PI-2024-20 Provisional Interconnection Study Report

Xcel Energy
September 11, 2025

Prepared by: Mitsubishi Electric Power Products, Inc on behalf of Public Service Company of Colorado

Peer Review by: James Nguyen, Principal Engineer

Approved by: Kevin Pera, OATT Program Manager

Revision History

Date	Rev	Description
09/05/2025	0	Initial report published for the PI-2024-20 study.
09/11/2025	1	Updated study report to reflect number of GSUs and gen-tie line length

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-2024-20 and associated with the 5RSC-2024-09 Generation Interconnection Request (GIR).

The PI request is for a 200 MW Battery Energy Storage System (BESS) with a Point of Interconnection (POI) at the Hartsel 230 kV substation.

The total estimated cost of the PSCo transmission system improvements required for PI-2024-20 to qualify for Provisional Interconnection service is estimated to be **$8.567** million.

The initial maximum permissible output allowed is 200 MW and up to 200 MW of the BESS can be charged from the grid at the POI. 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-2024-20 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.

---

[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 200 MW of Battery Energy Storage System located in Park County, Colorado. The Study will evaluate the impacts on the PSCo transmission system and Affected Systems by modeling the Generating Facility at the nameplate amount minus any losses for the interconnection facilities.

- The POI of this project is at the Hartsel 230 kV substation.
- The COD requested to be studied for PI-2024-20 is December 1, 2027.

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

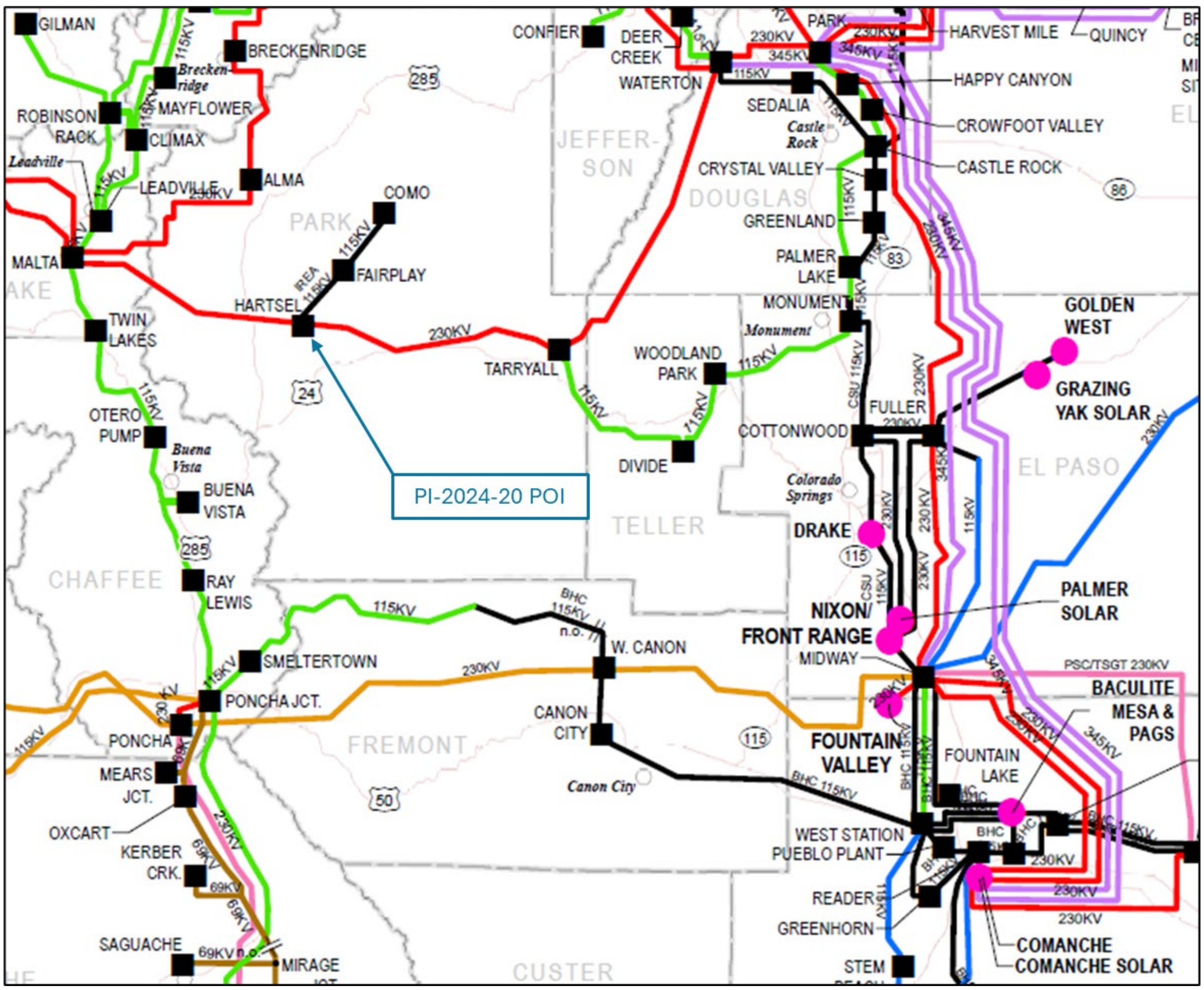


Figure 1: Approximate Point of Interconnection of PI-2024-20

3.0 Study Scope

The Study Scope includes 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 identifies 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 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 changing the study pocket generation dispatch to reflect heavy generation in the Western Slope study pocket.

3.4 Grid Charging Benchmark Case Modeling

The Grid Charging Benchmark Case was created from the Base Case (2028HS) as described in Chapter 3 of the BPM by changing the study pocket generation dispatch to reflect heavy generation in the Western Slope study pocket.

3.5 Study Case Modeling

The PI-2024-20 is a 200 MW net output at the Point of Interconnection (203 MW gross), Battery Energy Storage System (BESS) Generating Facility

- Machine model – One hundred and twenty (120) Tesla Megapack 2 XL P240 model batteries
- Length of Gen-Tie – Approximately 0.28 mile
- Number of main step-up transformer, voltage and rating – Two (2), 34.5-230 kV, 75/100/125 MVA

Discharging Study Case was created from the Benchmark Case as described in Chapter 3 of the BPM by turning on the PI-2024-20 generation.

Grid Charging Study Case was created from the Benchmark Case as described in Chapter 3 of the BPM by adding the PI-2024-20 BESS modeled as a load (200 MW).

3.6 Short-Circuit Modeling

All connected generating facilities were assumed capable of producing maximum fault current. As such, all generators were 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.

3.7 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 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-2024-20 GIR is modeled as follows:

- Generator gross capacity: Pmax = 202.8 MW, Pmin = -197.3 MW, Qmax = 204.5 Mvar, Qmin = -204.5 Mvar

The summary for the Voltage and Reactive Power Capability Evaluation for PI-2024-20 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-2024-20 are summarized in Table 1.

Table 1 – Reactive Power Capability Evaluation for PI-2024-20

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
202.8	103.9	204.5	-204.5	1.05	200.1	66.3	1.04	0.9492	200.0	66.2	1.04	0.9493
202.8	-26.6	204.5	-204.5	0.98	200.1	-65.8	0.99	-0.9499	200.0	-66.0	0.99	-0.9496
0.0	-0.4	204.5	-204.5	1.01	-1.0	0.1	1.01	-0.9950	0.0	0.2	1.01	-0.9806

3.8 Power Flow Analysis Results

Contingency analysis was performed on the Western Slope study pocket using the Study Case and the Grid Charging 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 attributed to PI-2024-20.
- Single Contingency analysis showed no thermal or voltage violations attributed to PI-2024-20.
- Multiple Contingency analysis showed no thermal or voltage violations attributed to PI-2024-20.

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-2024-20.
- Single Contingency analysis showed the following thermal overloads presented in Table 2. No voltage violations attributed to PI-2024-20 were observed. All the single contingency thermal overloads are alleviated via redispatch shown in Table 3.
- Multiple Contingency analysis showed the following thermal overloads presented in Table 4. No voltage violations attributed to PI-2024-20 were observed. Per TPL-001-5, Multiple Contingency overloads are mitigated using system adjustments, including generation redispatch (includes GIRs under study) and/or operator actions.

Xcel Energy®

Table 2 – Single Contingency Overloads

Ref. No.	Monitored Facility	Contingency Name	kVs	Areas	Normal Rating (MVA)	Benchmark Case Loading (%)	Study Case Loading (%)	Loading Difference (%)	Re-dispatched Study Case Loading (%)
1	Story (73192) - Pawnee (70311) 230 kV ckt 1	LoTC_51	230	73/70	581	102.51	106.79	4.28	100.00

Table 3 – Multiple Contingency Overloads

Ref. No.	Monitored Facility	Contingency Name	kVs	Areas	E-Rating (MVA)	Benchmark Case Loading (%)	Study Case Loading (%)	Loading Difference (%)
1	W. Canon (70550) – Hogback115 (71025) 115 kV ckt 1	BF_094d: Midway 5120 Stuck	115	70	120	123.47	131.05	7.58
2	Story (73192) – Pawnee (70311) 230 kV ckt 1	P7_160: Lines 7329, 7297	230	70	589	118.43	124.77	6.34
3	Smoky Hill (70396) – Harvest Mile (70596) 230 kV ckt 1	P7_137: Lines 7081, 7087	230	70	956	106.25	107.69	1.44

3.9 Stability Analysis Results

The following results were obtained for the disturbances analyzed for Discharging Study Case and the Grid Charging Study Case models:

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

The results of the contingency analysis for Discharging Study Case and Grid Charging Study Case models are shown in Table 5 and Table 6 respectively. The stability plots are shown in Appendix A and B in Section 10.0 of this report.

Table 4 – Stability Analysis Results for Study Case Model

Ref. No.	Contingency Name	Fault Category	Outage(s)	Clearing Time (Cycles)	Post-Fault Voltage Recovery	Angular Stability
1	Flat Run	P0	-	-	Stable	Stable
2	PI-2024-20 Gen	P1	PI-2024-20 Generation	5	Stable	Stable
3	Hartsel 230 kV (LoTC_29)	P1	Malta – Hartsel 230 kV ckt 1	5	Stable	Stable
4	Hartsel 230 kV (LoTC_144)	P1	Tarryall – Hartsel 230 kV ckt 1	5	Stable	Stable
5	Hartsel 230 kV (HARS-HARS_CR)	P1	Hartsel – Hartsel CR 230/115 kV transformer T1	5	Stable	Stable
6	Malta 230 kV (LoTC_30)	P1	Malta – Mt. Elbert 230 kV ckt 1	5	Stable	Stable
7	Malta 230 kV (LoTC_31)	P1	Malta – Basalt 230 kV ckt 1	5	Stable	Stable
8	Malta 230 kV (LoTC_47)	P1	Malta – Hagerman TP 230 kV ckt 1 Hagerman TP – Hopkins 230 kV ckt 1	5	Stable	Stable
9	Malta 230 kV (LoTC_89)	P1	Malta – Alma 230 kV Ckt 1 Alma – Breckrdg 230 kV ckt 1	5	Stable	Stable
10	Tarryall 230 kV (LoTC_128)	P1	Tarryall – Waterton 230 kV ckt 1	5	Stable	Stable
11	Hartsel 230 kV (BF_070a)	P4	Hartsel – Malta 230 kV ckt 1 Hartsel – Tarryall 230 kV ckt 1	17	Stable	Stable
12	Hartsel 230 kV (BF_070b)	P4	Hartsel – Malta 230 kV ckt 1 Hartsel – Hartsel CR 230/115 kV transformer T1	17	Stable	Stable
13	Hartsel 230 kV (BF_070c)	P4	Hartsel – Hartsel CR 230/115 kV transformer T1 Hartsel – Tarryall 230 kV ckt 1	17	Stable	Stable

Table 5 – Stability Analysis Results for Grid Charging Study Case Model

Ref. No.	Contingency Name	Fault Category	Outage(s)	Clearing Time (Cycles)	Post-Fault Voltage Recovery	Angular Stability
1	Flat Run	P0	-	-	Stable	Stable
2	PI-2024-20 Gen	P1	PI-2024-20 Generation	5	Stable	Stable
3	Hartsel 230 kV (LoTC_29)	P1	Malta – Hartsel 230 kV ckt 1	5	Stable	Stable
4	Hartsel 230 kV (LoTC_144)	P1	Tarryall – Hartsel 230 kV ckt 1	5	Stable	Stable
5	Hartsel 230 kV (HARS-HARS_CR)	P1	Hartsel – Hartsel CR 230/115 kV transformer T1	5	Stable	Stable
6	Malta 230 kV (LoTC_30)	P1	Malta – Mt. Elbert 230 kV ckt 1	5	Stable	Stable
7	Malta 230 kV (LoTC_31)	P1	Malta – Basalt 230 kV ckt 1	5	Stable	Stable
8	Malta 230 kV (LoTC_47)	P1	Malta – Hagerman TP 230 kV ckt 1 Hagerman TP – Hopkins 230 kV ckt 1	5	Stable	Stable
9	Malta 230 kV (LoTC_89)	P1	Malta – Alma 230 kV Ckt 1 Alma – Breckrdg 230 kV ckt 1	5	Stable	Stable
10	Tarryall 230 kV (LoTC_128)	P1	Tarryall – Waterton 230 kV ckt 1	5	Stable	Stable
11	Hartsel 230 kV (BF_070a)	P4	Hartsel – Malta 230 kV ckt 1 Hartsel – Tarryall 230 kV ckt 1	17	Stable	Stable
12	Hartsel 230 kV (BF_070b)	P4	Hartsel – Malta 230 kV ckt 1 Hartsel – Hartsel CR 230/115 kV transformer T1	17	Stable	Stable
13	Hartsel 230 kV (BF_070c)	P4	Hartsel – Hartsel CR 230/115 kV transformer T1 Hartsel – Tarryall 230 kV ckt 1	17	Stable	Stable

3.10 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.

The Short Circuit study on the PSCo transmission system has identified zero circuit breaker that became over-dutied because of adding the PI-2024-20. The fault currents at the POI for can be made available upon request by the Customer.

3.11 Affected Systems

The study did not identify any impacts to Affected Systems.

4.0 Cost Estimates

The total estimated cost of the required Upgrades for PI-2024-20 to interconnect for Provisional Interconnection Service at Hartsel 230 kV substation is **$8.567** million.

- **Cost of Transmission Provider's Interconnection Facilities (TPIF) is $3.672 million** (Table 7)
- **Cost of Station Network Upgrades is $4.895 million** (Table 8)
- **Cost of System Network Upgrades is $0**

The list of improvements required to accommodate the Provisional Interconnection Service of PI-2024-20 are given in Table 7, and Table 8.

