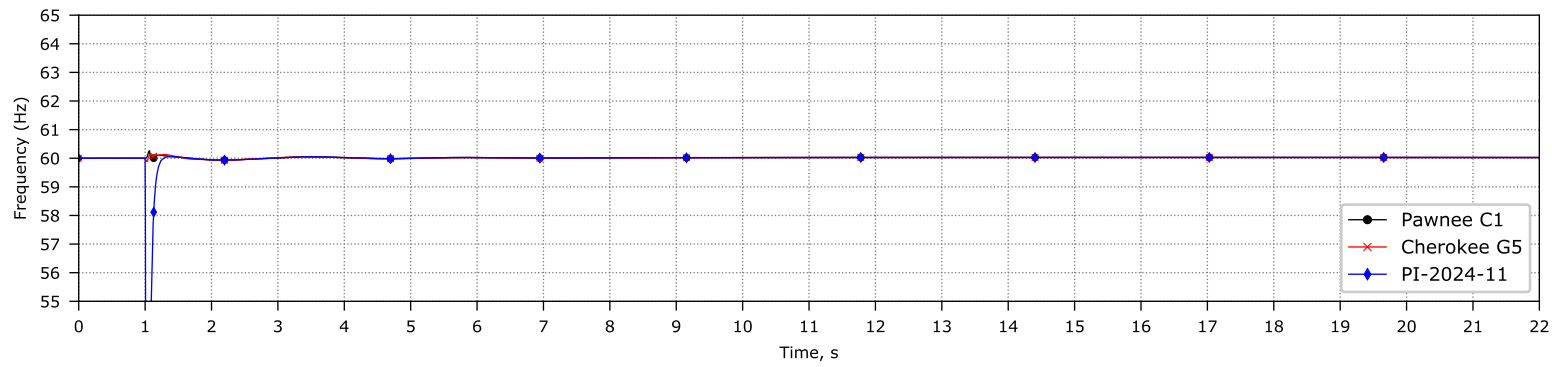
Ft-St-Vrain_230-345kV

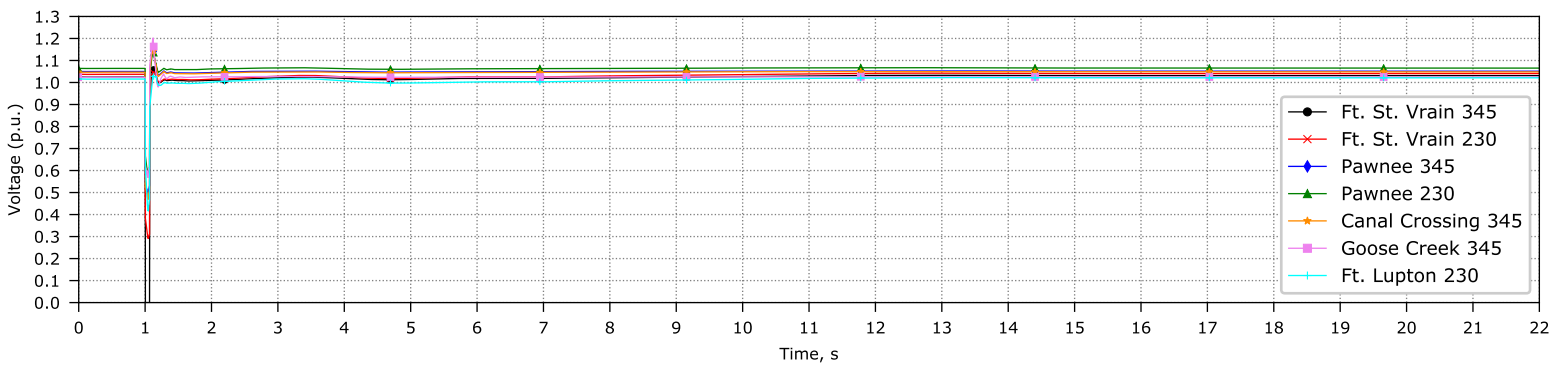




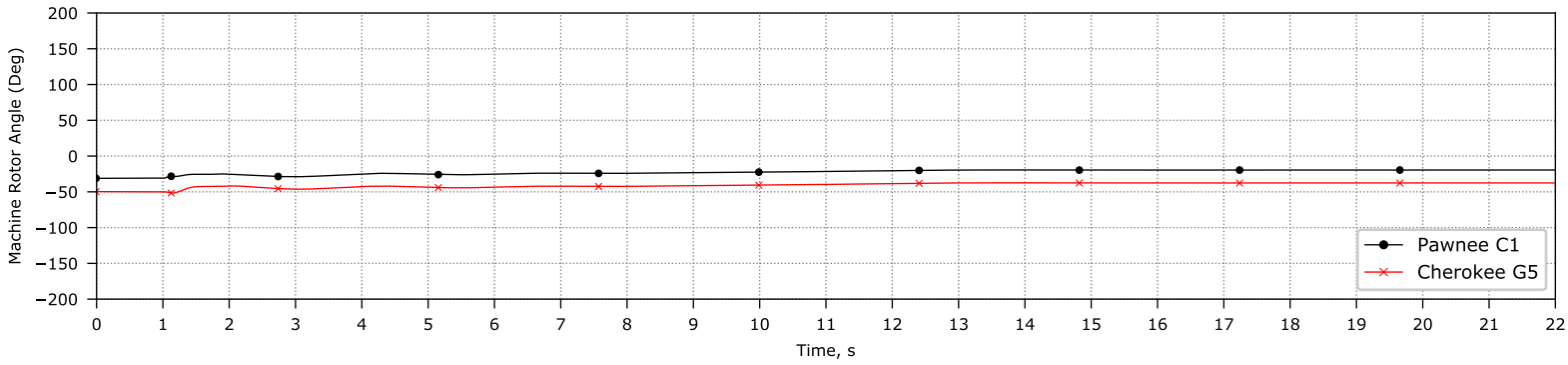


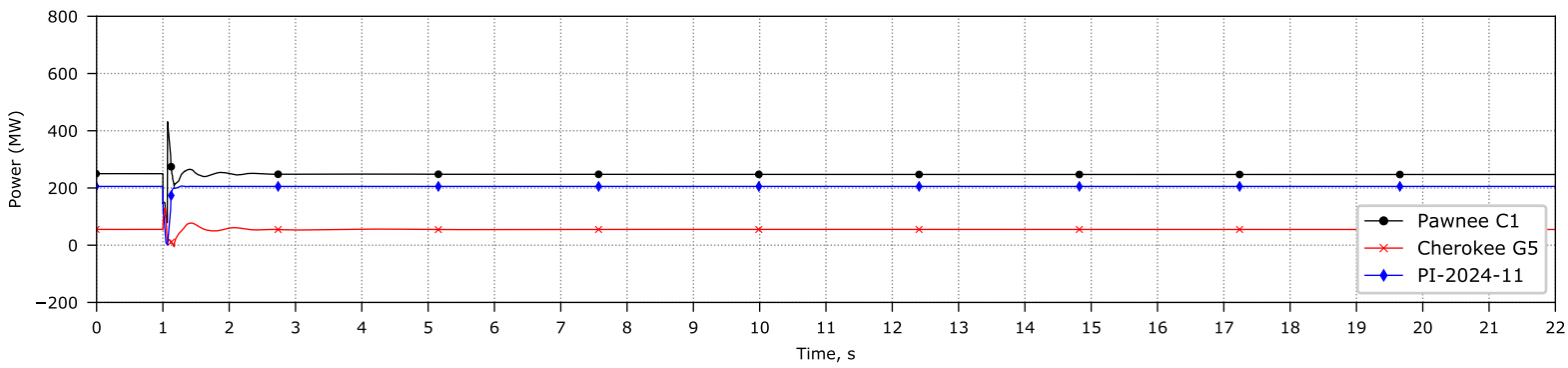


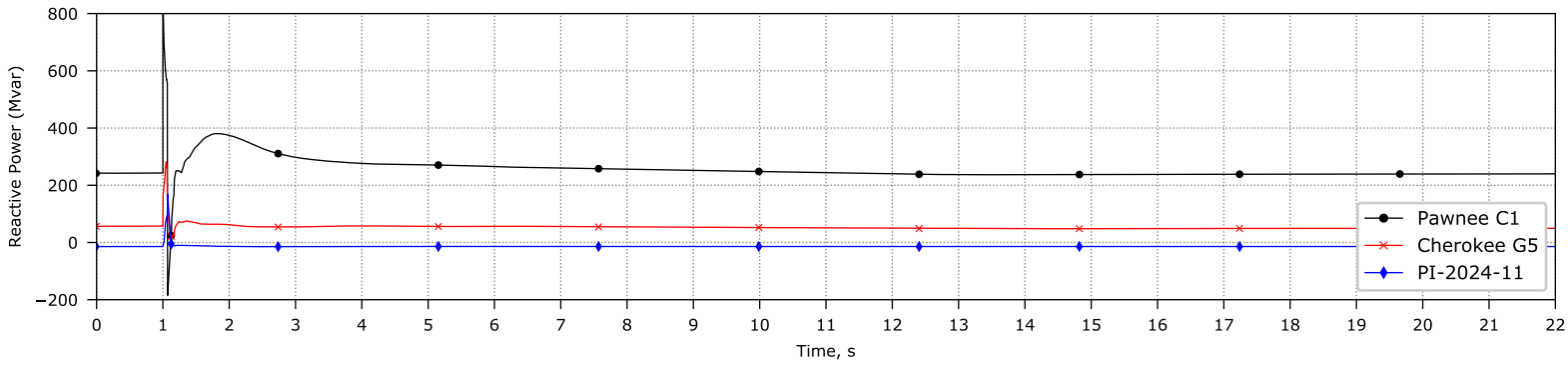


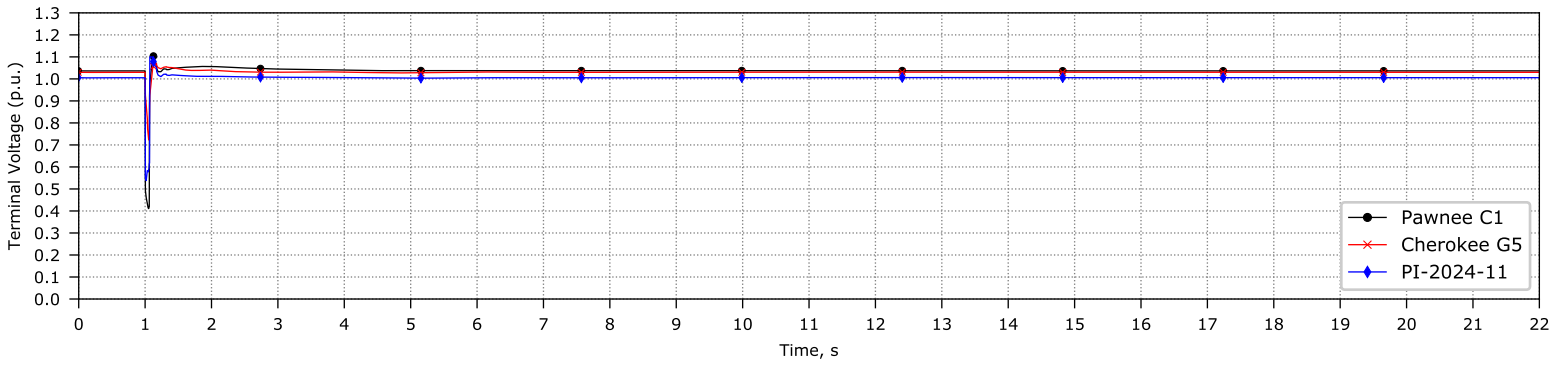


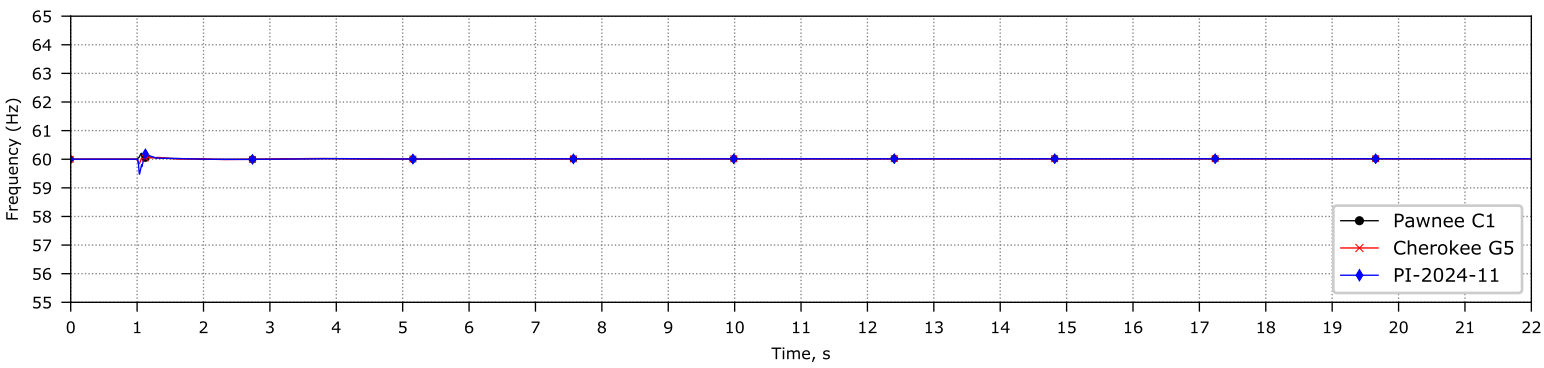
Canal-Crossing_Missile-Site_345kV

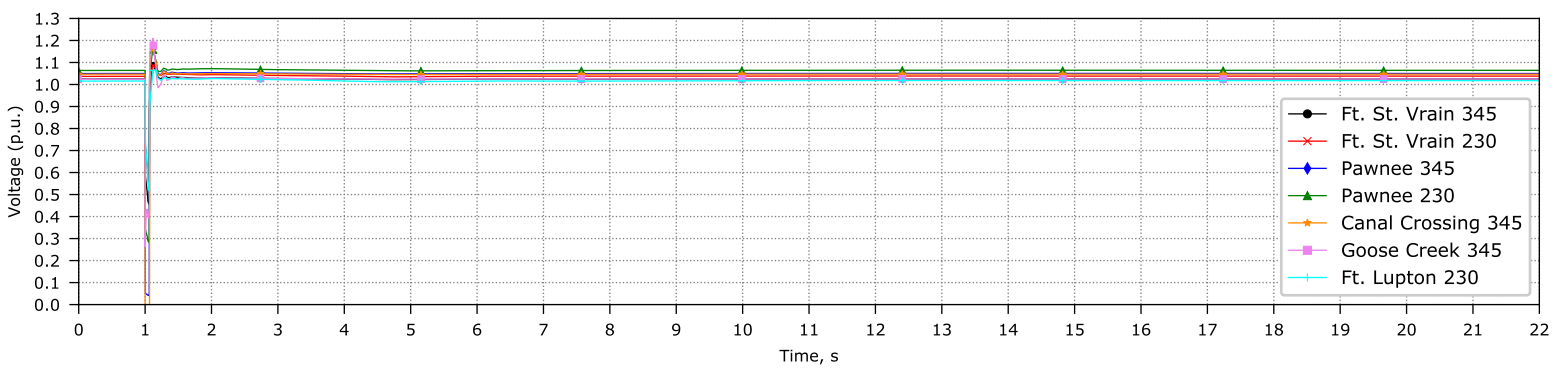




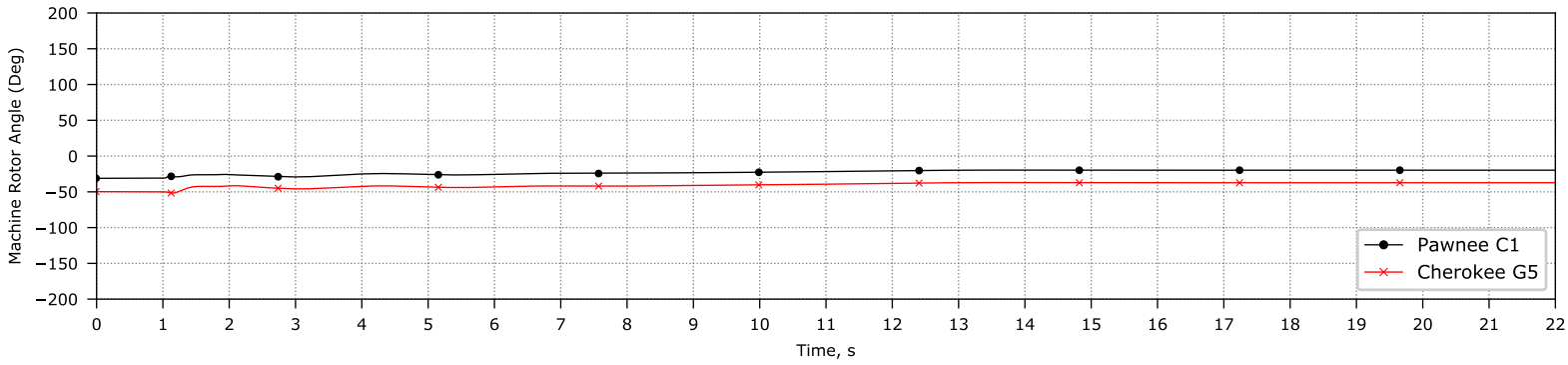


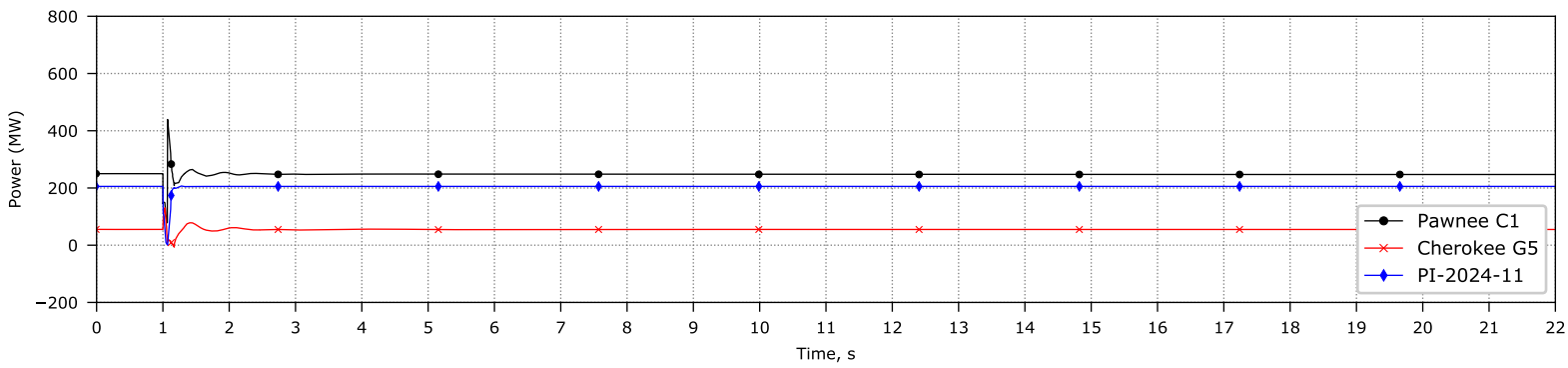


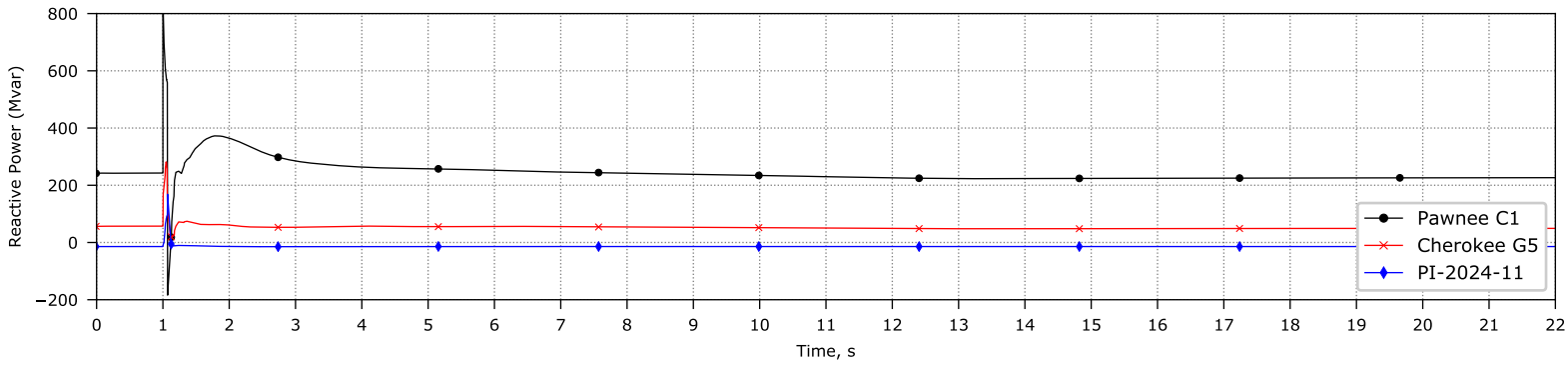


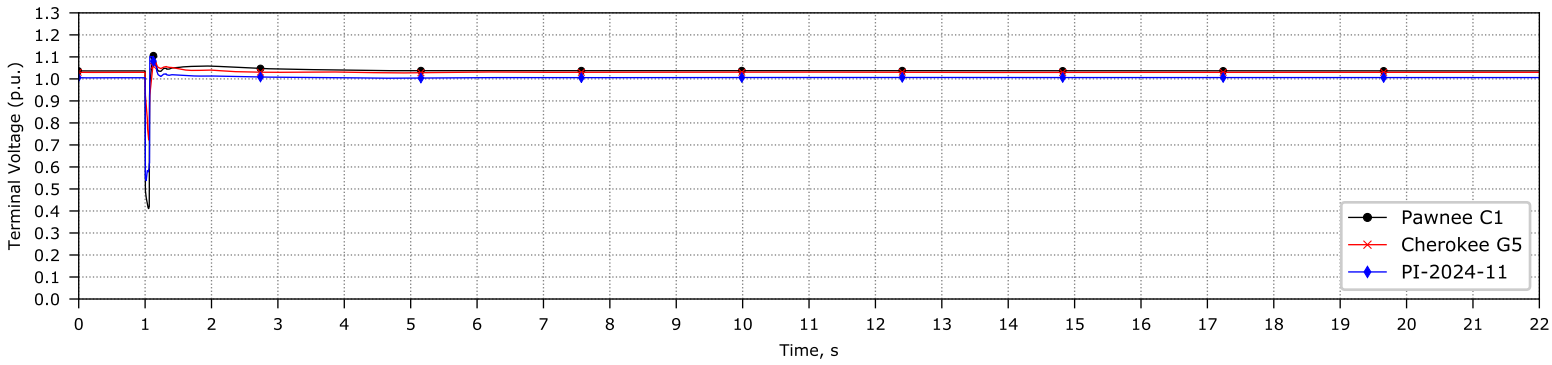


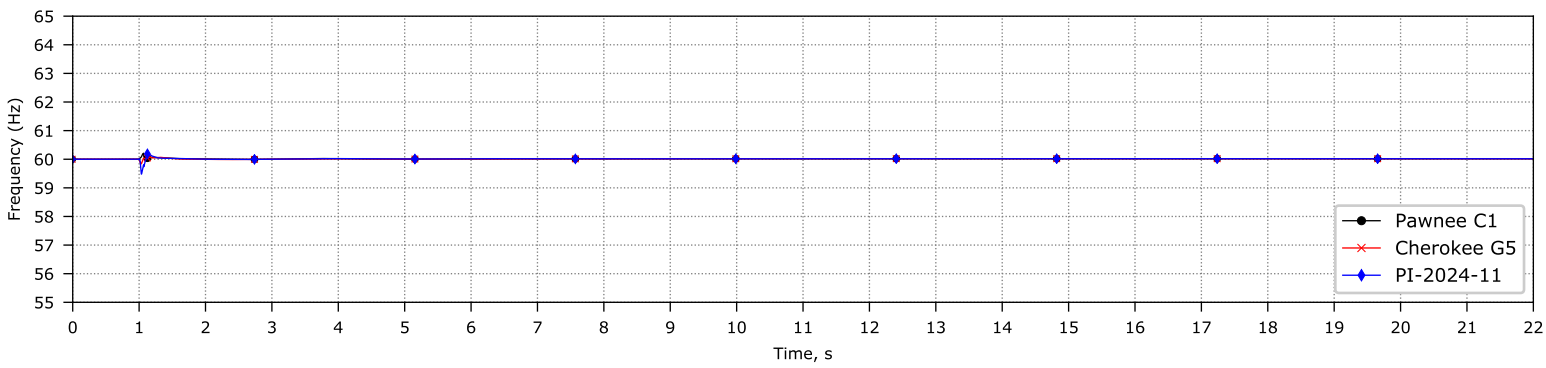
Canal-Crossing_Pawnee_345kV

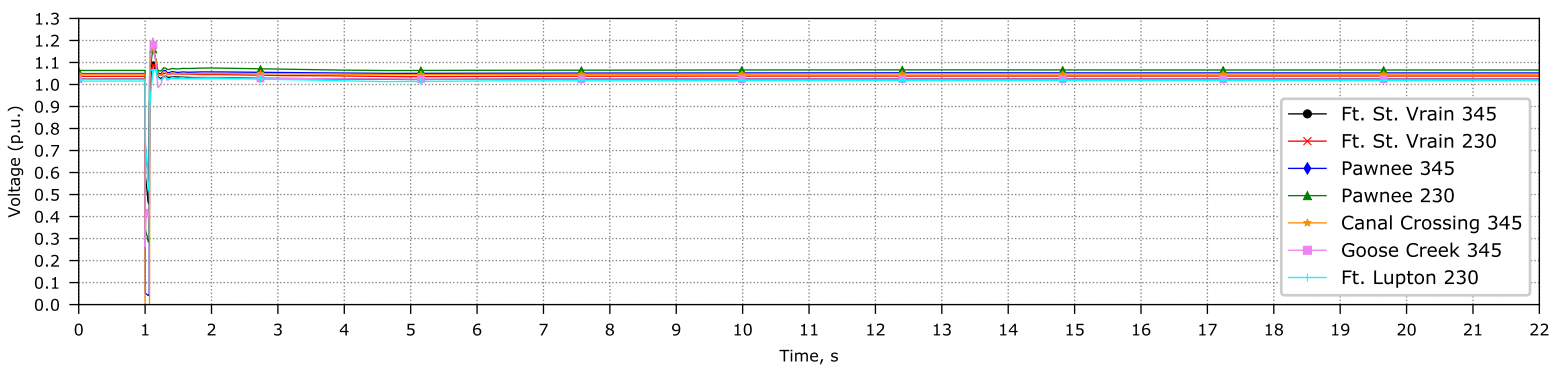




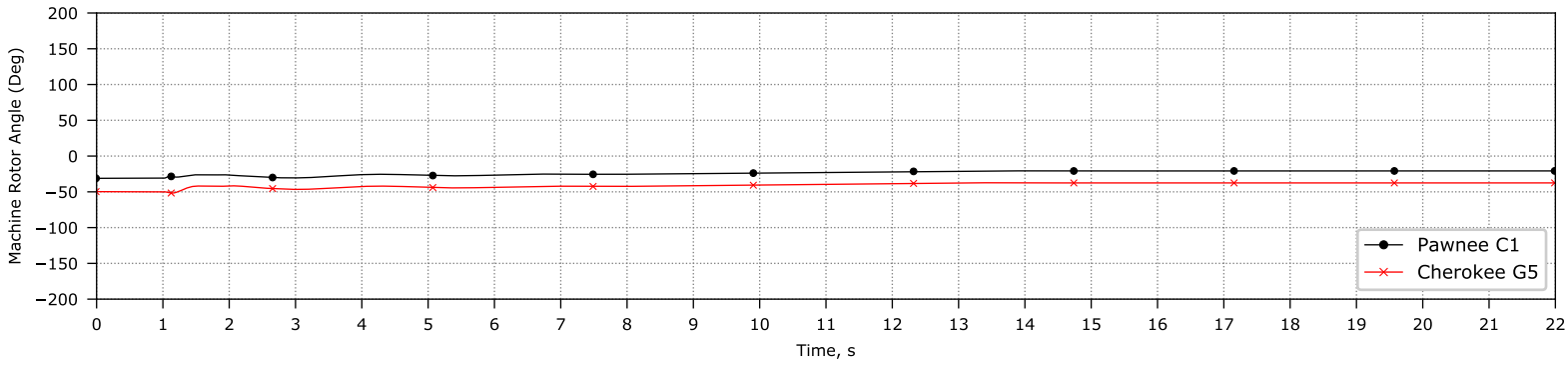


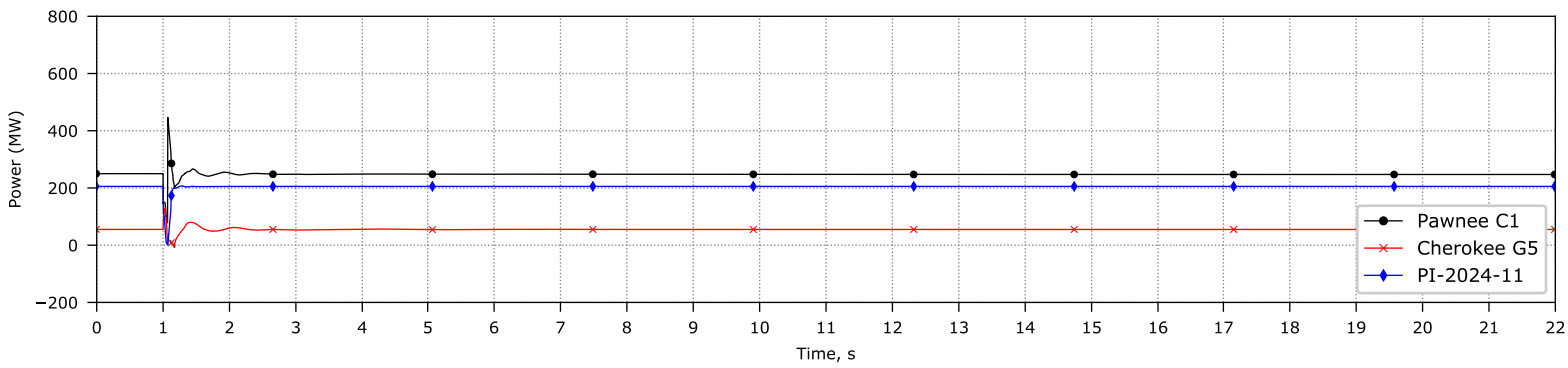


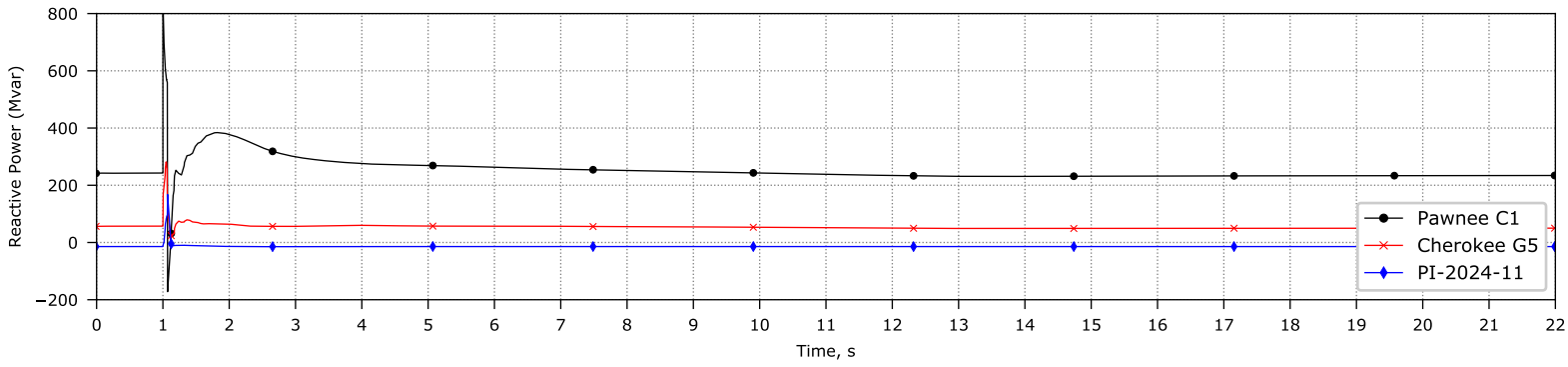


