




APPENDIX A CONNECTION ASSESSMENT

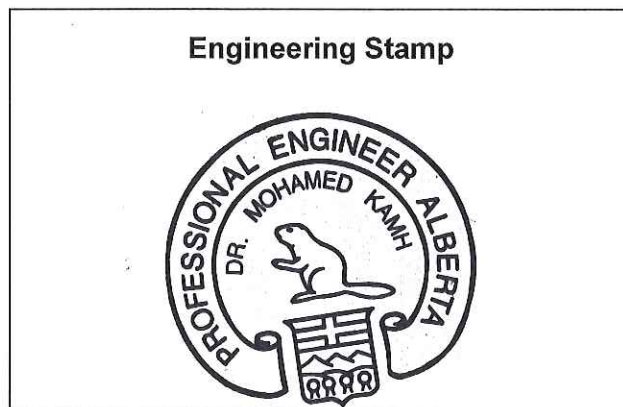
AESO Engineering Connection Assessment

Stirling Wind Project Connection

AESO Project Number: 1719

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Note:

The conclusion and recommendations stated in this Report are based on results listed in the Connection Assessment Results report prepared by a third party as part of the AESO's connection process (Attachment A of this report).

The AESO has reviewed the Connection Assessment Results Report, and finds it acceptable for the purpose of assessing potential impacts of the proposed connection on the transmission system.

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Attachments

Attachment A Engineering Connection Assessment Results

1. Introduction

This AESO Engineering Connection Assessment report describes the engineering studies that were completed to assess the impact of the Project (as defined below) on the performance of the Alberta interconnected electric system (AIES). This report also provides the AESO's conclusions and recommendations based on the results of the engineering studies.

Attached to this report are the results of the engineering studies (see Attachment A) and the scope and methodology used to perform the studies (see Attachment A1 to Attachment A). These attachments provide details regarding the technical criteria, assumptions, and methods for performing these engineering studies, and the results of the engineering studies.

1.1. Project Overview

Stirling Wind Project LP, by its General Partner Stirling Wind Project Ltd. (Market Participant), has submitted a request for system access service to the Alberta Electric System Operator (AESO) to connect its proposed Stirling Wind Project (the Facility) to the AIES. The Facility is a wind aggregated generating facility, and includes a proposed collector station, to be designated the Red Coat 967S substation. The Facility is planned to be located near the Village of Stirling in and around the AESO planning areas of Glenwood (Area 55) and Lethbridge (Area 54). The Market Participant's request includes: a request for a Rate STS, *Supply Transmission Service*, contract capacity of 113 MW and a request for a Rate DTS, *Demand Transmission Service*, contract capacity of 1.0 MW for new system access service in the area; and a request for transmission development (collectively, the Project).

The scheduled In-Service Date (ISD) for the Project is July 1, 2019.

2. Assessment Scope

2.1. Objectives

The objectives of the AESO Engineering Connection Assessment are as follows:

- Assess the impact of the Project on the performance of the AIES
- Evaluate Project connection alternatives and identify the AESO's preferred alternative
- Recommend mitigation measures, if required, to reliably connect the Project to the AIES.
- Identify Project dependencies, including any TFO projects or AESO plans to expand or enhance the transmission system that must be completed prior to connection.

2.2. Study Area

The Study Area for the Project consists of the AESO Planning areas of Glenwood (Area 55), Vauxhall (Area 52), Lethbridge (Area 54), and Stavely (Area 49), including the tie lines connecting these planning areas to the rest of the AIES. All transmission facilities within the Study Area were studied and monitored to assess the impact of the Project on the AIES, including any violations of the Reliability Criteria (defined in Section 3.1 of Attachment A1).

3. Connection Alternatives

The AESO, in consultation with the legal owner of transmission facilities (TFO) in the Study Area, and the Market Participant, identified seven transmission alternatives to meet the Market Participant's request for system access service.

3.1. Connection Alternatives Identified

Below is a description of the developments associated with the transmission alternatives that were examined for the Project.

Alternative 1: Radial connection to the Stirling 67S substation

Alternative 1 involves connecting the Facility to the existing Stirling 67S substation in a radial configuration. This alternative would require the addition of a new 138 kV circuit, approximately 15 km in length and the addition of a 138 kV circuit breaker and associated equipment at the Stirling 67S substation.

Alternative 2: In-and-out connection to the 138 kV transmission line 820L

Alternative 2 involves connecting the Facility to the 138 kV transmission line 820L (between the Stirling 67S substation and the Chin Chute 315S tap point) using an in-and-out configuration. This would require the addition of two 138 kV circuits, each approximately 5 to 7 km in length, and the addition of a new switching station with a minimum of three 138 kV circuit breakers.

Alternative 3: Radial connection to Chin Chute 315S substation

Alternative 3 involves connecting the Facility to the existing Chin Chute 315S substation. This alternative would require the addition of a new 138 kV circuit, approximately 15 km in length, and the addition of one 138 kV circuit breaker and associated equipment at the Chin Chute 315S substation.

Alternative 4: Radial connection to Hillridge 139S substation.

Alternative 4 involves connecting the Facility to the existing Hillridge 139S substation. This alternative would require the addition of a new 138 kV circuit, approximately 18 km in length, and the addition of one 138 kV circuit breaker and associated equipment at the Hillridge 139S substation.

Alternative 5: In-and-out connection to the 240 kV Montana-Alberta intertie

Alternative 5 involves connecting the Facility to the 240 kV Montana-Alberta intertie using an in-and-out configuration. This alternative would require the addition of one 240 kV circuit, approximately 10 km in length, and the addition of a new switching station with a minimum of three 240 kV circuit breakers.

Alternative 6: Radial connection to Picture Butte 120S substation

Alternative 6 involves connecting the Facility to the existing Picture Butte 120S substation in a radial configuration. This alternative would require the addition of a new 138 kV circuit, approximately 45 km in length, and the addition of a 138/240 kV transformer and associated equipment at the Picture Butte 120S substation.

Alternative 7: T-tap connection to the 138 kV transmission line 820L

Alternative 7 involves connecting the Facility to the 138 kV transmission line 820L (between the Stirling 67S substation and the Chin Chute 315S tap point) using a t-tap configuration. This alternative would require the addition of a new 138 kV circuit, approximately 5 to 7 km in length.

3.1.1. Connection Alternatives Selected for Further Studies

Alternative 7 is considered technically feasible and was selected for further study.

3.1.2. Connection Alternatives Not Selected for Further Studies

All other alternatives identified would involve increased transmission development, and hence overall increased cost compared to Alternative 7. Therefore, all other alternatives were not selected for further study.

4. Assessment Approach

4.1. Standards, Criteria, and Assumptions

A detailed description of the standards, criteria, and assumptions that were used for the connection assessment can be found in Attachment A1.

The AESO Planning Region load forecasts used for the connection studies were based on the *AESO 2016 Long-term Outlook (2016 LTO)*. While the AESO has updated its regional forecasts since the connection studies were performed, the use of the current AESO forecast, the *AESO 2017 Long-term Outlook*, would not materially alter the connection study results or affect the conclusions and recommendations in this report.

4.2. Studies Performed

The scheduled ISD for the Project is July 1, 2019. Therefore, the studies were performed using the 2019 summer light (SL) and summer peak (SP) scenarios. The short-circuit studies were also performed using the 2026 WP scenario.

Table 4-1 provides a list of the study scenarios. The post-Project scenarios reflect the requested Rate STS contract capacity of 113 MW. A power factor of 0.9 lagging (supply reactive power) and 0.95 leading (absorb reactive power) should be used for the new Project generation.

Table 4-1: List of the Connection Study Scenarios

Scenario	Year/Season Load	Pre-Project/Post-Project	Project Generation (MW)	System Generation Dispatch Conditions
1	2019 SL	Pre-Project	0	High Wind, Zero Import
2	2019 SP	Pre-Project	0	High Wind, High Import
3	2019 SL	Post-Project	113	High Wind, Zero Import
4	2019 SP	Post Project	113	High Wind, High Import
5	2026 WP	Post-Project	113	All generation in the Study Area on

4.2.1. Power flow studies

The purpose of the power flow studies is to identify and quantify any thermal and voltage criteria violations in the Study Area.

In addition, power flow studies are also used to identify point of delivery (POD) low voltage bus voltage deviations beyond the limits listed in Table 3-1 of Attachment A1.¹

Power flow studies were performed for the 2019 summer light (SL) and summer peak (SP) pre-Project and post-Project scenarios.

4.2.2. Transient Stability Studies

The purpose of the transient stability studies is to assess the post-Project stability of the transmission system after three-phase to ground faults are applied on selected transmission lines in the Study Area.

Transient stability studies were performed for the 2019 SL and SP post-Project scenarios.

4.2.3. Short-Circuit Studies

The purpose of the short-circuit studies is to determine the expected system short-circuit current levels in the vicinity of the Project.

Short-circuit studies were performed for the 2019 SP pre-Project scenario and for the 2019 SP and 2026 WP post-Project scenarios.

4.3. Mitigation Measure Development and Evaluation

As contemplated in Section 5 of Attachment A1, mitigation measures were developed to address the system performance issues that were identified in the post-Project scenarios. The studies completed to assess the effectiveness of the mitigation measures are briefly outlined below.

4.3.1. Post-Mitigation Studies

Power flow studies were performed to assess the impact of the Project on the performance of the AIES following the implementation of the AESO's proposed mitigation measures.

4.3.2. Constraint Effective Factor Studies

Constraint effective factor studies were used to determine the generator- and load- constraint effective factors and to identify the most effective generators or loads to manage the thermal criteria violations that were observed under Category B conditions.

¹ The AESO's desired post-contingency voltage deviations for low voltage busses represent guidelines rather than criteria. A POD bus voltage deviation that exceeds the desired limits shown in Table 3.1-1 of Attachment A1 does not represent a Reliability Criteria violation. Mitigation measures would not be developed to specifically address POD bus voltage deviations that exceed the desired values in Table 3-1 of Attachment A1.

5. Interpretation of Results

5.1. Results Overview

This section provides an assessment of the impact of the Project on the performance of the AES. The Reliability Criteria violations observed during the connection assessment studies, and the proposed mitigation measures are summarized in Table **5-1**.

Additional details are provided in the following sections:

- Section 5.2 includes an overview of the pre-Project studies results
- Section 5.3 includes an overview of the post-Project studies results
- Section 5.4 includes a description of the proposed mitigation measures to address the observed Reliability Criteria violations
- Section 5.5 includes an overview of the post-mitigation studies results

The detailed study results are provided in Attachment A.

Table 5-1: Summary of Reliability Criteria Violations, Project Impact and Mitigation Measures

Scenario	Details of Violation (Violation Observed On)	Contingency (System Element Lost)	Project Impact	Pre- Project Mitigation Measures	Post- Project Mitigation Measures							
2019 SL	172L (Taber 83S - Hillridge Tap)	1036L (Travers 554S - Milo 356S)	New thermal criteria violation	N/A	New 172L RAS and Real time operational practices							
	172L (Coaldale 254S - Hillridge Tap)				New 172L RAS							
	820L (Coaldale 254S - Chin Chute Tap)				New 820L RAS							
	172L (Taber 83S - Hillridge Tap)	607L (Fincastle 336S - Conrad 135S)			New 172L RAS							
	820L (Coaldale 254S - Chin Chute Tap)				New 820L RAS							
	172L (Taber 83S - Hillridge Tap)	Taber Wind Farm 134S			New 172L RAS							
	820L (Coaldale 254S - Chin Chute Tap)				New 820L RAS							
	172L (Taber 83S - Hillridge Tap)	1005L (Picture Butte 120S - Milo 356S)			New 172L RAS							
	1036L (Travers 554S - Milo 356S)				New 172L RAS							
	820L (Coaldale 254S - Chin Chute Tap)	Hillridge 139S Transformer T1			Magrath 225S Transformer T1)	New thermal criteria violation	N/A	New 820L RAS				
		146L/162L (Drywood 415S - Glenwood 229S)										
		Macdonald 146S Transformer T1										
		207L (Coalbanks 111S - North Lethbridge 370S)										
		225L (Glenwood 229S - Spring Coulee 385S)										
		225L (Spring Coulee 385S - Magrath 225S)										
		Glenwood 229S Transformer T1										
		Spring Coulee 385S Transformer T1										
		Drywood 415S Transformer T2										
		508L (Warner 344S - Stirling 67S)										
	725AL (Riverbend 618S - Riverbend Tap)	Lakeview 593S Transformer T1			Magrath 225S Transformer T1)	New thermal criteria violation	N/A	New 820L RAS				
	820L (Coaldale 254S - Chin Chute Tap)											
	820L (Chin Chute Tap - Red Coat Tap)											
	820L (Coaldale 254S - Chin Chute Tap)	725L (Coalbanks 111S - Bowron 674S)										
	820L (Coaldale 254S - Chin Chute Tap)	823L (Macdonald 146S - Lakeview 593S)										
	820L (Coaldale 254S - Chin Chute Tap)	824L (Lakeview 593S - Riverbend 618S)										
	725AL (Riverbend 618S - Riverbend Tap)											
	172L (Taber 83S - Hillridge Tap)	940L (North Lethbridge 370S - Picture Butte 120S)							Magrath 225S Transformer T1)	New thermal criteria violation	N/A	New 820L RAS
	1036L (Travers 554S - Milo 356S)											
	162L (Drywood 415S - Glenwood 229S)	863L (Magrath 225S - Riverbend 618S)							Magrath 225S Transformer T1)	Materially increased thermal criteria violation	Planned RAS 36	Planned RAS 36 and new 820L RAS
	225L (Glenwood 229S - Spring Coulee 385S)				Reduced thermal criteria violation	Planned RAS 36						
	225L (Magrath 225S - Raymond Reservoir Tap)				Materially increased thermal criteria violation	Planned RAS 36 and new 820L RAS						
	225L (Spring Coulee 385S - Magrath 225S)				Reduced thermal criteria violation	Planned RAS 36						
225L (Stirling 67S - Raymond Reservoir Tap)	Marginally increased thermal criteria violation		Planned RAS 36 and new 820L RAS									
Magrath 225S Transformer T1	Reduced thermal criteria violation		Planned RAS 36									
Stirling 67S Transformer T2	New thermal criteria violation		New 820L RAS									
820L (Chin Chute Tap - Red Coat Tap)	Improved low voltage range criteria violation		Planned RAS 36									
820L (Coaldale 254S - Chin Chute Tap)	Riverbend 618S Transformer T1		Magrath 225S Transformer T1)	Materially increased thermal criteria violation	Planned RAS 36	Planned RAS 36 and new 820L RAS						
Warner Substation 344S				Reduced thermal criteria violation		Planned RAS 36						
162L (Drywood 415S - Glenwood 229S)		Materially increased thermal criteria violation		Planned RAS 36 and new 820L RAS								
225L (Glenwood 229S - Spring Coulee 385S)		Reduced thermal criteria violation		Planned RAS 36								
225L (Magrath 225S - Raymond Reservoir Tap)		Materially increased thermal criteria violation		Planned RAS 36 and new 820L RAS								
225L (Spring Coulee 385S - Magrath 225S)		Reduced thermal criteria violation		Planned RAS 36								
225L (Stirling 67S - Raymond Reservoir Tap)	Marginally increased thermal criteria violation	Planned RAS 36 and new 820L RAS										
Magrath 225S Transformer T1	Reduced thermal criteria violation	Planned RAS 36										
Stirling 67S Transformer T2												

	820L (Chin Chute Tap - Red Coat Tap)		New thermal criteria violation	N/A	New 820L RAS
	820L (Coaldale 254S - Chin Chute Tap)	Riverbend 618S Transformer T1			
	Warner Substation 344S		Improved low voltage range criteria violation	Planned RAS 36	Planned RAS 36
	172L (Taber 83S - Hillridge Tap)	1005L (Picture Butte 120S - Milo 356S)	New thermal criteria violation	N/A	New 172L RAS
	1036L (Travers 554S - Milo 356S)		Materially increased thermal criteria violation	Real time operational practices	New 172L RAS and Real time operational practices
	172L (Coaldale 254S - Hillridge Tap)	1036L (Travers 554S - Milo 356S)	New thermal criteria violation	N/A	New 172L RAS
	172L (Taber 83S - Hillridge Tap)		Materially increased thermal criteria violation	Real time operational practices	New 172L RAS and Real time operational practices
	172L (Taber 83S - Hillridge Tap)	607L (Fincastle 336S - Conrad 135S)	Materially increased thermal criteria violation		New 172L RAS and Real time operational practices
	172L (Coaldale 254S - Hillridge Tap)		New thermal criteria violation	N/A	New 172L RAS
	172L (Taber 83S - Hillridge Tap)	Taber Wind Farm 134S	Materially increased thermal criteria violation	Real time operational practices	New 172L RAS and Real time operational practices
	172L (Coaldale 254S - Hillridge Tap)		New thermal criteria violation	N/A	New 172L RAS
	820L (Coaldale 254S - Chin Chute Tap)				New 820L RAS
	162L (Drywood 415S - Glenwood 229S)		New thermal criteria violation	N/A	Planned RAS 36 and new 820L RAS
	225L (Glenwood 229S - Spring Coulee 385S)		Materially increased thermal criteria violation		Planned RAS 36 and new 820L RAS
	225L (Magrath 225S - Raymond Reservoir Tap)		Reduced thermal criteria violation		Planned RAS 36
	225L (Spring Coulee 385S - Magrath 225S)		Materially increased thermal criteria violation	Planned RAS 36	Planned RAS 36 and new 820L RAS
	225L (Stirling 67S - Raymond Reservoir Tap)	863L (Magrath 225S - Riverbend 618S)	Reduced thermal criteria violation		Planned RAS 36
	Magrath 225S Transformer T1		Marginally increased thermal criteria violation		Planned RAS 36 and new 820L RAS
	Stirling 67S Transformer T2		Reduced thermal criteria violation		Planned RAS 36
	820L (Chin Chute Tap - Red Coat Tap)		New thermal criteria violation	N/A	New 820L RAS
	820L (Coaldale 254S - Chin Chute Tap)				
	Warner Substation 344S		Improved low voltage range criteria violation	Planned RAS 36	Planned RAS 36
	162L (Drywood 415S - Glenwood 229S)		New thermal criteria violation	N/A	Planned RAS 36 and new 820L RAS
2019 SP	225L (Glenwood 229S - Spring Coulee 385S)		Materially increased thermal criteria violation		Planned RAS 36
	225L (Magrath 225S - Raymond Reservoir Tap)		Reduced thermal criteria violation	Planned RAS 36	Planned RAS 36 and new 820L RAS
	225L (Spring Coulee 385S - Magrath 225S)		Materially increased thermal criteria violation		Planned RAS 36
	225L (Stirling 67S - Raymond Reservoir Tap)	Riverbend 618S Transformer T1	Reduced thermal criteria violation		Planned RAS 36 and new 820L RAS
	Magrath 225S Transformer T1		Marginally increased thermal criteria violation		Planned RAS 36
	Stirling 67S Transformer T2		Reduced thermal criteria violation		Planned RAS 36
	820L (Chin Chute Tap - Red Coat Tap)		New thermal criteria violation	N/A	New 820L RAS
	820L (Coaldale 254S - Chin Chute Tap)				
	Warner Substation 344S		Improved low voltage range criteria violation	Planned RAS 36	Planned RAS 36
	172L (Taber 83S - Hillridge Tap)	Macdonald 146S Transformer T1			
		161L (Vulcan 255S - Queenstown 504S)			
		180L (Fort Macleod 15S - East Stavely 928S)			
		180L (Vulcan 255S - East Stavely 928S)			
		Coaldale 254S Transformer T2			
		Vulcan 255S Transformer T1			
		Fincastle 336S Transformer T1			
		Lakeview 593S Transformer T1			
	725AL (Riverbend 618S - Riverbend Tap)	Lakeview 593S Transformer T1			
	172L (Taber 83S - Hillridge Tap)	Bowron 674S Transformer T1			
	725AL (Riverbend 618S - Riverbend Tap)	824L (Lakeview 593S - Riverbend 618S)			Real time operational practices
	172L (Taber 83S - Hillridge Tap)	1041L (North Lethbridge 370S - Travers 554S)			New 172L RAS
	725AL (Riverbend 618S - Riverbend Tap)	370ST1 (North Lethbridge 370S Transformer T1)			Real time operational practices
	820L (Coaldale 254S - Chin Chute Tap)	Magrath 225S Transformer T1			New 820L RAS

Notes:

Marginally increased refers to a thermal criteria violation that existed pre-Project and post-Project, and the percent loading difference (post-Project percent loading minus pre-Project percent loading) is below 3%.

Materially increased refers to a thermal criteria violation that existed pre-Project and post-Project, and the percent loading difference (post-Project percent loading minus pre-Project percent loading) above or equal to 3%

5.2. Pre-Project Studies Results

Category A condition

No Reliability Criteria violations were observed under the Category A condition (i.e., all elements in service) for any of the pre-Project scenarios.

Category B conditions

The pre-Project power flow studies identified a number of thermal criteria violations, both above the seasonal continuous rating and above the above short-term emergency rating, under Category B conditions (i.e., loss of a single system element). A voltage range criteria violation below the emergency minimum voltage, was also observed at Warner 344S substation under certain Category B conditions. In addition, voltage deviations beyond the limits listed in Table 3.1-1 of Attachment A1 (hereafter referred to as, point of delivery (POD) bus voltage deviations) were observed under certain Category B conditions.

5.3. Post-Project Studies Results

Category A condition

No Reliability Criteria violations were observed under the Category A condition for any of the post-Project scenarios. The post-Project short-circuit fault levels were not significantly higher than pre-Project levels. The long term short circuit levels were found to be within the designed capabilities of the nearby facilities.

Category B conditions

The post-Project power flow studies identified a number of thermal criteria violations, both above the seasonal continuous rating and above the above short-term emergency rating, under Category B conditions. A voltage range criteria violation below the emergency minimum voltage, was also observed at Warner 344S substation under certain Category B conditions. In addition, POD bus voltage deviations were observed under certain Category B conditions.

The results of the transient stability studies did not indicate any transient stability concerns associated with the Project, and the system showed acceptable dynamic response to all Category B conditions studied.

5.4. Mitigation Measures

This section discusses the AESO's proposed mitigation measures to address the system performance issues that were identified in the pre-Project and post-Project scenarios. As part of this Project, mitigation measures will not be specifically developed for the POD bus voltage deviations observed under certain Category B conditions during pre-Project and post-Project scenarios.

5.4.1. Pre-Project

Prior to connection of the Project, the observed Reliability Criteria violations can be mitigated by real-time operational practices and modifications to the existing RAS 36, referred to hereafter as “planned RAS 36” (the modifications to the existing RAS 36 will be included as part of the AESO's planned connection of the proposed Old Elm Wind Farm²).

5.4.2. Post-Project

After connection of the Project, two new RASs are required to mitigate observed Reliability Criteria violations. The thermal criteria violations observed on the 138 kV transmission line 172L and 240 kV transmission line 1036L can be mitigated by a new RAS, referred to as the “new 172L RAS”, in combination with real time operational practices, if necessary. The thermal criteria violations observed on the 138 kV transmission line 820L can be mitigated by a new RAS, referred to as the “new 820L RAS”. Planned RAS 36 can be used to mitigate various Reliability Criteria violations, and can be used in combination with the new 820L RAS, when necessary. The thermal criteria violations observed on 138 kV transmission line 725AL can be mitigated by either the new 820L RAS, the new 172L RAS or real time operational practices.

5.5. Post-Mitigation Studies Results

Category B conditions

Most of the thermal criteria violations observed under Category B conditions can be alleviated by new 820L RAS and/or planned RAS 36. After new 172L RAS action, real-time operational procedures would be required to fully alleviate the thermal criteria violations observed on 138 kV transmission line 172L or 240 kV transmission line 1036L under certain Category B conditions. The observed voltage range violations are alleviated by planned RAS 36.

In the event that the existing RAS 36 is not required to be modified as planned, the existing RAS 36 can be used to effectively mitigate all of the pre-Project and post-Project Reliability Criteria violations indicated in Table 5-1 as requiring mitigation by planned RAS 36.

² The specifics of planned RAS 36 are outside the scope of the Project, and will be included in a separate Needs Identification Document application for the connection of the proposed Old Elm Wind Farm, to be filed with the Alberta Utilities Commission at a later date.

6. Project Dependencies

The Project does not require the completion of any other AESO plans to expand or enhance the transmission system prior to connection.

7. Conclusions and Recommendations

Based on the study results, Alternative 7 is technically viable. The connection assessment identified a number of pre-Project and post-Project system performance issues. These issues can be mitigated through the use of planned RAS 36, the new 172L RAS, the new 820L RAS, and real-time operational practices, alone or in combination, as appropriate. With implementation of these proposed mitigation measures, the connection of the project with the proposed alternative does not adversely affect the performance of the AIES.

It is recommended to proceed with the Project using Alternative 7 as the preferred option to respond to the Market Participant's request for system access service. It is also recommended to use planned RAS 36, the new 172L RAS, the new 820L RAS, and real-time operational practices to mitigate the identified system performance issues.

Alternative 7 involves connecting the Facility to the existing 138 kV transmission line 820L using a T-tap configuration, which would require the addition of one new 138 kV circuit. The conductor used for the new 138 kV circuit should have a minimum thermal rating similar to the existing 138 kV transmission line 820L.




Attachment A

Engineering Connection Assessment Results

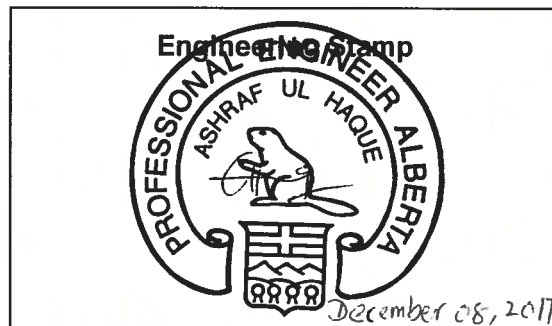
Engineering Connection Assessment Results

Stirling Wind Project Connection

Date: December 8, 2017

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1. Introduction

This report presents the results of the engineering studies that were completed by Teshmont Consultants LP (the Studies Consultant) to assess the impact of the Project (as defined in Attachment A1: AESO Engineering Connection Assessment Scope) on the performance of the Alberta interconnected electric system (AIES). The studies were performed in accordance with Attachment A1, which was prepared by the Alberta Electric System Operator (AESO). The following sections describe the results of the studies.

The power system network analysis tool that was used for the studies in this connection assessment was PSS/E version 33.

2. Pre-Project Study Results

This section describes the results of the pre-Project power flow studies.

2.1. Power Flow Studies

Power flow diagrams illustrating the pre-Project power flow studies results for the Category A condition, and the Category B conditions that resulted in Reliability Criteria violations, are provided in Attachment A2.

2.1.1. 2019 Summer Light Pre-Project

Category A condition

No Reliability Criteria (as defined in Section 3.1.1 of Attachment A1) violations were observed under the Category A condition.

Category B conditions

Thermal criteria violations, both above the seasonal continuous rating and above the above short-term emergency rating, were observed under certain Category B conditions, as shown in Table 2-1.

Table 2-1: Thermal Criteria Violations under Category B Conditions for the 2019 SL Pre-Project Scenario

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Pre-Project Results	
				Power Flow (MVA)	% Loading ^a
863L (Magrath 225S - Riverbend 618S)	162L (Drywood 415S - Glenwood 229S)	40	48	42.5	106.3
	225L (Glenwood 229S - Spring Coulee 385S)	22	24	42.6	193.7
	225L (Spring Coulee 385S - Magrath 225S)	24	28	44.5	185.2
	67ST2 (Stirling 67S Transformer T2)	50	50	71.5	143.0
	225L (Stirling 67S - Raymond Reservoir Tap)	25	28	71.0	284.1
	225ST1 (Magrath 225S Transformer T1)	50	50	86.5	173.1
	225L (Magrath 225S - Raymond Reservoir Tap)	25	28	54.9	219.6
618ST1 (Riverbend 618S Transformer T1)	162L (Drywood 415S - Glenwood 229S)	40	48	42.6	106.4
	225L (Glenwood 229S - Spring Coulee 385S)	22	24	42.7	194.0
	225L (Spring Coulee 385S - Magrath 225S)	24	28	44.5	185.5

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Pre-Project Results	
				Power Flow (MVA)	% Loading ^a
	67ST2 (Stirling 67S Transformer T2)	50	50	71.4	142.8
	225L (Stirling 67S - Raymond Reservoir Tap)	25	28	71.0	283.8
	225ST1 (Magrath 225S Transformer T1)	50	50	86.5	173.1
	225L (Magrath 225S - Raymond Reservoir Tap)	25	28	54.8	219.4

^a Reported as a percentage of the observed power flow (in MVA) relative to the transmission line's seasonal continuous rating (also in MVA, as shown in Attachment A1).

A voltage range criteria violation, below the emergency minimum voltage, was observed under certain Category B conditions as shown in Table 2-2.

Table 2-2: Voltage Range Criteria Violations under Category B Conditions for the 2019 SL Pre-Project Scenario

Contingency (System Element Lost)	Substation Name and Number	Bus Number	Nominal kV	Emergency Minimum Voltage (kV)	Emergency Maximum Voltage (kV)	Initial Voltage (kV)	Steady State Voltage (kV)
863L (Magrath 225S - Riverbend 618S)	Warner 344S	278	69	62	76	67.8	59.9
618ST1 (Riverbend 618S Transformer T1)		278	69	62	76	67.8	59.9

Voltage deviations beyond the desired limits listed in Table 3.1-1 of Attachment A1 (hereafter referred to as, point of delivery (POD) bus voltage deviations) were observed under certain Category B conditions as shown in Table 2-3.

Table 2-3: POD Bus Voltage Deviations under Category B Conditions for the 2019 SL Pre-Project Scenario

Contingency (System Element Lost)	Substation Name and Number	Bus Number	Nominal kV	Initial Voltage (kV)	Voltage Deviations for POD Buses					
					Post Transient (kV)	% Change	Post Auto (kV)	% Change	Post Manual (kV)	% Change
863L (Magrath 225S - Riverbend 618S)	Warner 344S	4278	25	27.2	24.0	-11.8	WL*	WL	WL	WL
618ST1 (Riverbend 618S Transformer T1)		4278	25	26	23.3	-11.8	WL	WL	WL	WL

* WL (Within Limit) - Voltage deviation was restored within the acceptable limit.

2.1.2. 2019 Summer Peak Pre-Project

Category A condition

No reliability criteria violations were observed under the Category A condition.

Category B conditions

Thermal criteria violations, both above the seasonal continuous rating and above the short-term emergency rating, were observed under certain Category B conditions, as shown in Table 2-4.

Table 2-4: Thermal Criteria Violations under Category B Conditions for the 2019 SP Pre-Project Scenario

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Pre-Project Results	
				Power Flow (MVA)	% Loading
607L (Fincastle 336S - Conrad Tap)	172L (Taber 83S - Tap)	119	131	126.6	106.4
1005L (Picture Butte 120S - Milo 356S)	1036L (Travers 554S - Milo 356S)	481	577	498.9	103.7
863L (Magrath 225S - Riverbend 618S)	225L (Glenwood 229S - Spring Coulee 385S)	22	24	37.8	172.0
	225L (Spring Coulee 385S - Magrath 225S)	24	28	43.4	180.7
	67ST2 (Stirling 67S Transformer T2)	50	50	71.1	142.2
	225L (Stirling 67S - Raymond Reservoir Tap)	25	28	71.2	284.8
	225ST1 (Magrath 225S Transformer T1)	50	50	85.5	171.1
	225L (Magrath 225S - Raymond Reservoir Tap)	25	28	54.4	217.5
1036L (Travers 554S - Milo 356S)	172L (Taber 83S - Hillridge Tap)	119	131	136.3	114.6
Taber Wind Farm 134S	172L (Taber 83S - Hillridge Tap)	119	131	131.2	110.3
618ST1 (Riverbend 618S Transformer T1)	225L (Glenwood 229S - Spring Coulee 385S)	22	24	38.0	172.5
	225L (Spring Coulee 385S - Magrath 225S)	24	28	43.5	181.1
	67ST2 (Stirling 67S Transformer T2)	50	50	71.1	142.1
	225L (Stirling 67S - Raymond Reservoir Tap)	25	28	71.1	284.5
	225ST1 (Magrath 225S Transformer T1)	50	50	85.5	171.1

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Pre-Project Results	
				Power Flow (MVA)	% Loading
	225L (Magrath 225S - Raymond Reservoir Tap)	25	28	54.3	217.1

A voltage range criteria violation, below the emergency minimum voltage, was observed under certain Category B conditions as shown in Voltage range violations and POD bus voltage deviations were observed under certain Category B conditions, as shown in Table 2-5.

Table 2-5: Voltage Range Violations under Category B Conditions for the 2019 SP Pre-Project Scenario

Contingency (System Element Lost)	Substation Name and Number	Bus Number	Nominal kV	Emergency Minimum Voltage (kV)	Emergency Maximum Voltage (kV)	Steady State Voltage (kV)
863L (Magrath 225S - Riverbend 618S)	Warner 344S	278	69	62	76	58.3
618ST1 (Riverbend 618S Transformer T1)		278	69	62	76	58.4

POD bus voltage deviations were observed under certain Category B conditions as shown in Table 2-6.

Table 2-6: POD Bus Voltage Deviations under Category B Conditions for the 2019 SP Pre-Project Scenario

Contingency (System Element Lost)	Substation Name and Number	Bus Number	Nominal kV	Initial Voltage (kV)	Voltage Deviations for POD Busses					
					Post Transient (kV)	% Change	Post Auto (kV)	% Change	Post Manual (kV)	% Change
863L (Magrath 225S - Riverbend 618S)	Warner 344S	4278	25	25.4	22.1	-13.0	WL*	WL	WL	WL
370ST1 (North Lethbridge 370S Transformer T1)	Chinook 181S	3367	13	13.9	12.3	-11.1	WL	WL	WL	WL
	Monarch 492S	4400	25	26.1	23.3	-10.5	WL	WL	WL	WL
618ST1 (Riverbend 618S Transformer T1)	Warner 344S	4278	25	25.4	22.1	-12.8	WL	WL	WL	WL

* WL (Within Limit) - Voltage deviation was restored within the acceptable limit.

3. Post-Project Study Results

This section describes the results of the post-Project power flow studies, and transient stability studies.

As described in Section 2 of Attachment A1, the post-Project studies were performed using Alternative 7.

3.1. Power Flow Studies

Power flow diagrams illustrating the pre-Project power flow studies results for the Category A condition, and the Category B conditions that resulted in Reliability Criteria violations, are provided in Attachment A3.

3.1.1. 2019 Summer Light Post-Project

Category A condition

No reliability criteria violations were observed under the Category A condition.

Category B conditions

Thermal criteria violations, both above the seasonal continuous rating and above the short-term emergency rating, were observed under certain Category B conditions, as shown in Table 3-1.

Table 3-1: Thermal Criteria Violations under Category B Conditions for the 2019 SL Post-Project Scenario

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Pre- Project Results		Post- Project Results		% Loading Difference
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading	Post-Pre
146L/162L (Drywood 415S - Glenwood 229S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.0	21.7	120.2	100.2	78.5
225L (Glenwood 229S - Spring Coulee 385S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.0	21.7	120.2	100.2	78.5
225L (Spring Coulee 385S - Magrath 225S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.6	22.2	120.8	100.7	78.5
940L (North Lethbridge 370S - Picture Butte 120S)	172L (Taber 83S - Hillridge Tap)	119	131	91.4	76.8	119.7	100.6	23.8
	1036L (Travers 554S - Milo 356S)	481	577	470.4	97.8	489.0	101.7	3.9
207L (Coalbanks 111S - North Lethbridge 370S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.5	22.1	120.2	100.2	78.1
823L (Macdonald 146S - Lakeview 593S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.6	22.2	120.3	100.2	78.1
824L (Lakeview 593S - Riverbend 618S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.9	22.4	120.6	100.5	78.1
	725AL (Riverbend 618S - Riverbend Tap)	96	132	90.4	94.2	100.3	104.4	10.2
725L (Coalbanks 111S - Riverbend 618S Tap - Riverbend 618S - Bowron 674S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	27.1	22.6	120.9	100.8	78.2
508L (Warner 344S - Stirling 67S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	29.8	24.9	123.2	102.7	77.8
607L (Fincastle 336S - Conrad Tap)	172L (Taber 83S - Hillridge Tap)	119	131	108.6	91.3	134.4	112.9	21.7
	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.8	22.3	120.4	100.3	78.0
1005L (Picture Butte 120S - Milo 356S)	172L (Taber 83S - Hillridge Tap)	119	131	90.8	76.3	119.2	100.2	23.8
	1036L (Travers 554S - Milo 356S)	481	577	465.0	96.7	485.1	100.9	4.2
863L (Magrath 225S - Riverbend 618S)	162L (Drywood 415S - Glenwood 229S)	40	48	42.5	106.3	49.5	123.8	17.5
	225L (Glenwood 229S - Spring Coulee 385S)	22	24	42.6	193.7	49.6	225.5	31.7
	225L (Spring Coulee 385S - Magrath 225S)	24	28	44.5	185.2	51.5	214.4	29.2
	67ST2 (Stirling 67S Transformer T2)	50	50	71.5	143.0	66.0	131.9	-11.1
	225L (Stirling 67S - Raymond Reservoir Tap)	25	28	71.0	284.1	66.1	264.3	-19.8
	820L (Coaldale 254S - Chin Chute Tap)	120	132	76.5	63.8	171.1	142.6	78.8
	225ST1 (Magrath 225S Transformer T1)	50	50	86.5	173.1	87.7	175.4	2.3
	225L (Magrath 225S - Raymond Reservoir Tap)	25	28	54.9	219.6	46.2	184.7	-34.9
	820L (Chin Chute Tap - Red Coat Tap)	120	132	-	-	161.9	134.9	-
1036L (Travers 554S - Milo 356S)	172L (Taber 83S - Hillridge Tap)	119	131	115.6	97.2	145.3	122.1	25.0
	172L (Coaldale 254S - Hillridge Tap)	119	131	89.7	75.4	123.9	104.1	28.8
	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.9	22.5	121.1	100.9	78.5
139ST1 (Hillridge 139S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.4	22.0	120.0	100.0	78.1
146ST1 (Macdonald 146S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.6	22.1	120.2	100.2	78.1
593ST1 (Lakeview 593S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.9	22.4	120.5	100.4	78.1
	725AL (Riverbend 618S - Riverbend Tap)	96	132	90.2	94.0	100.0	104.2	10.2

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Pre- Project Results		Post- Project Results		% Loading Difference
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading	Post-Pre
415ST2 (Drywood 415S Transformer T2)	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.0	21.7	120.2	100.2	78.5
229ST1 (Glenwood 229S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.0	21.7	120.2	100.2	78.5
385ST1 (Spring Coulee 385S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.6	22.2	120.8	100.7	78.5
Taber Wind Farm 134S	172L (Taber 83S - Hillridge Tap)	119	131	112.2	94.3	138.0	116.0	21.7
	820L (Coaldale 254S - Chin Chute Tap)	120	132	27.0	22.5	120.5	100.5	78.0
225ST1 (Magrath 225S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	120	132	32.2	26.8	130.0	108.3	81.5
	820L (Chin Chute Tap - Red Coat Tap)	120	132	-	-	120.0	100.0	-
618ST1 (Riverbend 618S Transformer T1)	162L (Drywood 415S - Glenwood 229S)	40	48	42.6	106.4	49.6	123.9	17.5
	225L (Glenwood 229S - Spring Coulee 385S)	22	24	42.7	194.0	49.7	225.7	31.7
	225L (Spring Coulee 385S - Magrath 225S)	24	28	44.5	185.5	51.5	214.7	29.2
	67ST2 (Stirling 67S Transformer T2)	50	50	71.4	142.8	65.9	131.8	-11.1
	225L (Stirling 67S - Raymond Reservoir Tap)	25	28	71.0	283.8	66.0	264.1	-19.8
	820L (Coaldale 254S - Chin Chute Tap)	120	132	76.5	63.7	171.1	142.6	78.8
	225ST1 (Magrath 225S Transformer T1)	50	50	86.5	173.1	87.7	175.4	2.3
	225L (Magrath 225S - Raymond Reservoir Tap)	25	28	54.8	219.4	46.1	184.5	-34.9
	820L (Chin Chute Tap - Red Coat Tap)	120	132	-	-	161.8	134.9	-

A voltage range criteria violation, below the emergency minimum voltage, was observed under certain Category B conditions as shown in Table 3-2.

Table 3-2: Voltage Range Violations under Category B Conditions for the 2019 SL Post-Project Scenario

Contingency (System Element Lost)	Substation Name and Number	Bus Number	Nominal kV	Emergency Minimum Voltage (kV)	Emergency Maximum Voltage (kV)	Initial Voltage (kV)	Steady State Voltage (kV)
863L (Magrath 225S - Riverbend 618S)	Warner 344S	278	69	62	76	69.4	61.9
618ST1 (Riverbend 618S Transformer T1)		278	69	62	76	69.4	61.9

POD bus voltage deviations were observed under certain Category B conditions as shown in Table 3-3.

Table 3-3: POD Bus Voltage Deviations under Category B Conditions for the 2019 SL Post-Project Scenario

Contingency (System Element Lost)	Substation Name and Number	Bus Number	Nominal kV	Initial Voltage (kV)	Voltage Deviations for POD Busses					
					Post Transient (kV)	% Change	Post Auto (kV)	% Change	Post Manual (kV)	% Change
863L (Magrath 225S - Riverbend 618S)	Warner 344S	4278	25	26.7	23.8	-10.9	WL*	WL	WL	WL
618ST1 (Riverbend 618S Transformer T1)	Warner 344S	4278	25	26.7	23.8	-10.9	WL	WL	WL	WL

* WL (Within Limit) - Voltage deviation was restored within the acceptable limit.

3.1.2. 2019 Summer Peak Post-Project

Category A condition

No reliability criteria violations were observed under the Category A condition.

Category B (N-1 Condition):

Thermal criteria violations, both above the seasonal continuous rating and above the short-term emergency rating, were observed under certain Category B conditions, as shown in Table 3-4.

Table 3-4: Thermal Criteria Violations under Category B Conditions for the 2019 SP Post-Project Scenario

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Pre- Project Results		Post- Project Results		% Loading Difference
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading	Post-Pre
180L (Fort Macleod 15S - East Stavely 928S)	172L (Taber 83S - Hillridge Tap)	119	131	102.9	86.5	126.1	106.0	19.5
180L (Vulcan 255S - East Stavely 928S)	172L (Taber 83S - Hillridge Tap)	119	131	100.0	84.1	123.0	103.4	19.3
161L (Vulcan 255S - Queenstown 504S)	172L (Taber 83S - Hillridge Tap)	119	131	97.5	82.0	120.4	101.2	19.2
1041L (North Lethbridge 370S - Travers 554S)	172L (Taber 83S - Hillridge Tap)	119	131	94.8	79.7	119.4	100.4	20.7
824L (Lakeview 593S - Riverbend 618S)	725AL (Riverbend 618S - Riverbend Tap)	96	132	81.9	85.3	97.1	101.1	15.8
607L (Fincastle 336S - Conrad Tap)	172L (Taber 83S - Hillridge Tap)	119	131	126.6	106.4	148.6	124.9	18.4
	172L (Coaldale 254S - Hillridge Tap)	119	131	100.7	84.6	122.2	102.7	18.1
1005L (Picture Butte 120S - Milo 356S)	172L (Taber 83S - Hillridge Tap)	119	131	117.4	98.7	141.9	119.2	20.6
	1036L (Travers 554S - Milo 356S)	481	577	498.9	103.7	527.0	109.6	5.9
863L (Magrath 225S - Riverbend 618S)	162L (Drywood 415S - Glenwood 229S)	40	48	34.7	86.8	44.0	110.1	23.3
	225L (Glenwood 229S - Spring Coulee 385S)	22	24	37.8	172.0	46.5	211.5	39.5
	225L (Spring Coulee 385S - Magrath 225S)	24	28	43.4	180.7	51.6	215.1	34.4
	67ST2 (Stirling 67S Transformer T2)	50	50	71.1	142.2	62.2	124.4	-17.8
	225L (Stirling 67S - Raymond Reservoir Tap)	25	28	71.2	284.8	66.0	264.0	-20.8
	820L (Coaldale 254S - Chin Chute Tap)	120	132	73.7	61.4	160.4	133.7	72.3
	225ST1 (Magrath 225S Transformer T1)	50	50	85.5	171.1	90.0	180.1	9.0
	225L (Magrath 225S - Raymond Reservoir Tap)	25	28	54.4	217.5	52.8	211.2	-6.4
1036L (Travers 554S - Milo 356S)	820L (Chin Chute Tap - Red Coat Tap)	120	132	-	-	151.3	126.1	-
	172L (Taber 83S - Hillridge Tap)	119	131	136.3	114.6	161.3	135.6	21.0
	172L (Coaldale 254S - Hillridge Tap)	119	131	112.6	94.7	137.0	115.1	20.5
254ST2 (Coaldale 254S Transformer T2)	172L (Taber 83S - Hillridge Tap)	119	131	97.5	81.9	120.1	100.9	19.0
370ST1 (North Lethbridge 370S Transformer T1)	725AL (Riverbend 618S - Riverbend Tap)	96	132	93.8	97.7	96.1	100.1	2.4
146ST1 (Macdonald 146S Transformer T1)	172L (Taber 83S - Hillridge Tap)	119	131	97.6	82.0	120.0	100.9	18.8
593ST1 (Lakeview 593S Transformer T1)	172L (Taber 83S - Hillridge Tap)	119	131	96.9	81.5	119.3	100.2	18.8
	725AL (Riverbend 618S - Riverbend Tap)	96	132	81.5	84.9	97.3	101.3	16.4
674ST1 (Bowron 674S Transformer T1)	172L (Taber 83S - Hillridge Tap)	119	131	96.7	81.3	119.2	100.2	18.9
336ST1 (Fincastle 336S Transformer T1)	172L (Taber 83S - Hillridge Tap)	119	131	102.3	86.0	121.3	101.9	16.0
255ST1 (Vulcan 255S Transformer T1)	172L (Taber 83S - Hillridge Tap)	119	131	98.9	83.1	121.8	102.4	19.3
134S_G1_G2 (Taber Wind Farm 134S)	172L (Taber 83S - Hillridge Tap)	119	131	131.2	110.3	153.9	129.4	19.1
	172L (Coaldale 254S - Hillridge Tap)	119	131	105.0	88.2	127.2	106.9	18.7
225ST1 (Magrath 225S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	120	132	26.2	21.8	120.1	100.1	78.3
618ST1 (Riverbend 618S Transformer T1)	162L (Drywood 415S - Glenwood 229S)	40	48	34.8	87.1	44.2	110.4	23.3

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Pre- Project Results		Post- Project Results		% Loading Difference
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading	Post-Pre
	225L (Glenwood 229S - Spring Coulee 385S)	22	24	38.0	172.5	46.6	212.0	39.5
	225L (Spring Coulee 385S - Magrath 225S)	24	28	43.5	181.1	51.8	215.6	34.5
	67ST2 (Stirling 67S Transformer T2)	50	50	71.1	142.1	62.1	124.3	-17.9
	225L (Stirling 67S - Raymond Reservoir Tap)	25	28	71.1	284.5	65.9	263.7	-20.8
	820L (Coaldale 254S - Chin Chute Tap)	120	132	73.6	61.3	160.3	133.6	72.3
	225ST1 (Magrath 225S Transformer T1)	50	50	85.5	171.1	90.0	180.1	9.0
	225L (Magrath 225S - Raymond Reservoir Tap)	25	28	54.3	217.1	52.7	210.8	-6.3
	820L (Chin Chute Tap - Red Coat Tap)	120	132	-	-	151.2	126.0	-

A voltage range criteria violation, below the emergency minimum voltage, was observed under certain Category B conditions as shown in Table 3-5.

Table 3-5: Voltage Range Violations under Category B Conditions for the 2019 SP Post-Project Scenario

Contingency (System Element Lost)	Substation Name and Number	Bus Number	Nominal kV	Emergency Minimum Voltage (kV)	Emergency Maximum Voltage (kV)	Initial Voltage (kV)	Steady State Voltage (kV)
863L (Magrath 225S - Riverbend 618S)	Warner 344S	278	69	62	76.0	66.9	58.8
618ST1 (Riverbend 618S Transformer T1)		278	69	62	76.0	66.9	58.8

POD bus voltage deviations were observed under certain Category B conditions as shown in Table 3-6.

Table 3-6: POD Bus Voltage Deviations under Category B Conditions for the 2019 SP Post-Project Scenario

Contingency (System Element Lost)	Substation Name and Number	Bus Number	Nominal kV	Initial Voltage (kV)	Voltage Deviations for POD Busses					
					Post Transient (kV)	% Change	Post Auto (kV)	% Change	Post Manual (kV)	% Change
863L (Magrath 225S - Riverbend 618S)	Glenwood 229S	4245	25	25.4	22.8	-10.3	WL*	WL	WL	WL
	Warner 344S	4278	25	26.3	22.9	-12.8	WL	WL	WL	WL
370ST1 (North Lethbridge 370S Transformer T1)	Chinook 181S	3367	13	13.8	12.1	-12.1	WL	WL	WL	WL
	Monarch 492S	4400	25	25.4	22.5	-11.4	WL	WL	WL	WL
618ST1 (Riverbend 618S Transformer T1)	Glenwood 229S	4245	25	25.4	22.8	-10.3	WL	WL	WL	WL
	Warner 344S	4278	25	26.3	22.9	-12.8	WL	WL	WL	WL

* WL (Within Limit) - Voltage deviation was restored within the acceptable limit.

3.2. Transient Stability

Transient stability studies were performed on the 2019 SL and 2019 SP post-Project scenarios for the selected Category B contingencies shown in Table 3.7-1 of Attachment A1.

The results did not indicate any transient stability concerns, and the system showed acceptable dynamic response to all Category B conditions studied, as shown in Table 3-7.

The post-Project transient stability plots are provided in Attachment A4. The transient stability studies identified three observations that are not Reliability Criteria violations, as explained further

below. To determine whether these observations were related to the Project, 2019 SL and 2019 SP pre-Project scenarios were studied. The pre-Project transient stability plots are also provided in Attachment A4.

1. The transient stability plots for Taylor Hydro and Raymond Reservoir units show undamped oscillations. These undamped oscillations are related to the respective generator control models in PSS/E.
2. The transient stability plots for Blackspring Ridge WAGF and Vulcan Solar Project show voltage and reactive power issues. These issues are localized and related to the respective generator control models in PSS/E.
3. The transient stability plots for Chin Chute Hydro and Stirling Wind Project show oscillations and large angle deviations after a fault on either end of 138 kV transmission line 820L (Coaldale 254S - Stirling 67S). These issues are resolved by the generation facility protection scheme, which are not entirely modelled in PSS/E.

All of these observations occur in both pre-Project and post-Project scenarios and are not related to the Project.

Dynamic data and assumptions of all equipment proposed for the Project connection are provided in Attachment A5.

Table 3-7: Transient Stability Study Results

Studied Contingency (System Element Lost)	Fault Description and Location	Results
820L (Coaldale 254S - Stirling 67S)	3-phase fault at Coaldale 254S	Stable
820L (Stirling 67S - Coaldale 254S)	3-phase fault at Stirling 67S	Stable
225L (Stirling 67S - Magrath 225S)	3-phase fault at Stirling 67S	Stable
225L (Magrath 225S - Stirling 67S)	3-phase fault at Magrath 225S	Stable
863L (Magrath 225S - Riverbend 618S)	3-phase fault at Magrath 225S	Stable
863L (Riverbend 618S - Magrath 225S)	3-phase fault at Riverbend 618S	Stable
170L (Coaldale 254S - N. Lethbridge 370S)	3-phase fault at Coaldale 254S	Stable
170L (N. Lethbridge 370S - Coaldale 254S)	3-phase fault at N. Lethbridge 370S	Stable
172L (Coaldale 254S - Taber 83S)	3-phase fault at Coaldale 254S	Stable
172L (Taber 83S - Coaldale 254S)	3-phase fault at Taber 83S	Stable
1041L (Travers 554S - N. Lethbridge 370S)	3-phase fault at Travers 554S	Stable
1041L (N. Lethbridge 370S - Travers 554S)	3-phase fault at N. Lethbridge 370S	Stable
968L (N. Lethbridge 370S - Windy Flats 138S)	3-phase fault at N. Lethbridge 370S	Stable
968L (Windy Flats 138S - N. Lethbridge 370S)	3-phase fault at Windy Flats 138S	Stable

4. Short-Circuit Studies Results

4.1. Pre-Project

Pre-Project short-circuit current levels are provided in Table 4-1.¹

Table 4-1: Short-Circuit Current Levels for the 2019 SP Pre-Project Scenario

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3- Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1- Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Chin Chute 315S	138	139.6	2.7	0.0599 + 0.1505j	2.1	0.0652 + 0.303j
Chin Chute Tap	138	139.2	3.4	0.0481 + 0.1205j	2.6	0.0628 + 0.2506j
Coaldale 254S	138	139.6	8.1	0.0186 + 0.052j	5.2	0.047 + 0.1392j
Stirling 67S	138	138.2	2.7	0.0635 + 0.1523j	2.0	0.0867 + 0.311j

4.2. Post-Project

Post-Project short-circuit current levels are provided in Table 4-2 and Table 4-3.

Table 4-2: Short-Circuit Current Levels for the 2019 SP Post-Project Scenario

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3- Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1- Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Chin Chute 315S	138	144.1	3.6	0.0399 + 0.1203j	2.4	0.0651 + 0.3041j
Chin Chute Tap	138	143.9	4.8	0.0272 + 0.0898j	3.0	0.0627 + 0.252j
Coaldale 254S	138	140.5	9.0	0.0159 + 0.0474j	5.5	0.0456 + 0.1385j
Stirling 67S	138	144.0	3.7	0.039 + 0.1168j	2.4	0.0856 + 0.3107j
Red Coat 967S	138	144.4	4.7	0.027 + 0.0928j	2.9	0.0705 + 0.2733j

¹ Short-circuit current studies were based on modeling information provided to the AESO by third parties. The authenticity of the modeling information has not been validated. Fault levels could change as a result of system developments, new customer connections, or additional generation in the area. It is recommended that these changes be monitored and fault levels reviewed to ensure that the fault levels are within equipment operating limits. The information provided in this study should not be used as the sole source of information for electrical equipment specifications or for the design of safety-grounding systems.

Table 4-3: Short-Circuit Current Levels for the 2026 WP Post-Project Scenario

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3- Φ Fault (kA)	Positive Sequence Thevenin Source Impedance ($R1+jX1$) (pu)	1- Φ Fault (kA)	Zero Sequence Thevenin Source Impedance ($R0+jX0$) (pu)
Chin Chute 315S	138	143.2	3.5	0.04 + 0.1191j	2.4	0.0632 + 0.2988j
Chin Chute Tap	138	143.3	4.7	0.0273 + 0.0886j	3.0	0.06 + 0.2455j
Coaldale 254S	138	140.6	9.1	0.0148 + 0.0445j	5.7	0.0382 + 0.1247j
Stirling 67S	138	143.1	3.6	0.0394 + 0.1157j	2.3	0.0832 + 0.3048j
Red Coat 967S	138	143.7	4.6	0.0273 + 0.0918j	2.8	0.0679 + 0.267j

5. Mitigation Measure Development and Evaluation

The Studies Consultant, in consultation with the AESO, developed mitigation measures to address the system performance issues that were identified in the pre-Project and post-Project scenarios. Existing remedial action schemes (RASs) are described in Section 1.2.2.2 of Attachment A1. As part of this Project, mitigation measures will not be specifically developed for the POD bus voltage deviations observed under certain Category B conditions during pre-Project and post-Project scenarios.²

5.1. Pre-Project

Pre-Project mitigation measures are summarized in Table 5-1.

Table 5-1: Pre-Project Mitigation Measures for Reliability Criteria Violations

Mitigation Measure	Details of Violation (Violation Observed On)	Contingency (System Element Lost)
Planned RAS 36*	162L (Drywood 415S - Glenwood 229S)	863L (Magrath 225S - Riverbend 618S)
		Riverbend 618S Transformer T1
	225L (Glenwood 229S - Spring Coulee 385S)	863L (Magrath 225S - Riverbend 618S)
		Riverbend 618S Transformer T1
	225L (Magrath 225S - Raymond Reservoir Tap)	863L (Magrath 225S - Riverbend 618S)
		Riverbend 618S Transformer T1
	225L (Spring Coulee 385S - Magrath 225S)	863L (Magrath 225S - Riverbend 618S)
		Riverbend 618S Transformer T1
	225L (Stirling 67S - Raymond Reservoir Tap)	863L (Magrath 225S - Riverbend 618S)
		Riverbend 618S Transformer T1
	Magrath 225S Transformer T1	863L (Magrath 225S - Riverbend 618S)
		Riverbend 618S Transformer T1
Stirling 67S Transformer T2	863L (Magrath 225S - Riverbend 618S)	
	Riverbend 618S Transformer T1	
Warner Substation 344S	863L (Magrath 225S - Riverbend 618S)	
	Riverbend 618S Transformer T1	
Real time operational practices	172L (Taber 83S - Hillridge Tap)	1036L (Travers 554S To Milo 356S)
		607L (Fincastle 336S Conrad 135S)

² The AESO’s desired post-contingency voltage deviations for low voltage busses represent guidelines rather than criteria. A POD bus voltage deviation that exceeds the desired limits shown in Table 3.1-1 of Attachment A1 does not represent a Reliability Criteria violation.

Mitigation Measure	Details of Violation (Violation Observed On)	Contingency (System Element Lost)
		Taber Wind Farm 134S
	1036L (Travers 554S - Milo 356S)	1005L (Picture Butte 120S - Milo 356S)

Note: *RAS 36 is an existing RAS (See Section 1.2.2.2 of Attachment A1). Modifications to RAS 36 are proposed for the planned Old Elm Wind Farm Project. This modified version of RAS 36 is referred to as "Planned RAS 36"

5.2. Post-Project

Post-Project mitigation measures are summarized in Table 5-2.

Table 5-2: Post-Project Mitigation Measures for Reliability Criteria Violations

Mitigation Measures	Details of Violation (Violation Observed On)	Contingency (System Element Lost)
New 172L RAS	1036L (Travers 554S - Milo 356S)	1005L (Picture Butte 120S - Milo 356S)
		940L (North Lethbridge 370S - Picture Butte 120S)
	172L (Coaldale 254S - Hillridge Tap)	1036L (Travers 554S - Milo 356S)
		607L (Fincastle 336S - Conrad 135S)
		Taber Wind Farm 134S
	172L (Taber 83S - Hillridge Tap)	1005L (Picture Butte 120S - Milo 356S)
		161L (Vulcan 255S - Queenstown 504S)
		1041L (North Lethbridge 370S - Travers 554S)
		180L (Fort Macleod 15S - East Stavely 928S)
		180L (Vulcan 255S - East Stavely 928S)
		607L (Fincastle 336S - Conrad 135S)
		940L (North Lethbridge 370S - Picture Butte 120S)
		Bowron 674S Transformer T1
		Coaldale 254S Transformer T2
		Fincastle 336S Transformer T1
Lakeview 593S Transformer T1		
Macdonald 146S Transformer T1		
Taber Wind Farm 134S		
Vulcan 255S Transformer T1		
725AL (Riverbend 618S - Riverbend Tap)	Lakeview 593S Transformer T1	
New 172L RAS and Real time operational practices	1036L (Travers 554S - Milo 356S)	1005L (Picture Butte 120S - Milo 356S)
	172L (Taber 83S - Hillridge Tap)	1036L (Travers 554S - Milo 356S)
		607L (Fincastle 336S - Conrad 135S)
		Taber Wind Farm 134S
New 820L RAS	725AL (Riverbend 618S - Riverbend Tap)	824L (Lakeview 593S - Riverbend 618S)
		Lakeview 593S Transformer T1
	820L (Chin Chute Tap - Red Coat Tap)	863L (Magrath 225S - Riverbend 618S)

Mitigation Measures	Details of Violation (Violation Observed On)	Contingency (System Element Lost)
		Riverbend 618S Transformer T1
		Magrath 225S Transformer T1
	820L (Coaldale 254S - Chin Chute Tap)	1036L (Travers 554S - Milo 356S)
		146L/162L (Drywood 415S - Glenwood 229S)
		207L (Coalbanks 111S - North Lethbridge 370S)
		225L (Glenwood 229S - Spring Coulee 385S)
		225L (Spring Coulee 385S - Magrath 225S)
		508L (Warner 344S - Stirling 67S)
		607L (Fincastle 336S - Conrad 135S)
		725L (Coalbanks 111S - Bowron 674S)
		823L (Macdonald 146S - Lakeview 593S)
		824L (Lakeview 593S - Riverbend 618S)
		863L (Magrath 225S - Riverbend 618S)
		Drywood 415S Transformer T2
		Glenwood 229S Transformer T1
		Hillridge 139S Transformer T1
		Lakeview 593S Transformer T1
		Macdonald 146S Transformer T2
		Magrath 225S Transformer T1
		Riverbend 618S Transformer T1
Spring Coulee 385S Transformer T1		
Taber Wind Farm 134S		
Planned RAS 36	225L (Magrath 225S - Raymond Reservoir Tap)	863L (Magrath 225S - Riverbend 618S) Riverbend 618S Transformer T1
	225L (Stirling 67S - Raymond Reservoir Tap)	863L (Magrath 225S - Riverbend 618S) Riverbend 618S Transformer T1
	Stirling 67S Transformer T2	863L (Magrath 225S - Riverbend 618S) Riverbend 618S Transformer T1
	Warner Substation 344S	863L (Magrath 225S - Riverbend 618S) Riverbend 618S Transformer T1
	162L (Drywood 415S - Glenwood 229S)	863L (Magrath 225S - Riverbend 618S) Riverbend 618S Transformer T1
	225L (Glenwood 229S - Spring Coulee 385S)	863L (Magrath 225S - Riverbend 618S) Riverbend 618S Transformer T1
	225L (Spring Coulee 385S - Magrath 225S)	863L (Magrath 225S - Riverbend 618S) Riverbend 618S Transformer T1
	Magrath 225S Transformer T1	863L (Magrath 225S - Riverbend 618S)

Mitigation Measures	Details of Violation (Violation Observed On)	Contingency (System Element Lost)
		Riverbend 618S Transformer T1
Real time operational practices	725AL (Riverbend 618S - Riverbend Tap)	824L (Lakeview 593S - Riverbend 618S)
		North Lethbridge 370S Transformer T1

5.3. Mitigation Measure Evaluation

This section describes the results of the power flow studies that were performed to assess the impact of the Project on the performance of the AIES following the implementation of proposed mitigation measures.

The post-mitigation measures studies were performed under Category B conditions for the 2019 SL and SP scenarios using Alternative 7 and the RASs described in Sections 5.1.

The post-mitigation power flow diagrams for selected Category B conditions are provided in Attachment A6.

5.3.1. 2019 Summer Light Post-Project

Category B conditions

Most of the thermal criteria violations observed under Category B conditions in the post-Project studies were alleviated by the RASs described in Section 5.2, as shown in Table 5-3. After RAS action, real-time operational procedures are required to fully alleviate the thermal criteria violations observed on 138 kV transmission line 172L during certain Category B conditions.

Table 5-3: Post-RAS Power Flow Study Results under Category B Conditions for the 2019 SL Post-Project Scenario

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Post- Project Results		Post- RAS Action Results	
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading
146L_162L (Drywood 415S - Glenwood 229S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.3	100.2	26.8	22.3
225L (Glenwood 229S - Spring Coulee 385S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.2	100.2	27.0	22.5
225L (Spring Coulee 385S - Magrath 225S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.8	100.7	27.6	23.0
940L (North Lethbridge)	172L (Taber 83S - Hillridge Tap)	119	131	119.7	100.6	95.8	80.5

Engineering Connection Assessment Results: Stirling Wind Project Connection

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Post- Project Results		Post- RAS Action Results	
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading
370S - Picture Butte 120S)	1036L (Travers 554S - Milo 356S)	481	577	489.1	101.7	464.2	96.5
207L (Coalbanks 111S - North Lethbridge 370S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.2	100.2	27.7	23.1
823L (Macdonald 146S - Lakeview 593S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.3	100.2	27.7	23.1
824L (Lakeview 593S - Riverbend 618S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.6	100.5	28.1	23.4
	725AL (Riverbend 618S - Riverbend Tap)	96	132	100.3	104.4	90.9	94.7
725L (Coalbanks 111S - Riverbend 618S Tap - Riverbend 618S - Bowron 674S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.9	100.8	28.3	23.6
508L (Warner 344S - Stirling 67S)	820L (Coaldale 254S - Chin Chute Tap)	120	132	123.2	102.7	31.0	25.8
607L (Fincastle 336S - Conrad Tap)	172L (Taber 83S - Hillridge Tap)	119	131	134.4	112.9	112.5	94.5
	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.4	100.3	28.0	23.3
1005L (Picture Butte 120S - Milo 356S)	172L (Taber 83S - Hillridge Tap)	119	131	119.2	100.2	95.2	80.0
	1036L (Travers 554S - Milo 356S)	481	577	485.2	100.9	459.8	95.6
863L (Magrath 225S - Riverbend 618S)	162L (Drywood 415S - Glenwood 229S)	40	48	49.5	123.7	5.6	14.1
	225L (Glenwood 229S - Spring Coulee 385S)	22	24	49.6	225.5	5.4	24.5
	225L (Spring Coulee 385S - Magrath 225S)	24	28	51.5	214.4	7.8	32.6
	67ST2 (Stirling 67S Transformer T2)	50	50	66.0	131.9	23.3	46.6
	225L (Stirling 67S - Raymond Reservoir Tap)	25	28	66.1	264.3	23.2	92.8
	820L (Coaldale 254S - Chin Chute Tap)	120	132	171.1	142.6	33.1	27.6
	225ST1 (Magrath 225S Transformer T1)	50	50	87.7	175.4	9.8	19.5
	225L (Magrath 225S - Raymond Reservoir Tap)	25	28	46.2	184.7	9.3	37.2
	820L (Chin Chute Tap - Red Coat Tap)	120	132	161.9	134.9	23.2	19.3

Engineering Connection Assessment Results: Stirling Wind Project Connection

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Post- Project Results		Post- RAS Action Results	
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading
1036L (Travers 554S - Milo 356S)	172L (Taber 83S - Hillridge Tap)	119	131	145.3	122.1	120.8	101.5
	172L (Coaldale 254S - Hillridge Tap)	119	131	124.0	104.2	100.8	84.7
	820L (Coaldale 254S - Chin Chute Tap)	120	132	121.1	100.9	27.8	23.2
139ST1 (Hillridge 139S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.0	100.0	27.5	22.9
146ST1 (Macdonald 146S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.2	100.2	27.7	23.1
593ST1 (Lakeview 593S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.5	100.5	28.1	23.4
	725AL (Riverbend 618S - Riverbend Tap)	96	132	100.0	104.2	90.7	94.5
415ST2 (Drywood 415S Transformer T2)	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.2	100.2	27.0	22.5
229ST1 (Glenwood 229S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.2	100.2	27.0	22.5
385ST1 (Spring Coulee 385S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.8	100.7	27.6	23.0
Taber Wind Farm 134S	172L (Taber 83S - Hillridge Tap)	119	131	138.0	116.0	117.9	99.1
	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.5	100.5	28.2	23.5
225ST1 (Magrath 225S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	120	132	130.0	108.3	26.8	22.3
	820L (Chin Chute Tap - Red Coat Tap)	120	132	120.0	100.0	17.9	14.9
618ST1 (Riverbend 618S Transformer T1)	162L (Drywood 415S - Glenwood 229S)	40	48	49.6	123.9	5.7	14.2
	225L (Glenwood 229S - Spring Coulee 385S)	22	24	49.7	225.7	5.4	24.6
	225L (Spring Coulee 385S - Magrath 225S)	24	28	51.5	214.7	7.8	32.7
	67ST2 (Stirling 67S Transformer T2)	50	50	65.9	131.8	23.3	46.5
	225L (Stirling 67S - Raymond Reservoir Tap)	25	28	66.0	264.1	23.2	92.6

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Post- Project Results		Post- RAS Action Results	
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading
	820L (Coaldale 254S - Chin Chute Tap)	120	132	171.1	142.6	33.0	27.5
	225ST1 (Magrath 225S Transformer T1)	50	50	87.7	175.4	9.8	19.5
	225L (Magrath 225S - Raymond Reservoir Tap)	25	28	46.1	184.5	9.3	37.2
	820L (Chin Chute Tap - Red Coat Tap)	120	132	161.8	134.9	23.0	19.2

All of the voltage range violations observed under certain Category B conditions in the post-Project studies were alleviated by planned RAS 36, as shown in Table 5-4

Table 5-4: Voltage Range Violations under Category B Conditions for the 2019 SL Post-Project Scenario

Contingency (System Element Lost)	Substation Name and Number	Bus Number	Nominal kV	Emergency Minimum Voltage (kV)	Emergency Maximum Voltage (kV)	Initial Voltage (kV)	Steady State Voltage (kV)	Post-Mitigation Steady State (kV)
863L (Magrath 225S - Riverbend 618S)	Warner 344S	278	69	62	76	69.4	61.9	68.8
618ST1 (Riverbend 618S Transformer T1)		278	69	62	76	69.4	61.9	68.8

5.3.2. 2019 Summer Peak Post-Project

Category B conditions

Most of the thermal criteria violations observed under Category B conditions in the post-Project studies were alleviated by the RASs described in Section 5.2, as shown in Table 5-5. After RAS action, real-time operational procedures are required to fully alleviate certain thermal criteria violations observed on 138 kV transmission line 172L and 240 kV transmission line 1036L.

Table 5-5: Post-RAS Power Flow Study Results under Category B Conditions for the 2019 SP Post-Project Scenario

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Post- Project Results		Post- RAS Action Results	
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading
180L (Fort Macleod 15S - East Stavely 928S)	172L (Taber 83S - Hillridge Tap)	119	131	126.1	106.0	103.6	87.1
180L (Vulcan 255S - East Stavely 928S)	172L (Taber 83S - Hillridge Tap)	119	131	123.0	103.4	100.6	84.5
161L (Vulcan 255S - Queenstown 504S)	172L (Taber 83S - Hillridge Tap)	119	131	120.4	101.2	97.9	82.3
1041L (North Lethbridge 370S - Travers 554S)	172L (Taber 83S - Hillridge Tap)	119	131	119.4	100.4	95.8	80.5
607L (Fincastle 336S - Conrad Tap)	172L (Taber 83S - Hillridge Tap)	119	131	148.6	124.9	127.2	106.9
	172L (Coaldale 254S - Hillridge Tap)	119	131	122.2	102.7	100.9	84.8
1005L (Picture Butte 120S - Milo 356S)	172L (Taber 83S - Hillridge Tap)	119	131	141.9	119.2	118.0	99.2
	1036L (Travers 554S - Milo 356S)	481	577	527.0	109.6	502.2	104.4
863L (Magrath 225S - Riverbend 618S)	162L (Drywood 415S - Glenwood 229S)	40	48	44.0	110.1	4.3	10.7
	225L (Glenwood 229S - Spring Coulee 385S)	22	24	46.5	211.5	1.9	8.6
	225L (Spring Coulee 385S - Magrath 225S)	24	28	51.6	215.1	8.8	36.7
	67ST2 (Stirling 67S Transformer T2)	50	50	62.2	124.4	16.5	32.9
	225L (Stirling 67S - Raymond Reservoir Tap)	25	28	66.0	264.0	23.6	94.3
	820L (Coaldale 254S - Chin Chute Tap)	120	132	160.4	133.7	23.4	19.5
	225ST1 (Magrath 225S Transformer T1)	50	50	90.0	180.1	9.5	19.0
	225L (Magrath 225S - Raymond Reservoir Tap)	25	28	52.8	211.2	5.4	21.7
	820L (Chin Chute Tap - Red Coat Tap)	120	132	151.3	126.1	15.8	13.2
	172L (Taber 83S - Hillridge Tap)	119	131	161.3	135.6	137.2	115.3

Engineering Connection Assessment Results: Stirling Wind Project Connection

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Post- Project Results		Post- RAS Action Results	
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading
1036L (Travers 554S - Milo 356S)	172L (Coaldale 254S - Hillridge Tap)	119	131	137.0	115.1	113.5	95.4
254ST2 (Coaldale 254S Transformer T2)	172L (Taber 83S - Hillridge Tap)	119	131	120.1	100.9	98.5	82.8
146ST1 (Macdonald 146S Transformer T1)	172L (Taber 83S - Hillridge Tap)	119	131	120.0	100.9	98.4	82.7
593ST1 (Lakeview 593S Transformer T1)	172L (Taber 83S - Hillridge Tap)	119	131	119.3	100.2	97.7	82.1
	725AL (Riverbend 618S - Riverbend Tap)	96	132	97.3	101.3	88.0	91.7
674ST1 (Bowron 674S Transformer T1)	172L (Taber 83S - Hillridge Tap)	119	131	119.2	100.2	97.5	81.9
336ST1 (Fincastle 336S Transformer T1)	172L (Taber 83S - Hillridge Tap)	119	131	121.3	101.9	103.3	86.8
255ST1 (Vulcan 255S Transformer T1)	172L (Taber 83S - Hillridge Tap)	119	131	121.8	102.4	99.4	83.5
Taber Wind Farm 134S	172L (Taber 83S - Hillridge Tap)	119	131	153.9	129.4	133.0	111.8
	172L (Coaldale 254S - Hillridge Tap)	119	131	127.2	106.9	106.9	89.8
225ST1 (Magrath 225S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	120	132	120.1	100.1	19.4	16.2
618ST1 (Riverbend 618S Transformer T1)	162L (Drywood 415S - Glenwood 229S)	40	48	44.2	110.4	4.2	10.4
	225L (Glenwood 229S - Spring Coulee 385S)	22	24	46.6	212.0	1.9	8.5
	225L (Spring Coulee 385S - Magrath 225S)	24	28	51.8	215.6	8.9	36.9
	67ST2 (Stirling 67S Transformer T2)	50	50	62.1	124.3	16.4	32.8
	225L (Stirling 67S - Raymond Reservoir Tap)	25	28	65.9	263.7	23.5	93.8

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term Emergency Rating (MVA)	Post- Project Results		Post- RAS Action Results	
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading
	820L (Coaldale 254S - Chin Chute Tap)	120	132	160.3	133.6	23.4	19.5
	225ST1 (Magrath 225S Transformer T1)	50	50	90.0	180.1	9.5	19.0
	225L (Magrath 225S - Raymond Reservoir Tap)	25	28	52.7	210.8	5.3	21.3
	820L (Chin Chute Tap - Red Coat Tap)	120	132	151.2	126.0	15.8	13.2

All of the voltage range criteria violations observed under Category B conditions in the post-Project studies were alleviated by planned RAS 36, as shown in Table 5-6.

Table 5-6: Voltage Range Violations under Category B Conditions for the 2019 SP Post-Project Scenario

Contingency (System Element Lost)	Substation Name and Number	Bus Number	Nominal kV	Emergency Minimum Voltage (kV)	Emergency Maximum Voltage (kV)	Initial Voltage (kV)	Steady State Voltage (kV)	Post-Mitigation Steady State (kV)
863L (Magrath 225S - Riverbend 618S)	Warner 344S	278	69	62	76	66.9	58.8	64.8
618ST1 (Riverbend 618S Transformer T1)		278	69	62	76	66.9	58.8	64.9

5.4. Constraint Effective Factors

Constraint effective factor studies were conducted for all post-Project scenarios. The constraint effective factors were calculated for all Category B conditions when the loadings of the monitored transmission elements in the Study Area exceeded 100% (i.e., for all of the contingencies that resulted in thermal criteria violations). The results of the constraint effective factor studies are provided in Attachment A7.

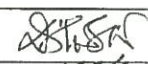
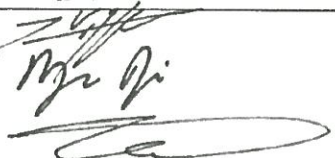
Attachment A1

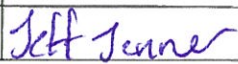
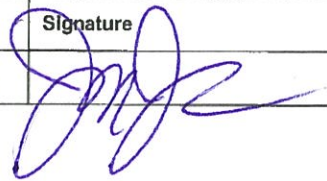
AESO Engineering Connection Assessment Scope

AESO Engineering Connection Assessment Scope

Stirling Wind Project Connection

AESO Project Number: 1719

Company Name	Engineer Name P.Eng.	Date	Engineer Signature
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Company Name	Name	Date	Signature
Stirling Wind Project Ltd		Nov 30 2017	

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Attachments

Attachment A1.1 Transmission Planning Criteria – Basis and Assumptions

1. Introduction

This AESO Engineering Connection Assessment Scope provides an overview of the engineering studies to be completed by Teshmont Consultants LP (the Studies Consultant) to assess the impact of the Project (as defined in Section 1.1) on the performance of the Alberta interconnected electric system (AIES). Technical criteria, assumptions, and methods for performing these engineering studies are provided in this document.

1.1. Project

1.1.1. Overview

Stirling Wind Project LP, by its General Partner Stirling Wind Project Ltd. (Market Participant), has submitted a request for system access service to the Alberta Electric System Operator (AESO) to connect its proposed Stirling Wind Project (the Facility) to the Alberta interconnected electric system (AIES). The Facility is a wind aggregated generating facility, and includes a proposed collector station, to be designated the Red Coat 967S substation. The Facility is planned to be located near the Village of Stirling in and around the AESO planning areas of Glenwood (Area 55) and Lethbridge (Area 54).

The Market Participant's request includes: a request for a Rate STS, *Supply Transmission Service*, contract capacity of 113 MW and a request for a Rate DTS, *Demand Transmission Service*, contract capacity of 1.0 MW for new system access service in the area; and a request for transmission development (collectively, the Project).

The scheduled In-Service Date (ISD) for the Project is July 1, 2019.

1.1.2. Load Component

The Project includes a load component:

- Rate DTS requested: 1 MW
- Load type: Substation service and auxiliary load.

1.1.3. Generation Component

The Project includes the following generation component:

- Requested Rate STS contract capacity: 113 MW

- Facility Maximum Authorized Real Power (MARP): 113 MW
- Facility Maximum Capability (MC): 113 MW.
- Generator type:: Wind
- The size and the manufacturer for the wind turbines has not been decided yet;
- It is assumed that the aggregated generating facility has the minimum continuous reactive power capability of either supplying reactive power at 0.9 power factor (PF) lagging or absorbing reactive power at 0.95 PF leading, per the technical requirements of Section 502.1 of the ISO rules, Wind Aggregated Generating Facilities Technical Requirements
- The Market Participant advised that there is no future expansion planned.

1.2. Study Scope

1.2.1. Study Objectives

The objectives of the studies are as follows:

- Study the impact of the Project on the performance of the AIES.
- Identify any violations of the relevant AESO criteria, standards or requirements, both pre-Project and post-Project.
- Recommend mitigation measures, if required, to reliably connect the Project to the AIES.

1.2.2. Study Area

1.2.2.1. Study Area Description

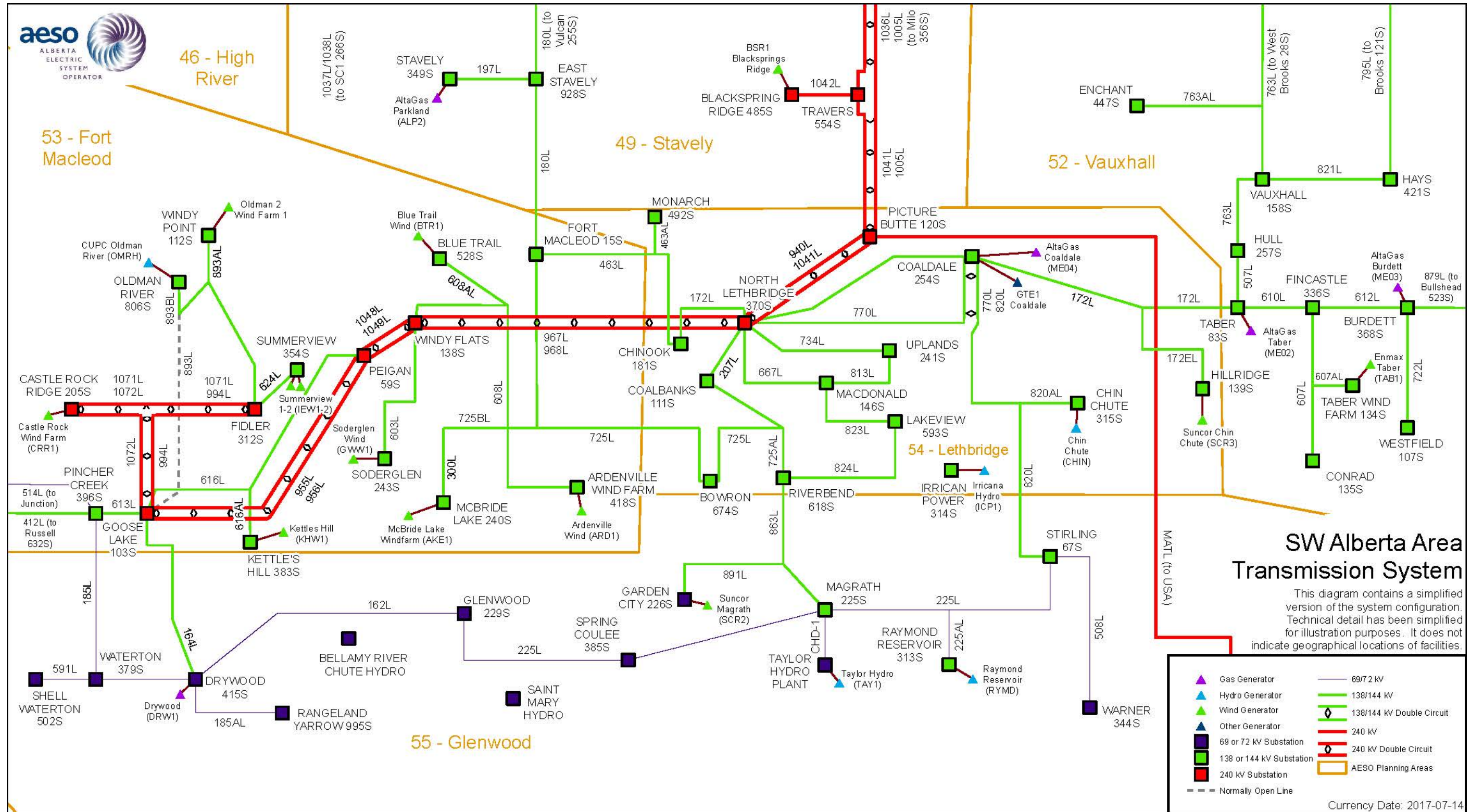
Geographically, the Project is located in the AESO planning area of Lethbridge (Area 54), which is part of the AESO South Planning Region.

The Study Area for the Project consists of the Glenwood (Area 55), Vauxhall (Area 52), Lethbridge (Area 54), and Stavely (Area 49) including the tie lines connecting these planning areas to the rest of the AIES.

All transmission facilities within the Study Area will be studied and monitored to assess the impact of the Project on the AIES, including any violations of the Reliability Criteria (as defined in Section 3.1).

The existing transmission system in the Study Area is shown in Figure 1-1. The Study Area is served by 240 kV, 138 kV, and 69 kV transmission systems. Generation in the Study Area includes hydro, wind and gas generation facilities.

Figure 1-1: Existing Study Area Transmission System



1.2.2.2. Existing Constraints

Existing constraints in the Study Area are managed in accordance with Section 302.1 of the ISO rules, *Real Time Transmission Constraint Management* (TCM Rule). Remedial action schemes (RASs) are being used to mitigate certain existing constraints in the Study Area, as follows:

1. RAS 36: Garden City 226s WAGF Trip Scheme.
2. RAS 42: Spring Coulee 385s - 225LW Overload Mitigation Scheme
3. RAS 43: Stirling 67s - 508L Load Trip Scheme
4. RAS 126: Magrath 225s Generation Trip Scheme
5. RAS 137: MATL Local Detection Scheme
6. RAS 612: 103S overvoltage - I-354S IPP trip

1.2.2.3. AESO Long-Term Transmission Plans

The *AESO 2015 Long-term Transmission Plan* (2015 LTP)¹ includes the following near term (by 2020) system transmission developments in the Study Area:²

- Upgrade existing 69 kV lines, from Stirling substation to Raymond substation and onto Magrath substation, to 138 kV
- Convert Raymond substation from 69 kV to 138 kV
- Add 138 kV breakers at North Lethbridge substation for better sectionalizing of Lethbridge 138 kV network

The above developments will not be included in the system topology for the pre-Project and post-Project studies because these transmission developments are not expected to be in service before the Project ISD.

1.2.3. Engineering Studies Required

The following engineering studies are required for the pre-Project and post-Project scenarios:

- Power flow studies
- Short-circuit studies

The following engineering studies are required for the post-Project scenarios:

- Power flow studies
- Transient stability studies
- Short-circuit studies

¹ The 2015 LTP document is available on the AESO website.

² The 2015 LTP identifies the transmission developments in the Glenwood and Lethbridge sub-regions on pages 34 and 35.

2. Connection Alternative to be Studied

The following alternative will be studied.

Alternative 7: T-tap connection to the 138 kV transmission line 820L.

This alternative includes the following developments:

- Connect the Facility to the existing 138 kV transmission line 820L (between the Stirling 67S substation and the Chin Chute 315S tap point) in a t-tap configuration. This would require the addition of a new 138 kV circuit, approximately 5 km to 7 km in length.
- Add or modify associated equipment as required for the above transmission developments

3. Criteria, System Data, and Study Assumptions

3.1. Criteria, Standards, and Requirements

3.1.1. AESO Reliability Criteria

The Transmission Planning (TPL) Standards, which are included in the Alberta Reliability Standards, and the AESO's *Transmission Planning Criteria – Basis and Assumptions*³ (collectively, the Reliability Criteria) will be applied to evaluate system performance under Category A system conditions (i.e., all elements in-service) and following Category B (i.e., single element outage) contingencies, prior to and following the studied alternatives. Below is a summary of Category A and Category B system conditions.

Category A, often referred to as the N-0 condition, represents a normal system with no contingencies and all facilities in service. Under this condition, the system will be able to supply all firm load and firm transfers to other areas. All equipment must operate within its applicable rating, voltages must be within their applicable range, and the system must be stable with no cascading outages.

Category B events, often referred to as an N-1 or N-G-1 with the most critical generator out of service, result in the loss of any single specified system element under specified fault conditions with normal clearing. These elements are a generator, a transmission circuit, a transformer, or a single pole of a DC transmission line. The acceptable impact on the system is the same as Category A. Planned or controlled interruptions of electric supply to radial customers or some local network customers, connected to or supplied by the faulted element or by the affected area, may occur in certain areas without impacting the overall reliability of the interconnected transmission systems. To prepare for the next contingency, system adjustments are permitted, including curtailments of contracted firm (non-recallable reserved) transmission service electric power transfers.

The TPL standards, TPL-001-AB-0 and TPL-002-AB-0, have referenced Applicable Ratings when specifying the required system performance under Category A and Category B events. For the purpose of applying the TPL standards to the studies documented in this report, Applicable Ratings are defined as follows:

- Seasonal continuous thermal rating of the line's loading limits.
- Highest specified loading limits for transformers.

³ Please refer to Attachment A1.1

- For Category A conditions: Voltage range under normal operating condition per AESO Information Document #2010-007RS, *General Operating Practices – Voltage Control* (ID #2010-007RS). ID #2010-007RS relates to Section 304.4 of the ISO rules, *Maintaining Network Voltage*. For the busses not listed in ID #2010-007RS, Table 2-1 in the *Transmission Planning Criteria – Basis and Assumptions* applies.
- For Category B conditions: The extreme voltage range values per Table 2-1 in the *Transmission Planning Criteria – Basis and Assumptions*.
- Desired post-contingency voltage change limits for three defined post event timeframes as provided in Table 3.1-1, below.

Table 3.1-1: Post Contingency Voltage Deviation Guidelines for Low Voltage Busses

Parameter and reference point	Time Period		
	Post Transient (up to 30 sec)	Post Auto Control (30 sec to 5 min)	Post Manual Control (Steady State)
Voltage deviation from steady state at POD low voltage bus.	±10%	±7%	±5%

3.1.2. ISO Rules and IDs

ID #2010-007RS will be used to establish system normal (i.e., pre- contingency) voltage profiles for the Study Area.

The TCM Rule will be followed to set up the study scenarios and assess the impact of the Project. In addition, due regard will be given to the AESO’s Connection Study Requirements and the AESO’s Generation and Load Interconnection Standard.

3.1.3. Wind Aggregated Generating Facility Requirements

The Facility should meet the technical requirements of Section 502.1 of the ISO rules, *Wind Aggregated Generating Facilities Technical Requirements*.

3.2. Study Scenarios

The Study Area has low load variation between winter and summer seasons and the transmission facilities in the Study Area have summer ratings that are significantly lower than the winter ratings. As a result, summer loading scenarios, both summer light (SL) and summer peak (SP), were selected since they provide the most stressed operating conditions. The scheduled ISD for the Project is July 1, 2019. Therefore, the studies will be conducted using 2019 summer peak (2019 SP) and 2019 summer light (2019 SL) study scenarios.

The Project load is not significant compared to the load in the Study Area, hence it will not be considered in this study.

Table 3.2-1 provides a list of the study scenarios. The post-Project scenarios reflect the requested Rate STS contract capacity of 113 MW.

Table 3.2-1: Connection Study Scenarios

Scenario No.	Year/Season Load	Pre-Project/Post-Project	Project Generation (MW)	System Generation Dispatch Conditions
1	2019 SL	Pre-Project	0	High Wind, Zero Import
2	2019 SP	Pre-Project	0	High Wind, High Import
3	2019 SL	Post-Project	113	High Wind, Zero Import
4	2019 SP	Post Project	113	High Wind, High Import
5	2026 WP	Post-Project	113	All generation in the Study Area on

3.3. Load and Generation Assumptions

3.3.1. Load Assumptions

The AESO Planning Region load forecasts to be used for this connection study are shown in Table 3.3-1 and are based on the *AESO 2016 Long-term Outlook (2016 LTO)* which was the available forecast at the time of the study. For the studies, when POD loads for the Alberta Internal Load (AIL) are modified to align with the load forecast in the 2016 LTO, the active power to reactive power ratio in the base case scenarios will be maintained.

Table 3.3-1: Forecast Area Load (2016 LTO at AESO South Planning Region Peak)

AESO Planning Region Name	2019 Forecast Peak Load (MW)	
	SP	SL
South Planning Region	1,548	920

3.3.2. Generation Assumptions

The generation forecast to be used for the studies is based on the 2016 LTO. The generation assumptions for the studies will assume high wind dispatch conditions.

The existing non-wind generating facilities in the Study Area and their dispatch levels for the studies are shown in Table 3.3-2.

Table 3.3-2: Existing Non-wind Generation Dispatch Levels

Generating Facility Name	Bus Number	AESO Planning Area	Pmax (MW)	2019 SL Unit Net Generation (MW)*	2019 SP Unit Net Generation (MW)*
Taylor Hydro Facility	4670	55	14	13.5	13.5
Raymond Reservoir Hydroelectric Facility	414	55	21	19.5	19
Irrican Hydro Facility	450	55	7	6.4	6.4
Drywood Power Plant	4226	55	6	0	4.6
Coaldale Cogeneration Station	4690	54	6.4	0	6.2
Chin Chute Hydroelectric Facility	407	54	15	10.6	10.6
Old Man River Dam	2230	53	32	31.5	31.7
Total				81.5	92

Note: *Unit Net Generation refers to Gross Generating unit output less Unit Service Load.

Per the 2016 LTO, the total forecast renewable electricity generation in 2019 is 1,973 MW. This includes existing, under-construction, and planned renewable electricity generation facilities.

Using the 2016 LTO's 2019 renewable generation forecast of 1,973 MW, the generation assumptions will dispatch the renewable electricity generation facilities to yield the credible worst-case power flow conditions for the Study Area. The pre-Project dispatch levels for the existing, under-construction, and planned renewable electricity generation facilities are shown in Table 3.3-3.

Table 3.3-3: Existing Renewable Generation Dispatch Levels

Facility Name and Code	AESO Planning Area No.	Bus No.	MC (MW)	2019 SP/SL Unit Net Generation (MW)*
Ardenville Wind (ARD1)	53	4735, 4740	68	68
Blue Trail Wind (BTR1)	53	66328, 67328	66	66
Castle River #1 (CR1)	53	2234, 3234	39	39
Castle Rock Wind Farm (CRR1)	53	67221	76	76
Cowley Ridge (CRWD)	53	255, 265, 4264	20	20
Enmax Taber (TAB1)	52	15343, 16343	81	81
Kettles Hill (KHW1)	53	2402, 3402	63	63
McBride Lake Windfarm (AKE1)	53	2901, 3901, 4901	75	75
Soderglen Wind (GWW1)	53	12358, 13358	68	68
Summerview 1 (IEW1)	53	2338, 3338	66	66

Facility Name and Code	AESO Planning Area No.	Bus No.	MC (MW)	2019 SP/SL Unit Net Generation (MW)*
Summerview 2 (IEW2)	53	4339, 5337	66	66
Suncor Chin Chute (SCR3)	54	2389	30	30
Suncor Magrath (SCR2)	53	11002	30	30
Suncor Wintering Hills (SCR4)	43	60789, 60791, 60793, 60846, 60848, 60850	88	88
Old Man River	53	61543	46	46
Blackspring Ridge	49	61736, 61737	300	300
South Region Subtotal			1182	1182
Ghost Pine (NEP1)	42	2621 to 2625	82	82
Halkirk (HAL1)	42	66435, 67435	150	150
Fortis Bull Creek Phases 1 and 2	37	4222	29.5	29.5
Central Region Subtotal			261.5	261.5
Total Existing/Under Construction			1443.5	1443.5

Note: *Unit Net Generation refers to Gross Generating unit output less Unit Service Load.

The remaining forecasted renewable generation growth (529.5 MW) is allocated to future renewable projects in the Study Area as identified in **Table 3.3-4** to create stressed study conditions.

Table 3.3-4: Pre-Project Scenario Dispatch Levels for Planned Renewable Generation

Queue Position	AESO Project Name	AESO Project No.	AESO Planning Area No.	Pmax (MW)	2019 SL/SP Unit Net Generation (MW) ^a
3	Heritage Wind Energy Centre	515	53	350	0
4	Enel Alberta Riverview Wind Farm ^b	524	53	115	115
5	Windy Point Wind Farm ^c	580	53	63	63
14	Old Elm Wind Farm	1080	55	60	60
32	Renewable Energy Service WAGF	1500	53	47	0
41	Joss MPC WAGF ^d	1533	48	120	0
58	Welsch Wind Farm	1660	53	69	69
65	RESL/ISE McLaughlin Phase 2 BTF Solar/WAGF	1728	53	40	0
77	Joss MPC WAGF Phase 2	1698	48	180	122.5
85	EDF EN Vulcan Solar PV	1762	49	100	100
Total					529.5

Notes:

^aUnit Net Generation refers to Gross Generating unit output less Unit Service Load.

^bThe *Riverview Wind Energy Connection* NID, as originally filed with the AUC on June 11, 2013 in Proceeding 2402.

^cThe *Windy Point Wind Energy Connection* NID, as originally filed with the AUC on November 24, 2014 in Proceeding 3541.

^dThe *Jenner Wind Energy Connection* NID, as originally approved by AUC Decision 21394-D01-2017 and Approval 21934-D02-2017.

For the post-project scenarios, adjust the renewable dispatches outlined in Table 3.3-4 as follows:

- Dispatch Joss MPC WAGF Phase 2 (AESO Project no. 1698) to 9.5 MW.
- Dispatch the Facility to 113 MW.

This will result in a total post-Project renewable dispatch consistent with the 2016 LTO's 2019 renewable generation forecast of 1,973 MW.

3.3.3. Intertie Flow Assumptions

Intertie assumptions are provided for the British Columbia-Alberta (BC-AB), Saskatchewan-Alberta (SK-AB), and Montana-Alberta (MATL) interties in Table 3.3-5.

Table 3.3-5: Intertie Assumptions

Scenario No.	Scenario Name	Intertie Flow Conditions	Intertie		
			Import (+) /Export (-) to BC-AB (MW)	Import (+)/ Export (-) to SK-AB (MW)	Import (+)/ Export (-) to MATL (MW)
1	2019 SL Pre- Project	Zero Import	0	0	0
2	2019 SP Pre-Project	High Import	+800	+150	+300
3	2019 SL Post- Project	Zero Import	0	0	0
4	2019 SP Post- Project	High Import	+800	+150	+300

3.3.4. HVDC Power Order

The Western Alberta Transmission Line (WATL) and the Eastern Alberta Transmission Line (EATL) are high-voltage direct current (HVDC) transmission lines. The HVDC power order assumptions for the studies will be set to minimize losses for the pre-Project and post-Project study scenarios, as shown in Table 3.3-6

Table 3.3-6: HVDC Power Order by Scenario

Scenario No.	Scenario Name	WATL (MW)*	EATL (MW)*
1	2019 SL Pre- Project	Blocked	550 S → N
2	2019 SP Pre-Project	550 S → N	450 S → N
3	2019 SL Post- Project	250 S → N	550 S → N
4	2019 SP Post- Project	550 S → N	450 S → N

Note: *S → N: HVDC flow direction is South to North

3.4. System Projects

No system transmission project will be considered in the system topology for the study scenarios because planned system transmission developments are not expected to be in service before the scheduled Project ISD.

3.5. Connection Projects

There are no connection projects within the Study Area that have passed Gate 2 of the AESO Connection Process as of November 2017 and that have queue positions before the Project, except those renewable generation projects listed in Table 3.3-4.

3.6. Facility Ratings and Shunt Elements

The legal owner of transmission facilities (TFO) provided the thermal ratings for the transmission lines in the vicinity of the Study Area. The seasonal continuous ratings and the short-term emergency ratings for the key transmission lines in the Study Area are shown in Table 3.6-1.

Table 3.6-1: Thermal Rating Assumptions for Transmission Lines in the Study Area

Line ID	Line Description	Voltage Class (kV)	Summer Nominal Rating (MVA)	Summer Short-term Emergency Rating (MVA)
820L	Stirling 67S - 820L Tap - Coaldale 254S	138	120	132
820AL	Chin Chute 315S - 820L Tap	138	120	132
164L	Goose Lake 103S - Drywood 415S	138	85	94
185L	Pincher Creek 396S - Shell Canada Wateron 379S	69	41	45
185L	Shell Canada Wateron 379S - Drywood 415S	69	57	63
162L	Drywood 415S - Glenwood 229S	69	40	44
1041L	North Lethbridge 370S - Travers 554S	240	481	553
940L	North Lethbridge 370S - Picture Butte 120S	240	481	577
1036L	Travers 554S - Milo 356S	240	481	577
1005L	Picture Butte 120S - Milo 356S	240	481	577
225L	Glenwood 229S - Spring Coulee 385S	69	22	24
225L	Spring Coulee 385S -Magrath 225S	69	24	28
225L	Magrath 225S - Stirling 67S	69	25	28
863L	Magrath 225S - Riverbend 618S	138	120	132
725AL	Riverbend 618S- 725L	138	96	132
725L	Bowron 674S- 725AL tap	138	122	134
725L	725AL tap - Coalbanks 111S	138	116	128
725L	McBride tap - Fort Macleod 15S	138	119	131
725L	McBride tap - Bowron 674S	138	91	100
207L	Coalbanks 111S - North Lethbridge 370S	138	120	132
734L	Uplands 241S - North Lethbridge 370S	138	167	184
824L	Lakeview 593S - Riverbend 618S	138	142	142
823L	Macdonald 146S - Lakeview 593S	138	142	142

Line ID	Line Description	Voltage Class (kV)	Summer Nominal Rating (MVA)	Summer Short-term Emergency Rating (MVA)
667L	Macdonald 146S - North Lethbridge 370S	138	174	175
813L	Macdonald 146S - Uplands 241S	138	175	175
770L	North Lethbridge 370S - Coaldale 254S	138	120	132
172L	North Lethbridge 370S - Coaldale 254S	138	119	131
172L	Fort Macleod 15S - North Lethbridge 370S	138	85	94
172L	Coaldale 254S - Taber 83S	138	119	131
180L	Ft Macleod 15S - East Stavely 928S	138	112	124
180L	Vulcan 255S - East Stavely 928S	138	112	124
100L	Tilley 498S - Suffield 895S	138	69	76
612L	Fincastle 336S - Burdett 368S	138	85	94
610L	Taber 83S - Fincastle 336S	138	85	94
763L	West Brooks 28S - Vauxhall 158S	138	120	132
763L	Vauxhall 158S - Hull 257S	138	120	132
821L	Hays 421S - Vauxhall 158S	138	85	94
795L	Hays 421S - Brooks 121S	138	119	131
814L/827L	Brooks 121S - West Brooks 28S	138	167	184

The TFO also provided the ratings for the key existing transformers in the Study Area. The ratings of the key transformers in the Study Area are shown Table 3.6-2.

Table 3.6-2: Summary of Key Transformer Ratings in the Study Area

Substation Name and Number	Transformer ID	Transformer Voltages (kV)	MVA Rating
North Lethbridge 370S	T3	240/138	193.6
	T5	240/138	200
	T6	240/138	200
West Brooks 28S	T1	240/138	400
	T2	240/138	400
Stirling 67S	T2	138/69	50
Magrath 225S	T1	138/69	50

Substation Name and Number	Transformer ID	Transformer Voltages (kV)	MVA Rating
Drywood 415S	T1	138/69	50
Pincher 396S	T1	138/69	50

The TFO provided the details of shunt elements in the Study Area, as shown in Table 3.6-3.

Table 3.6-3: Summary of Shunt Elements in the Study Area

Substation Name and Number	Voltage Class (kV)	Capacitors	
		Number of Switched Shunt Blocks	Total at Nominal Voltage (MVA _r)
Taber 83S	138	1 x 24.46 MVA _r + 1 x 24.50 MVA _r	48.96
Hays 421S	138	1 x 22.96 MVA _r	22.96
Picture Butte 120S	240	2 x 50.00 MVA _r	100.00
Burdett 368S	138	1 x 22.96 MVA _r + 1 x 24.50 MVA _r	47.46

3.7. Protection Fault Clearing Times

The transient stability studies will be performed for the contingencies shown in Table 3.7-1. The studies will be performed using the actual fault clearing times for the selected contingencies, as provided by the TFO. If the TFOs do not specify the fault clearing times for one of the selected contingencies, then the studies for that contingency will be performed using the standard fault clearing times that are specified in Table 2-3 of the *Transmission Planning Criteria – Basis and Assumptions*. Transient stability studies should be performed using PSS/E and with a bolted three phase to ground fault to be applied in the fault location shown below. Transient stability studies should be performed using PSS/E and with a bolted three phase to ground fault to be applied in the fault location shown below.

Table 3.7-1: Contingencies to be Studied for Transient Stability Assessment and the Respective Protection Fault Clearing Times

Contingency (System Element Lost)					Faulted Location	Clearing Time (No. of Cycles)		
Line ID	Nominal Bus Voltage (kV)	Terminal Location				Terminal 1	Terminal 2	Terminal 3
		Terminal 1	Terminal 2	Terminal 3				
820L	138	Coaldale	Stirling	Chin	Coaldale 254S	6	7	36

		254S	67S	Chute tap	Stirling 67S	6	7	16
225L	69	Stirling 67S	Magrath 225S	Raymond Reservoir tap	Stirling 67S	10.75	6.75	40.75
					Magrath 225S	5.75	11.75	42.75
863L	138	Magrath 225S	Riverbend 618S	n/a	Magrath 225S	9	6	n/a
					Riverbend 618S	6	9	n/a
170L	138	Coaldale 254S	North Lethbridge 370S	n/a	Coaldale 254S	5.5	6.5	n/a
					North Lethbridge 370S	5.5	6.5	n/a
172L	138	Coaldale 254S	Taber 83S	n/a	Coaldale 254S	6	7	n/a
					Taber 83S	6	7	n/a
1041L	240	Travers 554S	North Lethbridge 370S	n/a	Travers 554S	5	6	n/a
					North Lethbridge 370S	5	6	n/a
968L	240	N Lethbridge 370S	Windy Flats 138S	n/a	N Lethbridge 370S	5	6	n/a
					Windy Flats 138S	5	6	n/a

Notes: n/a means not applicable

3.8. Voltage Profile Assumption

AESO ID #2010-007RS must be used to establish normal system (i.e., pre-contingency) voltage profiles for key area busses prior to commencing any studies. Table 2-1 of the *Transmission Planning Criteria – Basis and Assumptions* applies for all the busses not included in the ID #2010-007RS. These voltages will be used to set the voltage profile for the study base cases prior to power flow analysis.

4. Study Methodology

All studies will be performed using PSS/E v33.

4.1. Engineering Studies to be Performed

The engineering studies to be performed for this connection assessment are identified in Table 4.1-1.

Table 4.1-1: Studies to be Performed

Scenario Number and Name		System Conditions	Power Flow	Transient Stability	Short-circuit*
1	2019 SL Pre-Project	Category A and Category B	X		
2	2019 SP Pre-Project	Category A and Category B	X		X
3	2019 SL Post-Project	Category A and Category B	X	X	
4	2019 SP Post-Project	Category A and Category B	X	X	X
5	2026 WP Post-project	Category A			X

Notes: *Only Category A with all generators in the study area on.

4.2. Power Flow Studies

Power flow studies will be performed to identify thermal and voltage criteria violations as per the Reliability Criteria, and any deviations from the limits listed in Table 3.1-1.

For the Category B power flow studies, the transformer taps and switched shunt reactive compensating devices such as shunt capacitors and reactors will be locked and continuous shunt devices will be enabled.

Point-of-delivery (POD) low voltage bus deviations will also be assessed for both the pre-Project and post-Project networks by first locking all tap changers and area shunt reactive compensating devices to identify any post-transient voltage deviations above 10%. Second, tap changers will be allowed to move while shunt reactive compensating devices remain locked to determine if any voltage deviations above 7% occur in the area. Third, all the taps and shunt reactive compensating devices will be allowed to adjust, and voltage deviations above 5% will be reported.

The scenarios to be studied are as shown in Table 4.1-1.

4.2.1. Contingencies to be Studied

Power flow studies will be performed for the Category A condition and all Category B contingencies in the Study Area.

4.3. Transient Stability Studies

Transient stability analysis will be performed for the post-Project scenarios, as shown in Table 4.1-1. If any transient stability issues are observed, transient stability analysis will be performed for the pre-Project scenarios.

Keephills generating unit 3 in Wabamun (Area 40) will be used as the reference for the studies.

The report presenting the results of the transient stability studies will provide response plots for bus voltage, machine relative angle and active and reactive power outputs for all available generation units within the Study Area will be provided. The results report will also provide the key branch active and reactive power flow surrounding the Facility.

4.3.1. Contingencies to be Studied

Transient stability studies will be performed for selected Category B contingencies, as shown in Table 3.7-1.

4.4. Short-Circuit Studies

Winter peak scenarios will be used for the short-circuit studies because winter peak scenarios generally produce higher short-circuit current levels than summer peak scenarios.

A maximum fault level will be provided for the substations in the vicinity of the Project assuming normal system operation with all transmission elements in service and generation dispatched. Three-phase faults and single line-to-ground faults will be simulated. Polar coordinates and per-unit values will be used for reporting the results.

Estimated maximum three-phase faults and single line-to-ground short-circuit current levels will be reported for the Chin Chute tap and for the following substations:

- Chin Chute 315S
- Stirling 67S
- Coaldale 254S
- Red Coat 967S

The scenarios and cases to be studied are as shown in Table 4-1.

5. Mitigation Measures

5.1. Development

Mitigation measures may be required if the post-Project study results identify system performance issues. Mitigation measures for the Project may involve real-time operational practices and/or modifying or adding remedial action schemes (RASs).

The Studies Consultant will notify the AESO of any system performance issues in a timely manner, following which the AESO Studies Engineer may instruct the Studies Consultant as follows:

- Develop tables showing the constraint effective factors⁴ for generation or load based on thermal criteria violations that are observed.
- Collaborate with the AESO to propose changes, if any, to the connection alternatives that could remove the requirement for a RAS.
- Collaborate with the AESO to study modifications to existing and/or planned RASs, proposed by the AESO, to ensure the coordination of existing protection schemes with the addition of any proposed protection schemes.
- Collaborate with the AESO to identify and study new RASs, if any, that may be required to ensure post-Project system reliability is maintained.

The AESO Studies Engineer will work closely with the Studies Consultant and guide the development and/or modifications of the proposed mitigation measures to ensure system reliability, security and compliance with the AESO's system access business practices.

⁴ Constraint effective factor studies are performed to determine the generator- and load- constraint effective factors. Constraint effective factors are used to estimate the ability of generators and loads to manage transmission constraints. A generator's or load's constraint effective factor is defined as the change in power flow over a specific transmission line following a change in the generator's energy production or in the load's energy consumption. The greater the constraint effective factor, the more effective a generator or load can be in managing a thermal criteria violation on the specific transmission line.

5.2. Evaluation

5.2.1. Post-Mitigation Studies

Studies to evaluate the effectiveness of mitigation measures, if required, will be performed in accordance with the technical criteria, assumptions, and methods provided in this AESO Engineering Connection Assessment Scope and in accordance with further instructions from the AESO.

5.2.2. Constraint Effective Factor Studies

Constraint effective factor studies will be used to determine the generator- and load- constraint effective factors and to identify the most effective generators or loads to manage the thermal criteria violations, if any, that are observed.

Attachment A1.1

Transmission Planning Criteria- Basis and Assumptions (Reliability Criteria)

1. Introduction

This document presents the reliability standards, criteria, and assumptions to be used as the basis for planning the Alberta Transmission System. The criteria, standards and assumptions identified in this document supersede those previously established.

2. Transmission Reliability Standards and Criteria¹

The AESO applies the following Alberta Reliability Standards to ensure that the transmission system is planned to meet applicable performance requirements under a defined set of system conditions and contingencies. A brief description of each of these standards is given below:

1. TPL-001-AB-0: System Performance Under Normal Conditions

Category A represents a normal system condition with all elements in service (N-0). All equipment must be within its applicable rating, voltages must be within their applicable ratings and the system must be stable with no cascading outages. Under Category A, electric supply to load cannot be interrupted and generating units cannot be removed from service.

2. TPL-002-AB-0: System Performance Following Loss of a Single BES Element

Category B events result in the loss of any single element (N-1) under specified fault conditions with normal clearing. The specified elements are a generating unit, a transmission circuit, a transformer or a single pole of a direct current transmission line. The acceptable impact on the system is the same as Category A with the exception that radial customers or some local network customers, including loads or generating units, are allowed to be disconnected from the system if they are connected through the faulted element. The loss of opportunity load or opportunity interchanges is allowed. No cascading can occur.

3. TPL-003-AB-0: System Performance Following Loss of Two or More BES Elements

Category C events result in the loss of two or more bulk electric system elements (sequential, N-1-1 or concurrent, N-2) under specified fault conditions and include both normal and delayed fault clearing. All of the system limits for Category A and B events apply with the exception that planned and controlled loss of firm load, firm transfers and/or generation is acceptable provided there is no cascading.

4. TPL-004-AB-0: System Performance Following Extreme BES Events

Category D represents a wide variety of extreme, rare and unpredictable events, which may result in the loss of load and generation in widespread areas. The system may not be able to reach a new stable steady state, which means a blackout is a possible outcome. The AESO needs to evaluate these events, at its discretion, for risks and consequences prior to creating mitigation plans.

5. FAC-014-AB-2: Establishing and Communicating System Operating Limits

The AESO is required to establish system operating limits where a contingency is not mitigated through construction of transmission facilities.

¹ A complete description of these standards are given in: AESO. *Alberta Reliability Standards*. Available from <http://www.aeso.ca/rulesprocedures/17004.html>

2.1 Thermal Loading Criteria

The AESO Thermal Loading Criteria require that the continuous thermal rating of any transmission element is not exceeded under normal and post-contingency operating conditions. Thermal limits are assumed to be 100% of the respective normal summer and winter ratings. Emergency limits are not considered in the planning evaluations.

2.2 Voltage Range and Voltage Stability Criteria

The normal minimum and maximum voltage limits as specified in the following table are used to identify Category A system voltage violations, while the extreme minimum and maximum limits are used to identify Category B and C system violations. Table 2-1 presents the acceptable steady state and contingency state voltage ranges for the AIES. Table 2-2 provides voltage stability criteria used to test the system performance.

Table 2-1: Acceptable Range of Steady State Voltage (kV)

Nominal Voltage	Extreme Minimum	Normal Minimum	Normal Maximum	Extreme Maximum
500	475	500	525	550
240	216	234	252	264
260 (Northeast & Northwest)*	234	247	266	275
144	130	137	151	155
138	124	135	145	150
72	65	68.5	75.5	79
69	62	65.5	72.5	76

Table 2-2: Voltage Stability Criteria

Performance Level	Disturbance (1)(2)(3)(4) Initiated by: Fault or No fault DC Disturbance	MW Margin (P-V method) (5)(6)(7)	MVar Margin (V-Q method) (6)(7)
A	Any element such as: One Generator One Circuit One Transformer One Reactive Power Source One DC Monopole	$\geq 5\%$	Worst Case Scenario(8)
B	Bus Section	$\geq 5\%$	50% of Margin Requirement

Performance Level	Disturbance (1)(2)(3)(4) Initiated by: Fault or No fault DC Disturbance	MW Margin (P-V method) (5)(6)(7)	MVAr Margin (V-Q method) (6)(7)
			in Level A
C	Any combination of two elements such as: A Line and a Generator A Line and a Reactive Power Source Two Generators Two Circuits Two Transformers Two Reactive Power Sources DC Bipole	$\geq 2.5\%$	50% of Margin Requirement in Level A
D	Any combination of three or more elements. i.e.: Three or More Circuits on ROW Entire Substation Entire Plant Including Switchyard	> 0	> 0

2.3 Transient Stability Analysis Assumptions

Standard fault clearing times as shown in Table 2-3 are used for the new facilities or when the actual clearing times are not available for the existing facilities. Double line-to-ground faults are applied for the Category C5 events with normal clearing times. Single line-to-ground faults are applied for Category C6 to C9 events with delayed clearing times as depicted in Table 2-4 and Table 2-5.

Table 2-3: Fault Clearing Times

Nominal	Near End	Far End
kV	Cycles	Cycles
500	4	5
240	5	6
144/138	6	8

with telecommunications		
144/138	6	30
without telecommunications		

Table 2-4: Stuck Breaker Clearing Times for Lines

Fault Clearing Time			Fault Clearing Time			Fault Clearing Time		
138/144 kV			240 kV			500 kV		
Near End	Far End	2 nd Ckt (for C5 and C7 Only)	Near End	Far End	2 nd Ckt (for C5 and C7 Only)	Near End	Far End	2 nd Ckt (for C5 and C7 Only)
15	24	24	12	6	14	9	5	11

Table 2-5: Stuck Breaker Clearing Times for Transformers

Fault Clearing Time (Cycles)						Fault Clearing Time (Cycles)					
240/138 kV						500/240 kV					
Fault on 240 kV Side			Fault on 138 kV Side			Fault on 500 kV Side			Fault on 240 kV Side		
240 kV Side	138 kV Side	2 nd Ckt (for Breaker Fail)	138 kV Side	240 kV Side	2 nd Ckt (for Breaker Fail)	500 kV Side	240 kV Side	2 nd Ckt (for Breaker Fail)	240 kV Side	500 kV Side	2 nd Ckt (for Breaker Fail)
12	6	14	15	5	24	9	5	11	12	4	14

Attachment A2

Pre-Project Power Flow Diagrams

List of Figures

Scenario and Case Name	Contingency (System Element Lost)	Figure Number
2019 Summer Light Pre-Project	N-0 (System Normal Condition)	Figure A2-1
	863L (Magrath 225S - Riverbend 618S)	Figure A2-2
	618ST1 (Riverbend 618S Transformer T1)	Figure A2-3
2019 Summer Peak Pre-Project	N-0 (System Normal Condition)	Figure A2-4
	607L (Fincastle 336S - Conrad Tap)	Figure A2-5
	618ST1 (Riverbend 618S Transformer T1)	Figure A2-6
	Taber Wind Farm 134S	Figure A2-7
	863L (Magrath 225S - Riverbend 618S)	Figure A2-8
	1005L (Picture Butte 120S - Milo 356S)	Figure A2-9
	1036L (Travers 554S - Milo 356S)	Figure A2-10

Figure A2-1: 2019 Summer Light Pre-Project - N-0 (System Normal Condition)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 9675

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 — Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

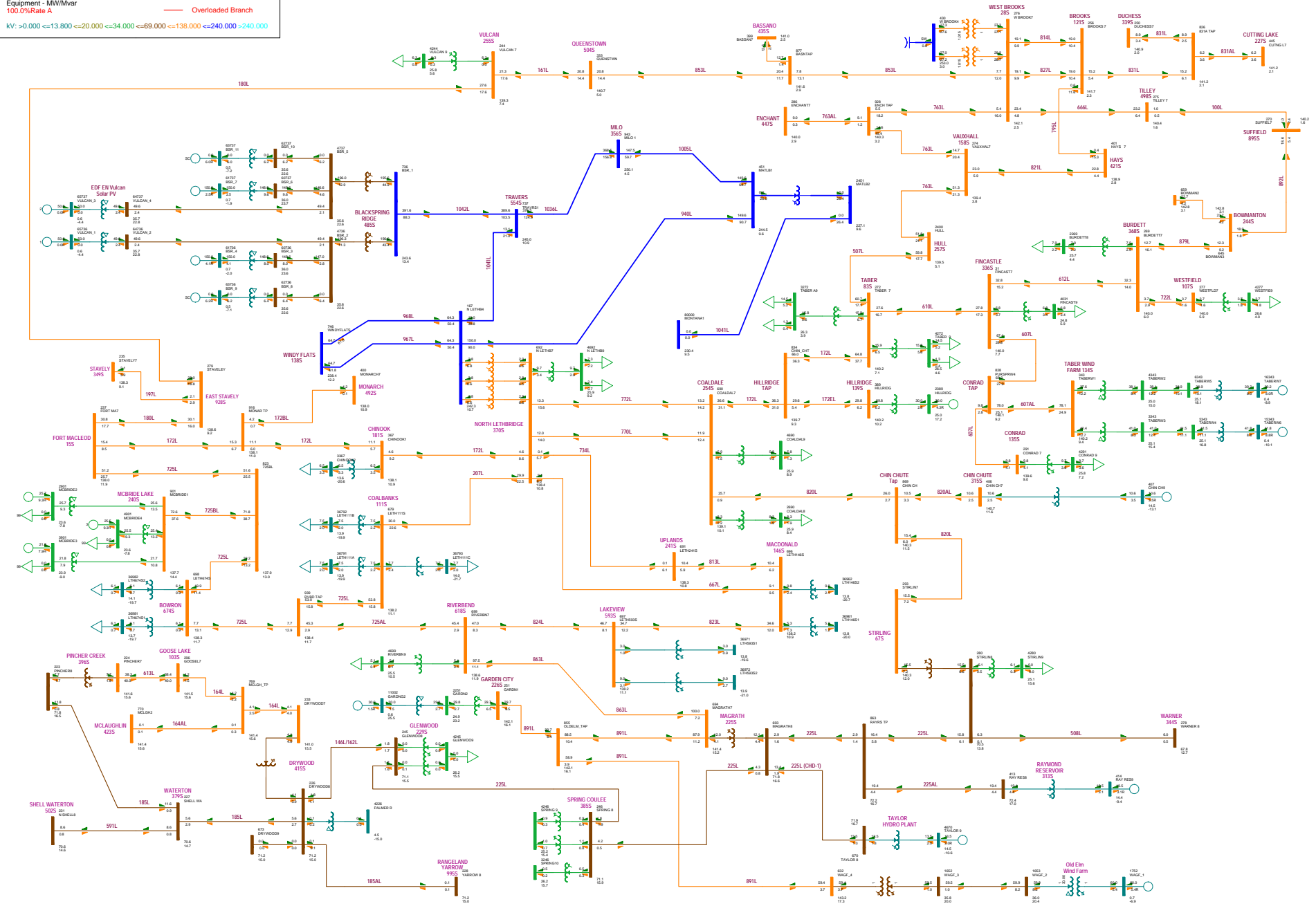


Figure A2-2: 2019 Summer Light Pre-Project - Contingency of 863L (Magrath 225S - Riverbend 618S)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage

----- Overloaded Branch

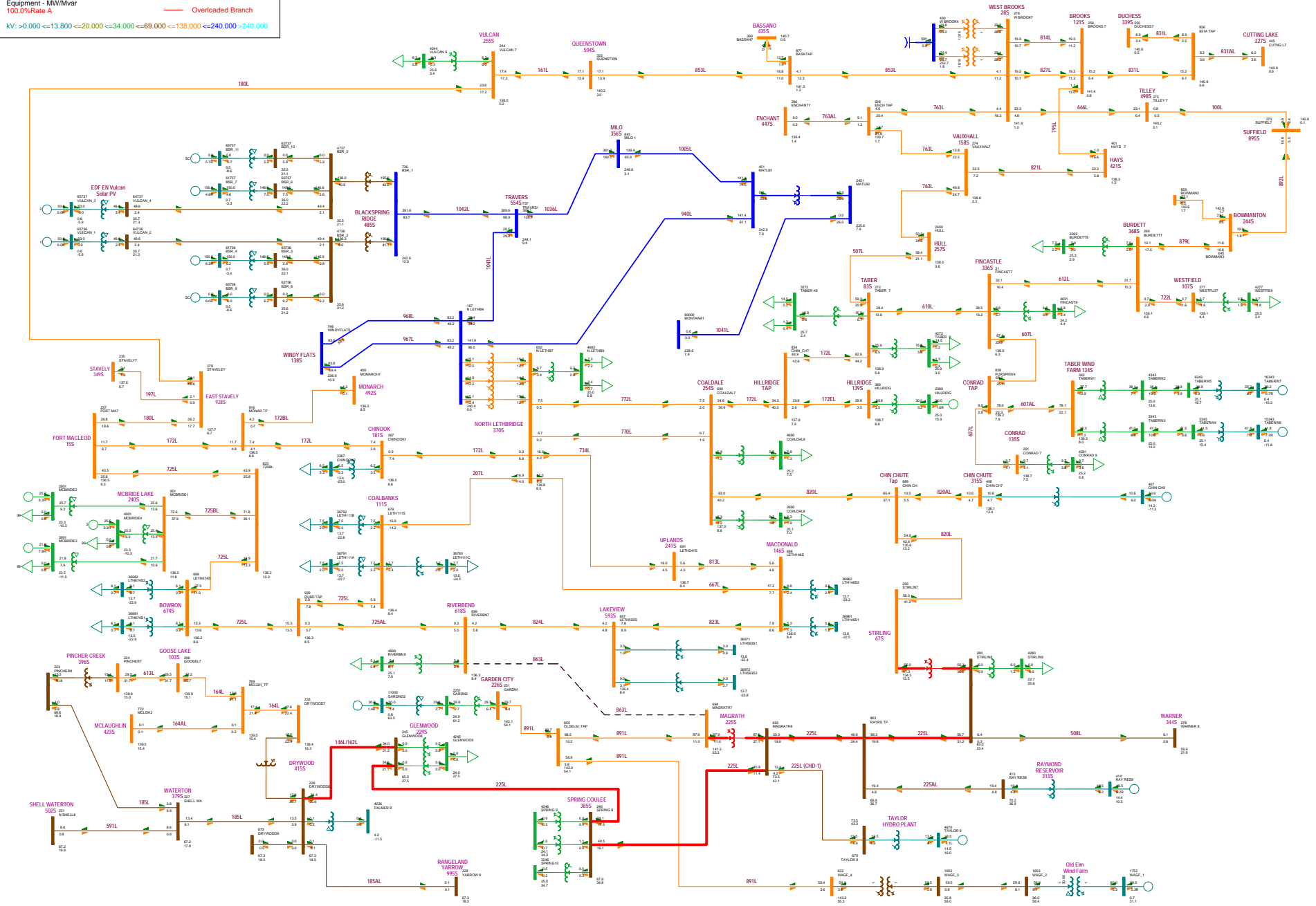


Figure A2-3: 2019 Summer Light Pre-Project - Contingency of 618ST1 (Riverbend 618S Transformer T1)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage

----- Overloaded Branch

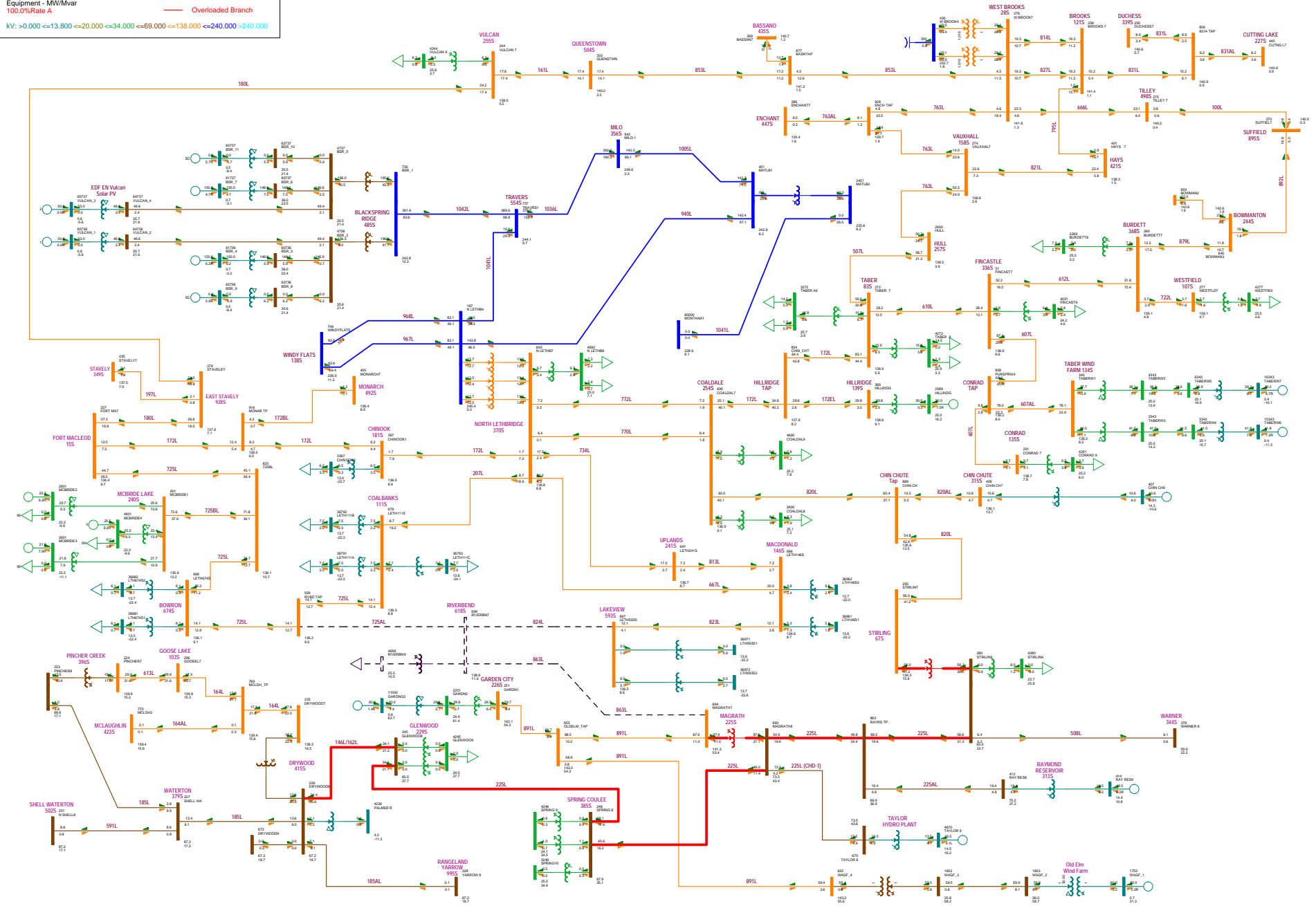


Figure A2-4: 2019 Summer Peak Pre-Project - N-0 (System Normal Condition)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage

----- Overloaded Branch

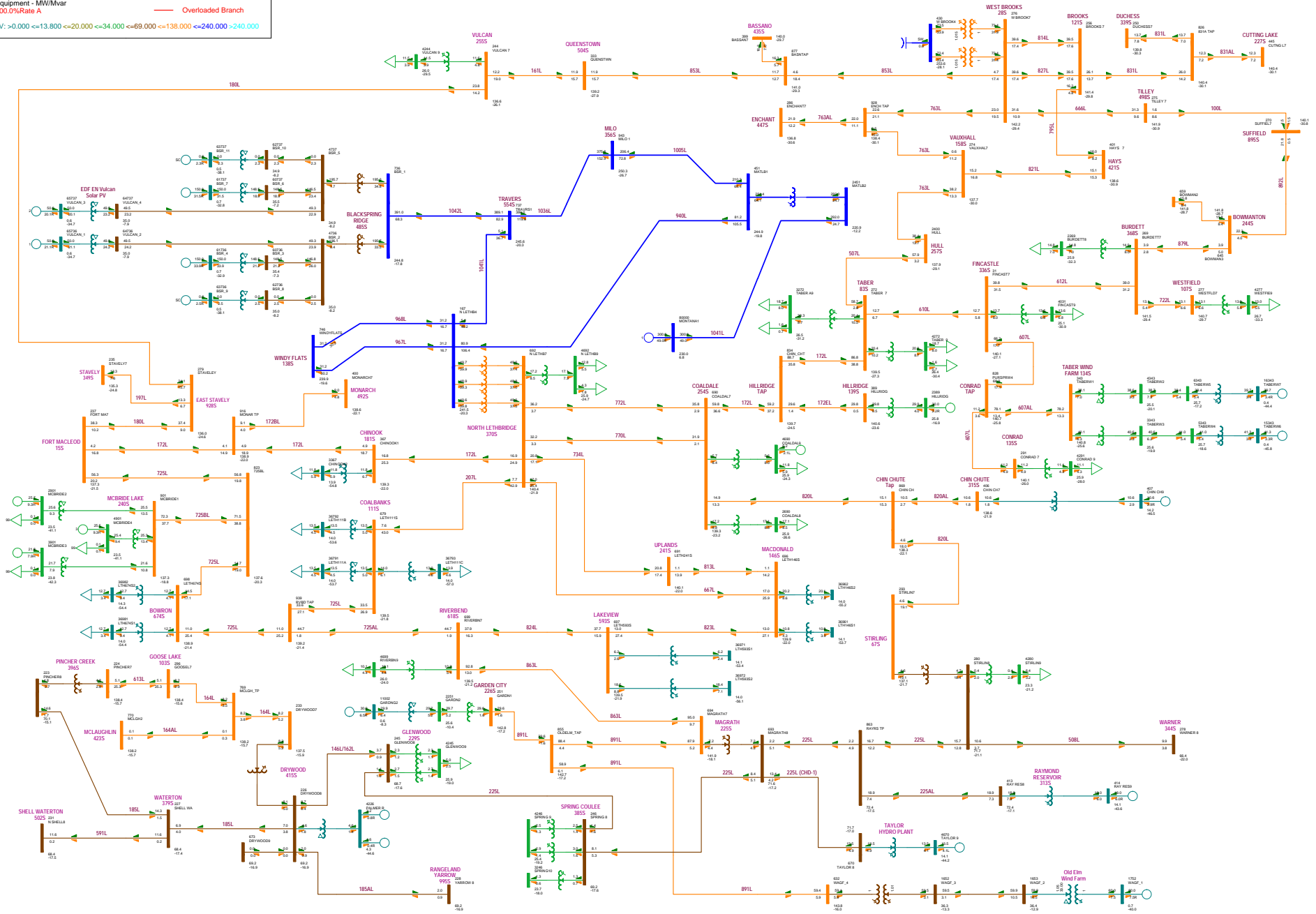


Figure A2-5: 2019 Summer Peak Pre-Project - Contingency of 607L (Fincastle 336S - Conrad Tap)

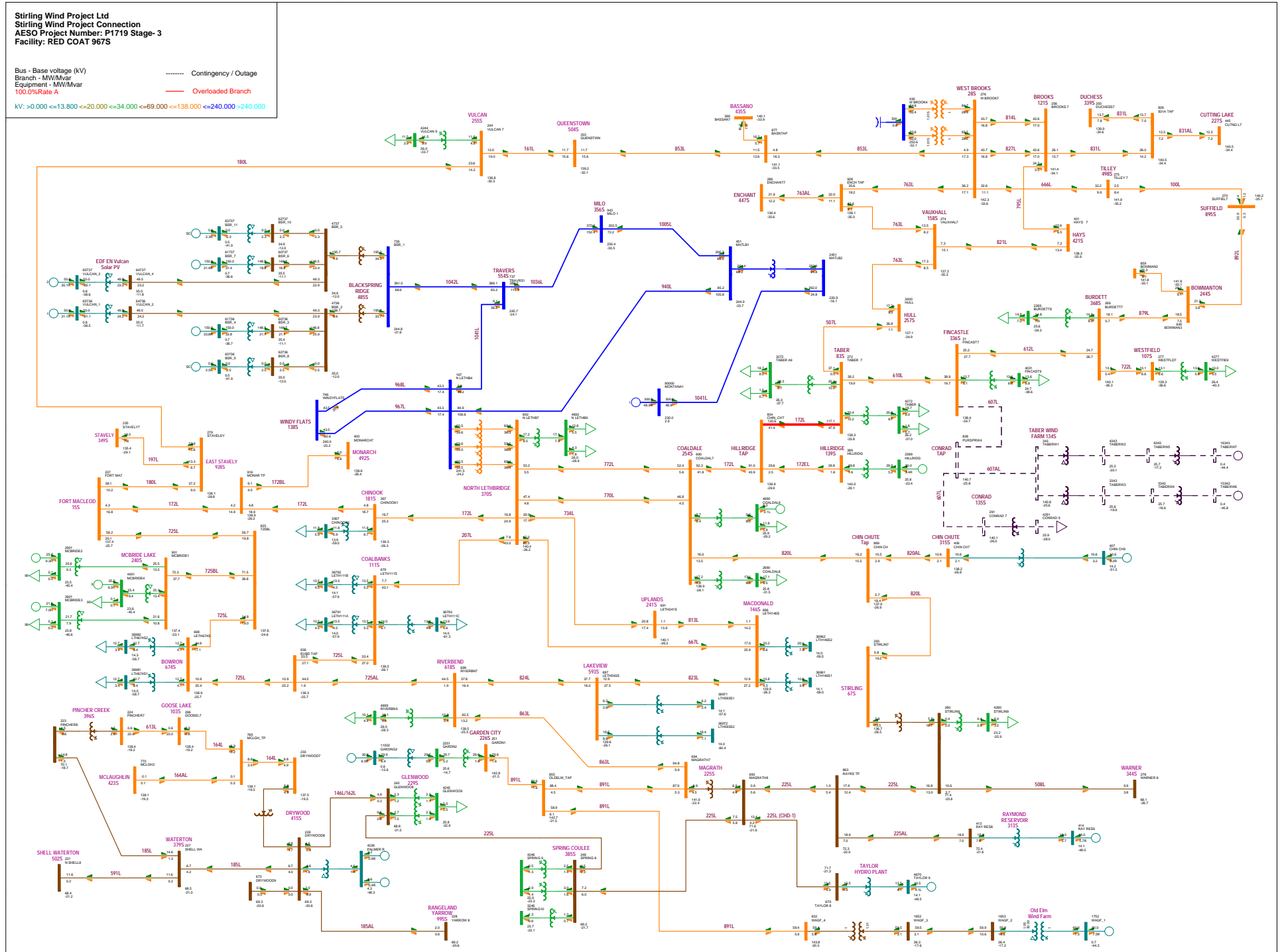


Figure A2-6: 2019 Summer Peak Pre-Project - Contingency of 618ST1 (Riverbend 618S Transformer T1)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 967S

Bus - Base voltage (kV) - - - - - Contingency / Outage
 Branch - MW/Mvar - - - - - Overloaded Branch
 Equipment - MW/Mvar
 100.0%Rate A

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

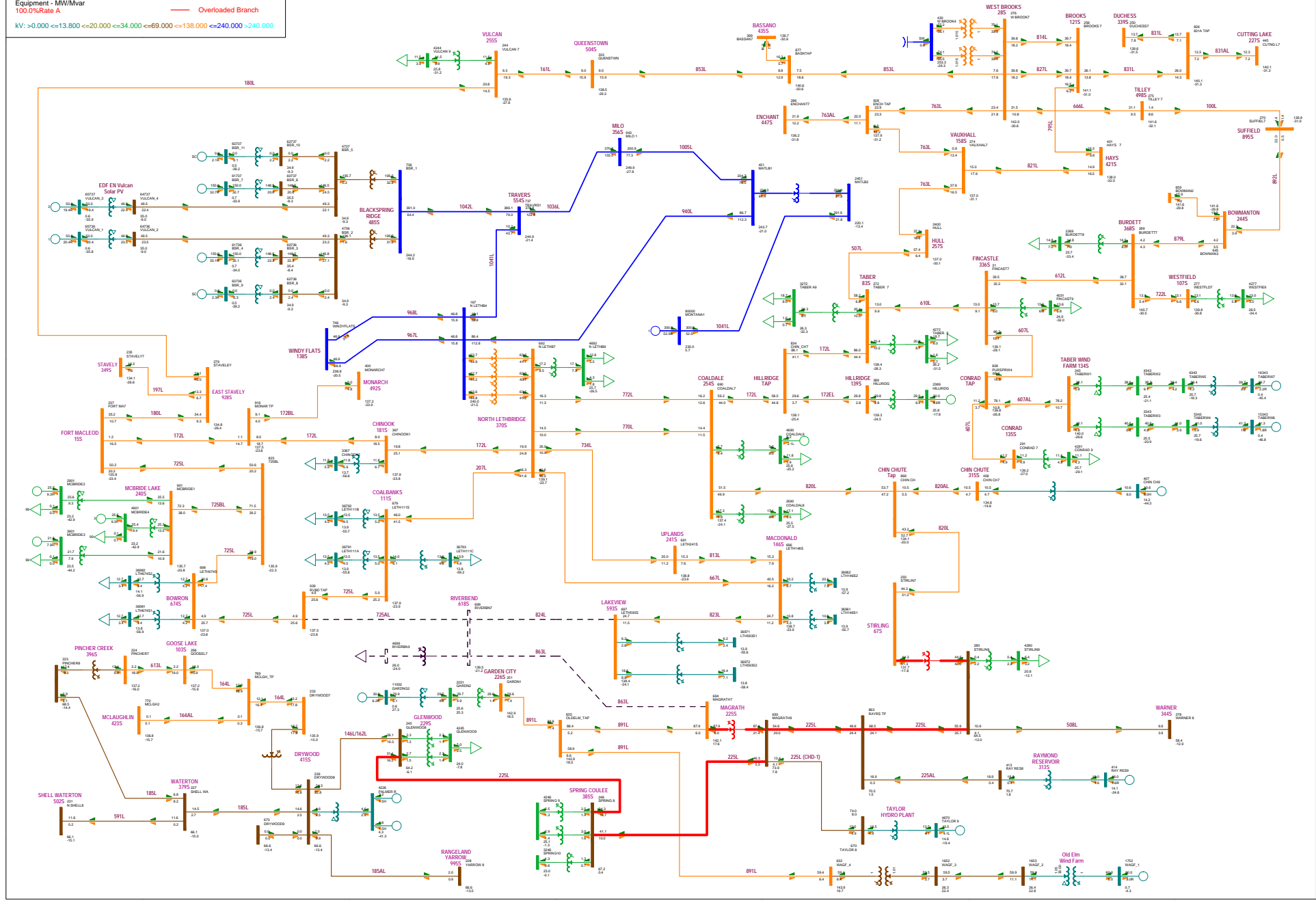


Figure A2-7: 2019 Summer Peak Pre-Project - Contingency of Taber Wind Farm 1345

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 9675

Bus - Base voltage (kV)
Branch - MWM/Mvar
Equipment - MWM/Mvar
100.0%Rate A

----- Contingency / Outage
----- Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

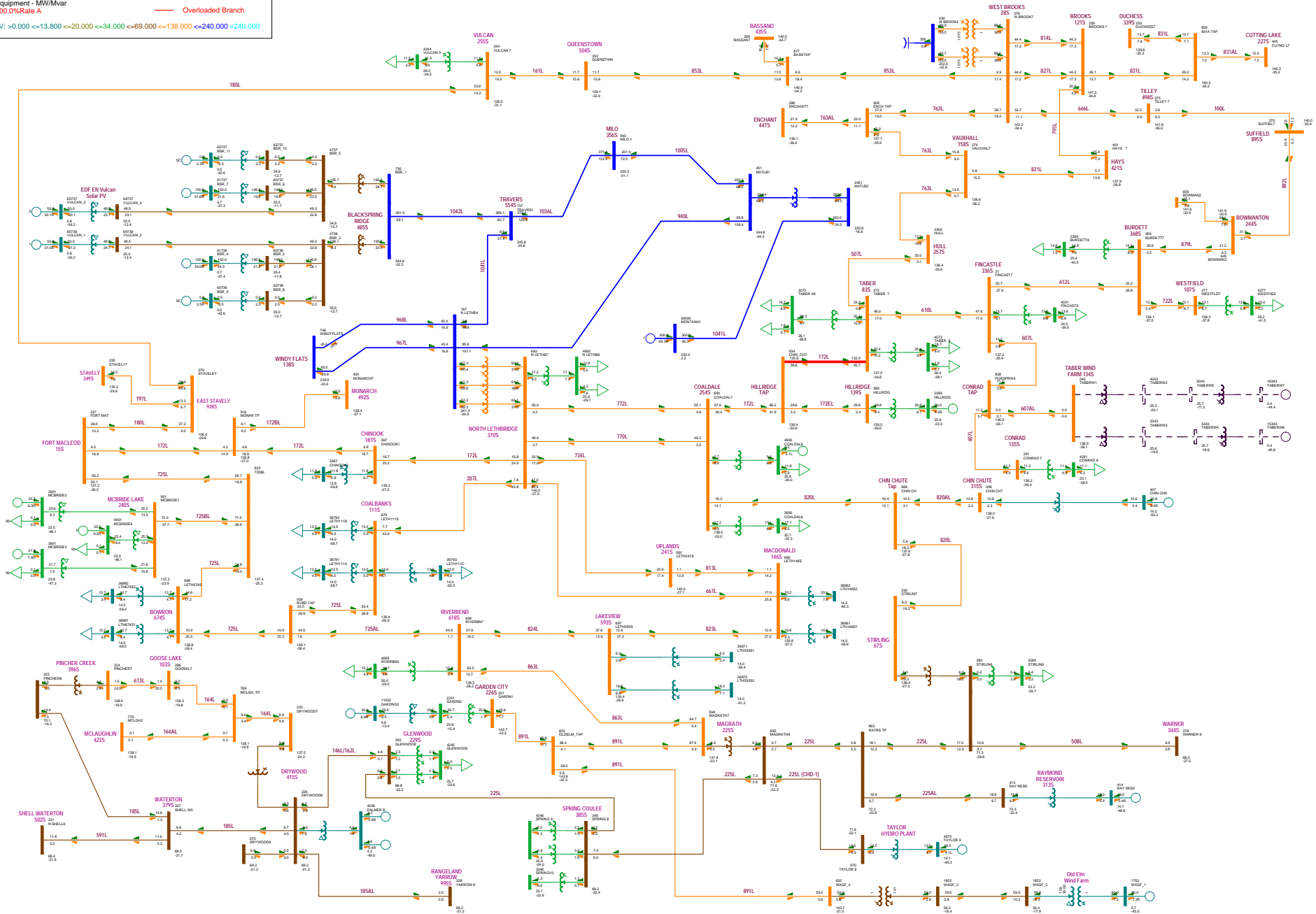


Figure A2-8: 2019 Summer Peak Pre-Project - Contingency of 863L (Magrath 225S - Riverbend 618S)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage

----- Overloaded Branch

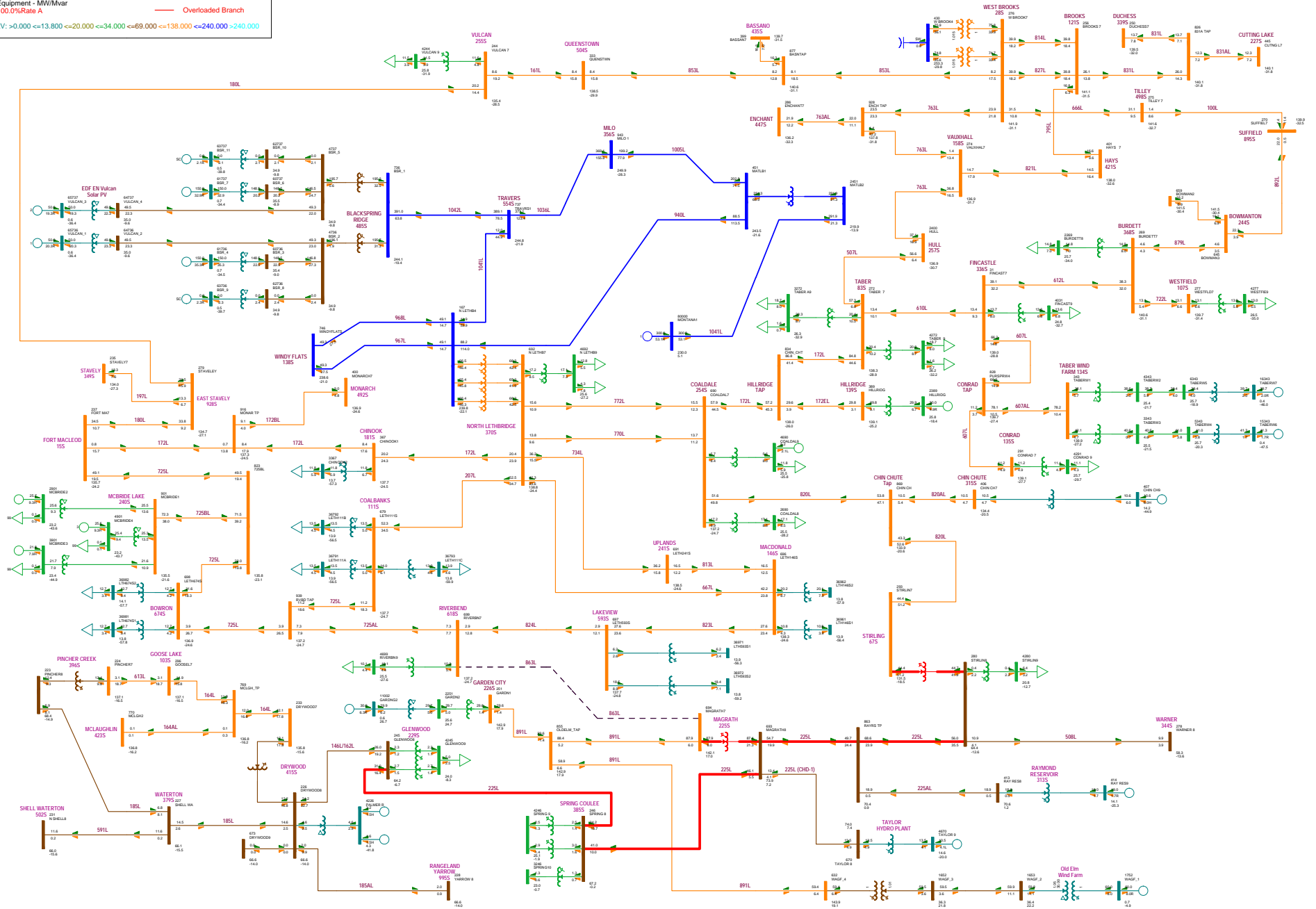


Figure A2-9: 2019 Summer Peak Pre-Project - Contingency of 1005L (Picture Butte 1205 - Milo 356S)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV) - - - - - Contingency / Outage
 Branch - MW/Mvar - - - - - Overloaded Branch
 Equipment - MW/Mvar
 100.0%Rate A

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

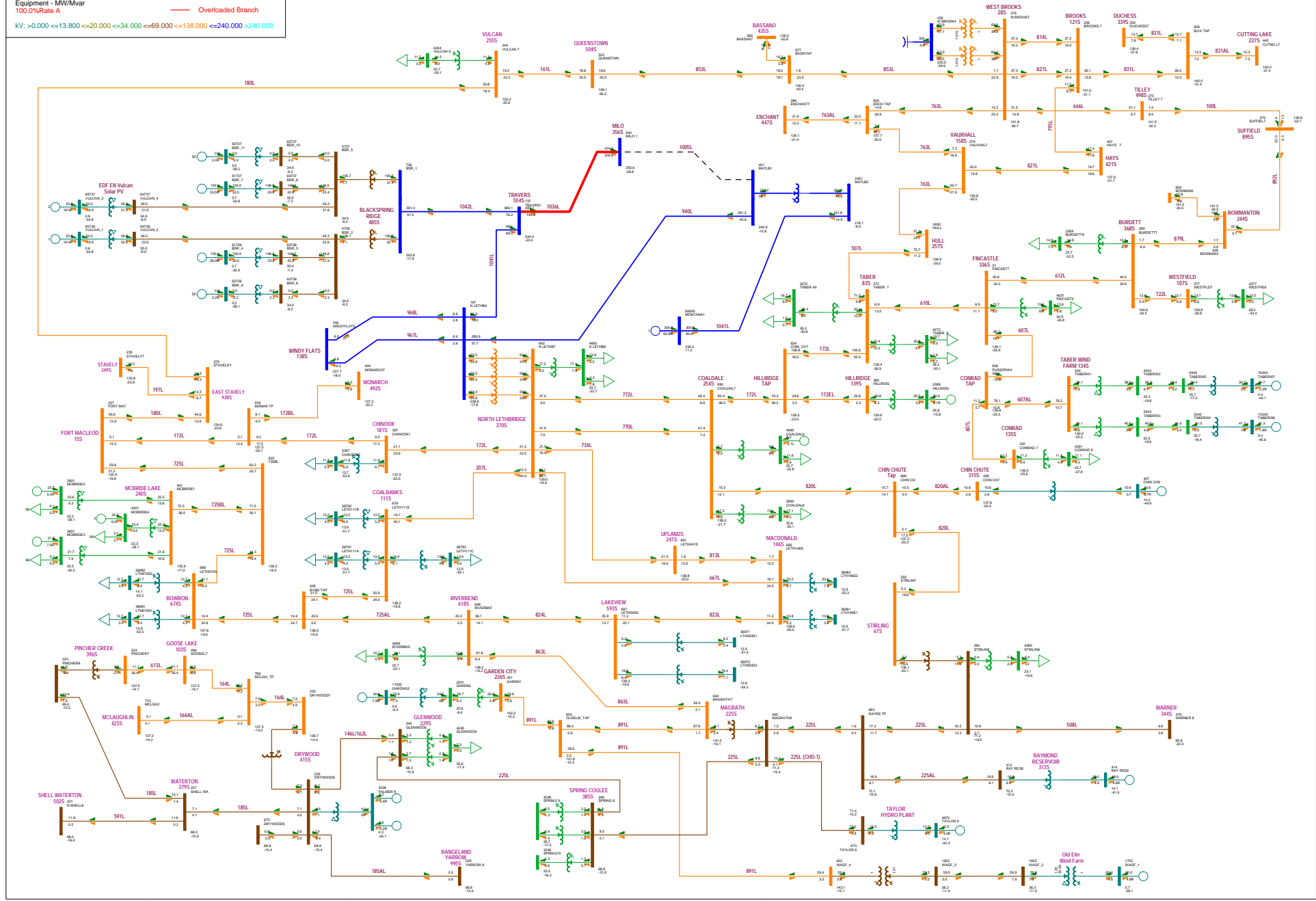
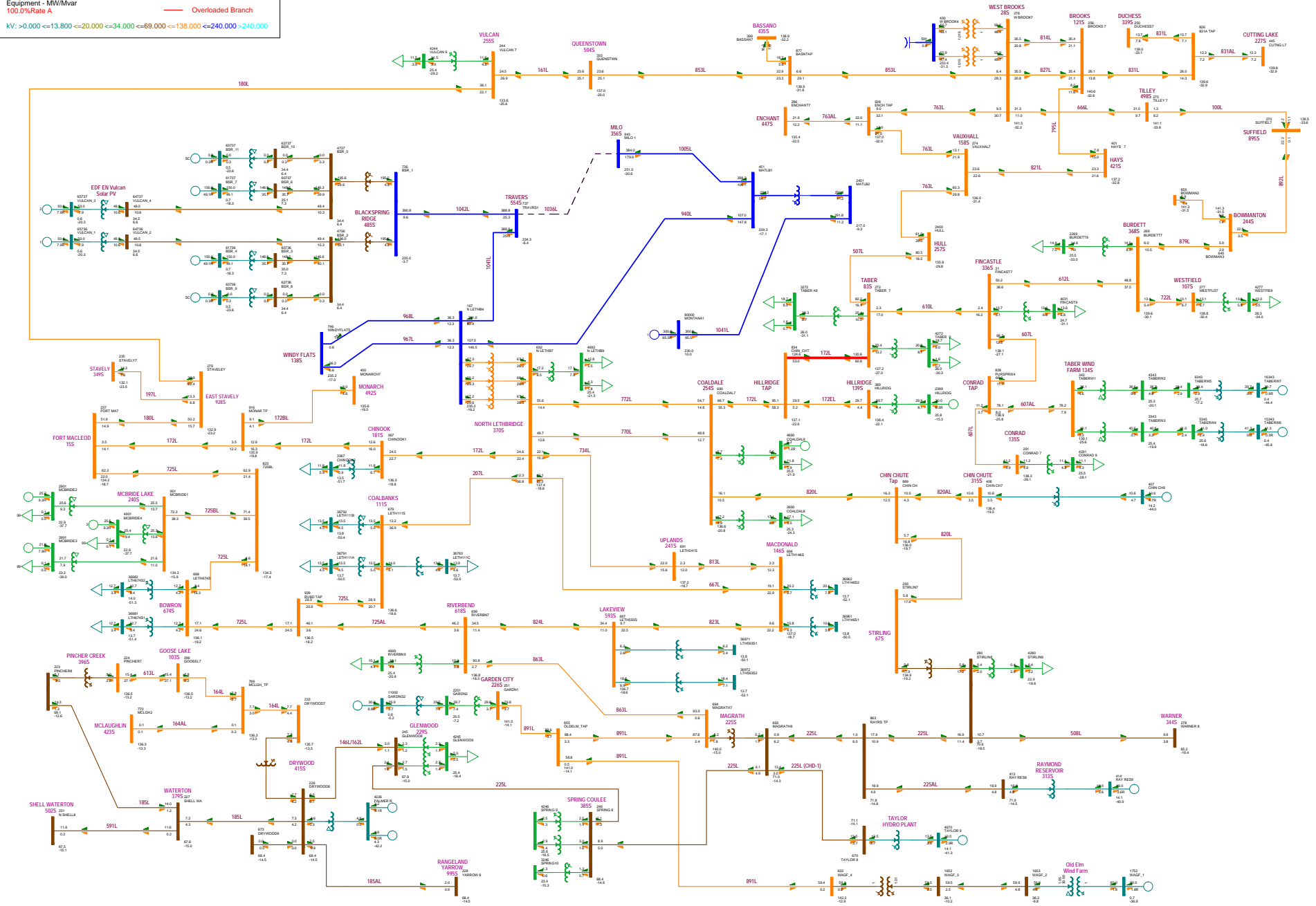


Figure A2-10: 2019 Summer Peak Pre-Project - Contingency of 1036L (Travers 554S - Milo 356S)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage
 --- Overloaded Branch



Attachment A3

Post-Project Power Flow Diagrams

List of Figures

Scenario and Case Name	Contingency (System Element Lost)	Figure Number
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	139ST1 (Hillridge 139S Transformer T1)	Figure A3-4
	593ST1 (Lakeview 593S Transformer T1)	Figure A3-5
	146ST1 (Macdonald 146S Transformer T1)	Figure A3-6
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	863L (Magrath 225S - Riverbend 618S)	Figure A3-13
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Figure A3-1: 2019 Summer Light Post-Project - N-0 (System Normal Condition)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage

----- Overloaded Branch

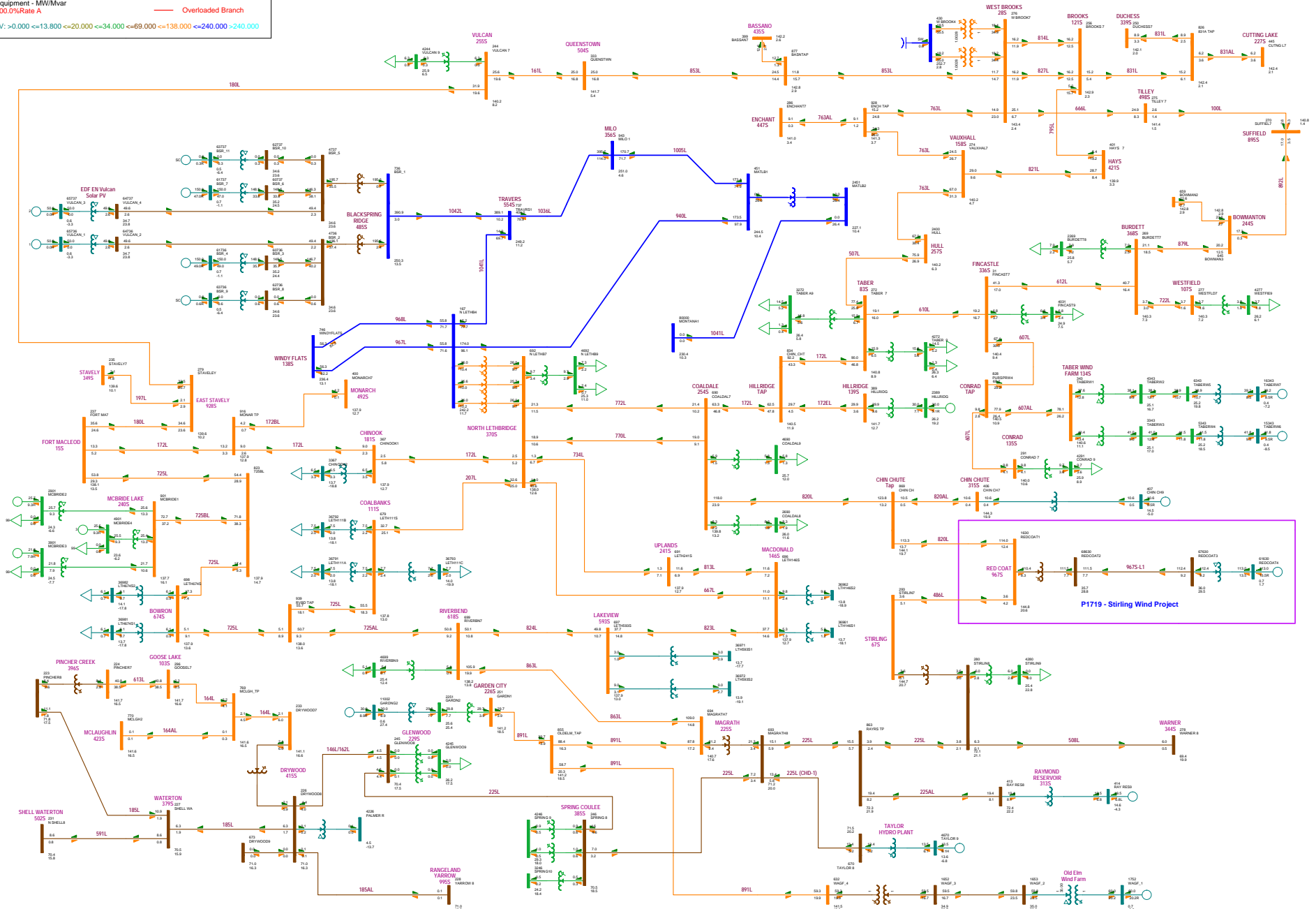


Figure A3-2: 2019 Summer Light Post-Project - Contingency of Taber Wind Farm 134S

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage
 --- Overloaded Branch

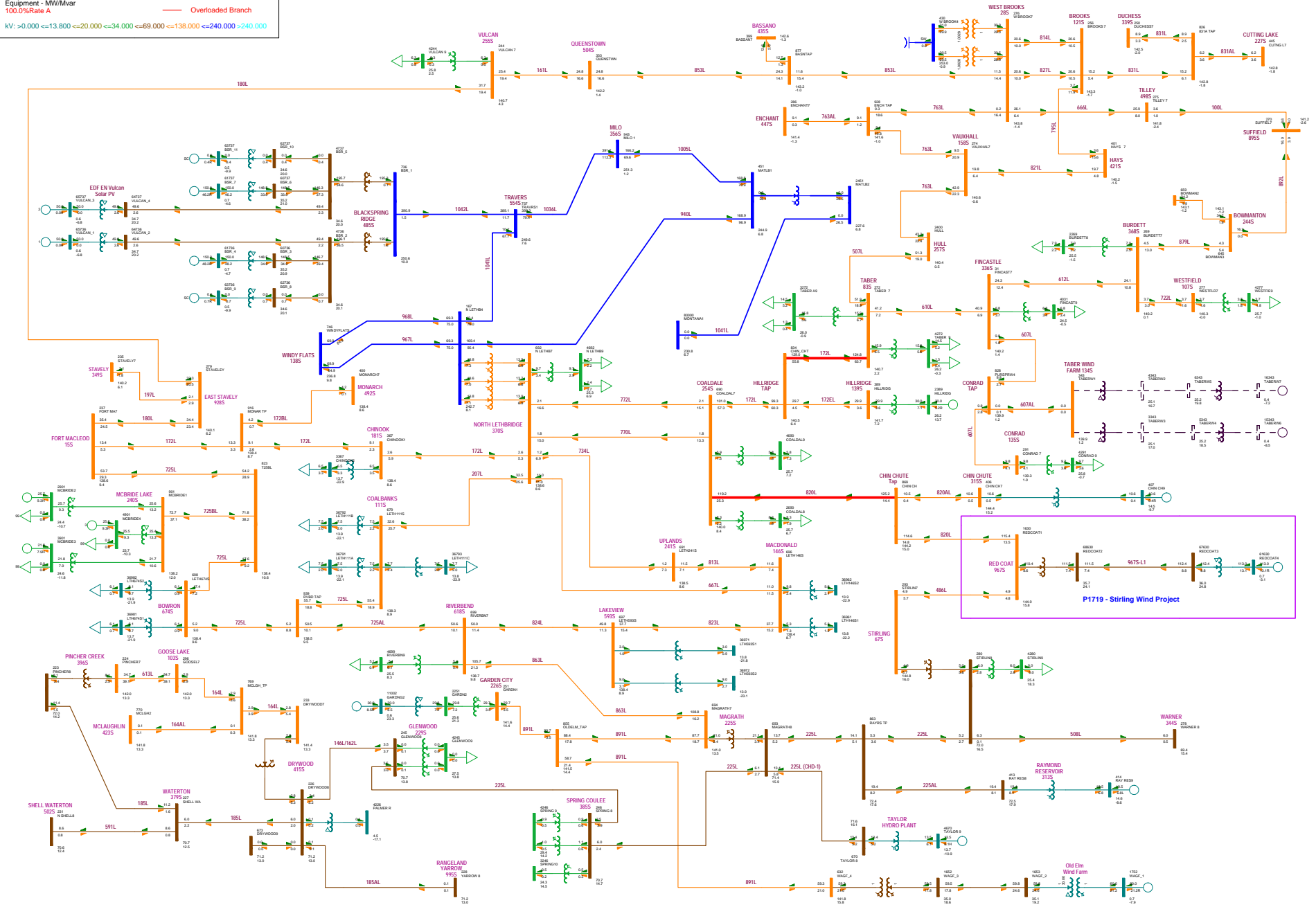
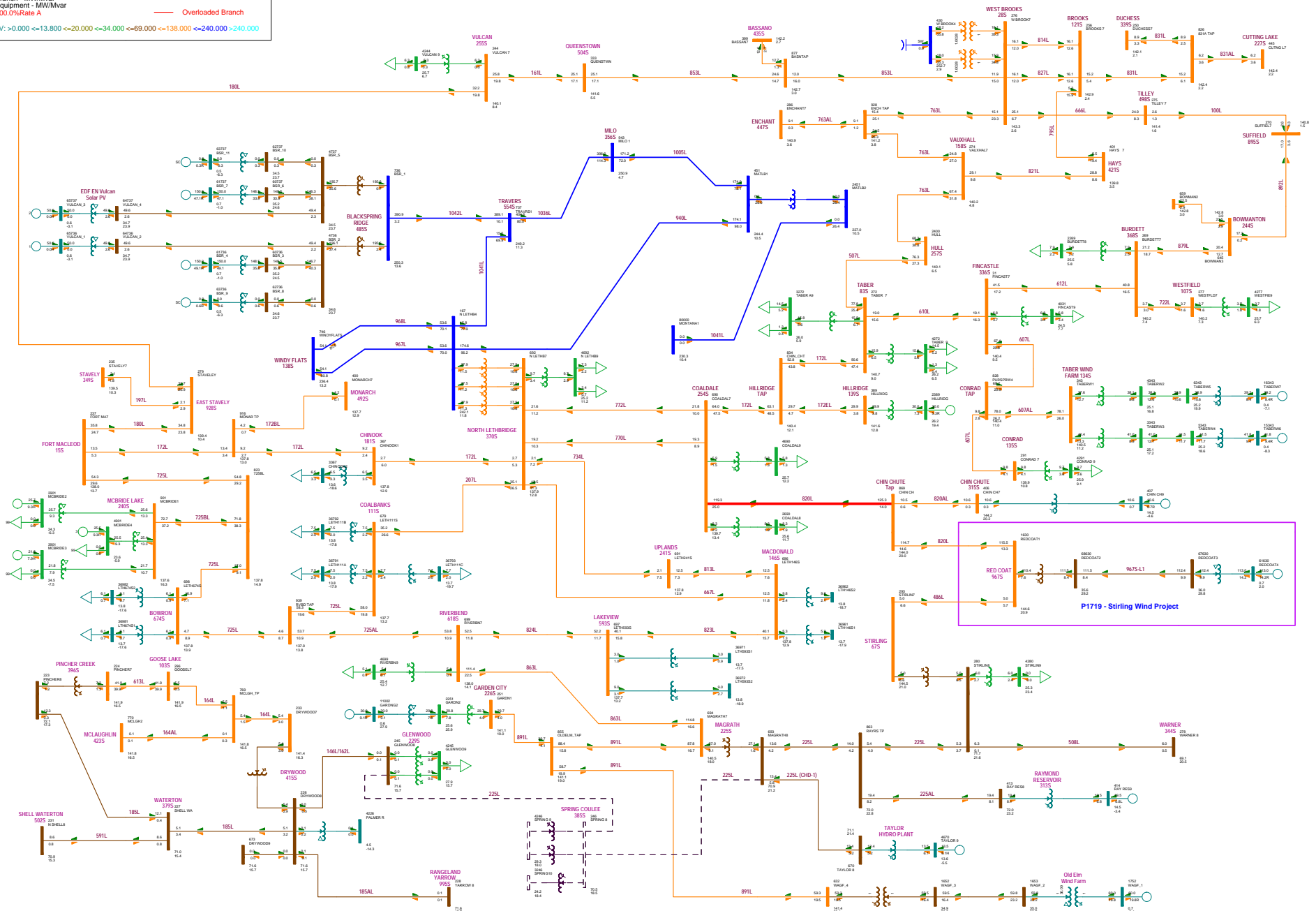


Figure A3-3: 2019 Summer Light Post-Project - Contingency of 385ST1 (Spring Coulee 385S Transformer T1)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV) - - - - - Contingency / Outage
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000



P1719 - Stirling Wind Project
 RED COAT 967S

Figure A3-4: 2019 Summer Light Post-Project - Contingency of 139ST1 (Hillridge 139S Transformer T1)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

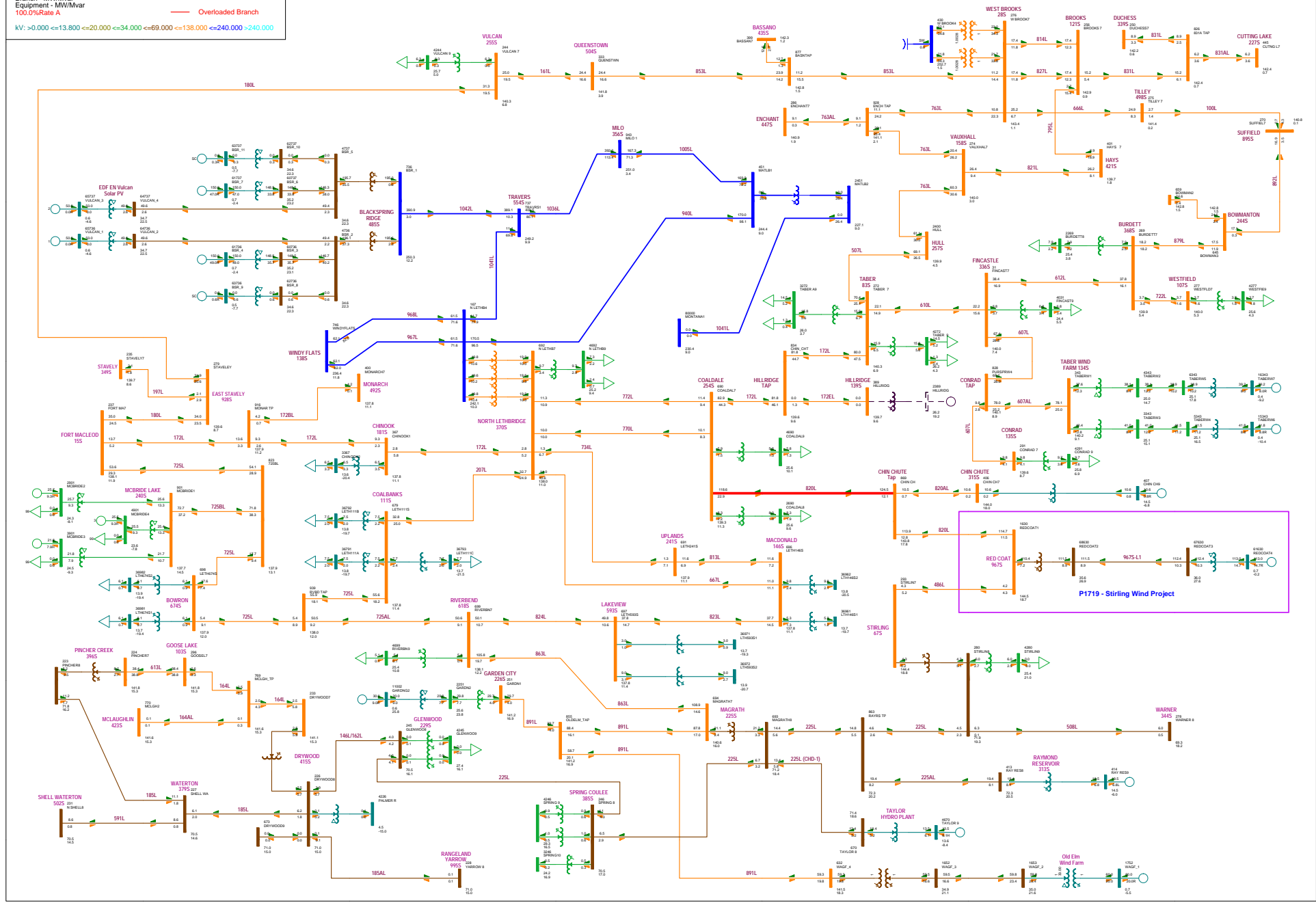


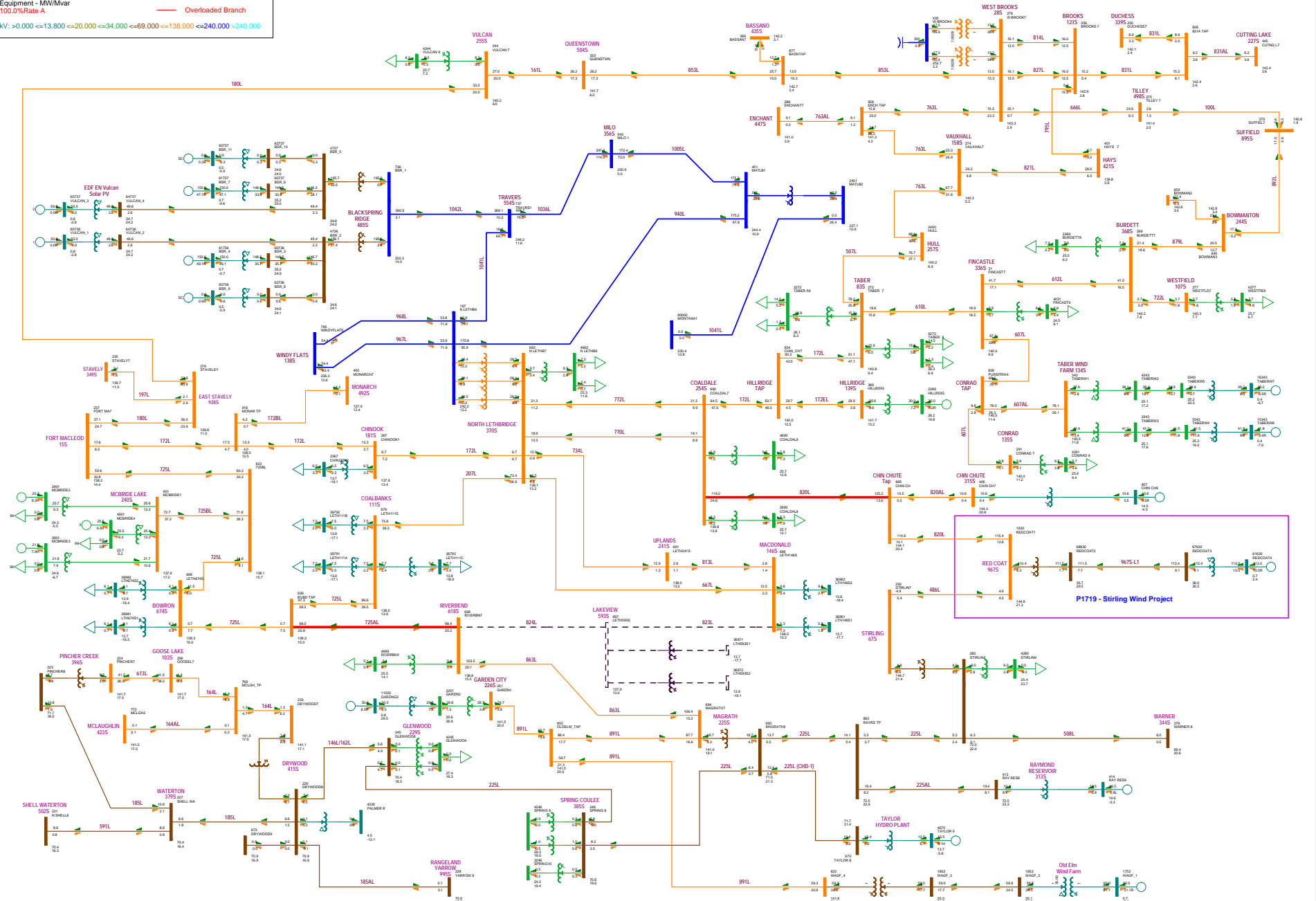
Figure A3-5: 2019 Summer Light Post-Project - Contingency of 593ST1 (Lakeview 593S Transformer T1)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

----- Contingency / Outage
----- Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000



P1719 - Stirling Wind Project

Figure A3-6: 2019 Summer Light Post-Project - Contingency of 146ST1 (Macdonald 146S Transformer T1)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage

Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

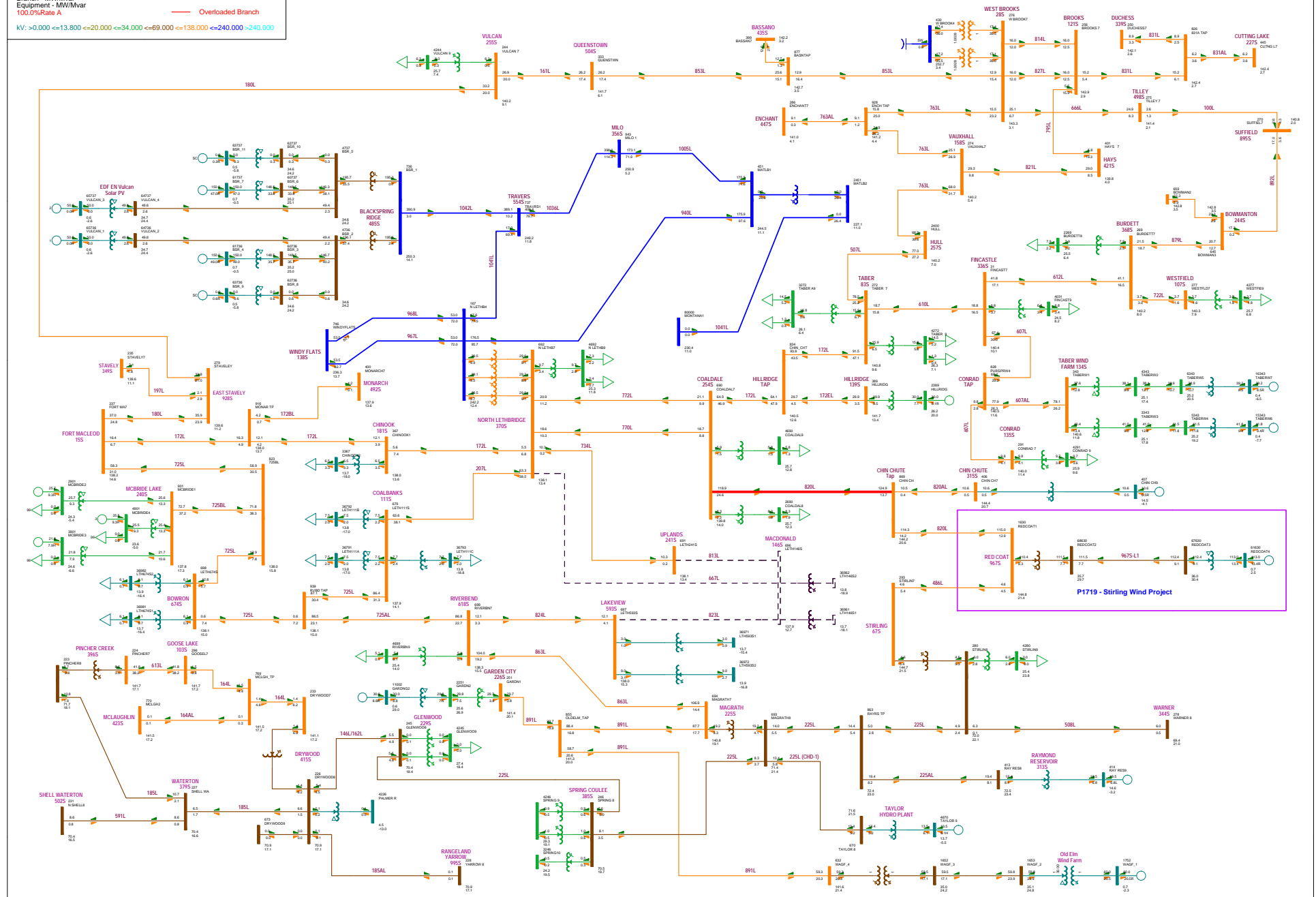


Figure A3-7: 2019 Summer Light Post-Project - Contingency of 225S11 (Magrath 225S Transformer T1)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage

----- Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

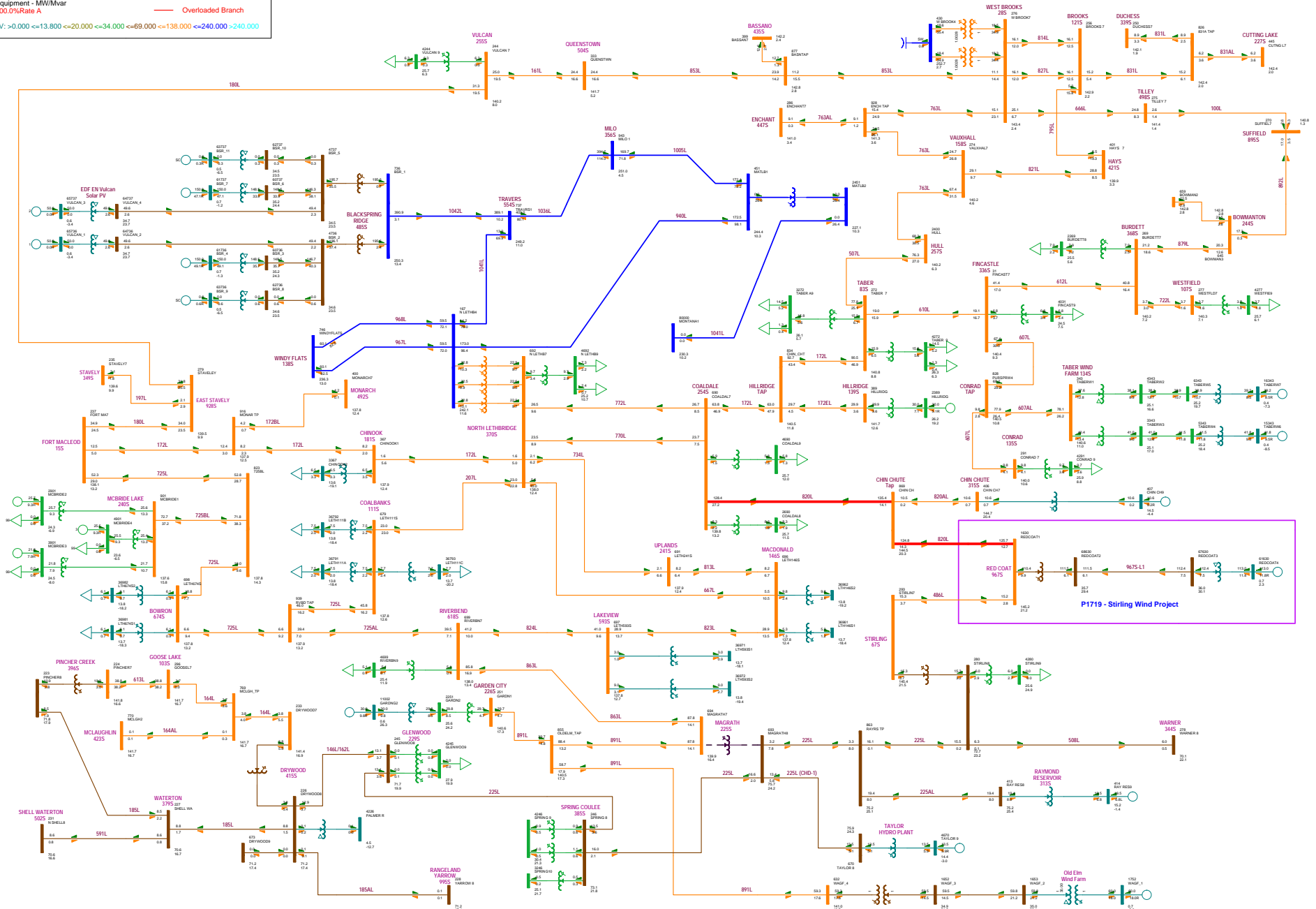


Figure A3-9: 2019 Summer Light Post-Project - Contingency of 225L (Glenwood 229S - Spring Coulee 385S)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 kV:>0.000 <math>\leq 13.800 <math>\leq 20.000 <math>\leq 34.000 <math>\leq 69.000 <math>\leq 138.000 <math>\leq 240.000 >240.000