Table 6 – Transmission Provider's Interconnection Facilities

Element	Description	Cost Est. (Million)
PSCo's Hartsel 230 kV substation	Interconnection of 5RSC-2024-09 (PI-2024-20) at the Hartsel 230 kV substation. The new equipment includes: • (1) 230 kV single bay dead end structure • (1) 230 kV 3-phase arrester • (3) 230 kV 1-phase CTs for metering • (3) 230 kV 1-phase CCVTs • Associated electrical equipment, bus, wiring and grounding • Associated foundations and structures • Associated transmission line communications, fiber, relaying and testing	$2.574
PSCo's Hartsel 230 kV substation	Transmission Provider's single circuit dead-end structure (5997-PCO STR) at the Point of Change of Ownership (PCO) and transmission line and OPGW from the PCO into substation from the PCO. The line will connect to (2) double circuit dead end structures, but those costs are covered under the System Network Upgrades. Three (3) spans, 3 conductors, OPGW, insulators, hardware and installation.	$0.848
PSCo's Hartsel 230 kV substation	Siting and Land Rights land acquisition and permitting, no land purchase costs included	$0.250
Total Cost Estimate for Interconnection Customer-Funded, PSCo-Owned Interconnection Facilities		**$3.672**

Table 7 – Station Network Upgrades

Element	Description	Cost Est. (Million)
PSCo's Hartsel 230 kV substation	Interconnection of 5RSC-2024-09 (PI-2024-20) at Hartsel 230 kV substation. The new equipment includes: • (1) 230 kV 3000 A SF6 circuit breaker • (2) 230 kV 3000 A disconnect switches • (2) Gate relocations • Associated electrical equipment, bus, wiring and grounding • Associated foundations and structures	$2.822
PSCo's Hartsel 230 kV substation	Install required communication in the EEE at the Hartsel 230 kV substation	$0.651
PSCo's Hartsel 230 kV substation	5145 Tline - Move the 5145 circuit from the existing double circuit structure for 5995/5145 lines to a new single circuit dead end structure (5145-1163).	$0.415
PSCo's Hartsel 230 kV substation	5995 Tline - Move the 5995 circuit from the existing double circuit structure for 5995/5145 lines to a new configuration that includes (2) double-circuit dead end structures (5995_5997-1 and 5995_5997-2) shared with line 5997 from the generating facility. The existing double circuit structure 5415-1163 will be removed.	$1.007
Total Cost Estimate for PSCo-Funded, PSCo-Owned Interconnection Facilities		**$4.895**

PSCo has developed cost estimates for Interconnection Facilities and Network/Infrastructure Upgrades required for the interconnection of PI-2024-20 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:

- 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 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 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

4.1 Schedule

This section provides proposed milestones for the interconnection of PI-2024-20 to the Transmission Provider's Transmission System. The customer requested back-feed date (In-Service Date for Transmission Provider's Interconnection Facilities and Station Network Upgrades required for interconnection) for the Provisional Interconnection Service is May 31, 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 9.

Table 8 – Proposed Milestones for PI-2024-20

Milestone	Responsible Party	Estimated Completion Date
PLGIA Execution	Interconnection Customer and Transmission Provider	December, 2025
In-Service Date for Transmission Provider Interconnection Facilities and Station Network Upgrades required for interconnection	Transmission Provider	May 31, 2027

In-Service Date & Energization of Interconnection Customer's Interconnection Facilities	Interconnection Customer	May 31, 2027
Initial Synchronization Date	Interconnection Customer	July 1, 2027
Begin trial operation & testing	Interconnection Customer and Transmission Provider	September 1, 2027
Commercial Operation Date	Interconnection Customer	December 1, 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 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.
- 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.

5.0 Conclusion

The total estimated cost of the PSCo transmission system improvements required for PI-2024-20 to qualify for Provisional Interconnection Service would be **$8.567** million.

Based on the Power Flow and Stability analyses, the initial maximum permissible output allowed is 200 MW and up to 200 MW of the BESS can be charged from the grid at the POI. 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 study on the PSCo transmission system has identified zero circuit breaker that became over-dutied because of adding the PI-2024-20.

Security: PI-2024-20 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.

6.0 Contingent Facilities

The Contingent Facilities identified for PI-2024-20 include the TPIF and Station Network Upgrades identified in Table 7 and Table 8, respectively.

[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.

7.0 Preliminary One-Line Diagram, General Arrangement, and Site Layout for PI-2024-20

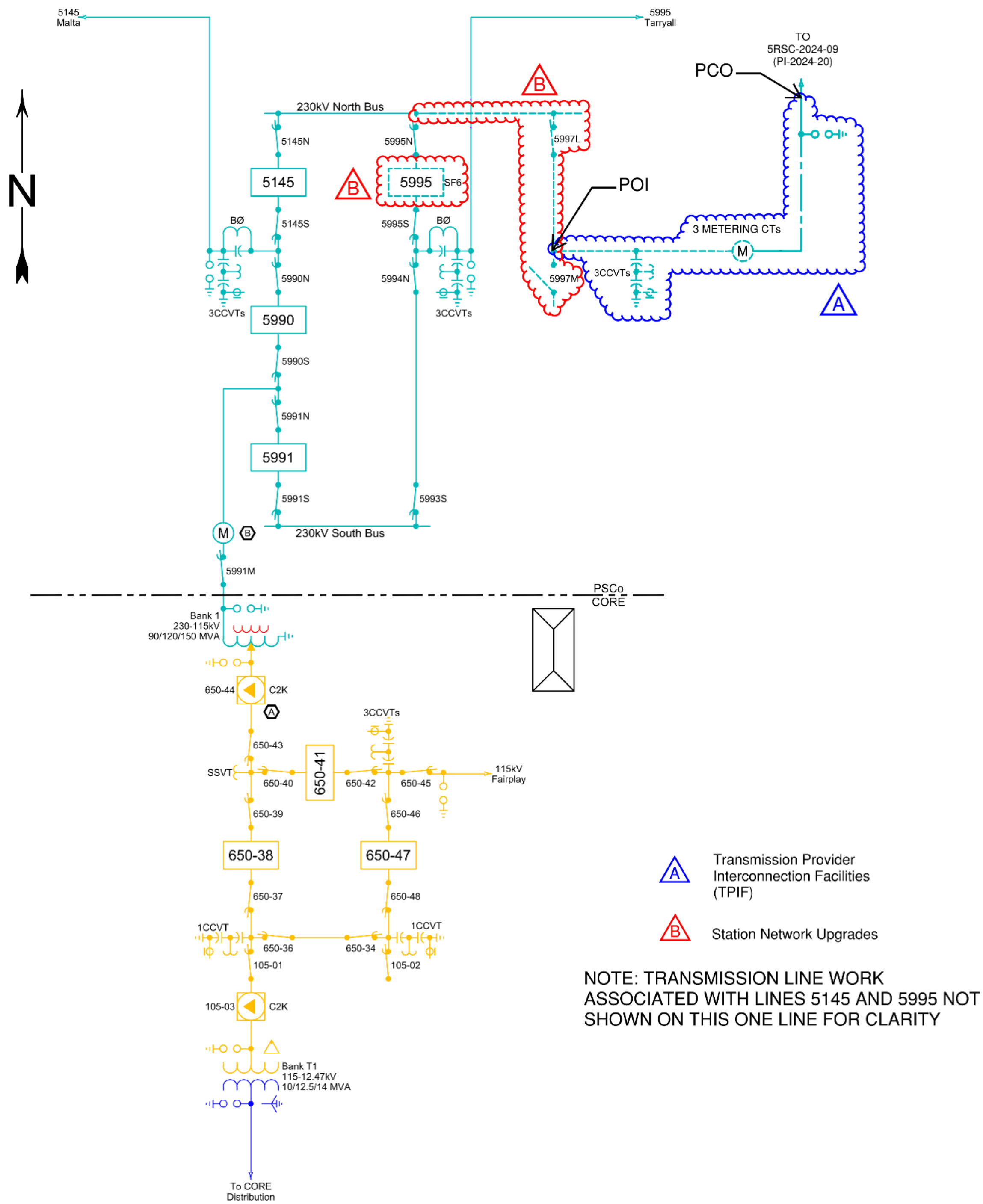


Figure 2: Preliminary One-Line for PI-2024-20 at the Hartsel 230 kV Substation

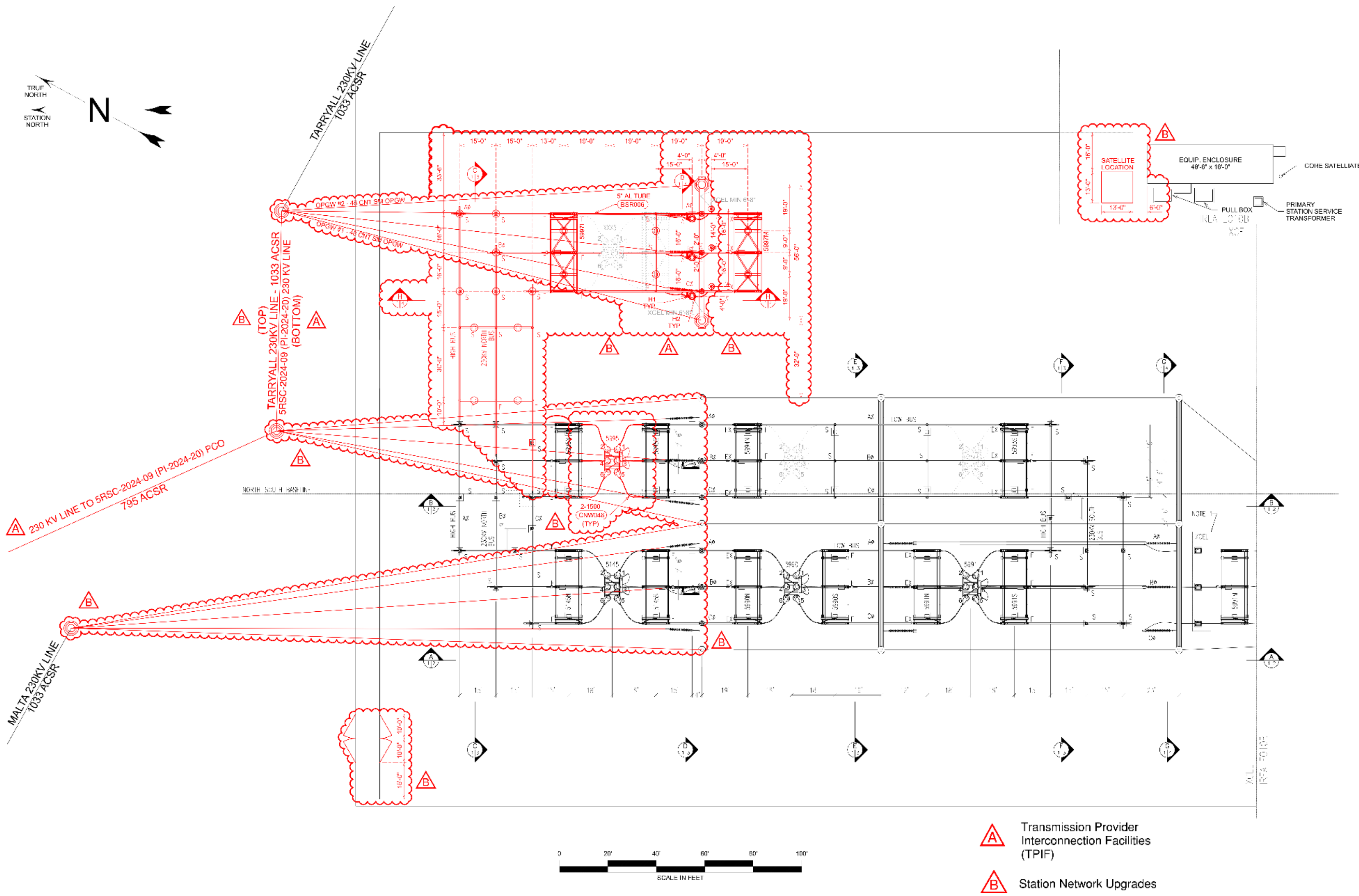


Figure 3: Preliminary General Arrangement for PI-2024-20 at the Hartsel 230 kV Substation

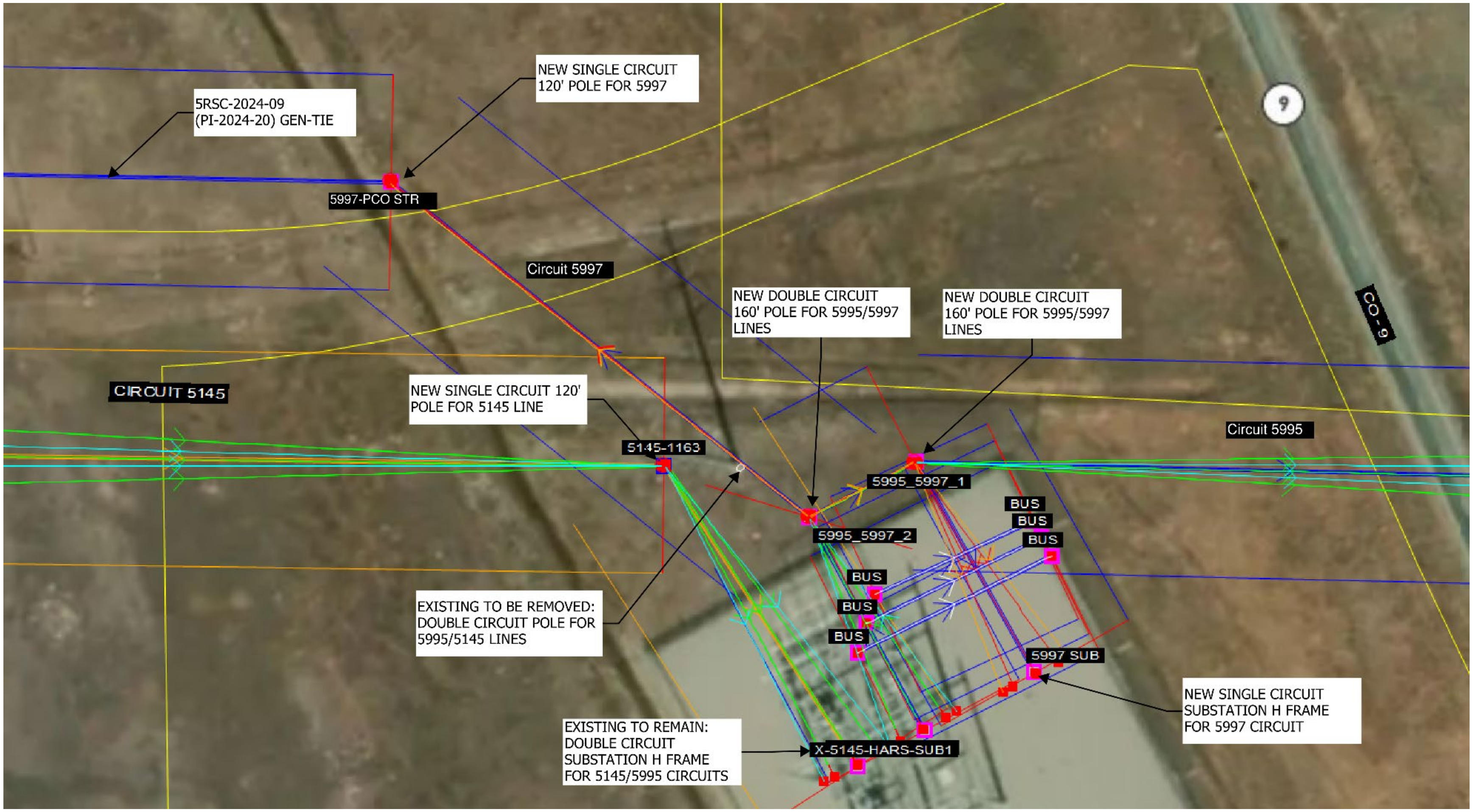
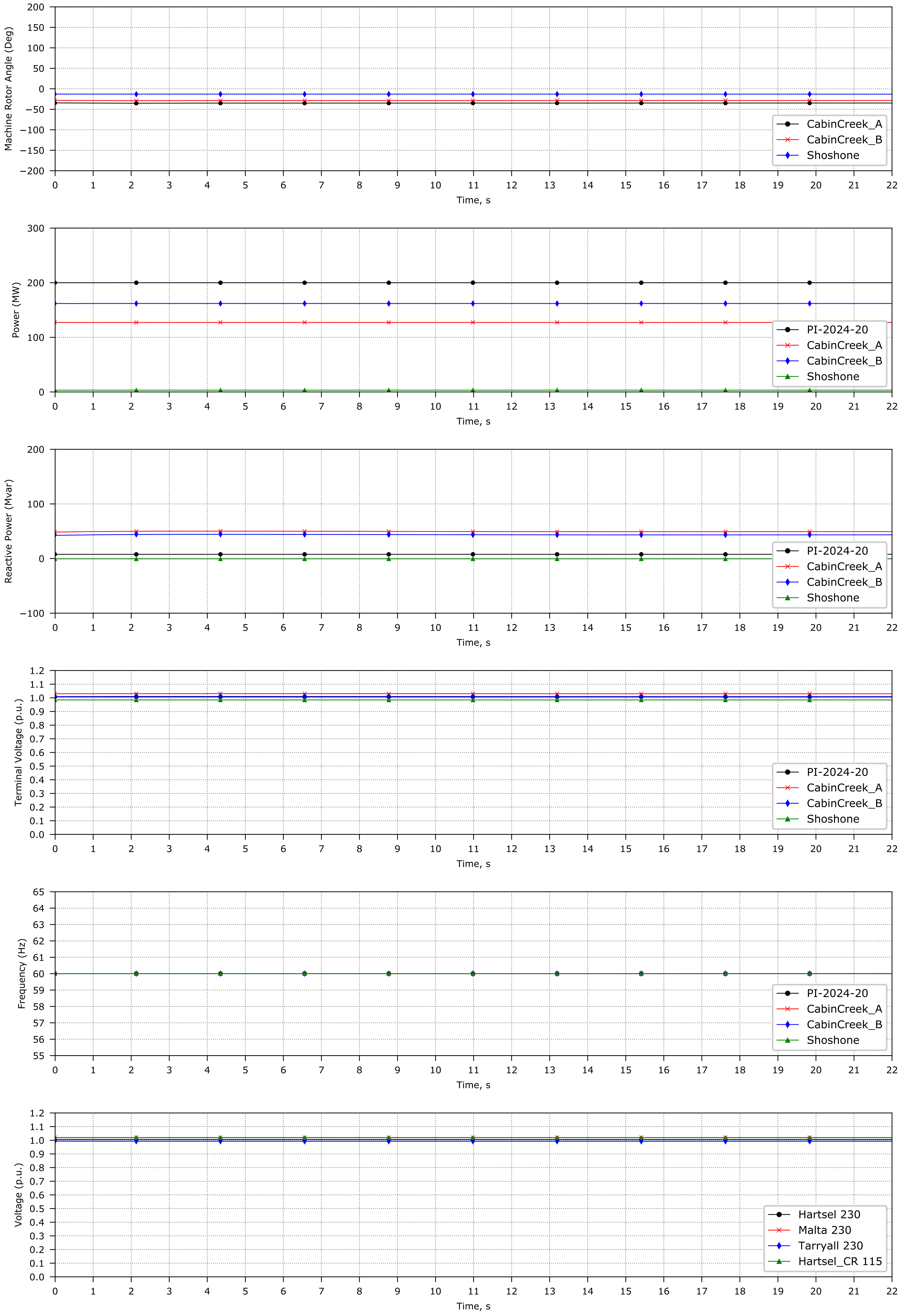