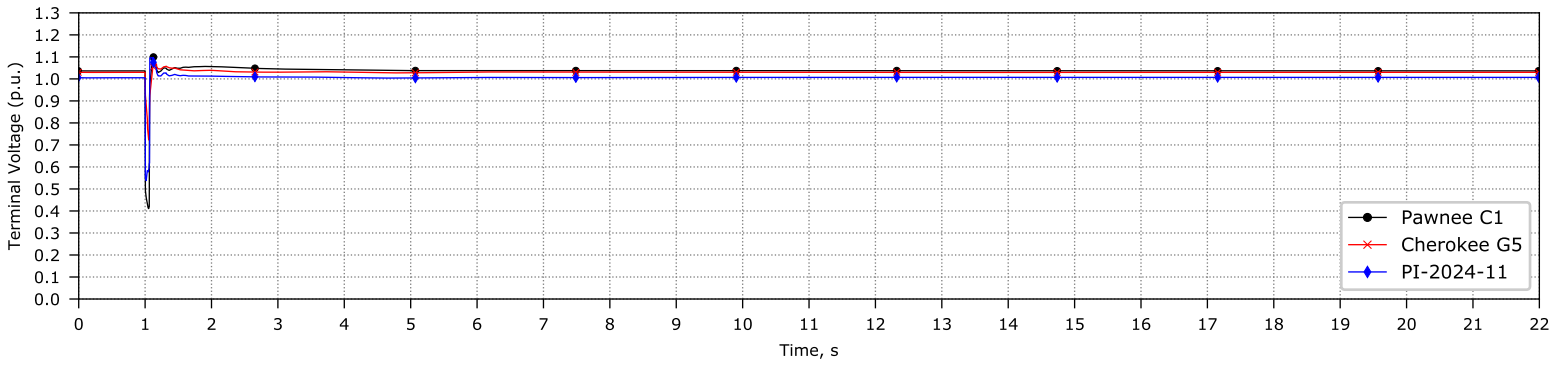


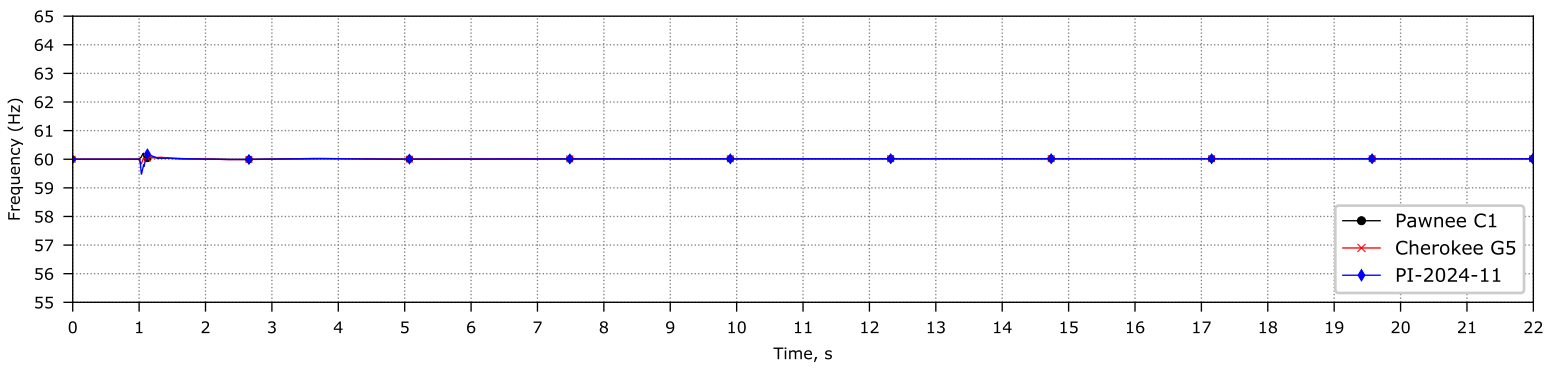
Canal-Crossing_GooseCk_345kV

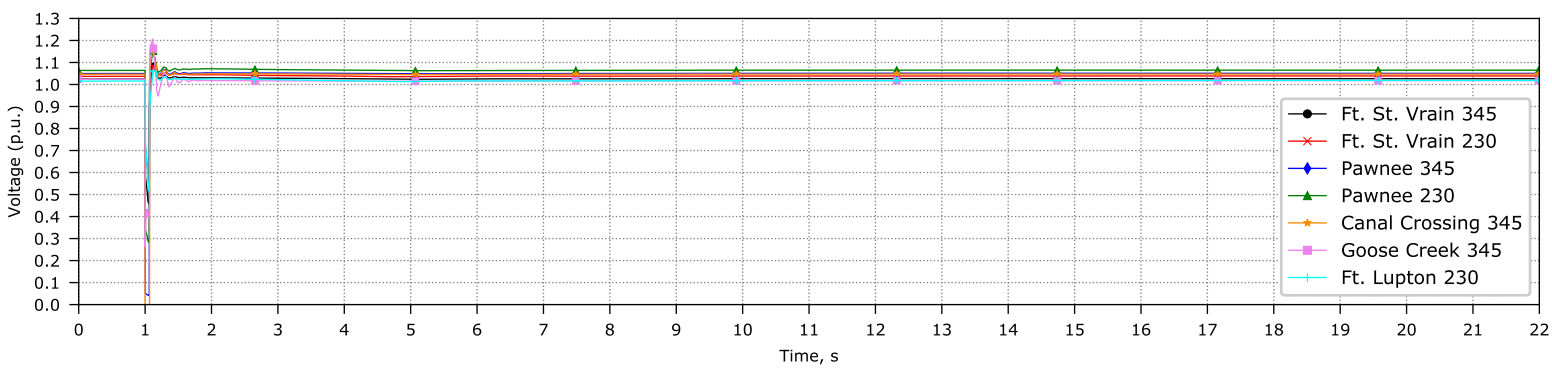




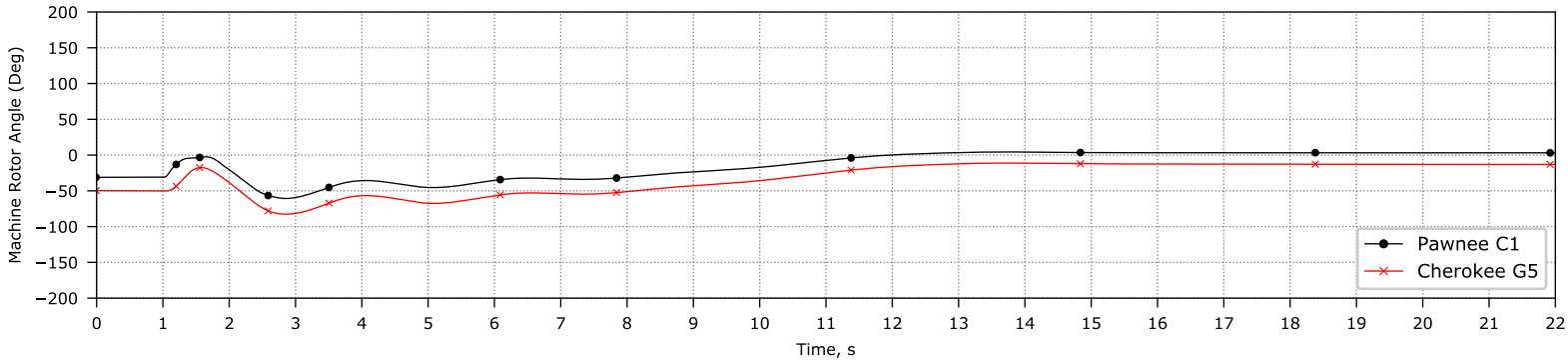


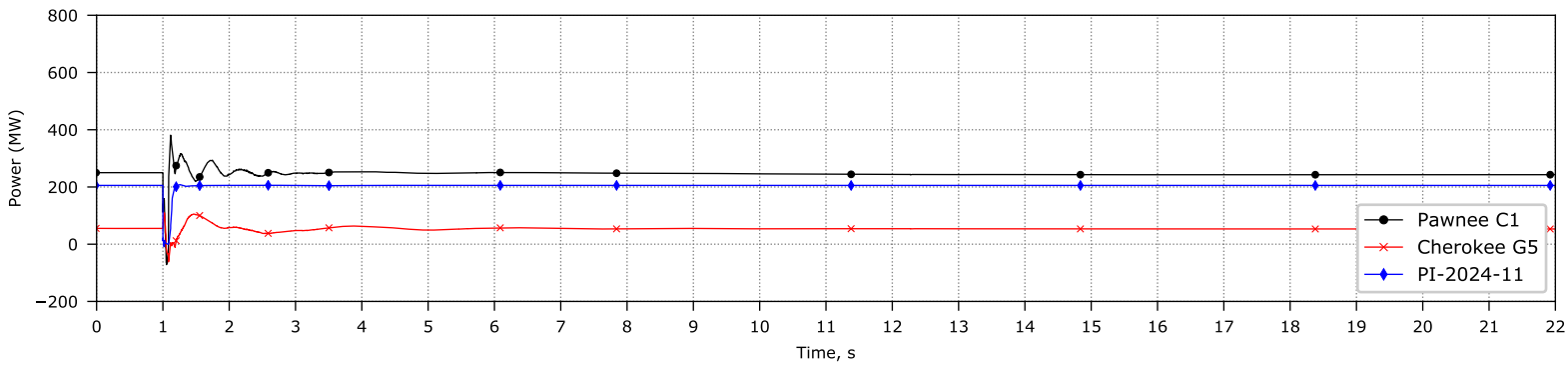


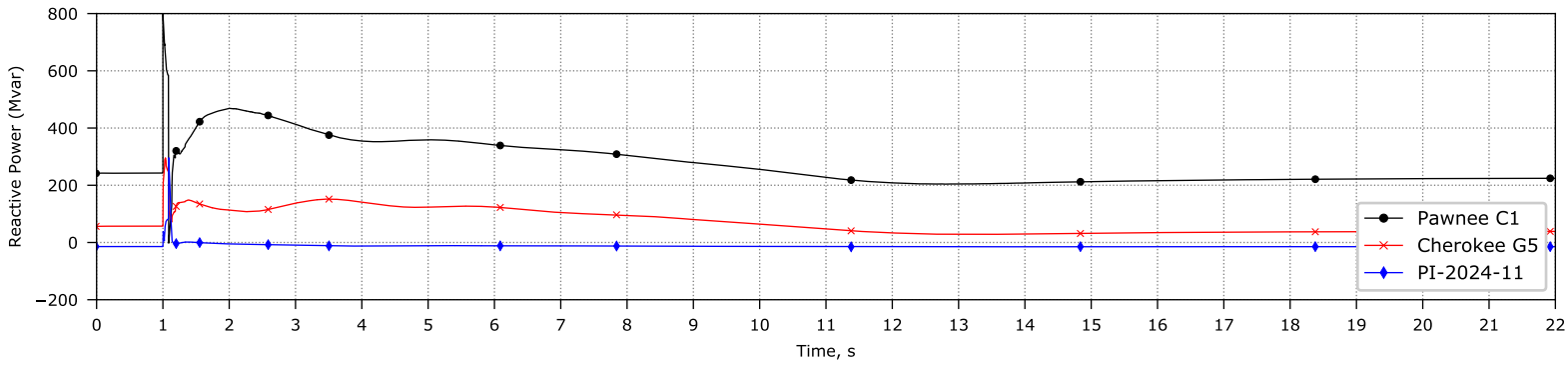


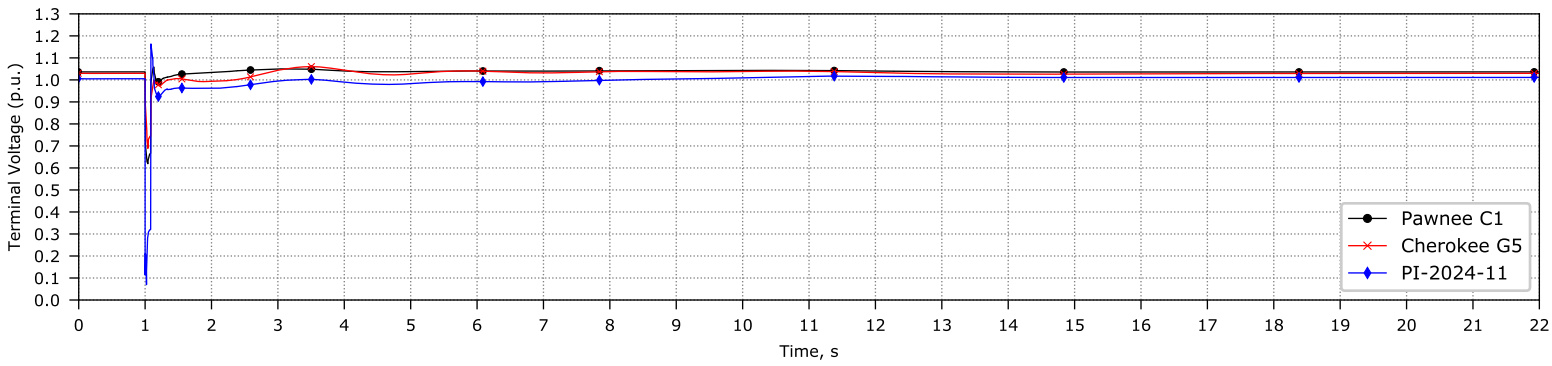


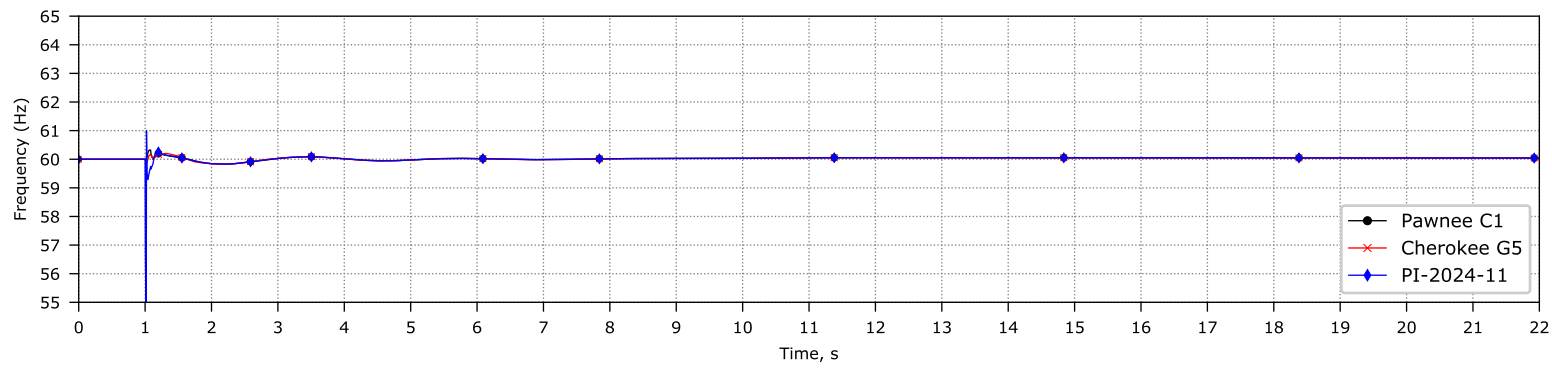
Ft-St-Vrain_Ft-Lupton_230kV

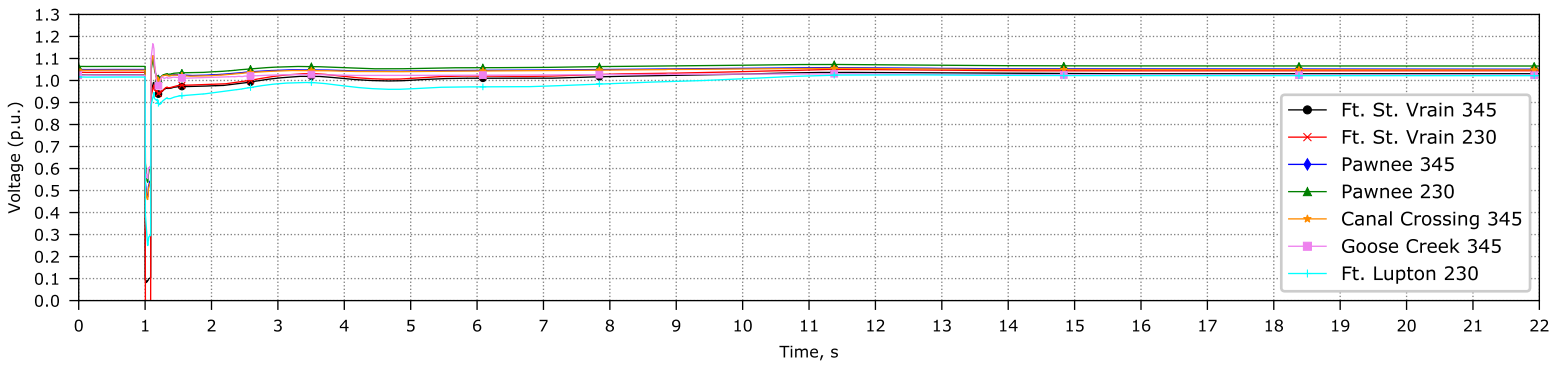




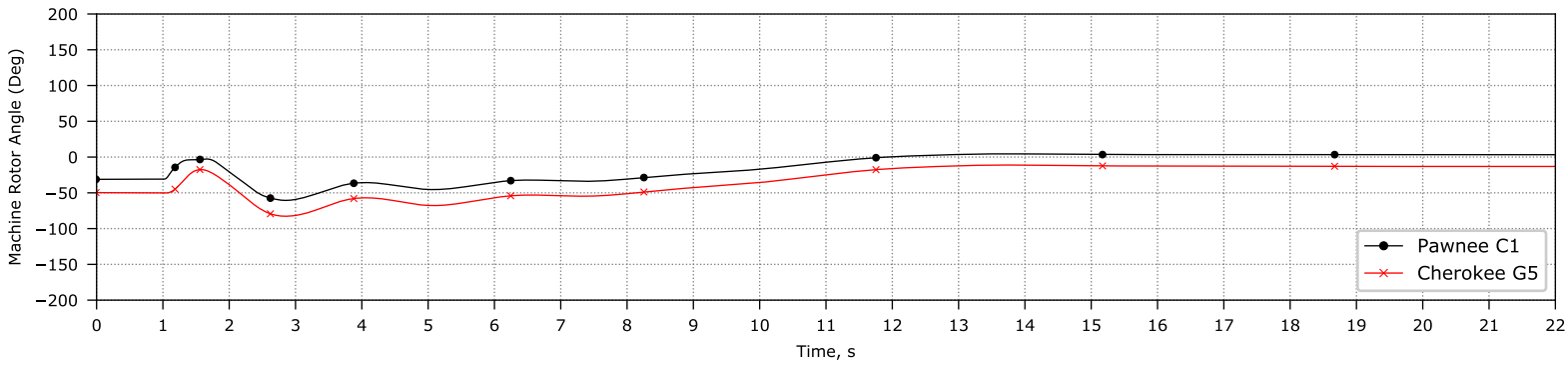


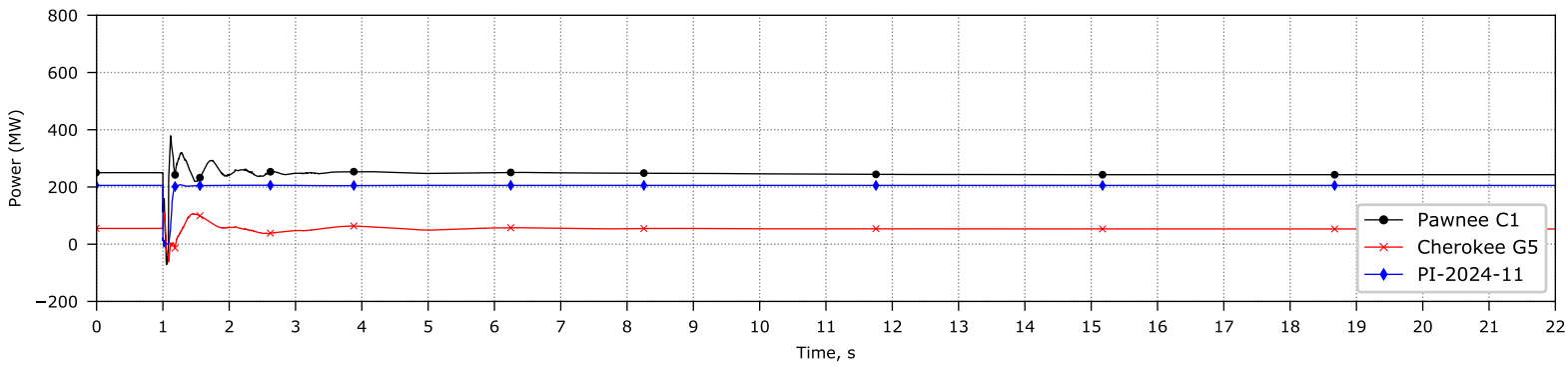


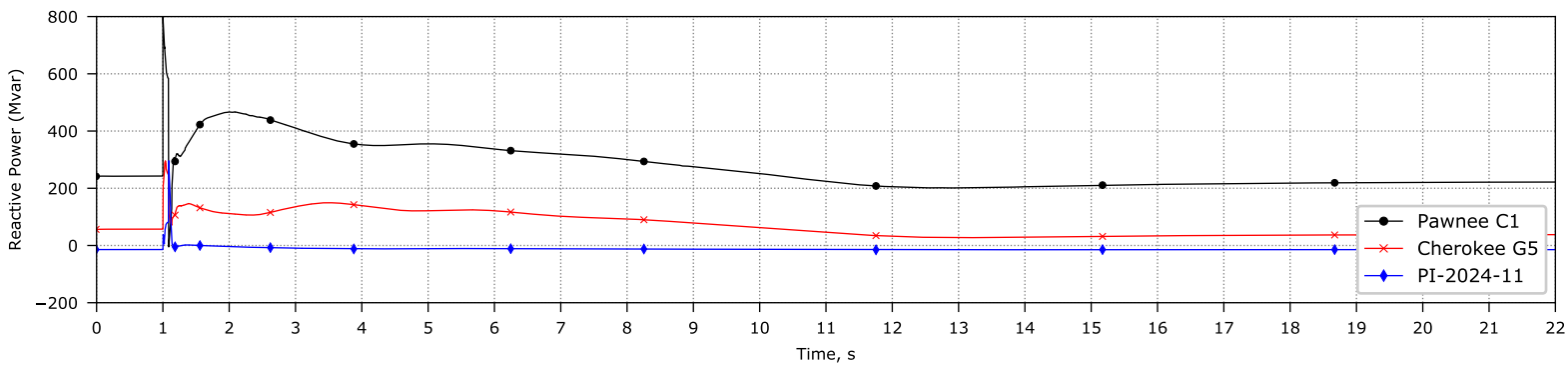


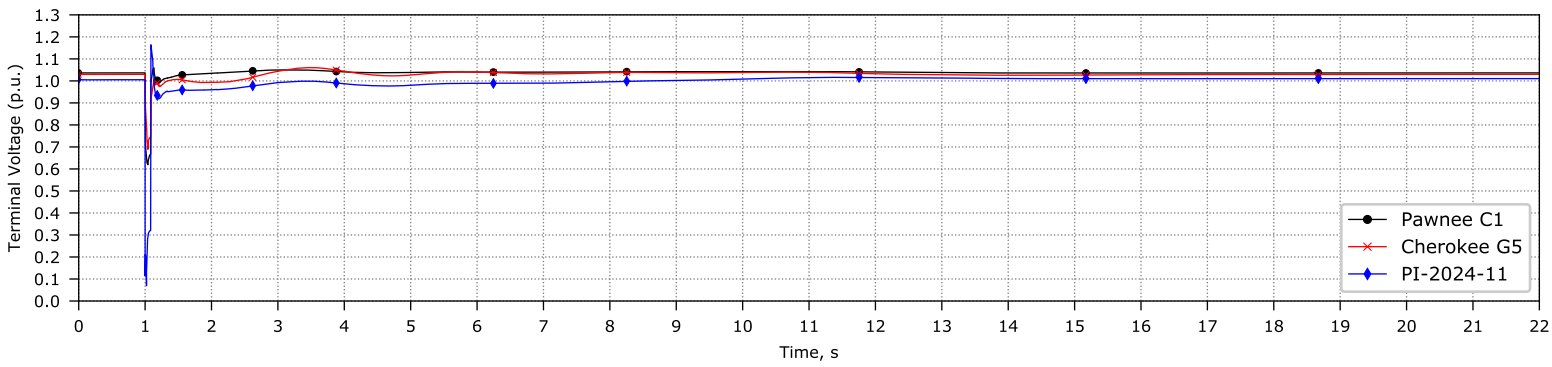


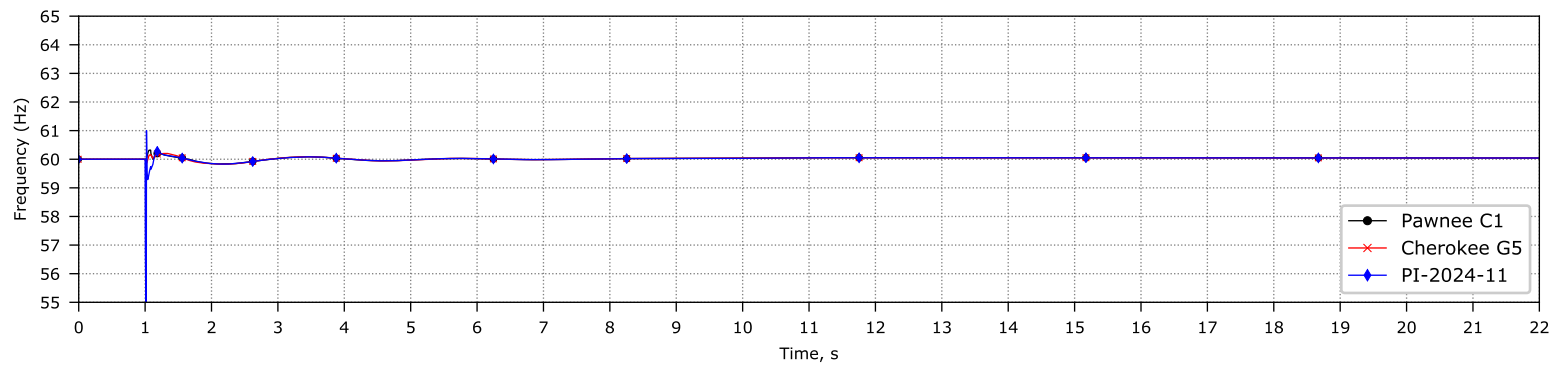
Ft-St-Vrain_Spindle_230kV

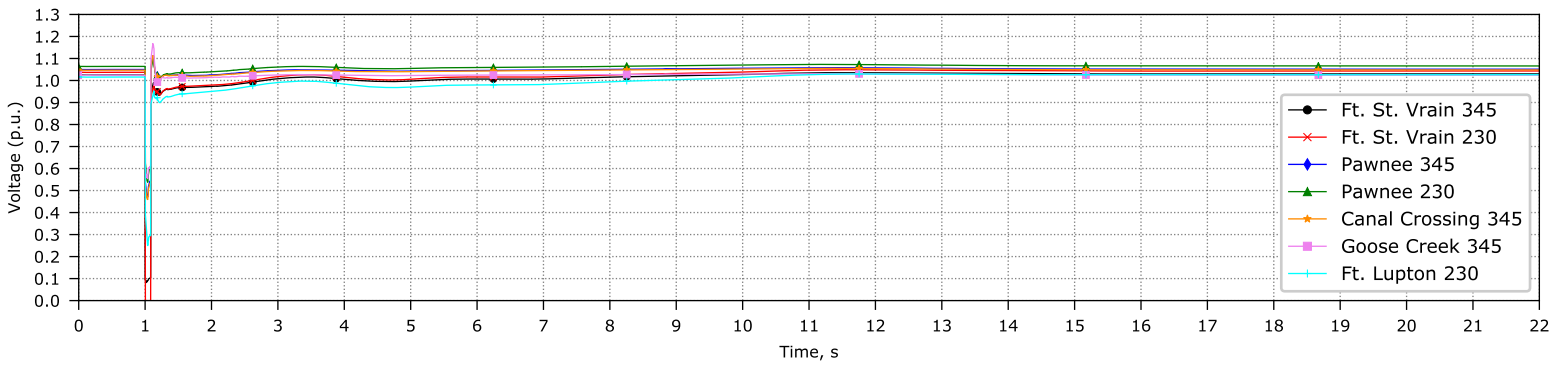




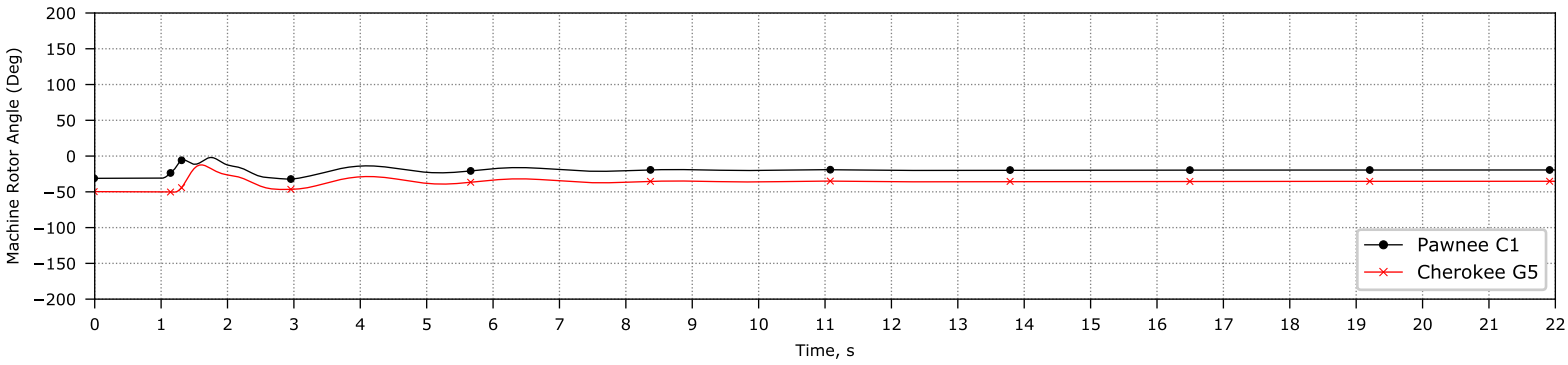


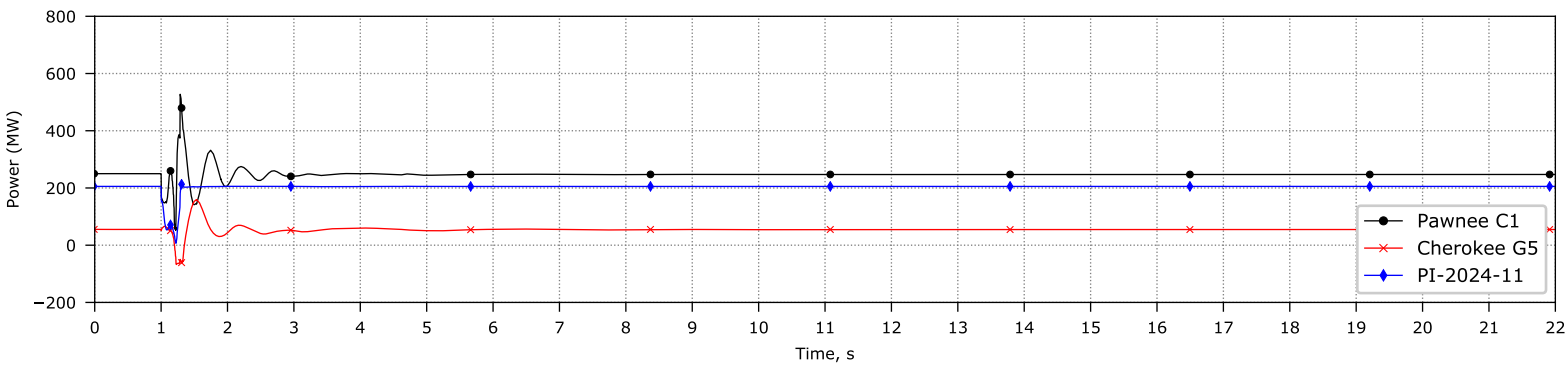