..... Contingency / Outage
 Overloaded Branch

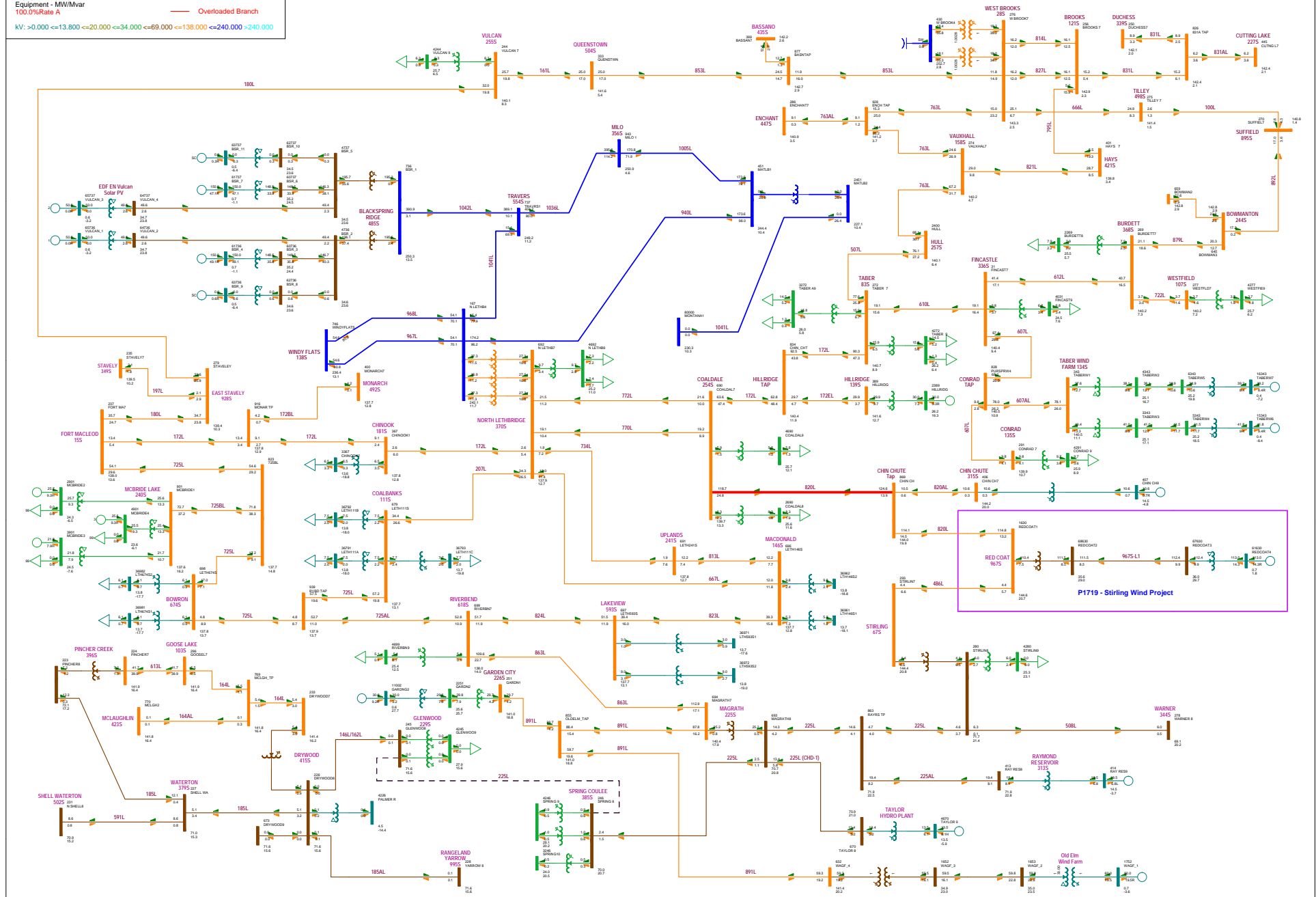


Figure A3-10: 2019 Summer Light Post-Project - Contingency of 1036L (Travers 554S - Milo 356S)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

----- Contingency / Outage
--- Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

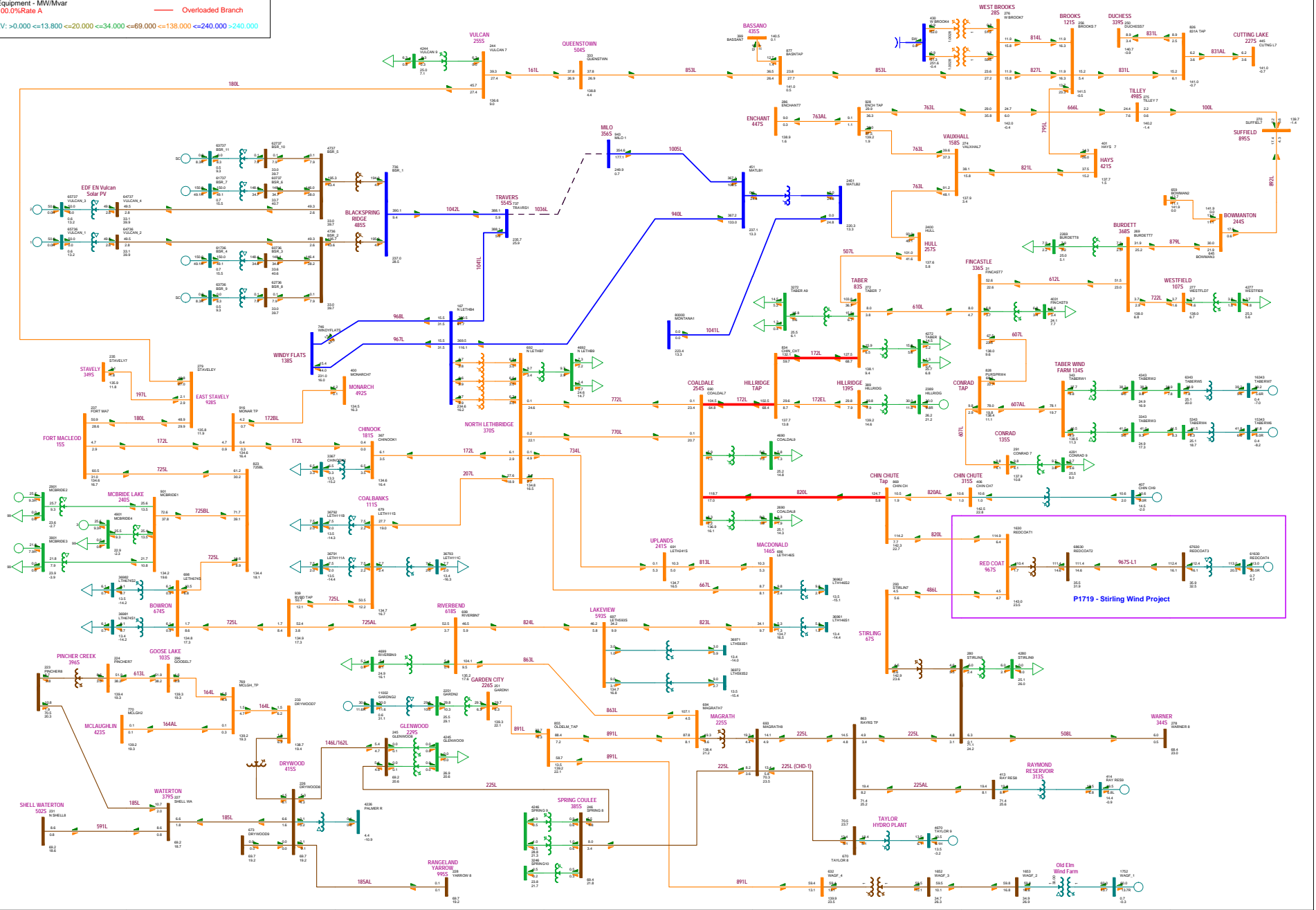


Figure A3-11: 2019 Summer Light Post-Project - Contingency of 508L (Warner 344S - Stirling 67S)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 ——— Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

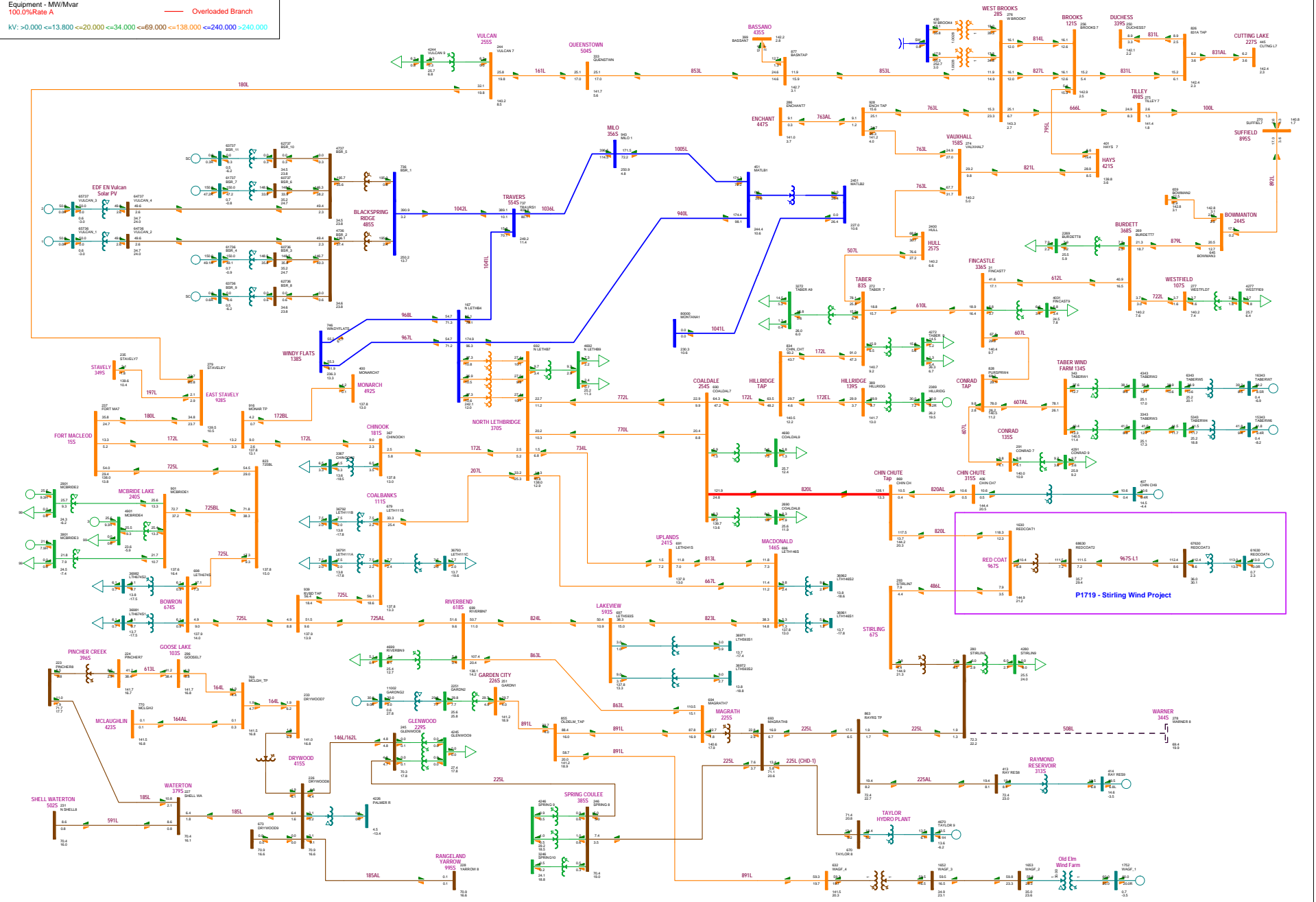


Figure A3-12: 2019 Summer Light Post-Project - Contingency of 618ST1 (Riverbend 618S Transformer T1)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 — Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

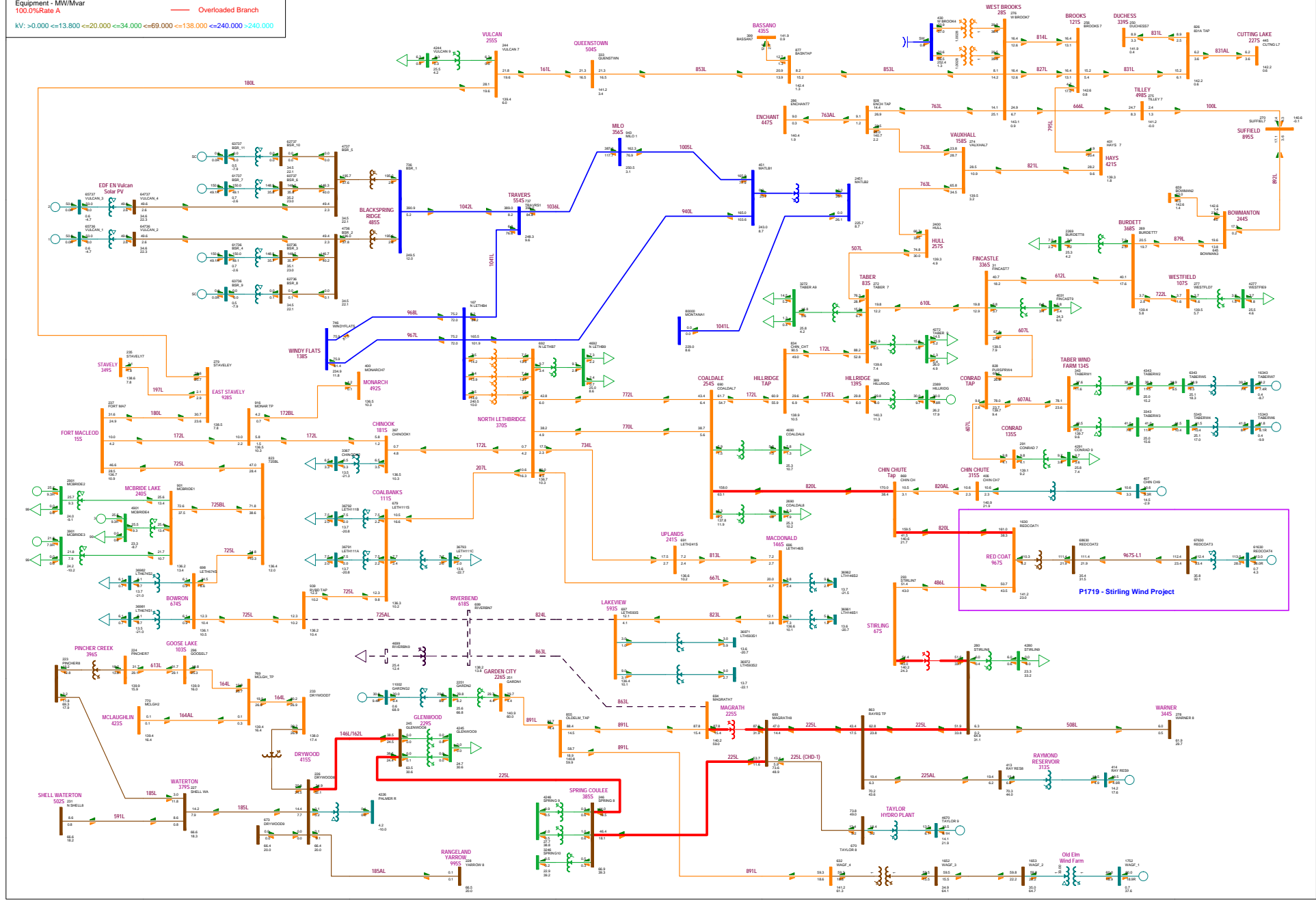


Figure A3-14: 2019 Summer Light Post-Project - Contingency of 823L (Macdonald 146S - Lakeview 593S)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

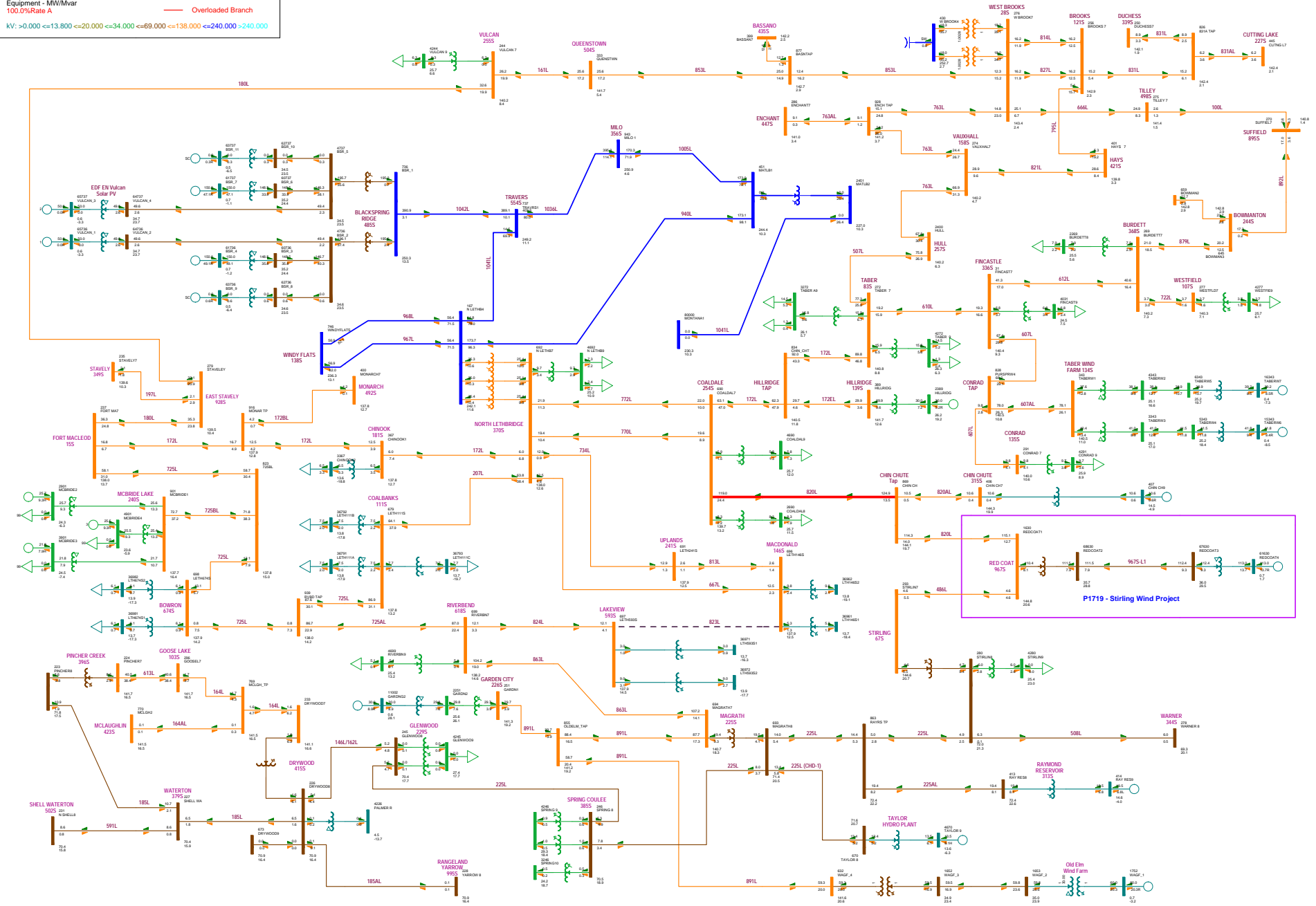


Figure A3-15: 2019 Summer Light Post-Project - Contingency of 940L (North Lethbridge 370S - Picture Butte 120S)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage

----- Overloaded Branch

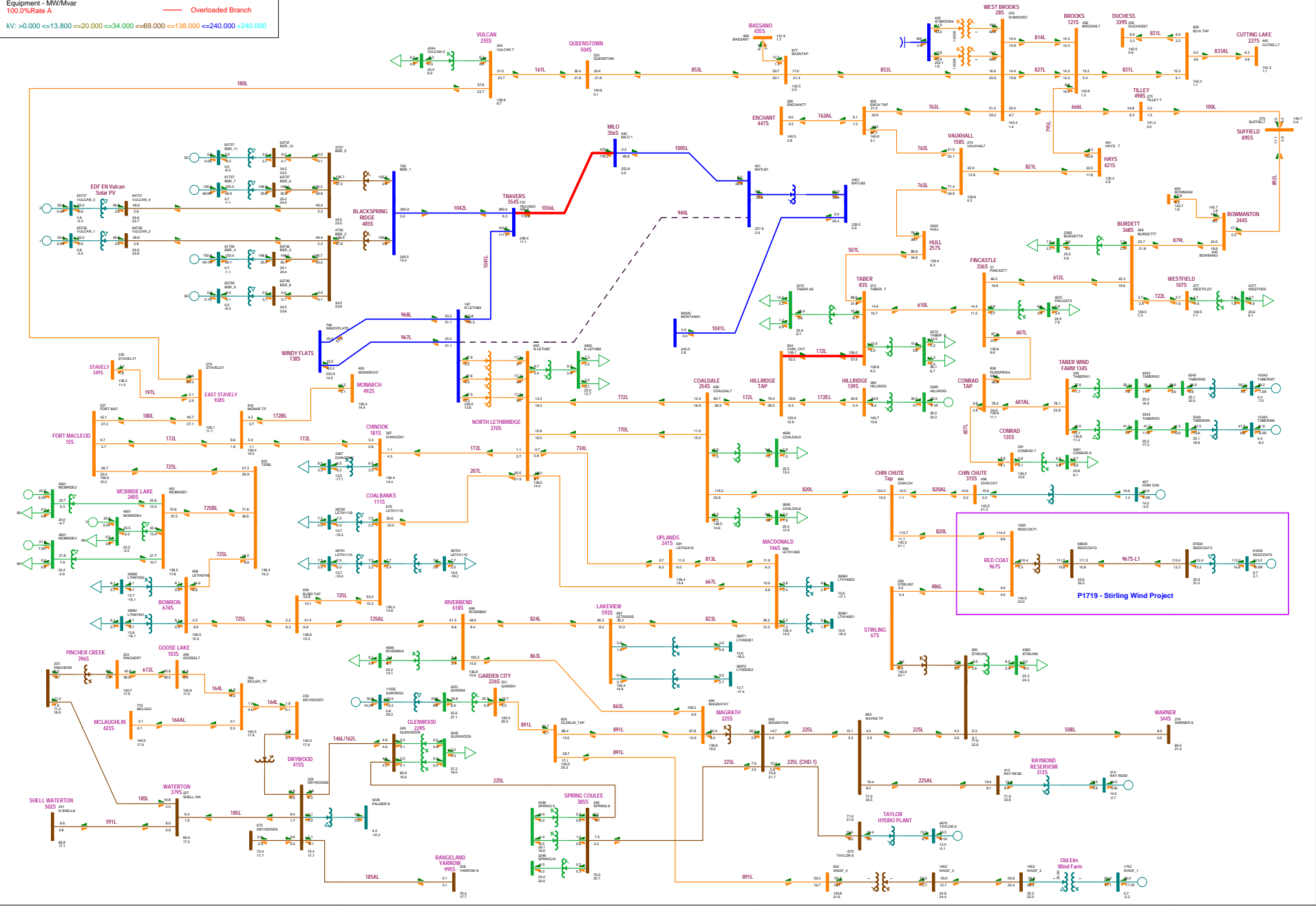


Figure A3-16: 2019 Summer Light Post-Project - Contingency of 229ST1 (Glenwood 229S Transformer T1)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV) - - - - - Contingency / Outage
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A - - - - - Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

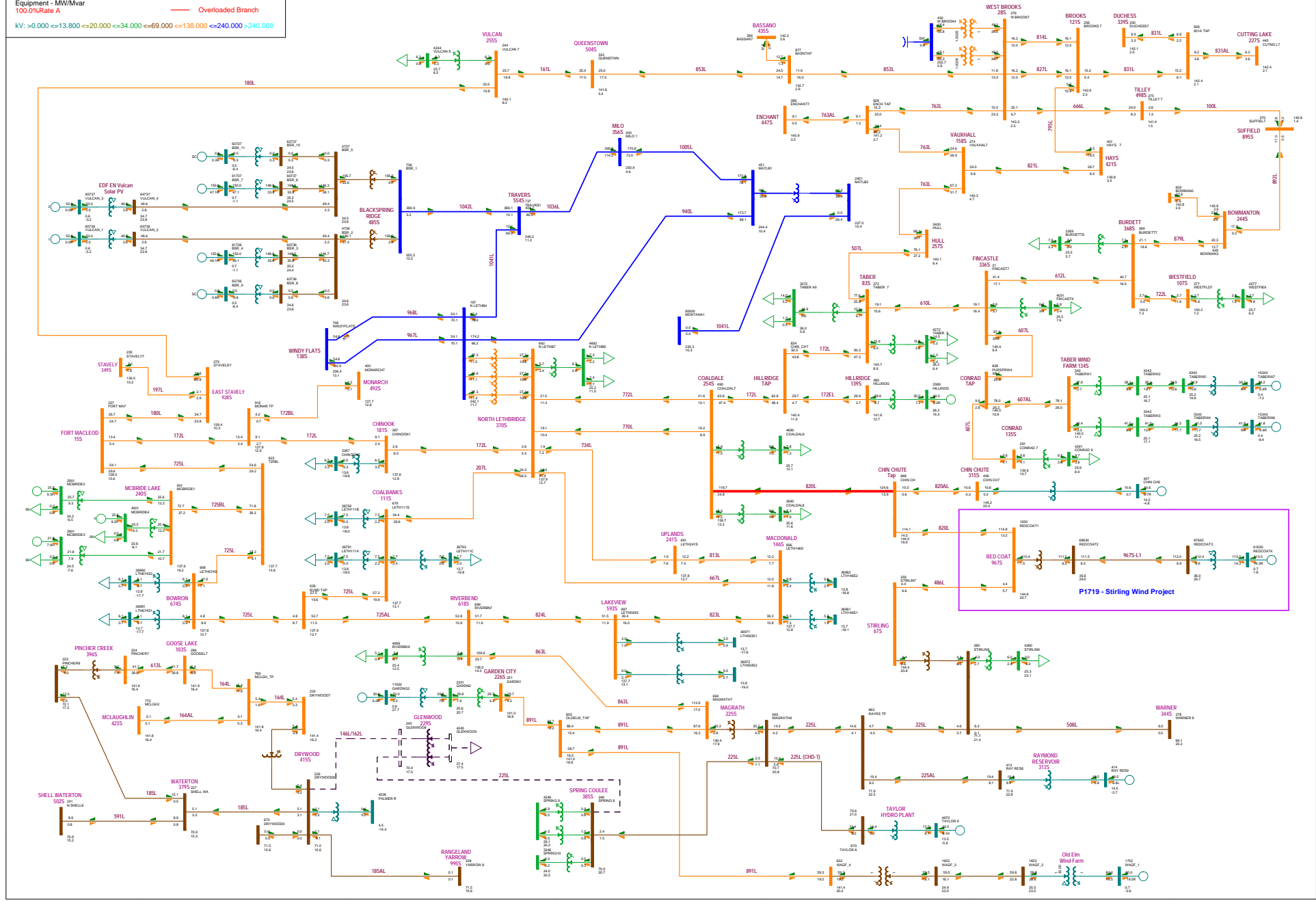


Figure A3-17: 2019 Summer Light Post-Project - Contingency of 207L (Coalbanks 111S - North Lethbridge 370S)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage

----- Overloaded Branch

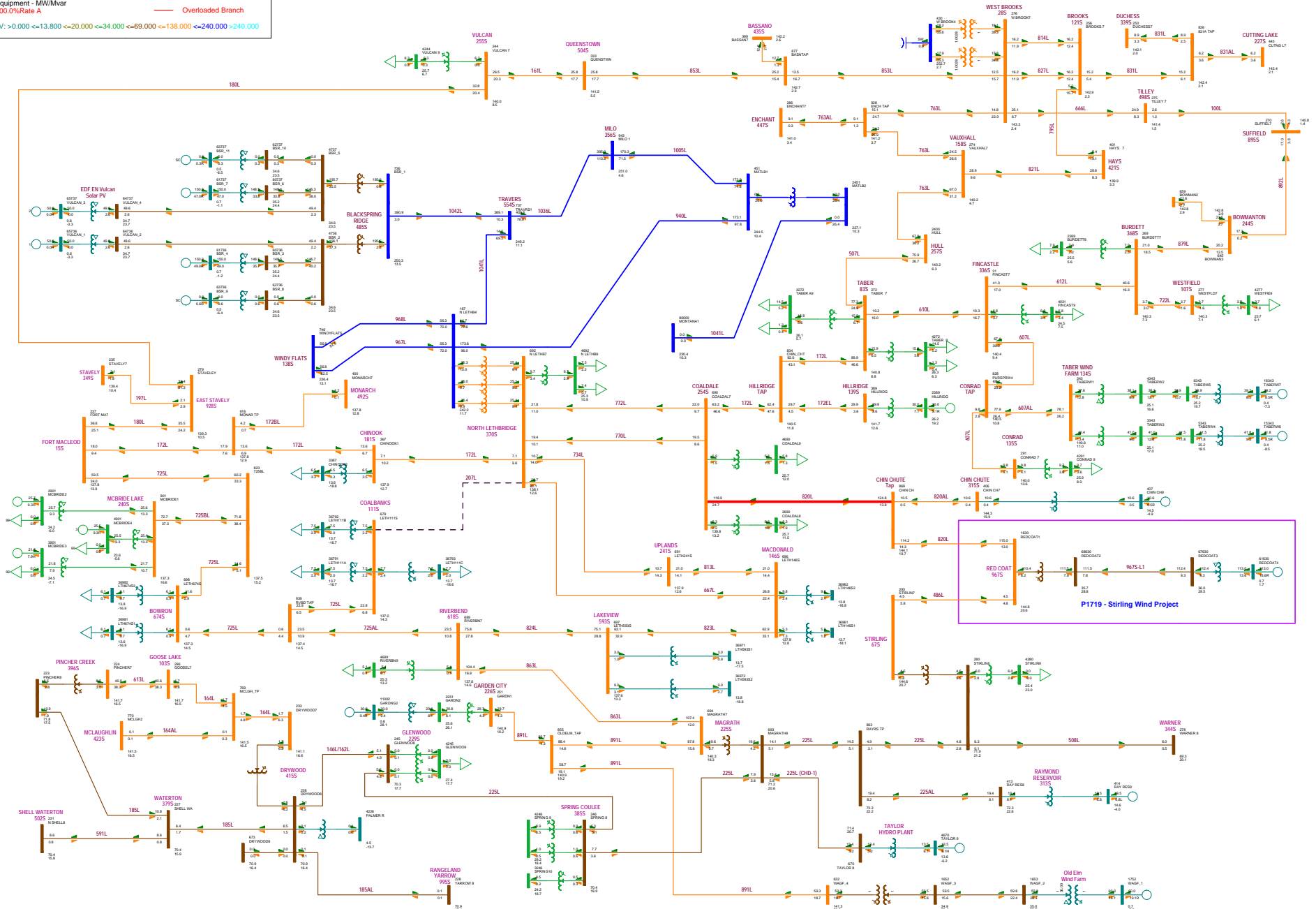


Figure A3-18: 2019 Summer Light Post-Project - Contingency of 1005L (Picture Butte 1205 - Milo 356S)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage

----- Overloaded Branch

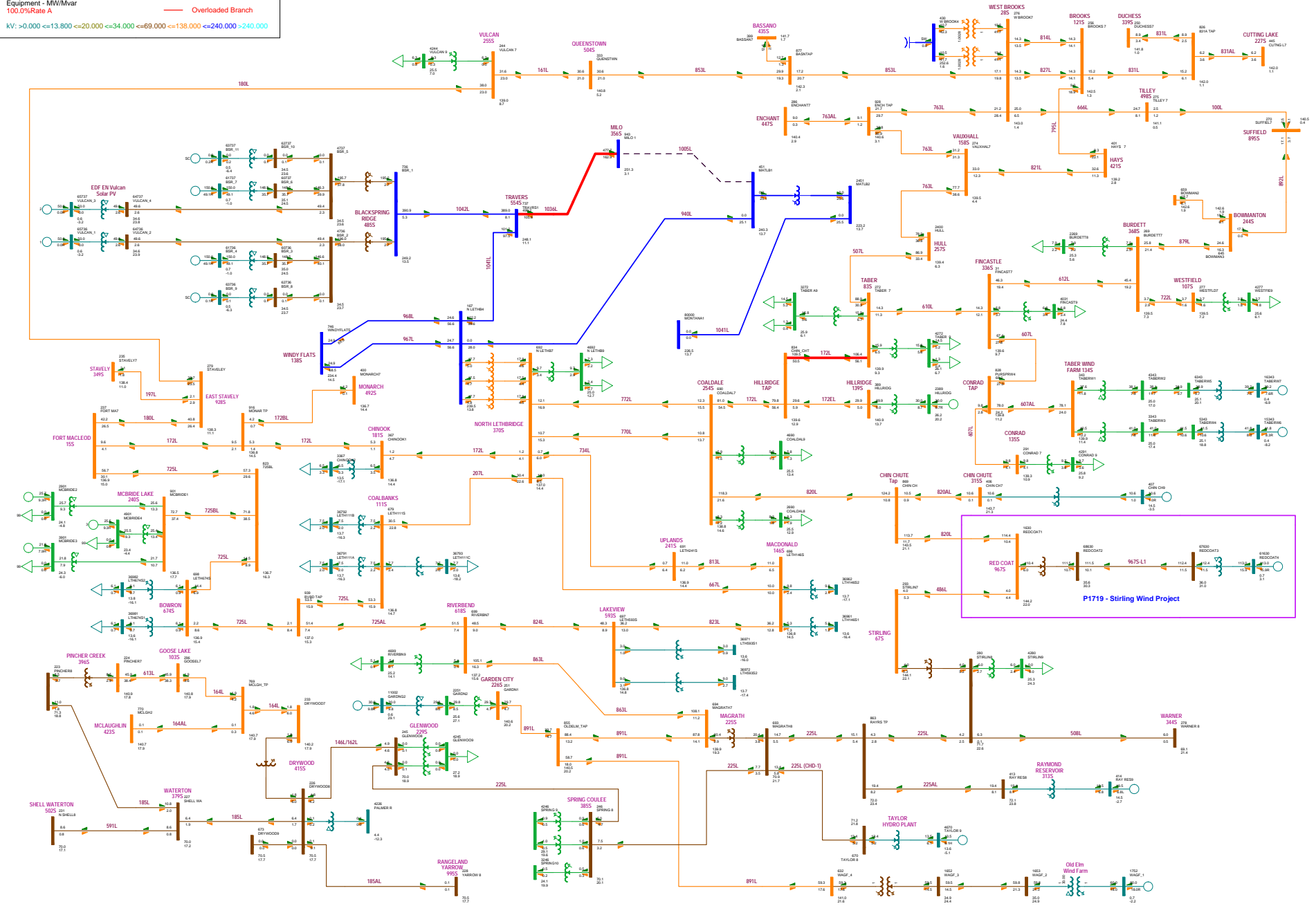


Figure A3-19: 2019 Summer Light Post-Project - Contingency of 225L (Spring Coulee 385S - Magrath 225S)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 — Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

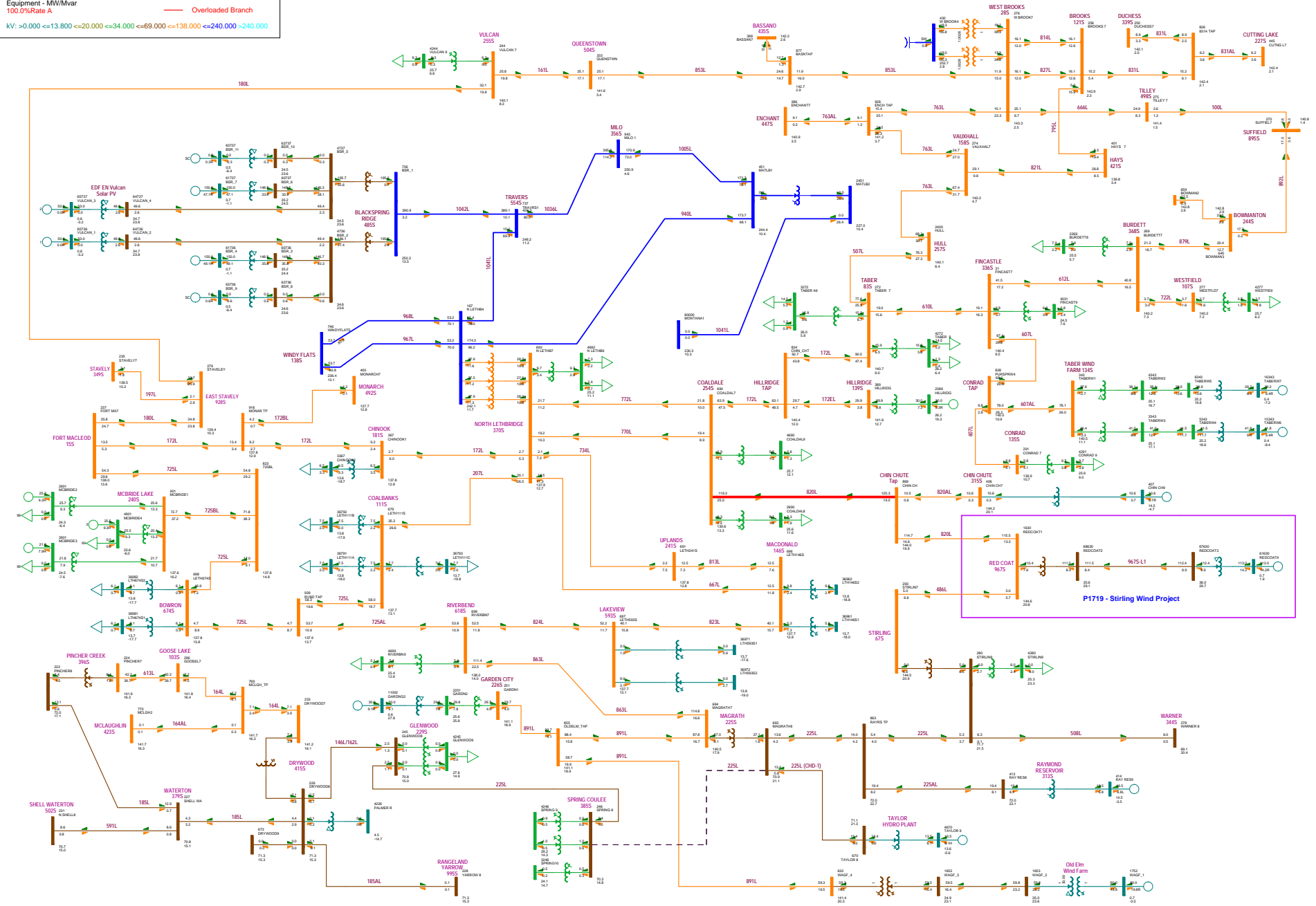


Figure A3-20: 2019 Summer Light Post-Project - Contingency of 725L (Coalbanks 111S - Riverbend 618S Tap - Riverbend 618S - Bowron 674S)

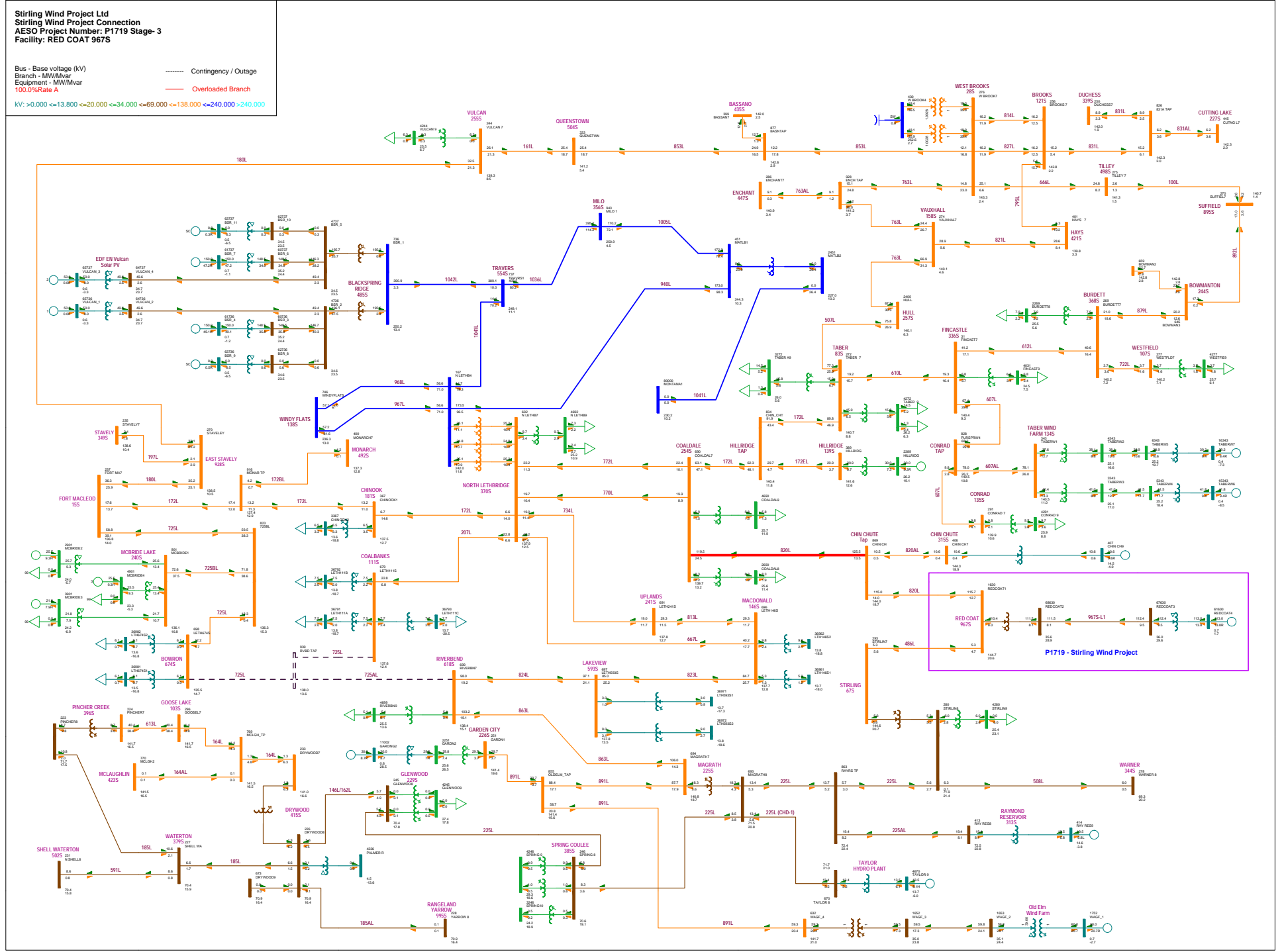


Figure A3-21: 2019 Summer Light Post-Project - Contingency of 607L (Fincastle 336S - Conrad Tap)

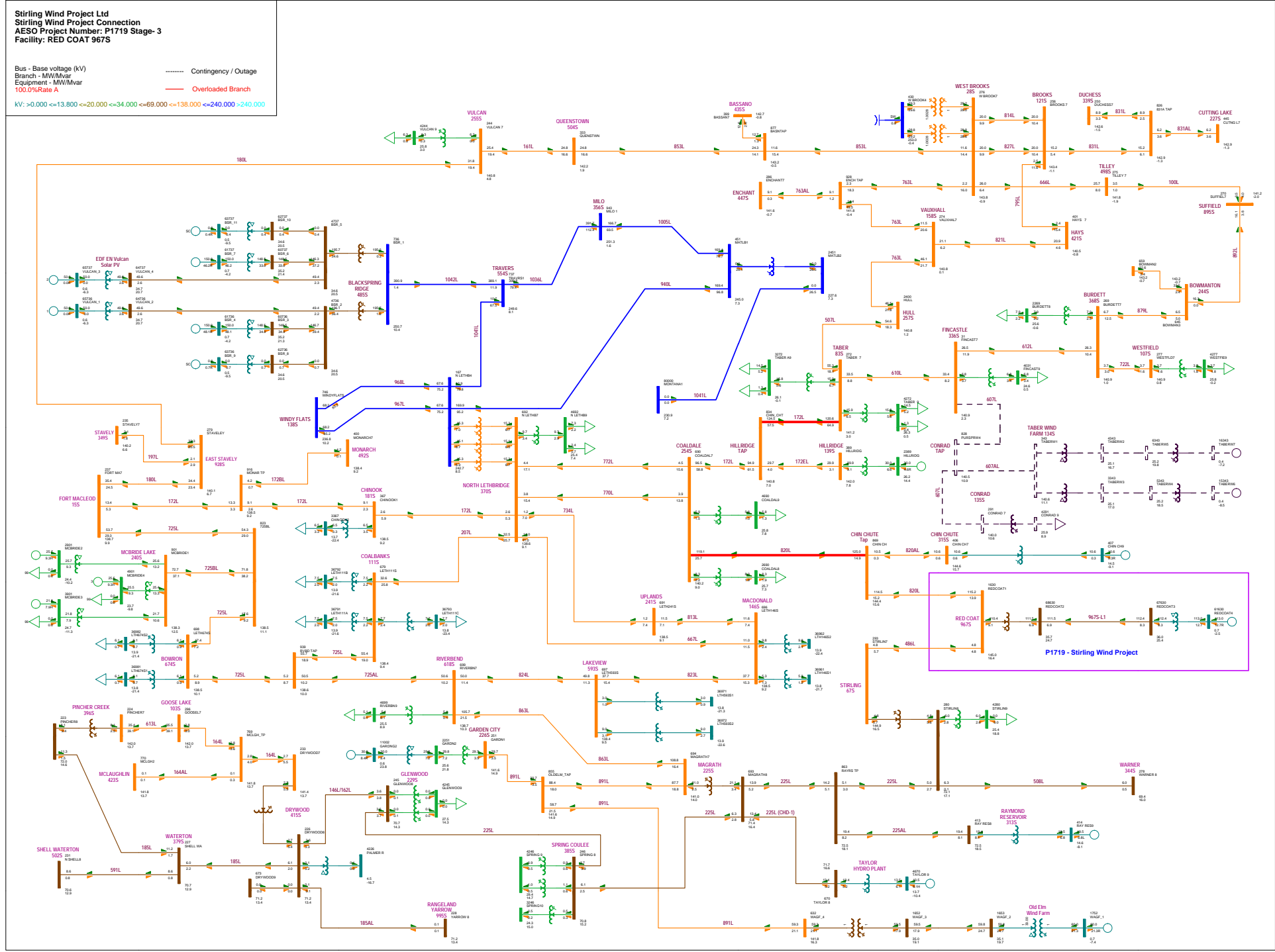


Figure A3-22: 2019 Summer Light Post-Project - Contingency of 415S2T (Drywood 415S Transformer T2)

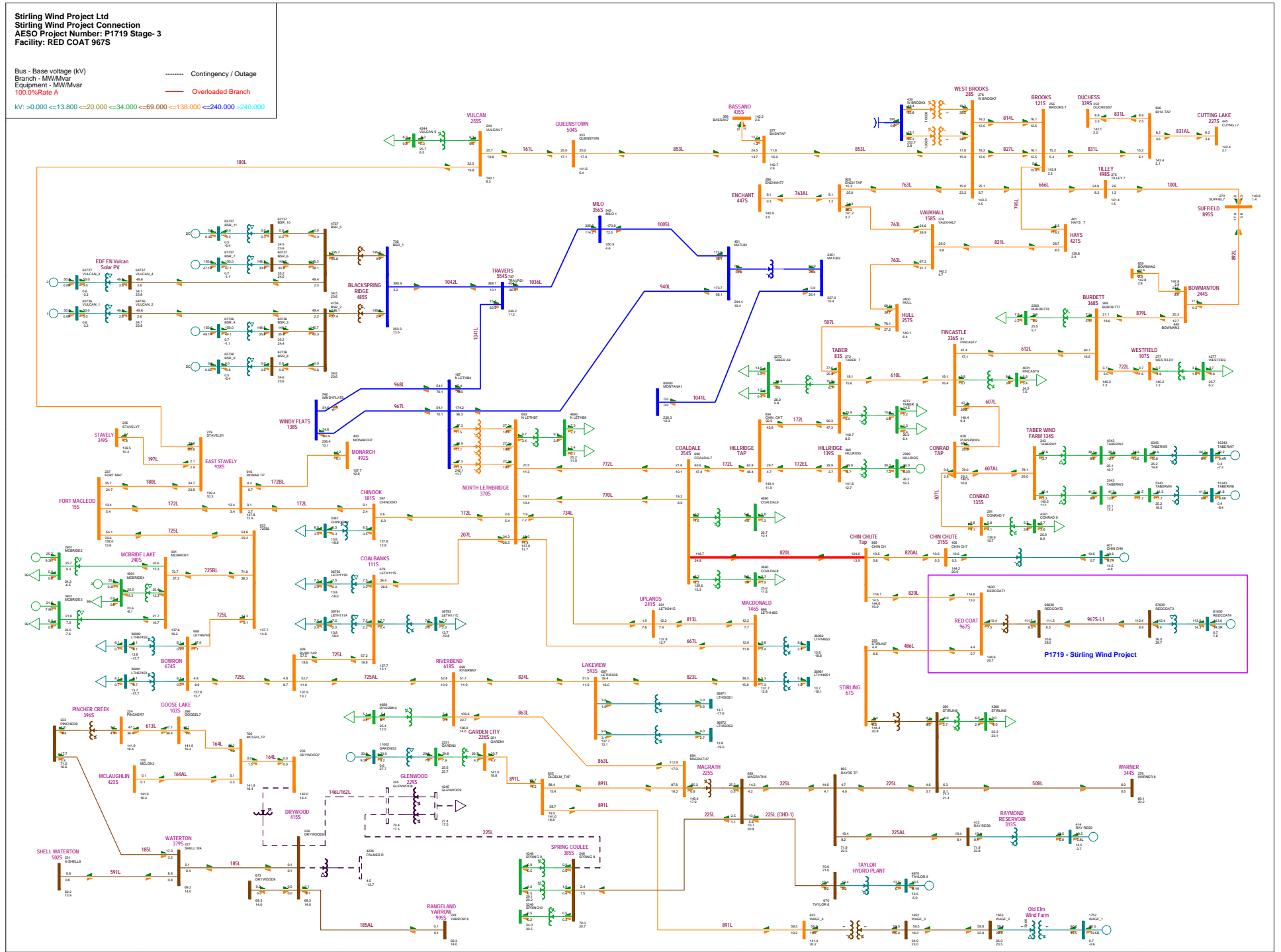


Figure A3-23: 2019 Summer Light Post-Project - Contingency of 824L (Lakeview 5935 - Riverbend 6185)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 9675

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 ——— Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

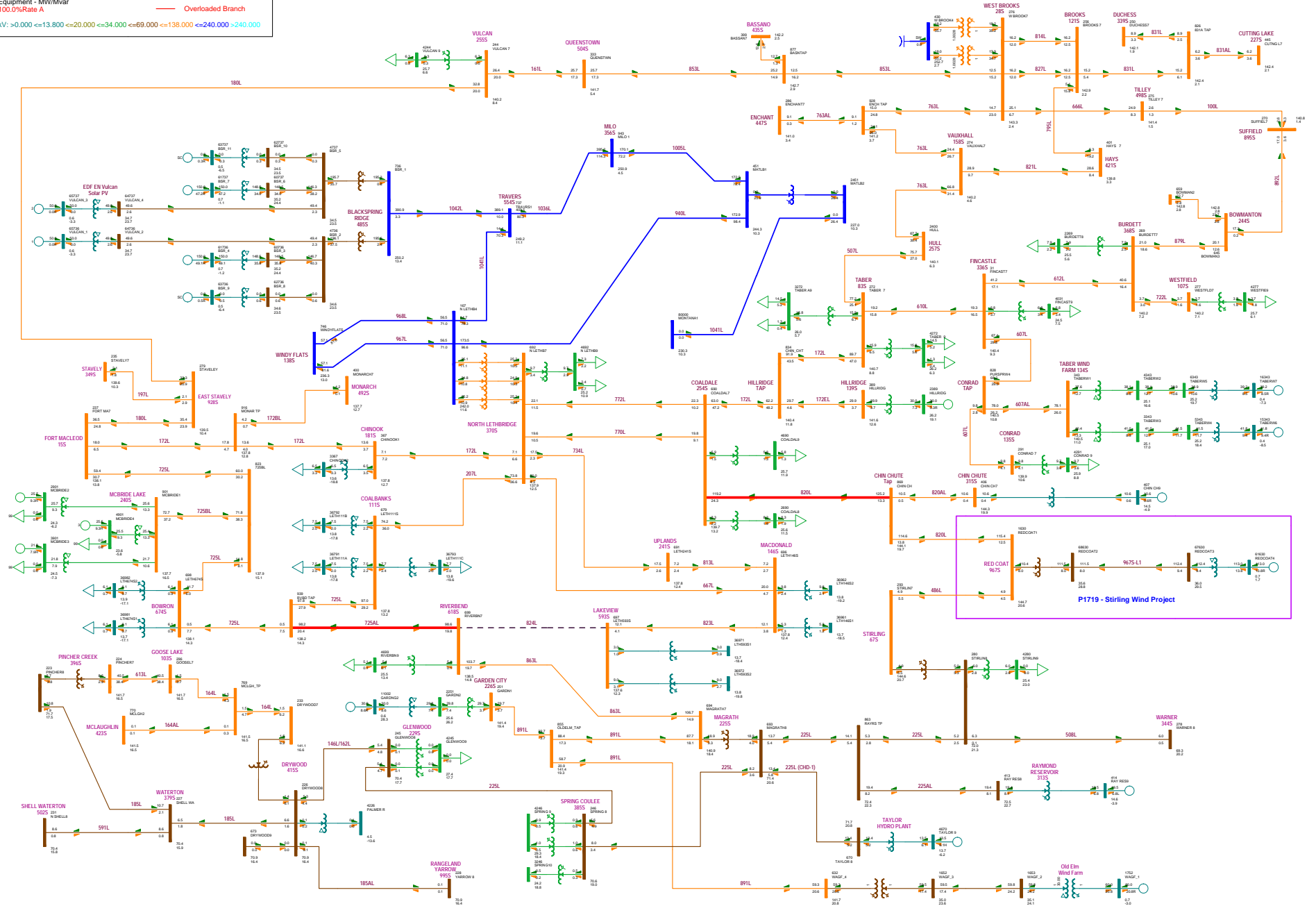


Figure A3-24: 2019 Summer Peak Post-Project - N-0 (System Normal Condition)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage
----- Overloaded Branch

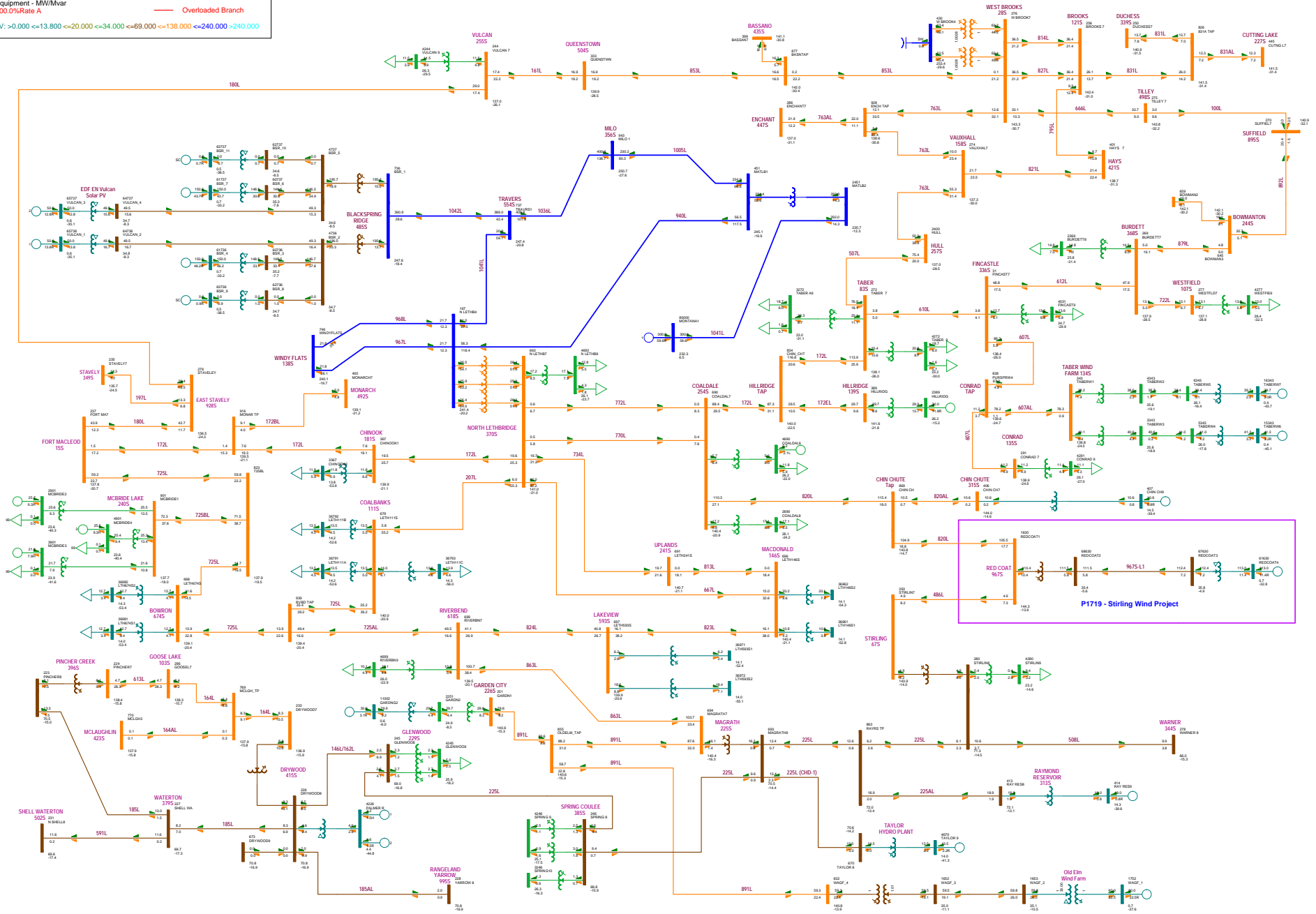


Figure A3-25: 2019 Summer Peak Post-Project - Contingency of 146ST1 (Macdonald 146S Transformer T1)

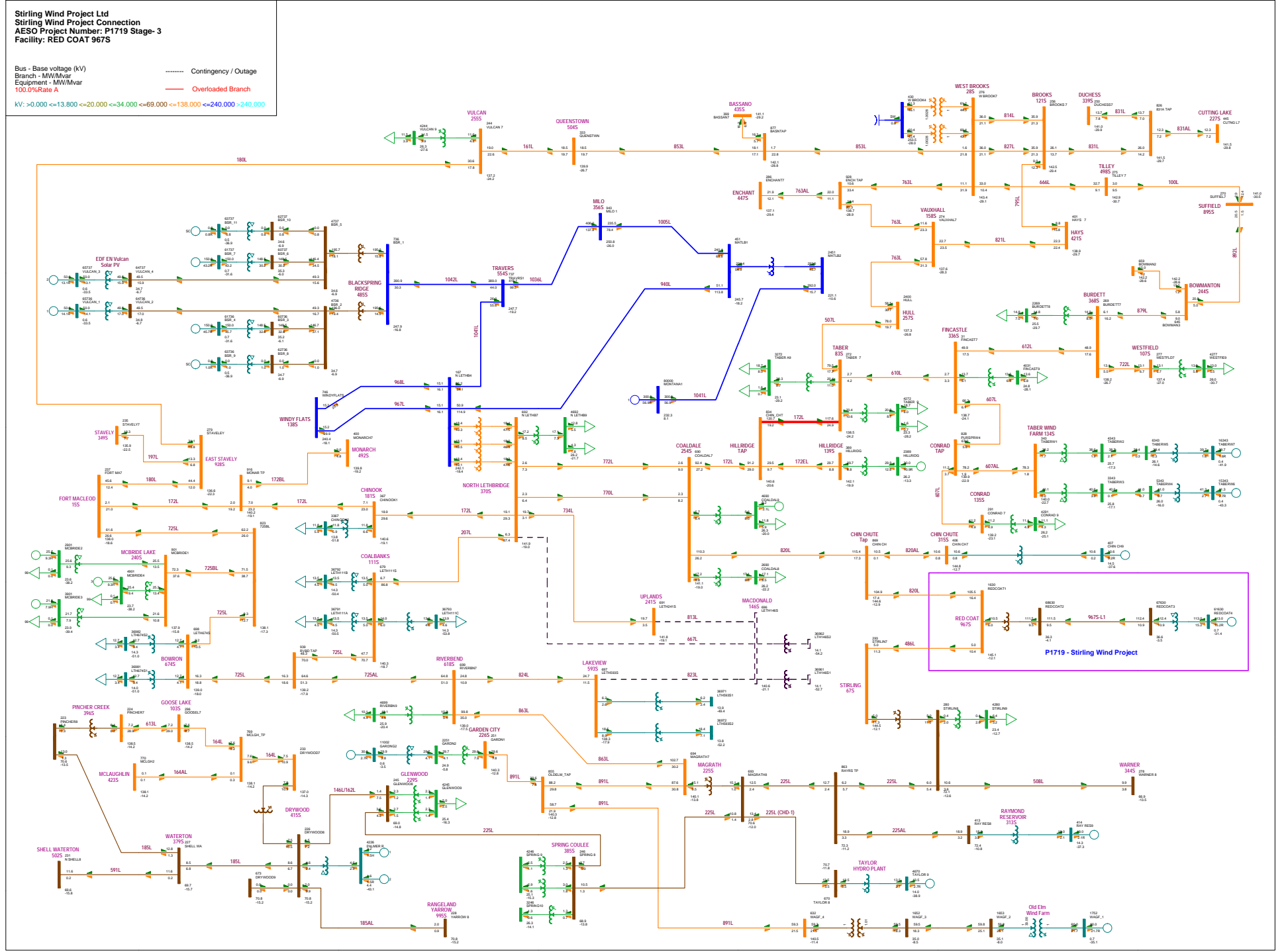


Figure A3-26: 2019 Summer Peak Post-Project - Contingency of 1005L (Picture Butte 120S - Milo 356S)

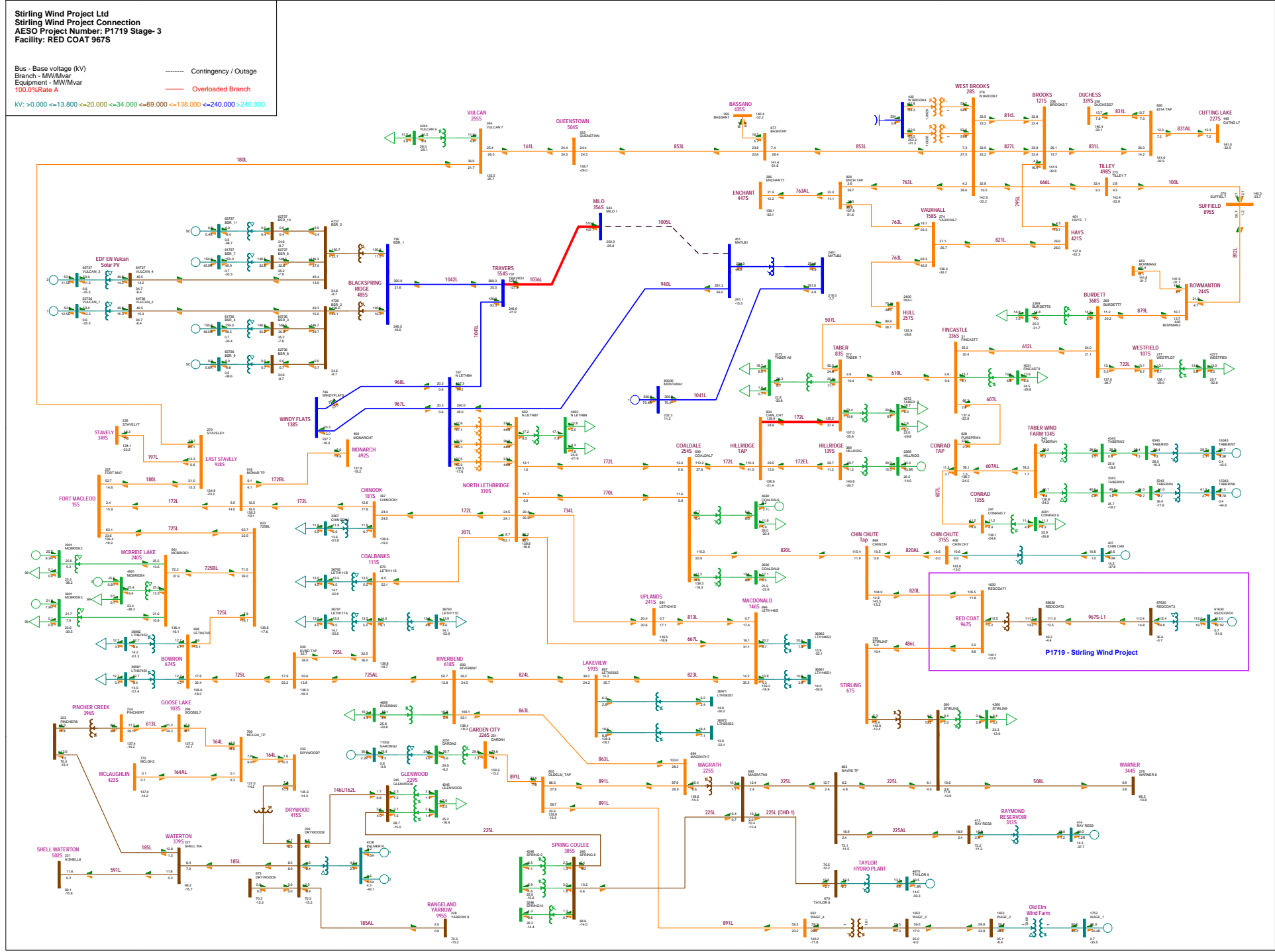


Figure A3-27: 2019 Summer Peak Post-Project - Contingency of 1036L (Travers 554S - Milo 356S)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MVA/Mvar
 Equipment - MVA/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage

----- Overloaded Branch

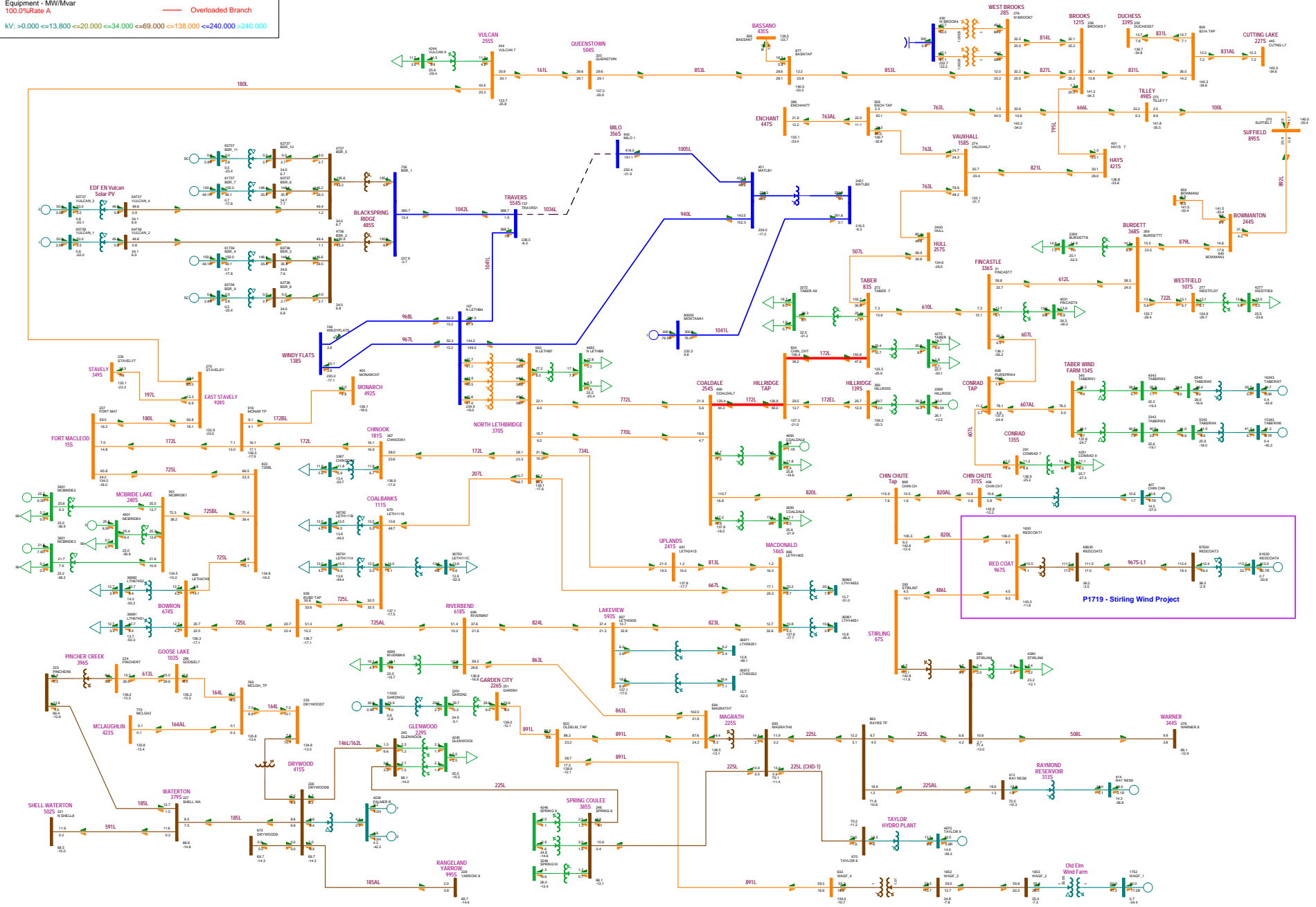


Figure A3-28: 2019 Summer Peak Post-Project - Contingency of 225ST1 (Magrath 225S Transformer T1)

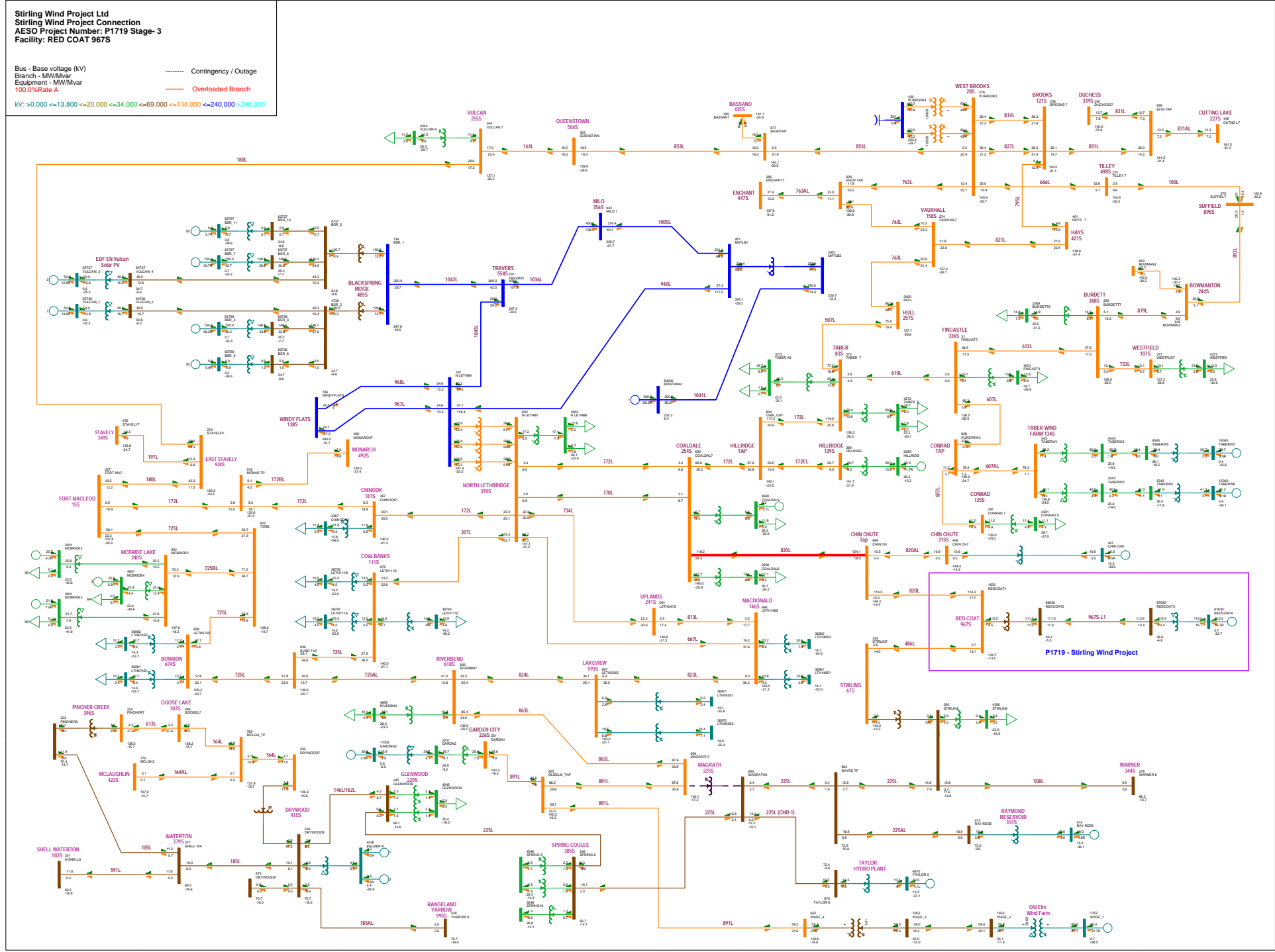


Figure A3-29: 2019 Summer Peak Post-Project - Contingency of Taber Wind Farm 1345

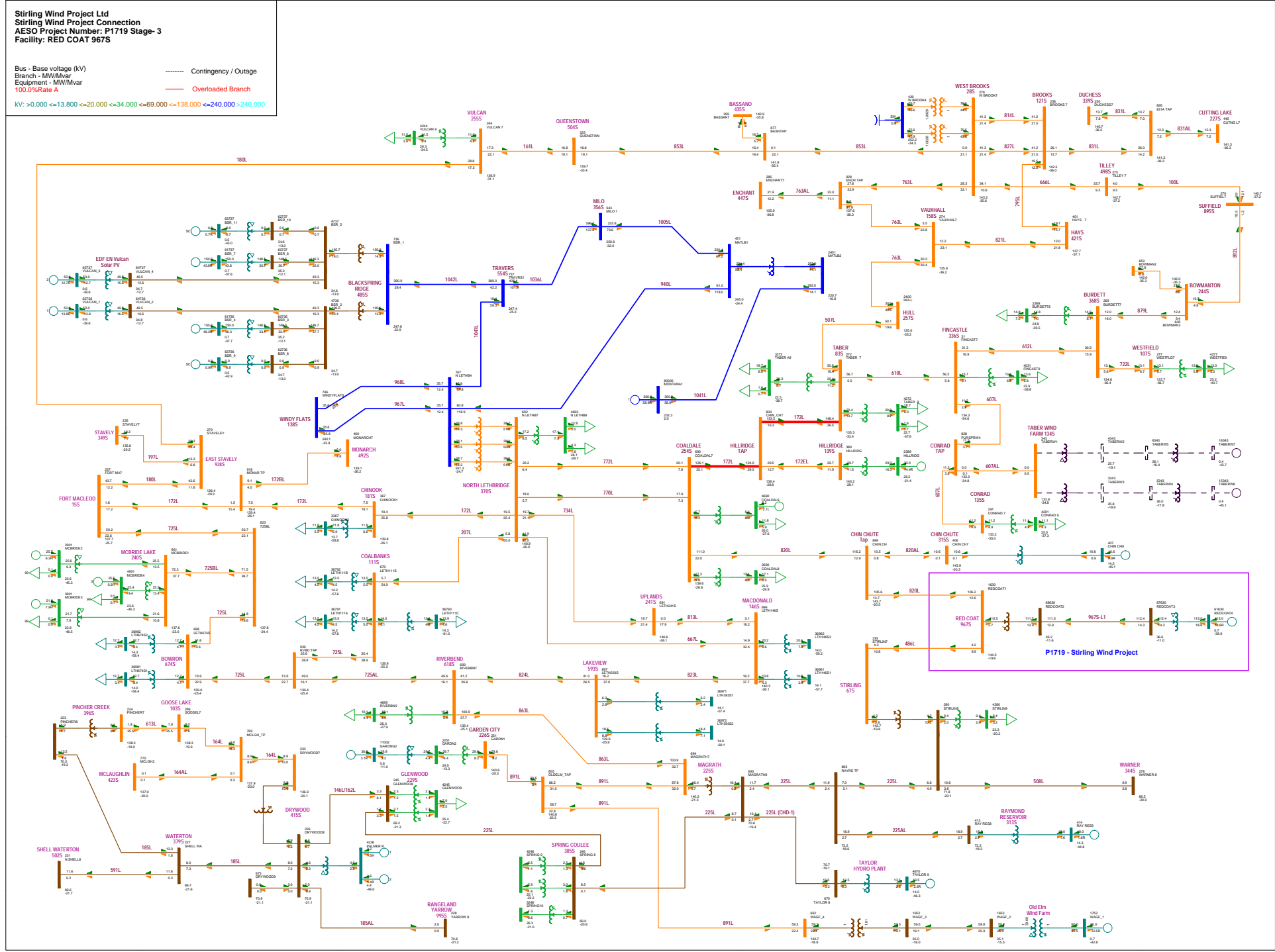
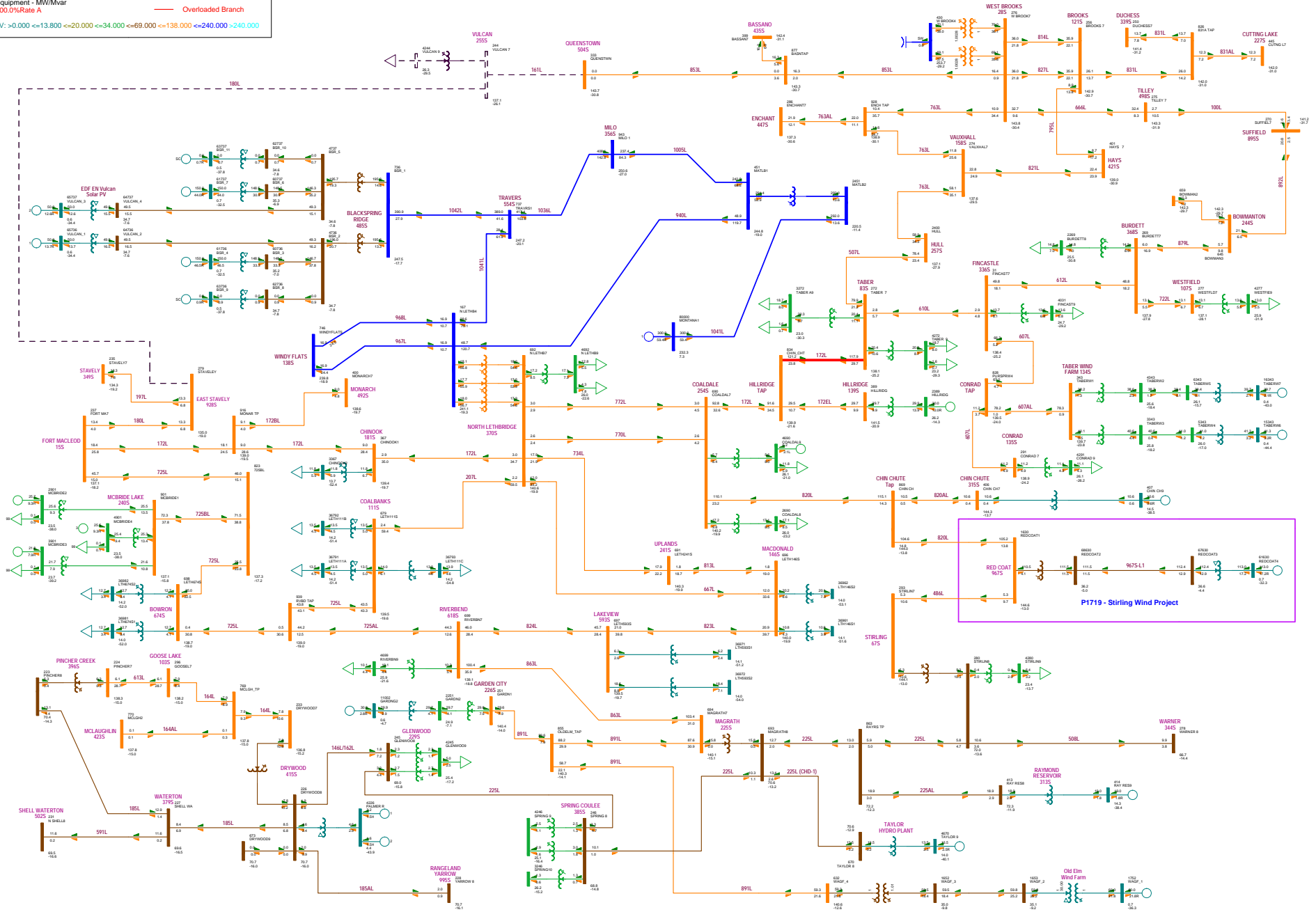


Figure A3-30: 2019 Summer Peak Post-Project - Contingency of 25S5T1 (Vulcan 25S5 Transformer T1)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 KV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

..... Contingency / Outage
 --- Overloaded Branch



P1719 - Stirling Wind Project

Figure A3-31: 2019 Summer Peak Post-Project - Contingency of 607L (Fincastle 336S - Conrad Tap)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 --- Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

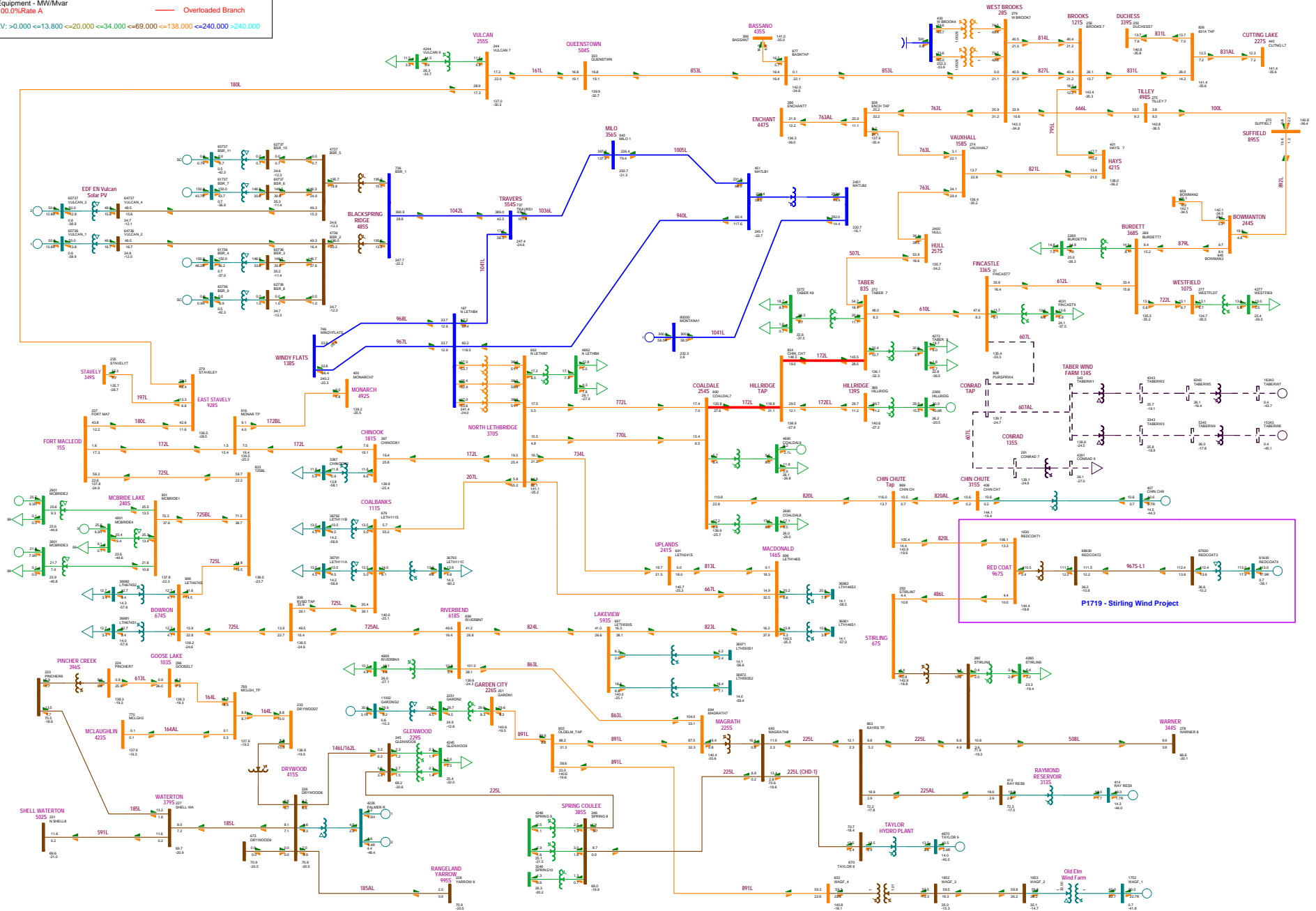


Figure A3-32: 2019 Summer Peak Post-Project - Contingency of 824L (Lakeview 593S - Riverbend 618S)

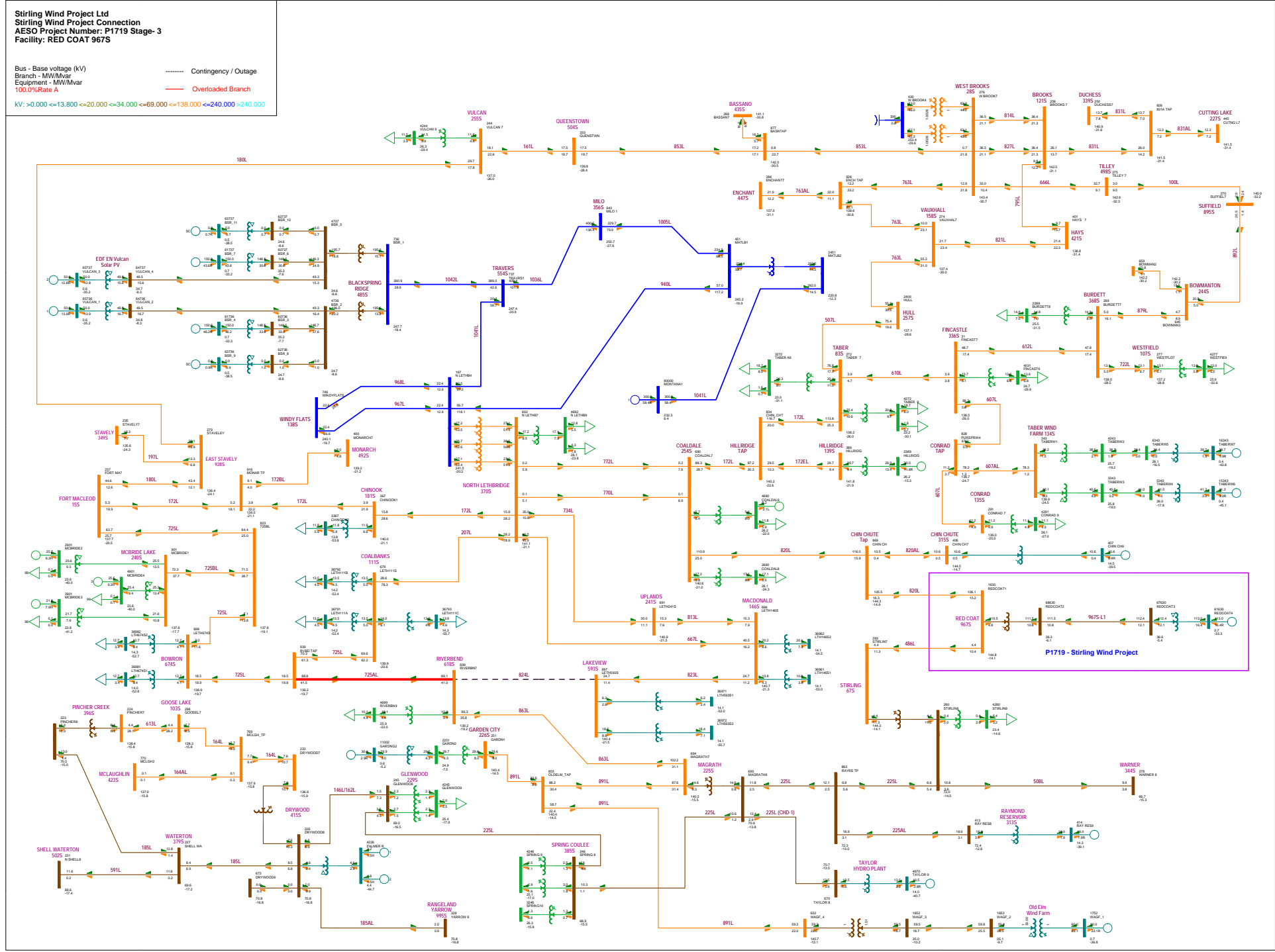


Figure A3-33: 2019 Summer Peak Post-Project - Contingency of 161L (Vulcan 255S - Queenstown 504S)

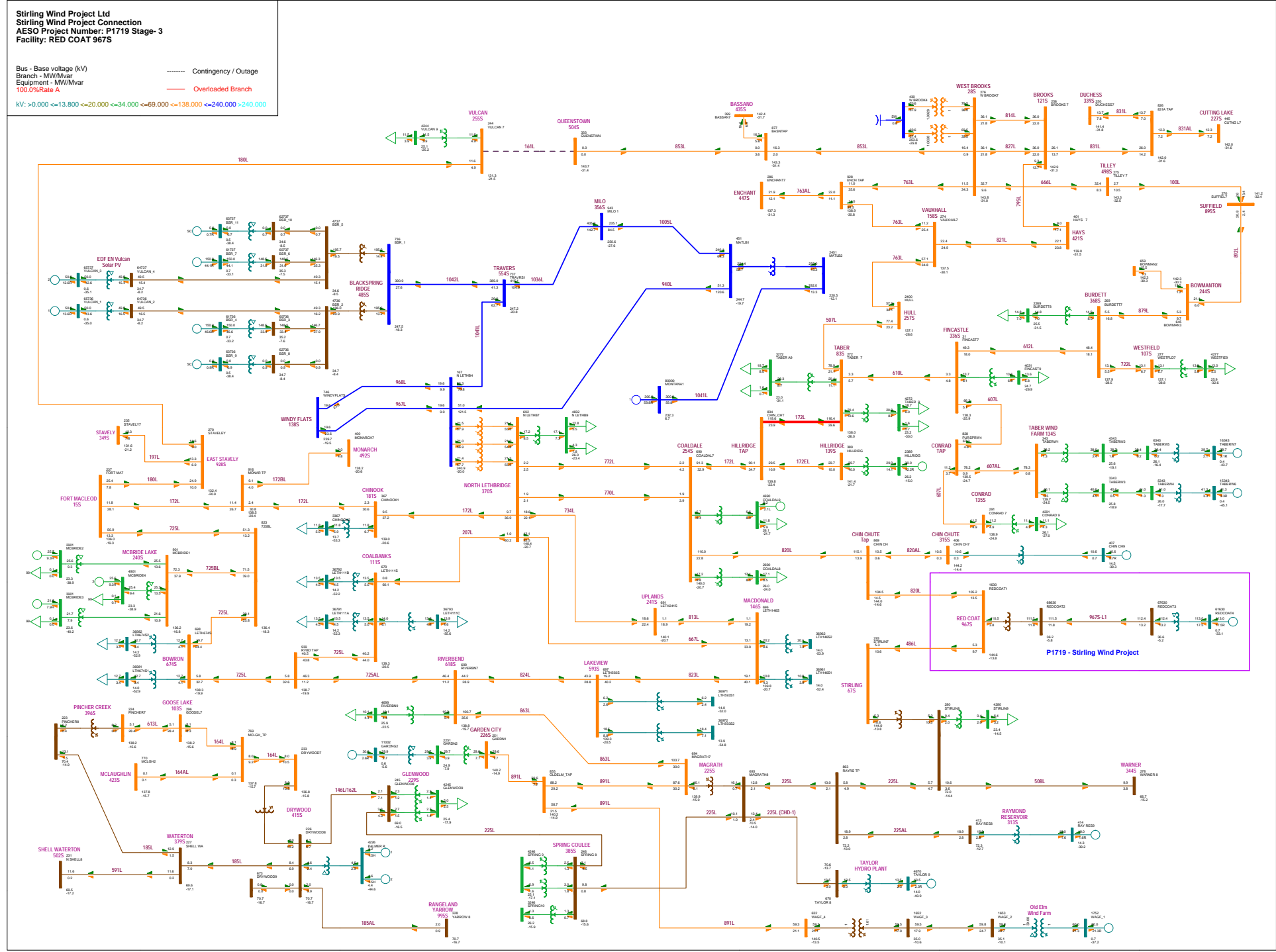


Figure A3-34: 2019 Summer Peak Post-Project - Contingency of 180L (Fort Macleod 15S - East Staveley 928S)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

----- Contingency / Outage
----- Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

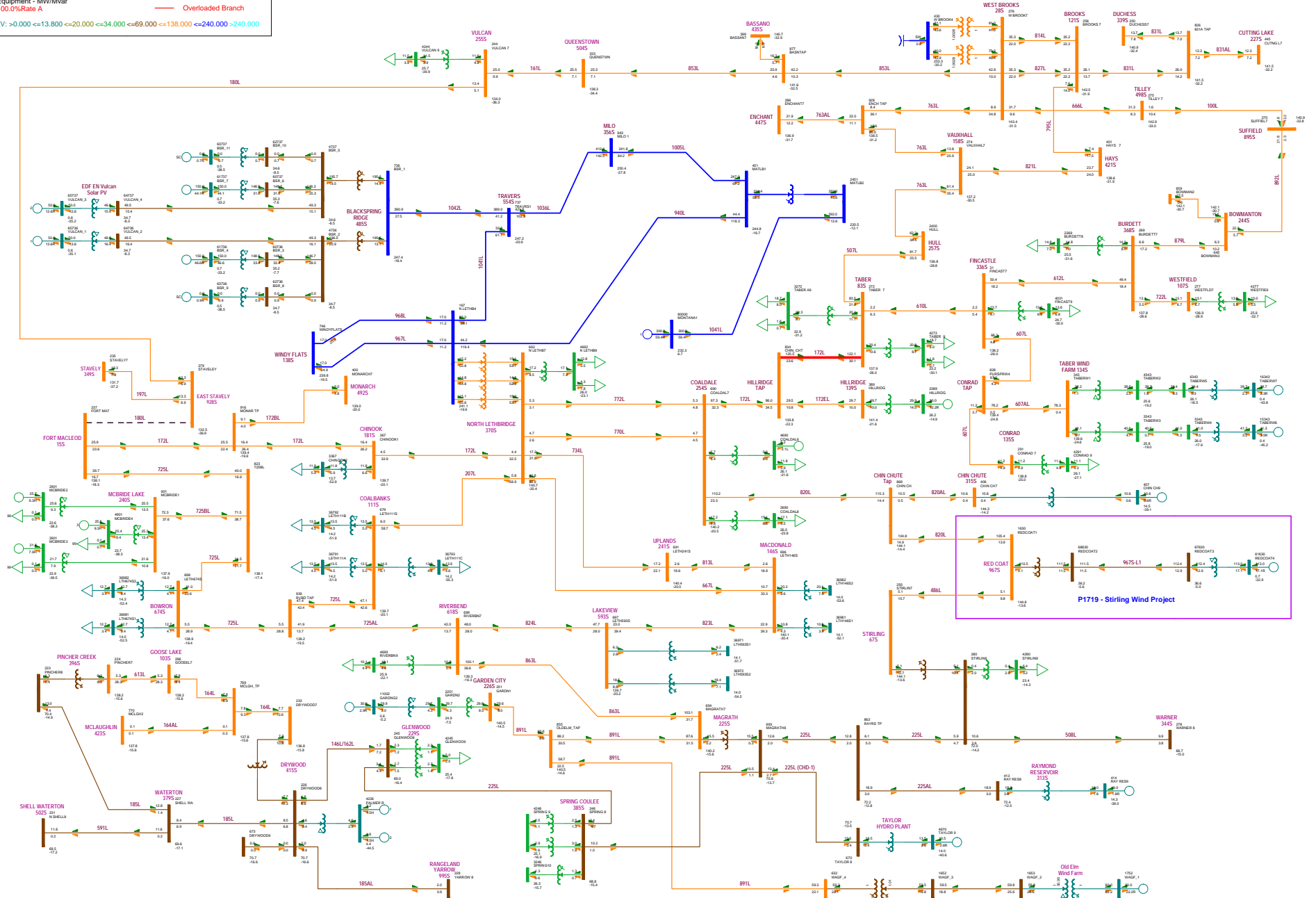


Figure A3-35: 2019 Summer Peak Post-Project - Contingency of 674ST1 (Bowron 674S Transformer T1)

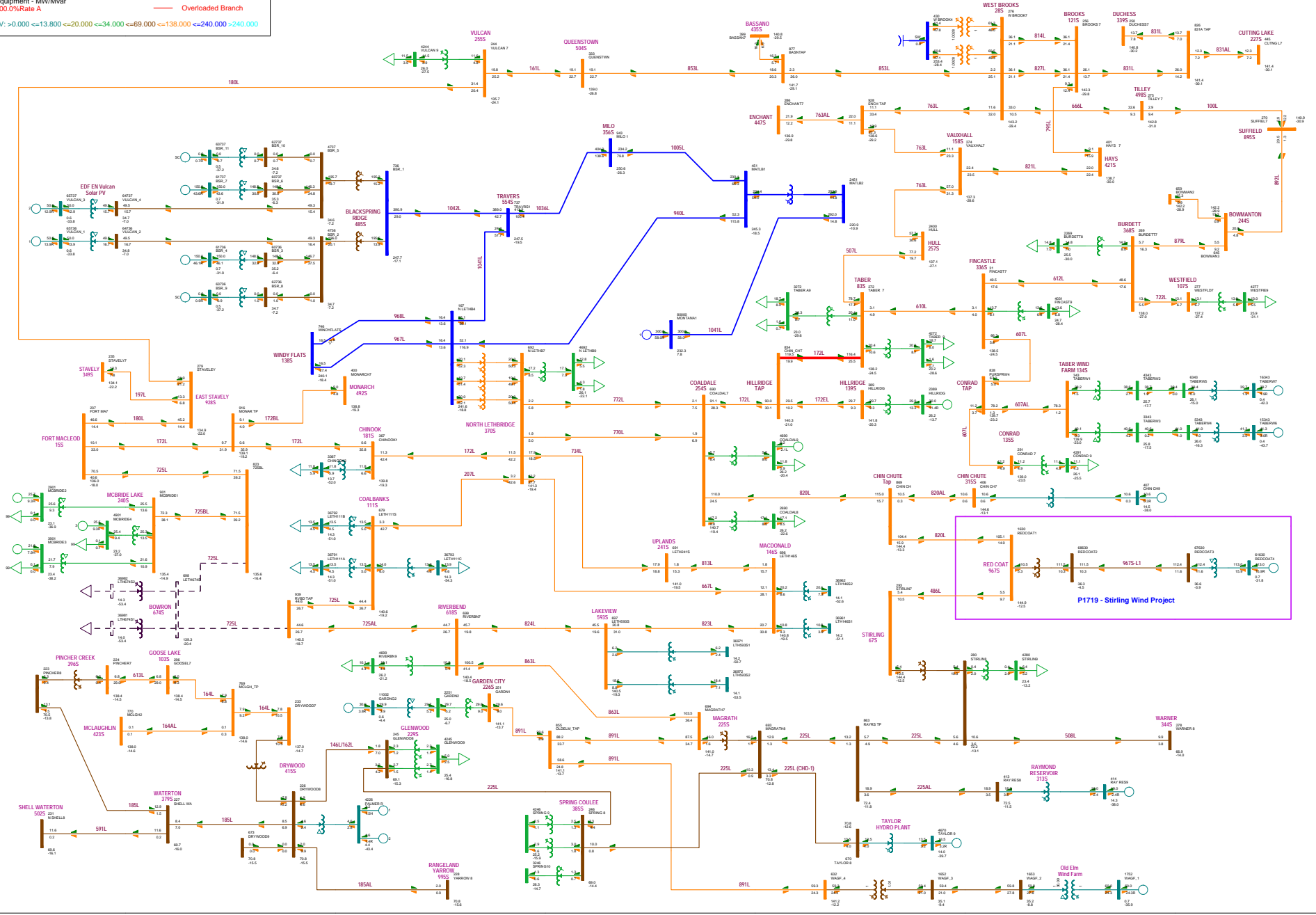
Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

----- Contingency / Outage

----- Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000



P1719 - Stirling Wind Project

Figure A3-36: 2019 Summer Peak Post-Project - Contingency of 1041L (North Lethbridge 3705 - Travers 5545)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 9675

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 — Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

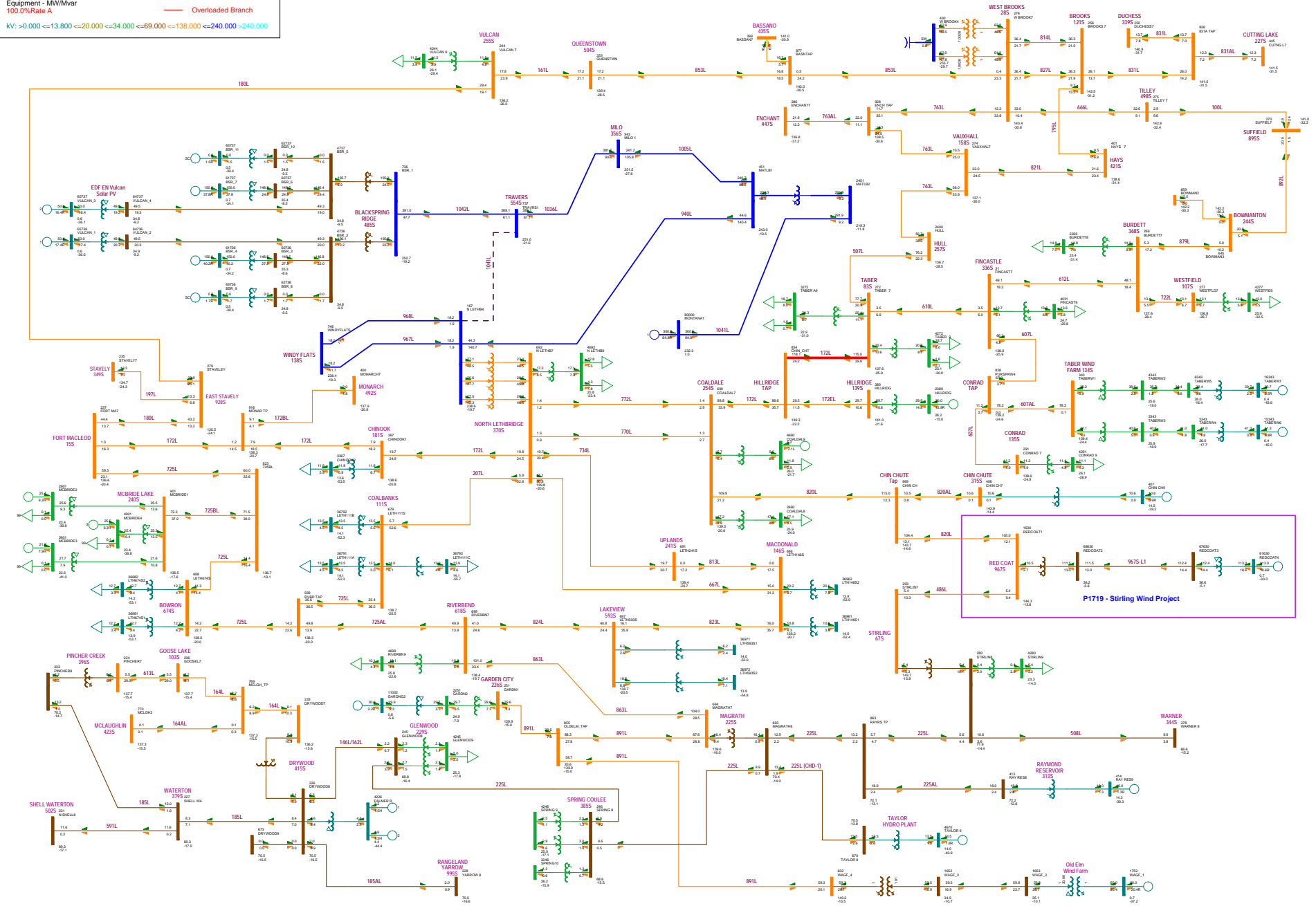


Figure A3-37: 2019 Summer Peak Post-Project - Contingency of 618ST1 (Riverbend 618S Transformer T1)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MWM/Mvar
Equipment - MWM/Mvar
100.0%Rate A
kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage
----- Overloaded Branch

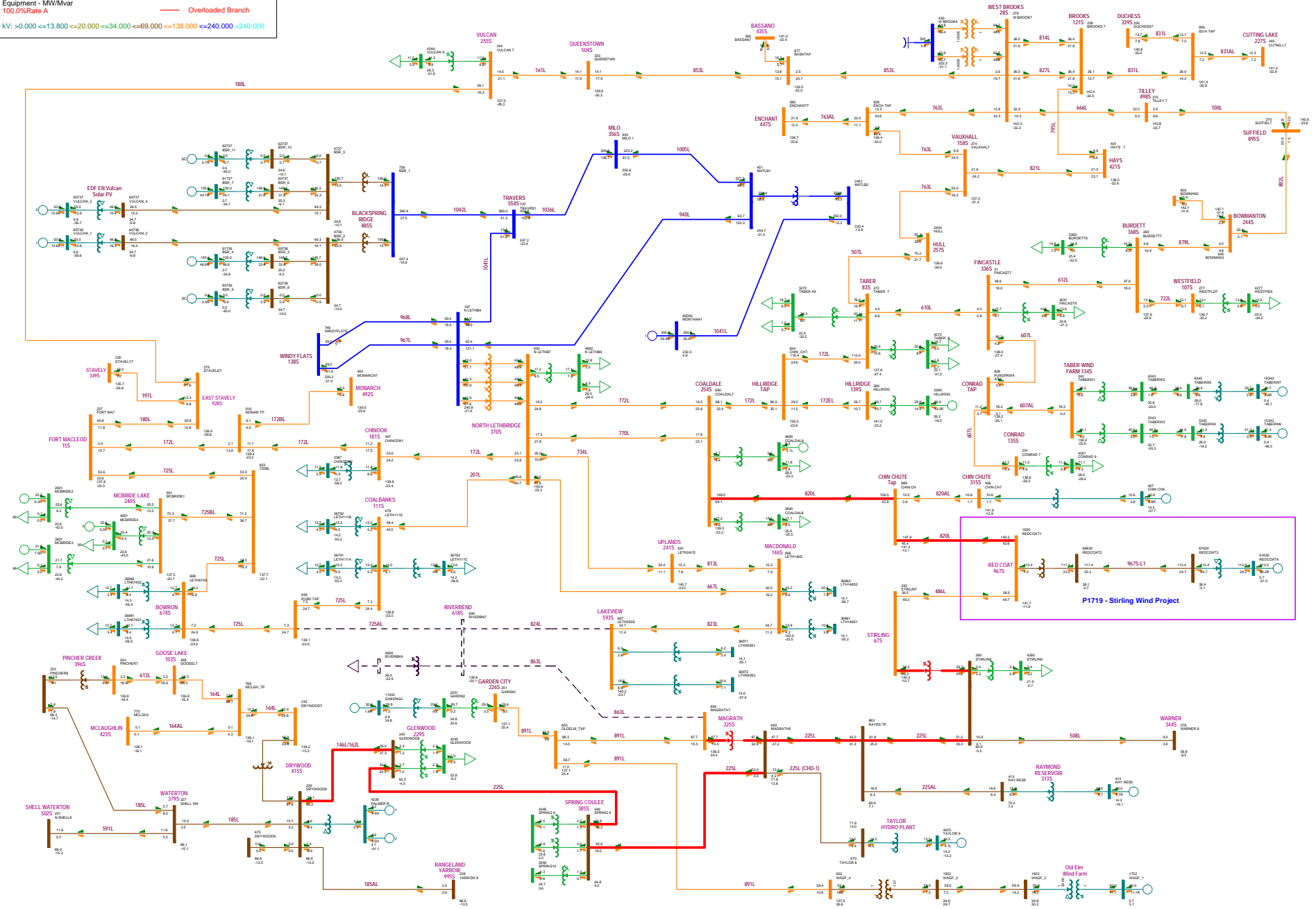


Figure A3-38: 2019 Summer Peak Post-Project - Contingency of 336ST1 (Fincastle 336S Transformer T)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MVA/Mvar
 Equipment - MVA/Mvar
 100.0%Rate A

----- Contingency / Outage
 — Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

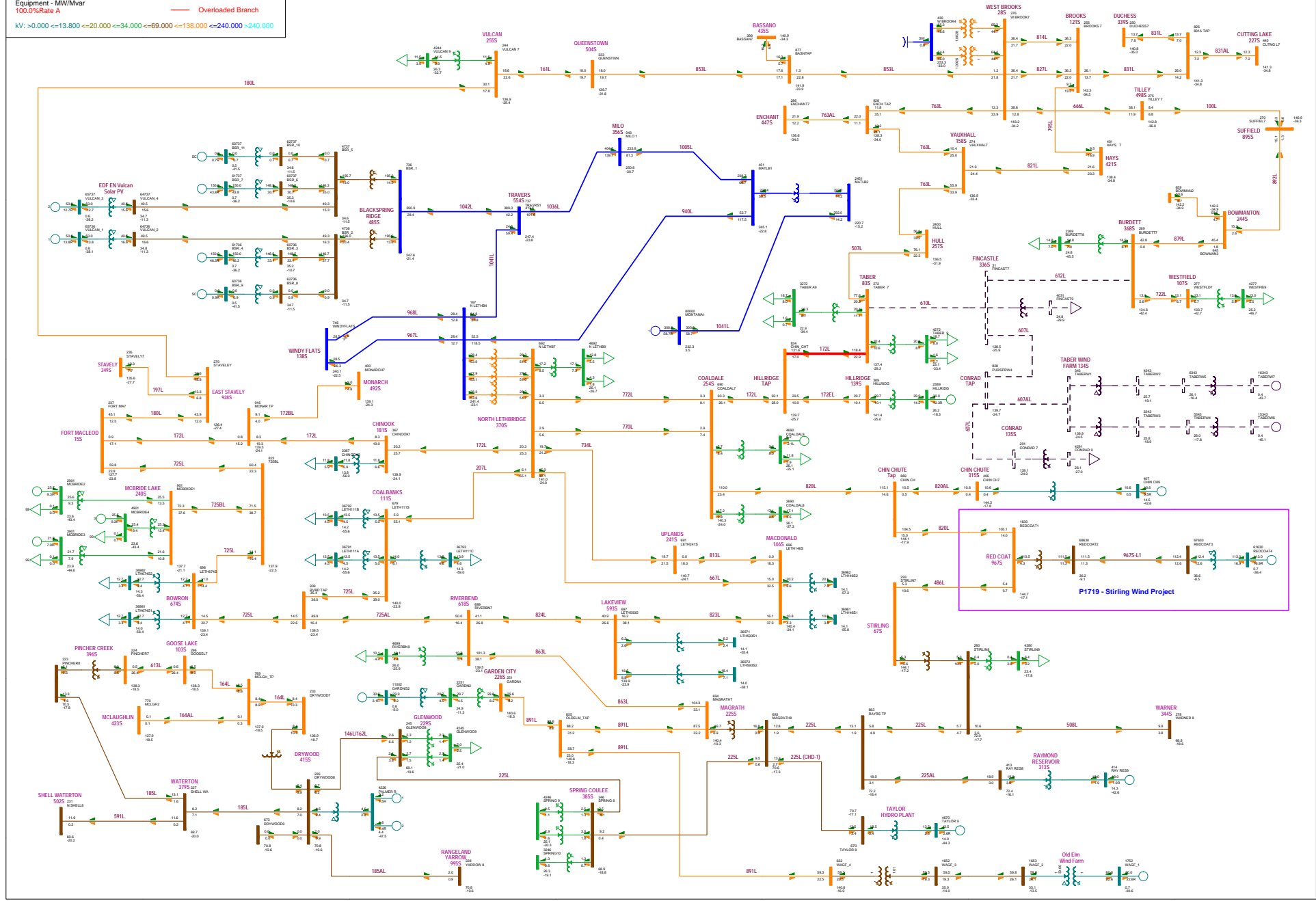


Figure A3-39: 2019 Summer Peak Post-Project - Contingency of 370ST1 (North Lethbridge 370S Transformer T1)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage
 --- Overloaded Branch

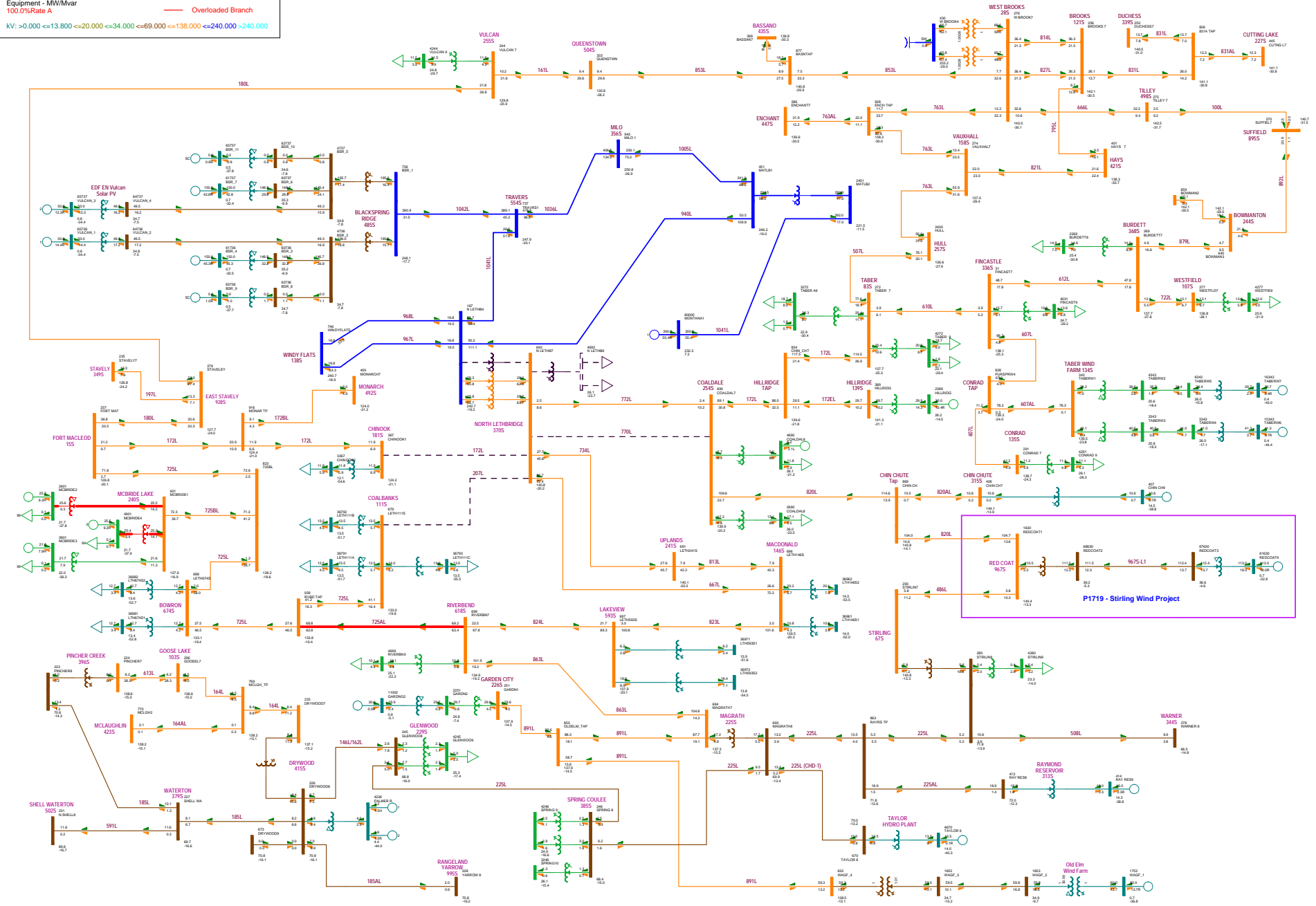


Figure A3-40: 2019 Summer Peak Post-Project - Contingency of 863L (Magrath 225S - Riverbend 618S)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MWM/Mvar
 Equipment - MWM/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage

----- Overloaded Branch

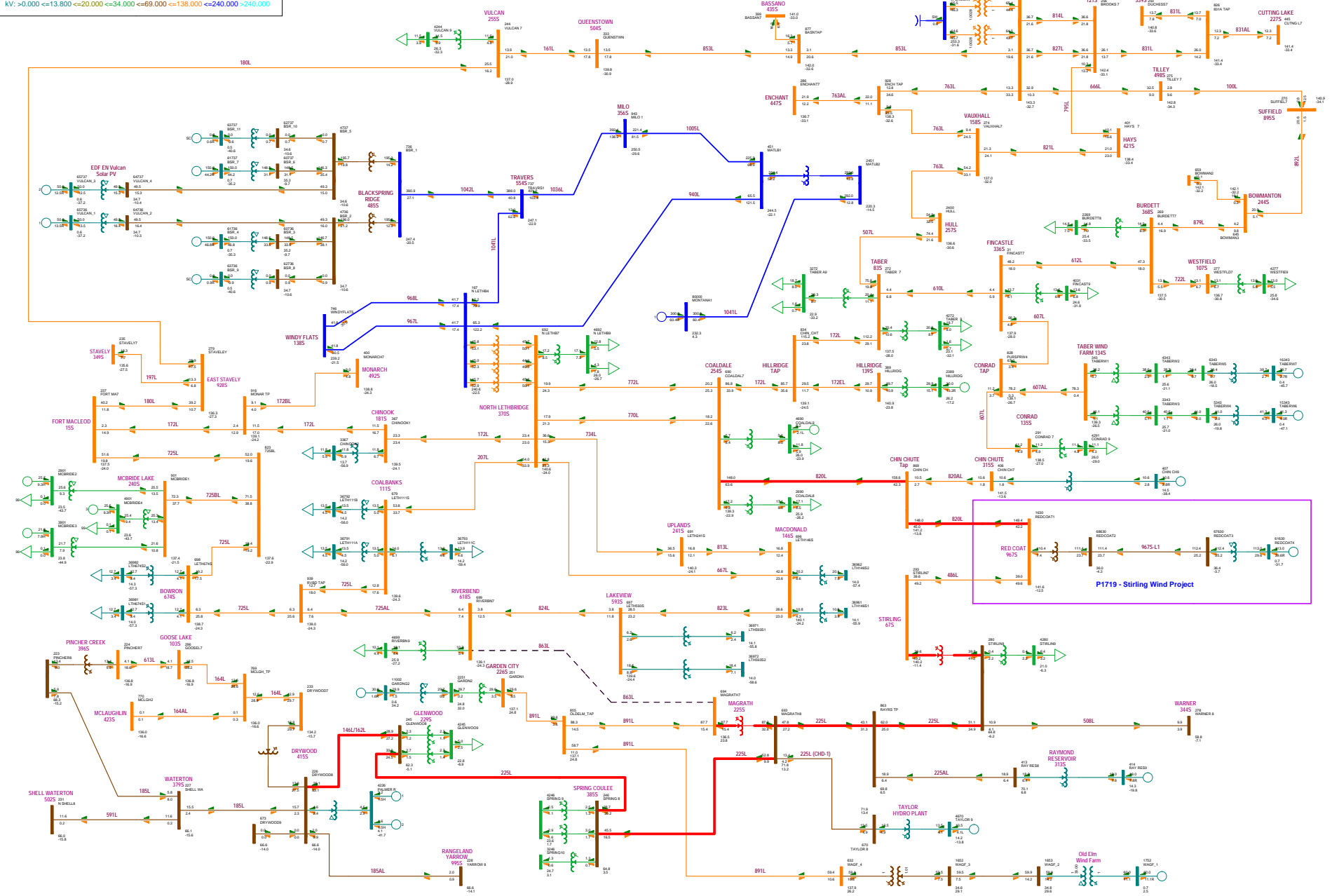


Figure A3-41: 2019 Summer Peak Post-Project - Contingency of 593ST1 (Lakeview 593S Transformer T1)

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MWM/Mvar
Equipment - MWM/Mvar
100.0%Rate A

----- Contingency / Outage

----- Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

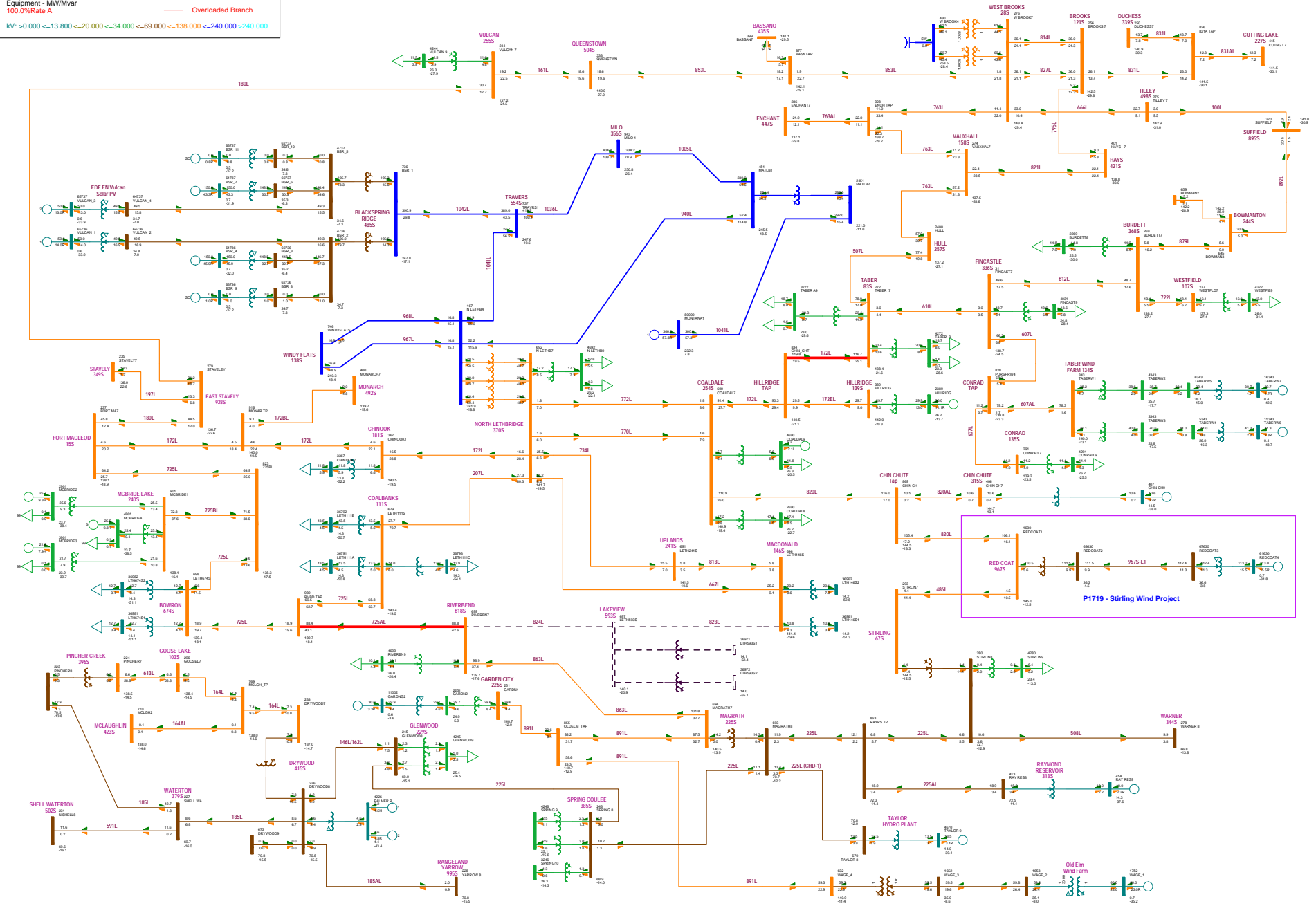
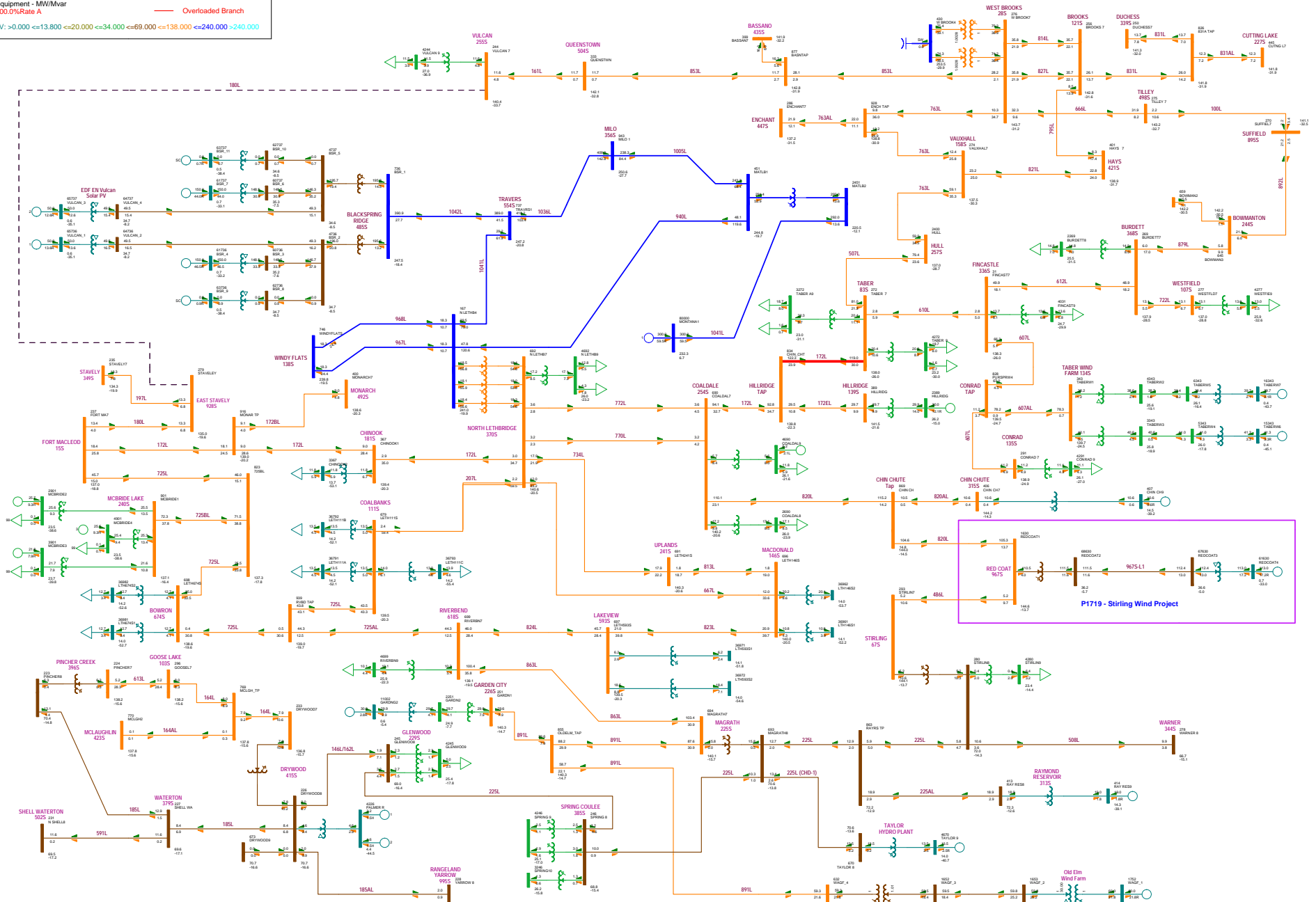


Figure A3-43: 2019 Summer Peak Post-Project - Contingency of 180L (Vulcan 2555 - East Stavelay 9285)

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 KV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage
 --- Overloaded Branch



Attachment A4

Transient Stability Diagrams

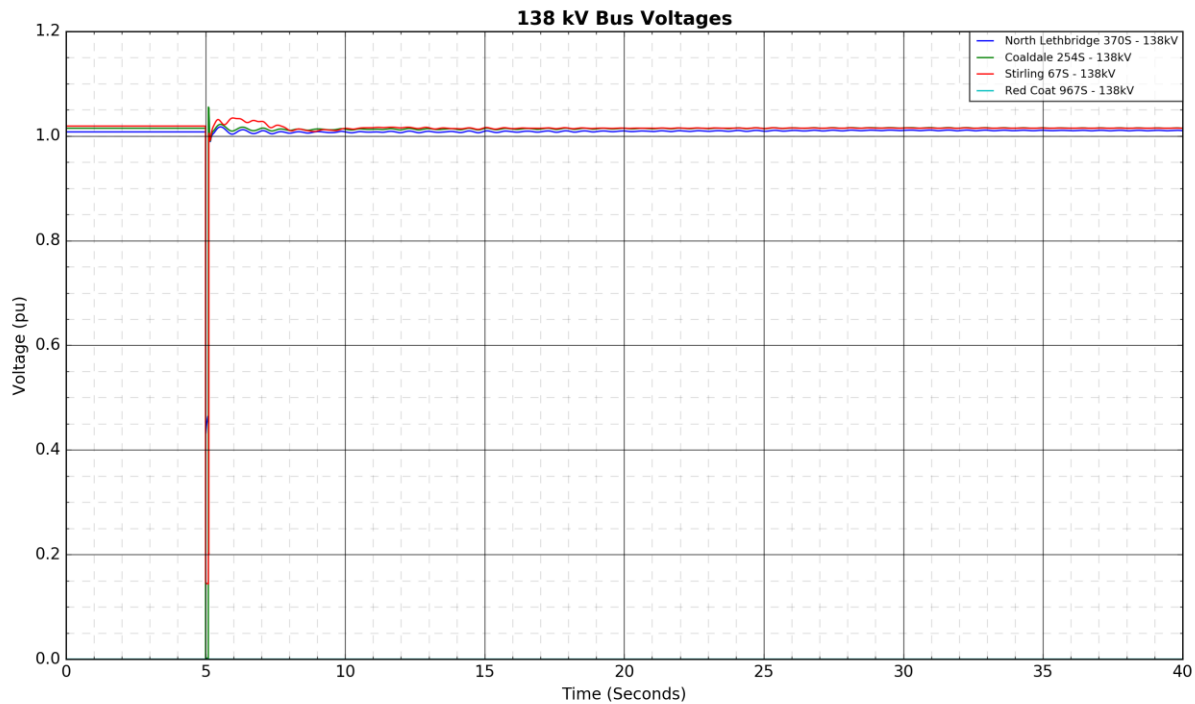
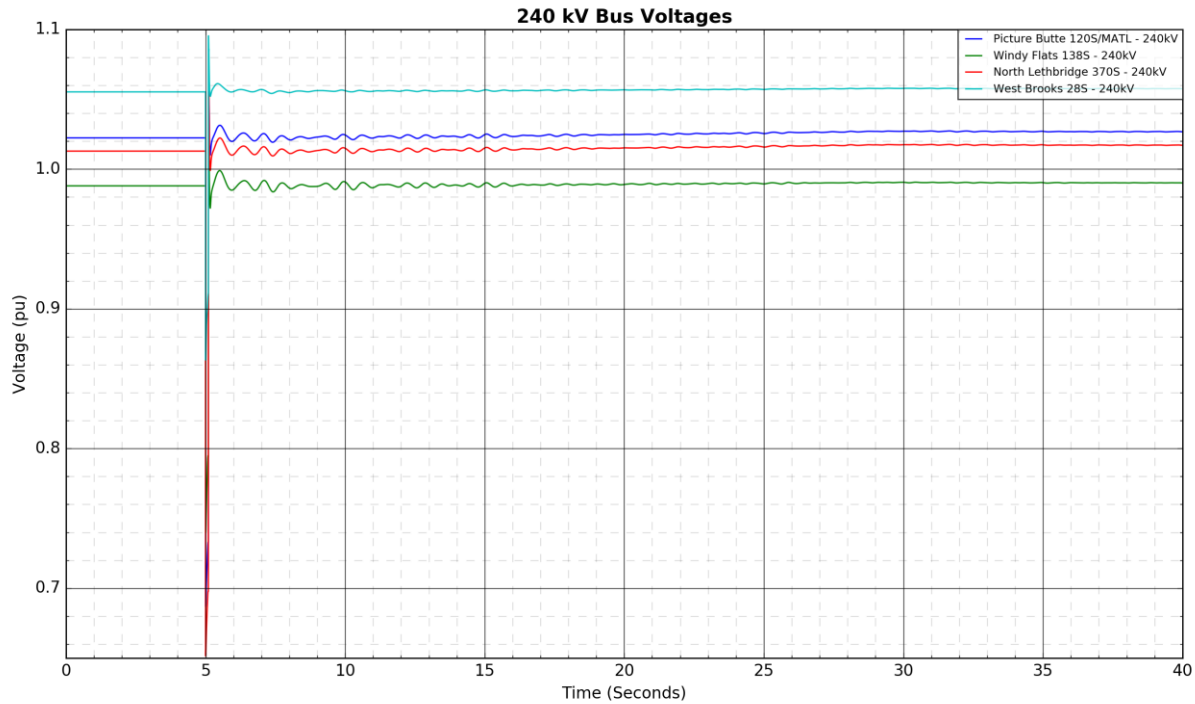
Table A4-1: Transient Stability Figures for Contingencies

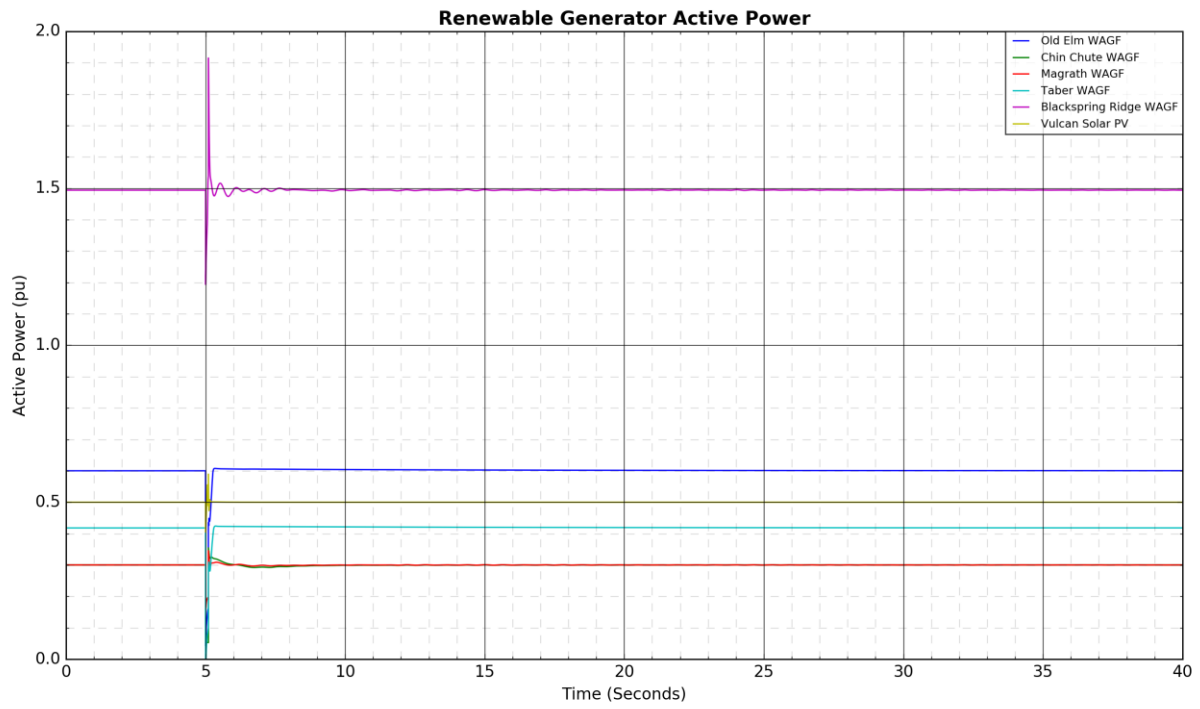
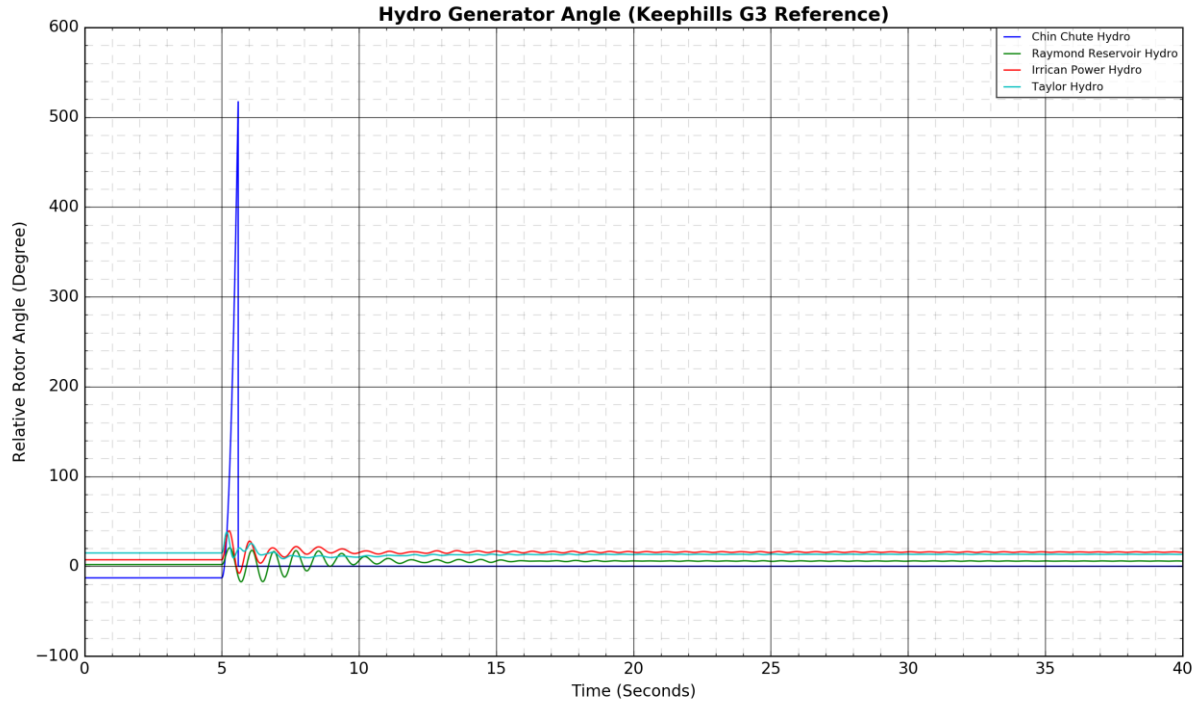
Category	Contingency	Fault Location	Fault Clearing Time			Pre-Project 2019 SL	Pre-Project 2019 SP	Post-Project 2019 SL	Post-Project 2019 SP
			Near End Cycle	Far End Cycle	Terminal 3 Cycles				
N-1	820L Coaldale 254S to Chin Chute 315S T-Tap to Red Coat 967S T-Tap to Stirling 67S	Coaldale 254S	6	7	36	Figure A4-1	Figure A4-15	Figure A4-29	Figure A4-43
N-1	820L Coaldale 254S to Chin Chute 315S T-Tap to Red Coat 967S T-Tap to Stirling 67S	Stirling 67S	6	7	16	Figure A4-2	Figure A4-16	Figure A4-30	Figure A4-44
N-1	225L Stirling 67S to Raymond Reservoir 313S T-Tap to Magrath 225S	Stirling 67S	5.75	6.75	36.75	Figure A4-3	Figure A4-17	Figure A4-31	Figure A4-45
N-1	225L Stirling 67S to Raymond Reservoir 313S T-Tap to Magrath 225S	Magrath 225S	5.75	6.75	36.75	Figure A4-4	Figure A4-18	Figure A4-32	Figure A4-46
N-1	863L Magrath 225S to Riverbend 618S	Magrath 225S	6	9	-	Figure A4-5	Figure A4-19	Figure A4-33	Figure A4-47
N-1	863L Magrath 225S to Riverbend 618S	Riverbend 618S	6	9	-	Figure A4-6	Figure A4-20	Figure A4-34	Figure A4-48
N-1	170L Coaldale 254S to North Lethbridge 370S	Coaldale 254S	5.5	6.5	-	Figure A4-7	Figure A4-21	Figure A4-35	Figure A4-49
N-1	170L Coaldale 254S to North Lethbridge 370S	Near North Lethbridge 370S	5.5	6.5	-	Figure A4-8	Figure A4-22	Figure A4-36	Figure A4-50
N-1	172L Coaldale 254S to Taber 83S	Coaldale 254S	6	7	-	Figure A4-9	Figure A4-23	Figure A4-37	Figure A4-51
N-1	172L Coaldale 254S to Taber 83S	Taber 83S	6	7	-	Figure A4-10	Figure A4-24	Figure A4-38	Figure A4-52
N-1	1041L Travers 554S to North Lethbridge 370S	Travers 554S	5	6	-	Figure A4-11	Figure A4-25	Figure A4-39	Figure A4-53
N-1	1041L Travers 554S to North Lethbridge 370S	North Lethbridge 370S	5	6	-	Figure A4-12	Figure A4-26	Figure A4-40	Figure A4-54
N-1	968L North Lethbridge 370S to Windy Flats 138S	North Lethbridge 370S	5	6	-	Figure A4-13	Figure A4-27	Figure A4-41	Figure A4-55
N-1	968L North Lethbridge 370S to Windy Flats 138S	Windy Flats 138S	5	6	-	Figure A4-14	Figure A4-28	Figure A4-42	Figure A4-56

Transient Stability Results

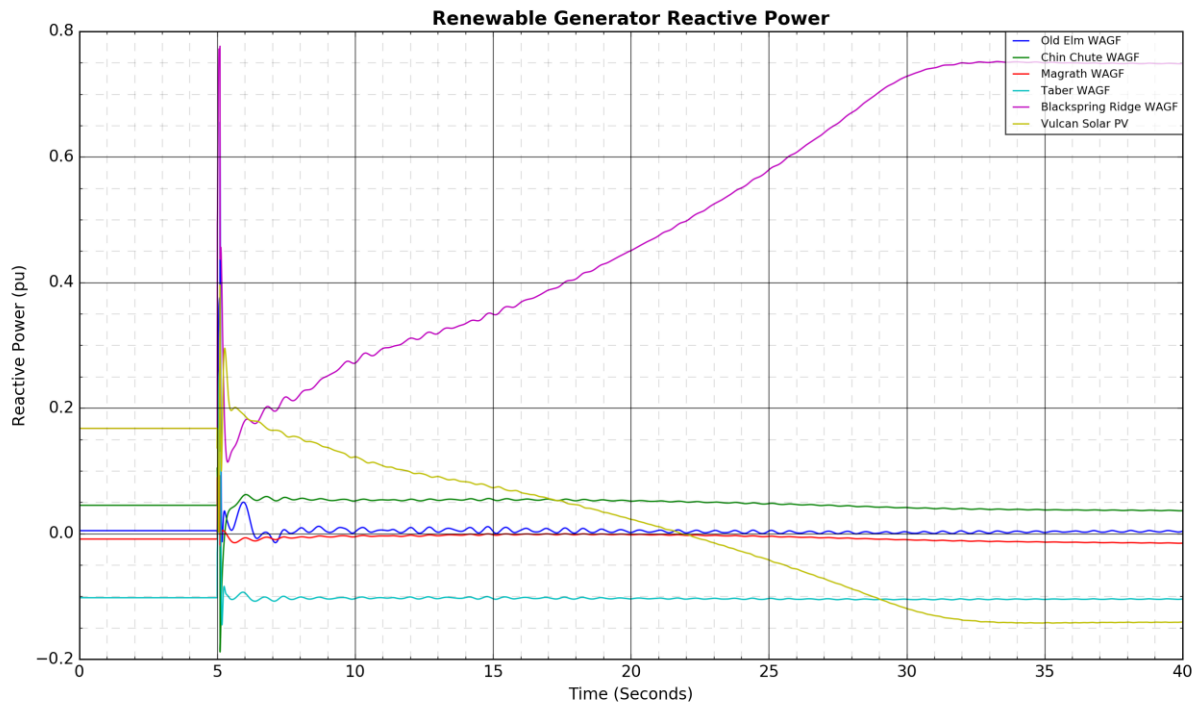
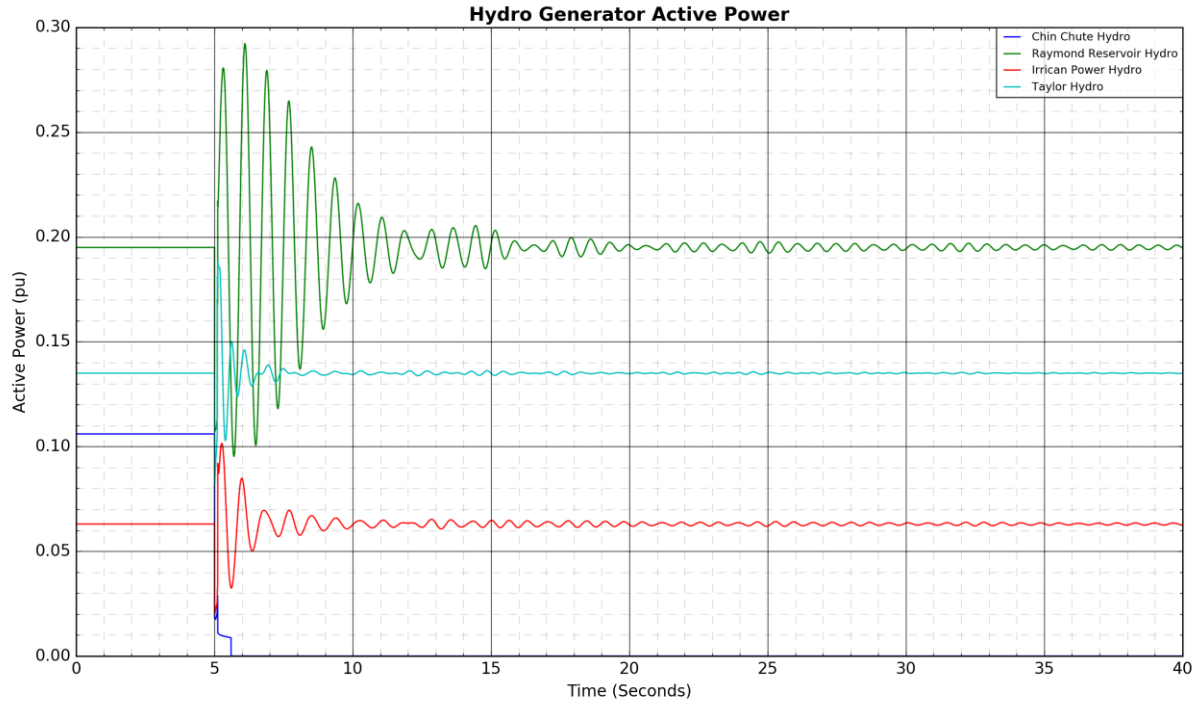
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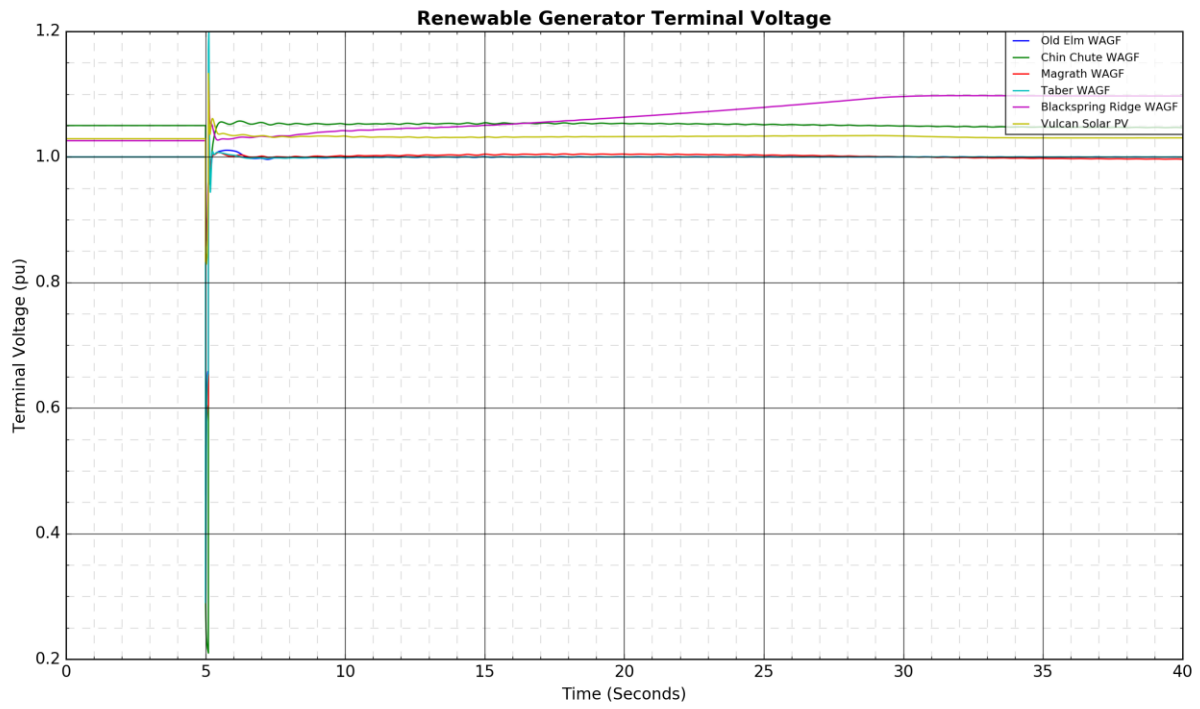
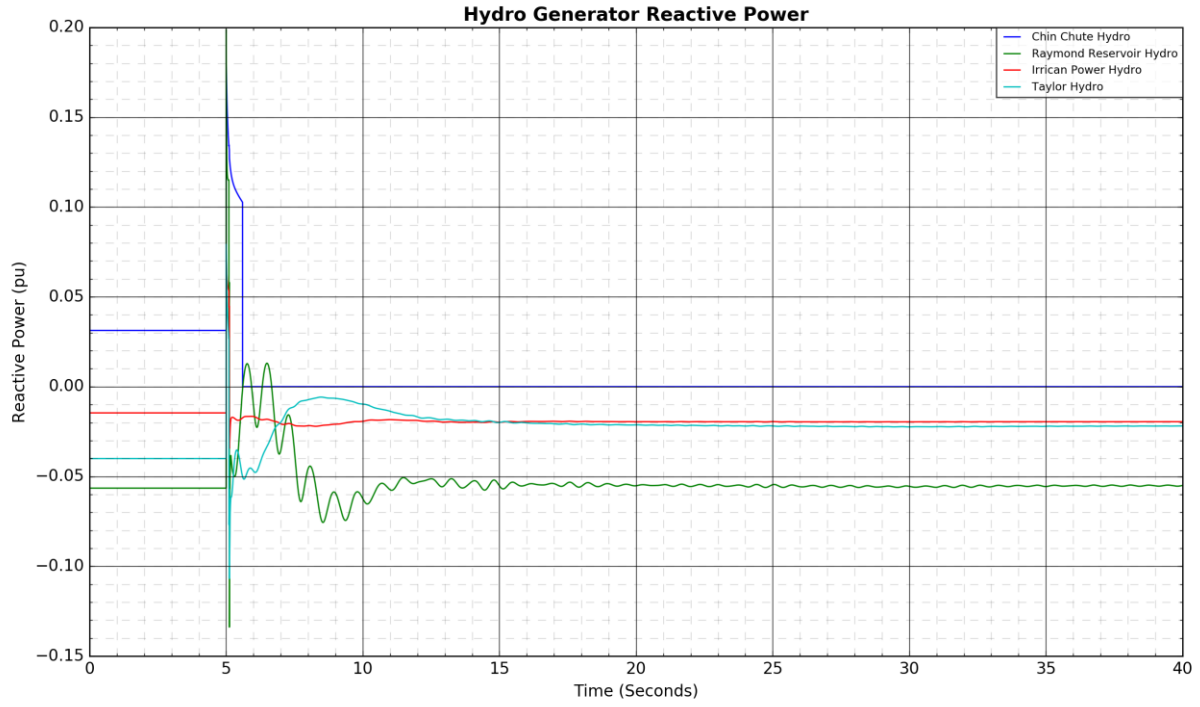
Figure A4-1: 820L Coaldale 254S to Chin Chute 315S T-Tap to Stirling 67S: Fault Near Coaldale 254S

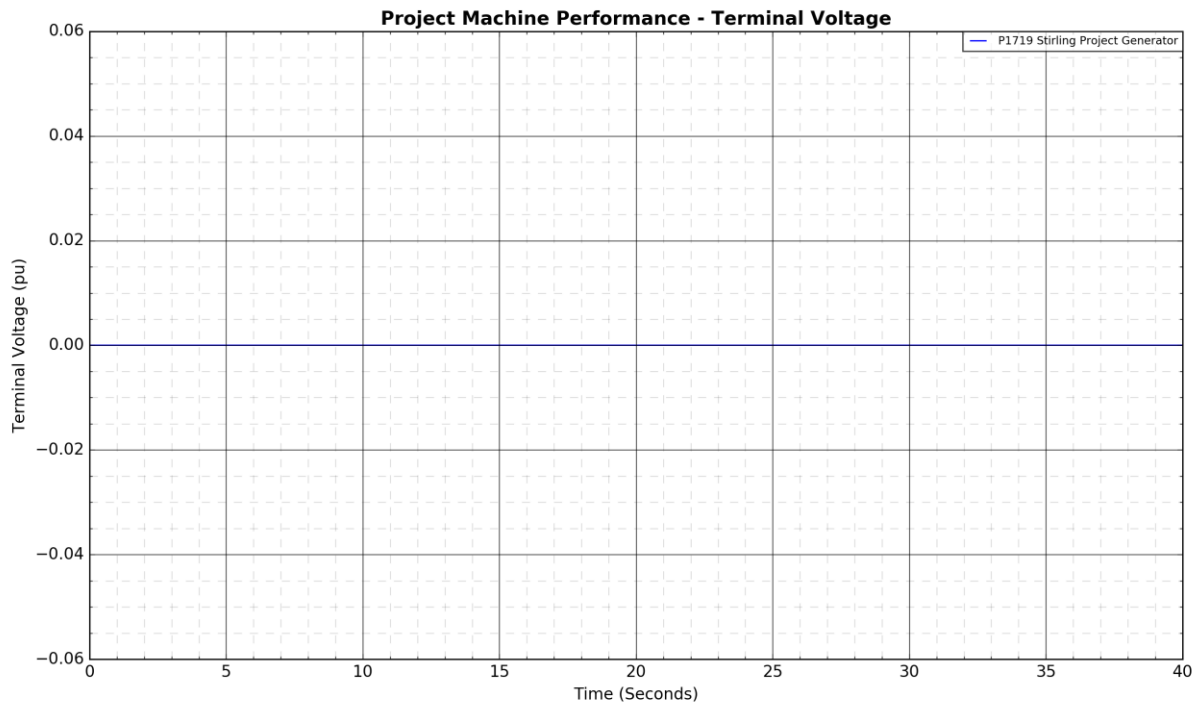
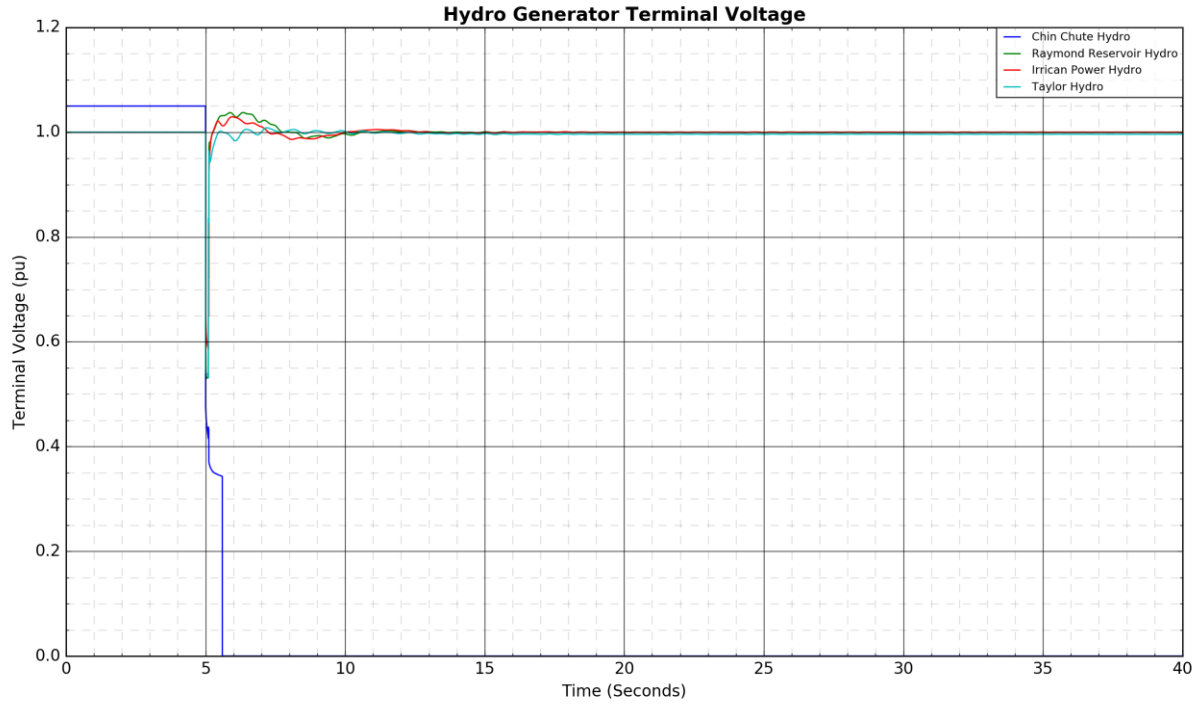




Engineering Connection Assessment Results: Stirling Wind Project Connection







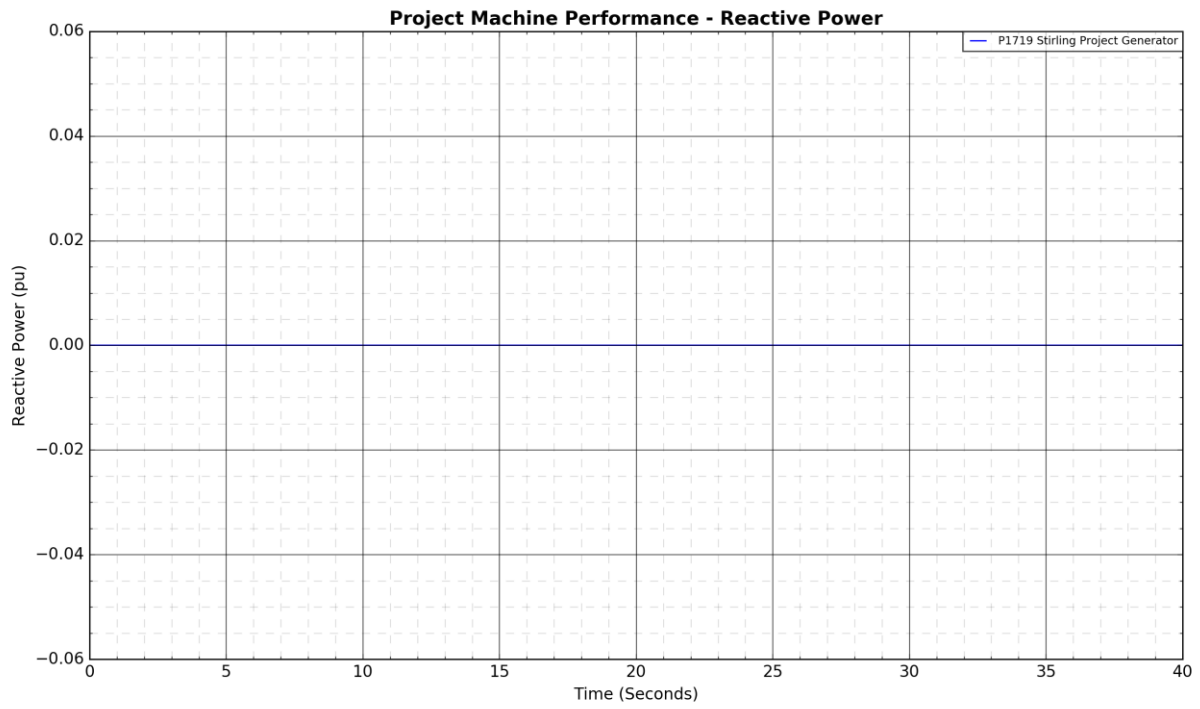
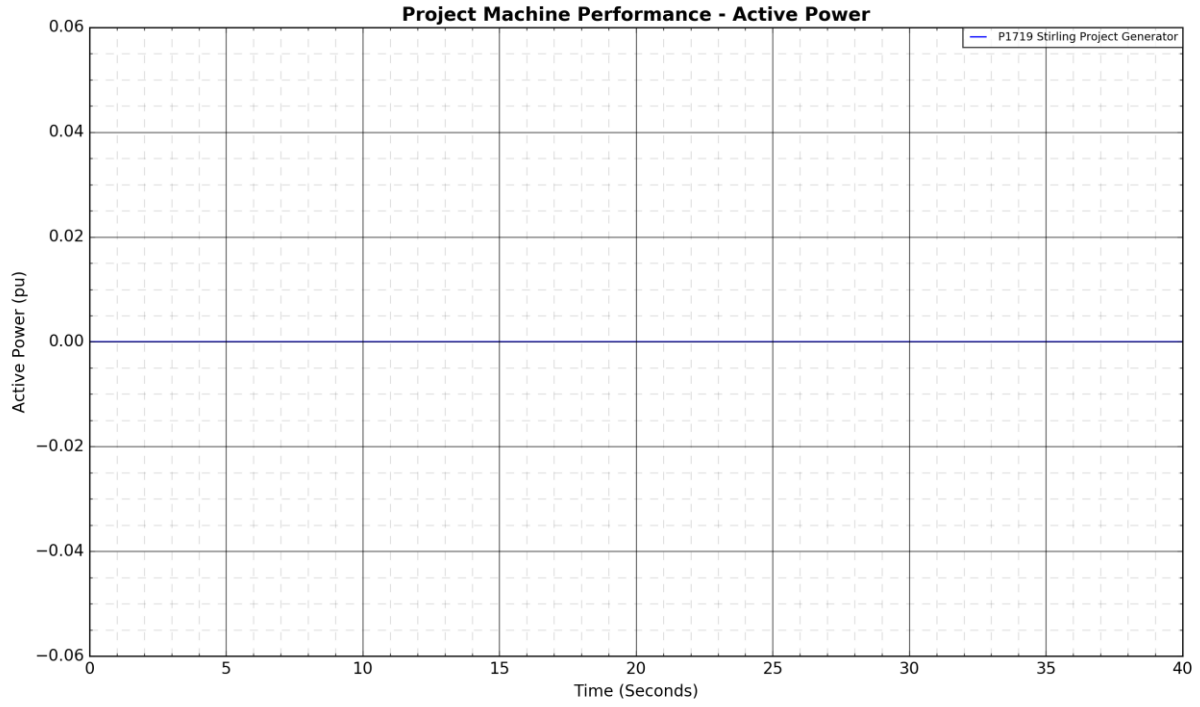
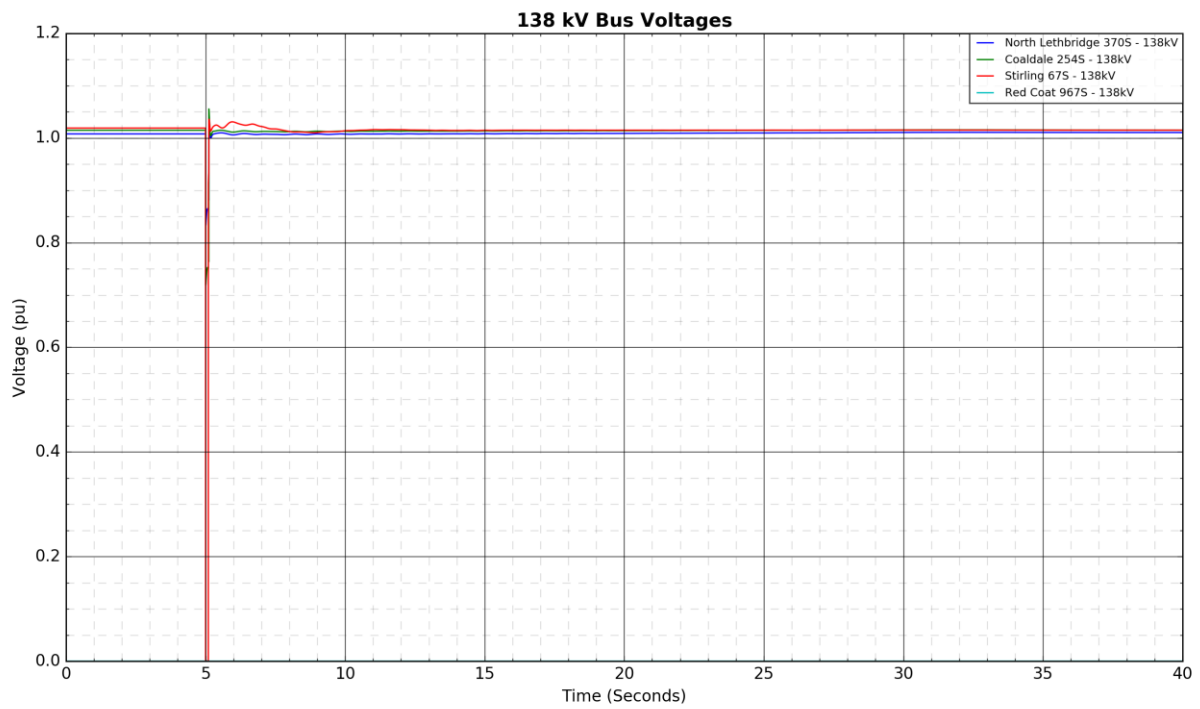
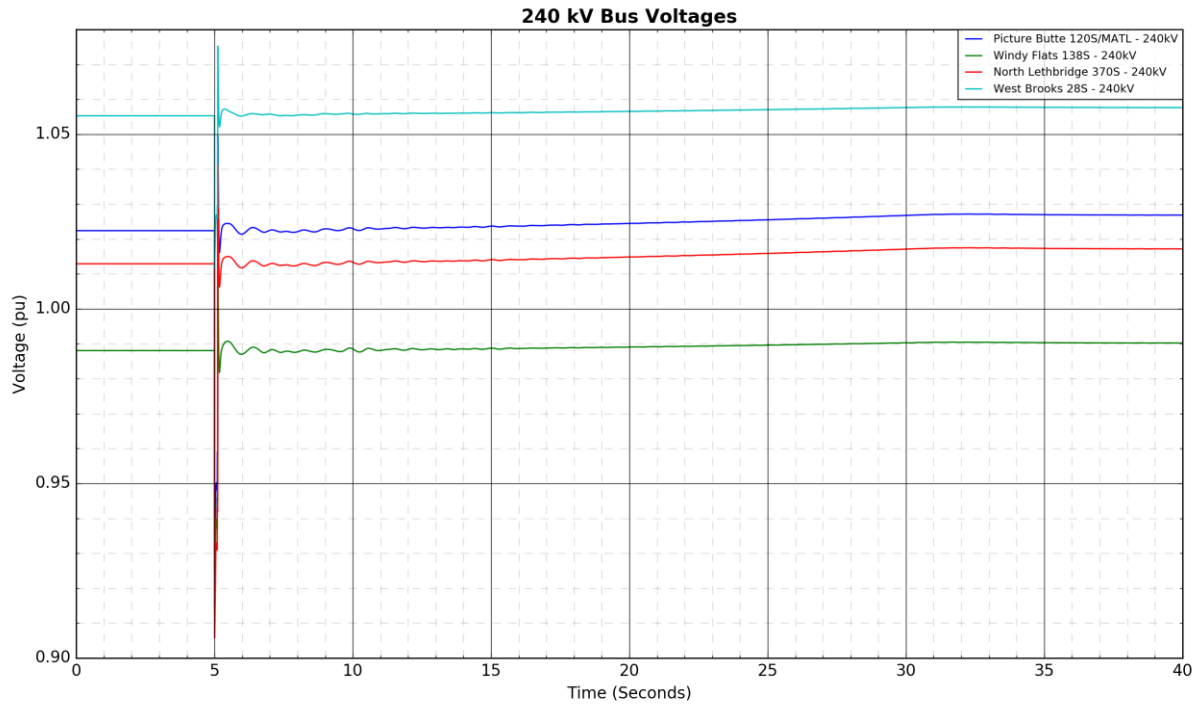
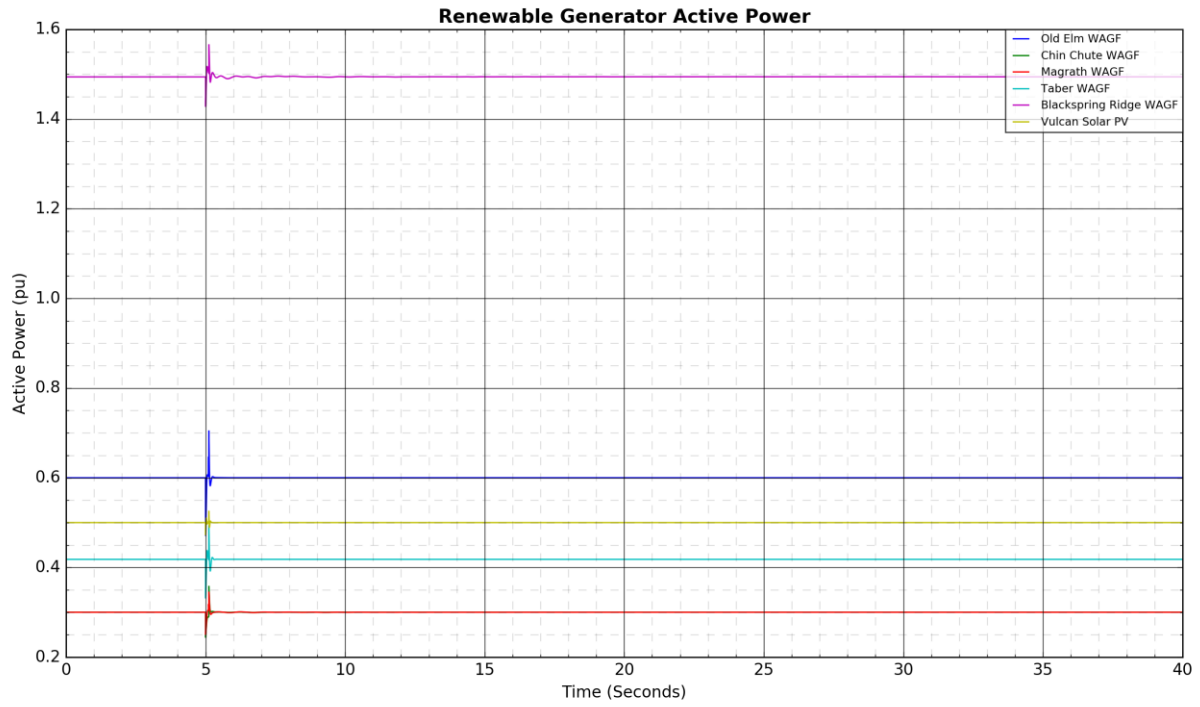
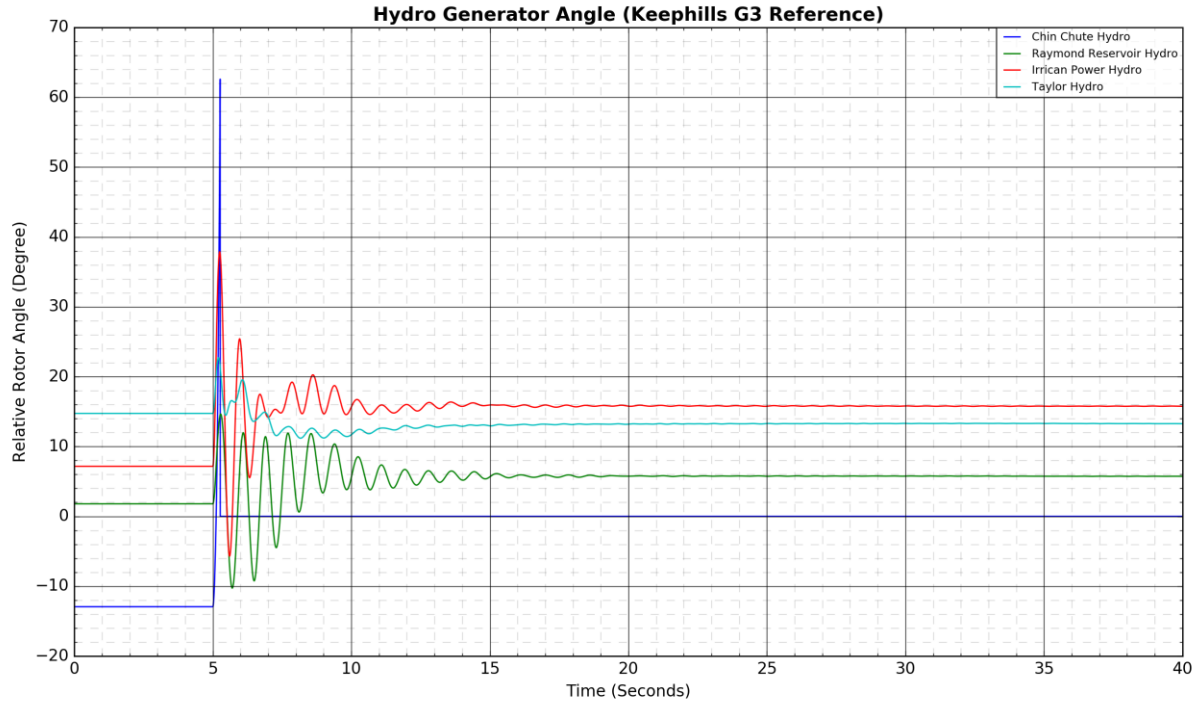
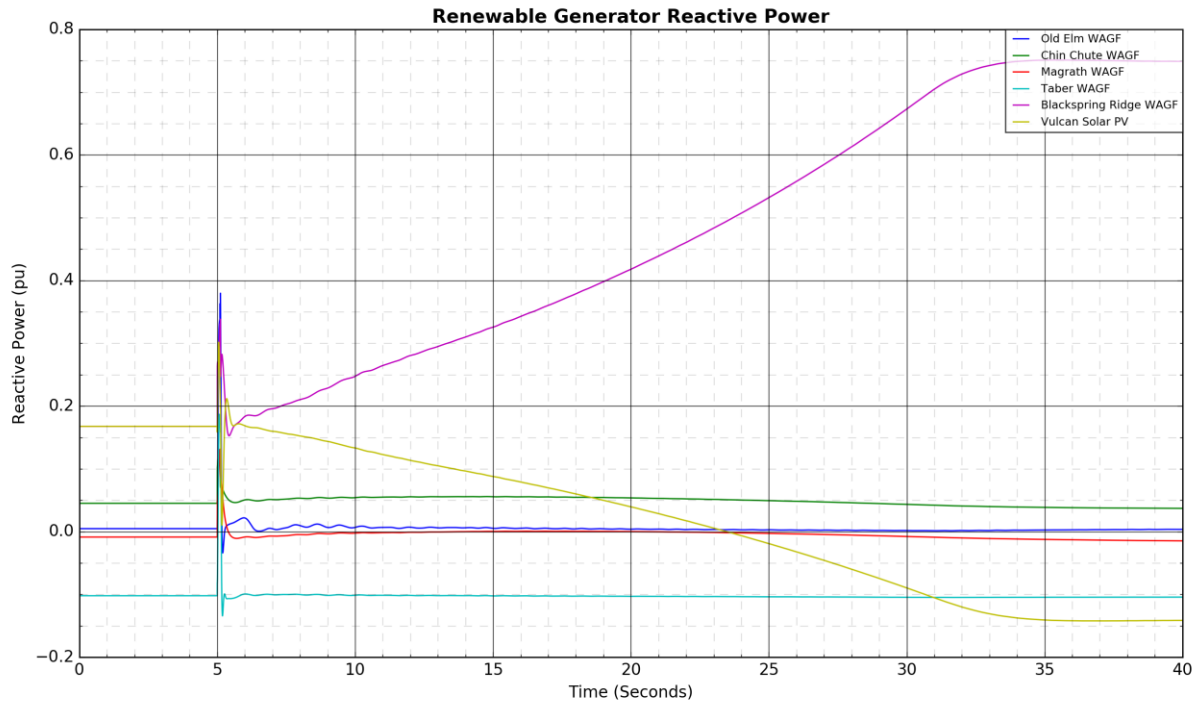
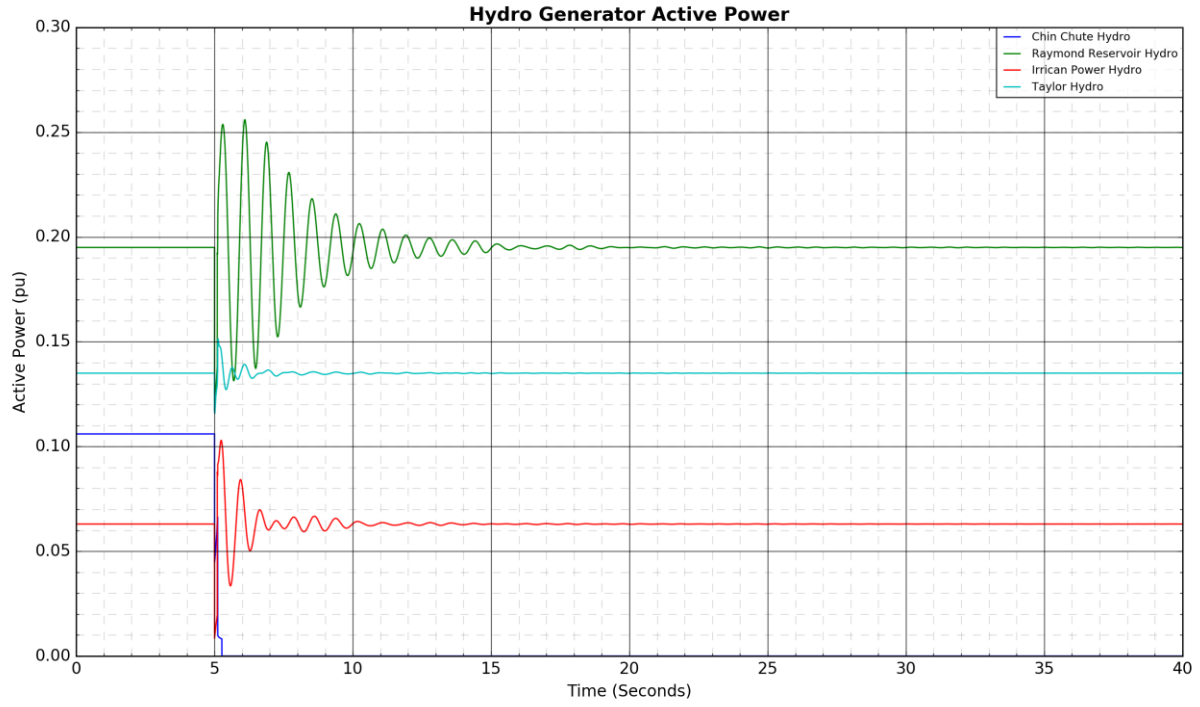
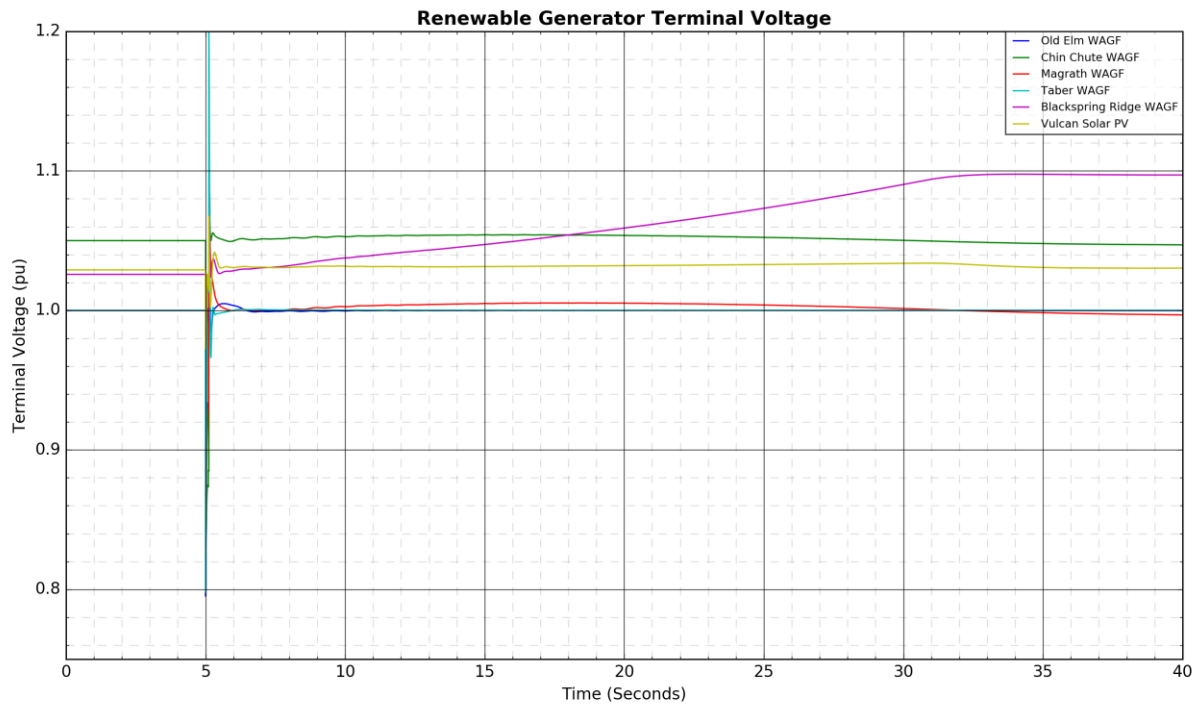
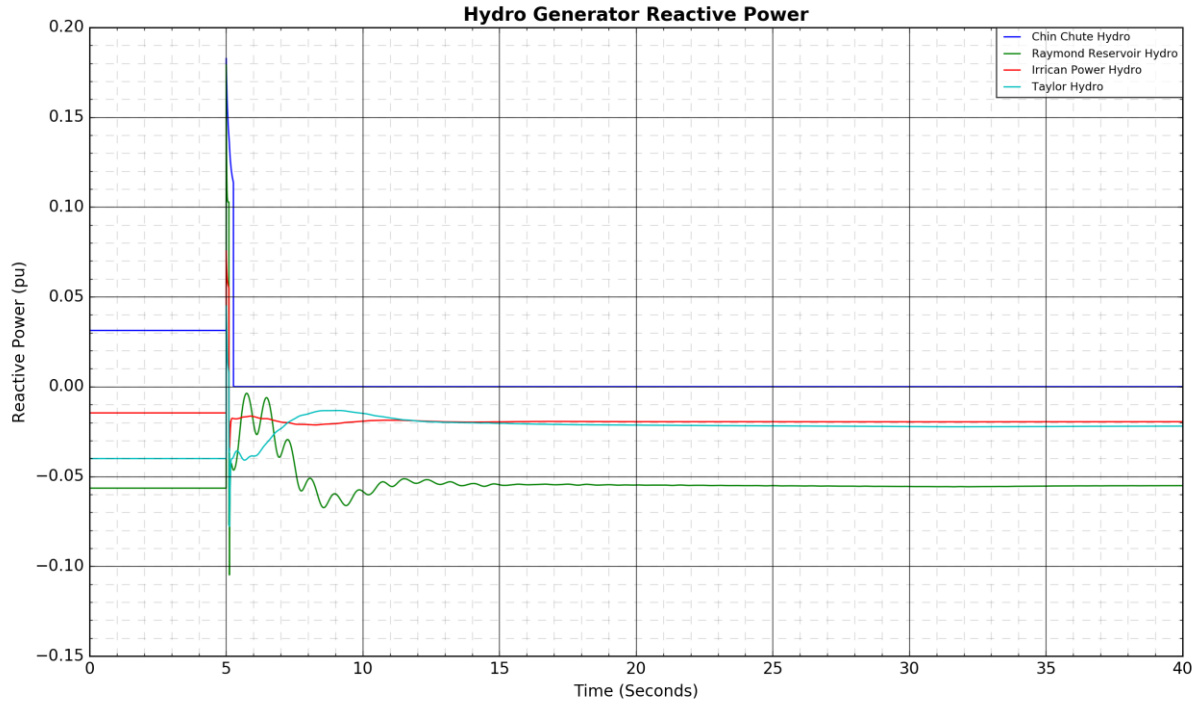