Figure 4: Preliminary Site Layout for PI-2024-20 at the Hartsel 230 kV Substation

8.0 Appendices

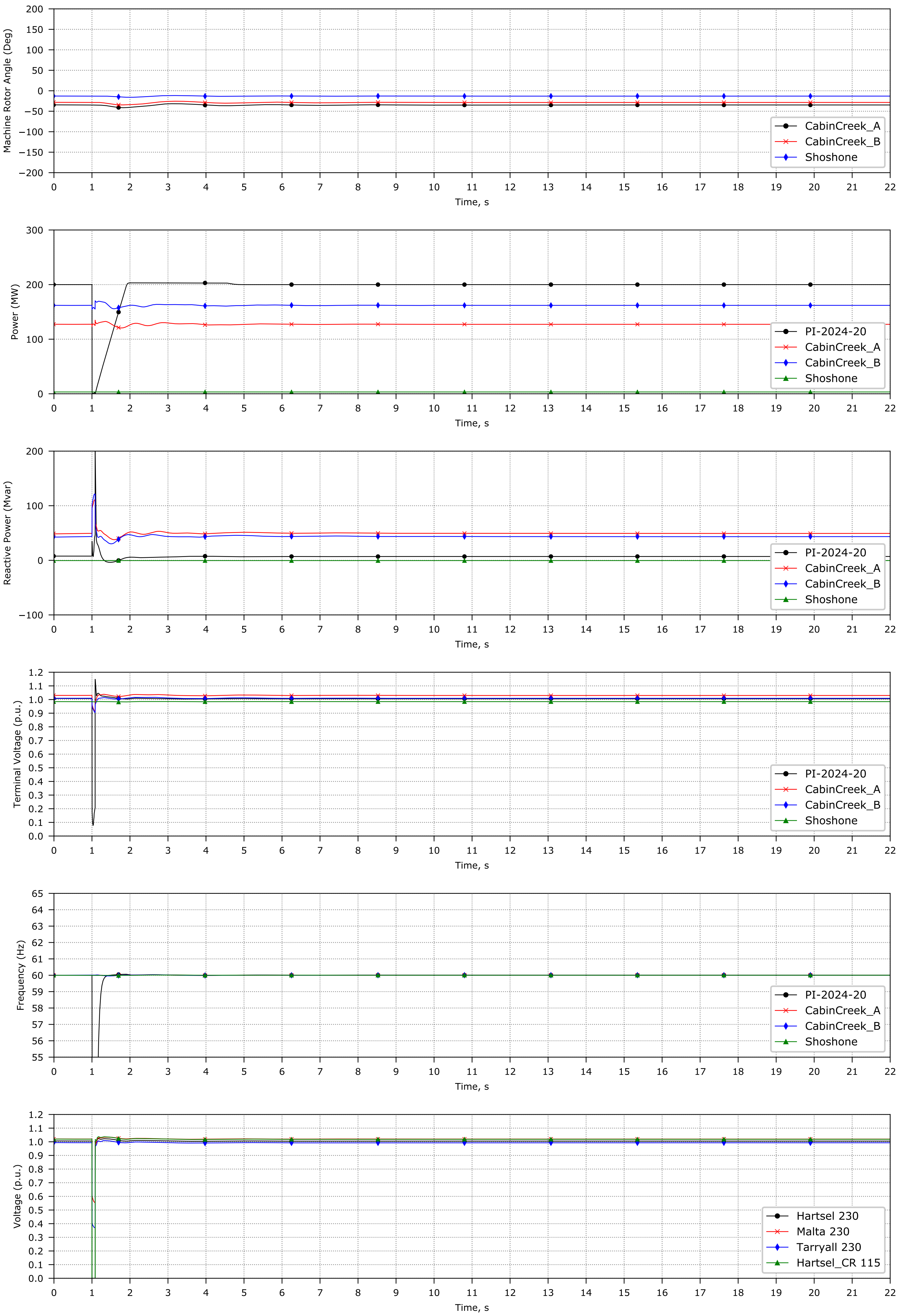
Appendix A: Stability Plots for Discharging Scenario	PI-2024-20_Discharging
Appendix B: Stability Plots for Grid Charging Scenario	PI-2024-20_Charging

Flat run

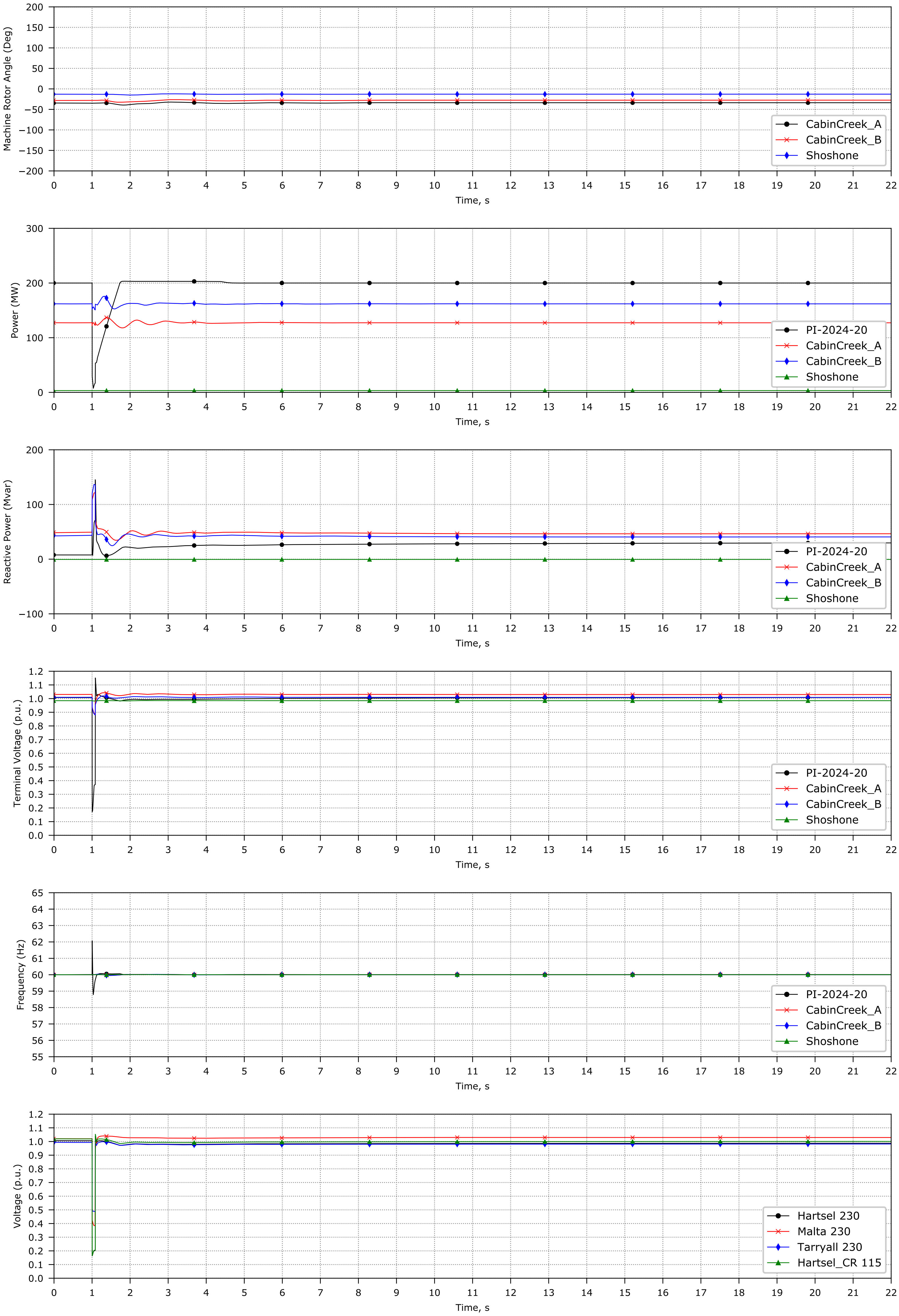


Machine Rotor Angle (Deg)
CabinCreek_A
CabinCreek_B
Shoshone
Time, s
Power (MW)
PI-2024-20
CabinCreek_A
CabinCreek_B
Shoshone
Time, s
Reactive Power (Mvar)
PI-2024-20
CabinCreek_A
CabinCreek_B
Shoshone
Time, s
Terminal Voltage (p.u.)
PI-2024-20
CabinCreek_A
CabinCreek_B
Shoshone
Time, s
Frequency (Hz)
PI-2024-20
CabinCreek_A
CabinCreek_B
Shoshone
Time, s
Voltage (p.u.)
Hartsel 230
Malta 230
Tarryall 230
Hartsel_CR 115
Time, s