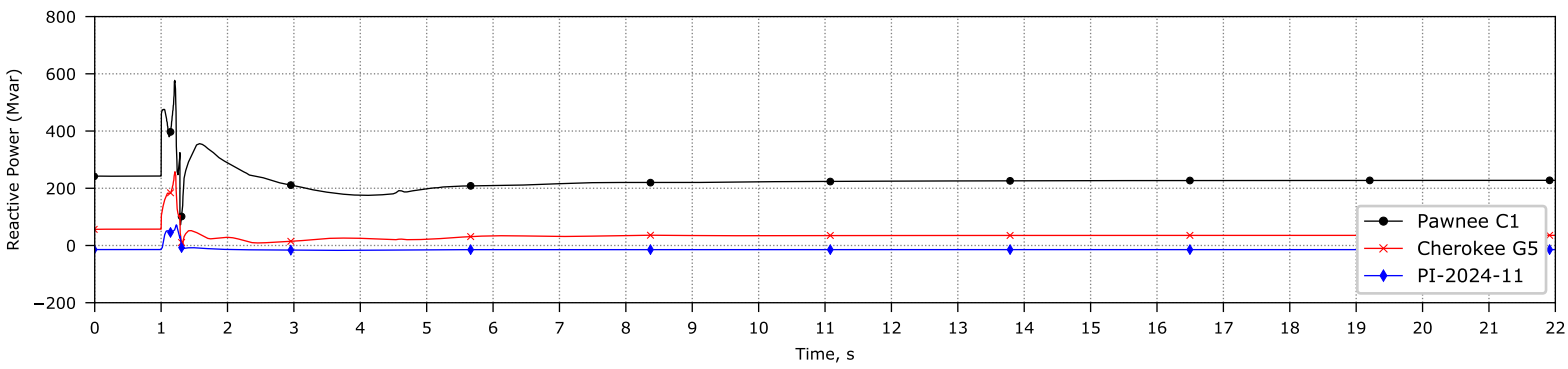


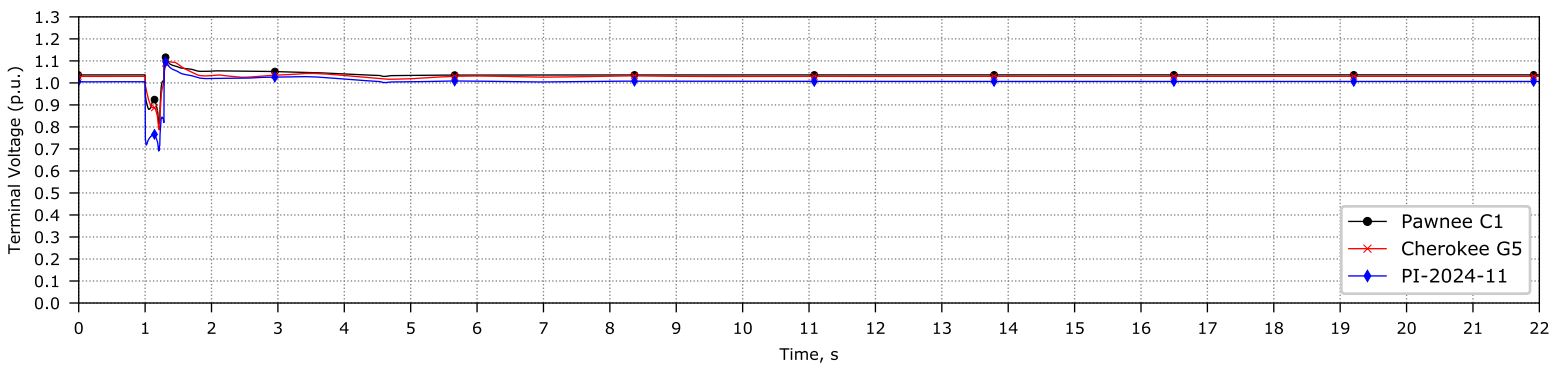


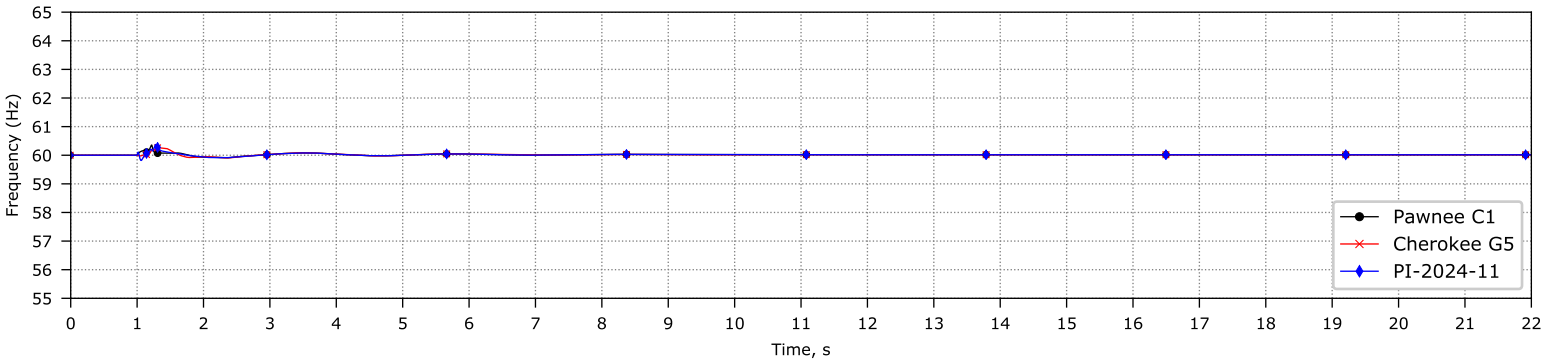
Ft-St-Vrain_Line-214

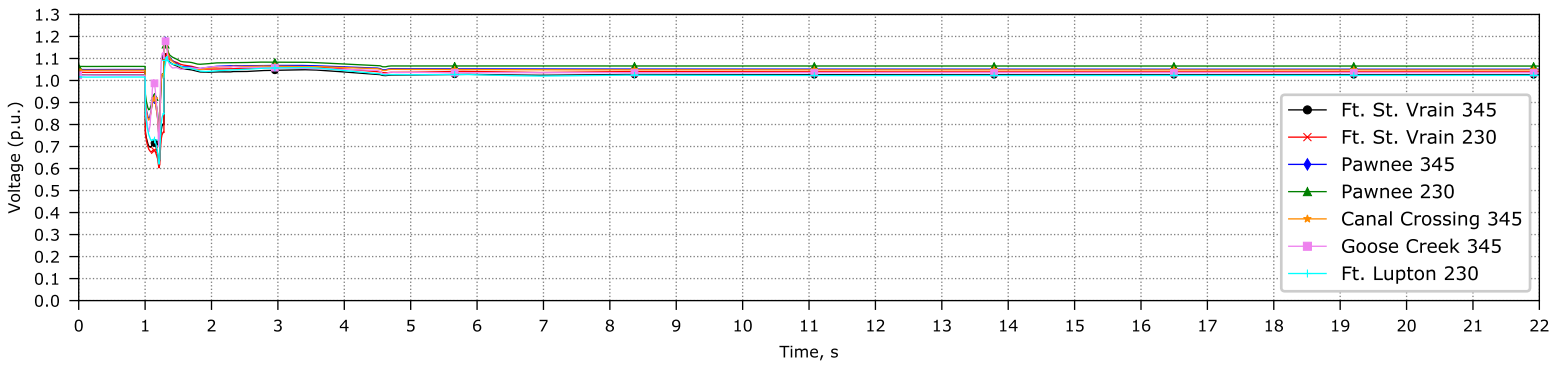




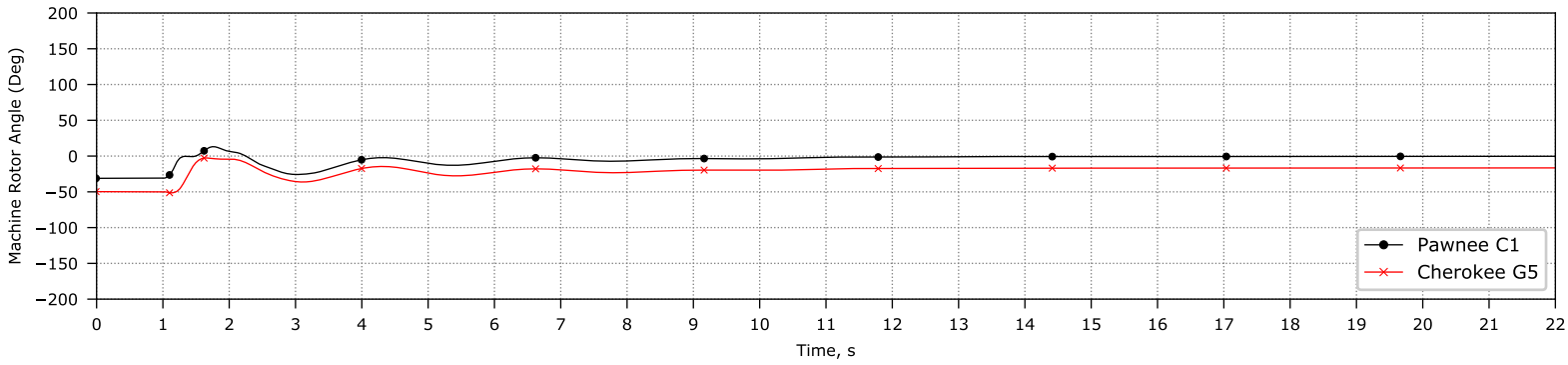


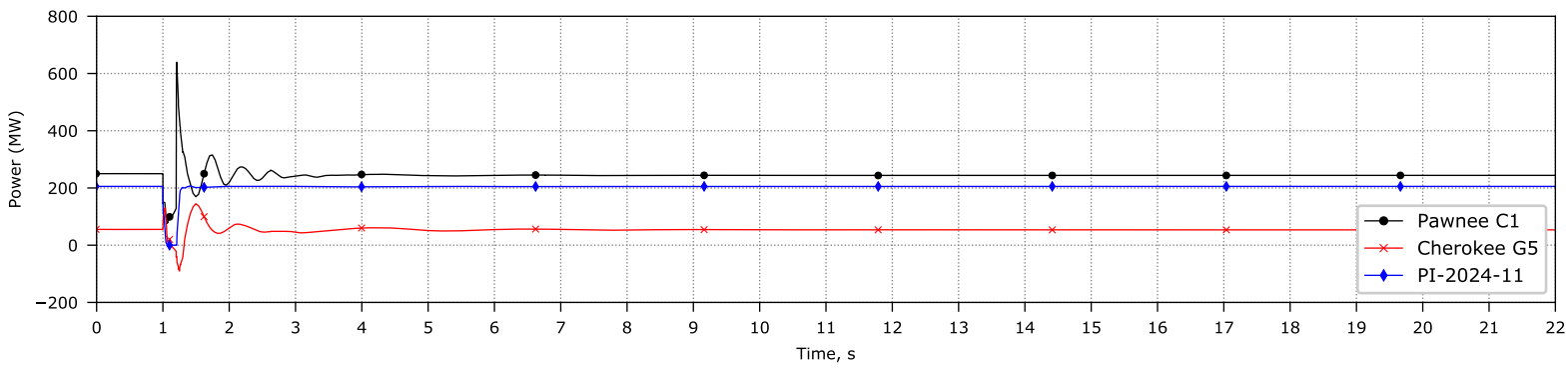


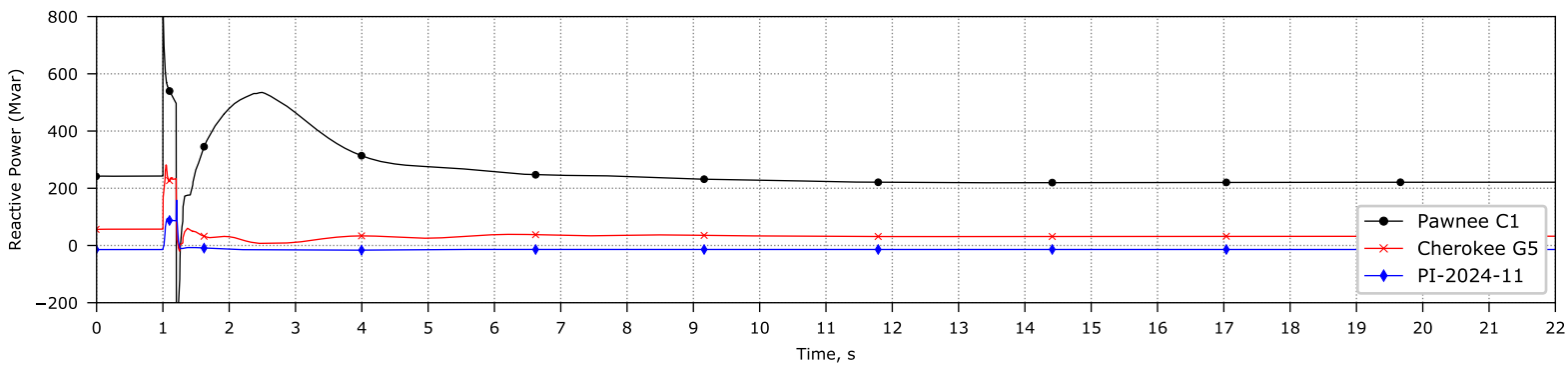


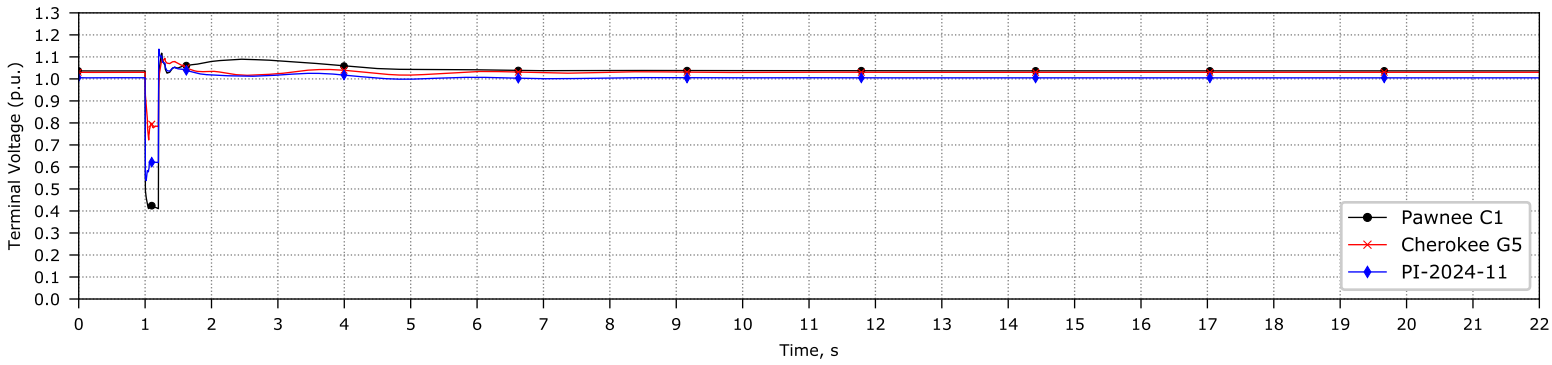


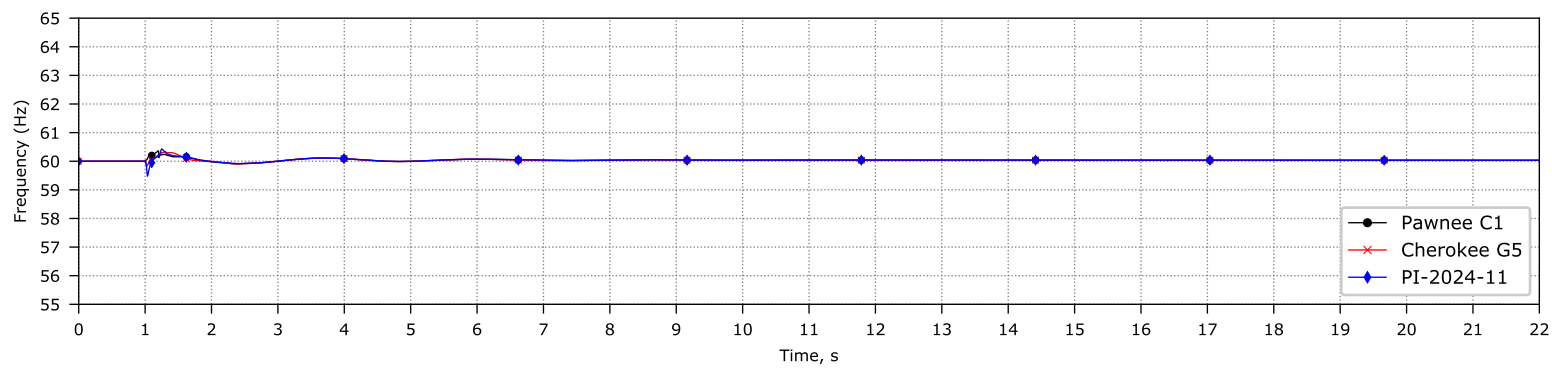
Canal-Crossing_7304

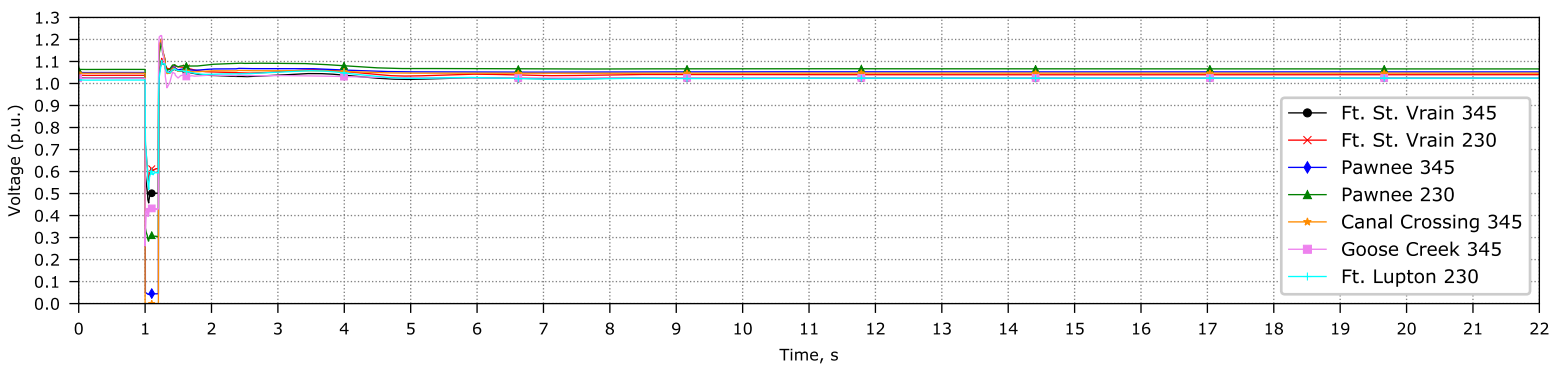




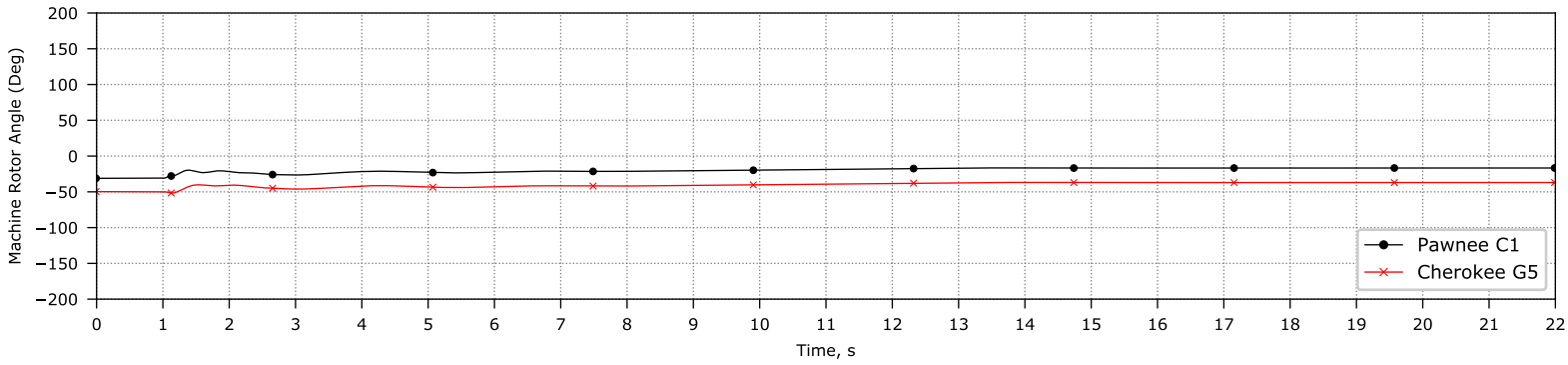


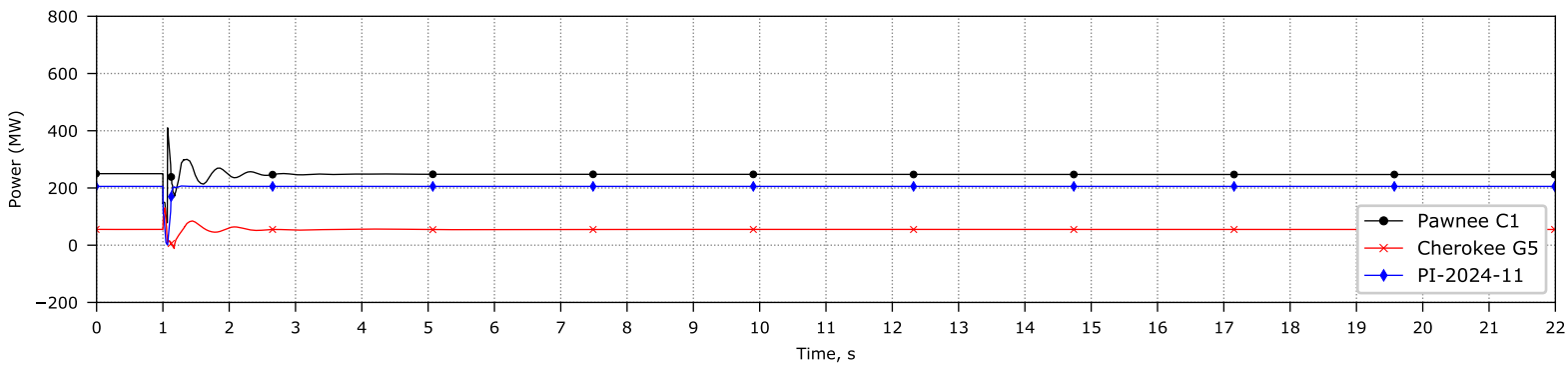


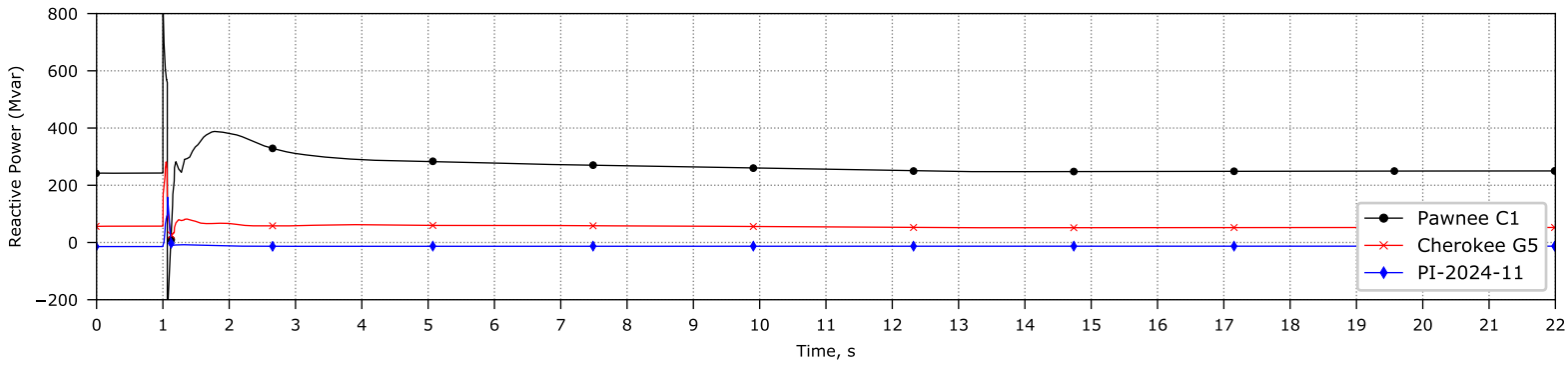


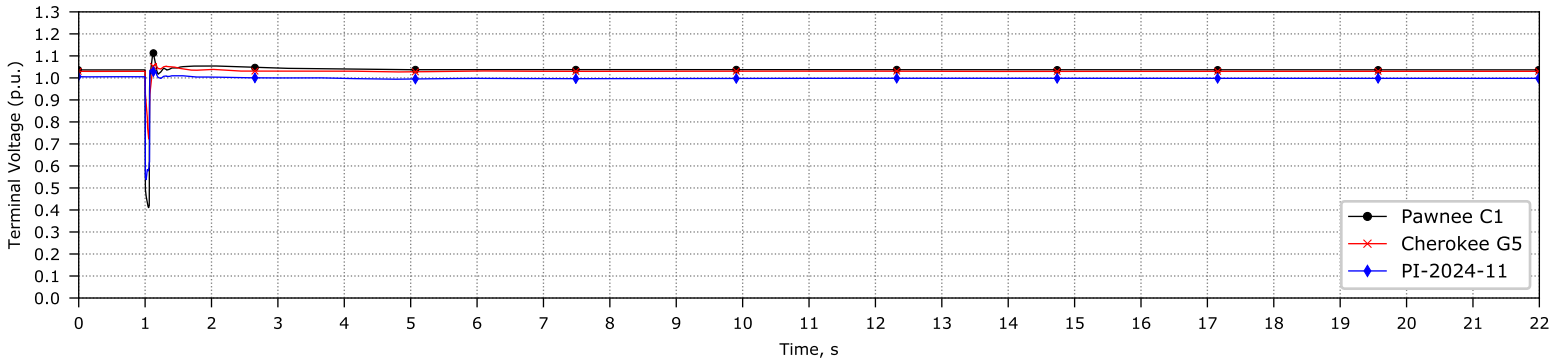


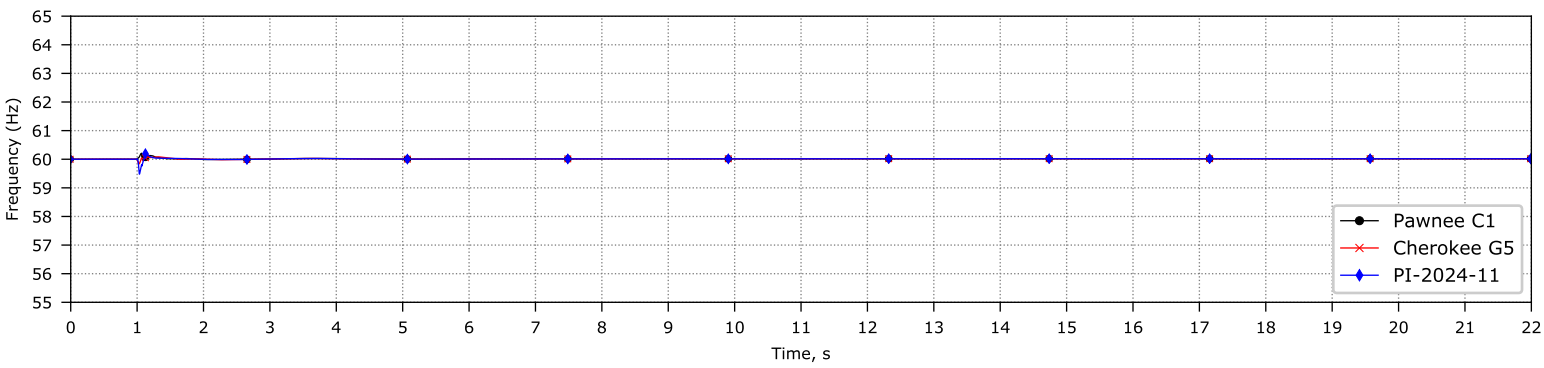
Canal-Crossing_Lines-7329-7297

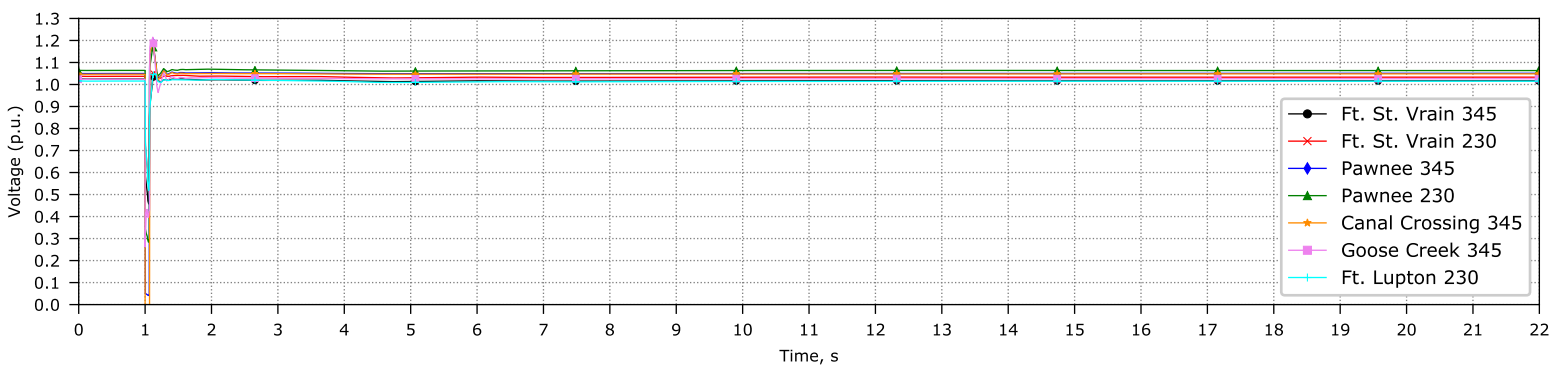




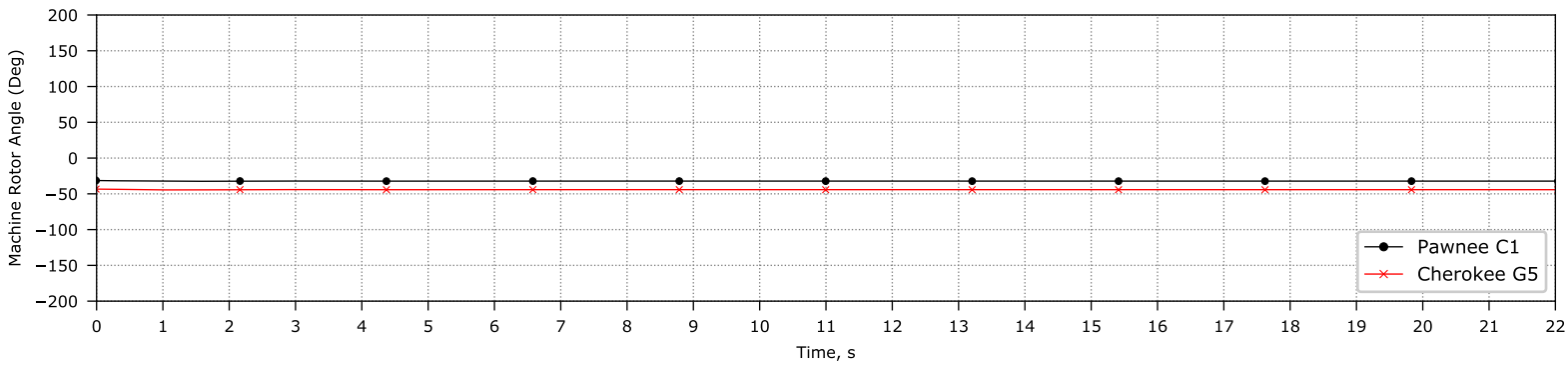