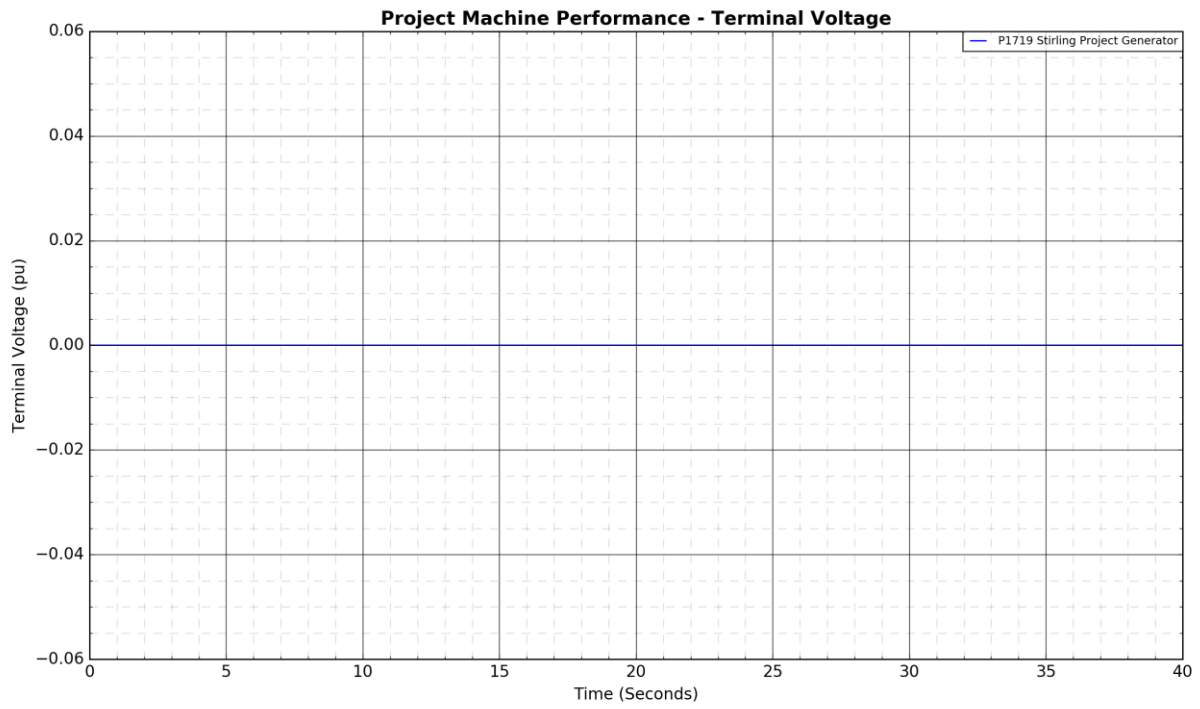
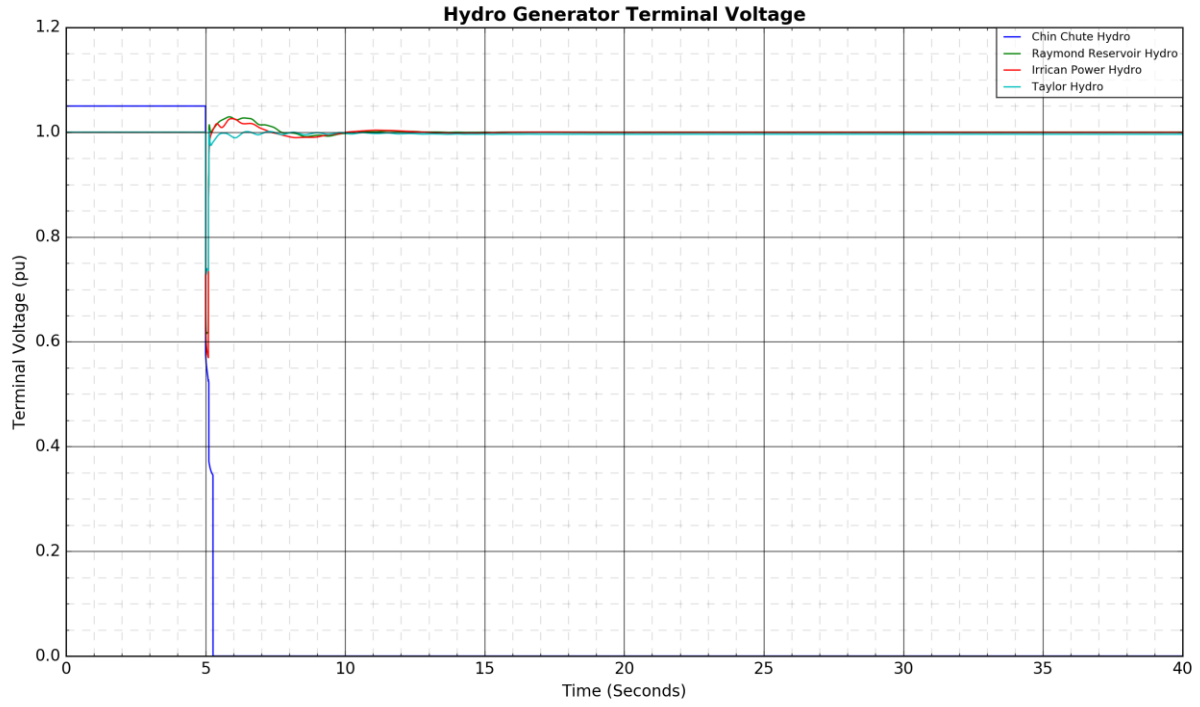
Figure A4-2: 820L Coaldale 254S to Chin Chute 315S T-Tap to Stirling 67S: Fault Near Stirling 67S











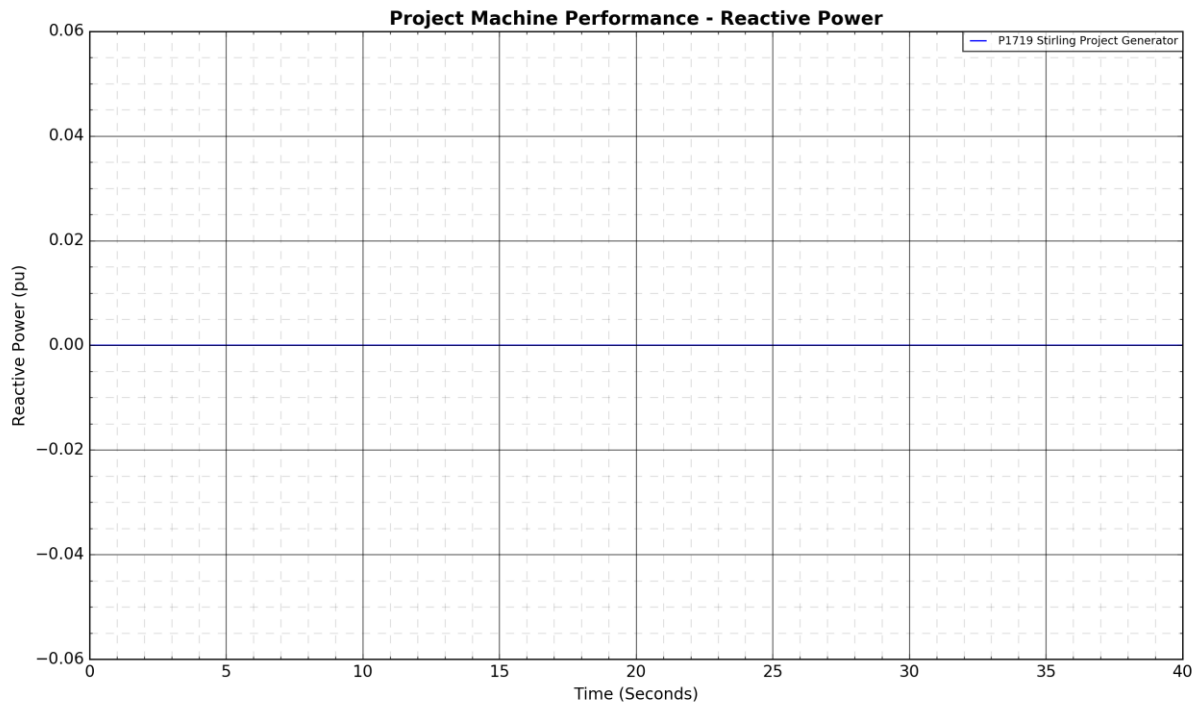
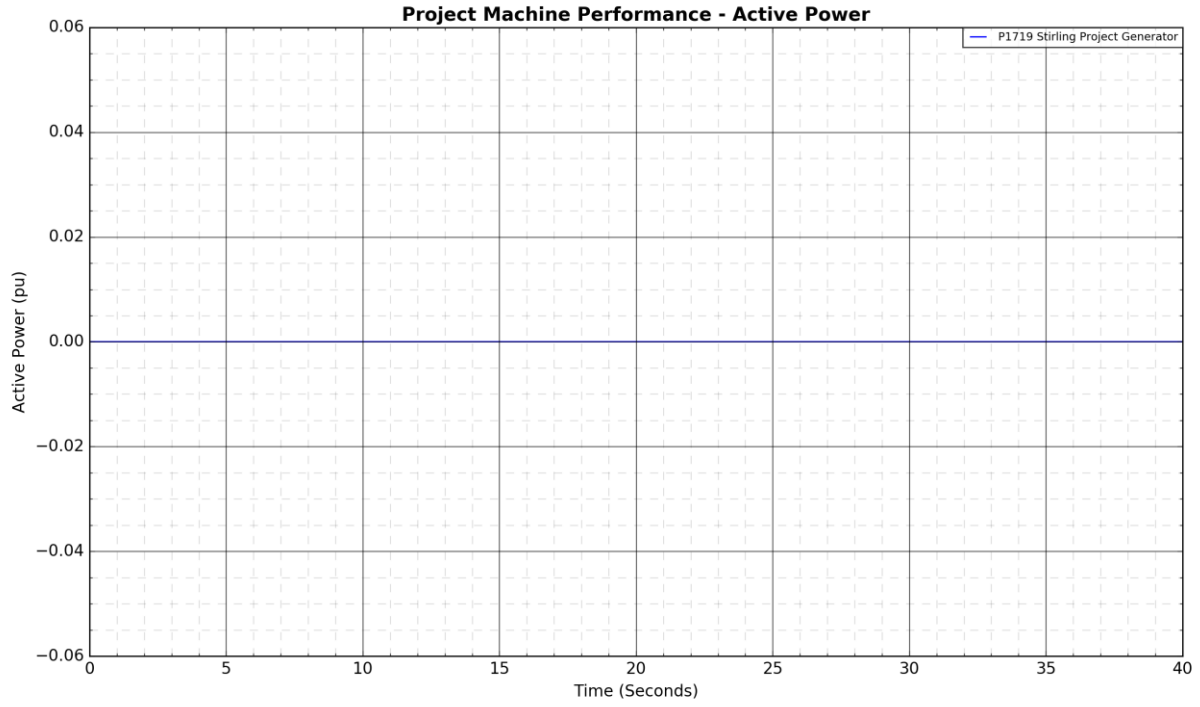
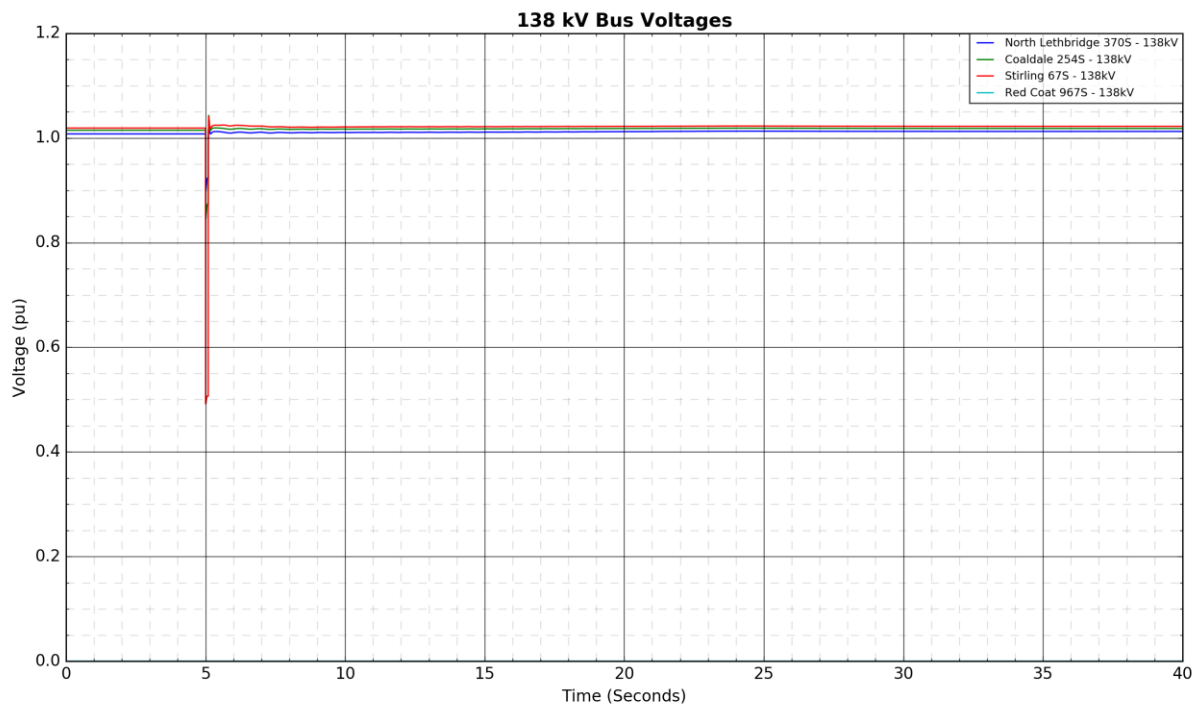
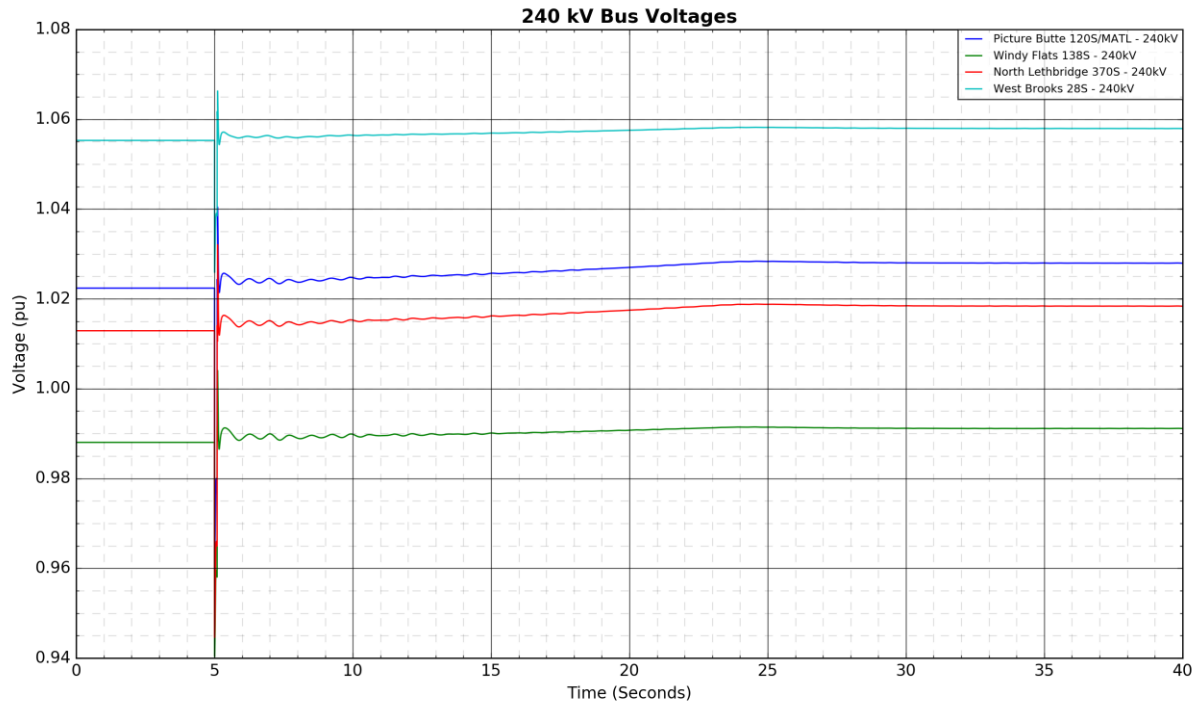
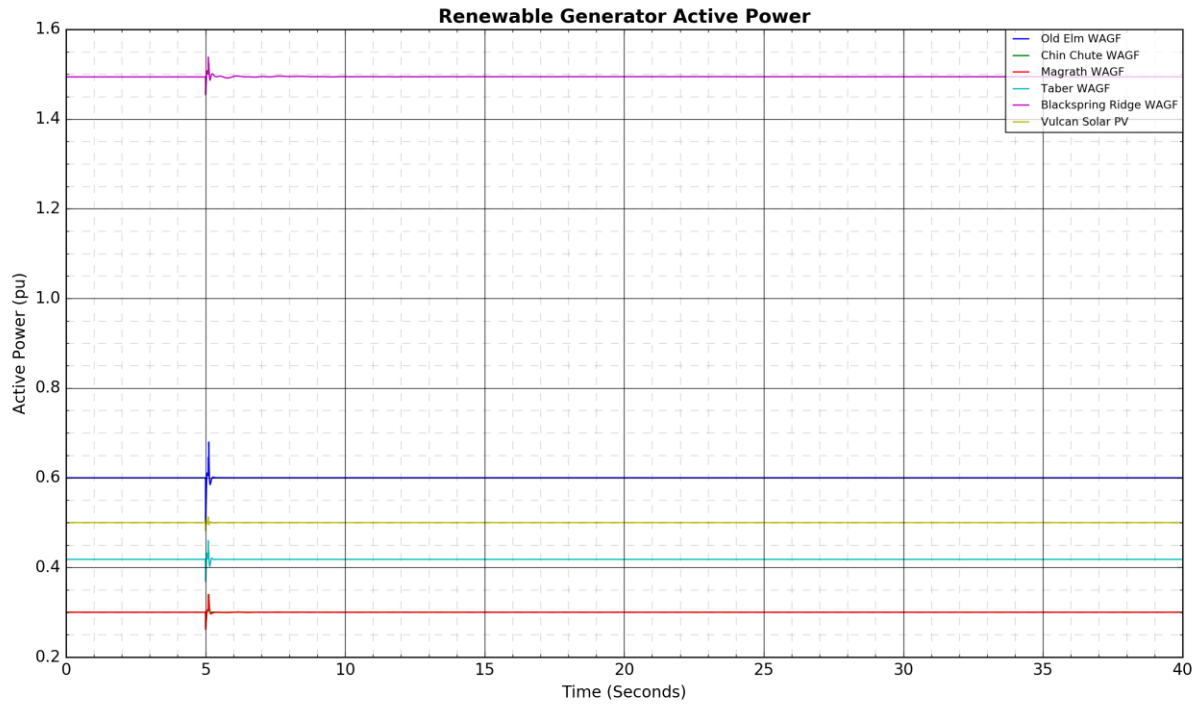
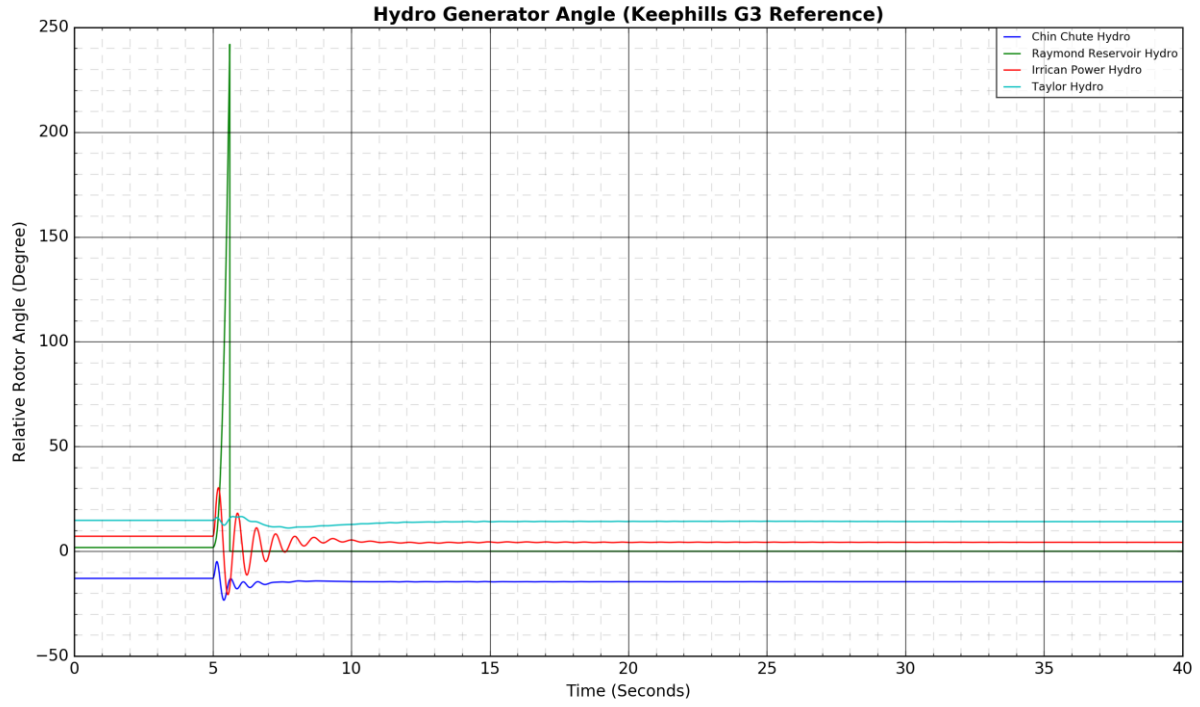
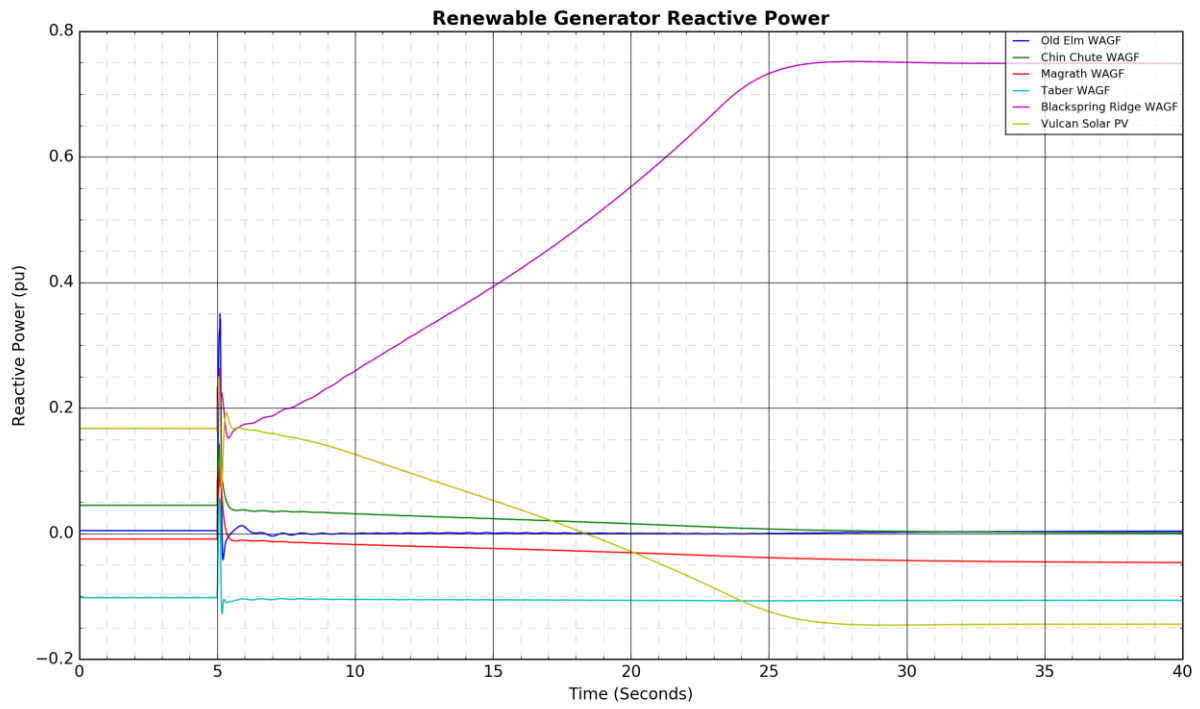
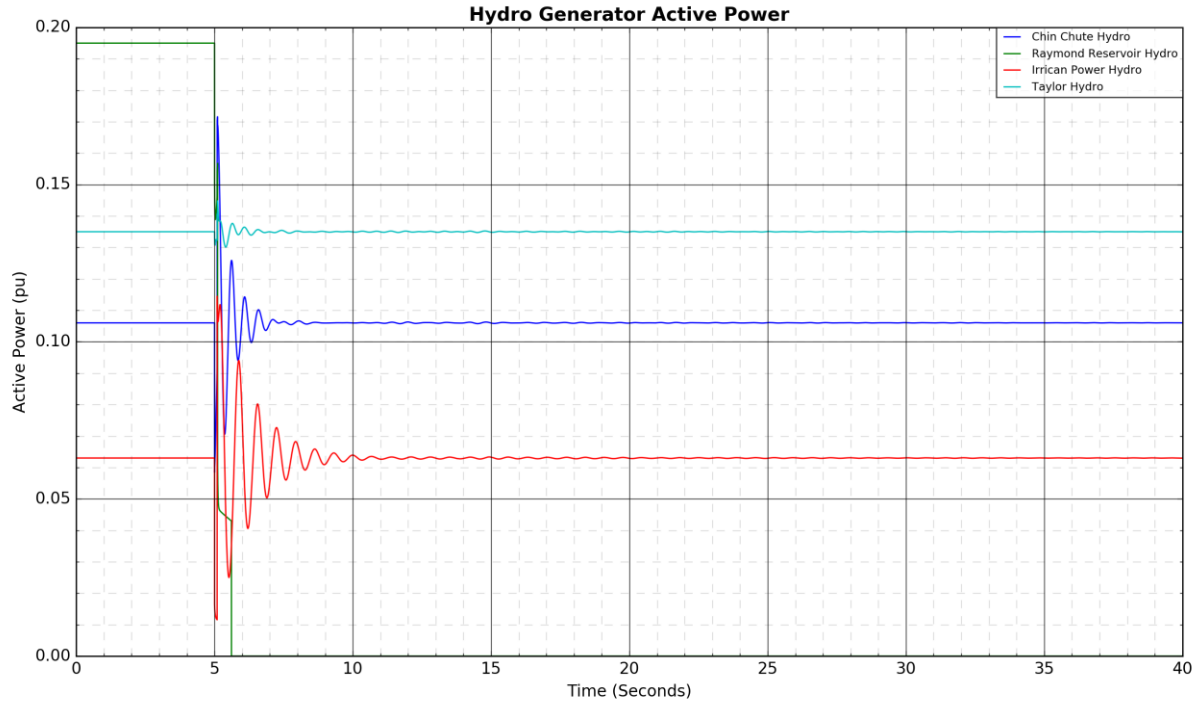


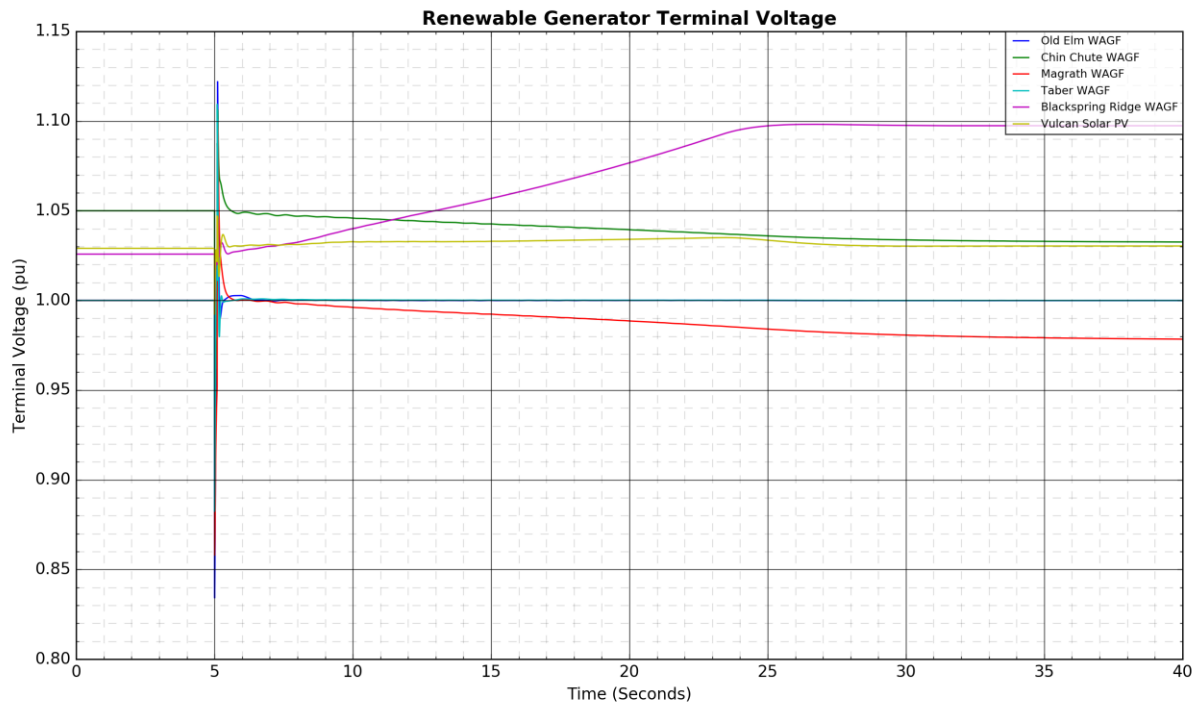
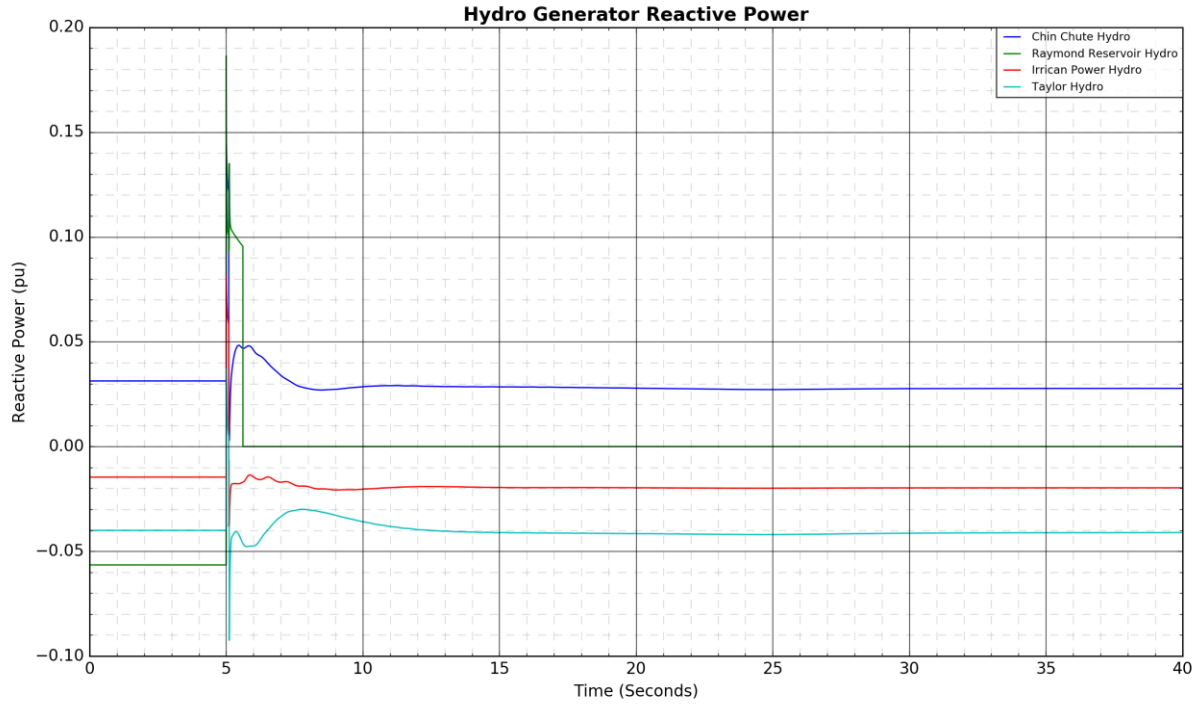
Figure A4-3: 225L Stirling 67S to Raymond Reservoir 313S T-Tap to Magrath 225S: Fault Near Stirling 67S

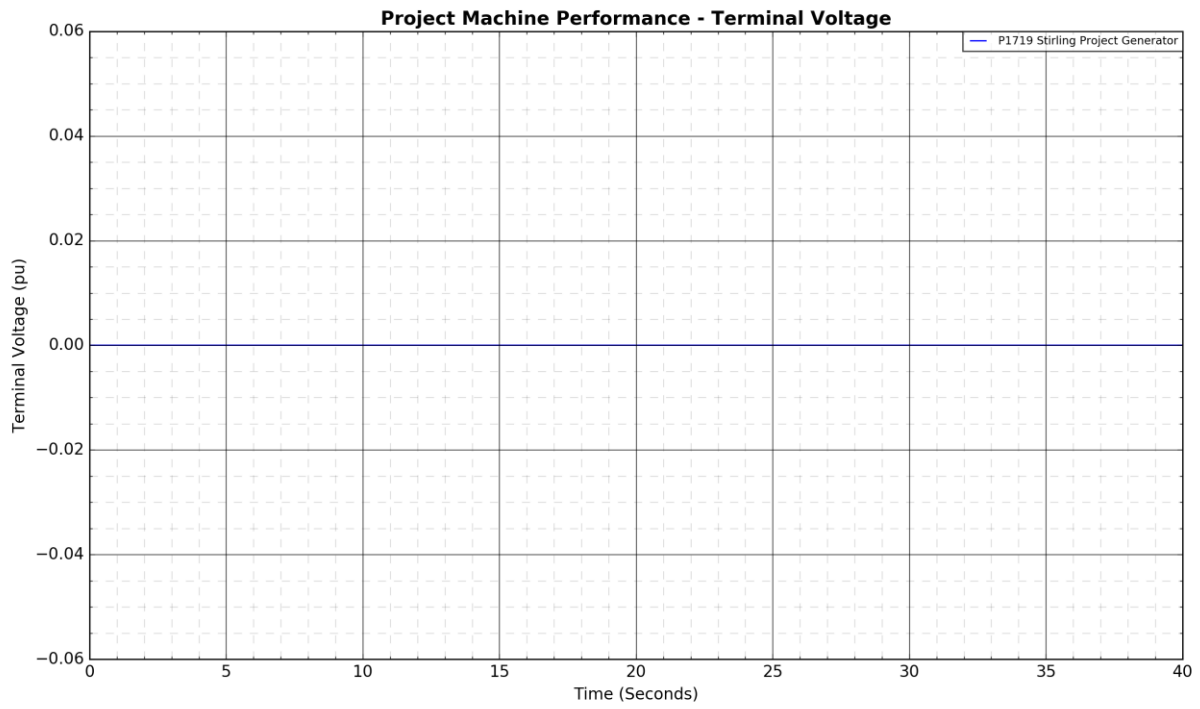
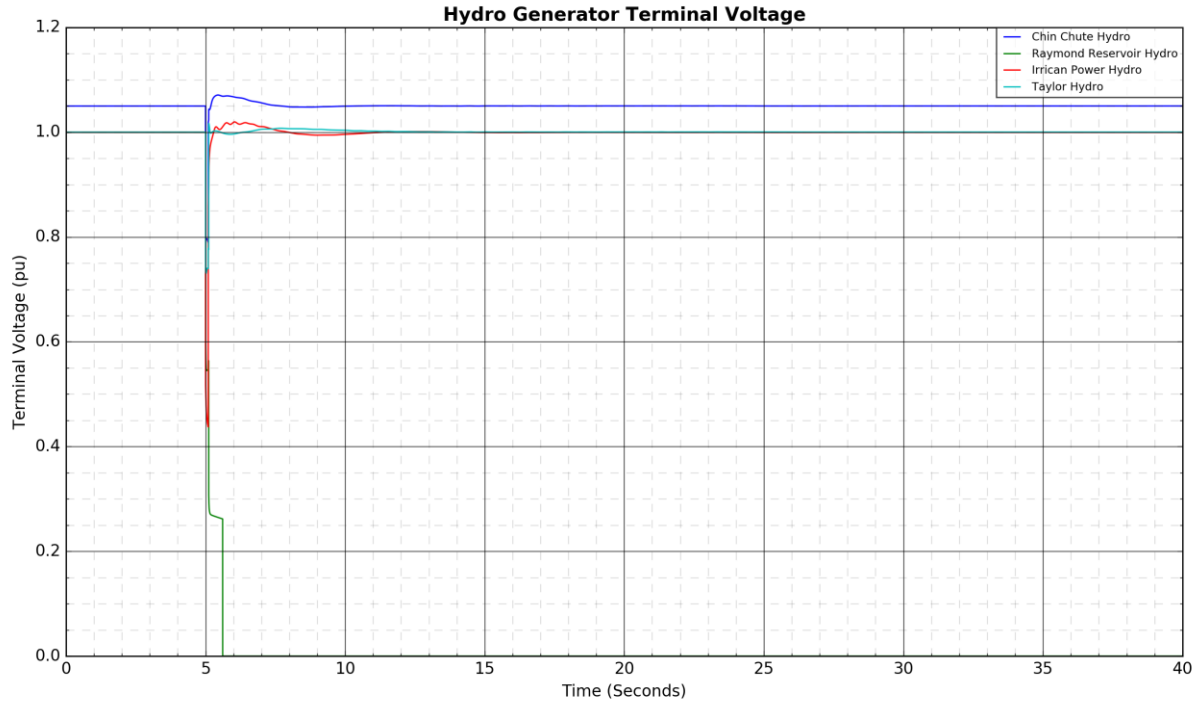




Engineering Connection Assessment Results: Stirling Wind Project Connection







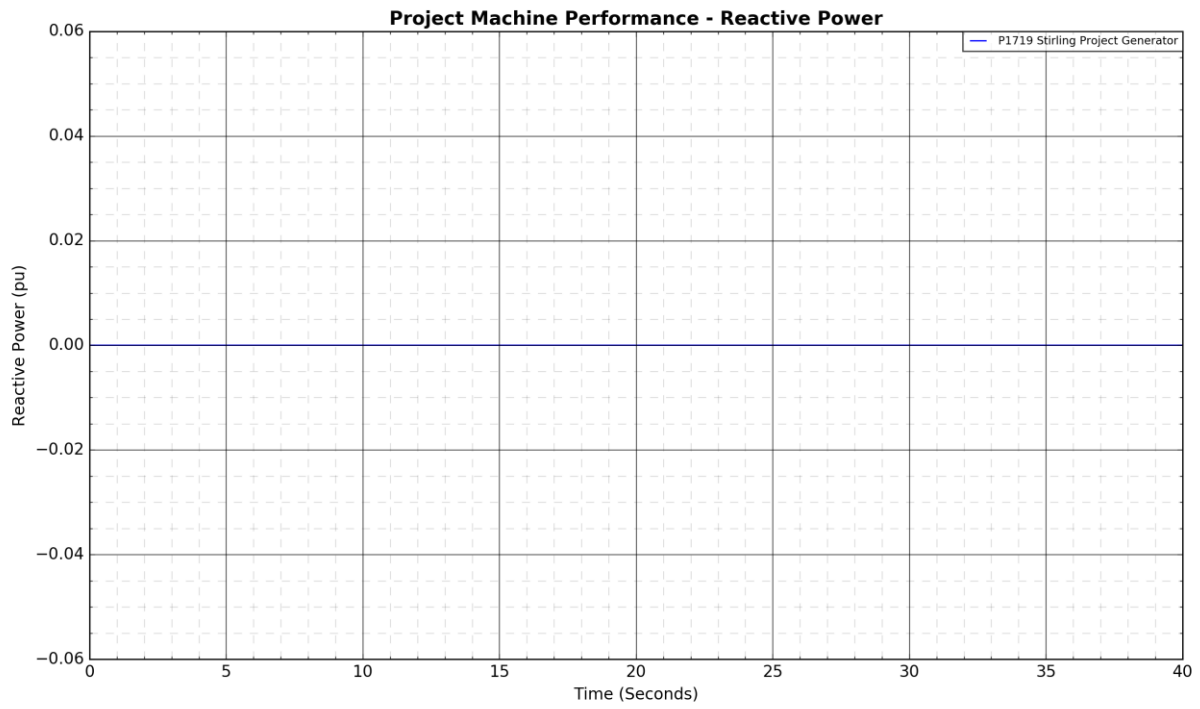
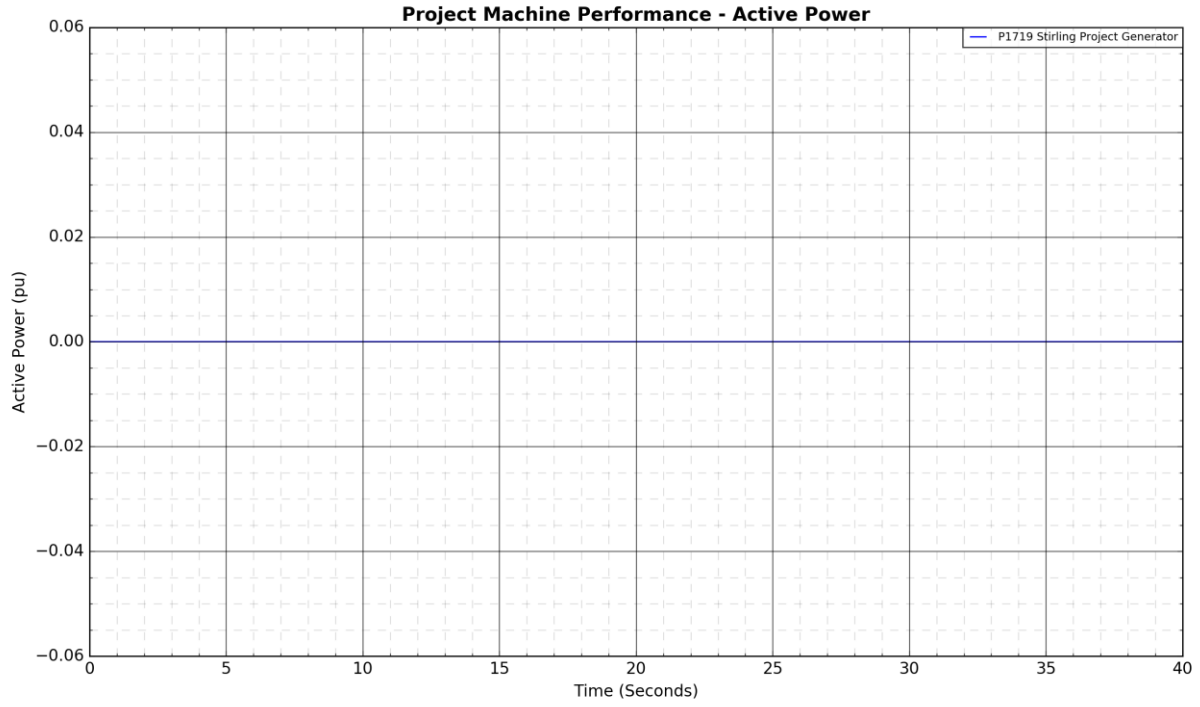
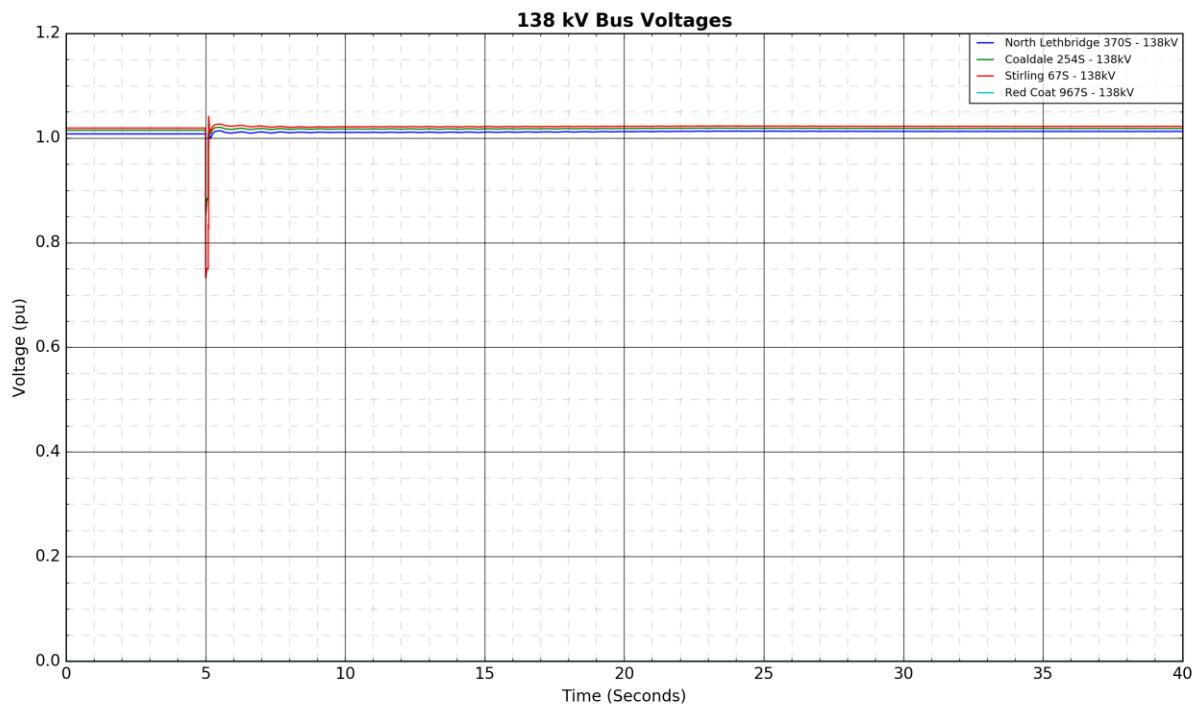
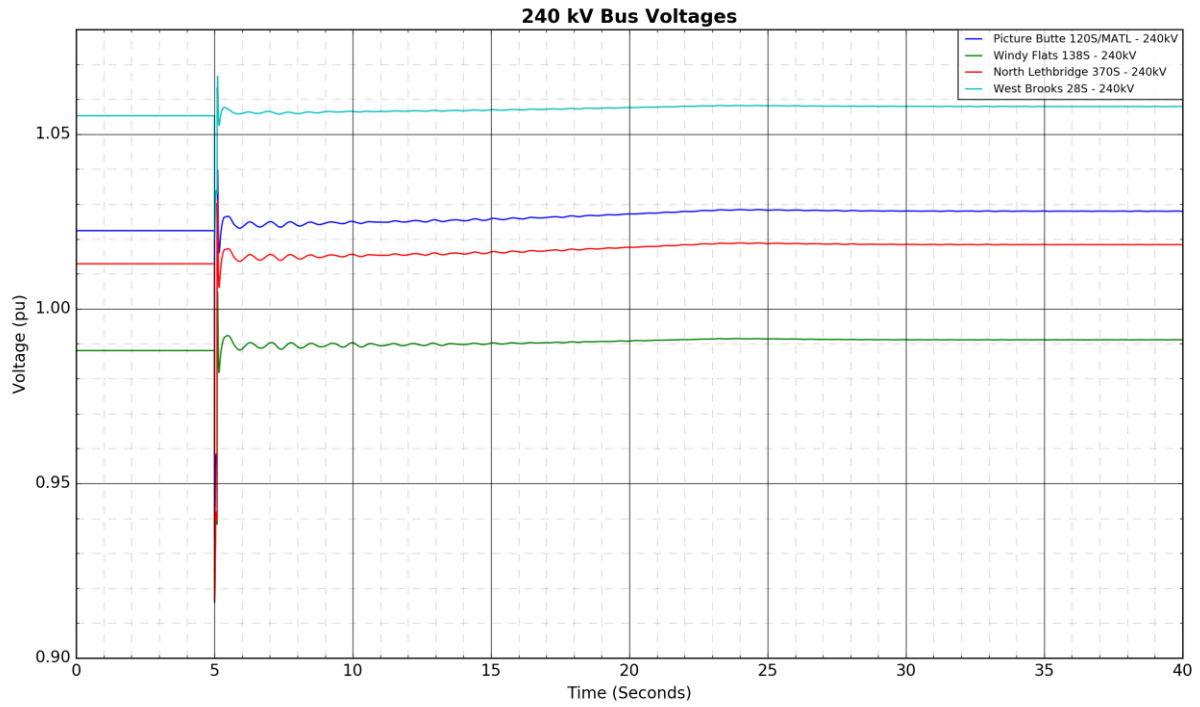
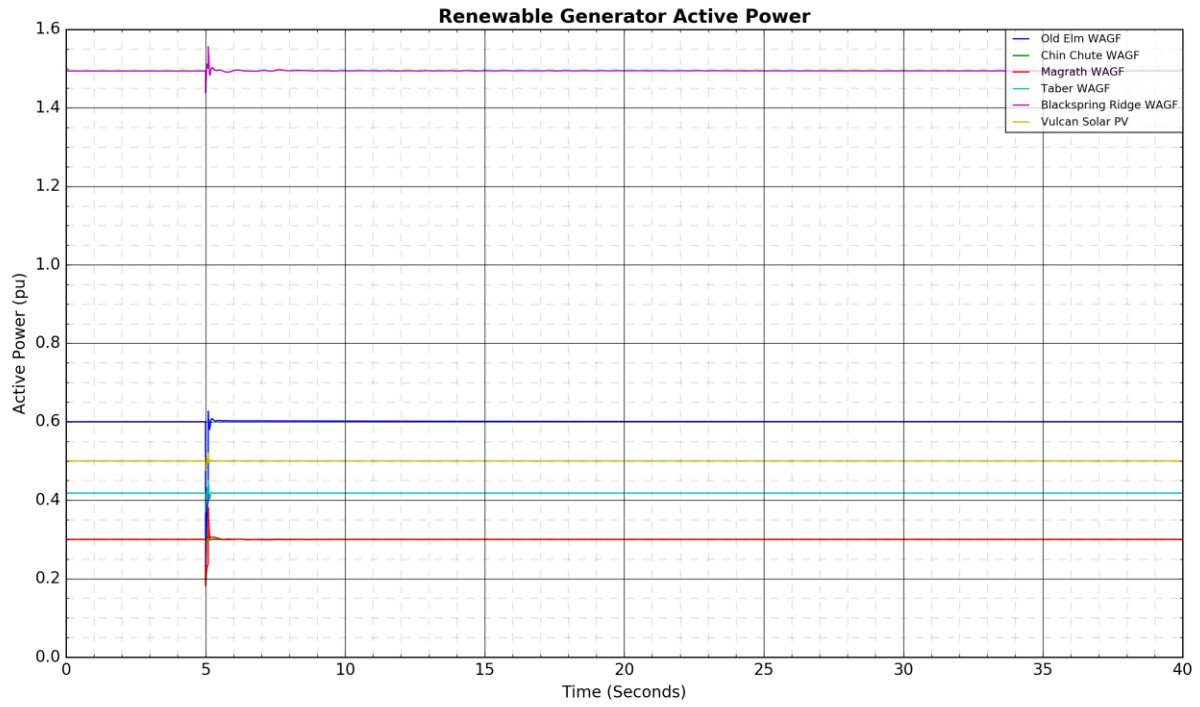
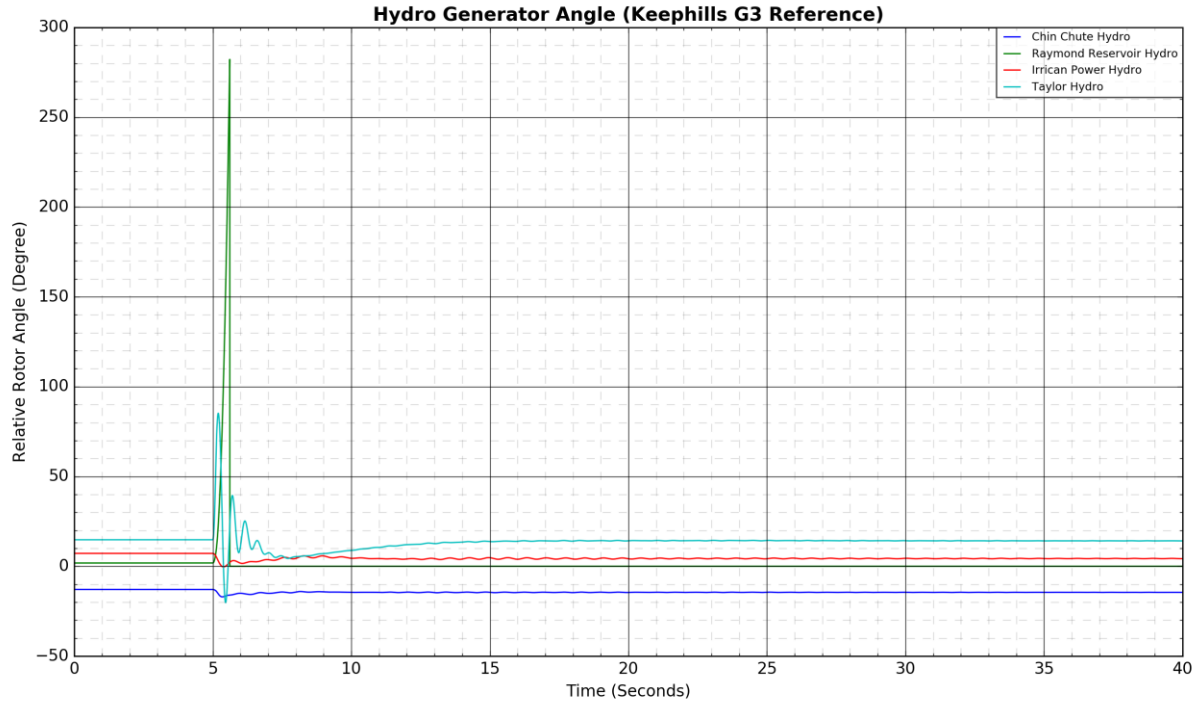
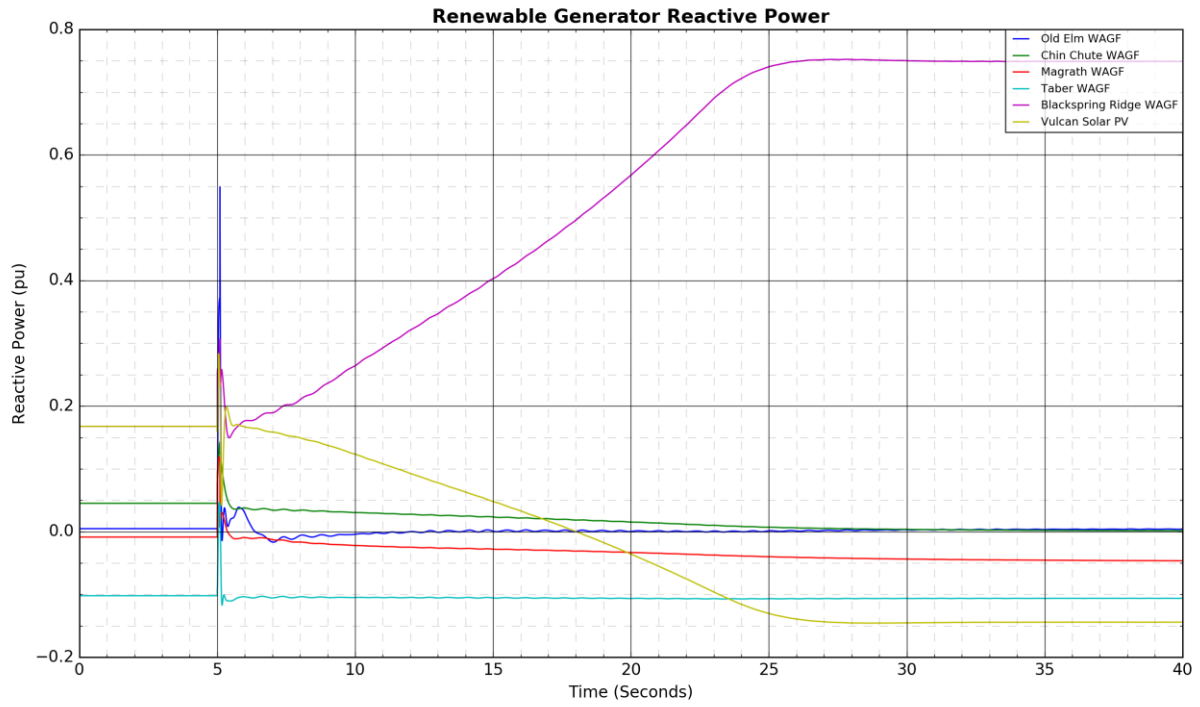
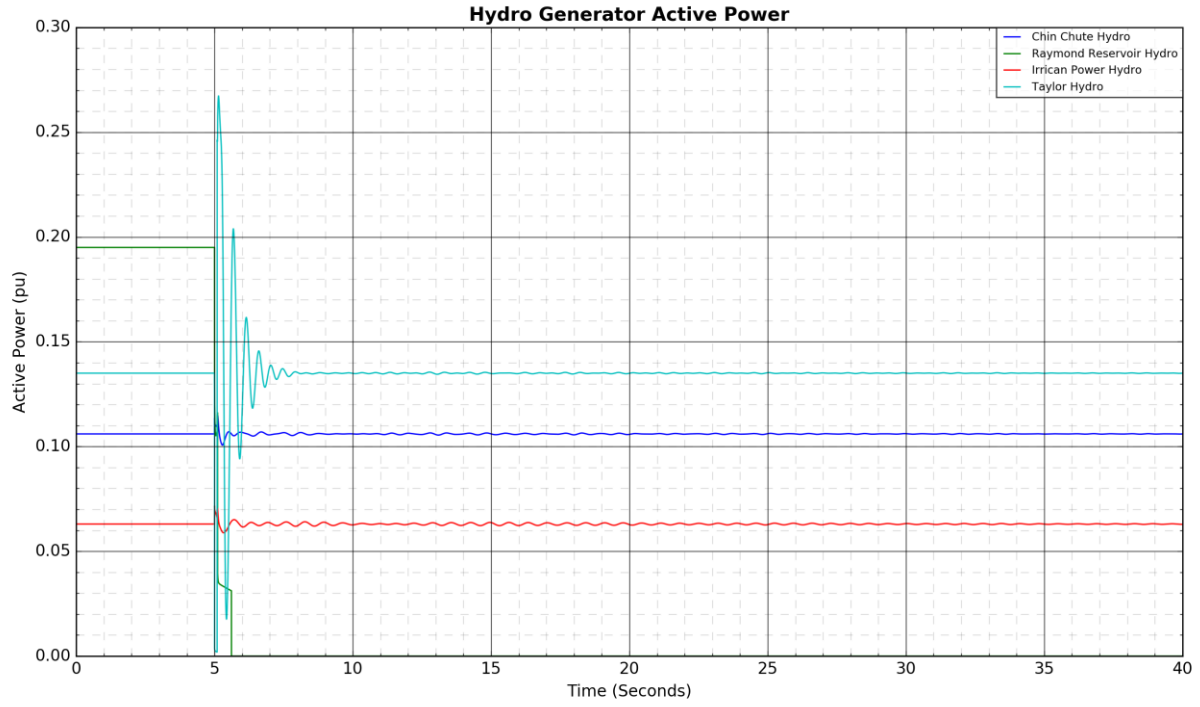
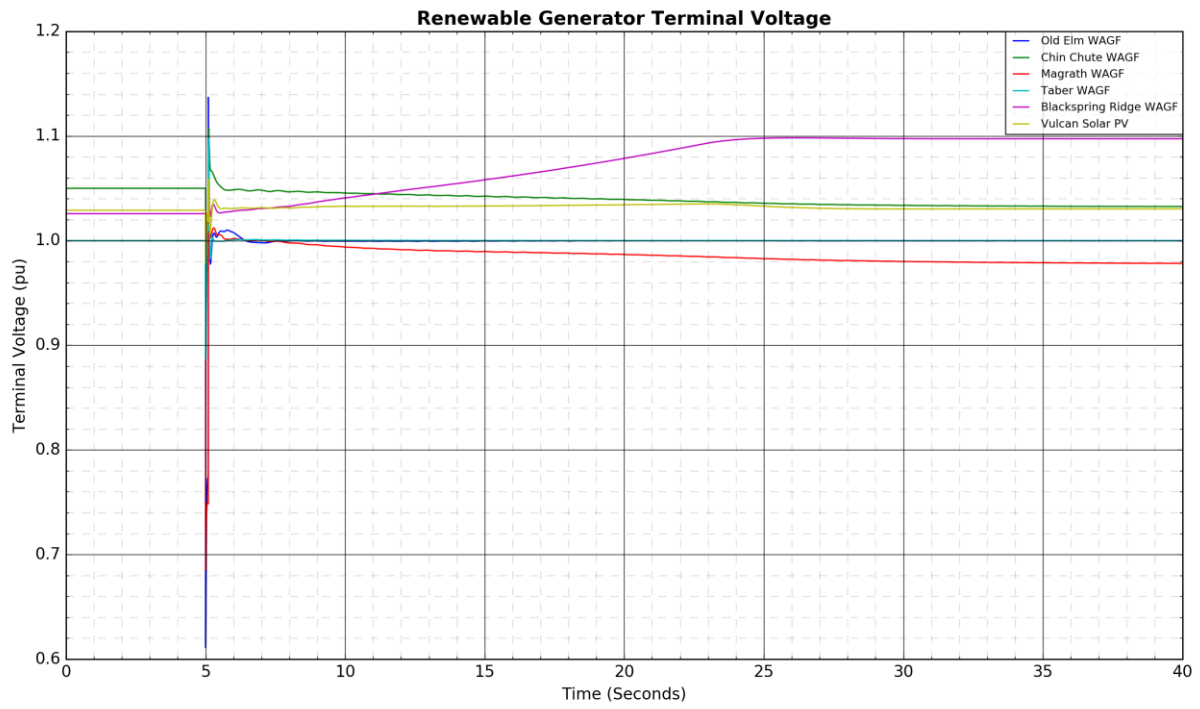
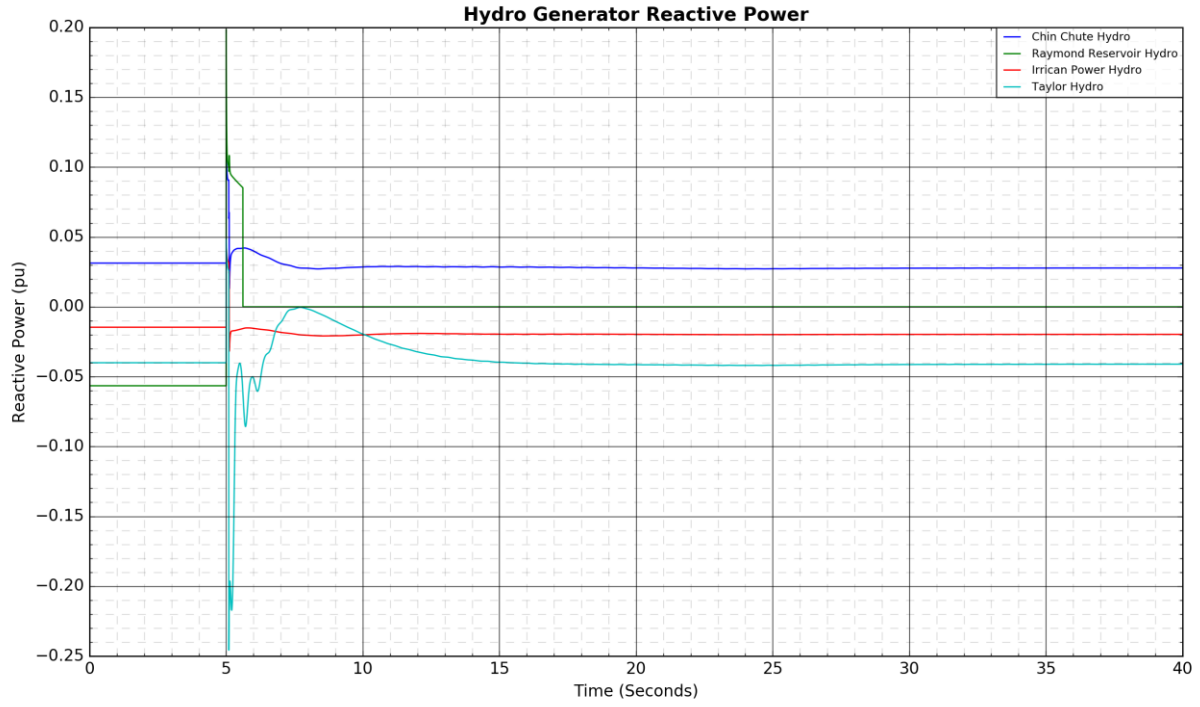


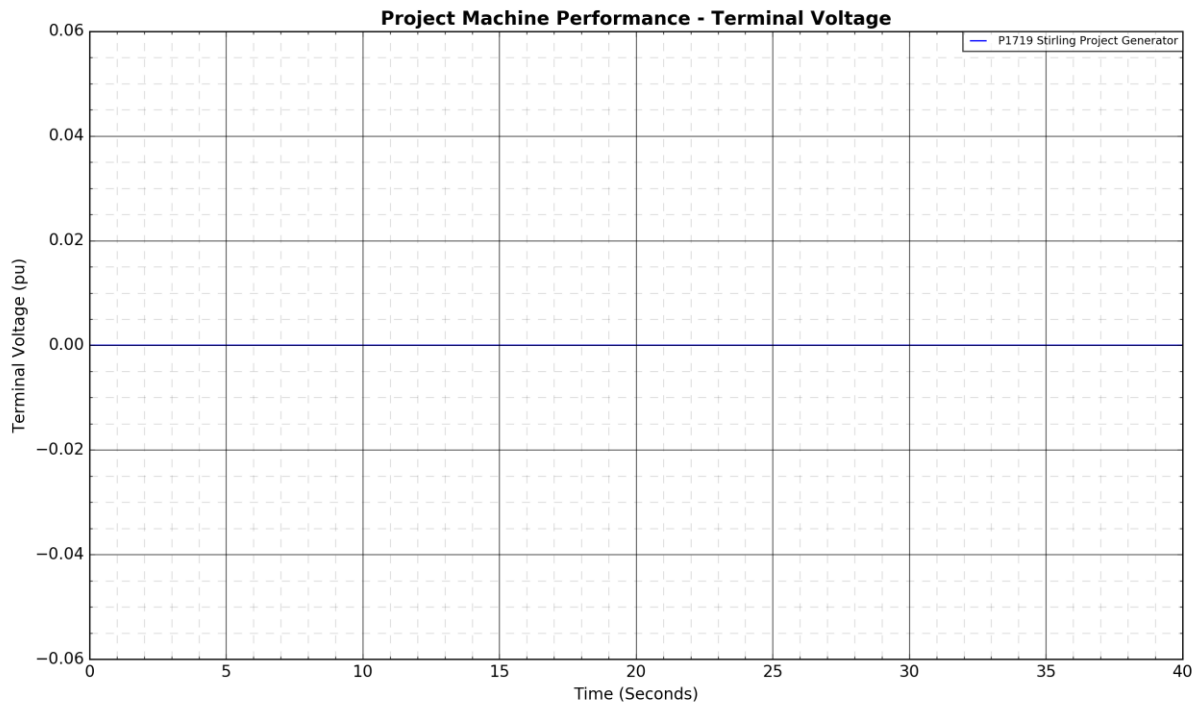
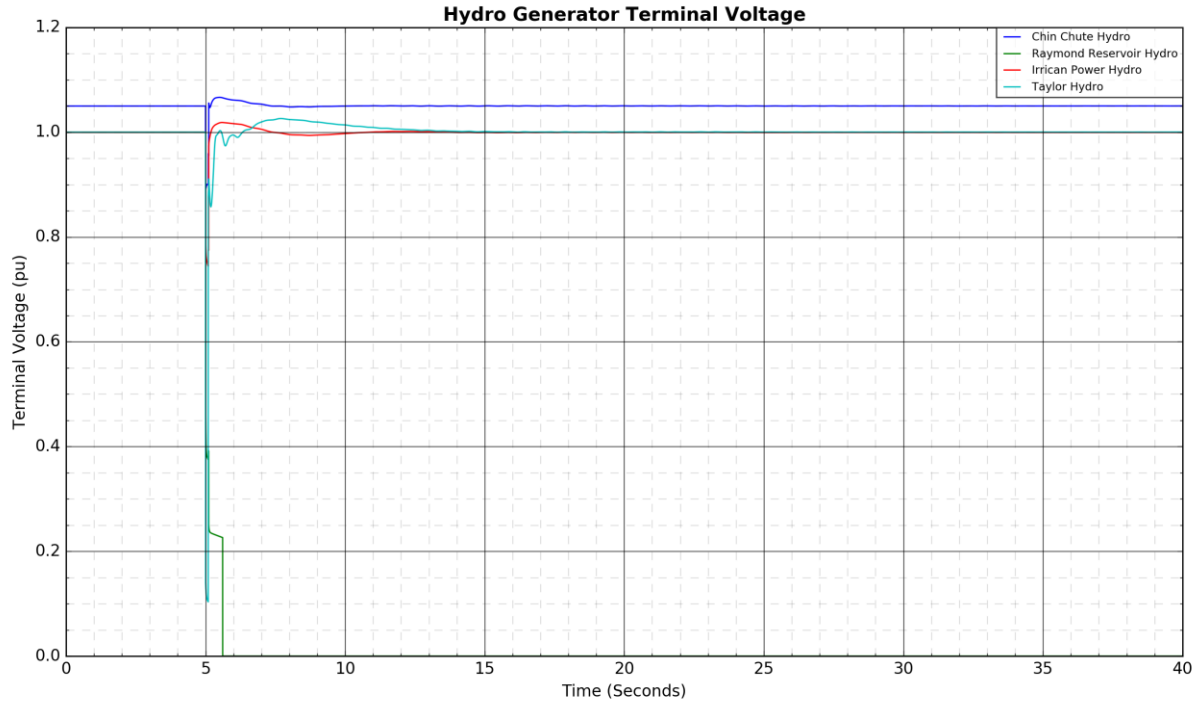
Figure A4-4: 225L Stirling 67S to Raymond Reservoir 313S T-Tap to Magrath 225S: Fault Near Magrath 225S











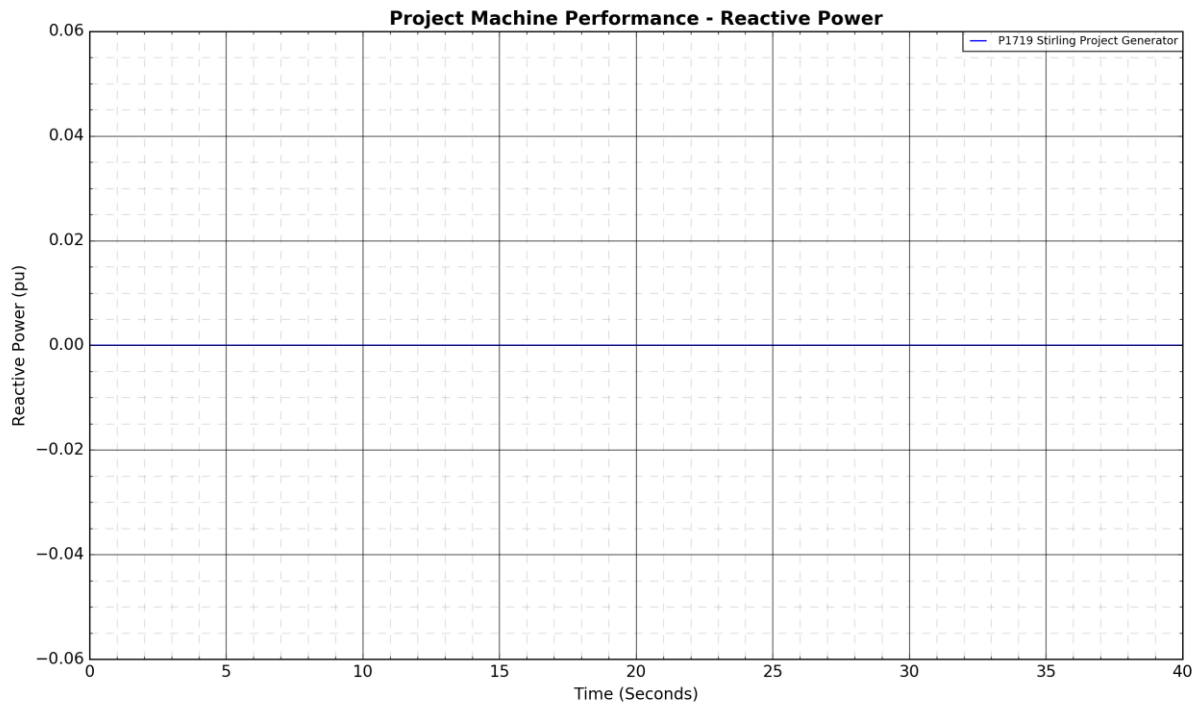
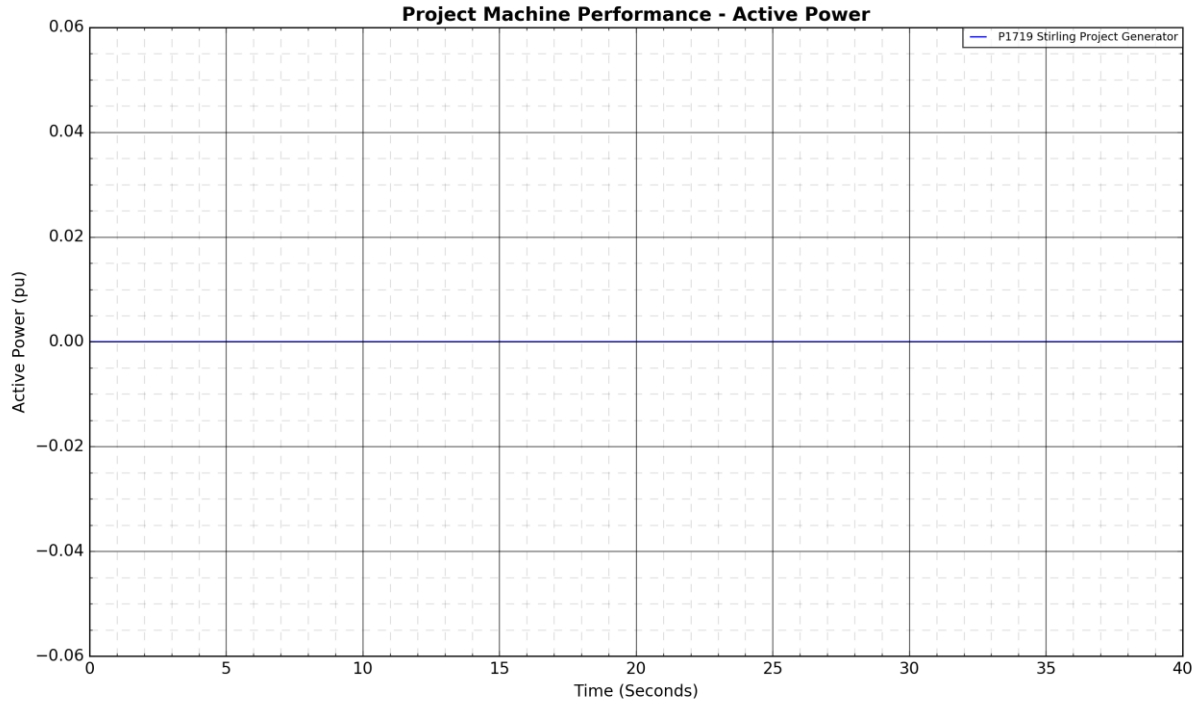
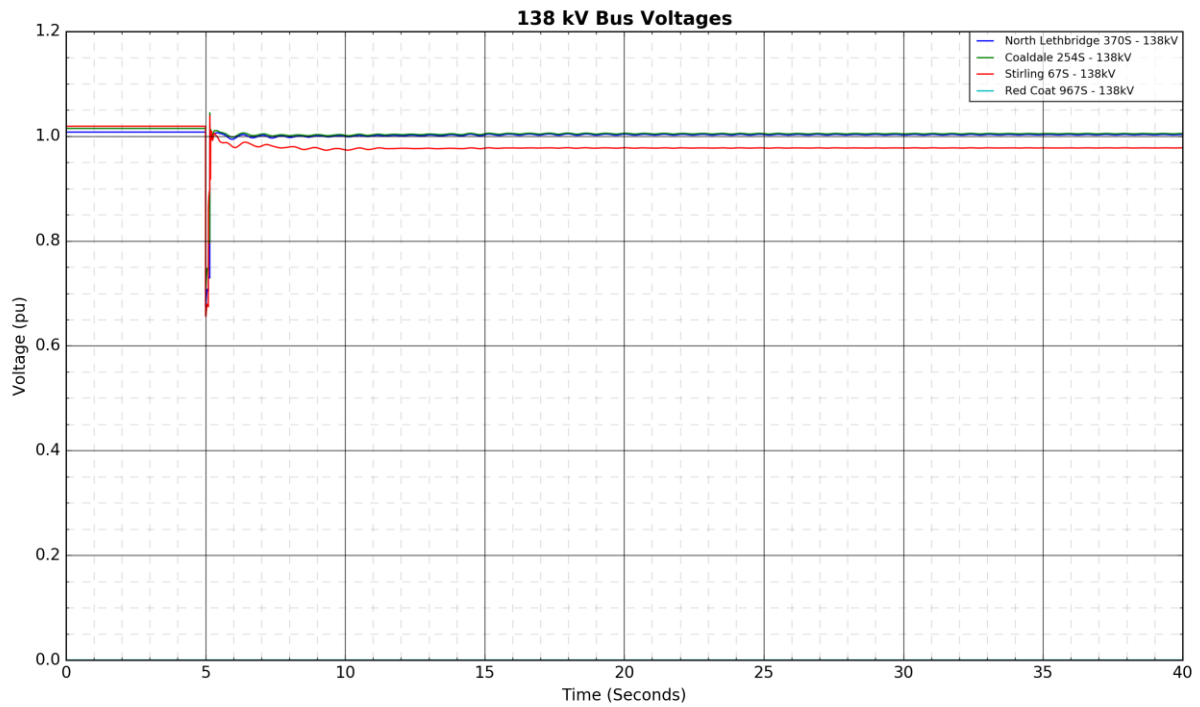
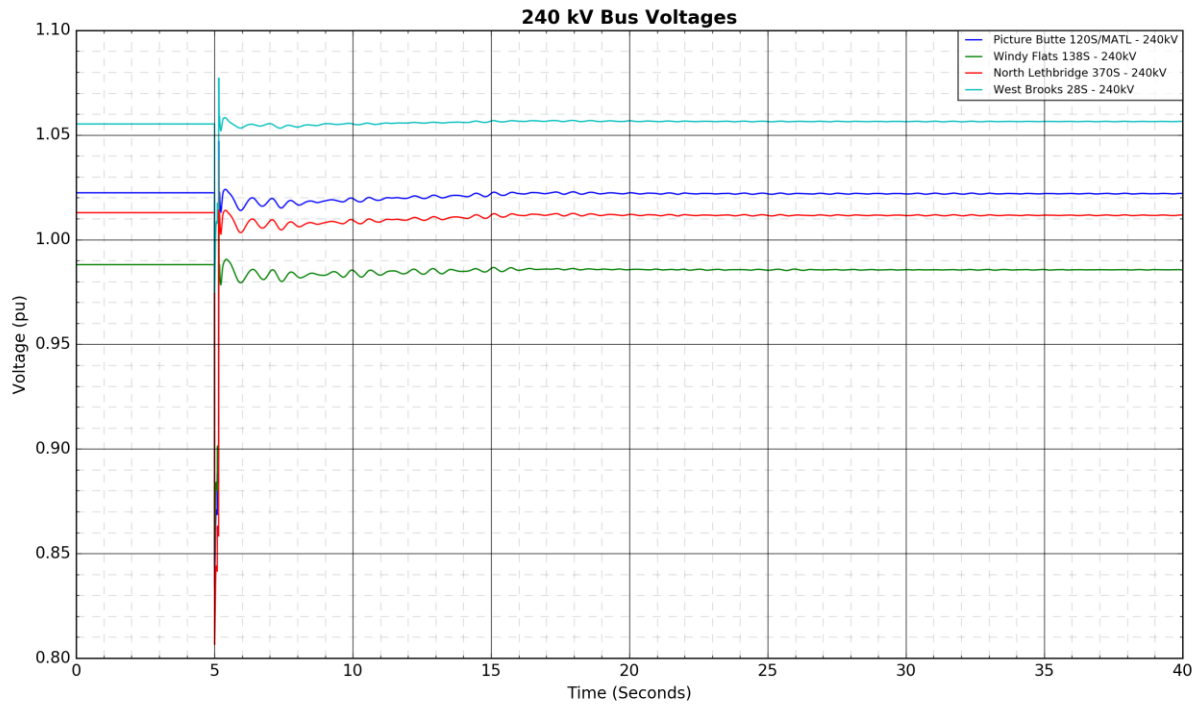
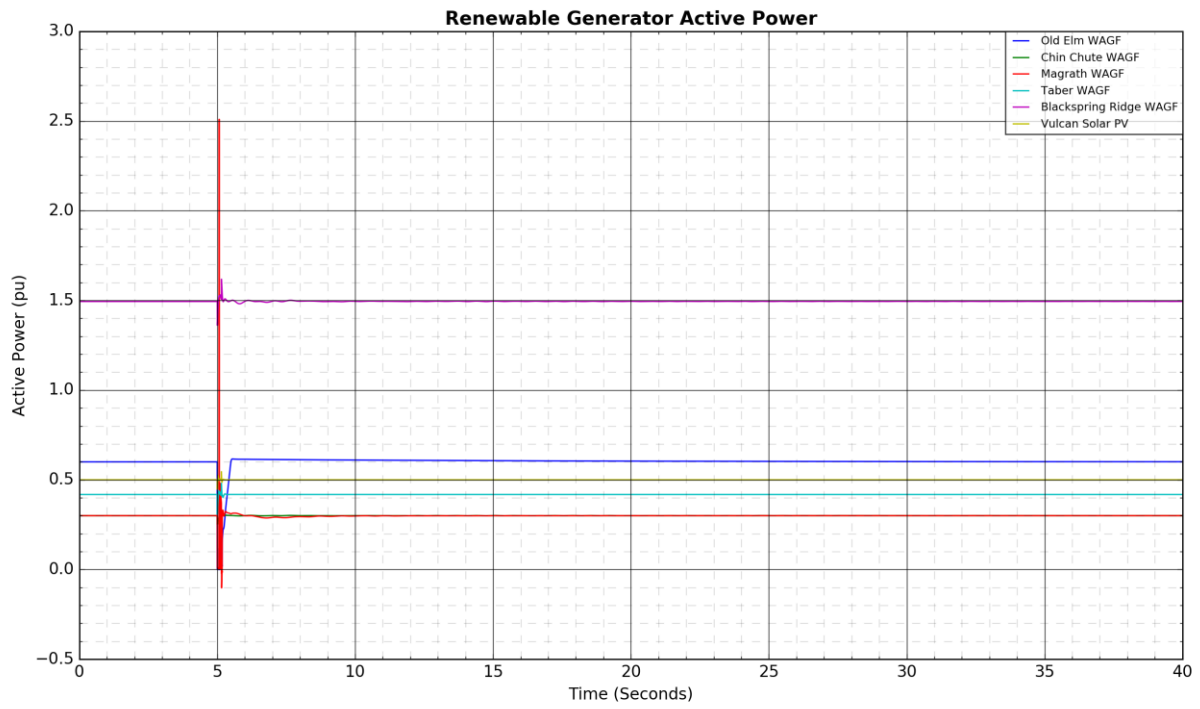
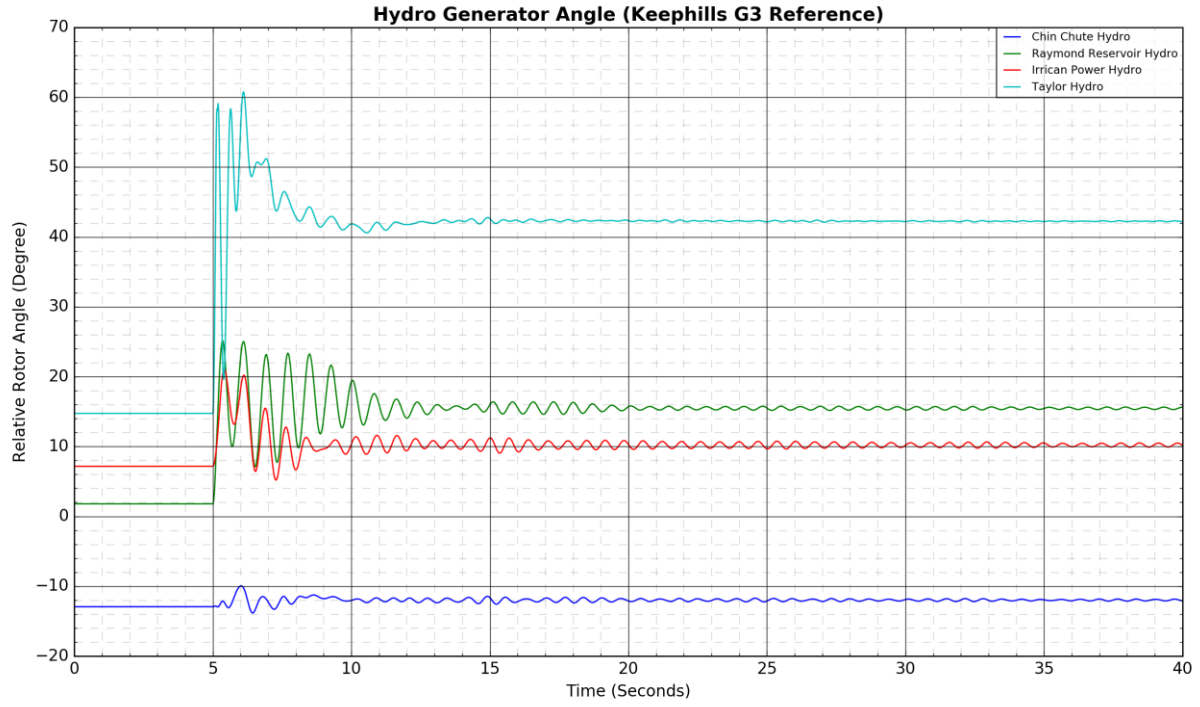
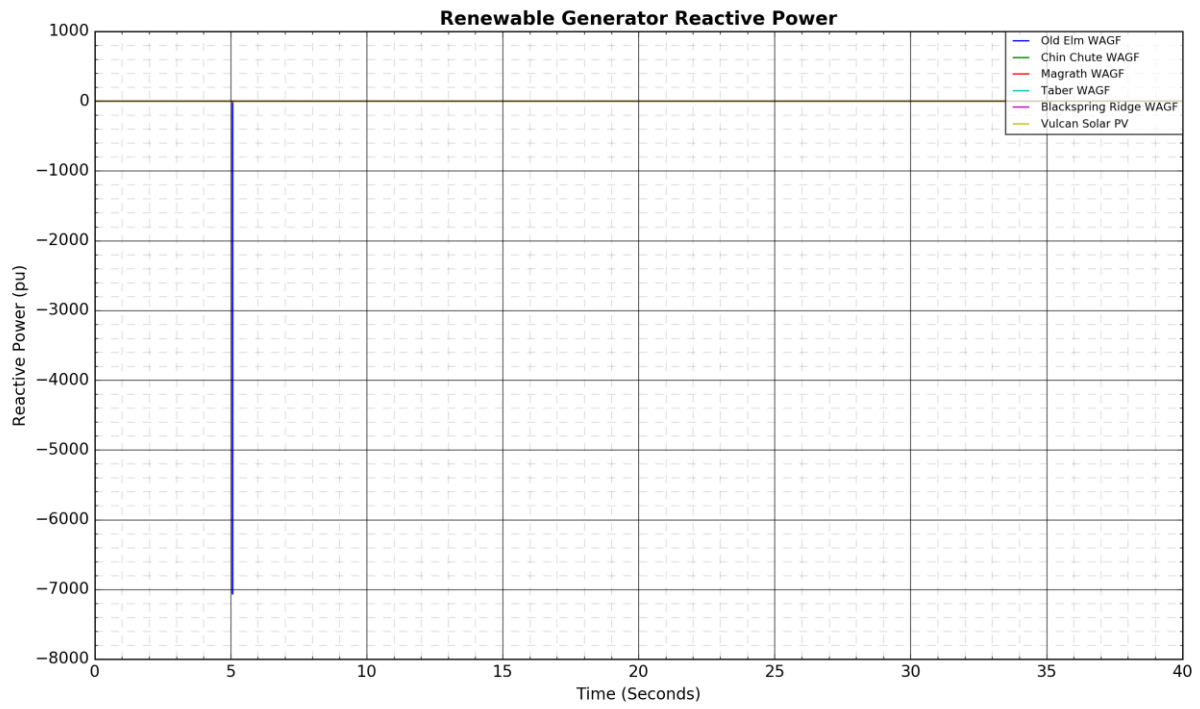
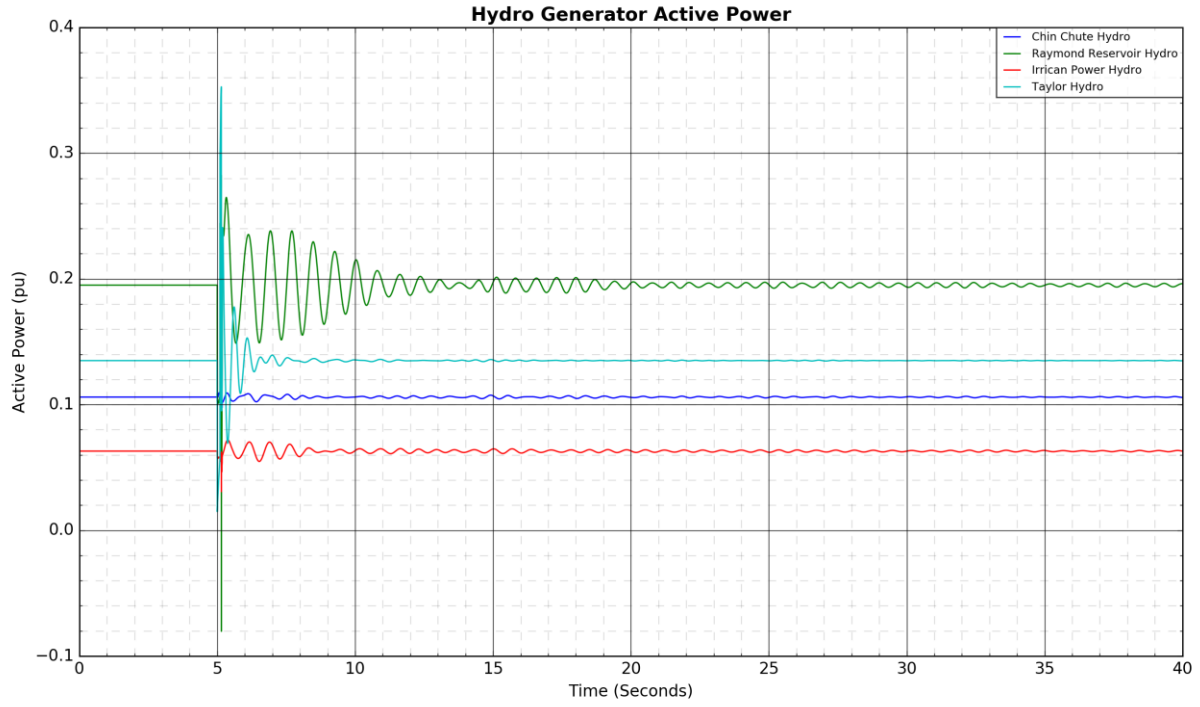


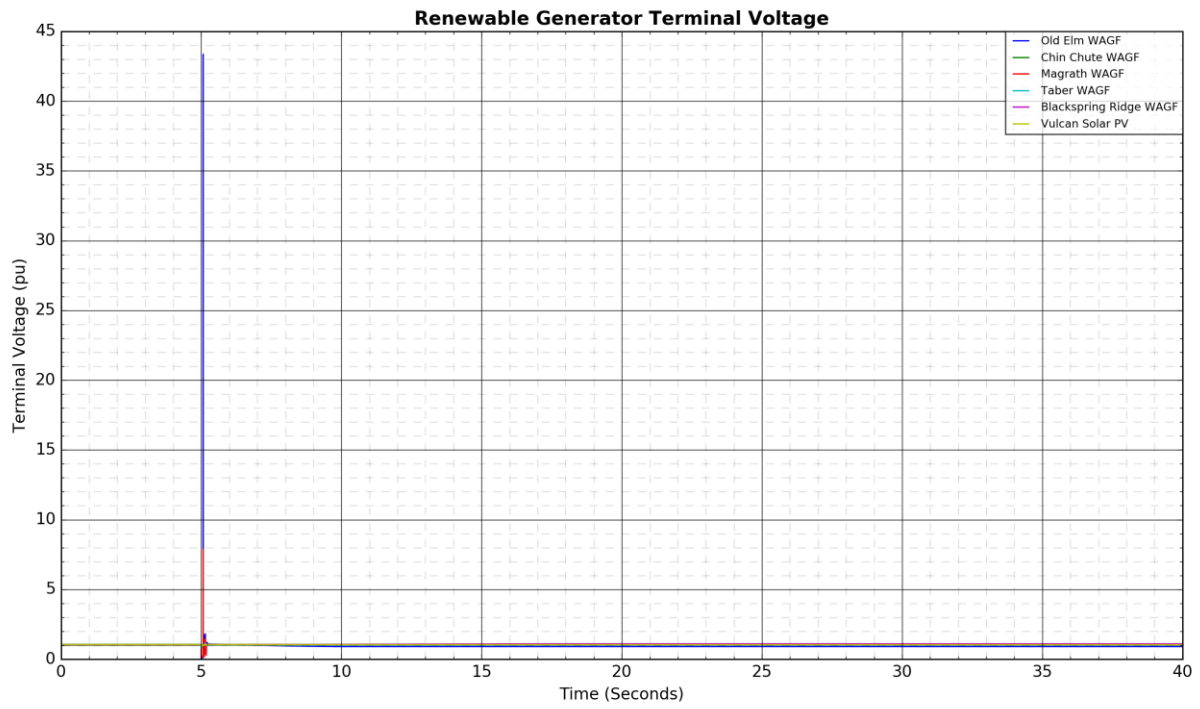
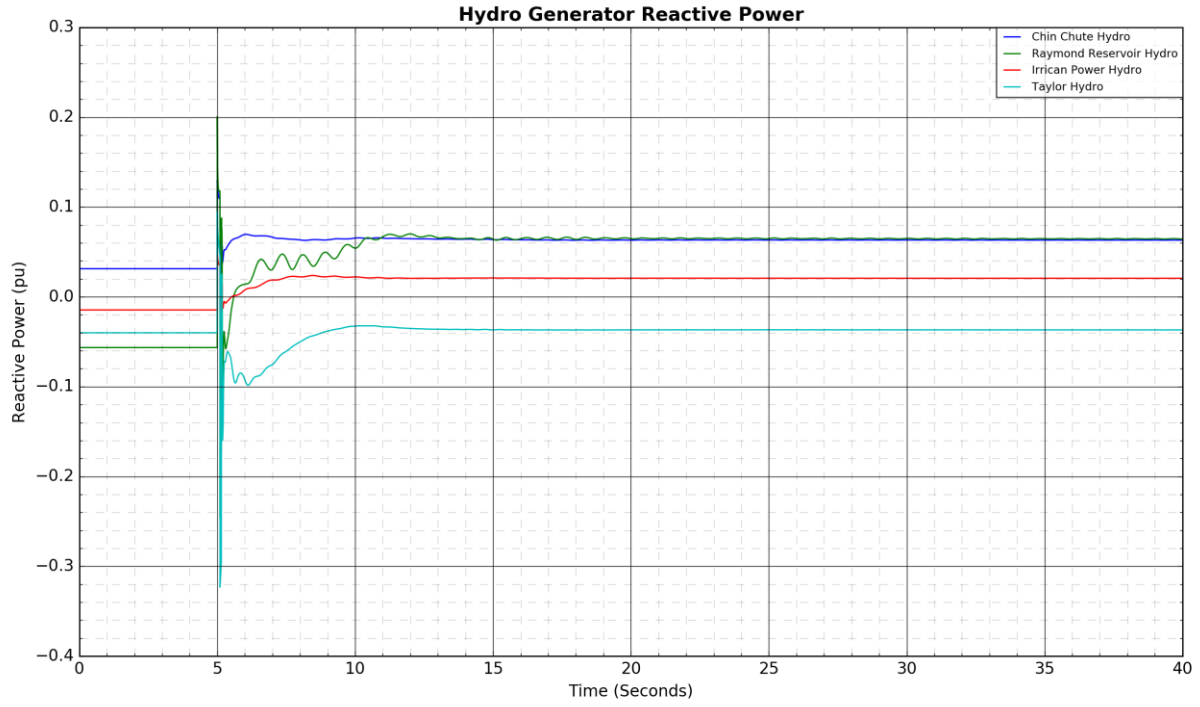
Figure A4-5: 863L Magrath 225S to Riverbend 618S: Fault Near Magrath 225S

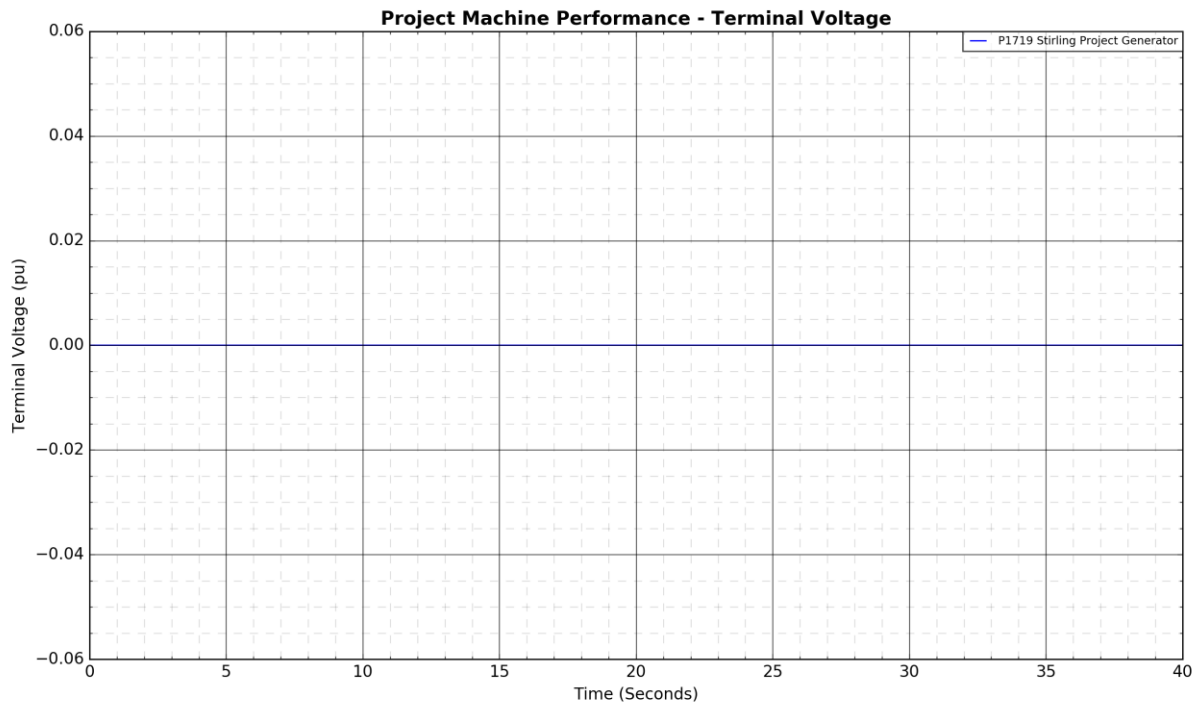
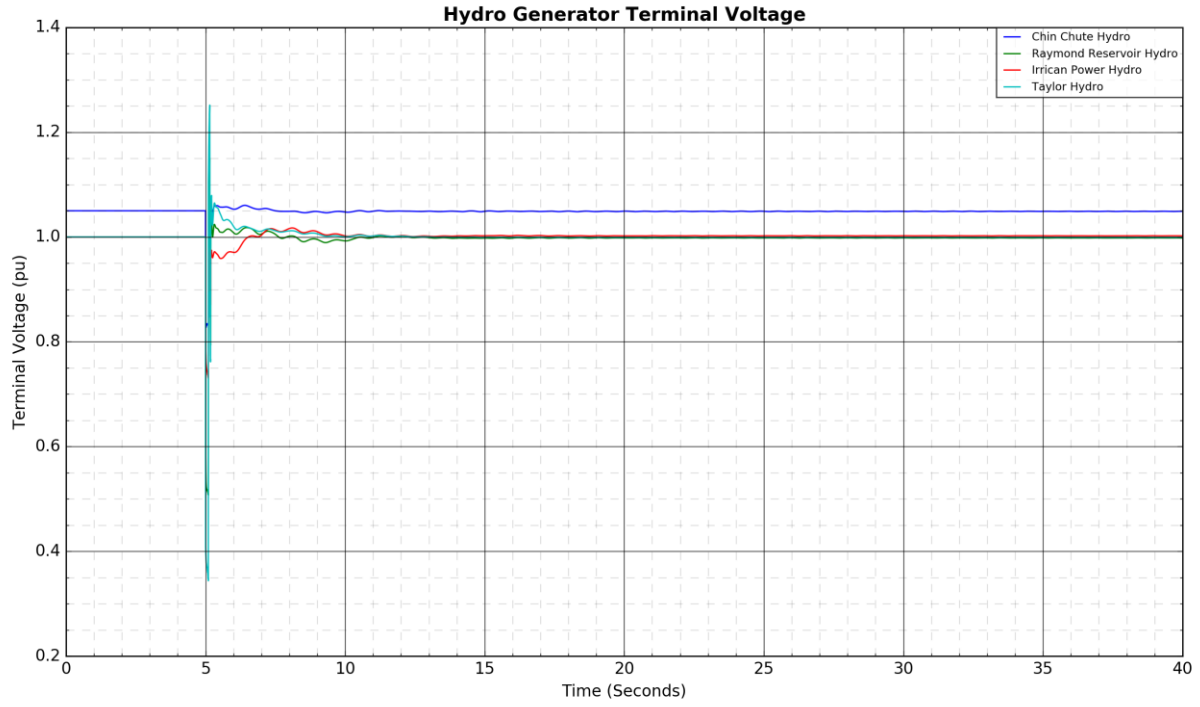




Engineering Connection Assessment Results: Stirling Wind Project Connection







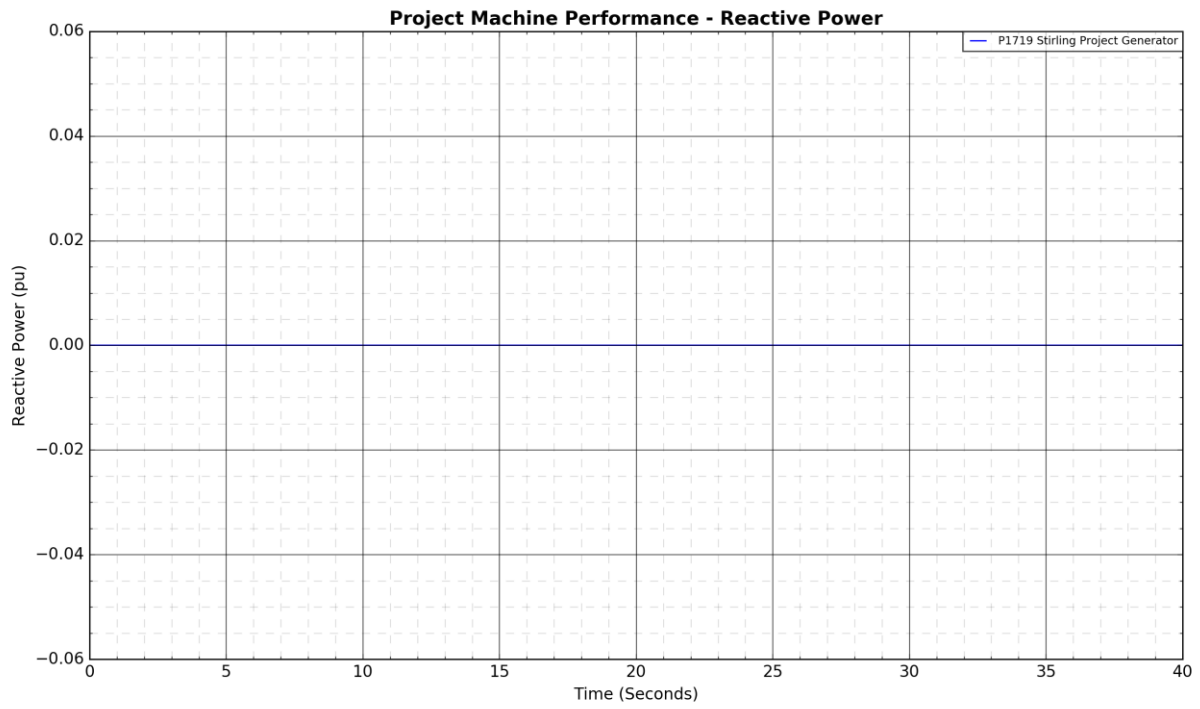
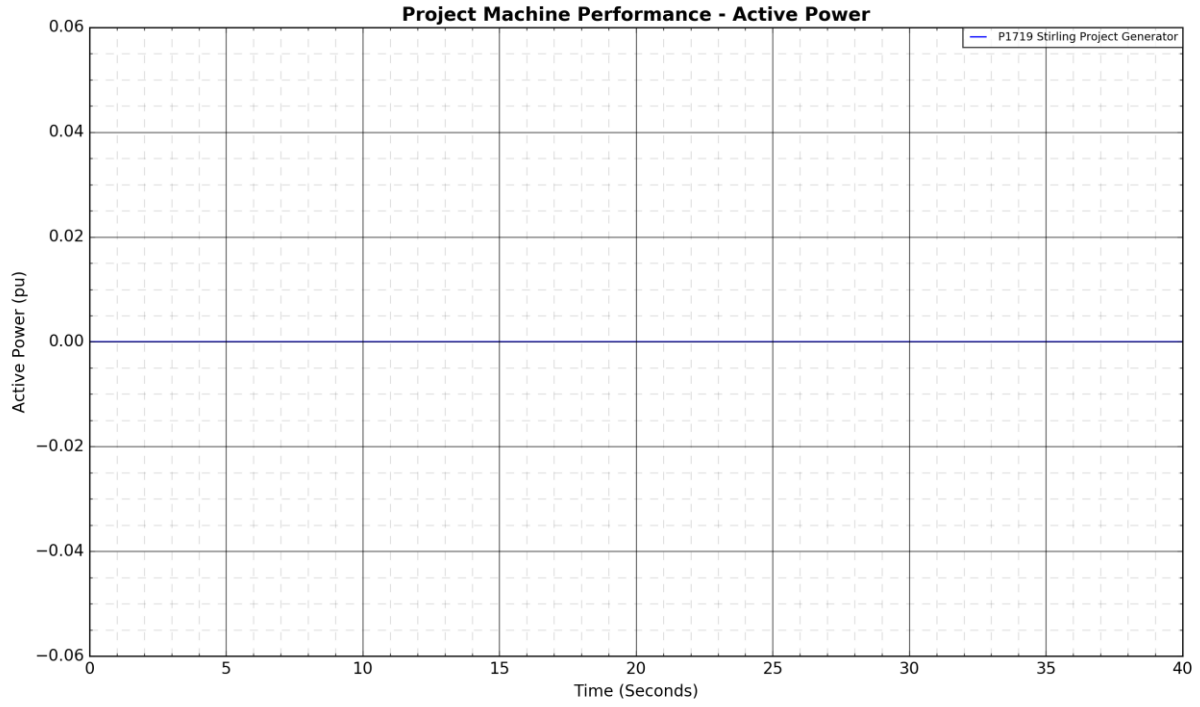
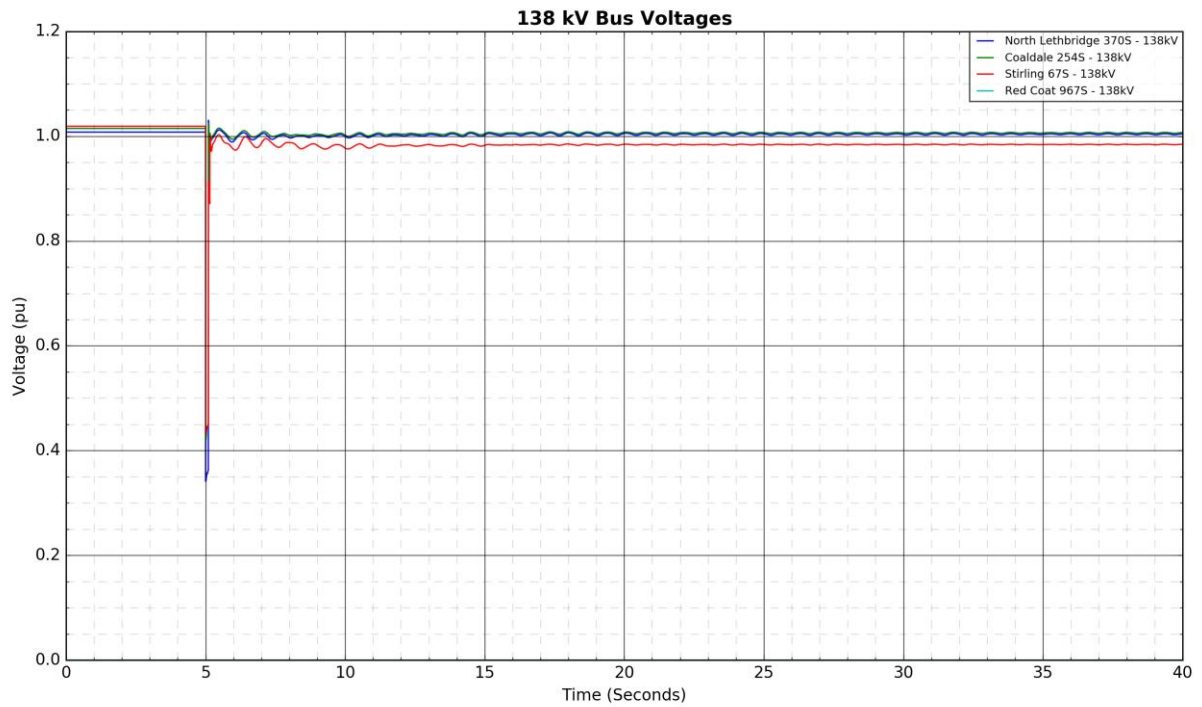
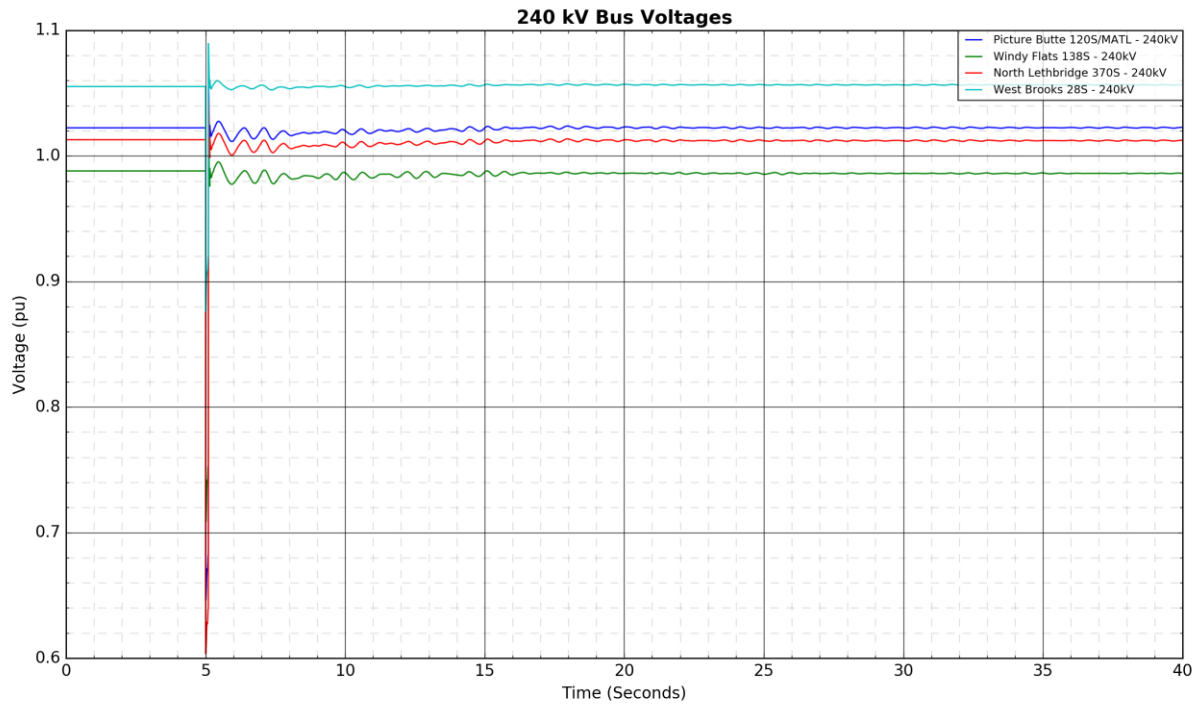
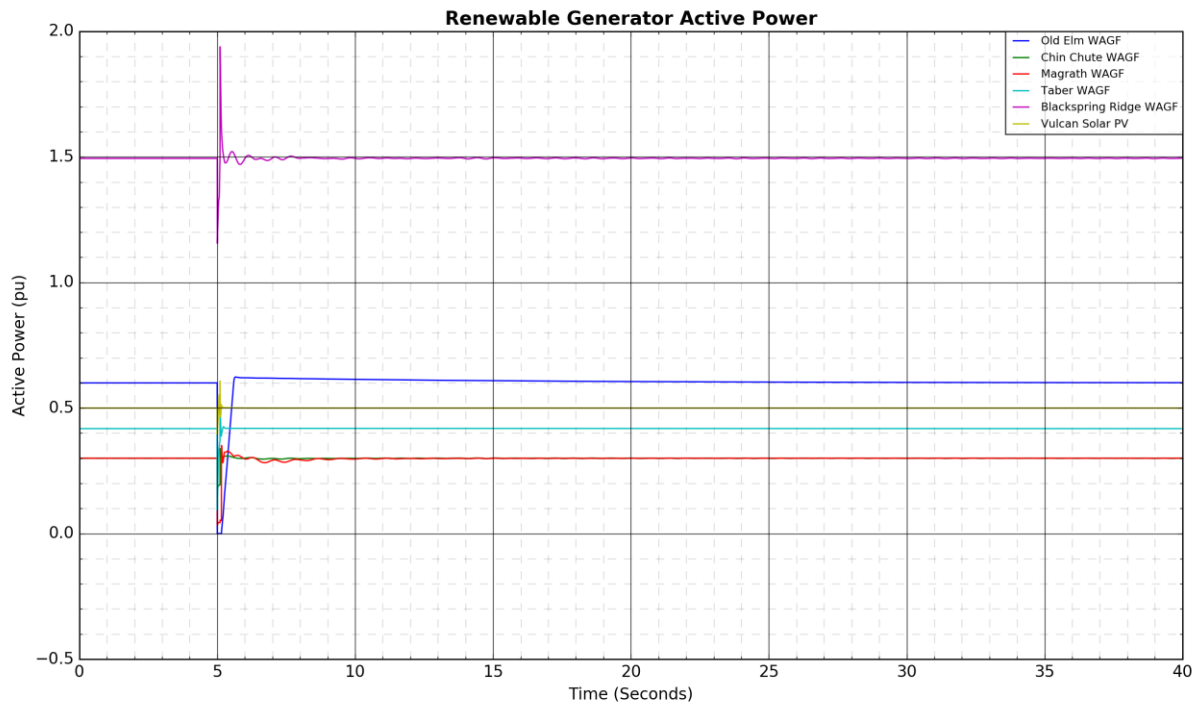
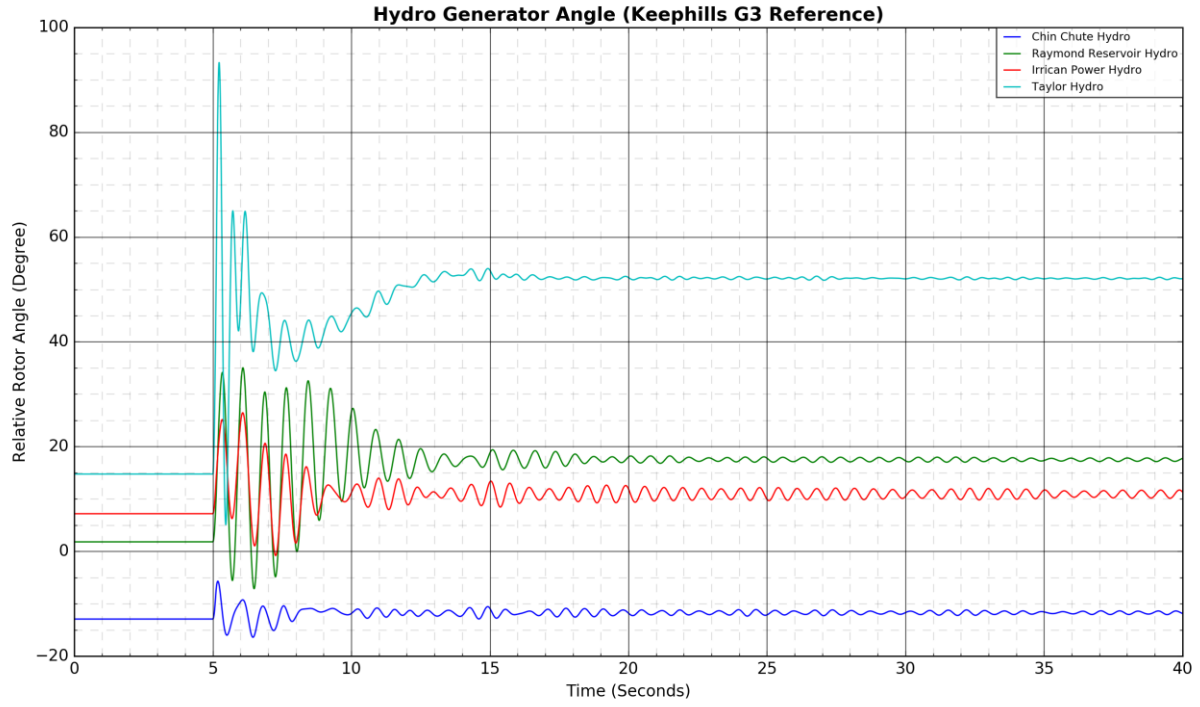
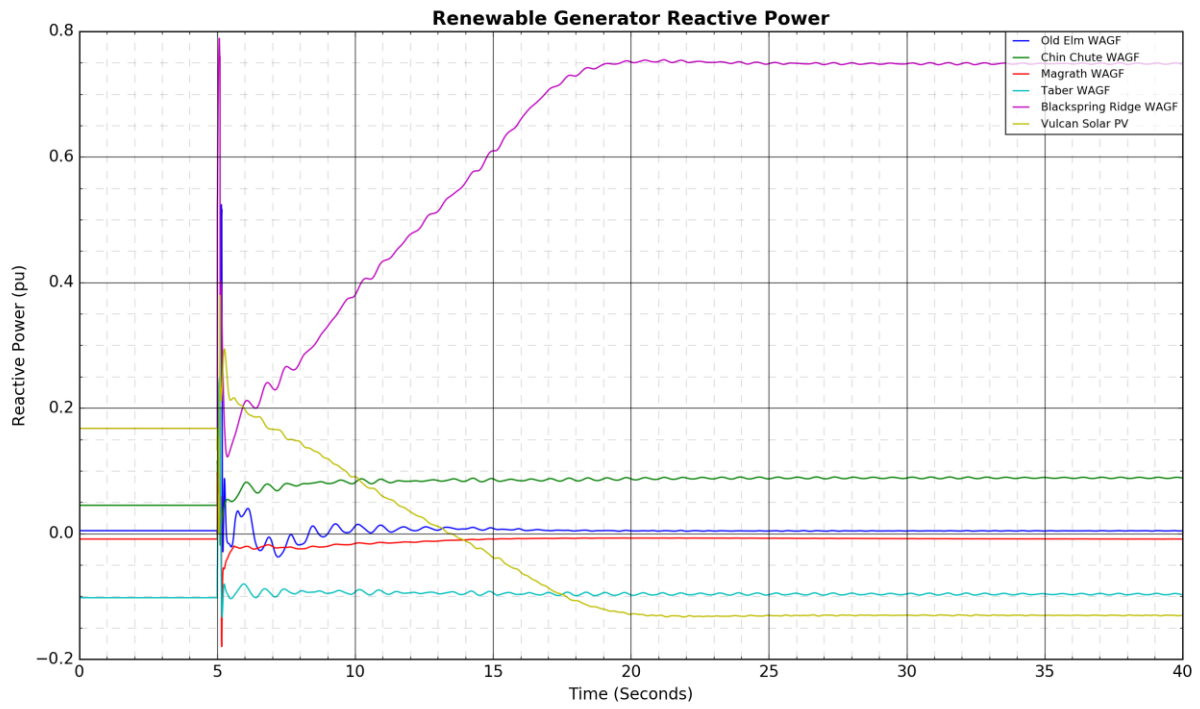
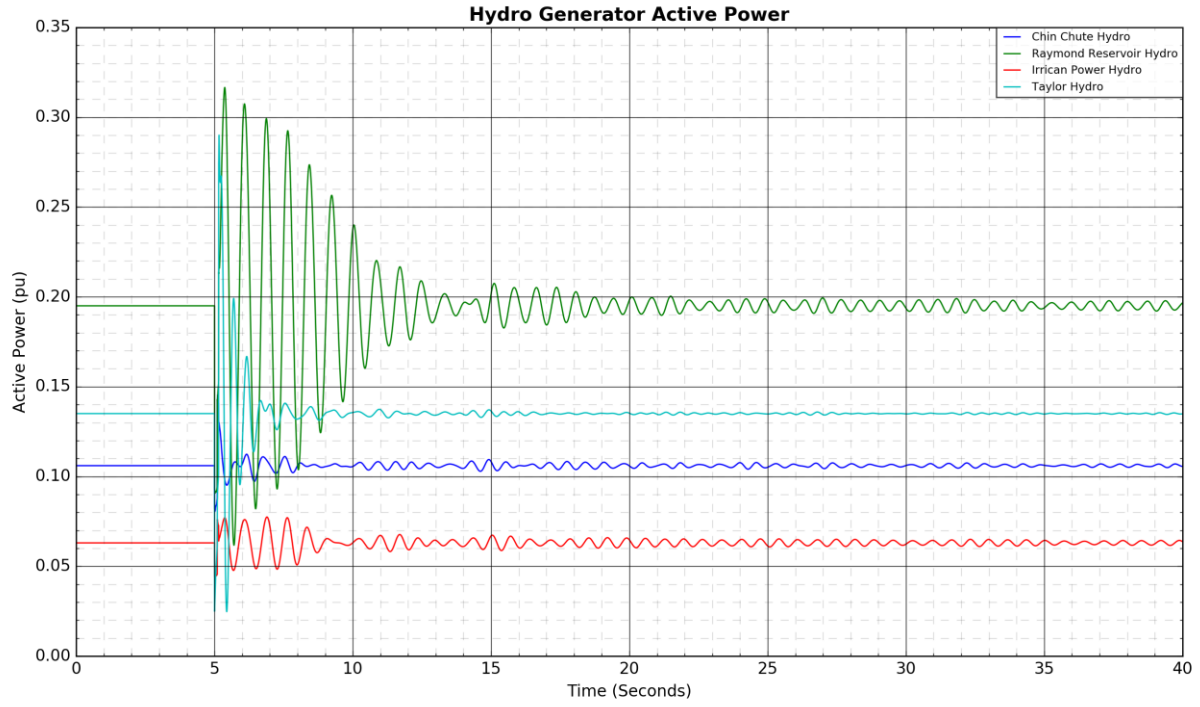


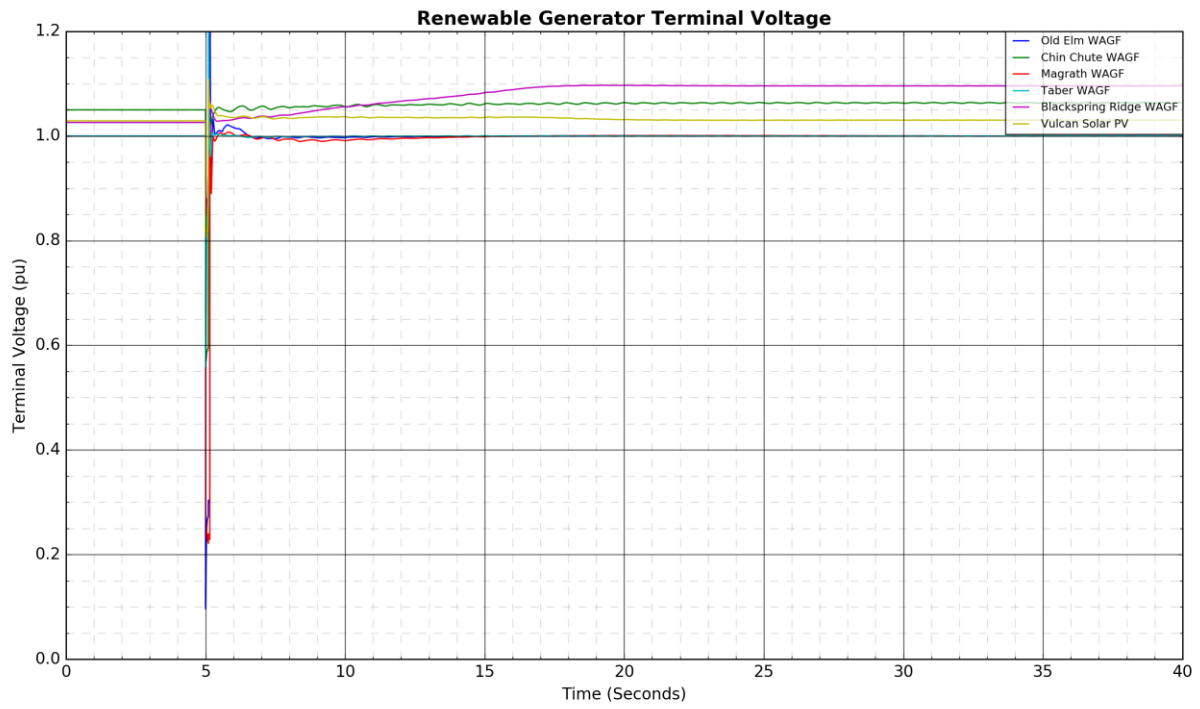
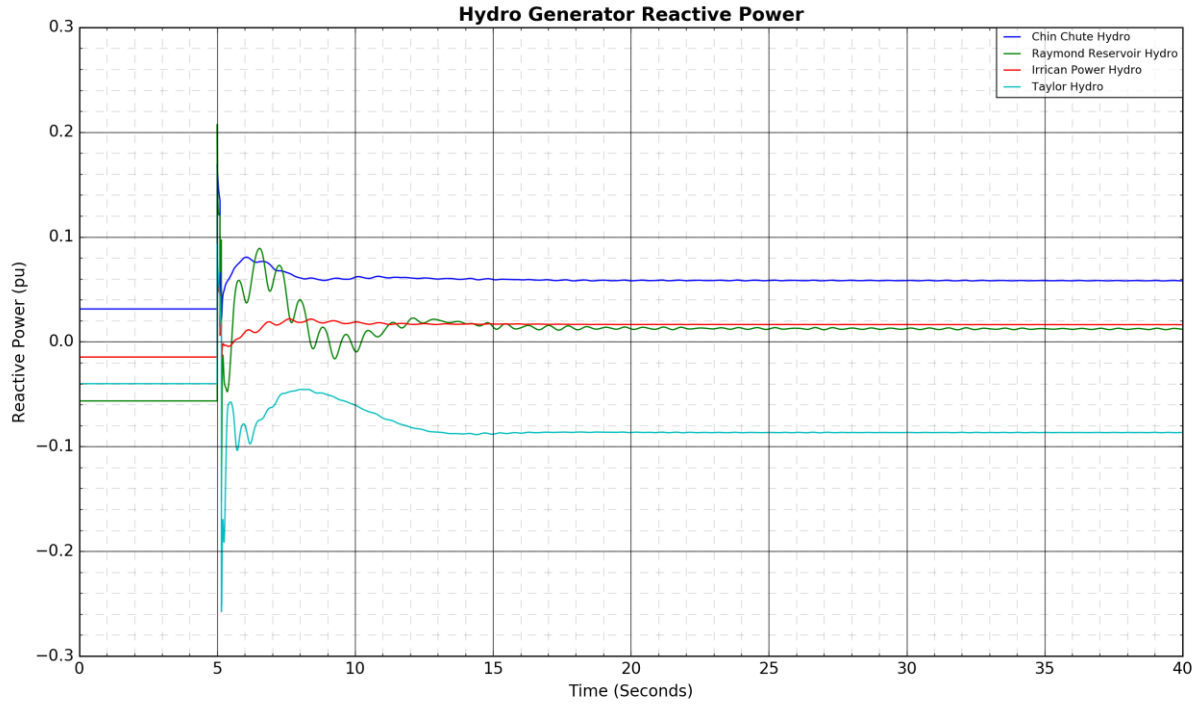
Figure A4-6: 863L Magrath 225S to Riverbend 618S: Fault Near Riverbend 618S

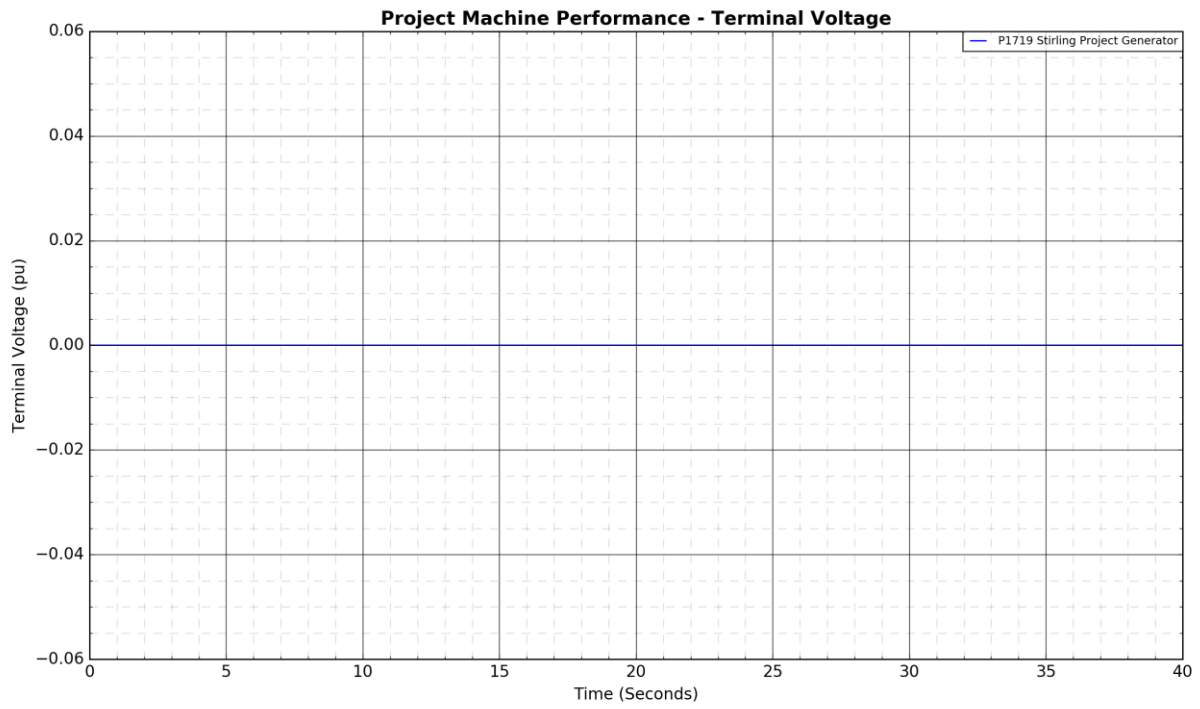
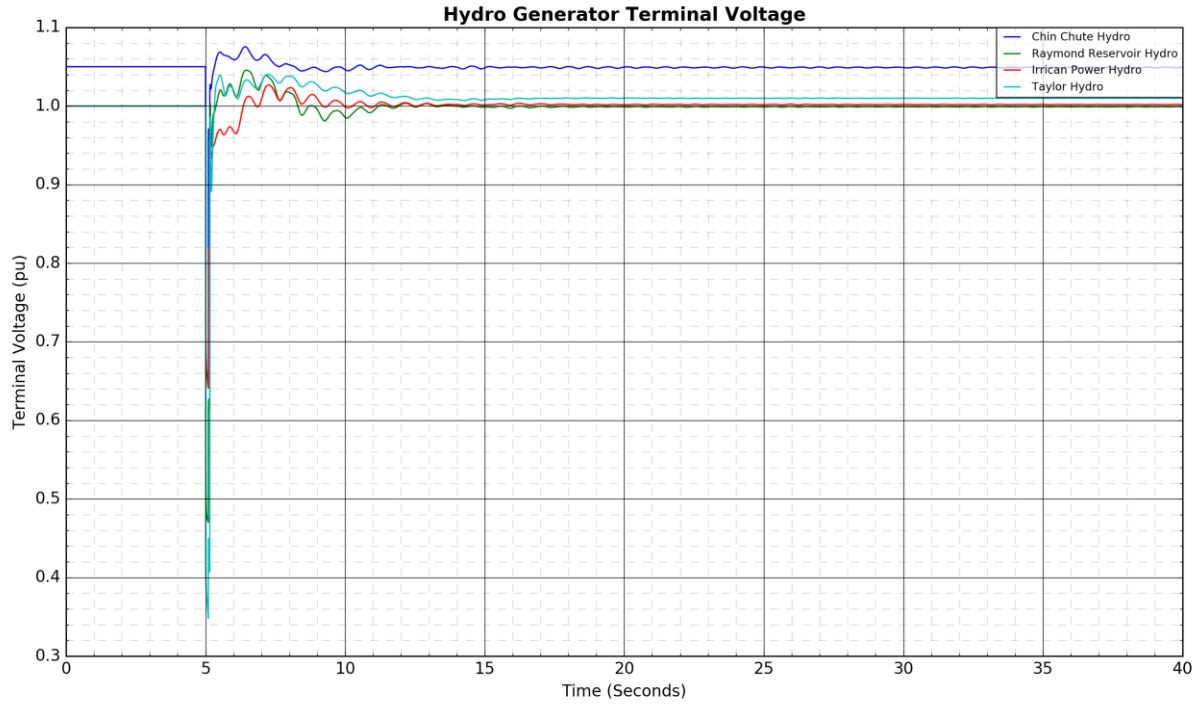




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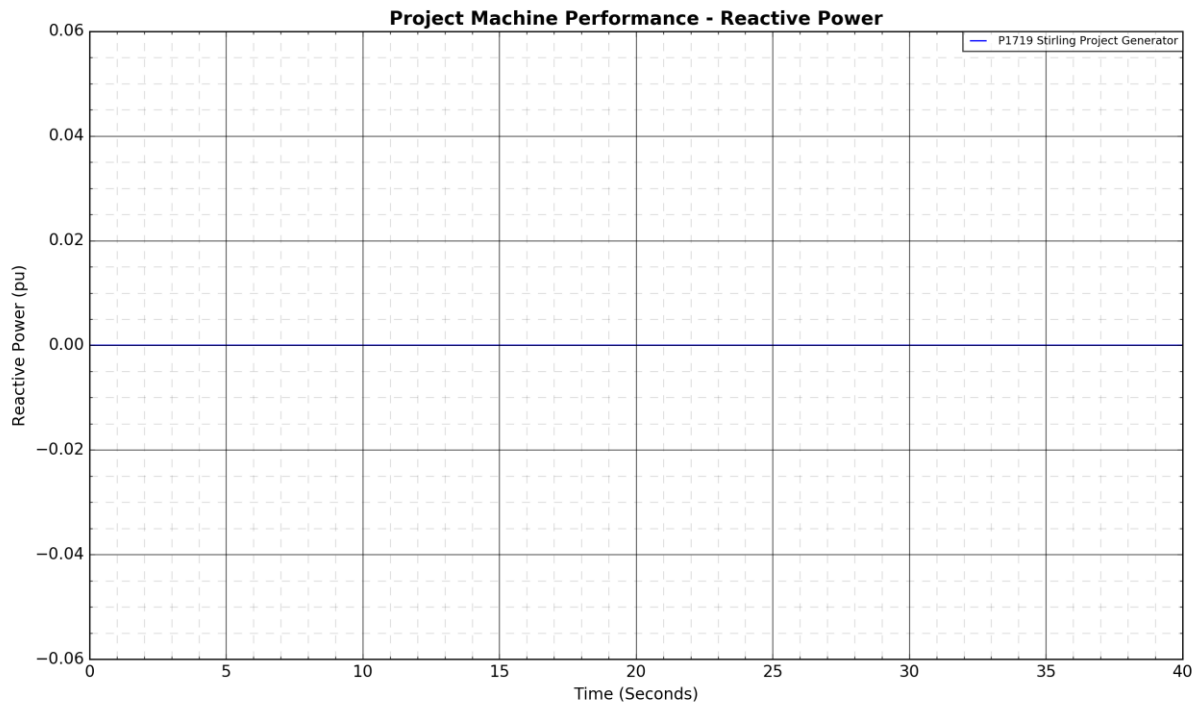
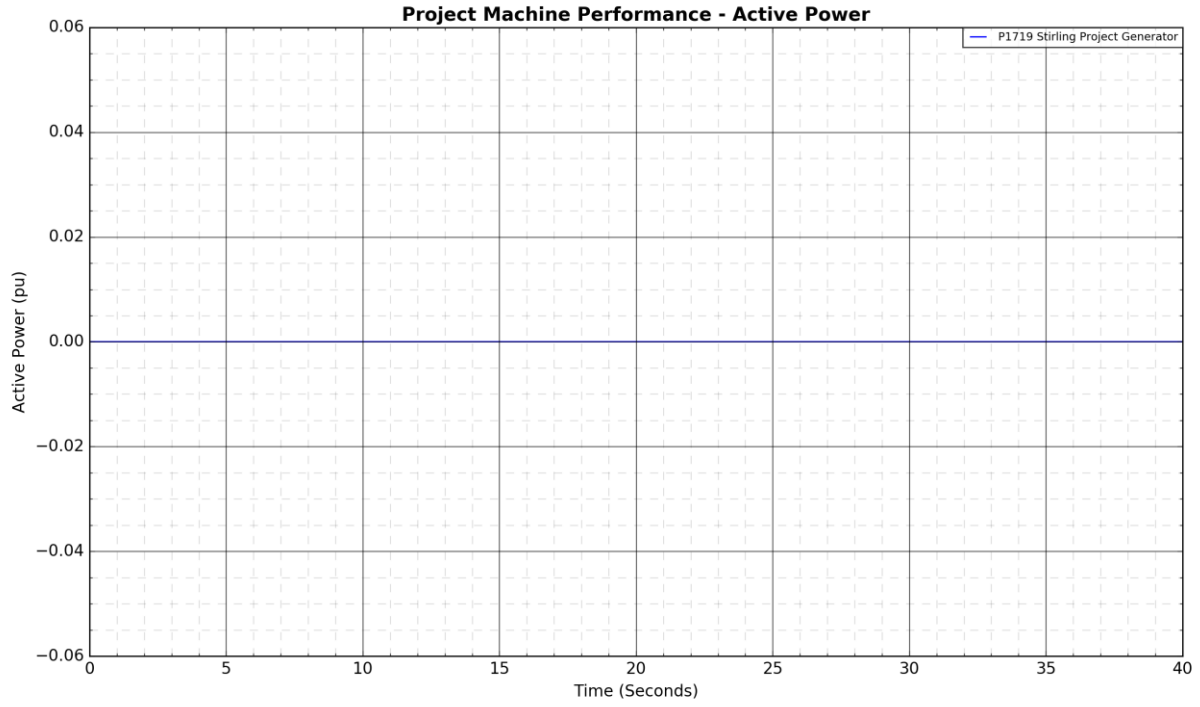
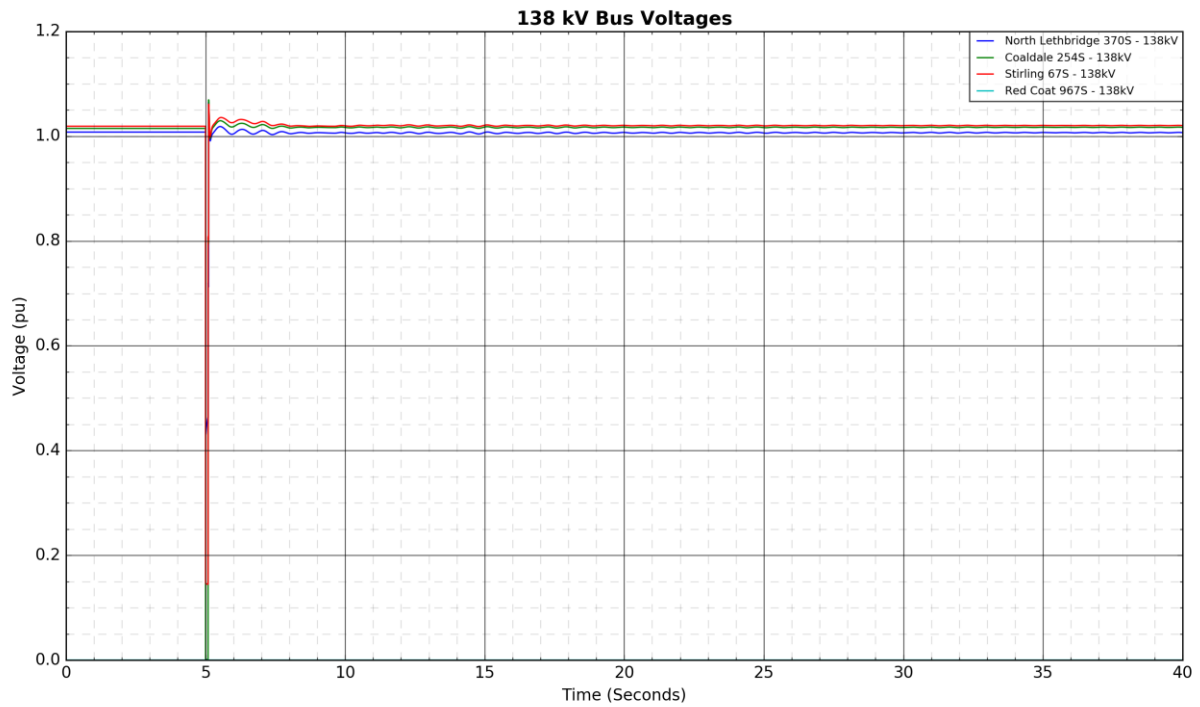
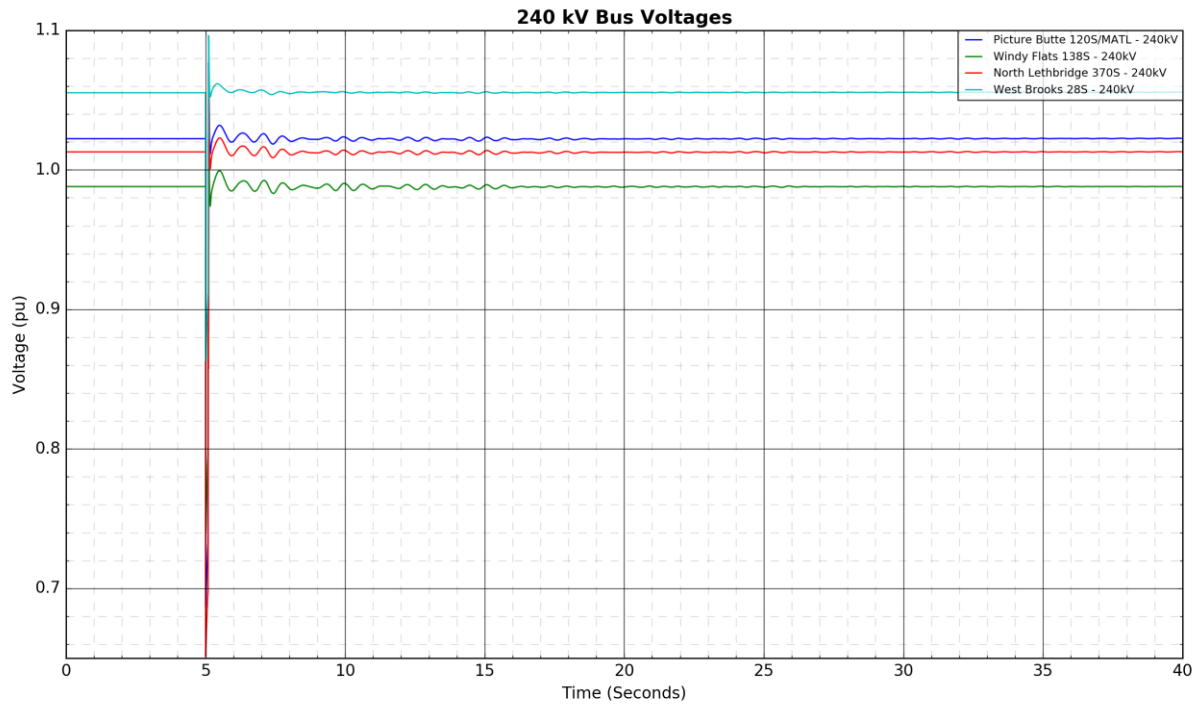
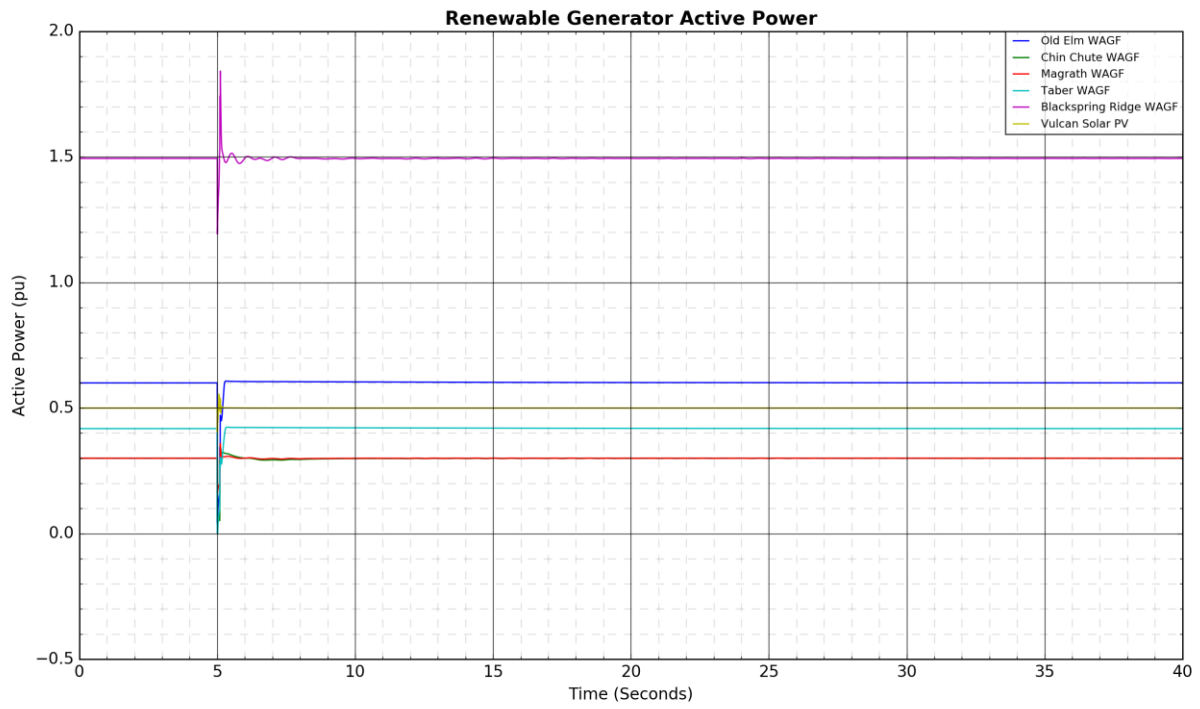
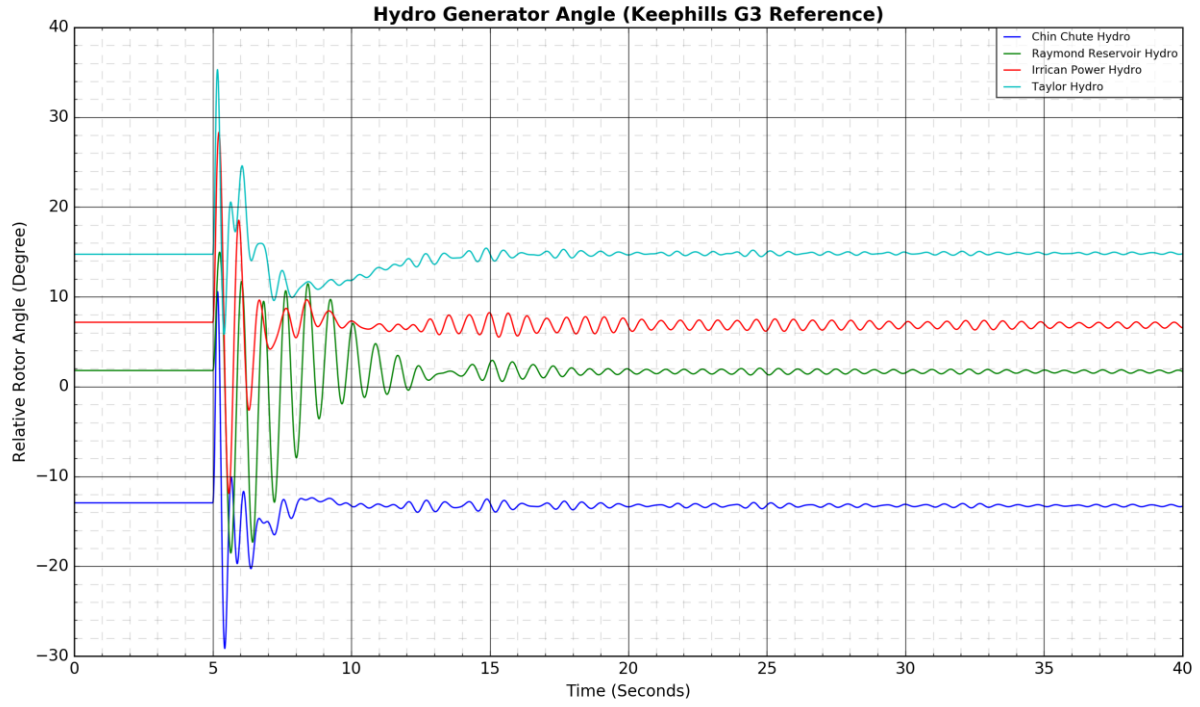
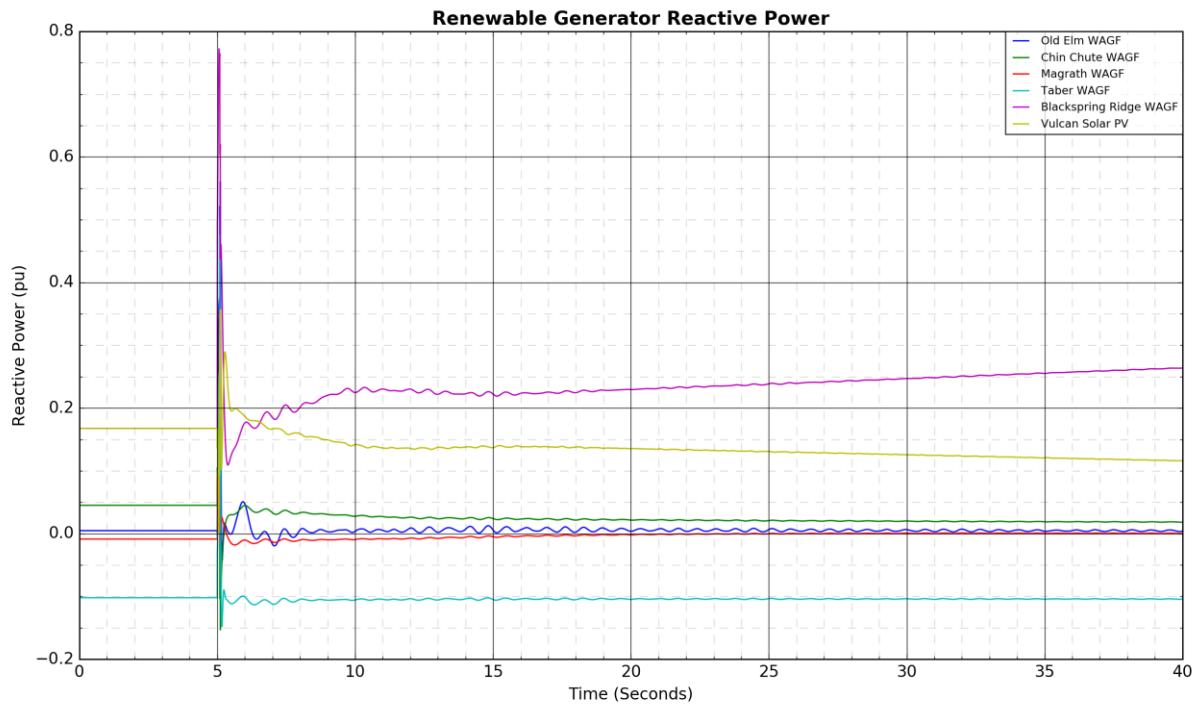
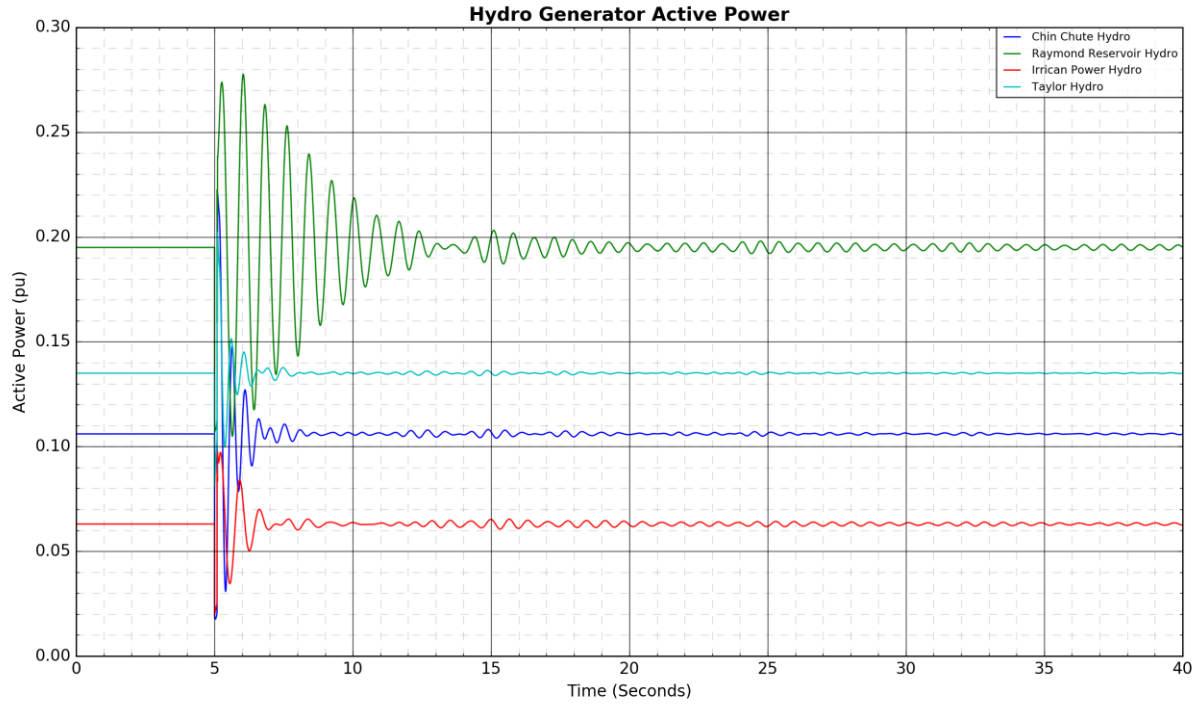


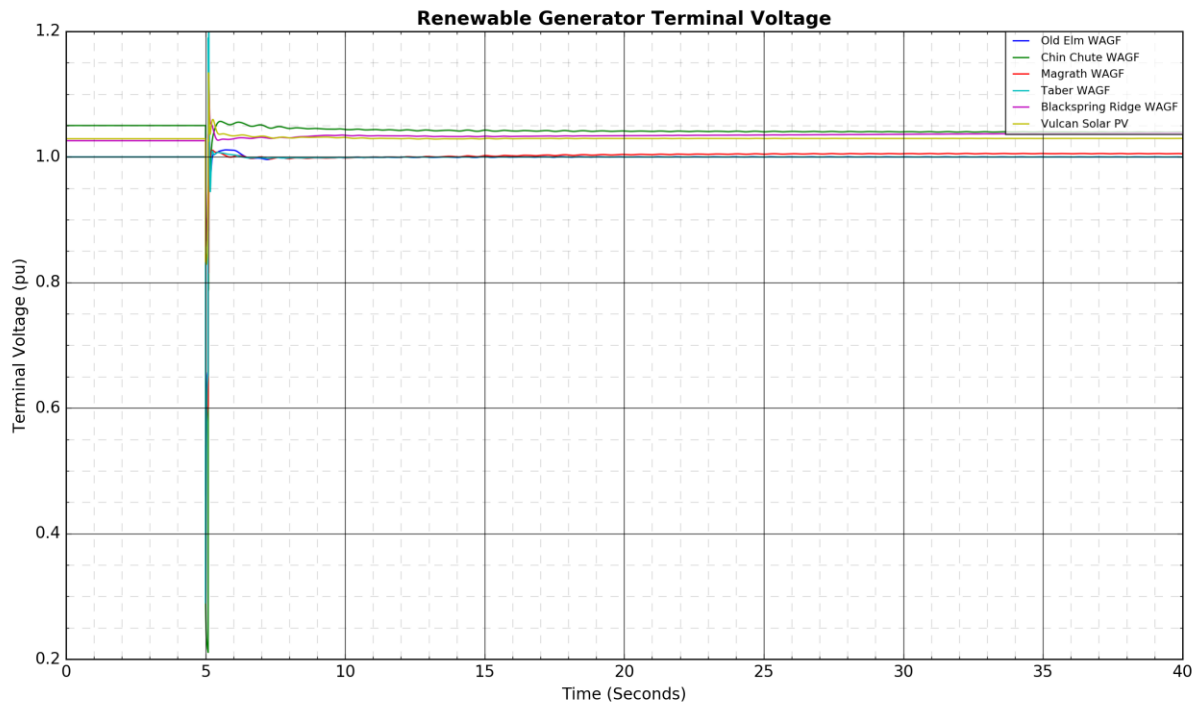
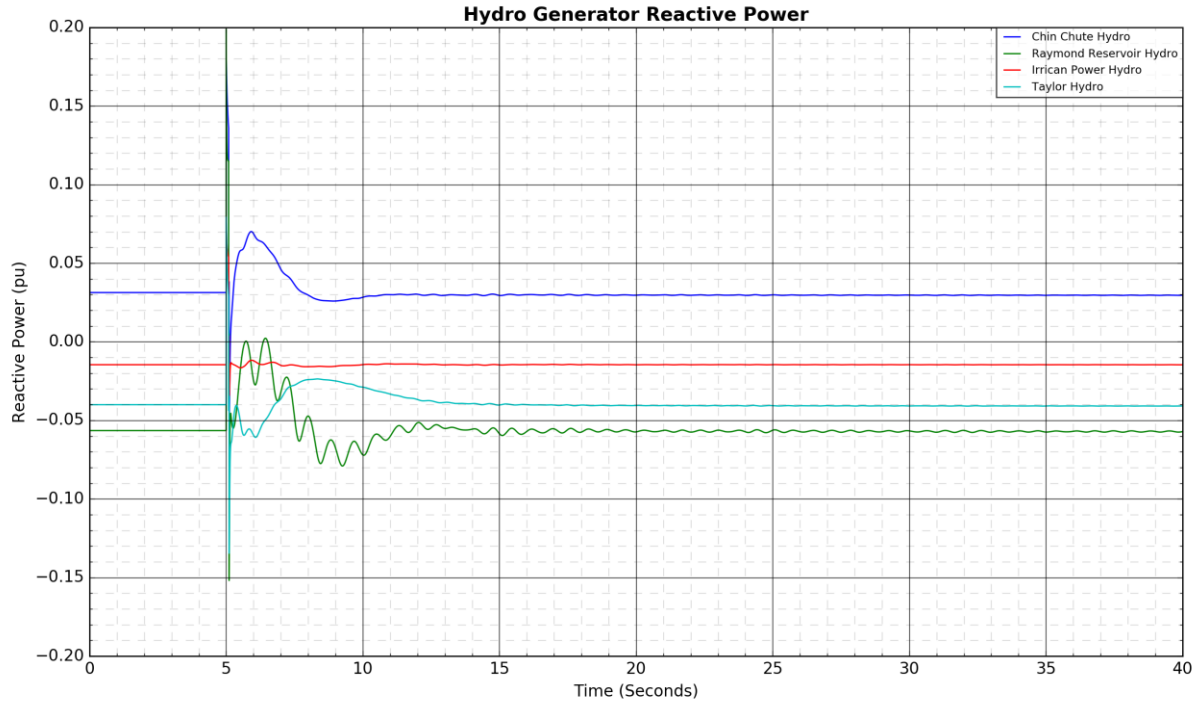
Figure A4-7: 170L Coaldale 254S to North Lethbridge 370S: Fault Near Coaldale 254S

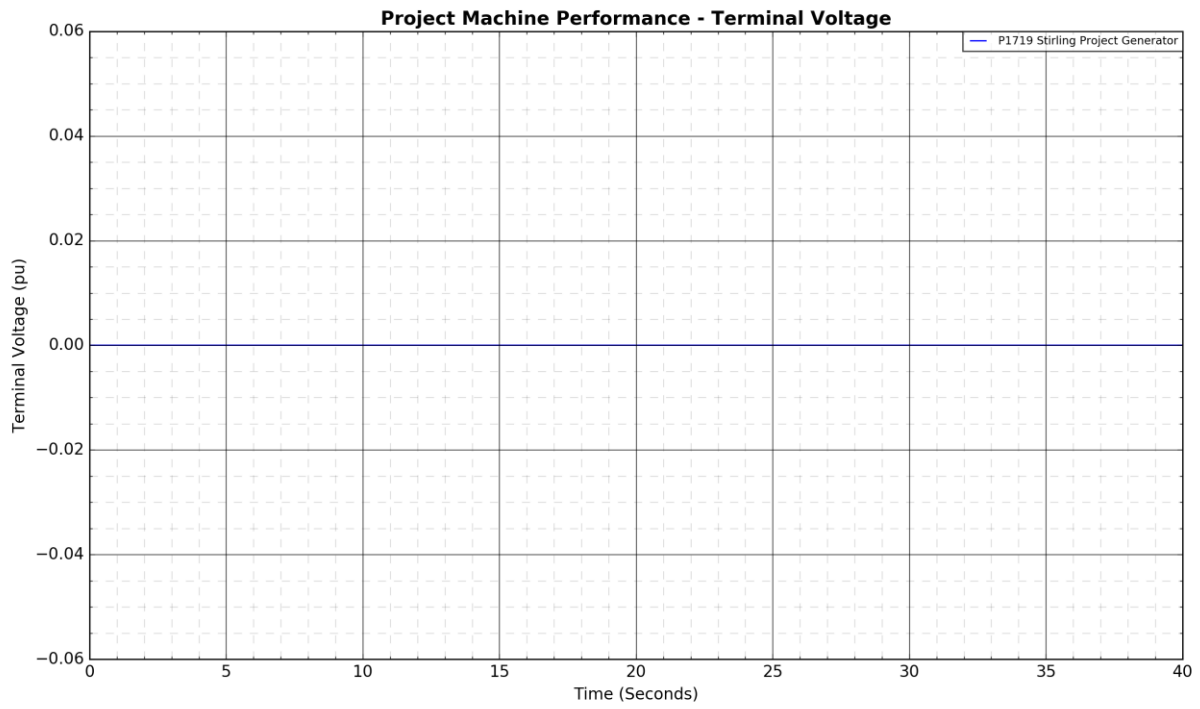
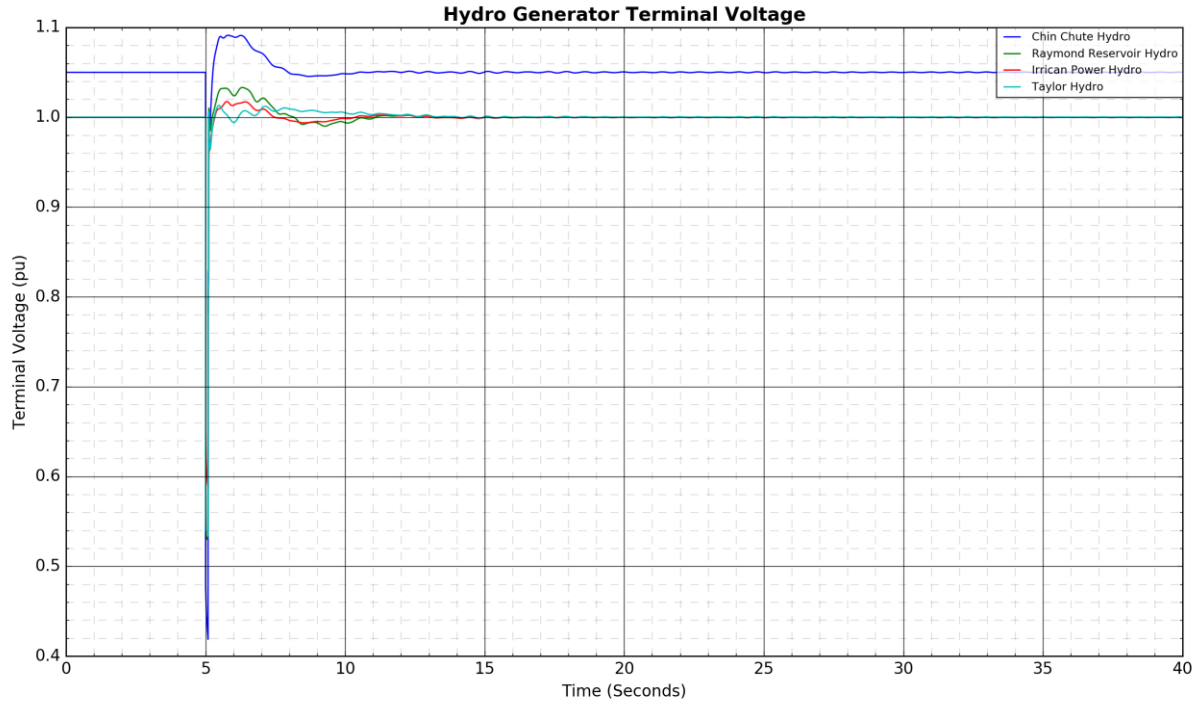




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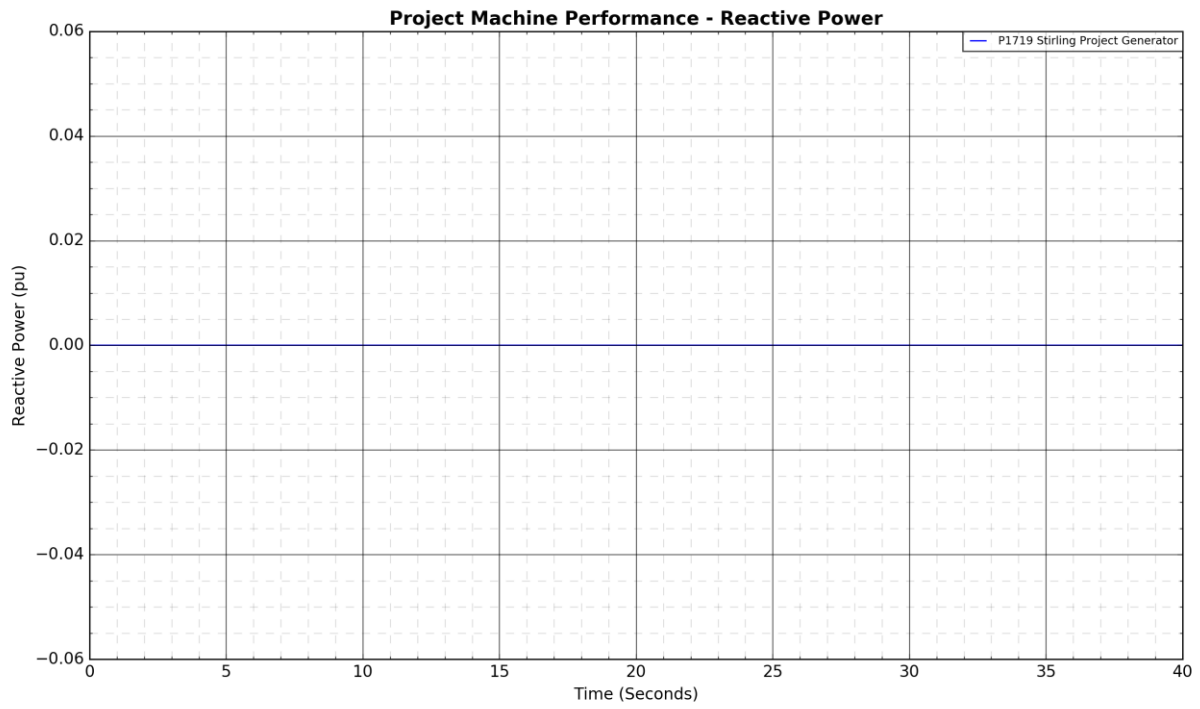
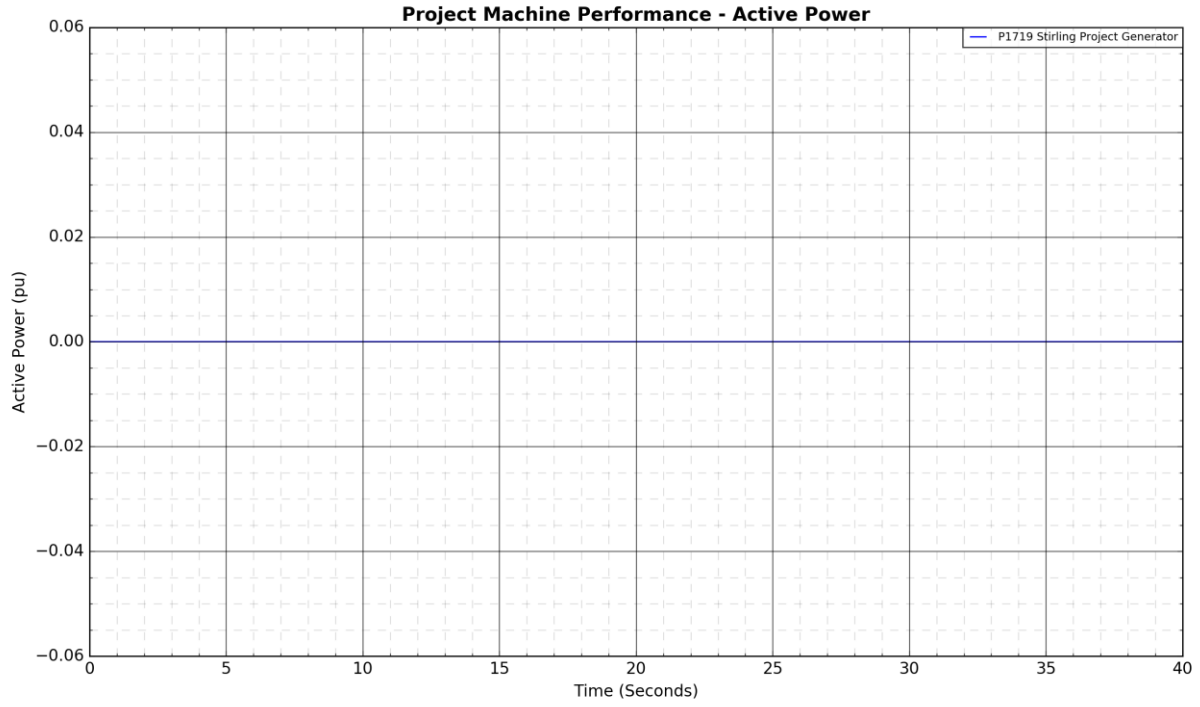
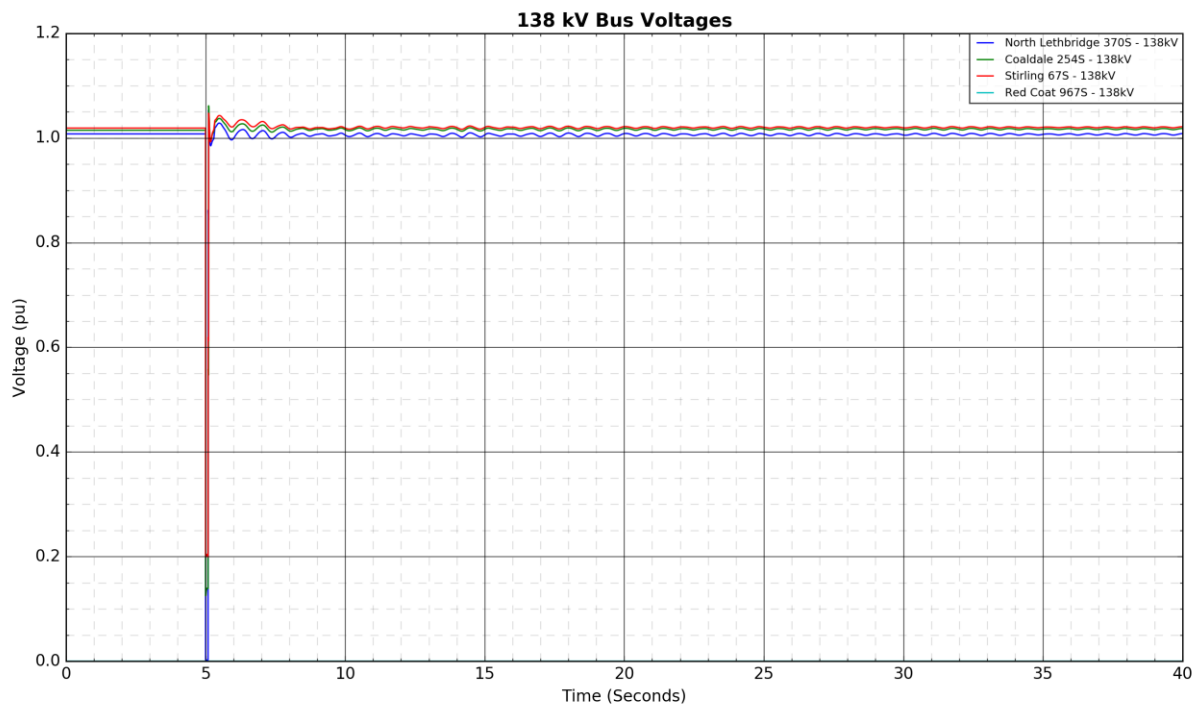
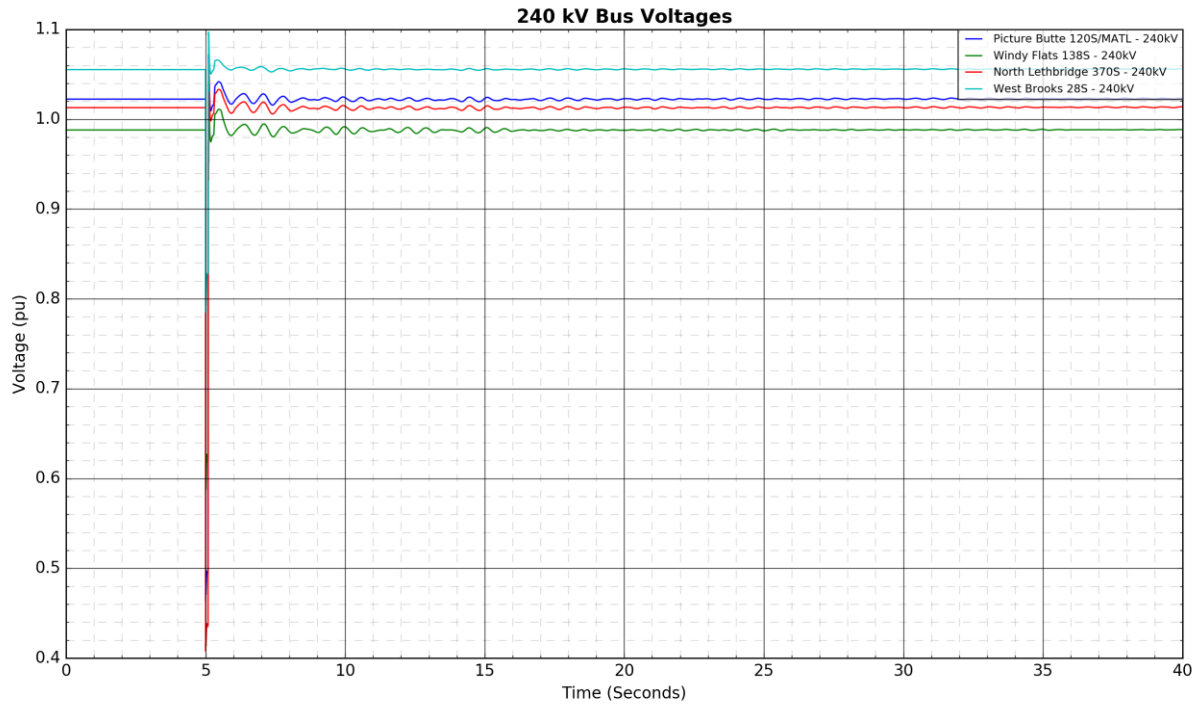
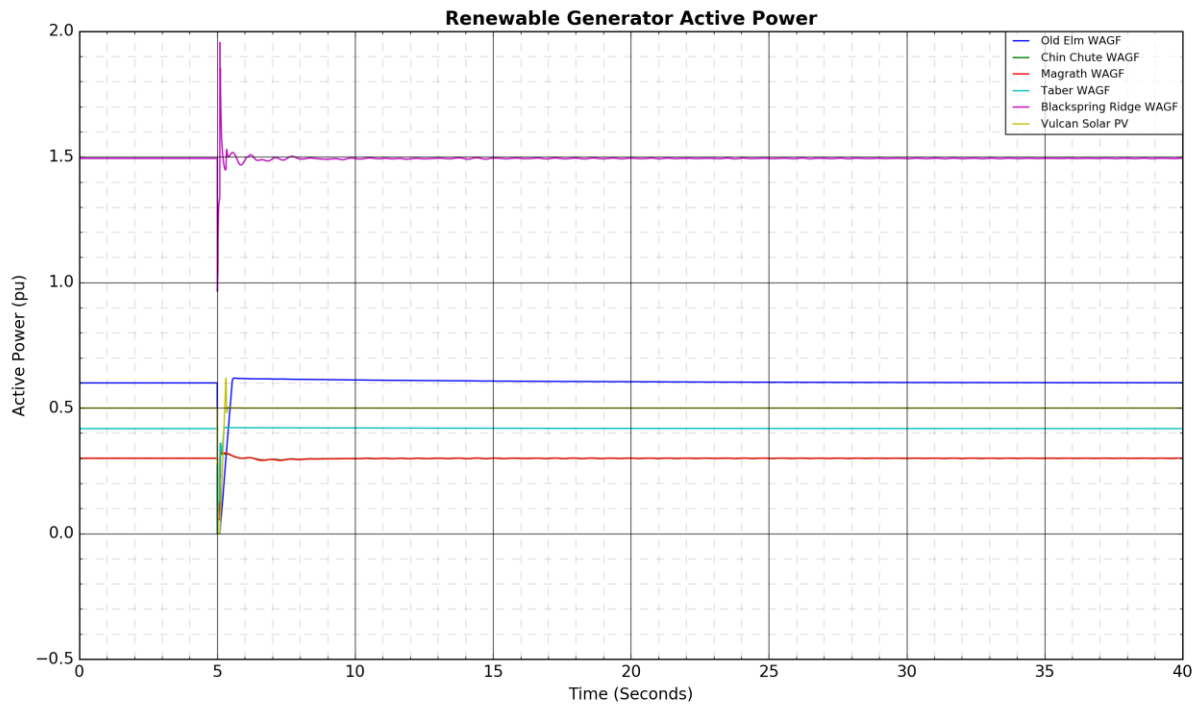
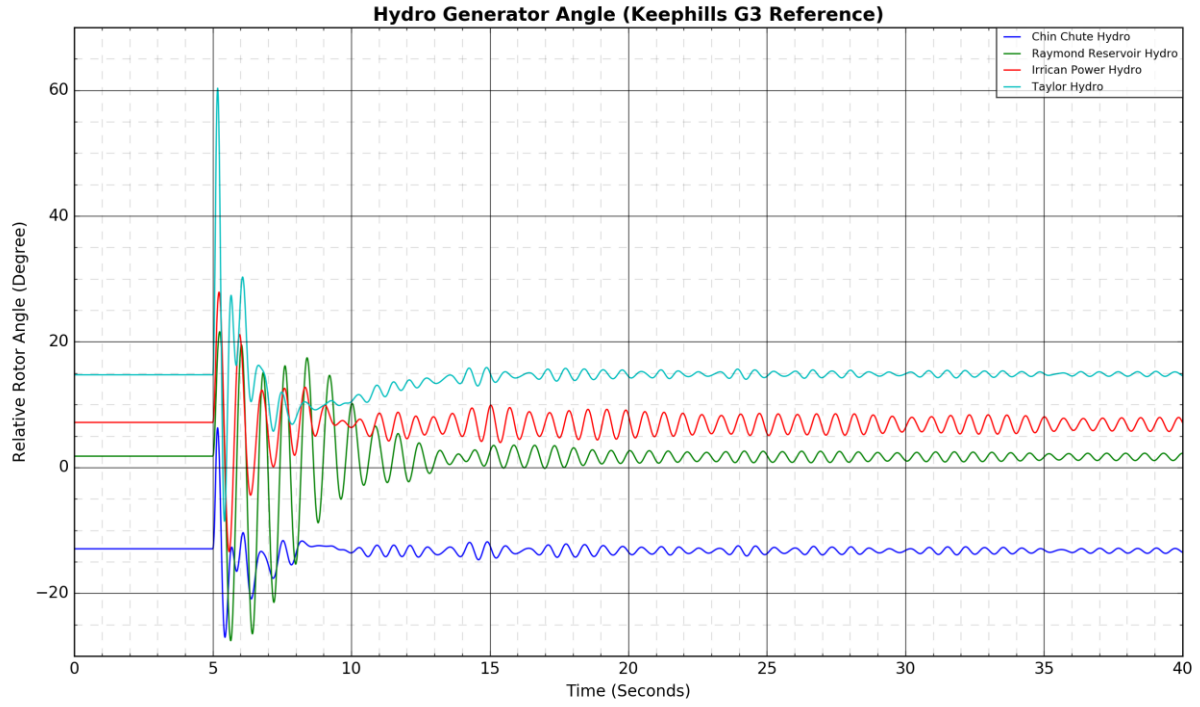
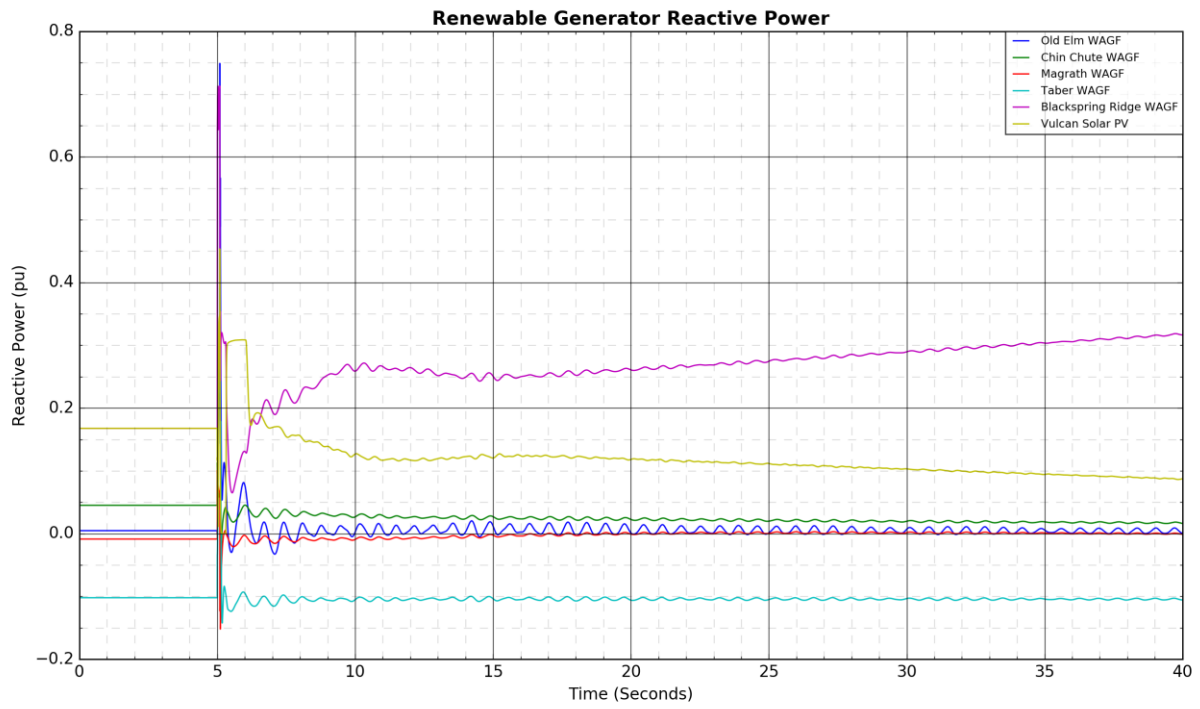
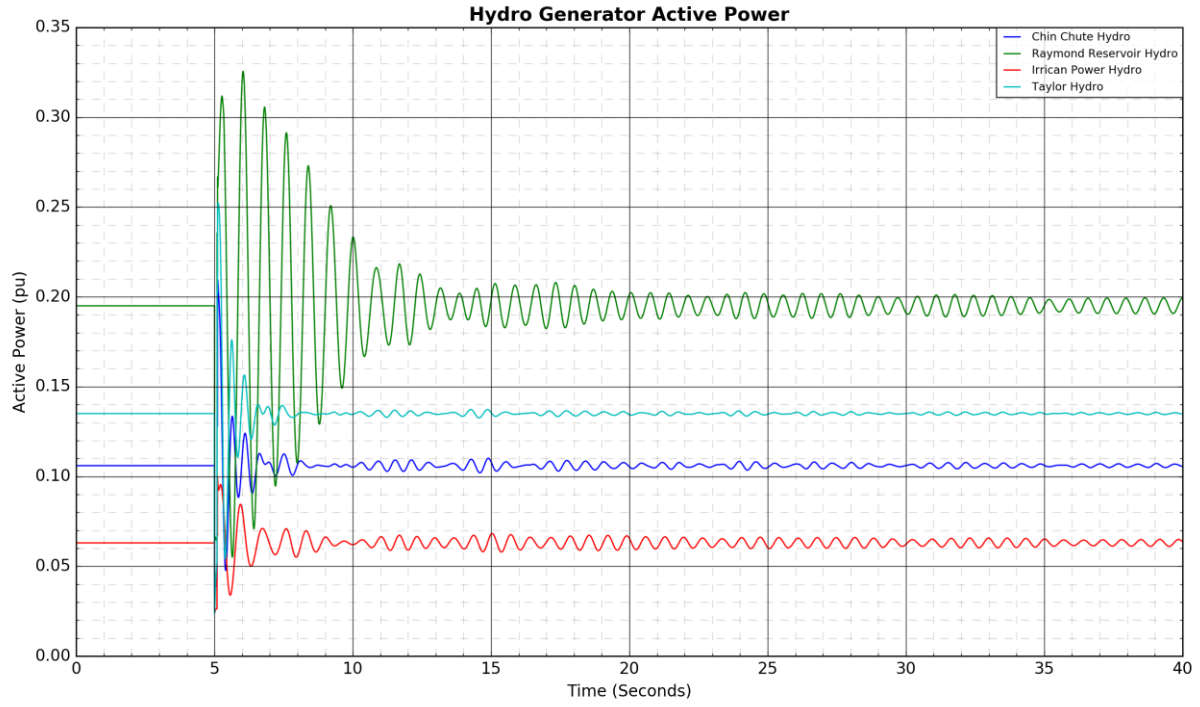