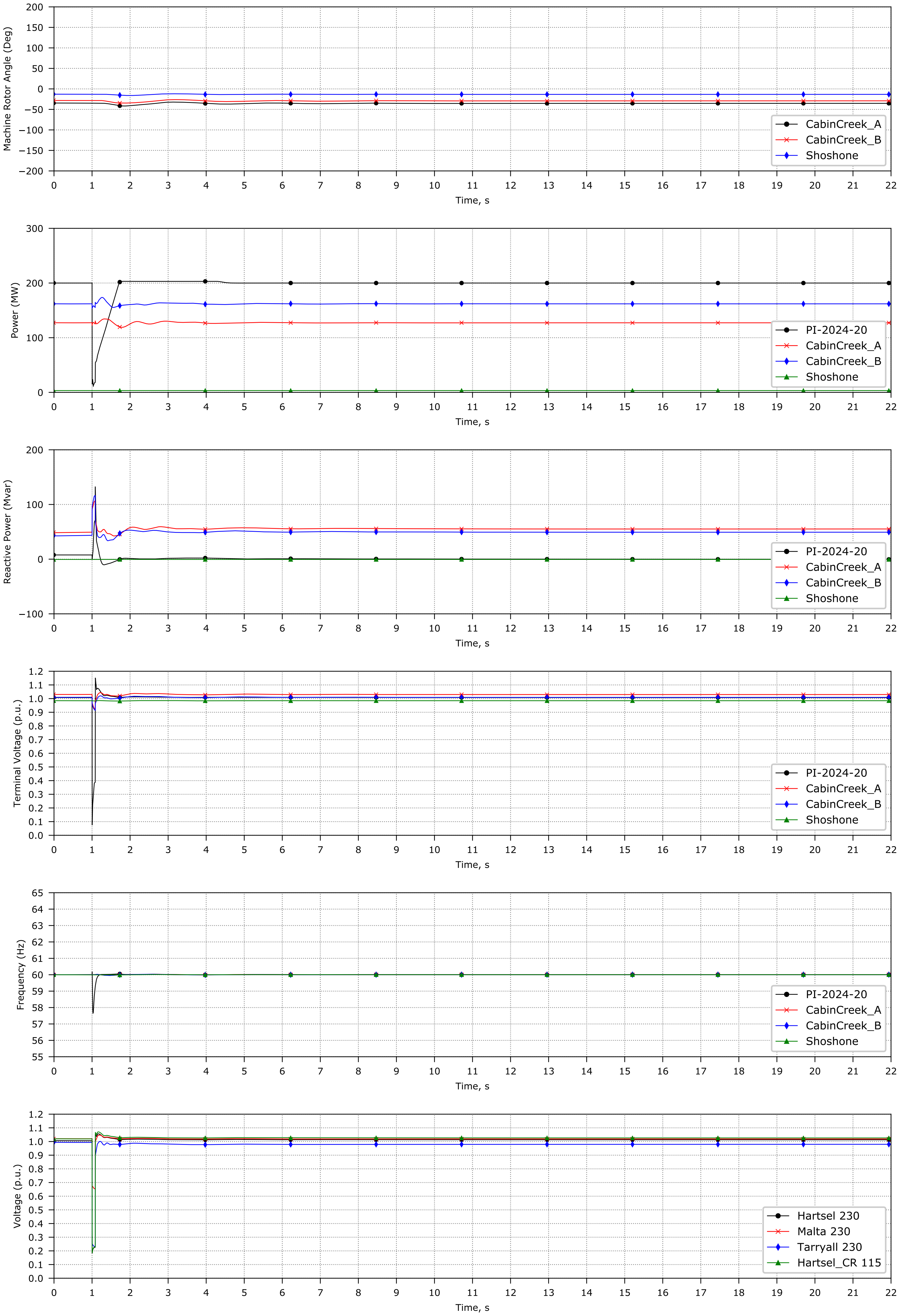
PI-2024-20 Gen



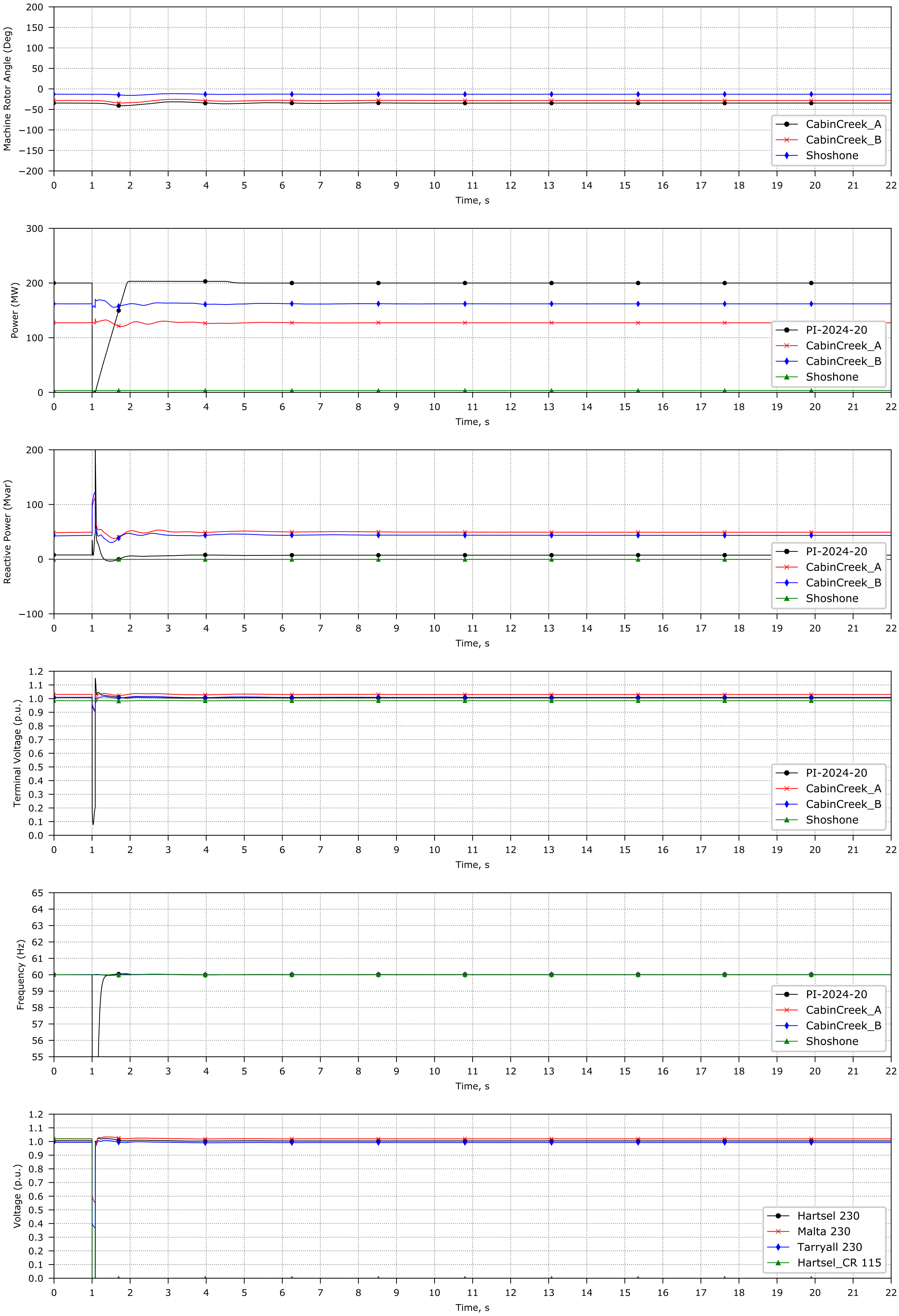
Hartsel 230 kV (LoTC_29)



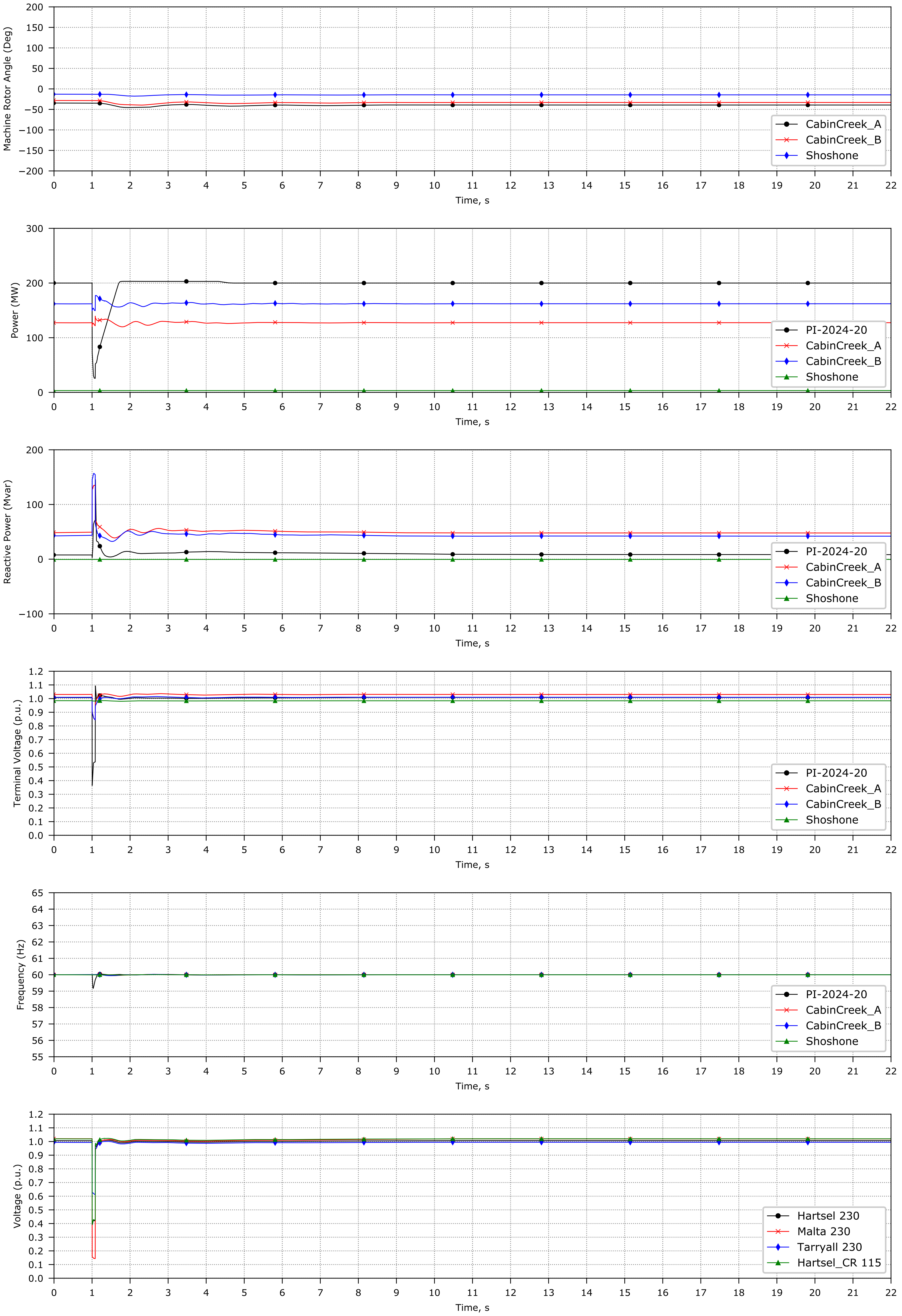
Hartsel 230 kV (LoTC_144)



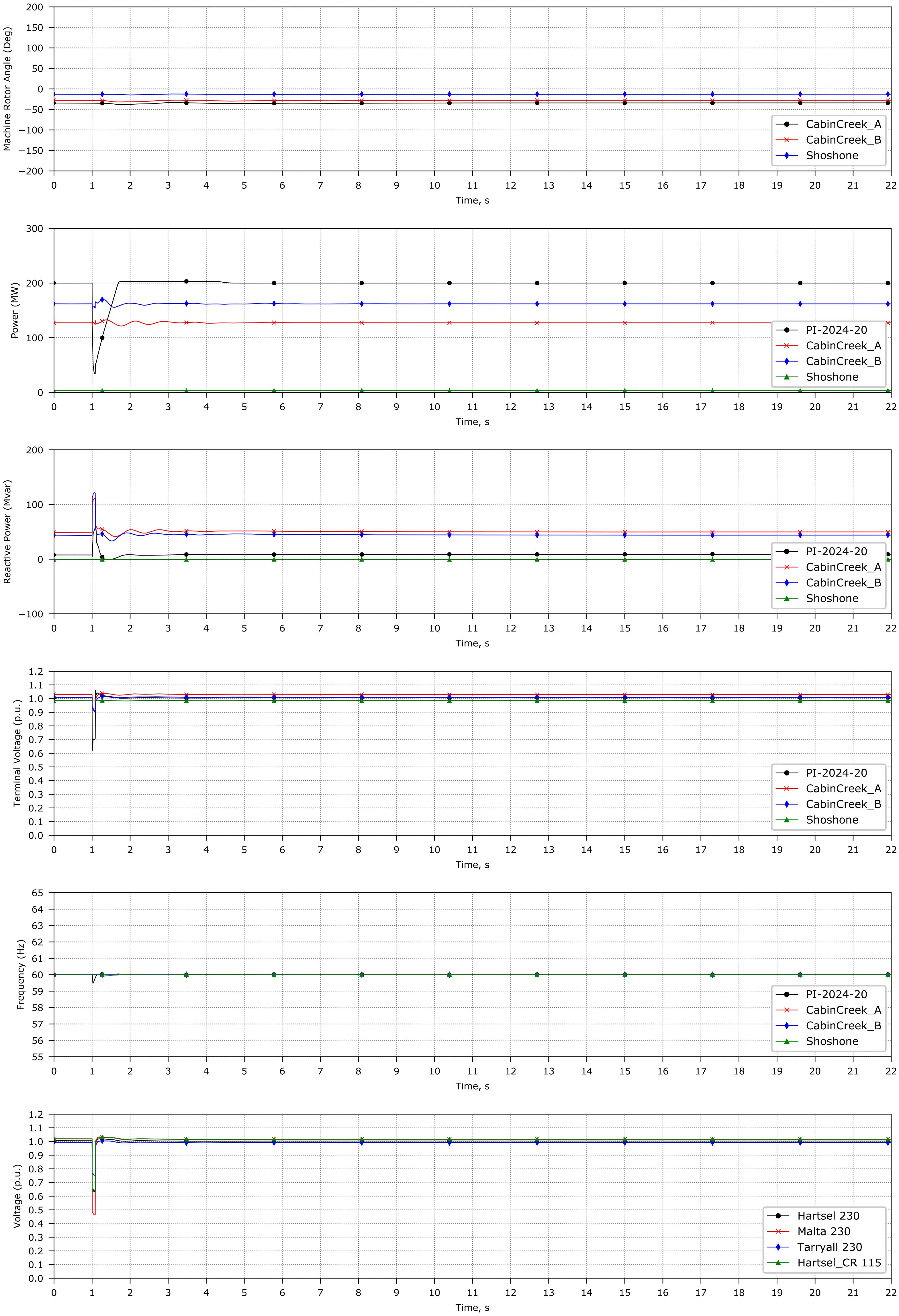
Hartsel 230 kV(HARS-HARS_CR)



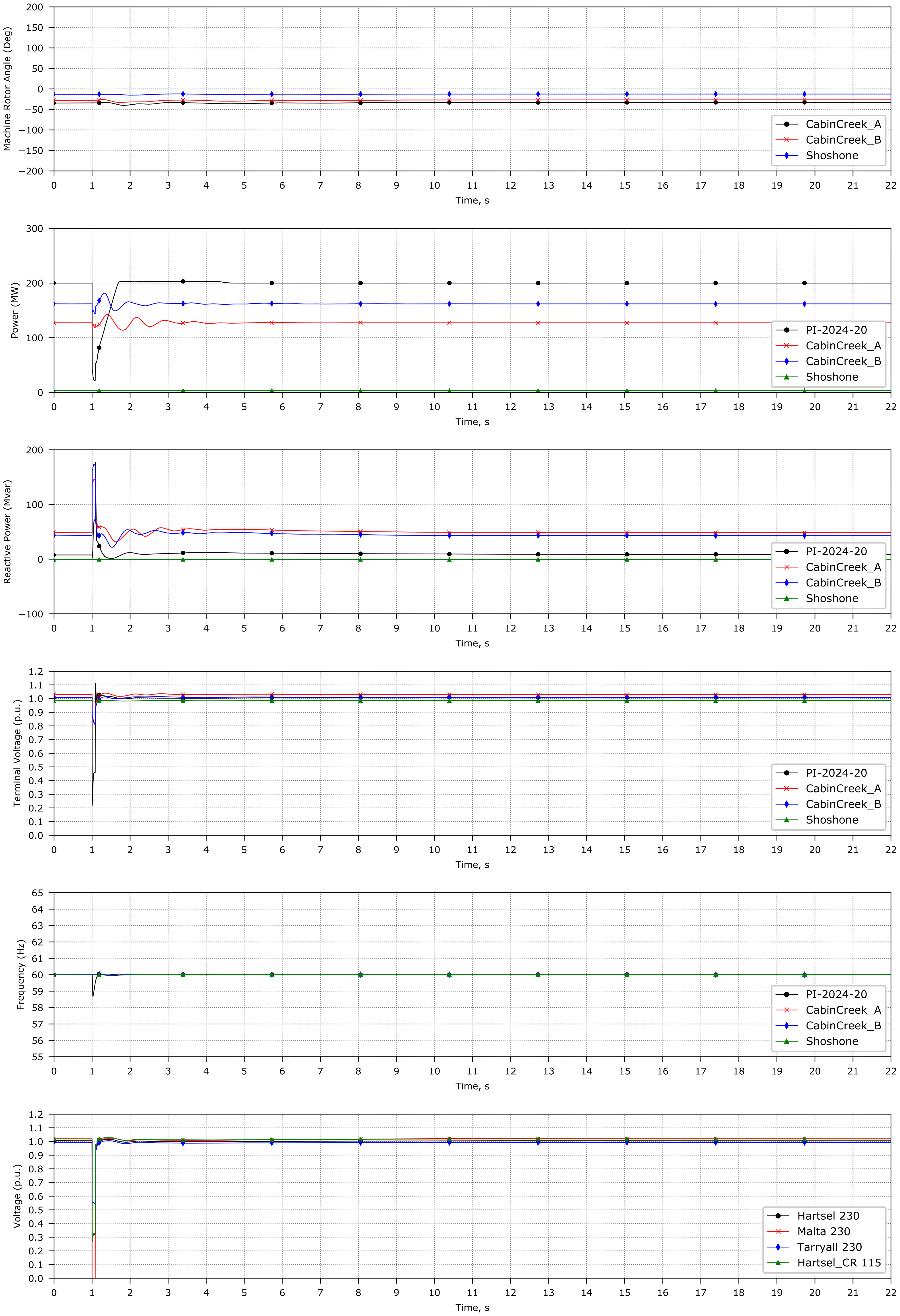
Malta 230 kV (LoTC_30)



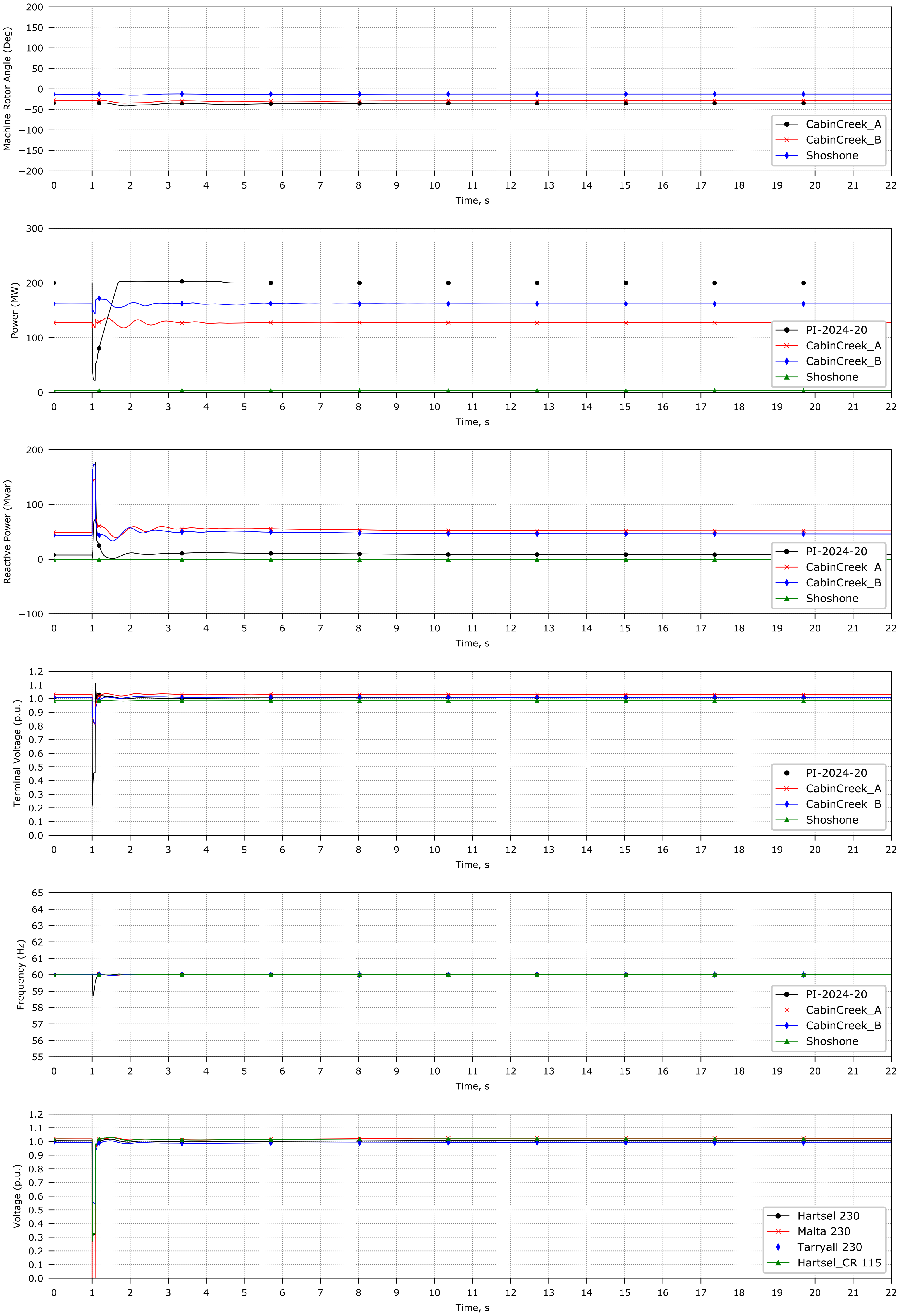
Malta 230 kV (LoTC_31)