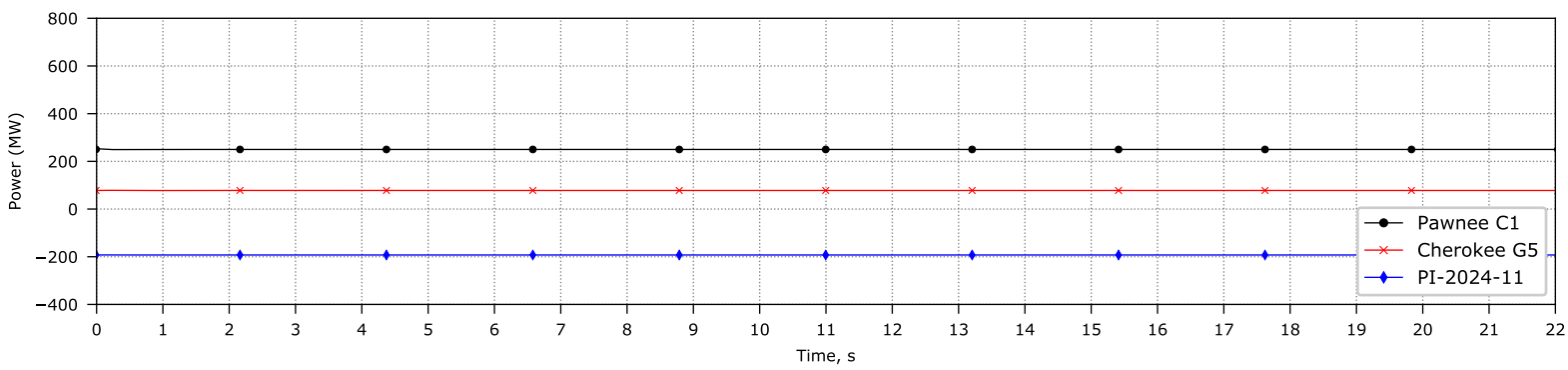


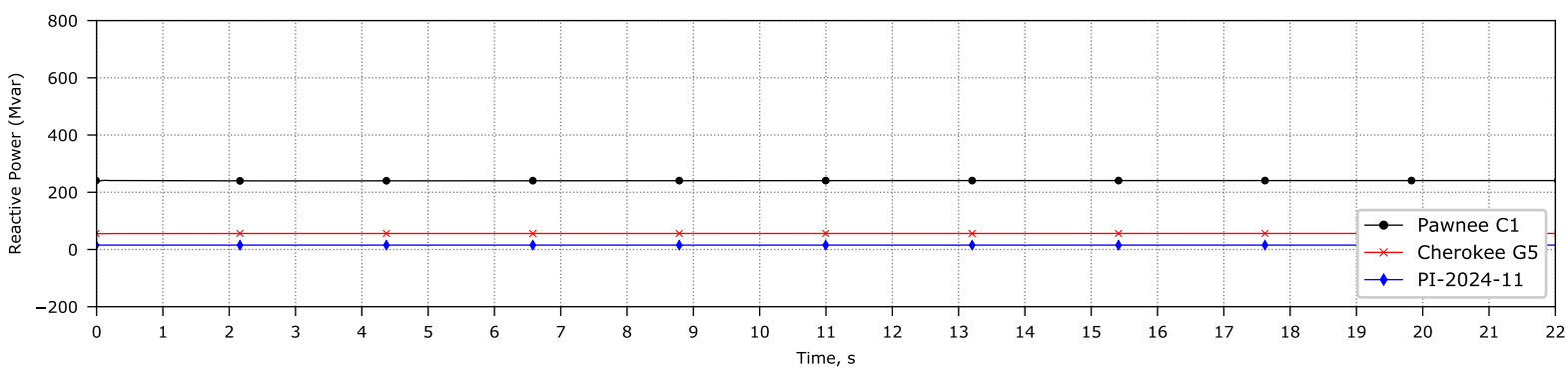


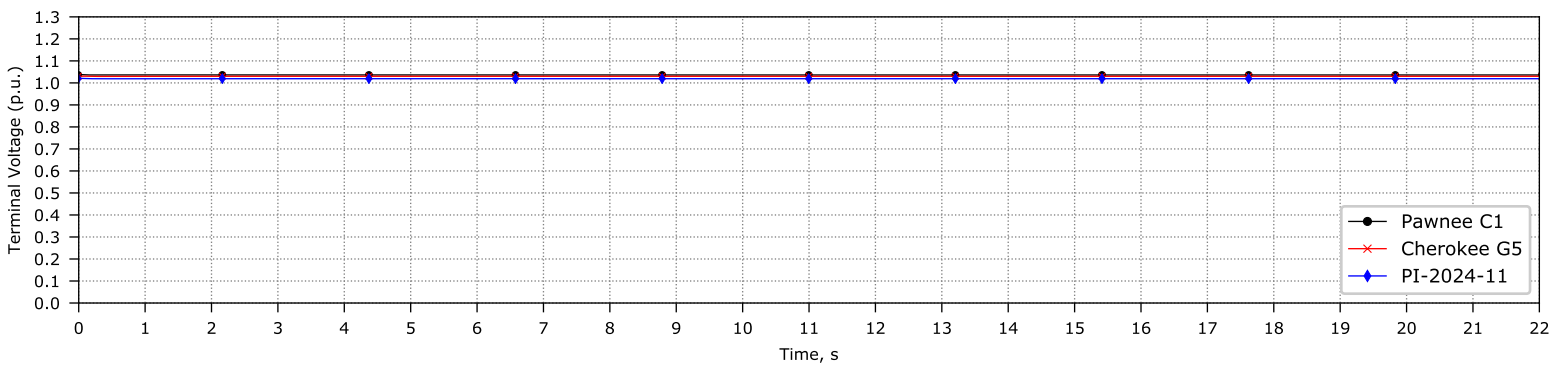


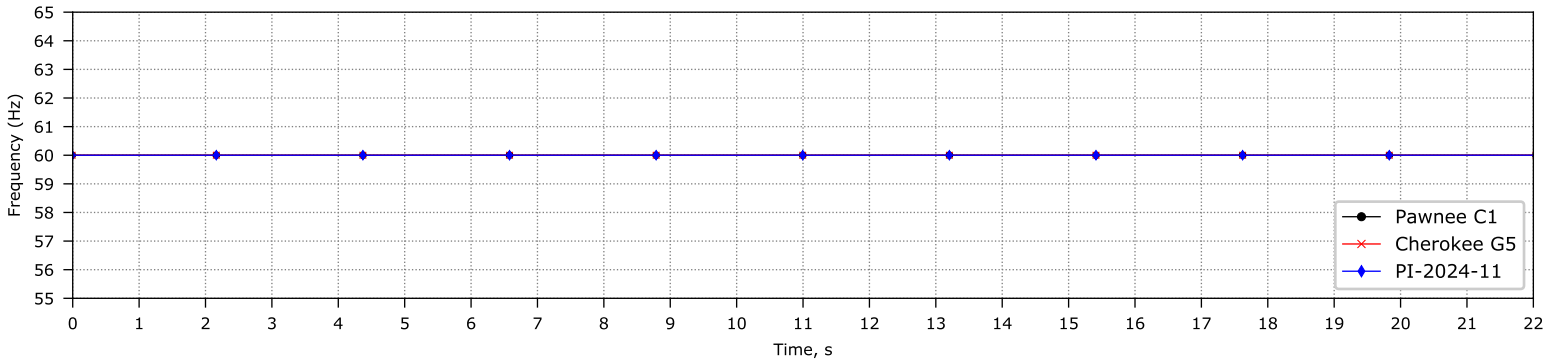
Flat Run

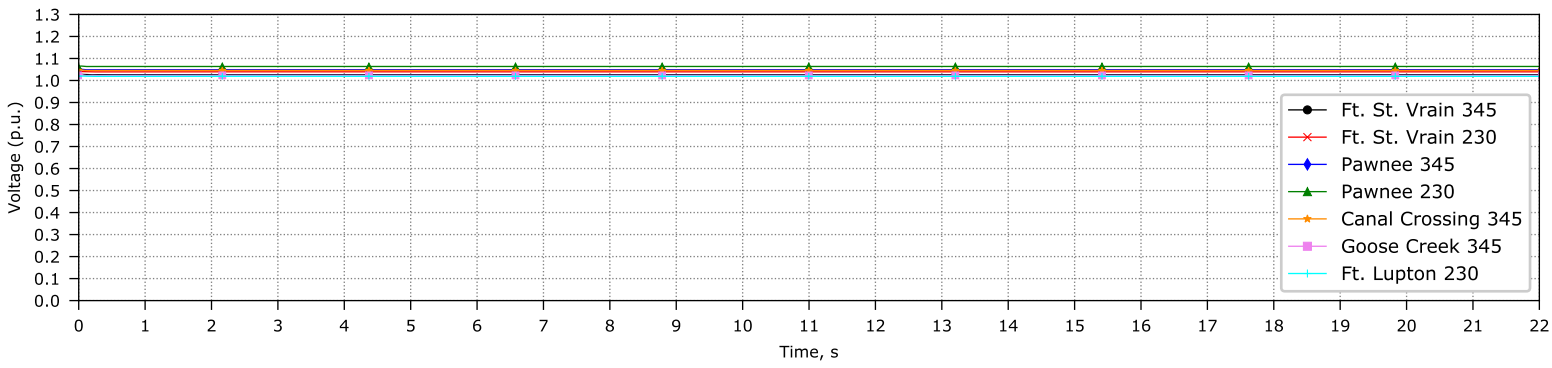

Machine Rotor Angle (Deg)
Time, s
Pawnee C1
Cherokee G5


Power (MW)
Time, s
Pawnee C1
Cherokee G5
PI-2024-11

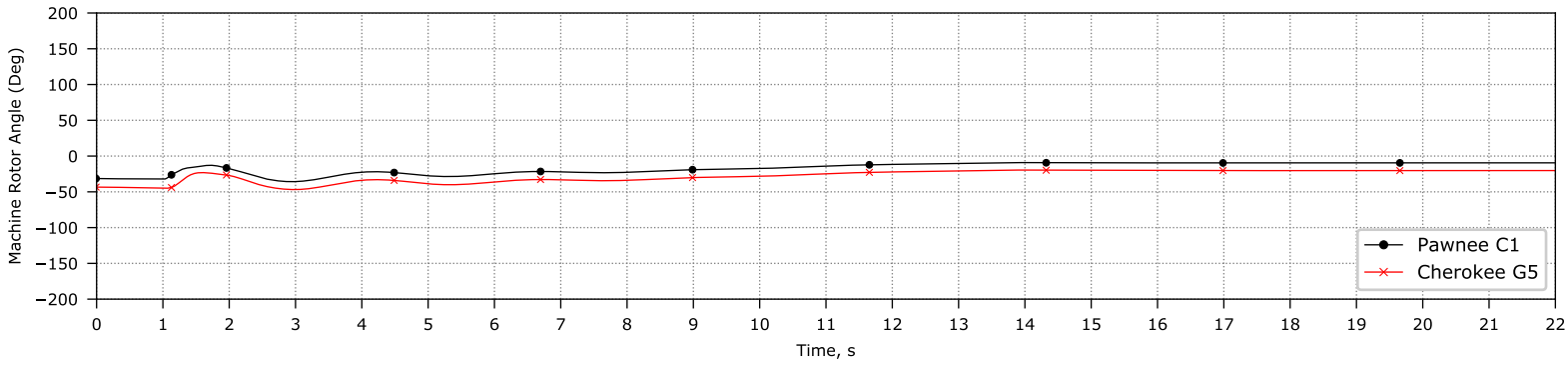

Reactive Power (Mvar)
Time, s
Pawnee C1
Cherokee G5
PI-2024-11

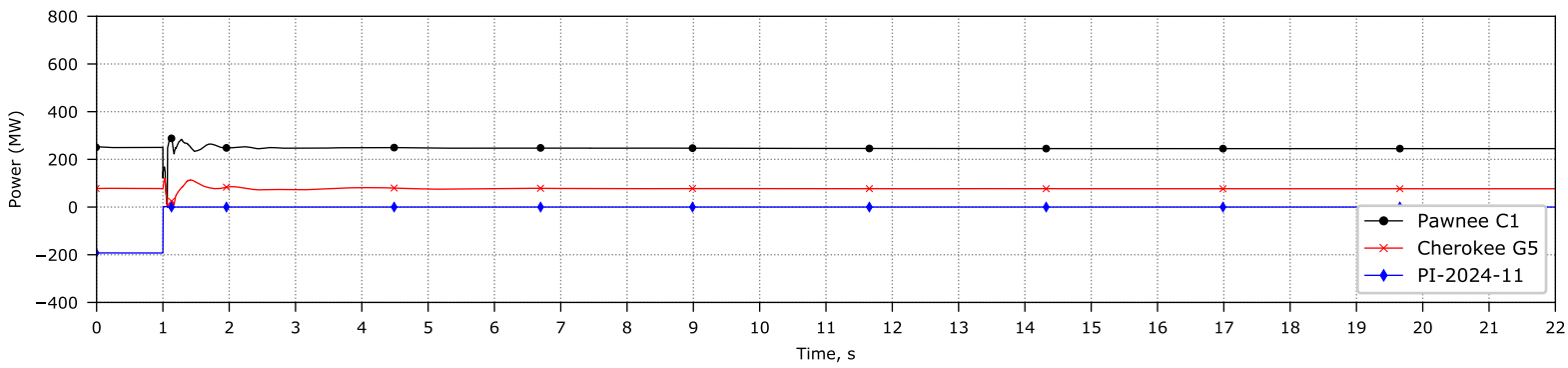

Terminal Voltage (p.u.)
Time, s
Pawnee C1
Cherokee G5
PI-2024-11

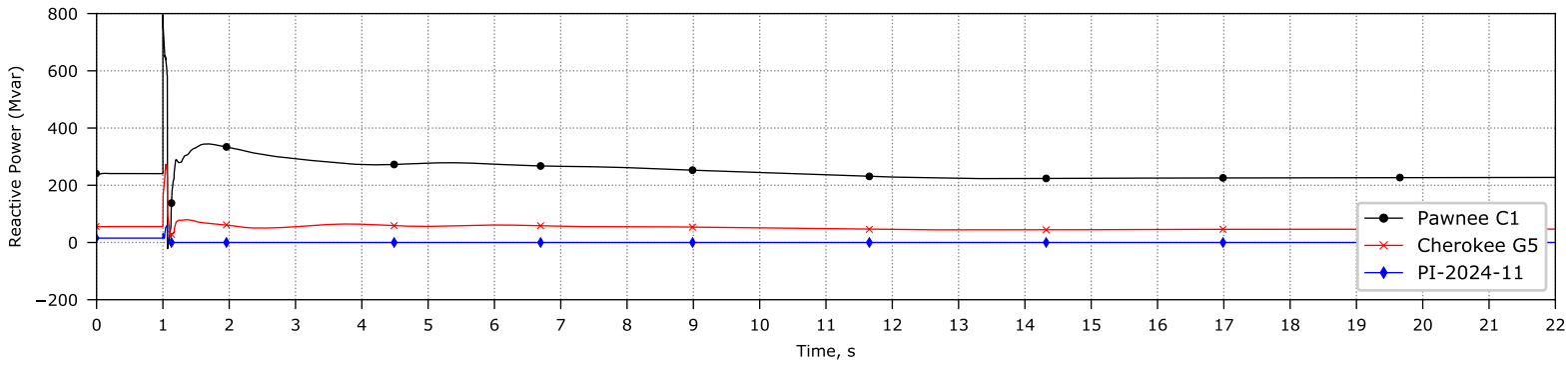

Frequency (Hz)
Time, s
Pawnee C1
Cherokee G5
PI-2024-11

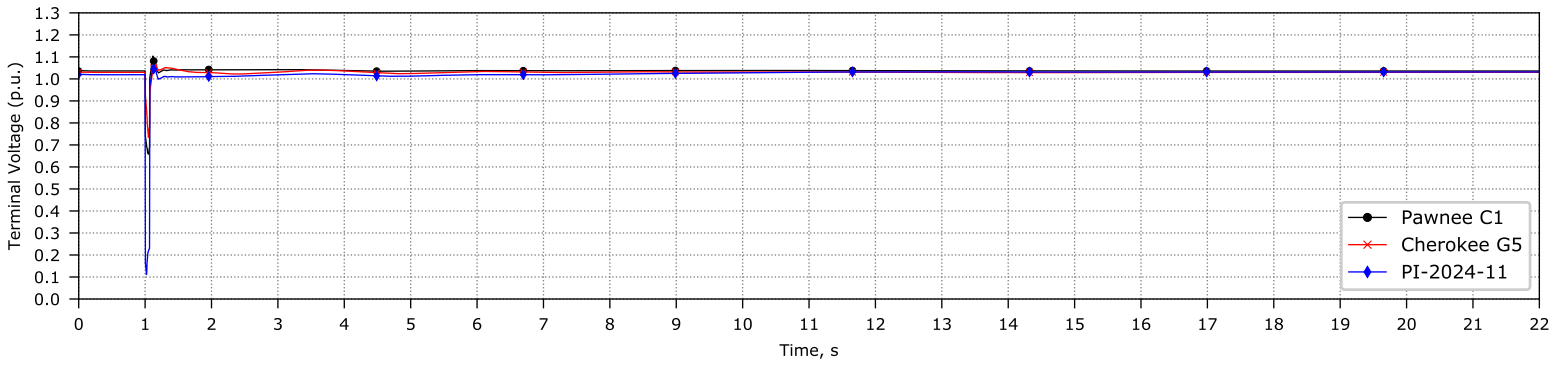

Voltage (p.u.)
Time, s
Ft. St. Vrain 345
Ft. St. Vrain 230
Pawnee 345
Pawnee 230
Canal Crossing 345
Goose Creek 345
Ft. Lupton 230