Figure A4-8: 170L Coaldale 254S to North Lethbridge 370S: Fault Near North Lethbridge 370S

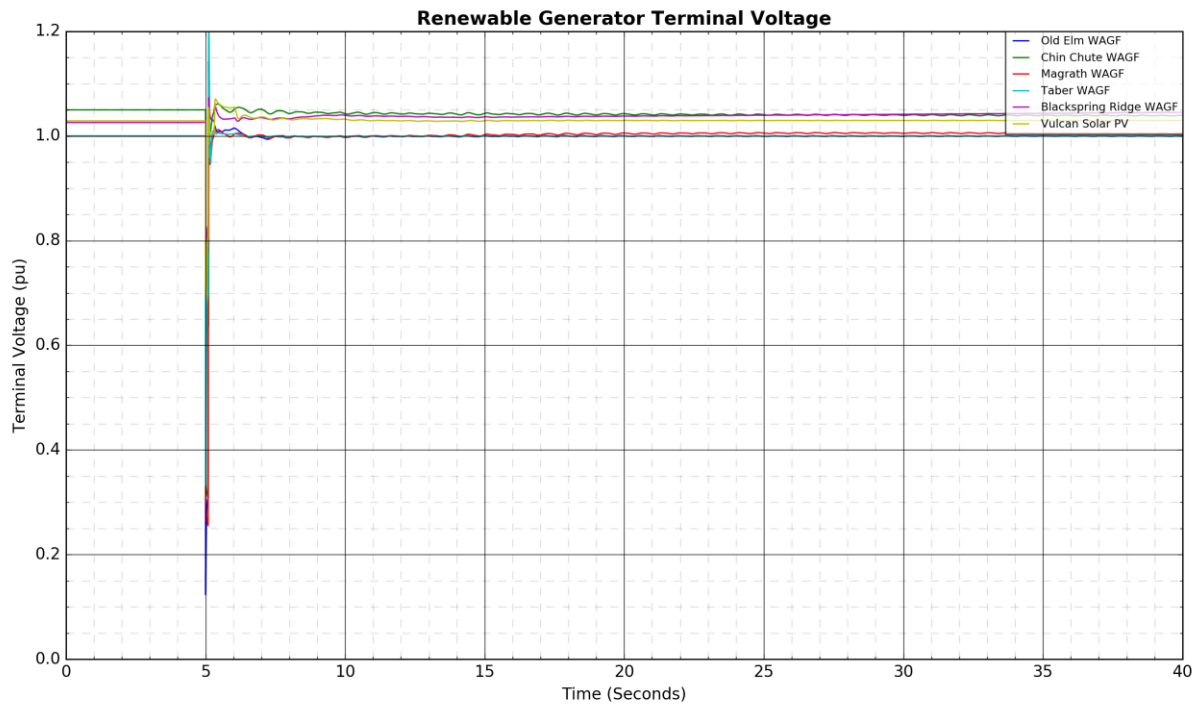
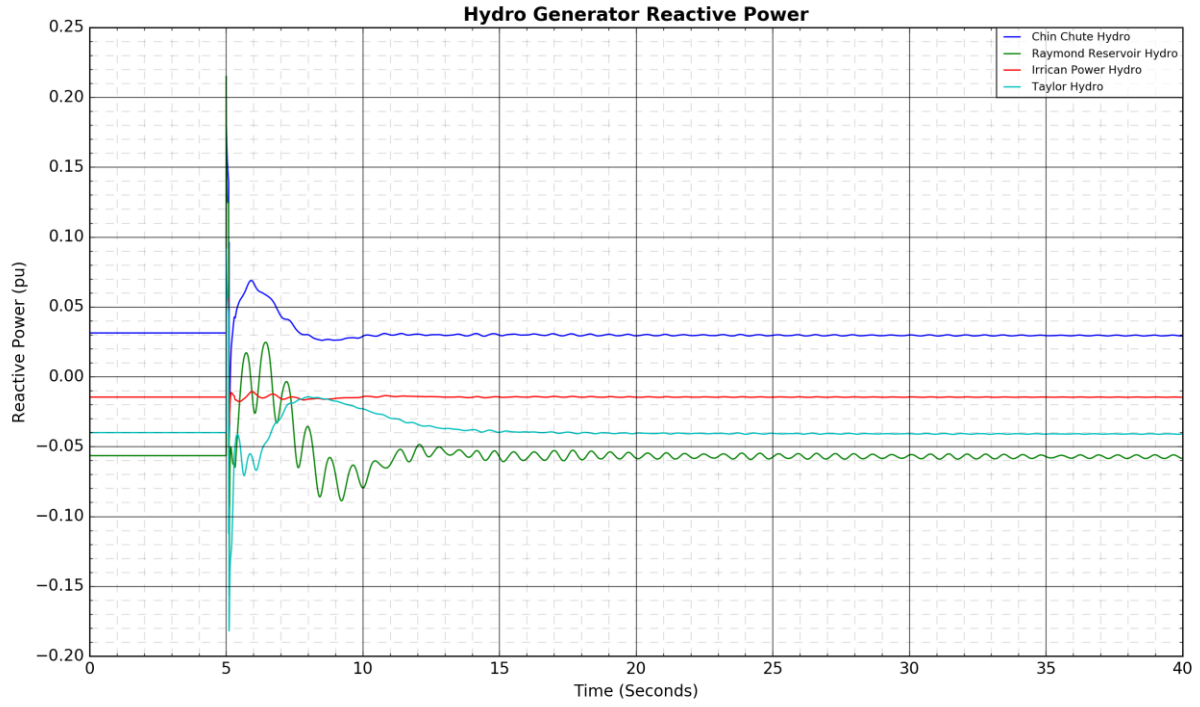




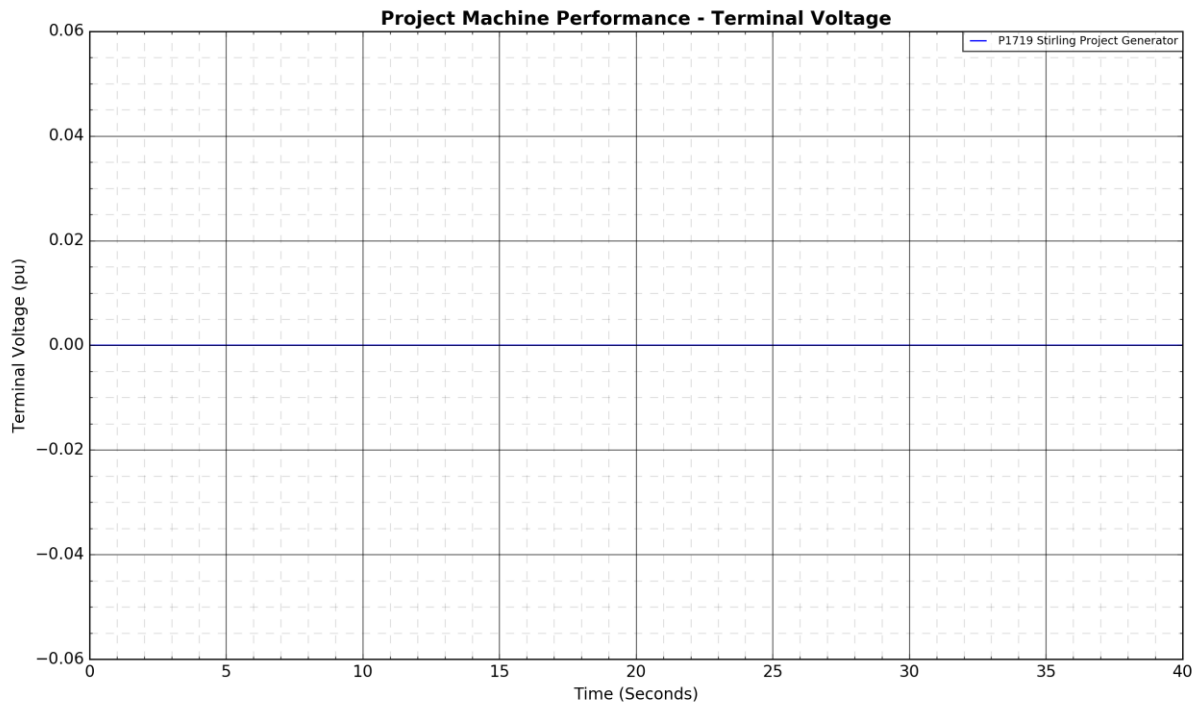
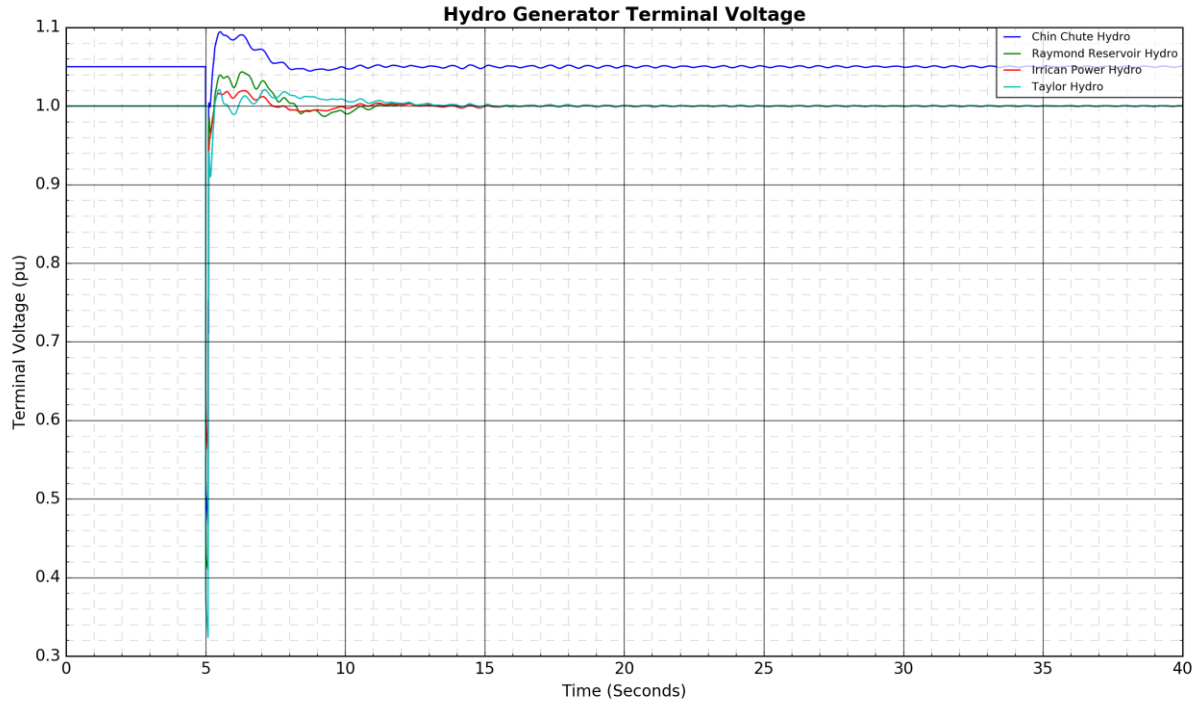
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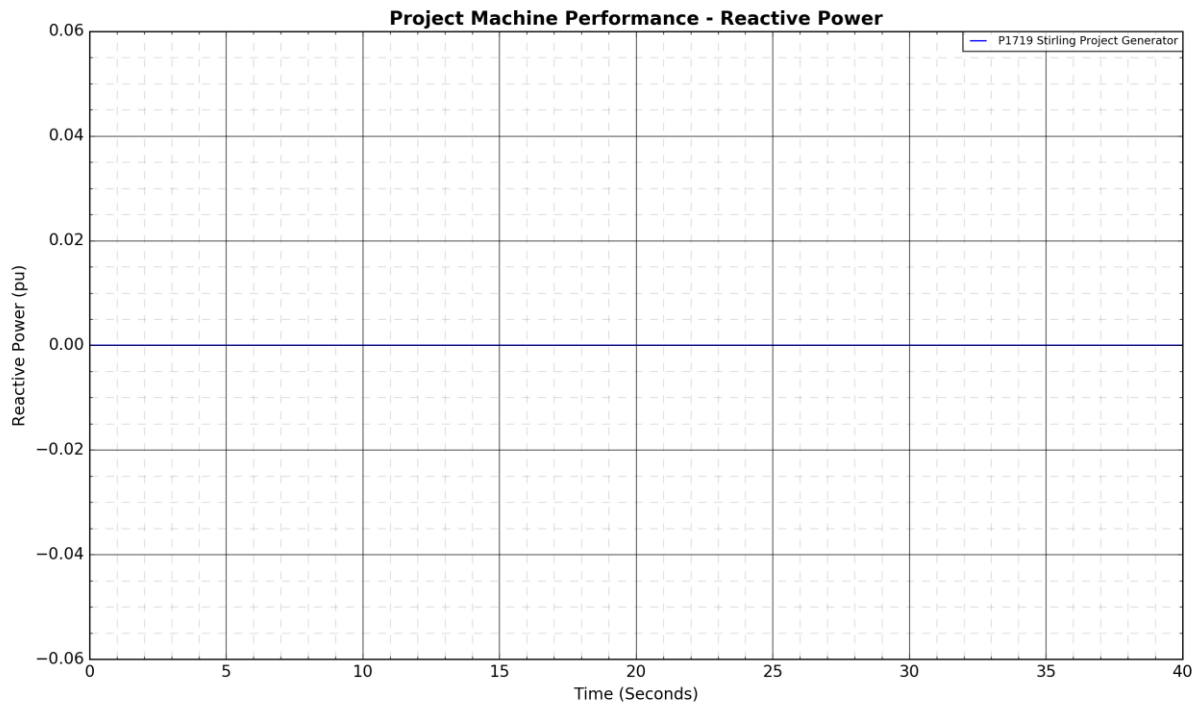
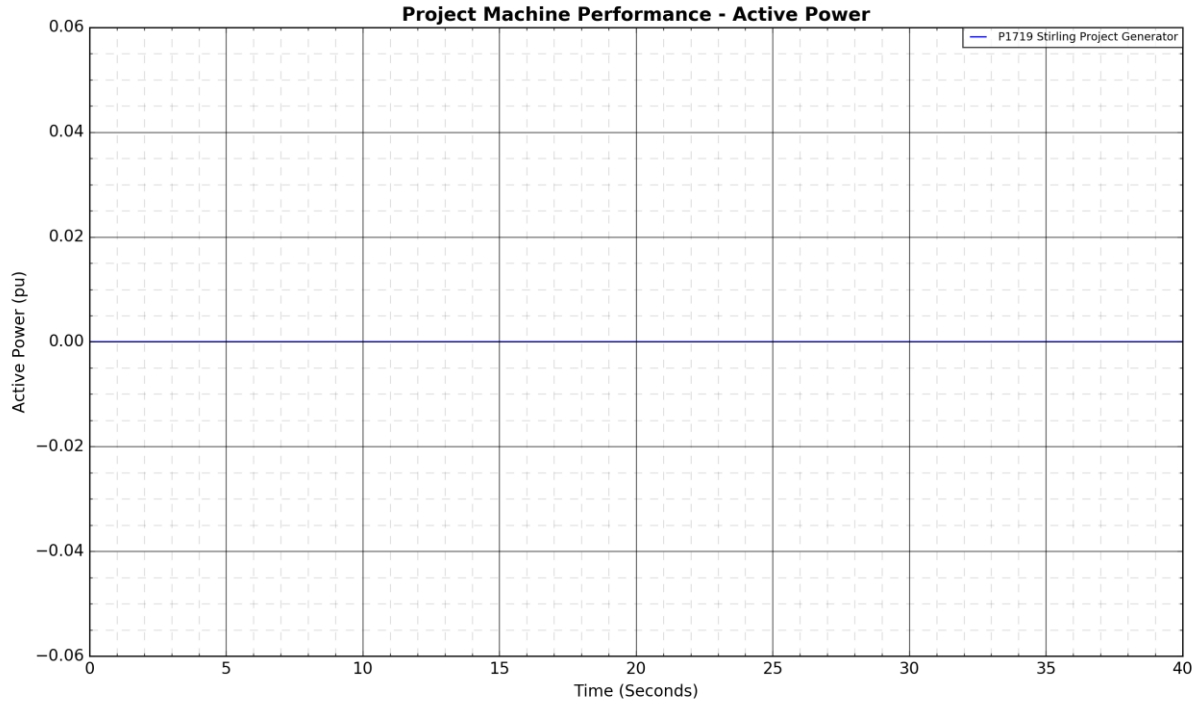
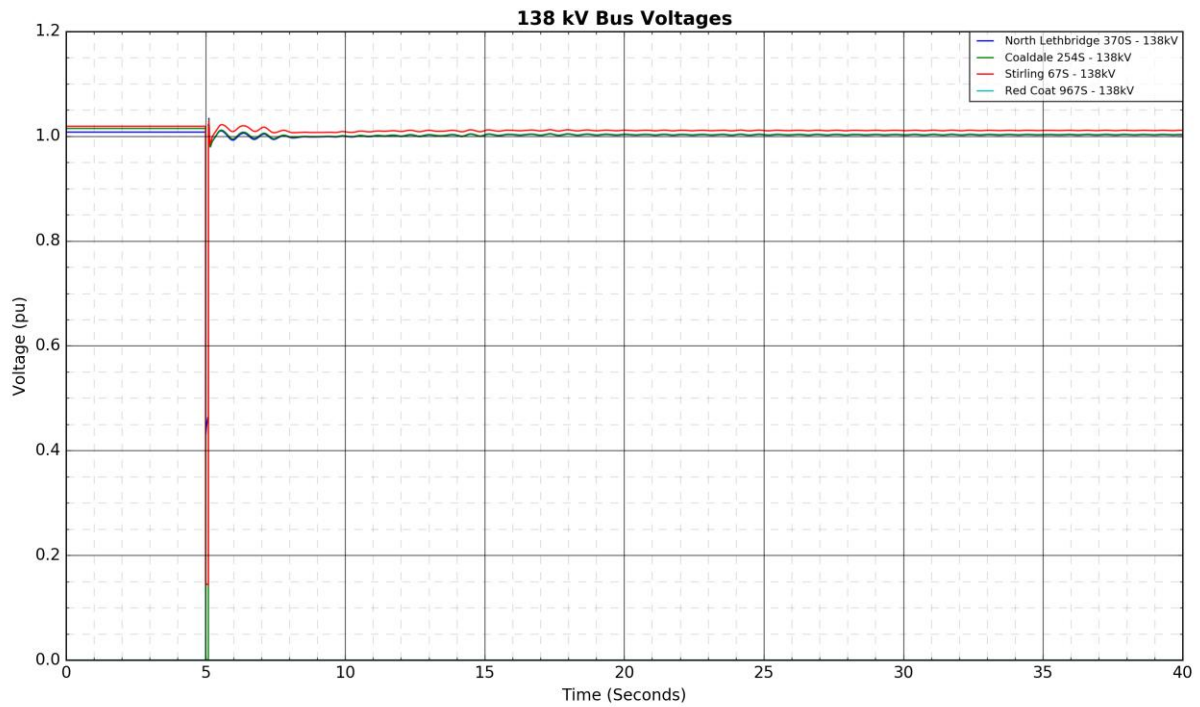
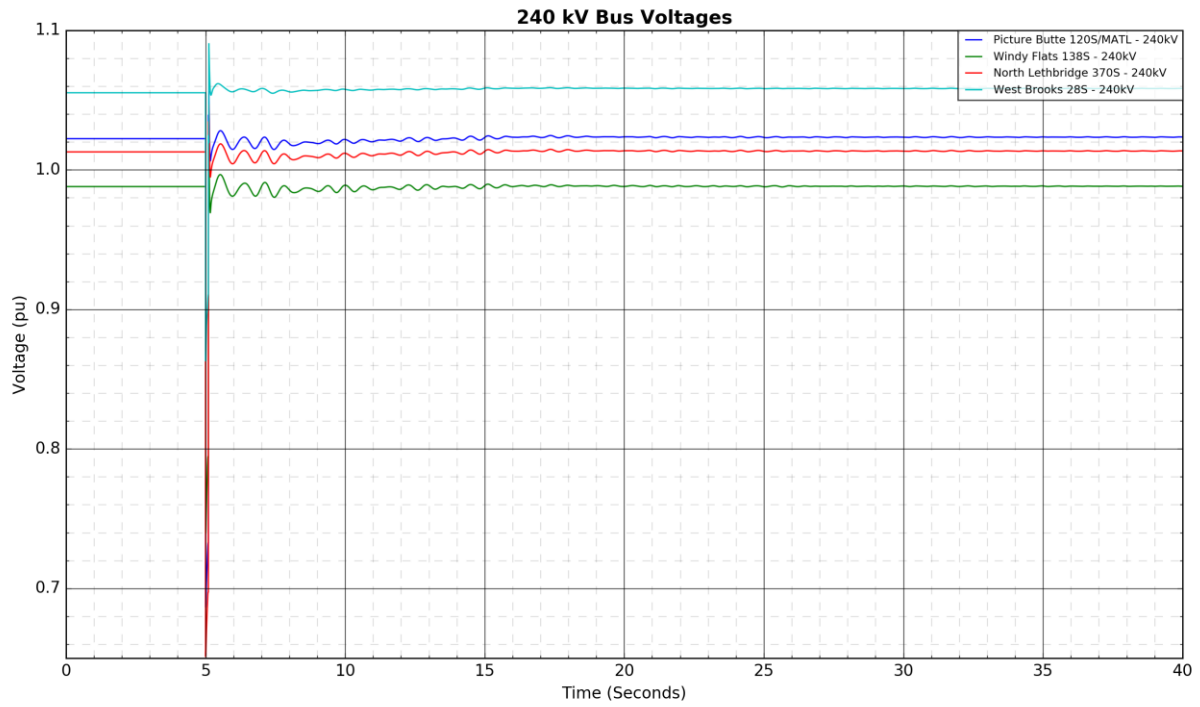
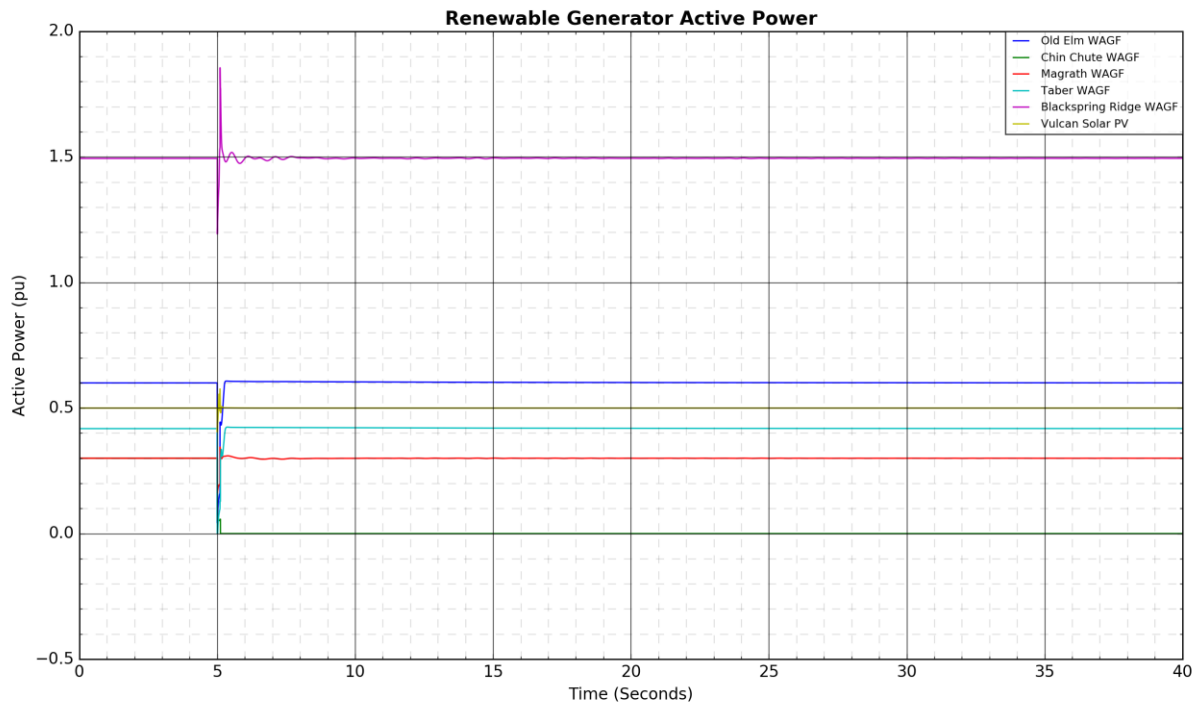
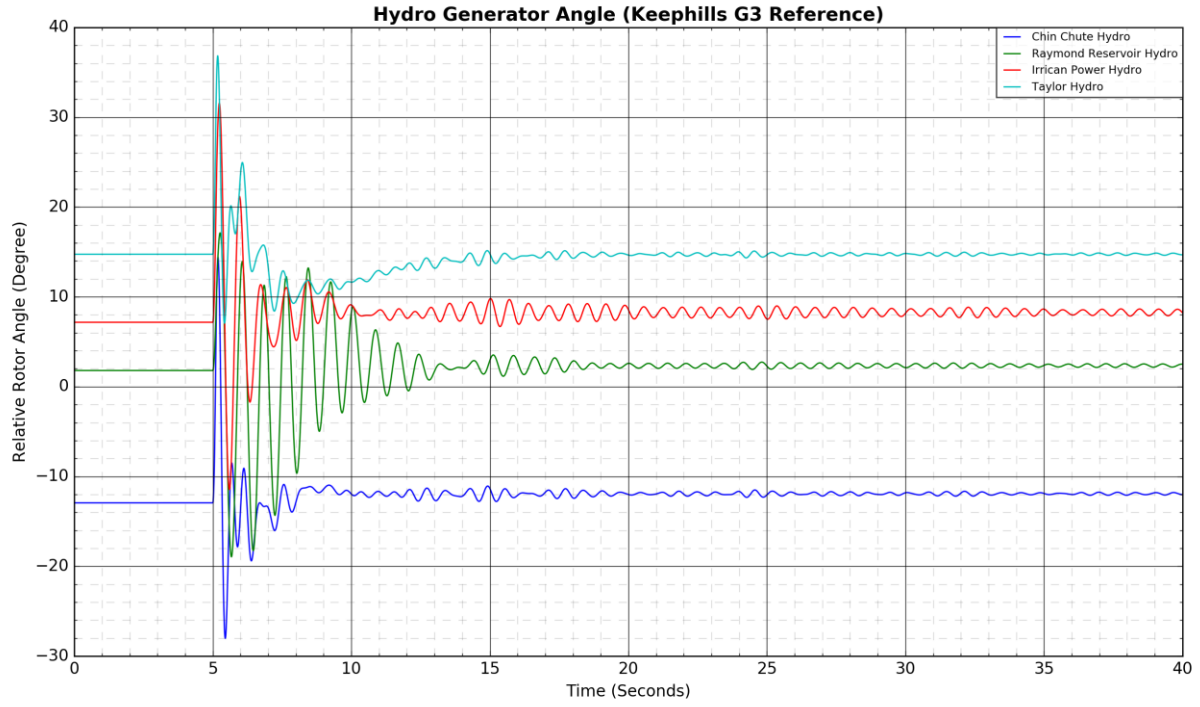
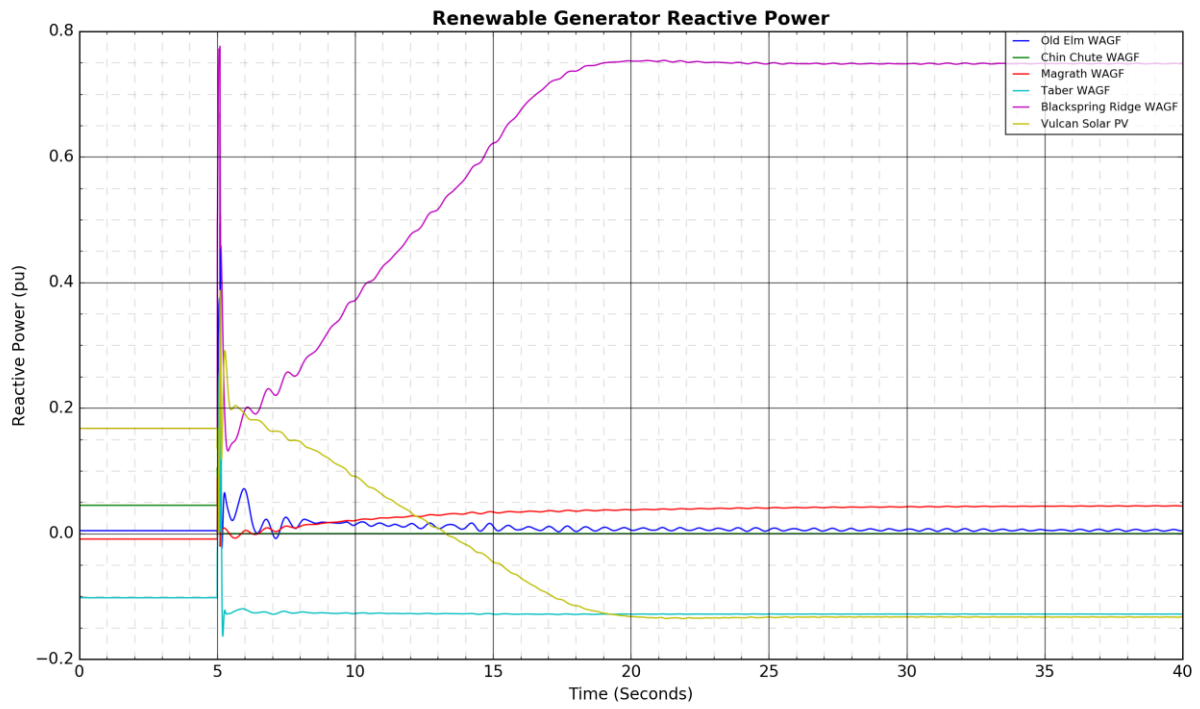
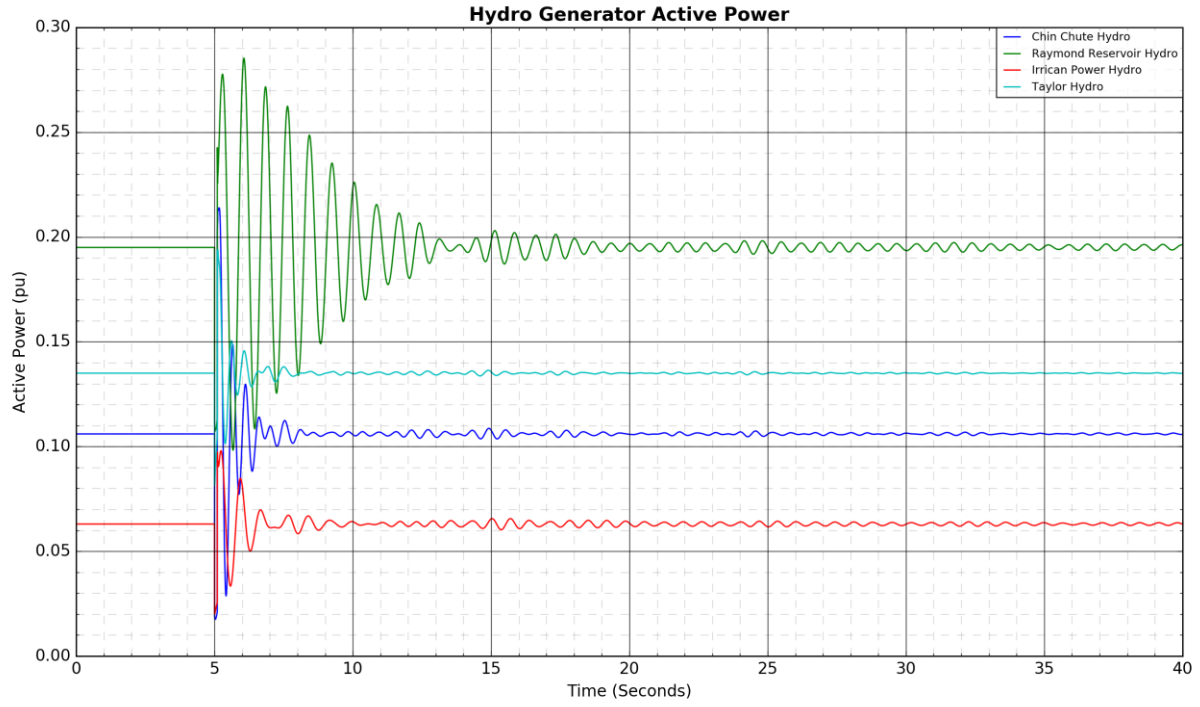


Figure A4-9: 172L Coaldale 254S to Taber 83S: Fault Near Coaldale 254S

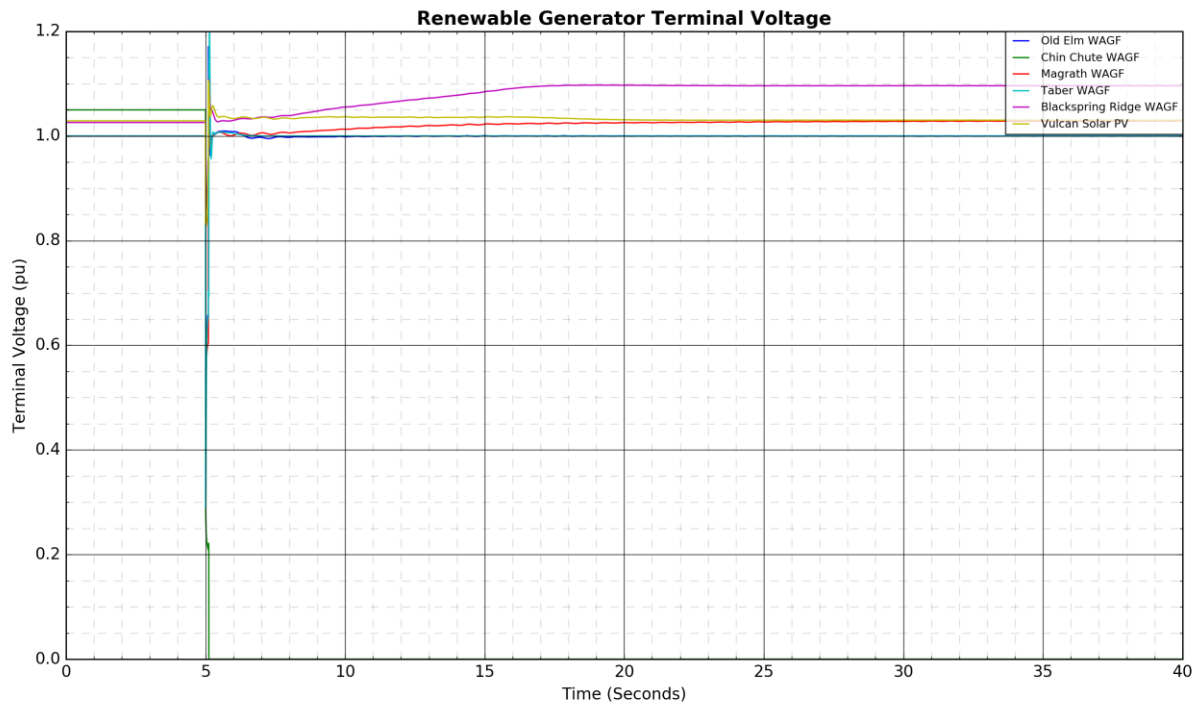
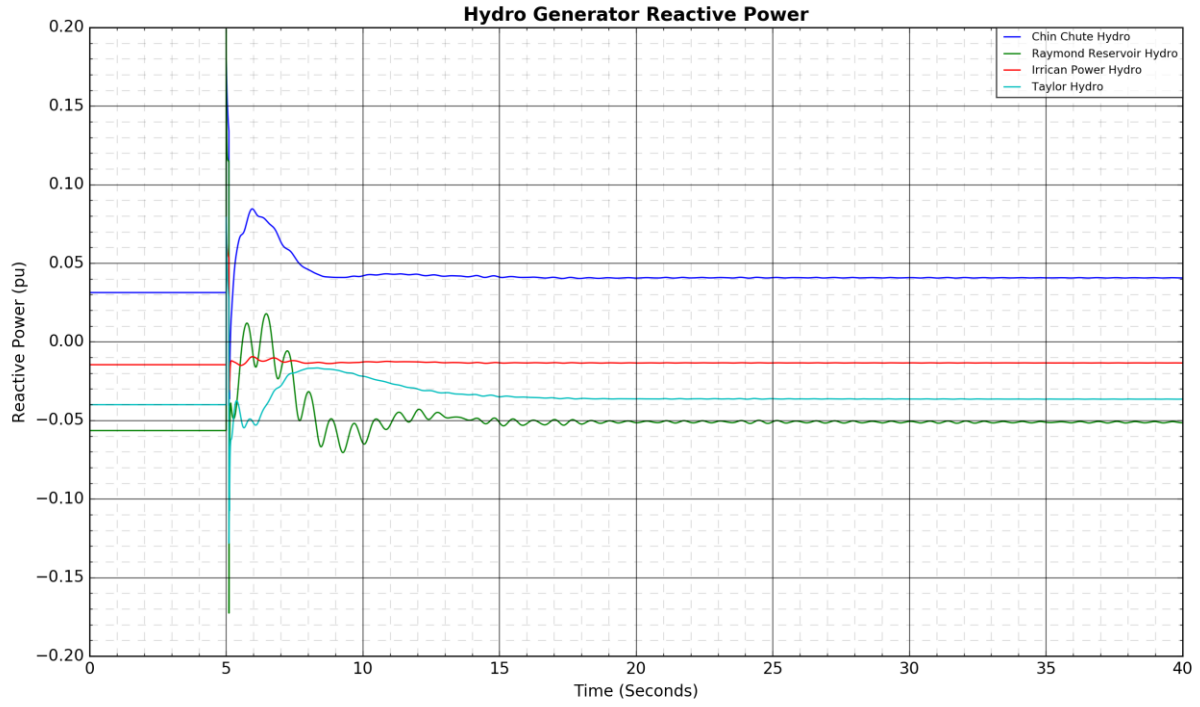


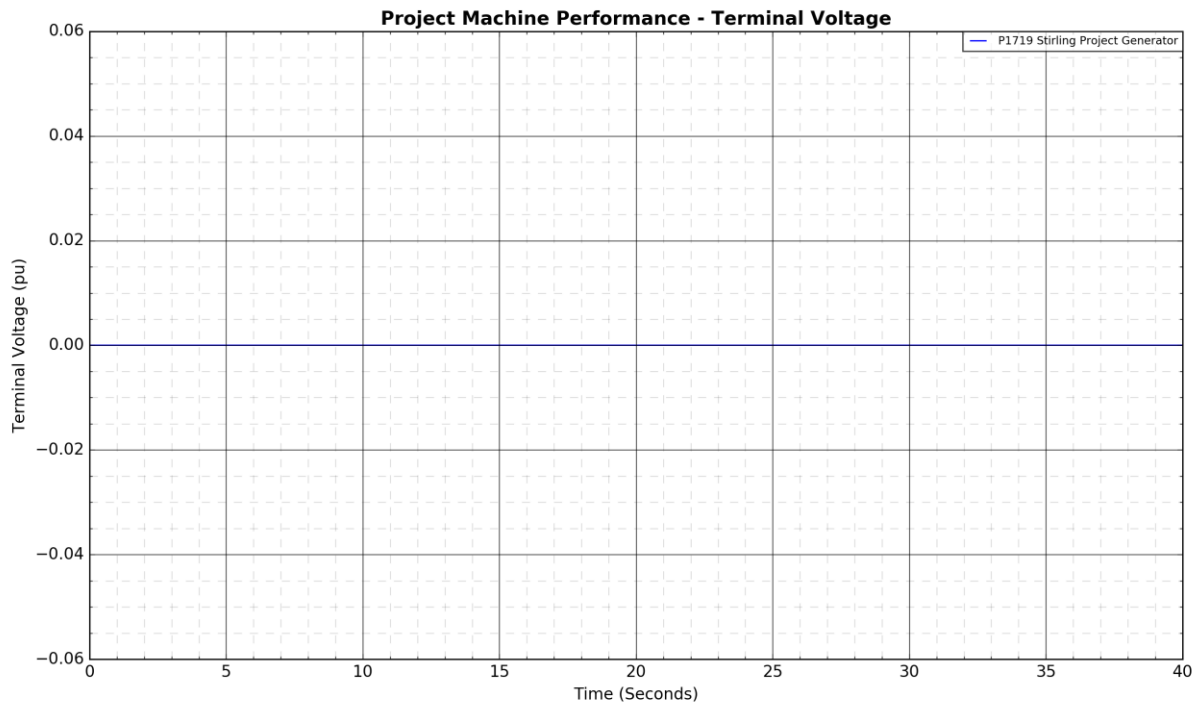
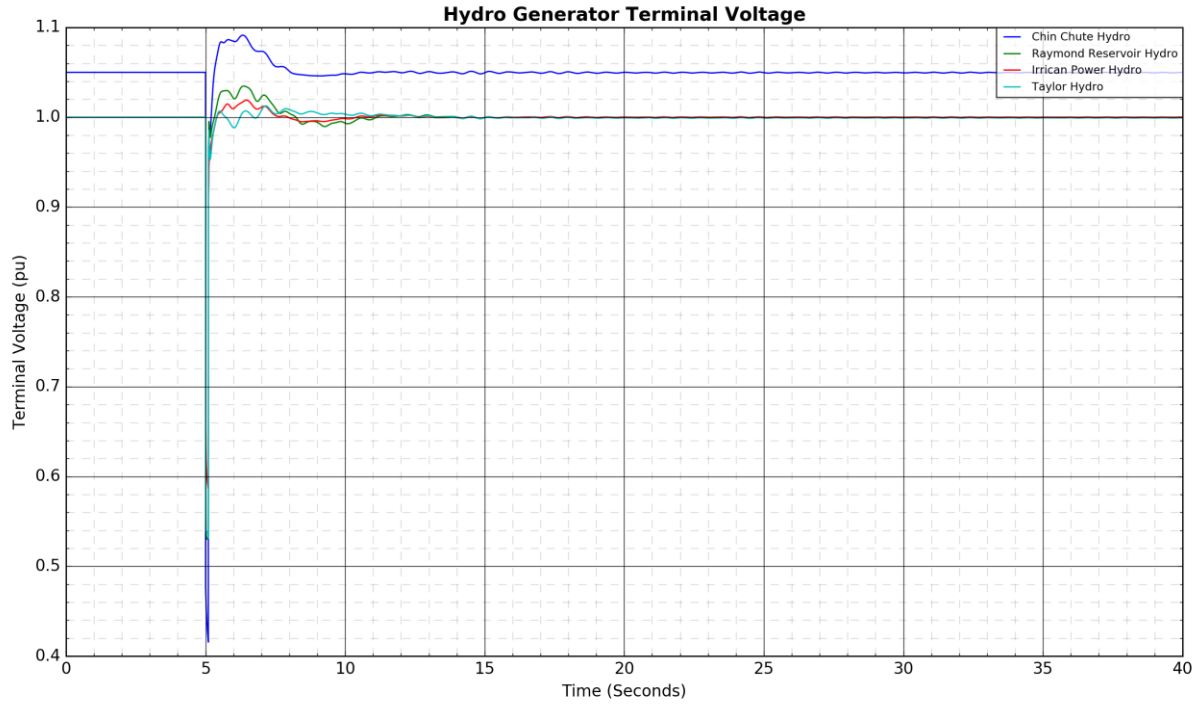


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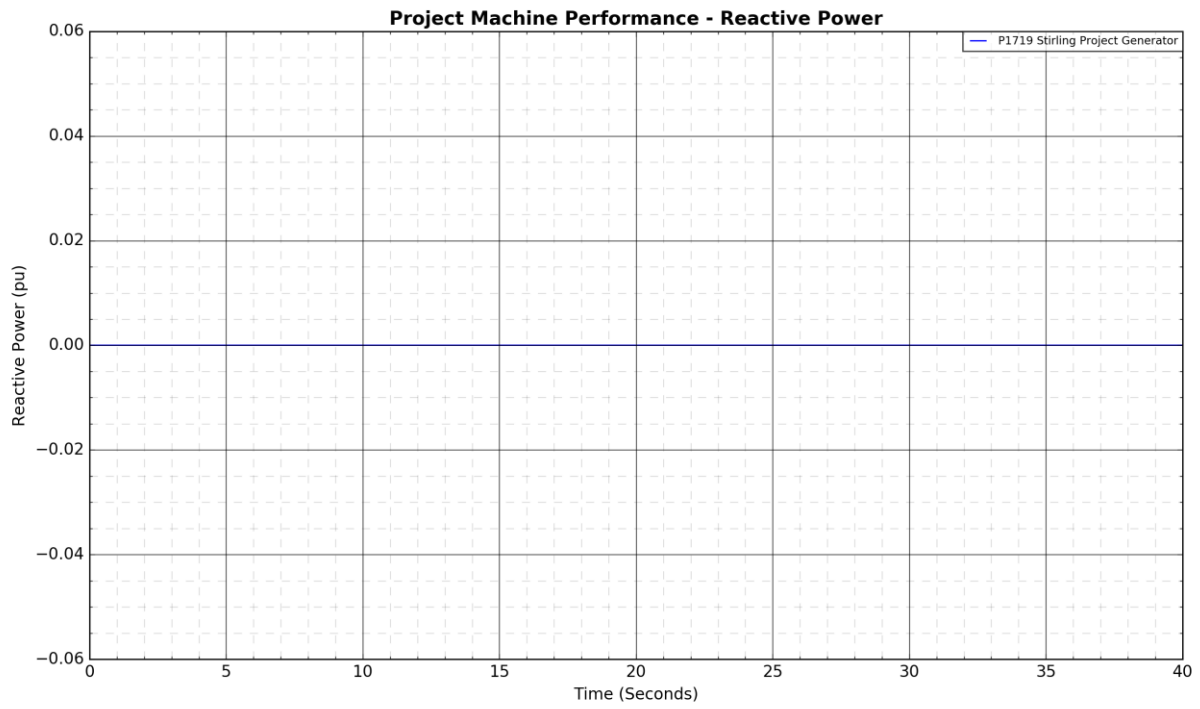
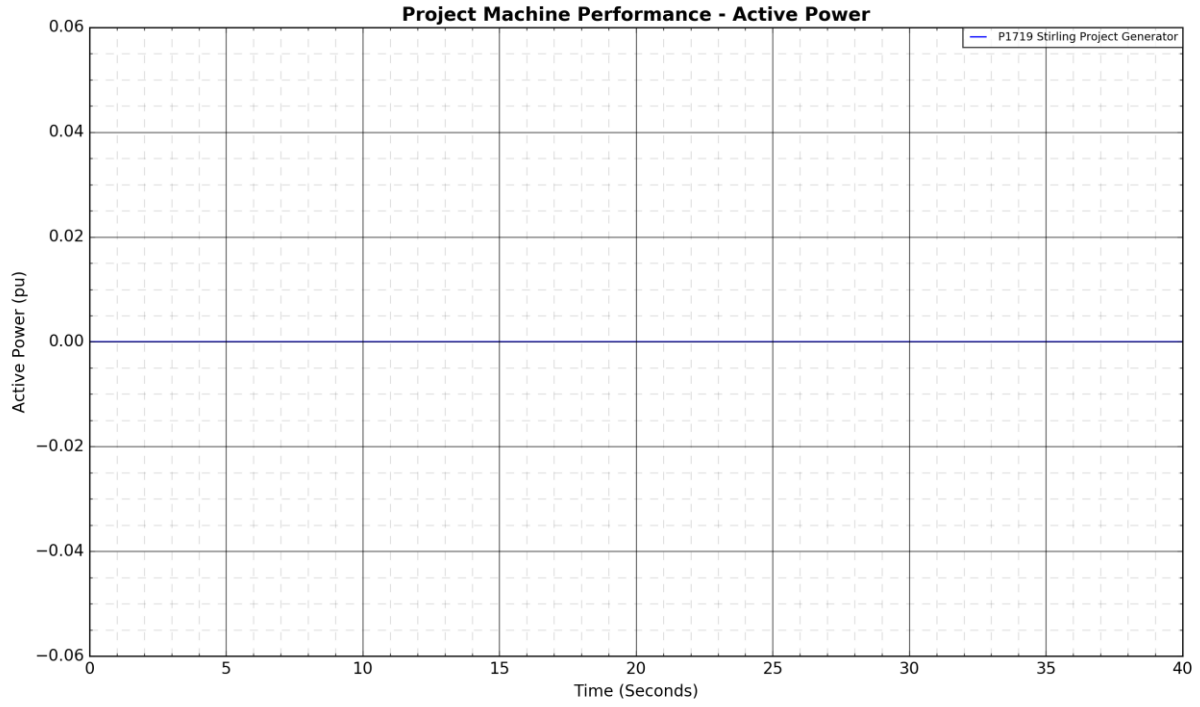
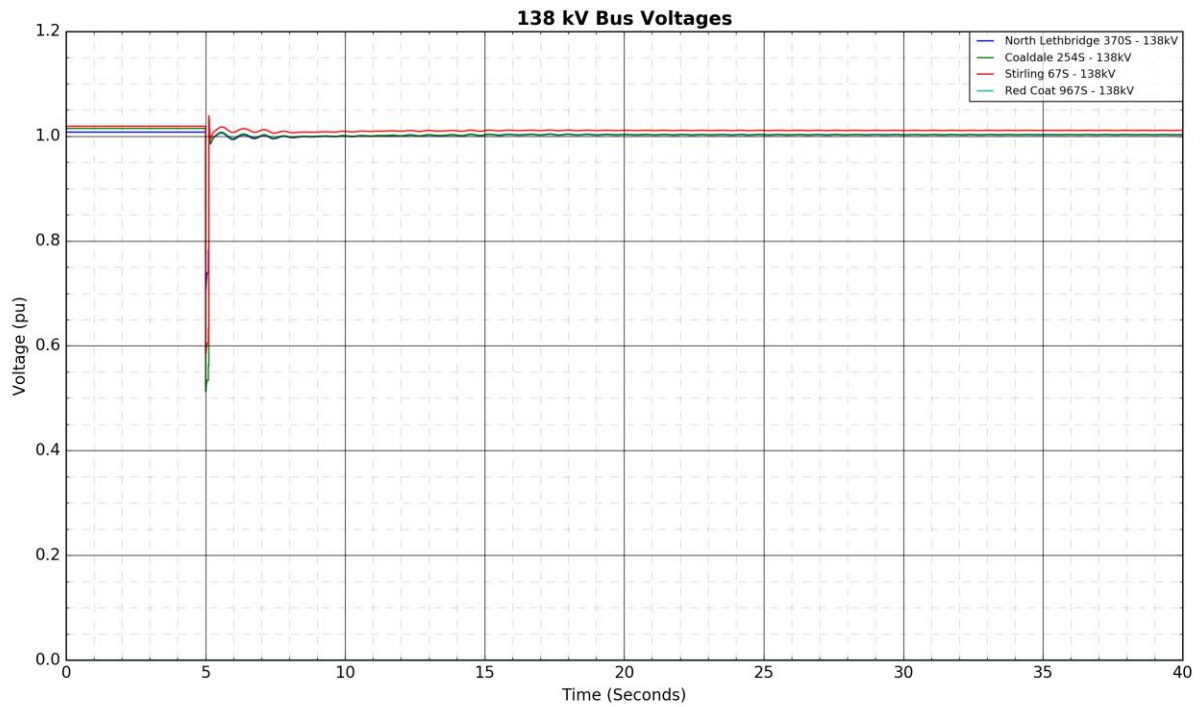
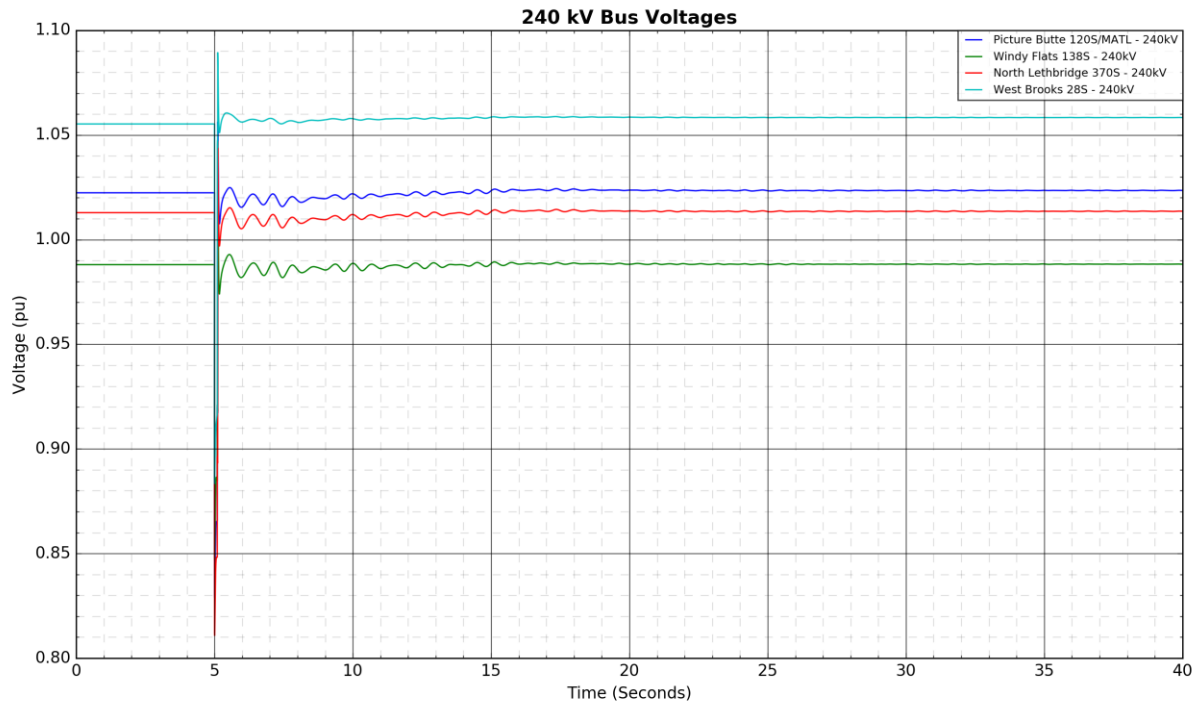
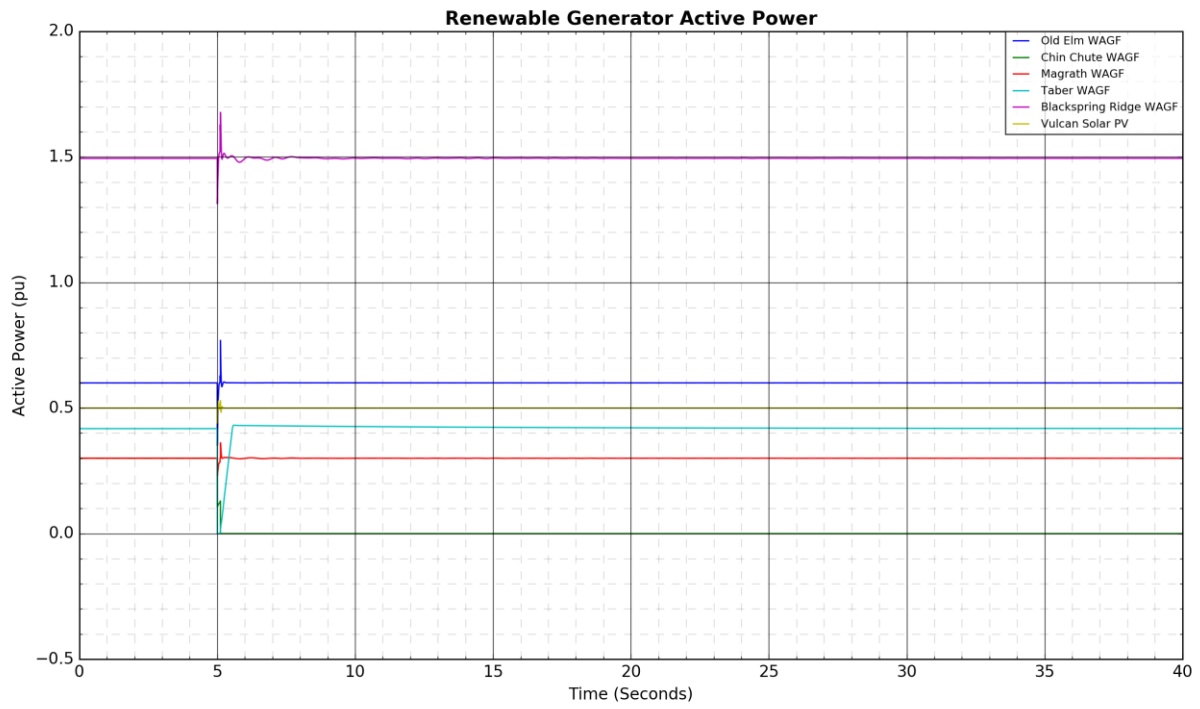
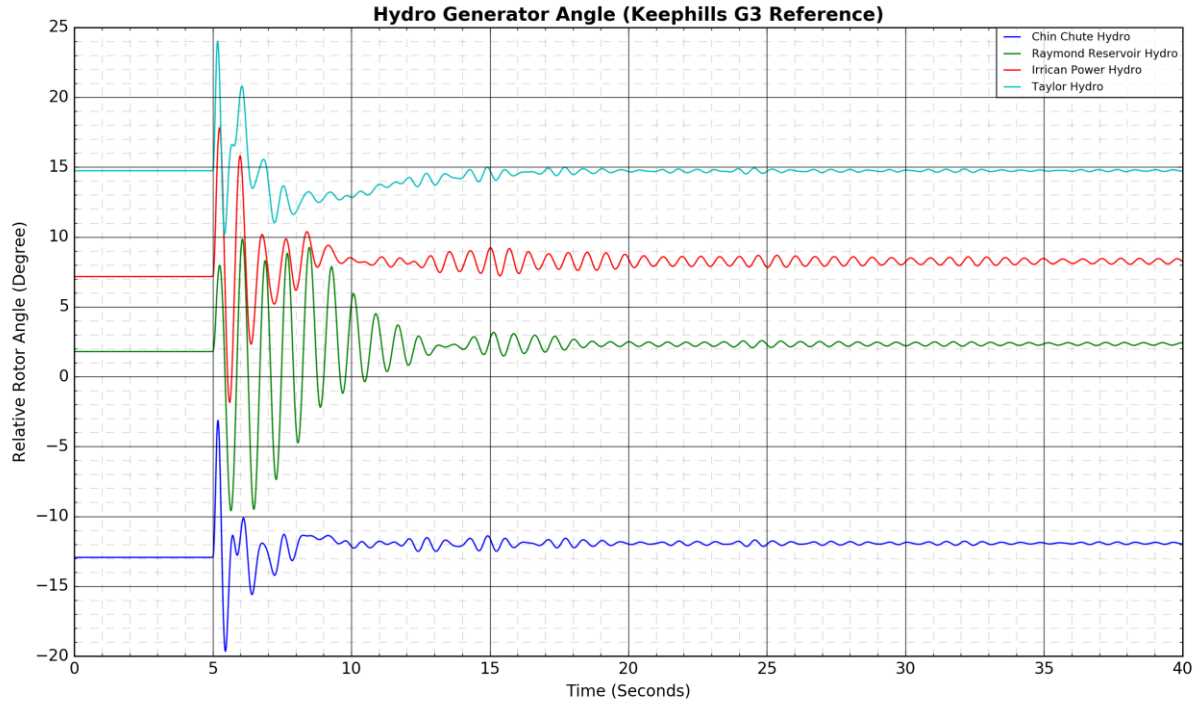
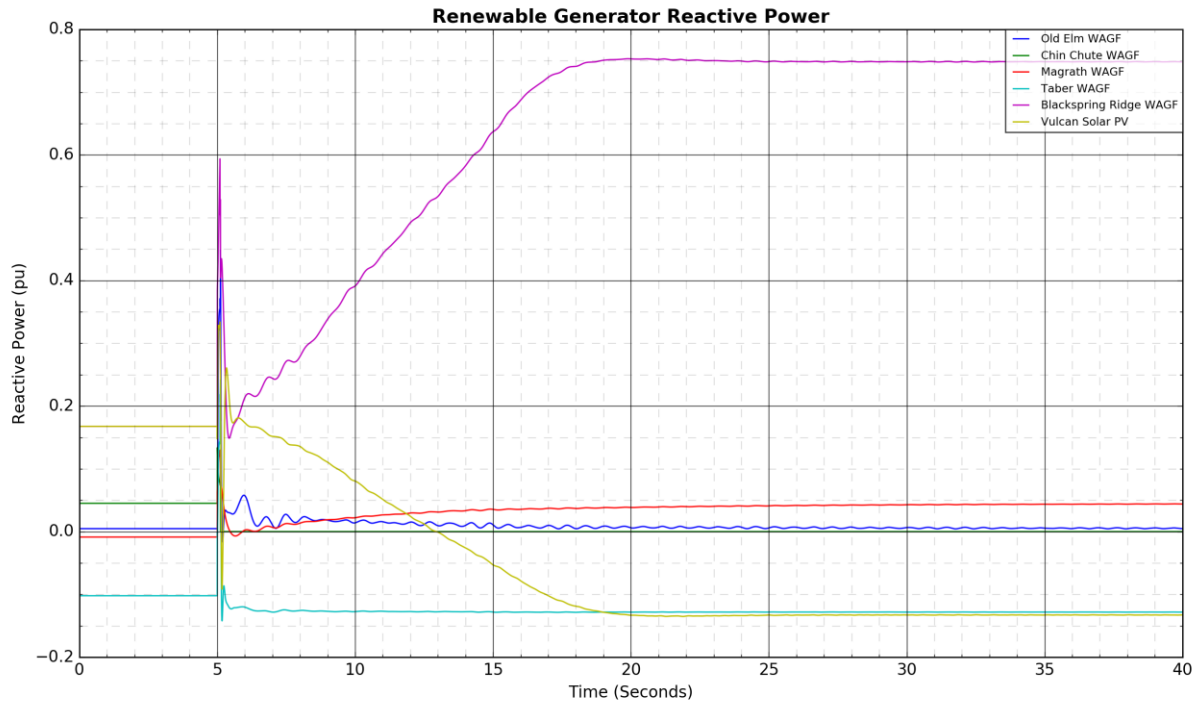
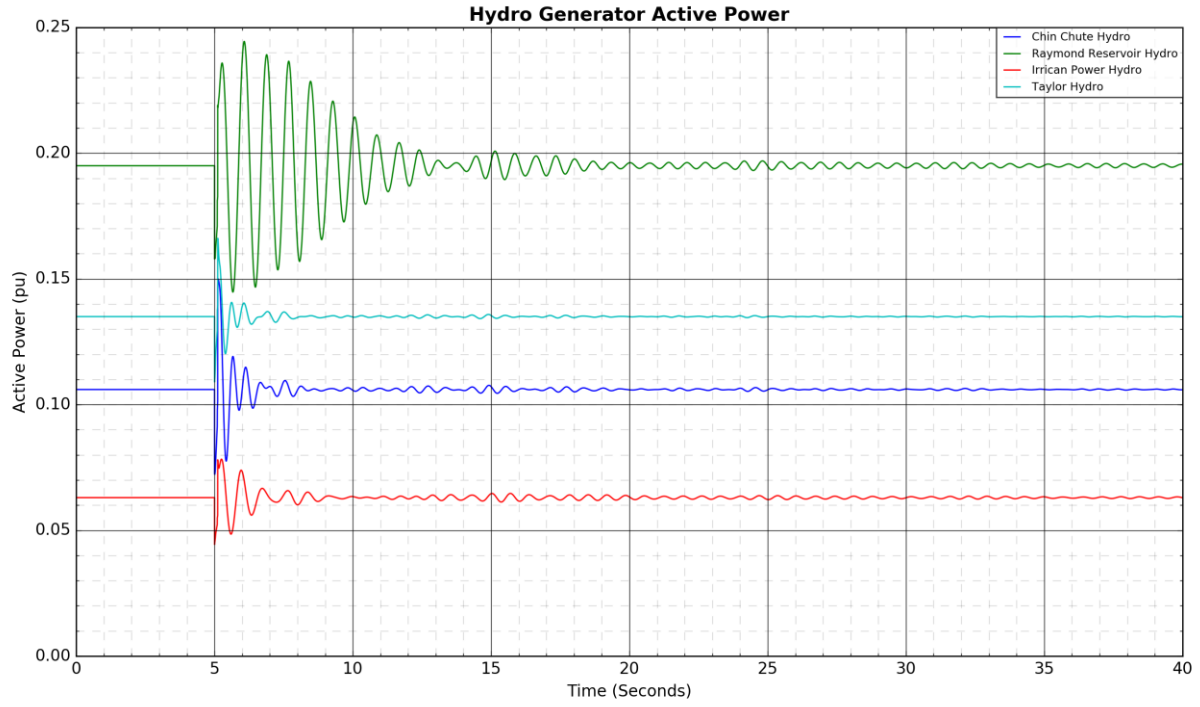


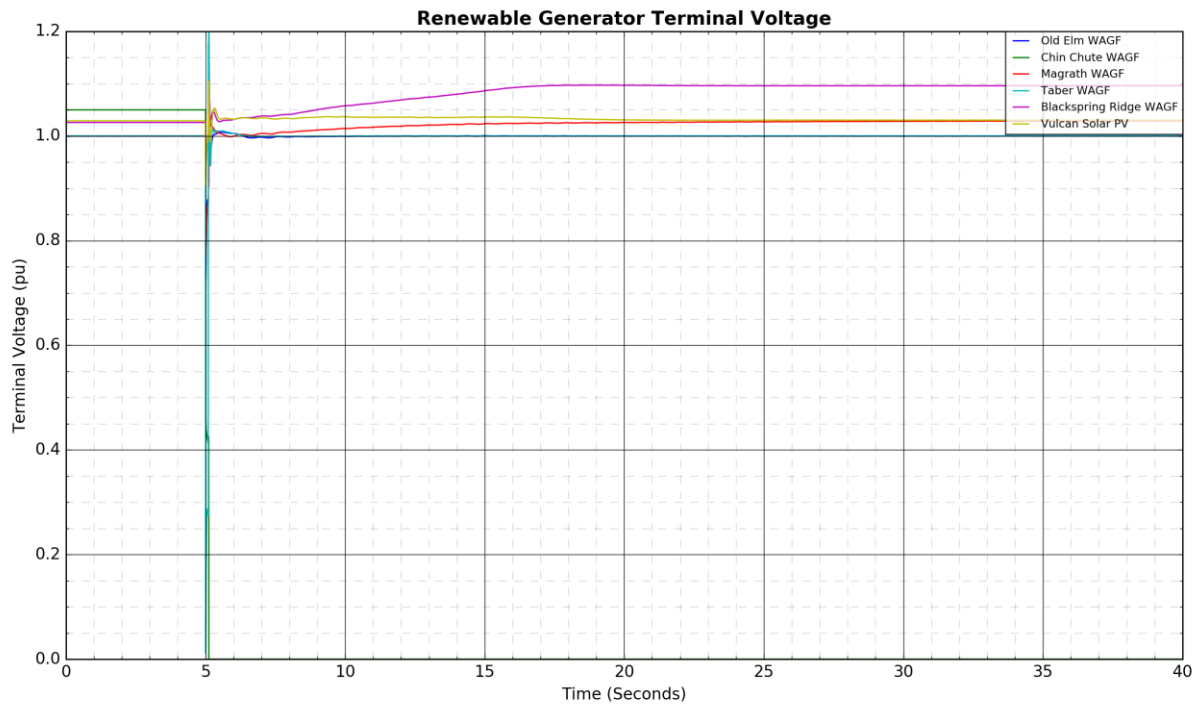
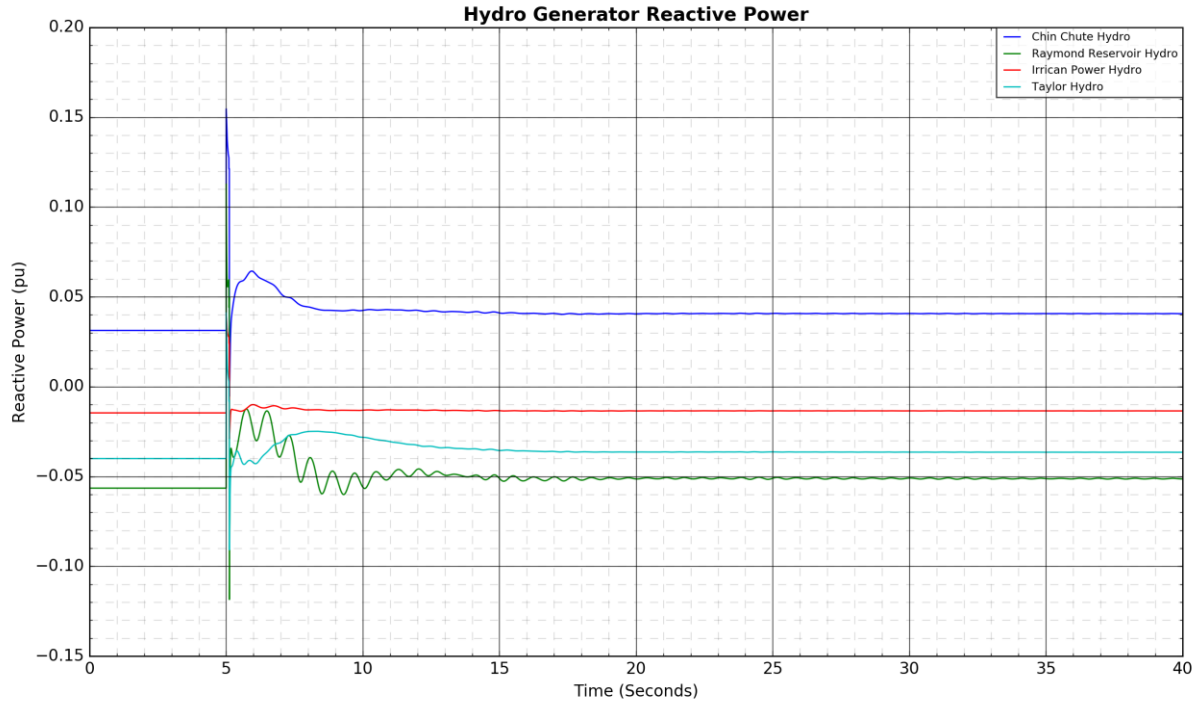
Figure A4-10: 172L Coaldale 254S to Taber 83S: Fault Near Taber 83S

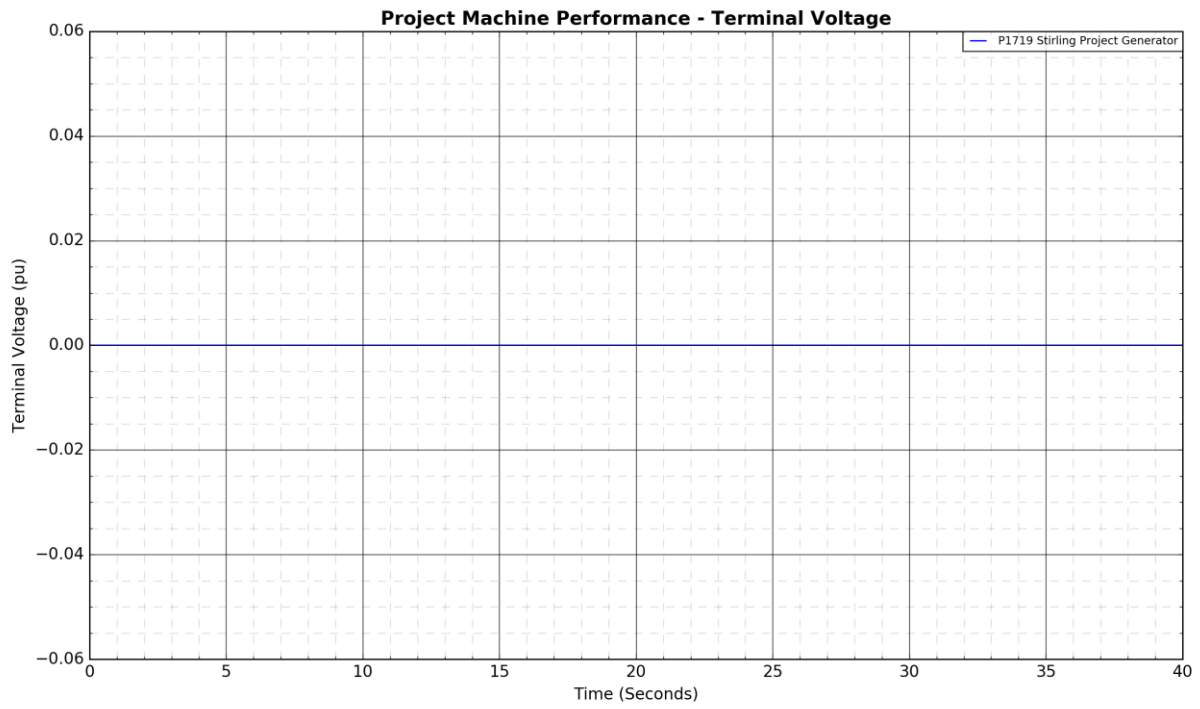
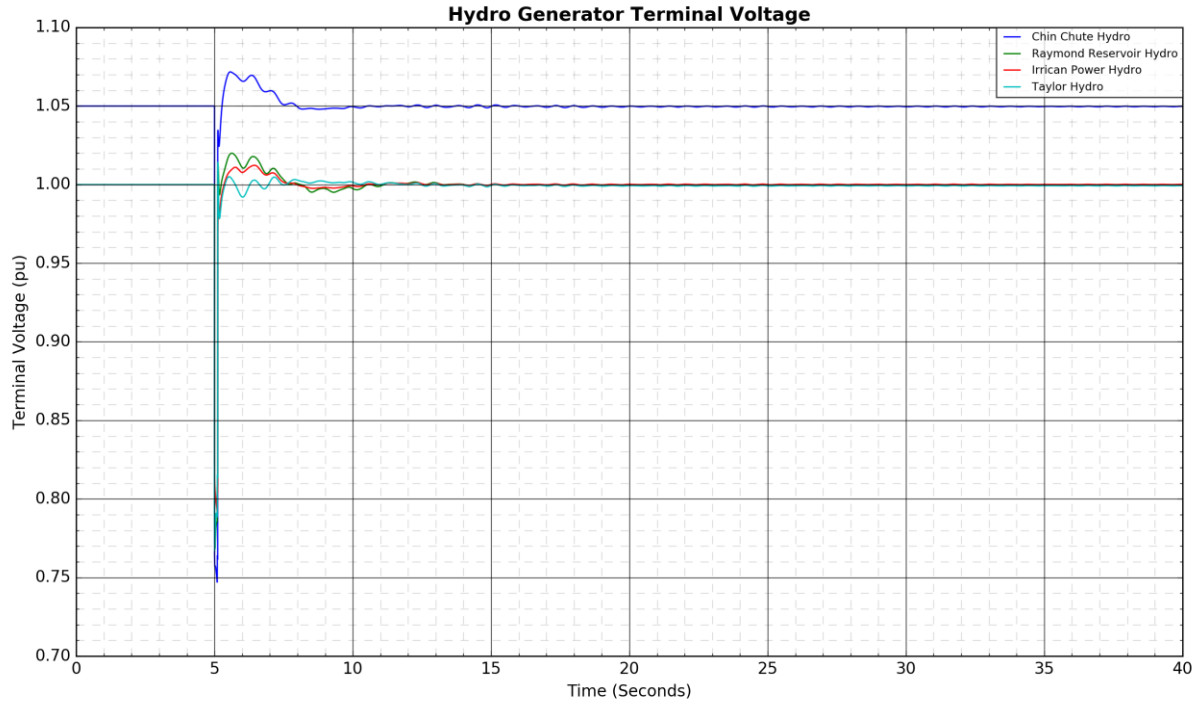




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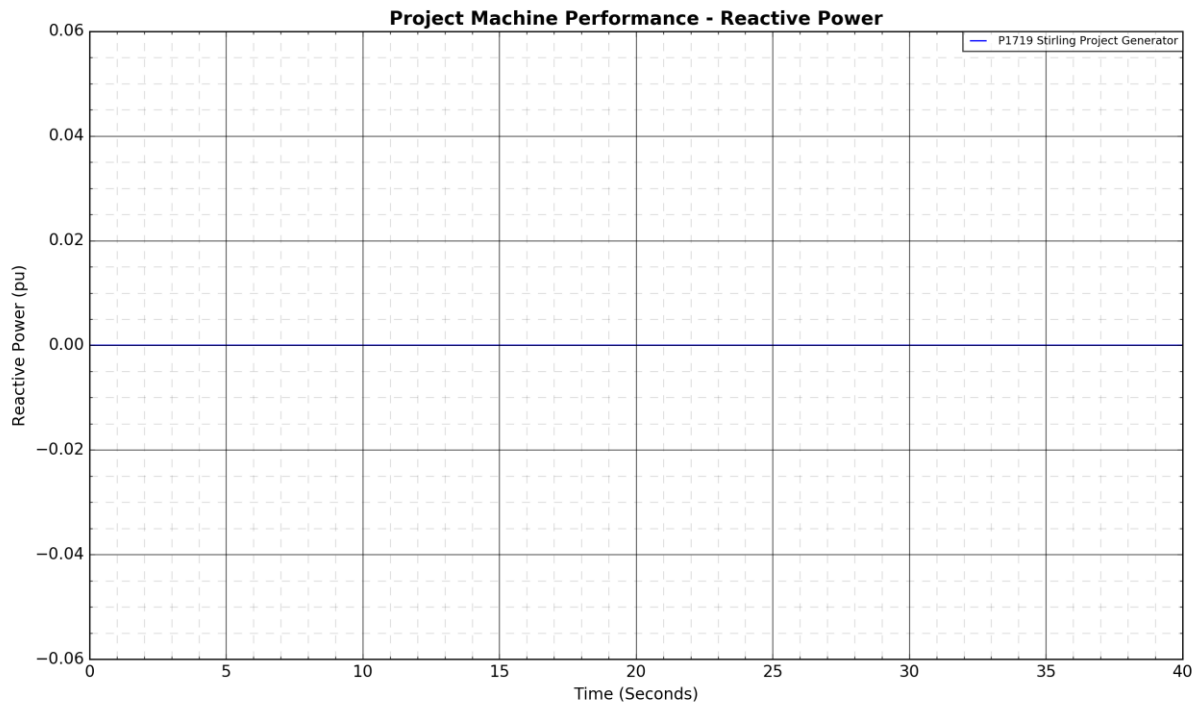
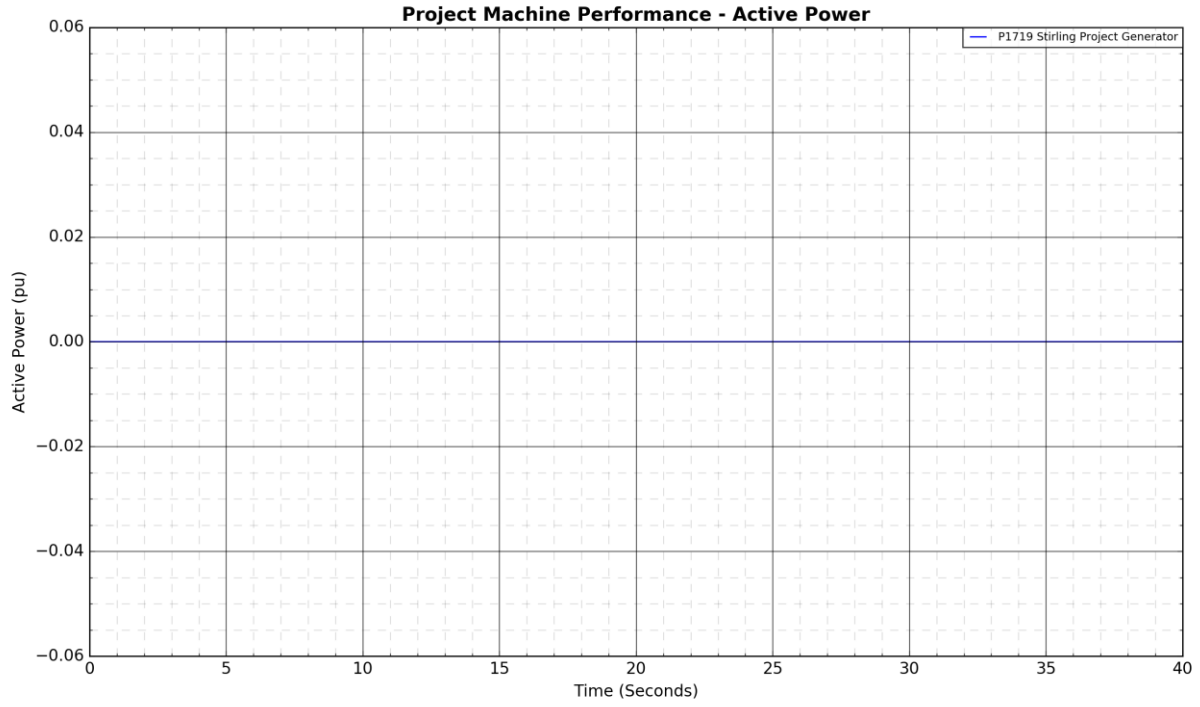
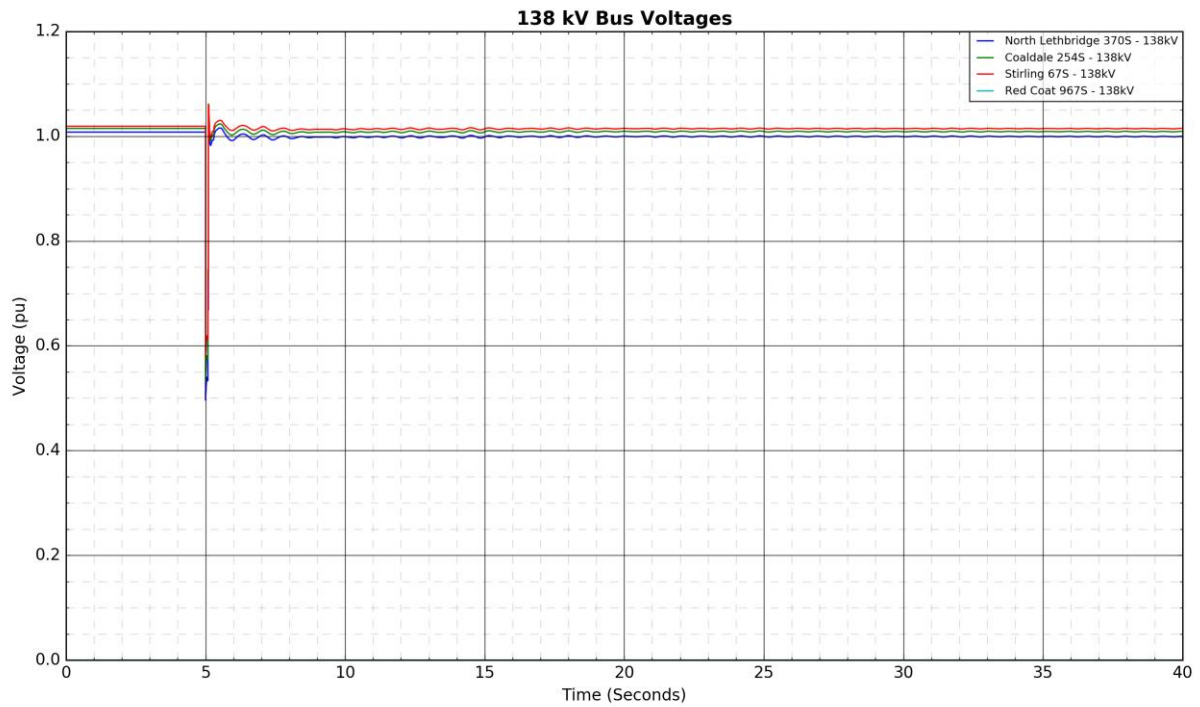
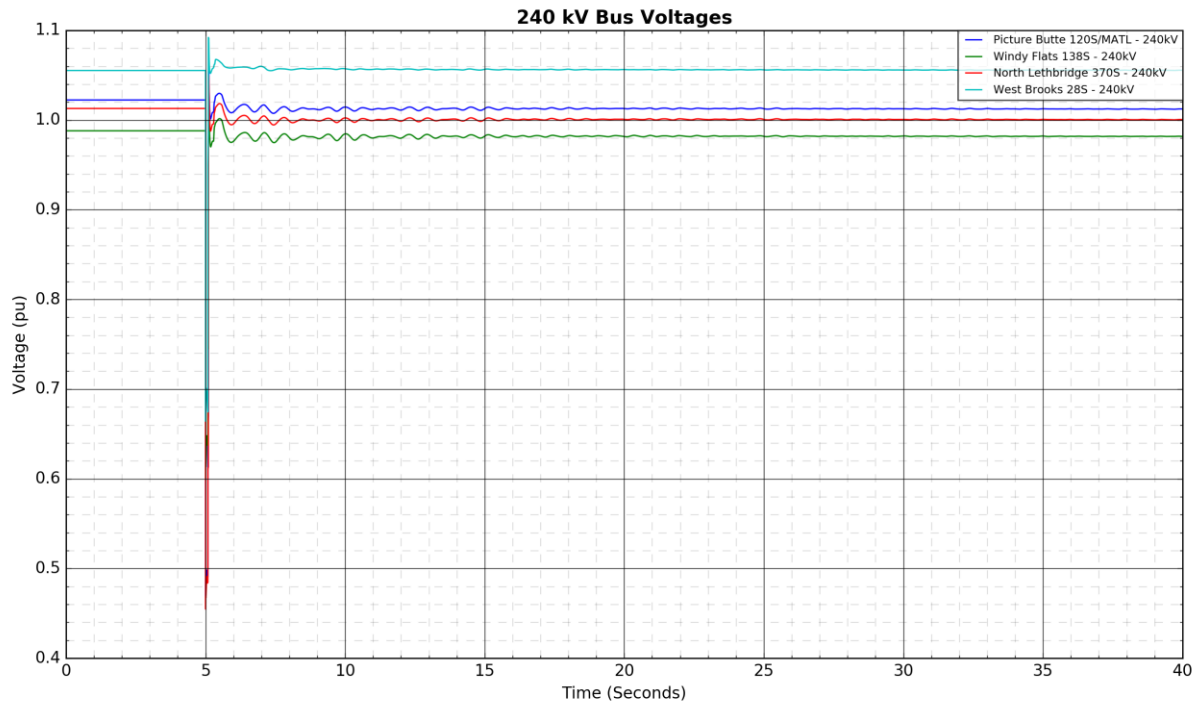
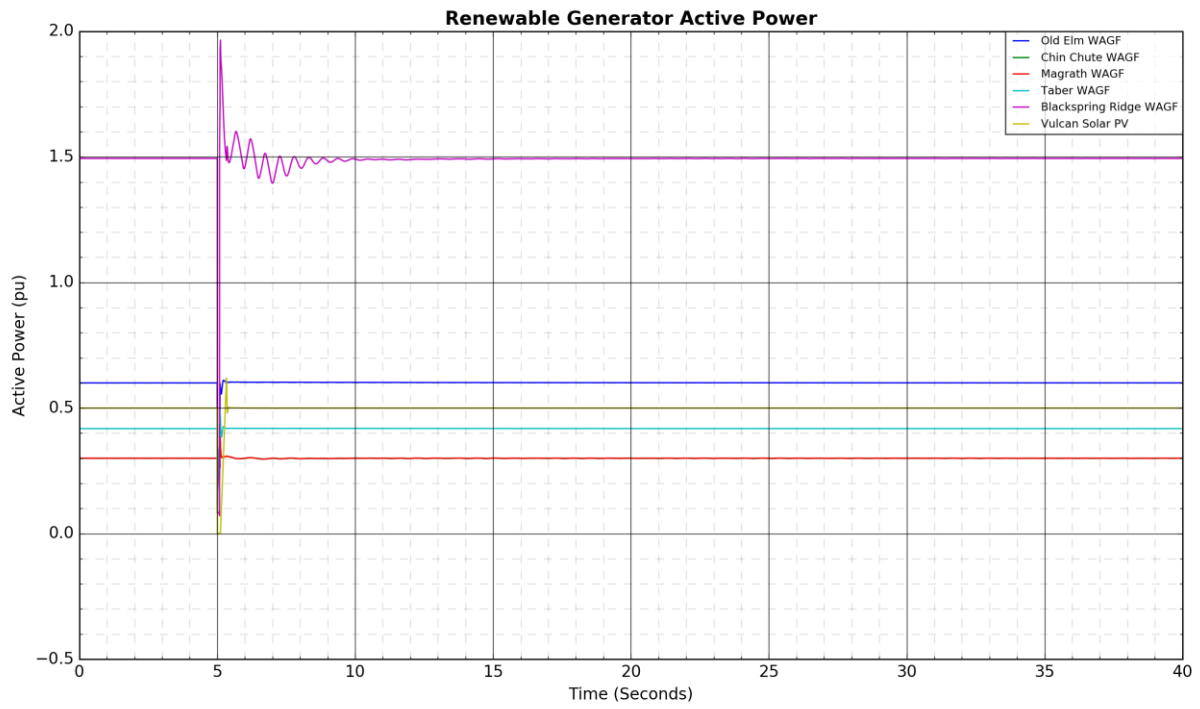
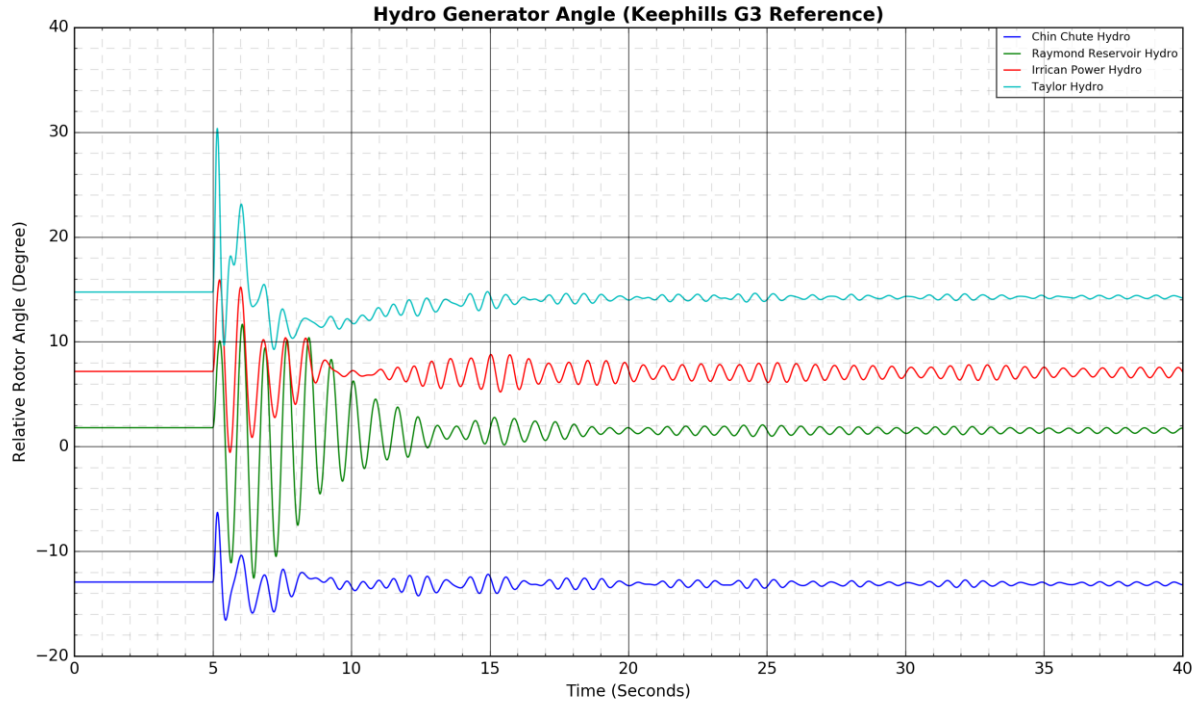
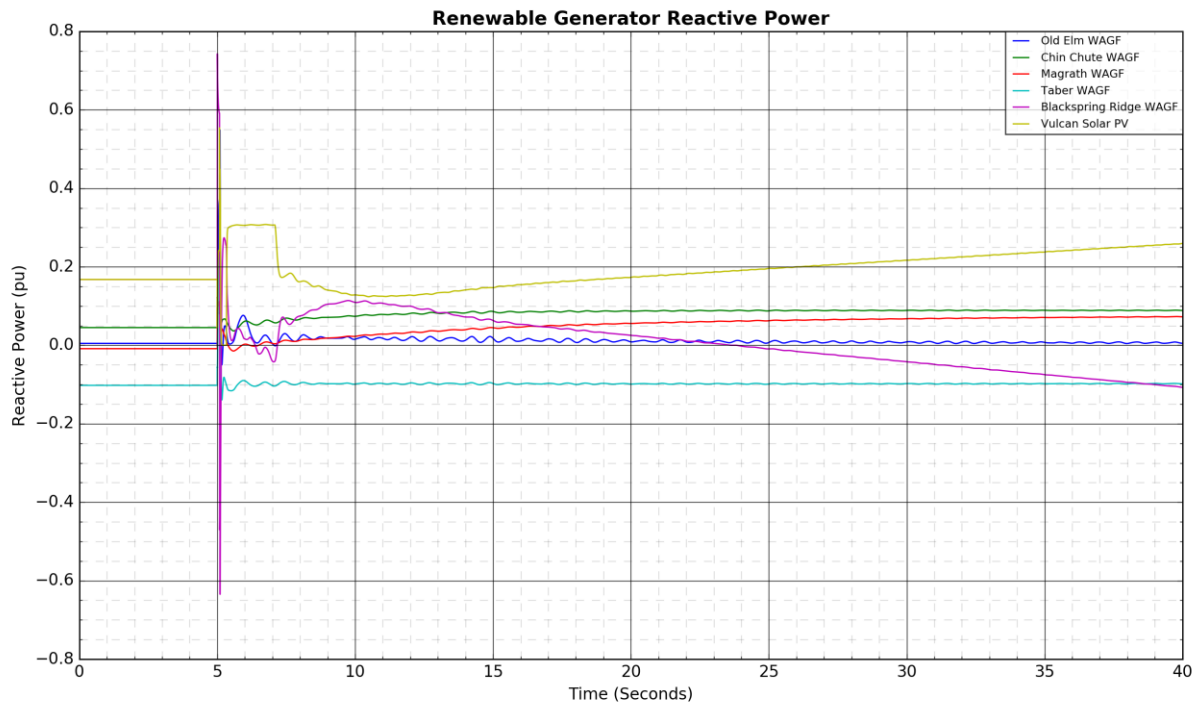
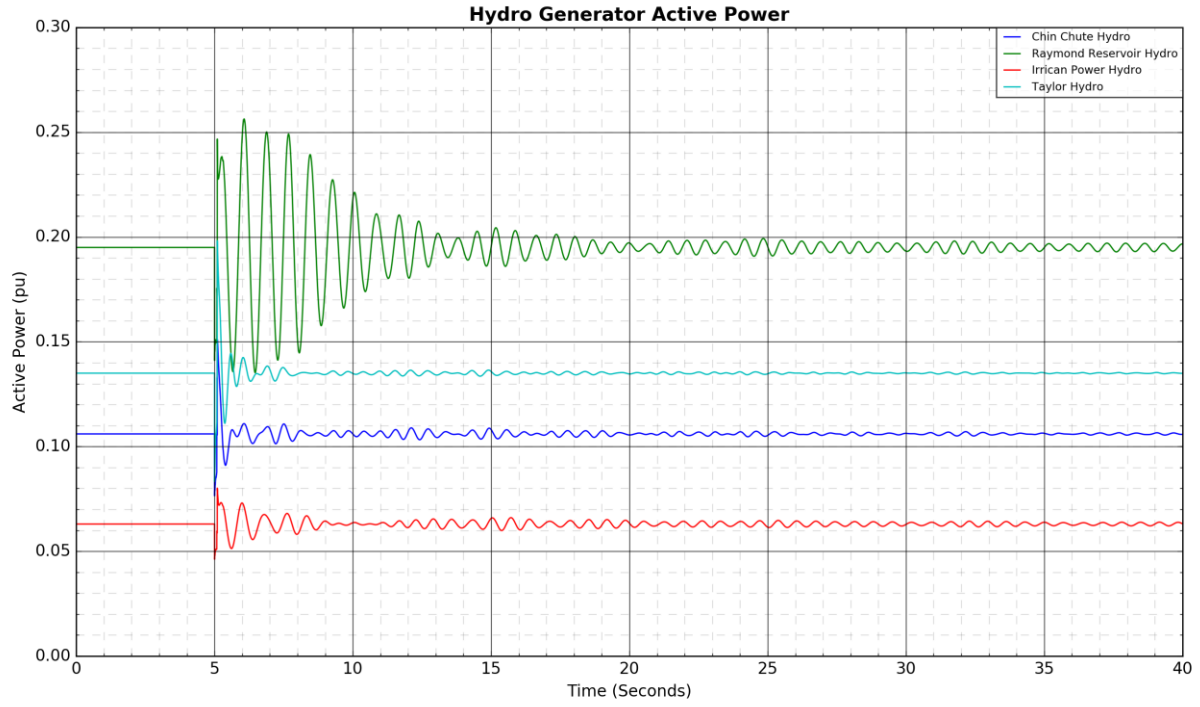


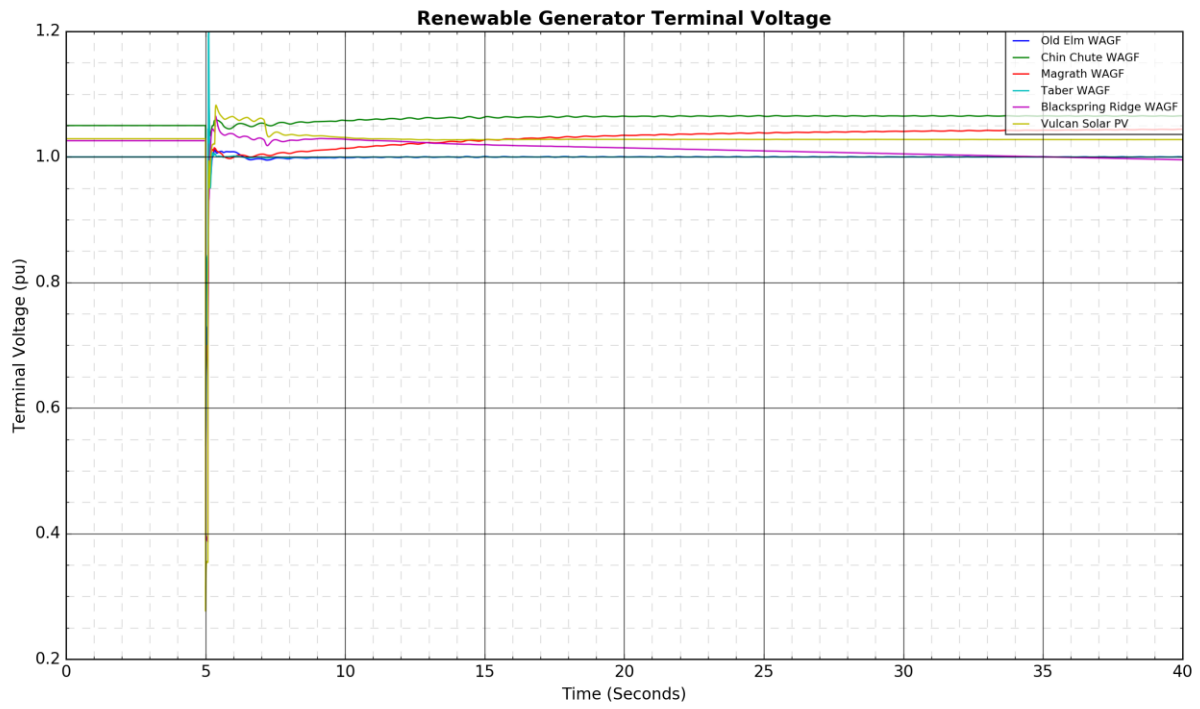
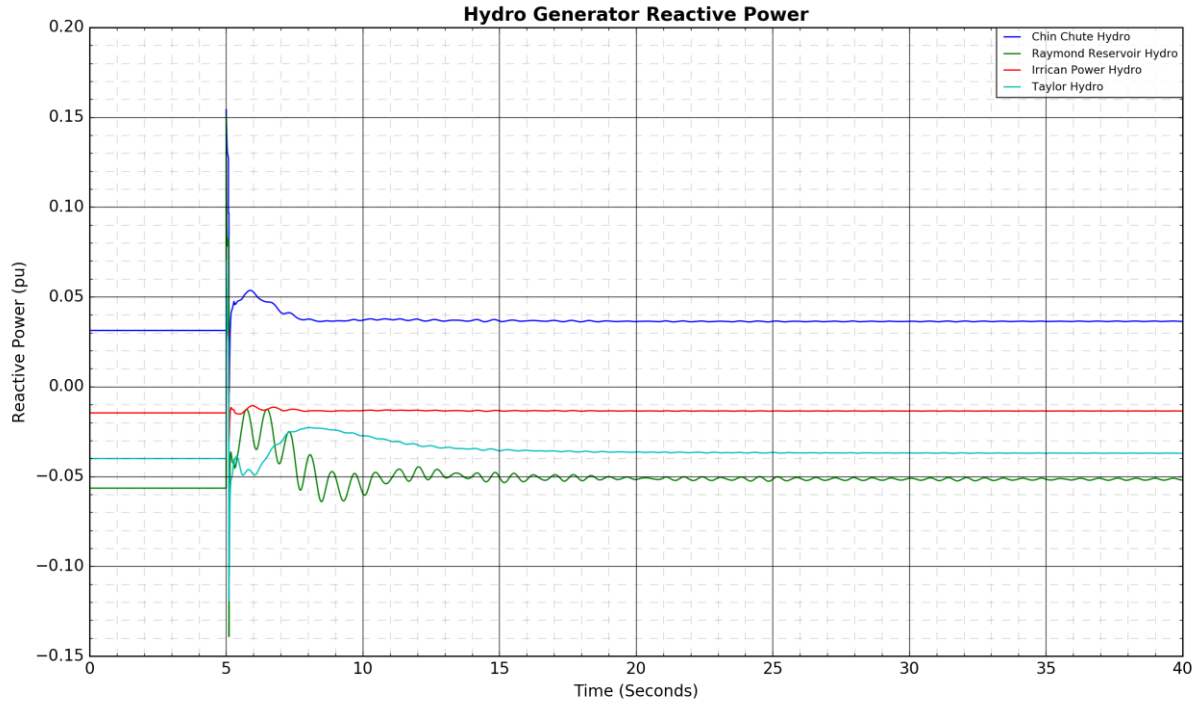
Figure A4-11: 1041L Travers 554S to North Lethbridge 370S: Fault Near Travers 554S

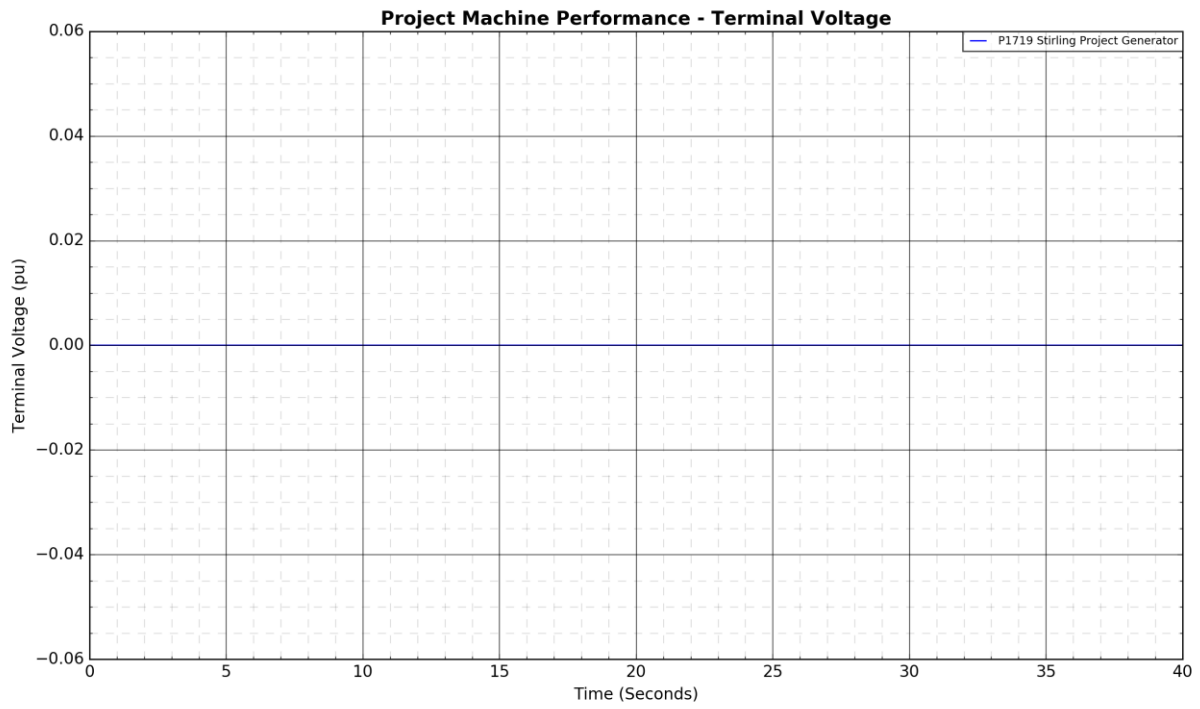
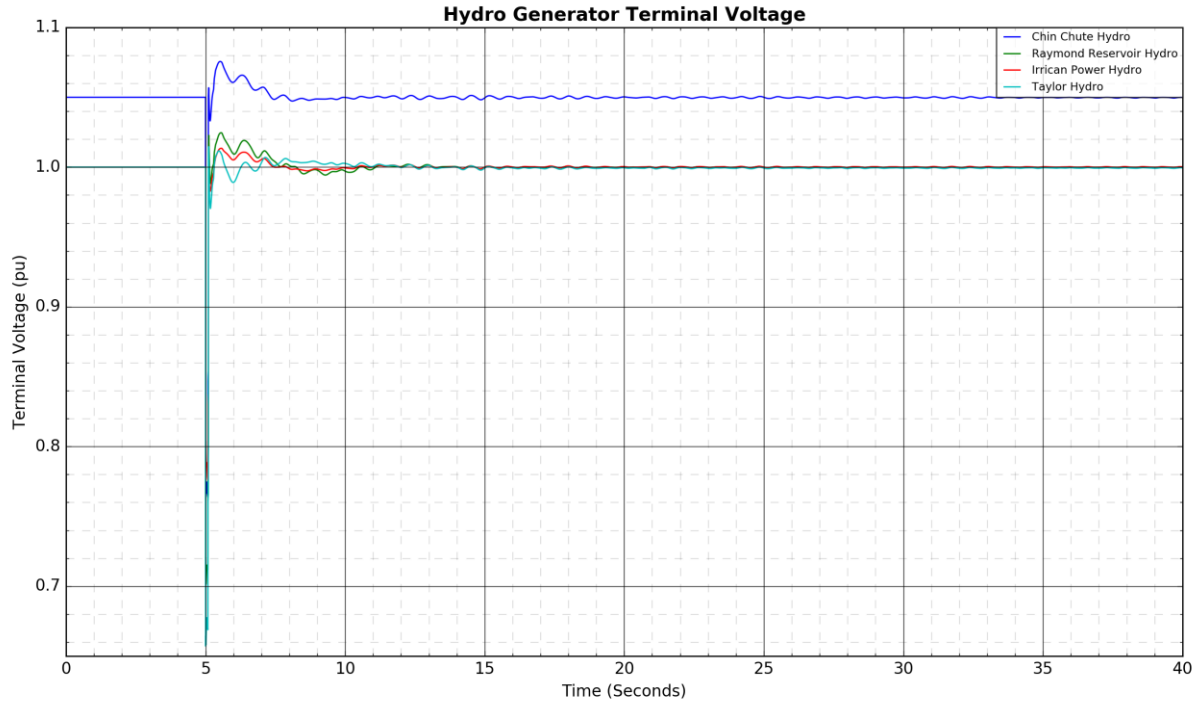




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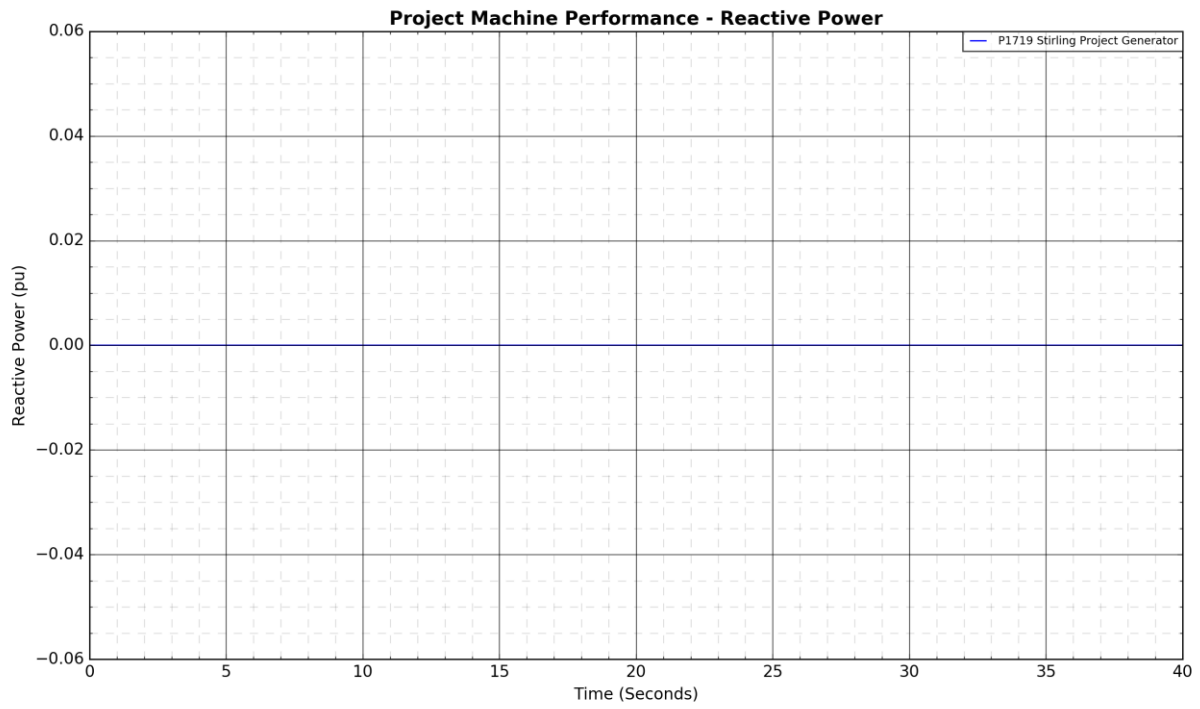
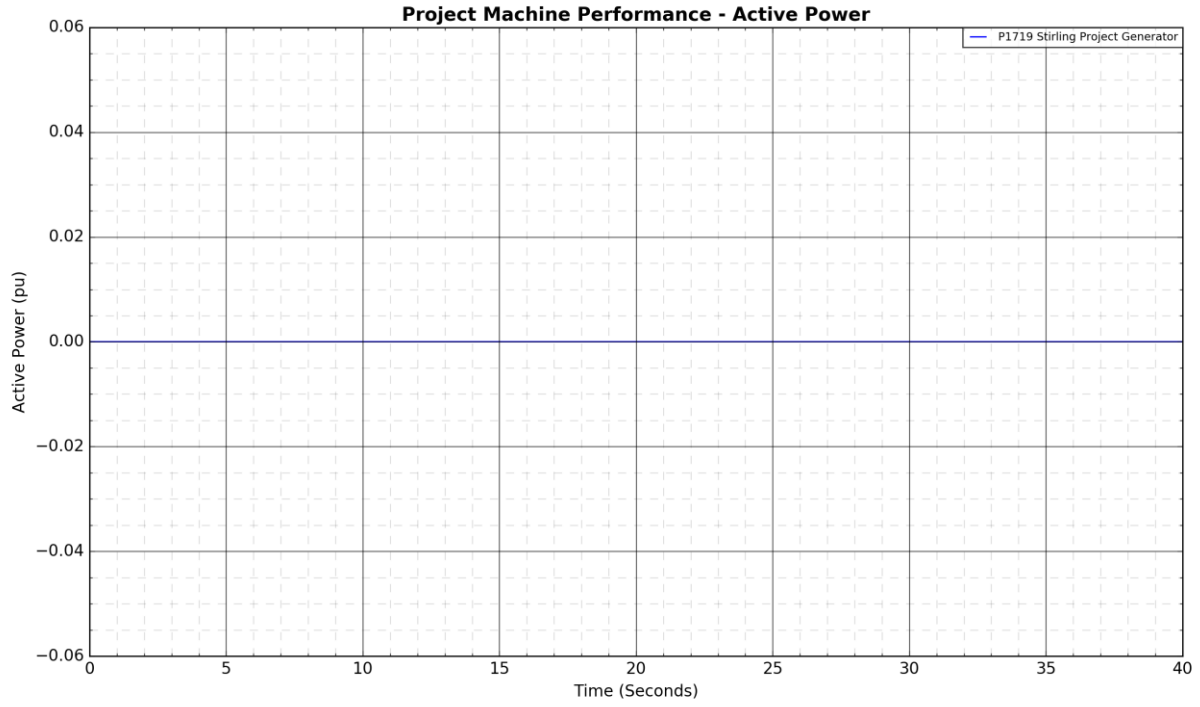
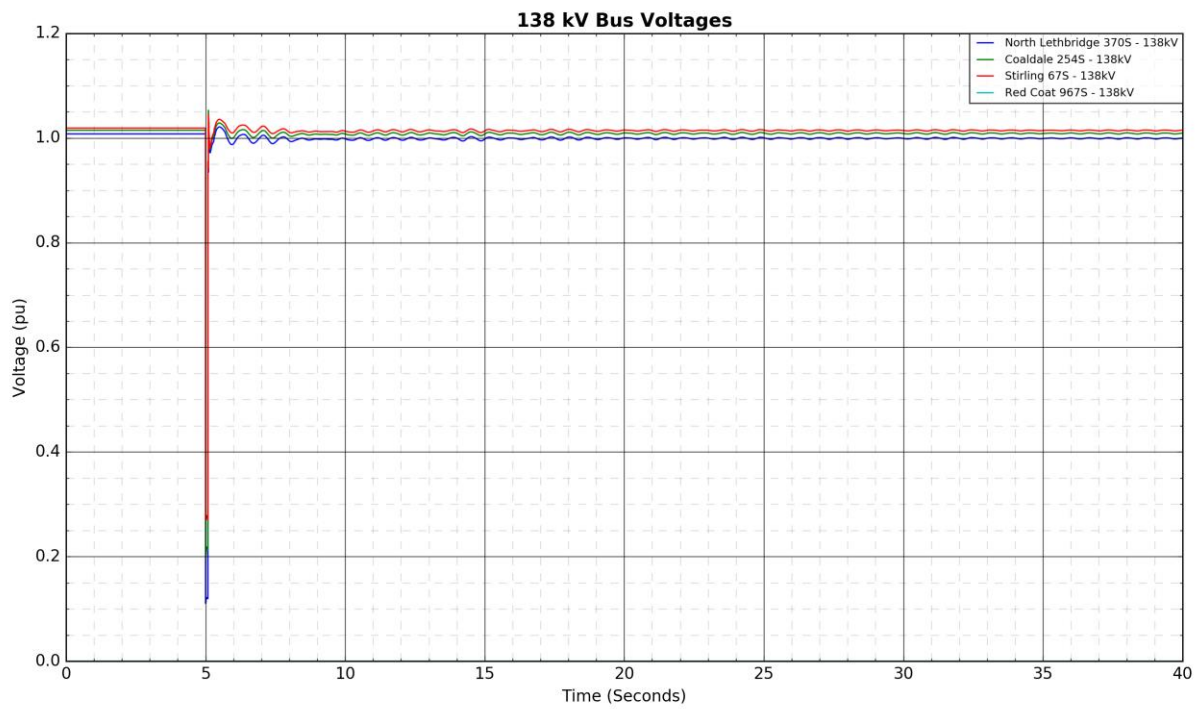
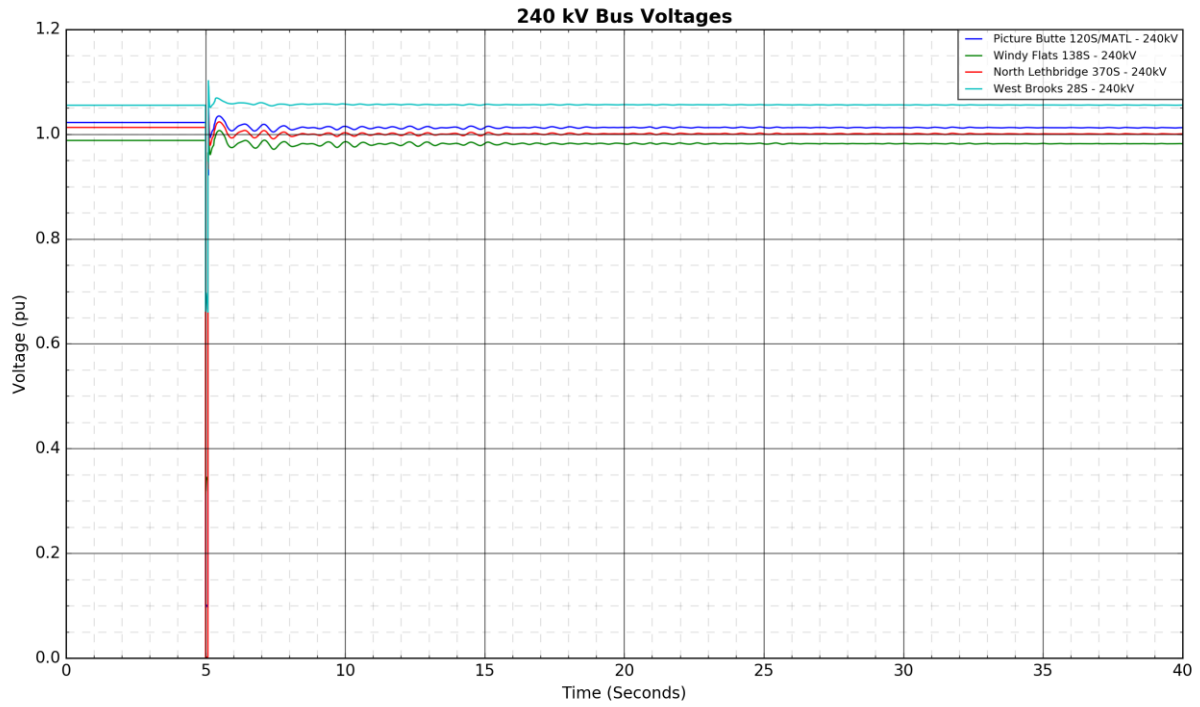
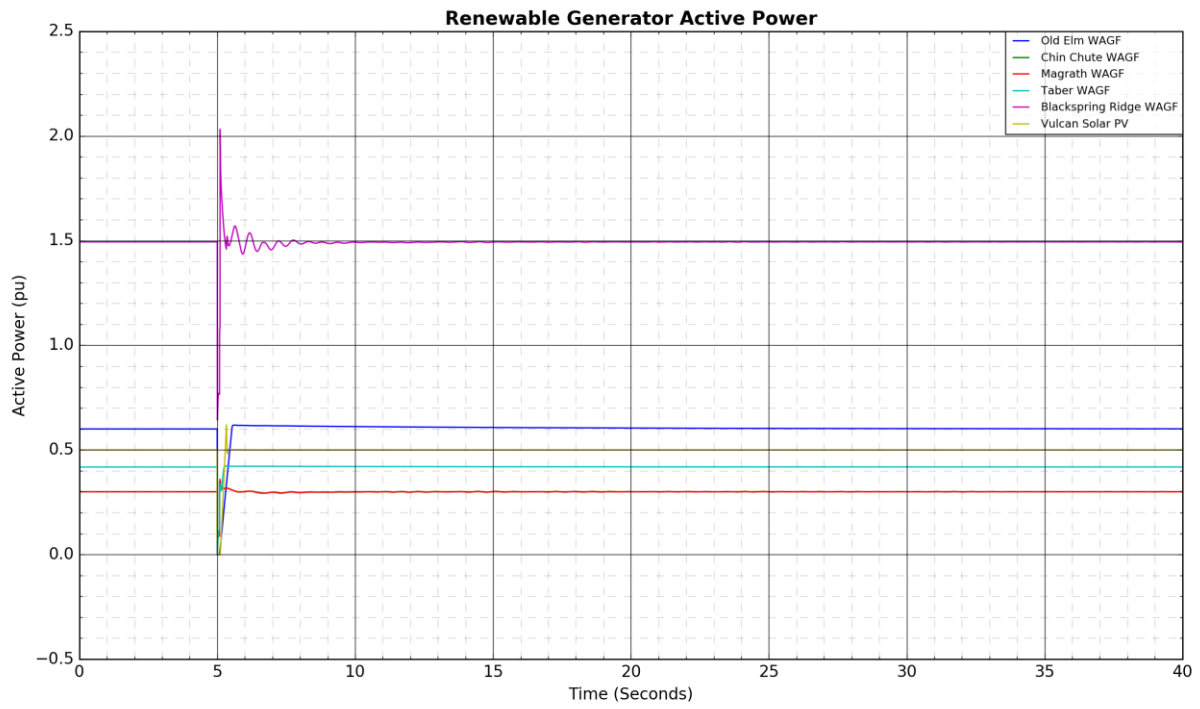
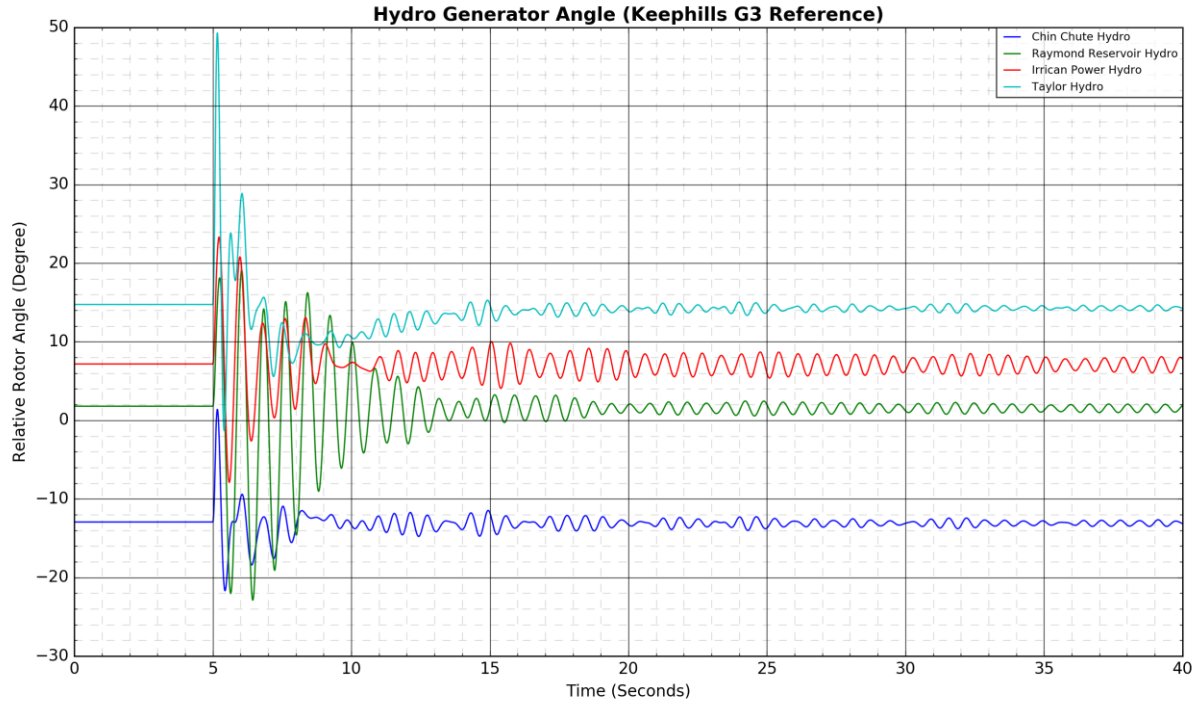
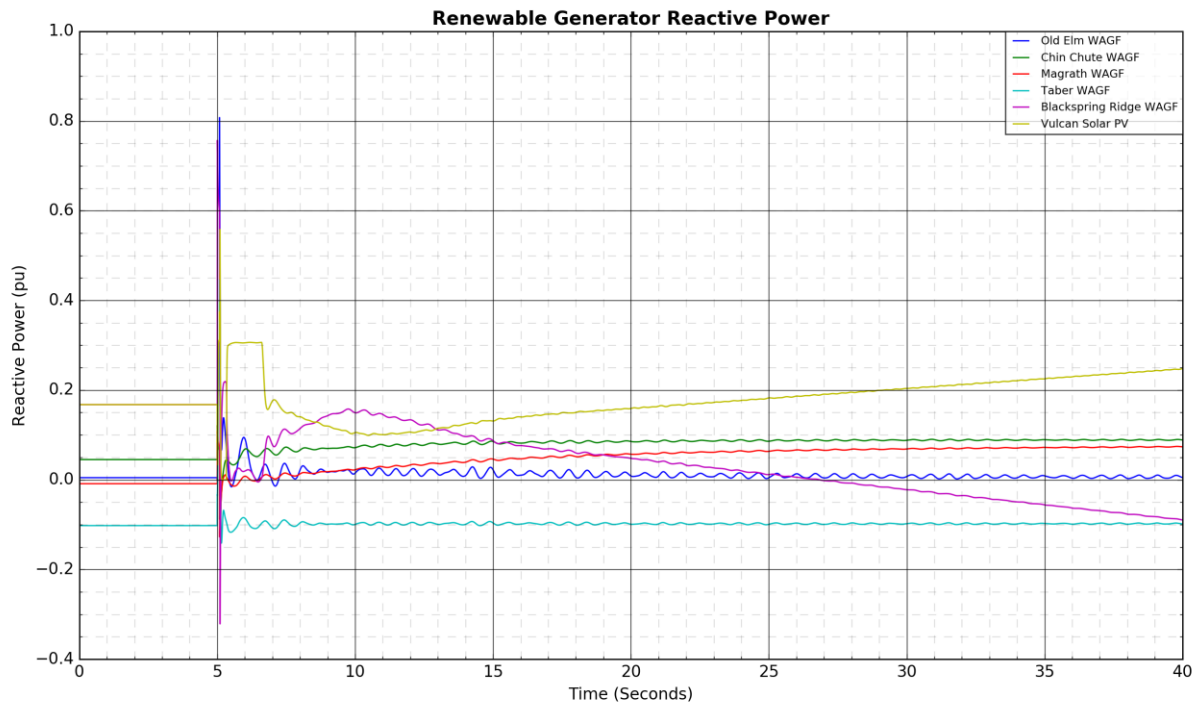
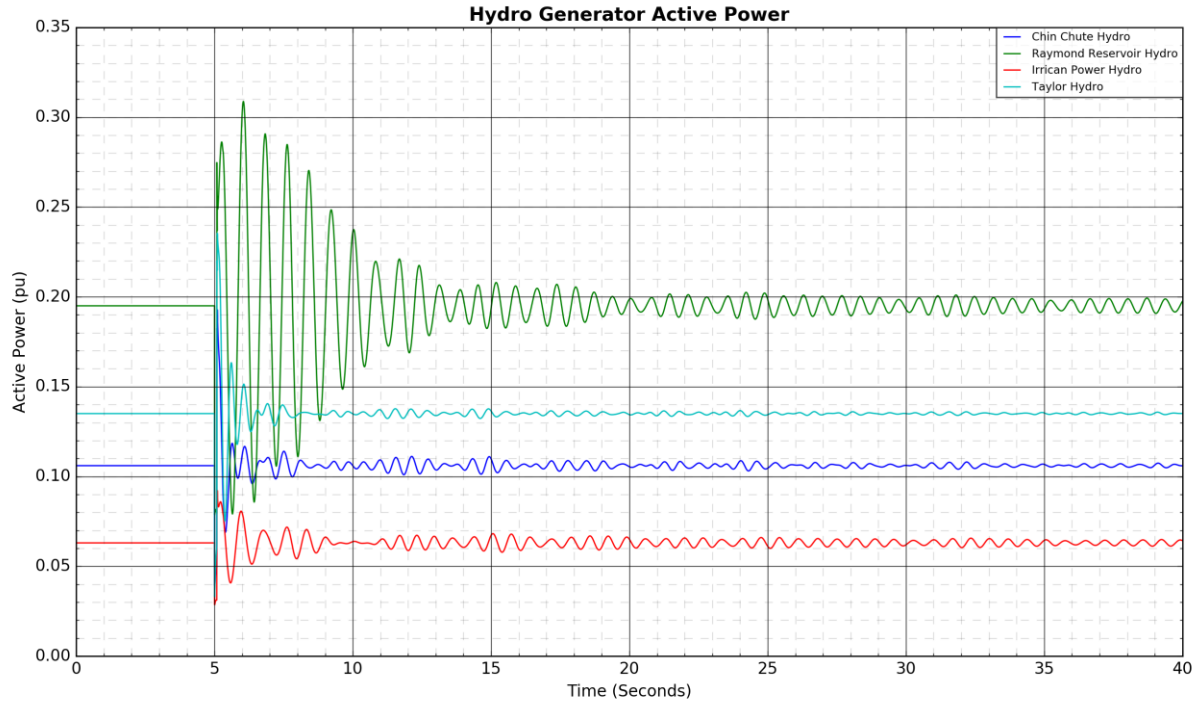


Figure A4-12: 1041L Travers 554S to North Lethbridge 370S: Fault Near North Lethbridge 370S

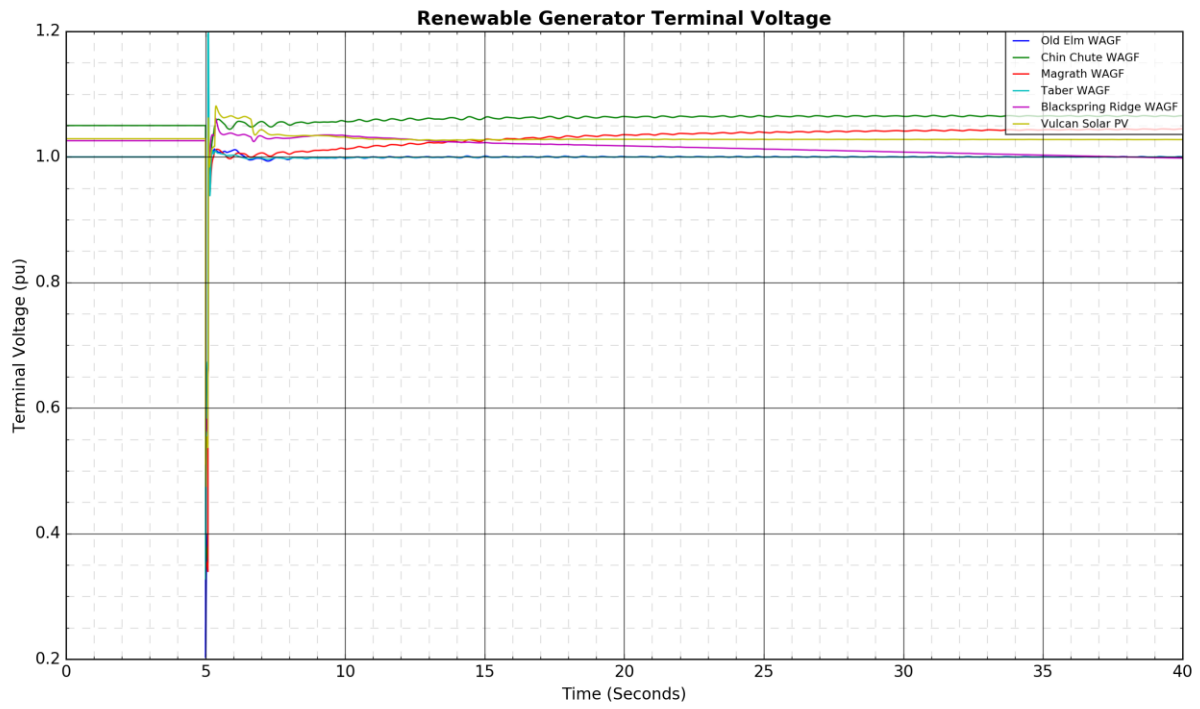
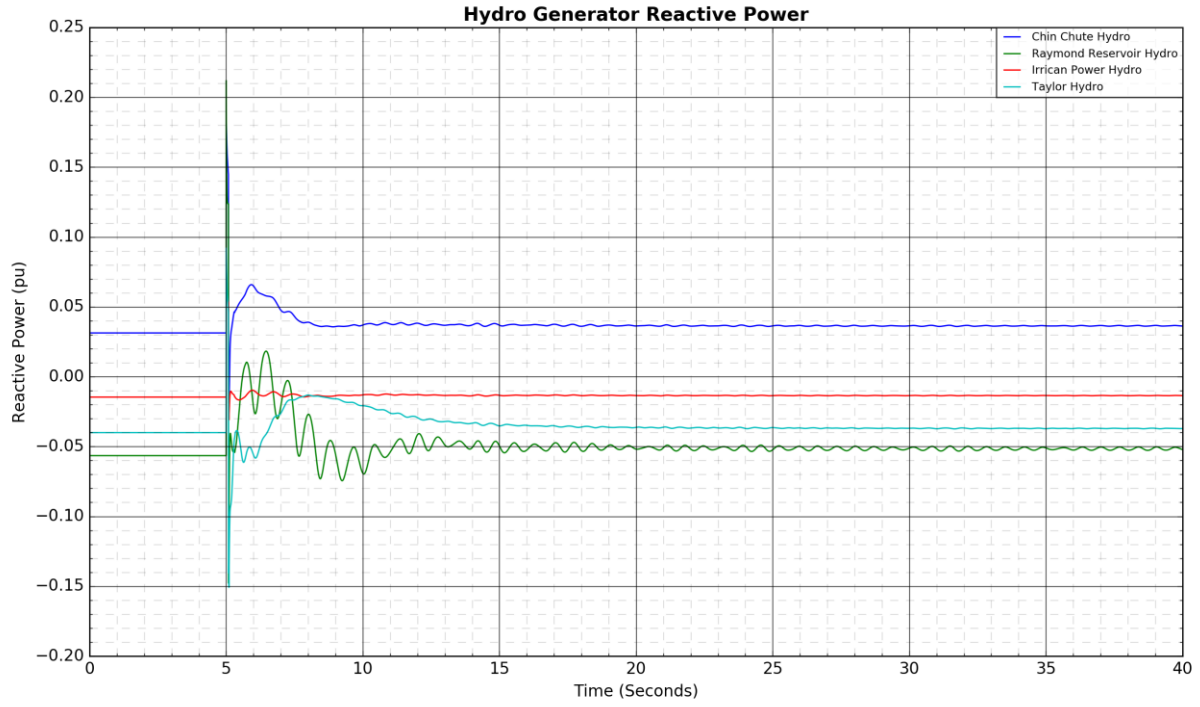


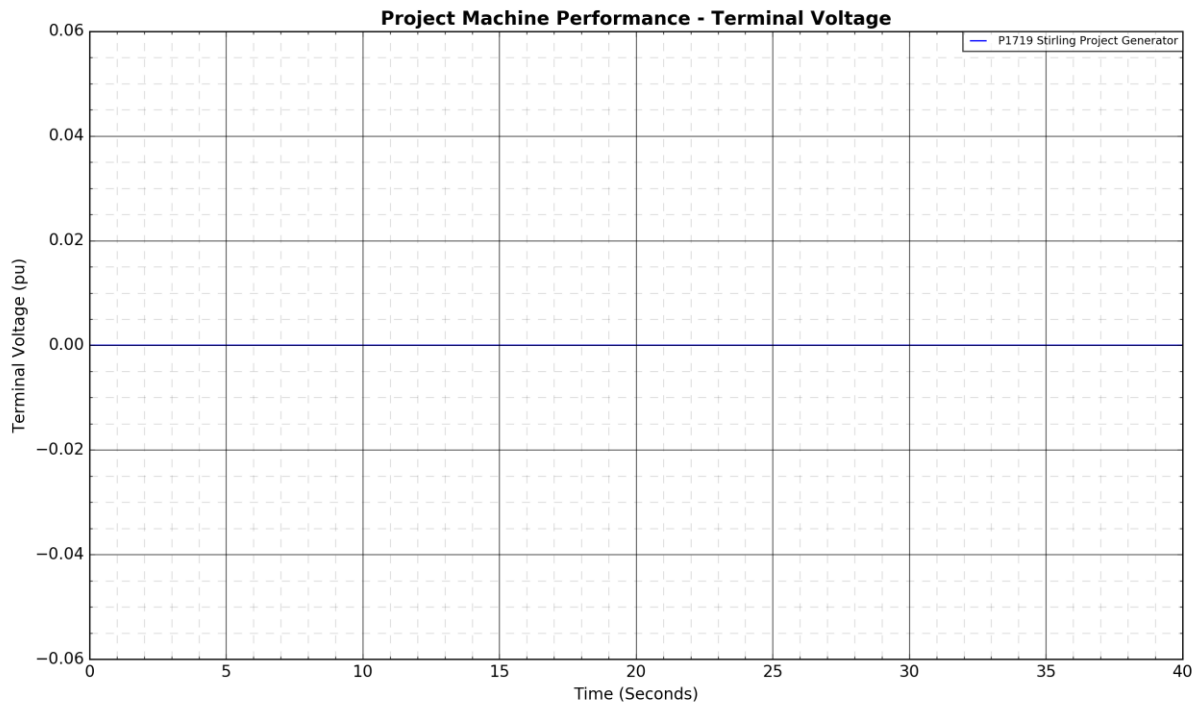
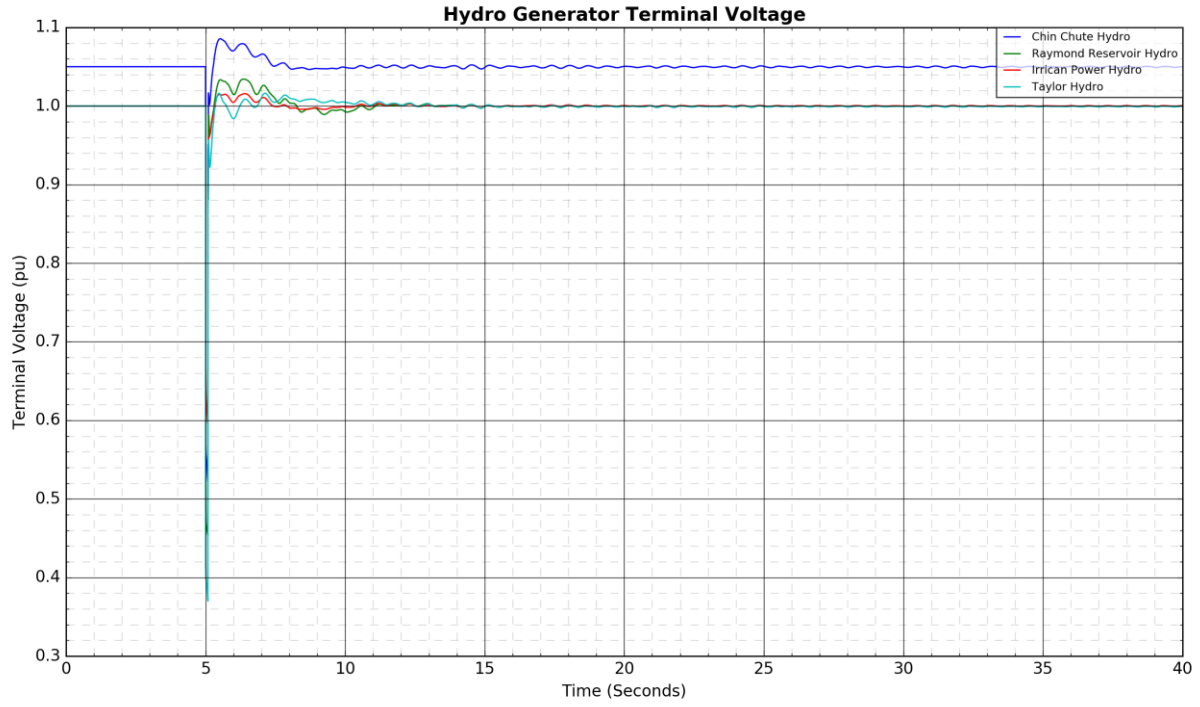


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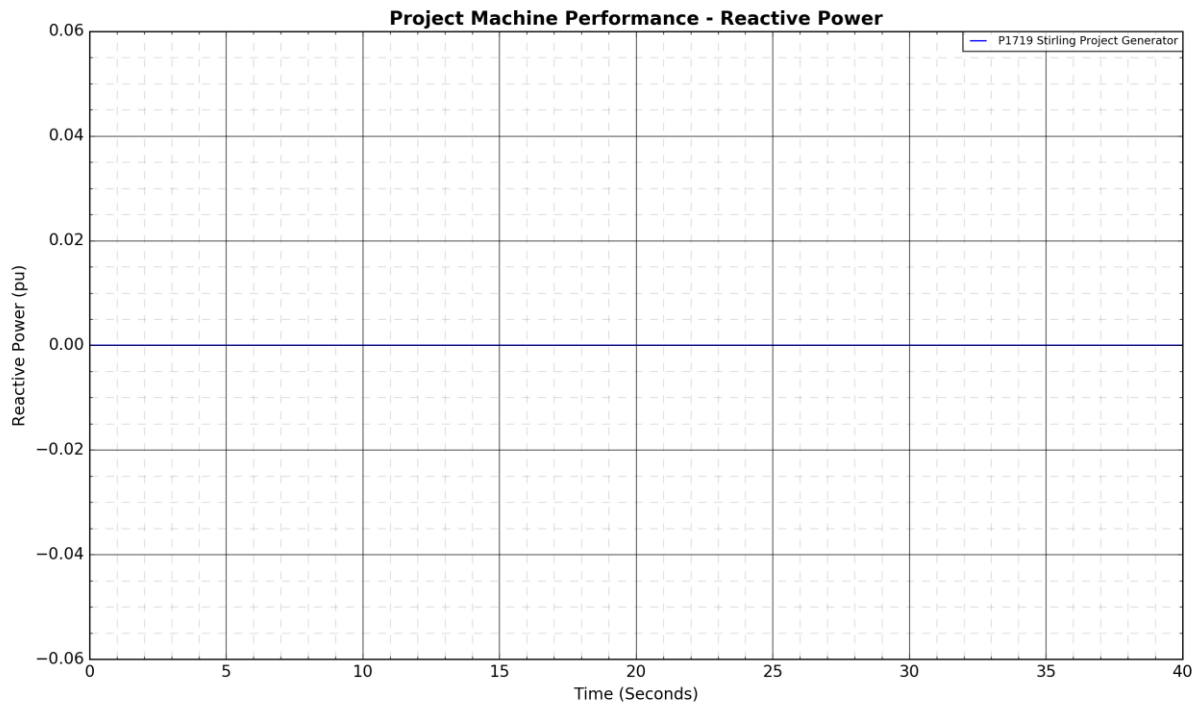
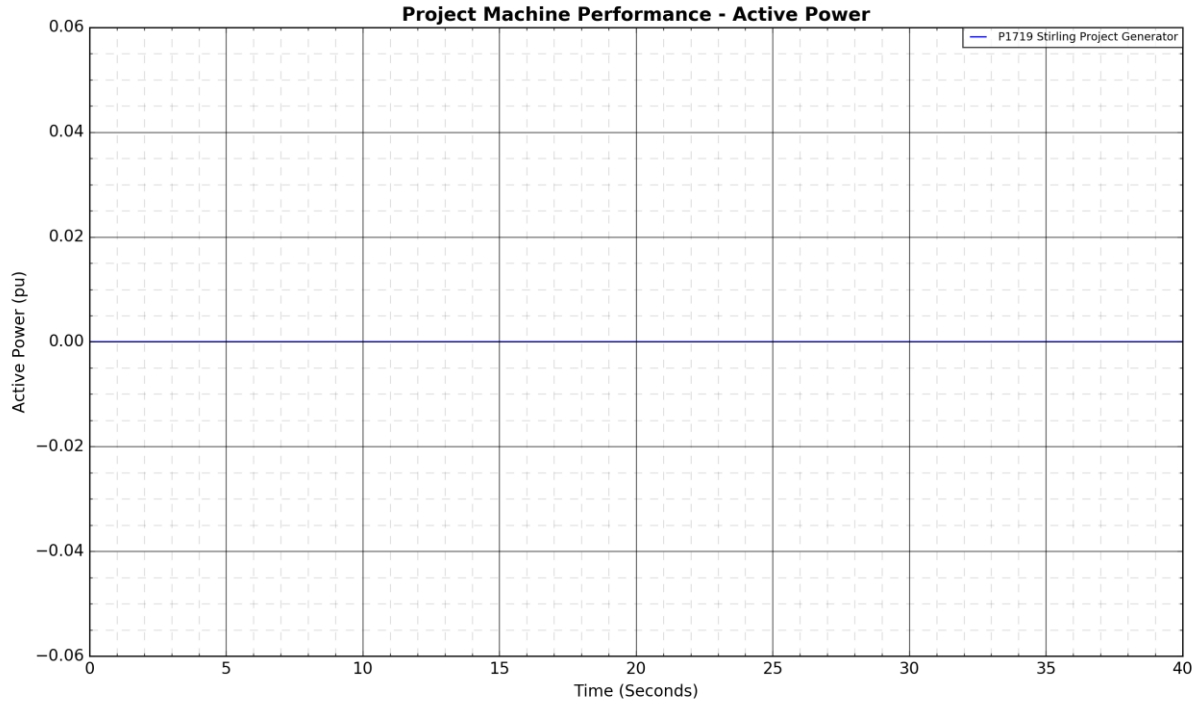
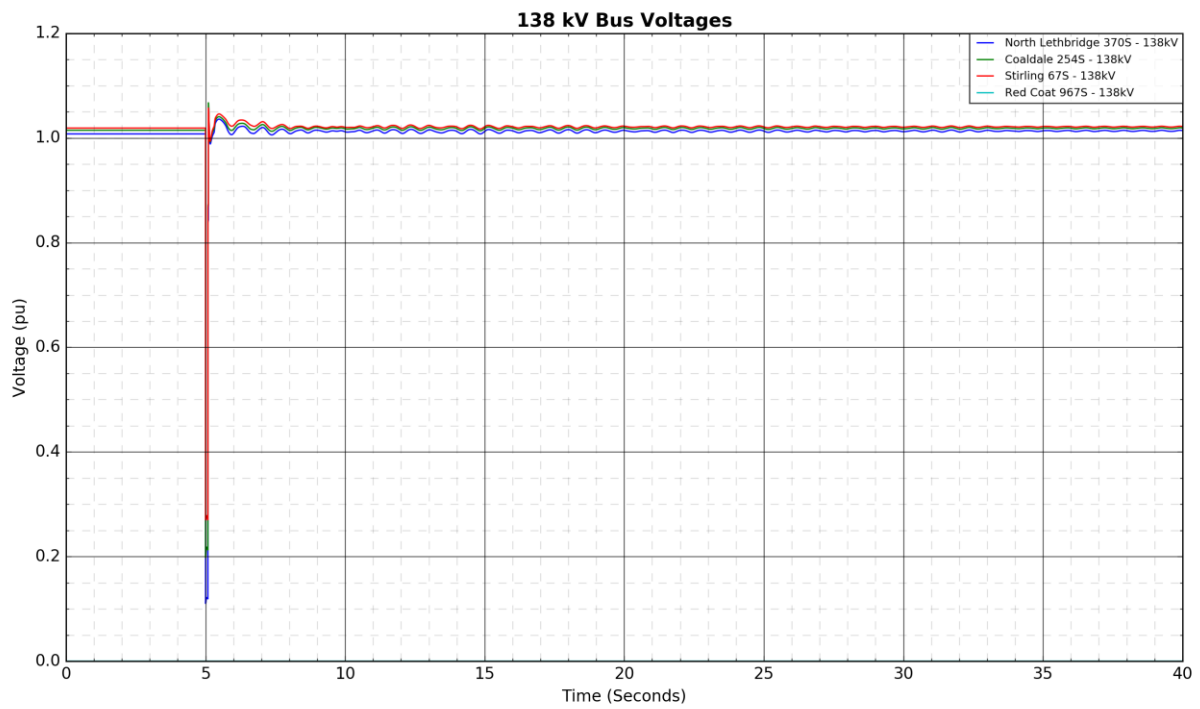
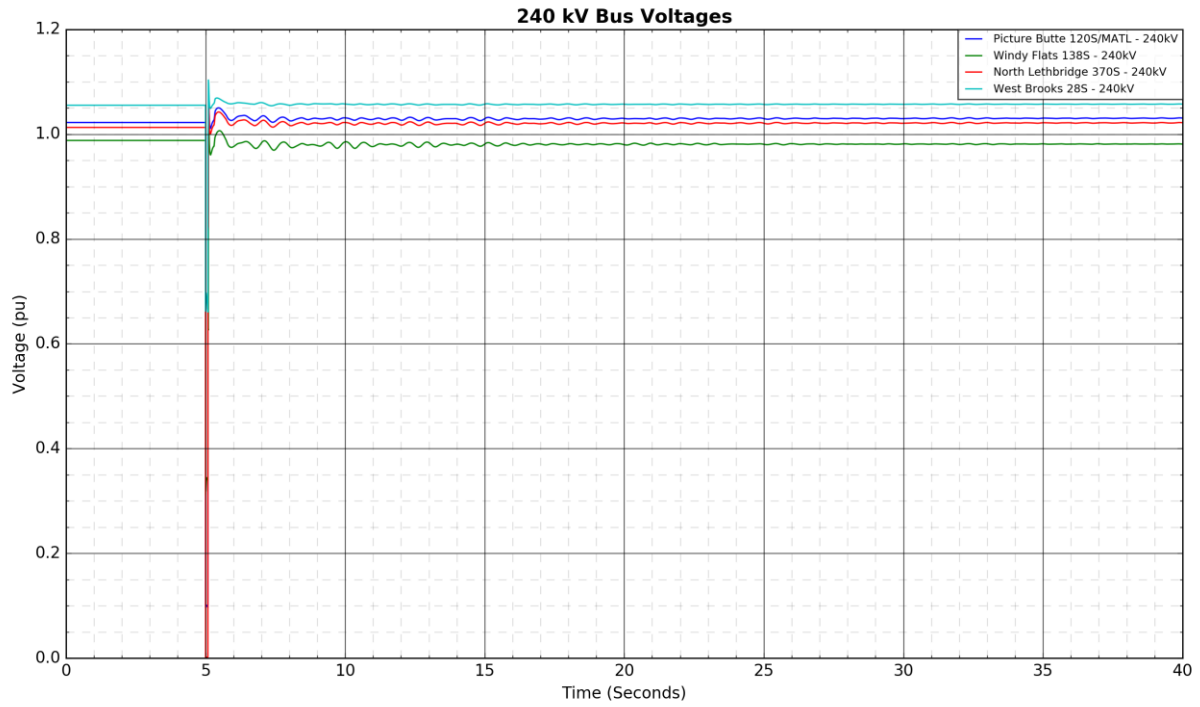
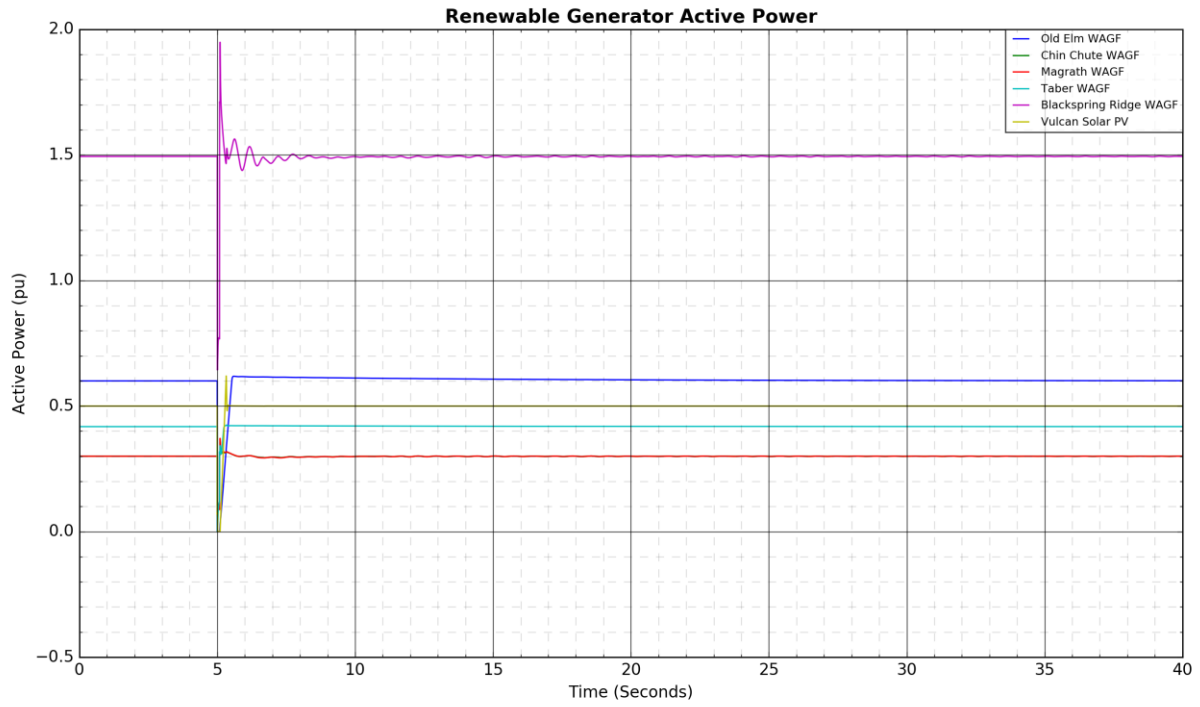
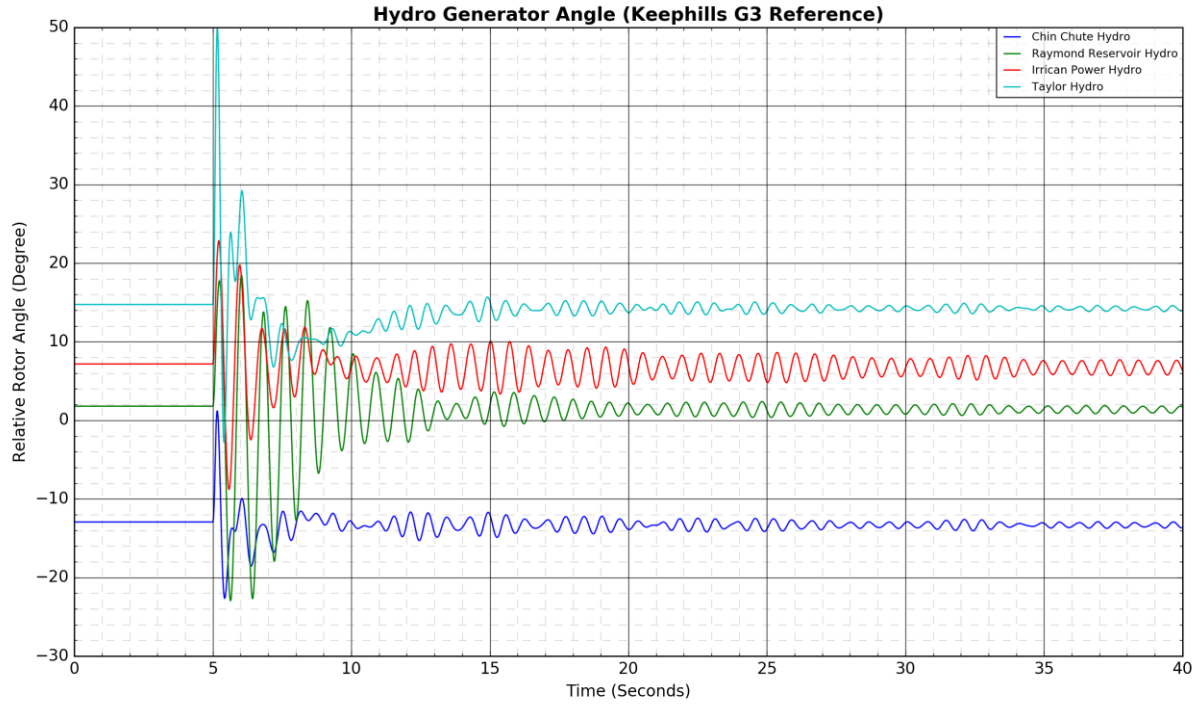
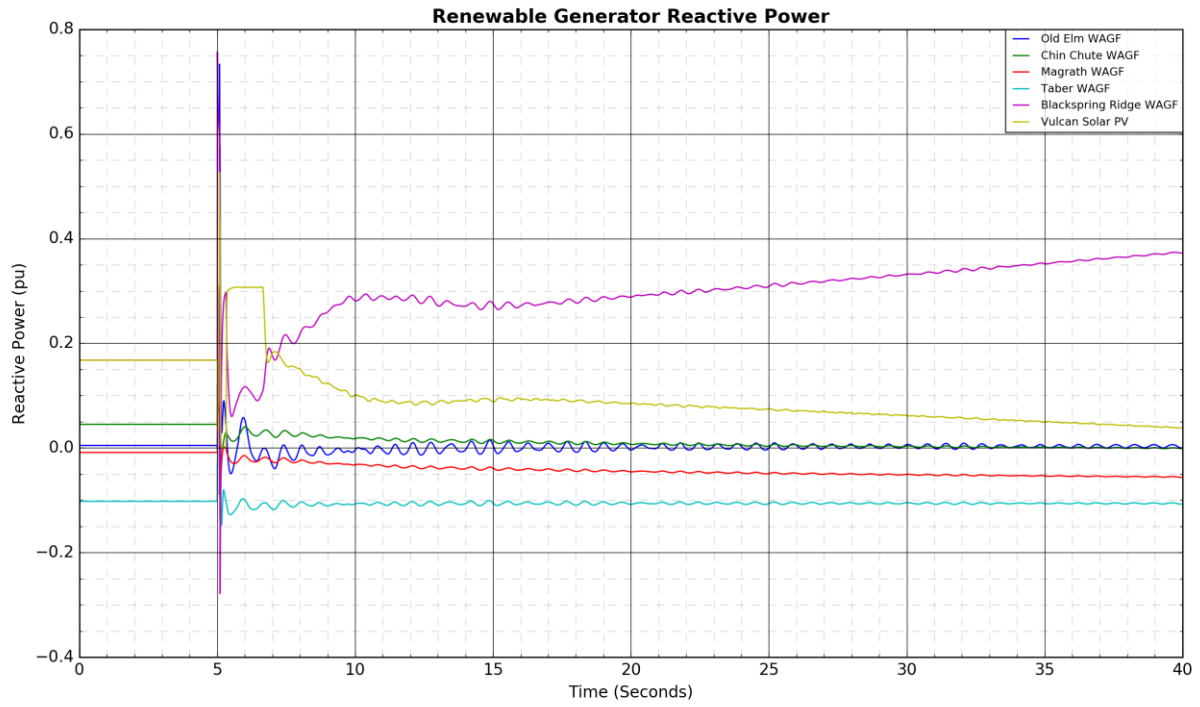
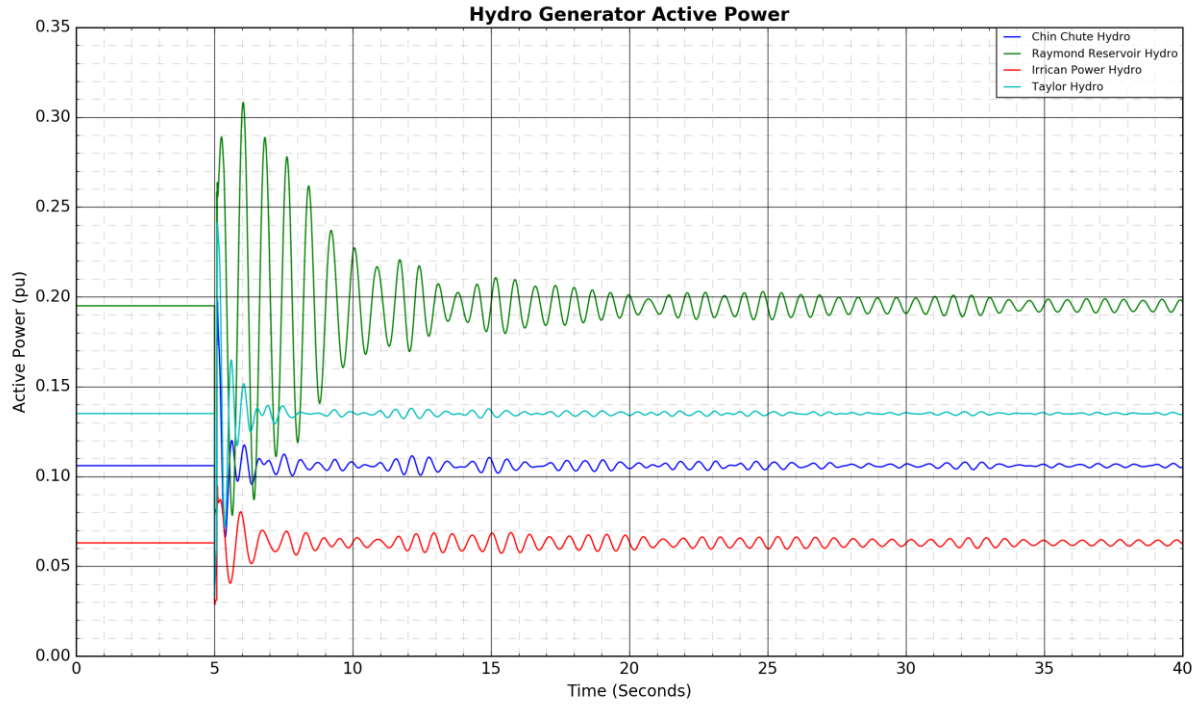
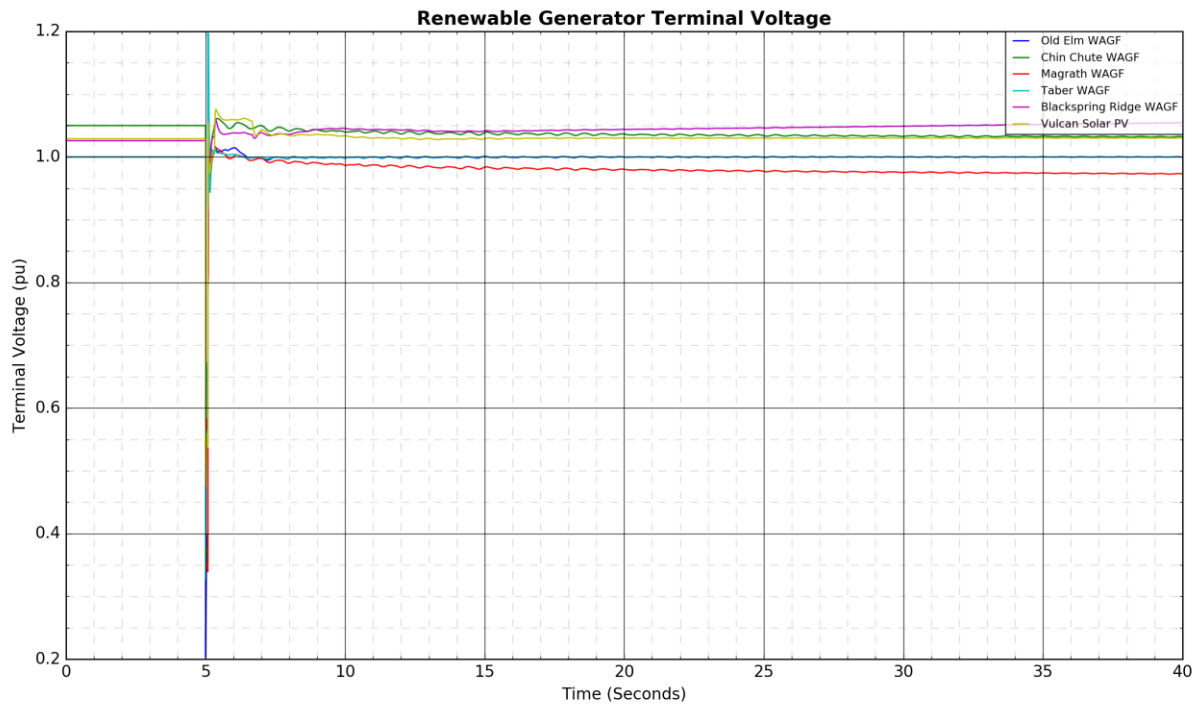
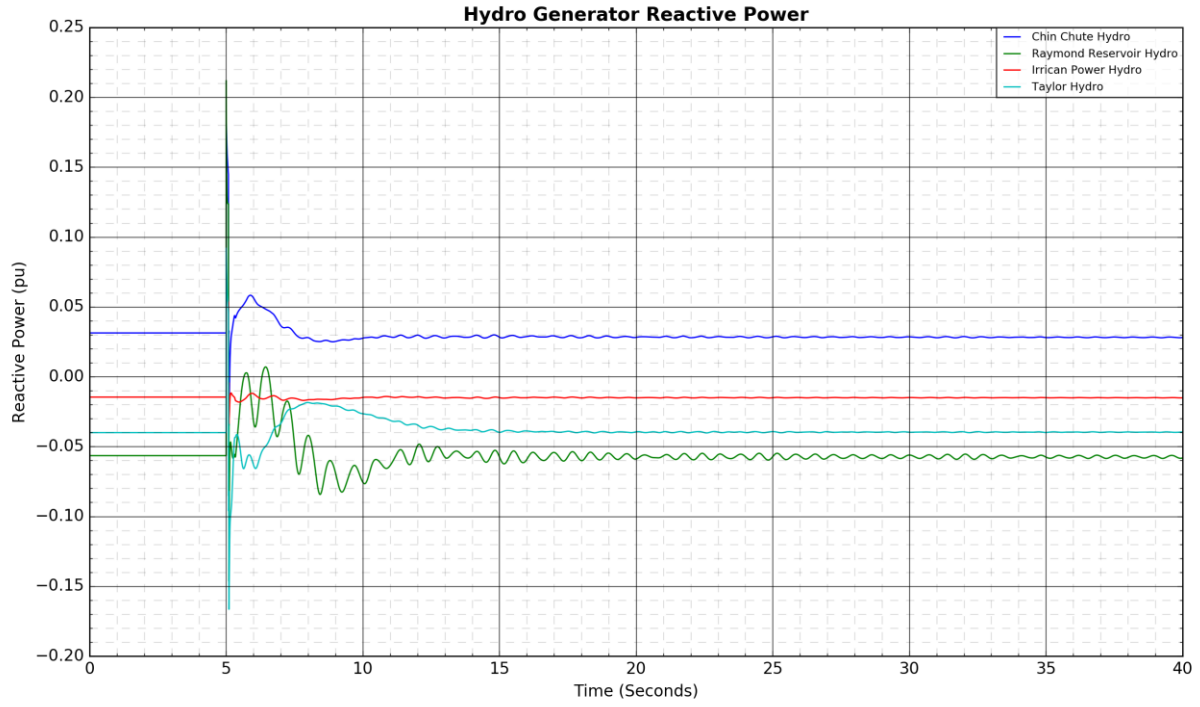


Figure A4-13: 968L North Lethbridge 370S to Windy Flats 138S: Fault Near North Lethbridge 370S

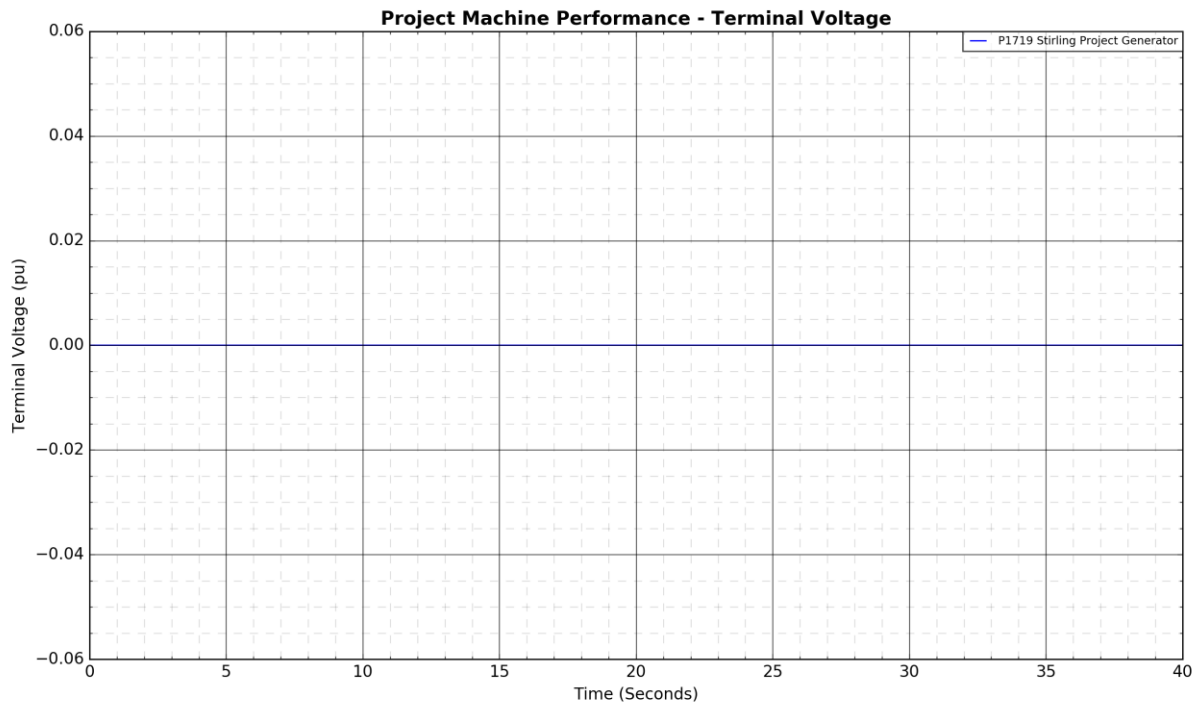
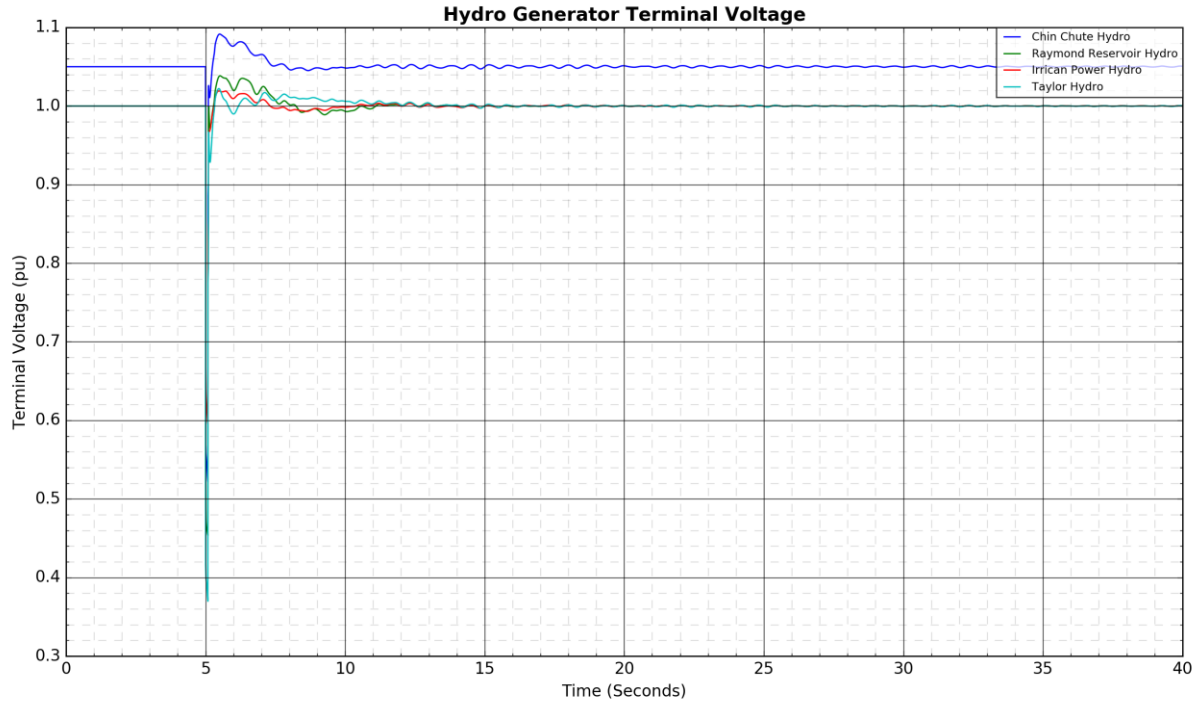