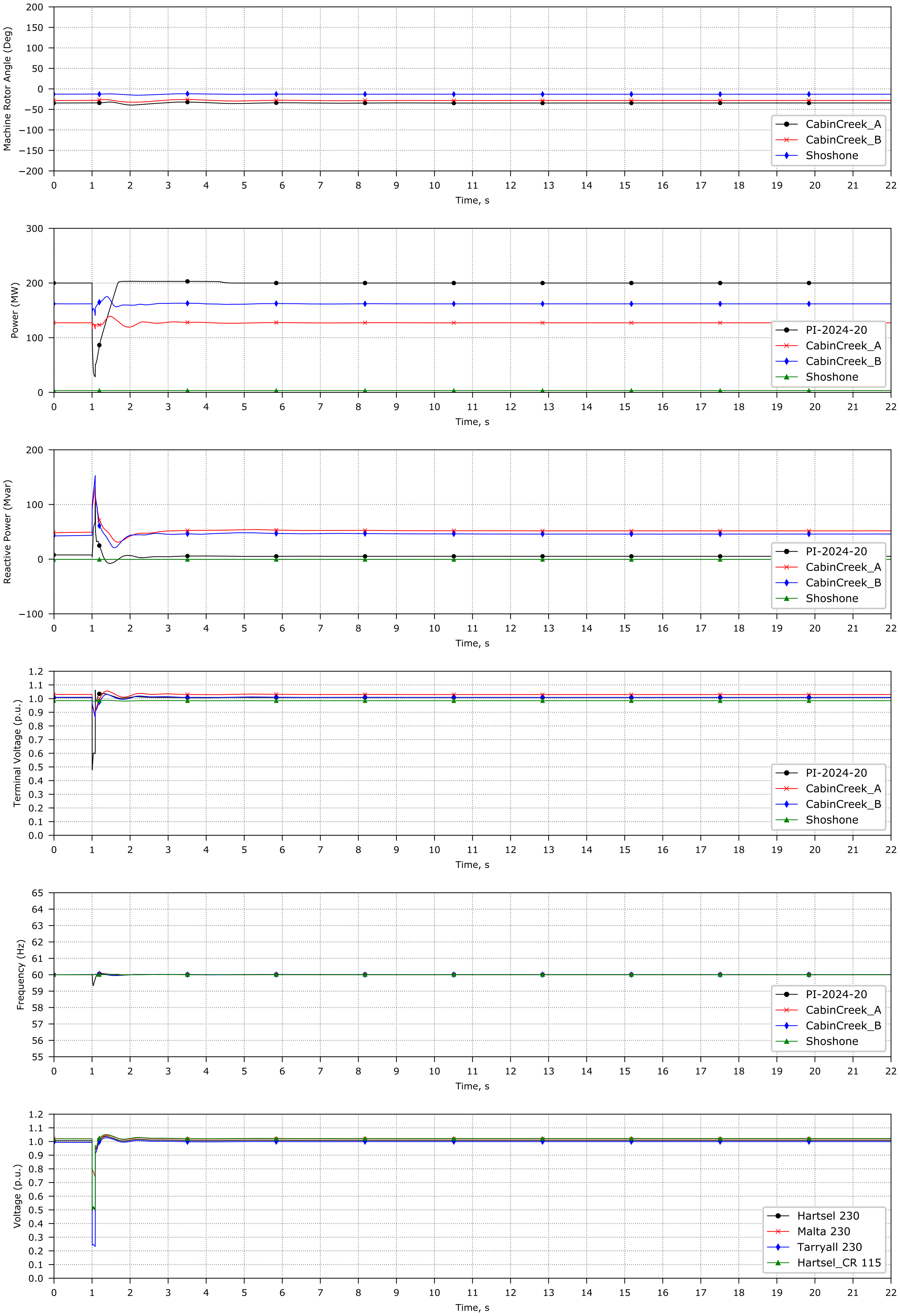
Malta 230 kV (LoTC_47)



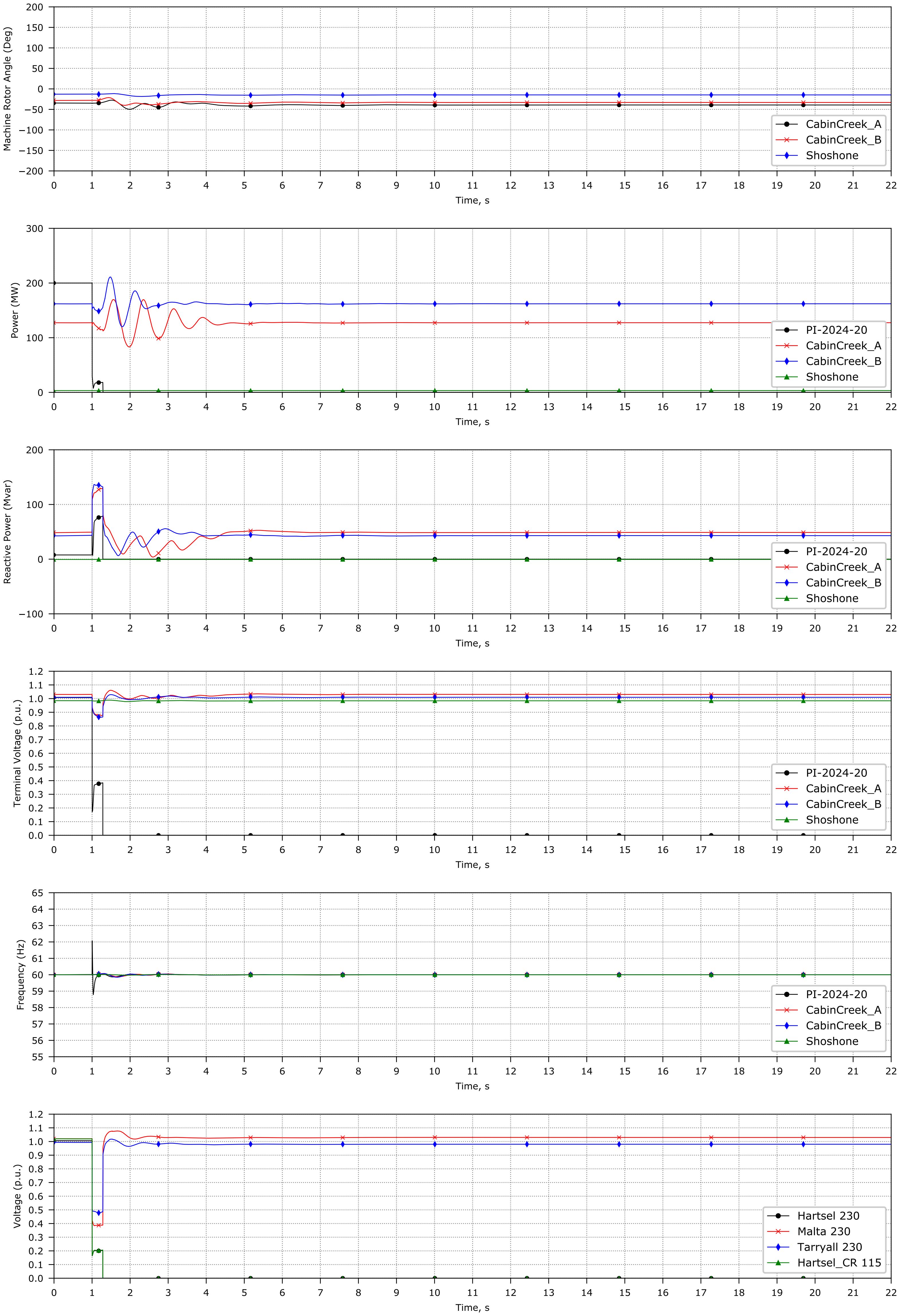
Malta 230 kV (LoTC_89)



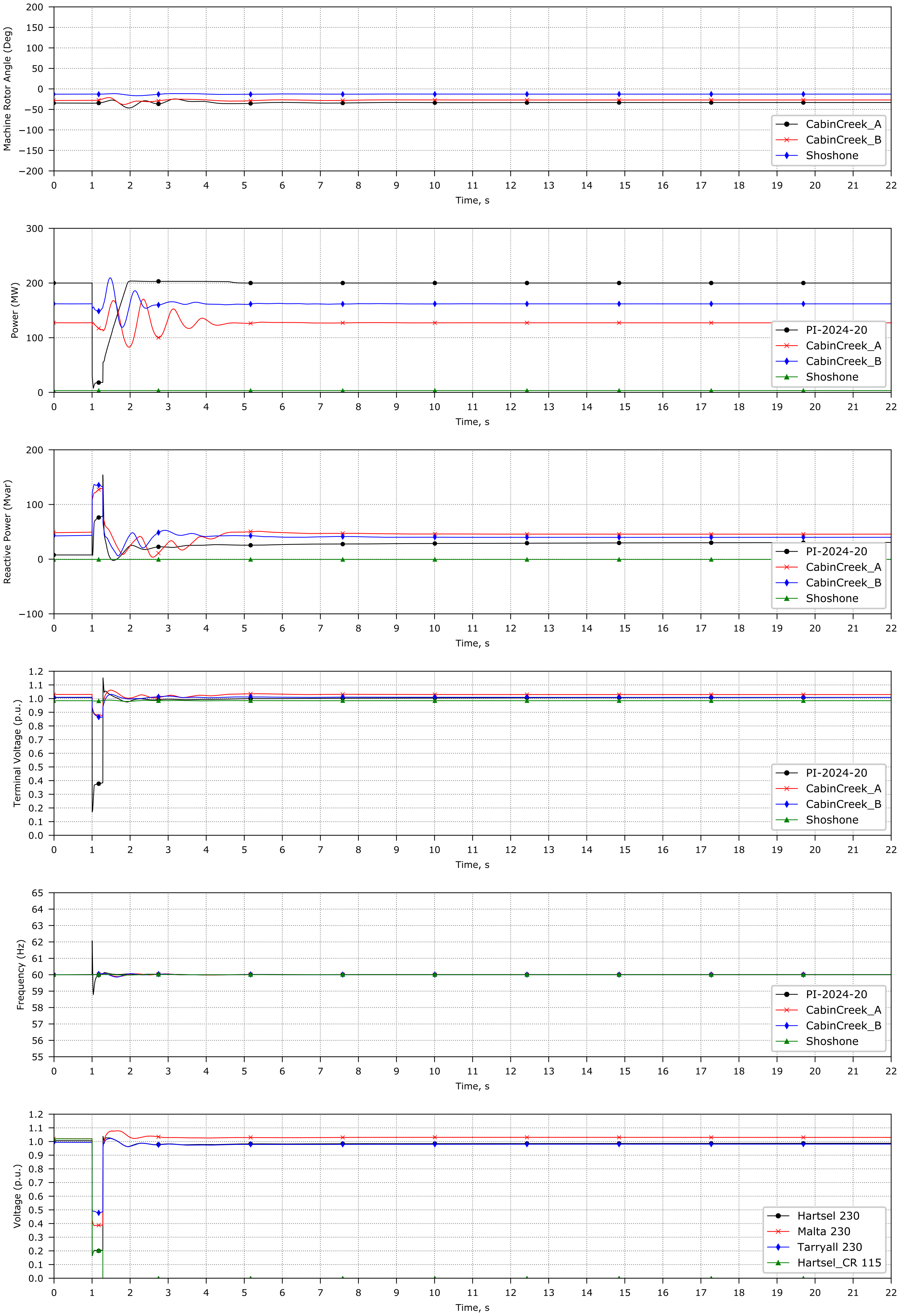
Tarryall 230 kV (LoTC_128)



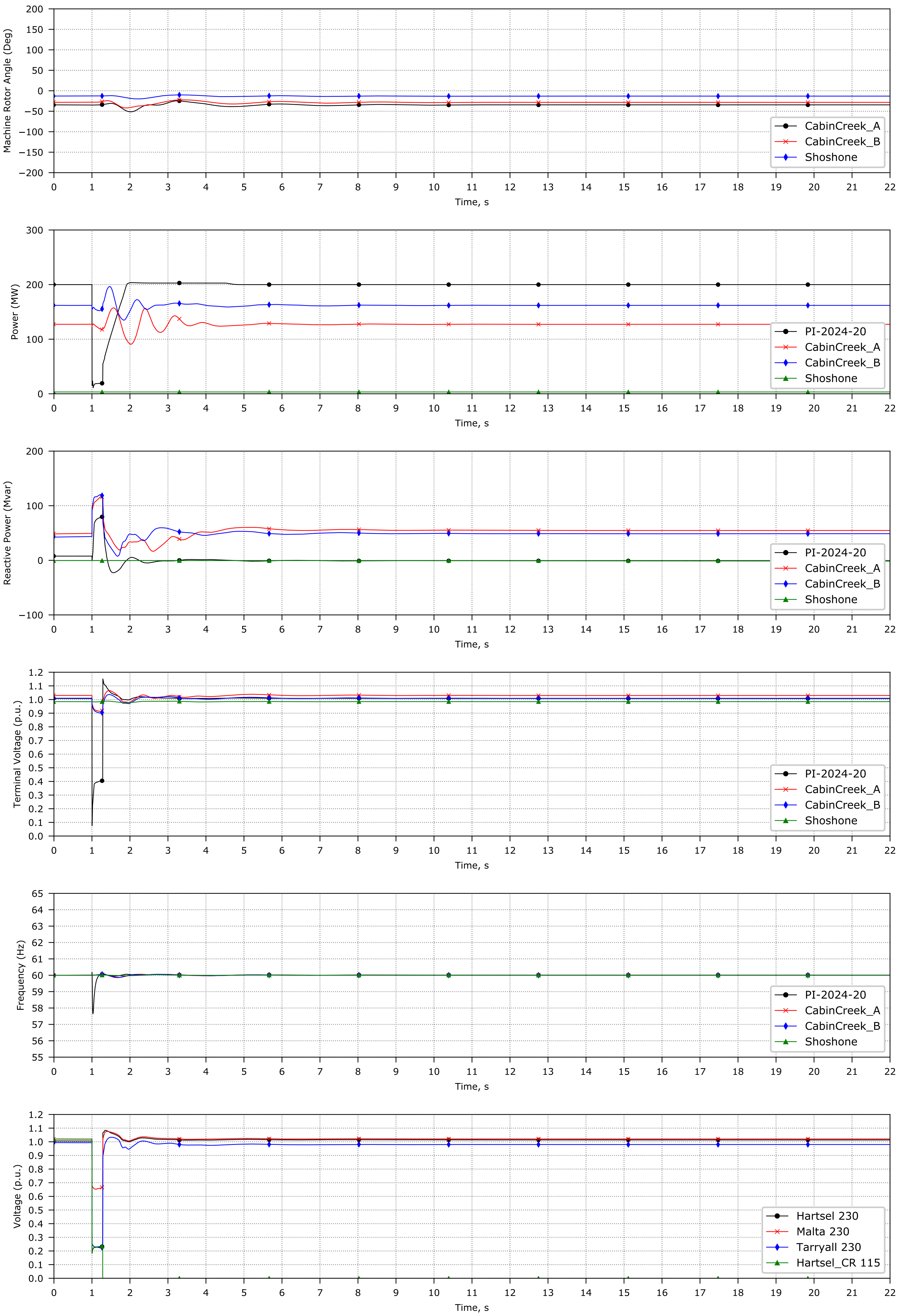
Hartsel 230 kV (BF_070a)