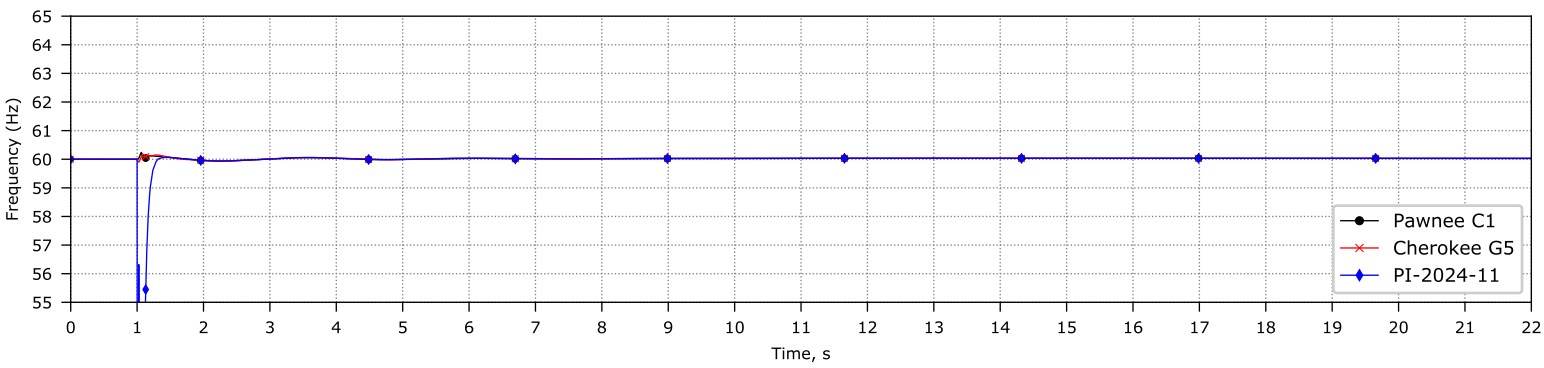
PI-2024-11_Gen

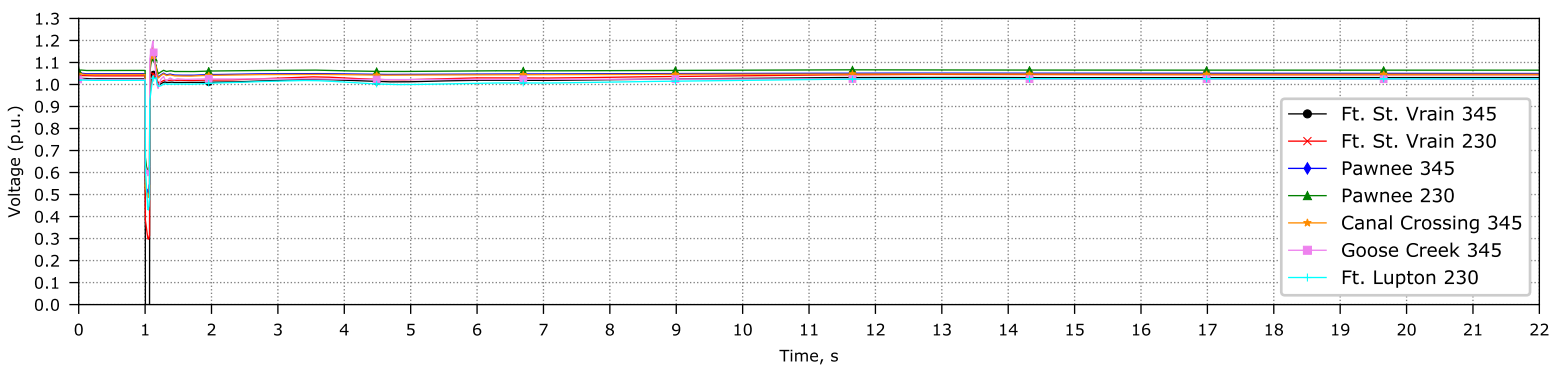




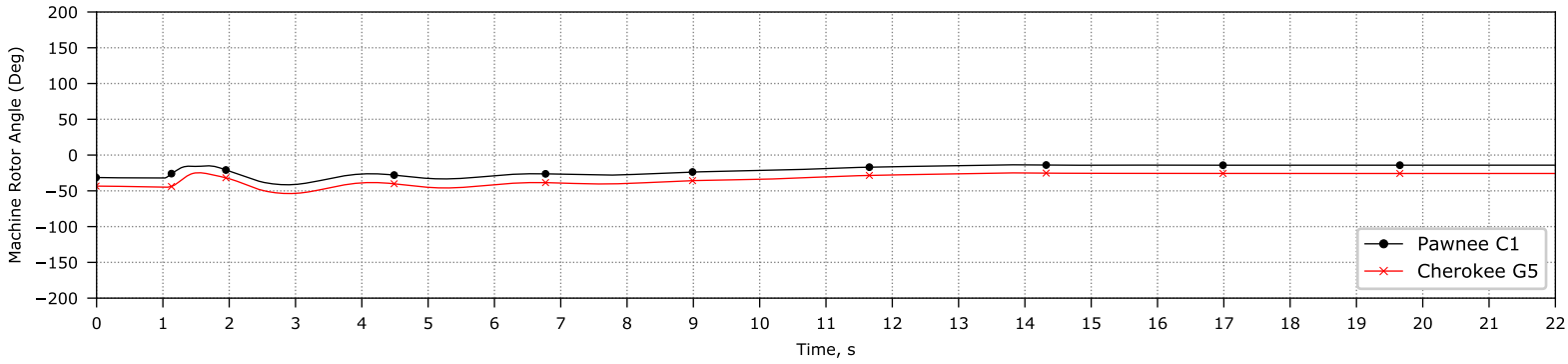


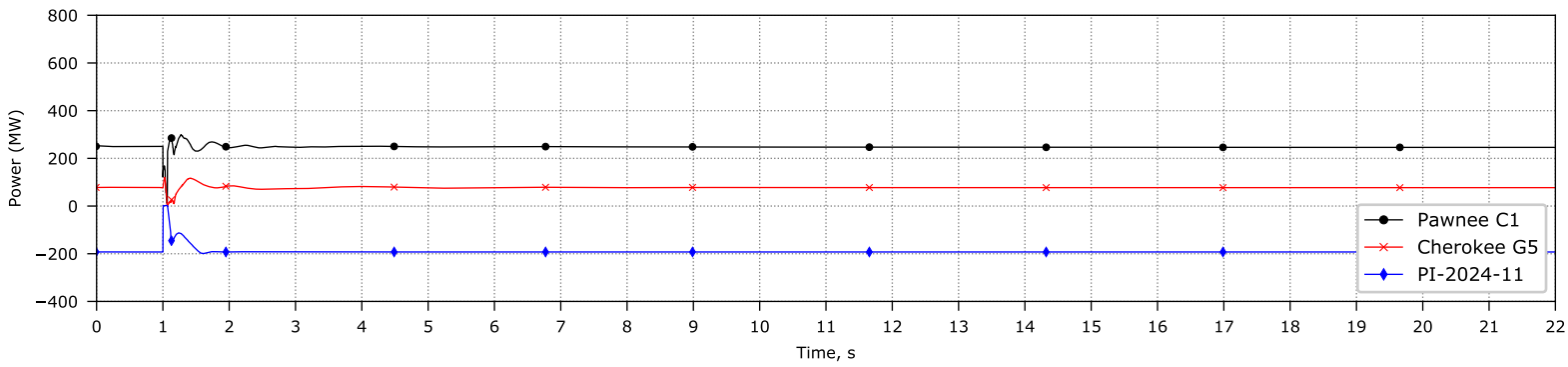


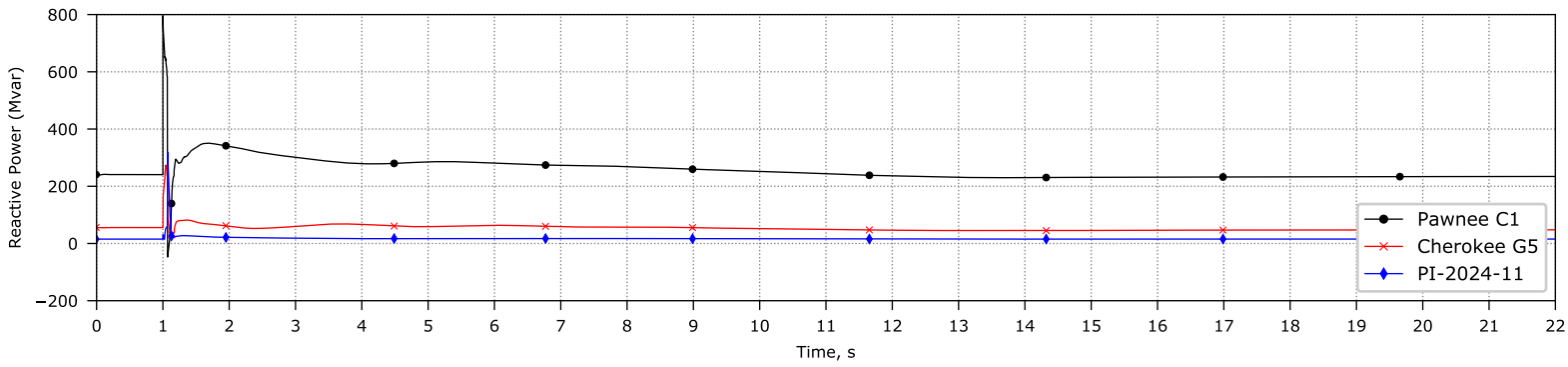


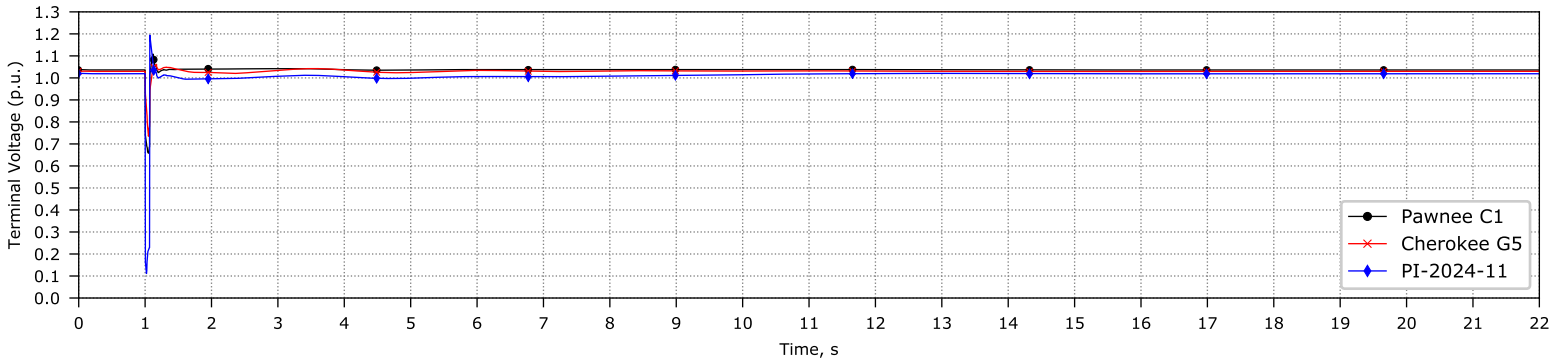


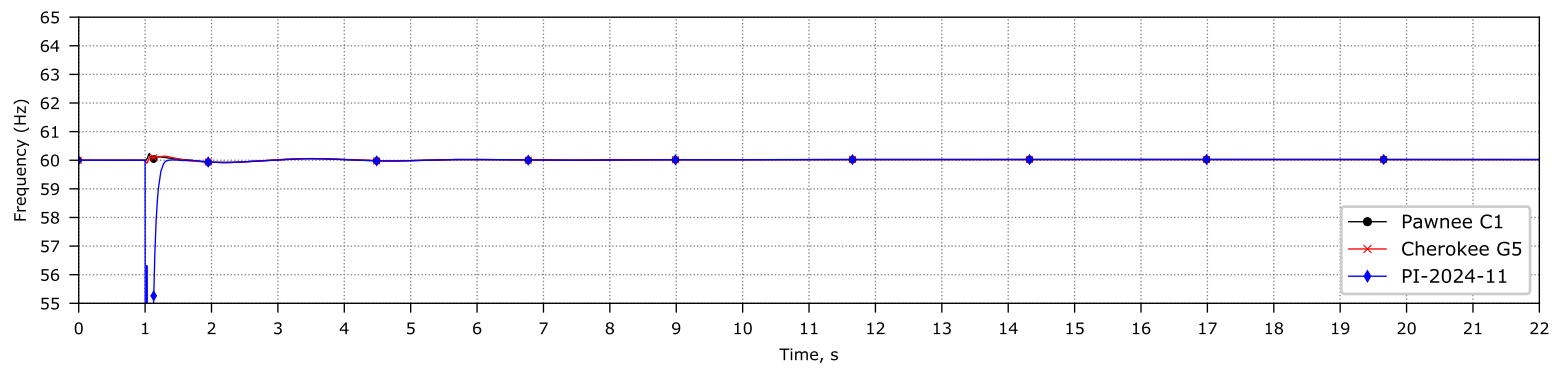
Ft-St-Vrain_Canal-Crossing_345kV

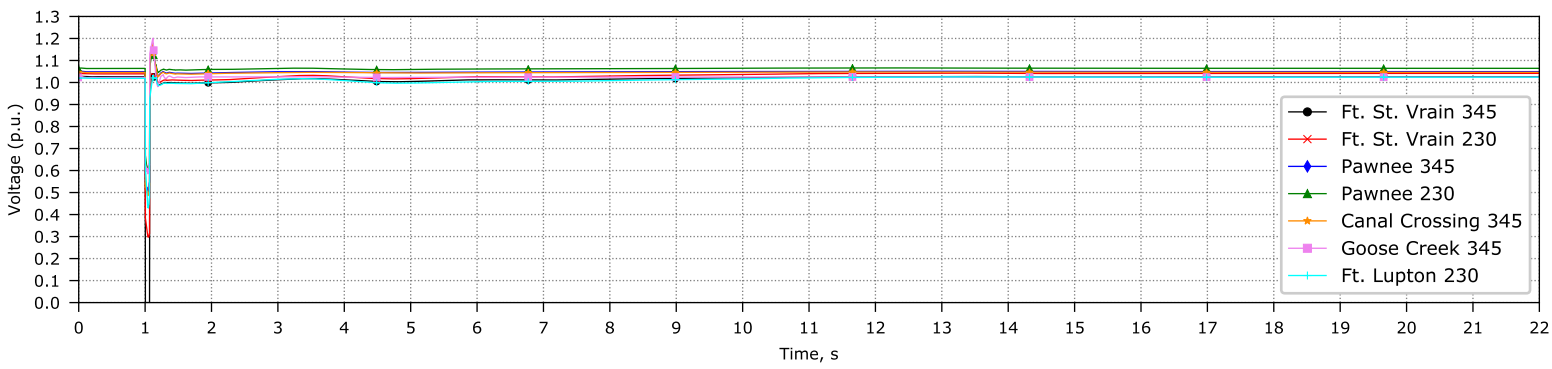




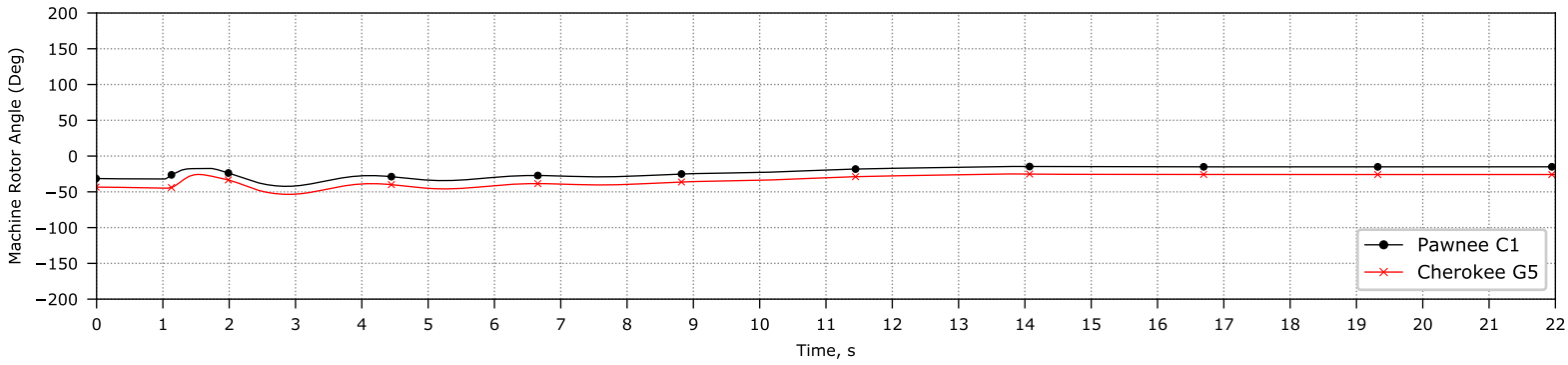


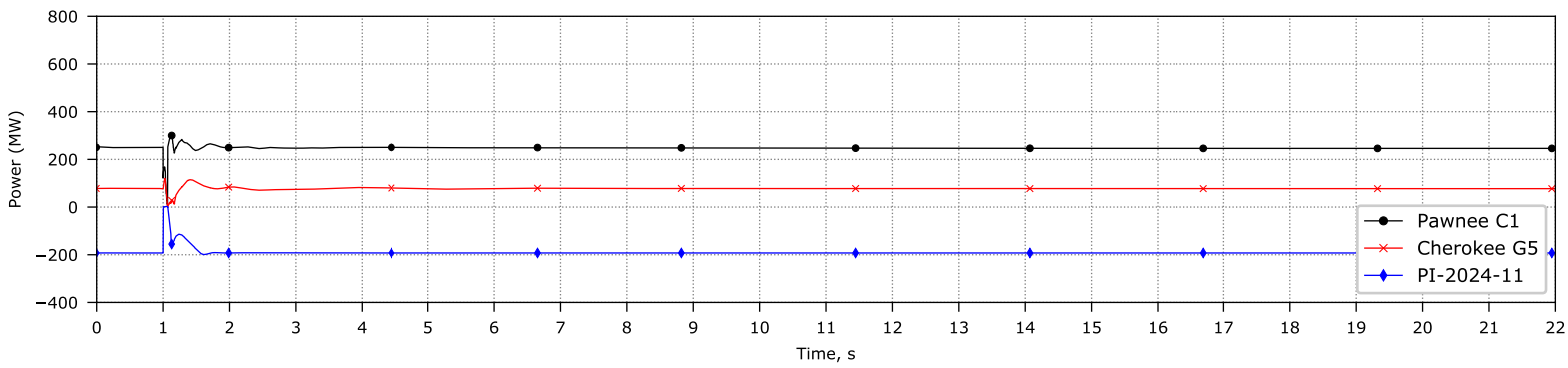


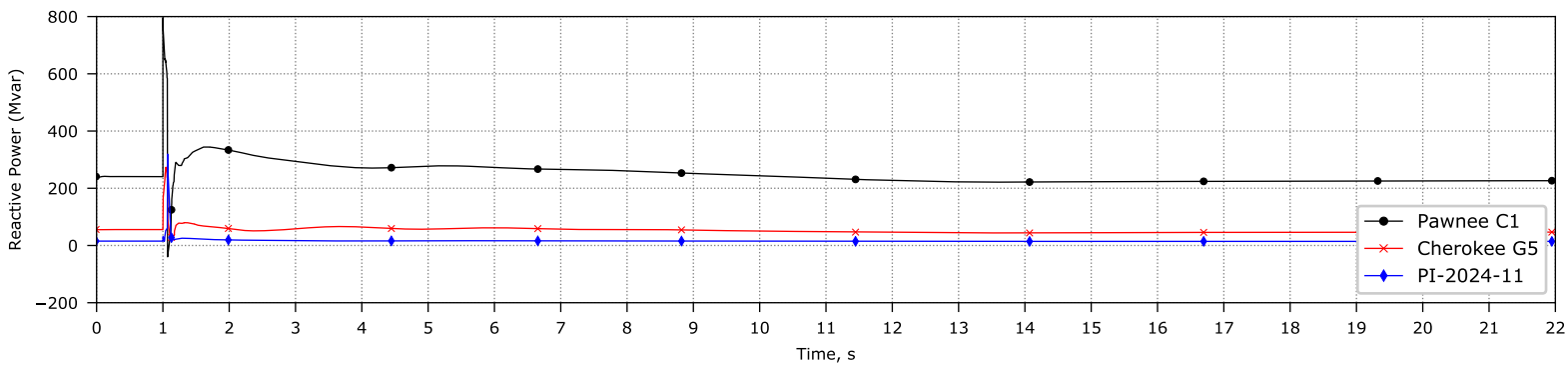


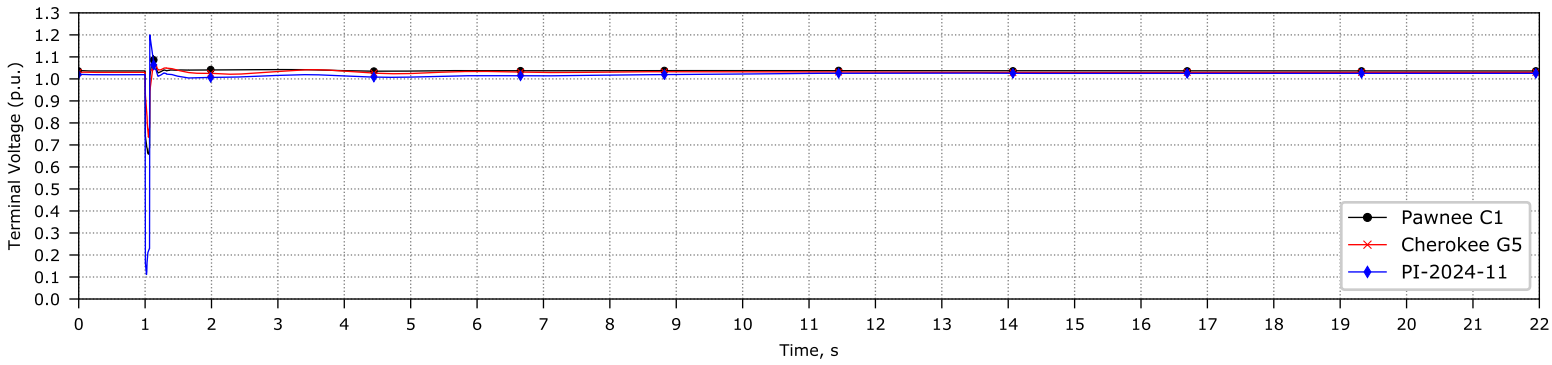


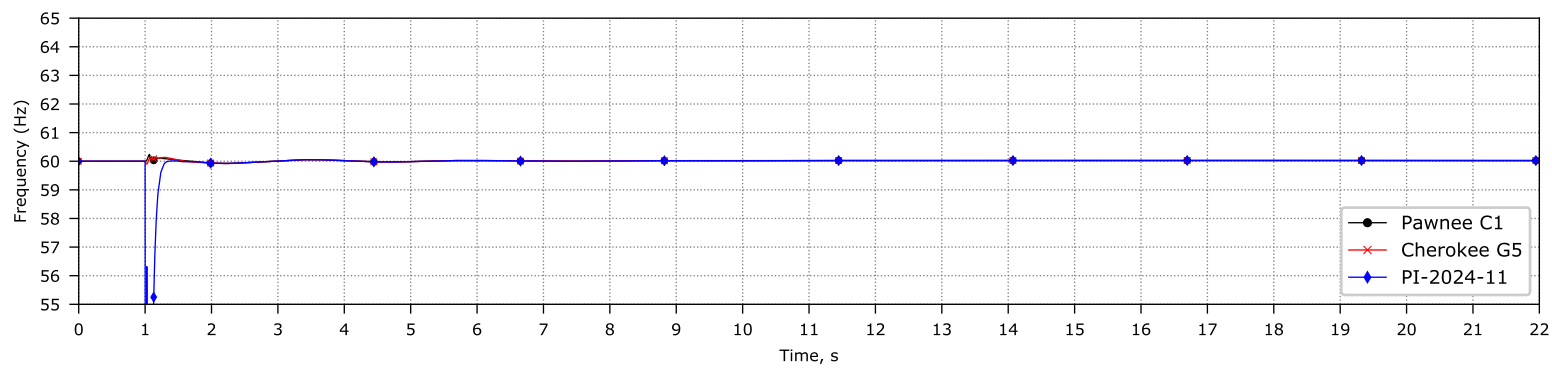
Ft-St-Vrain_230-345kV

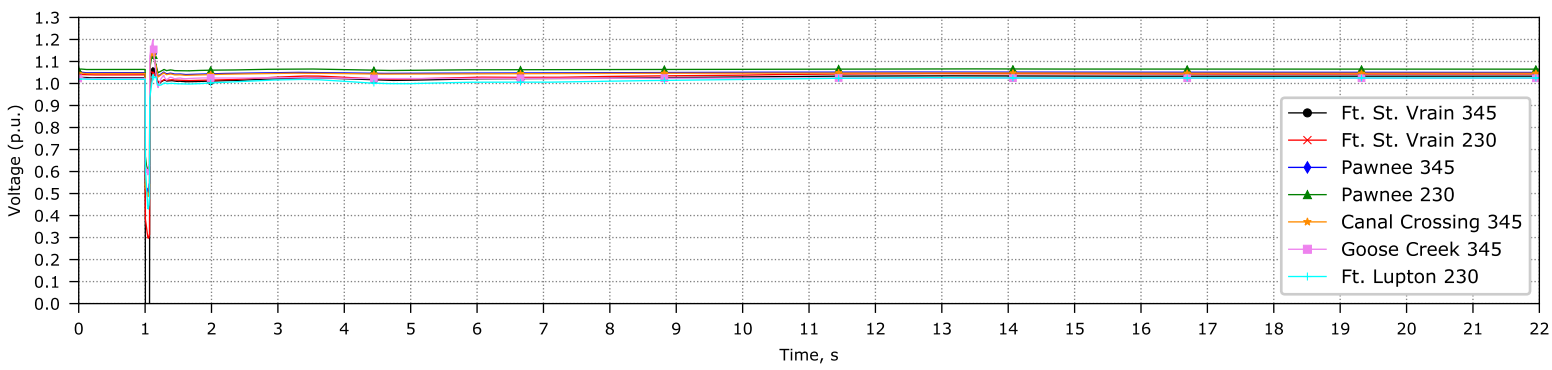