Engineering Connection Assessment Results: Stirling Wind Project Connection



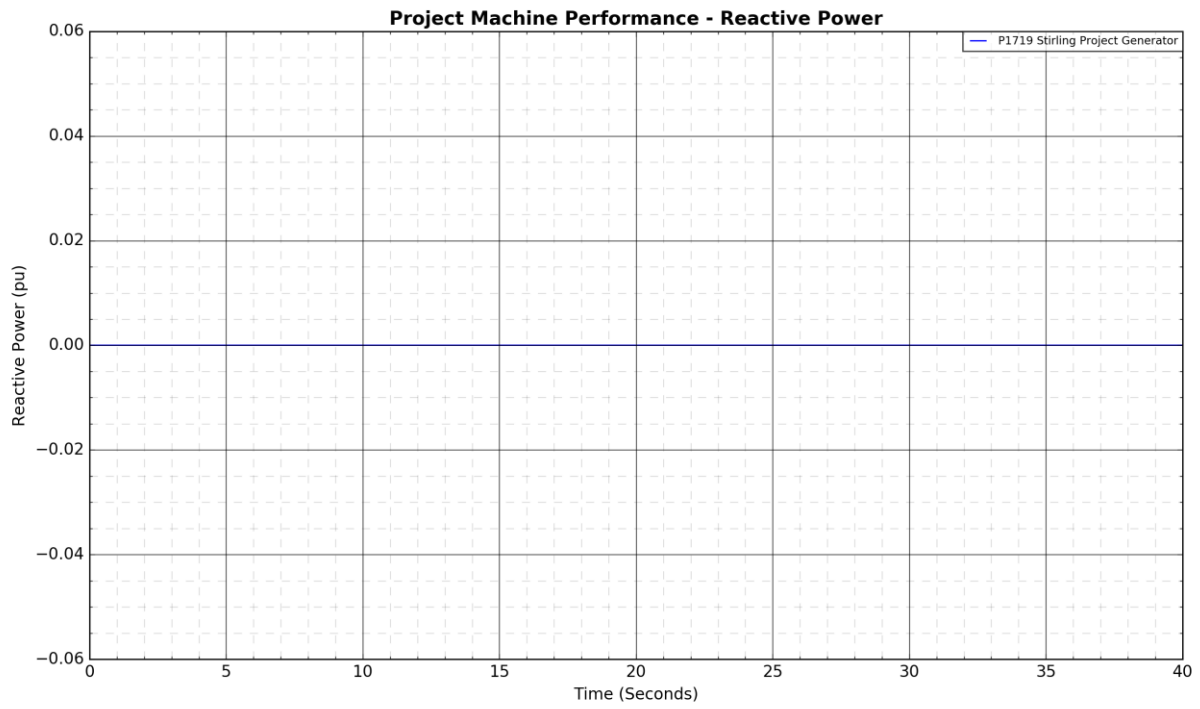
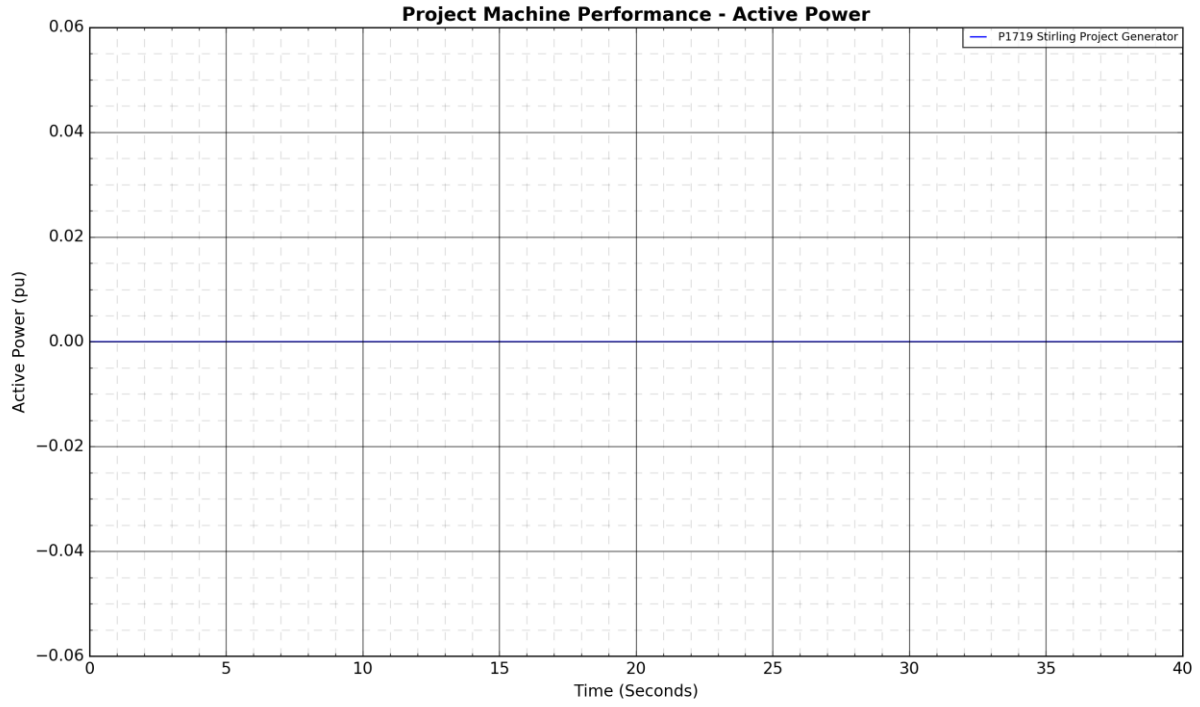
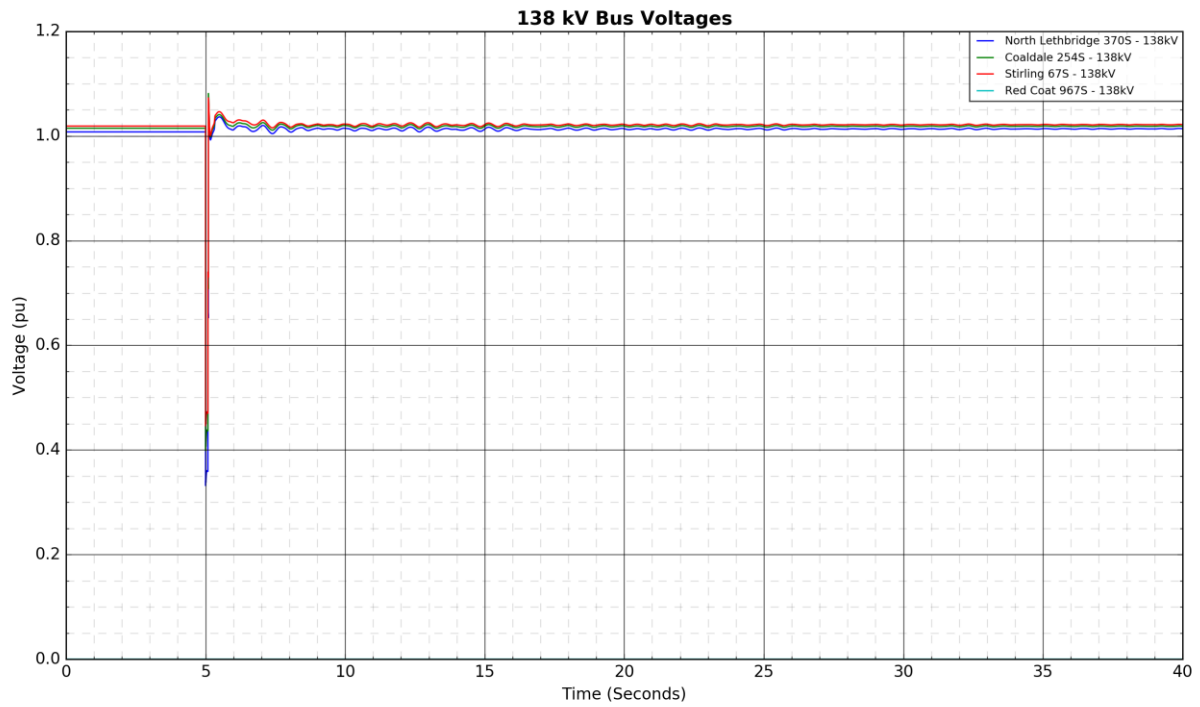
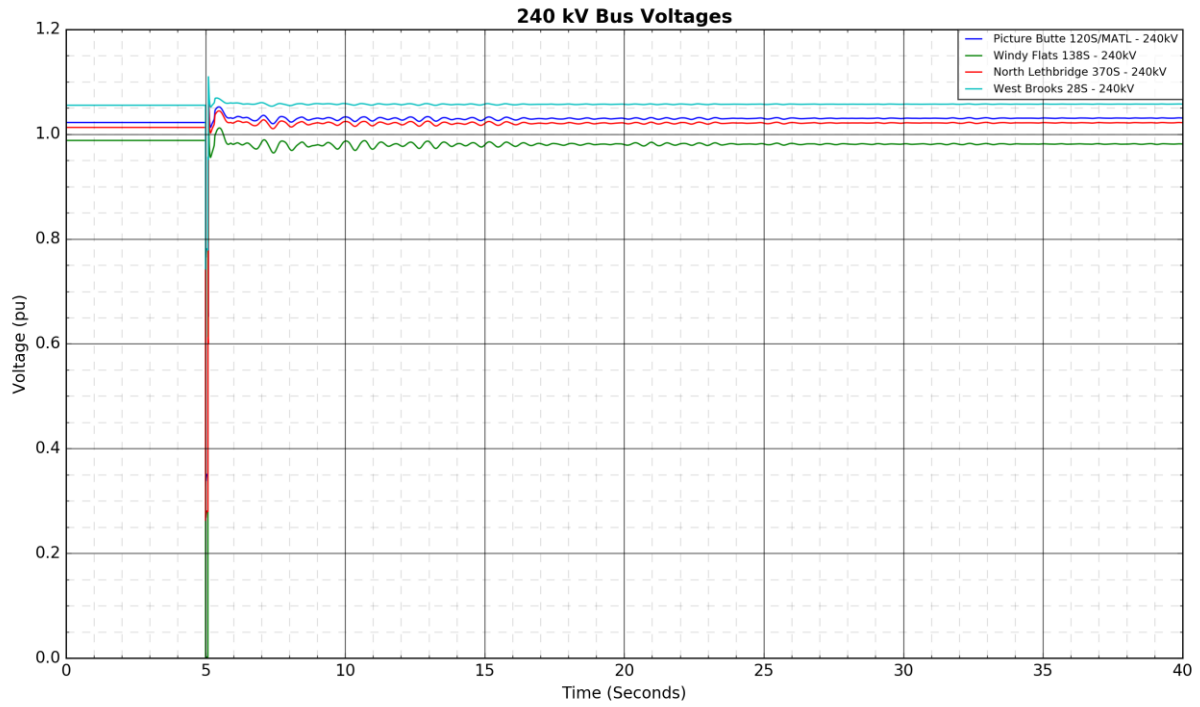
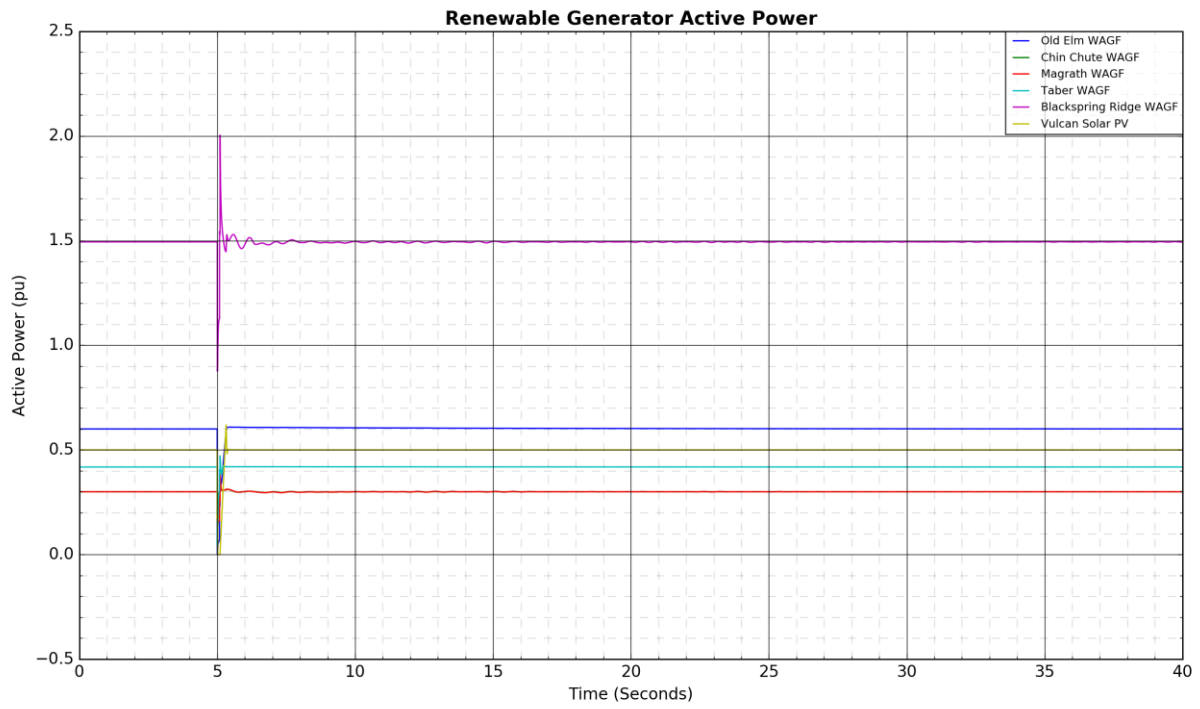
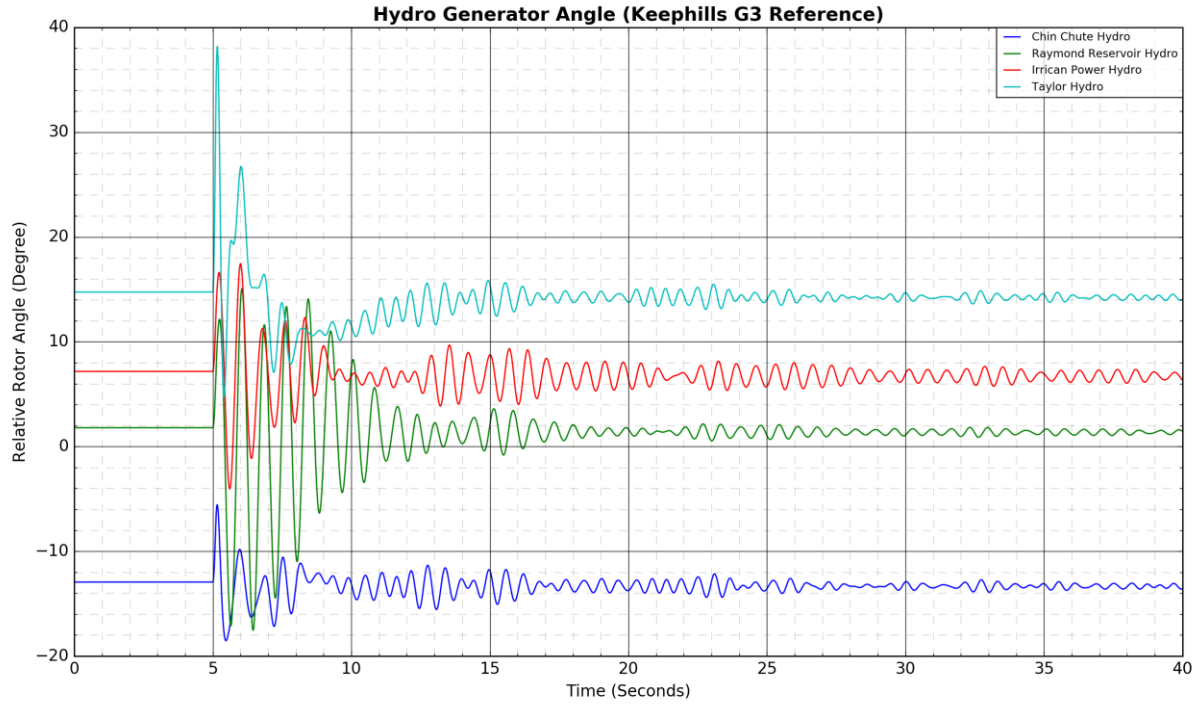
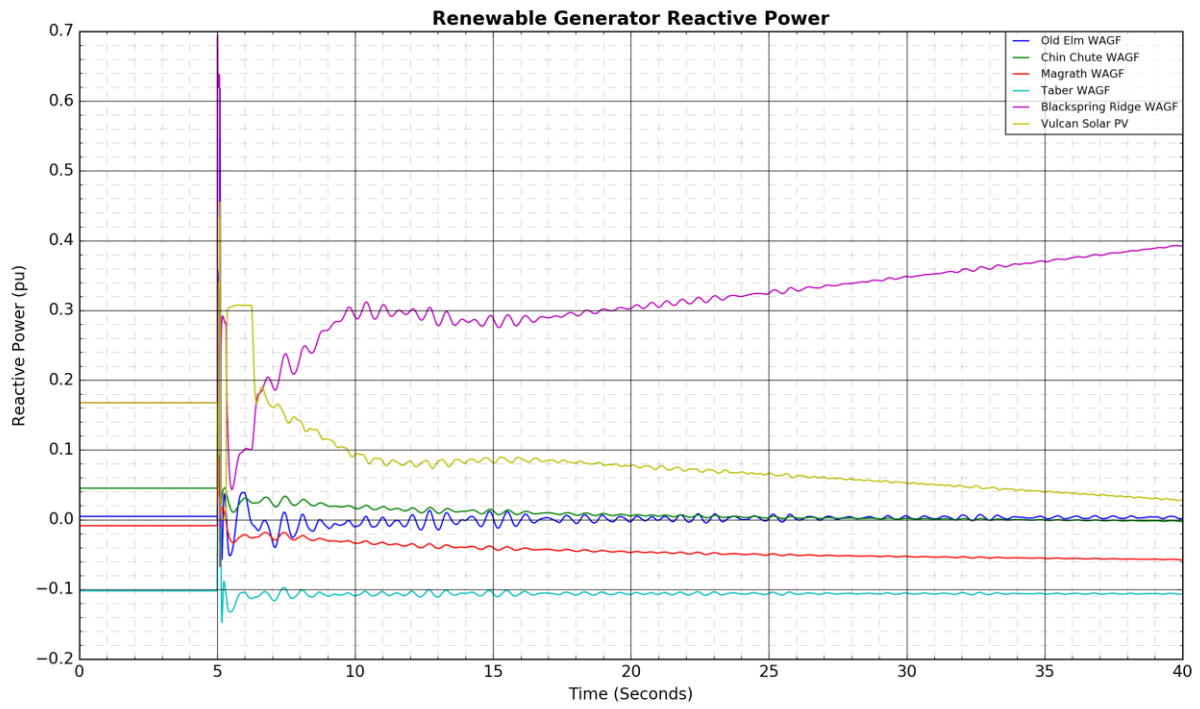
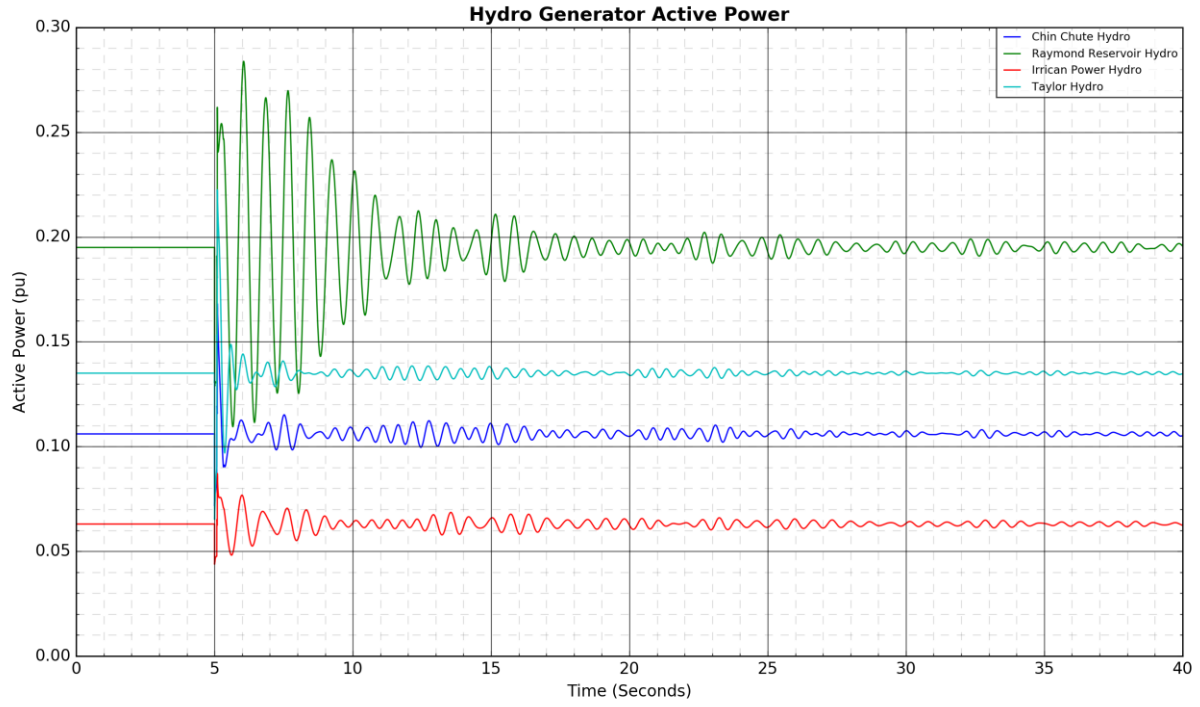


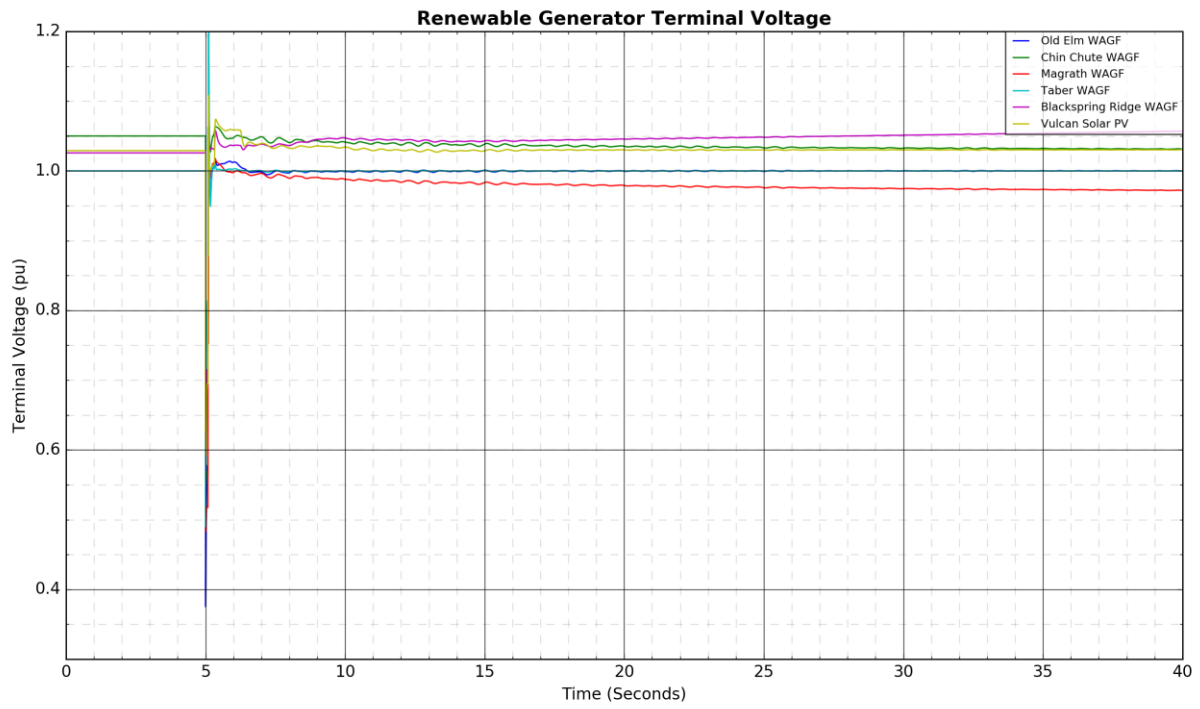
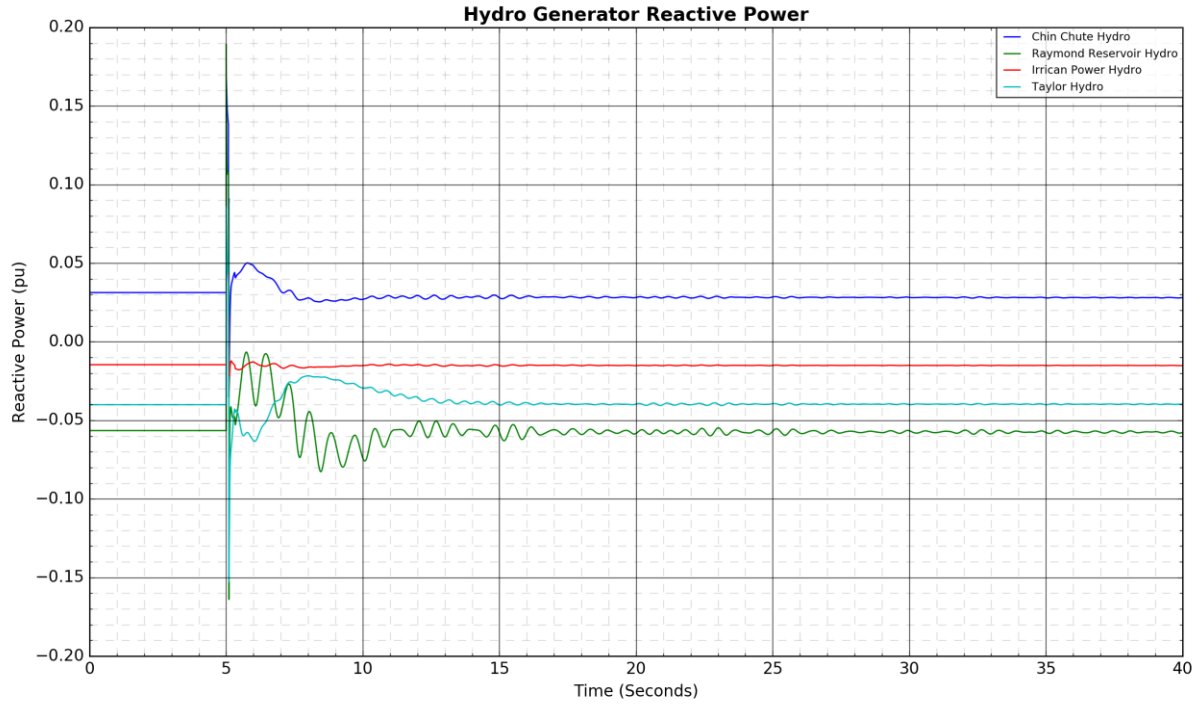
Figure A4-14: 968L North Lethbridge 370S to Windy Flats 138S: Fault Near Windy Flats 138S

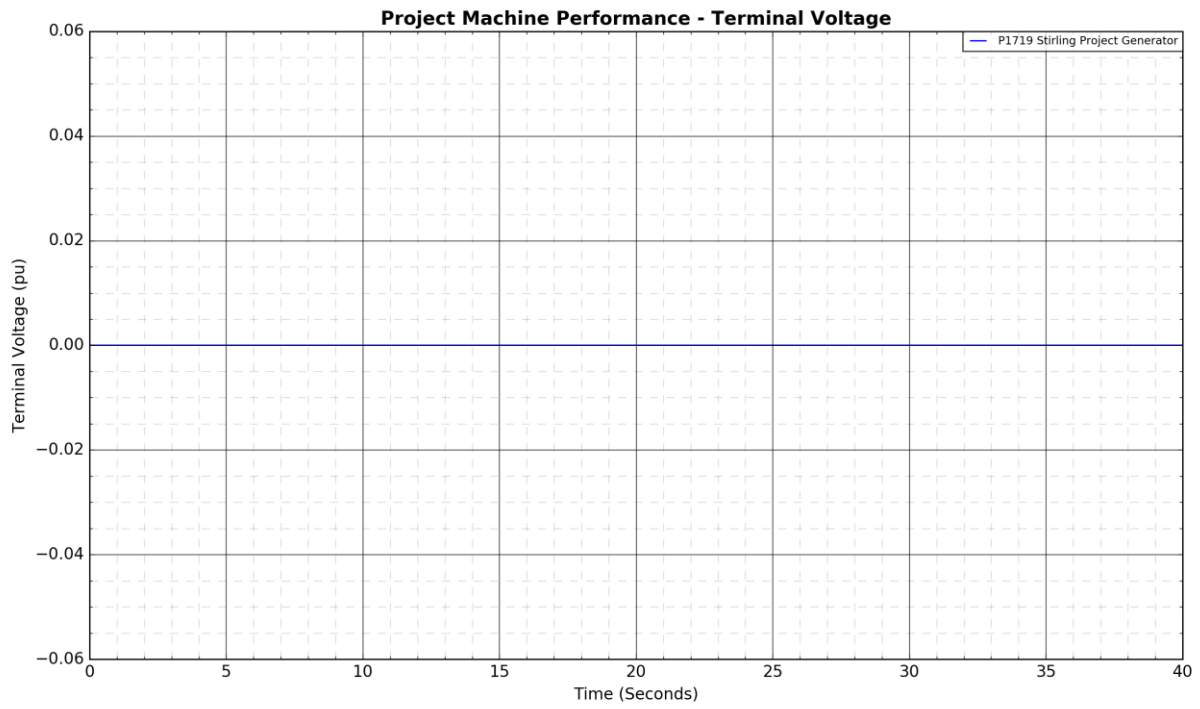
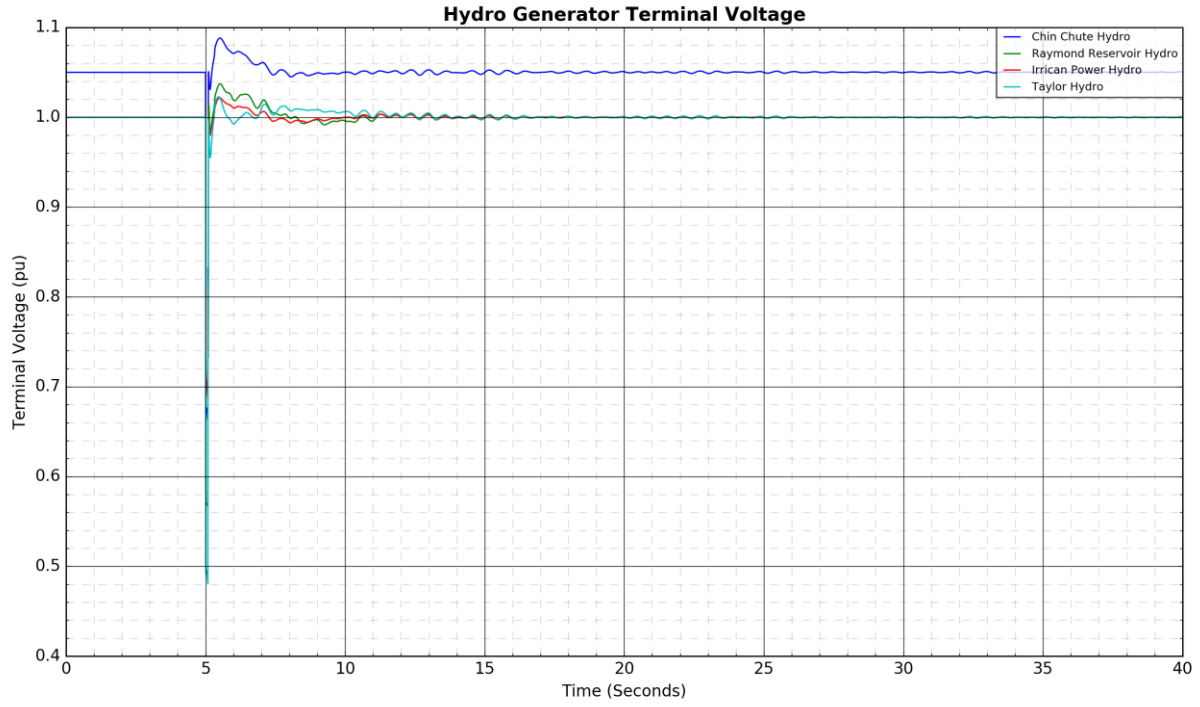


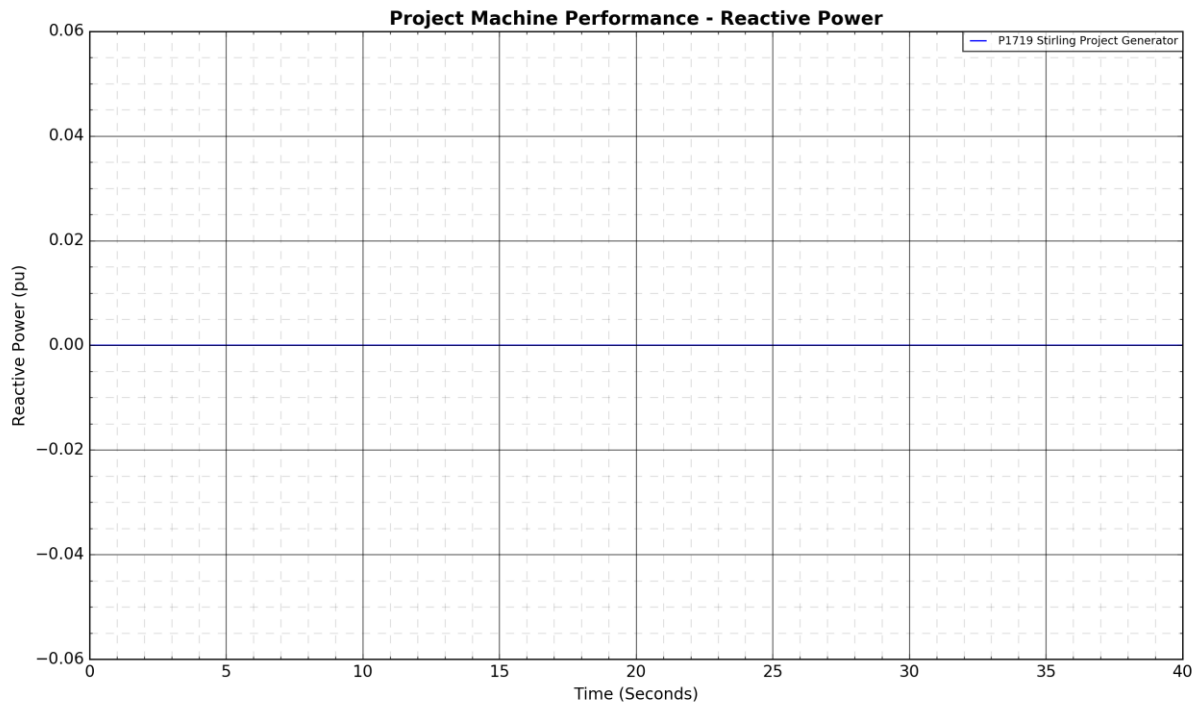
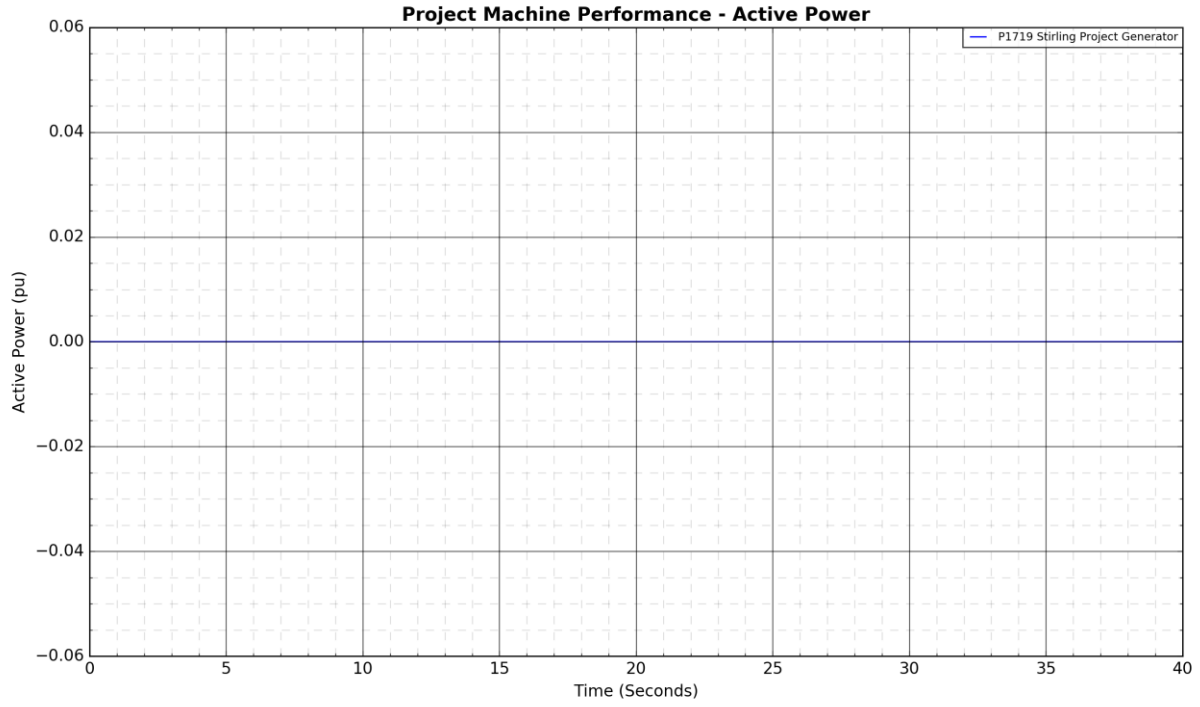


Engineering Connection Assessment Results: Stirling Wind Project Connection



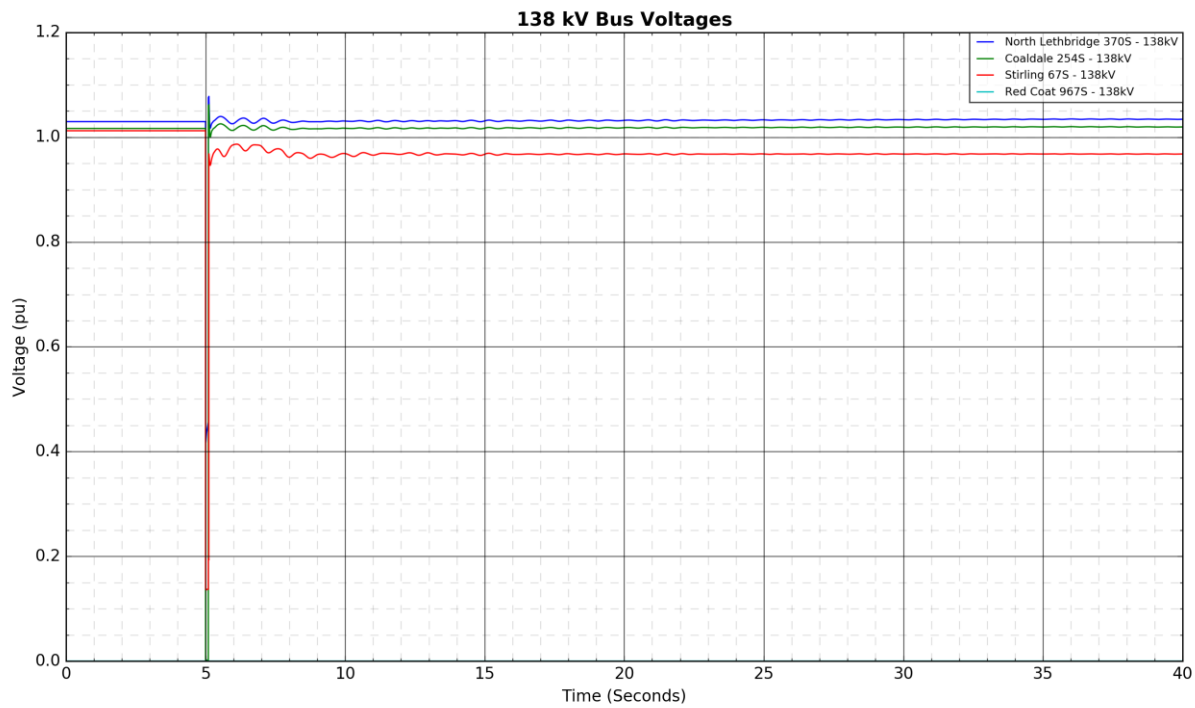
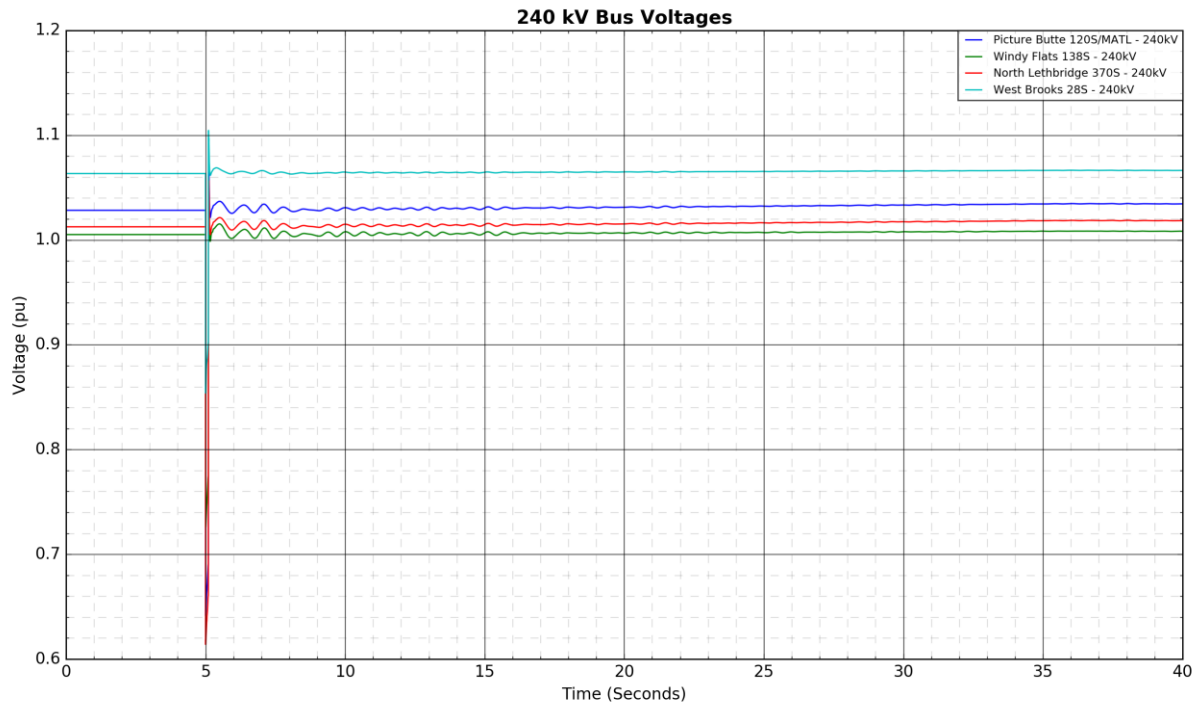


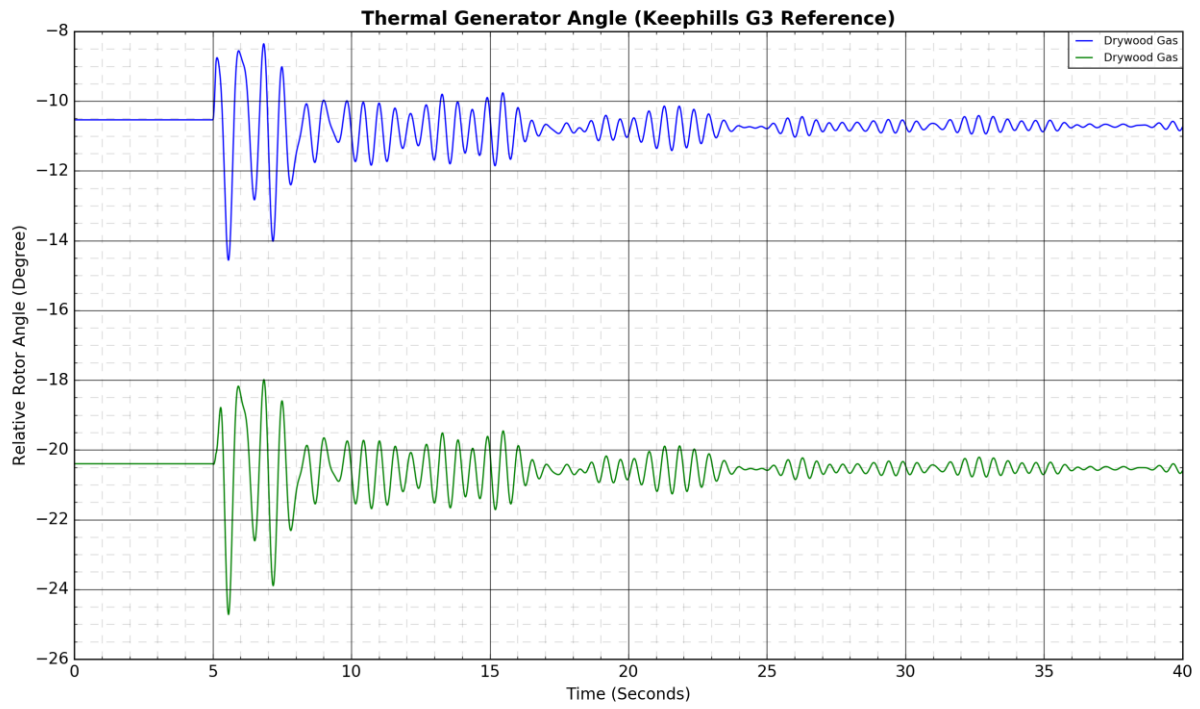
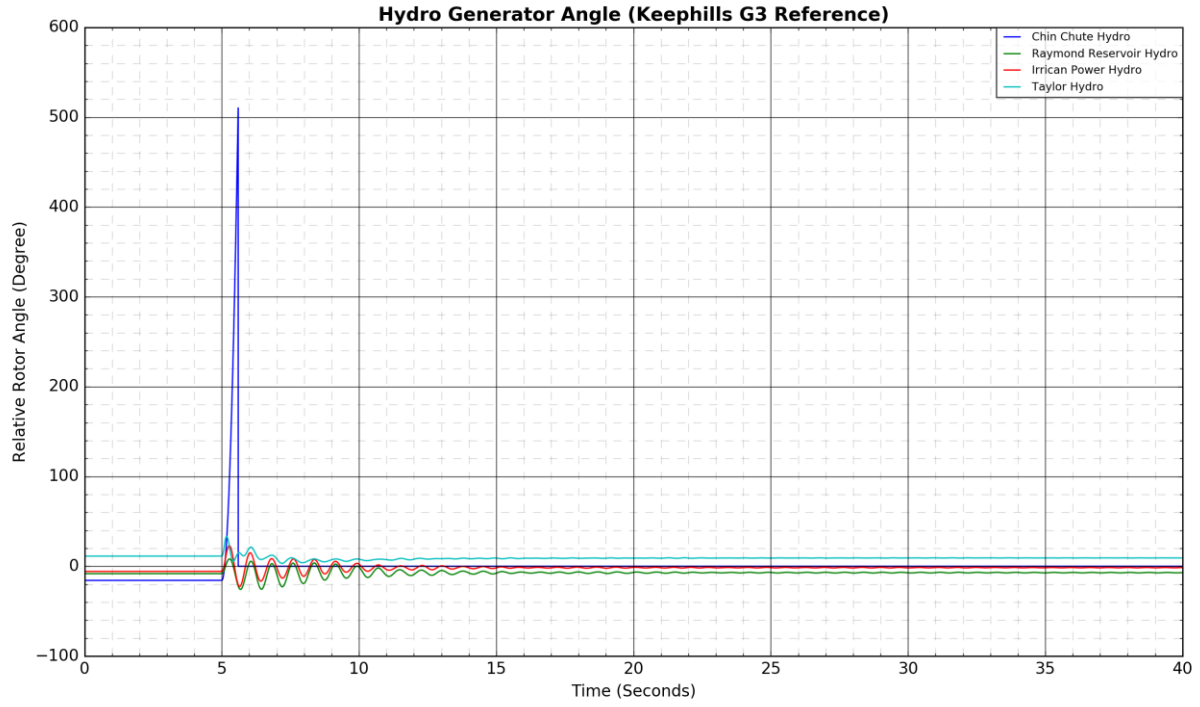


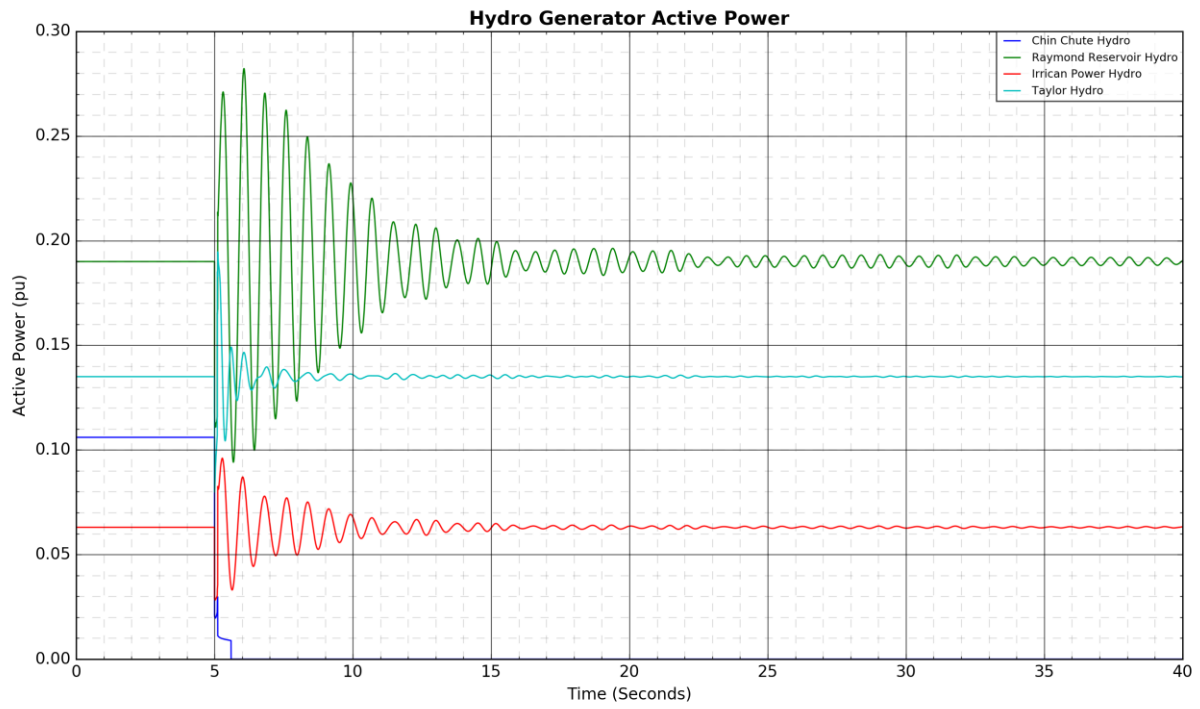
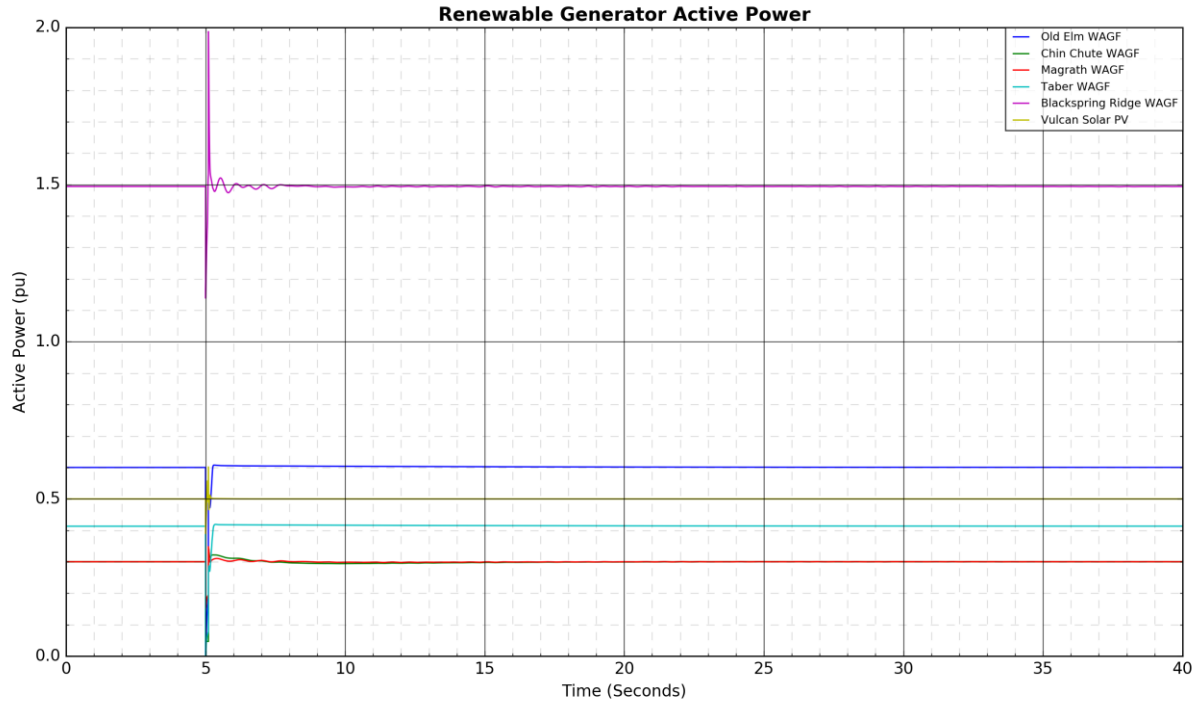


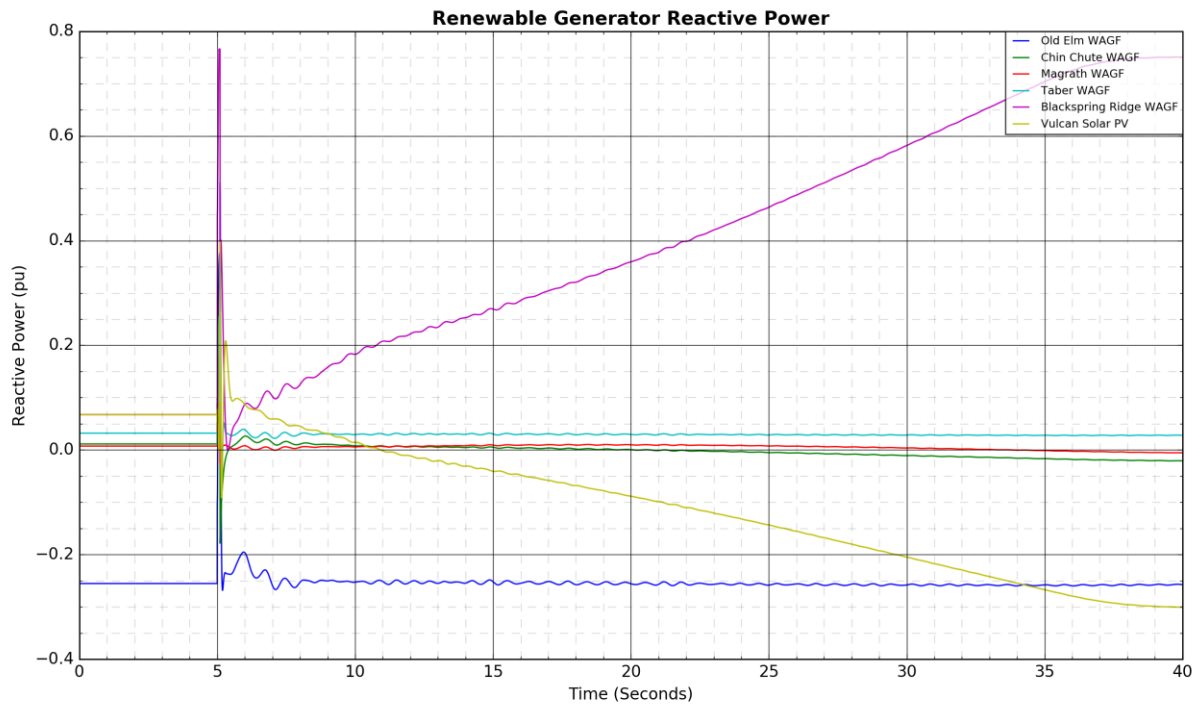
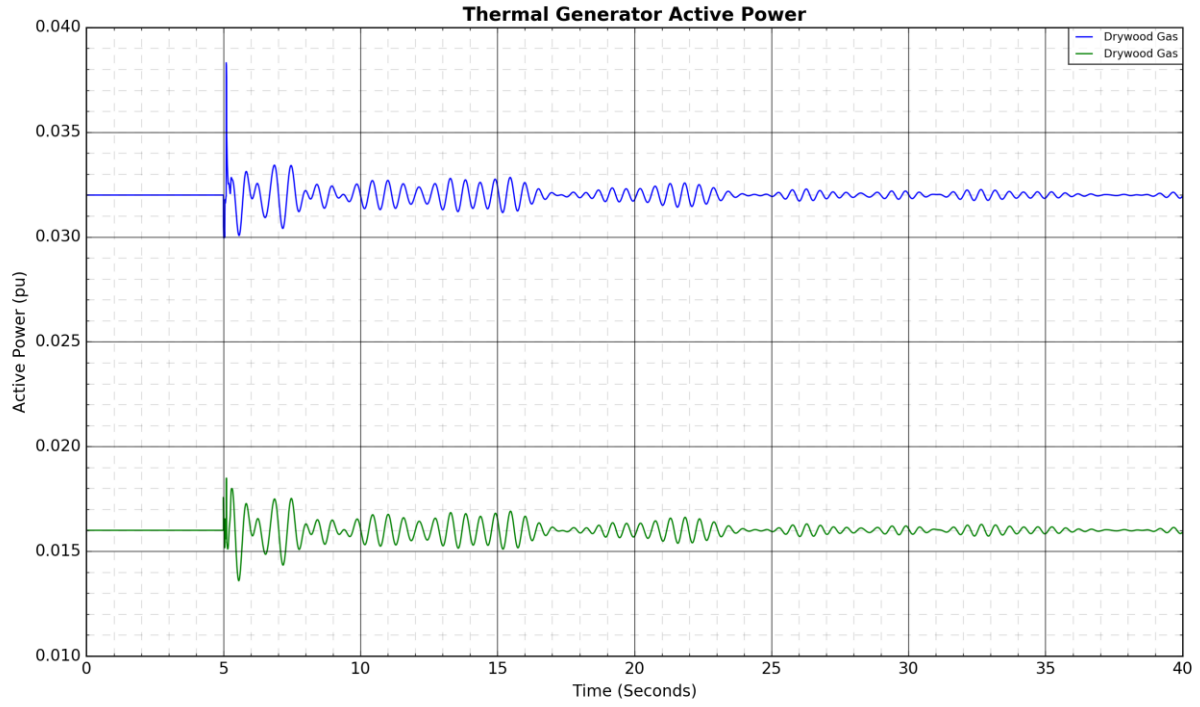
2. Stability Results 2019 Summer Peak - Case Pre

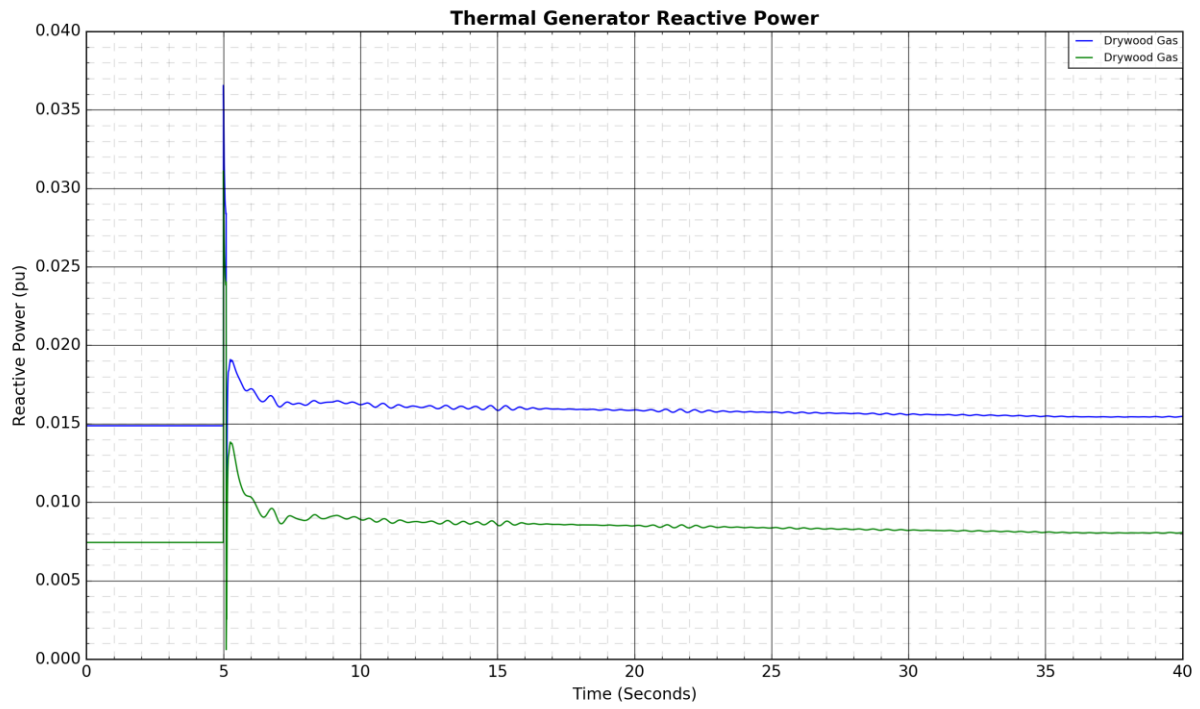
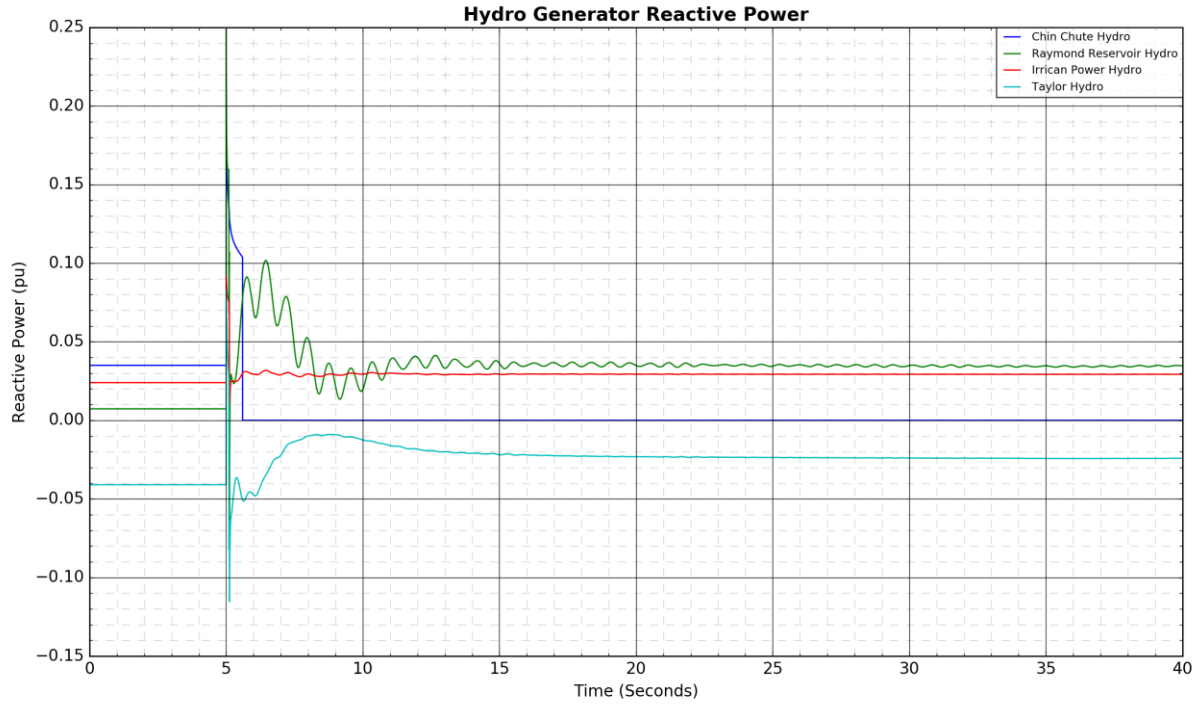
Figure A4-15: 820L Coaldale 254S to Chin Chute 315S T-Tap to Stirling 67S: Fault Near Coaldale 254S

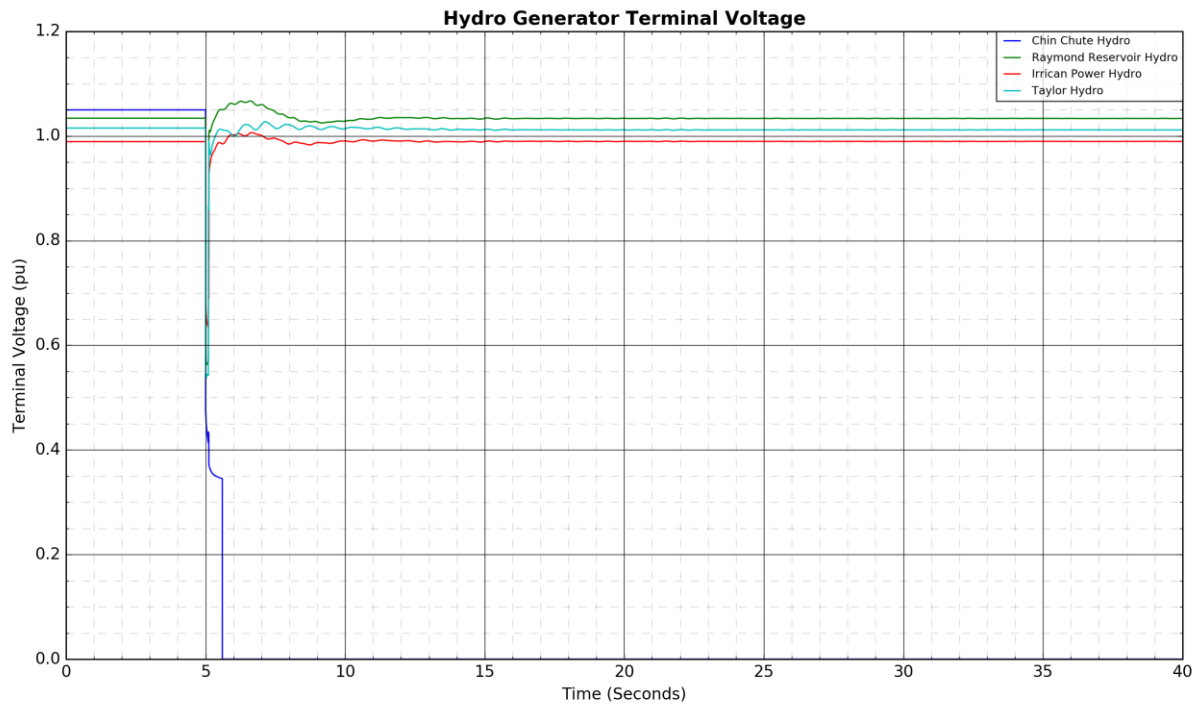
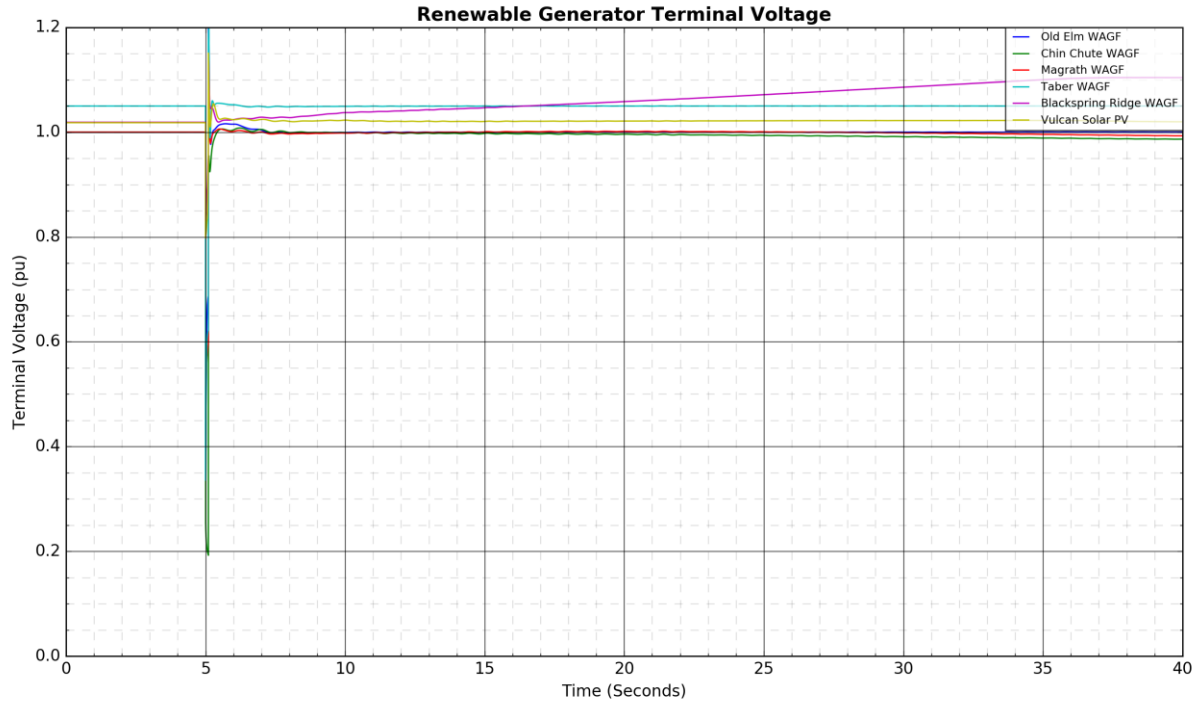


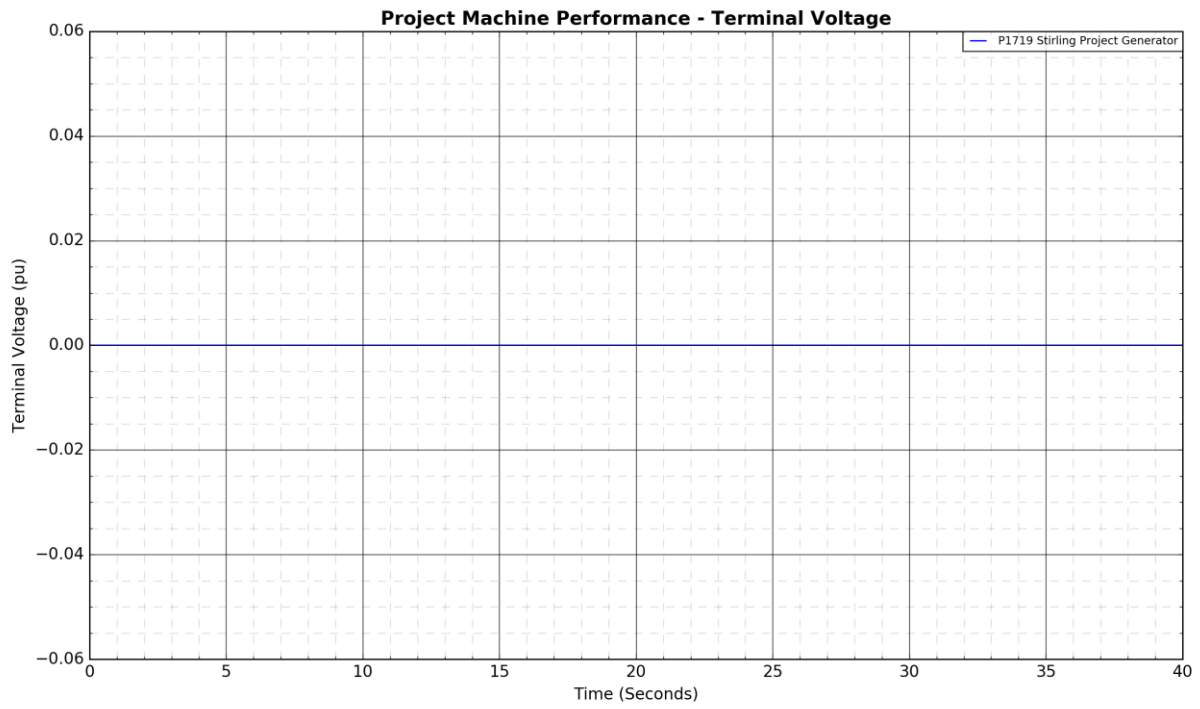
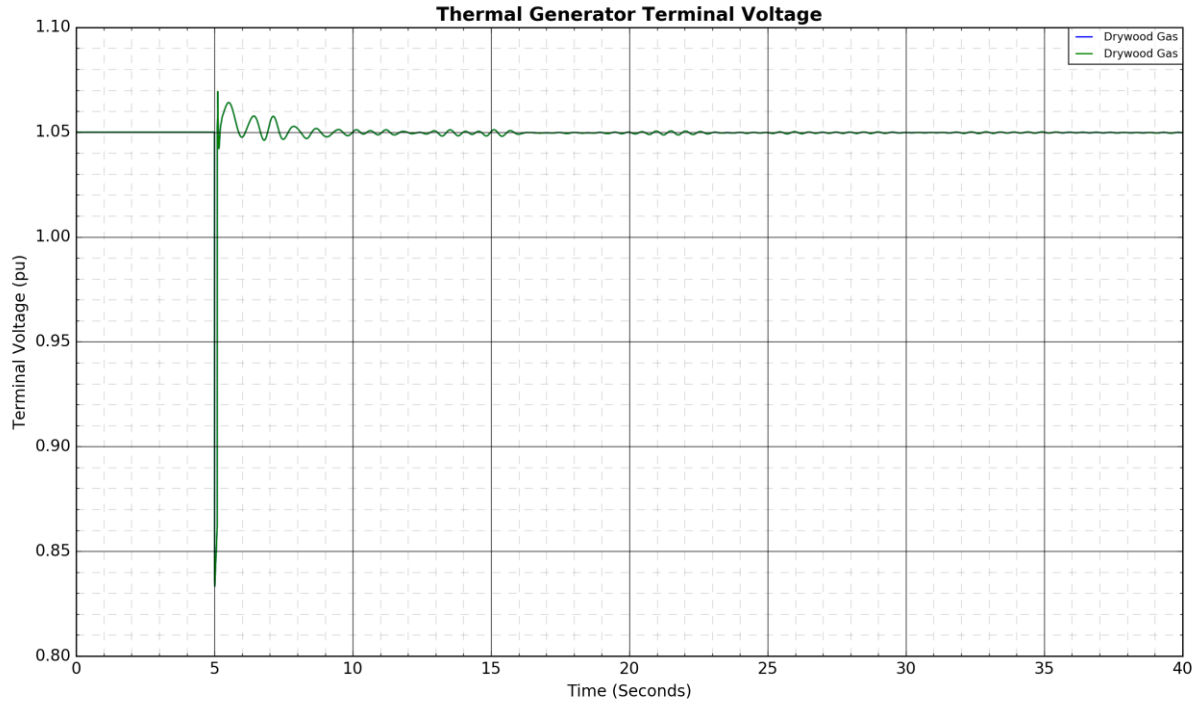












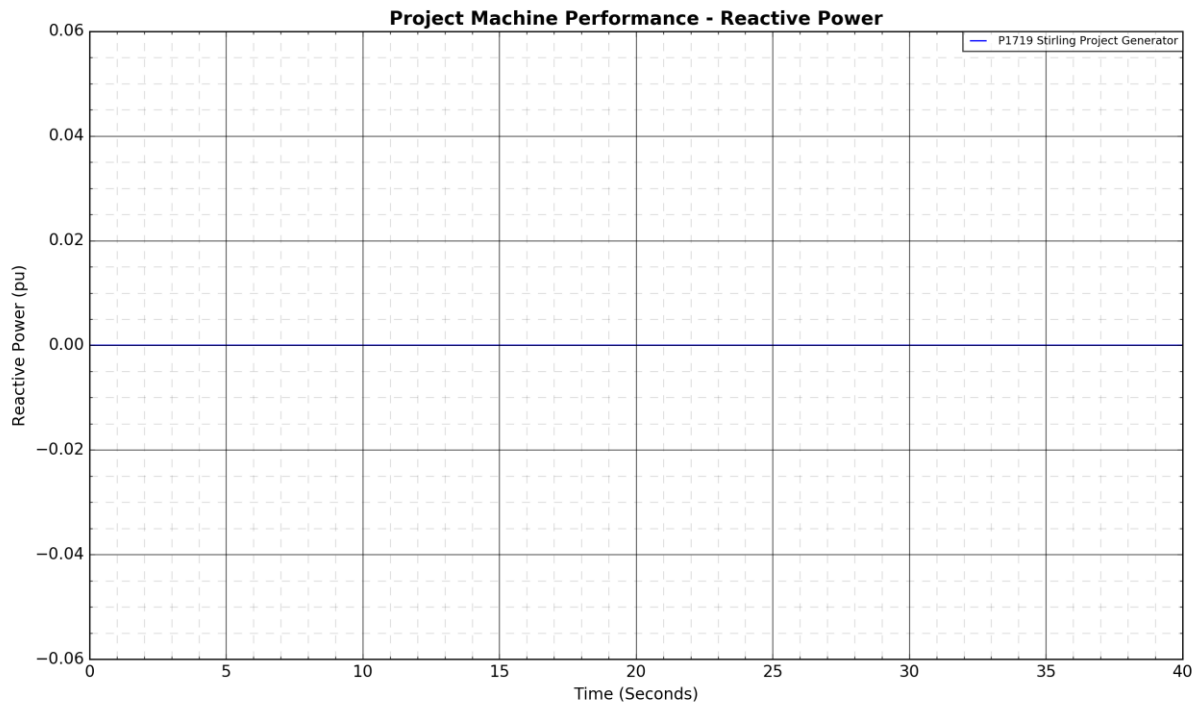
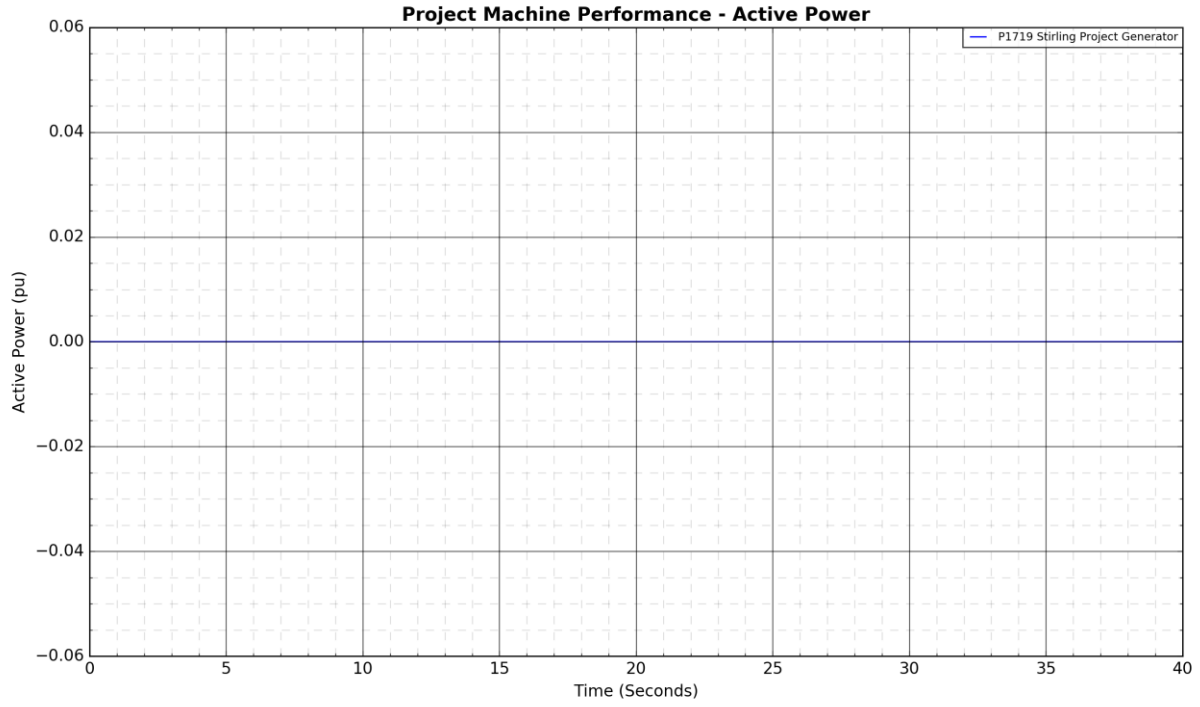
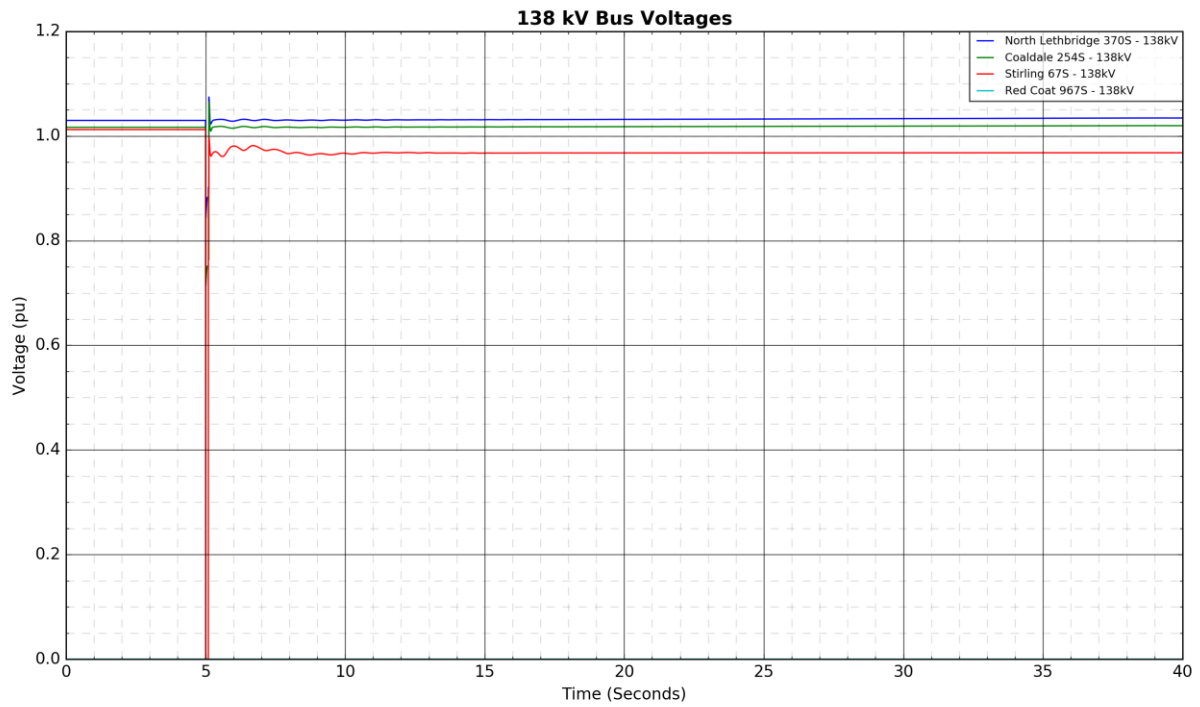
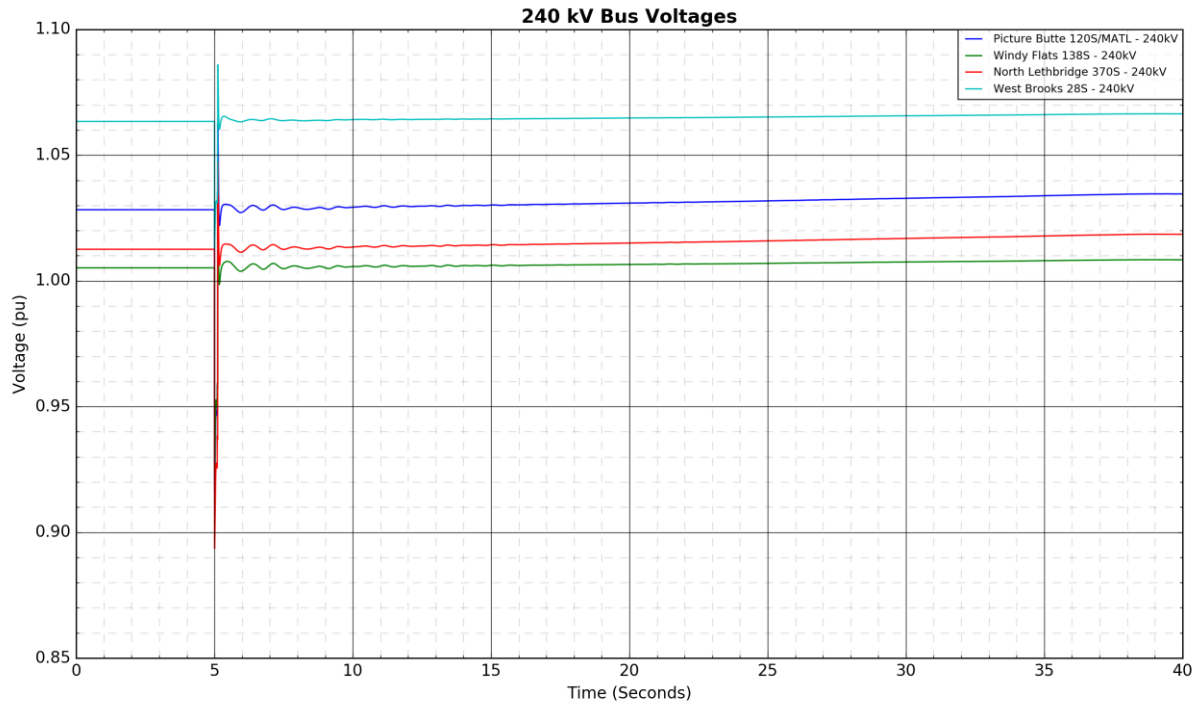
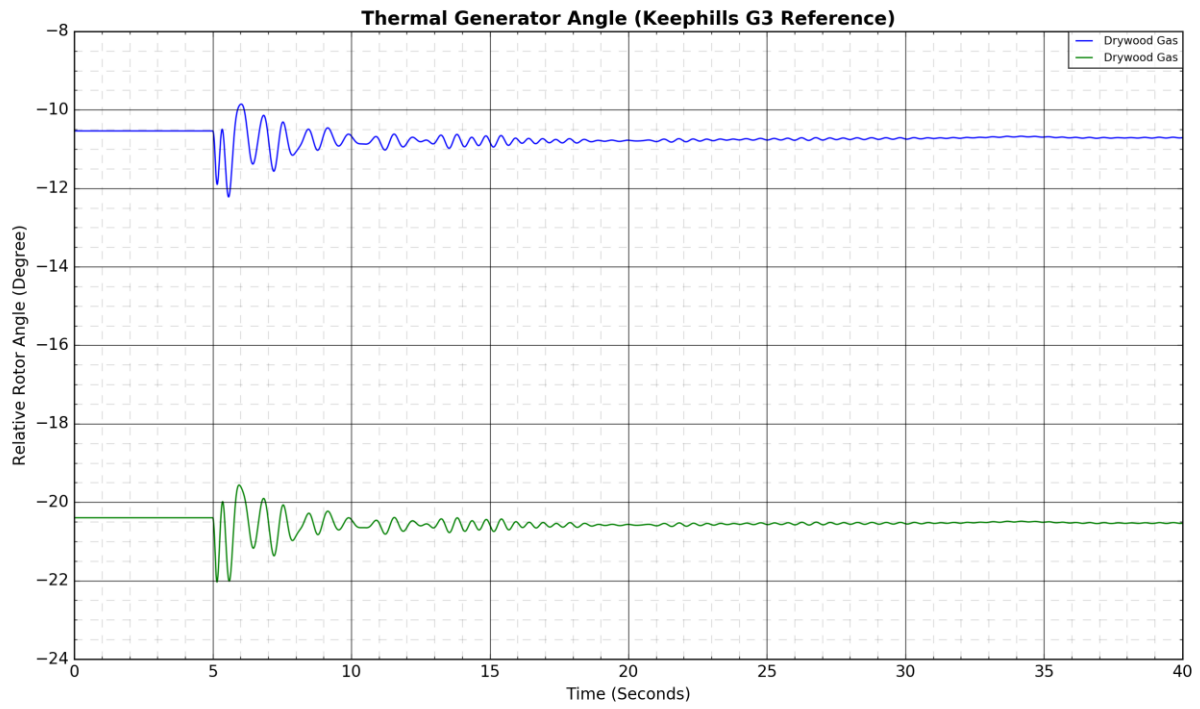
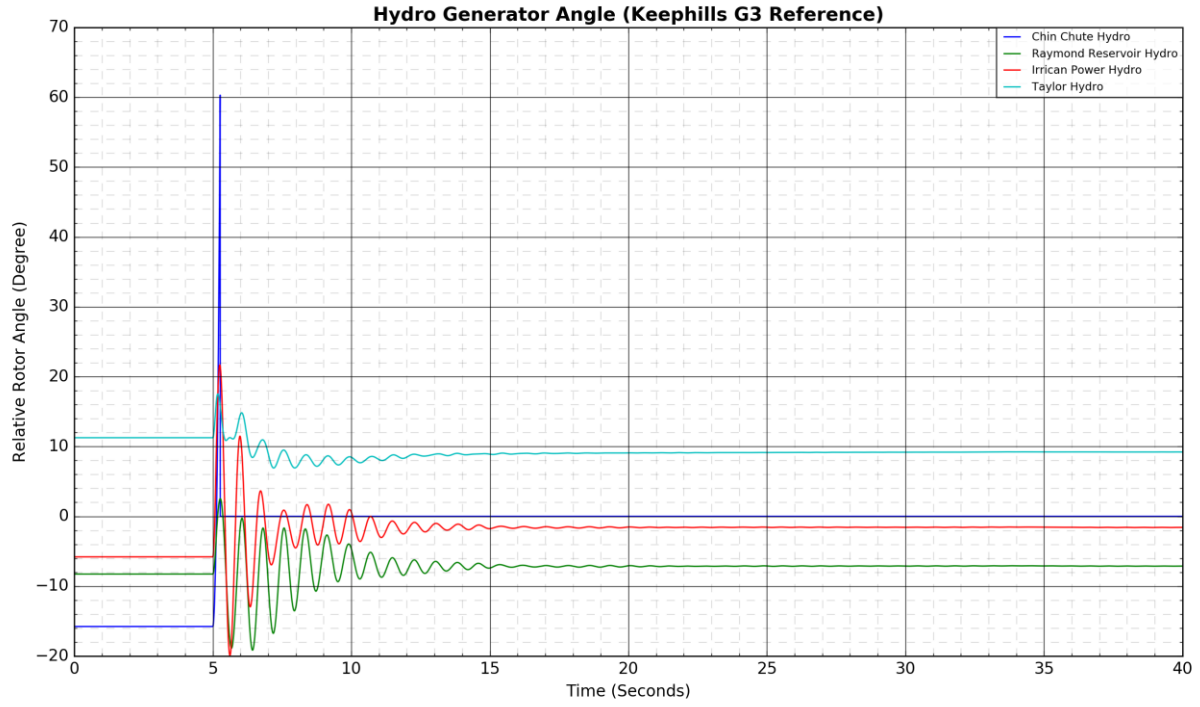
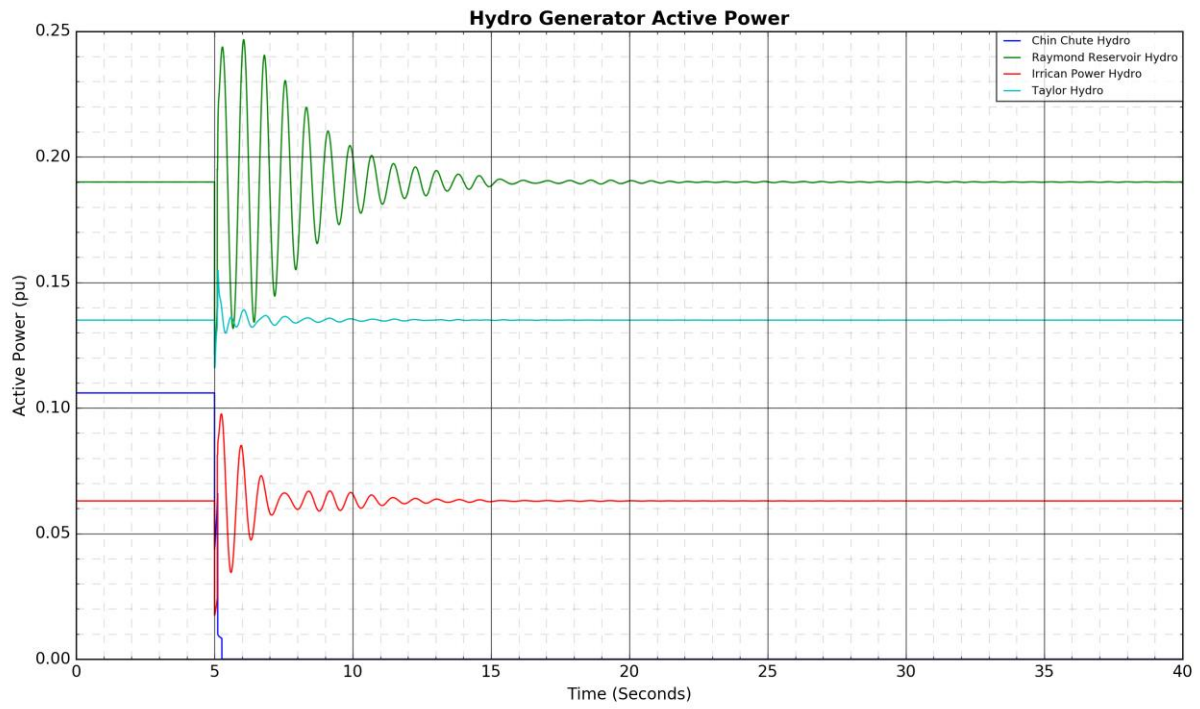
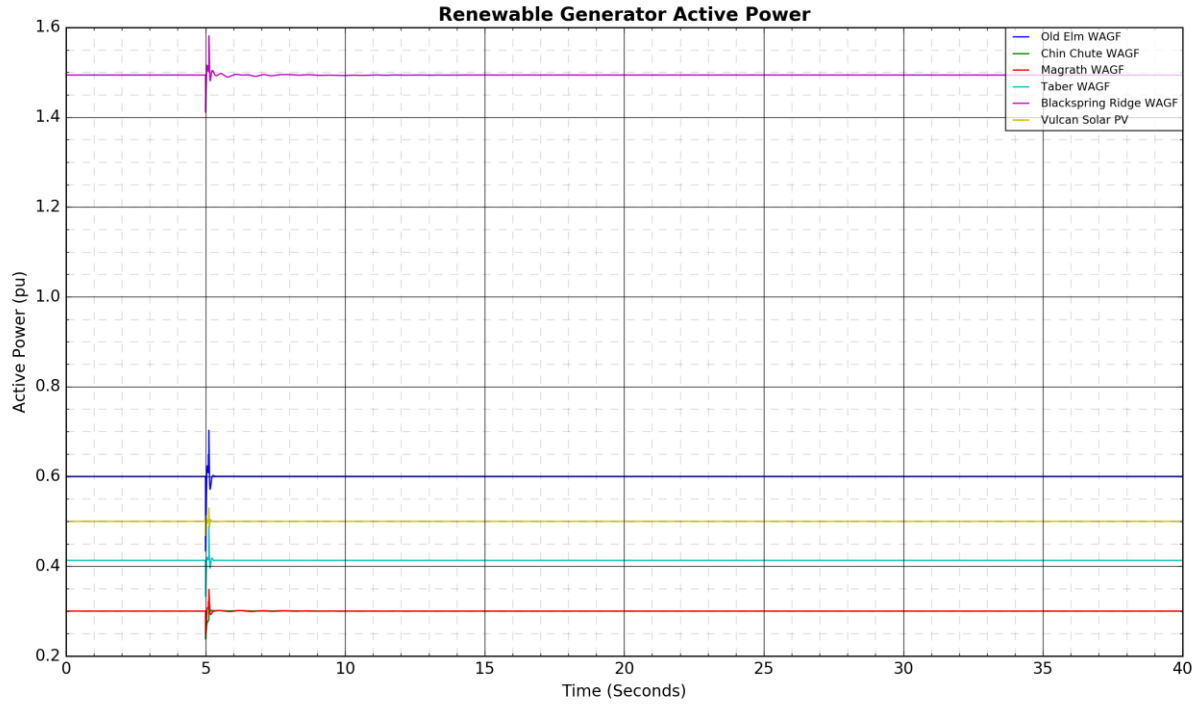
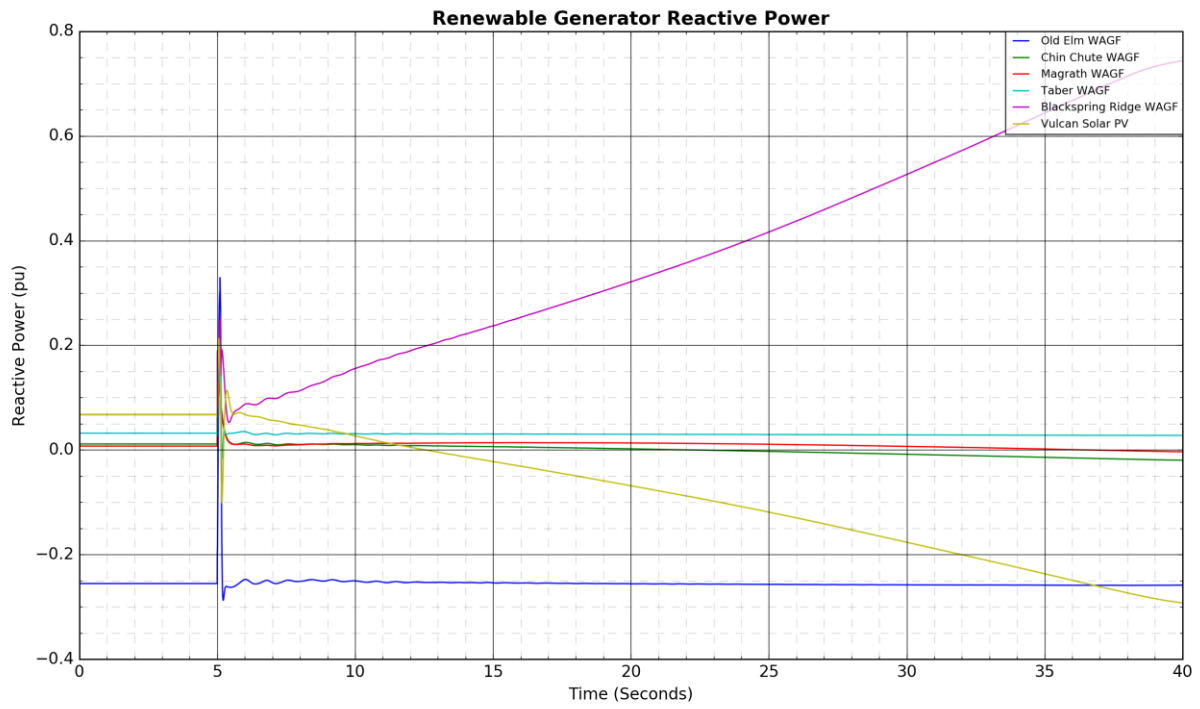
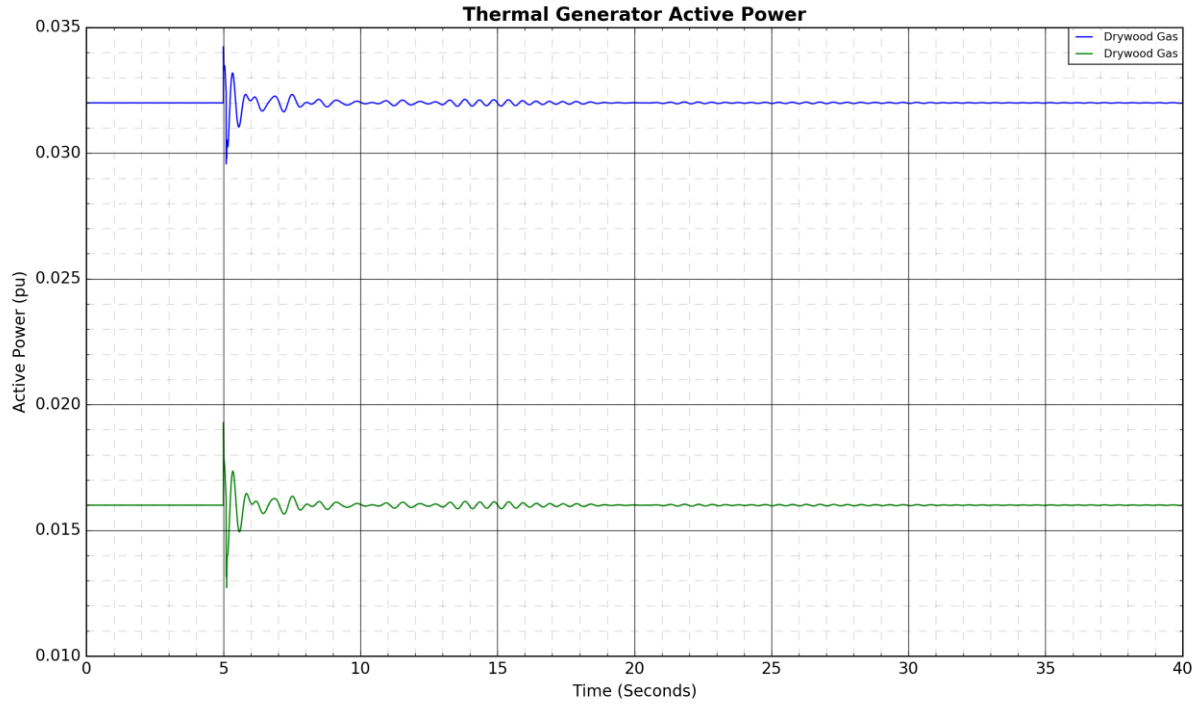


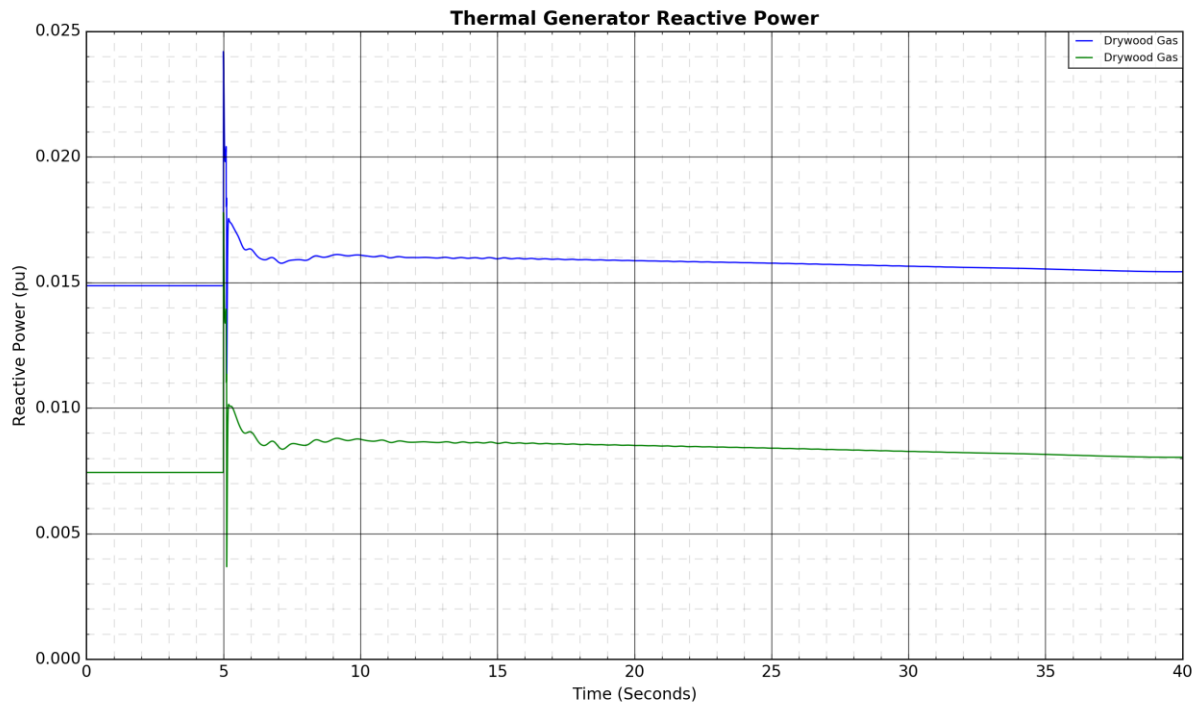
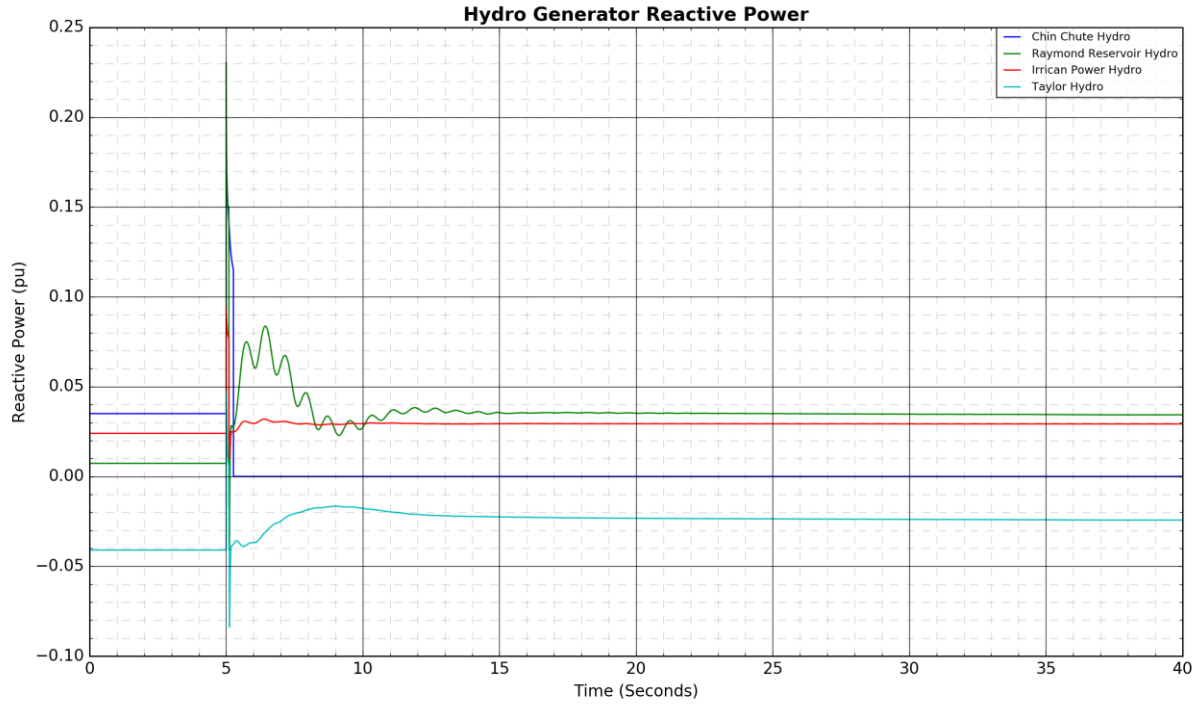
Figure A4-16: 820L Coaldale 254S to Chin Chute 315S T-Tap to Stirling 67S: Fault Near Stirling 67S

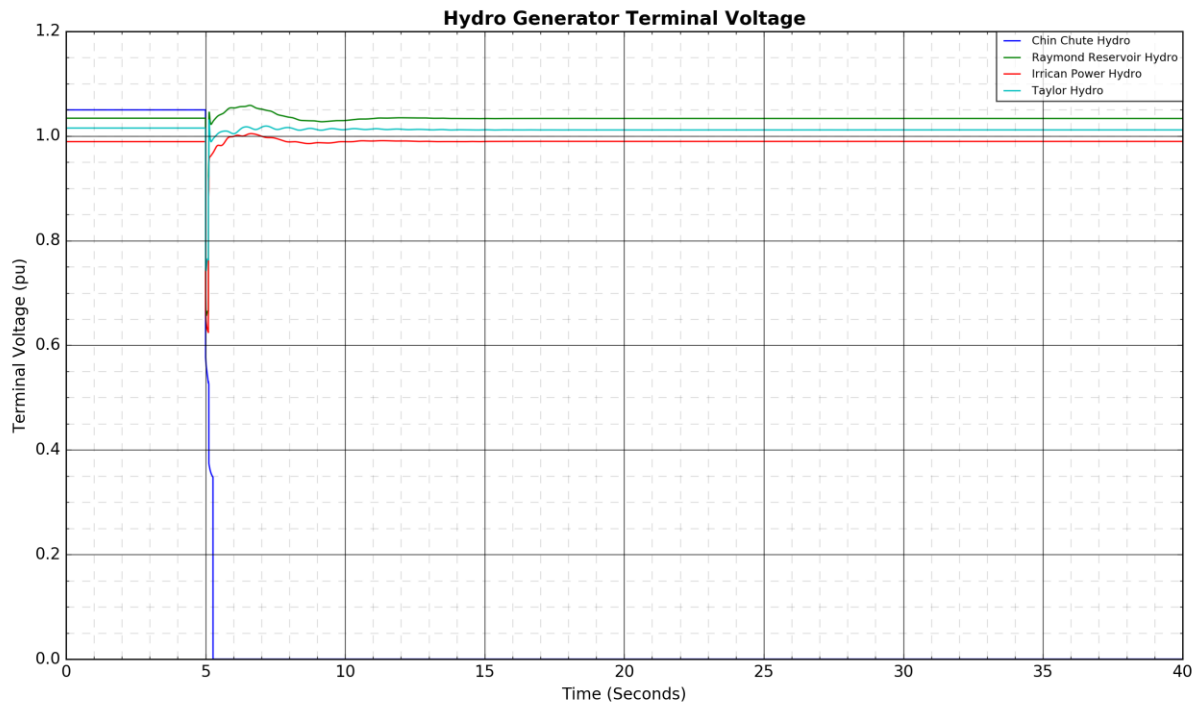
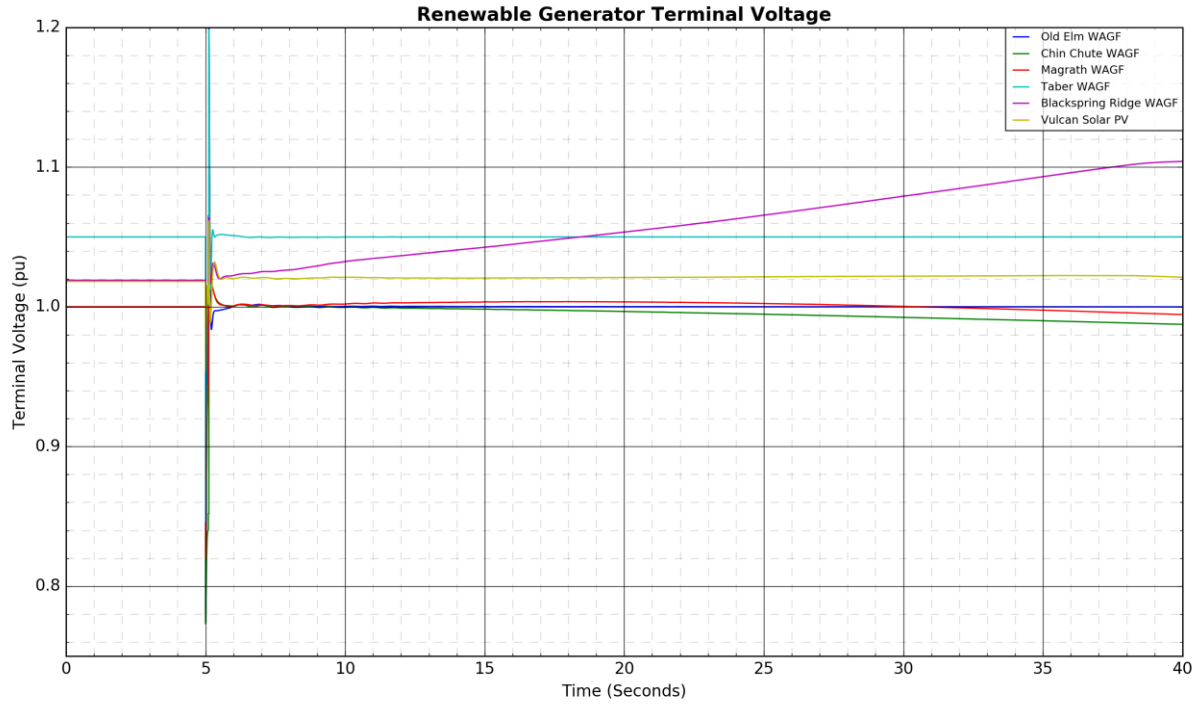


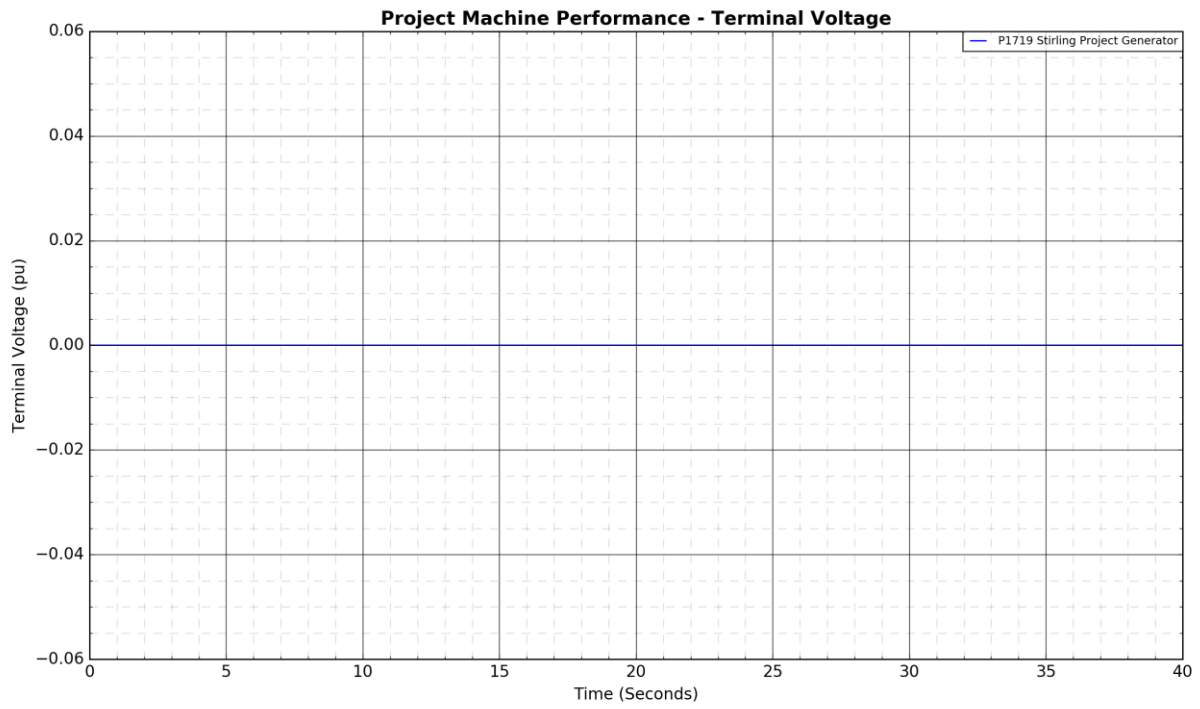
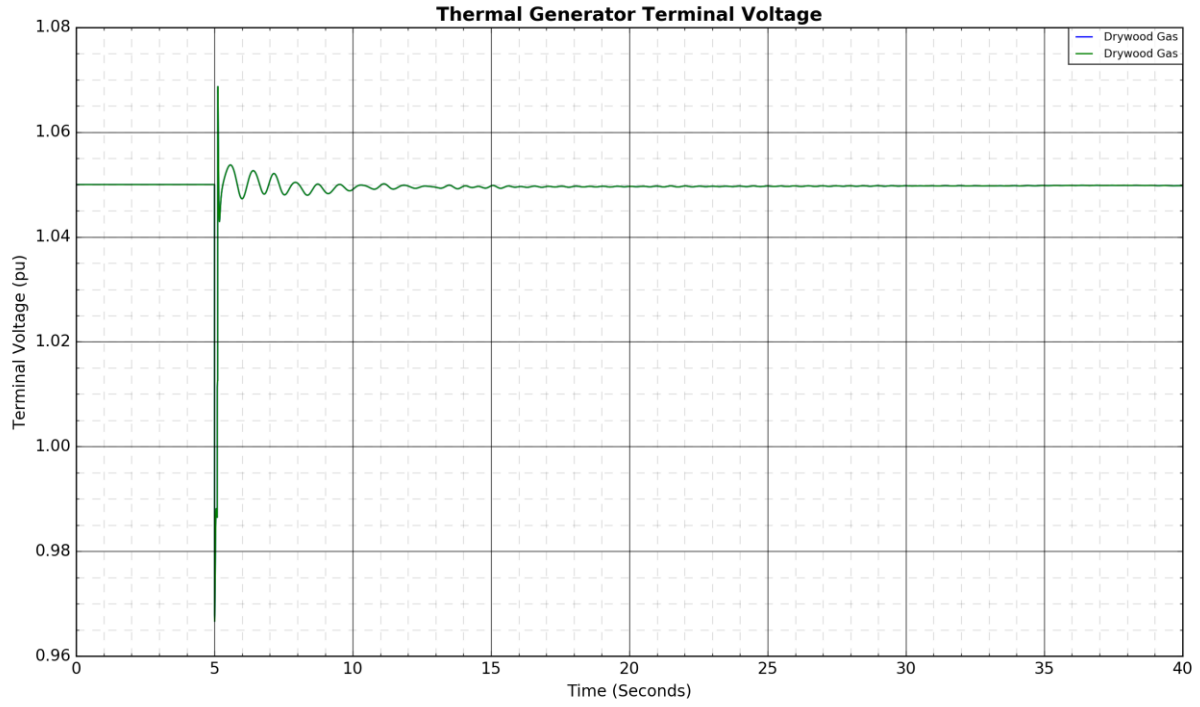


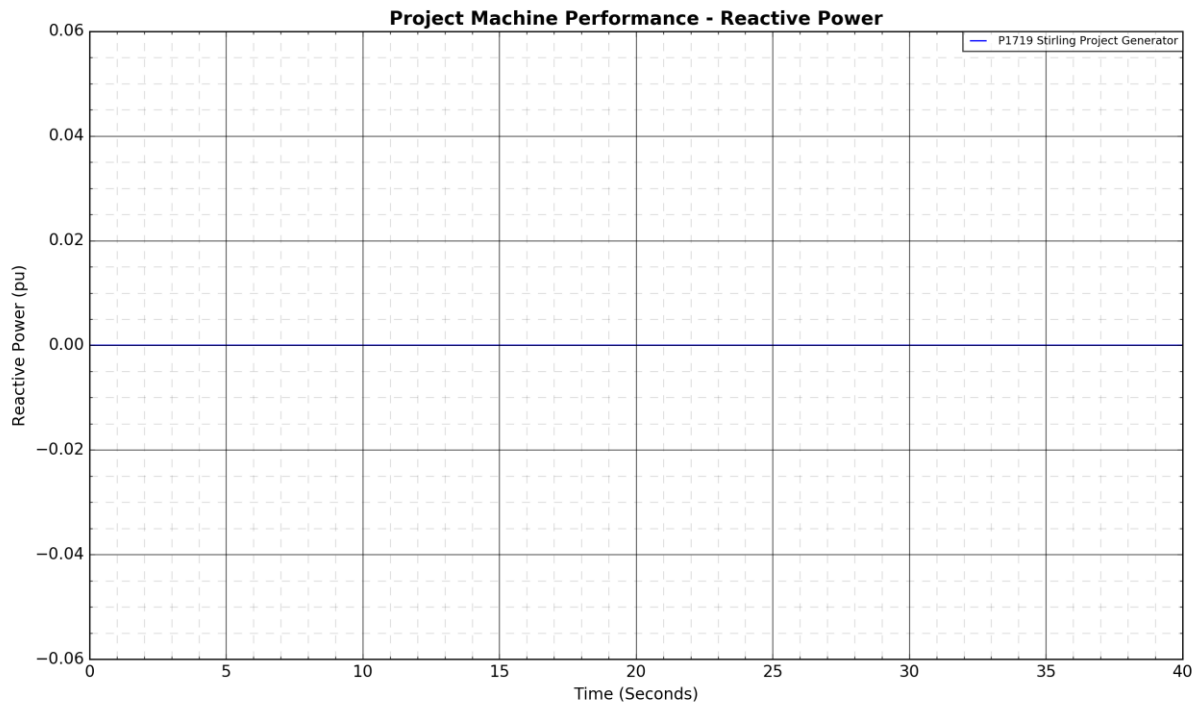
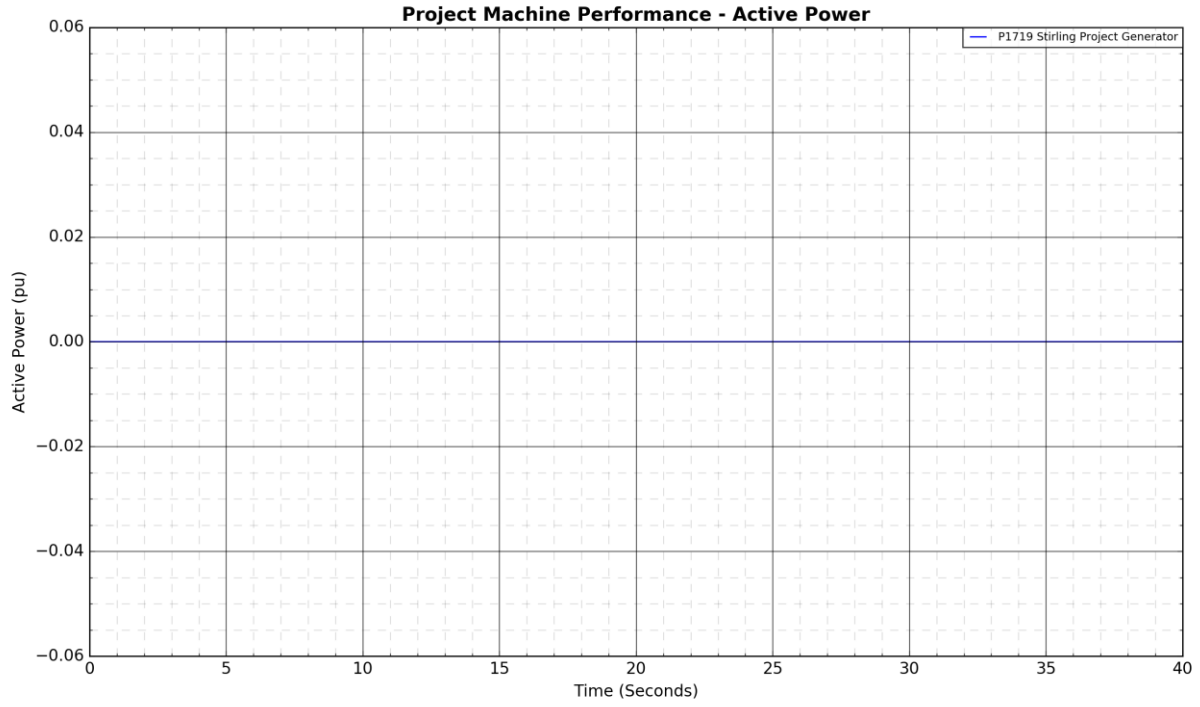




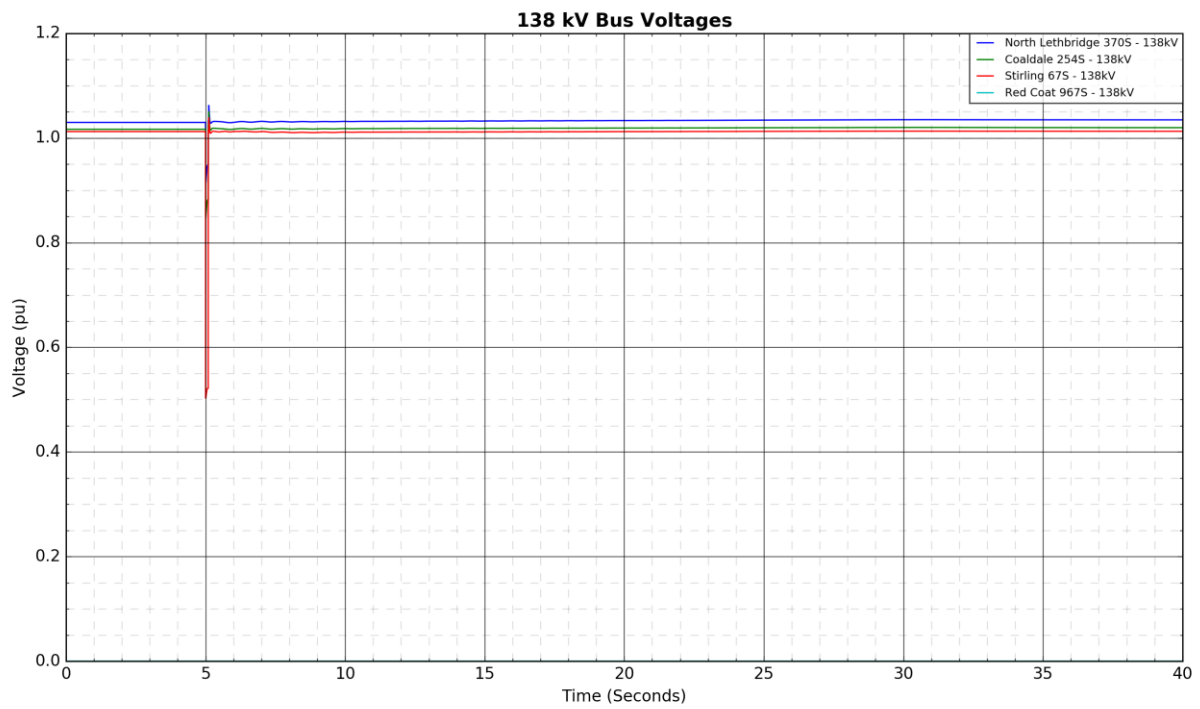
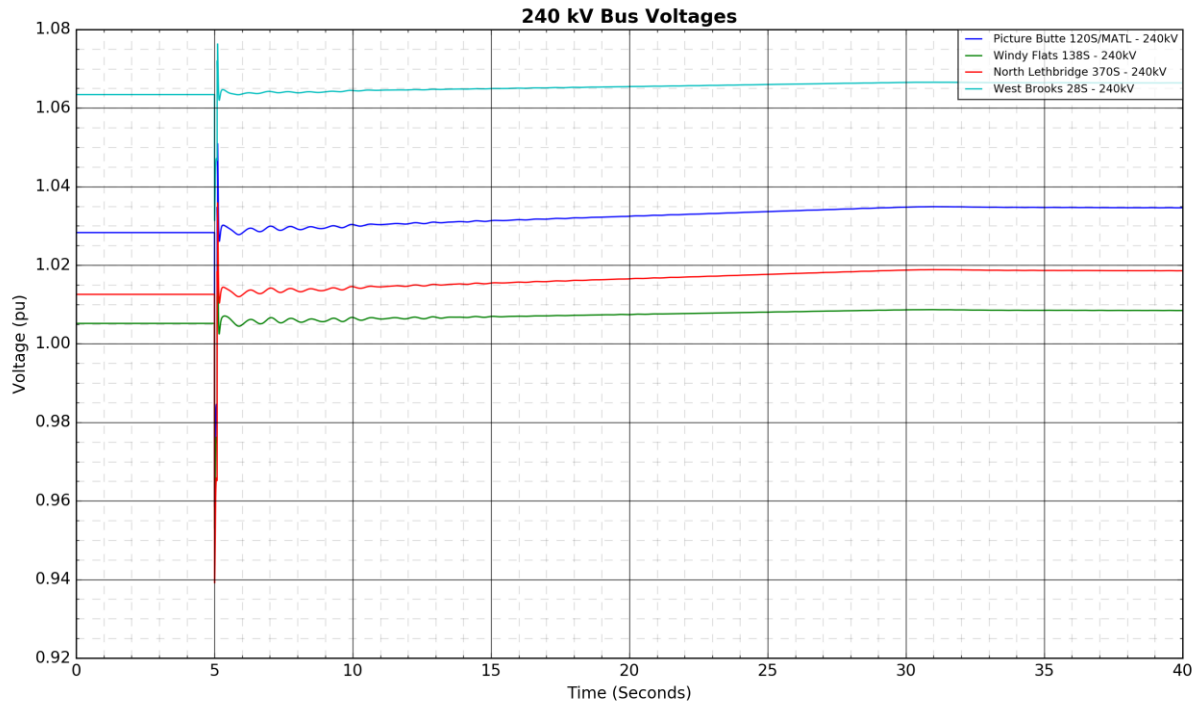


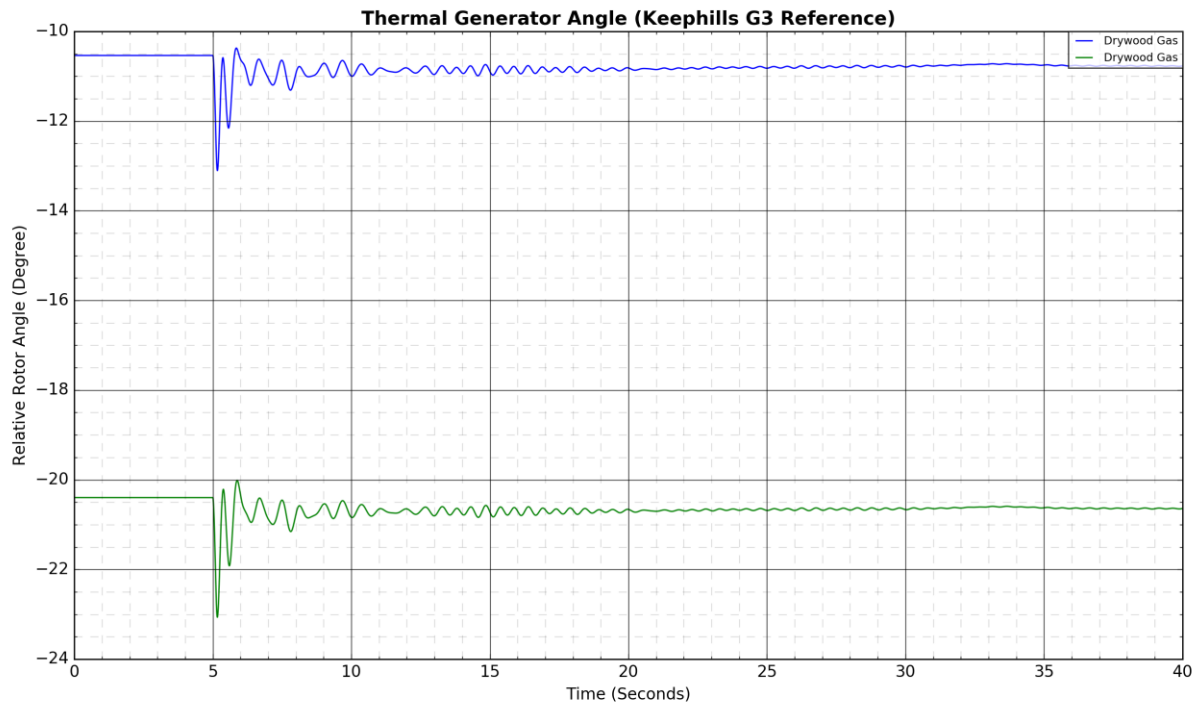
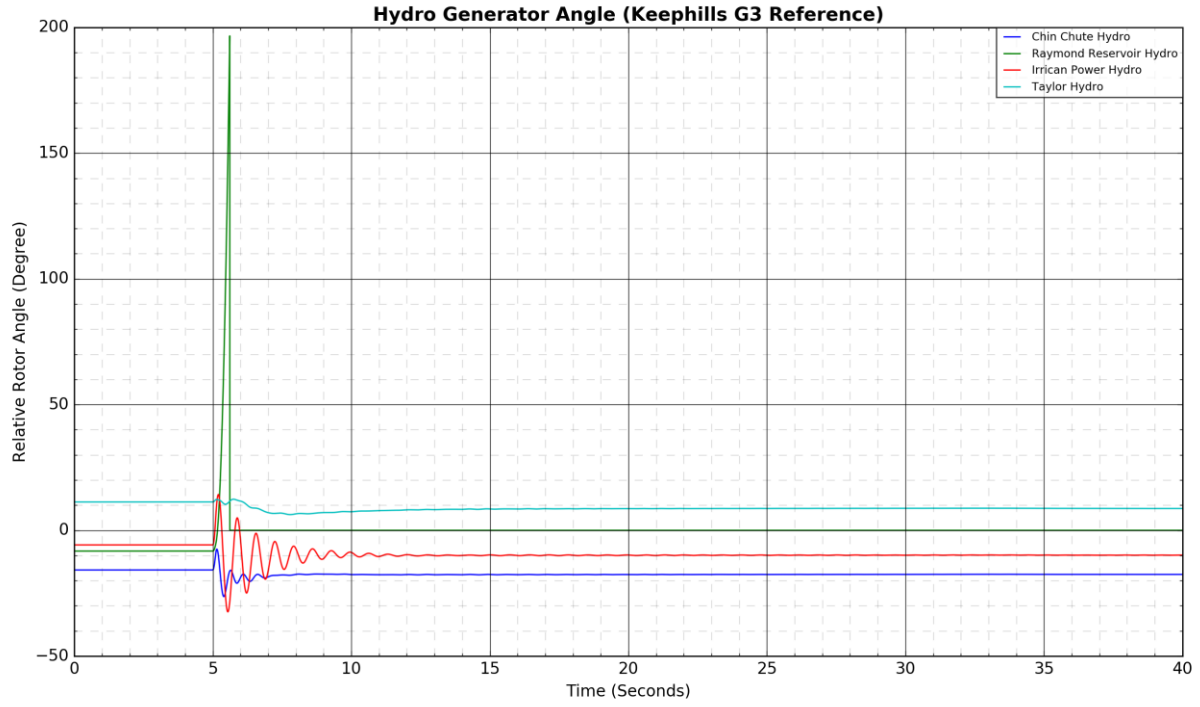


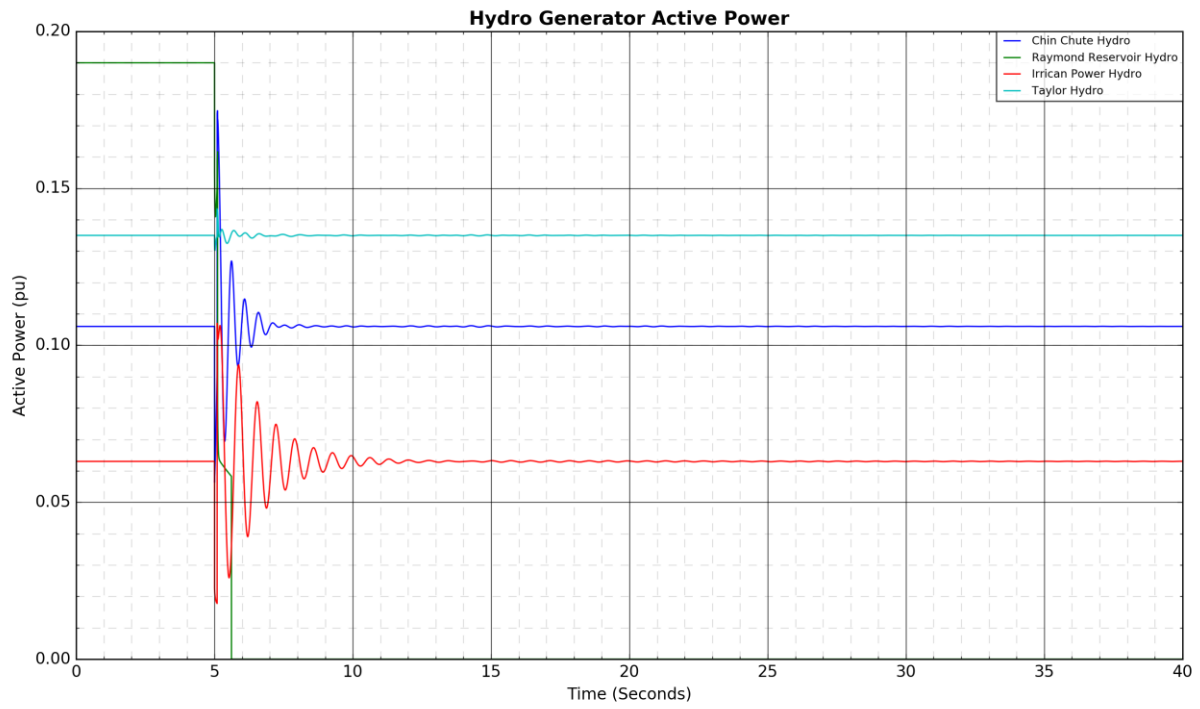
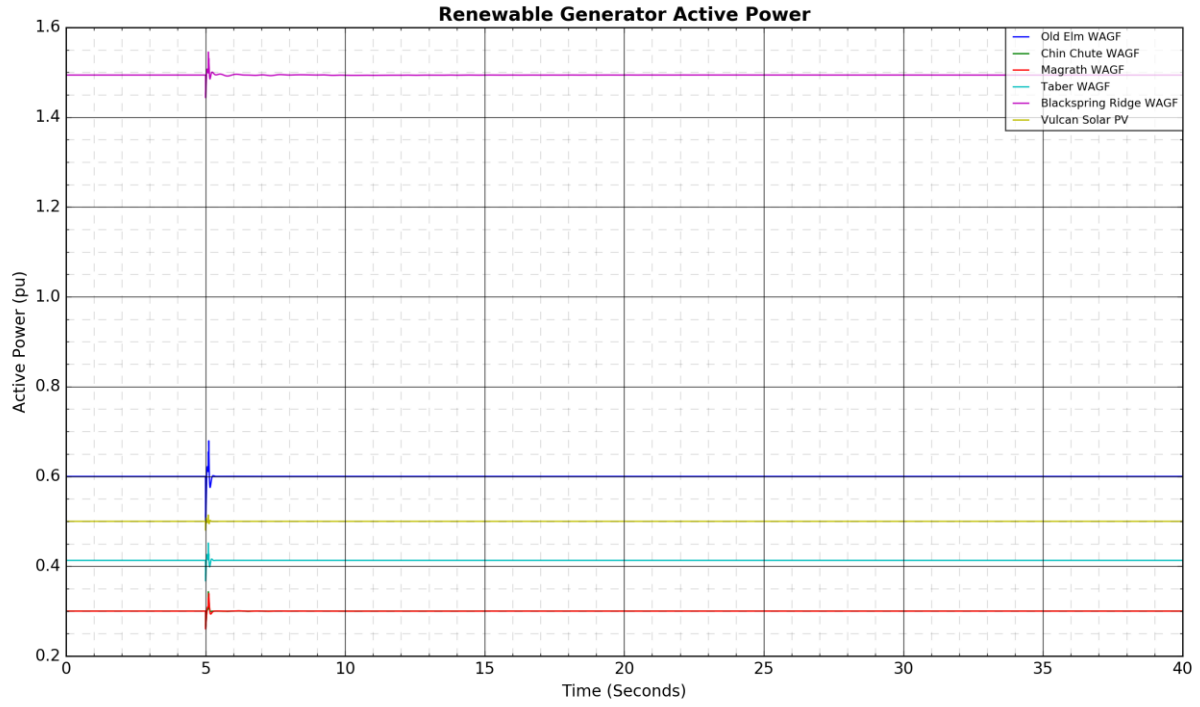


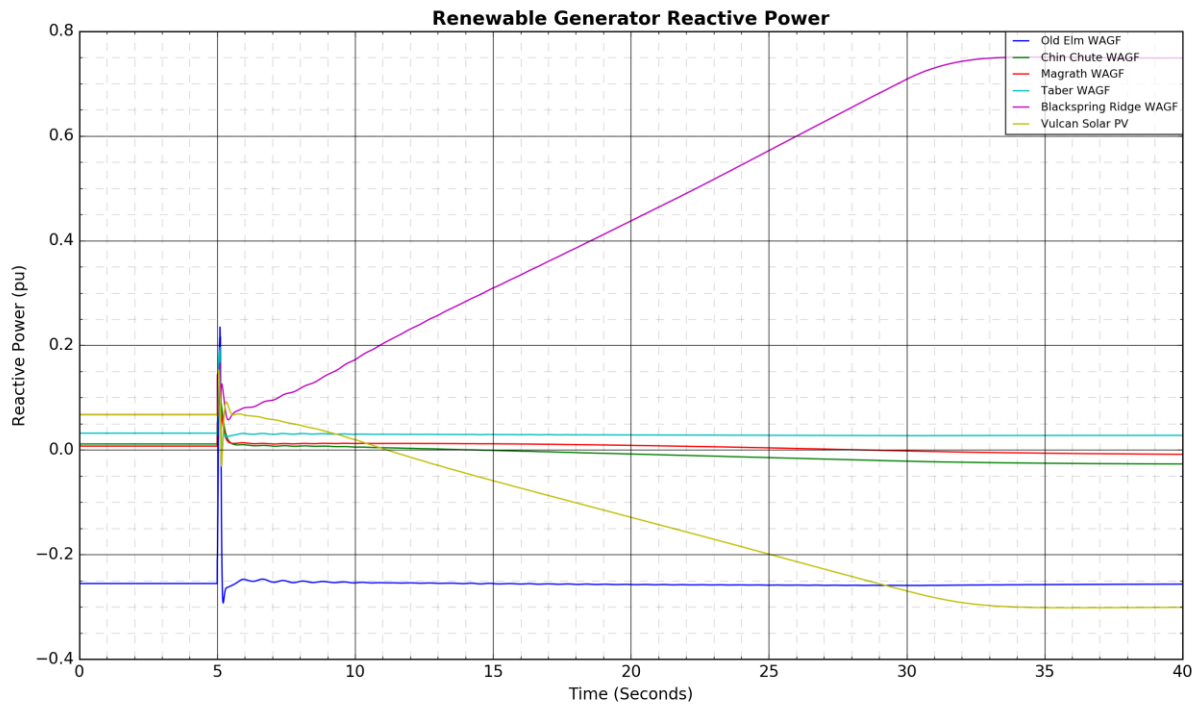
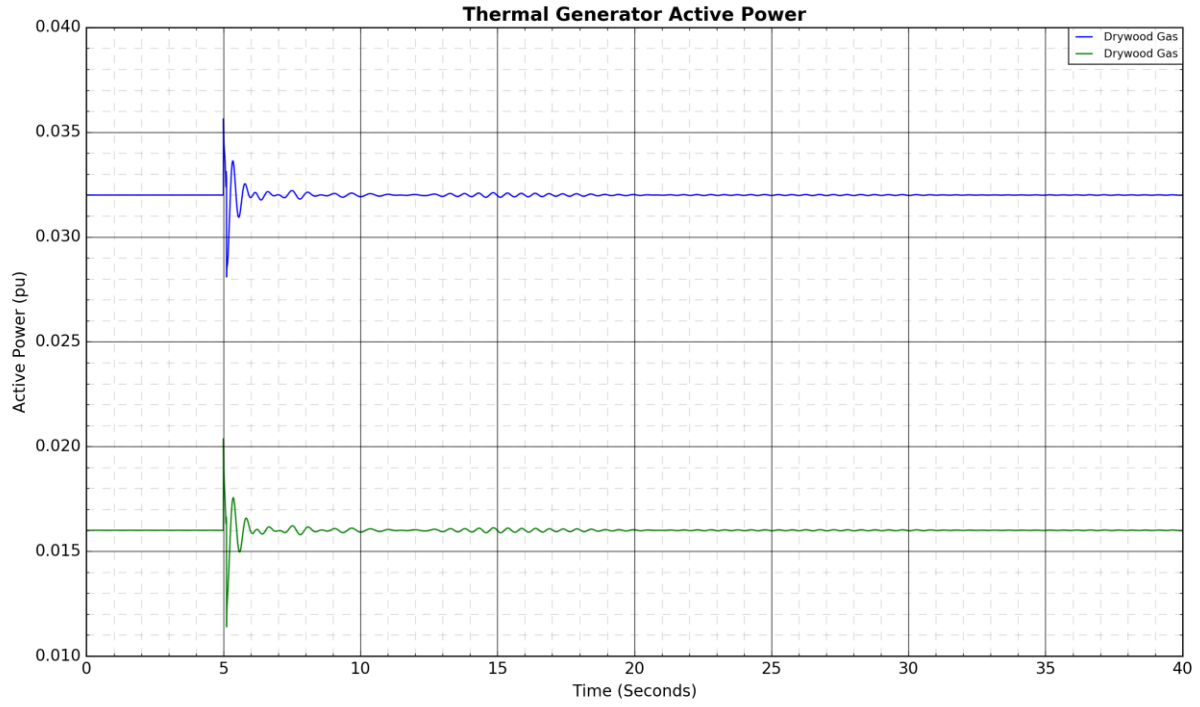


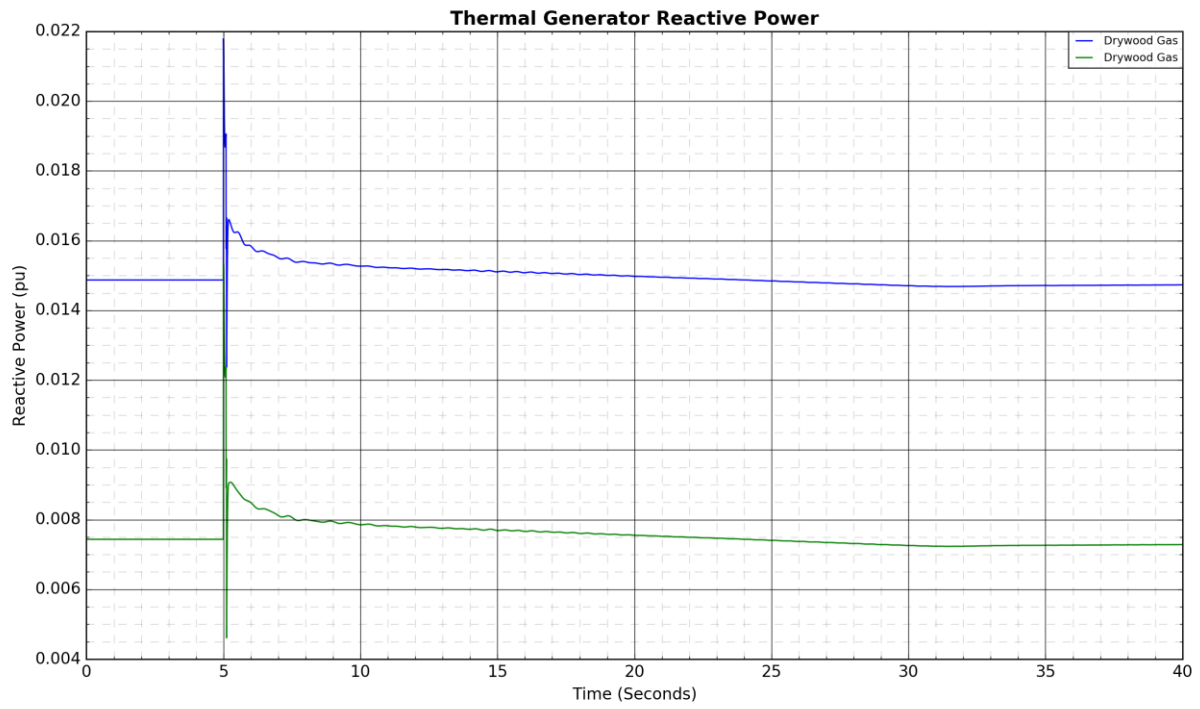
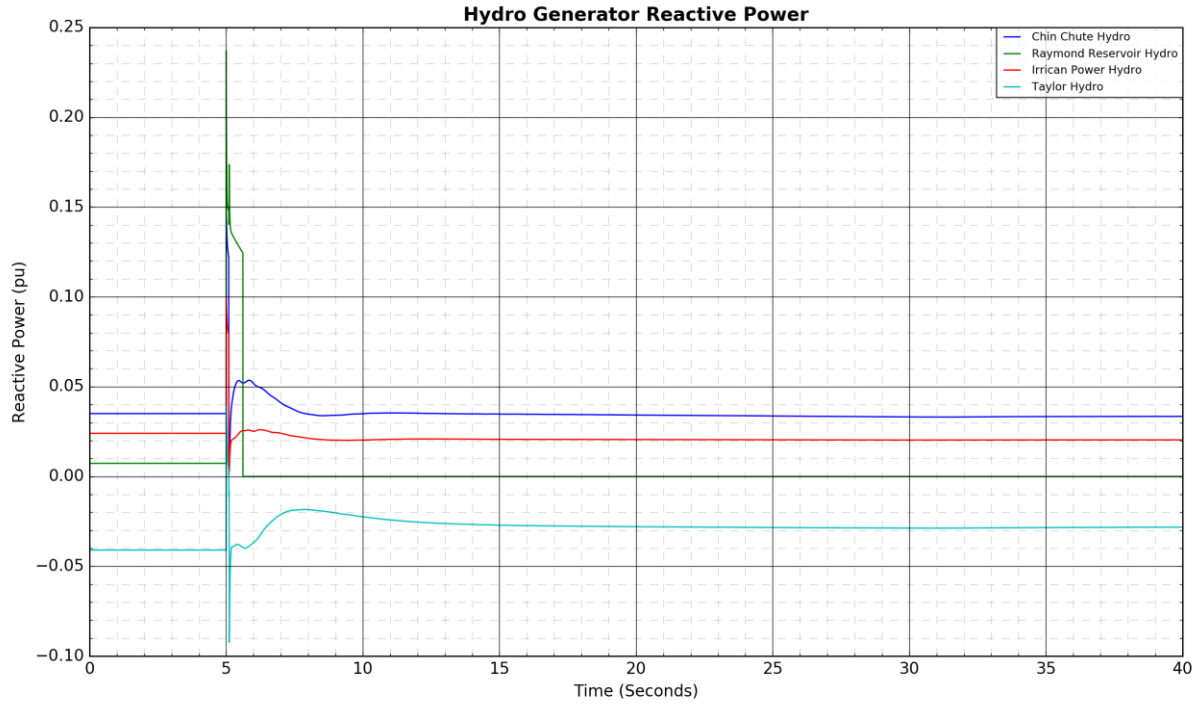
**Figure A4-17: 225L Stirling 67S to Raymond Reservoir 313S T-Tap to Magrath 225S:
Fault Near Stirling 67S**

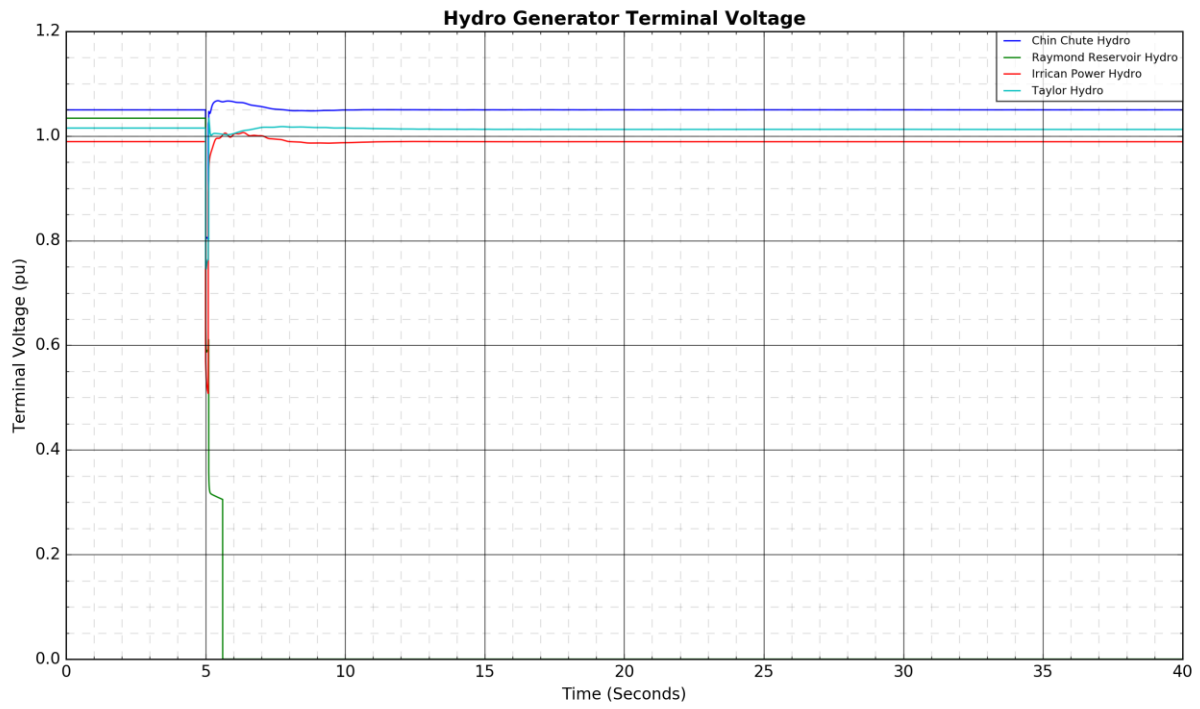
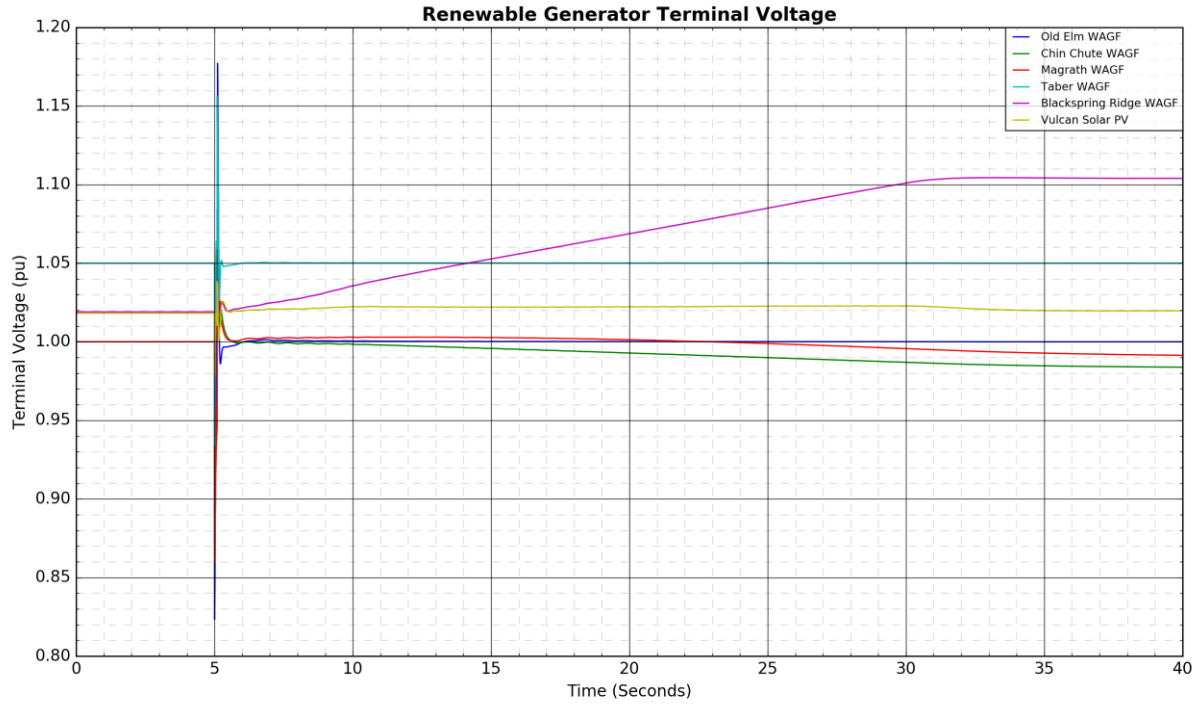


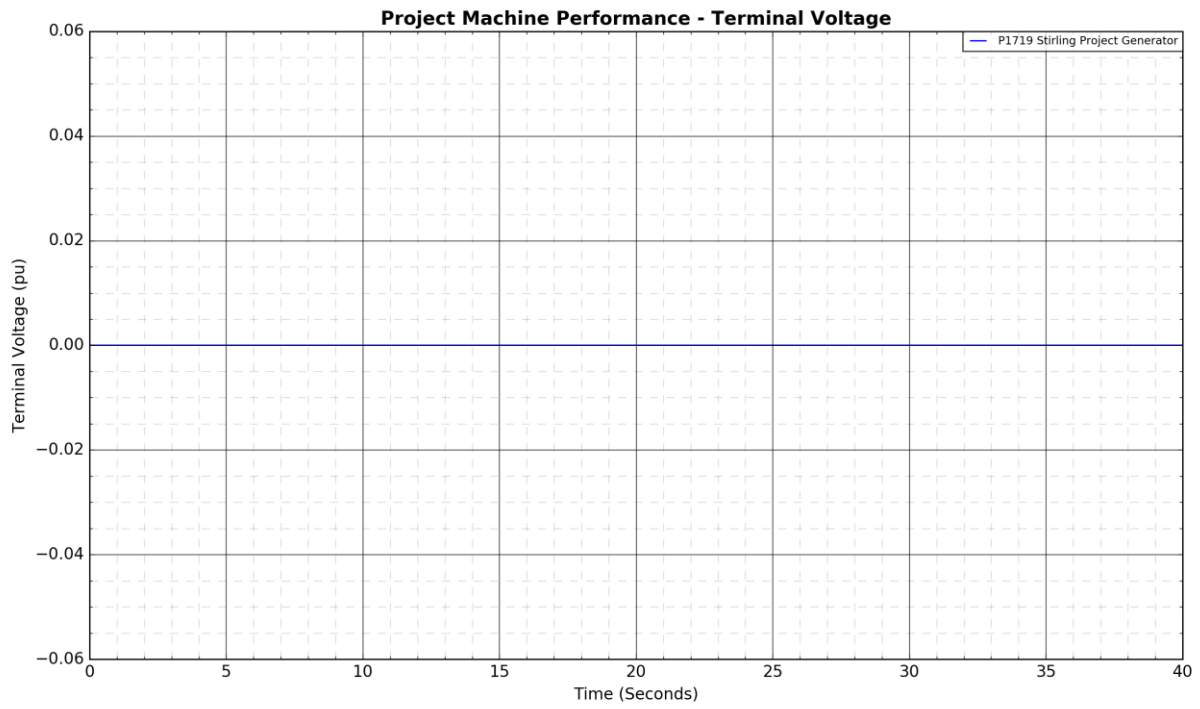
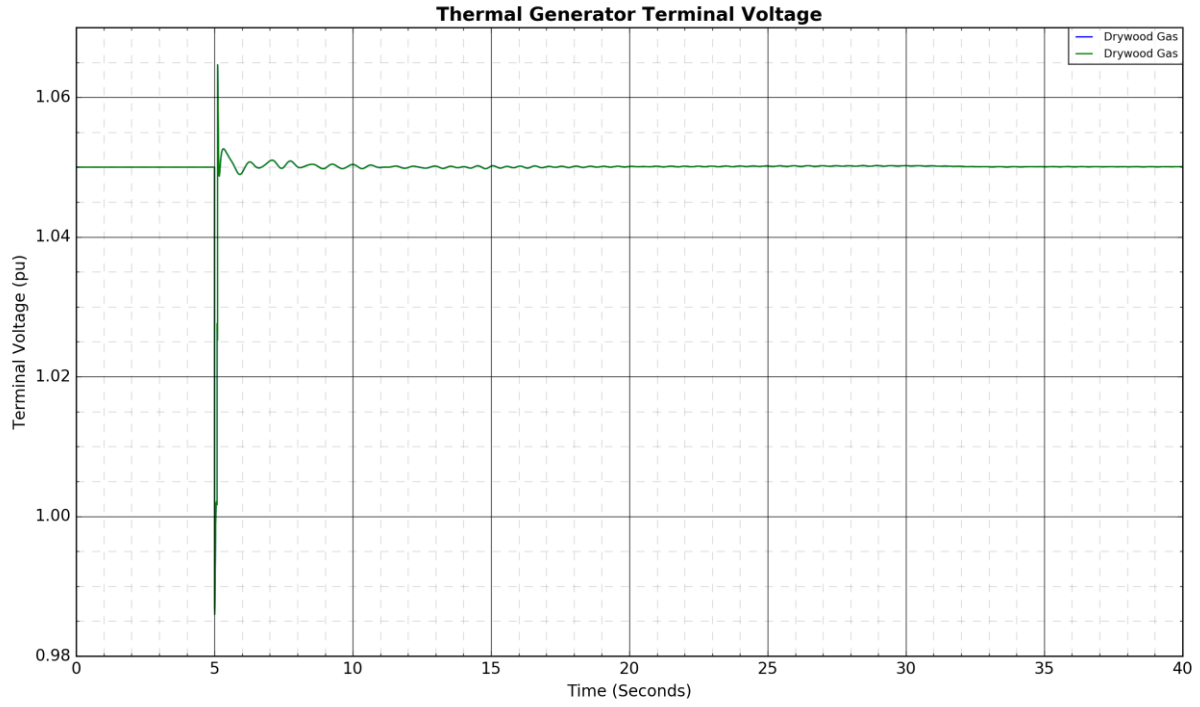












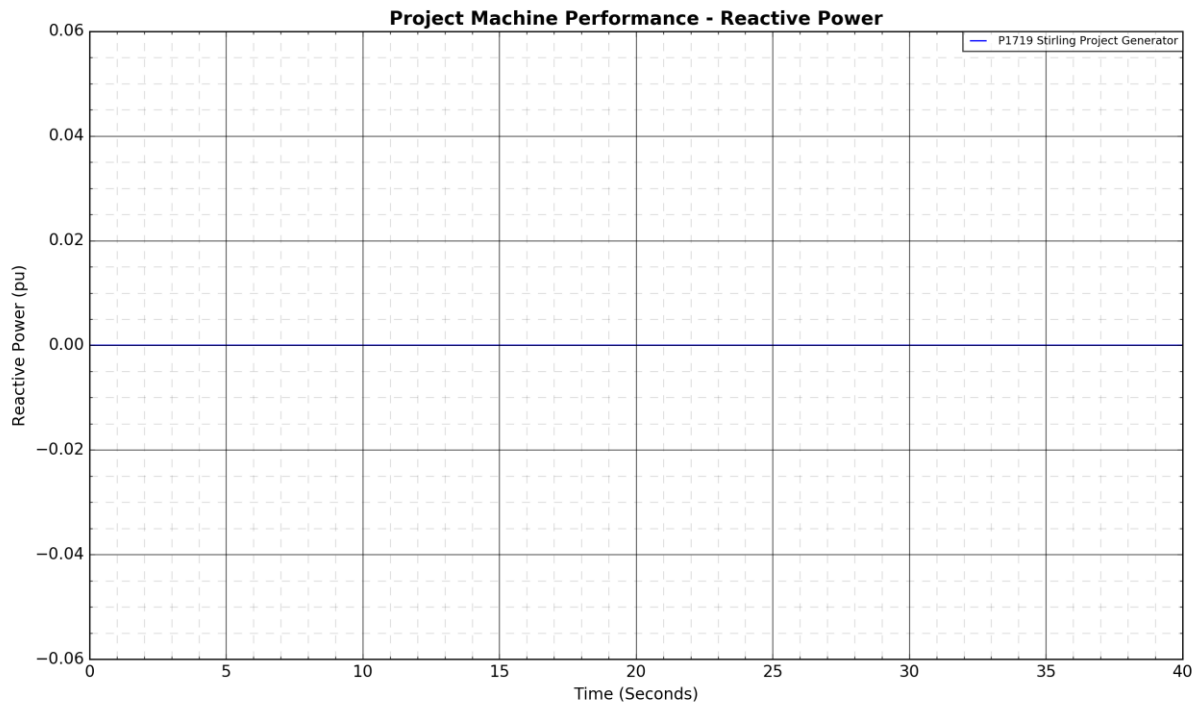
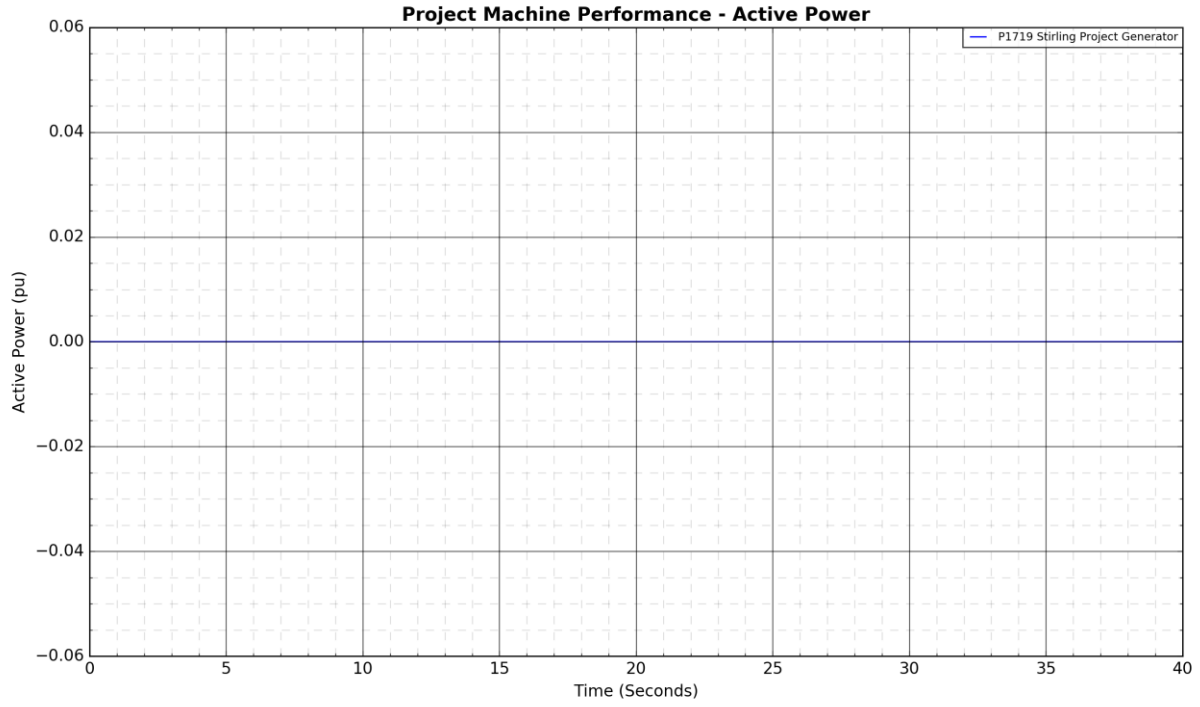
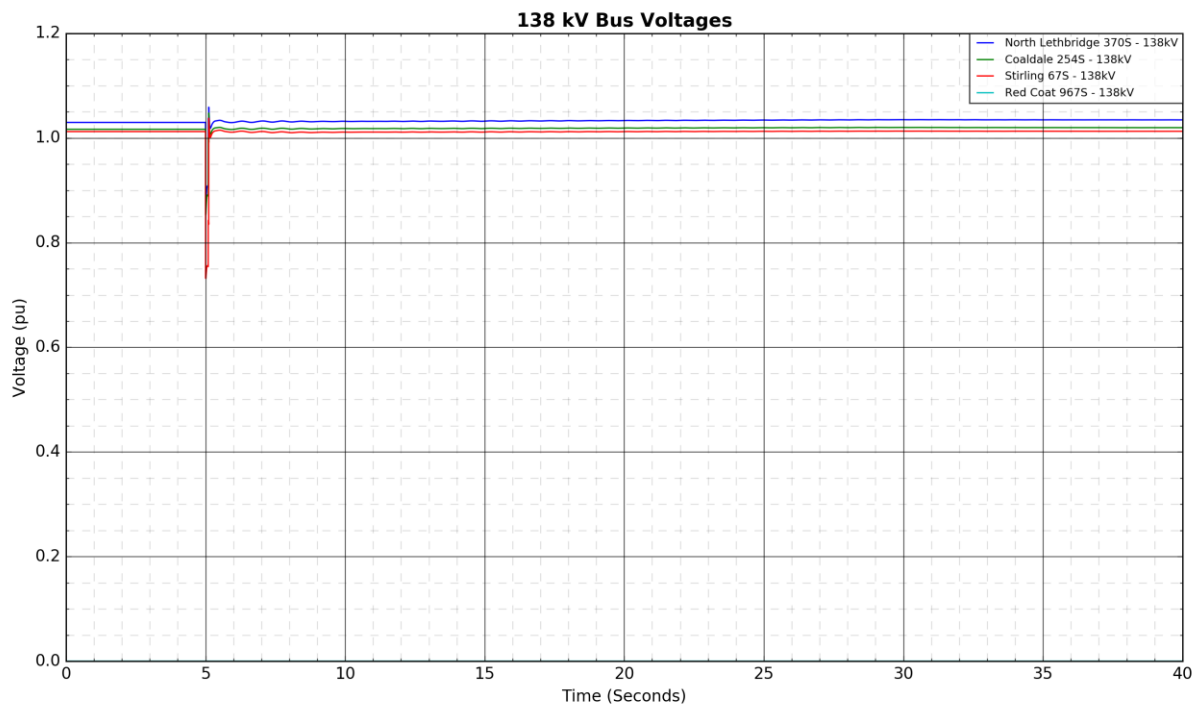
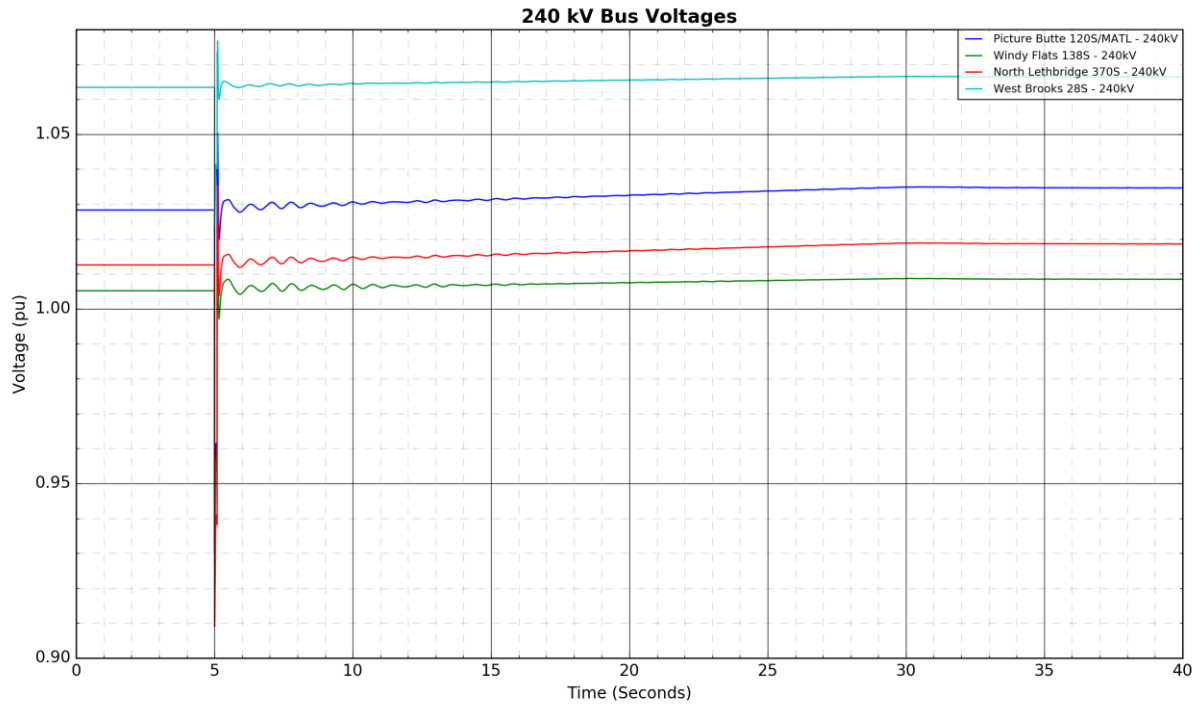
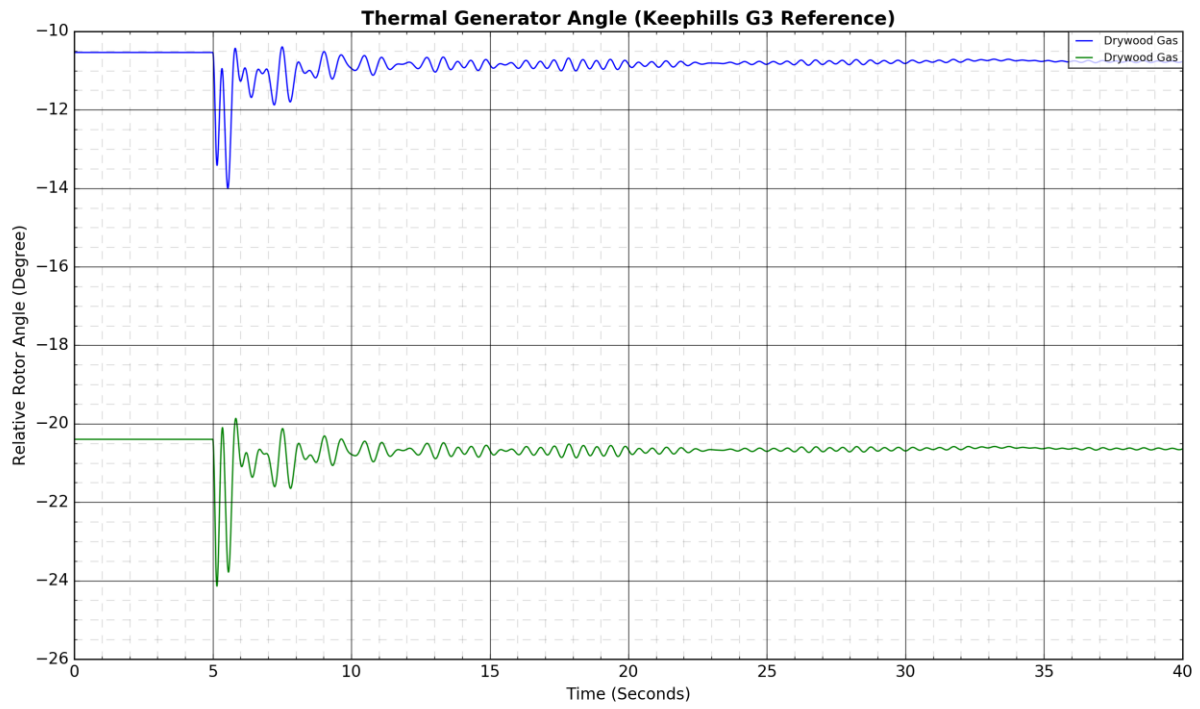
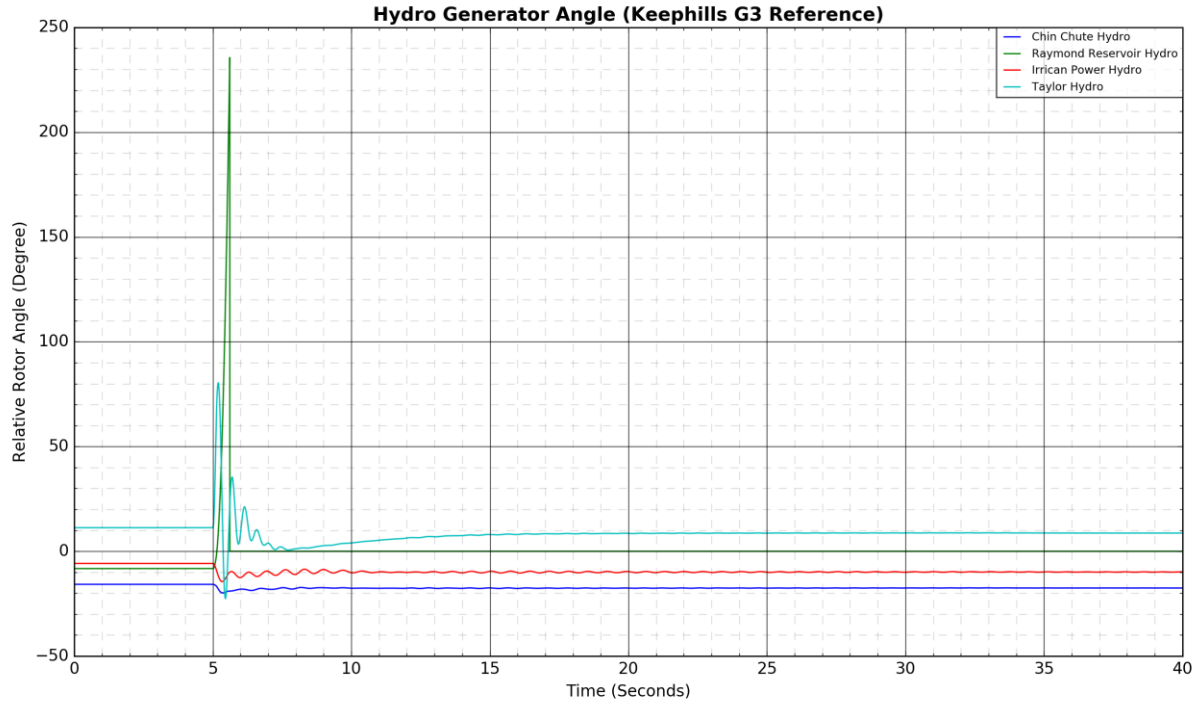
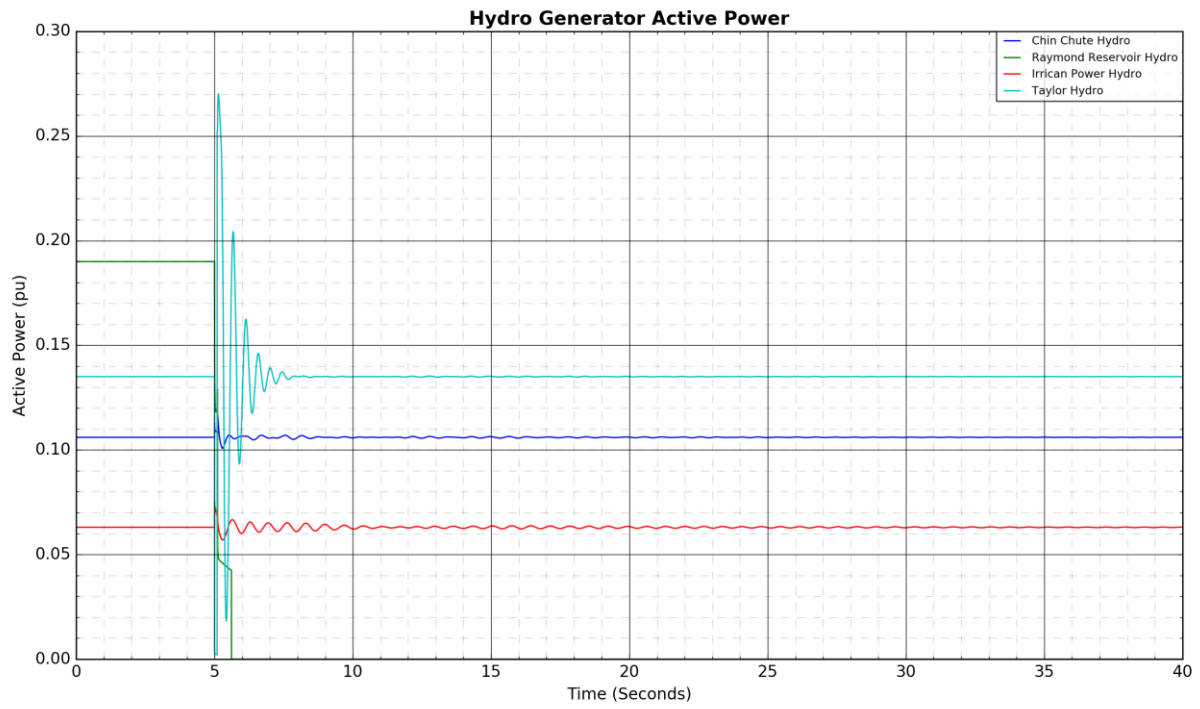
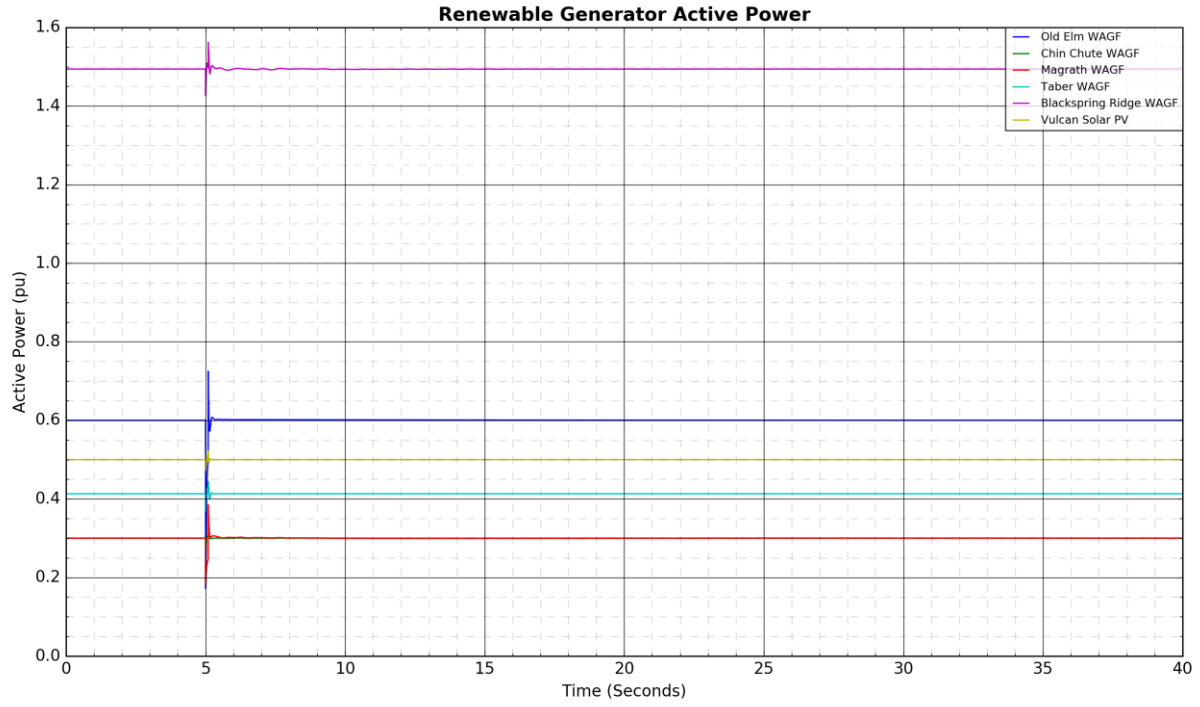