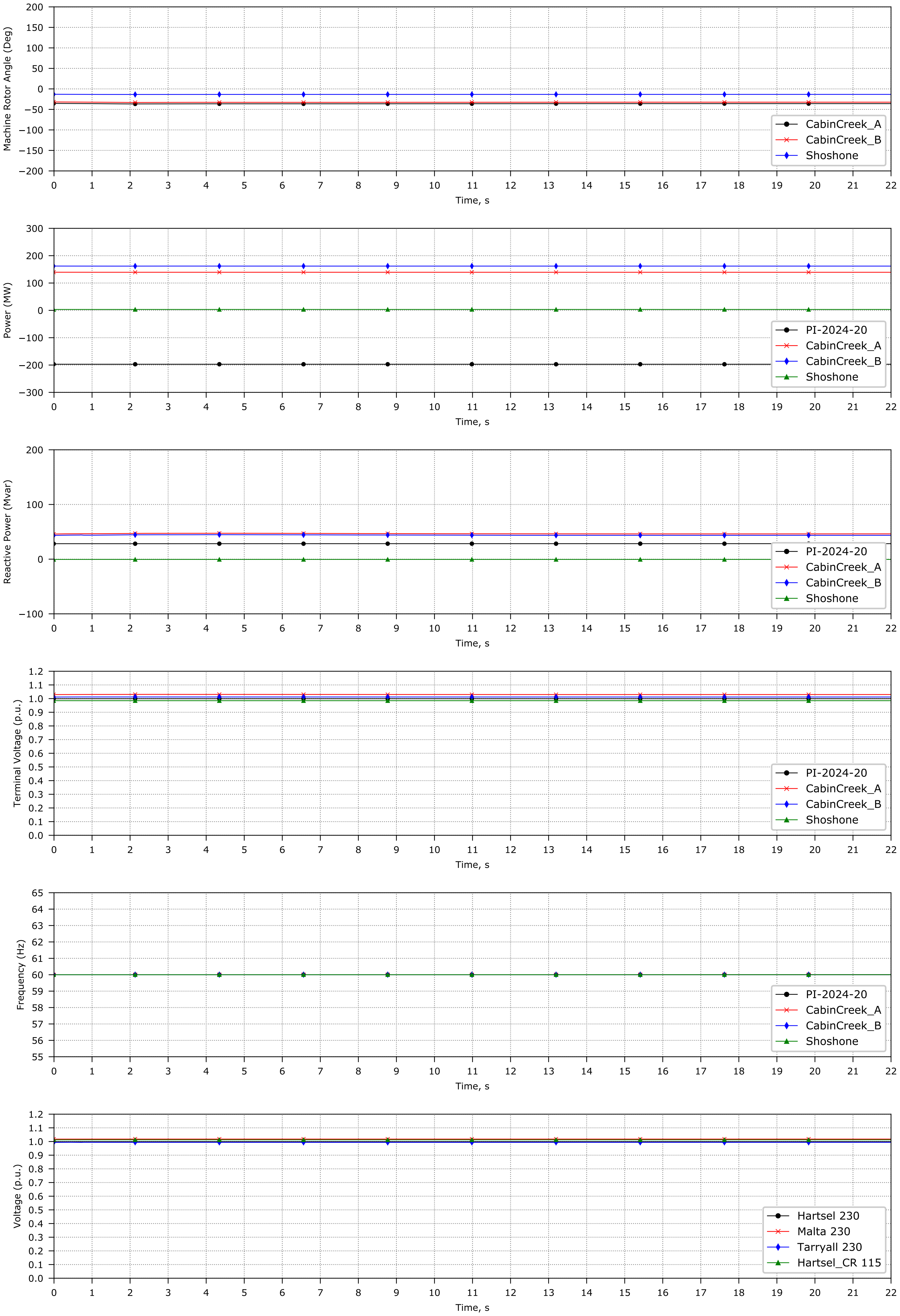
Hartsel 230 kV (BF_070b)



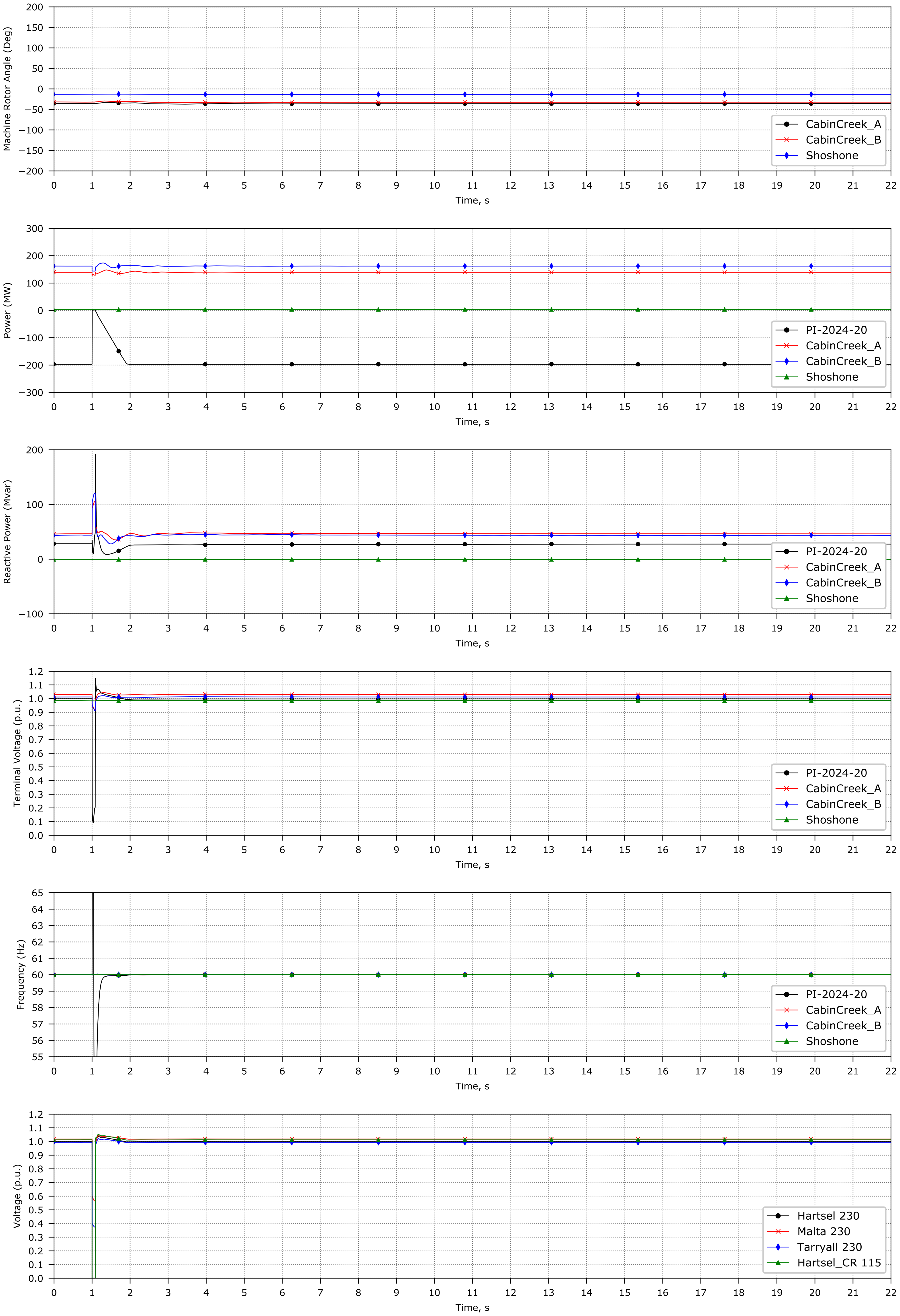
Hartsel 230 kV (BF_070c)



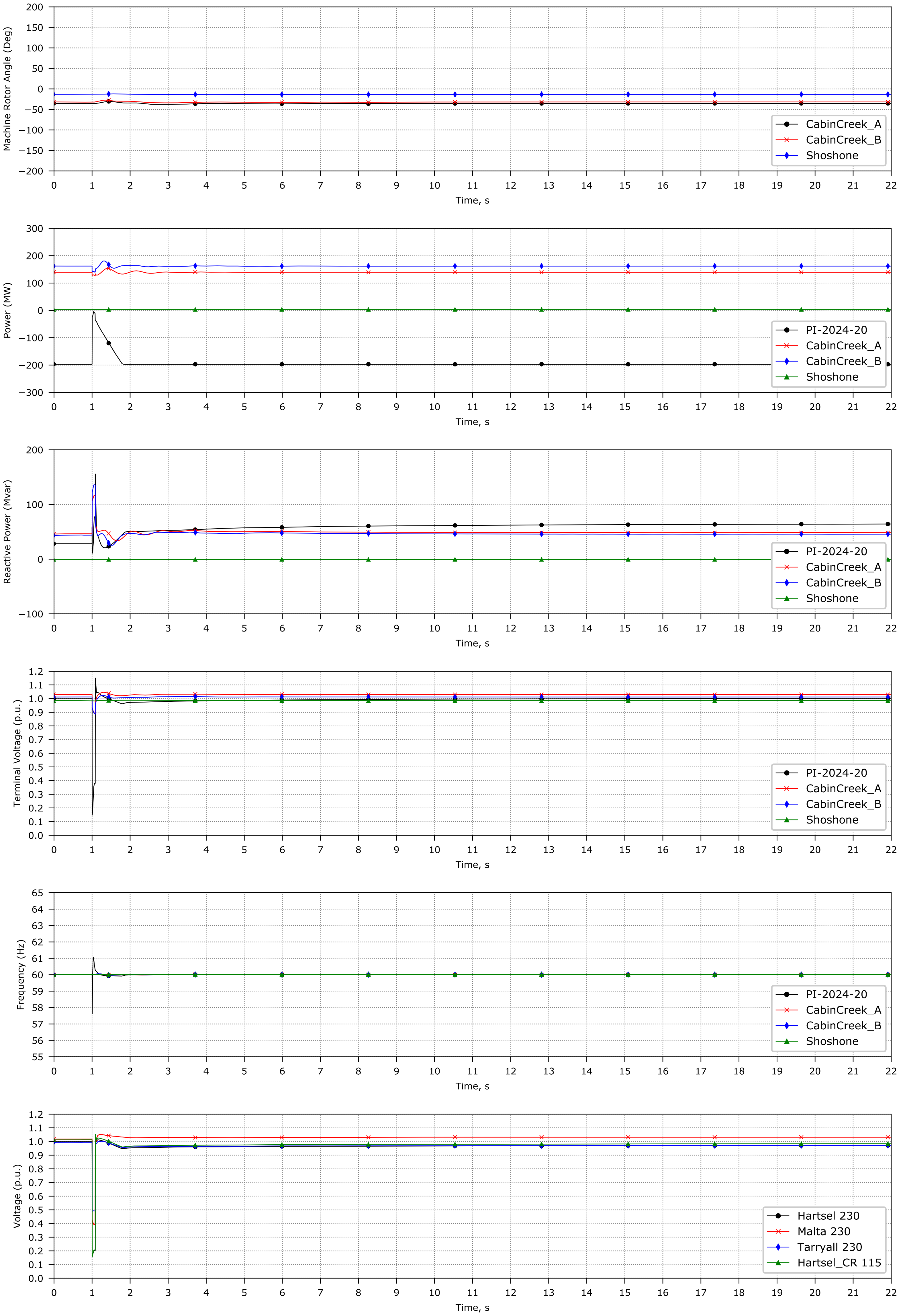
Flat run


Machine Rotor Angle (Deg)
CabinCreek_A
CabinCreek_B
Shoshone
Time, s
Power (MW)
PI-2024-20
CabinCreek_A
CabinCreek_B
Shoshone
Time, s
Reactive Power (Mvar)
PI-2024-20
CabinCreek_A
CabinCreek_B
Shoshone
Time, s
Terminal Voltage (p.u.)
PI-2024-20
CabinCreek_A
CabinCreek_B
Shoshone
Time, s
Frequency (Hz)
PI-2024-20
CabinCreek_A
CabinCreek_B
Shoshone
Time, s
Voltage (p.u.)
Hartsel 230
Malta 230
Tarryall 230
Hartsel_CR 115
Time, s