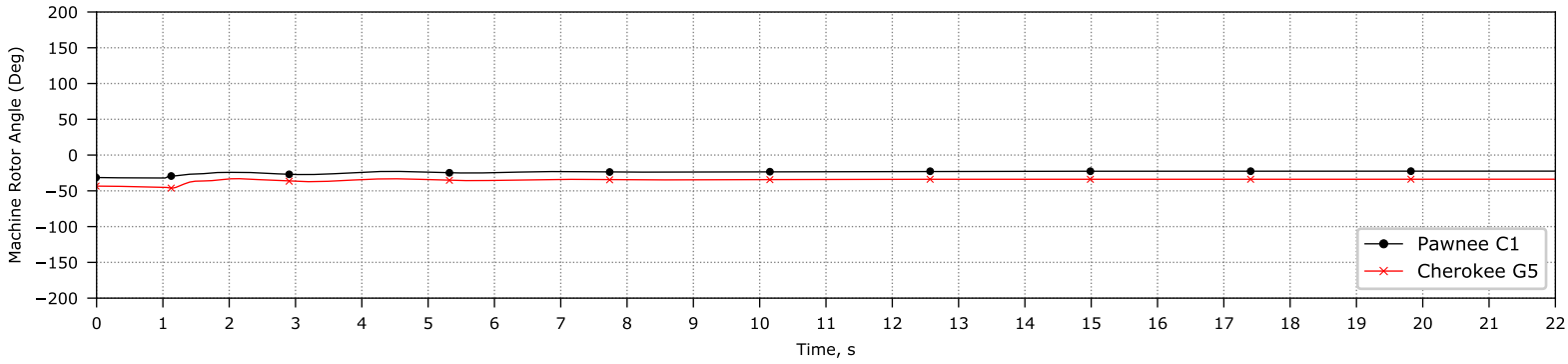


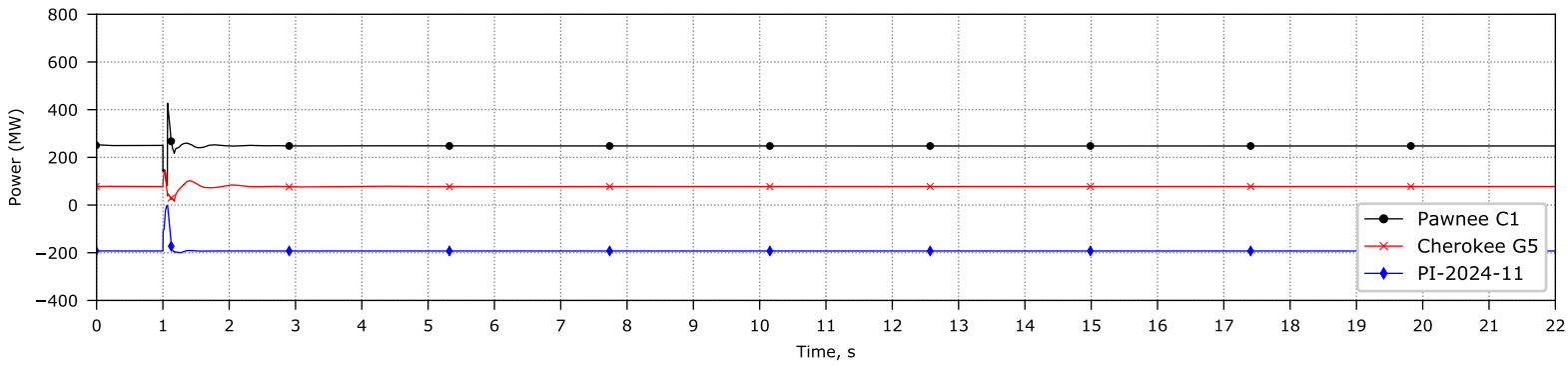


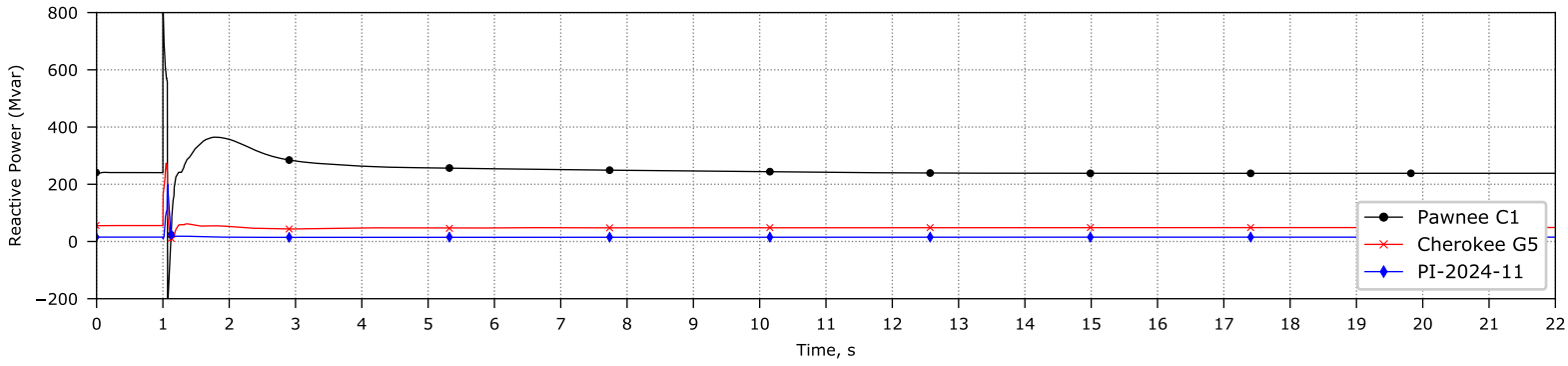


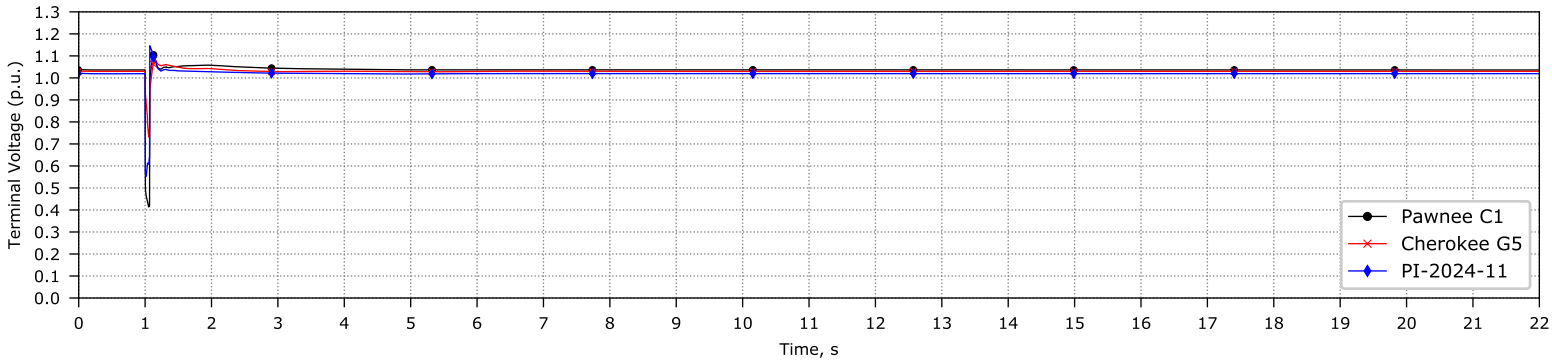


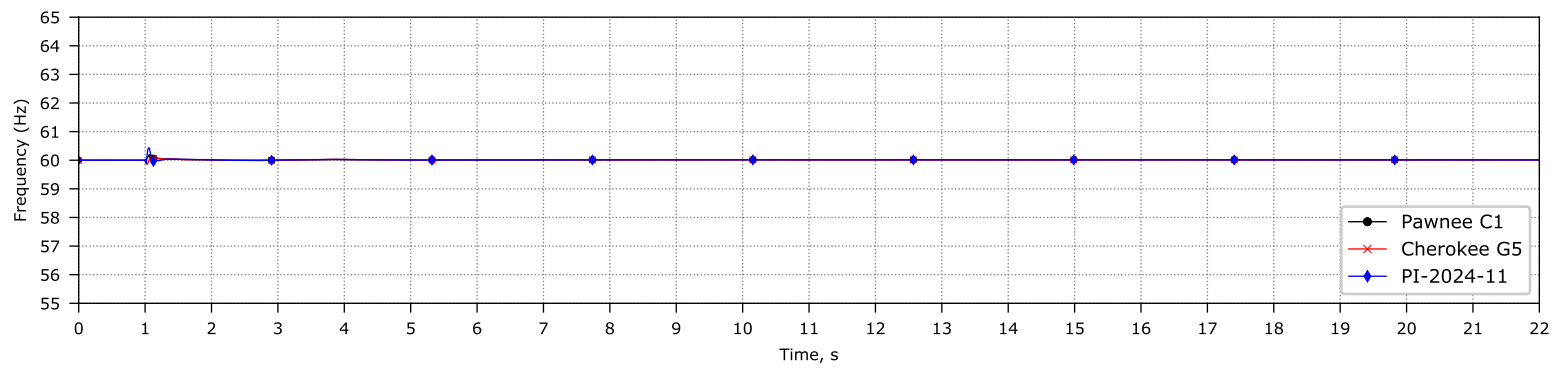
Canal-Crossing_Missile-Site_345kV

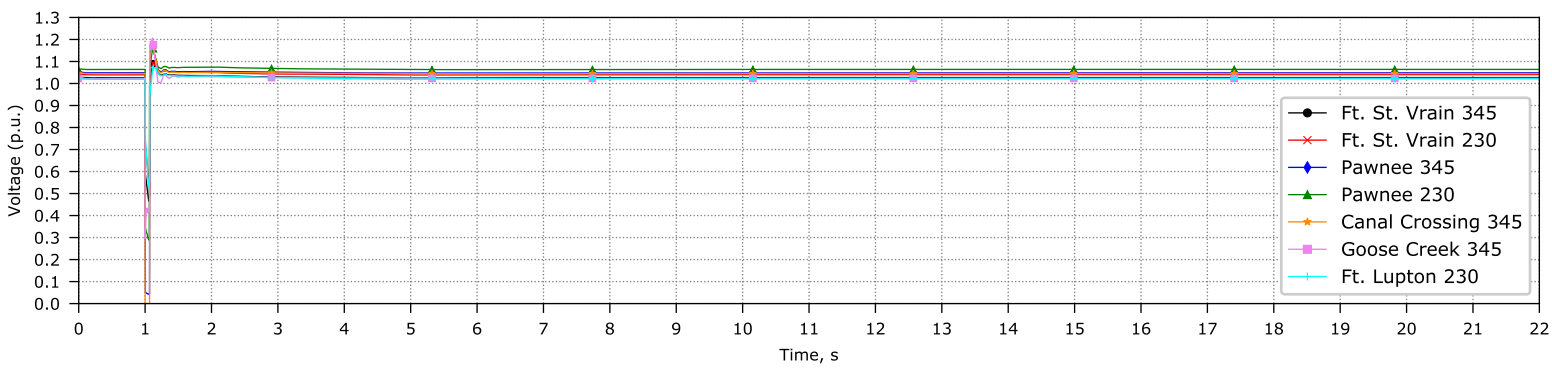




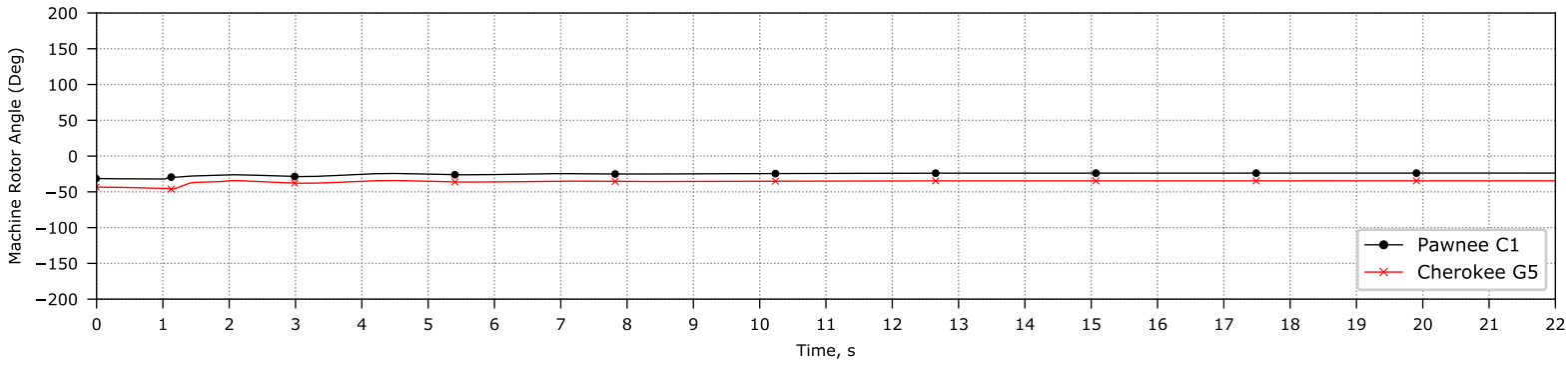


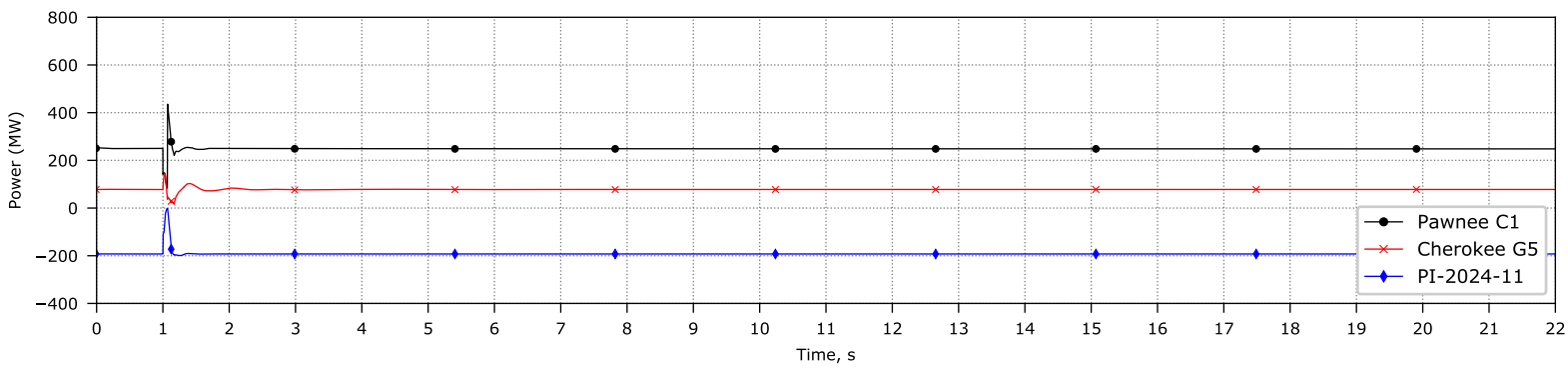


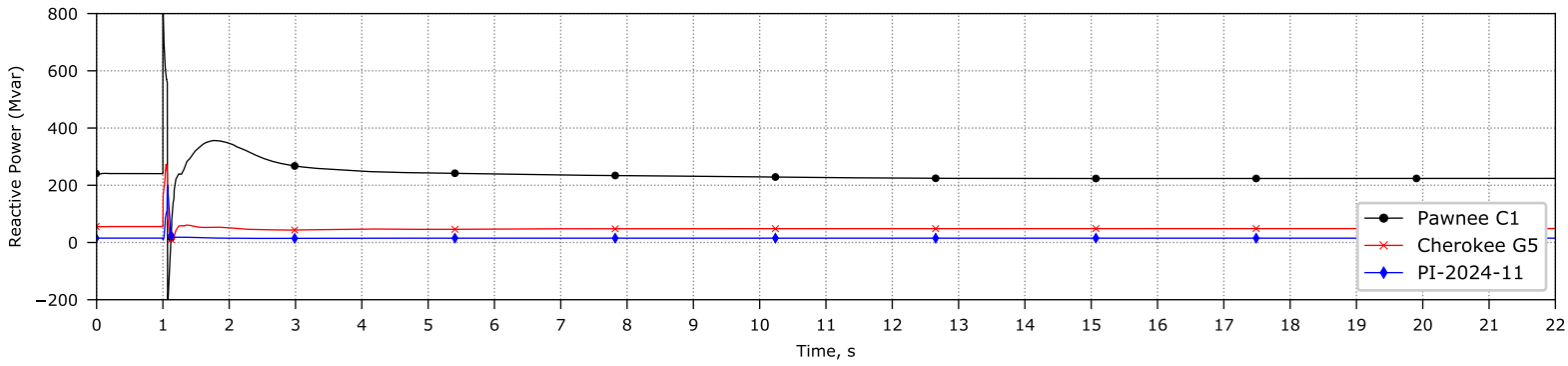


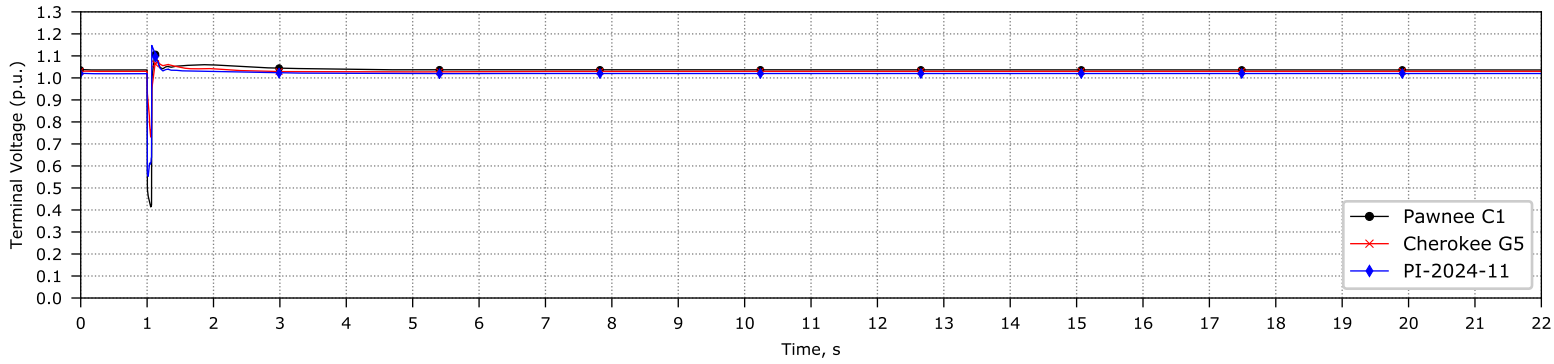


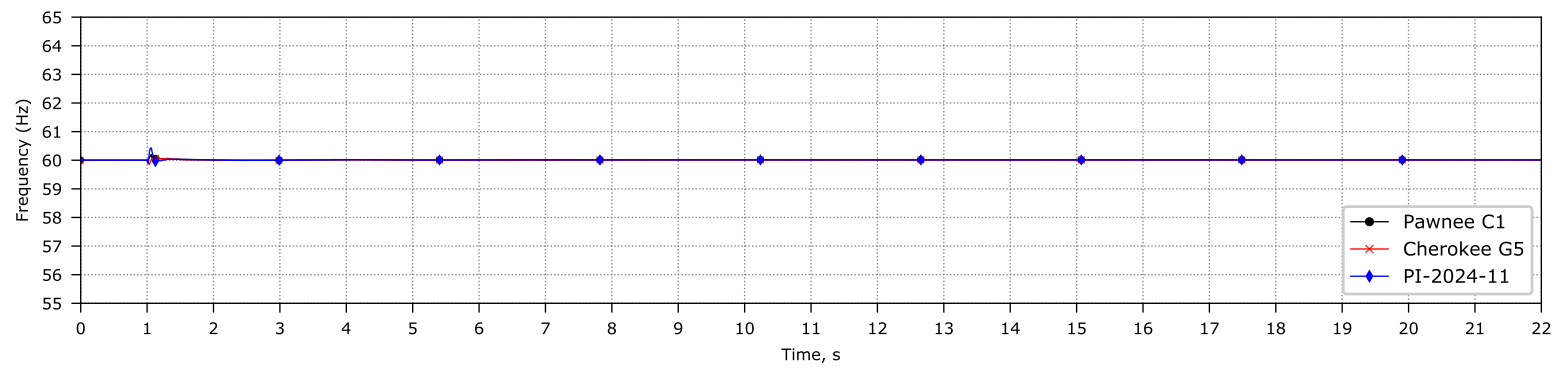
Canal-Crossing_Pawnee_345kV

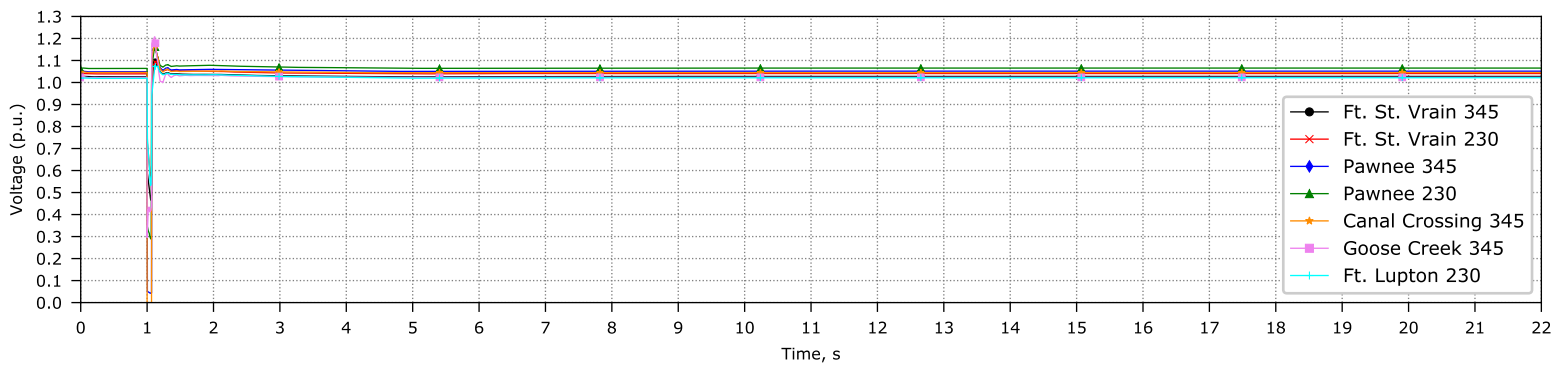




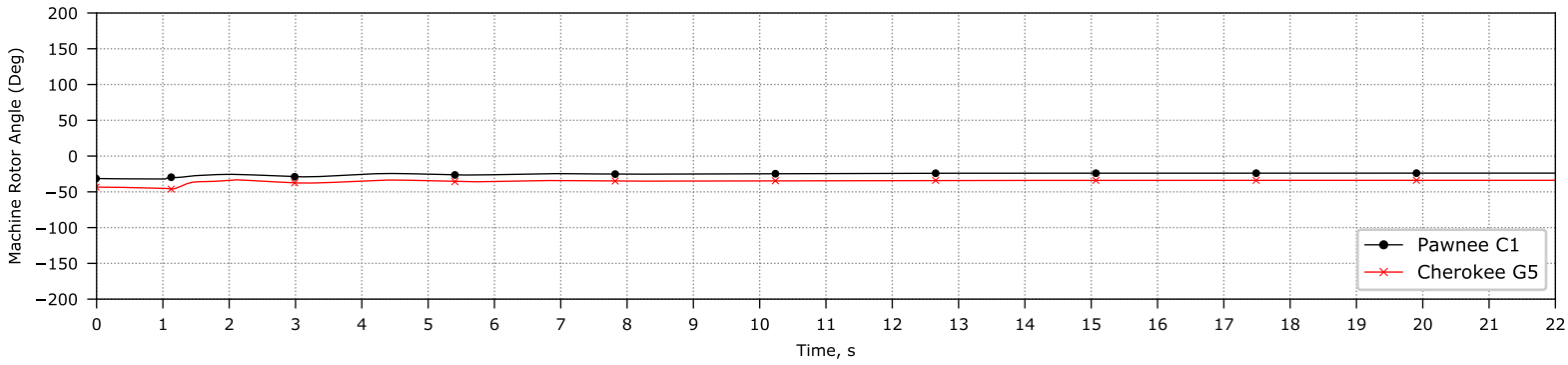


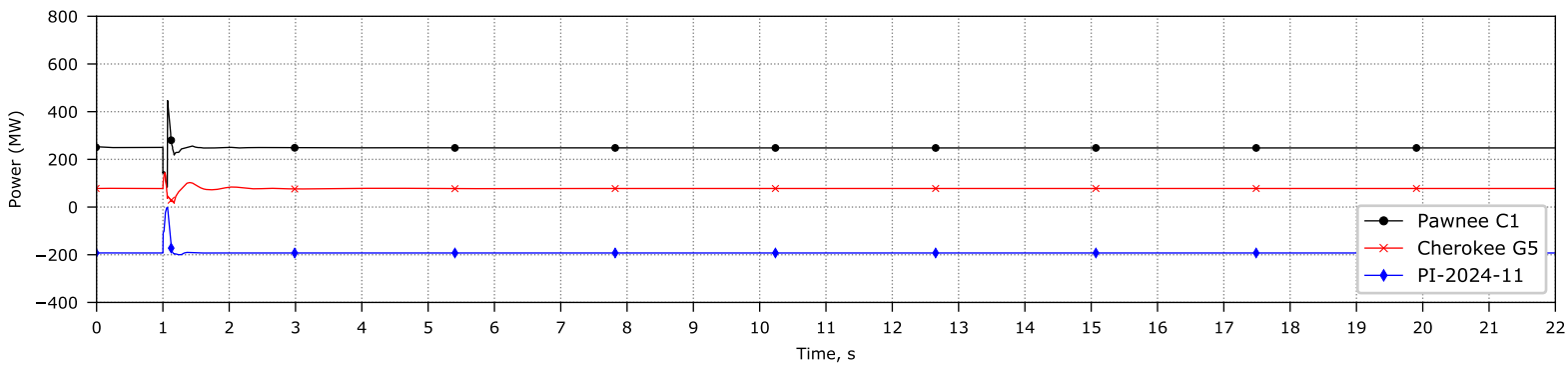