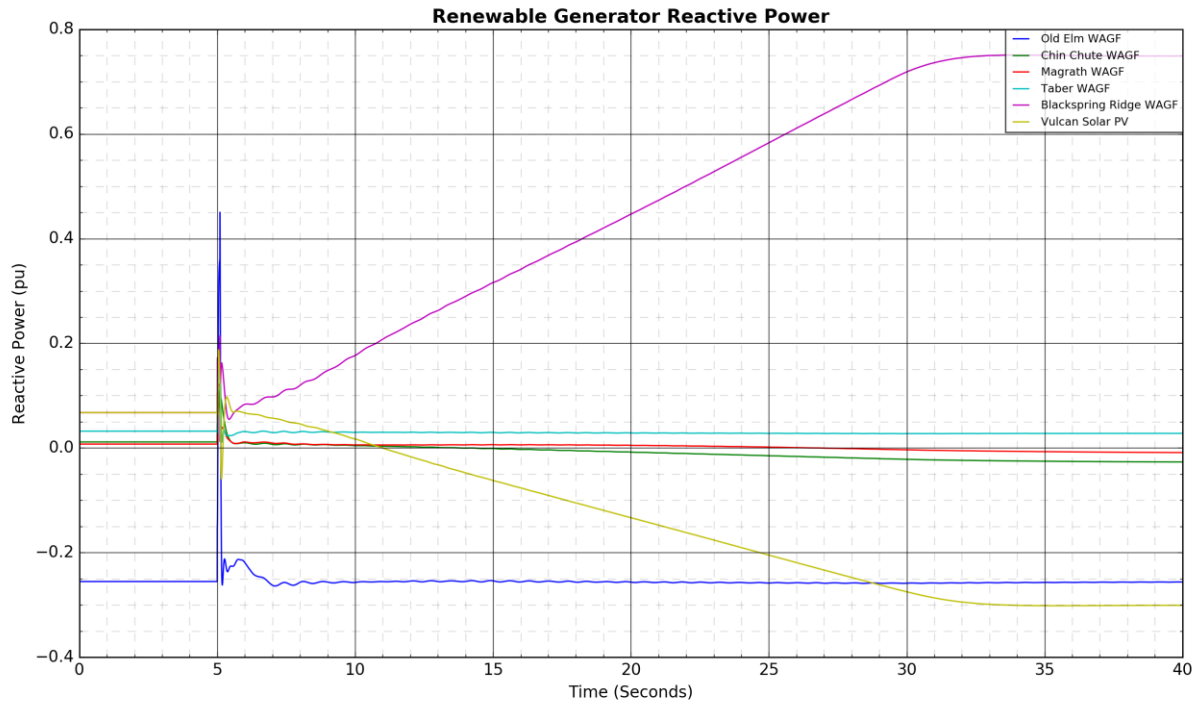
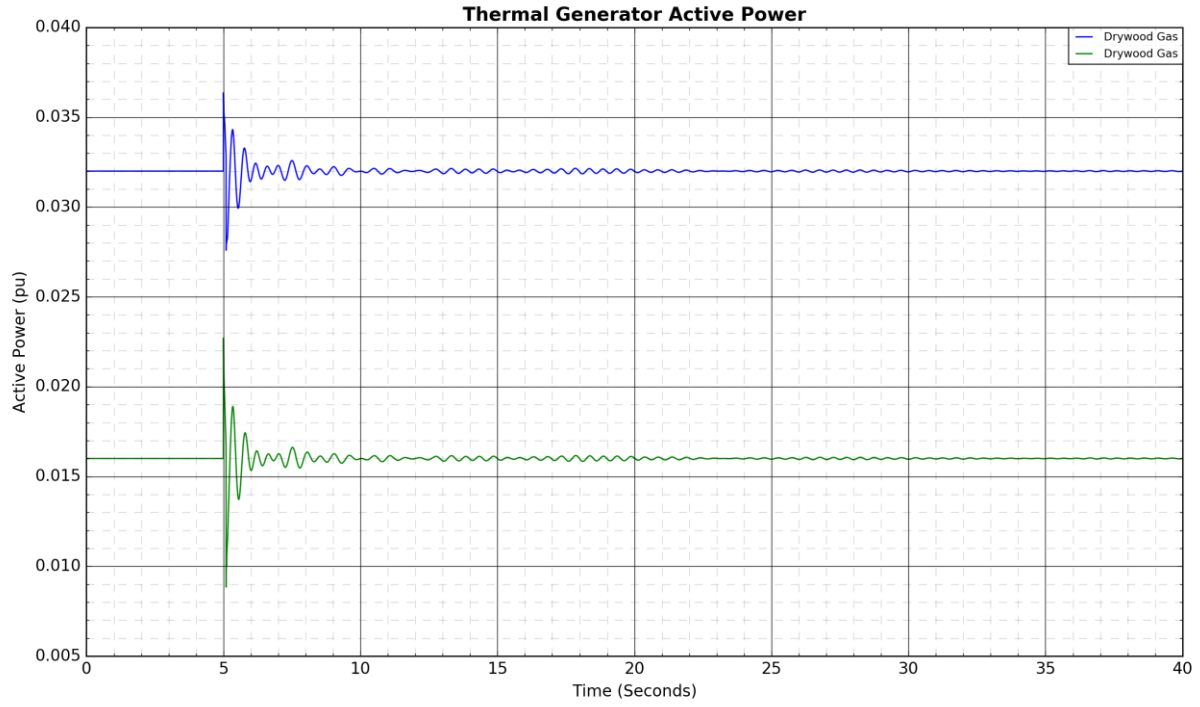
Figure A4-18: 225L Stirling 67S to Raymond Reservoir 313S T-Tap to Magrath 225S: Fault Near Magrath 225S

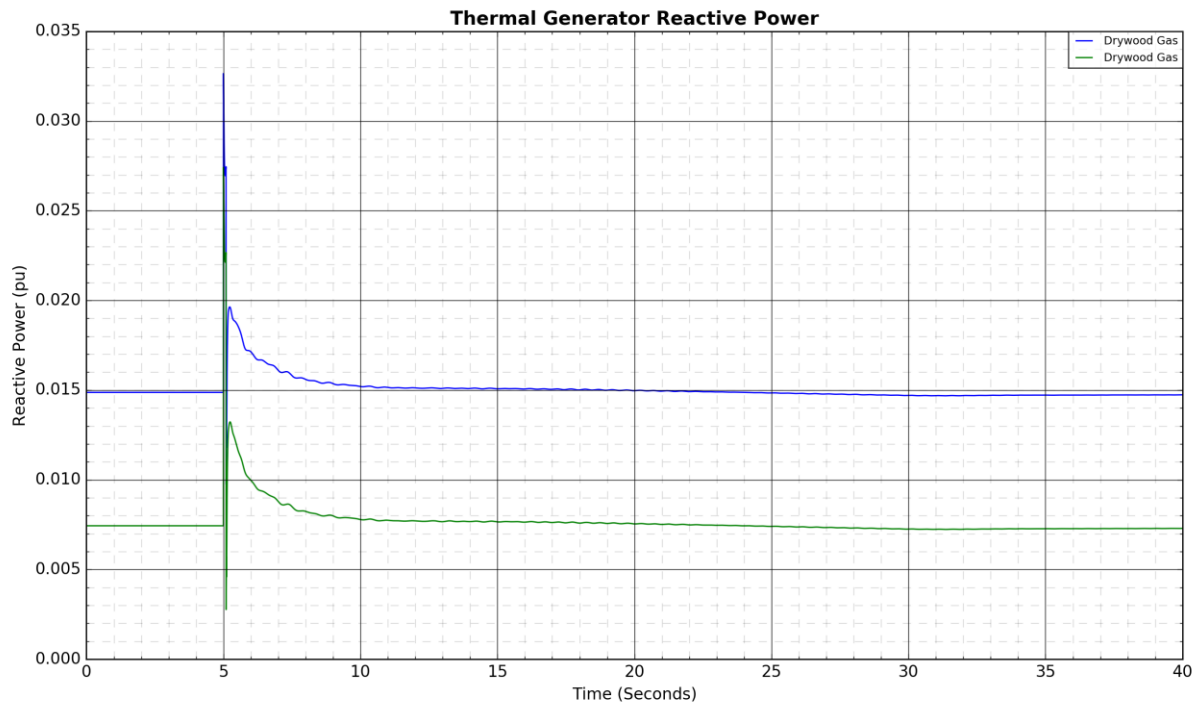
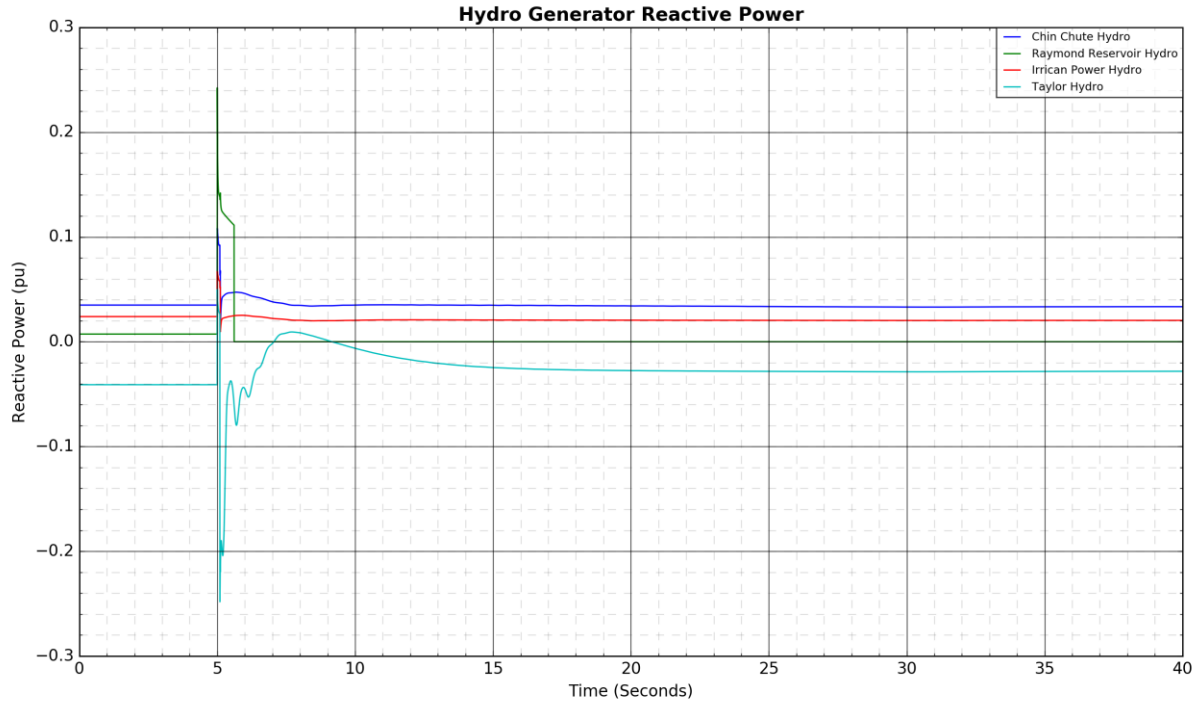


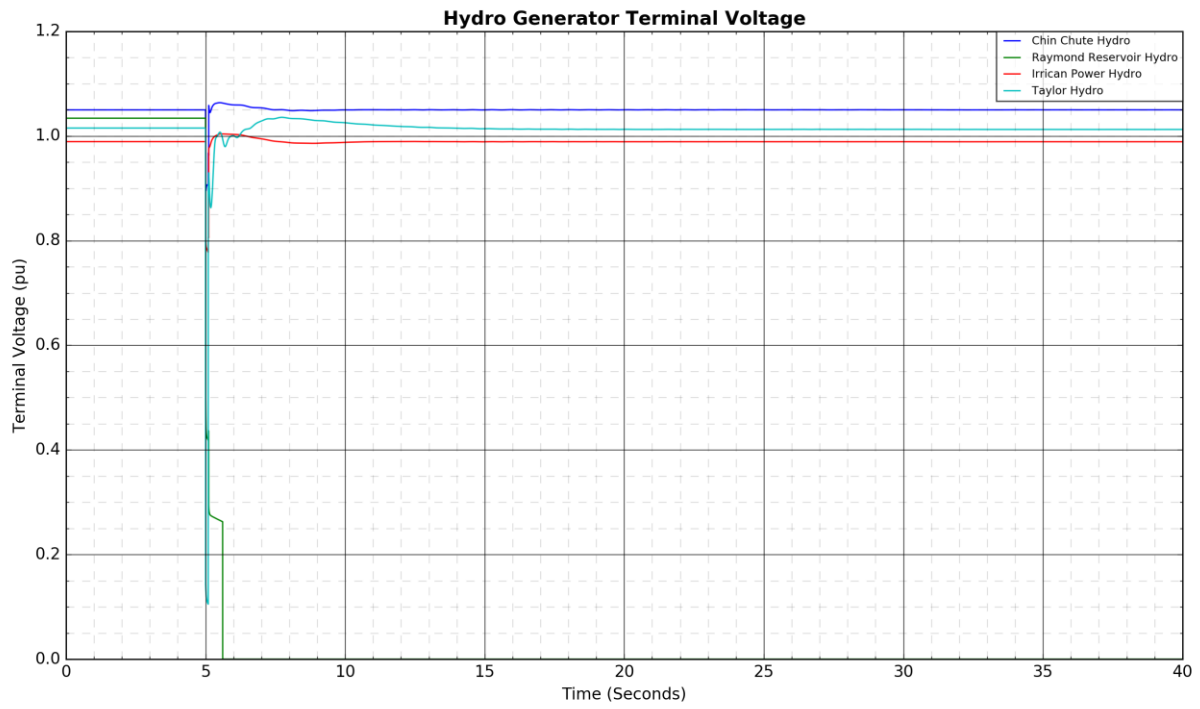
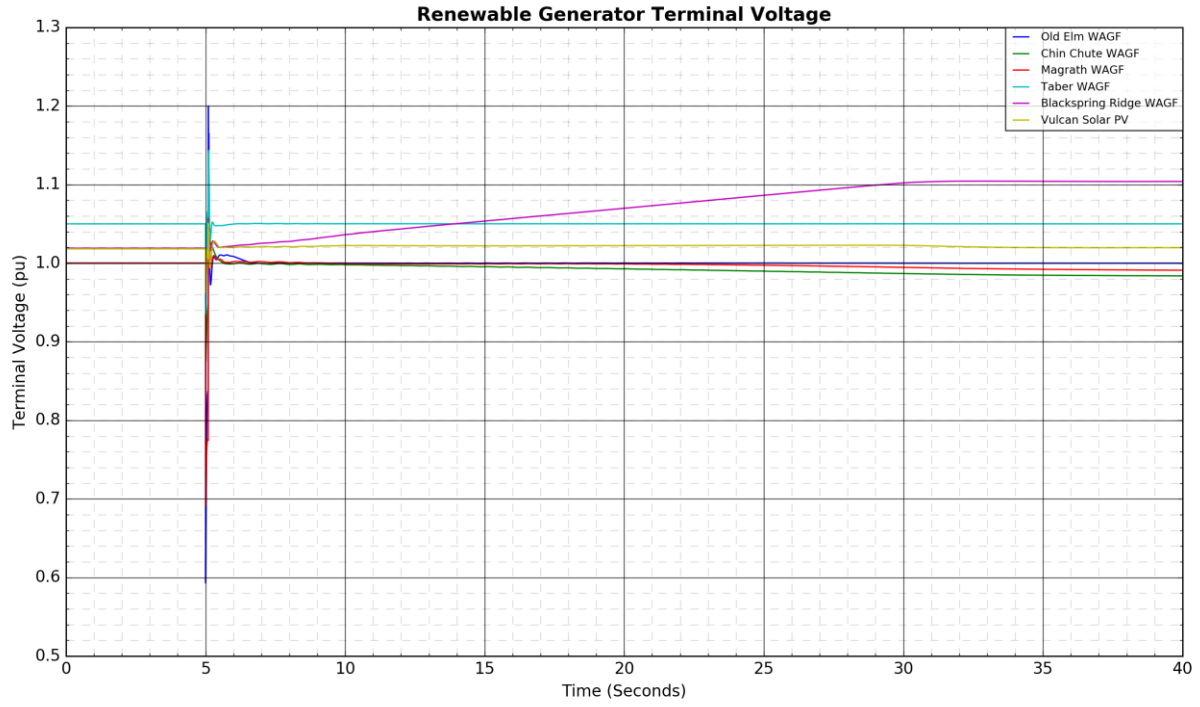


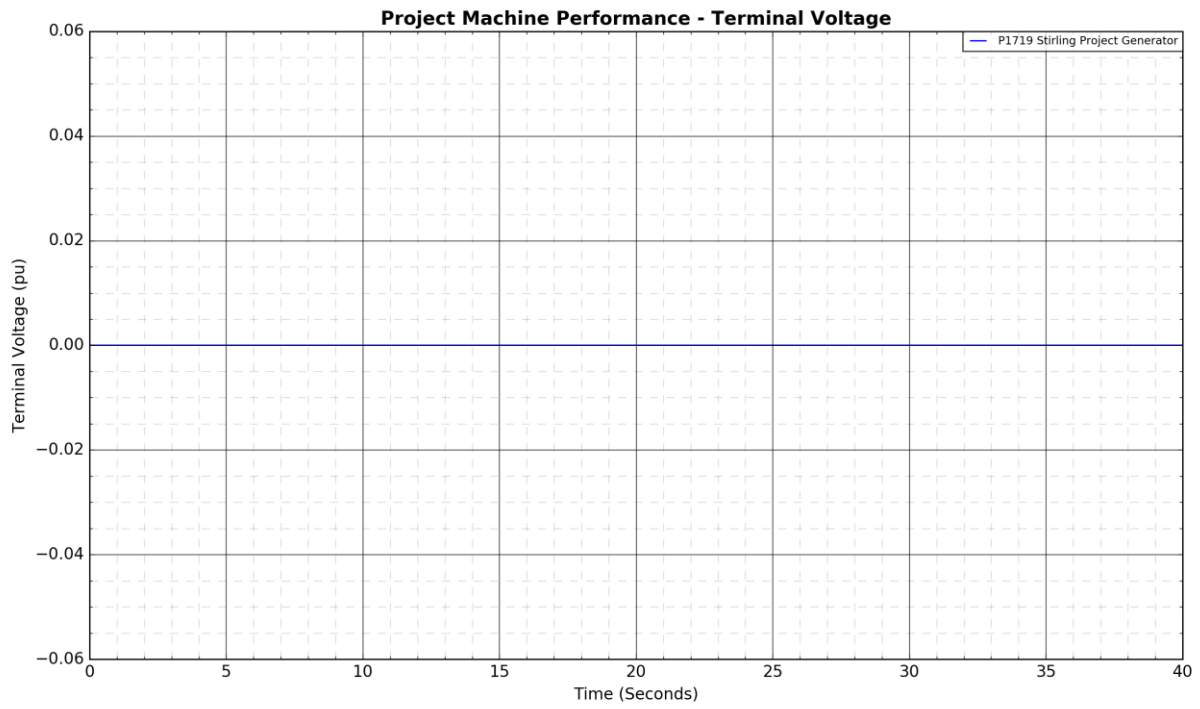
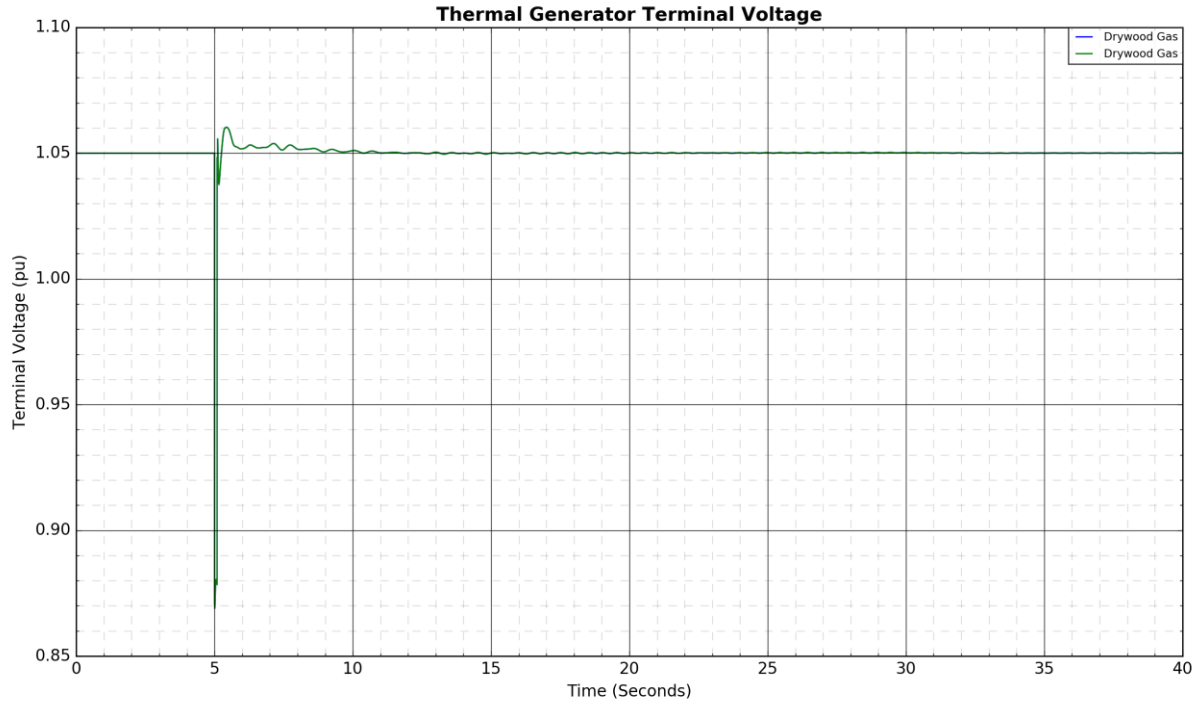
Engineering Connection Assessment Results: Stirling Wind Project Connection











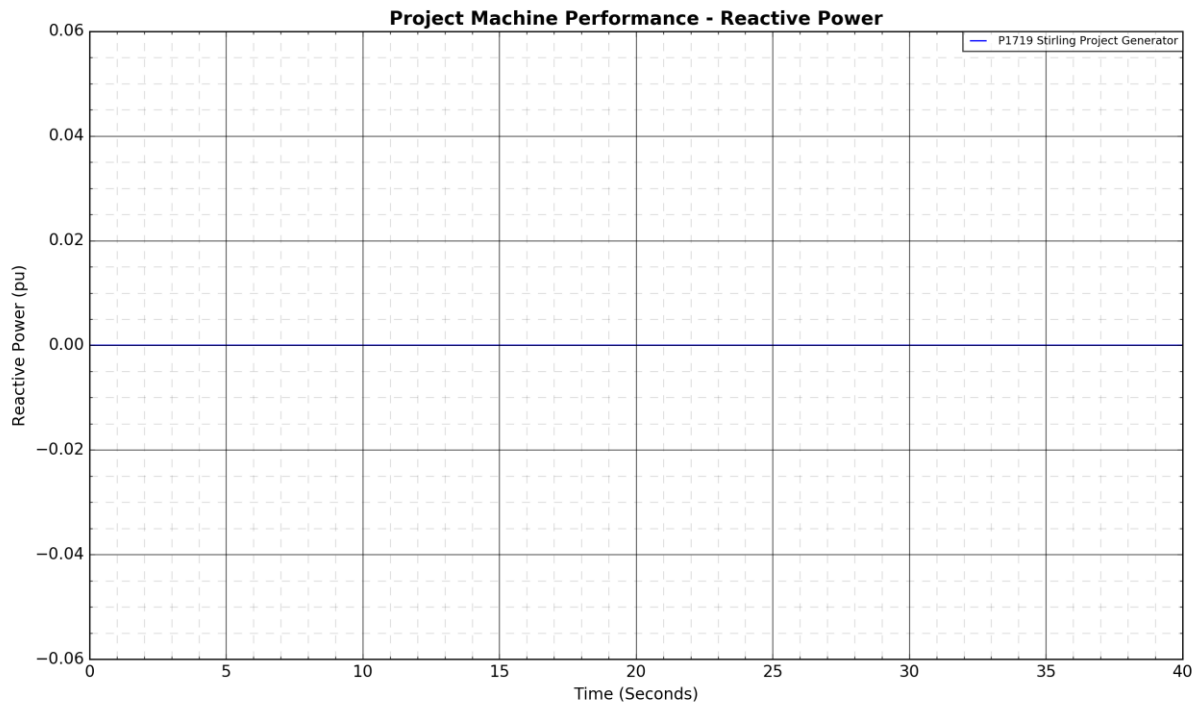
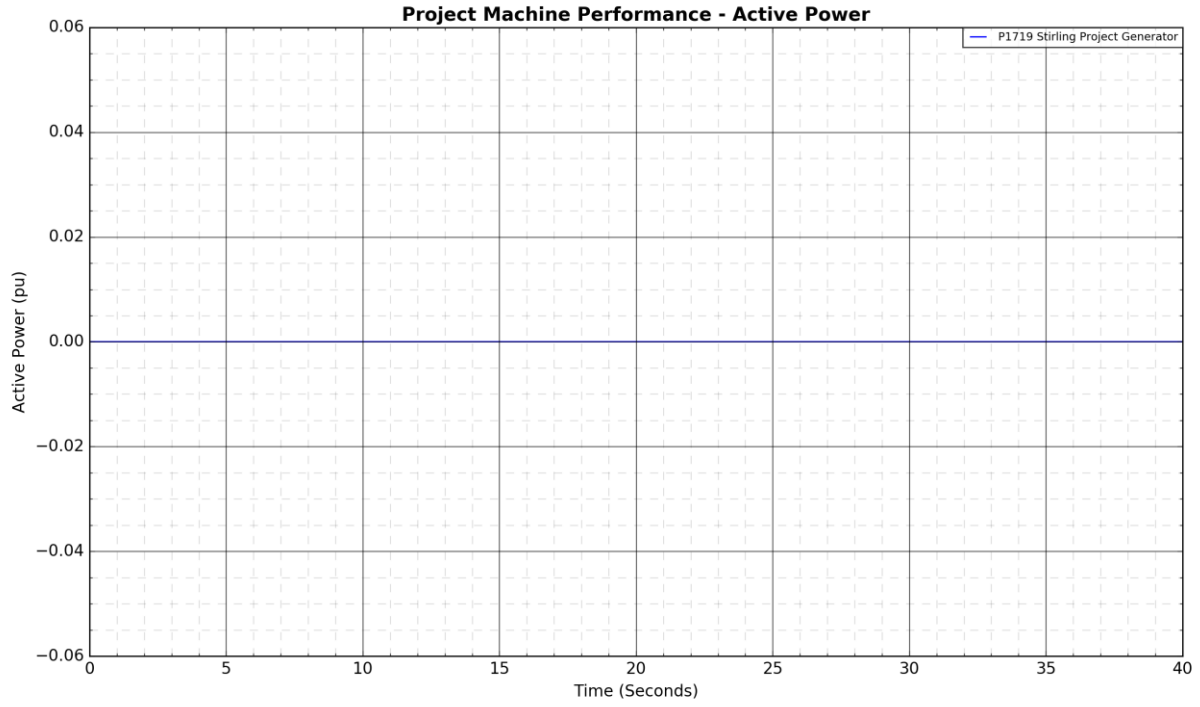
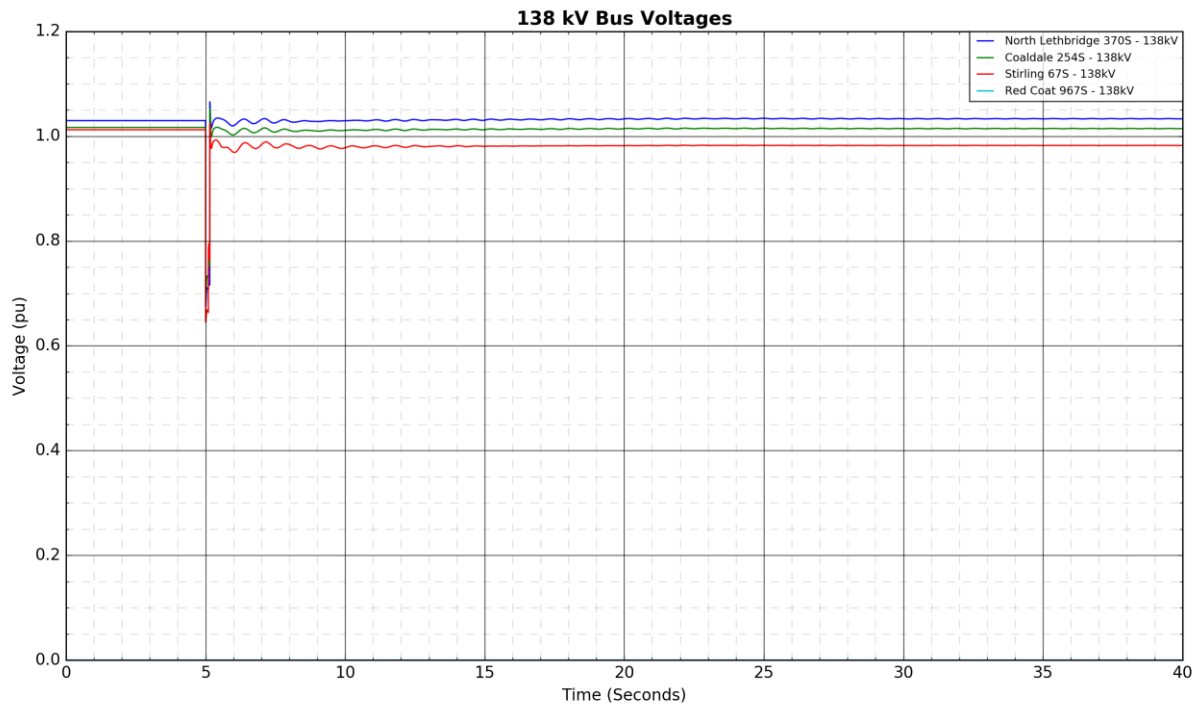
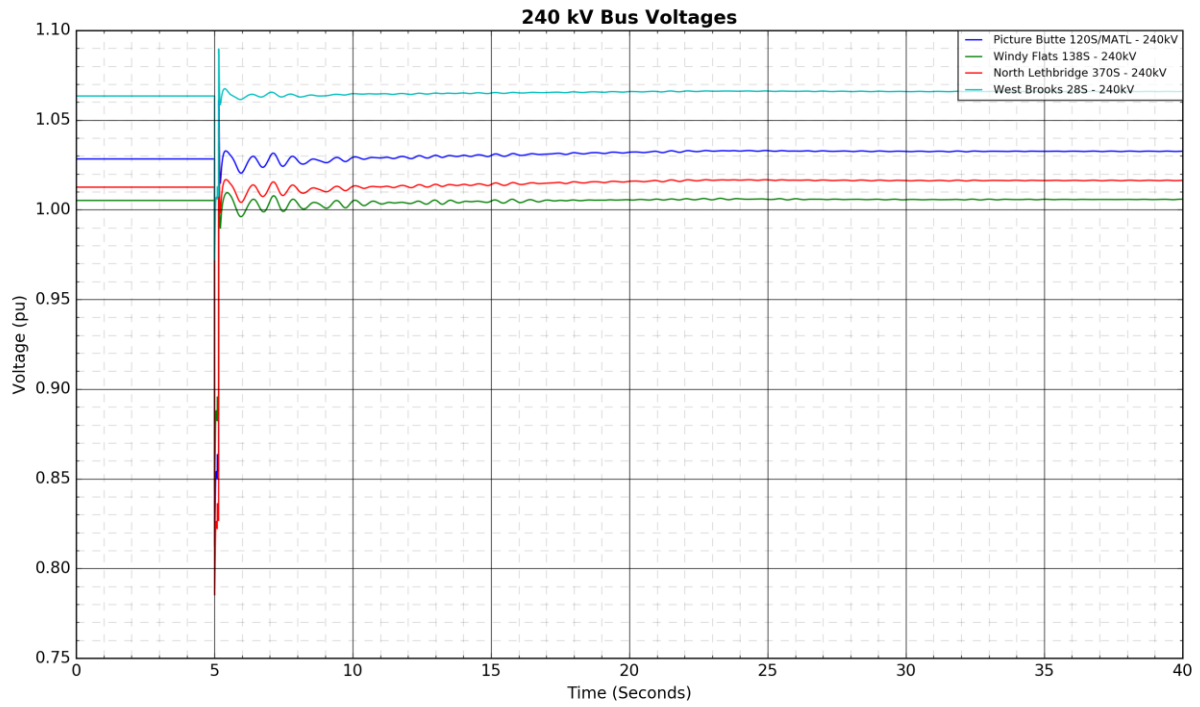
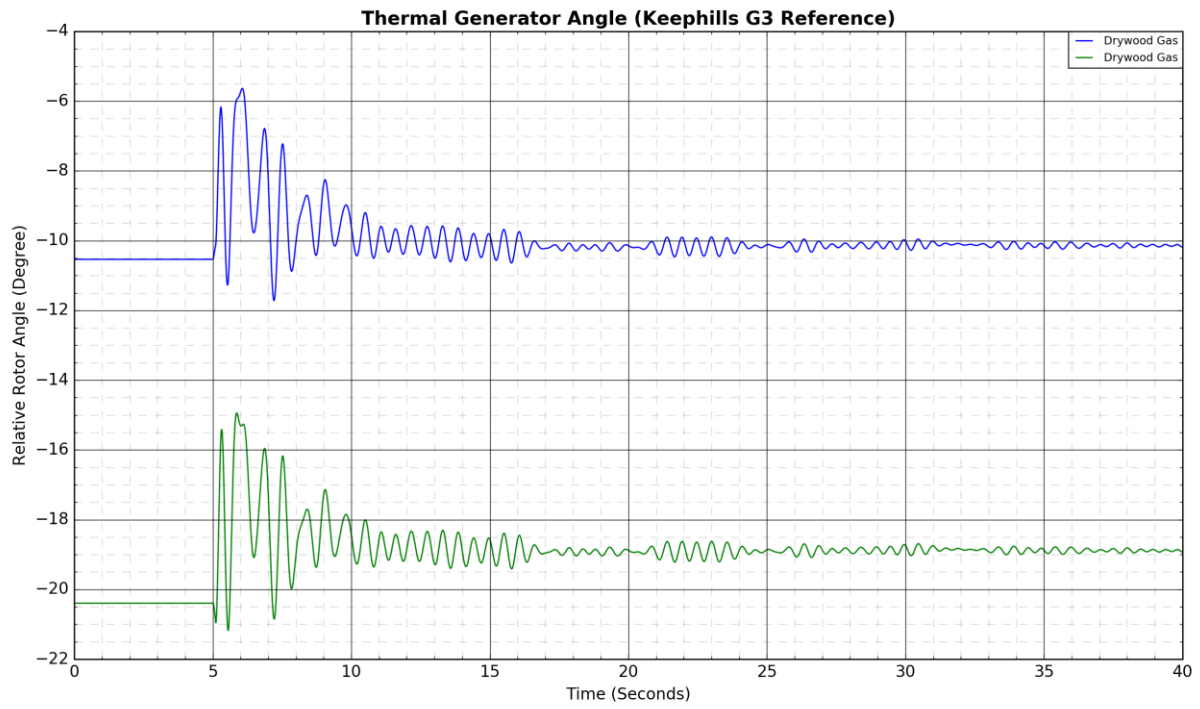
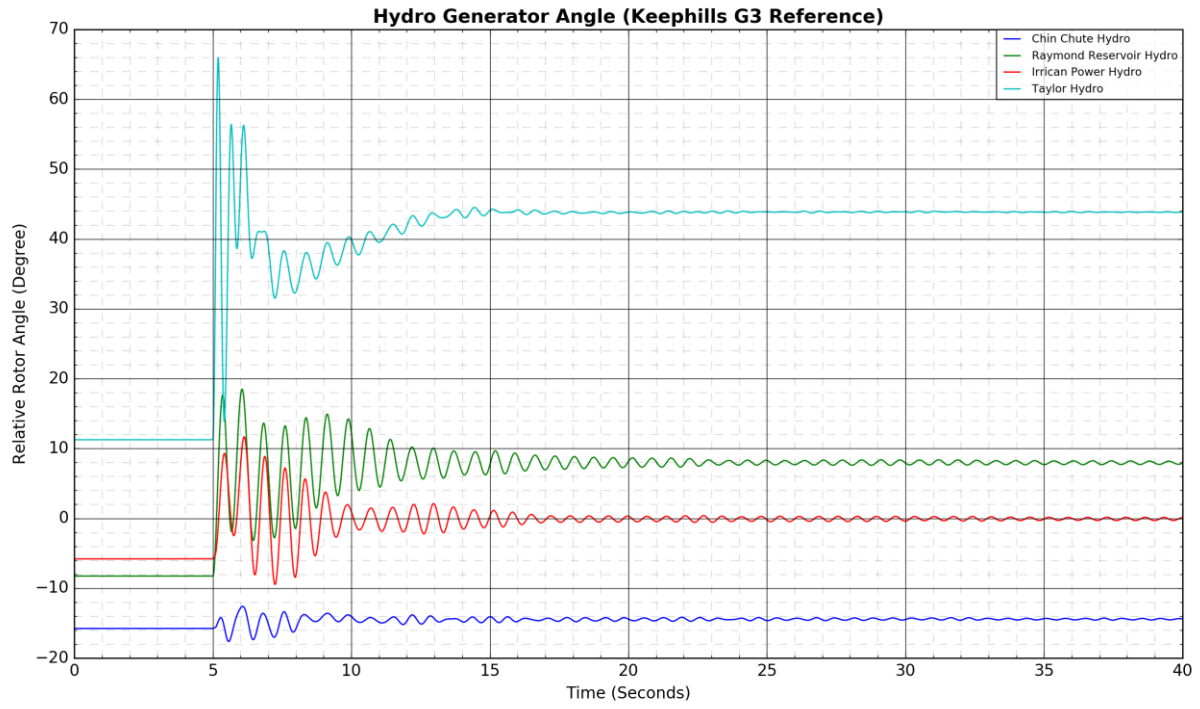
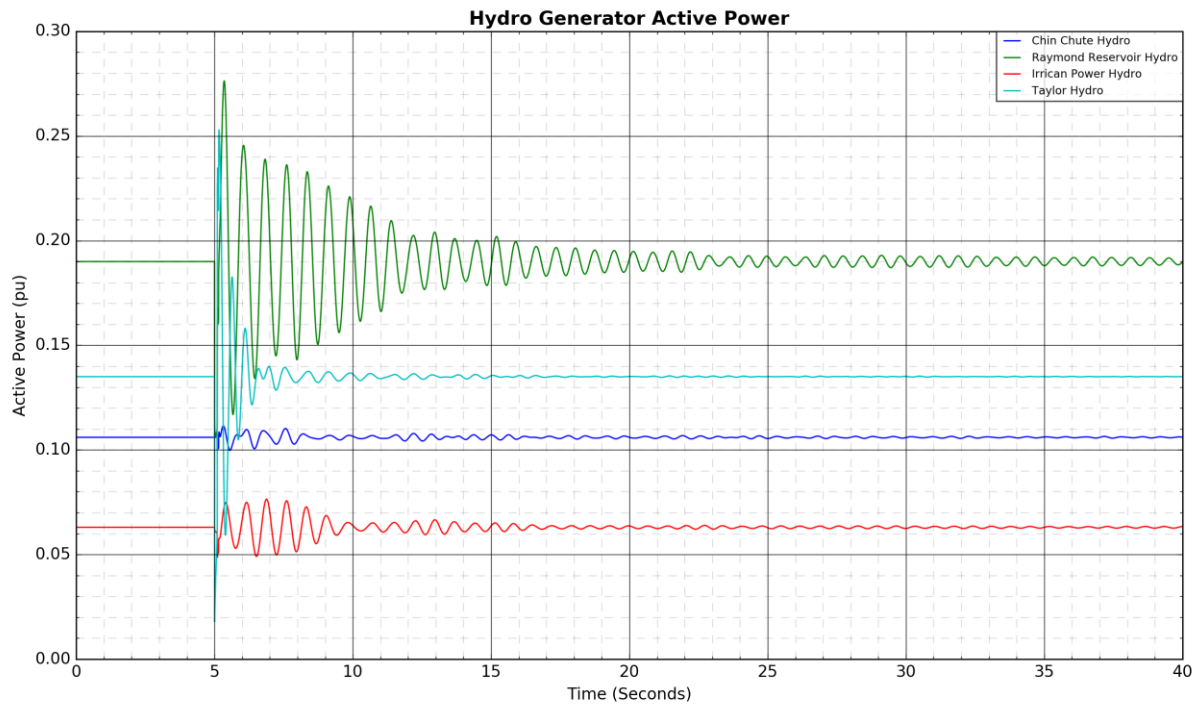
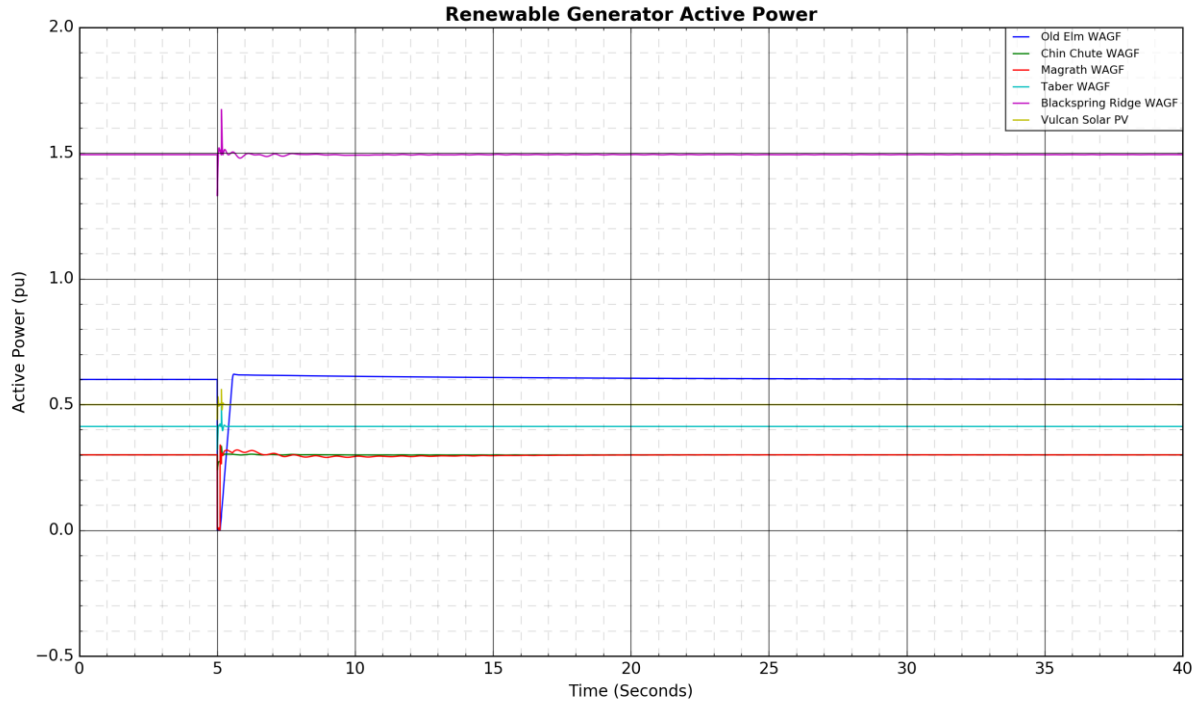
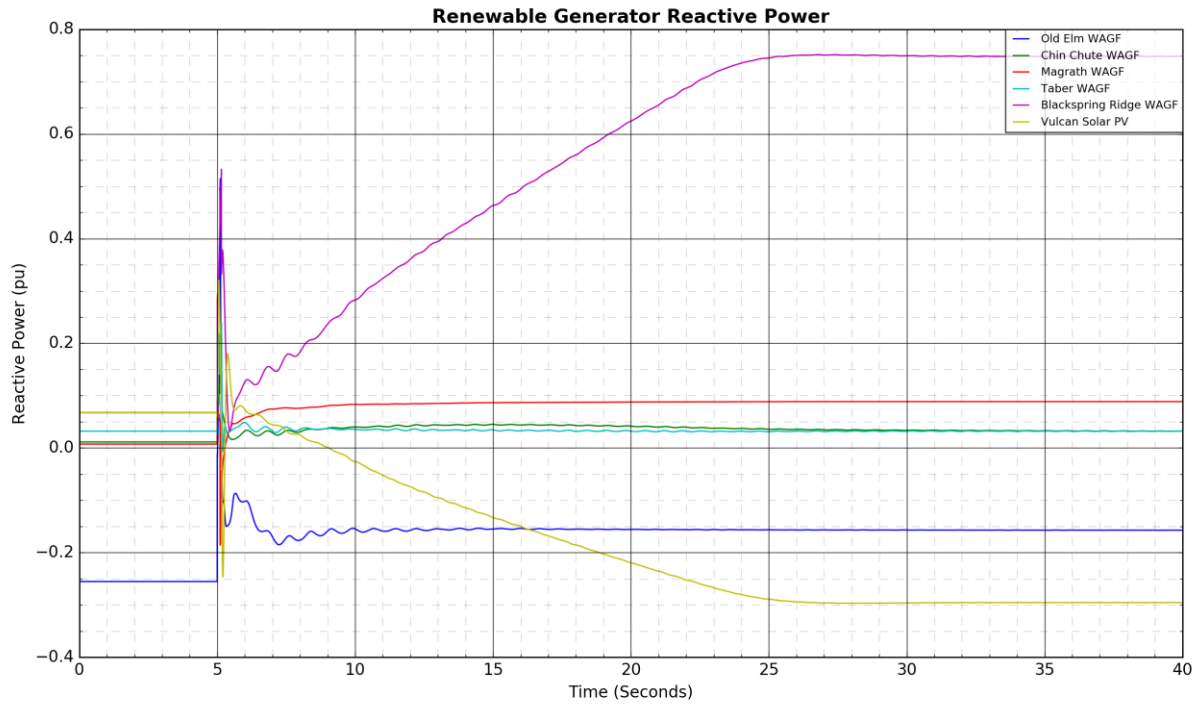
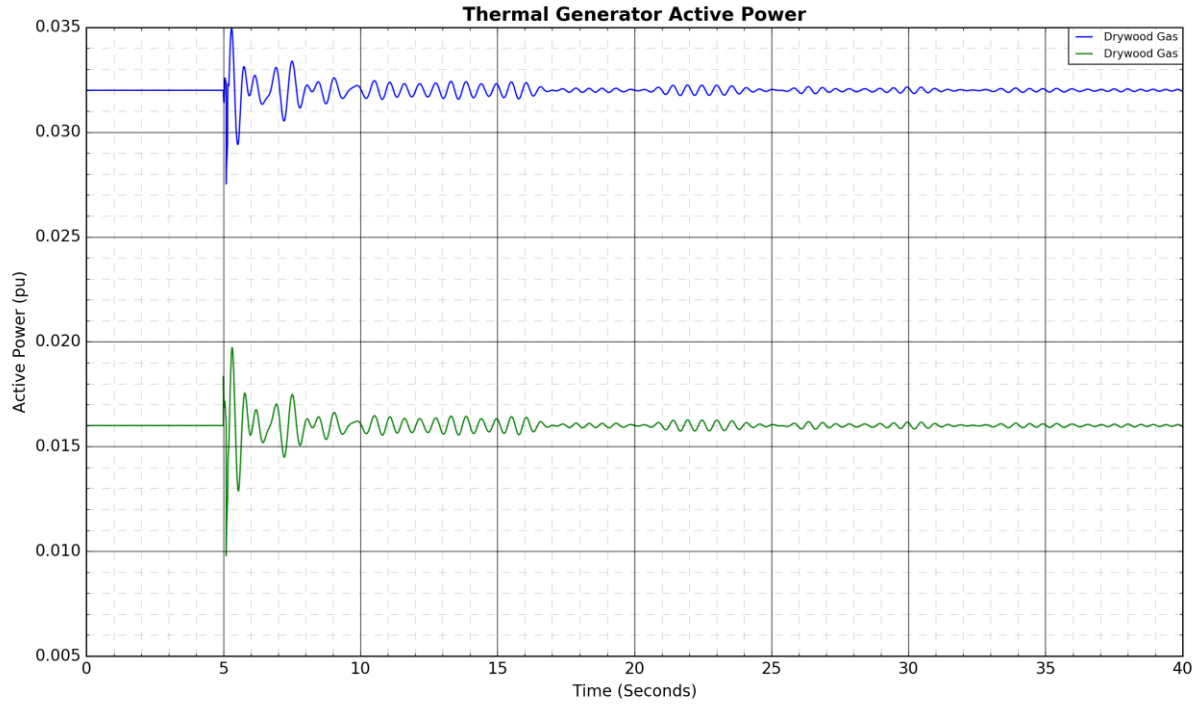


Figure A4-19: 863L Magrath 225S to Riverbend 618S: Fault Near Magrath 225S

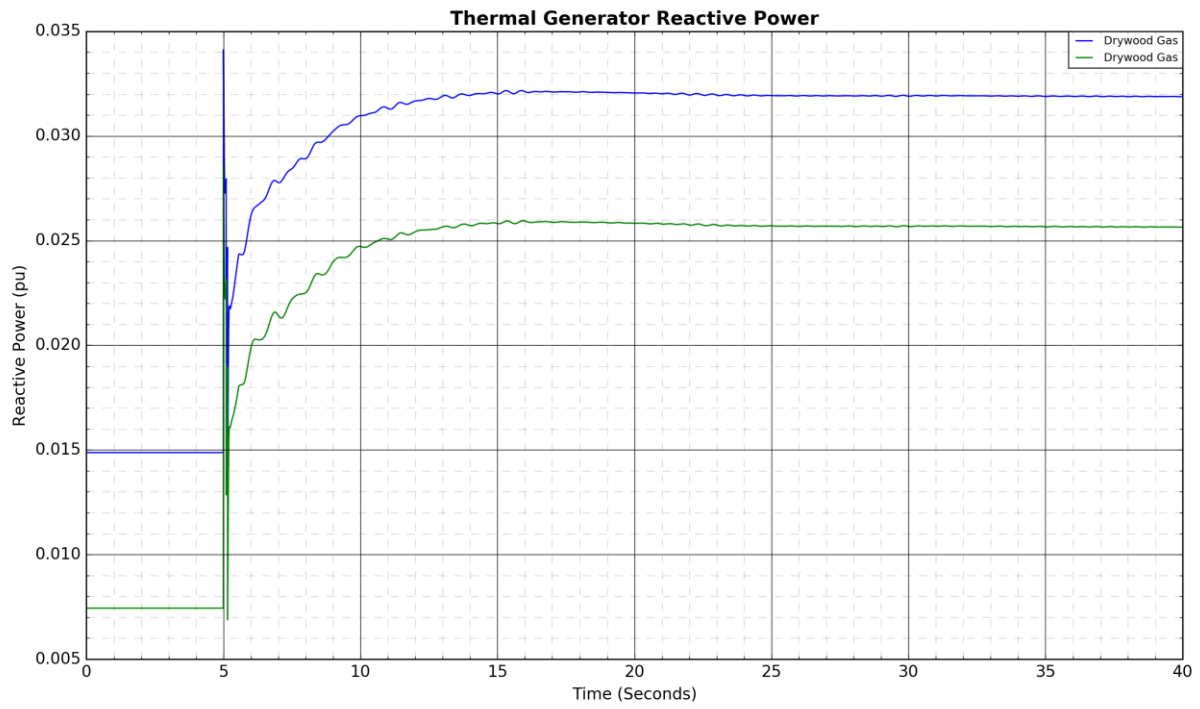
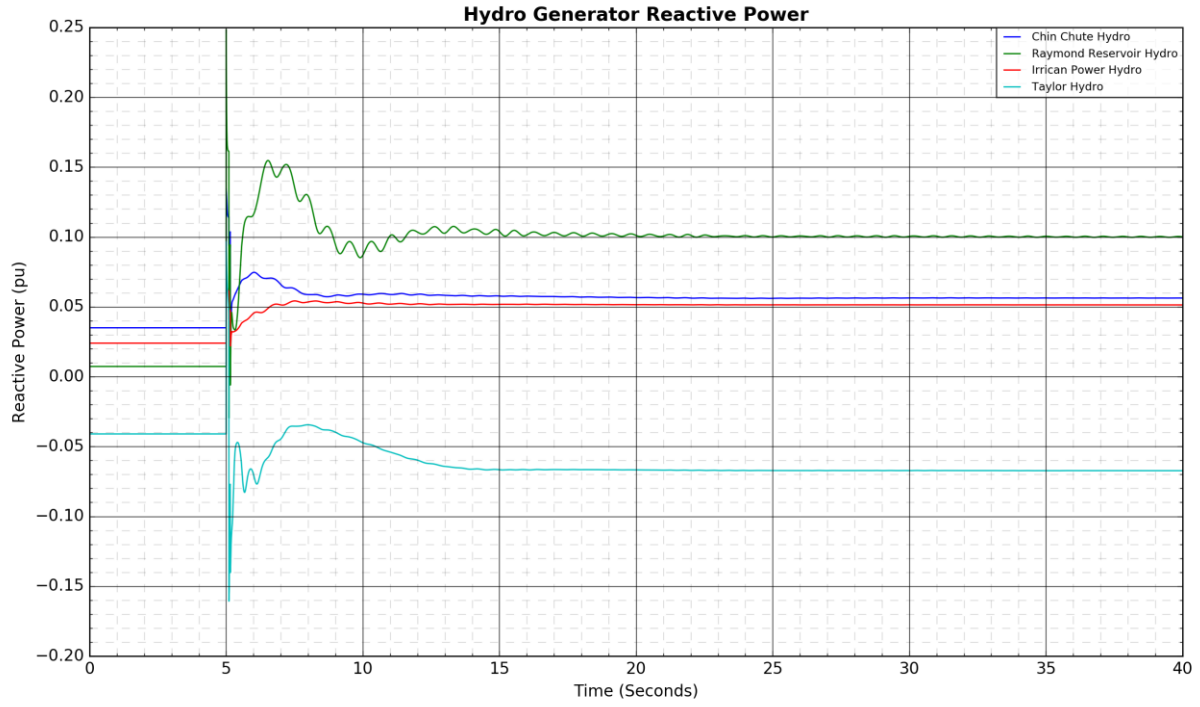


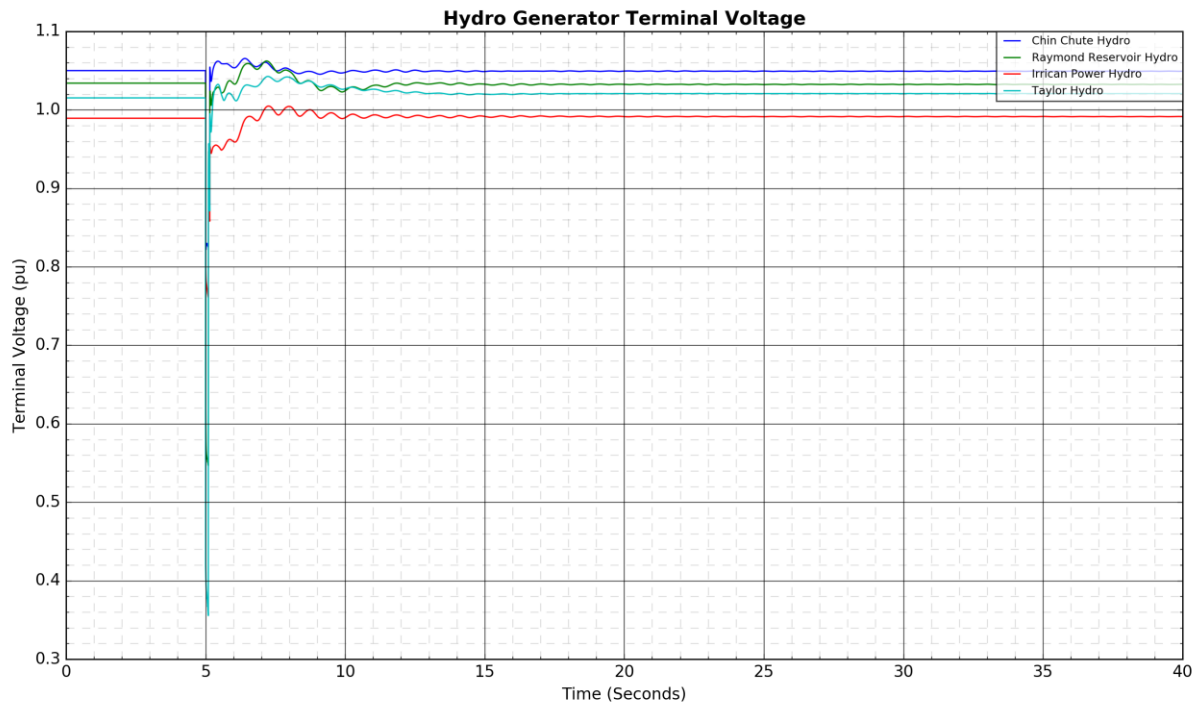
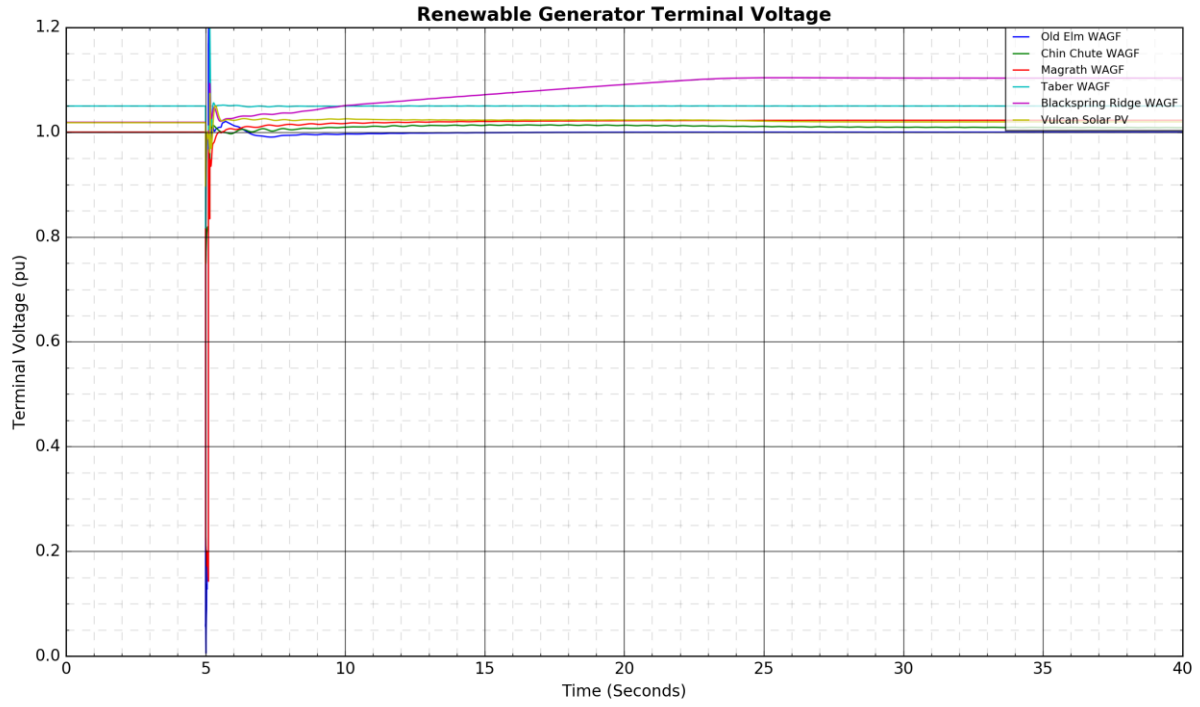


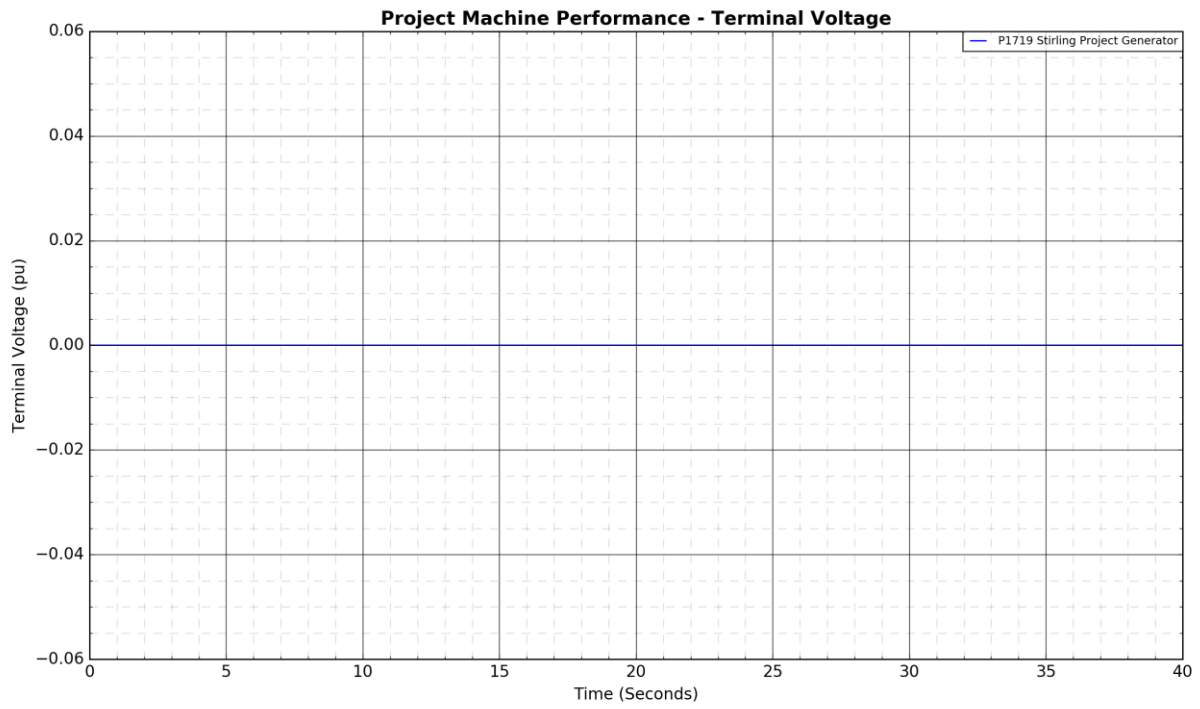
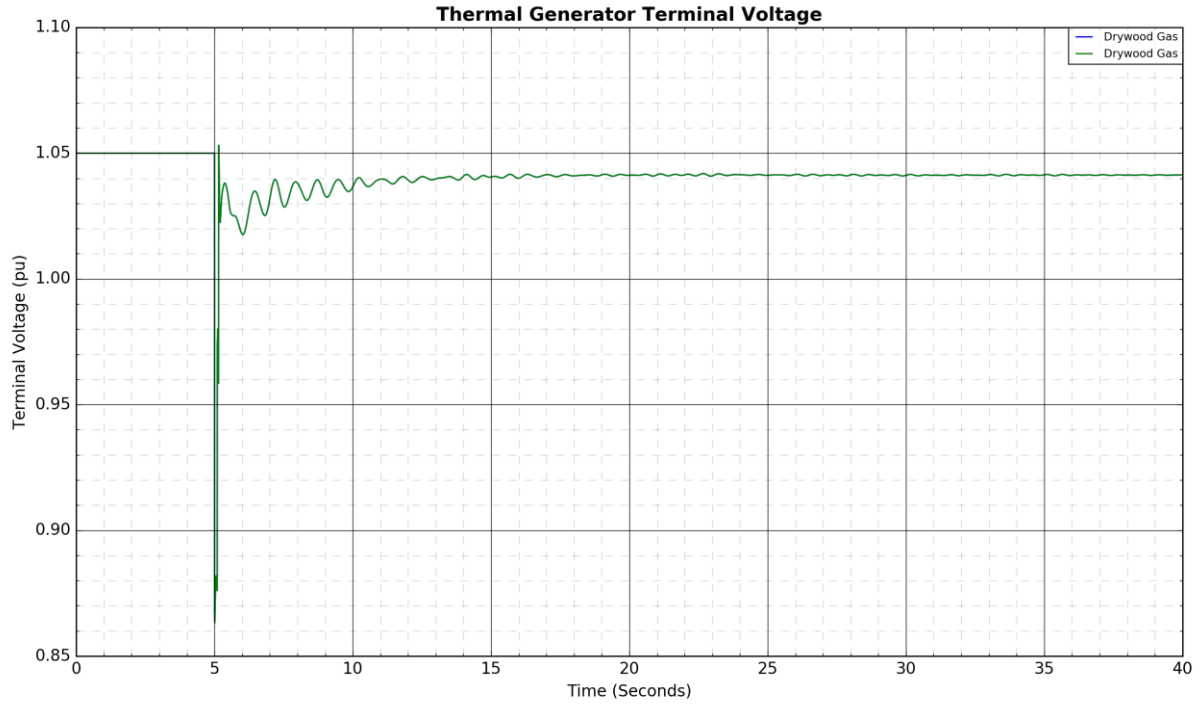




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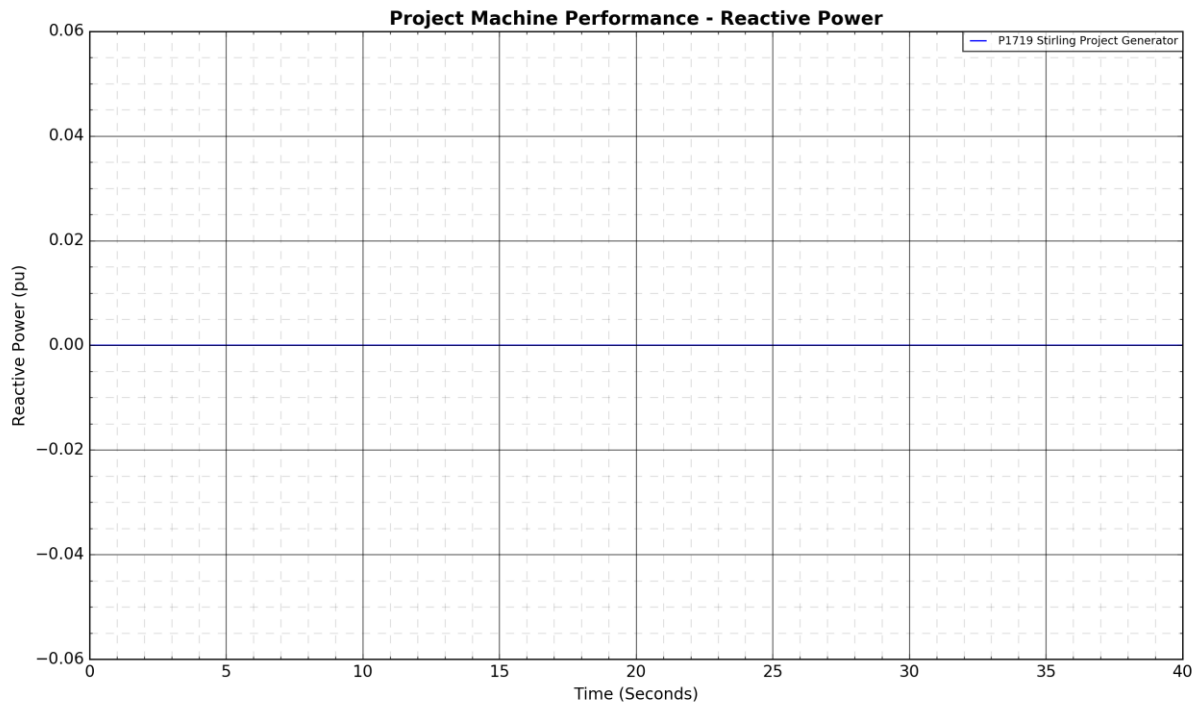
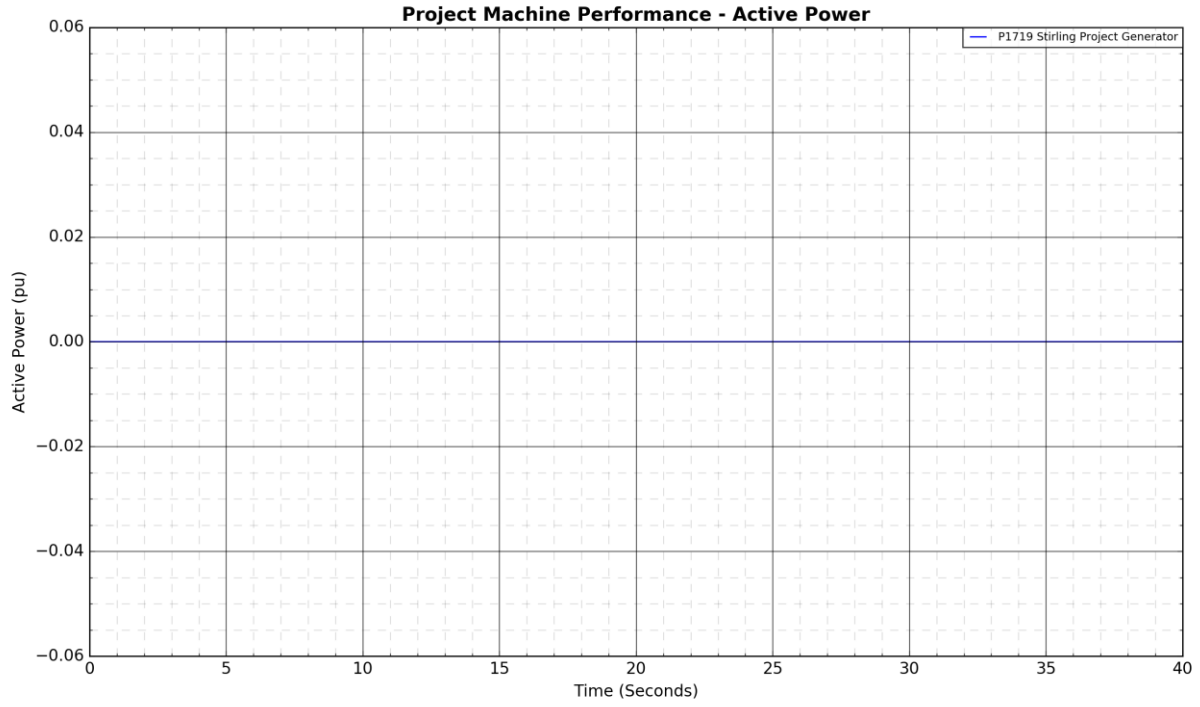
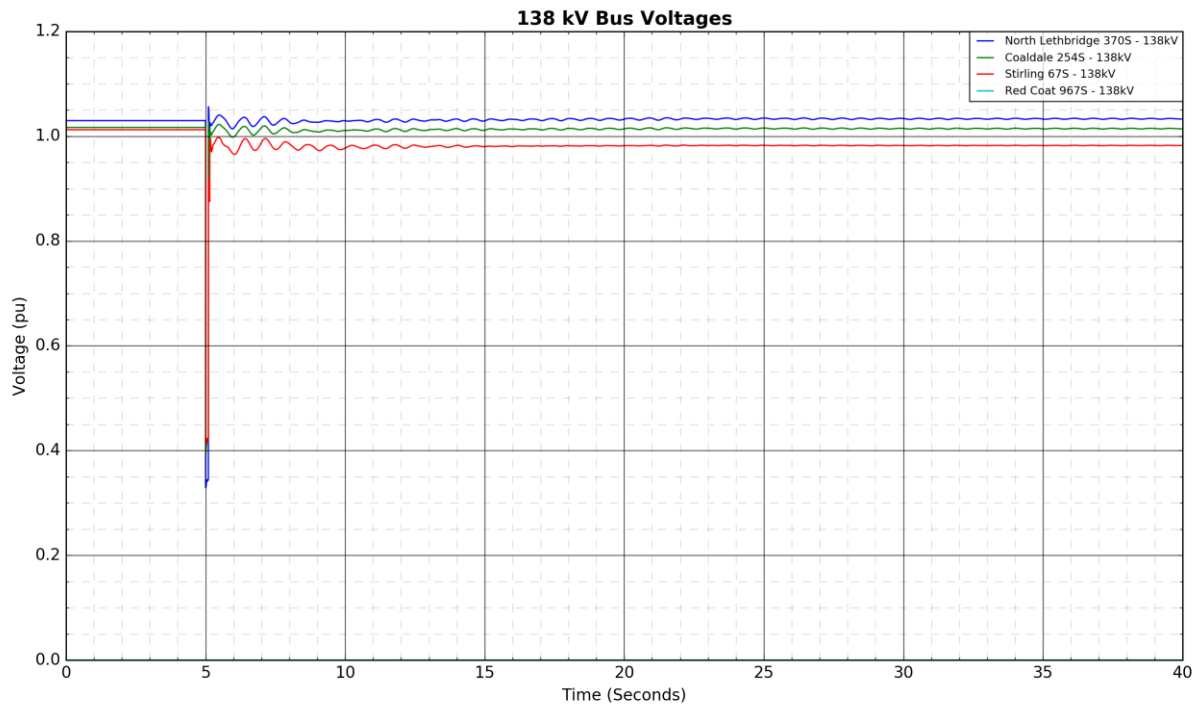
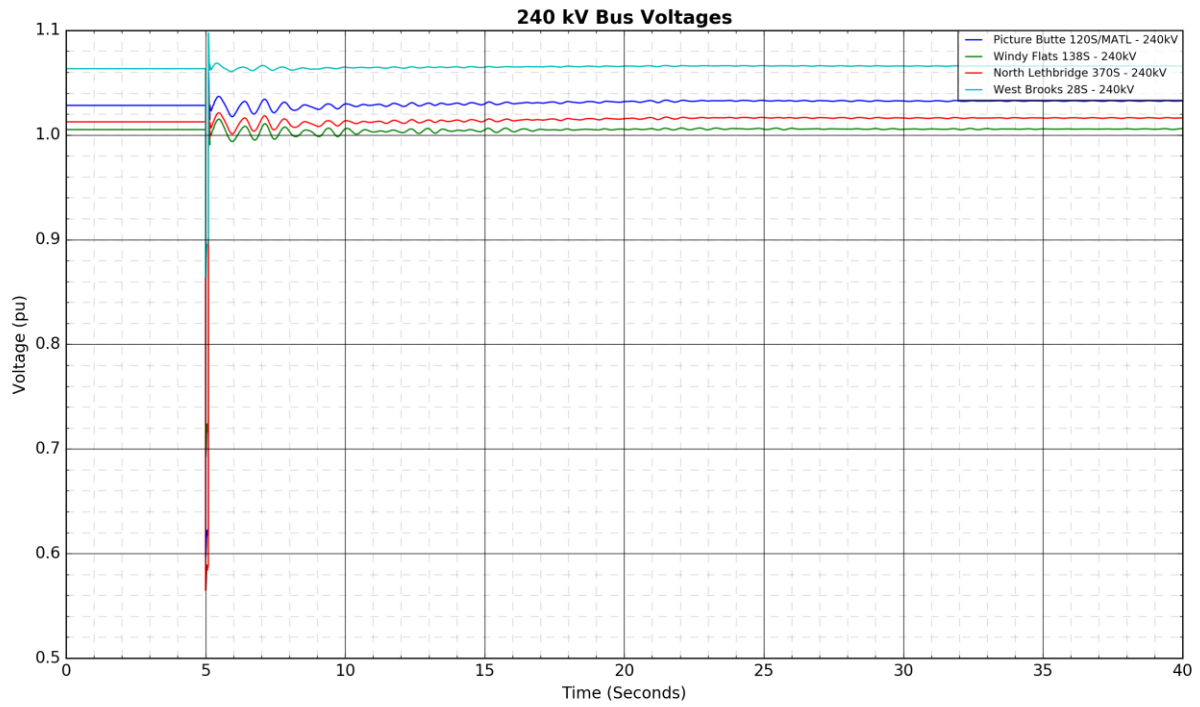
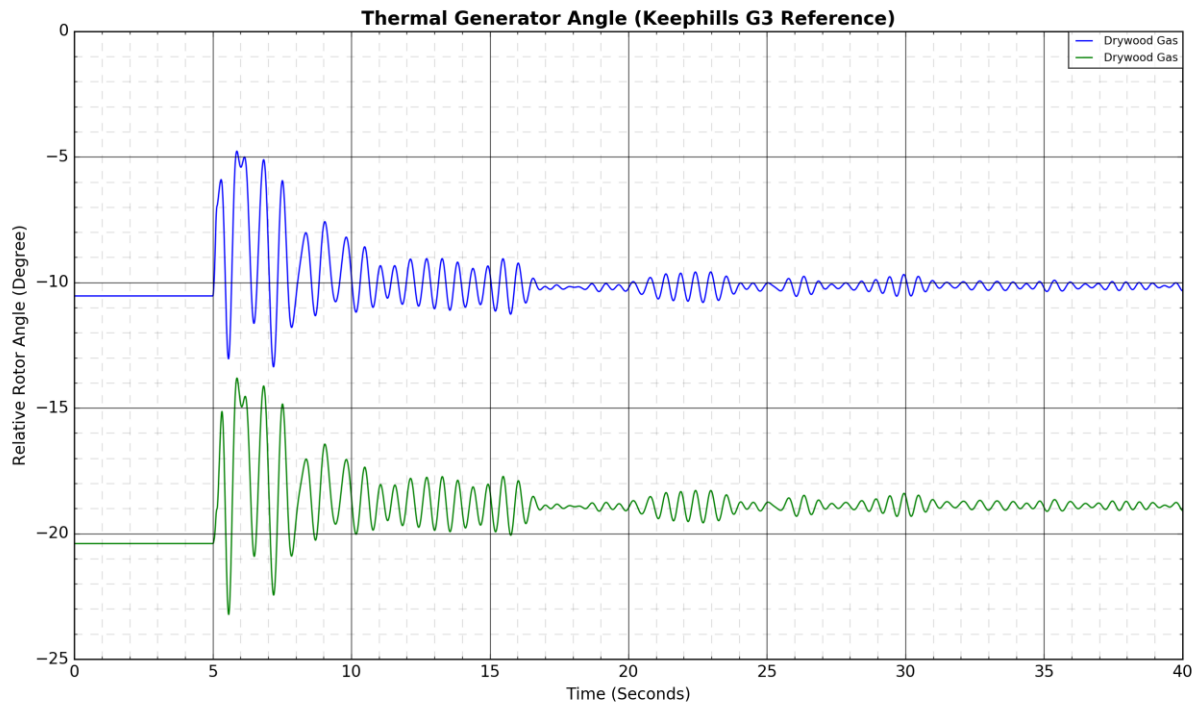
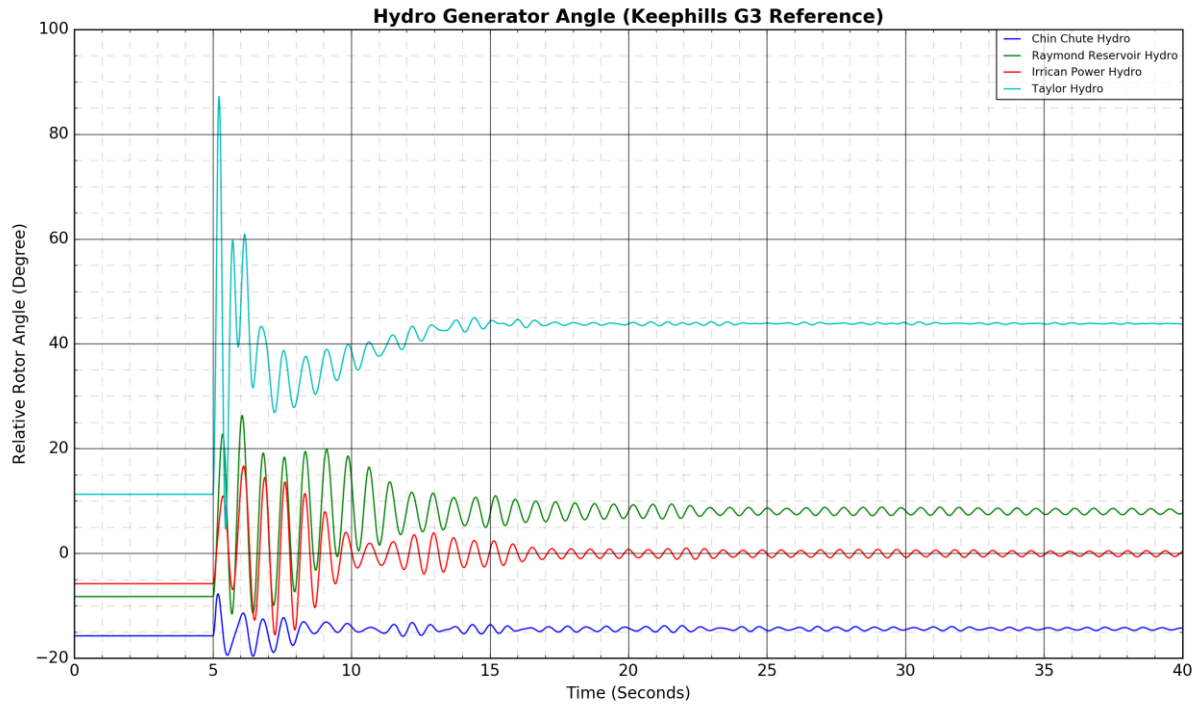
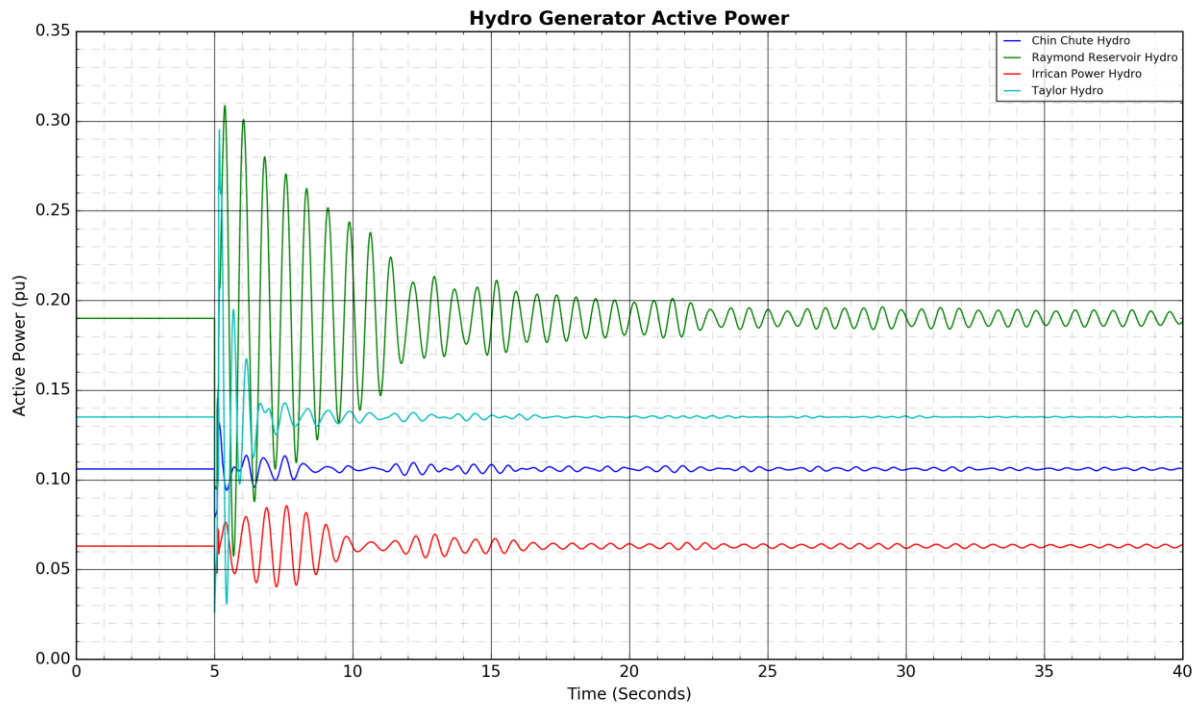
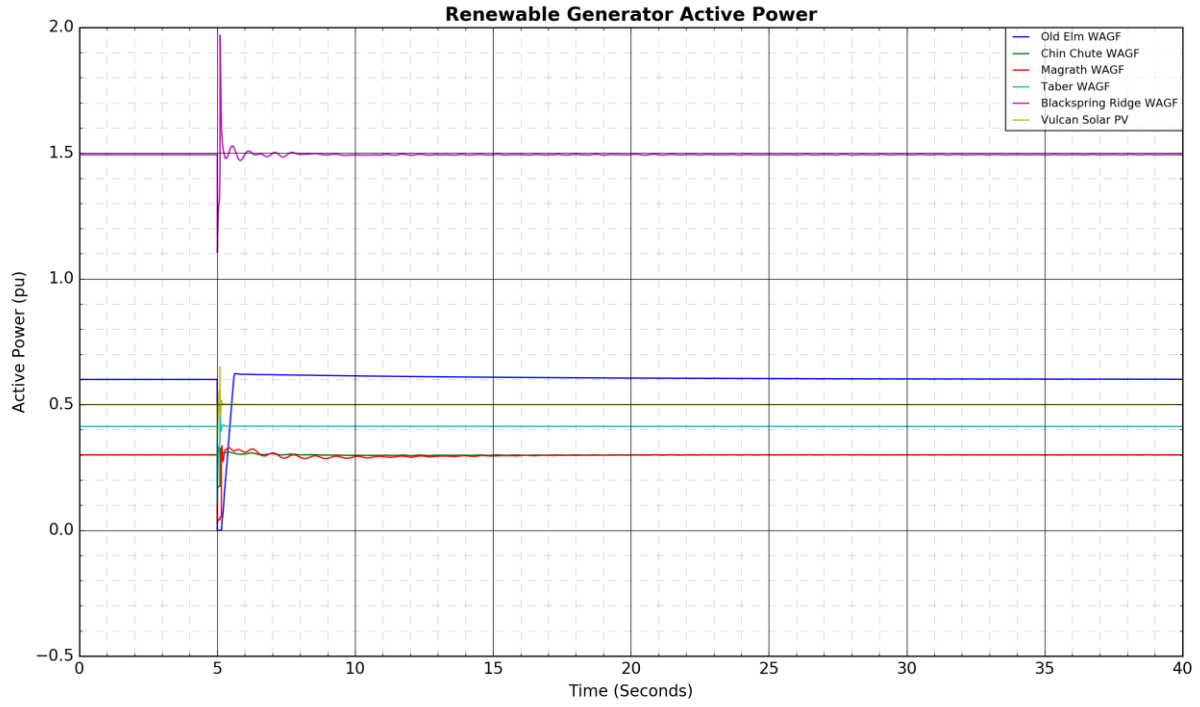


Figure A4-20: 863L Magrath 225S to Riverbend 618S: Fault Near Riverbend 618S

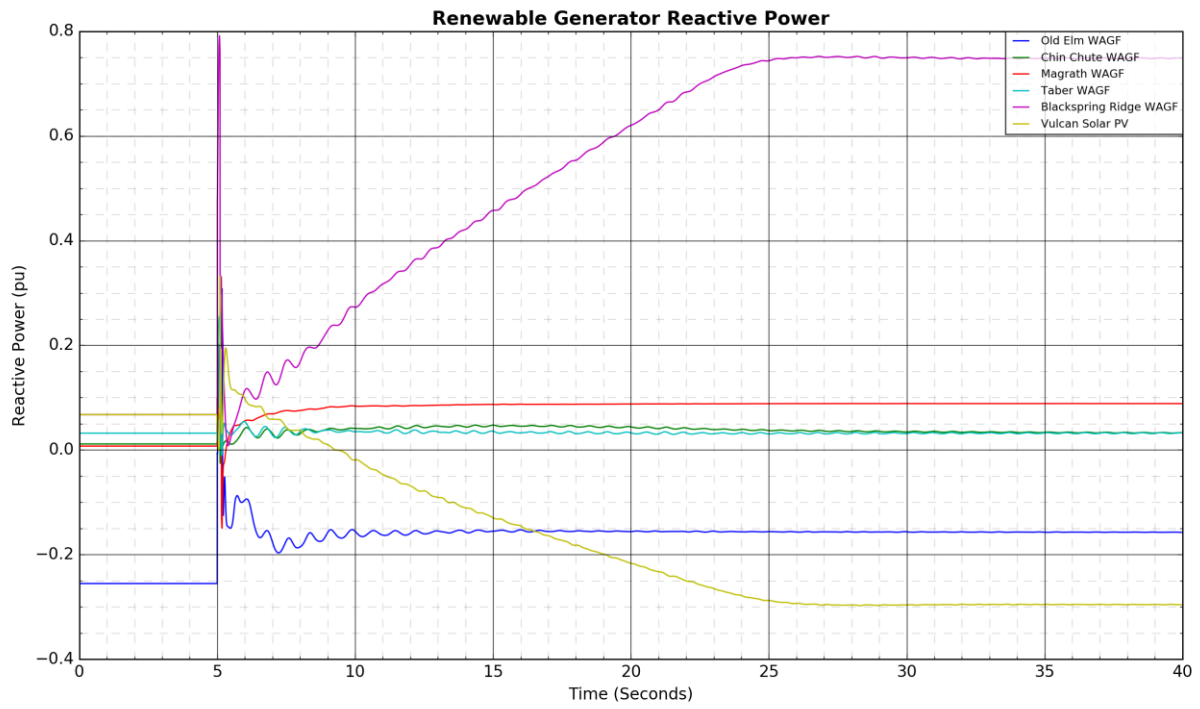
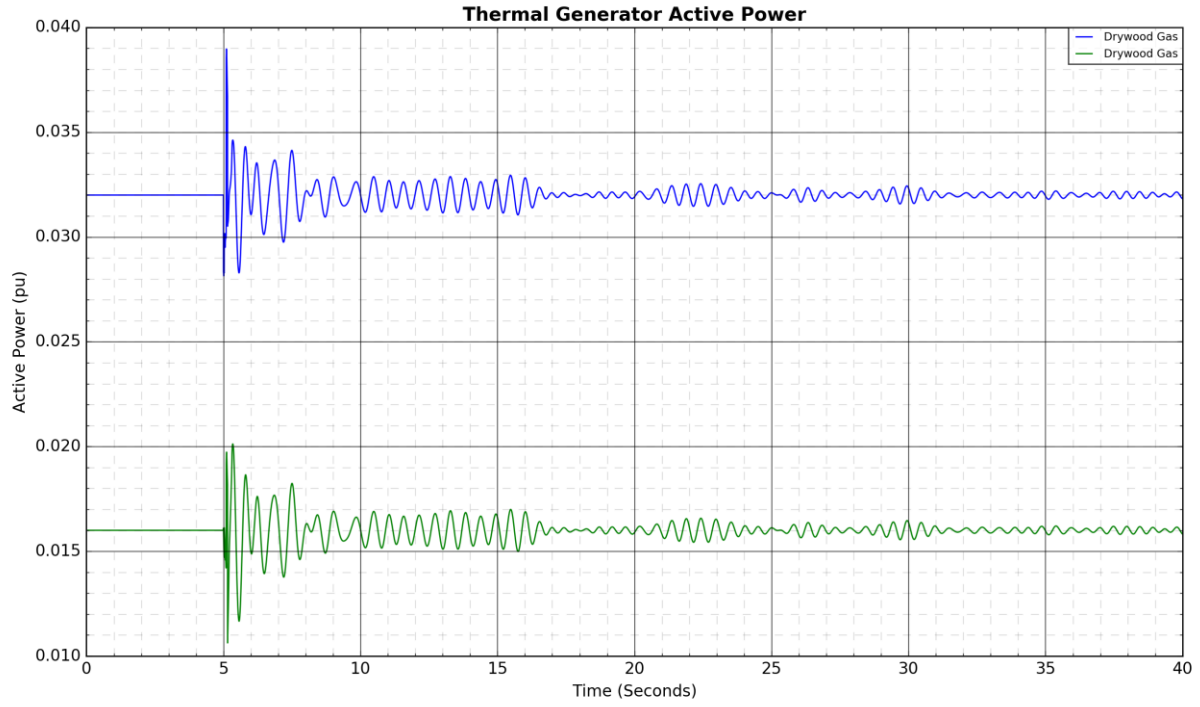




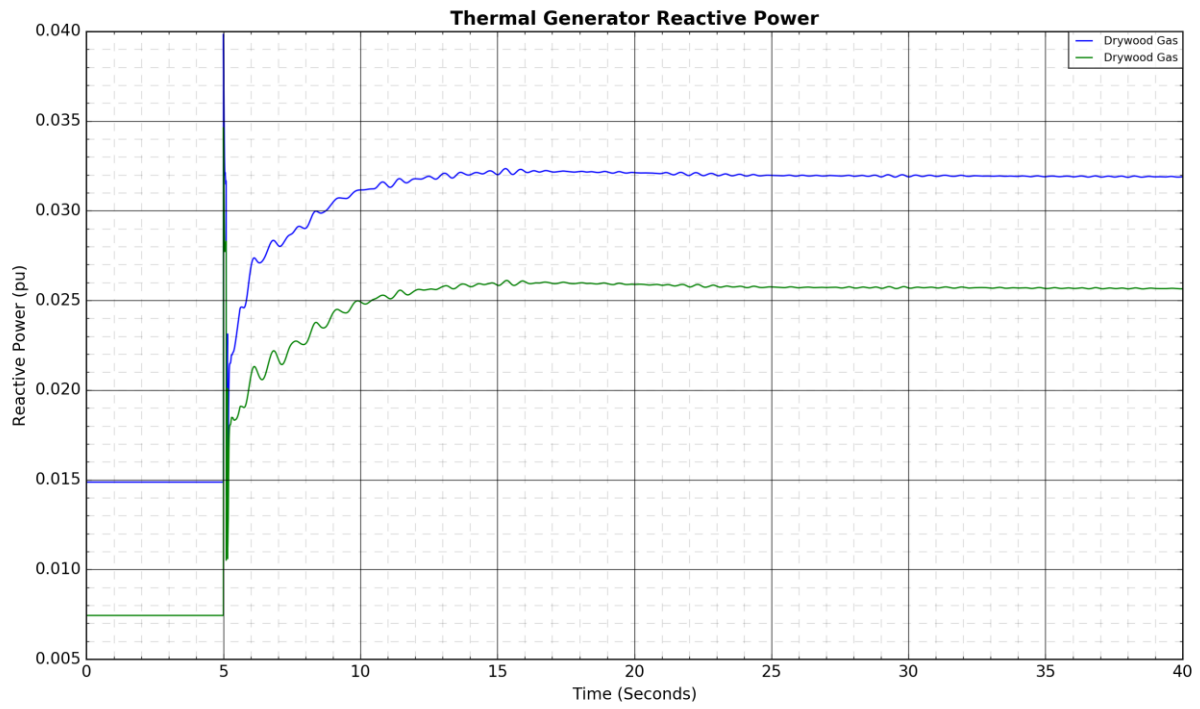
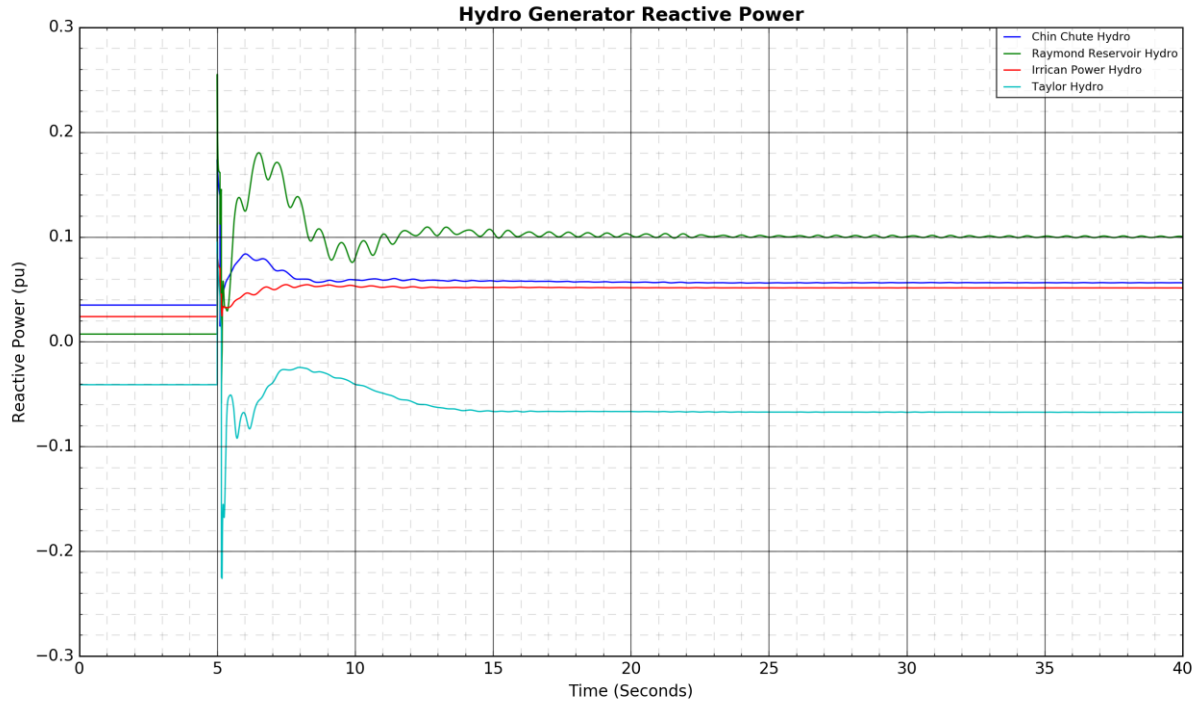
Engineering Connection Assessment Results: Stirling Wind Project Connection

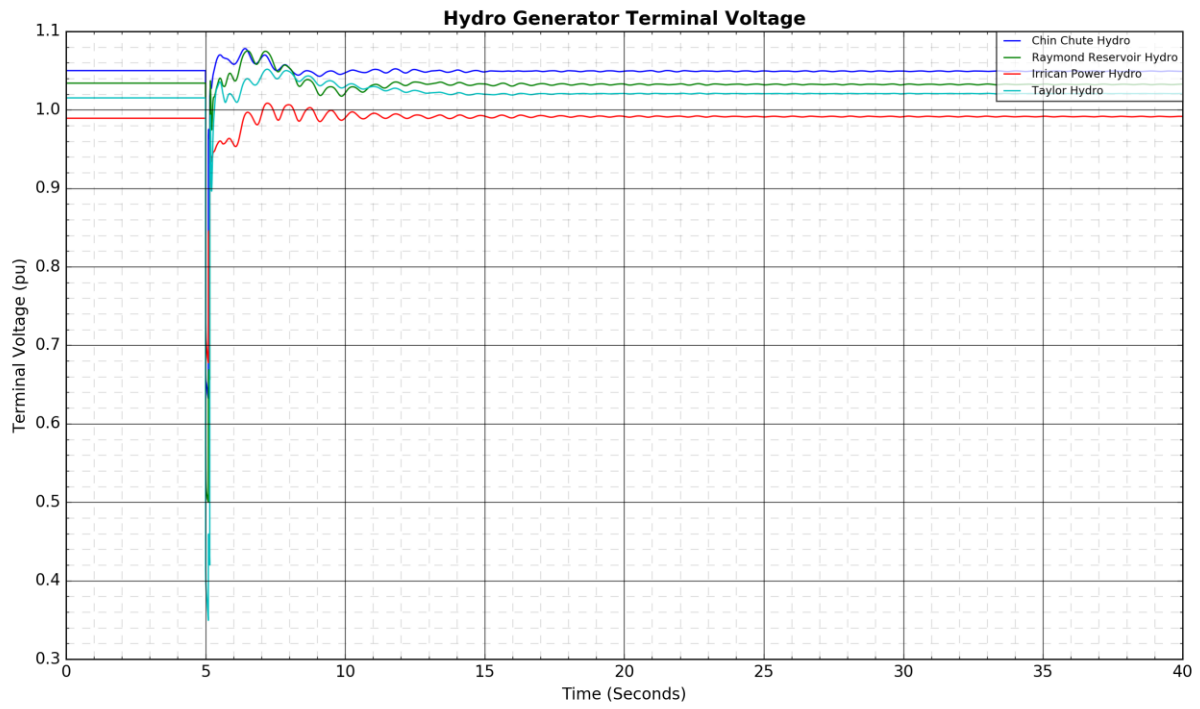
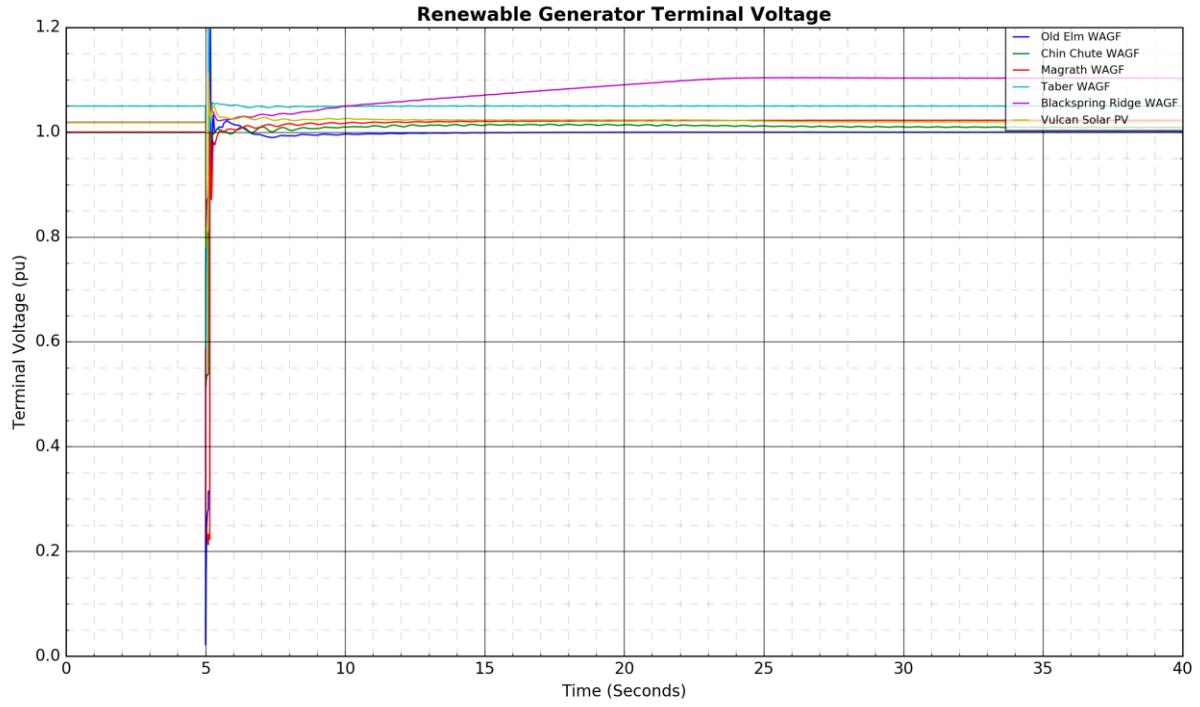


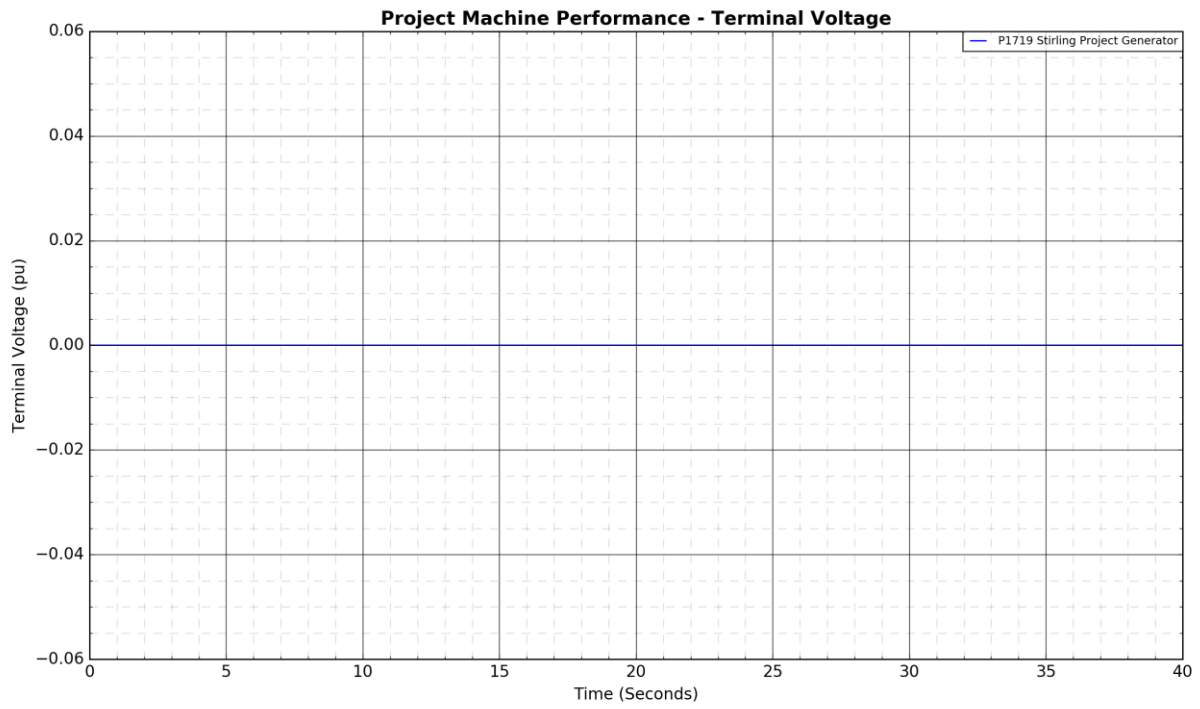
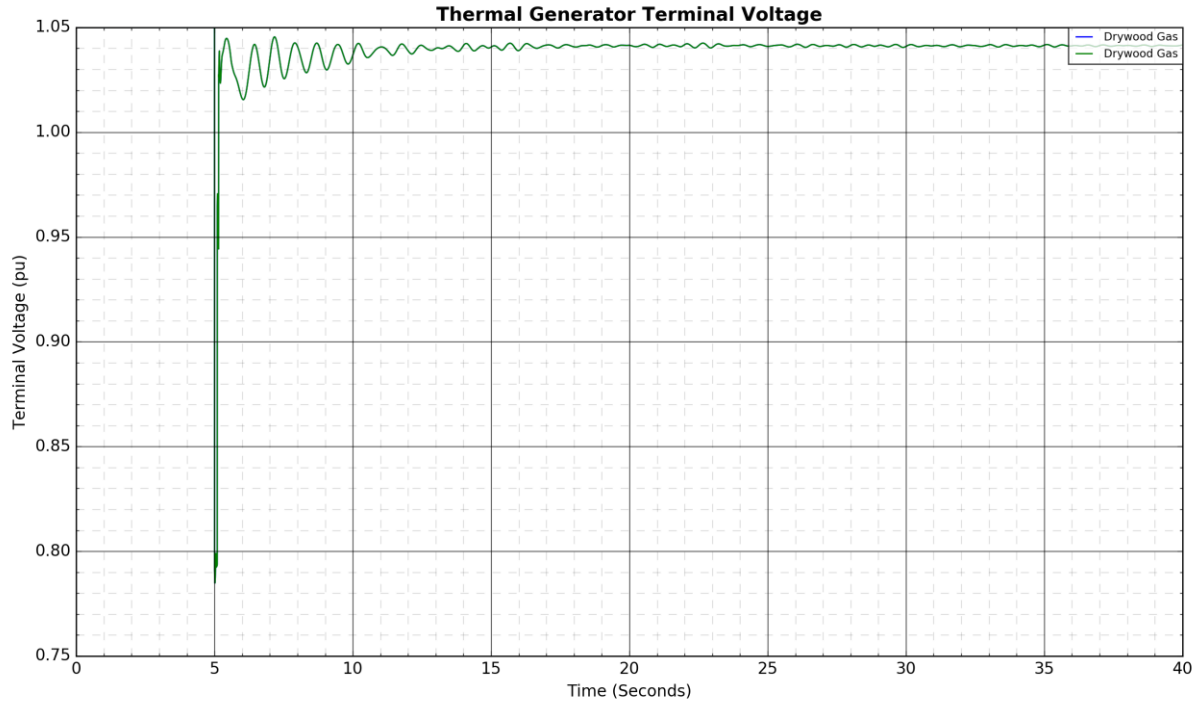
Engineering Connection Assessment Results: Stirling Wind Project Connection



Engineering Connection Assessment Results: Stirling Wind Project Connection







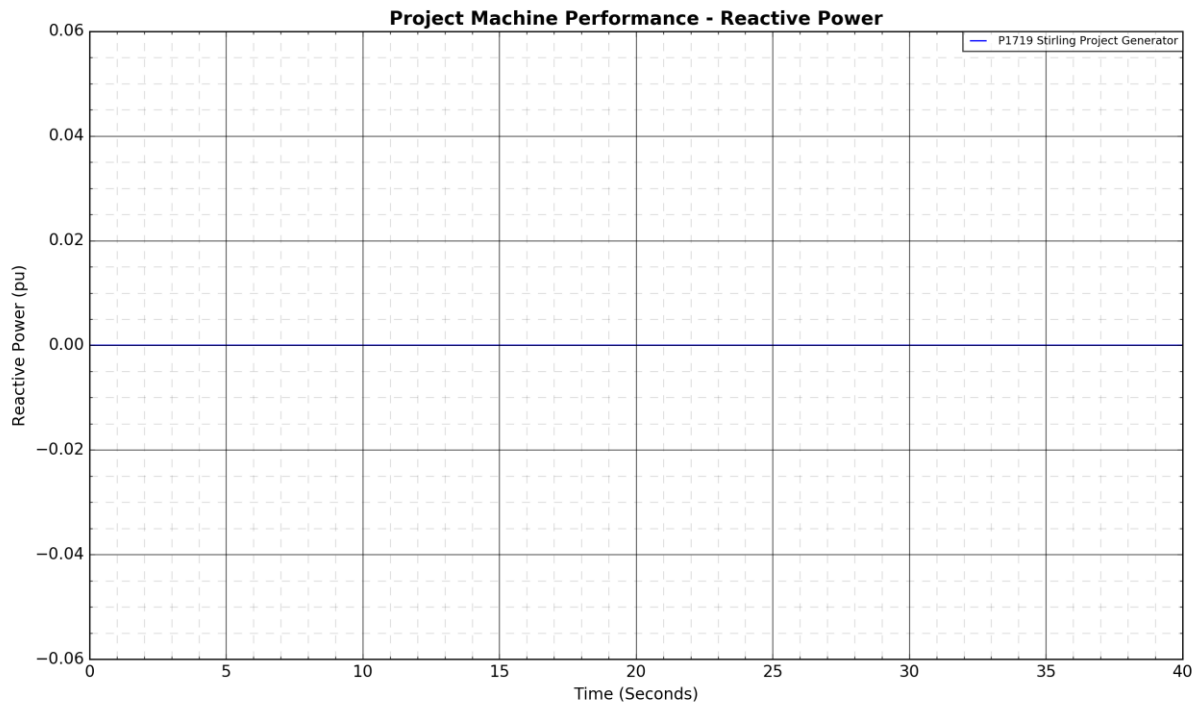
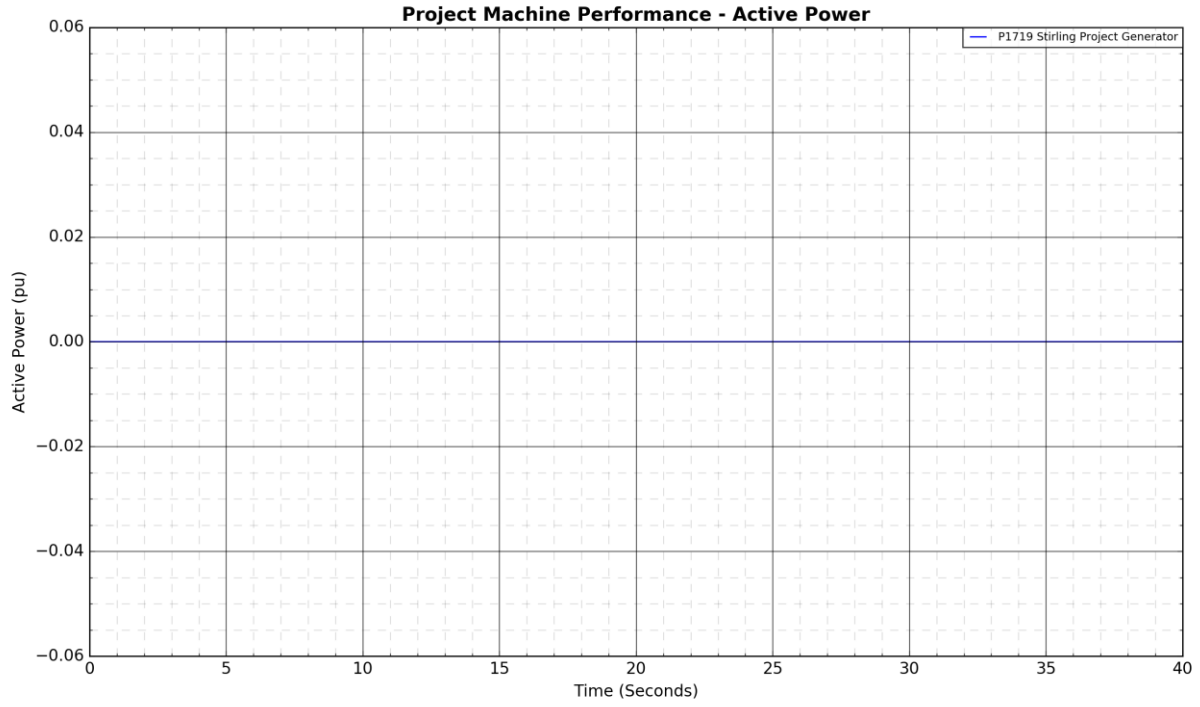
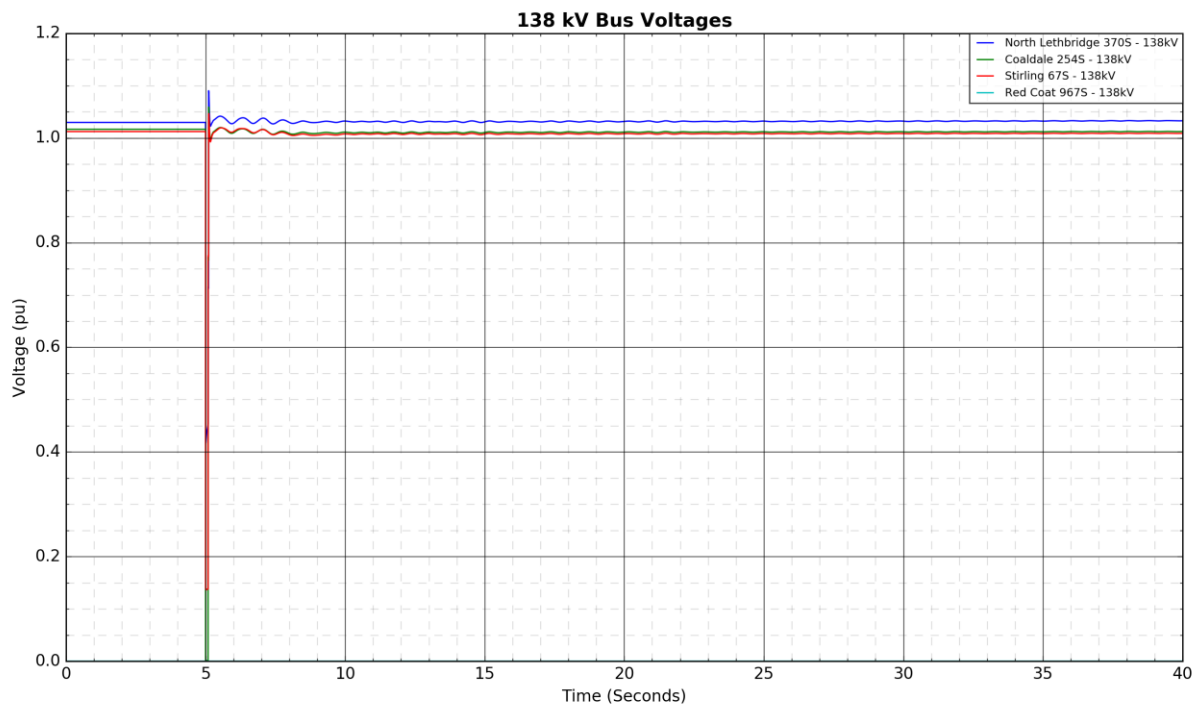
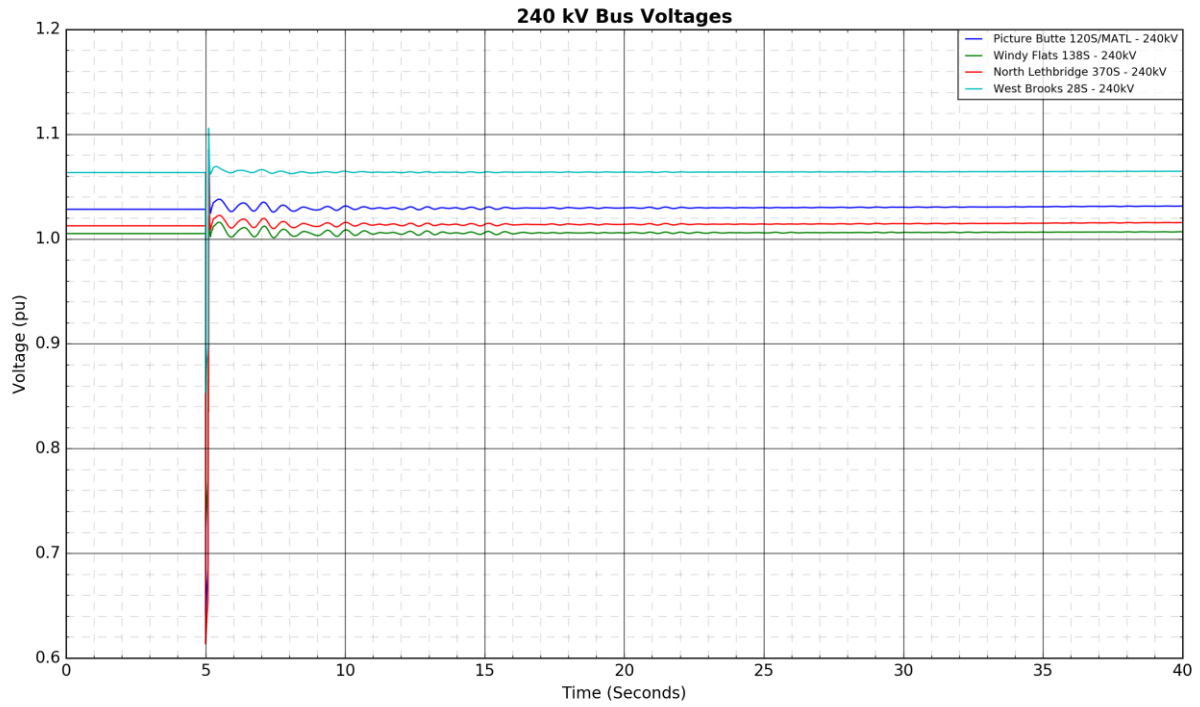
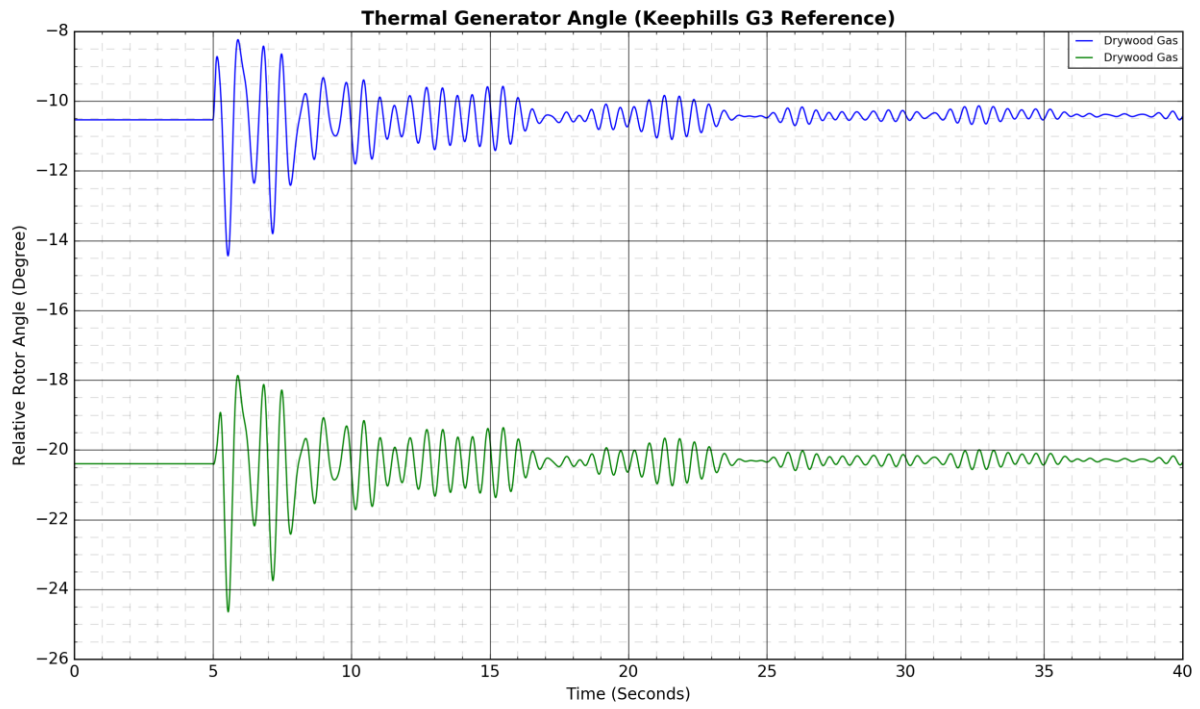
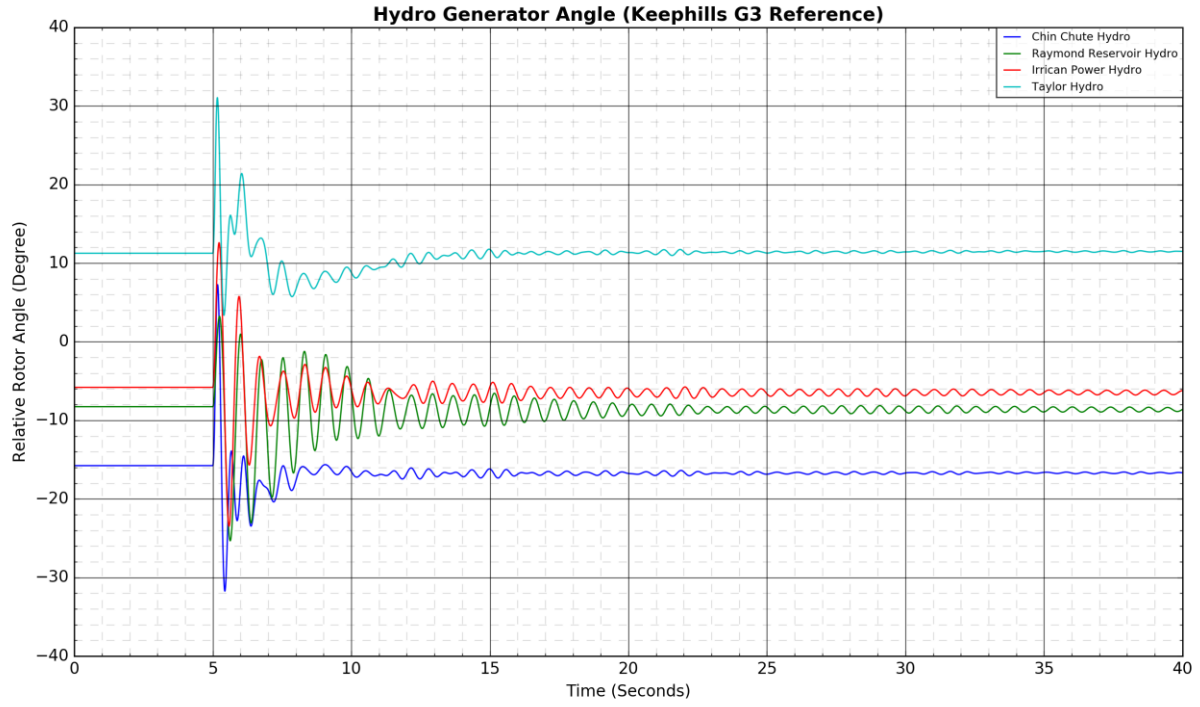
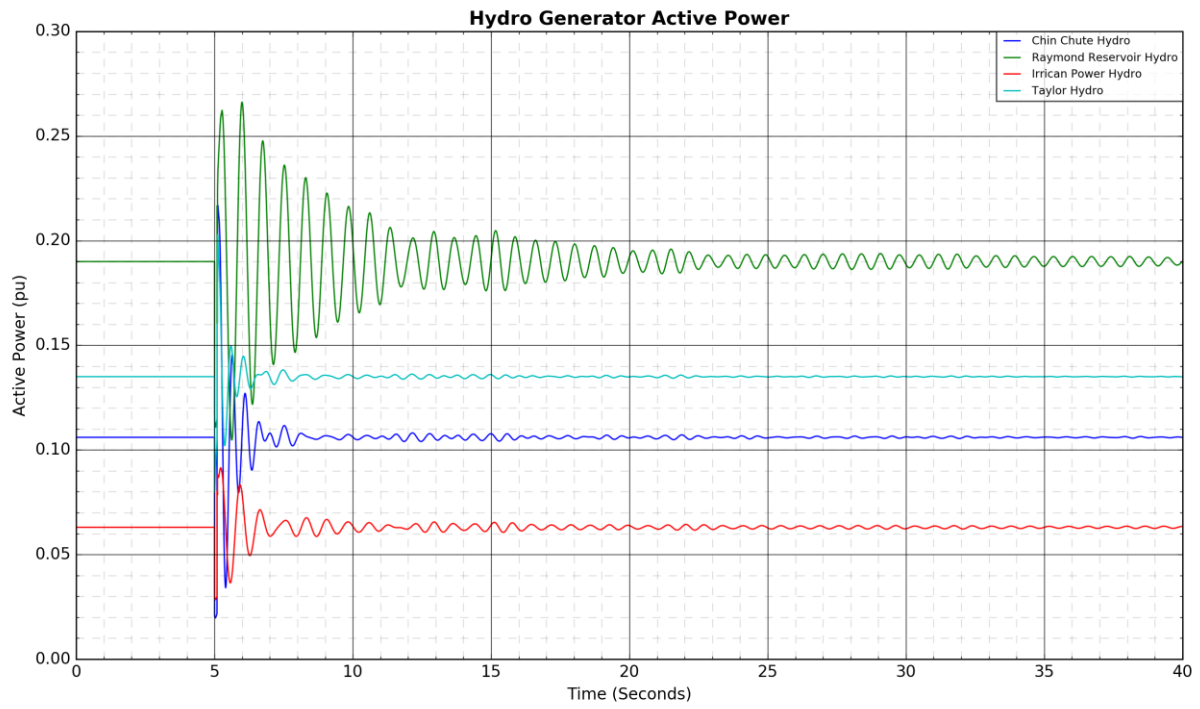
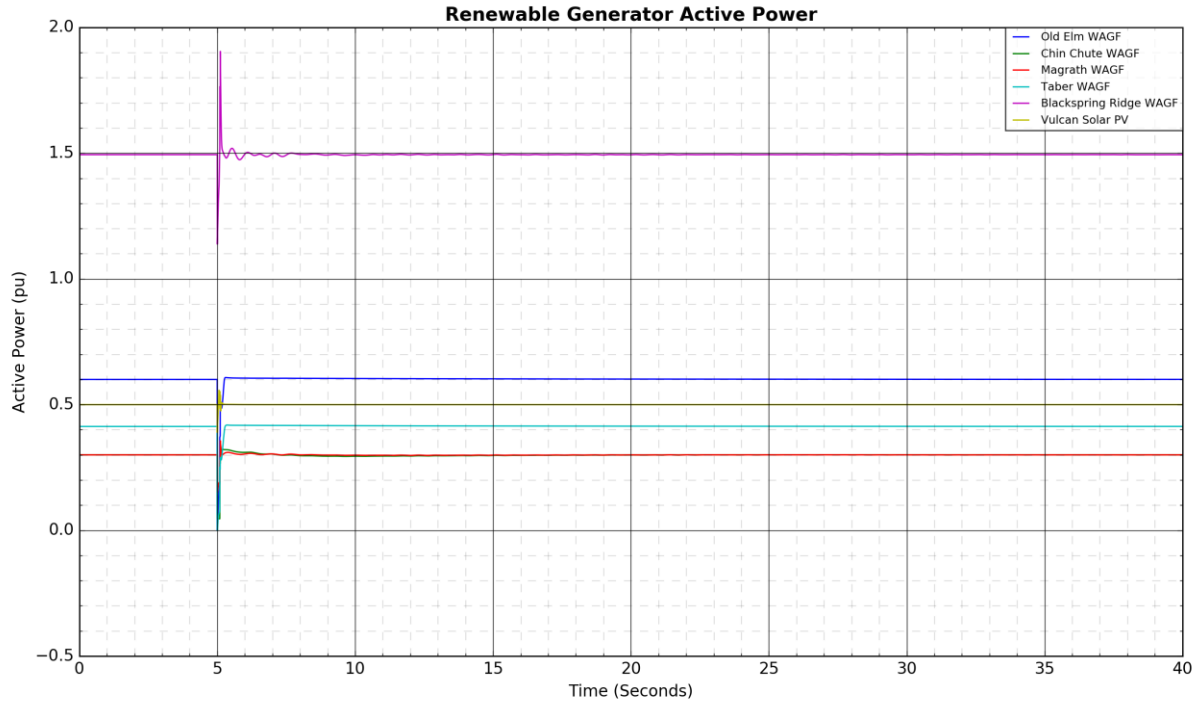


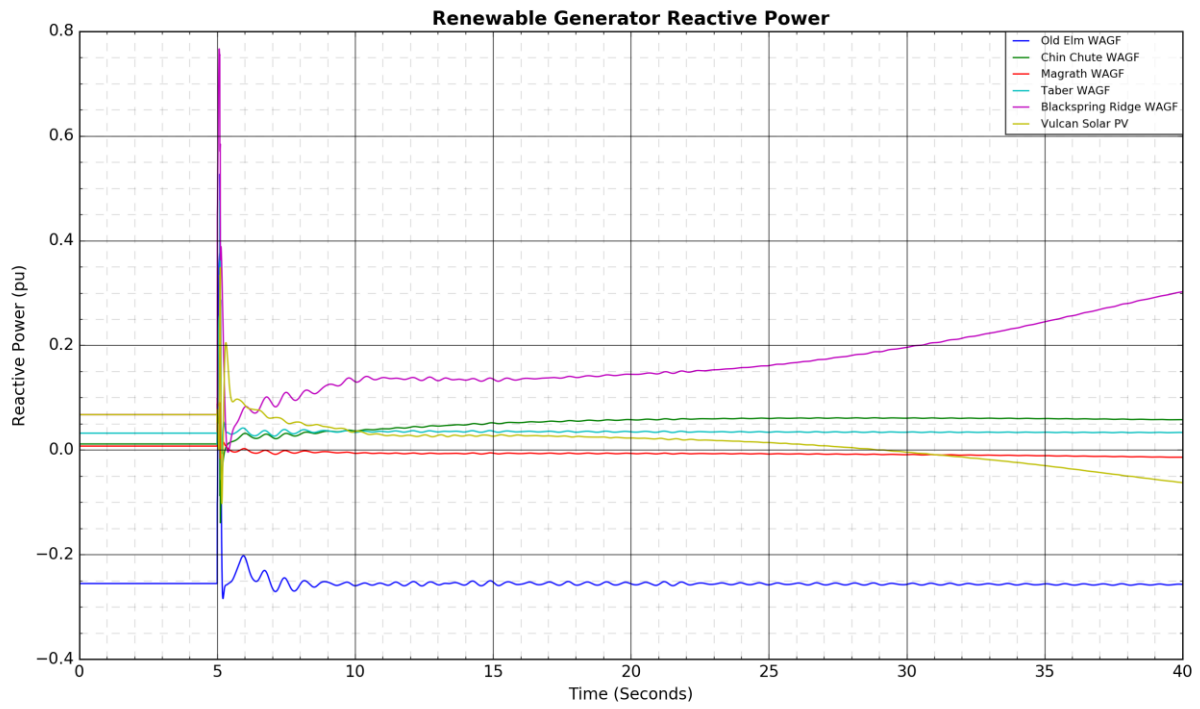
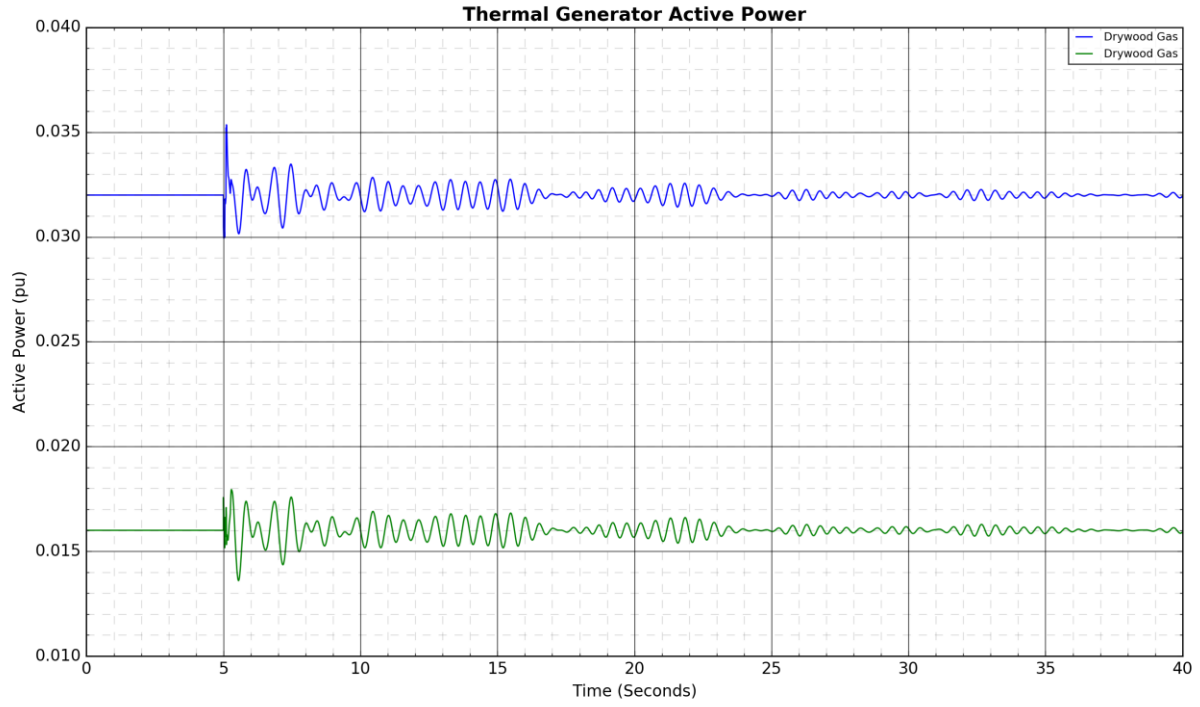
Figure A4-21: 170L Coaldale 254S to North Lethbridge 370S: Fault Near Coaldale 254S



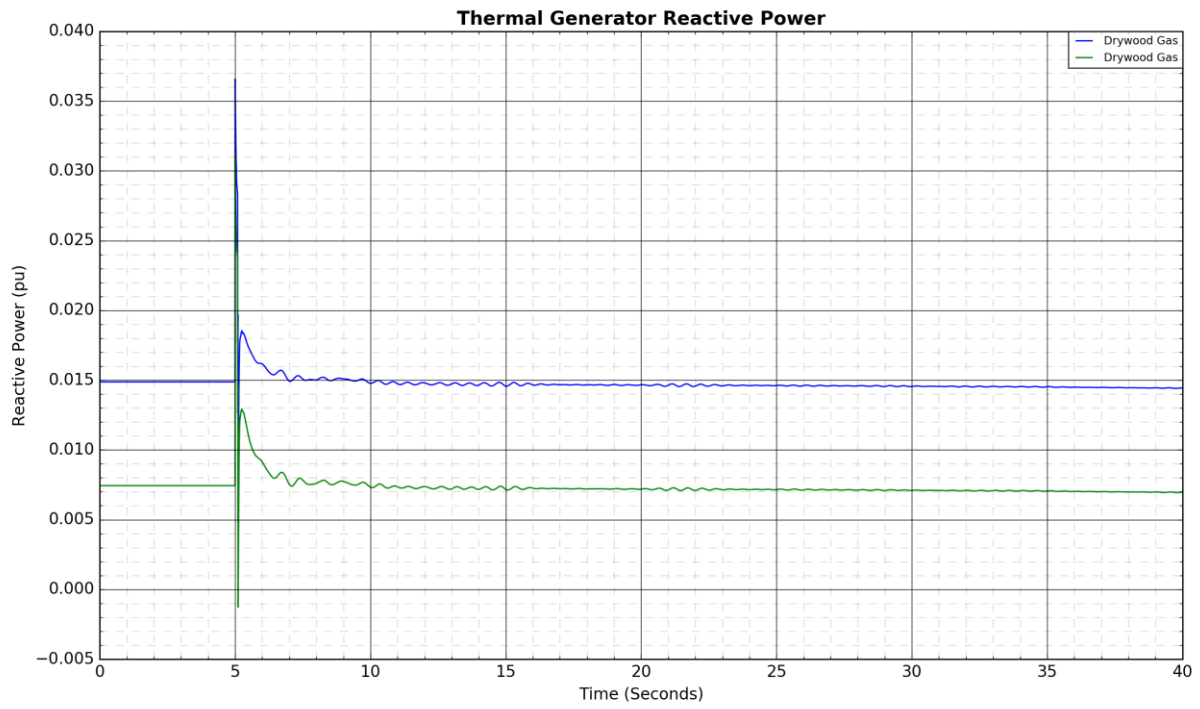
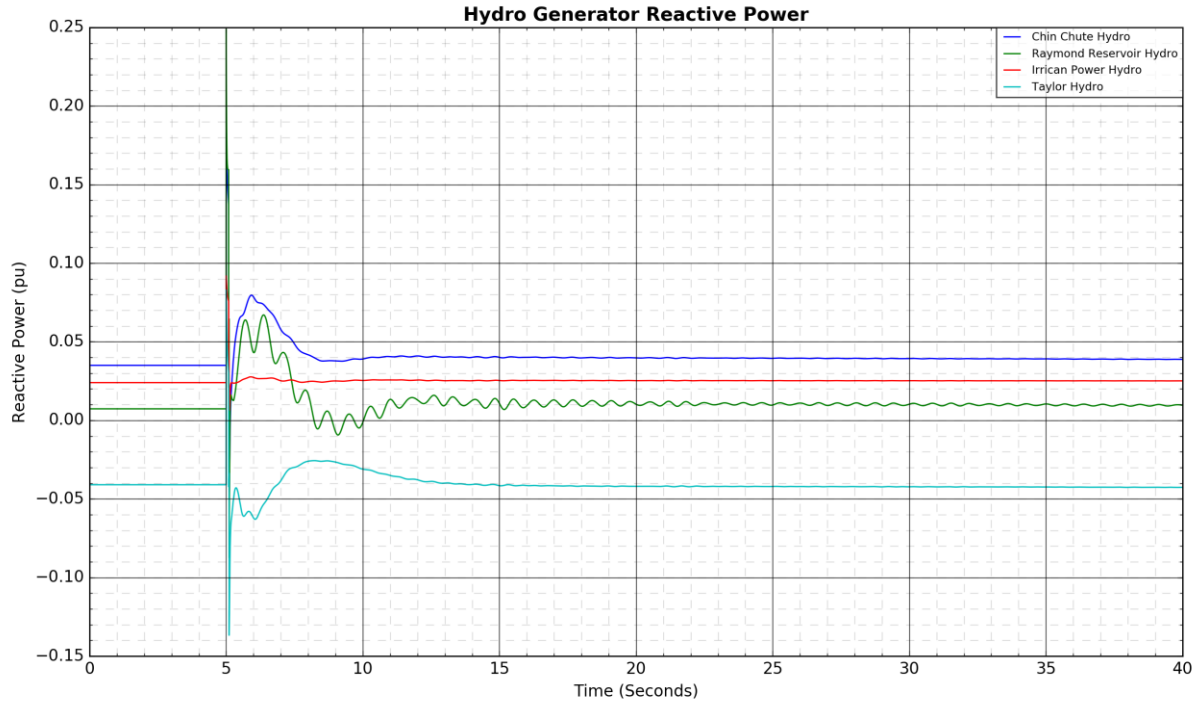


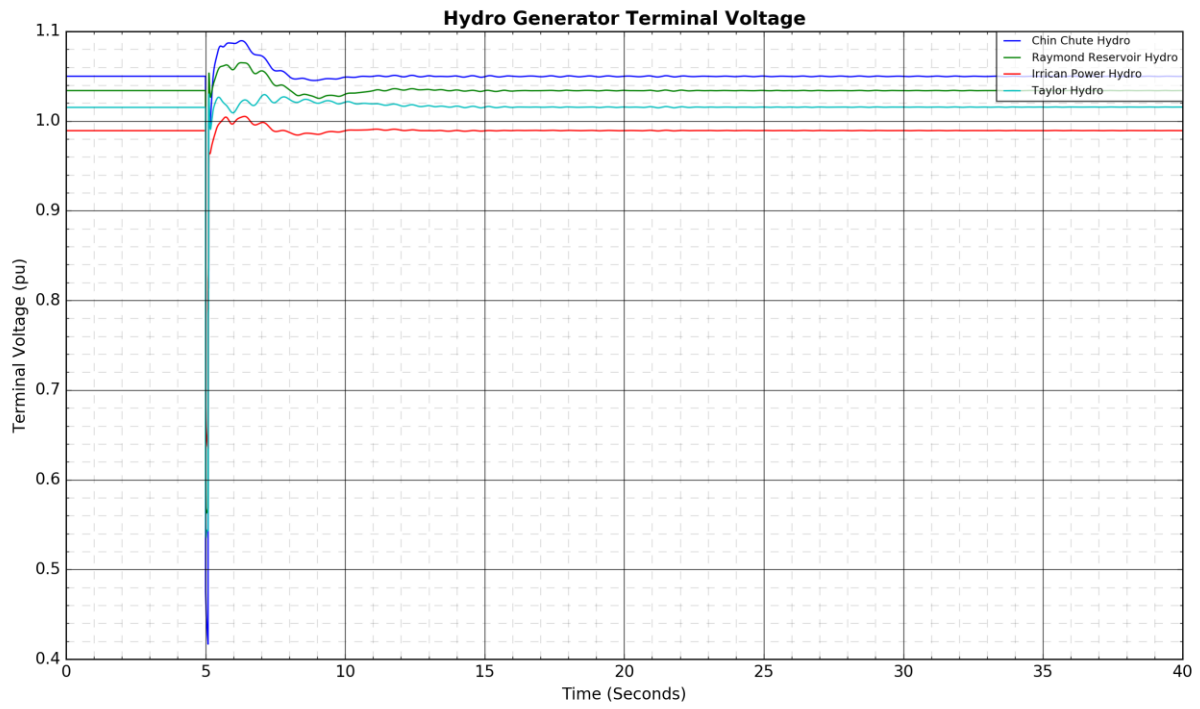
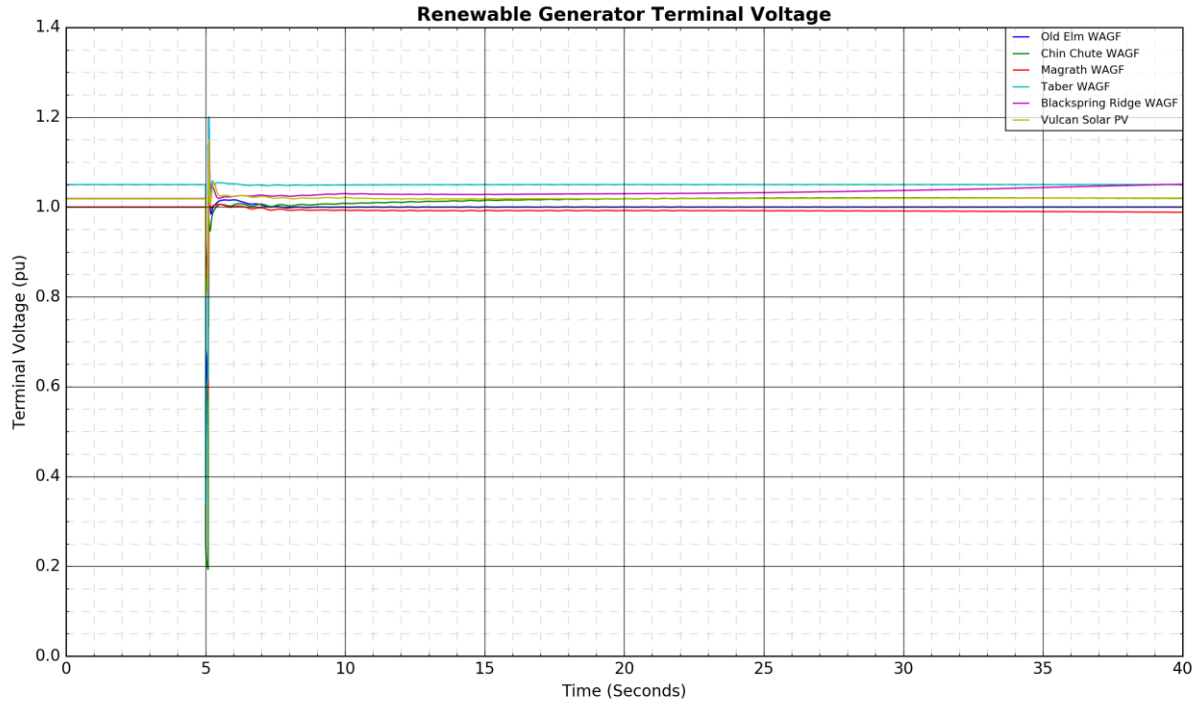
Engineering Connection Assessment Results: Stirling Wind Project Connection

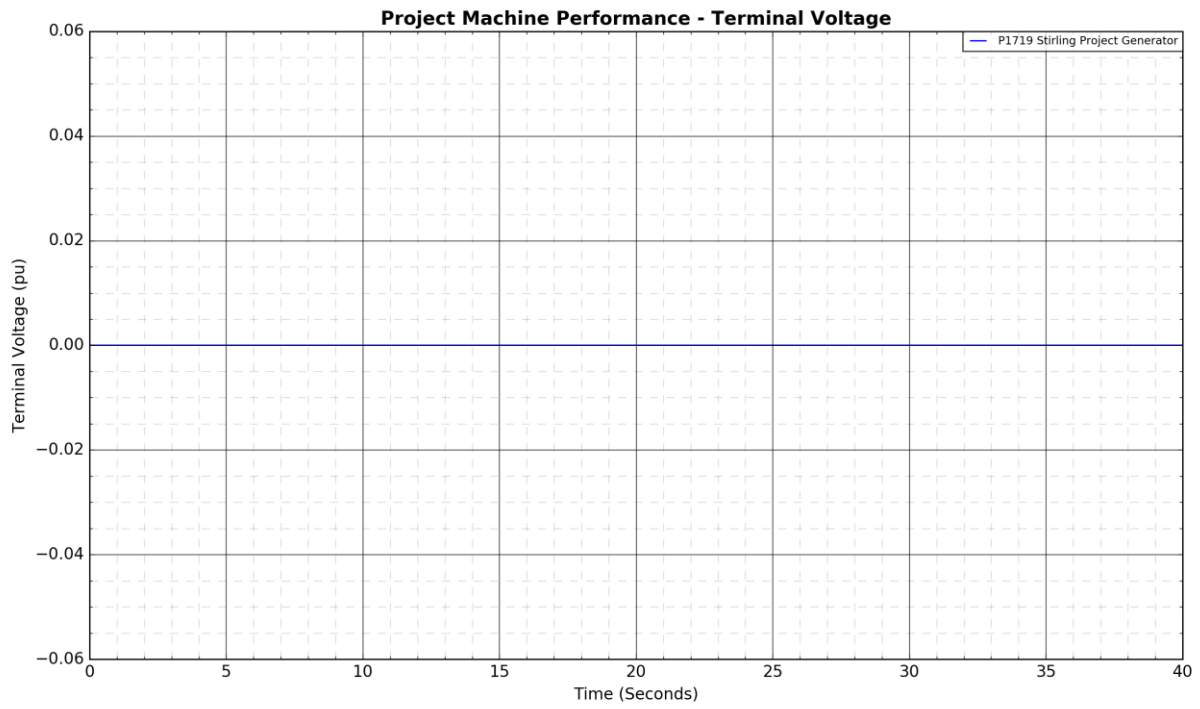
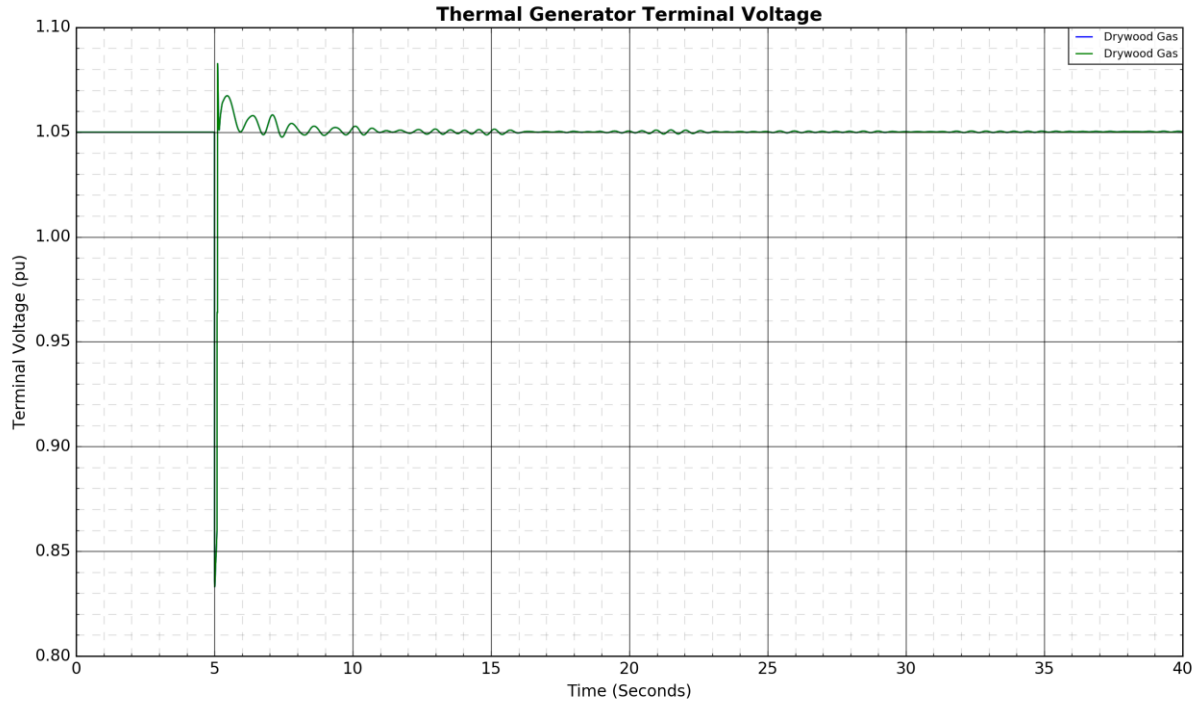




Engineering Connection Assessment Results: Stirling Wind Project Connection







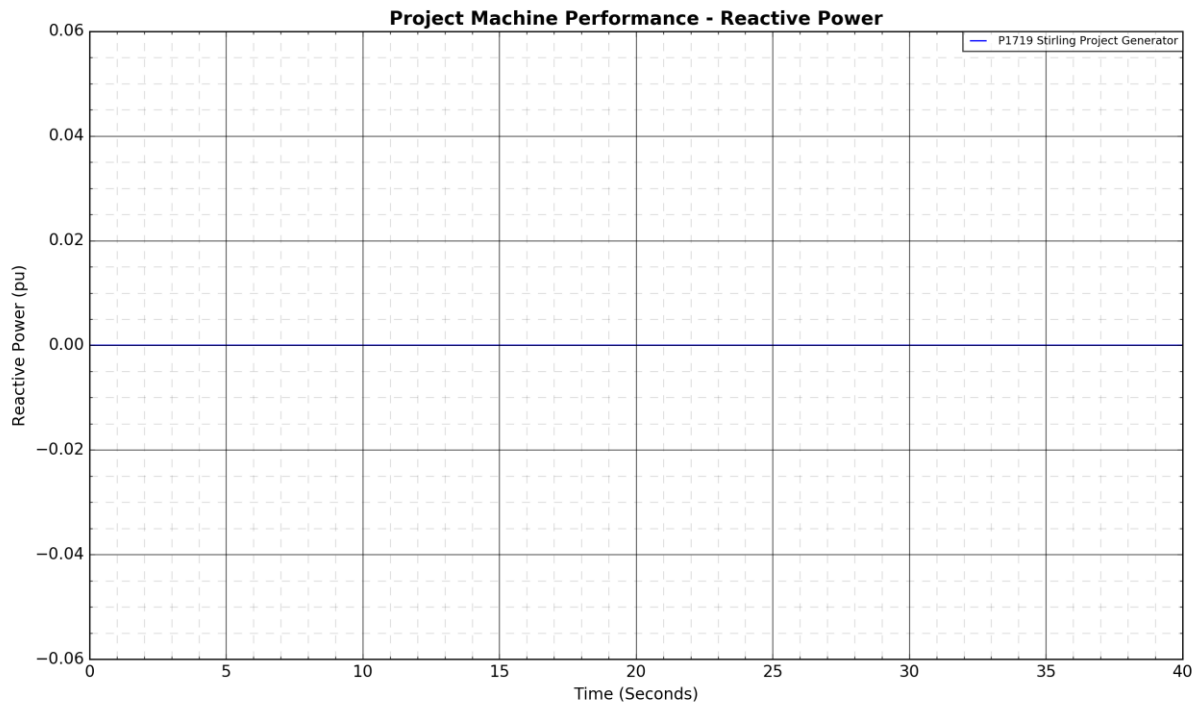
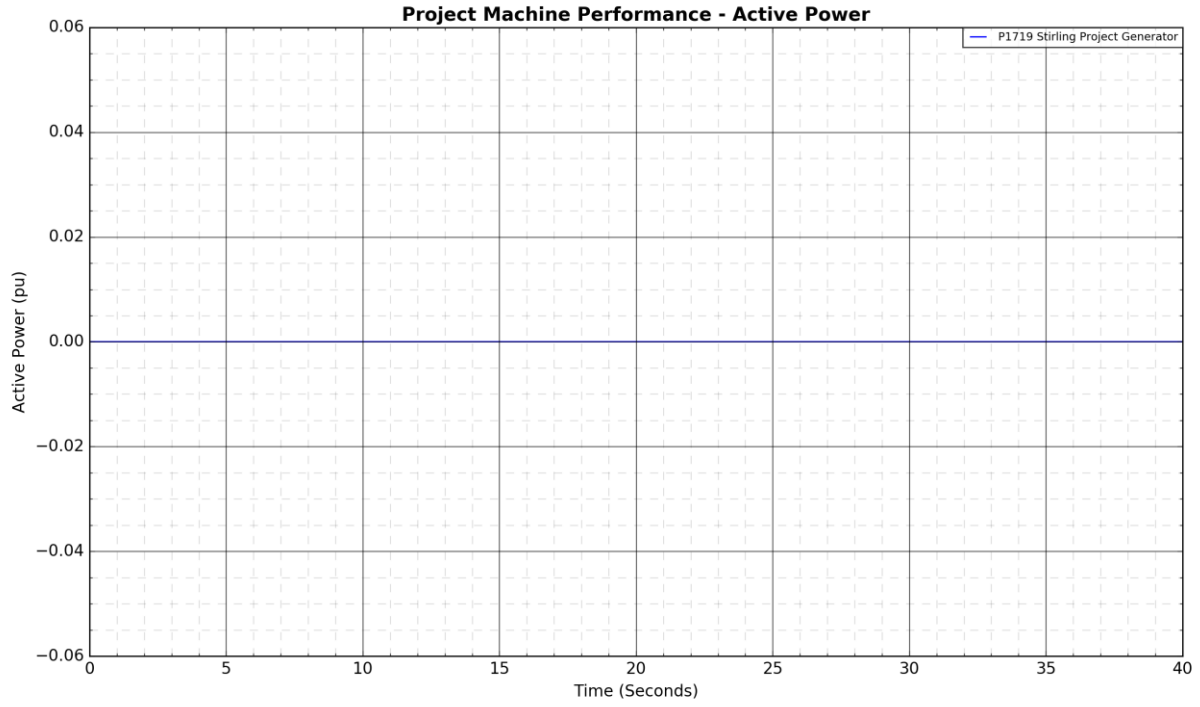
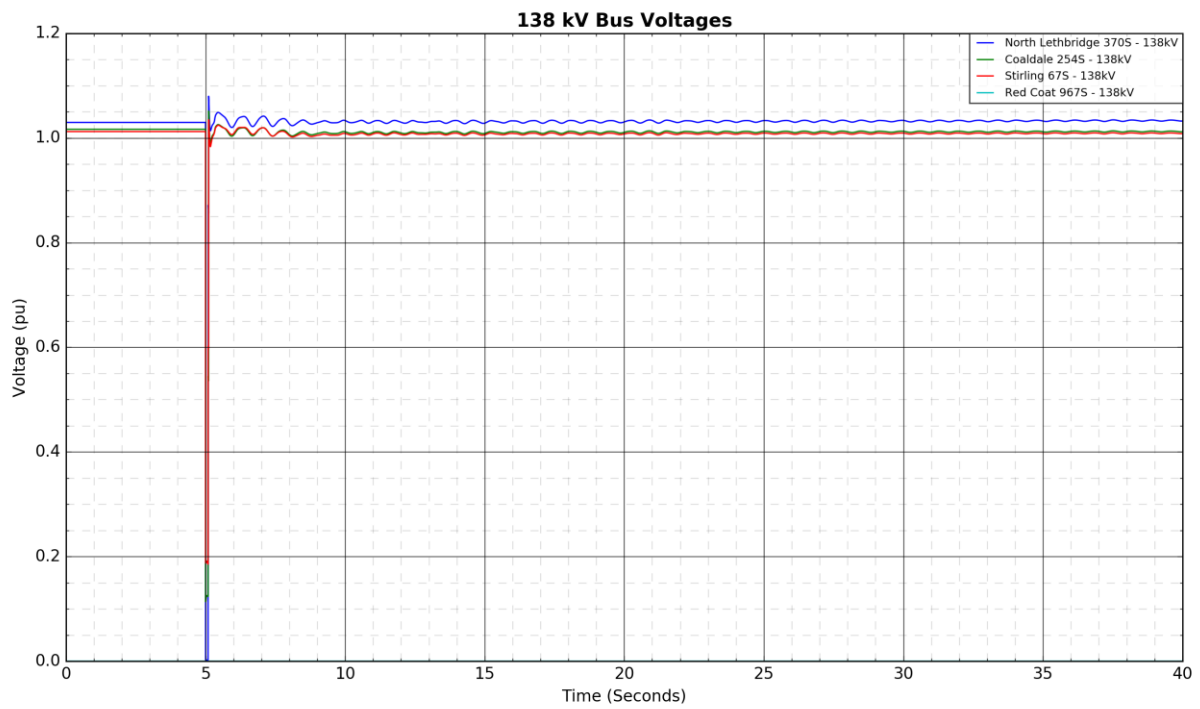
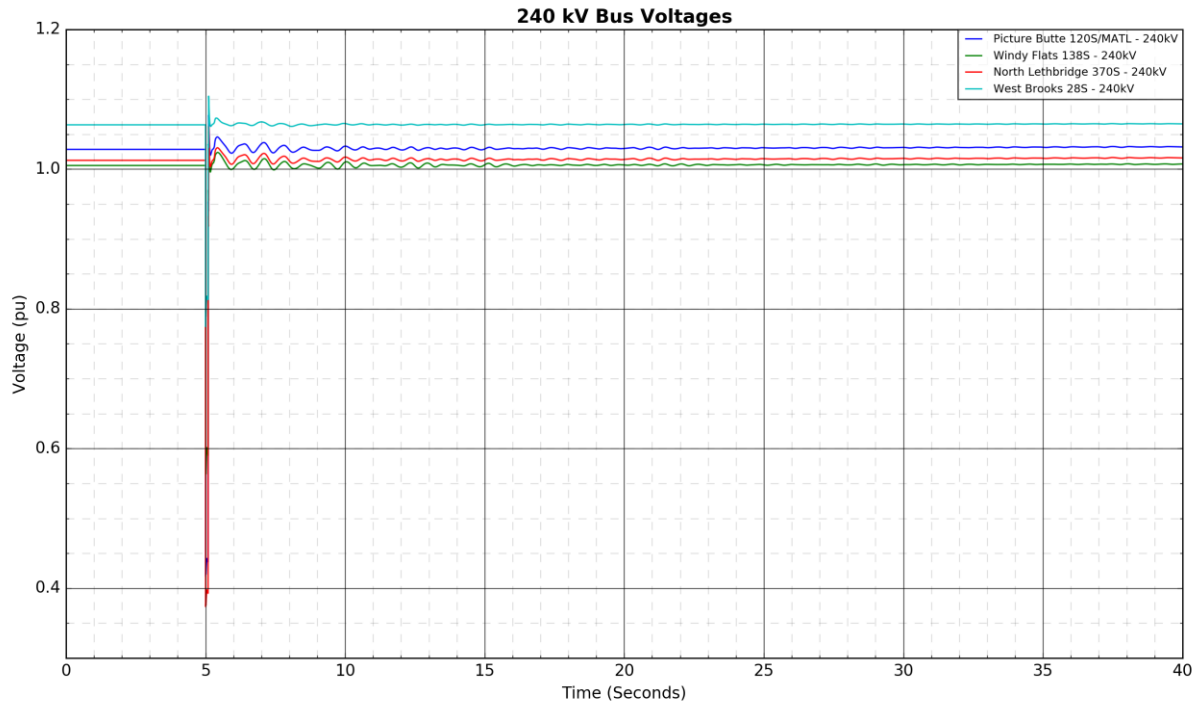
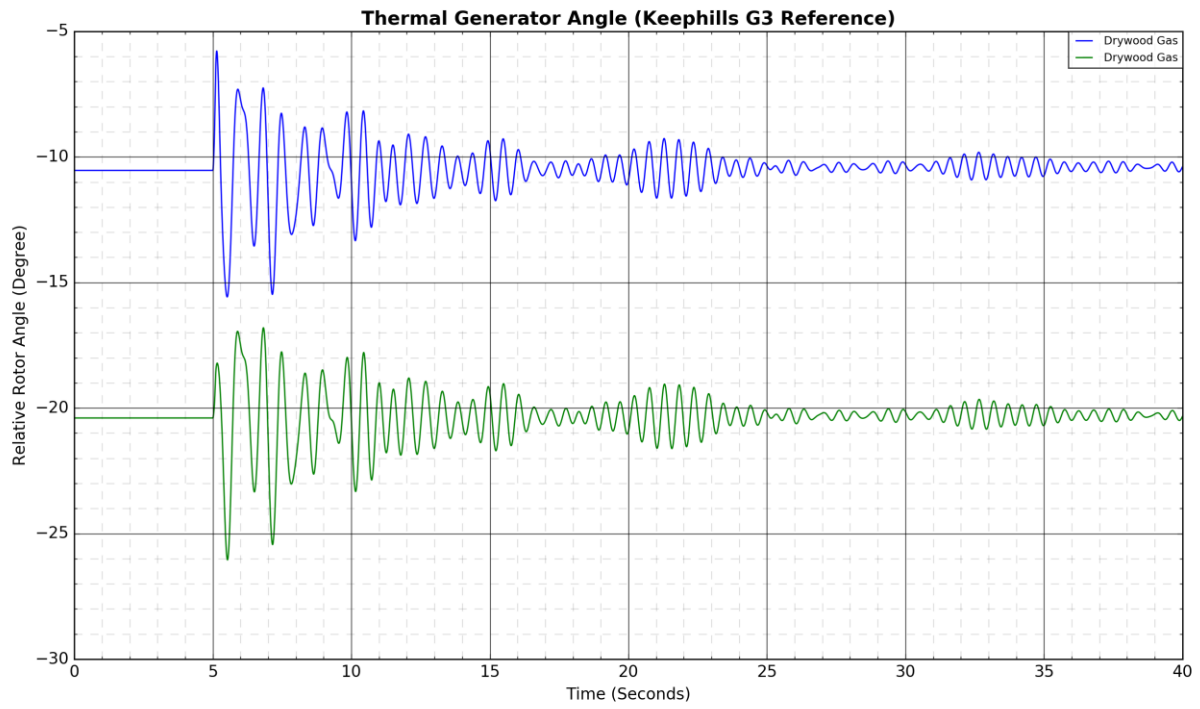
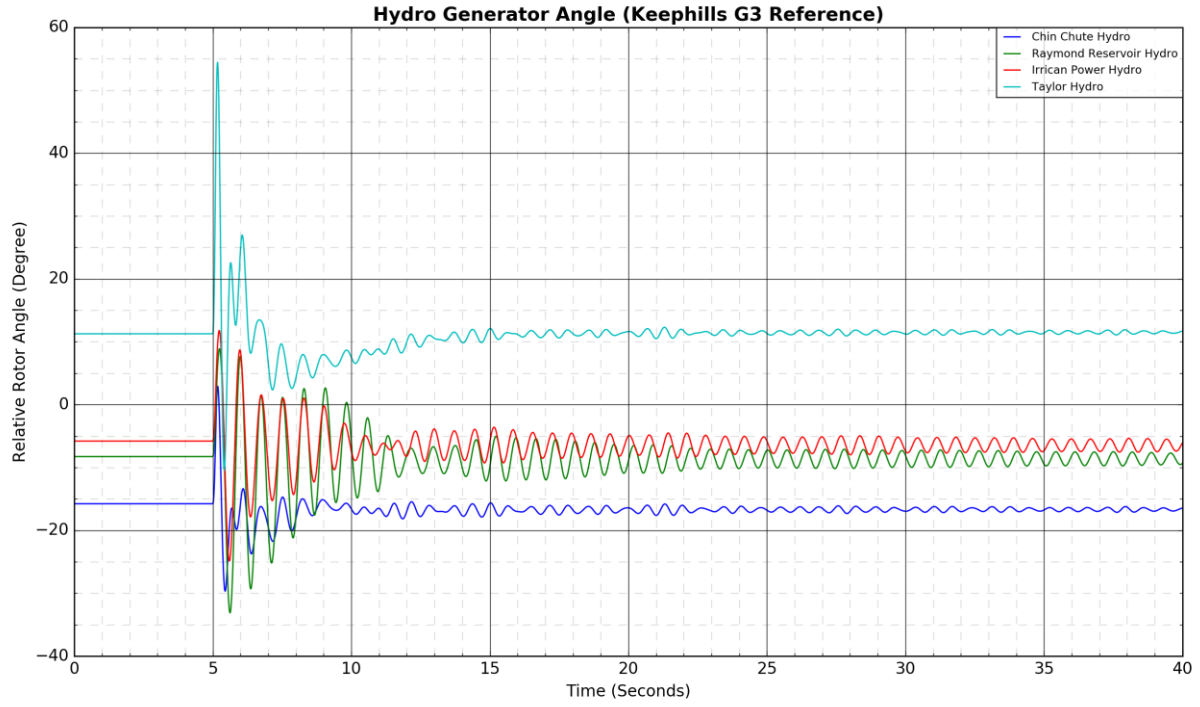
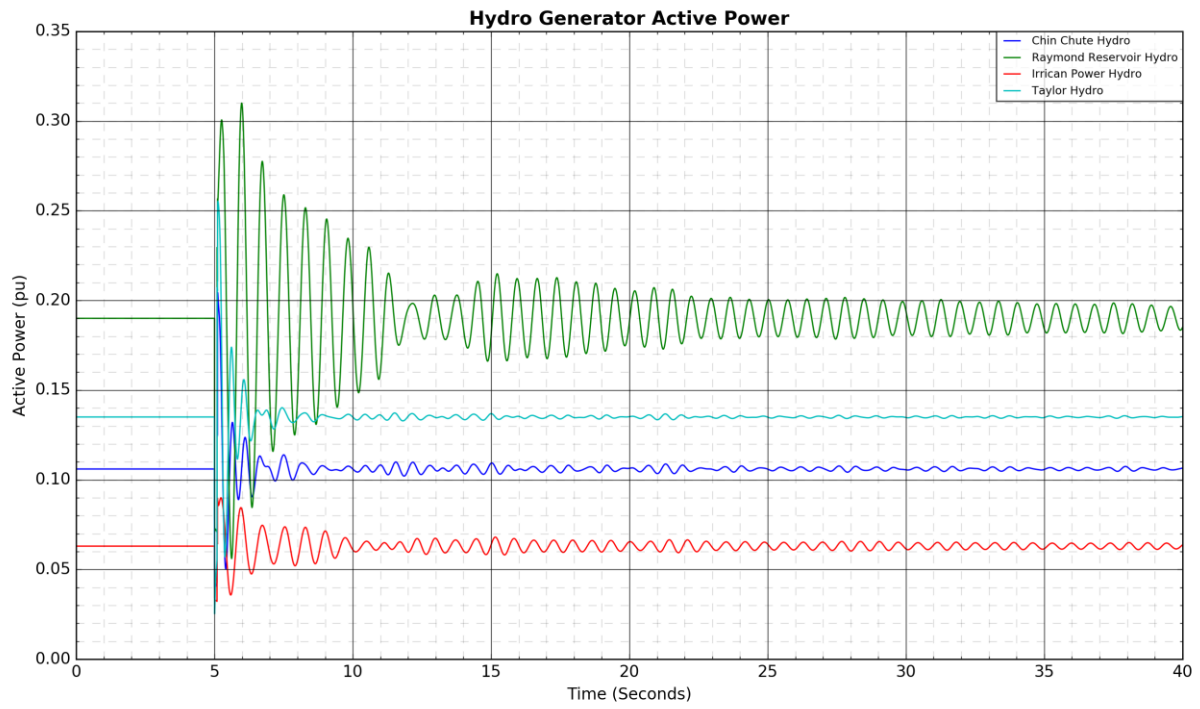
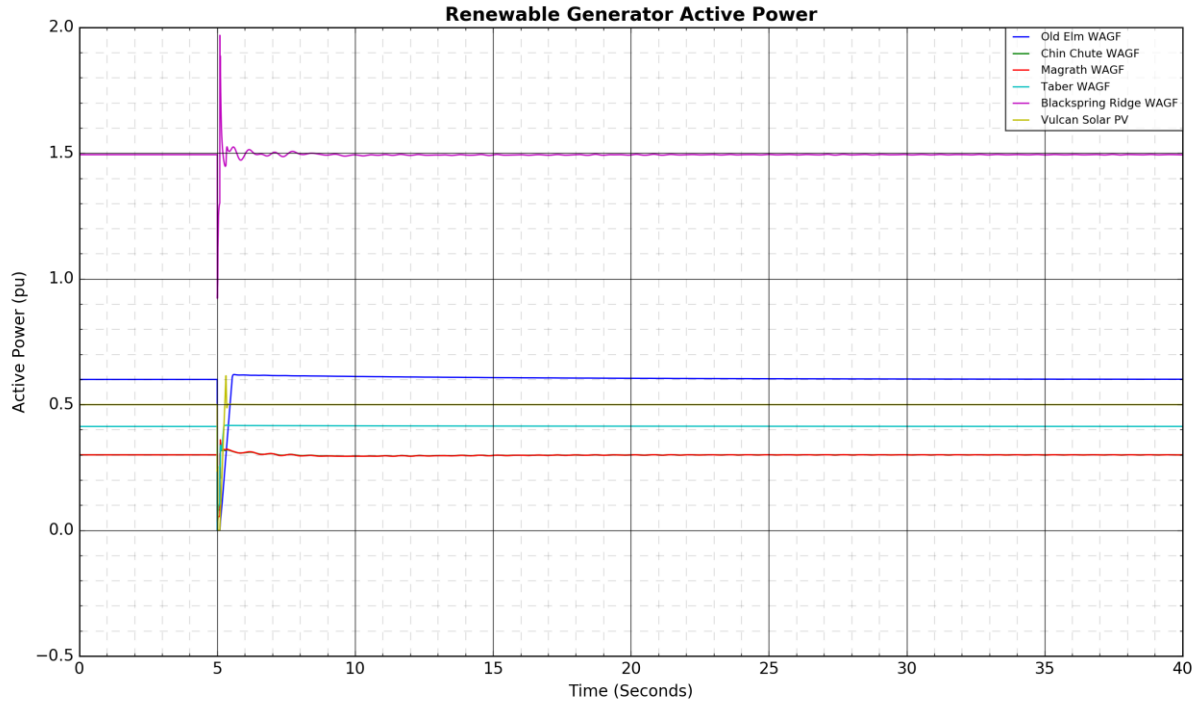


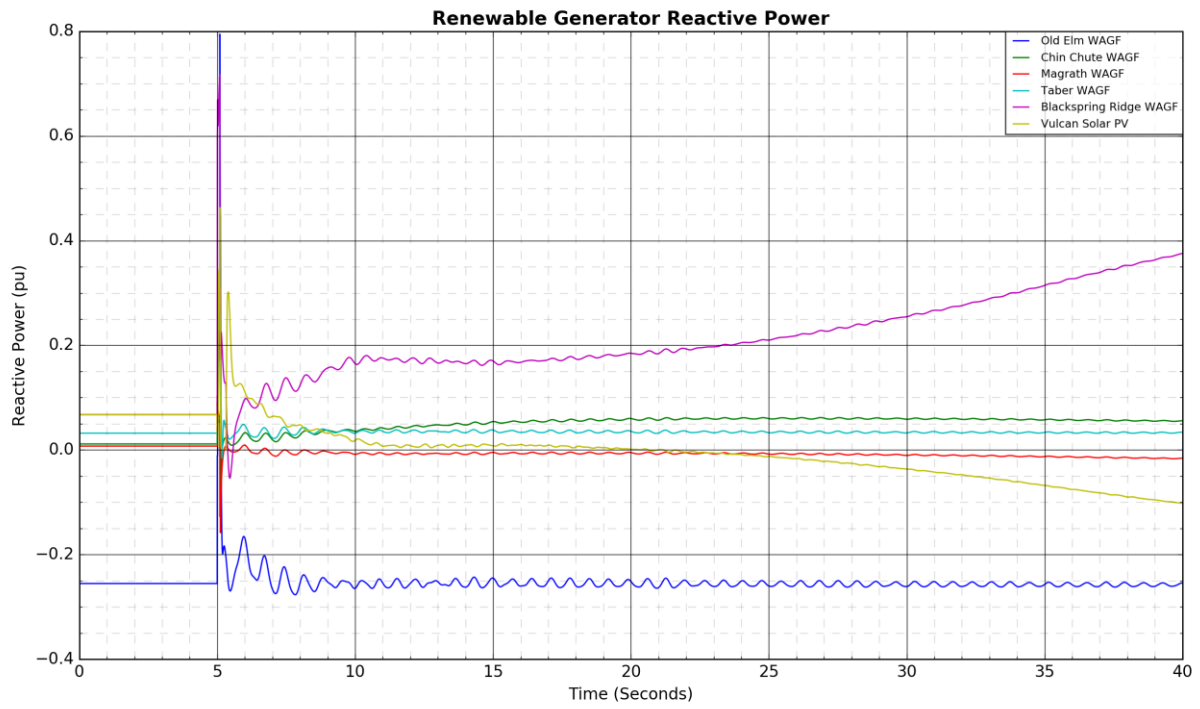
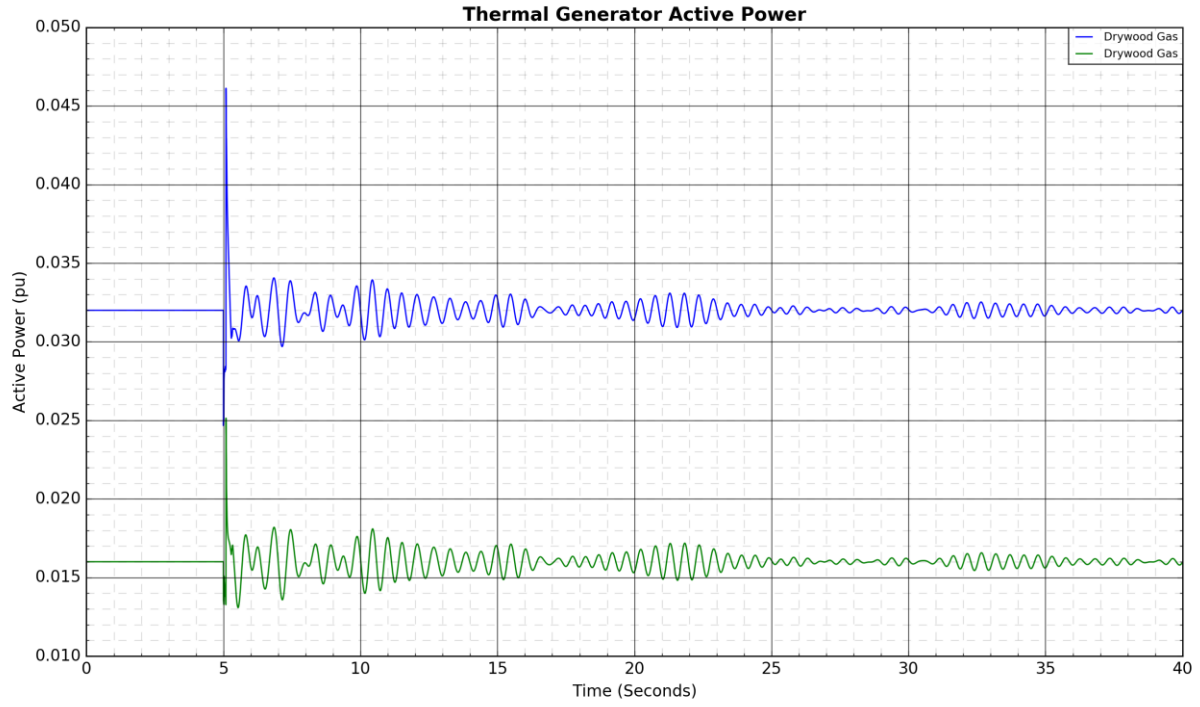
Figure A4-22: 170L Coaldale 254S to North Lethbridge 370S: Fault Near North Lethbridge 370S



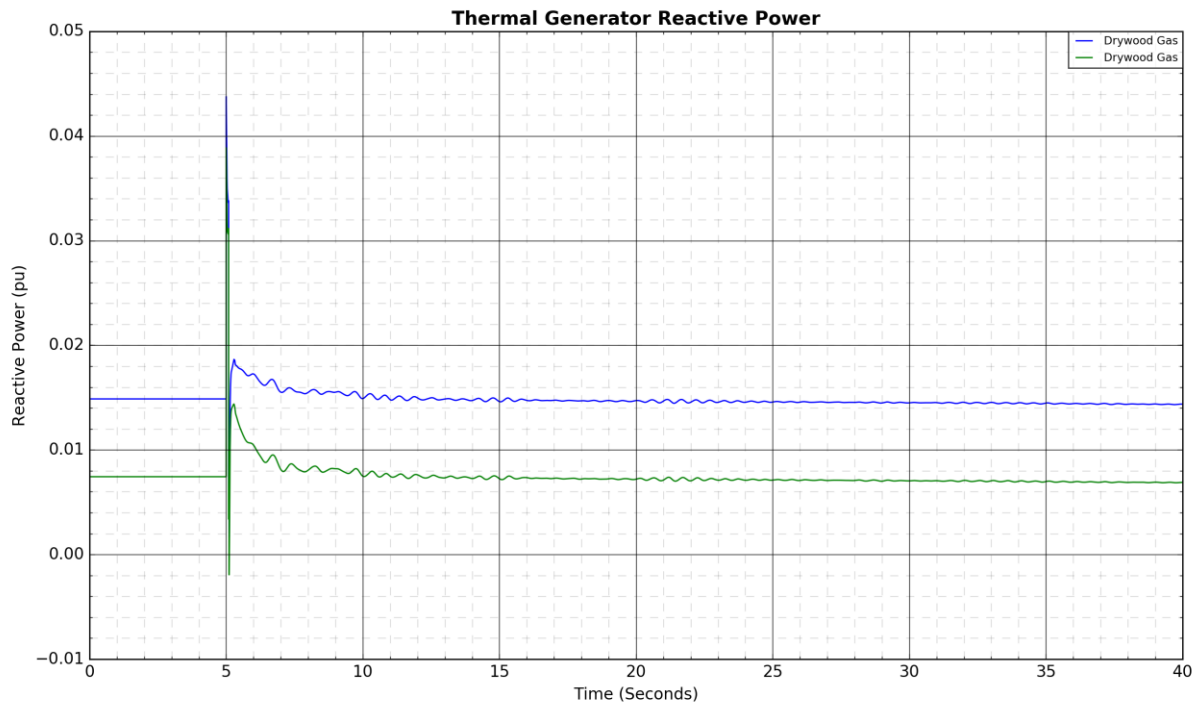
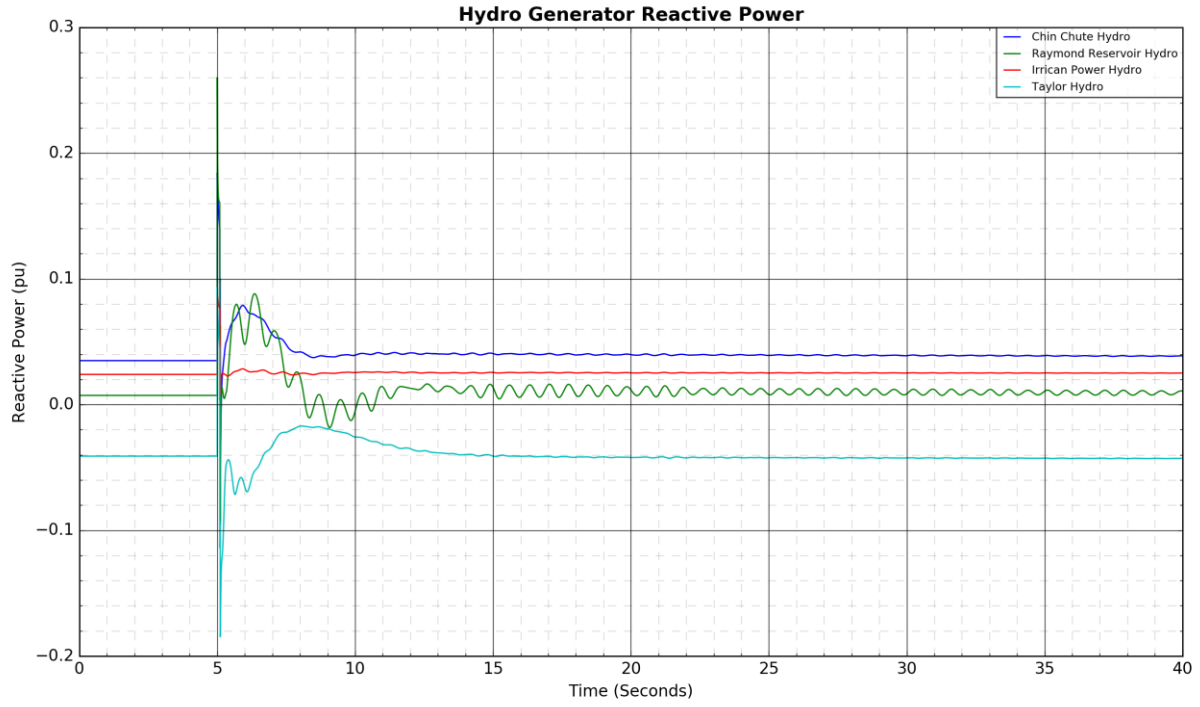