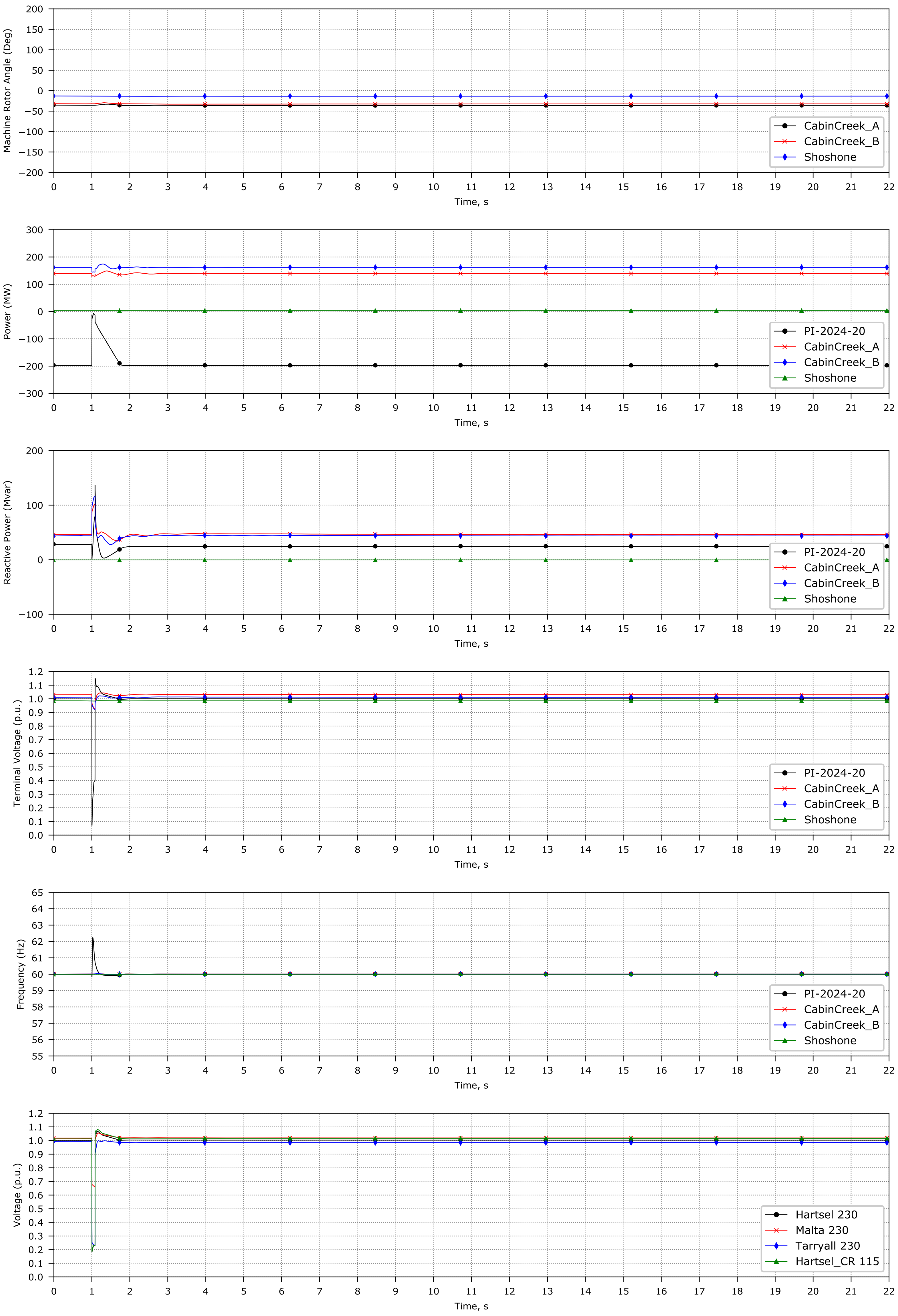
PI-2024-20 Gen



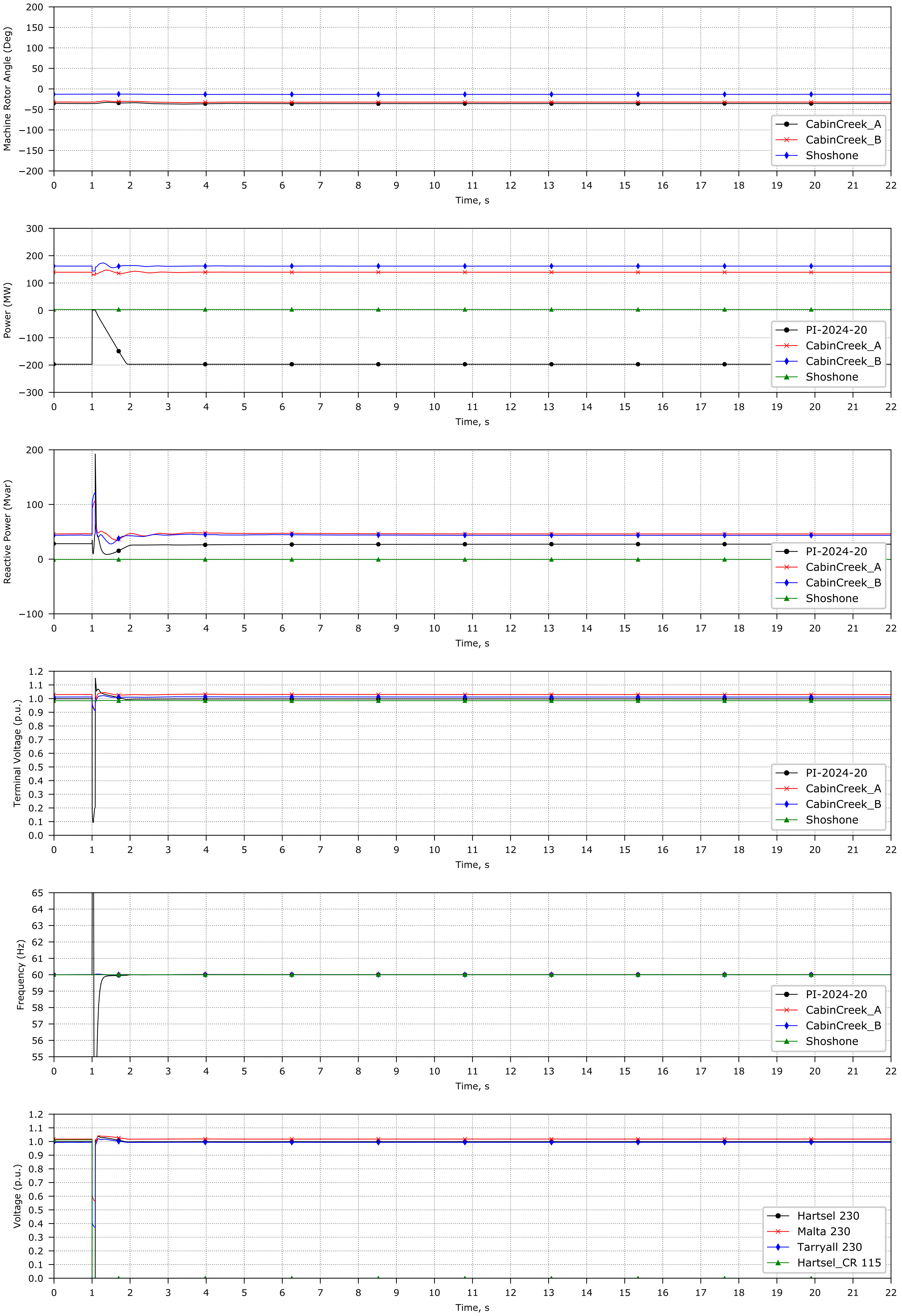
Hartsel 230 kV (LoTC_29)



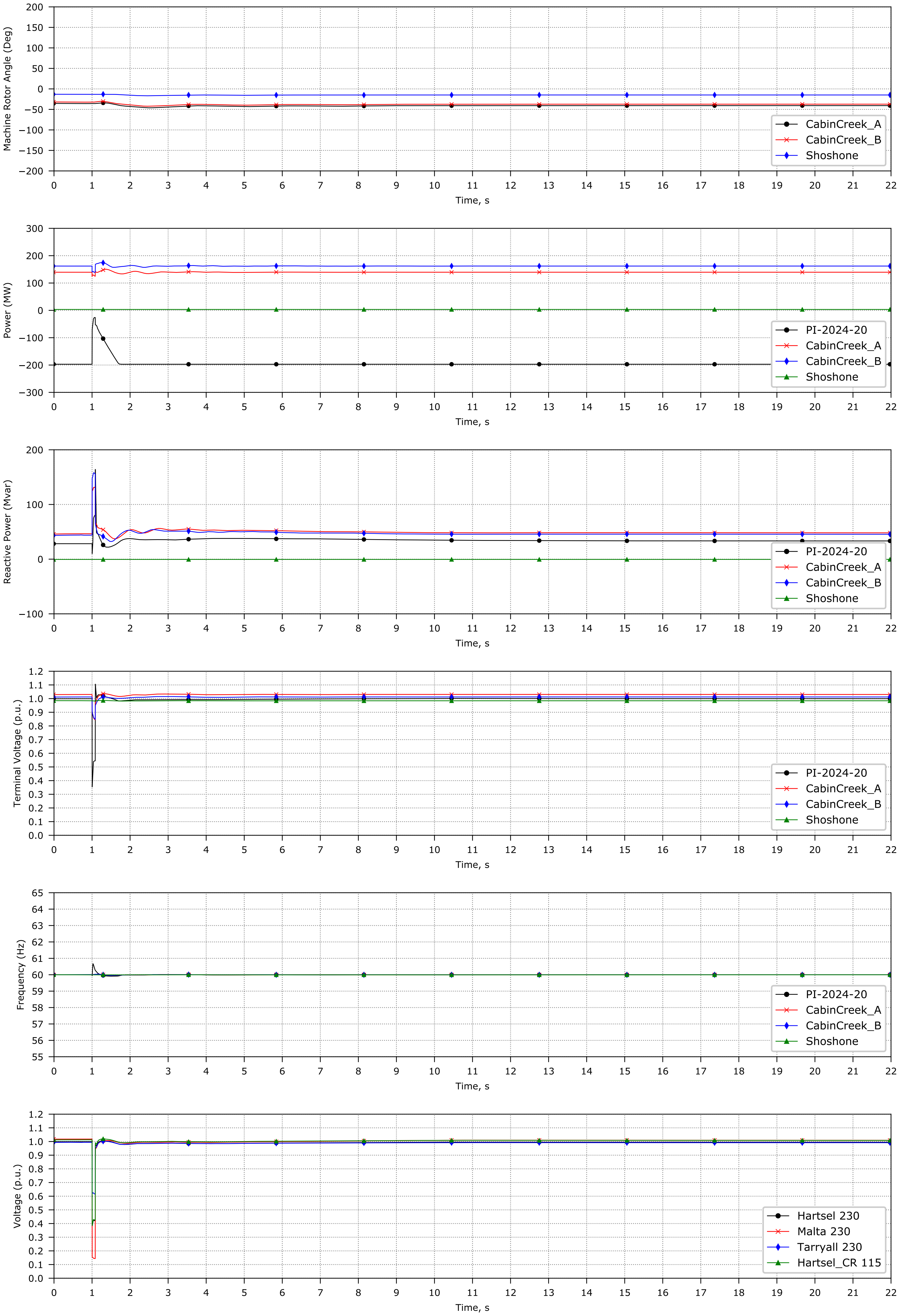
Hartsel 230 kV (LoTC_144)



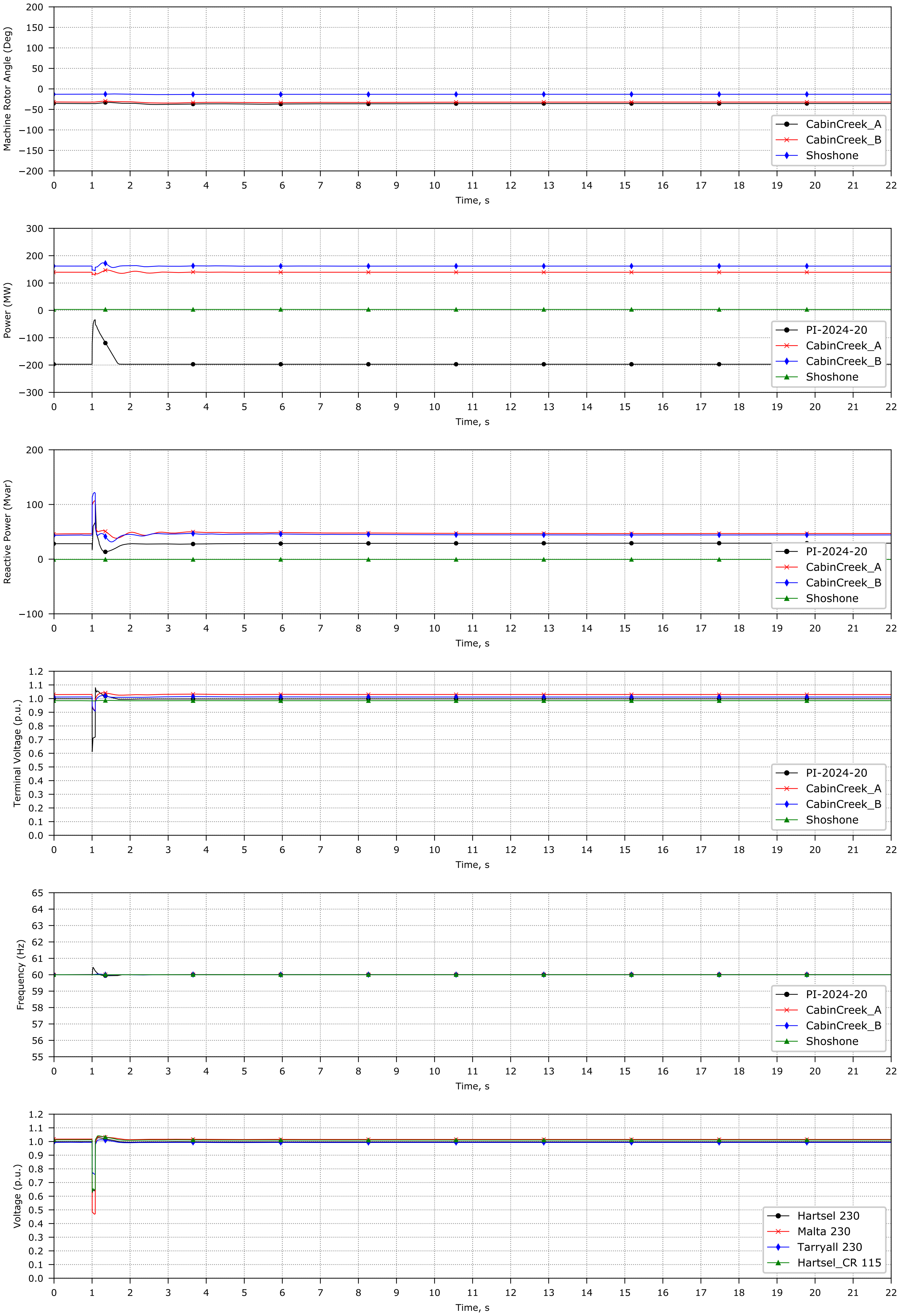
Hartsel 230 kV(HARS-HARS_CR)



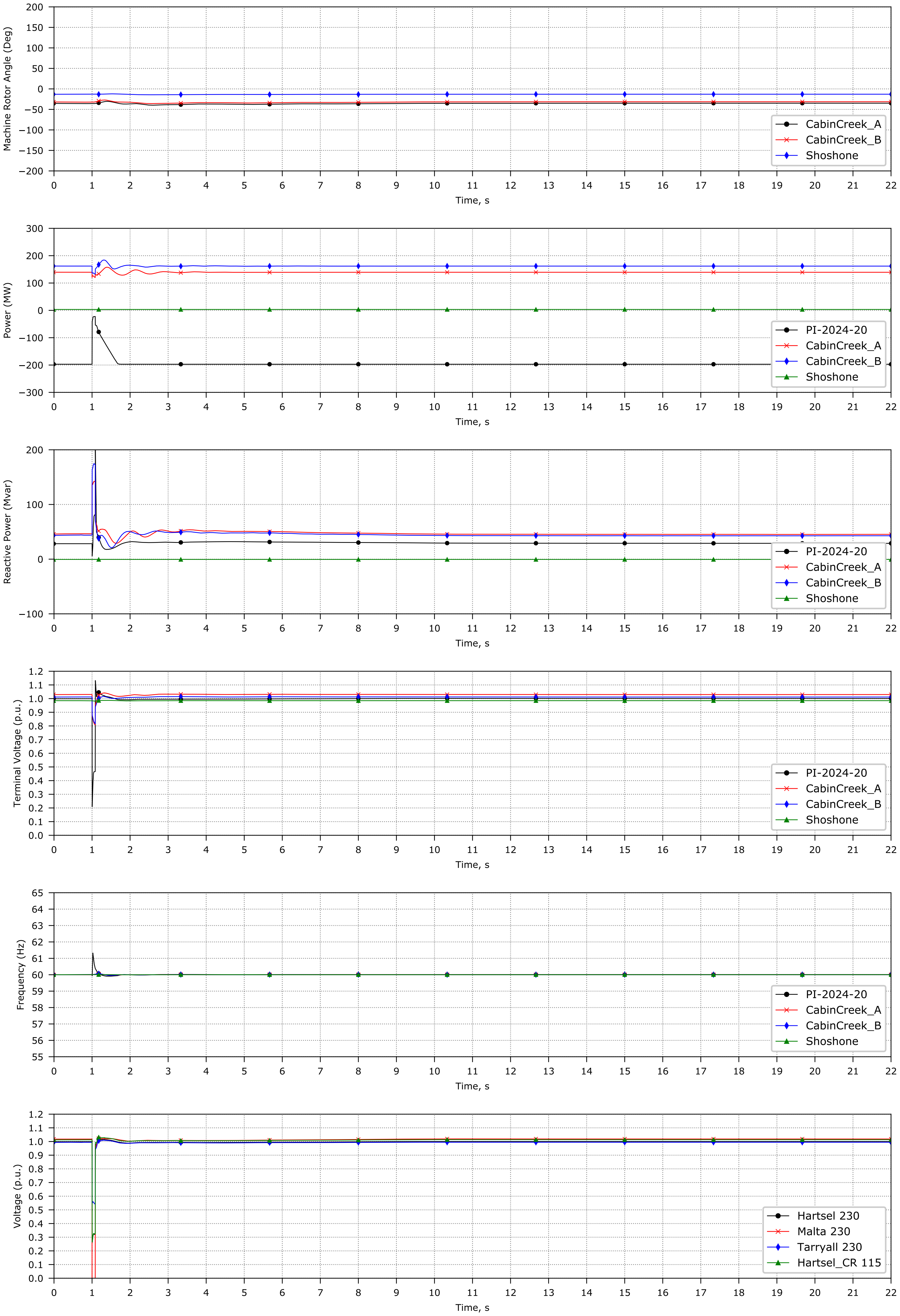
Malta 230 kV (LoTC_30)