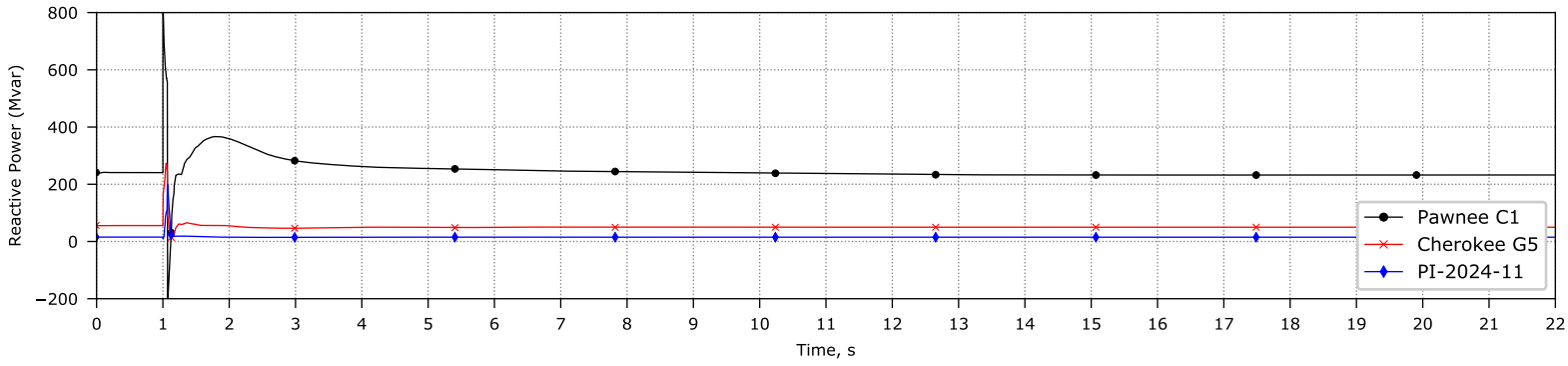


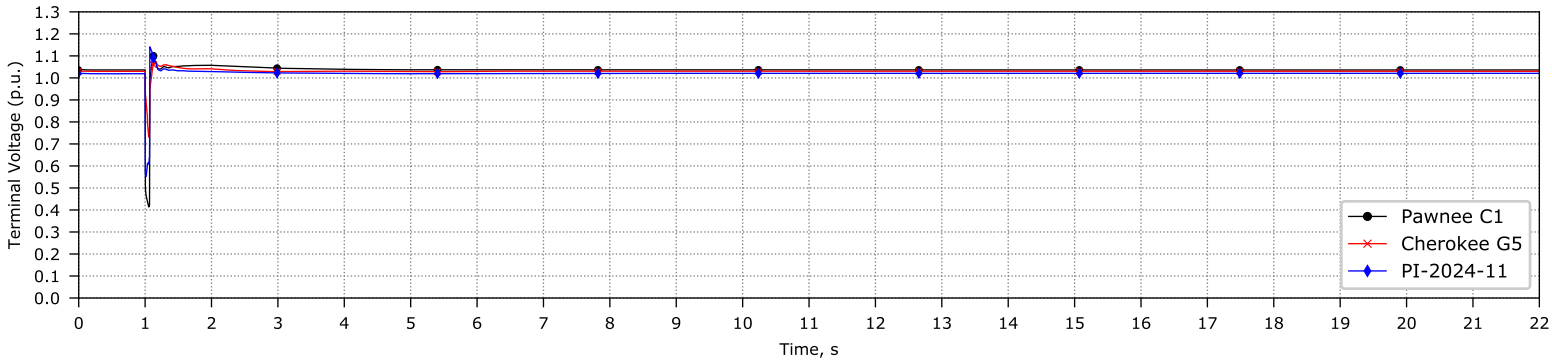


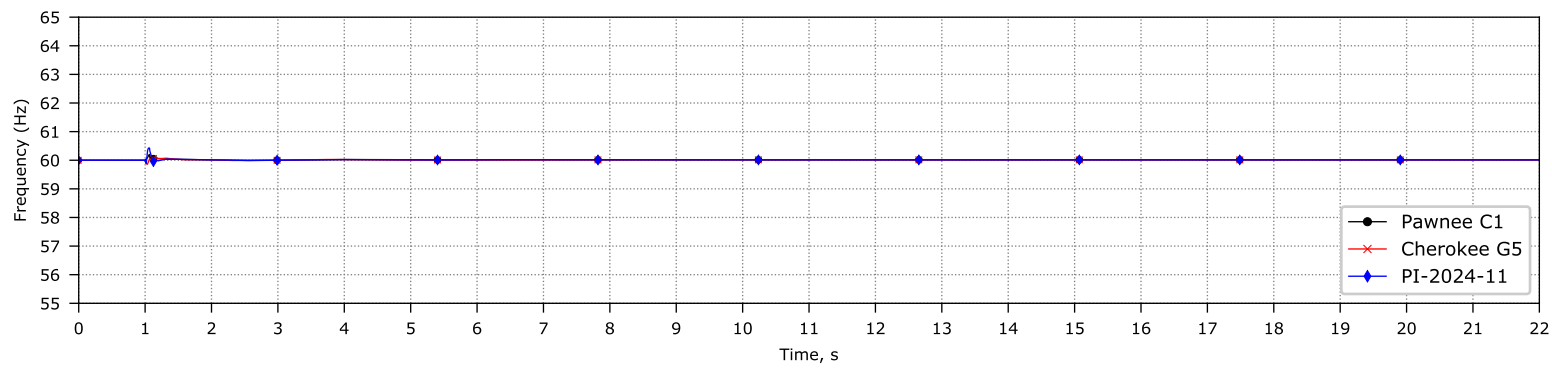
Canal-Crossing_GooseCk_345kV

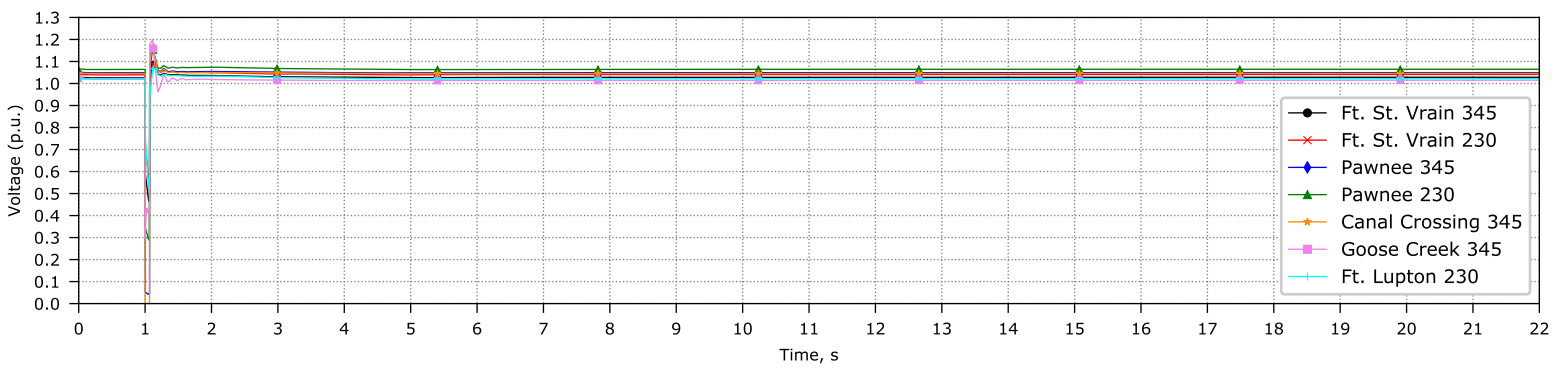




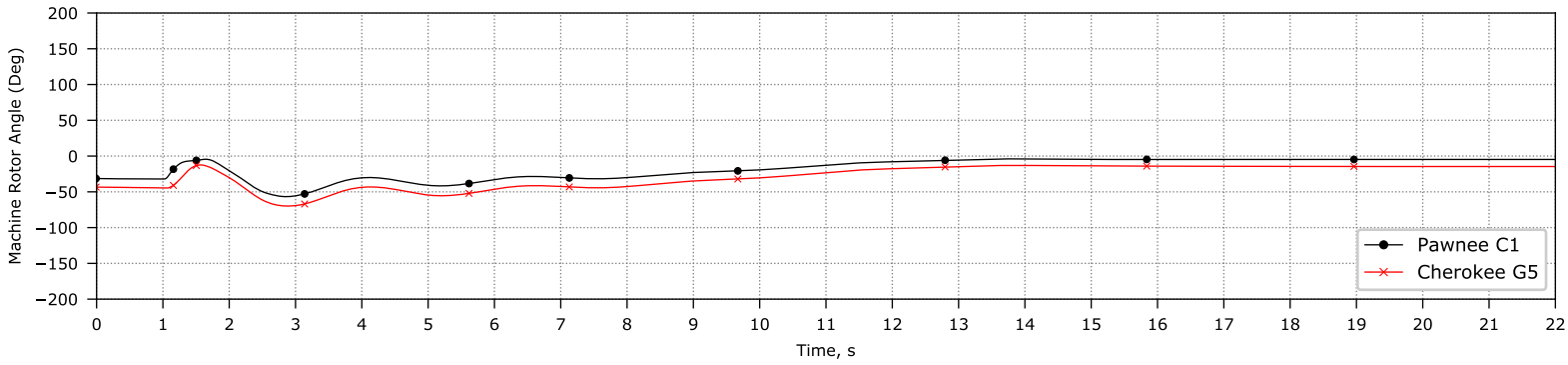


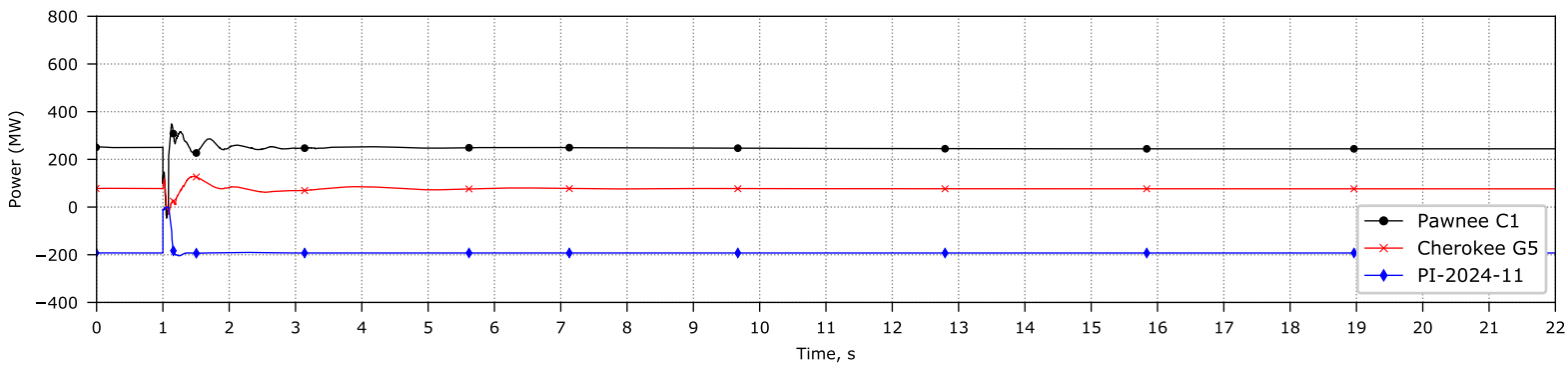


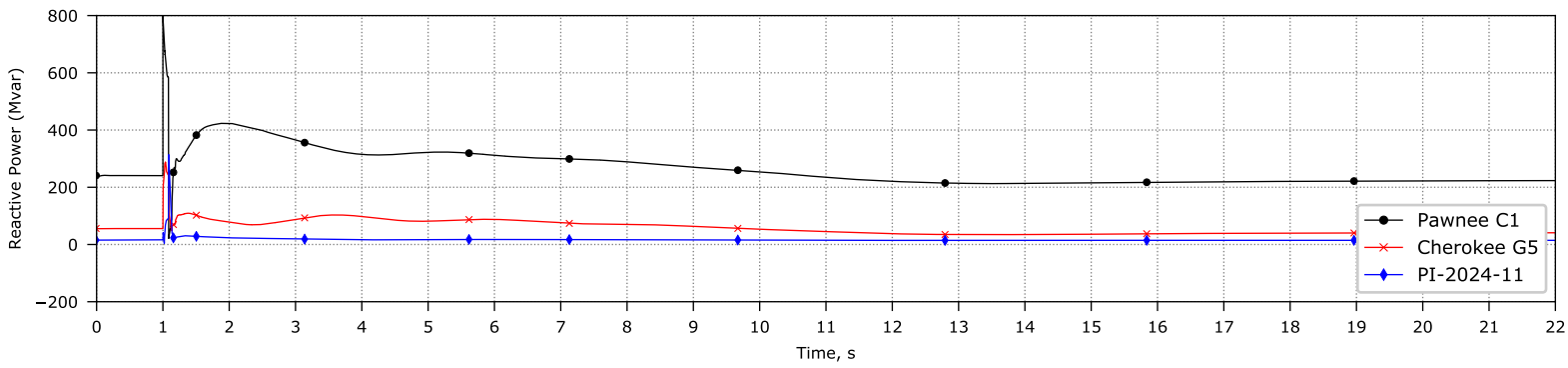


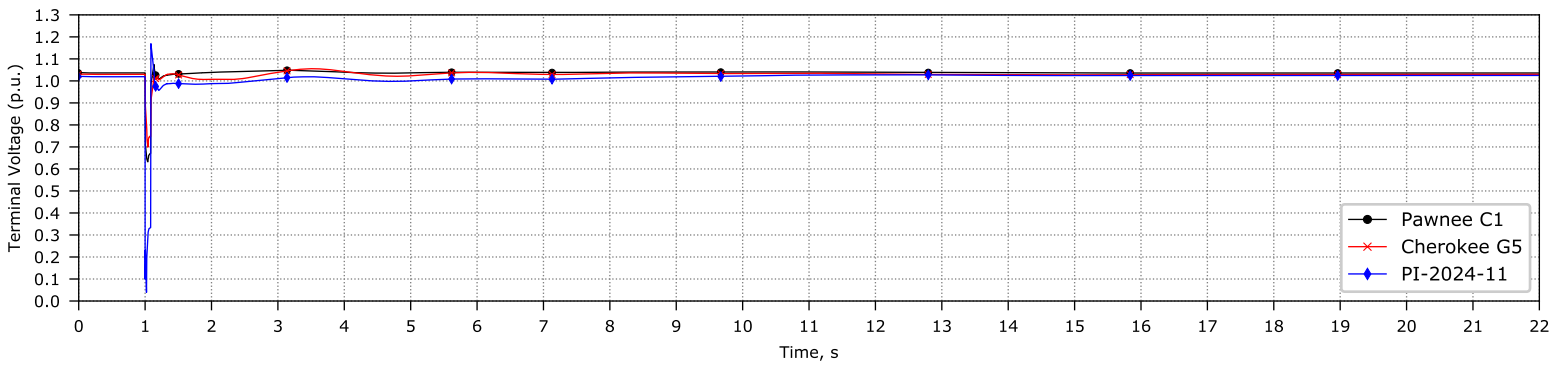


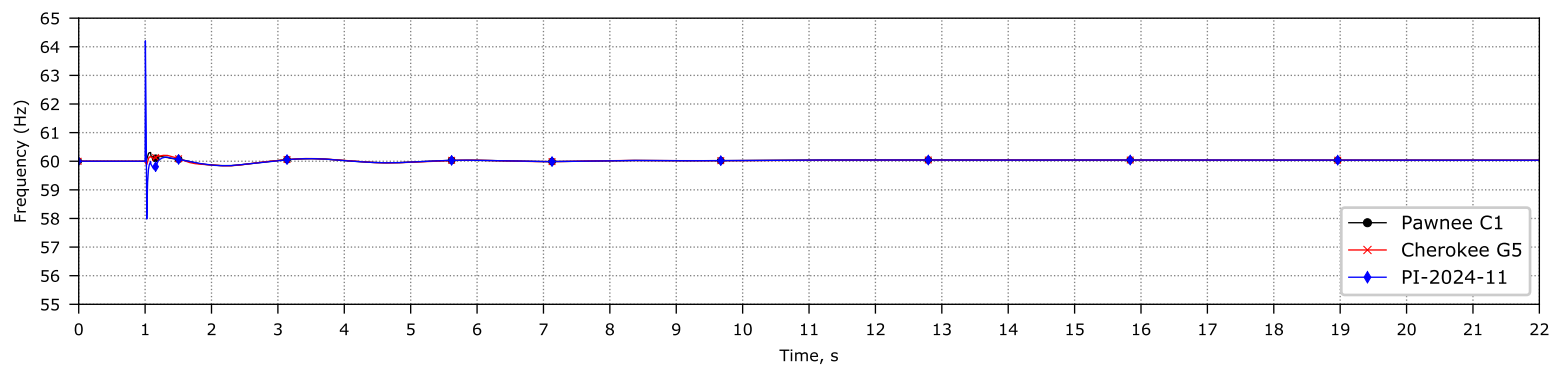
Ft-St-Vrain_Ft-Lupton_230kV

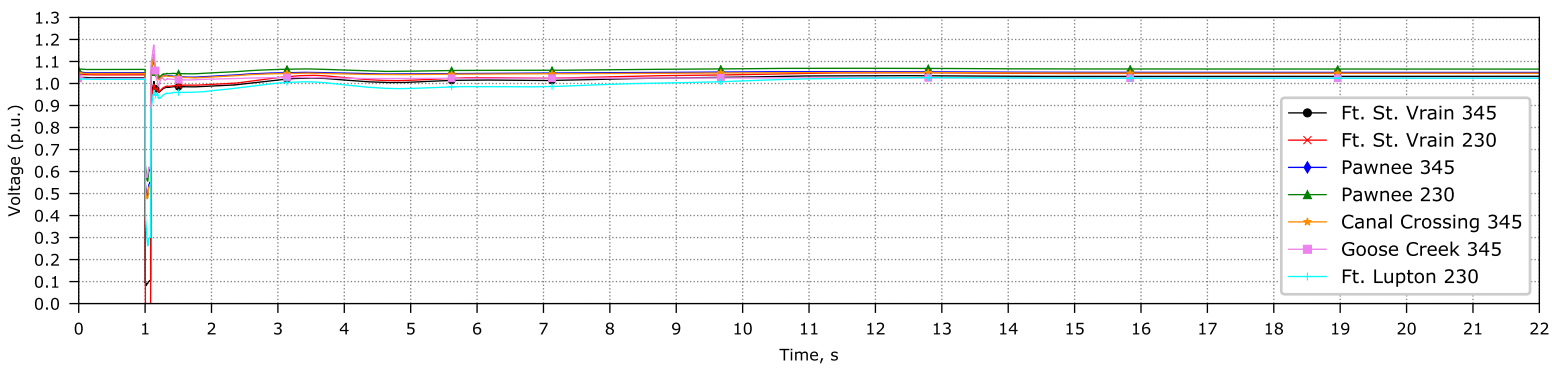




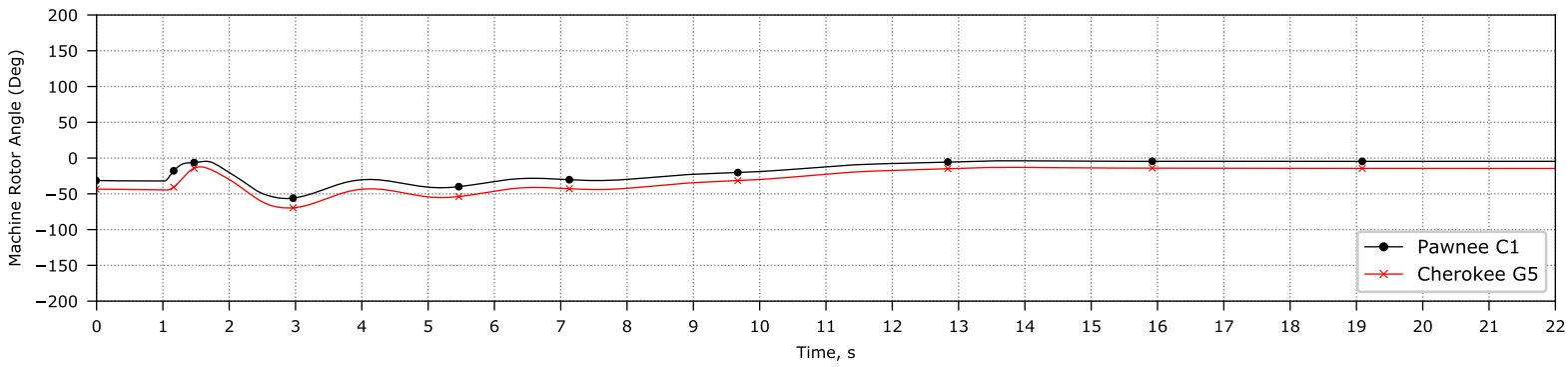


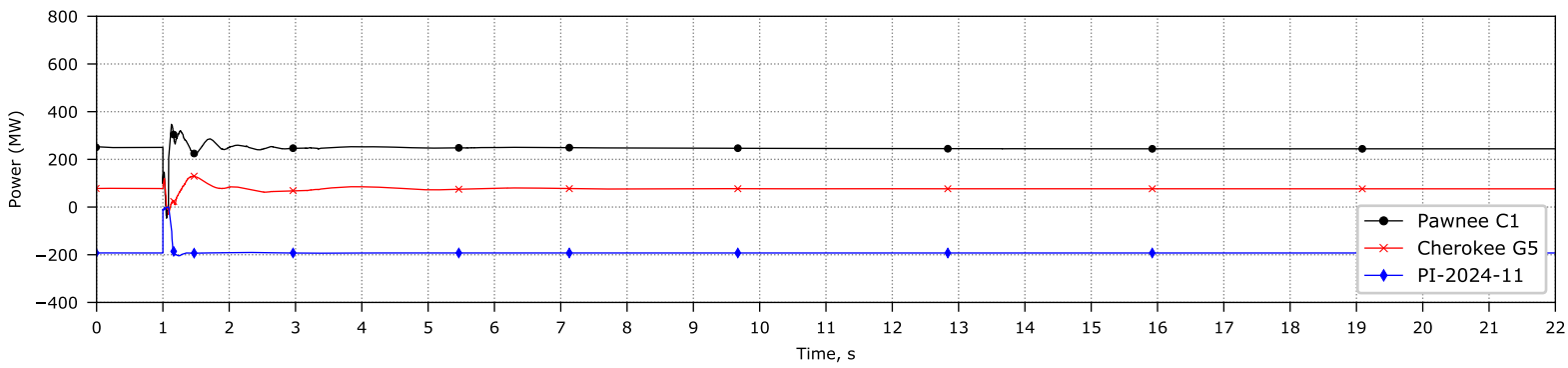


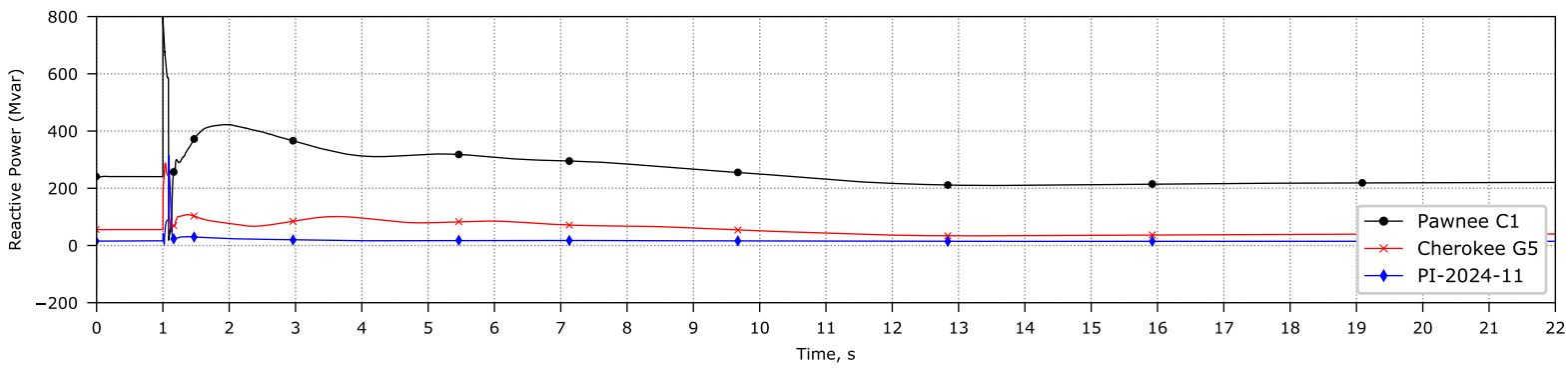


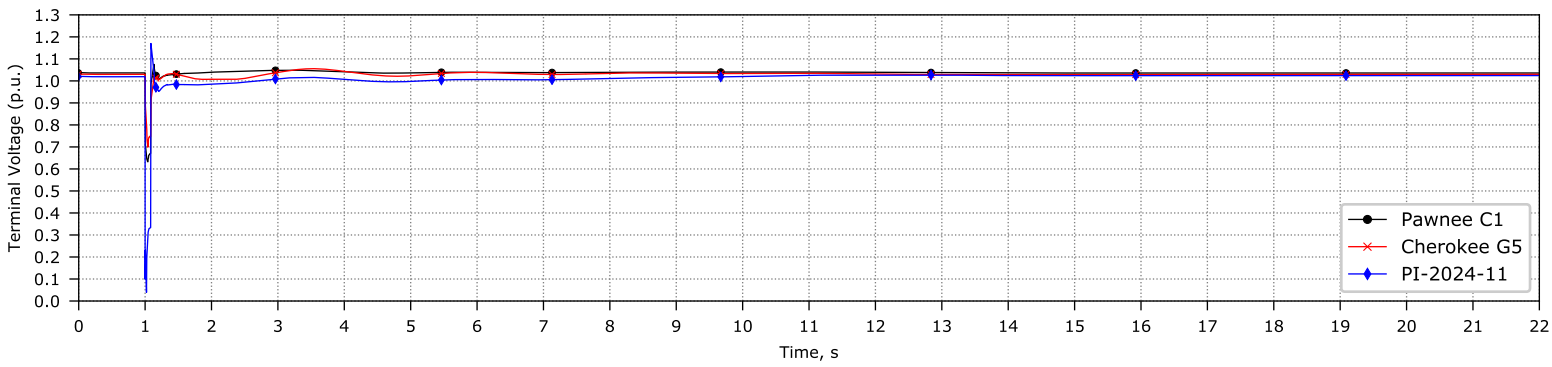


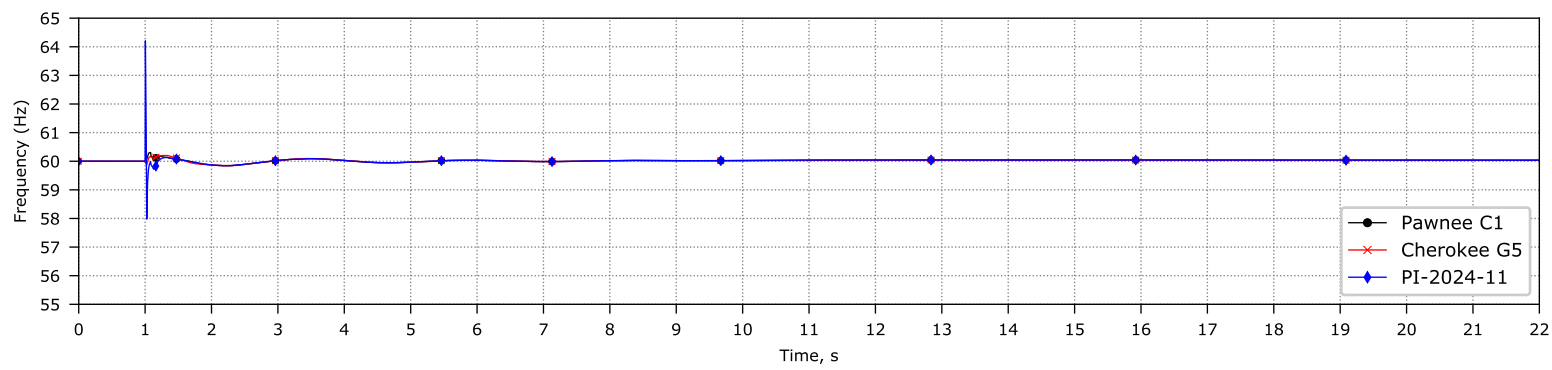