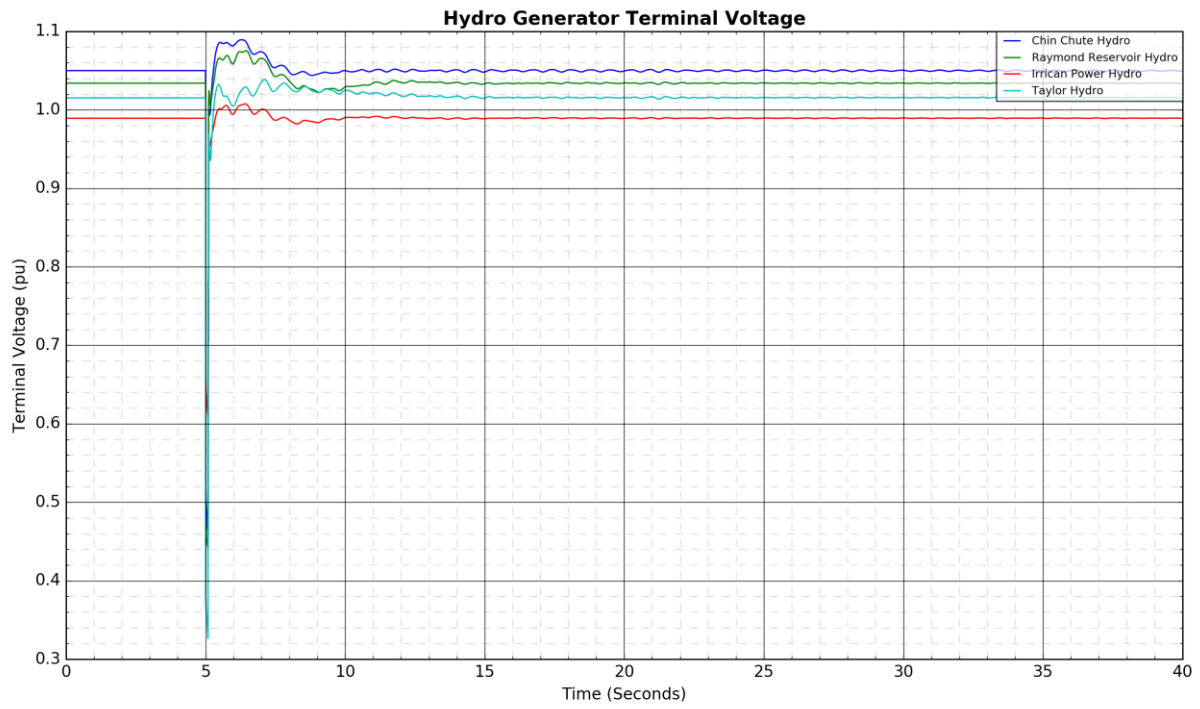
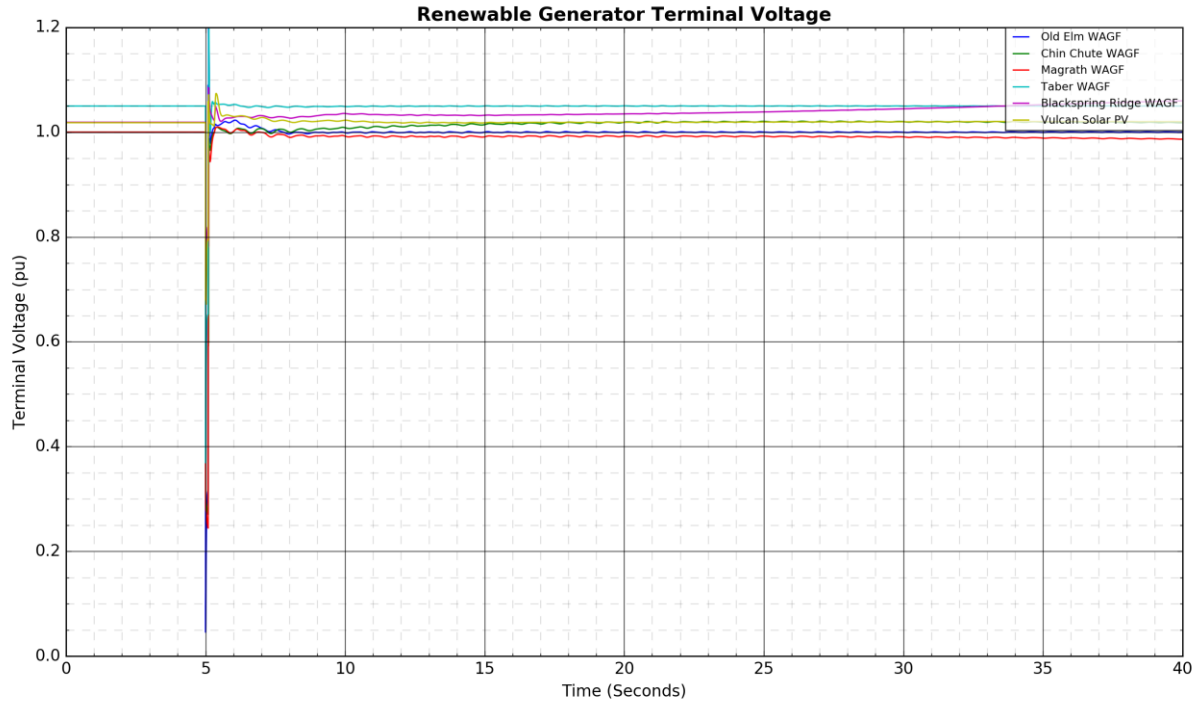
Engineering Connection Assessment Results: Stirling Wind Project Connection

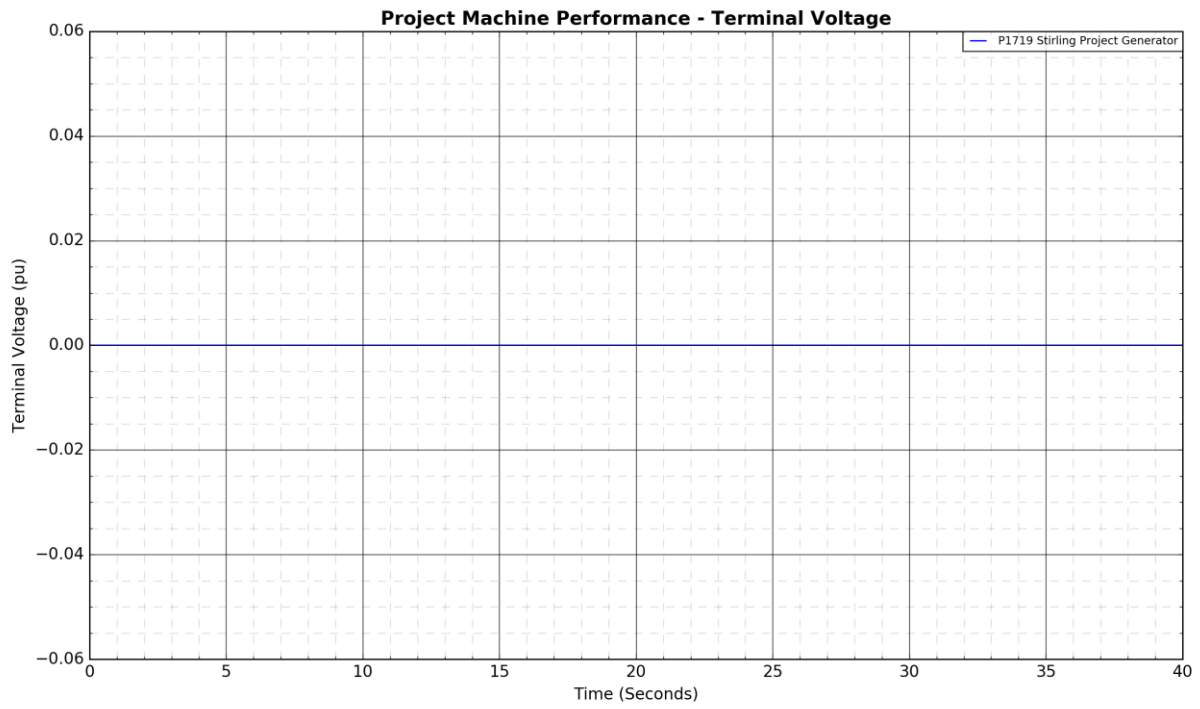
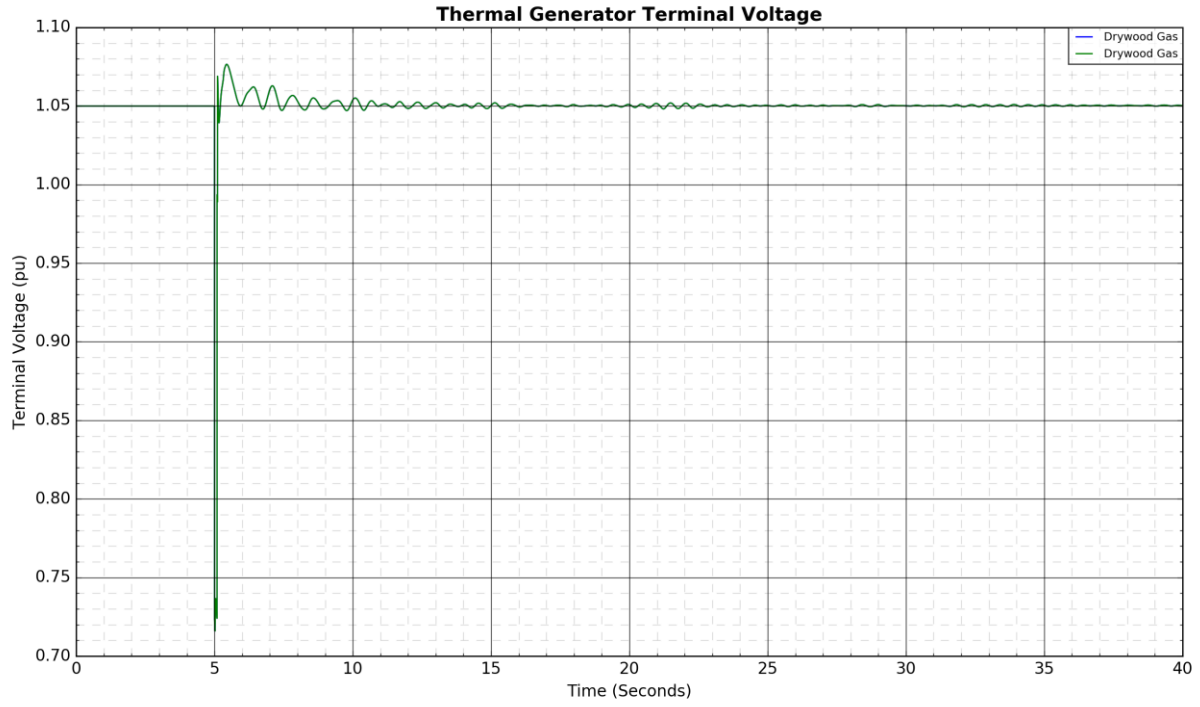




Engineering Connection Assessment Results: Stirling Wind Project Connection







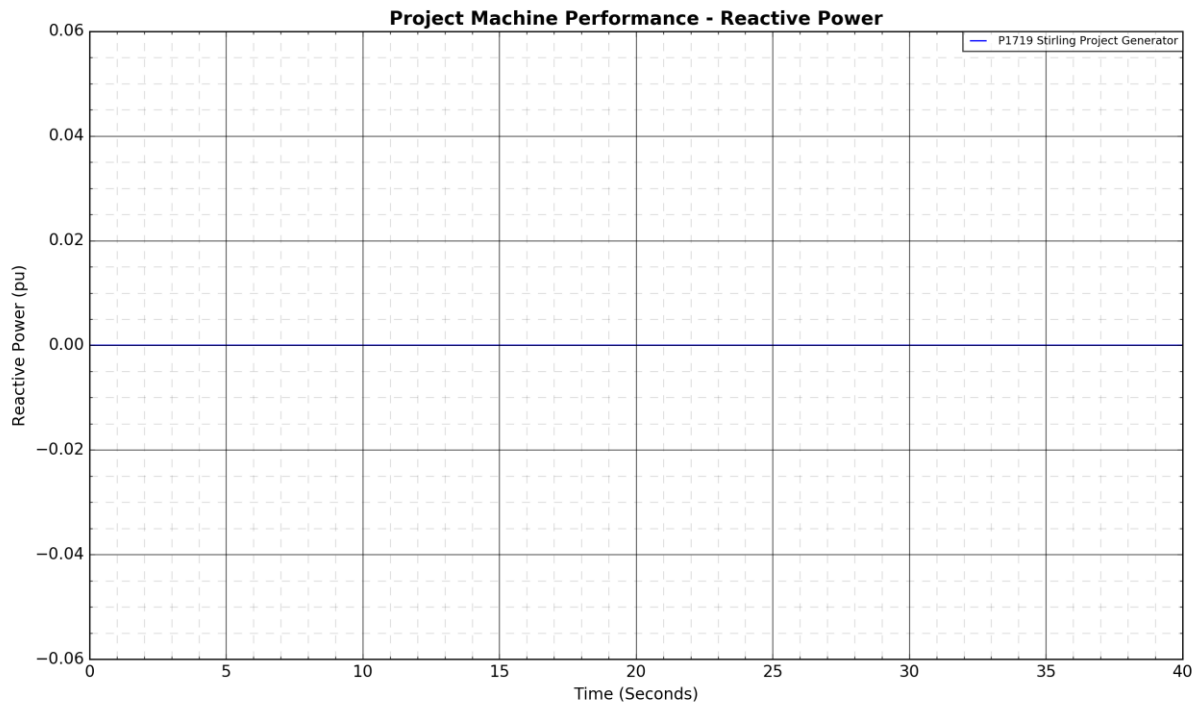
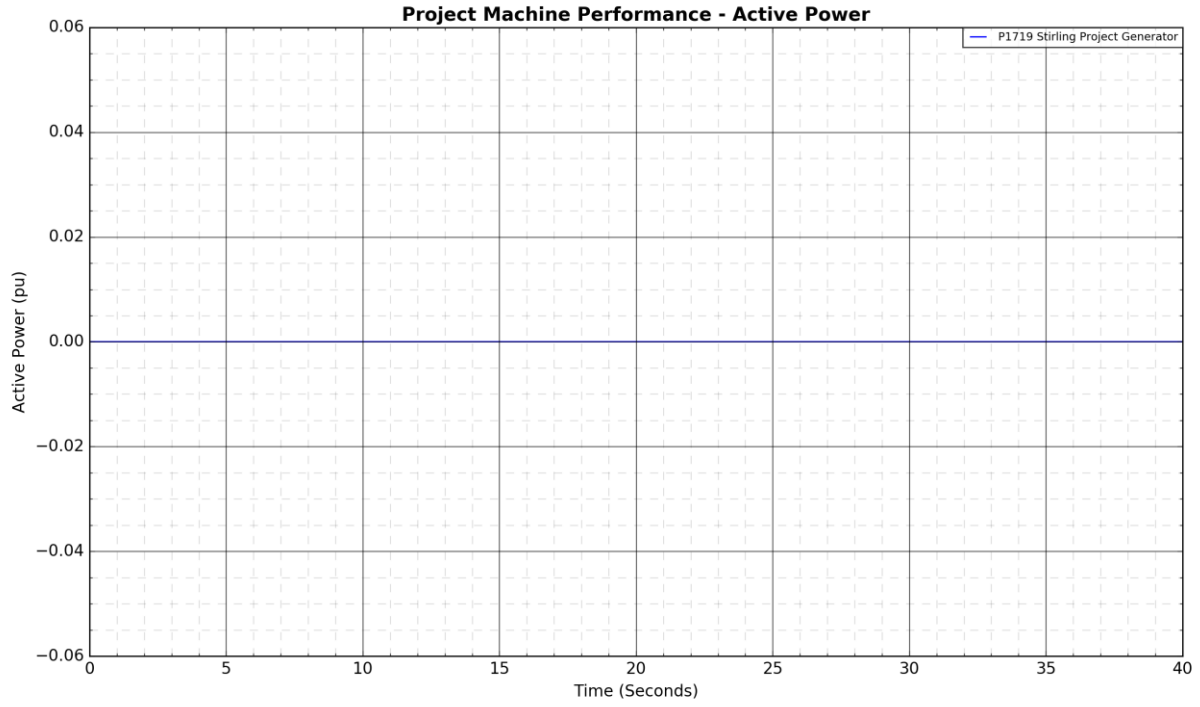
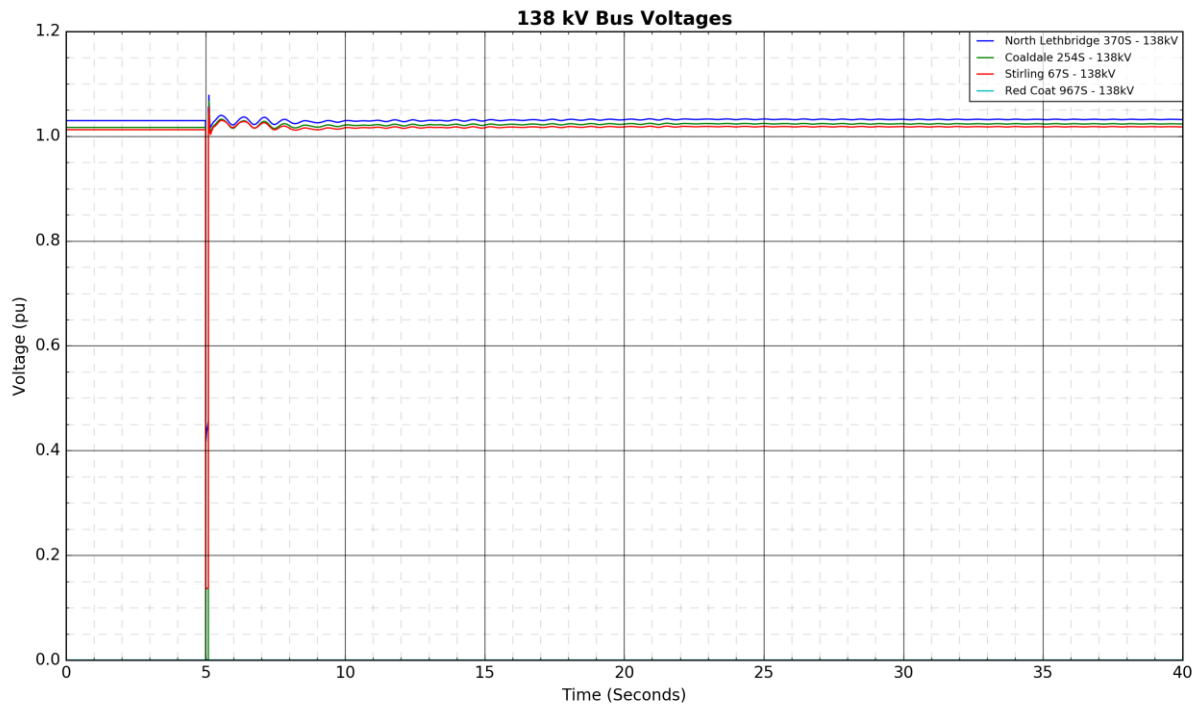
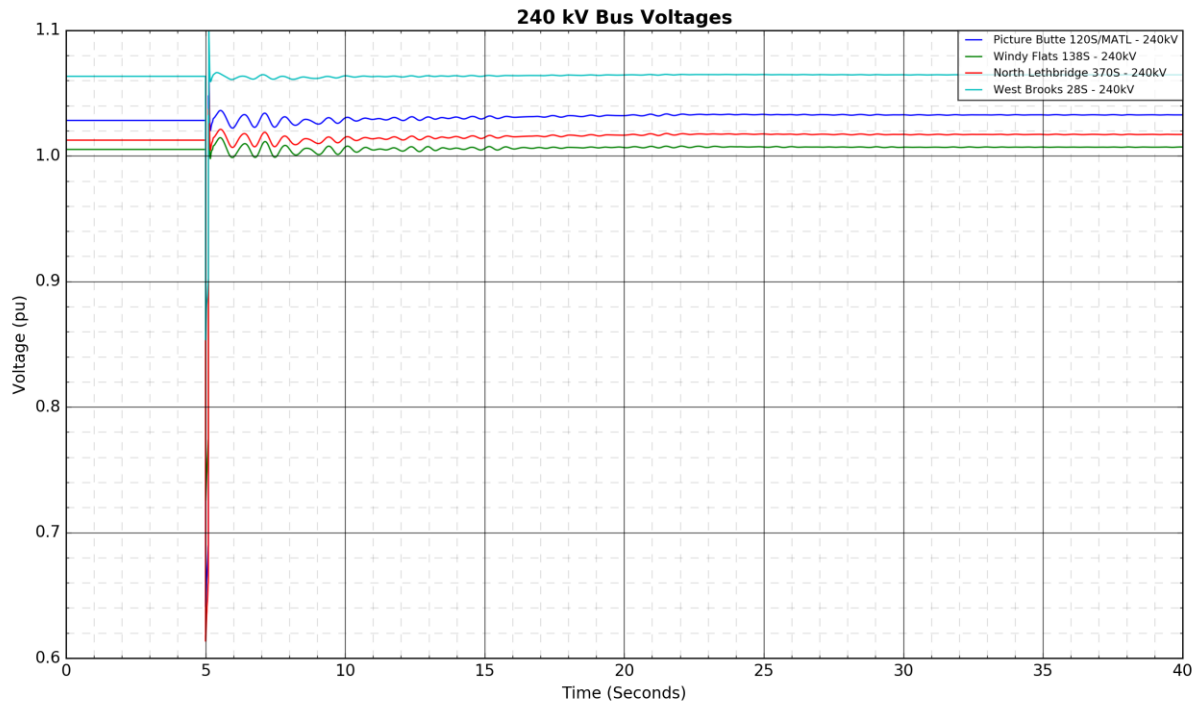
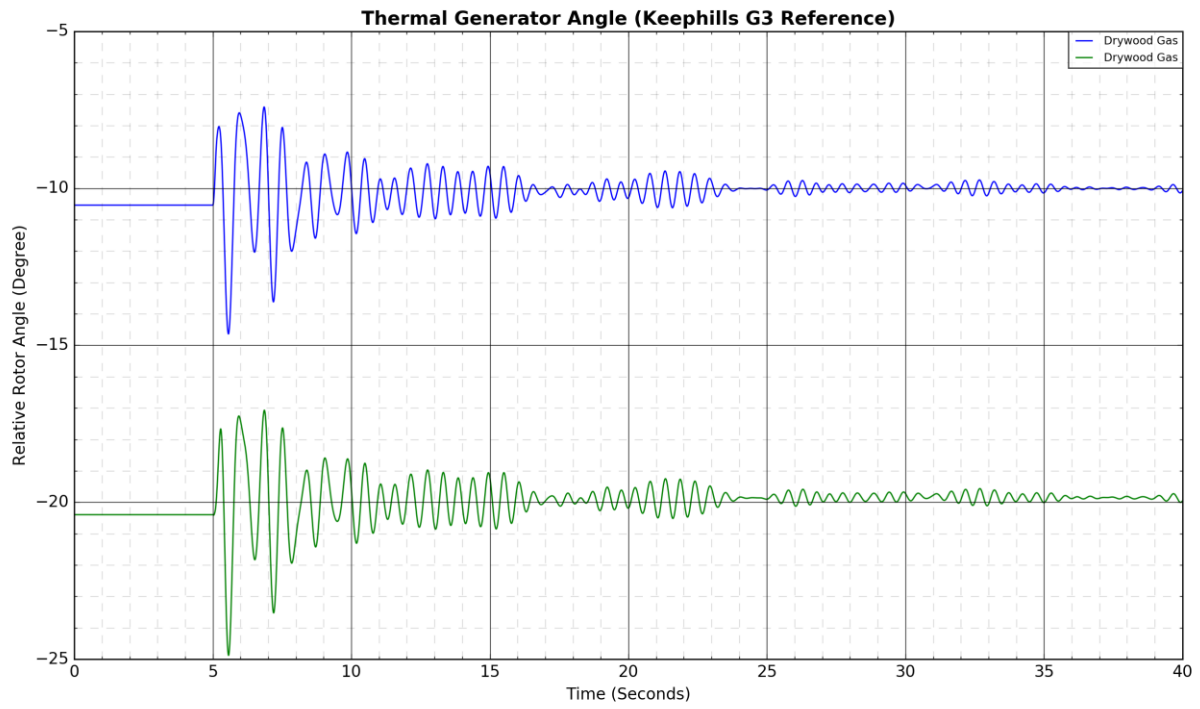
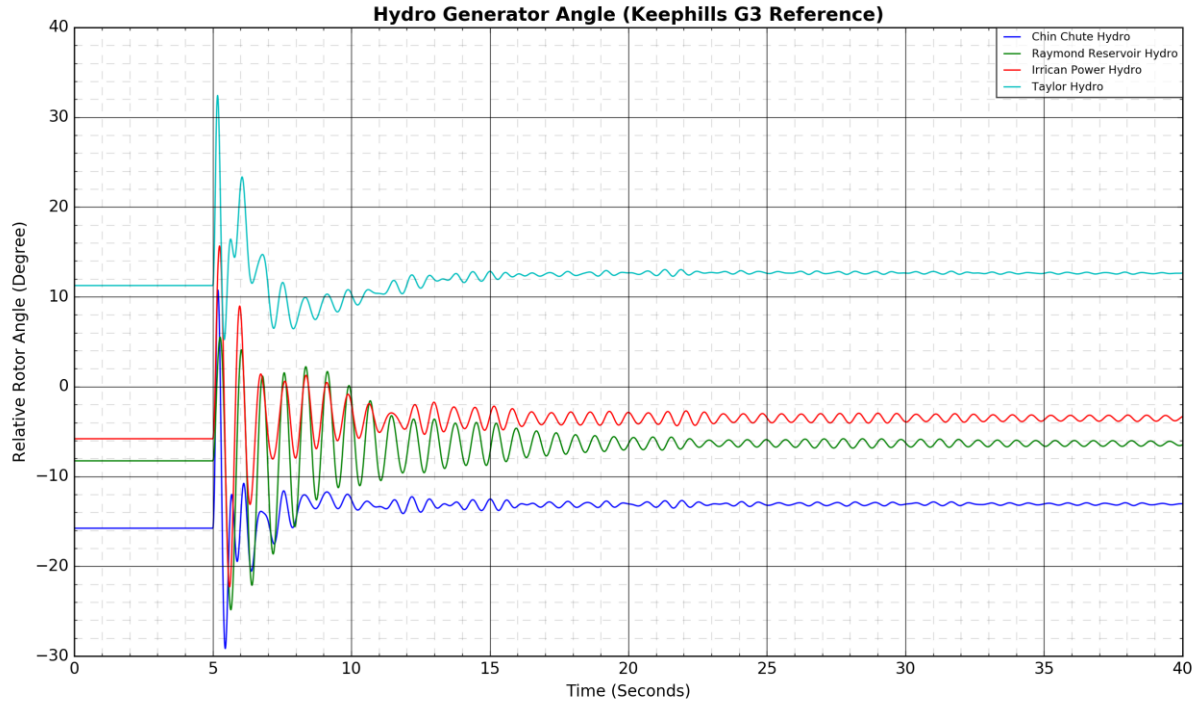
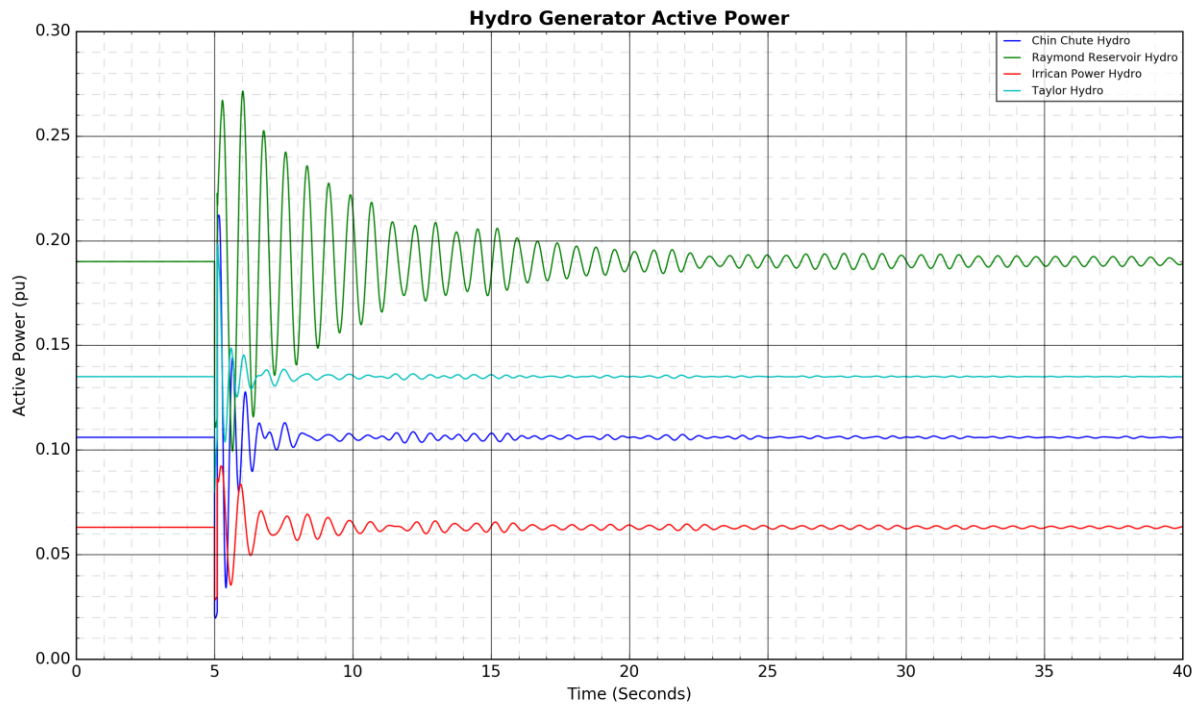
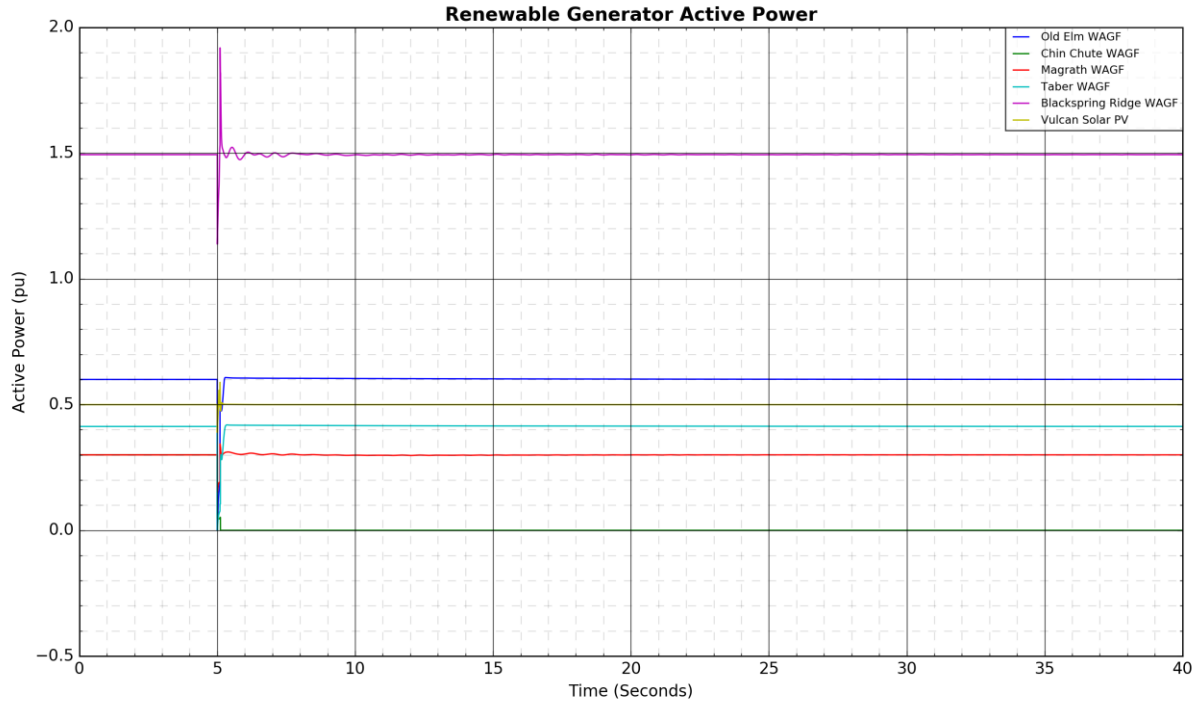


Figure A4-23: 172L Coaldale 254S to Taber 83S: Fault Near Coaldale 254S

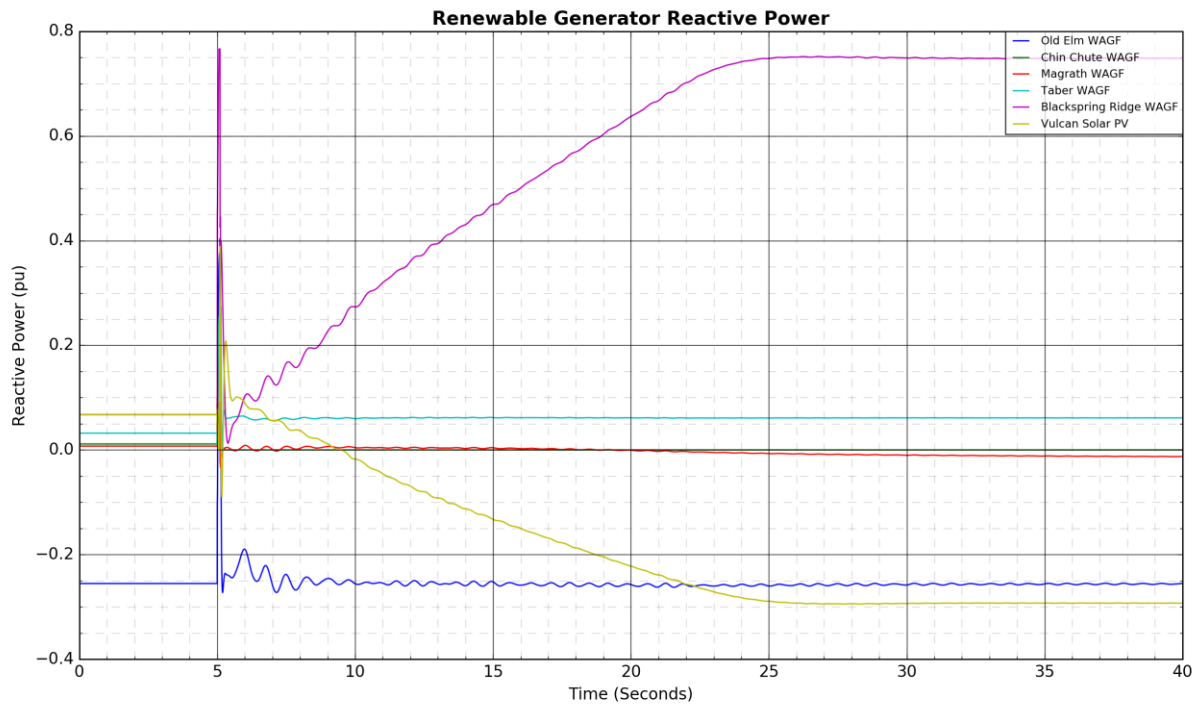
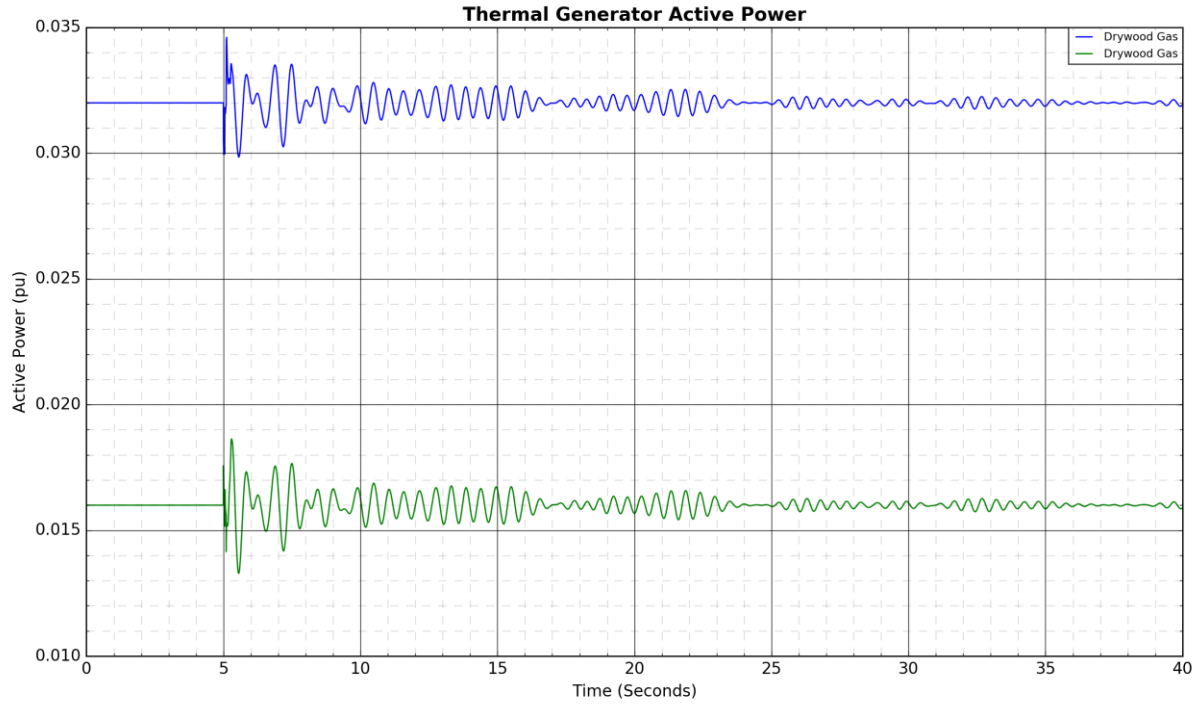


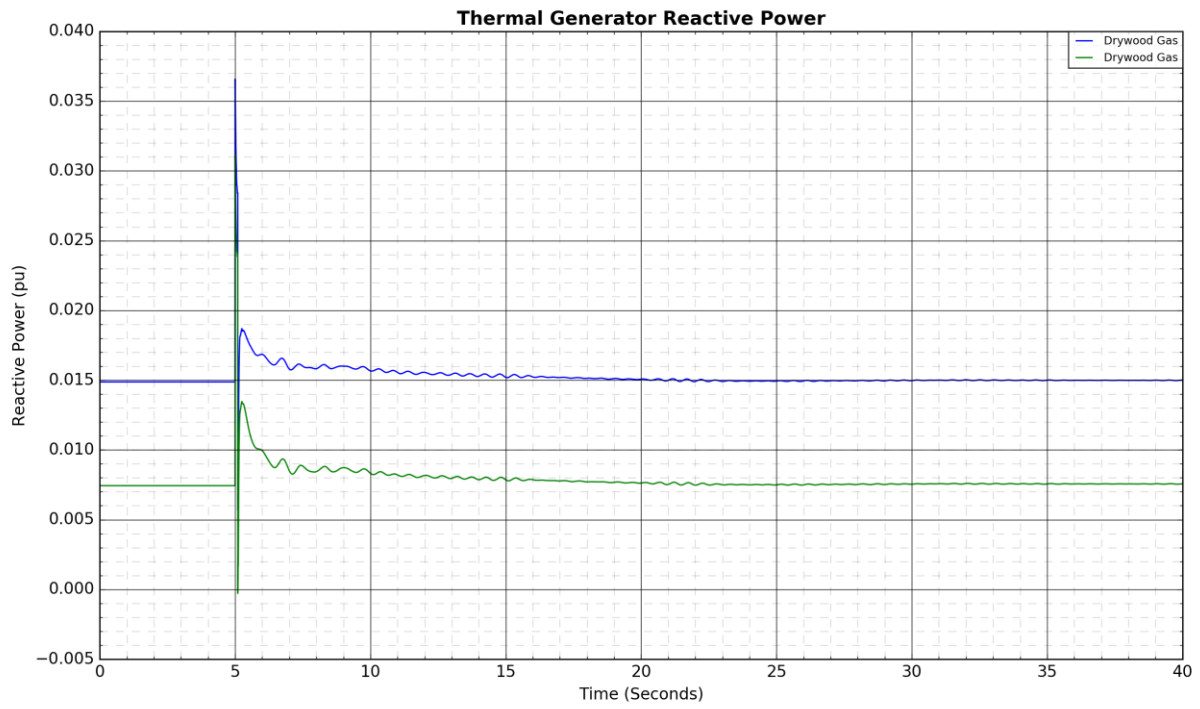
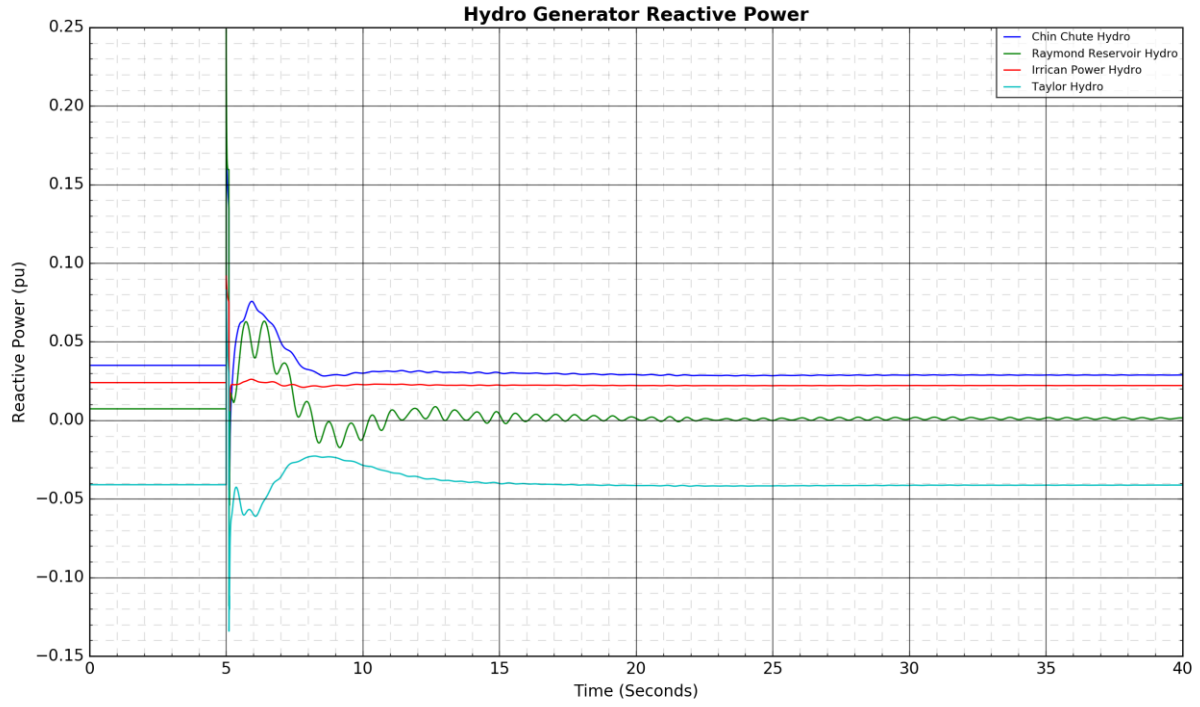


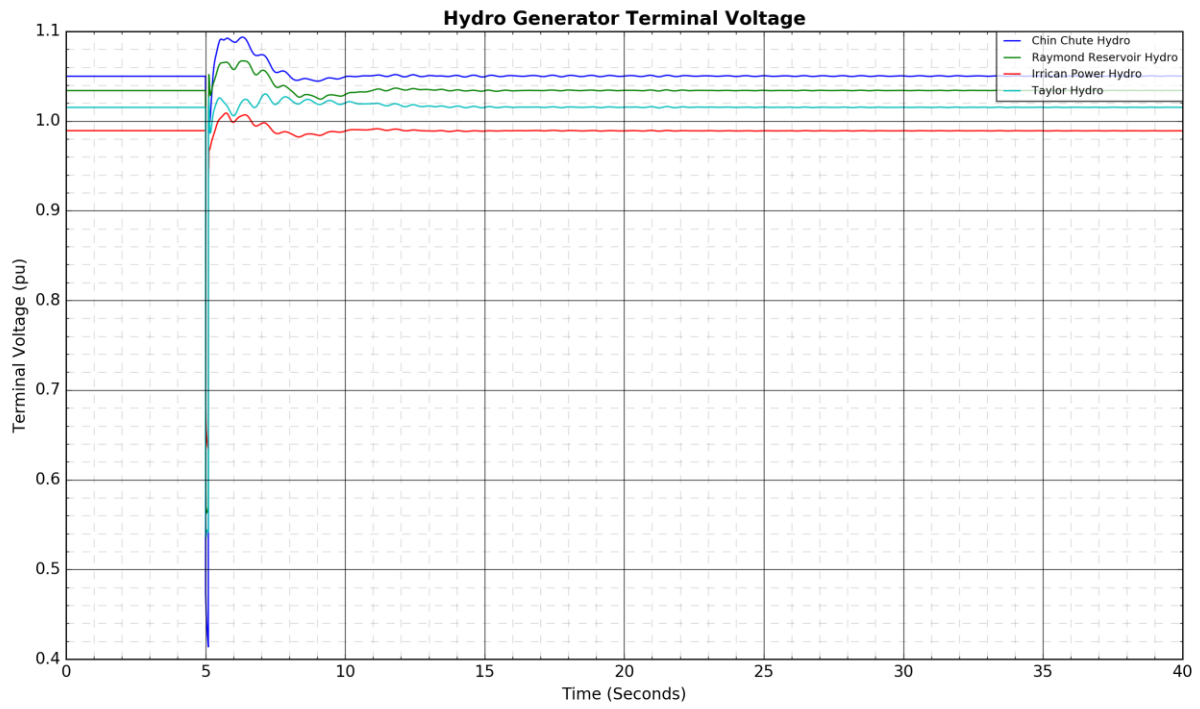
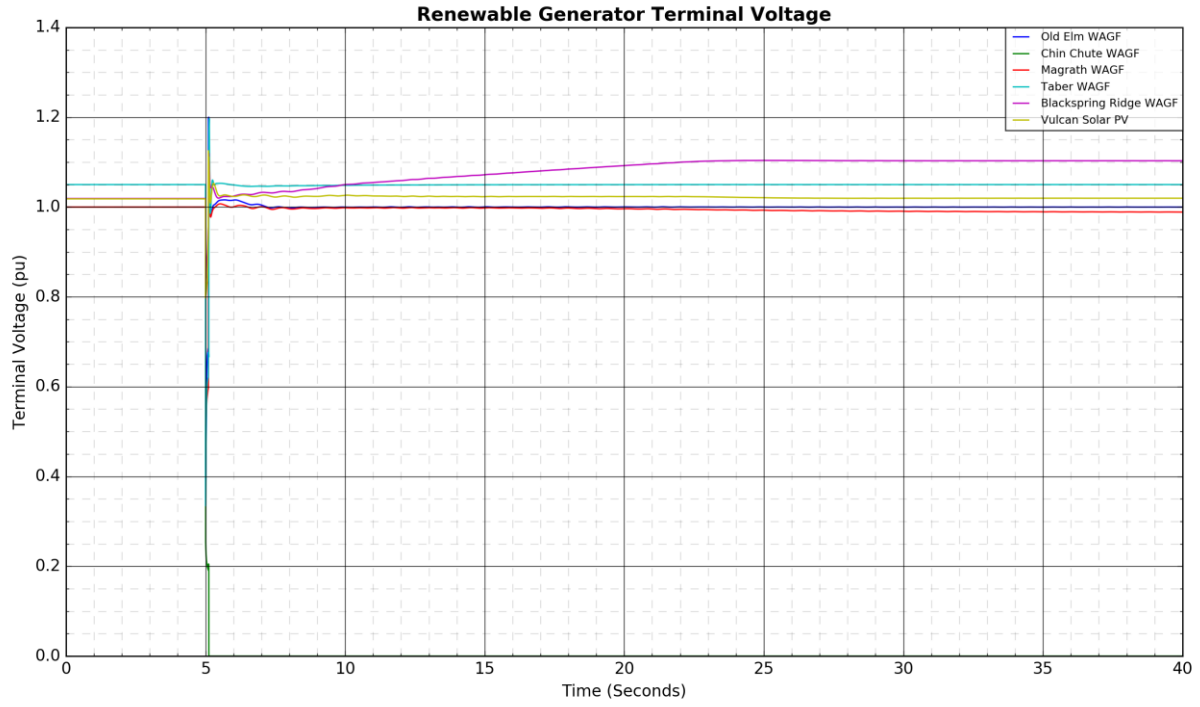
Engineering Connection Assessment Results: Stirling Wind Project Connection

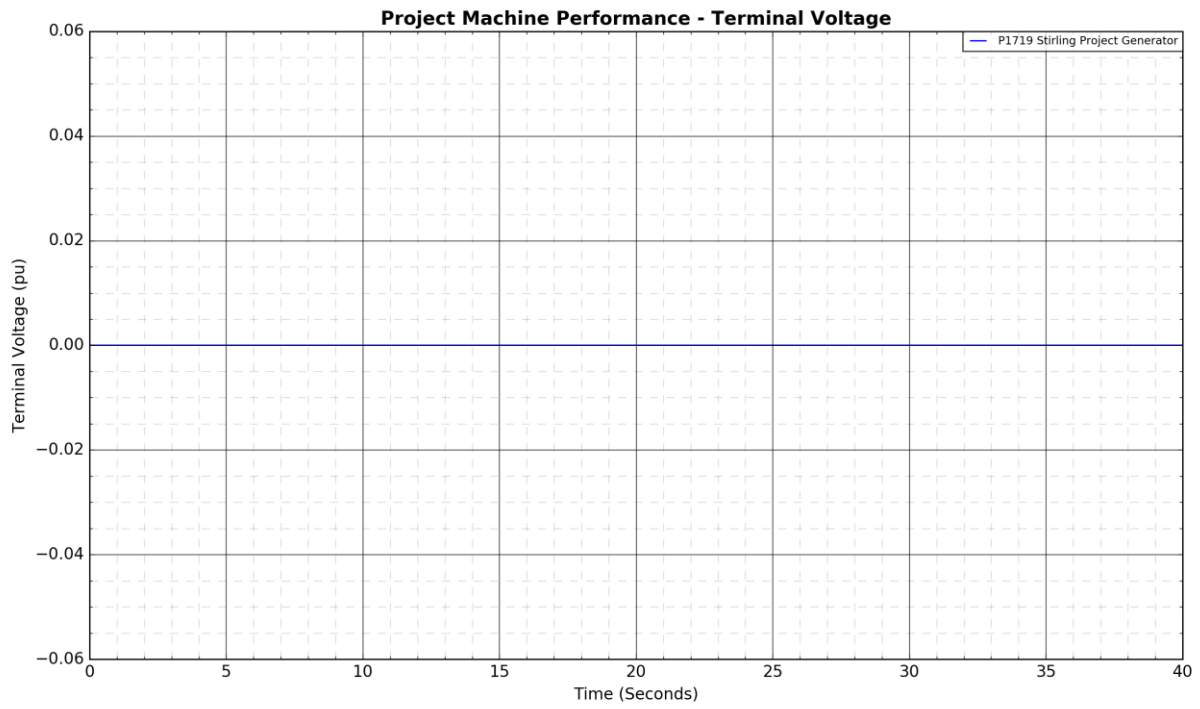
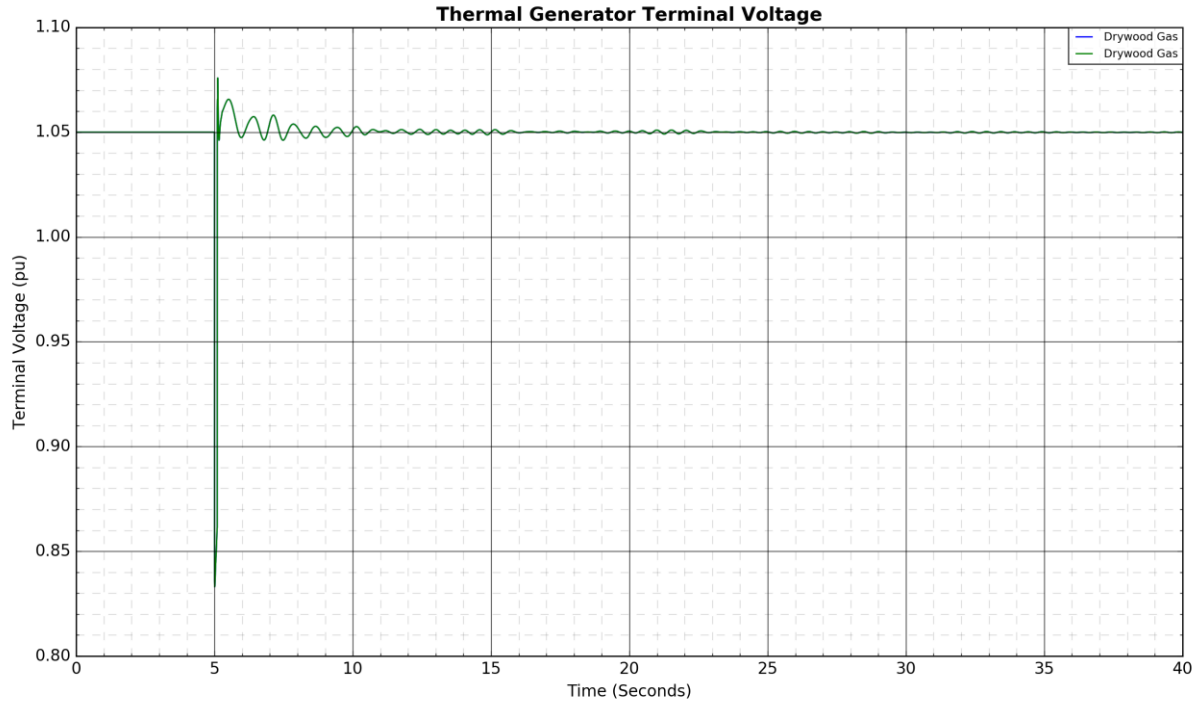


Engineering Connection Assessment Results: Stirling Wind Project Connection









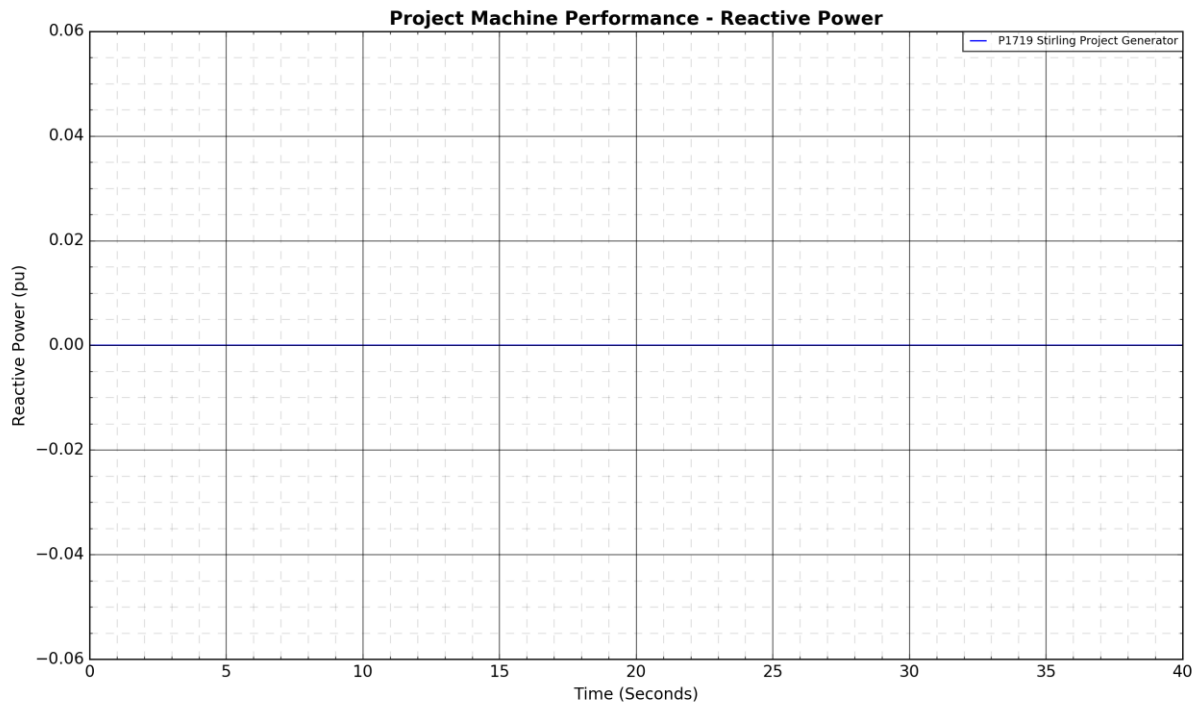
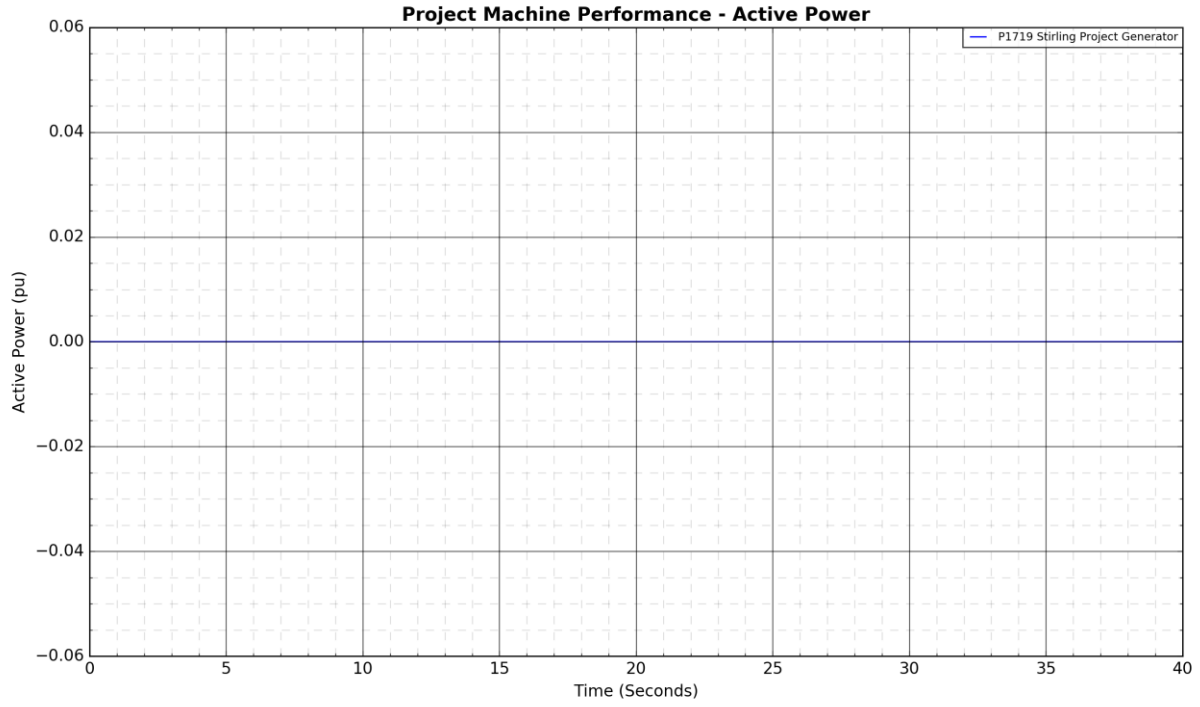
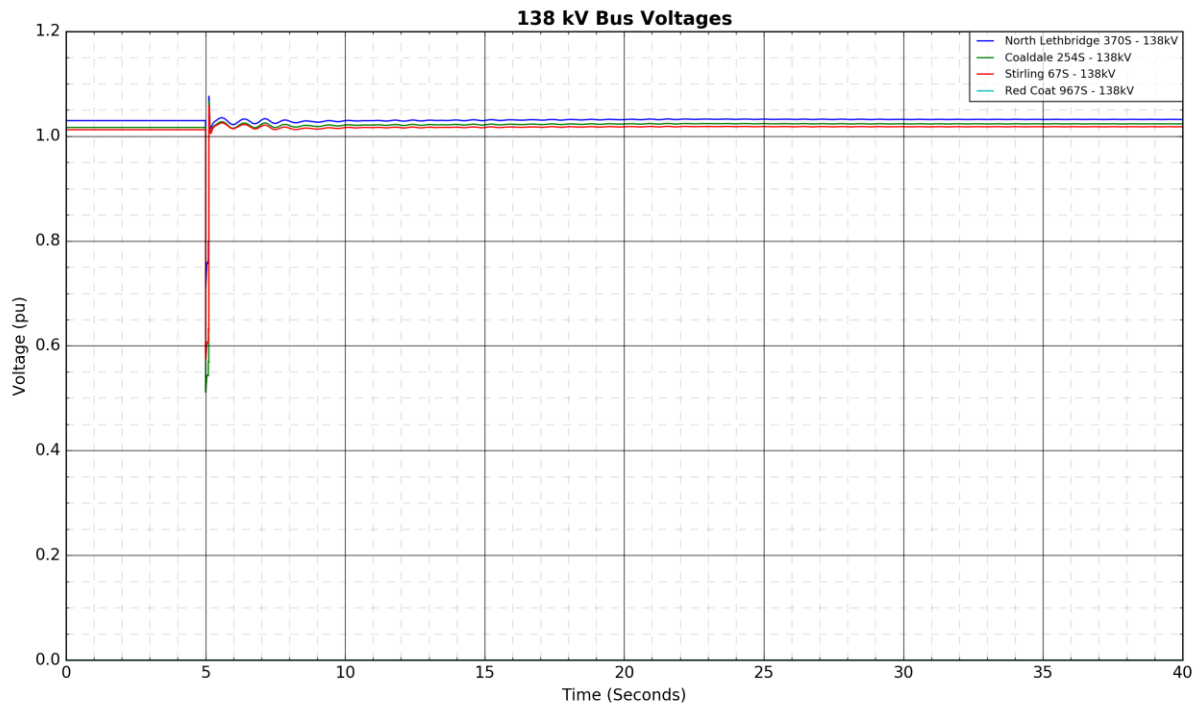
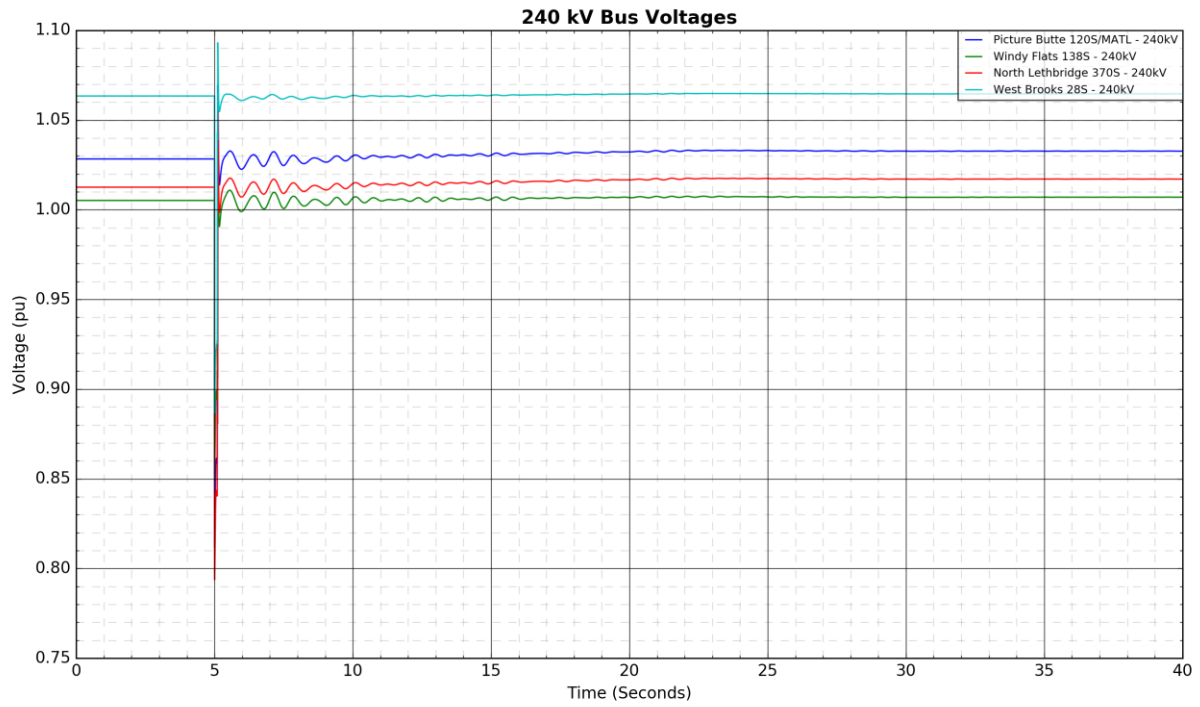
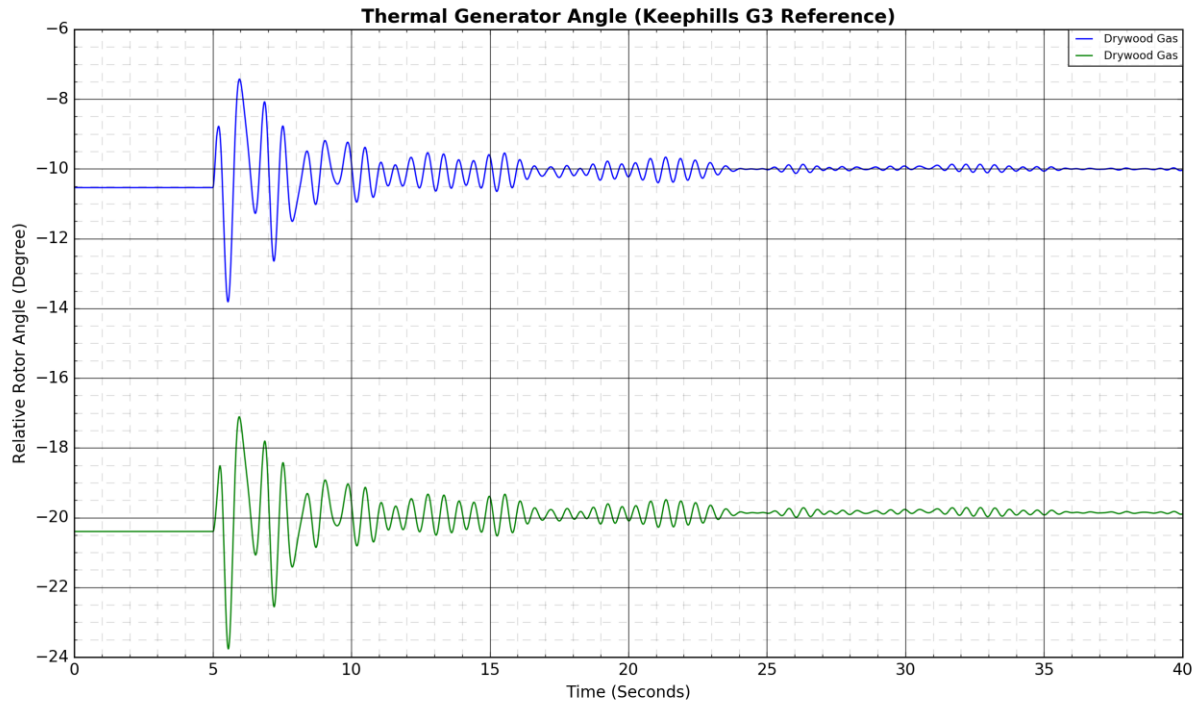
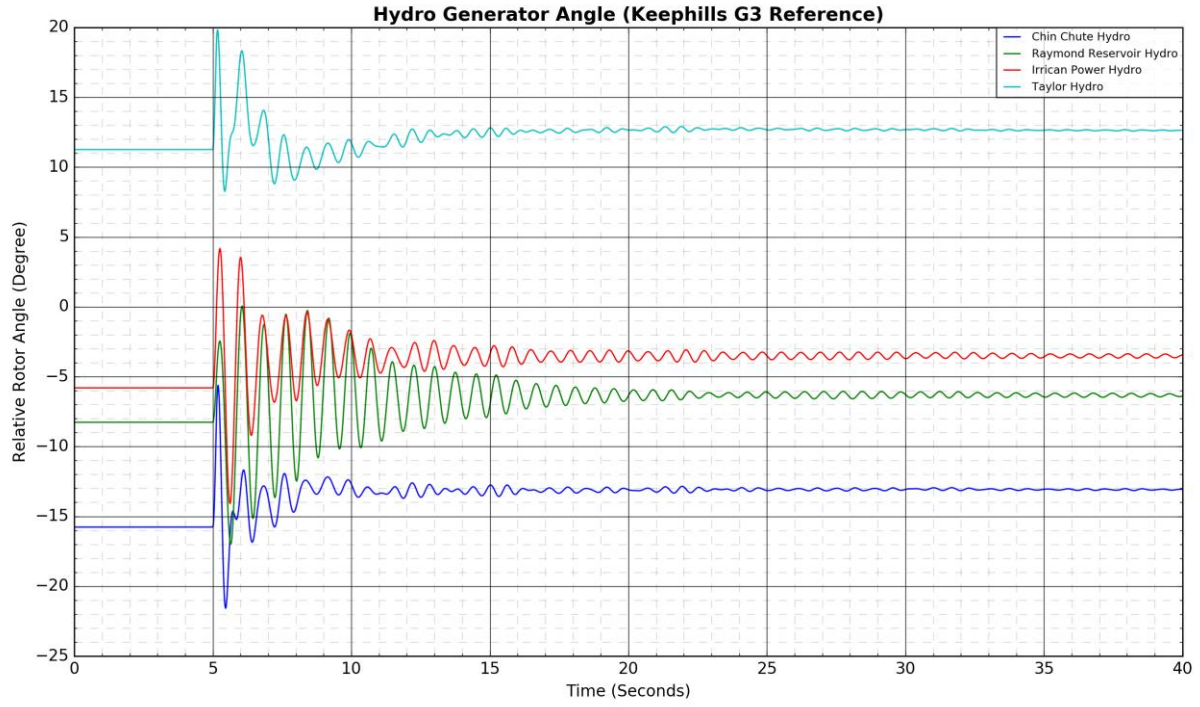
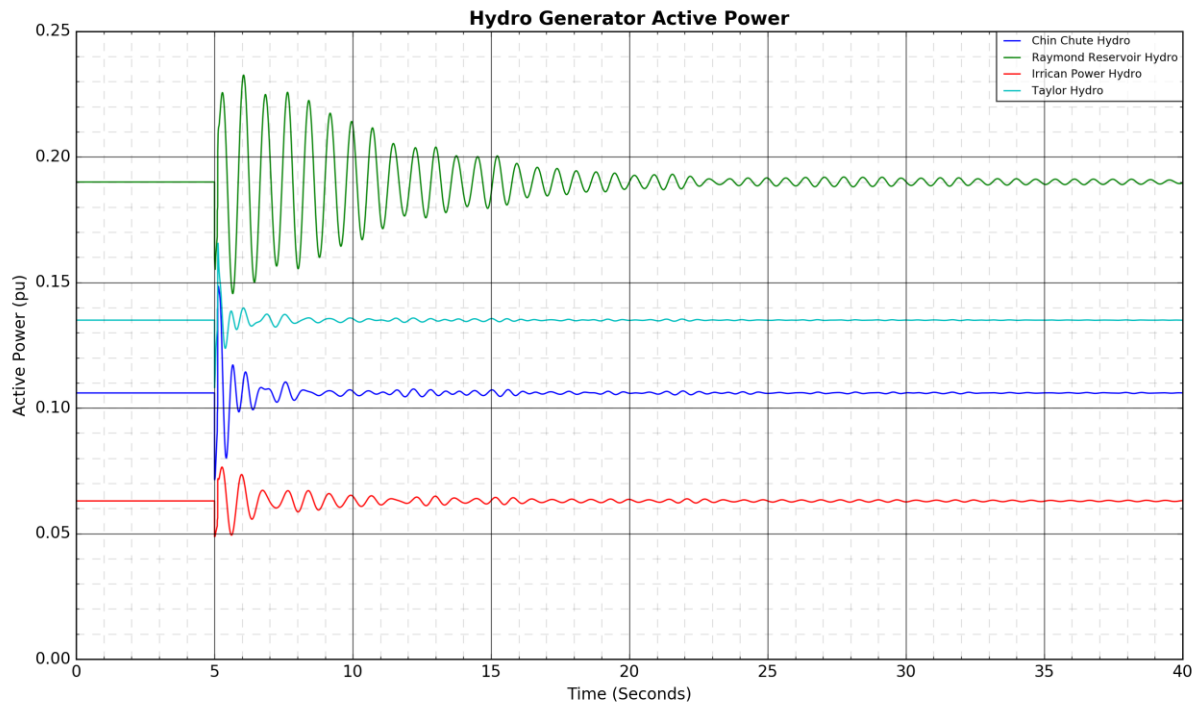
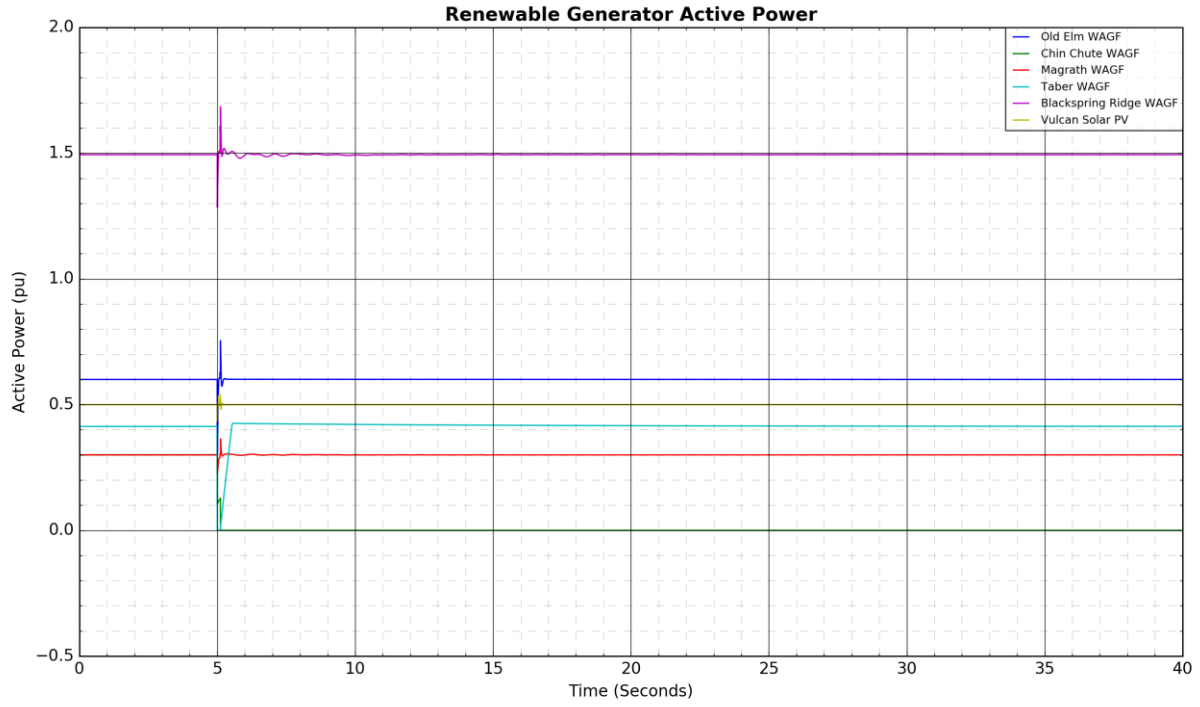


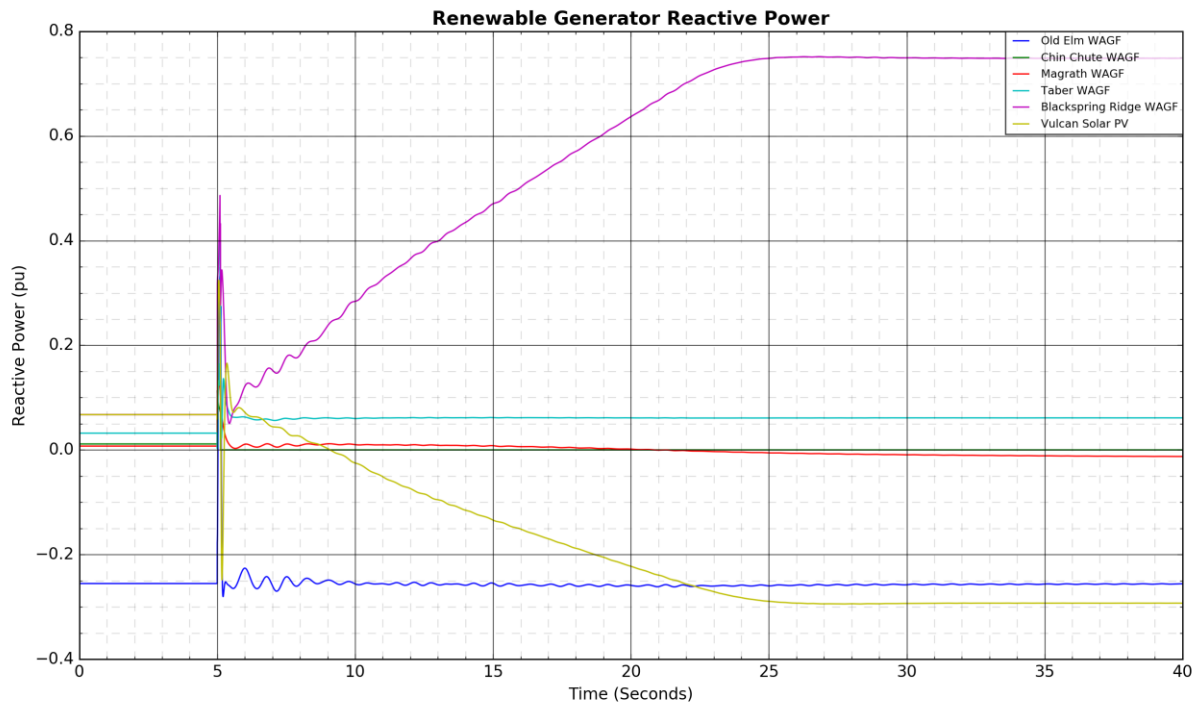
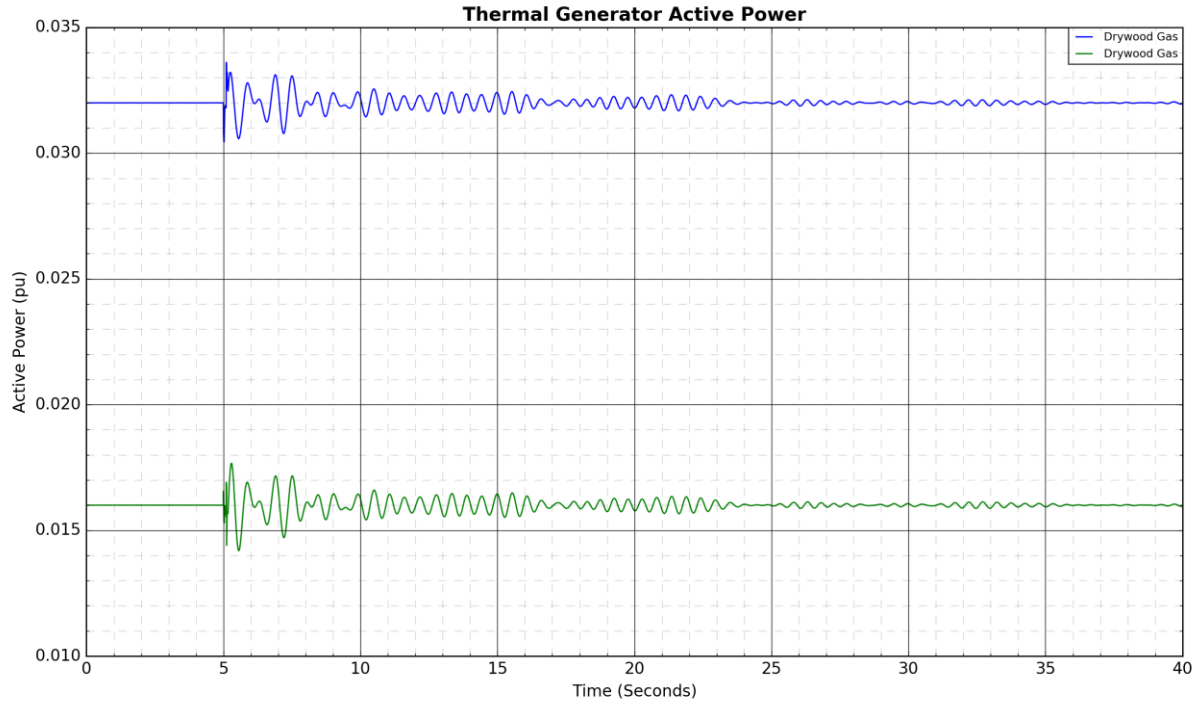
Figure A4-24: 172L Coaldale 254S to Taber 83S: Fault Near Taber 83S

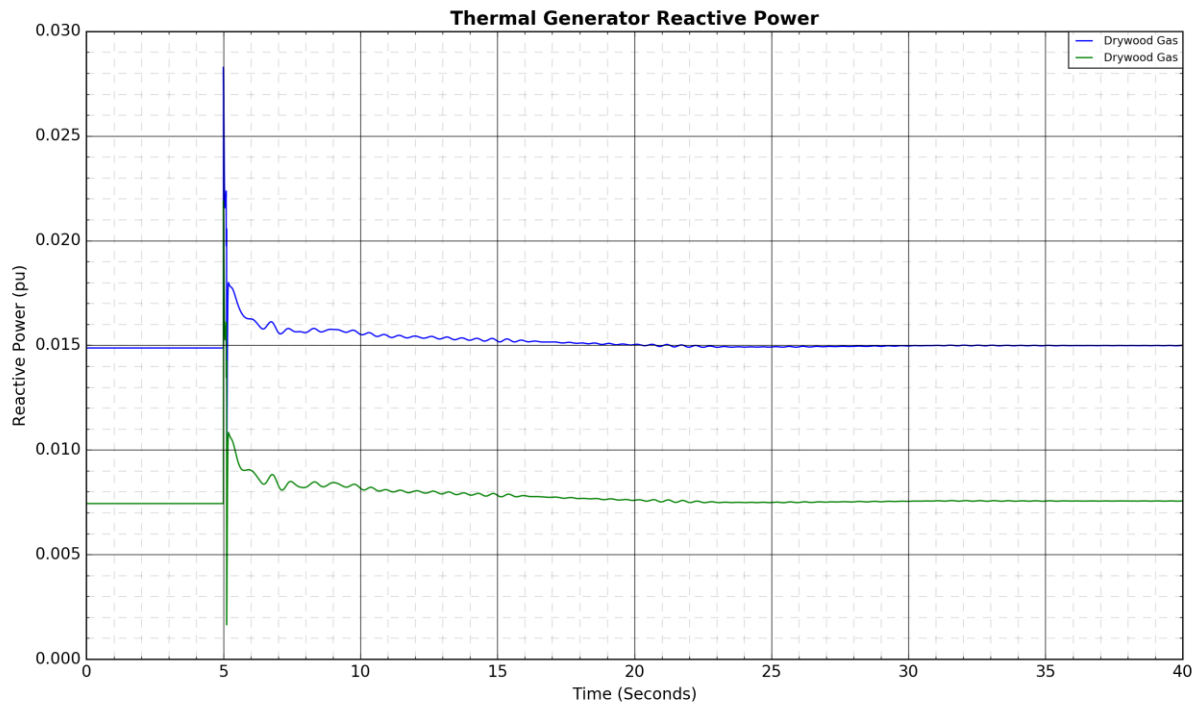
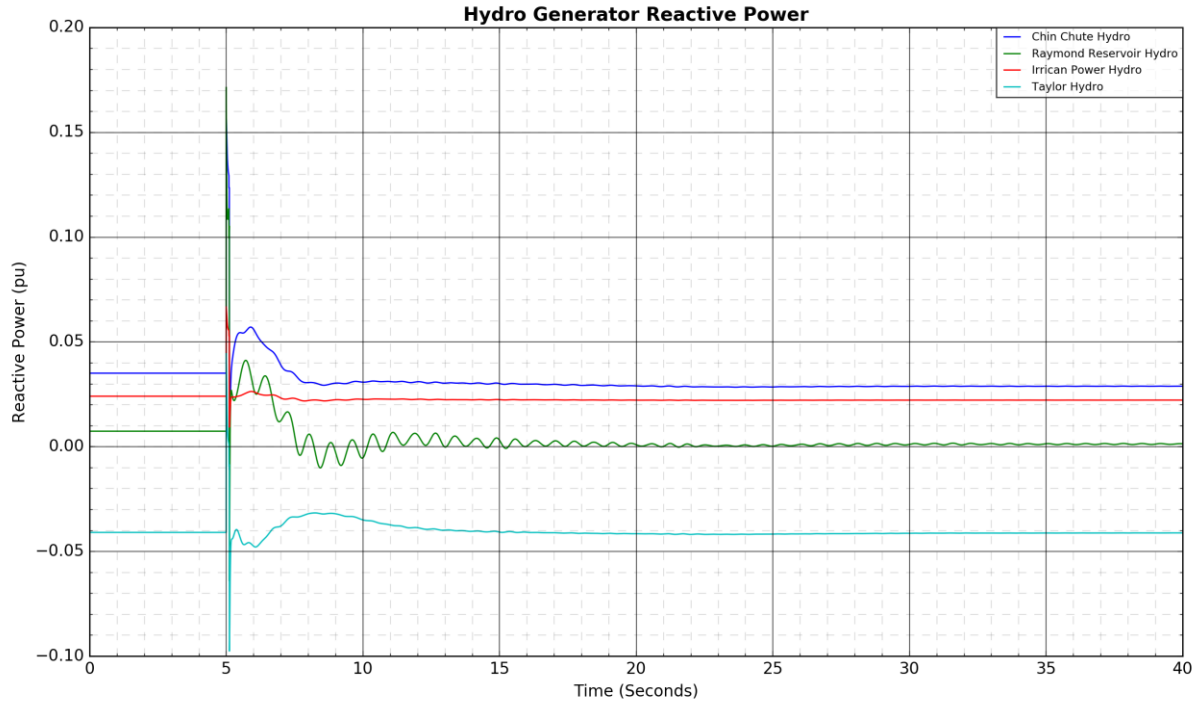


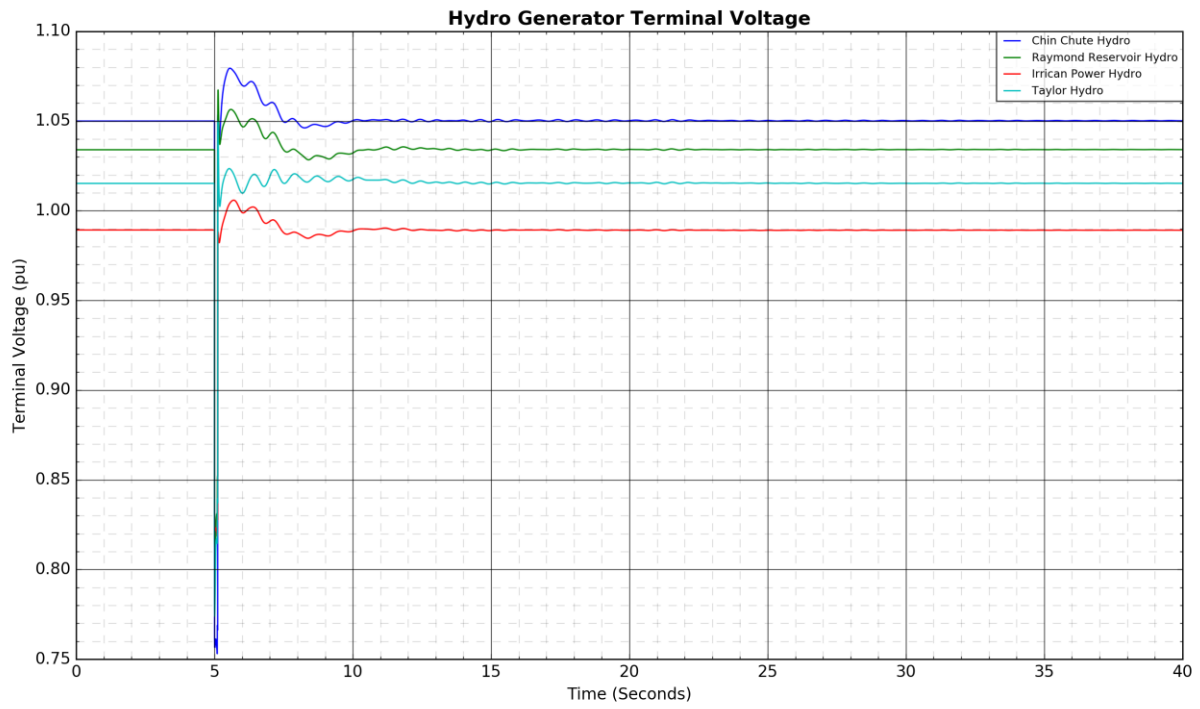
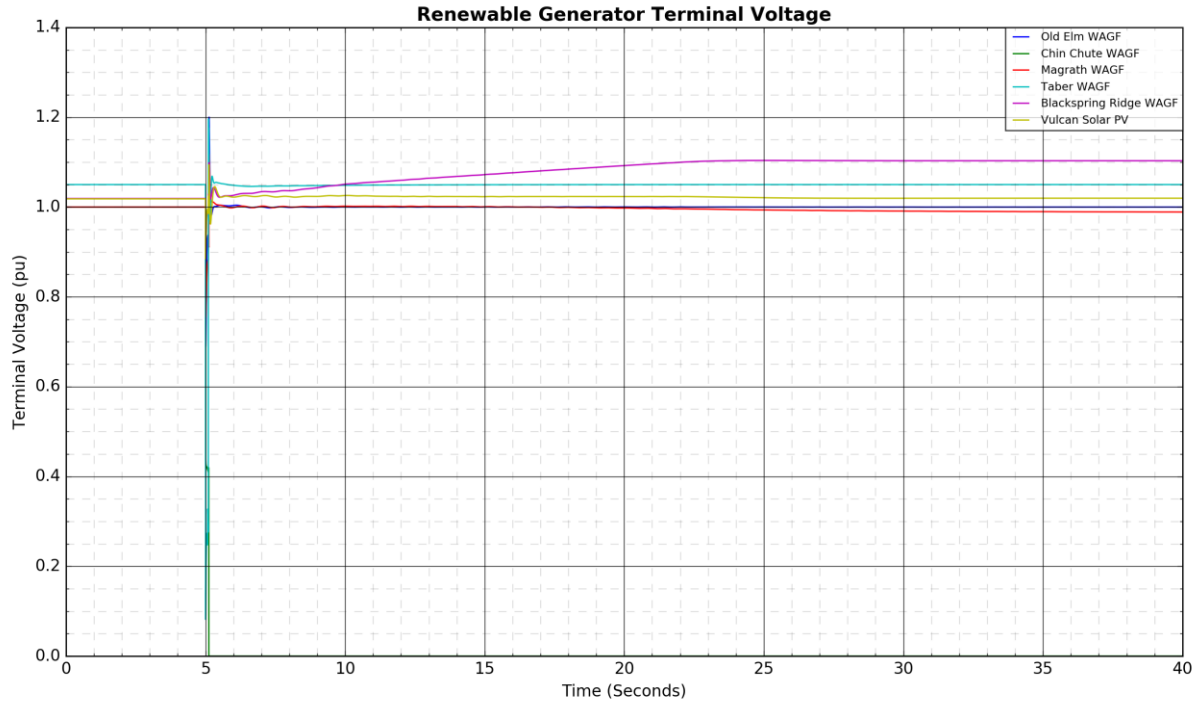


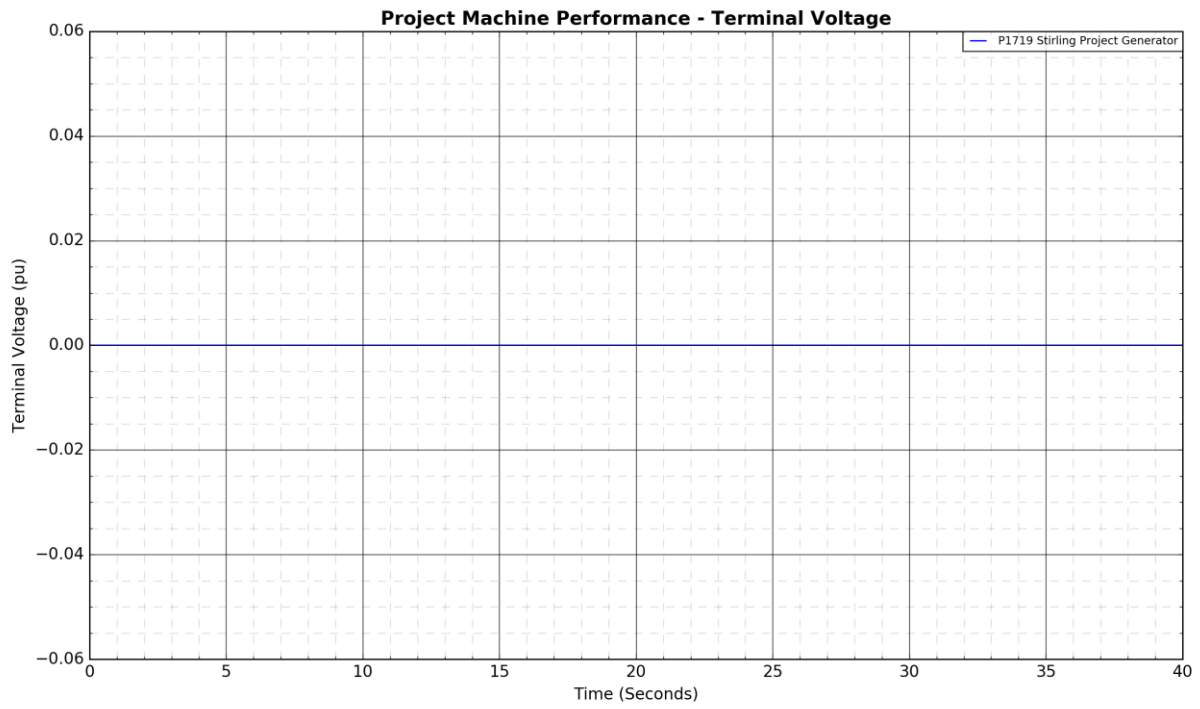
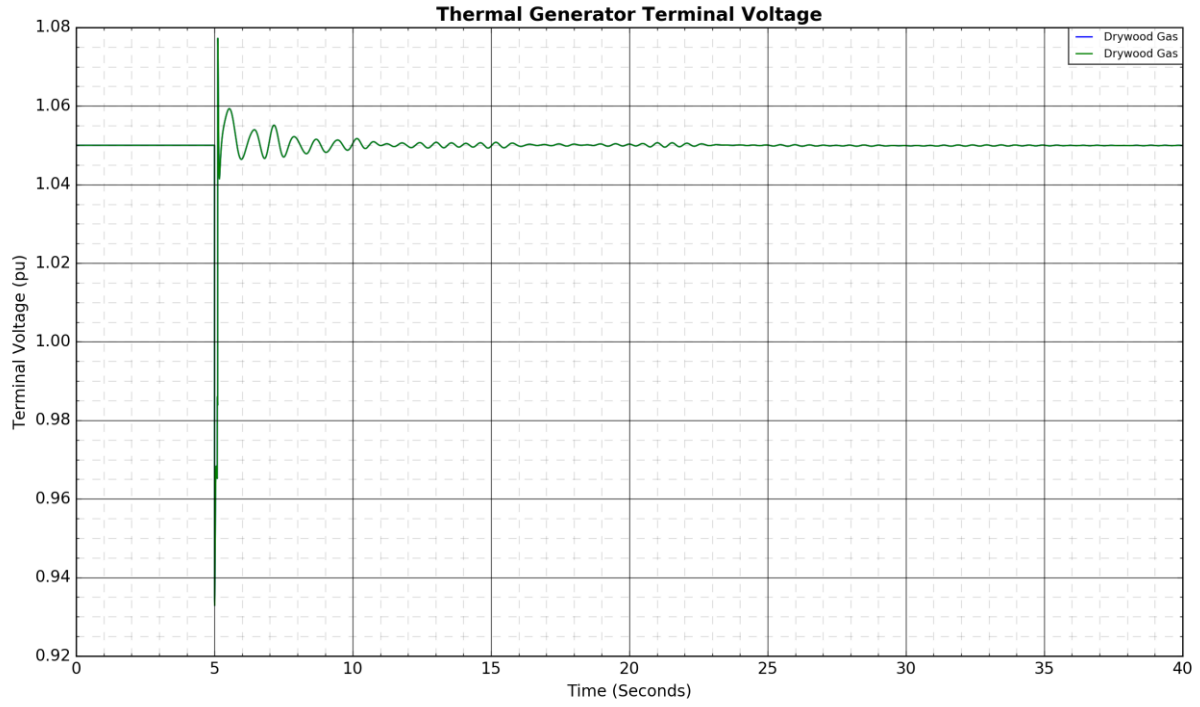
Engineering Connection Assessment Results: Stirling Wind Project Connection











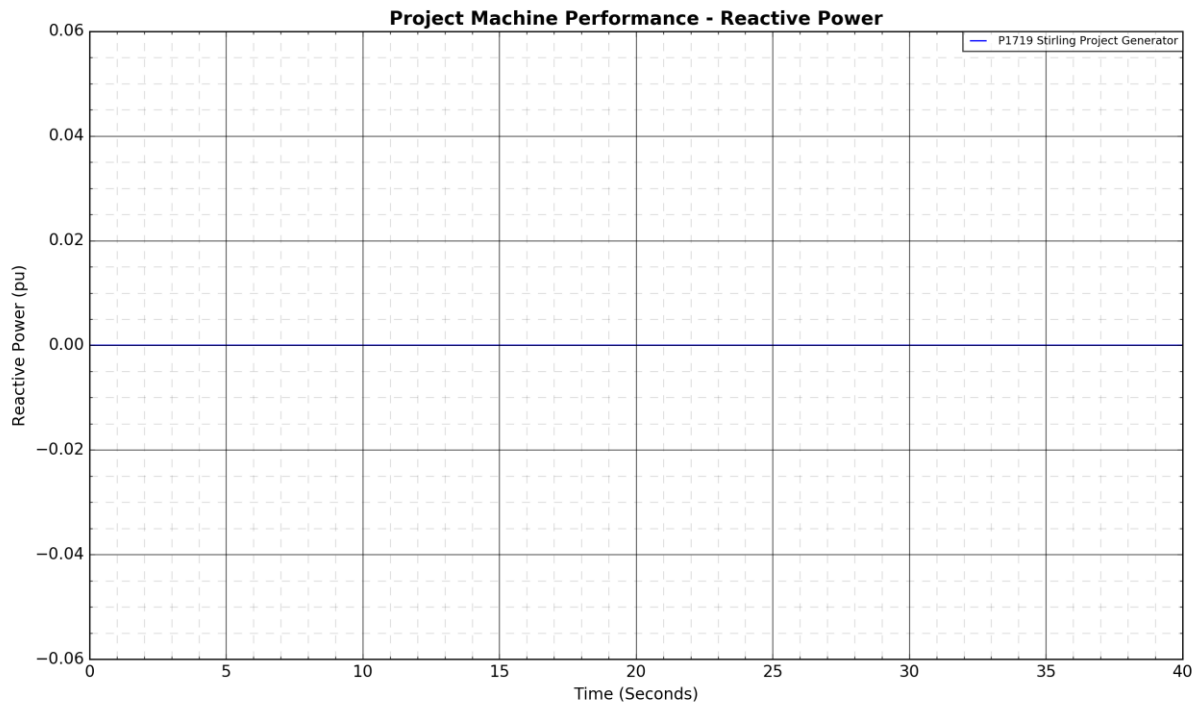
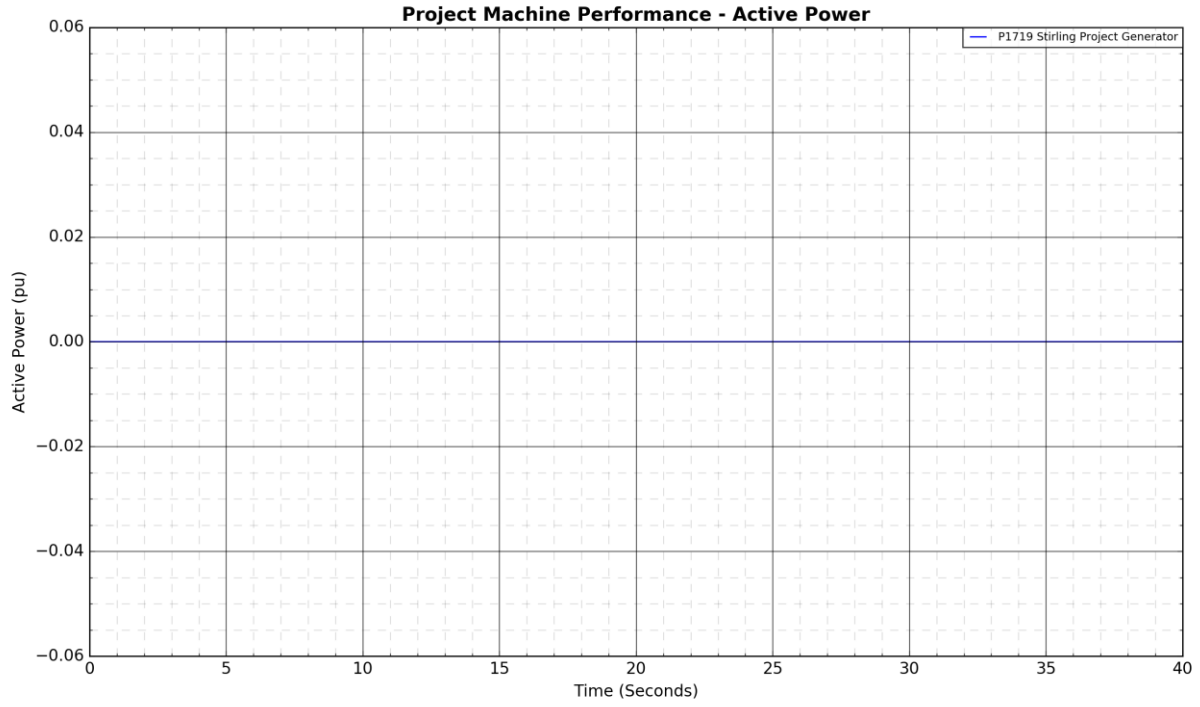
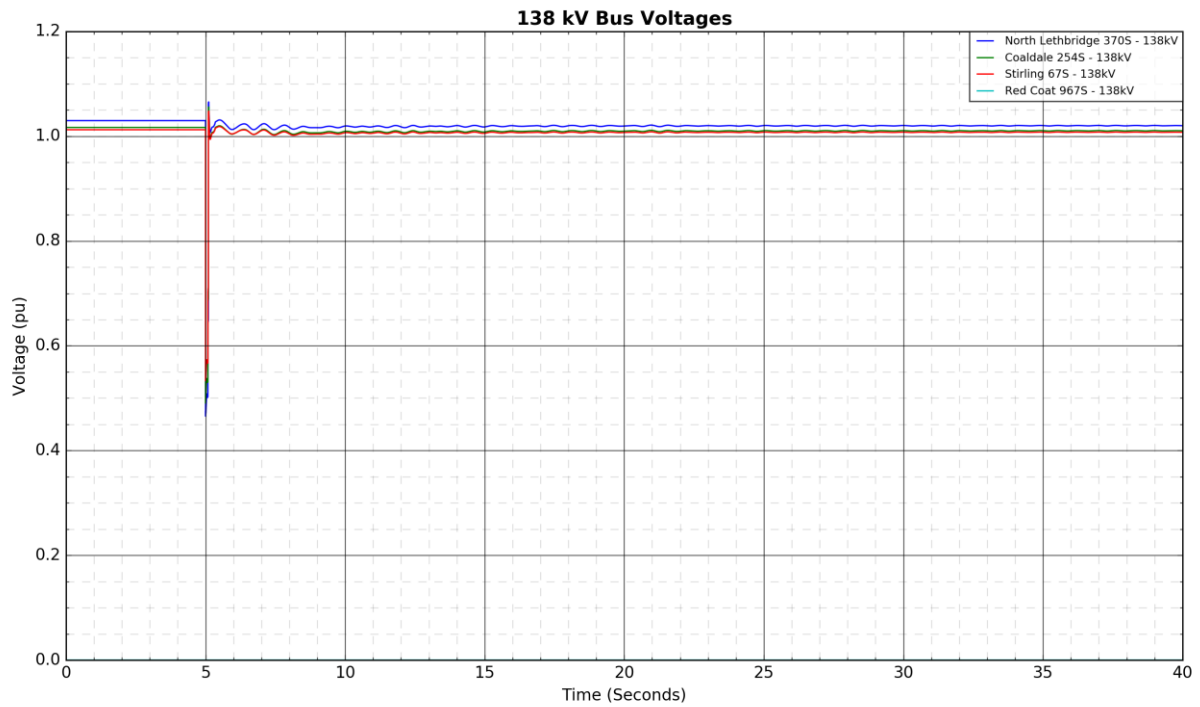
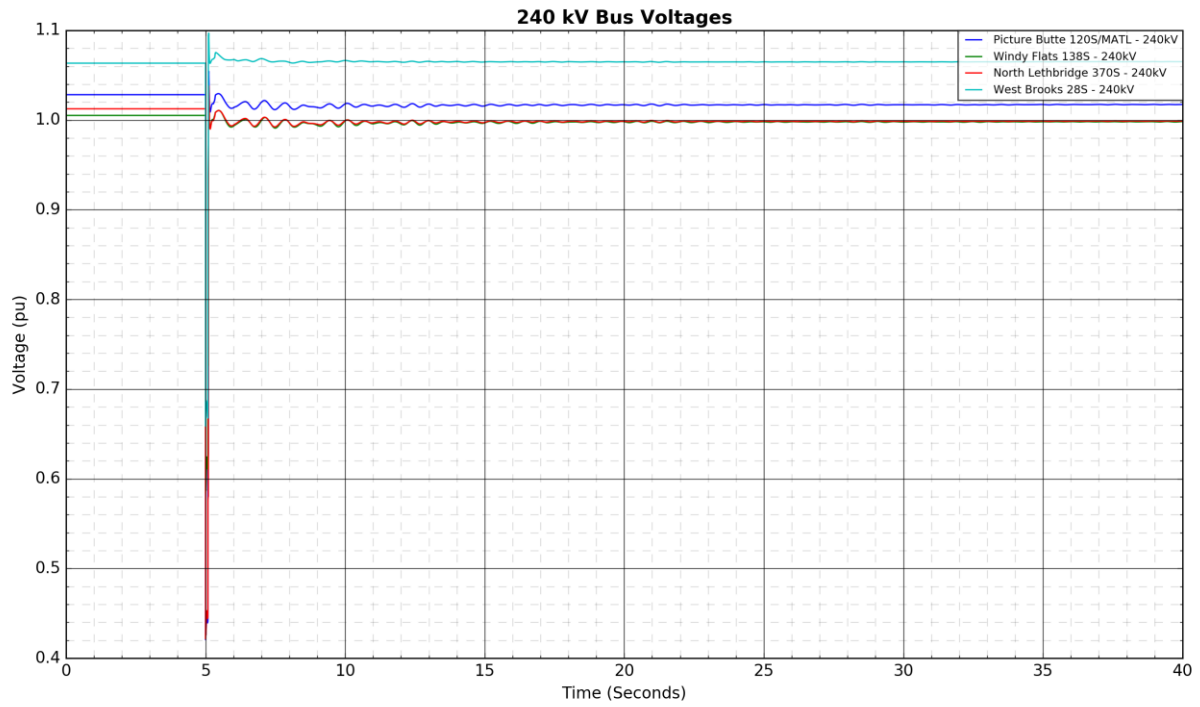
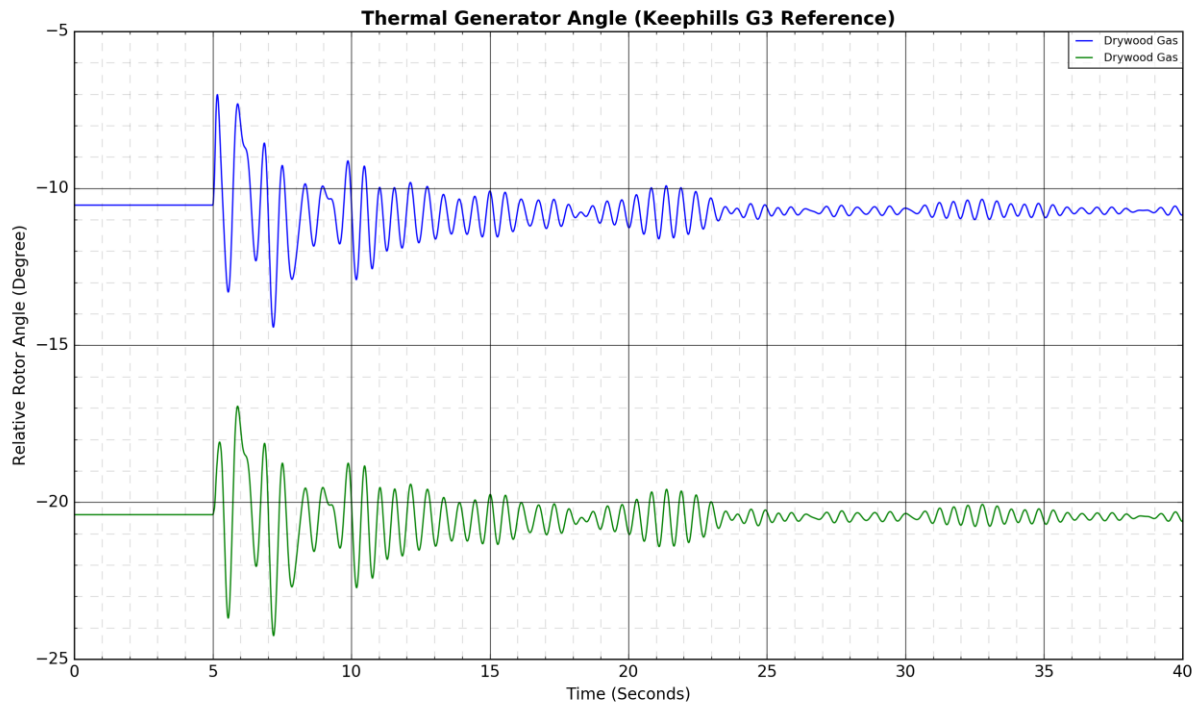
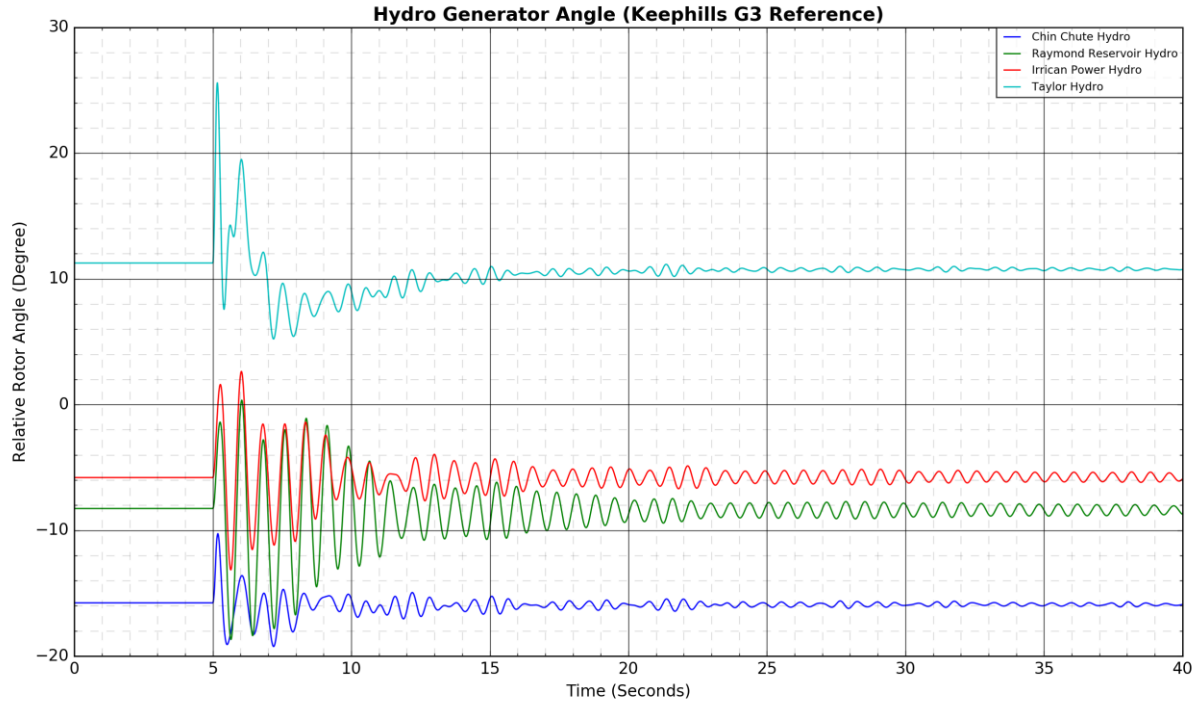
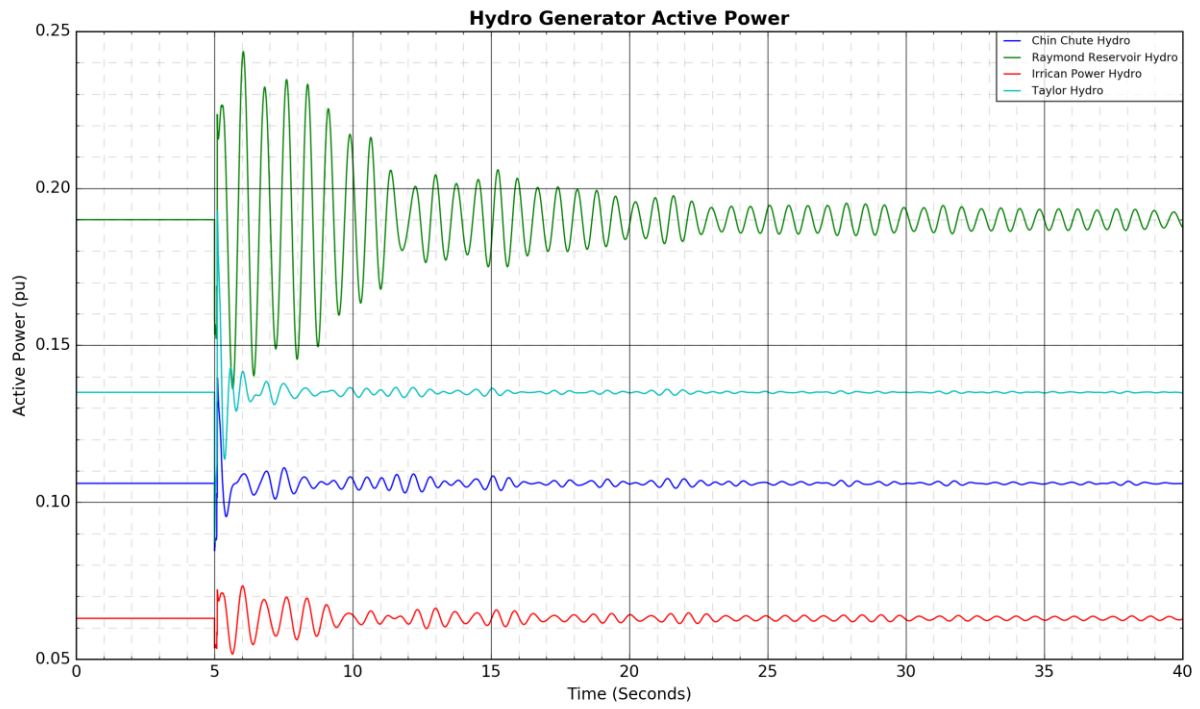
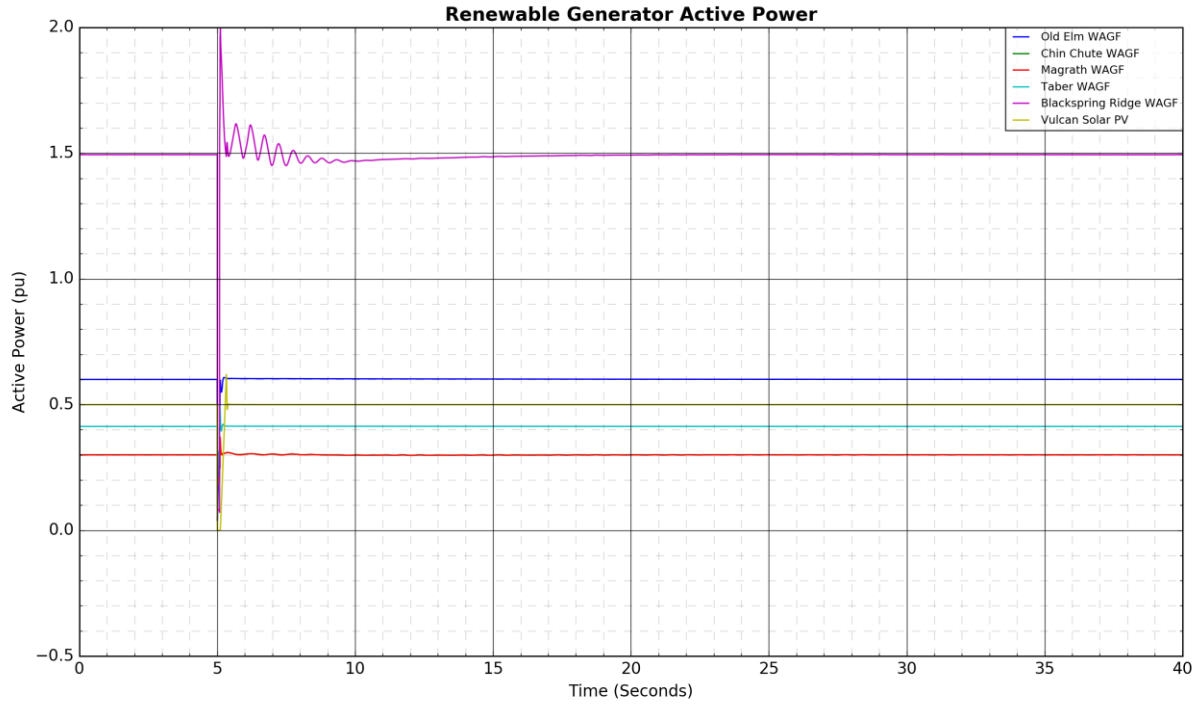


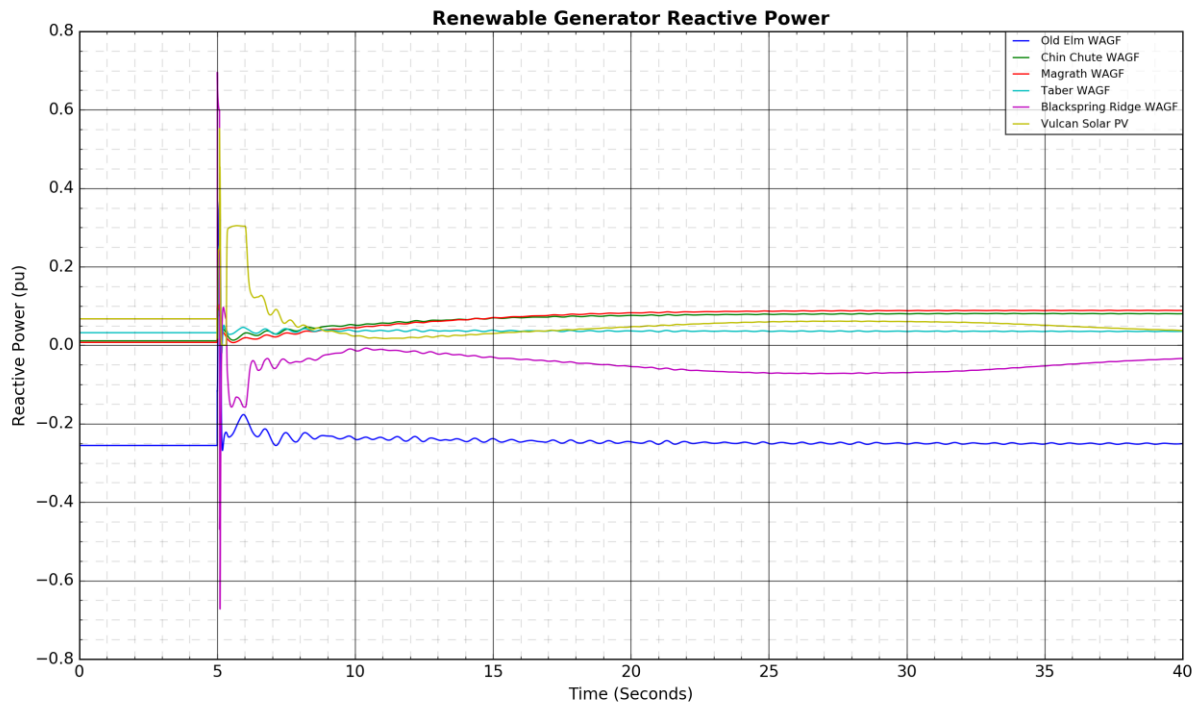
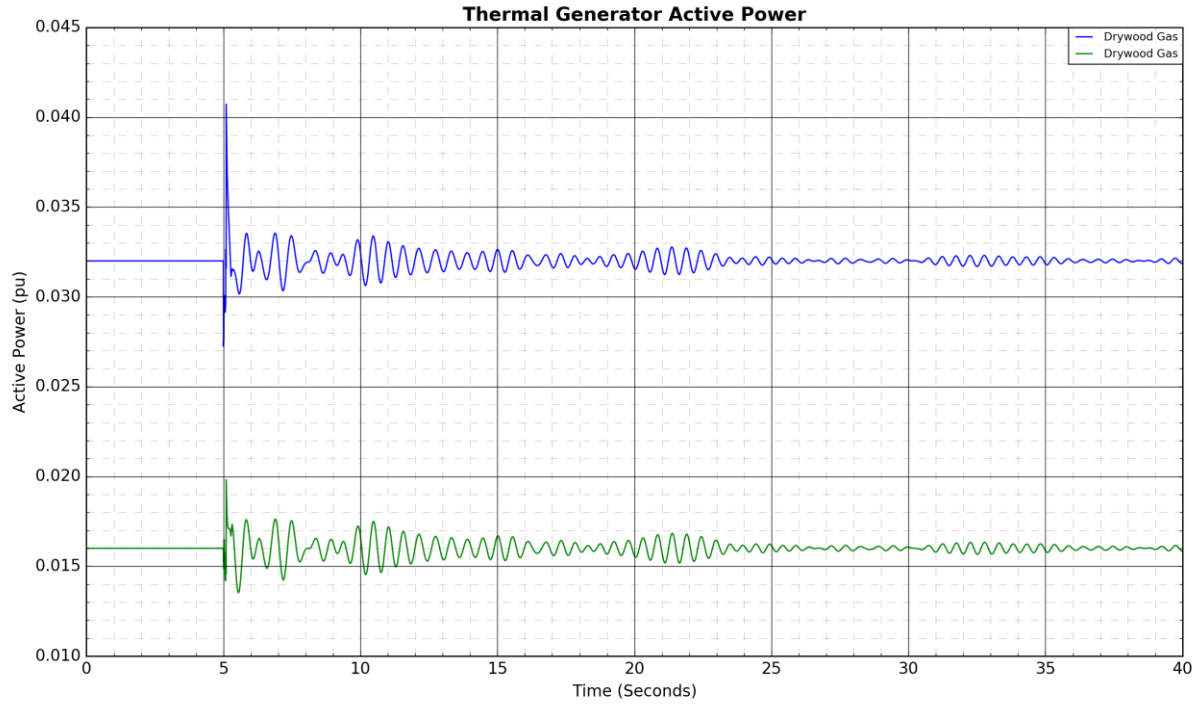
Figure A4-25: 1041L Travers 554S to North Lethbridge 370S: Fault Near Travers 554S

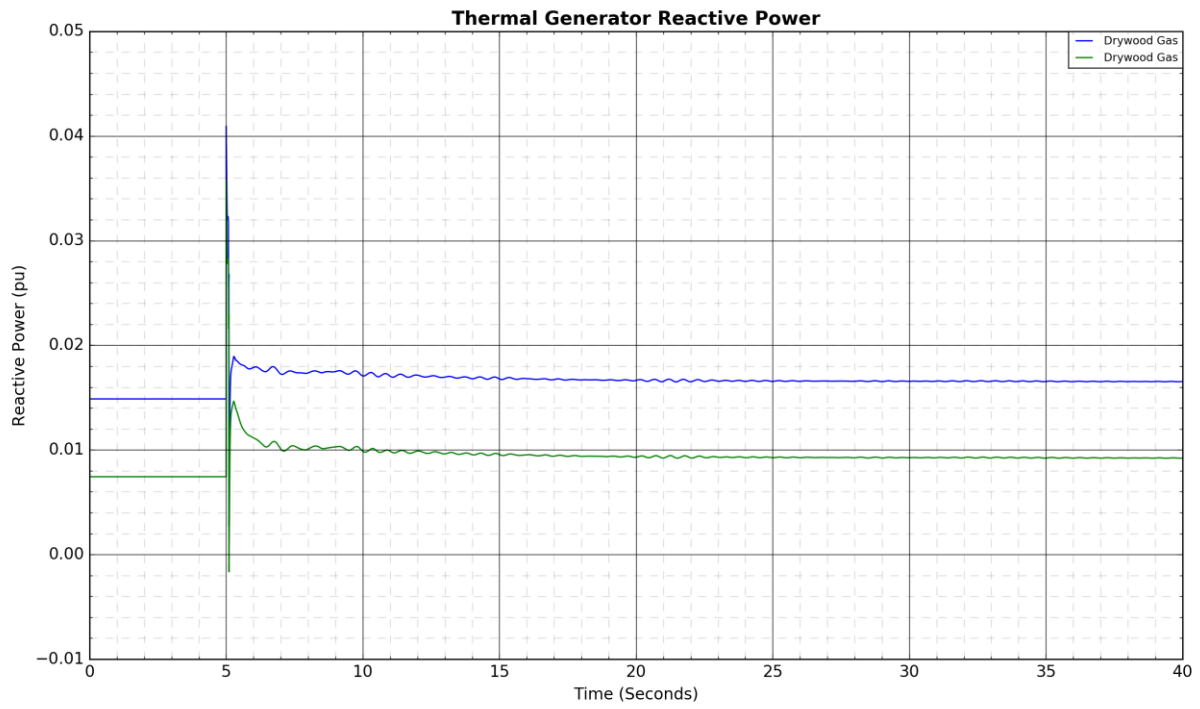
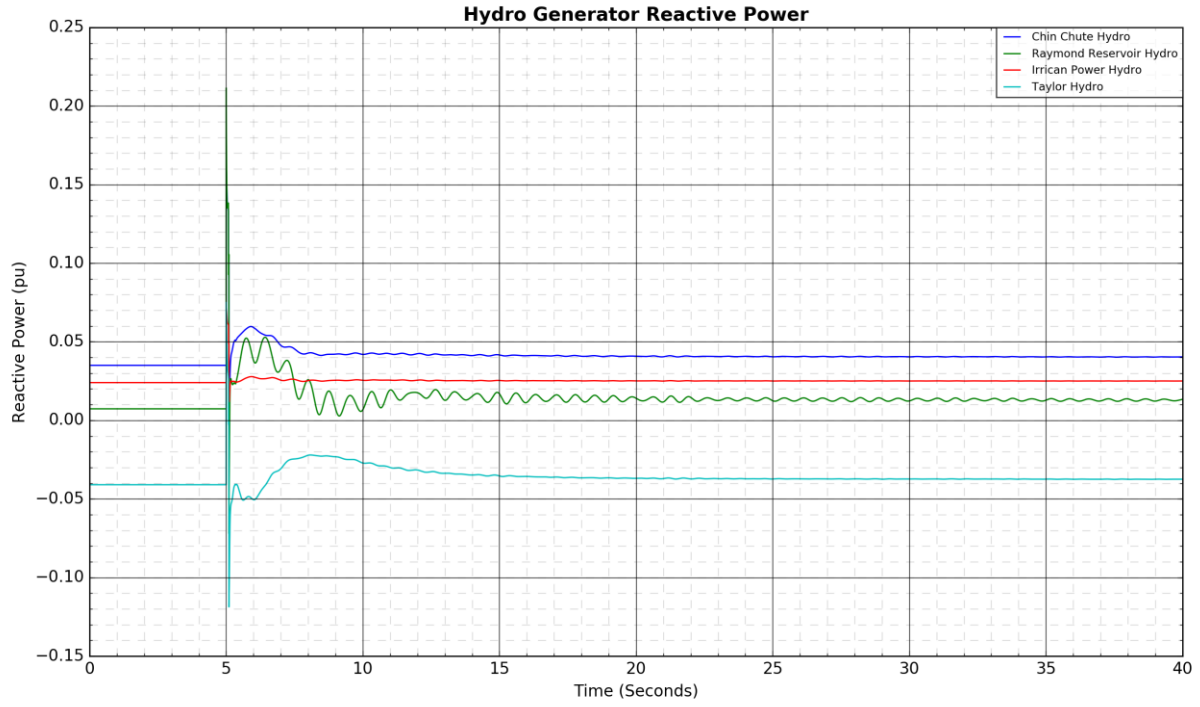


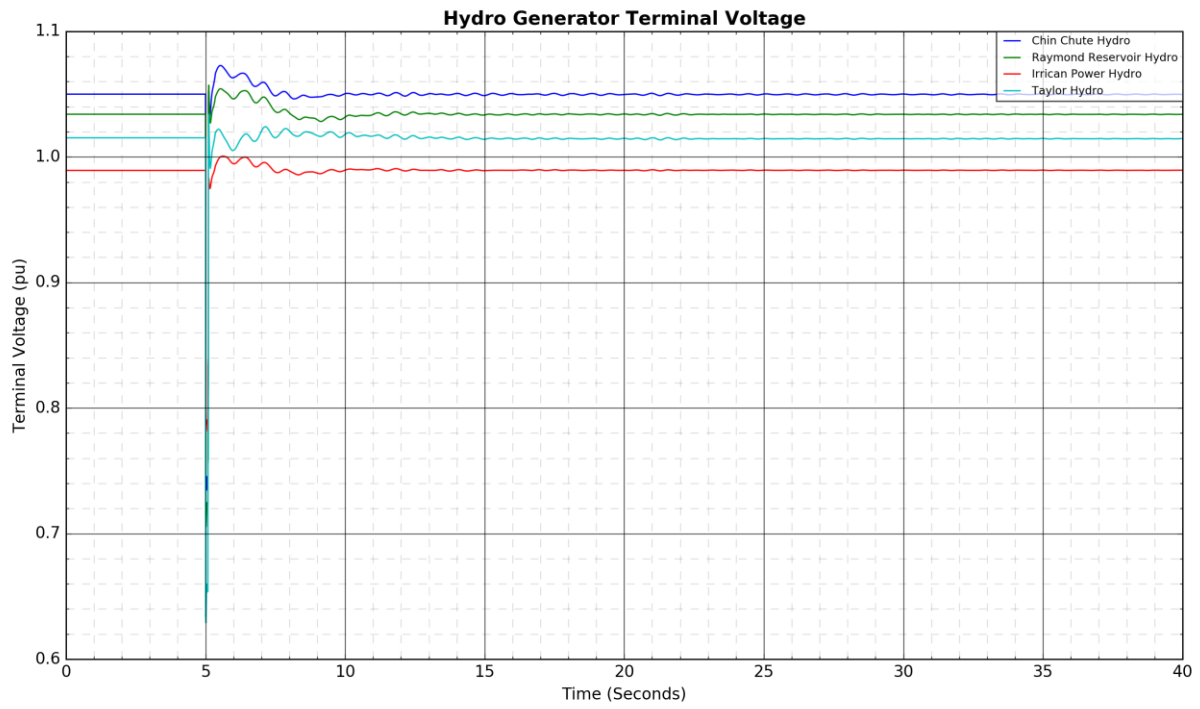
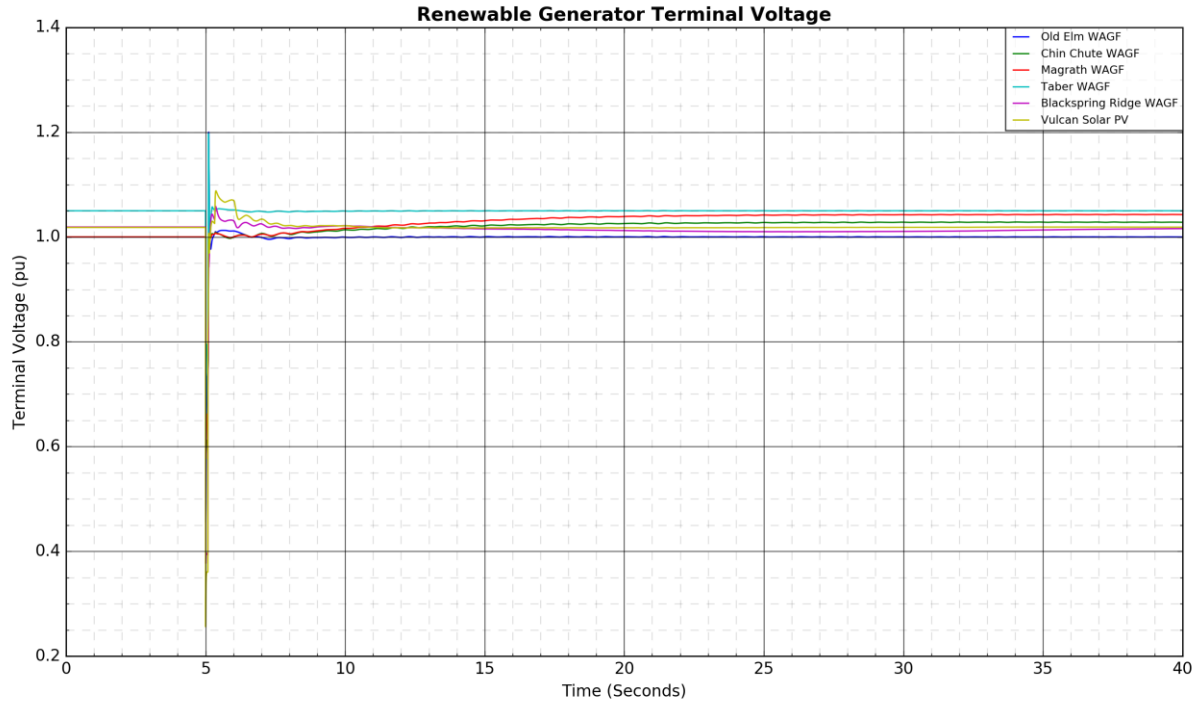


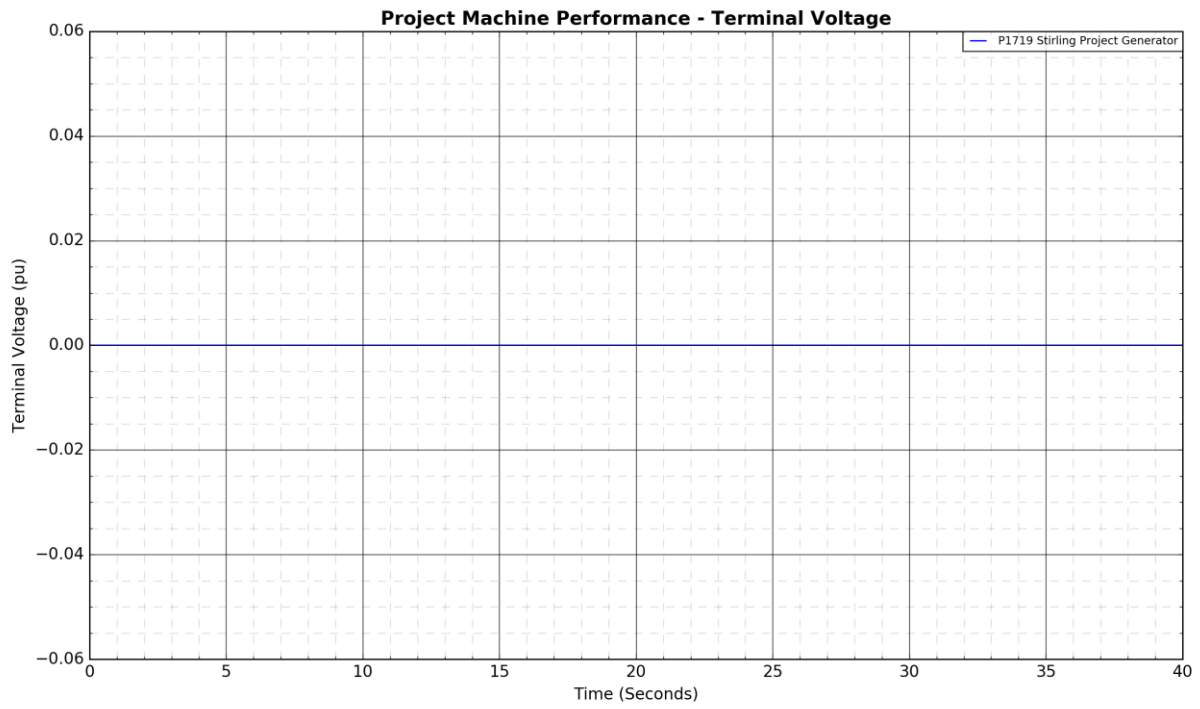
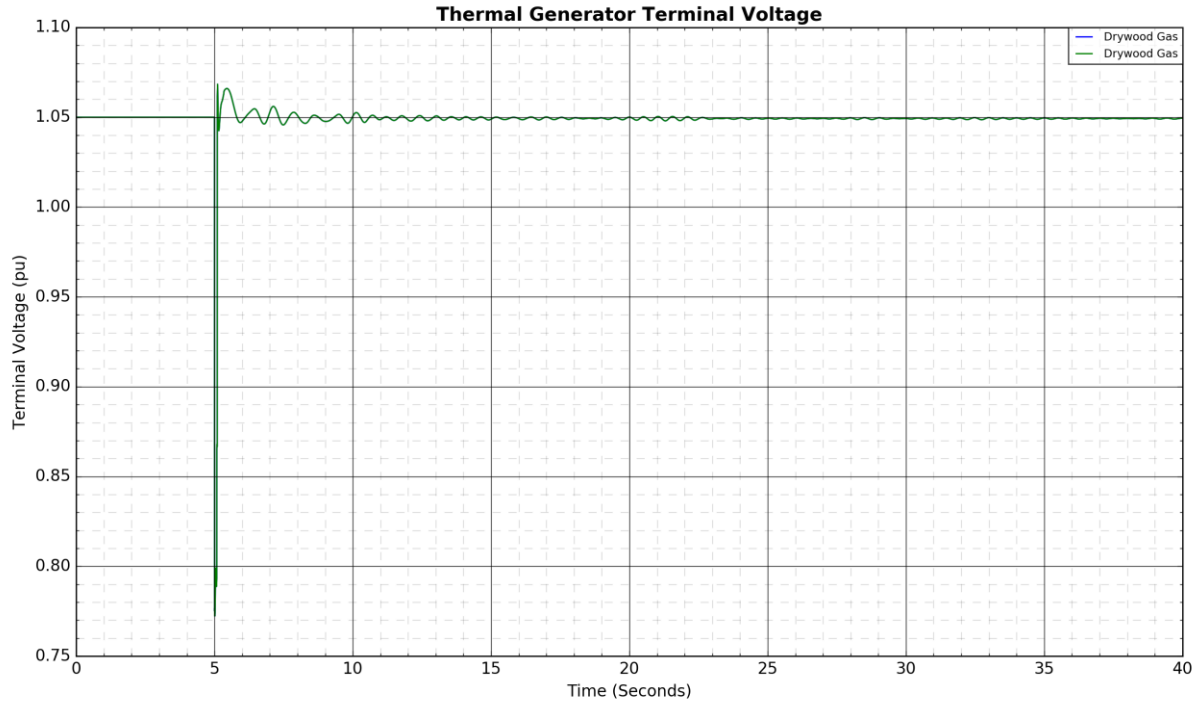
Engineering Connection Assessment Results: Stirling Wind Project Connection











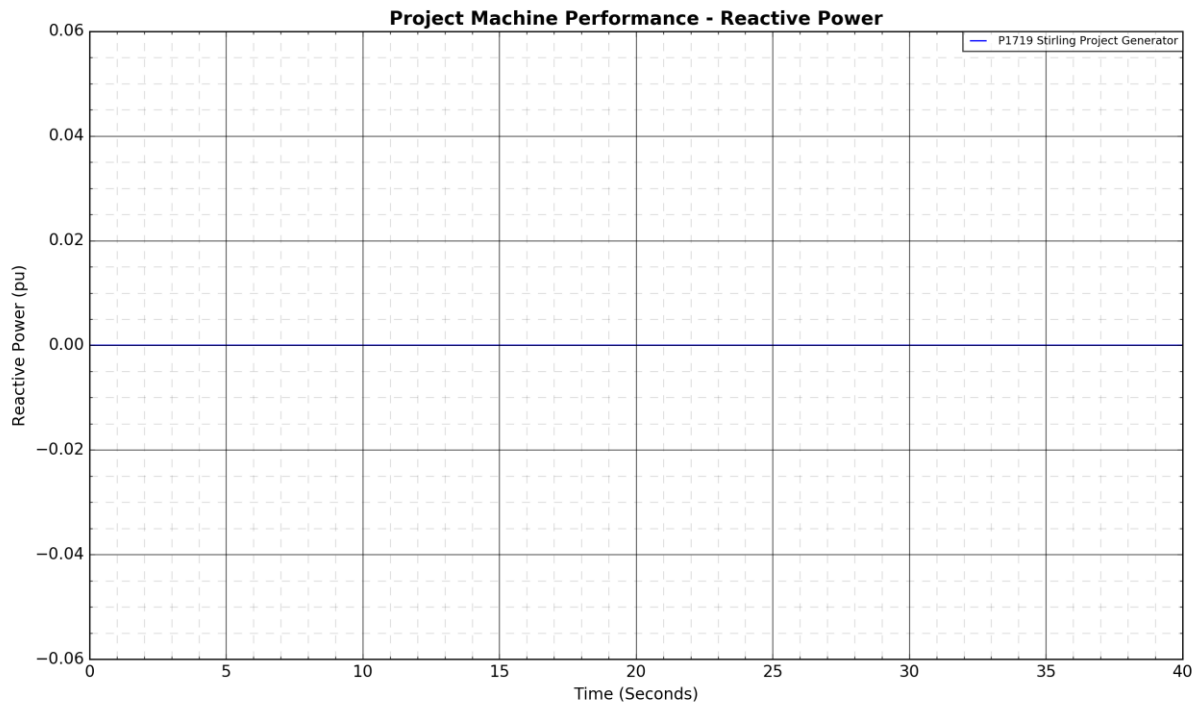
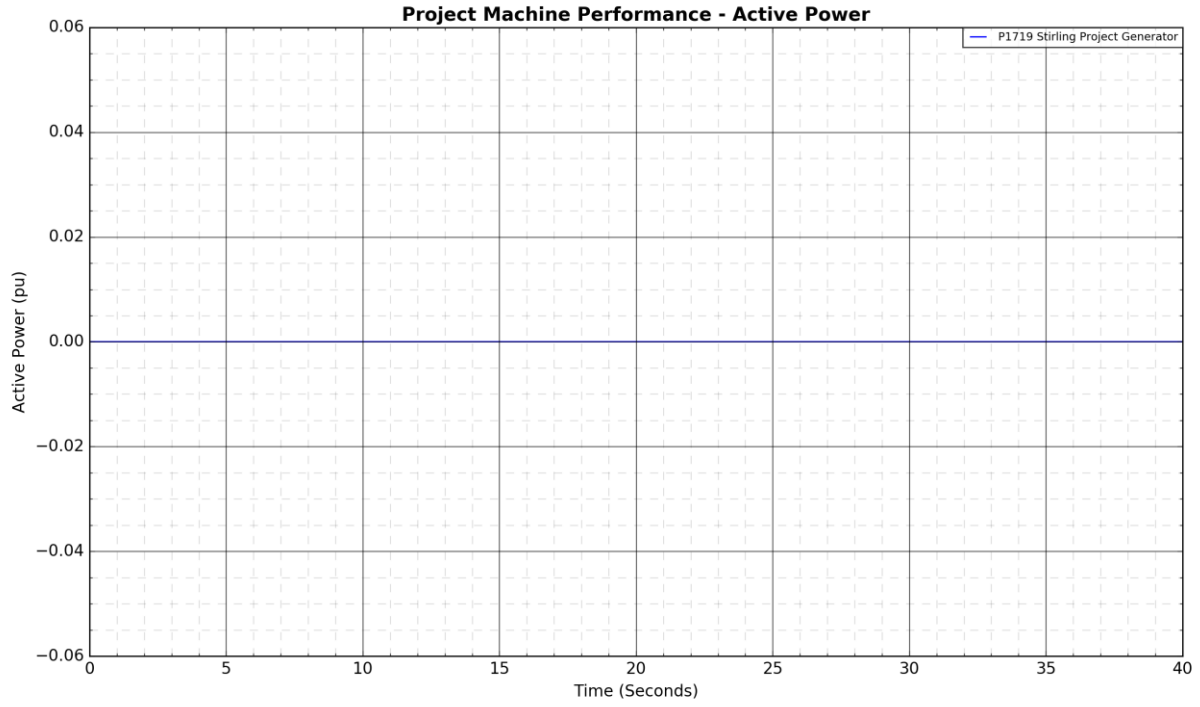
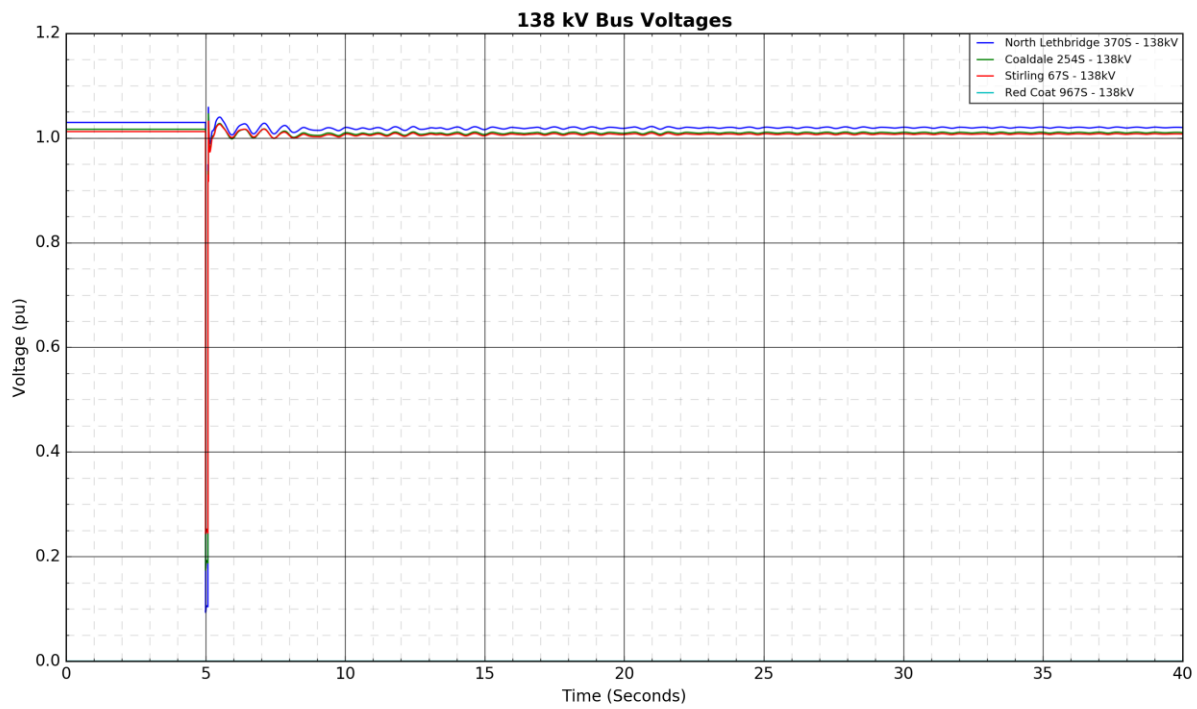
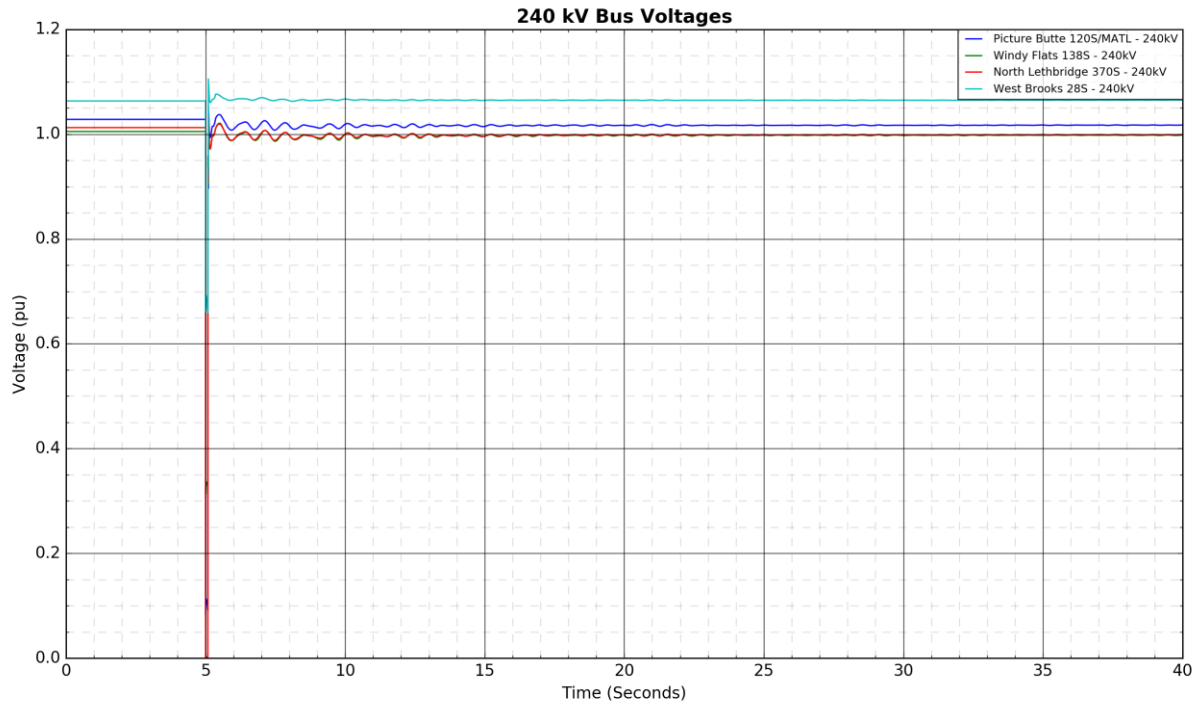
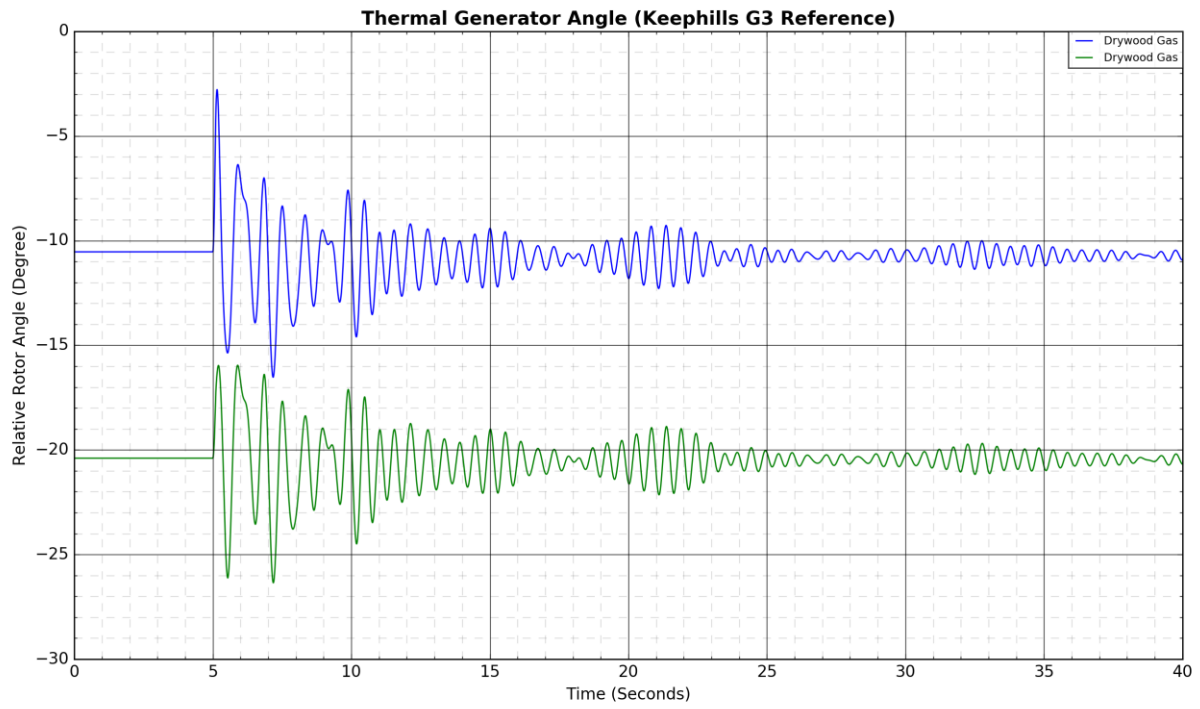
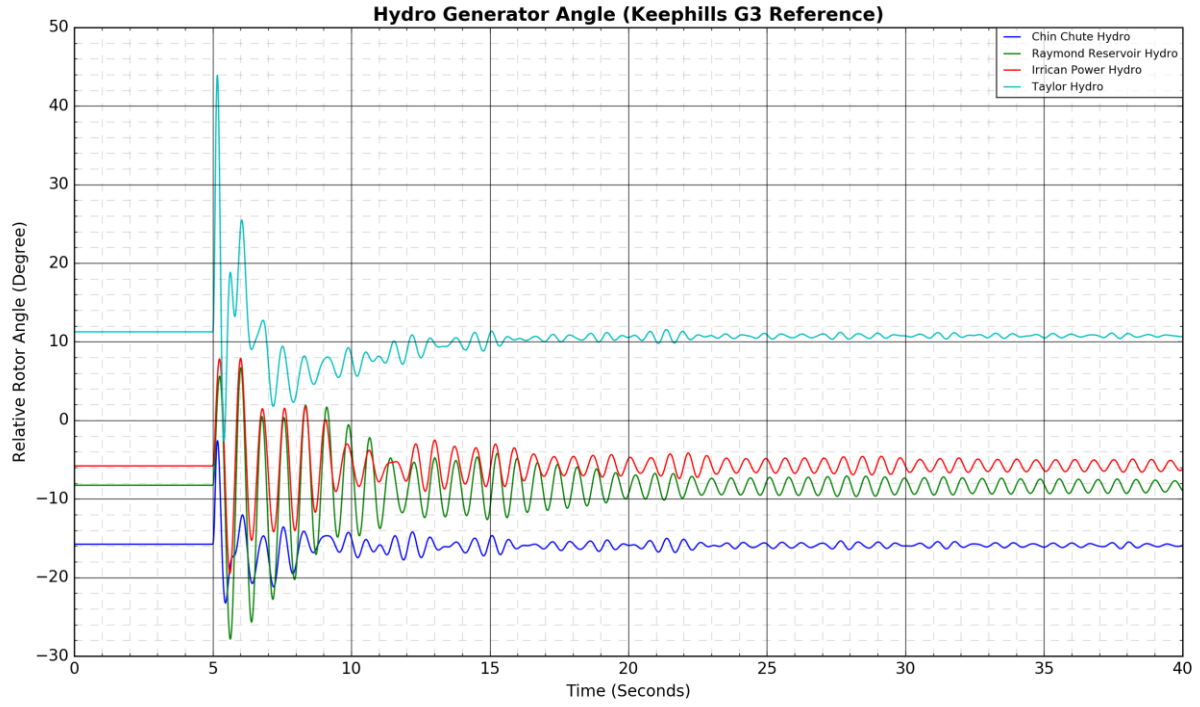
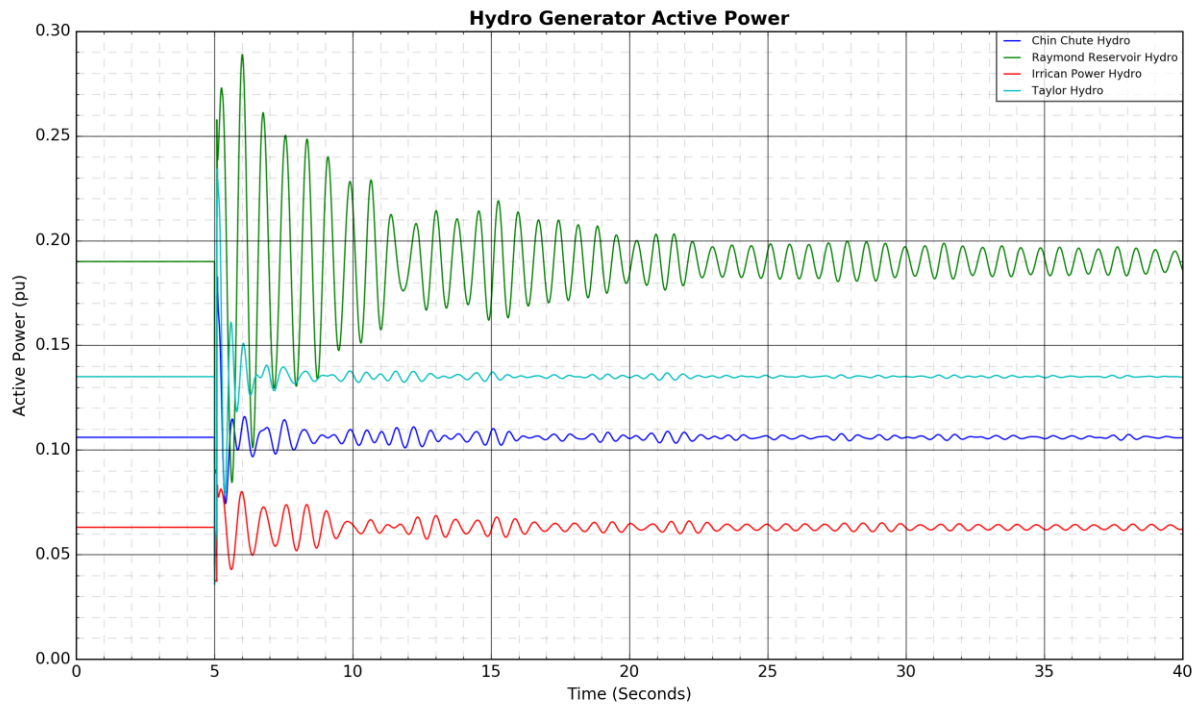
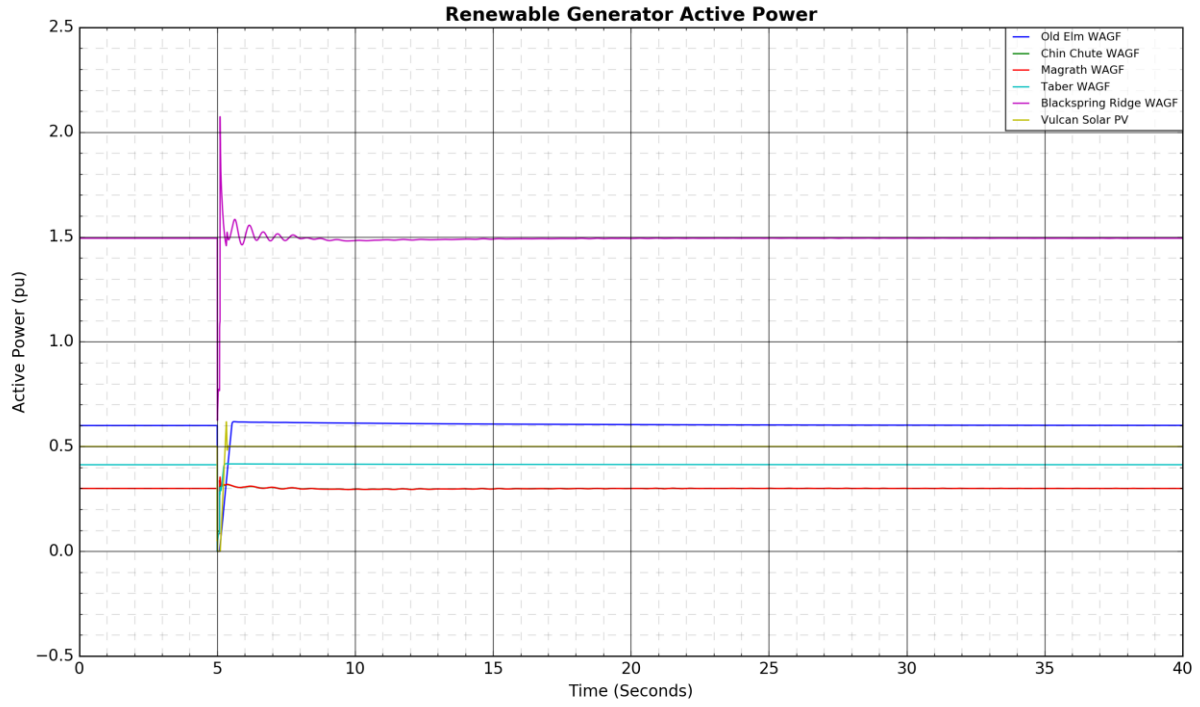


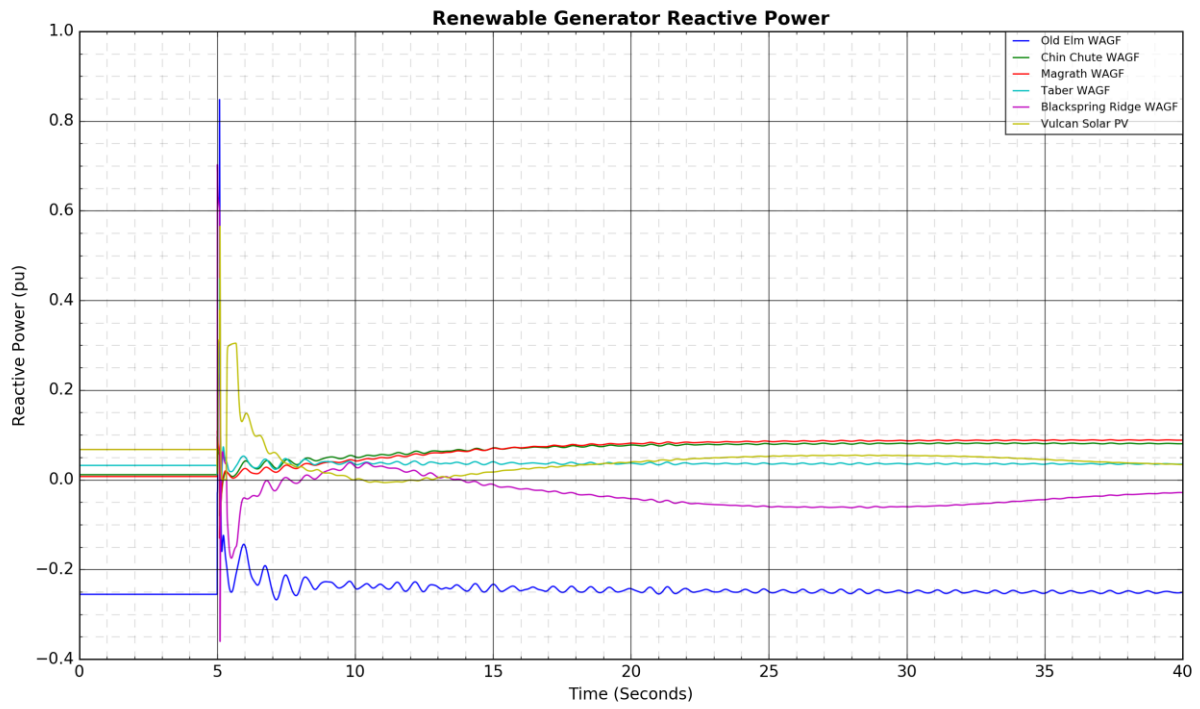
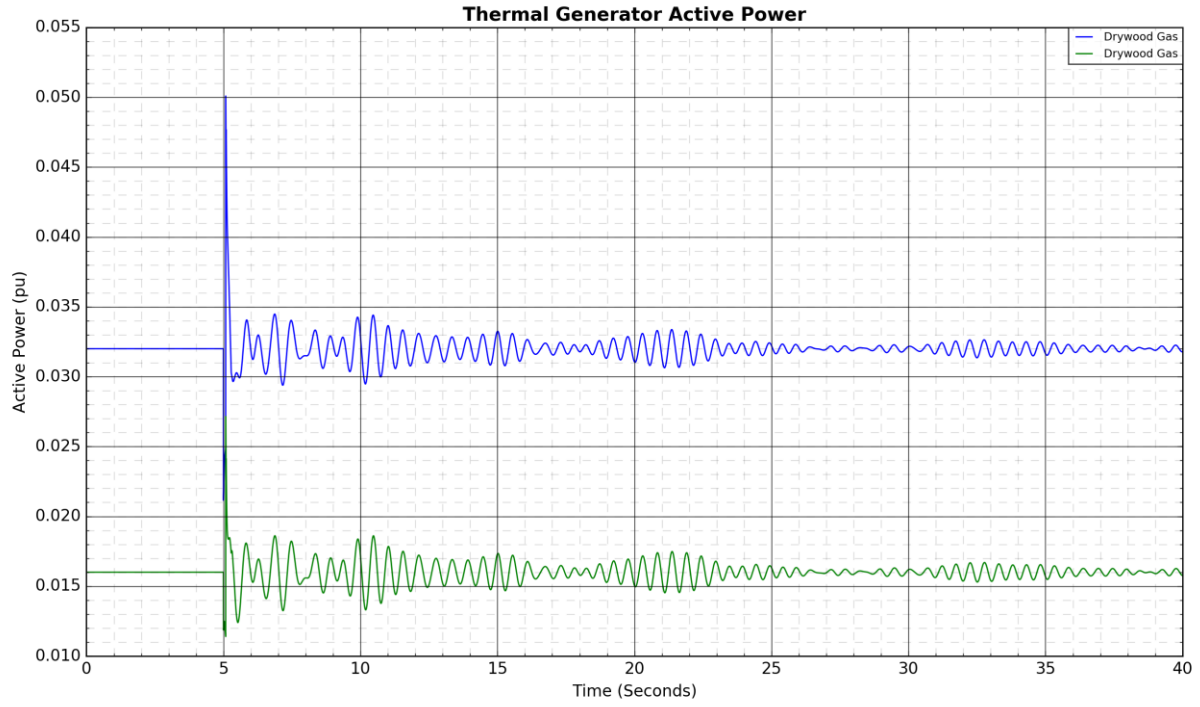
Figure A4-26: 1041L Travers 554S to North Lethbridge 370S: Fault Near North Lethbridge 370S

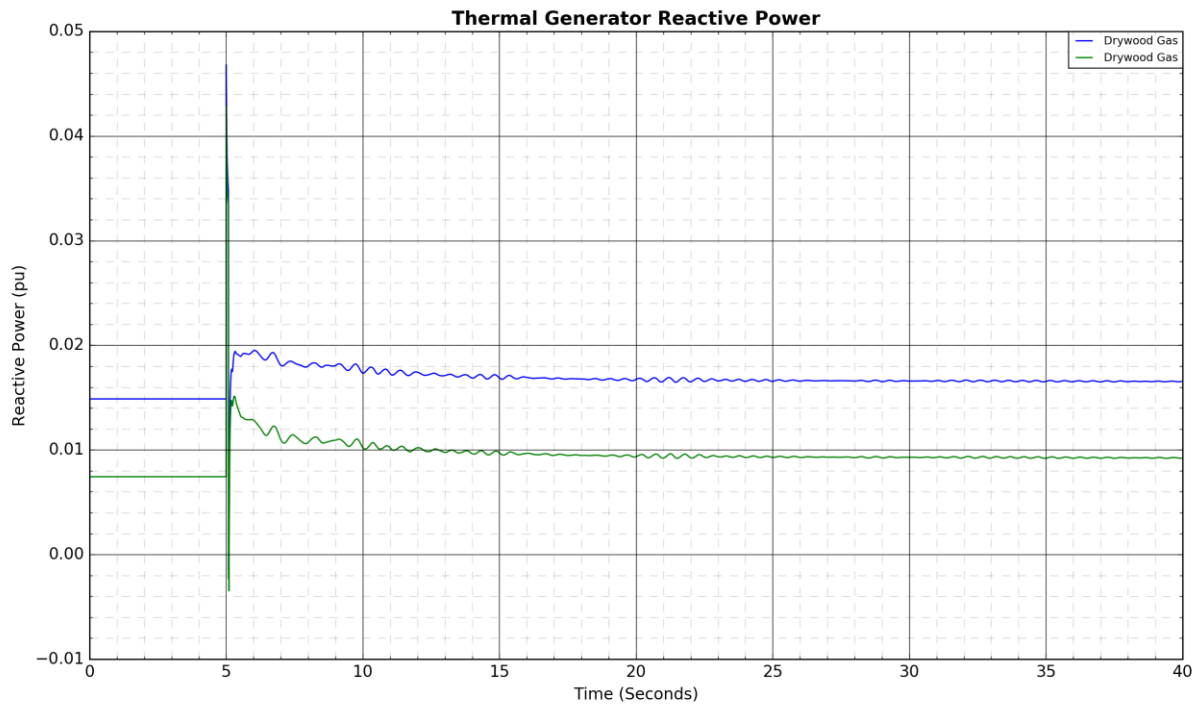
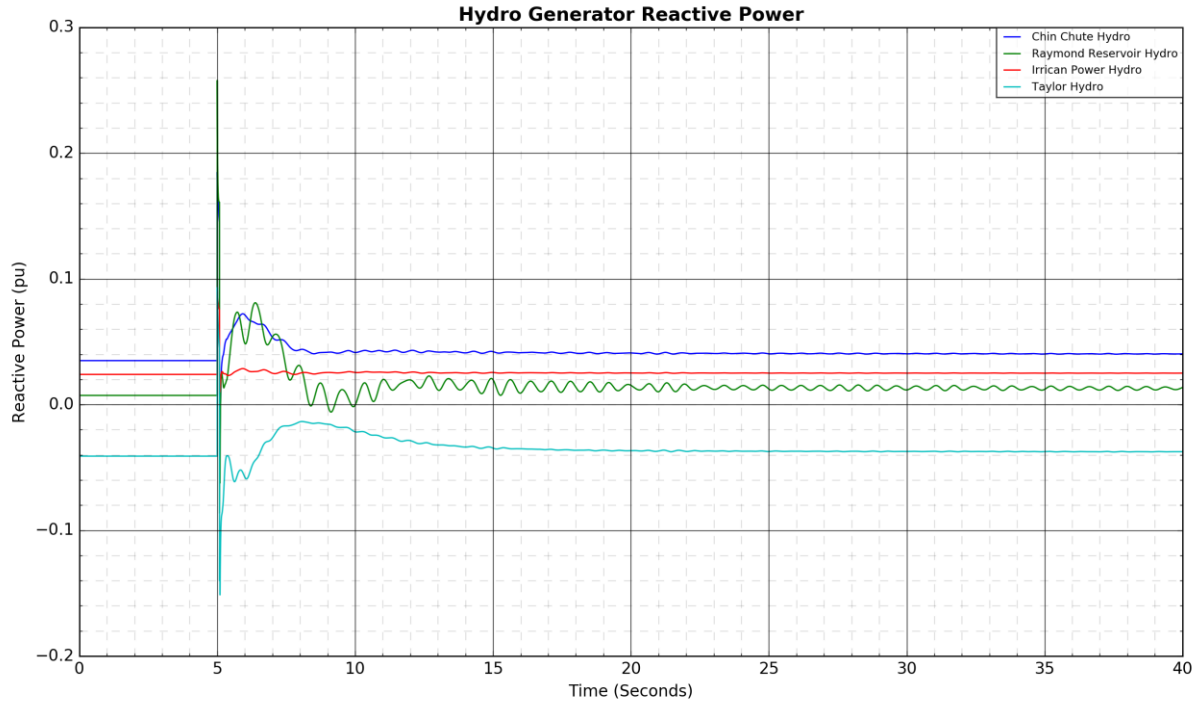


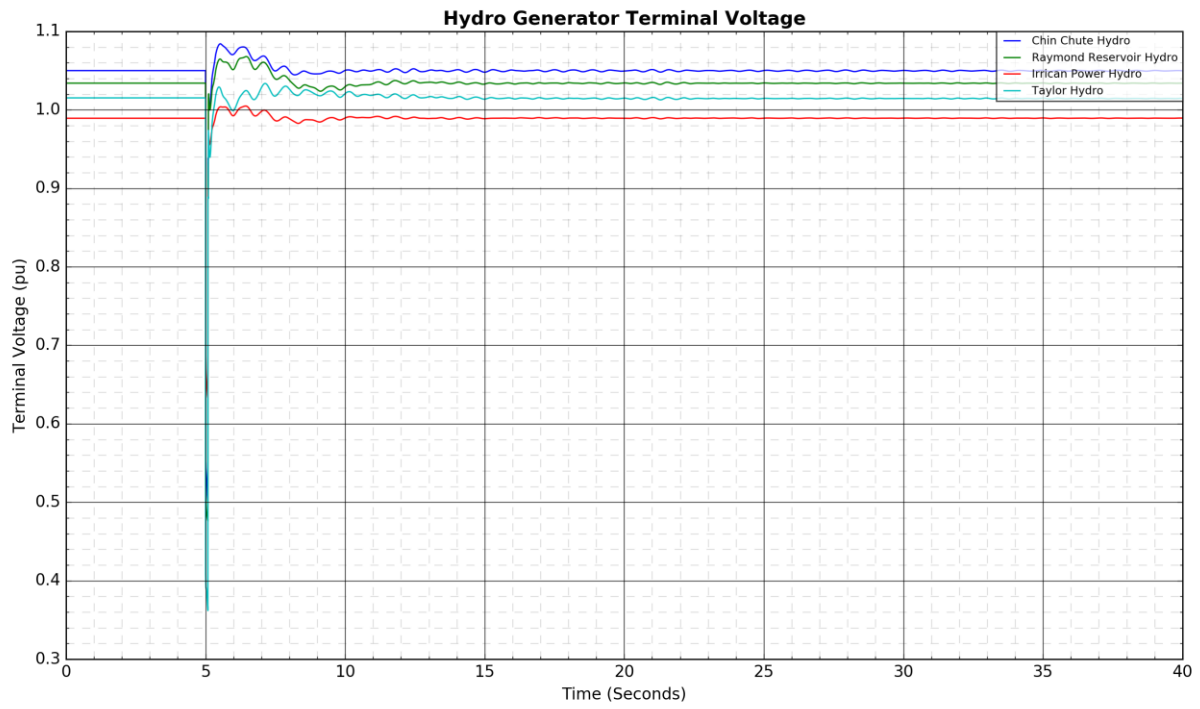
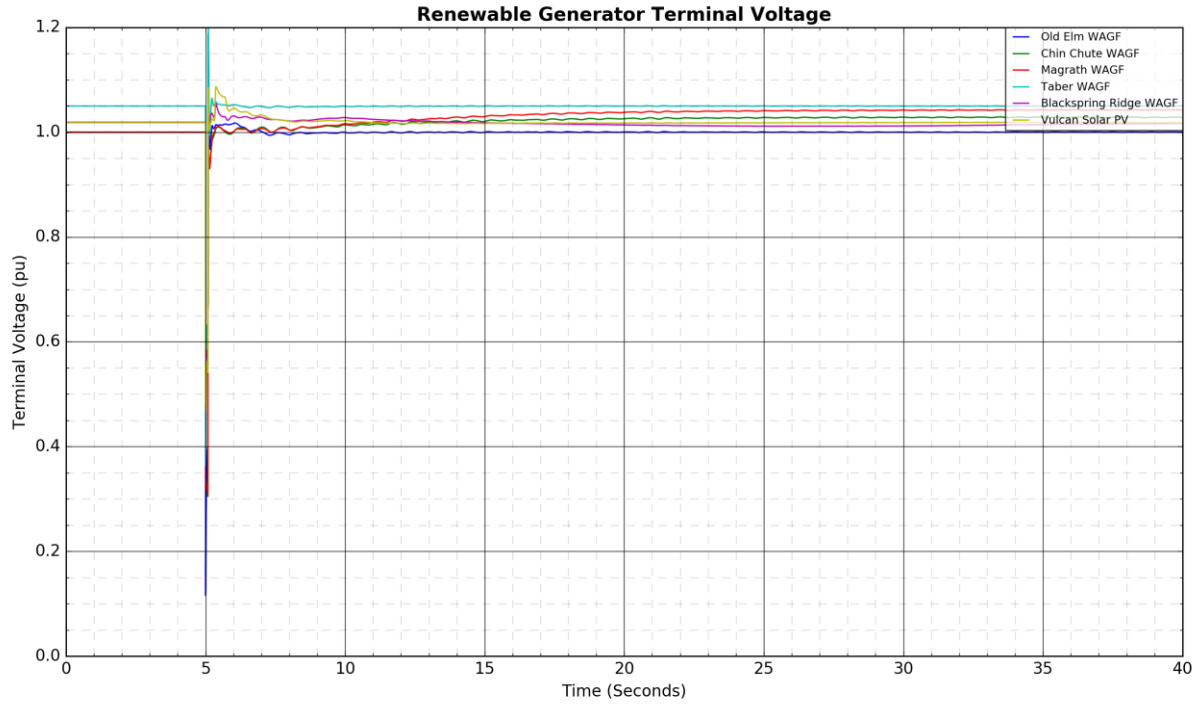


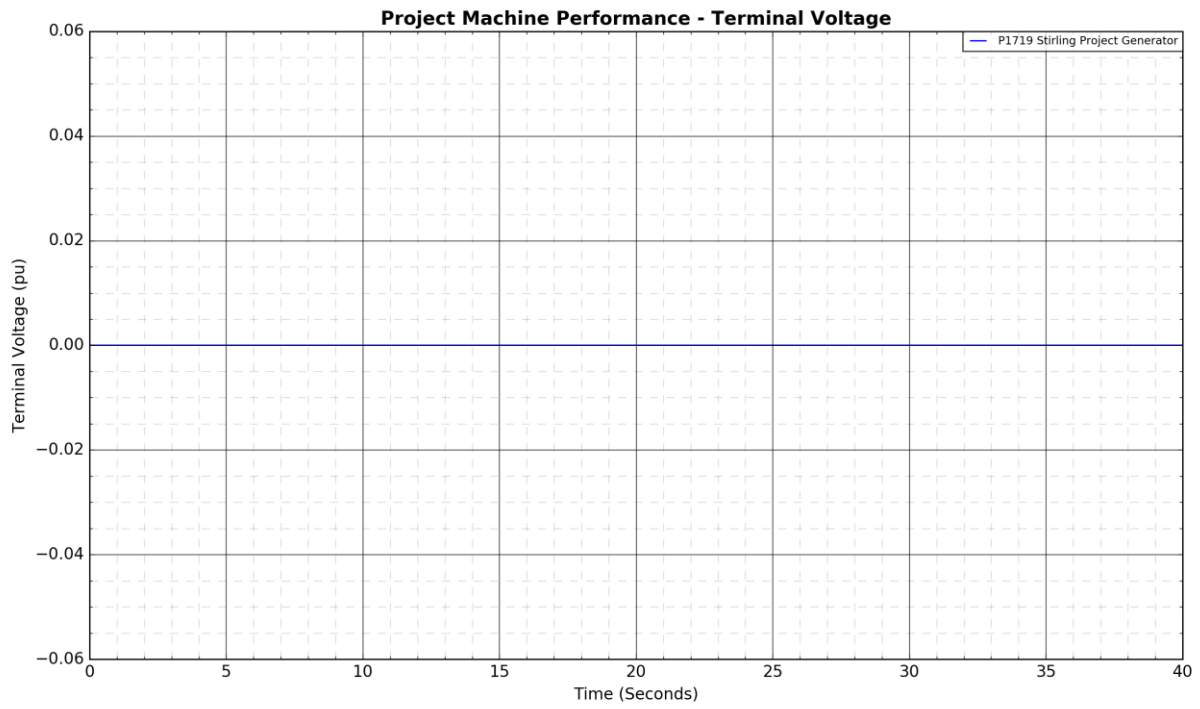
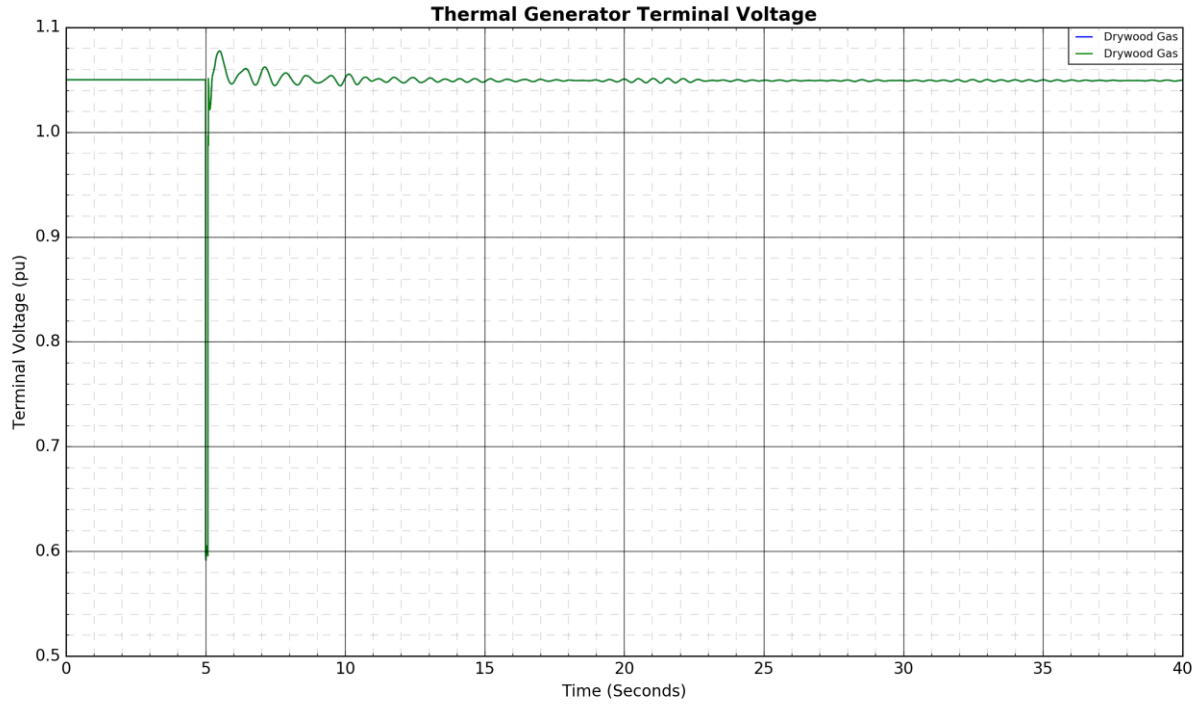
Engineering Connection Assessment Results: Stirling Wind Project Connection