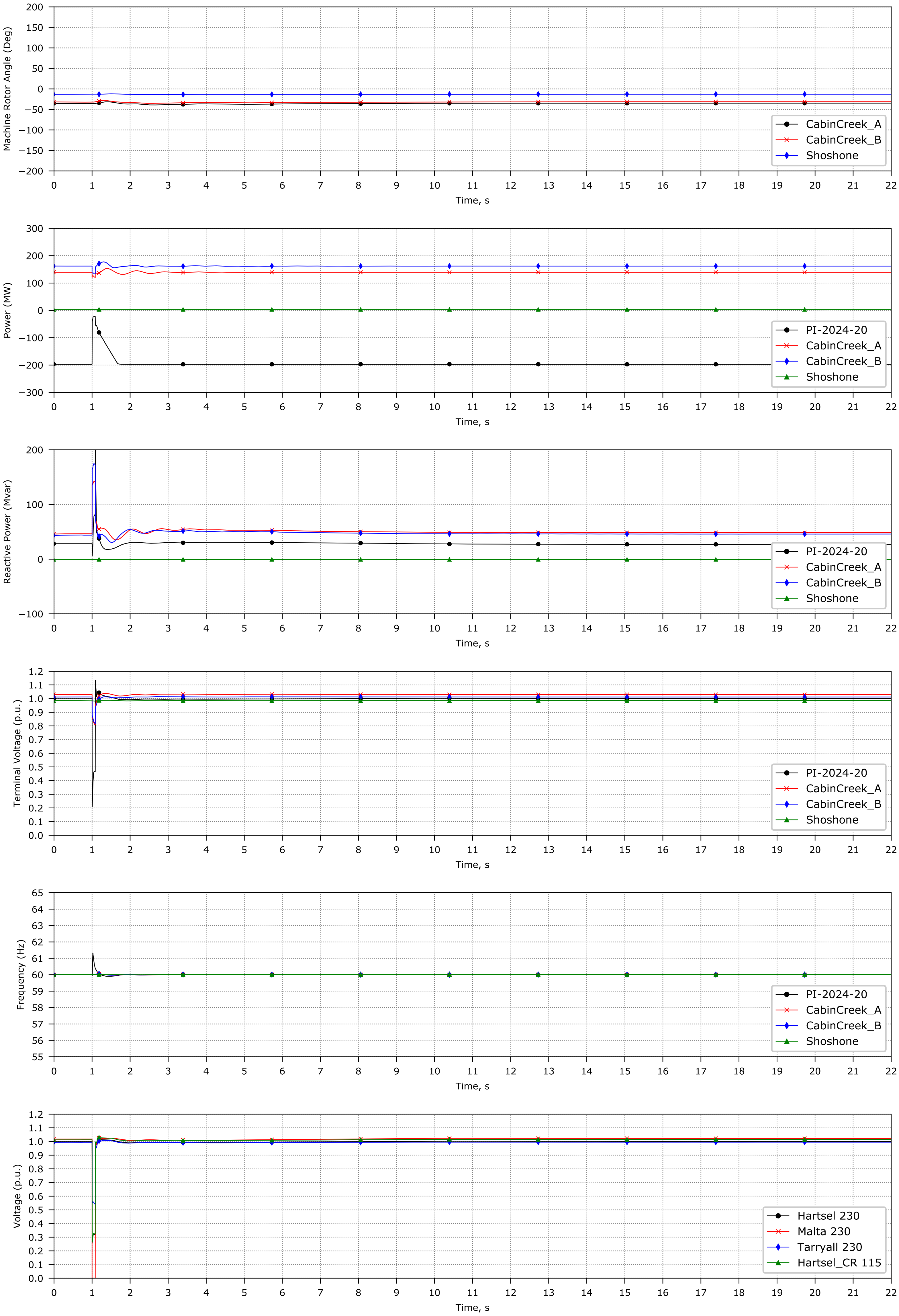
Malta 230 kV (LoTC_31)



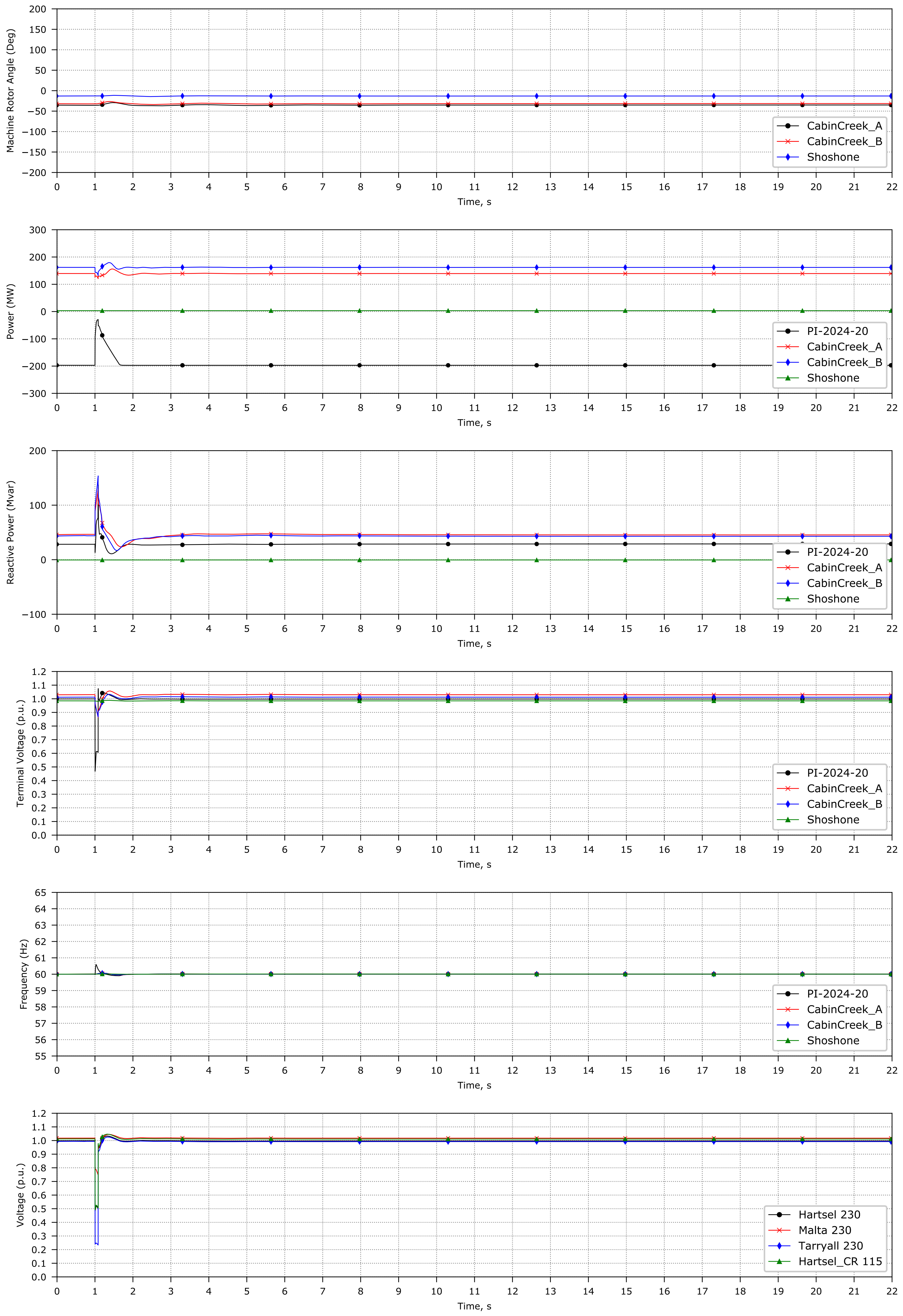
Malta 230 kV (LoTC_47)



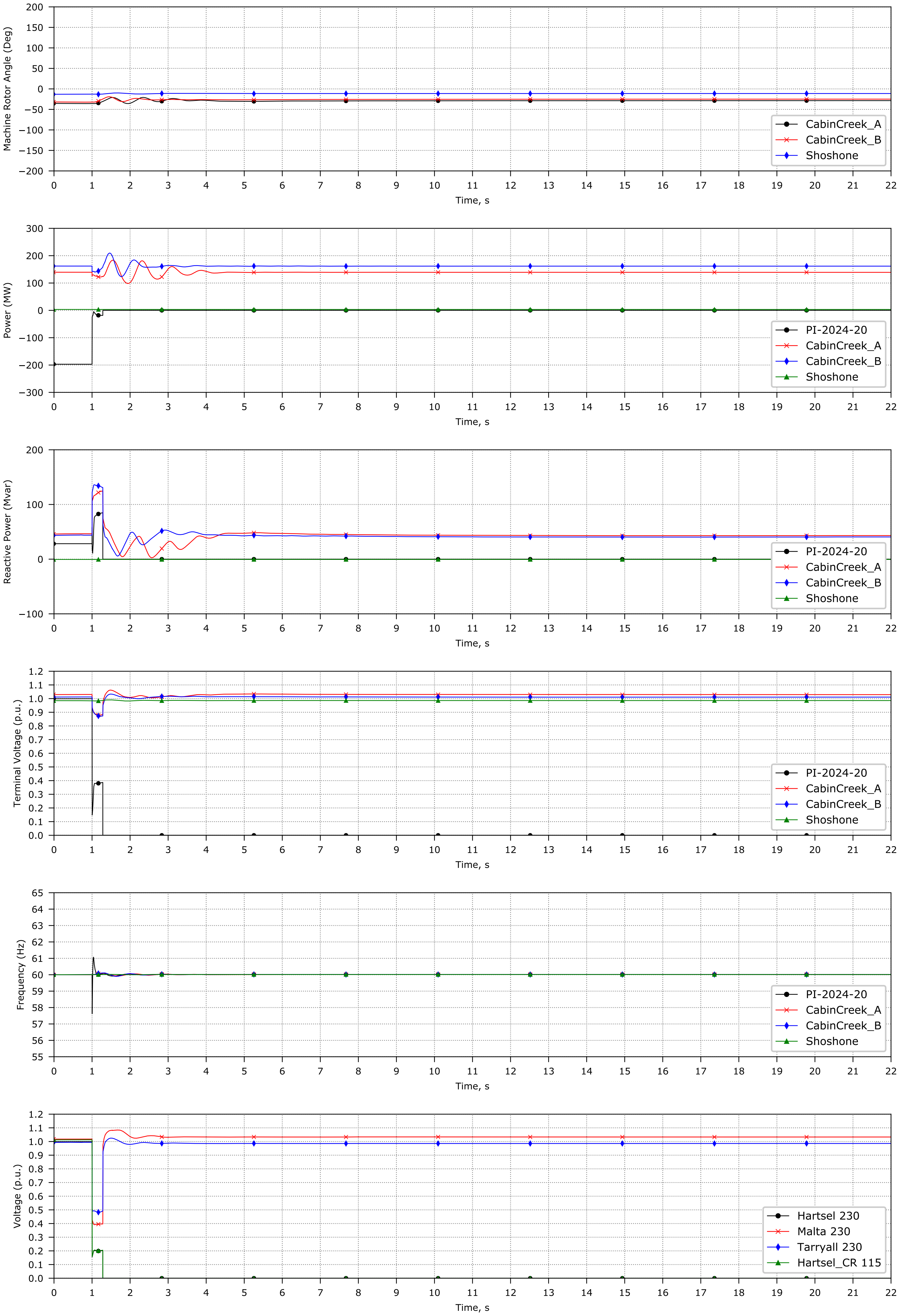
Malta 230 kV (LoTC_89)



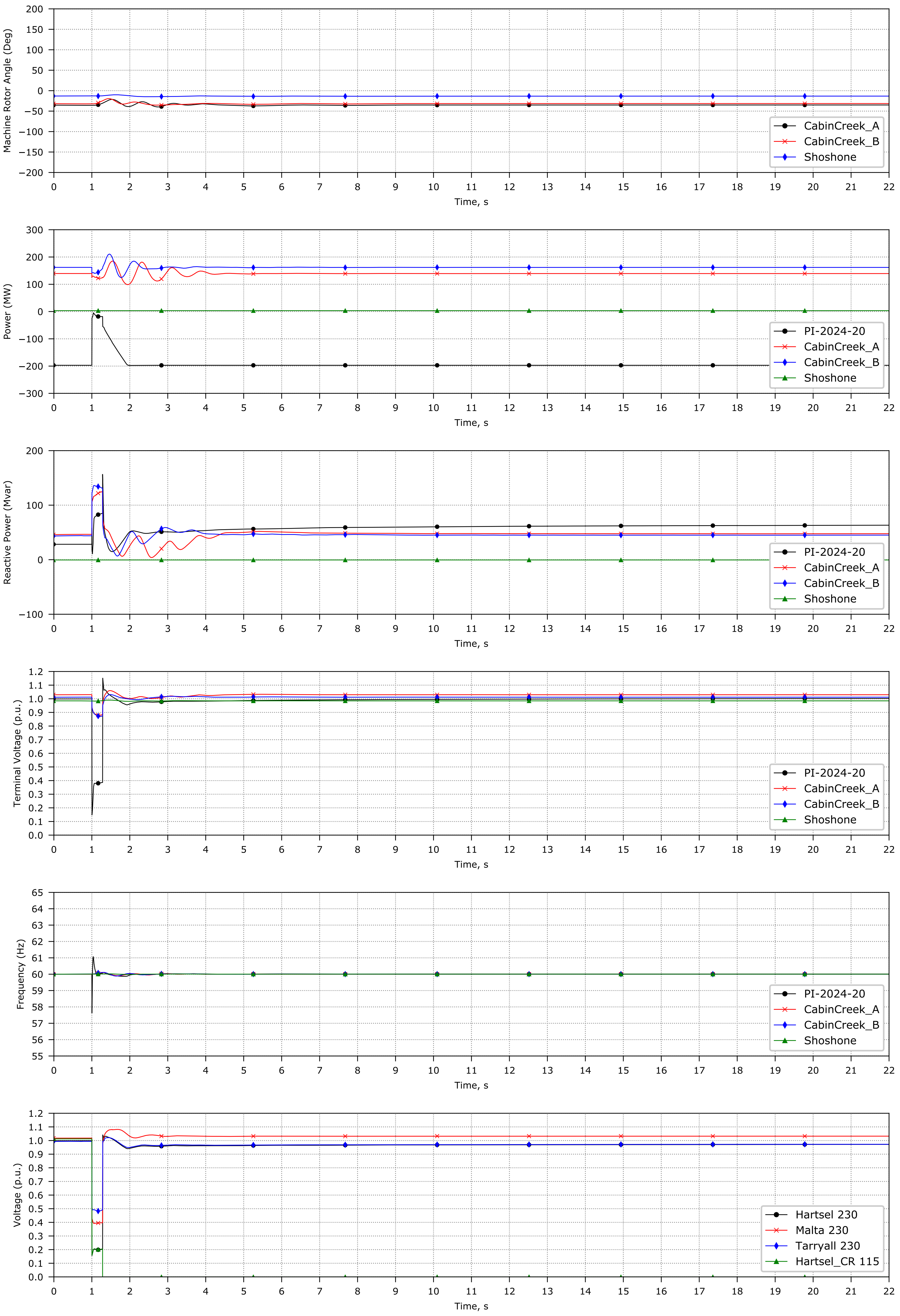
Tarryall 230 kV (LoTC_128)



Hartsel 230 kV (BF_070a)



Hartsel 230 kV (BF_070b)



Hartsel 230 kV (BF_070c)