Ft-St-Vrain_Spindle_230kV

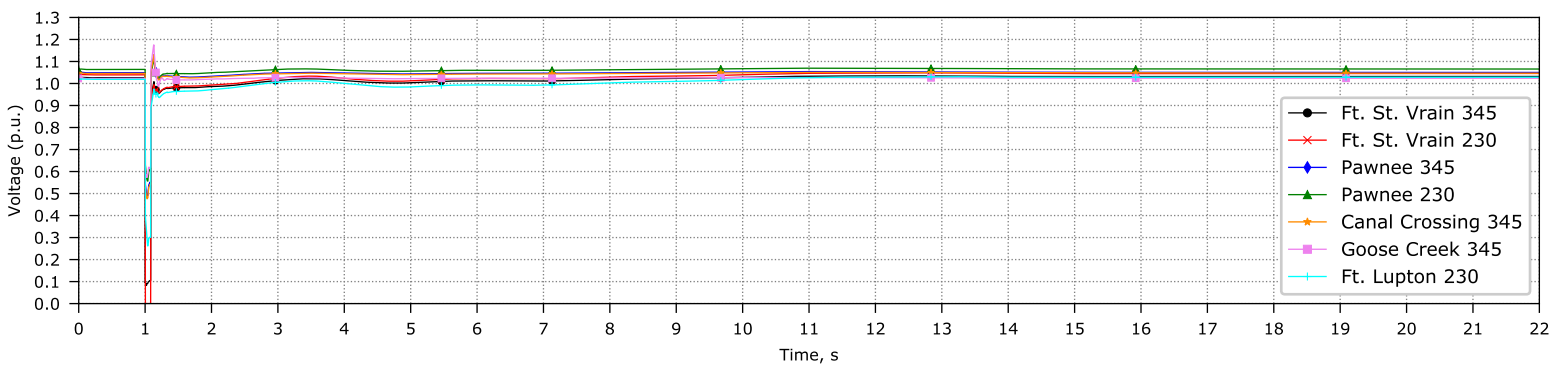




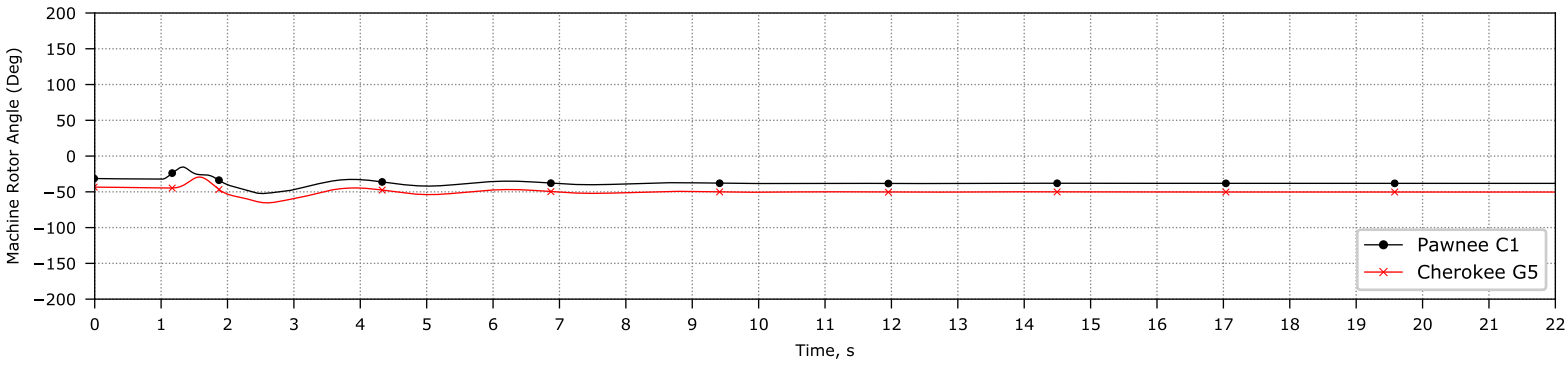


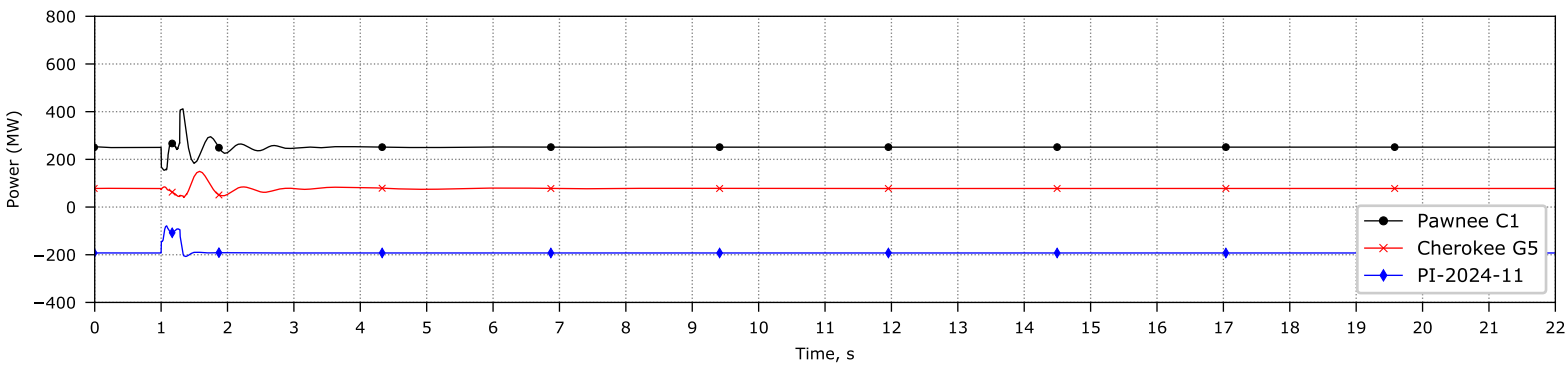


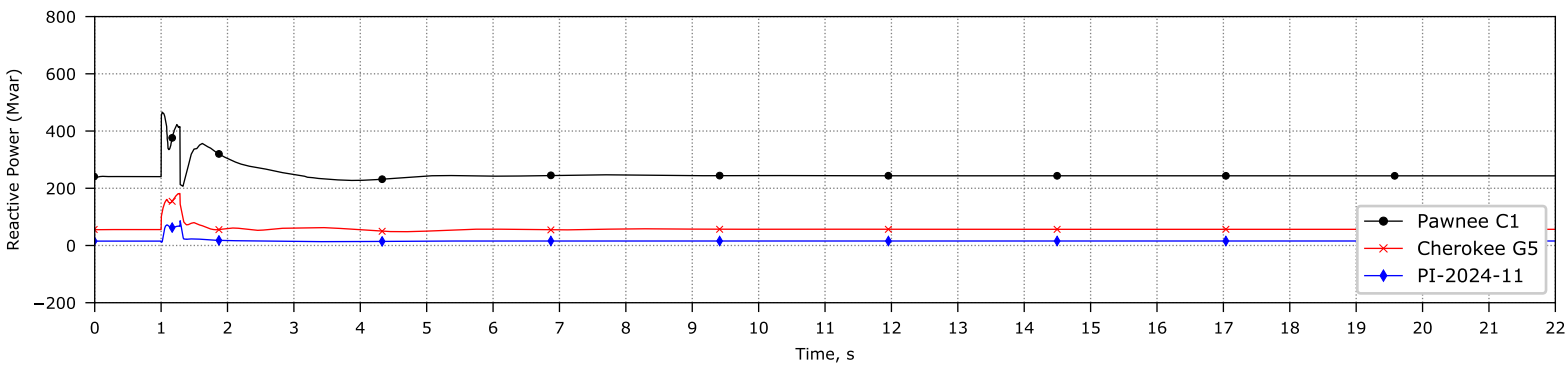


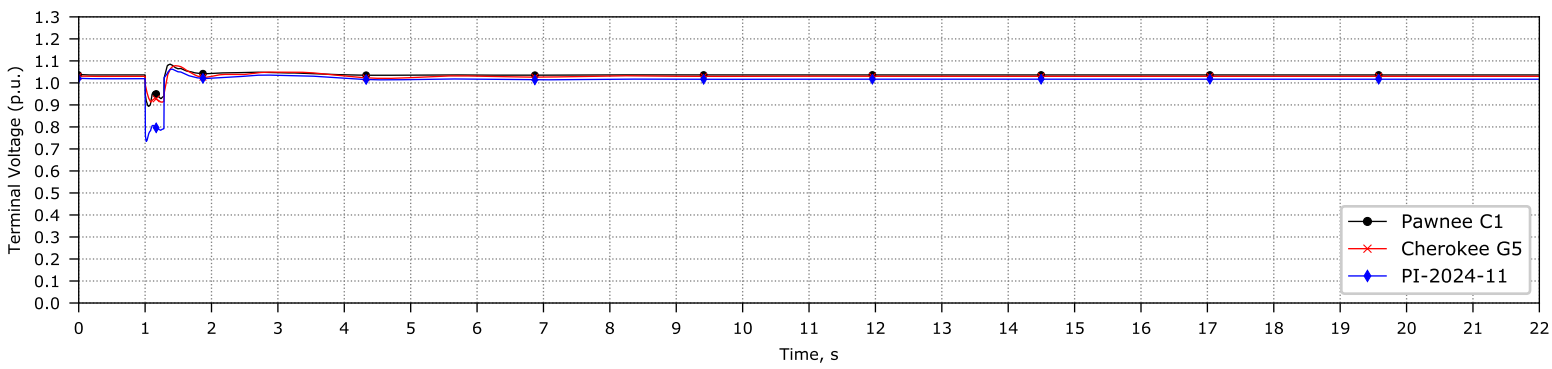


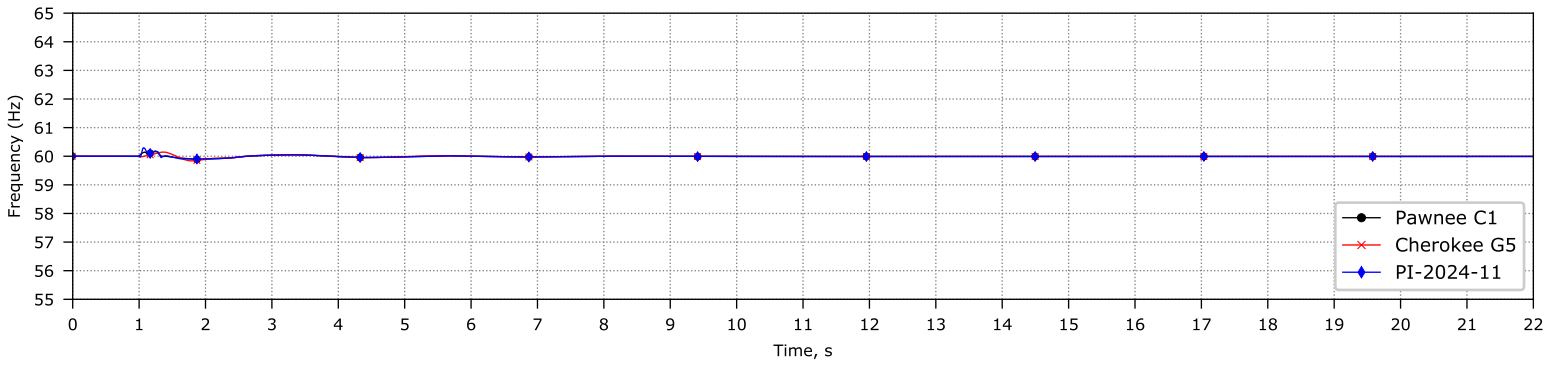
Ft-St-Vrain_Line-214

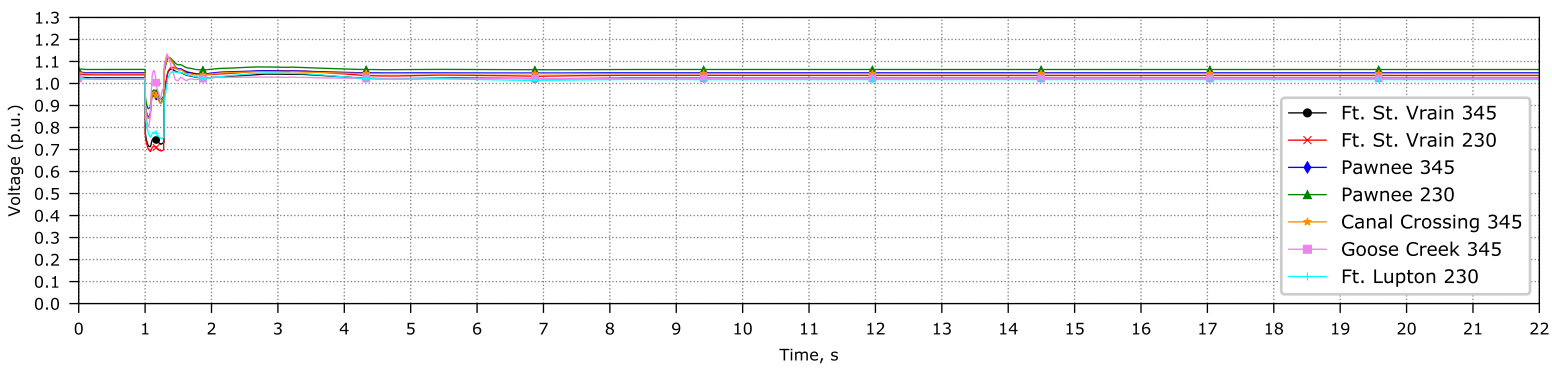




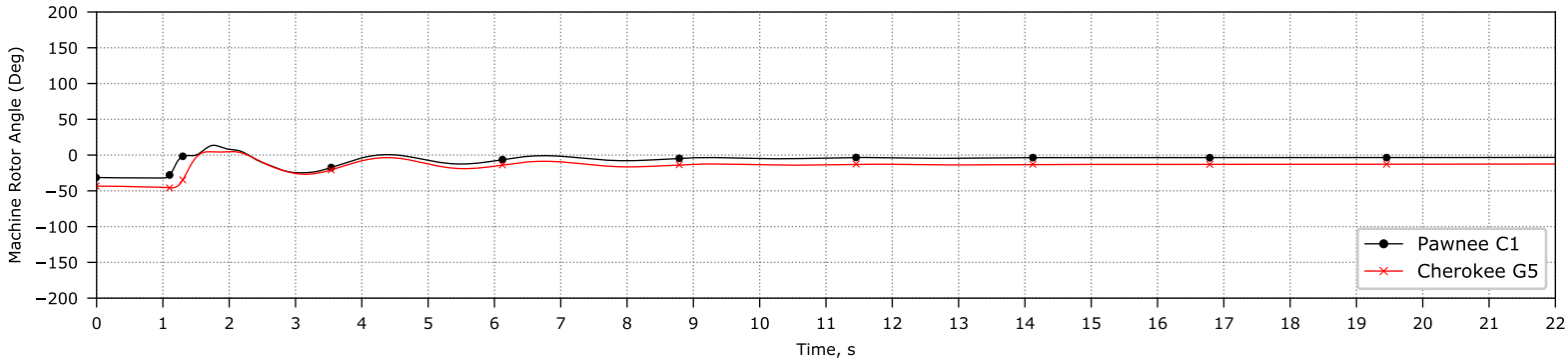


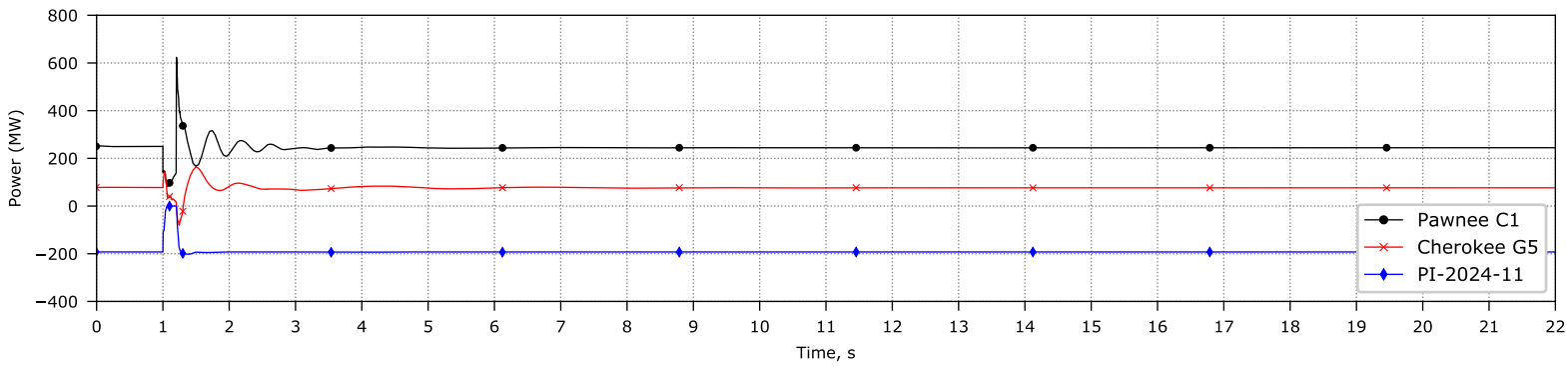


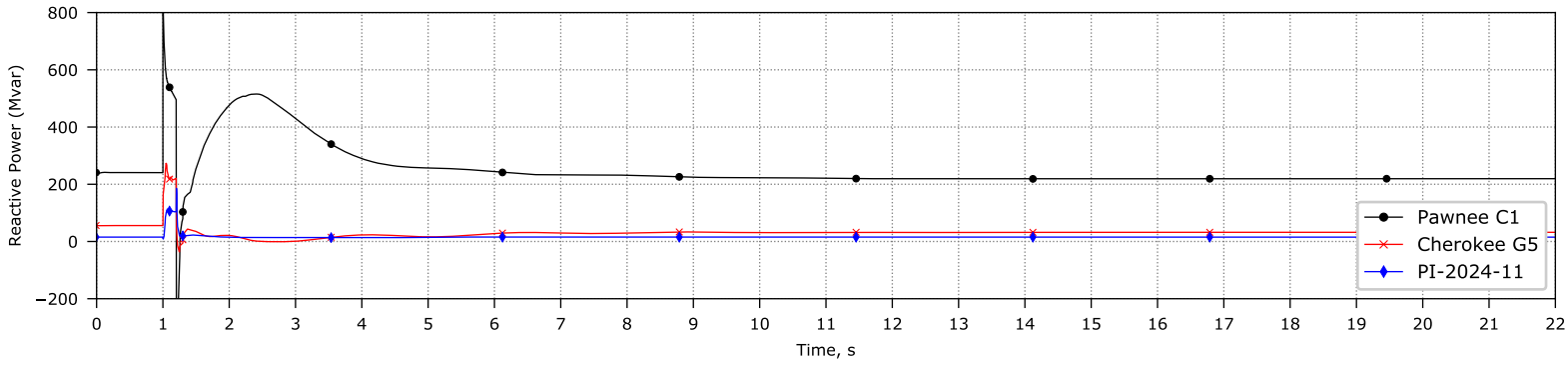


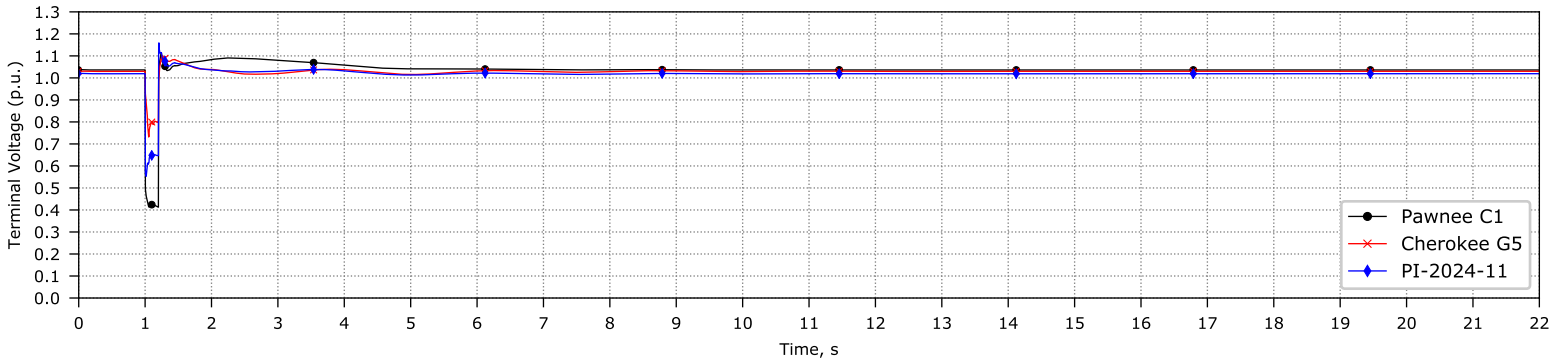


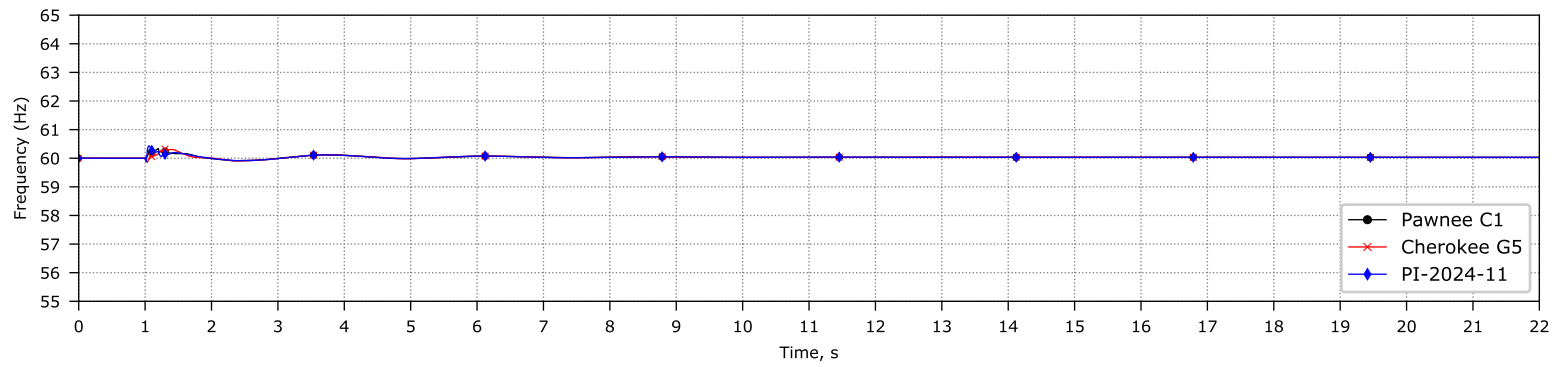
Canal-Crossing_7304

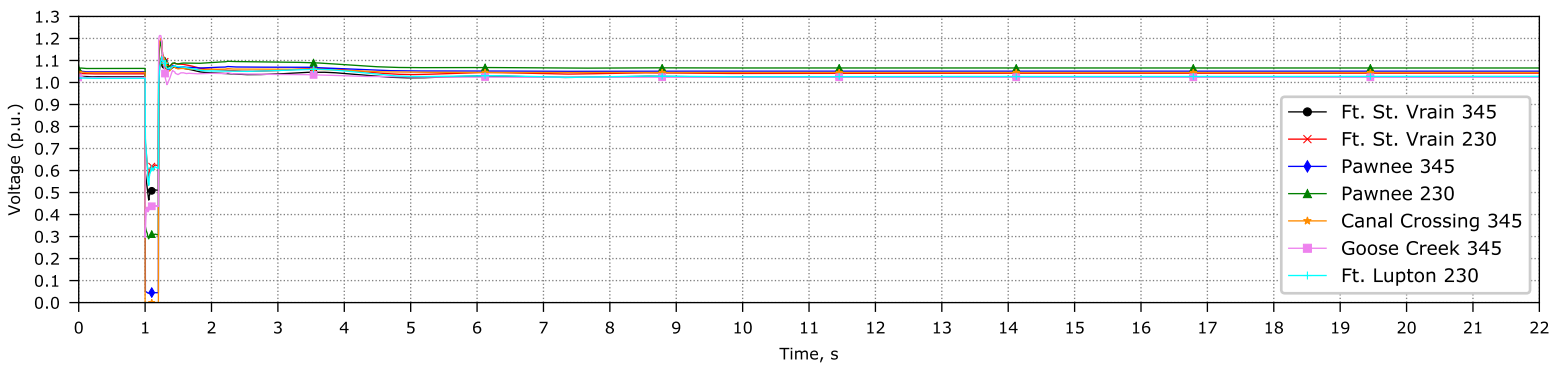












Canal-Crossing_Lines-7329-7297