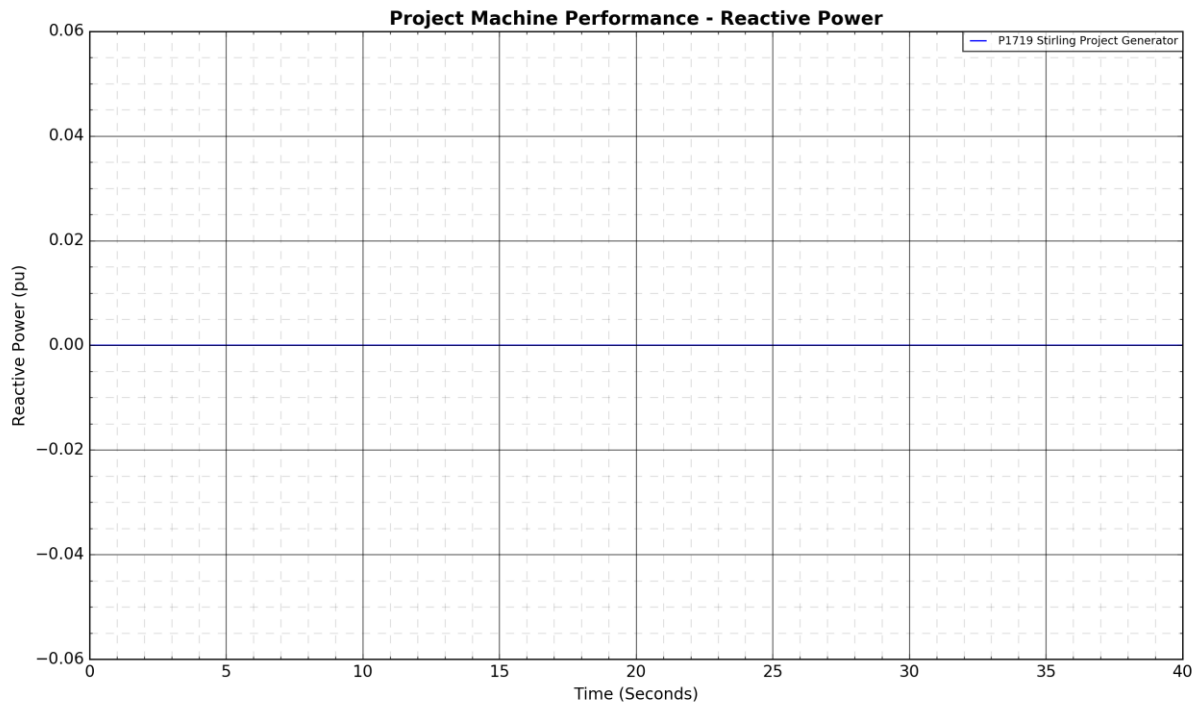
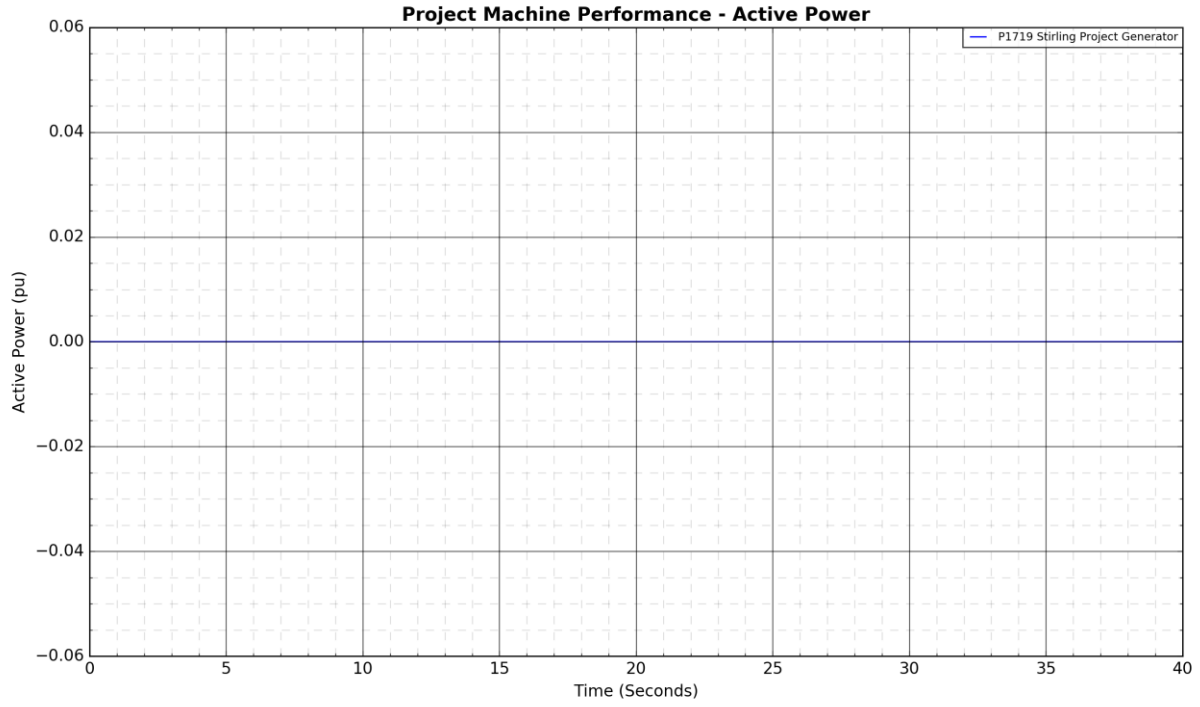
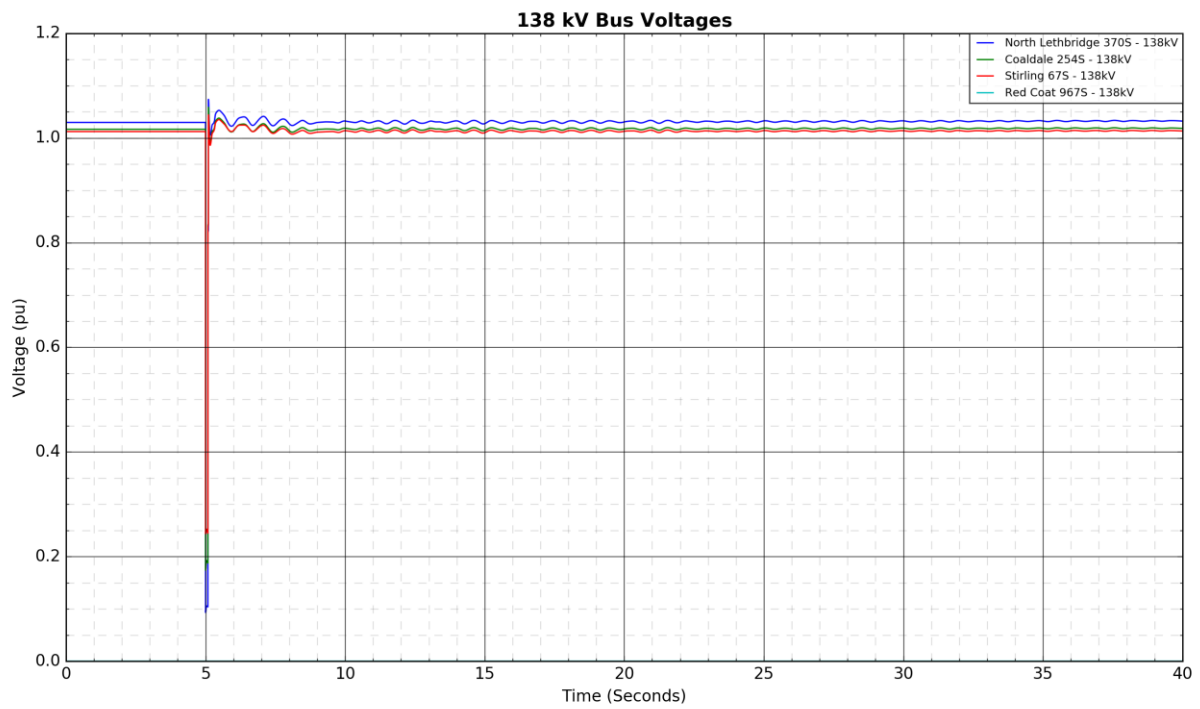
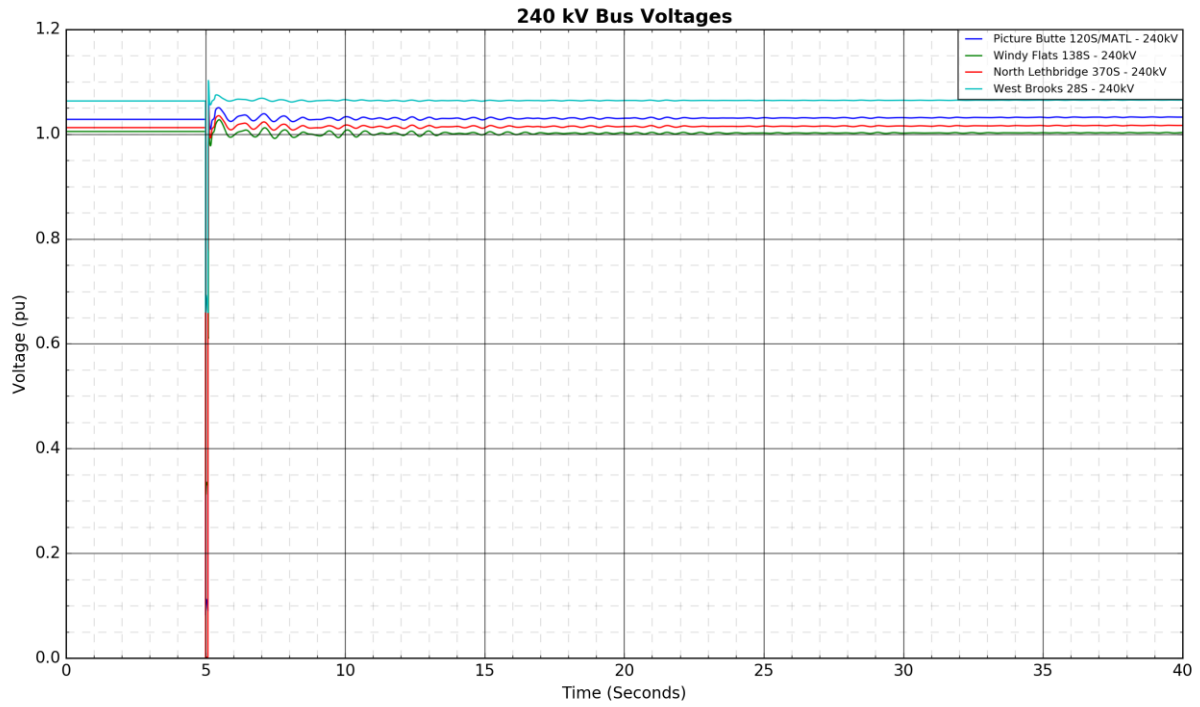
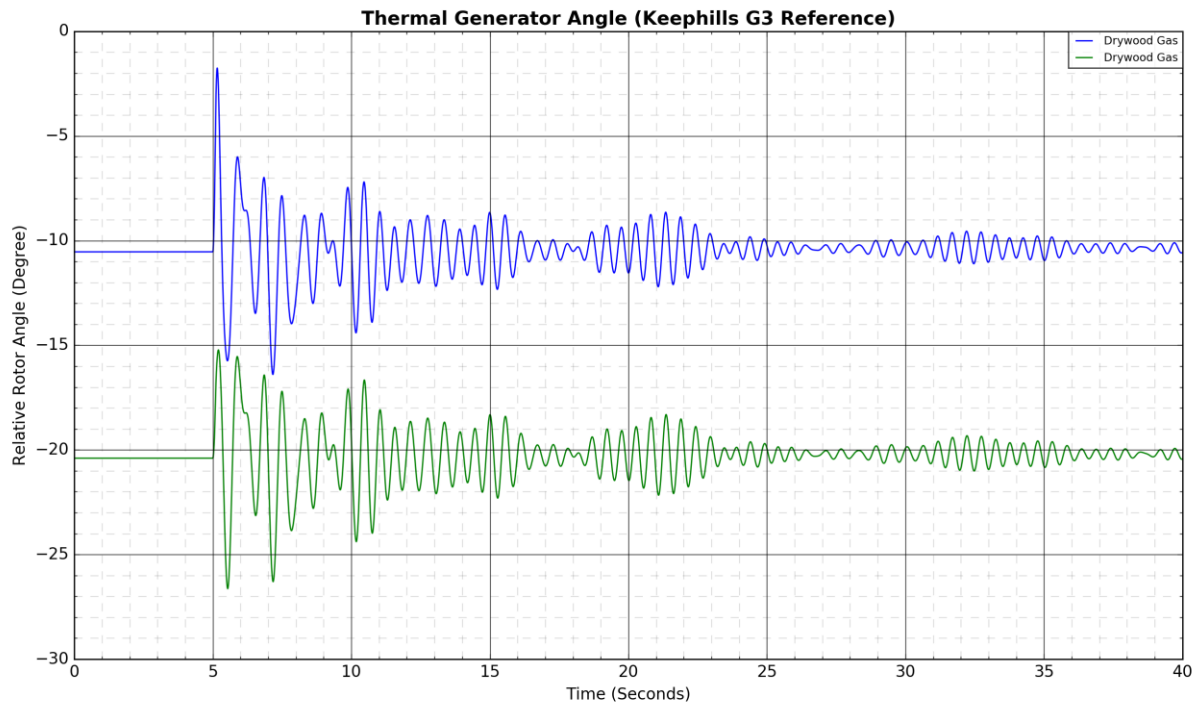
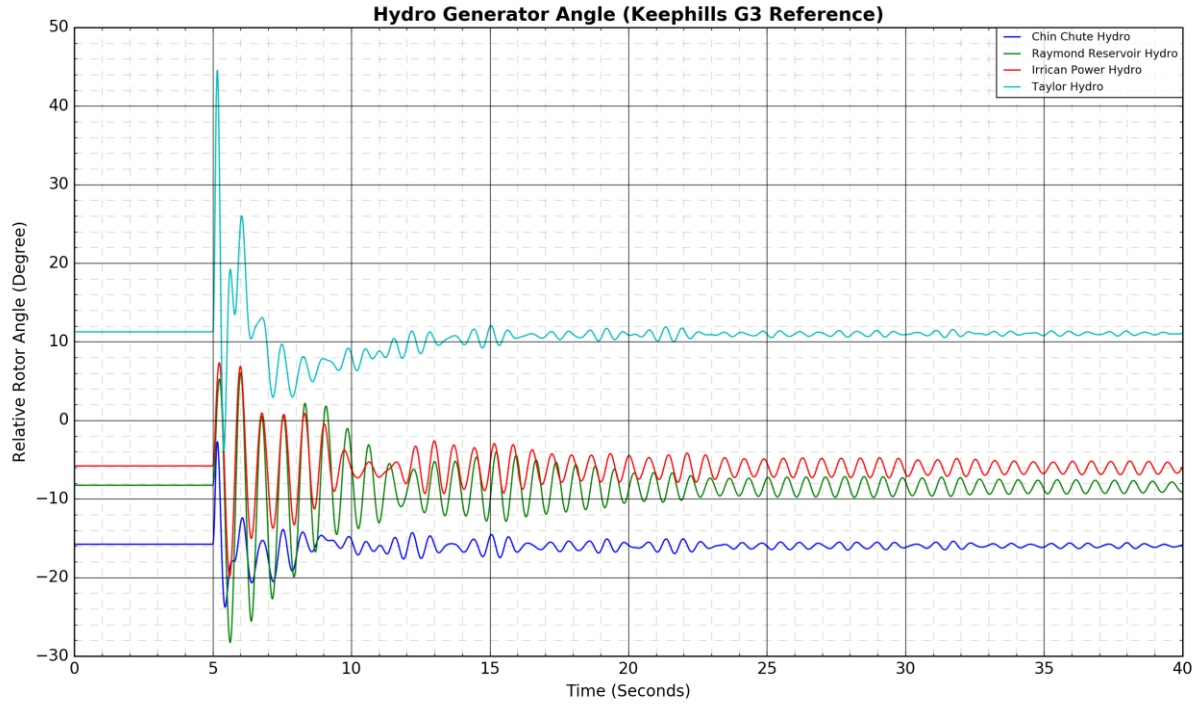
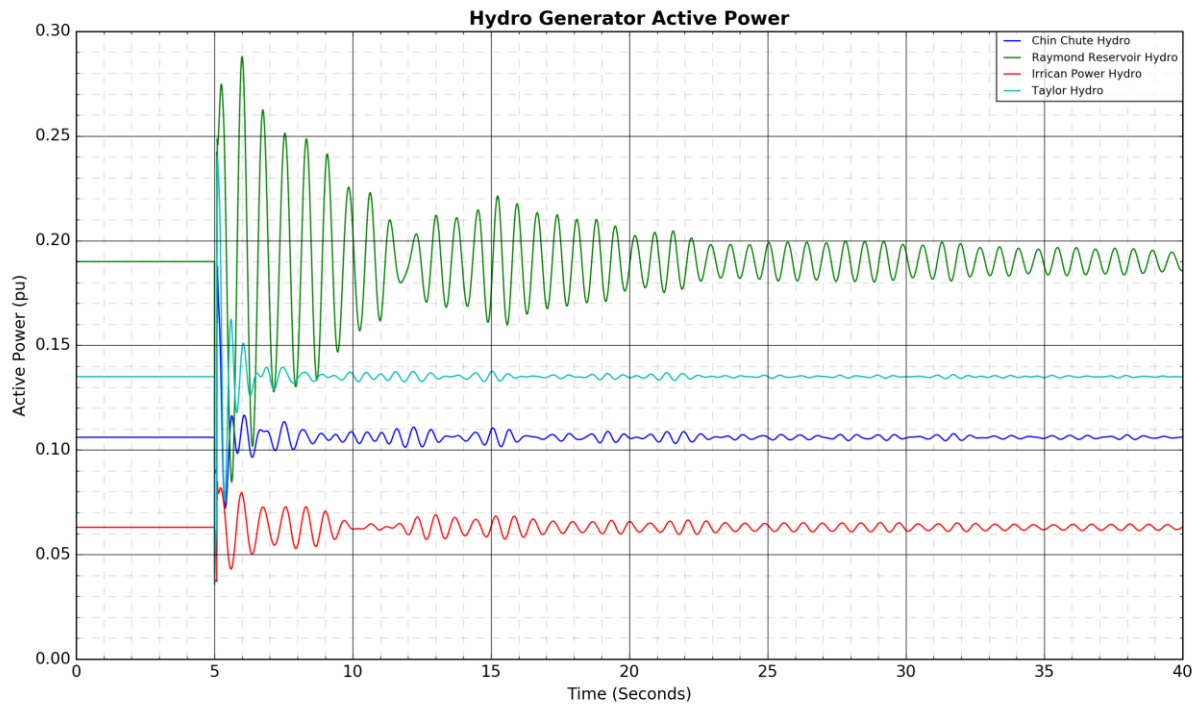
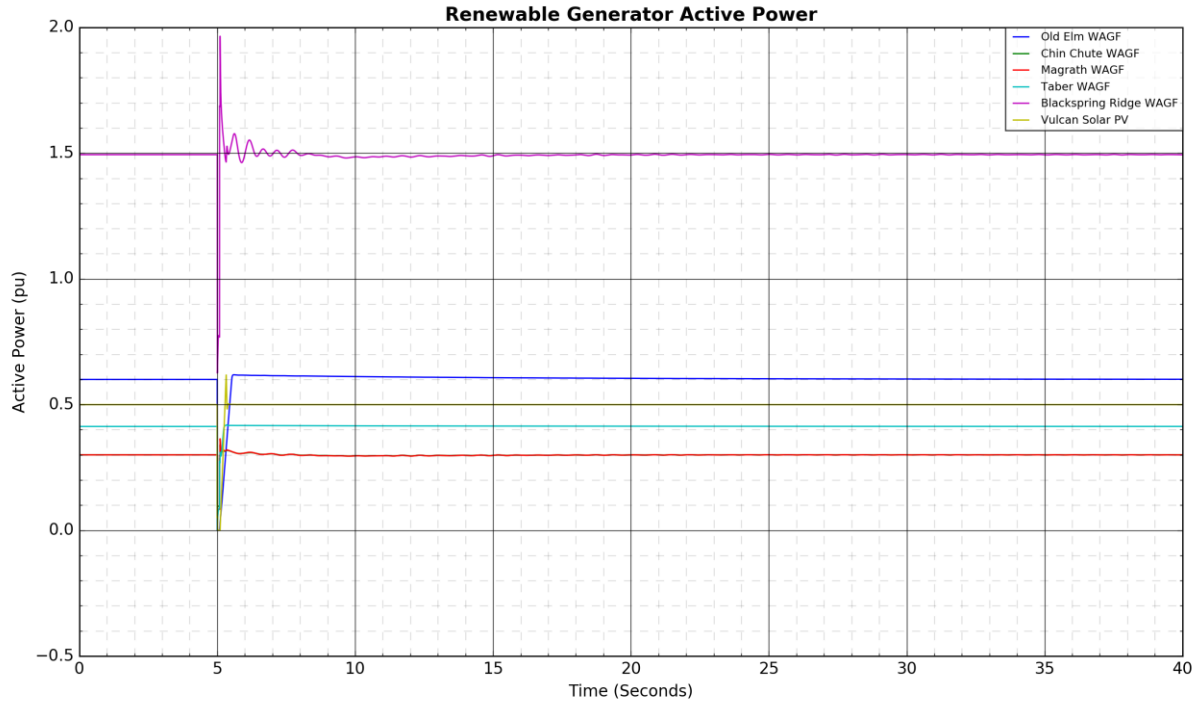


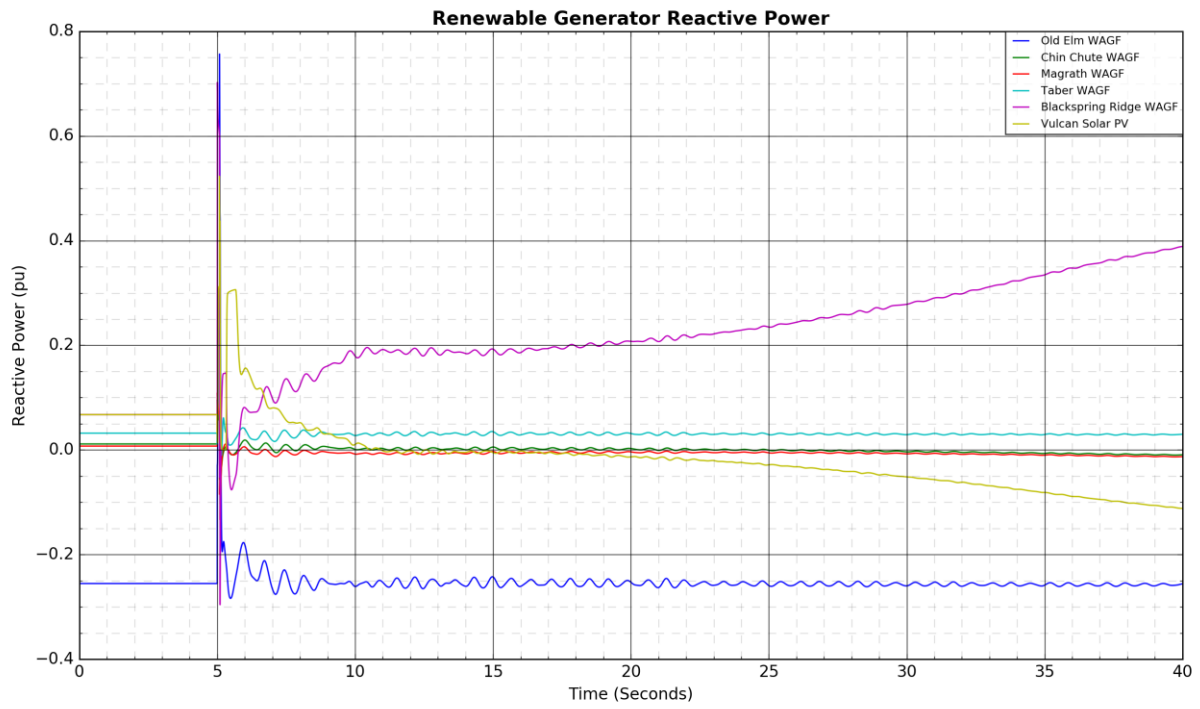
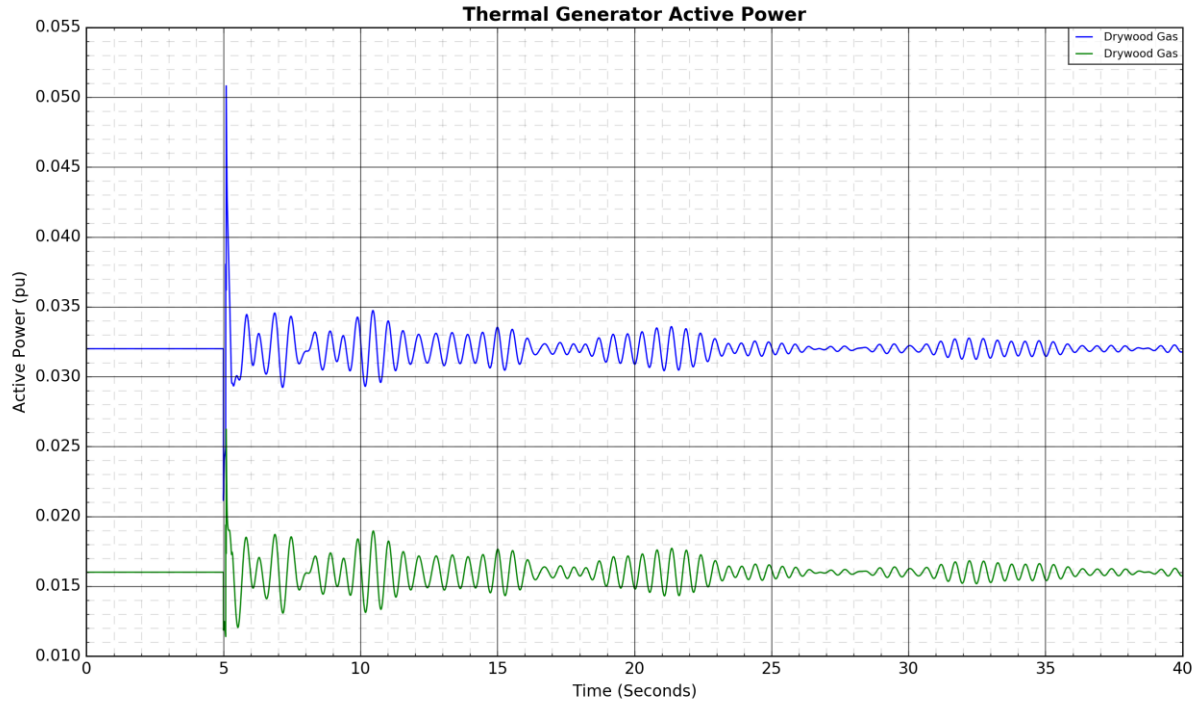
Figure A4-27: 968L North Lethbridge 370S to Windy Flats 138S: Fault Near North Lethbridge 370S

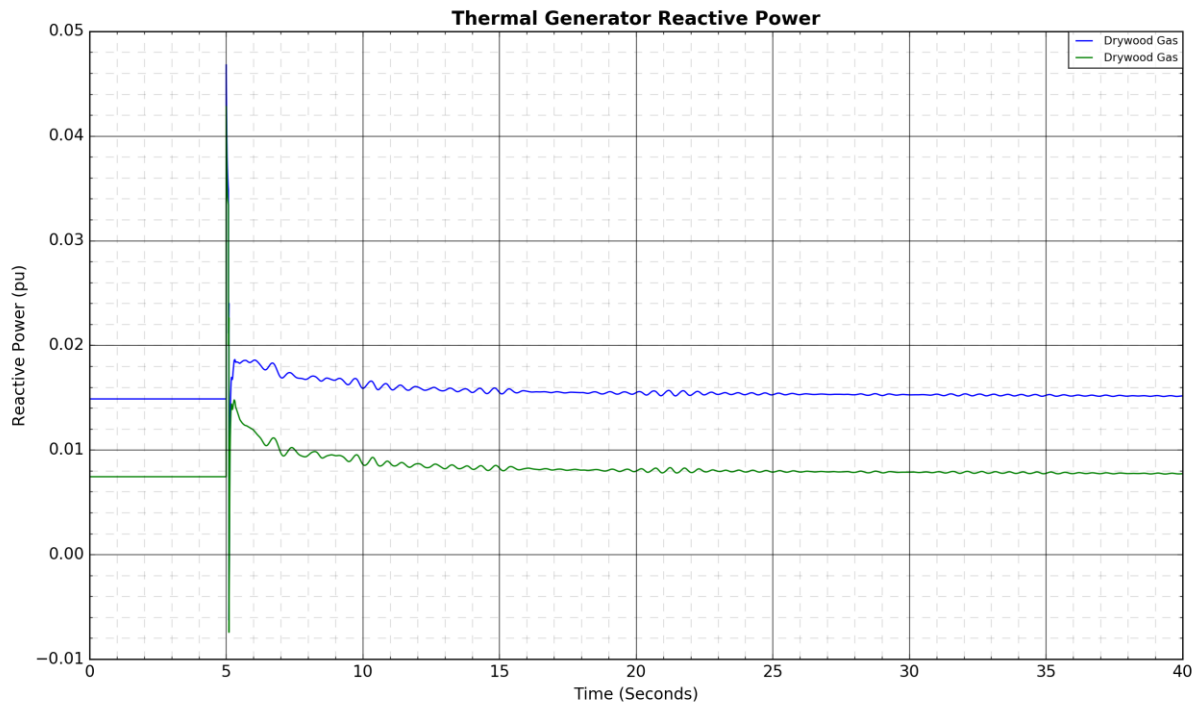
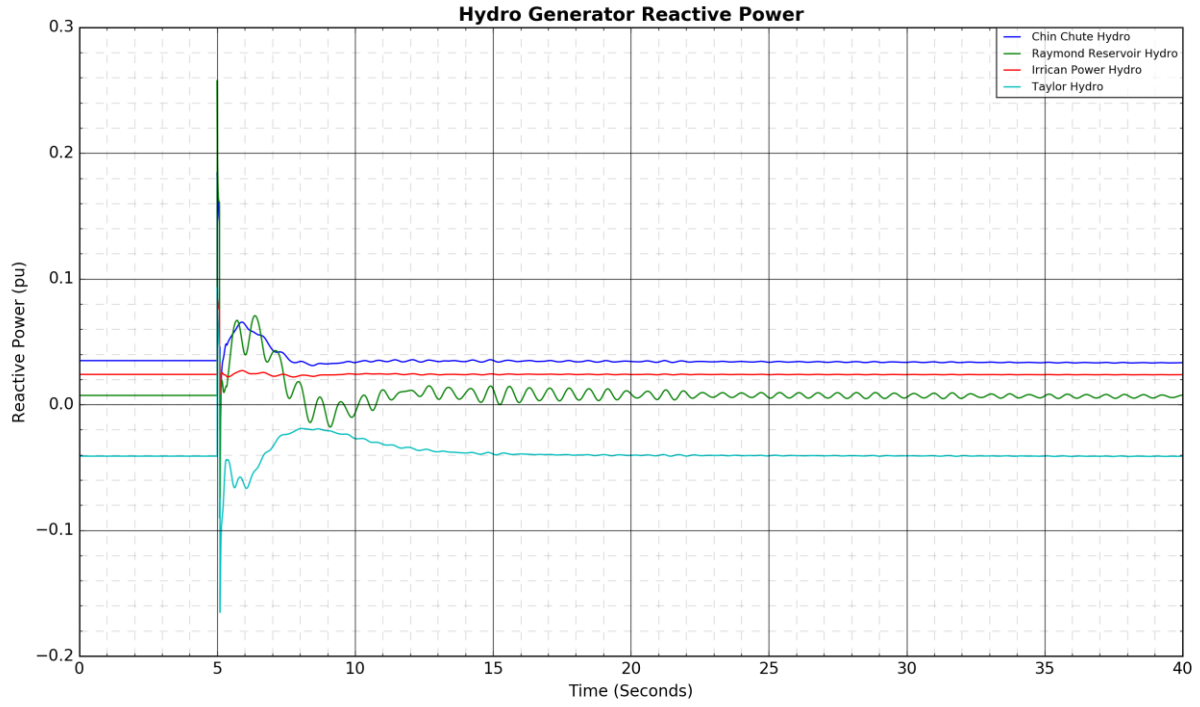


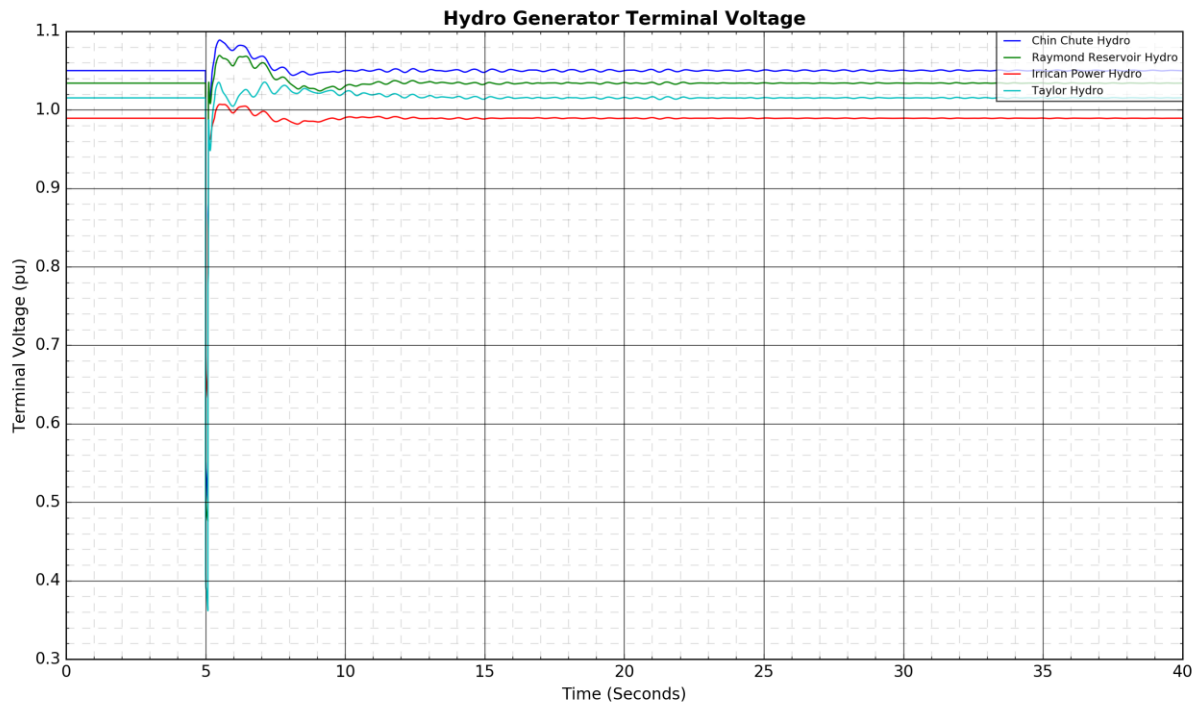
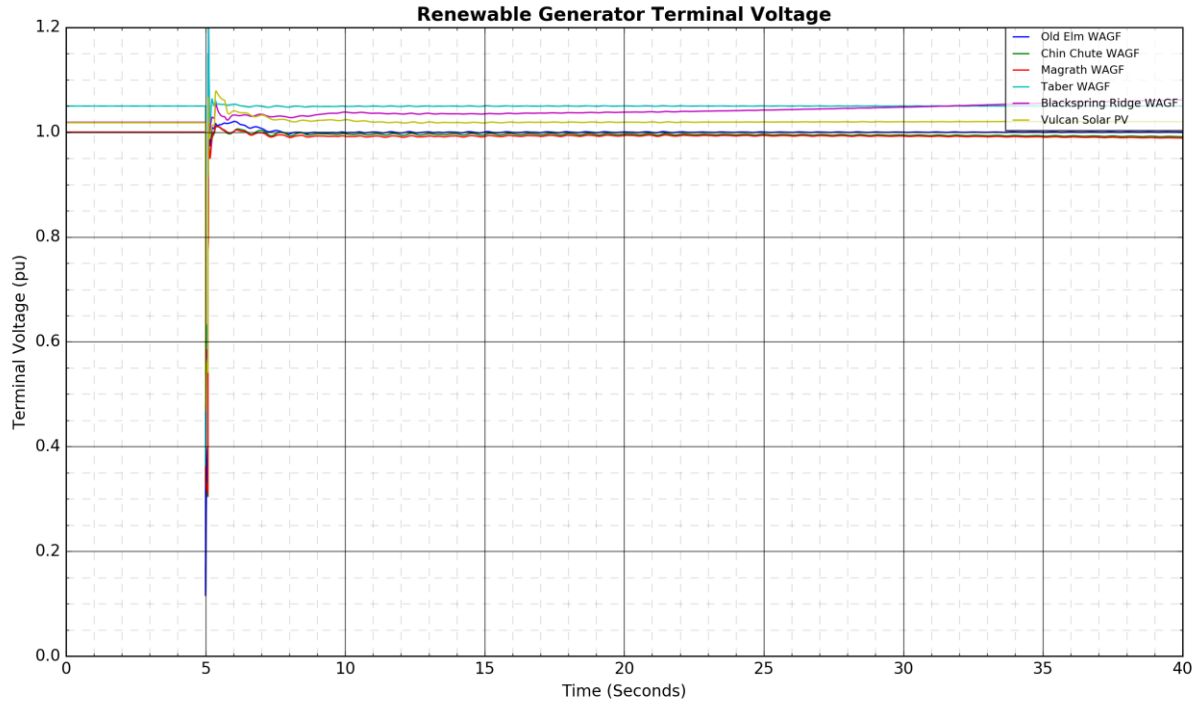


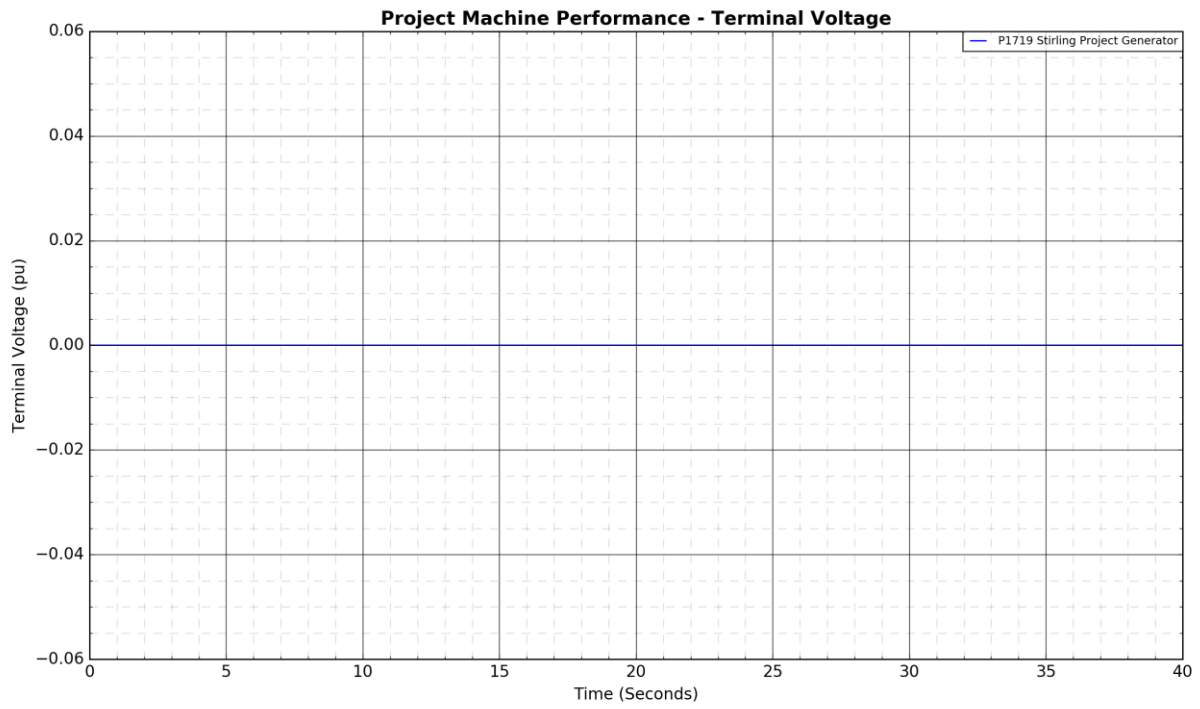
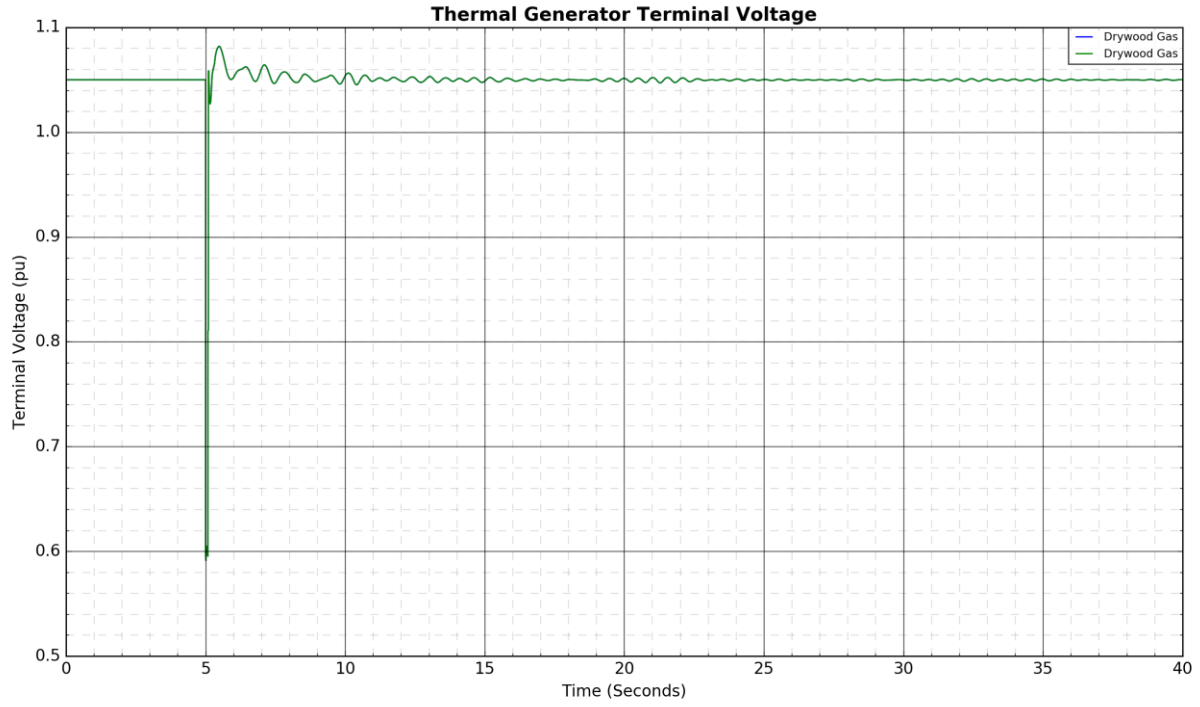
Engineering Connection Assessment Results: Stirling Wind Project Connection











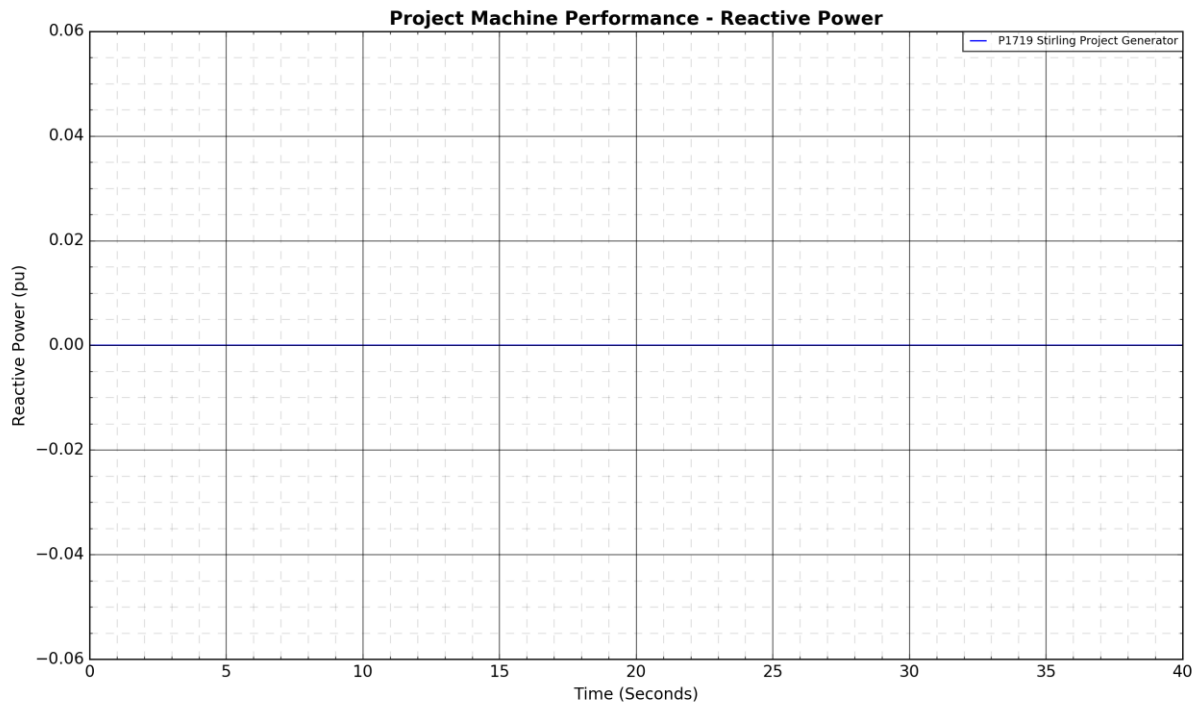
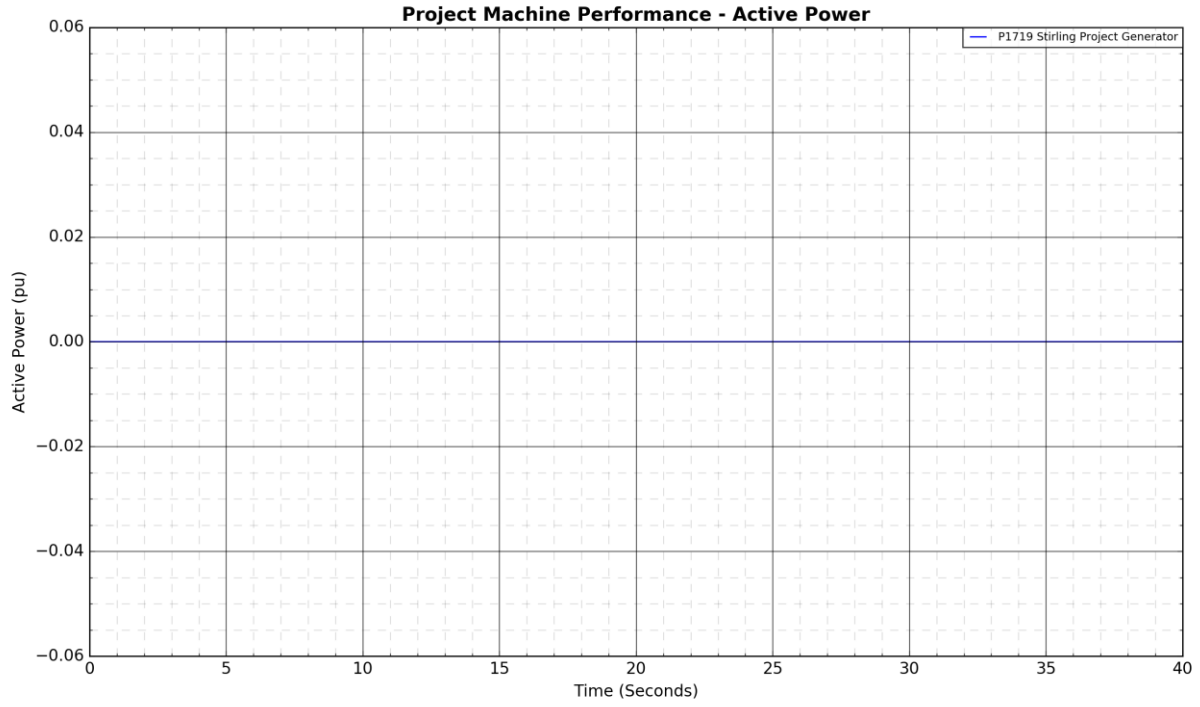
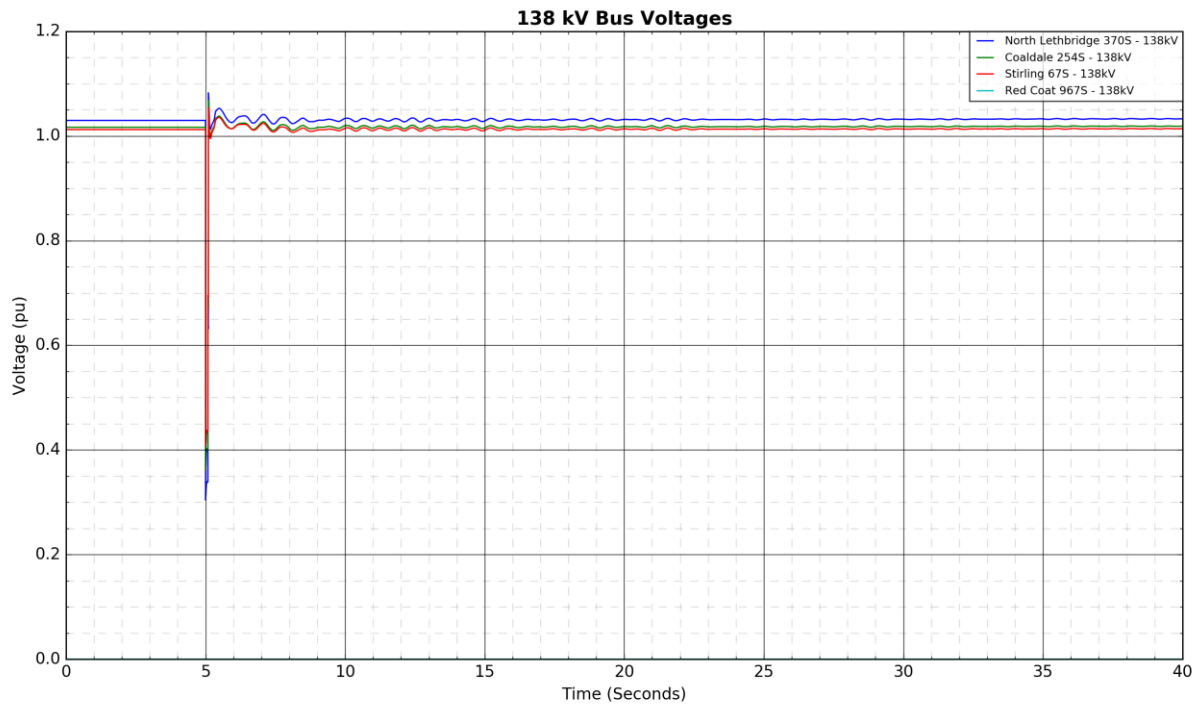
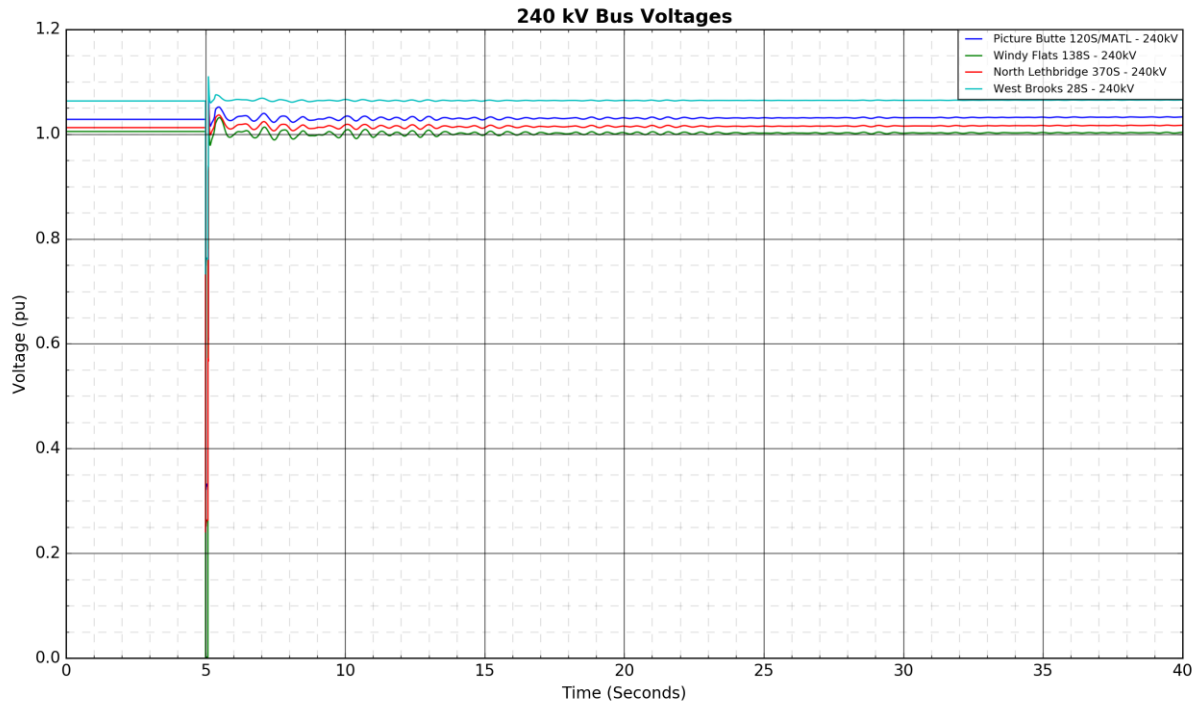
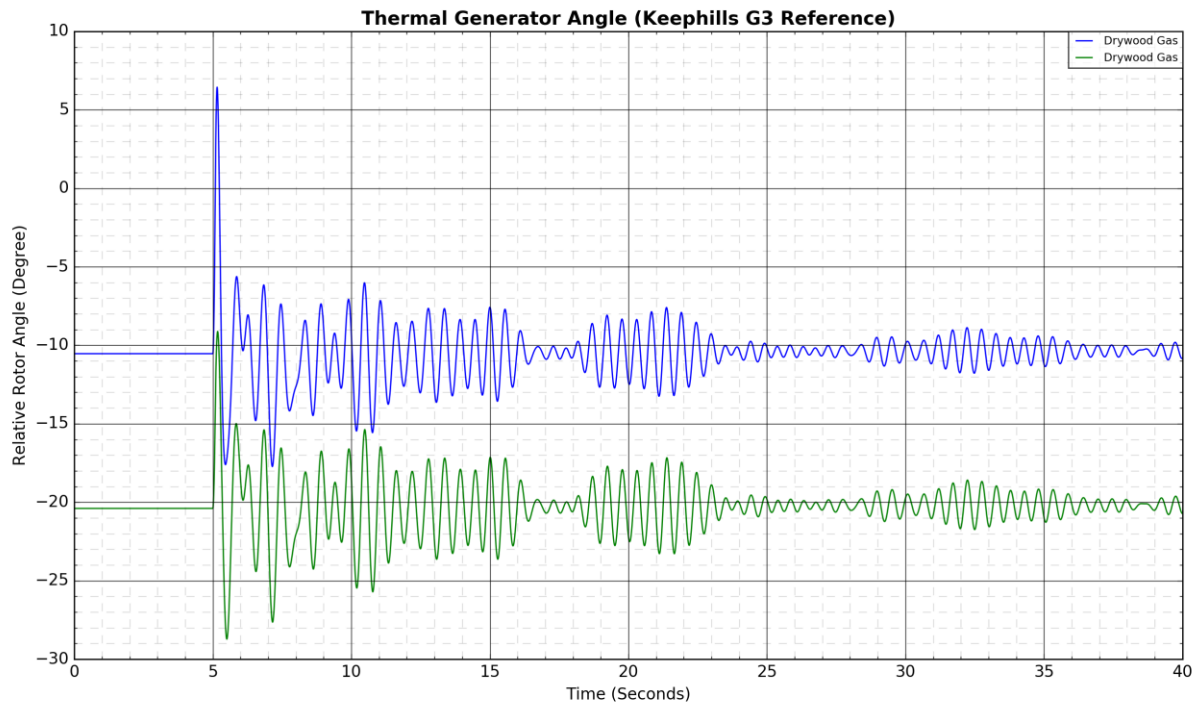
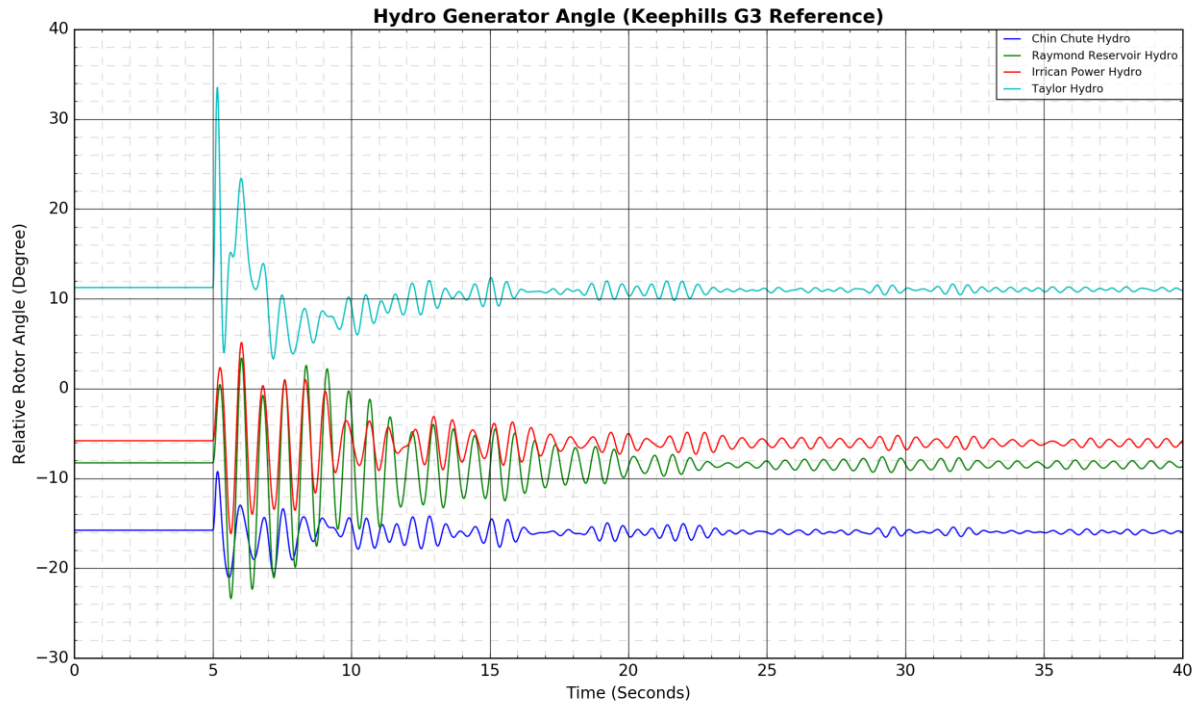
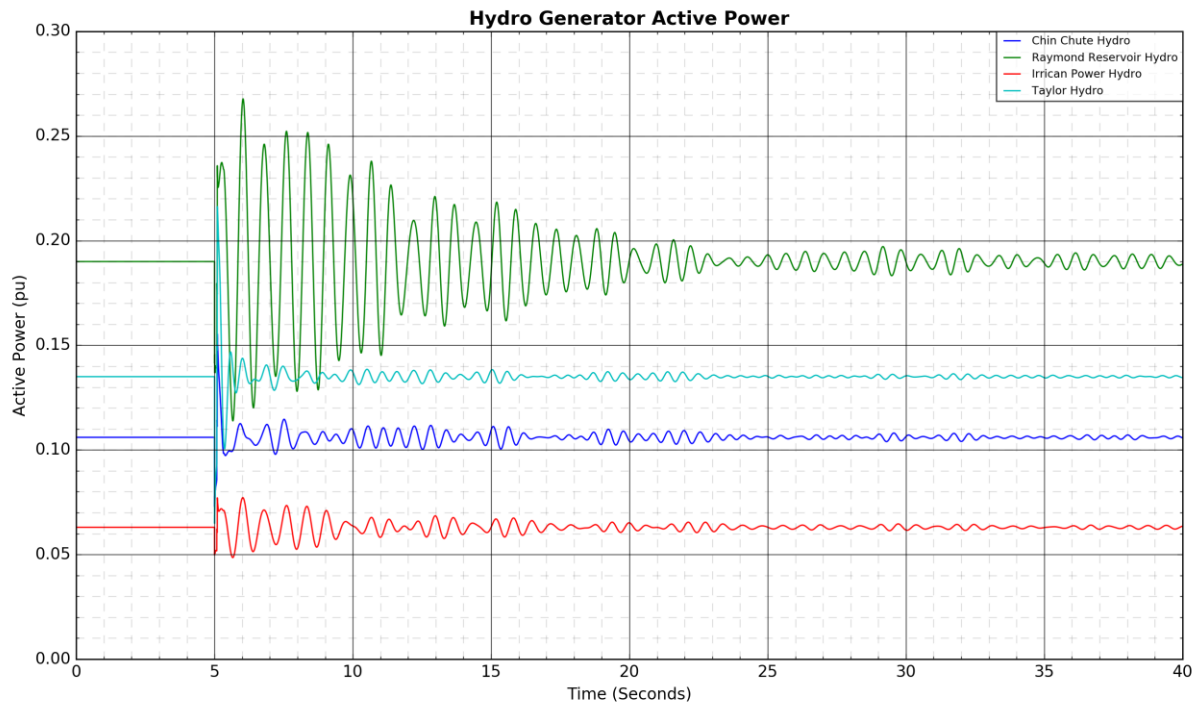
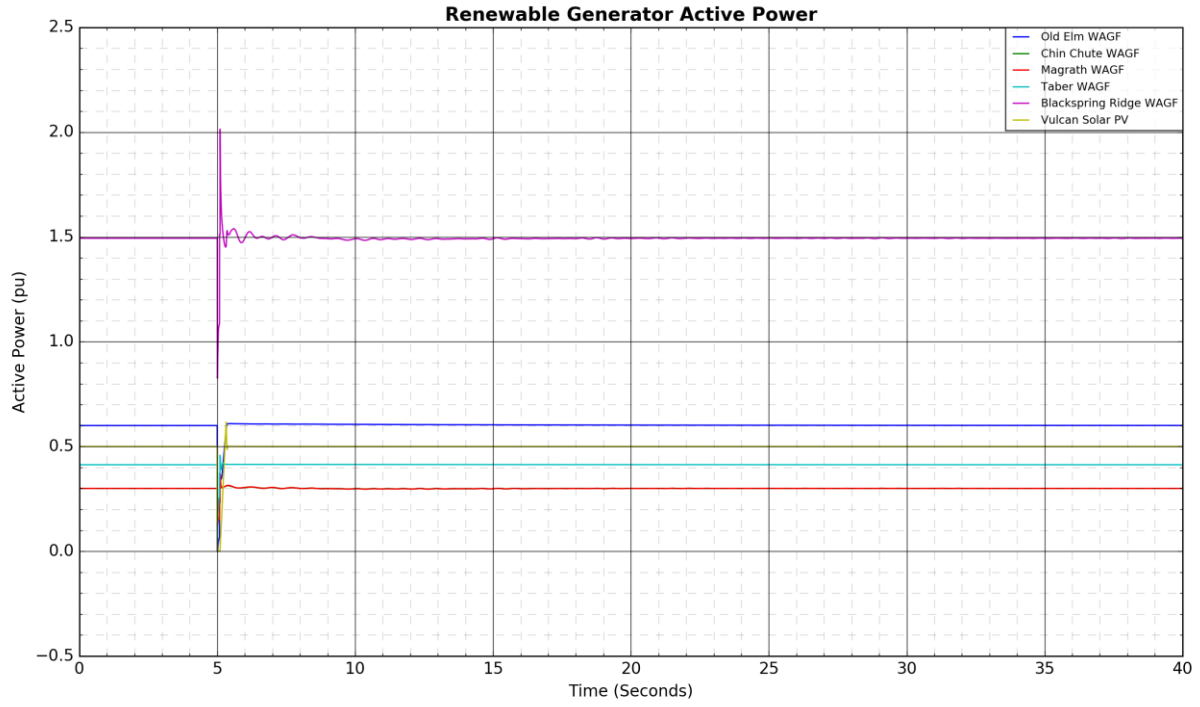


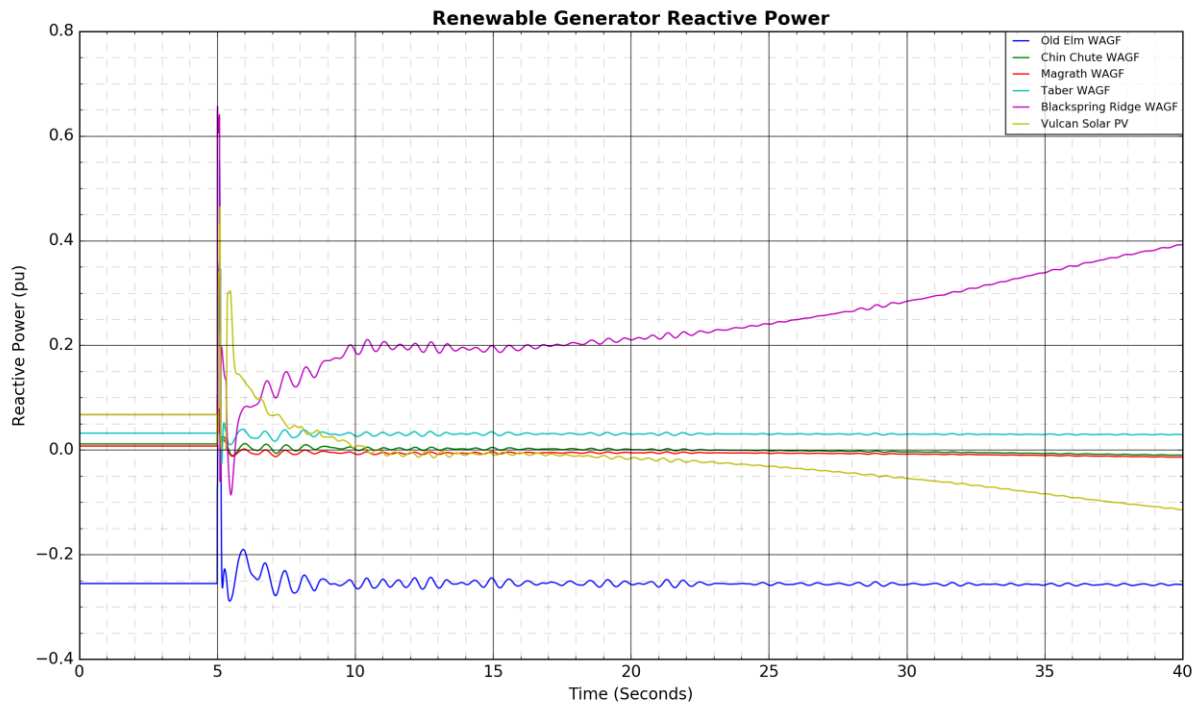
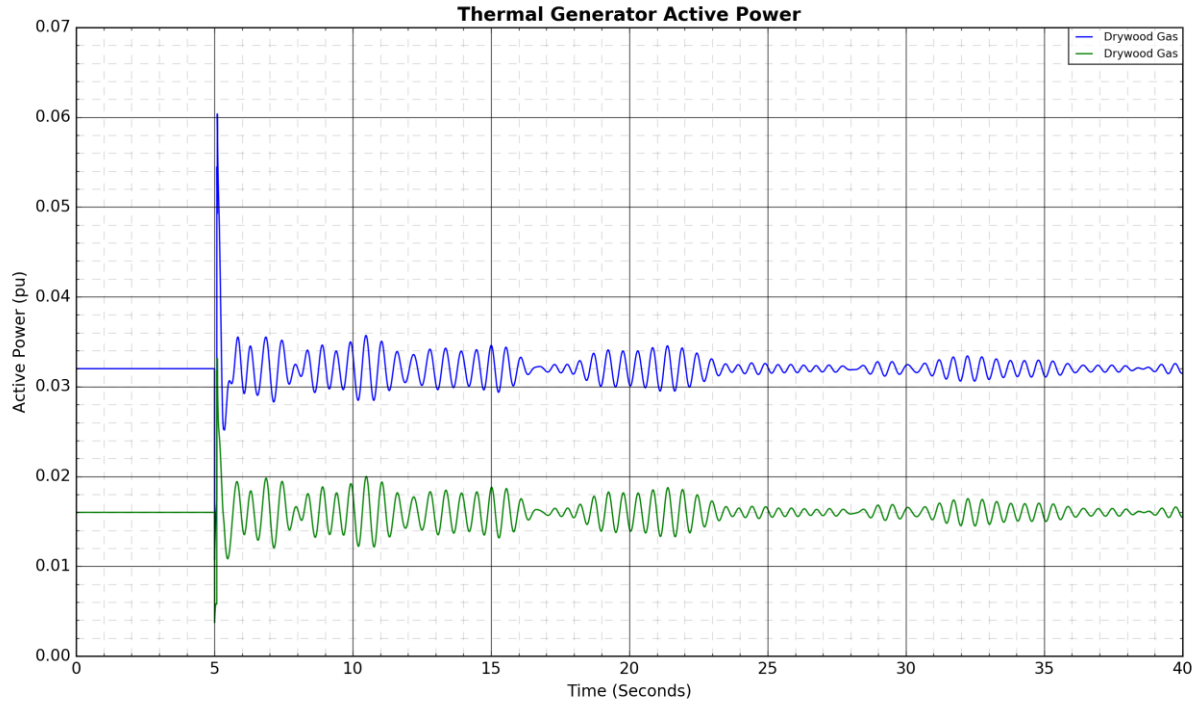
Figure A4-28: 968L North Lethbridge 370S to Windy Flats 138S: Fault Near Windy Flats 138S

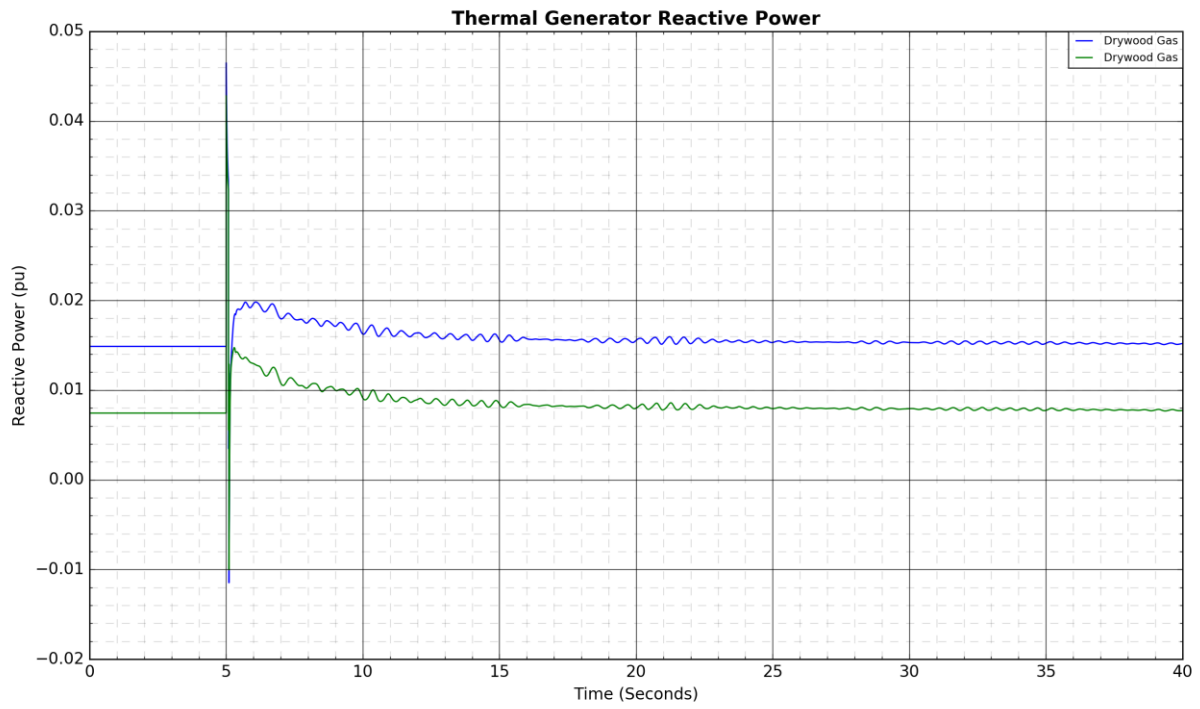
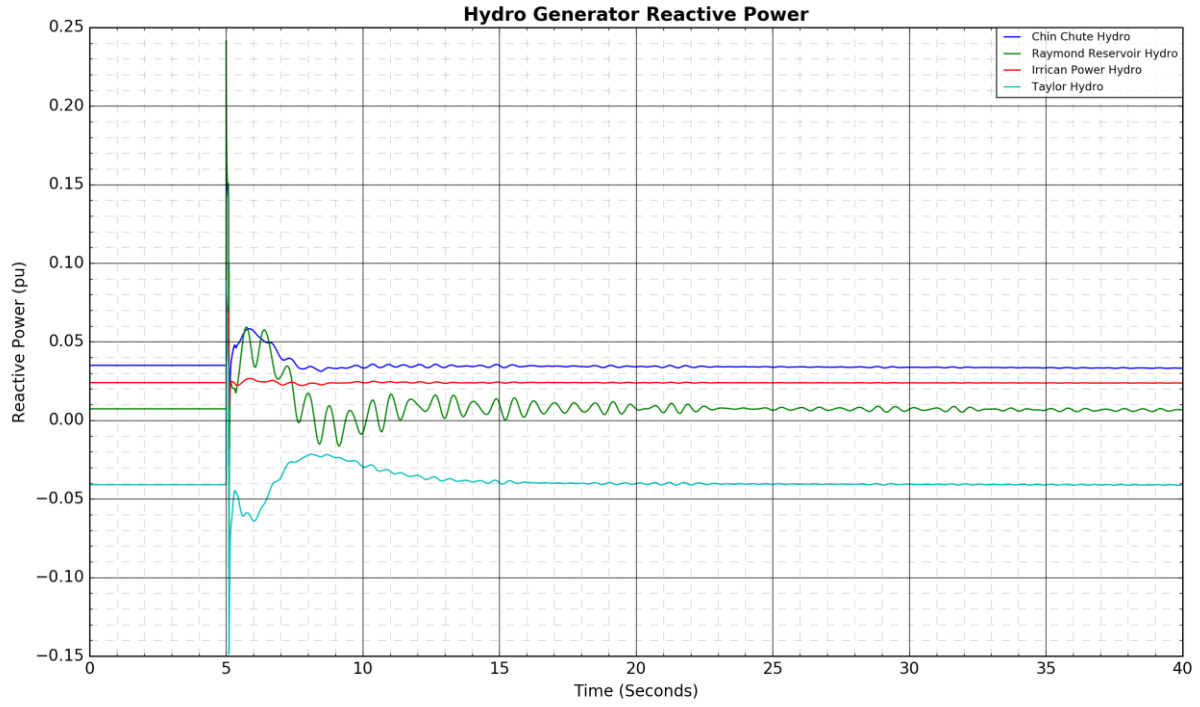


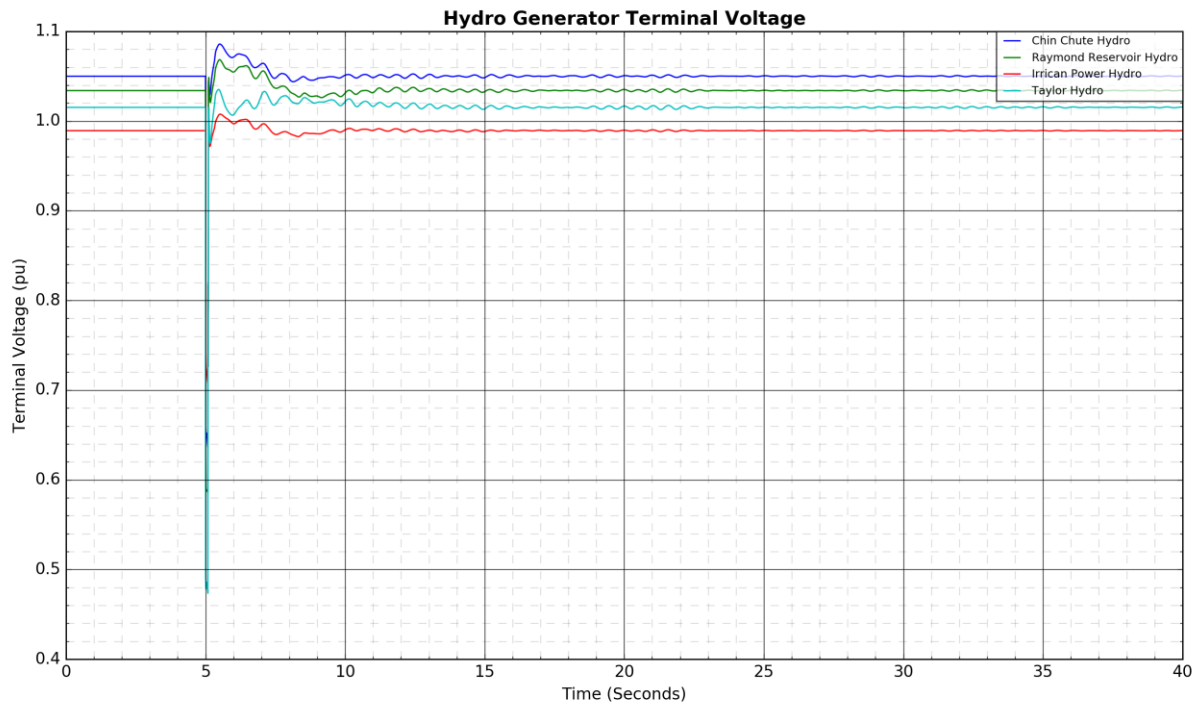
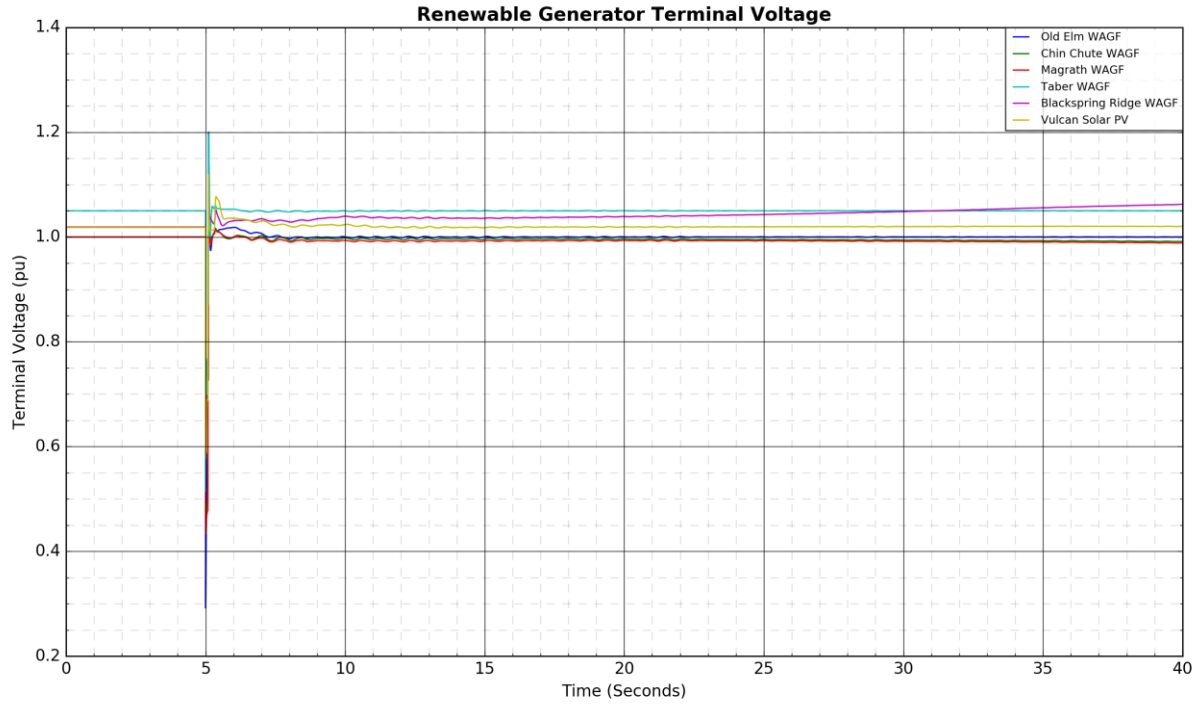


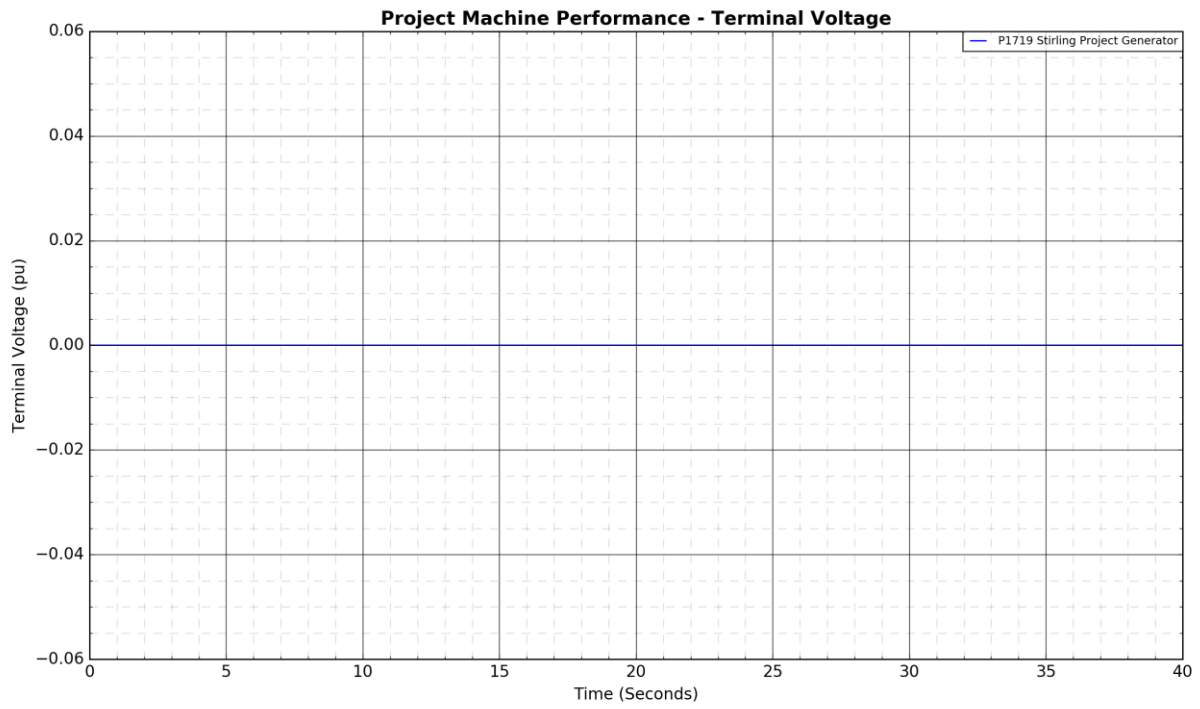
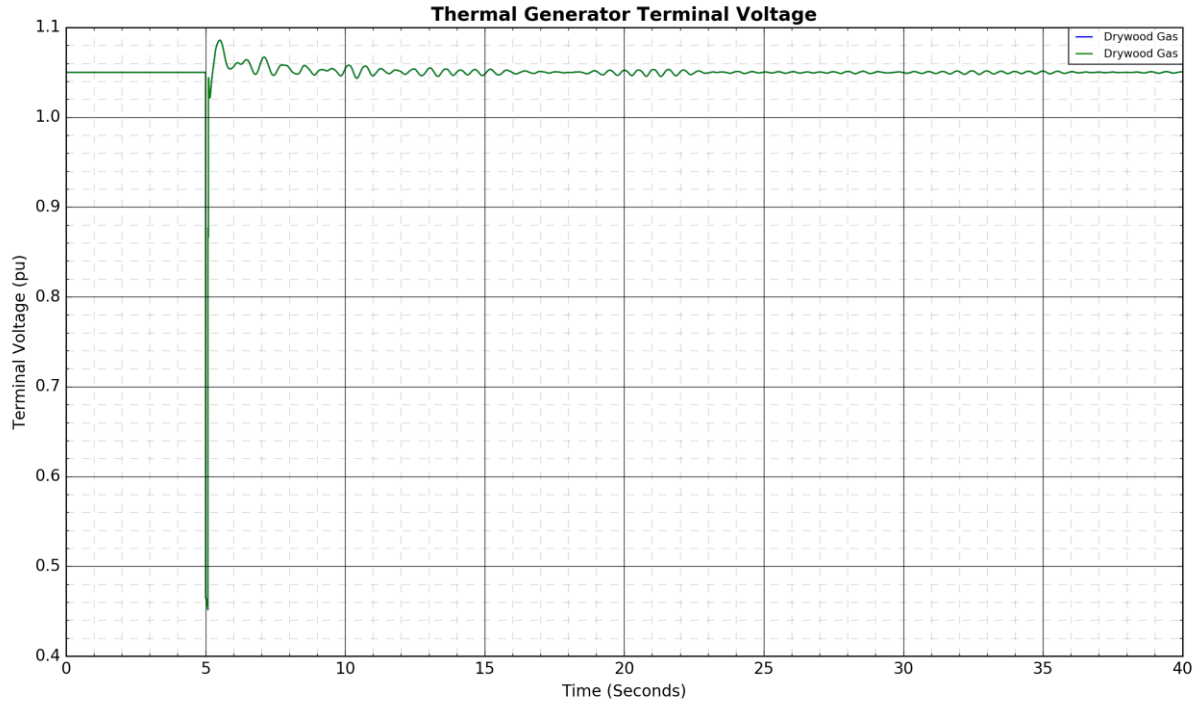
Engineering Connection Assessment Results: Stirling Wind Project Connection

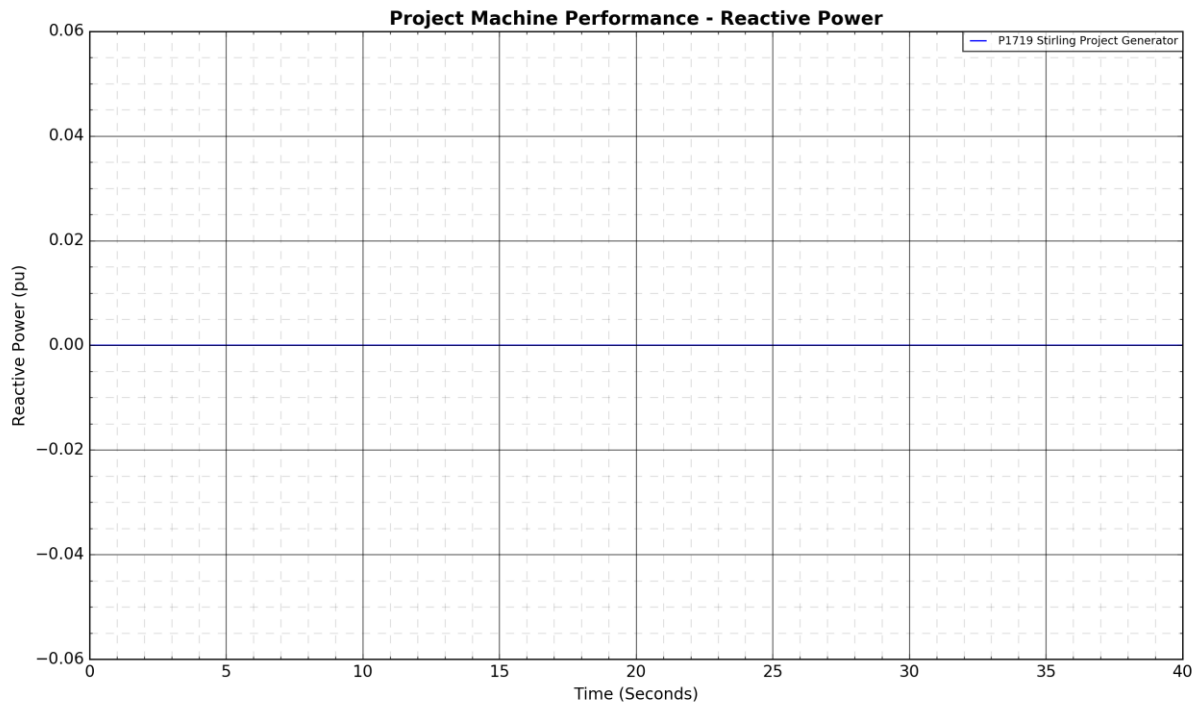
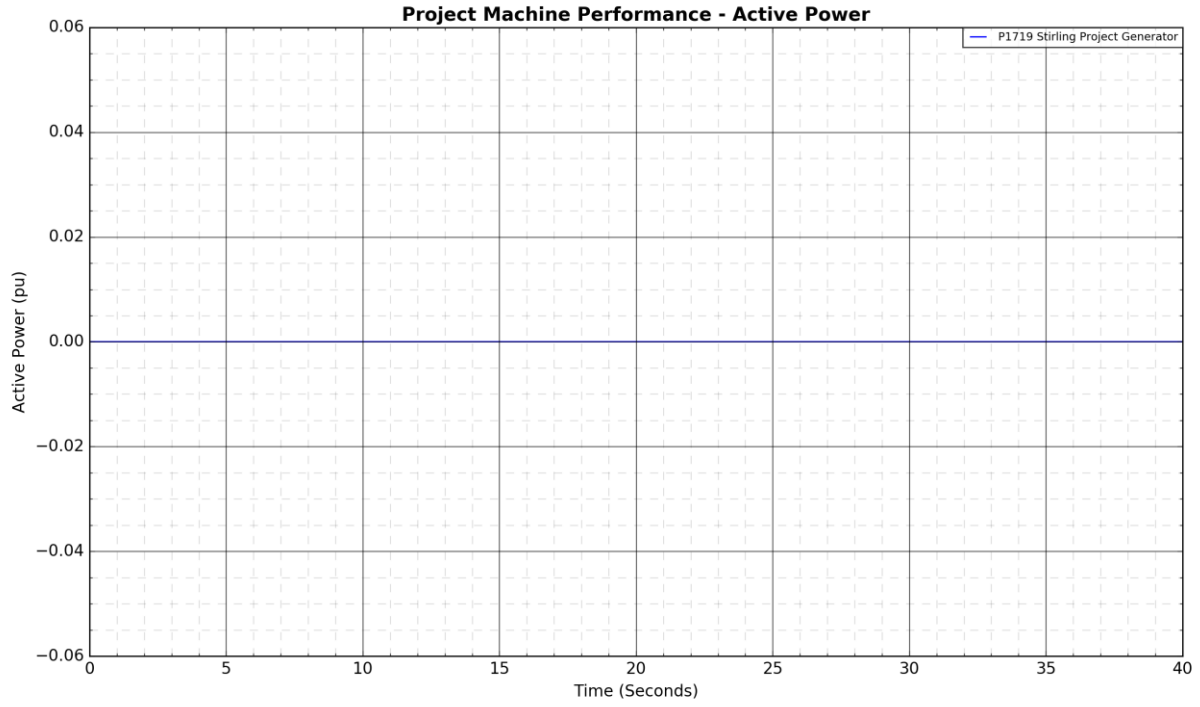






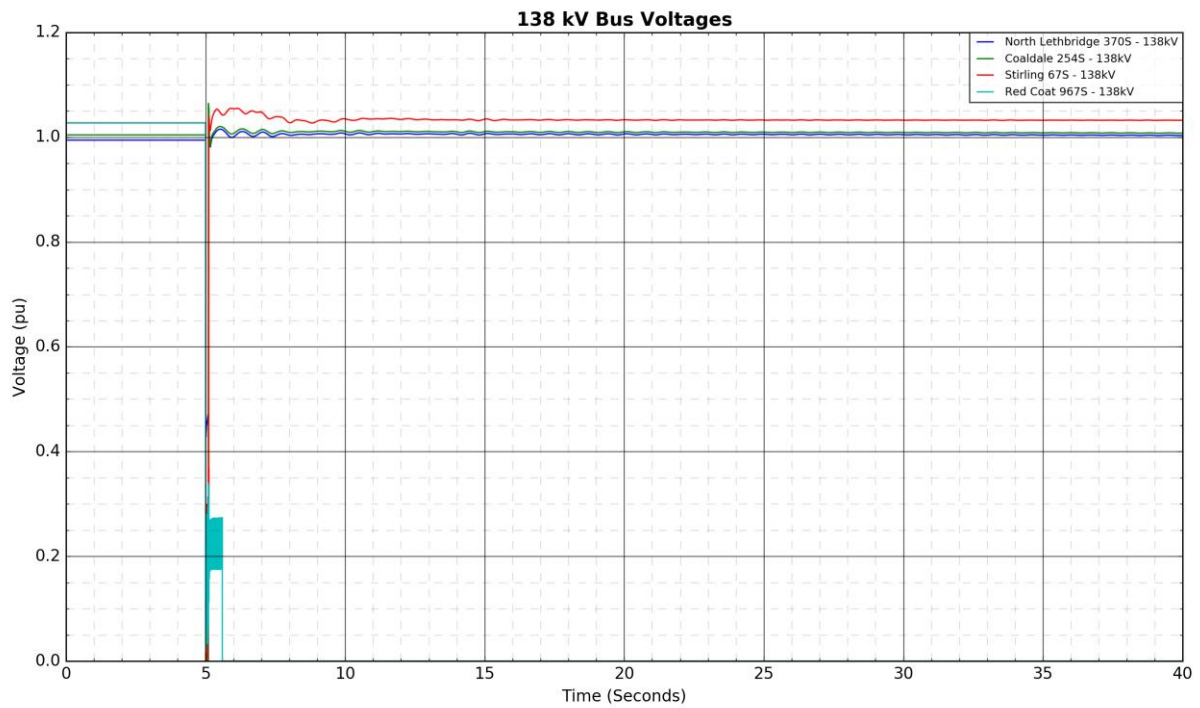
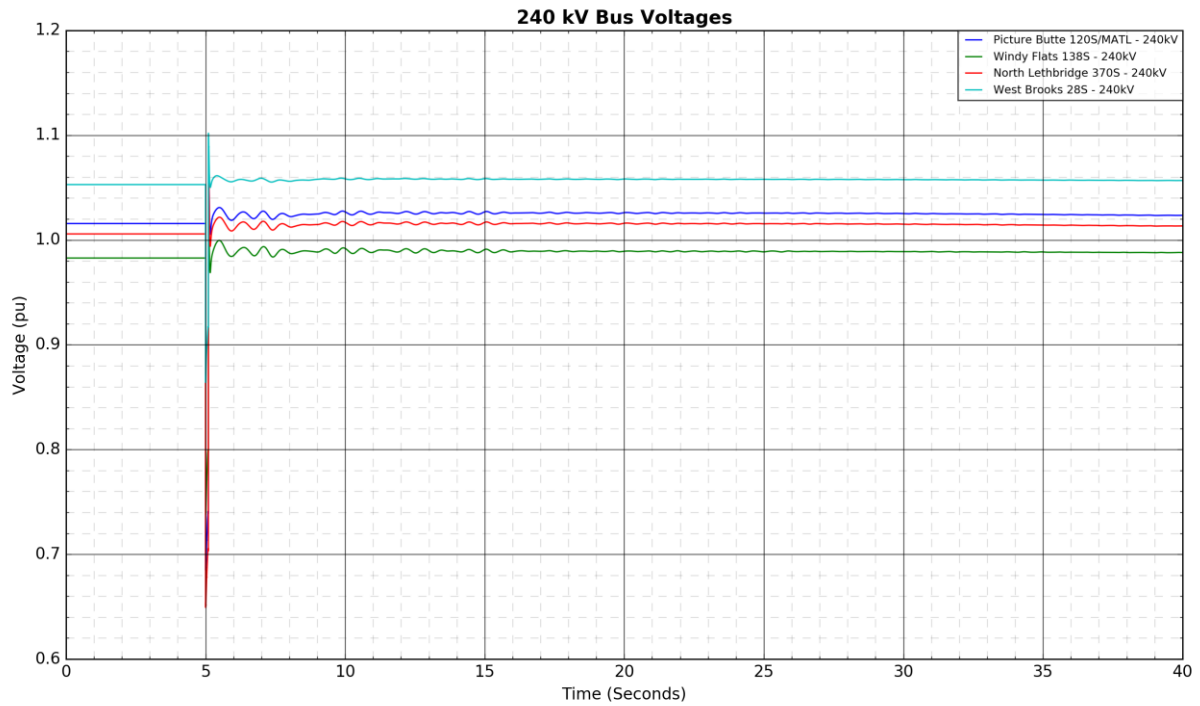


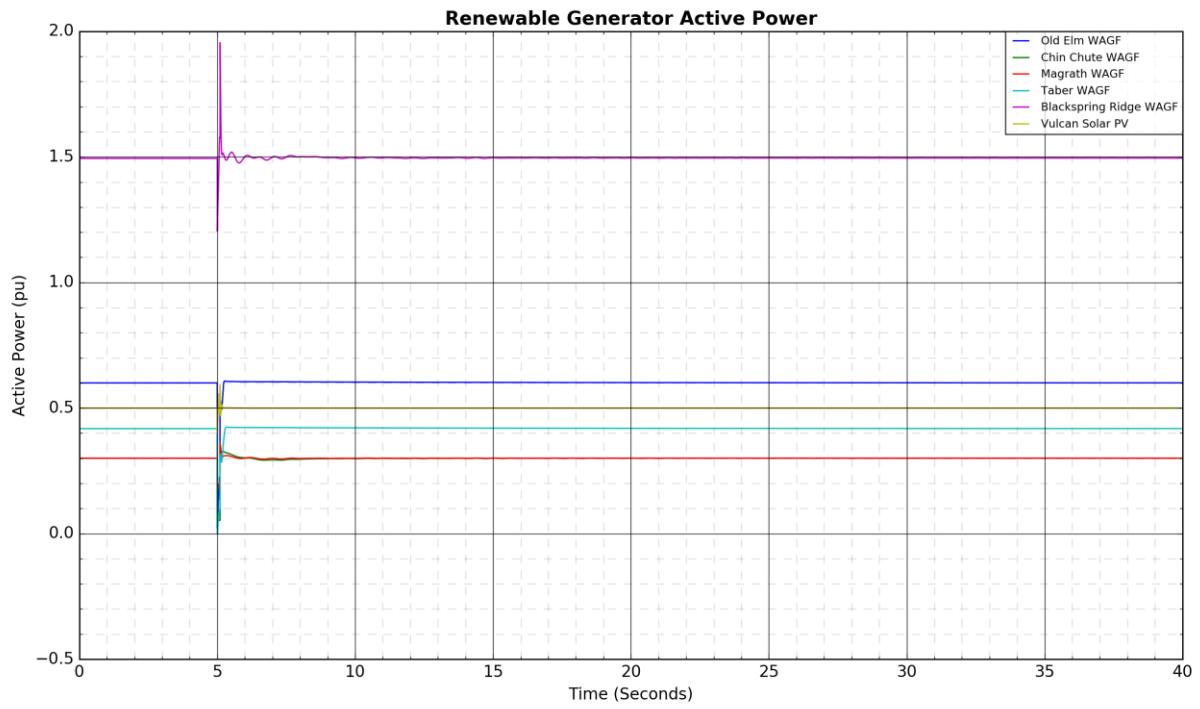
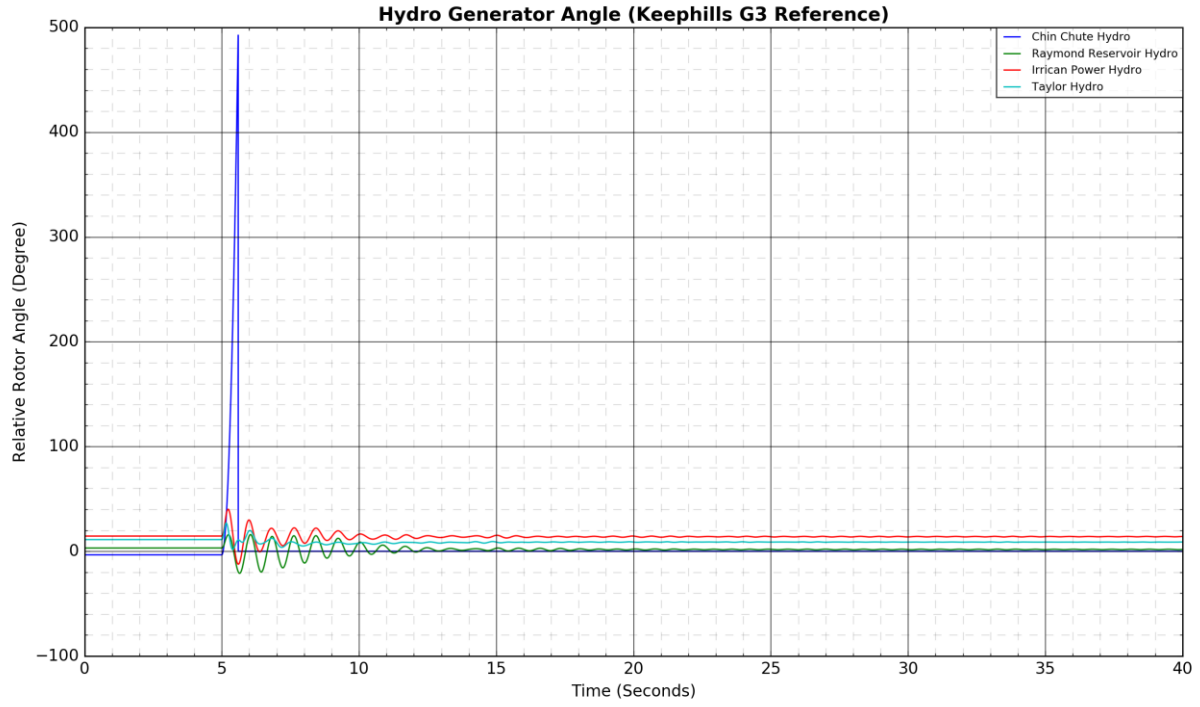




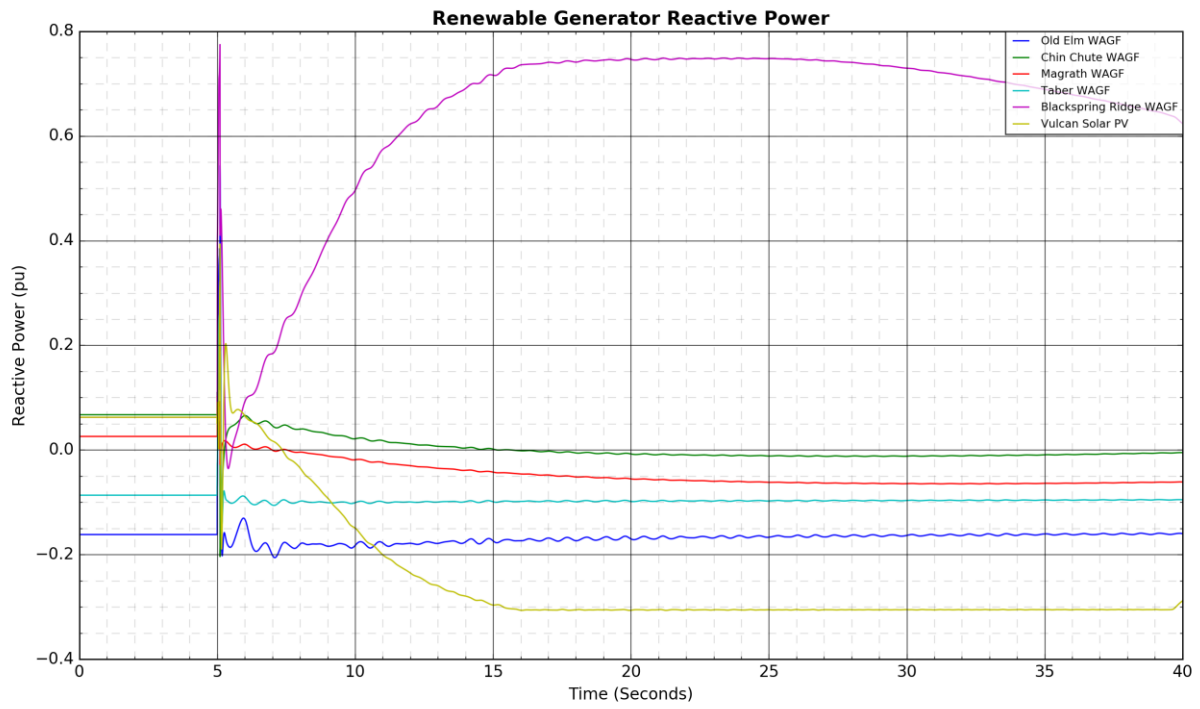
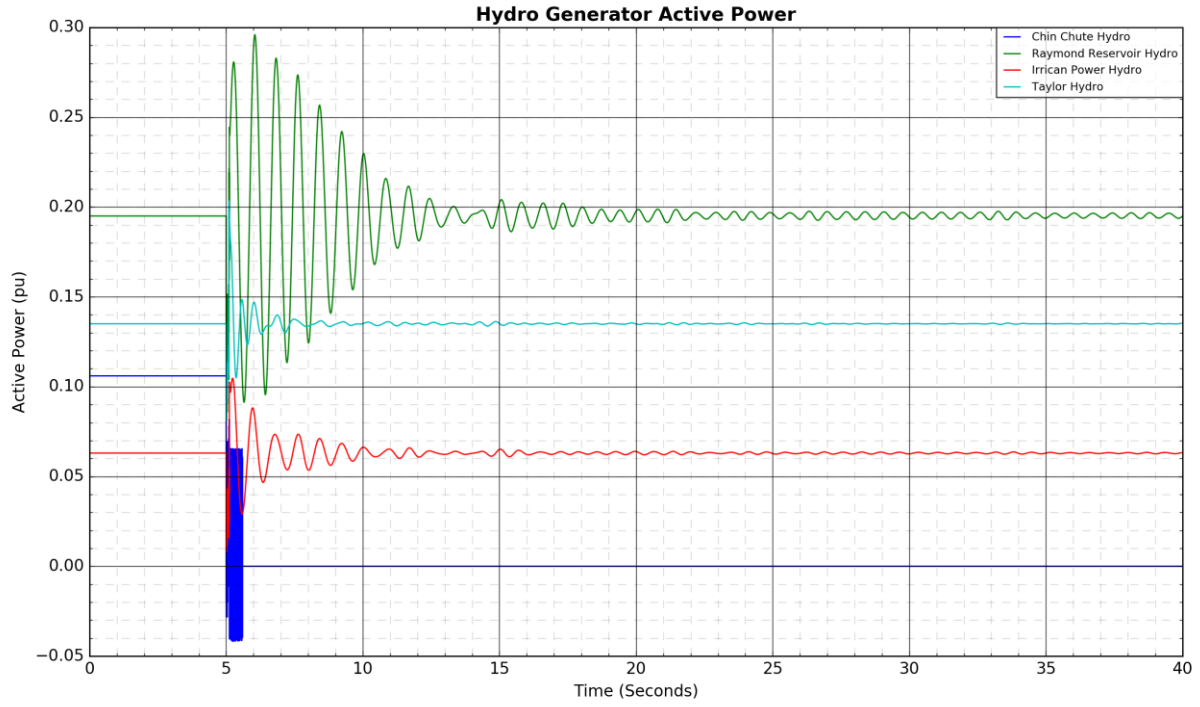
3. Stability Results 2019 Summer Light - Case Post

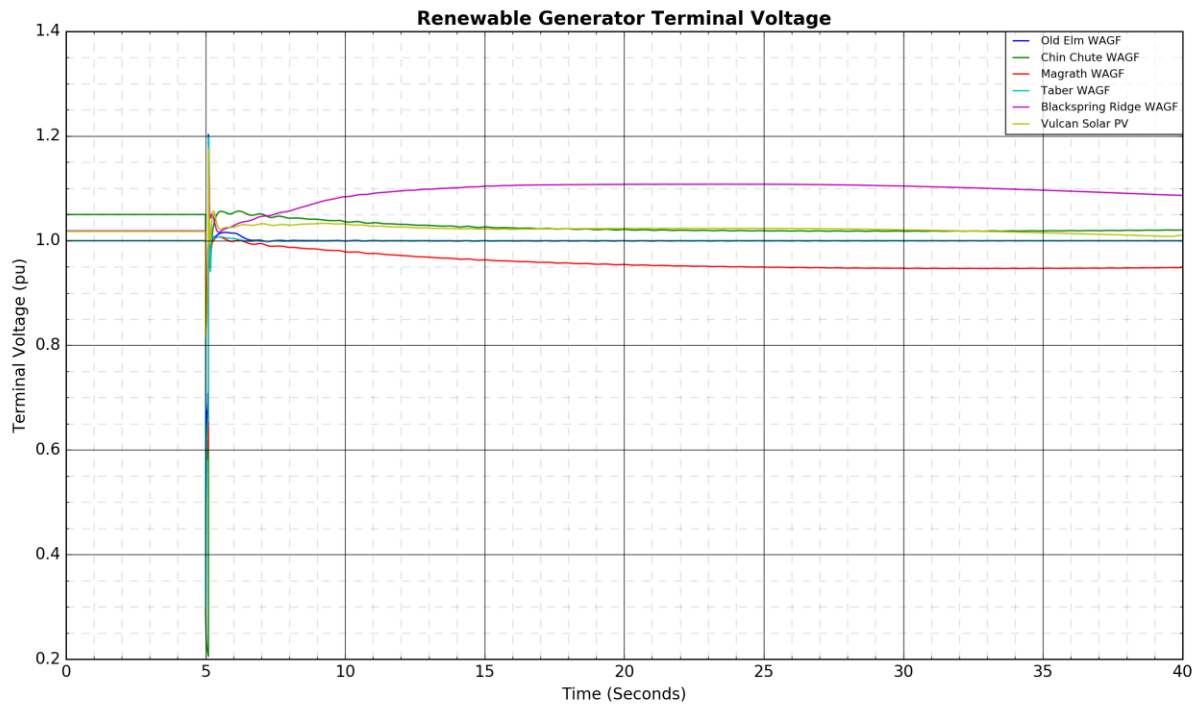
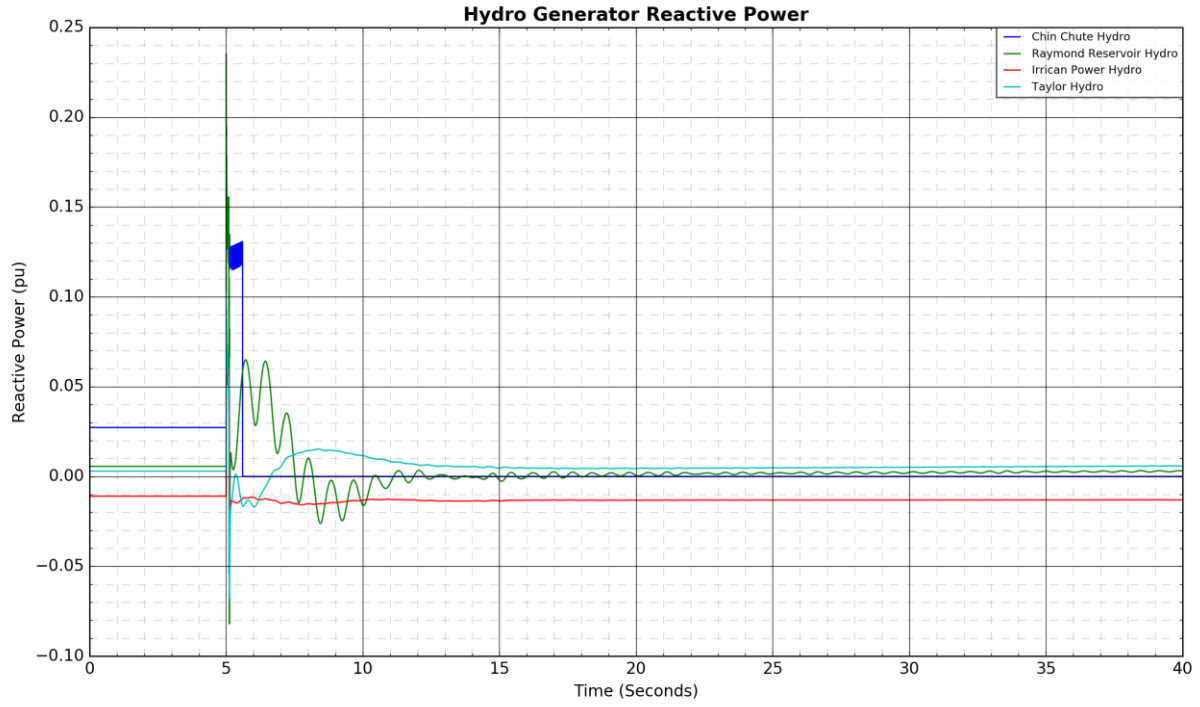
Figure A4-29: 820L Coaldale 254S to Chin Chute 315S T-Tap to Red Coat 967S T-Tap to Stirling 67S: Fault Near Coaldale 254S

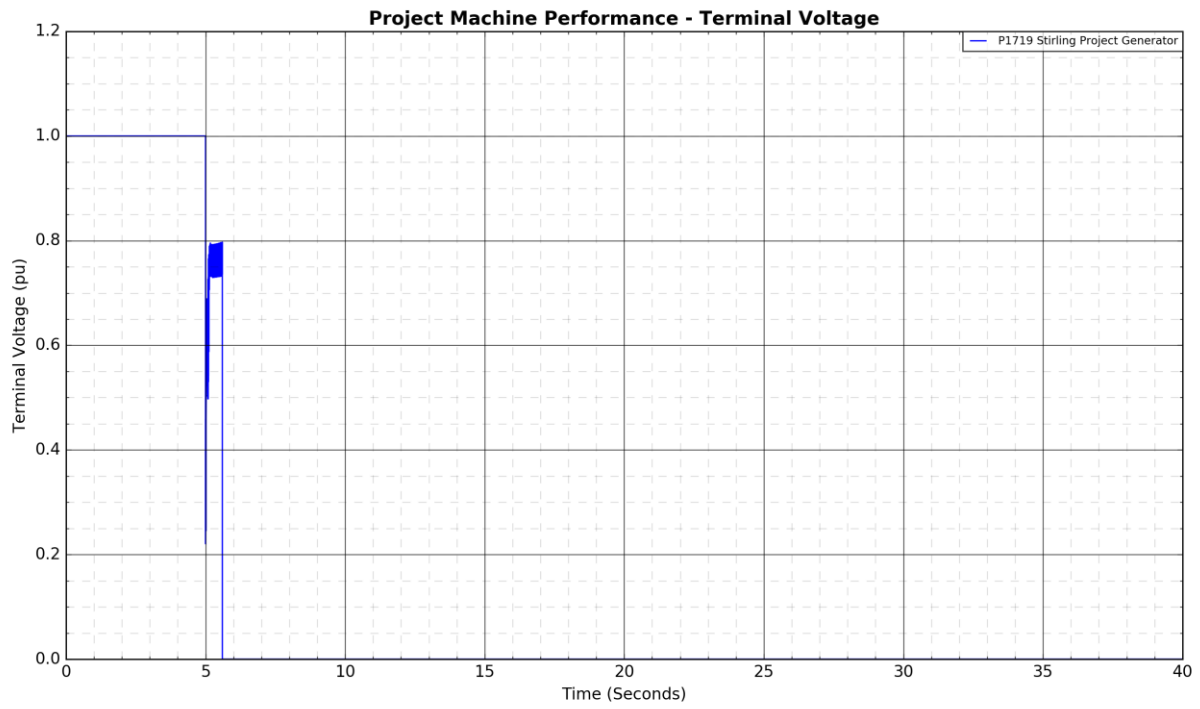
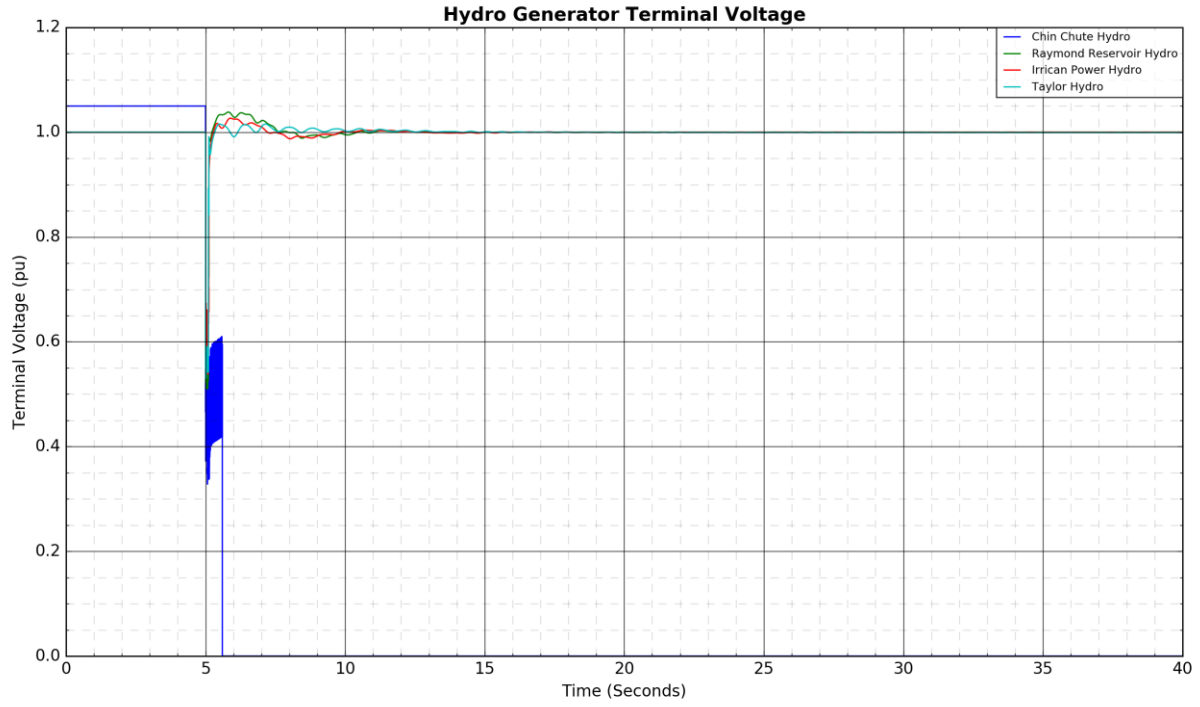




Engineering Connection Assessment Results: Stirling Wind Project Connection







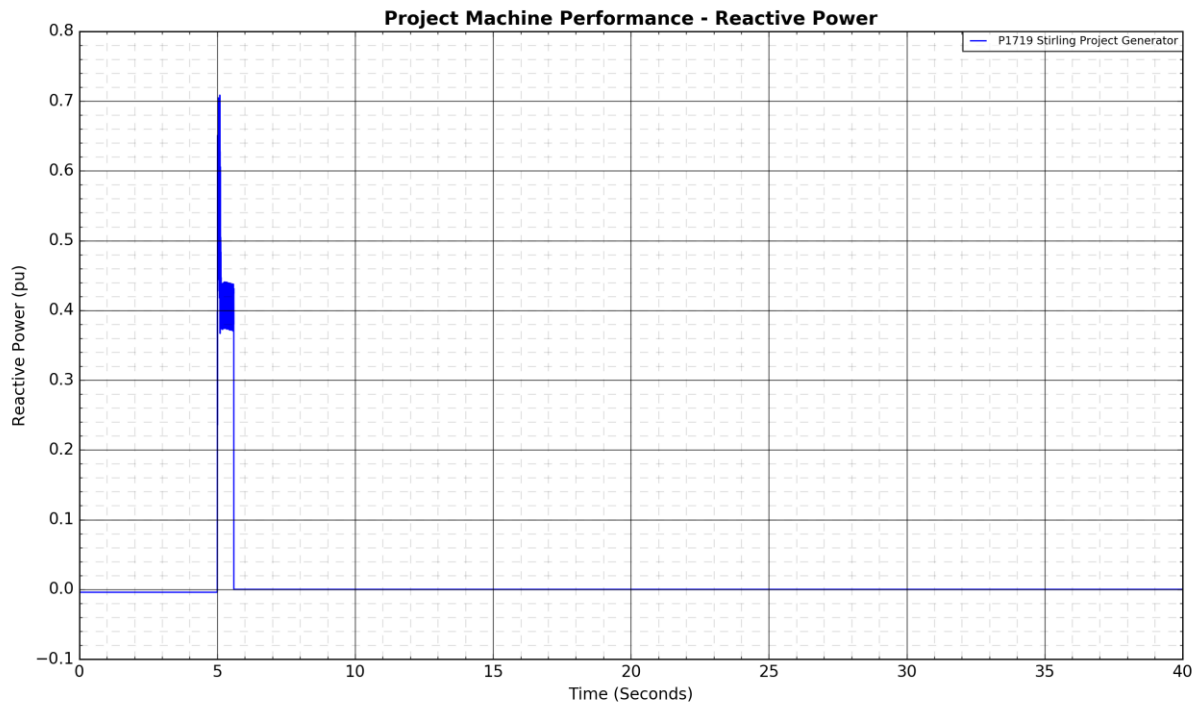
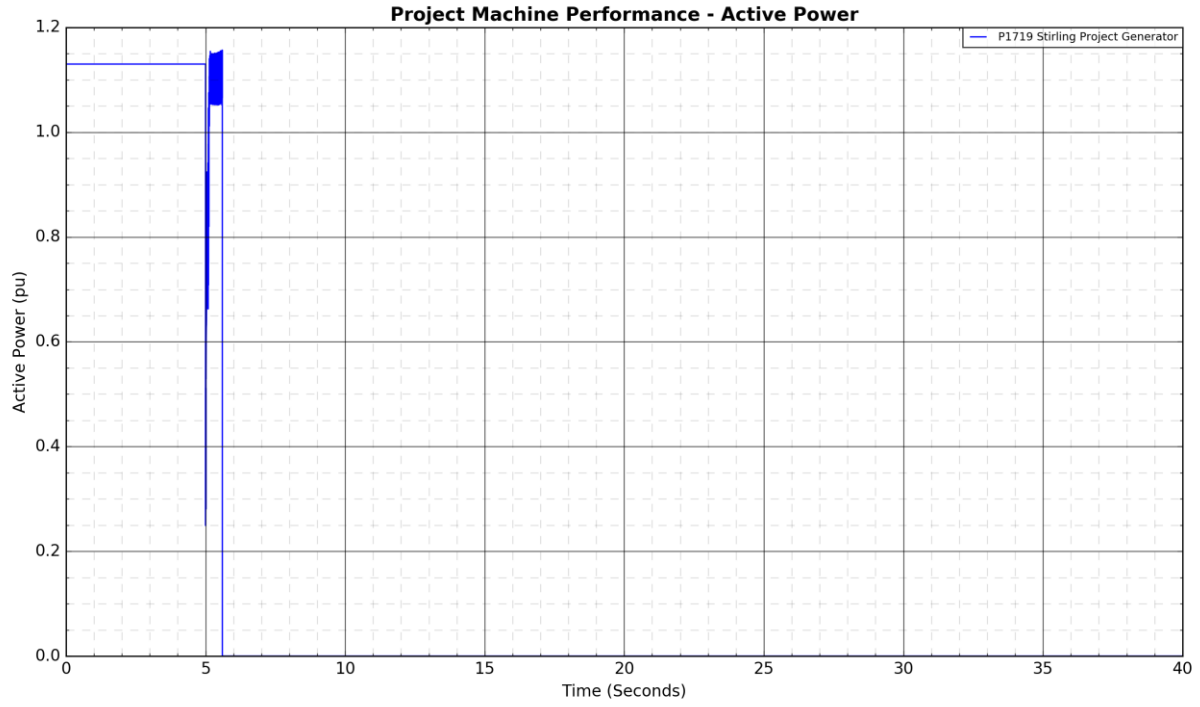
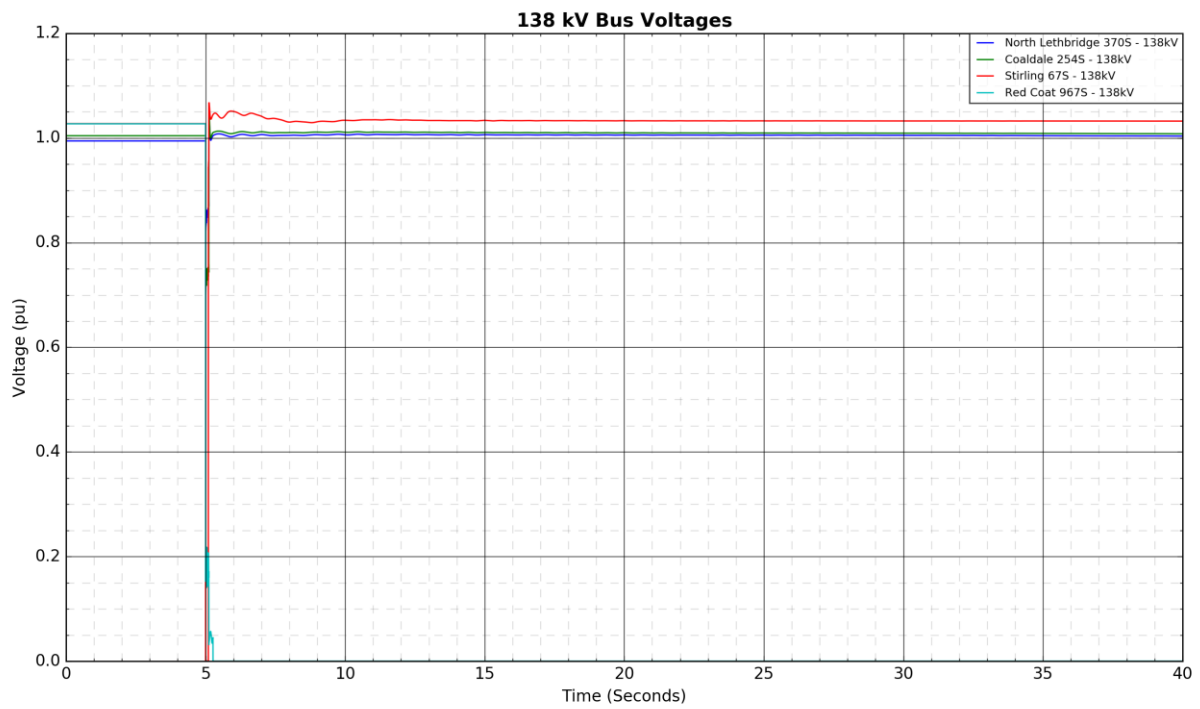
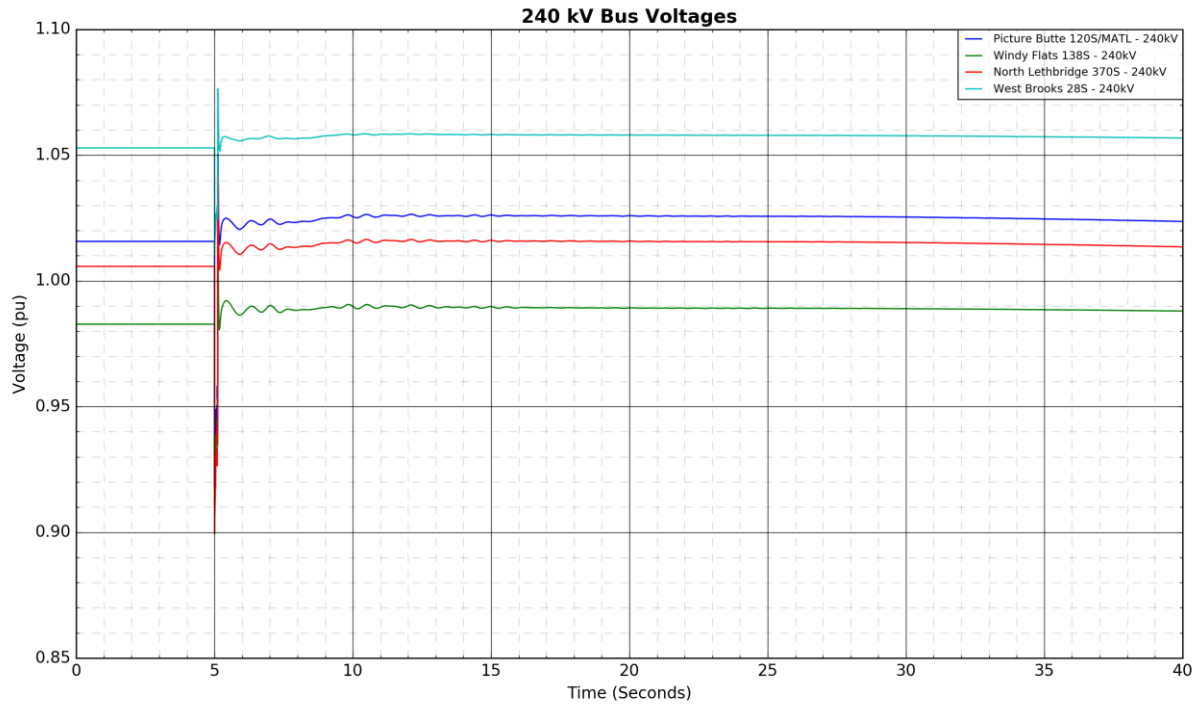
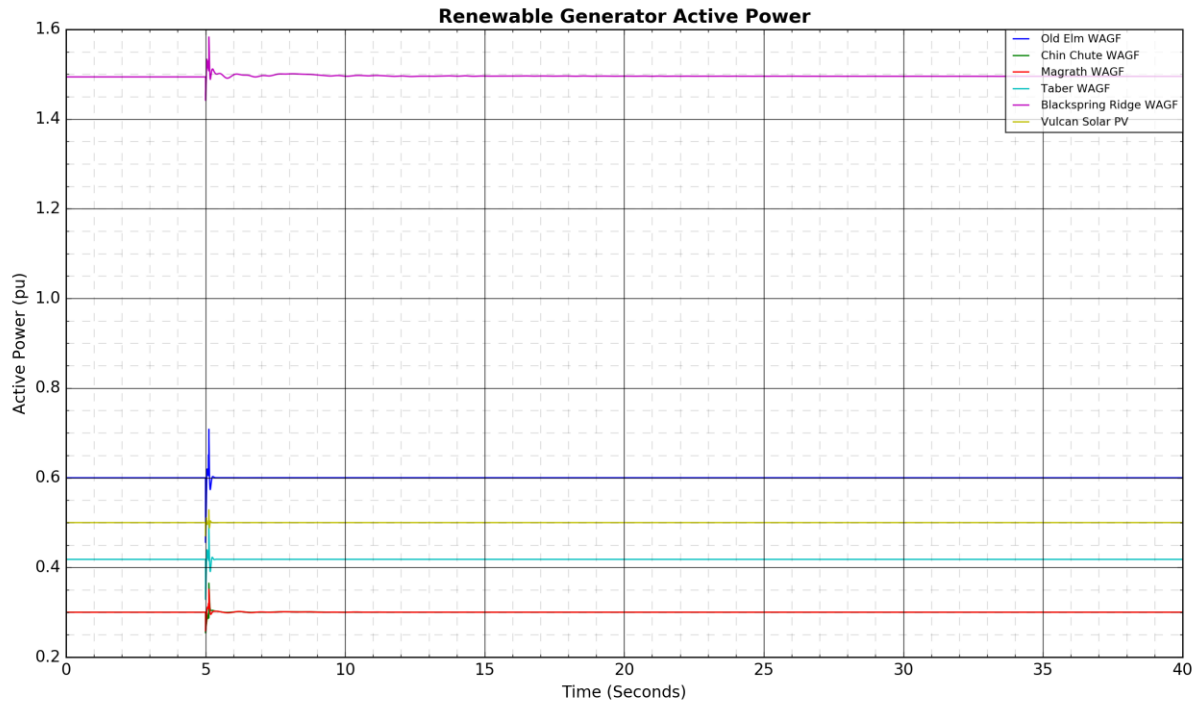
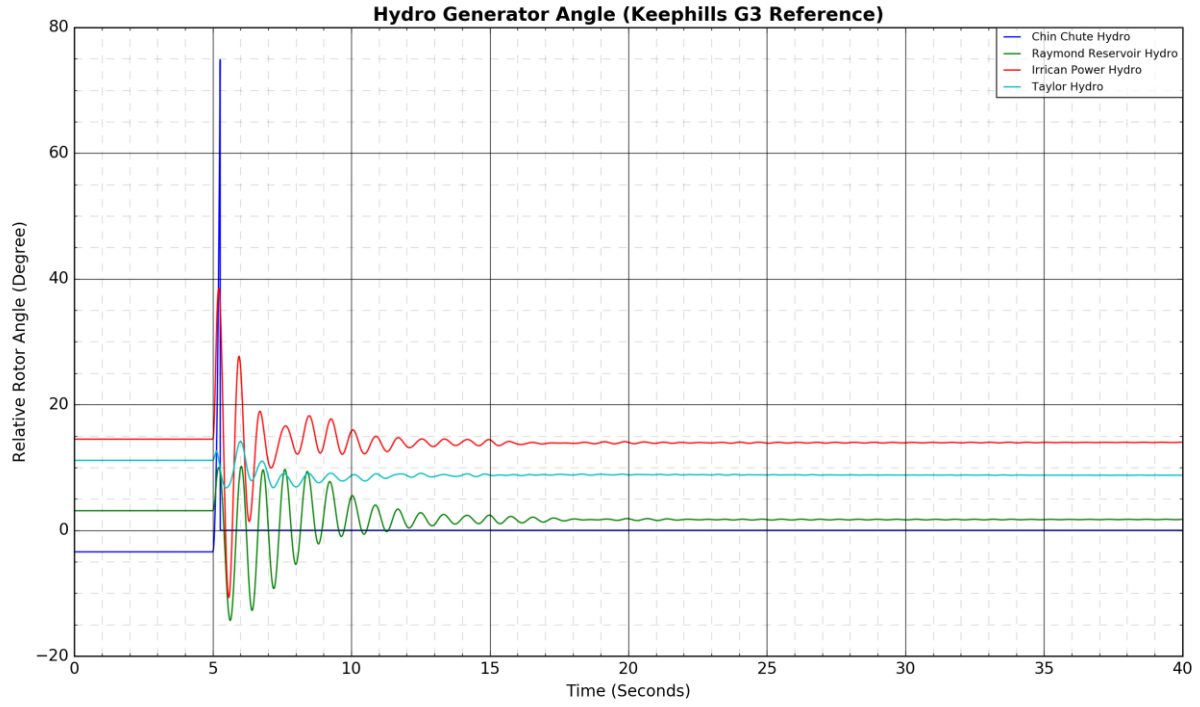
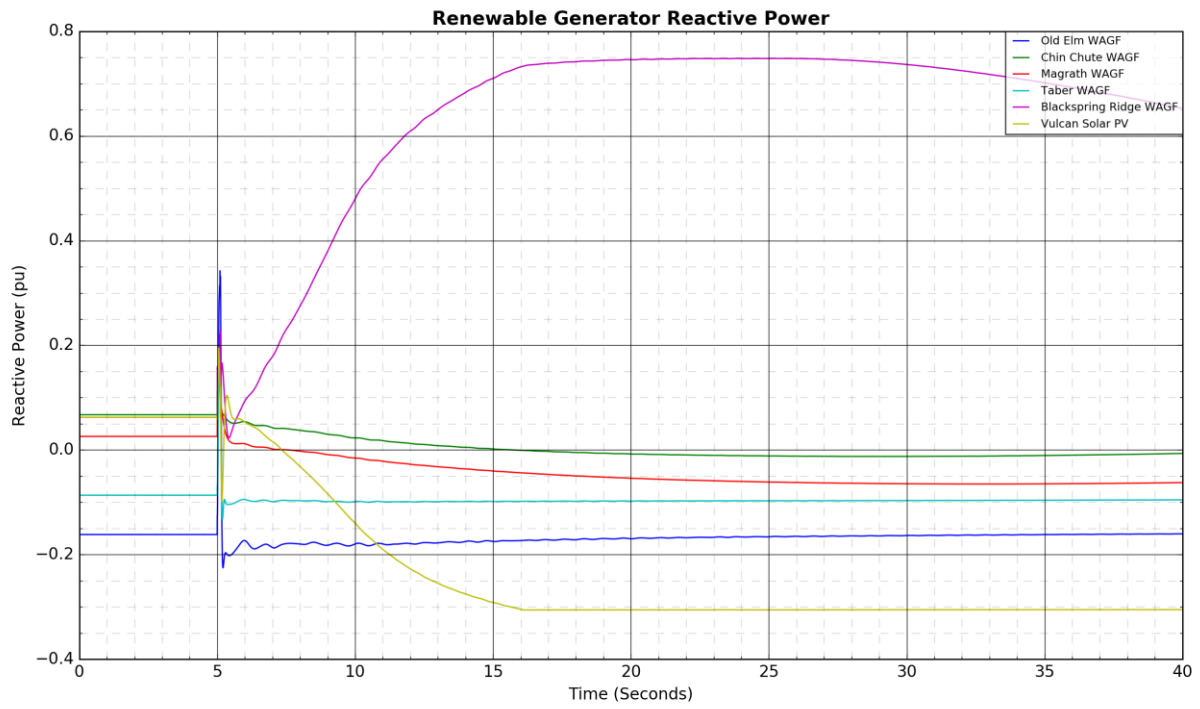
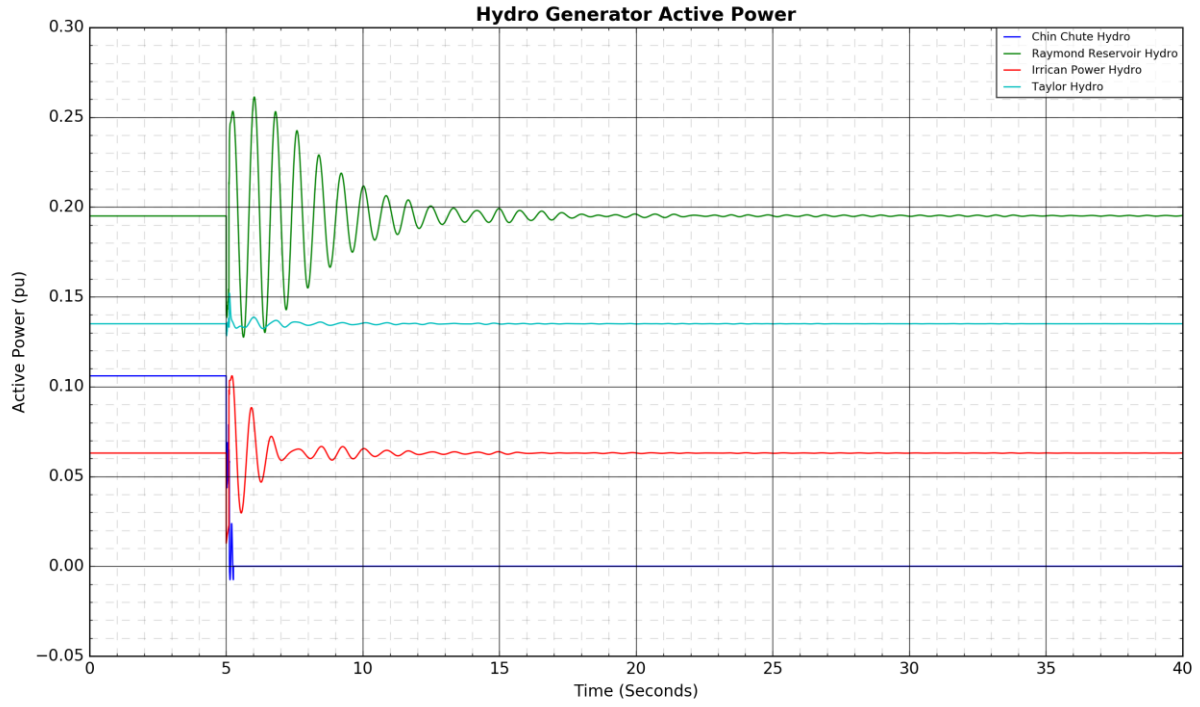


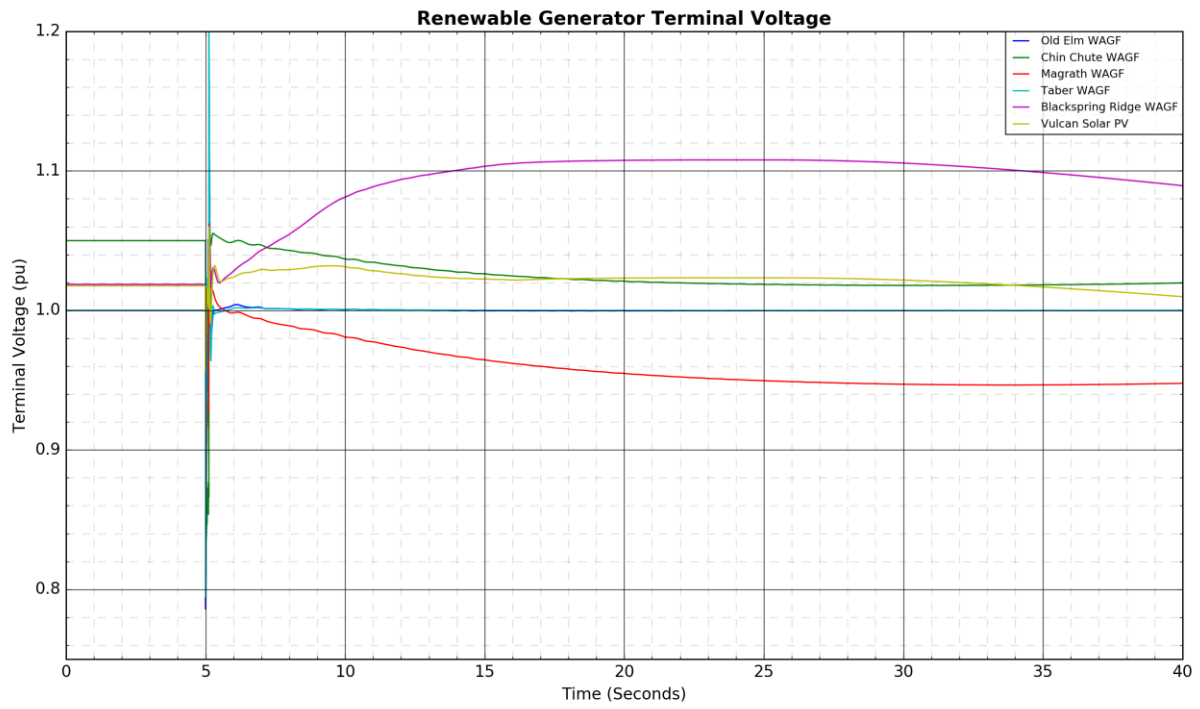
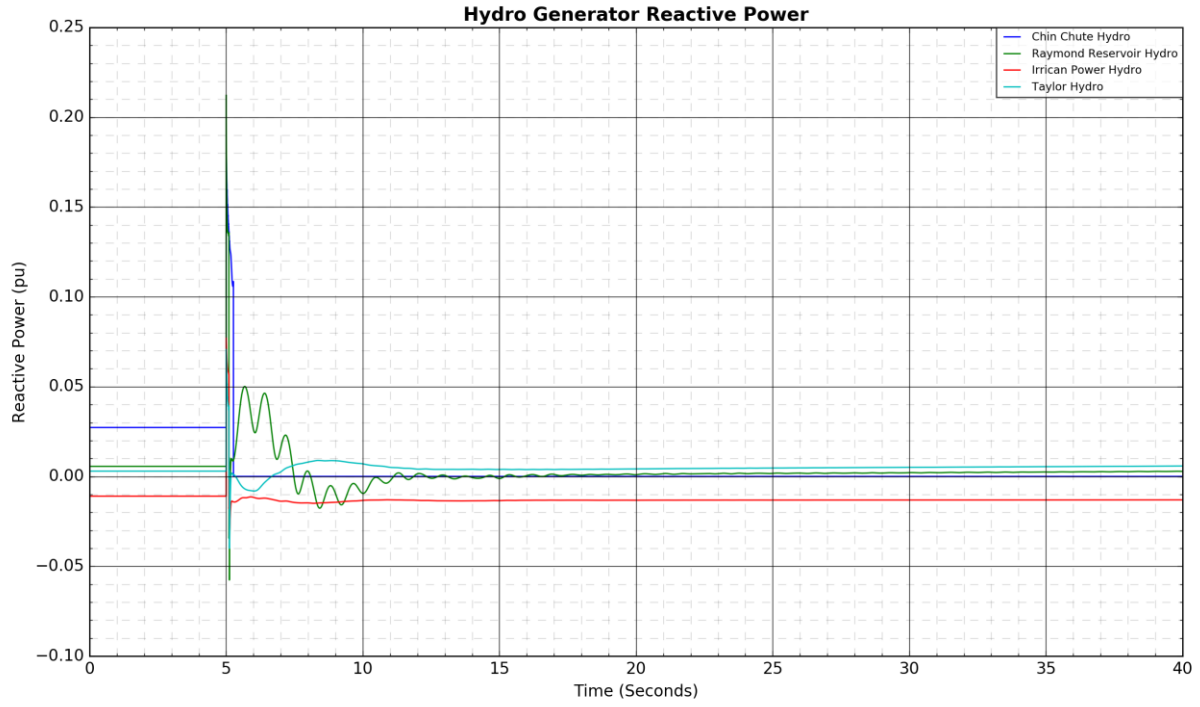
Figure A4-30: 820L Coaldale 254S to Chin Chute 315S T-Tap to Red Coat 967S T-Tap to Stirling 67S: Fault Near Stirling 67S

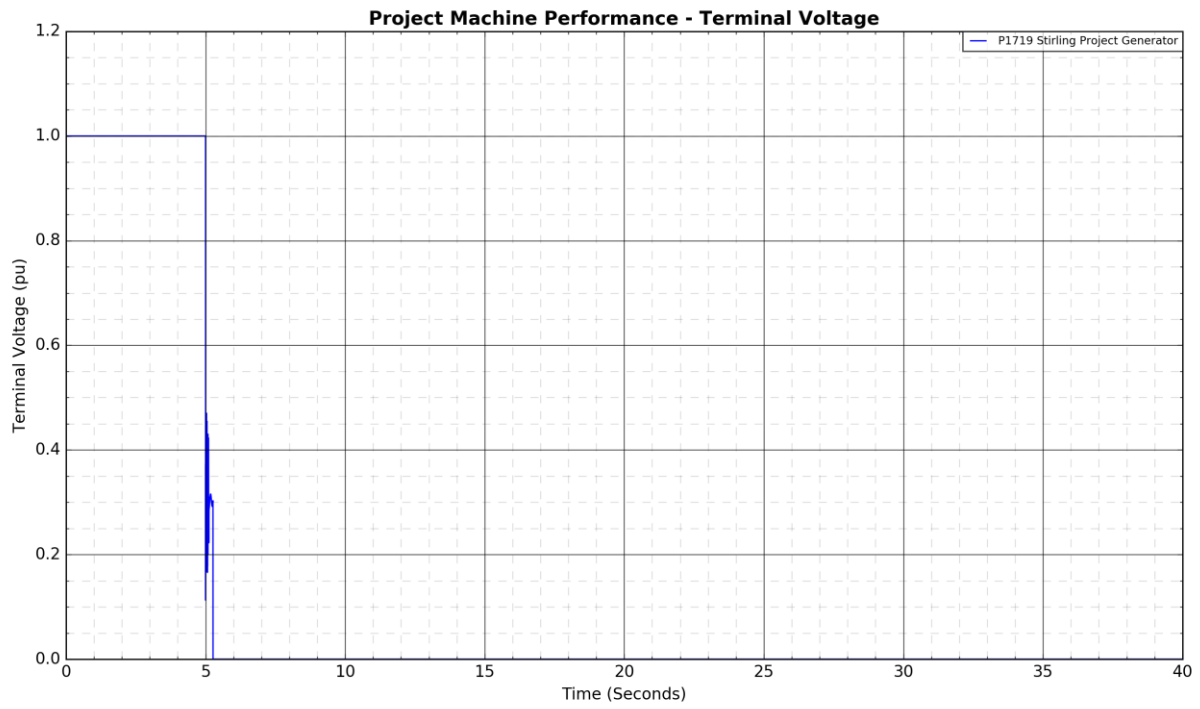
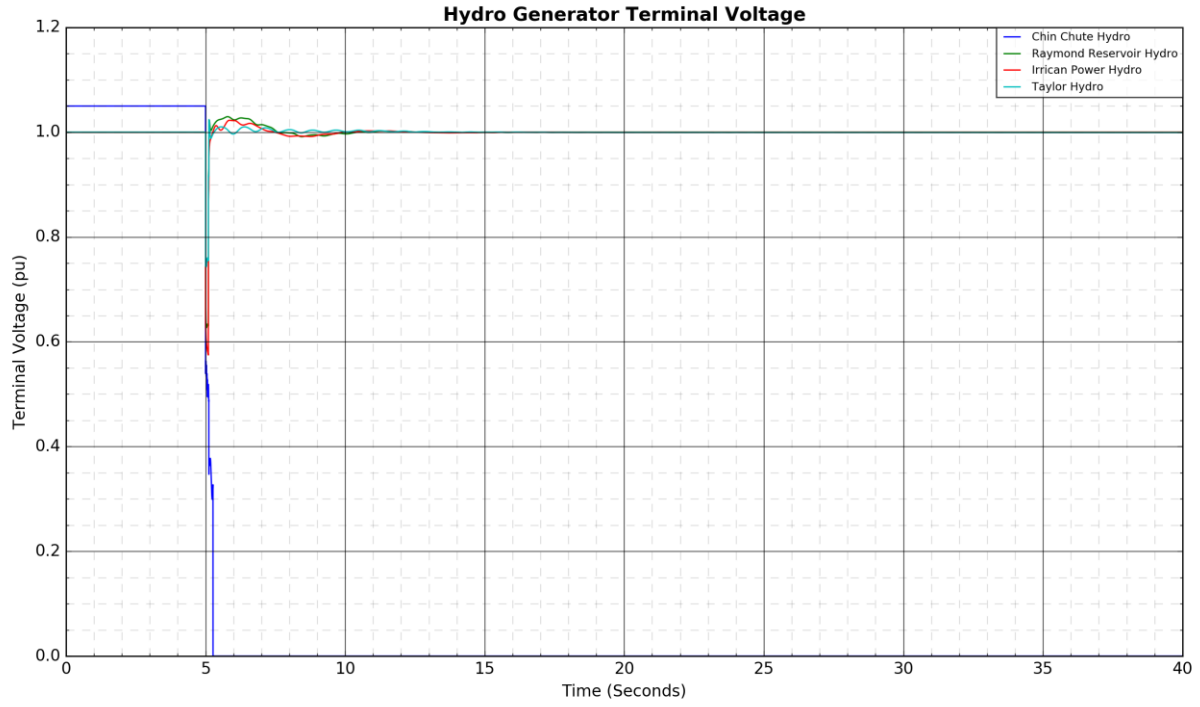


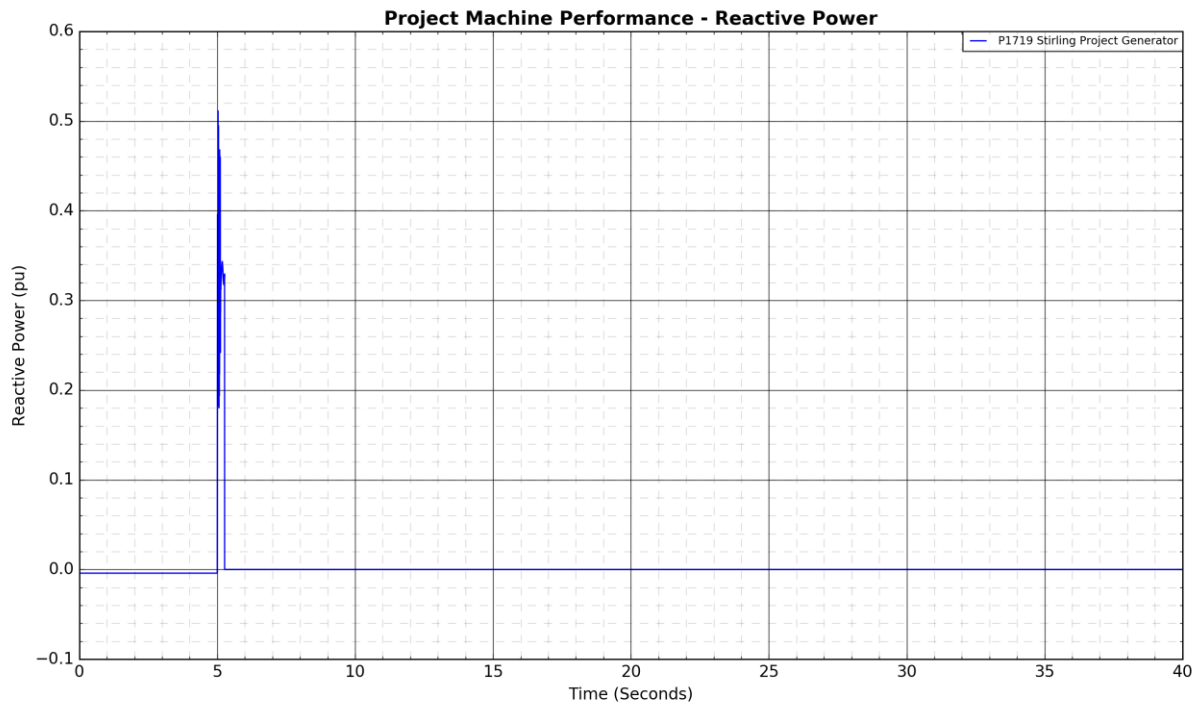
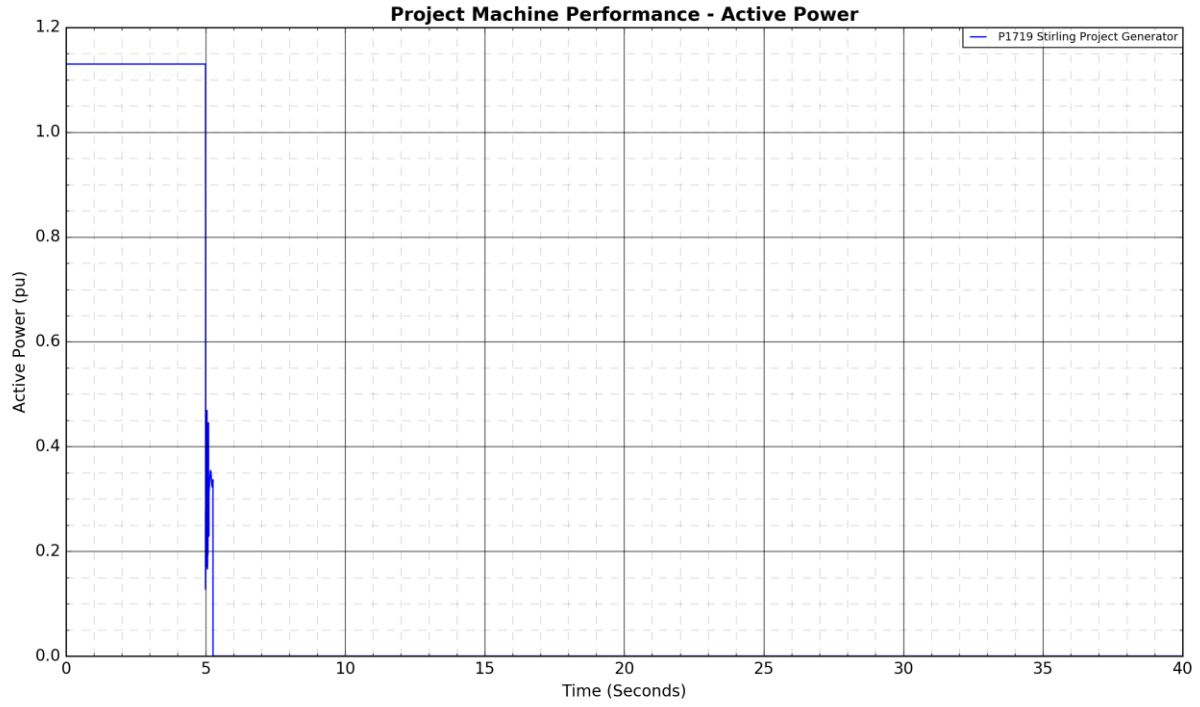


Engineering Connection Assessment Results: Stirling Wind Project Connection

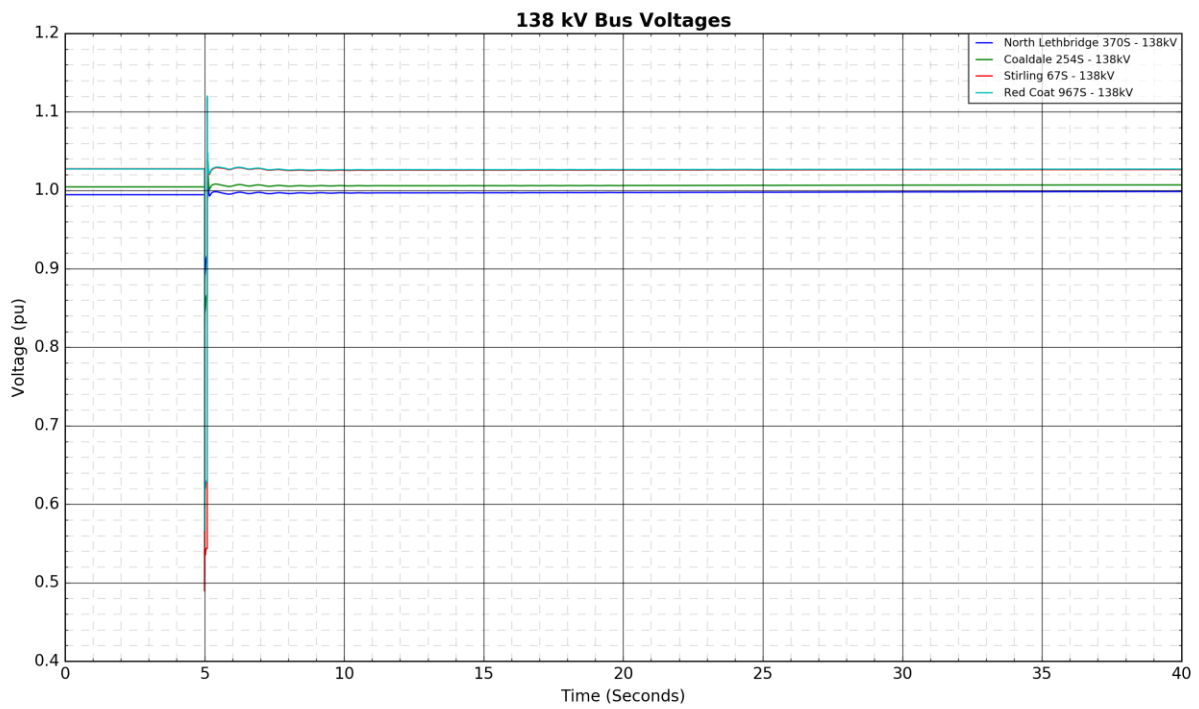
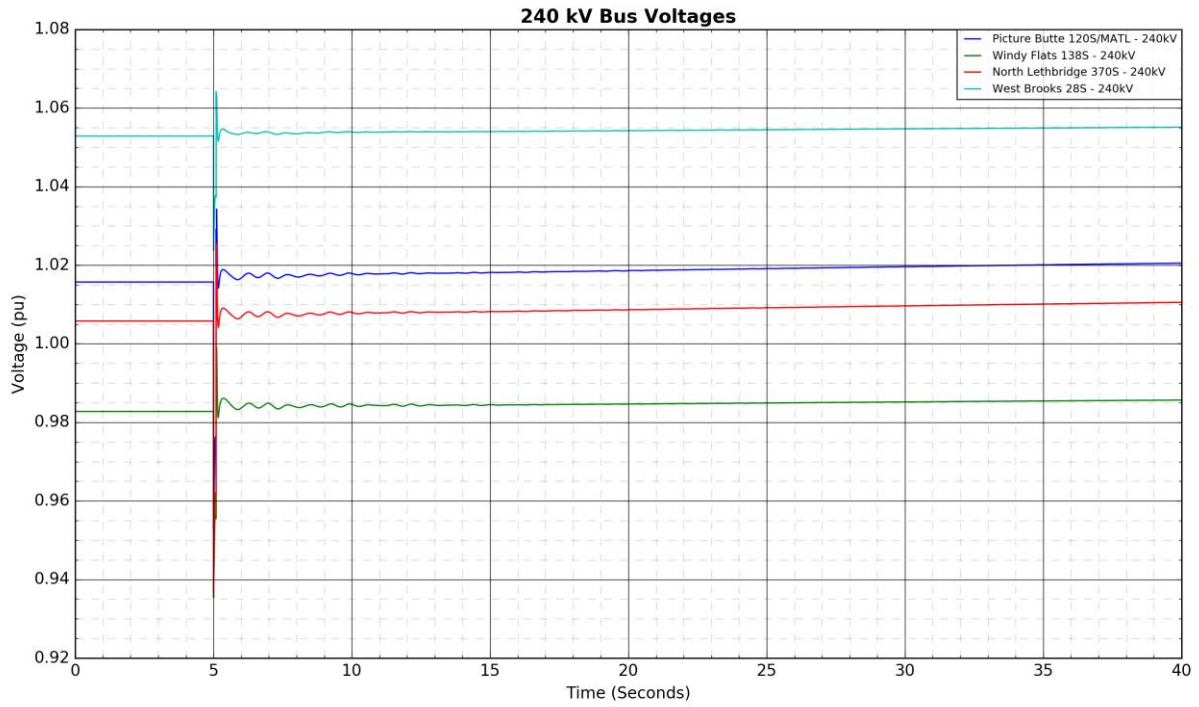


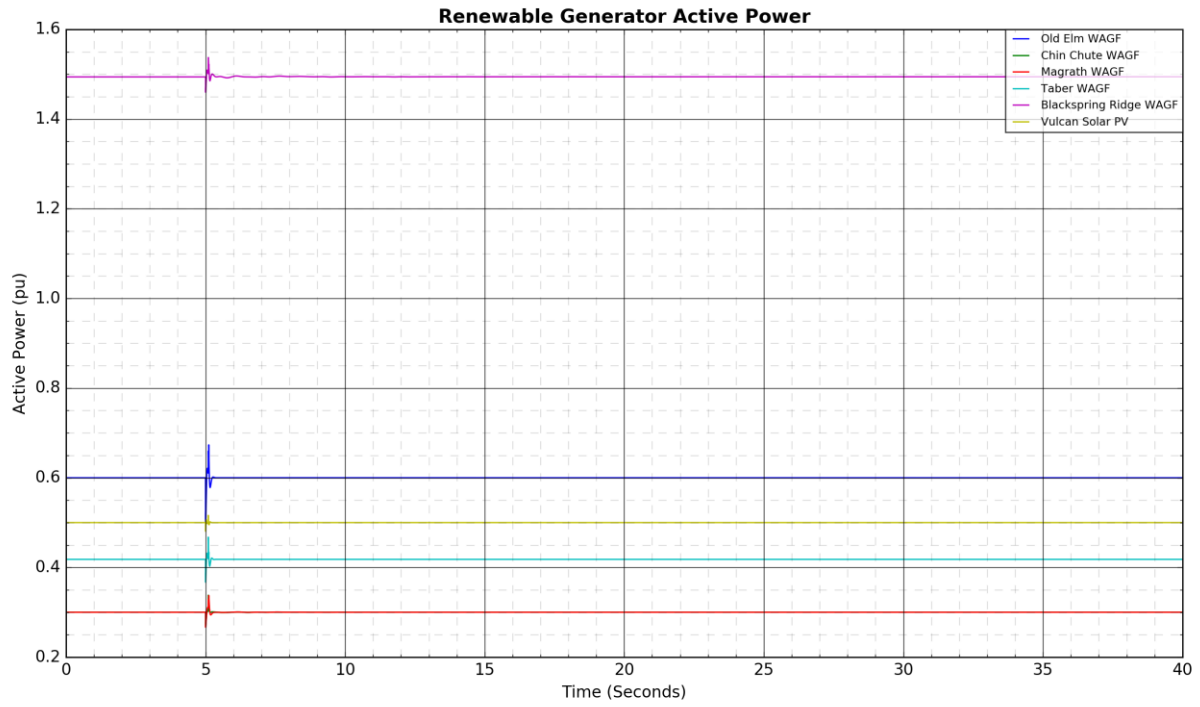
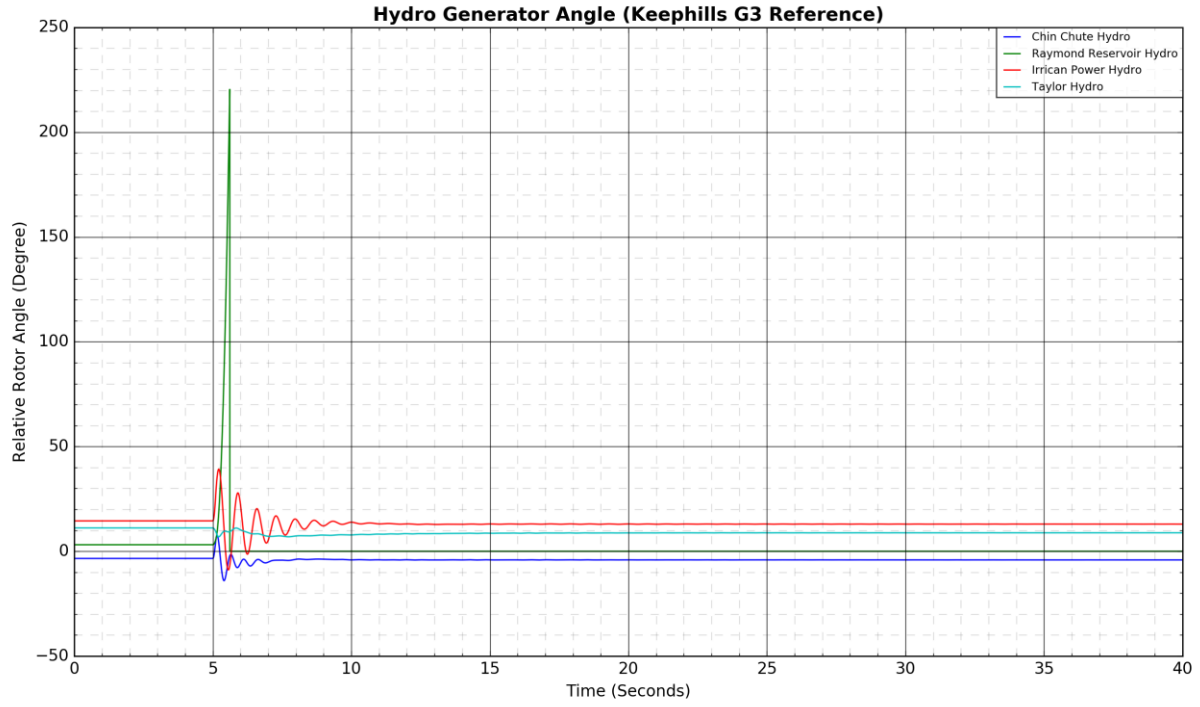




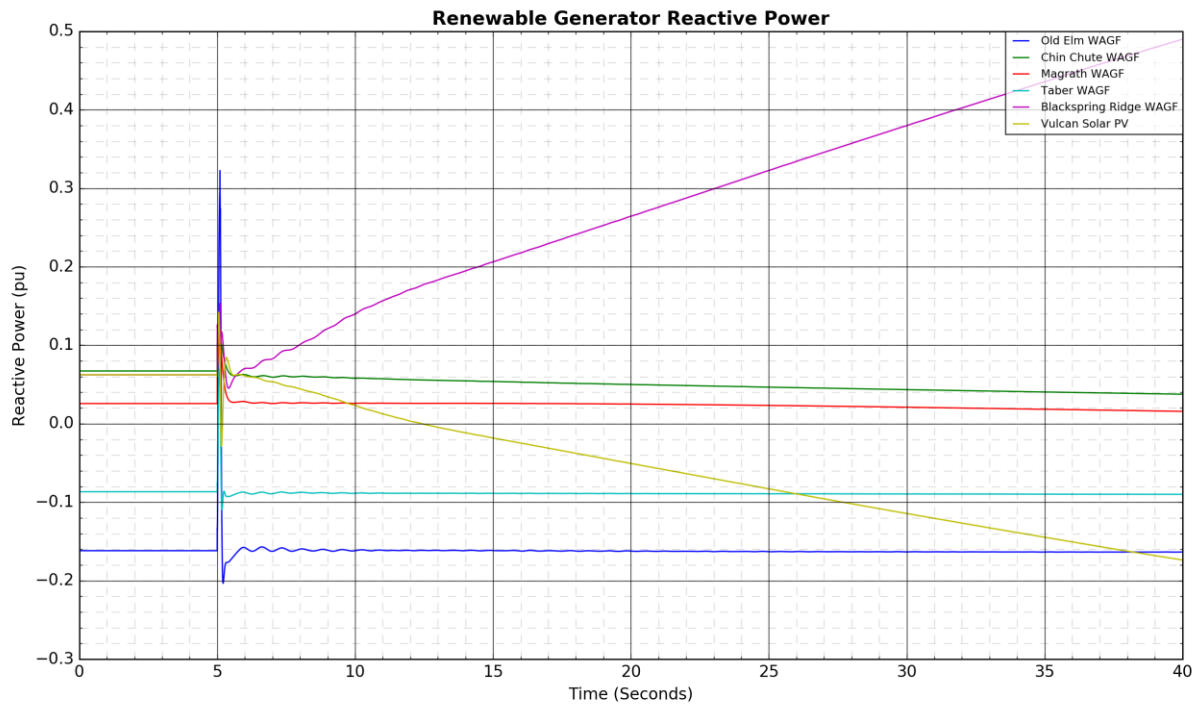
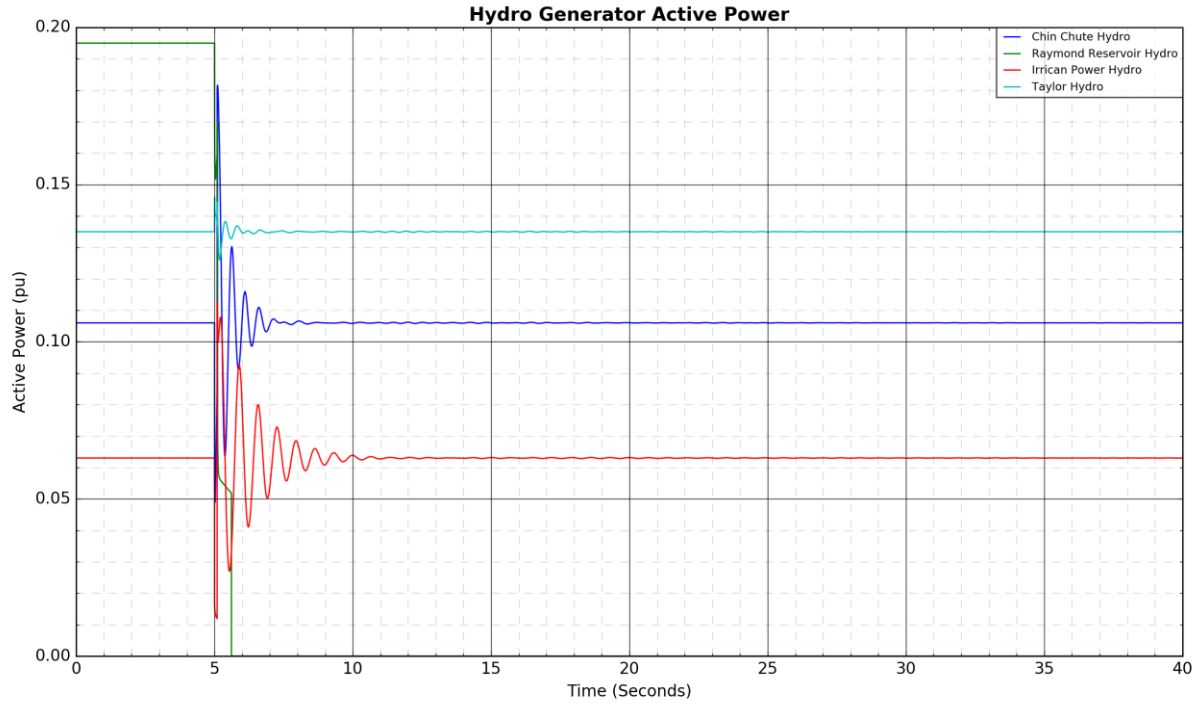


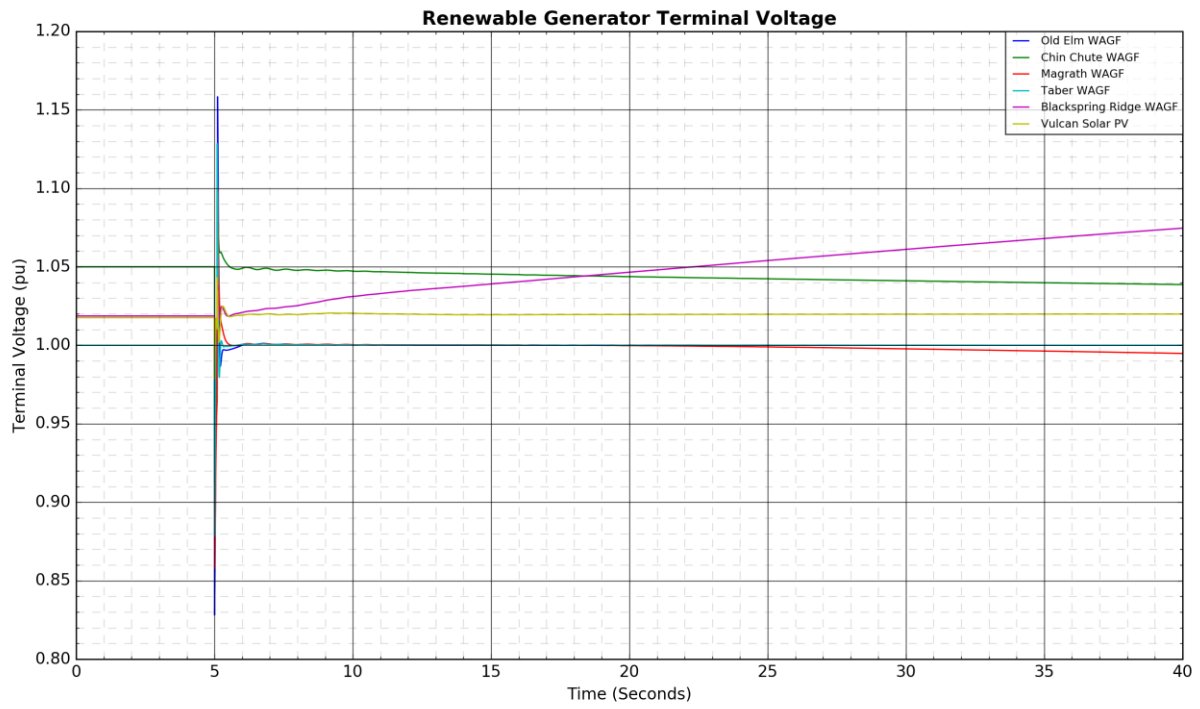
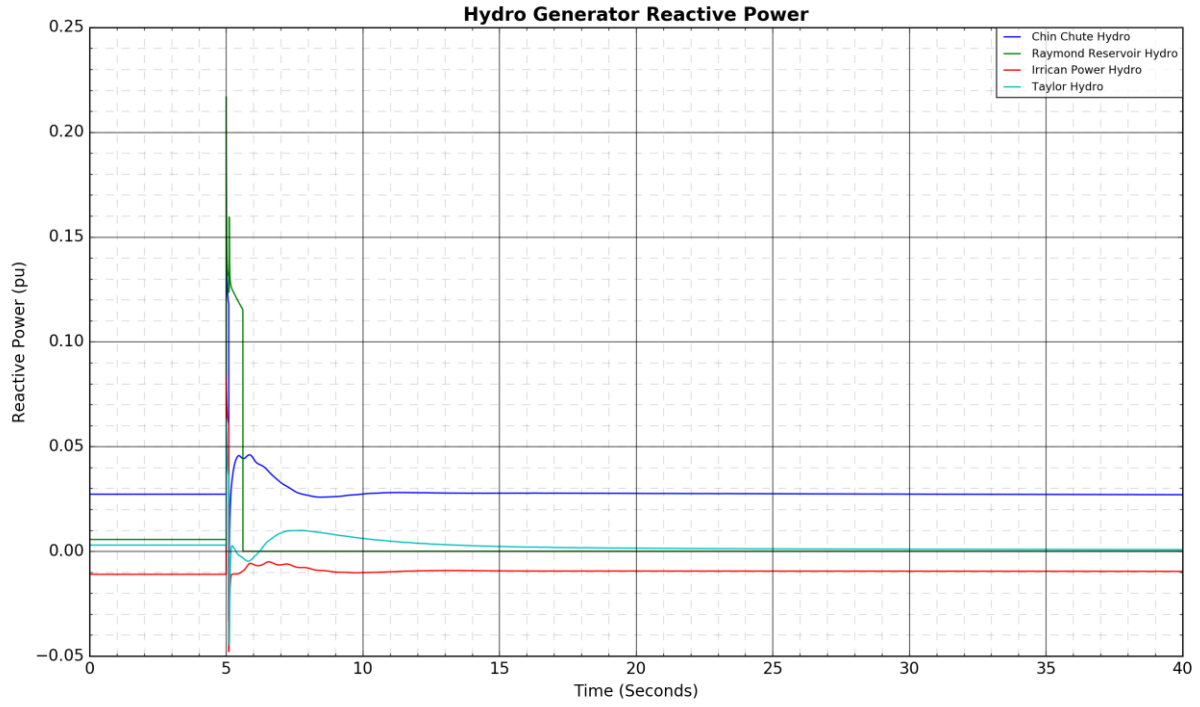
**Figure A4-31: 225L Stirling 67S to Raymond Reservoir 313S T-Tap to Magrath 225S:
Fault Near Stirling 67S**

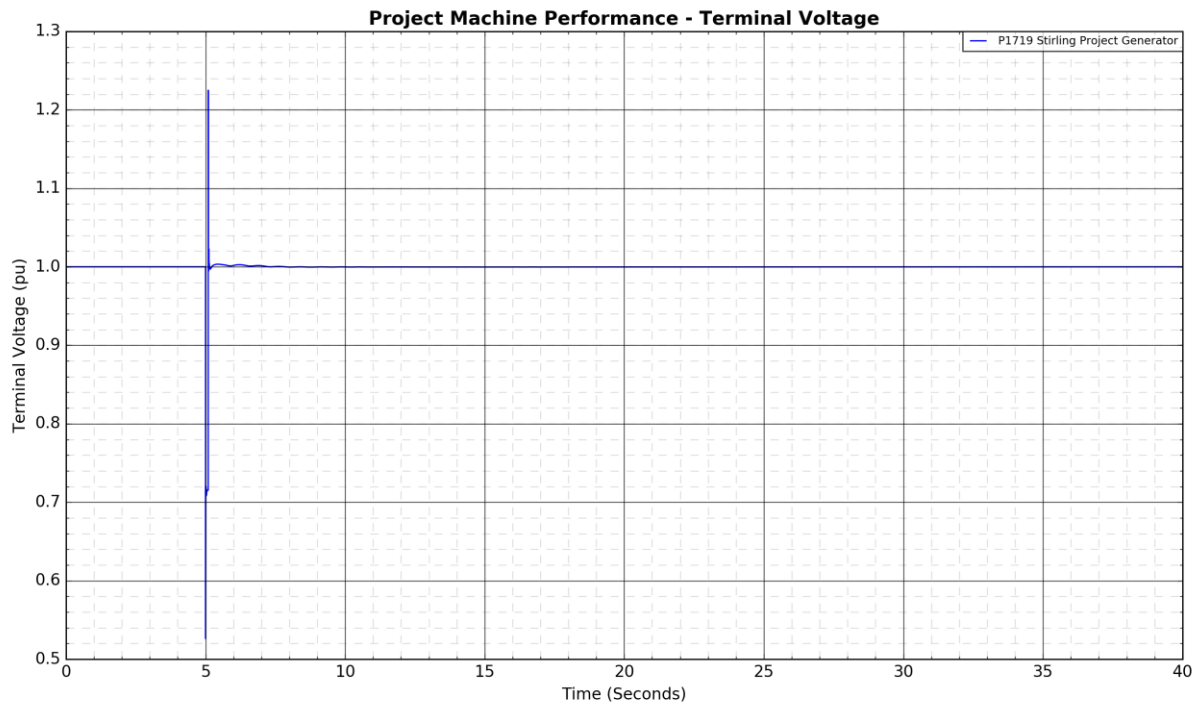
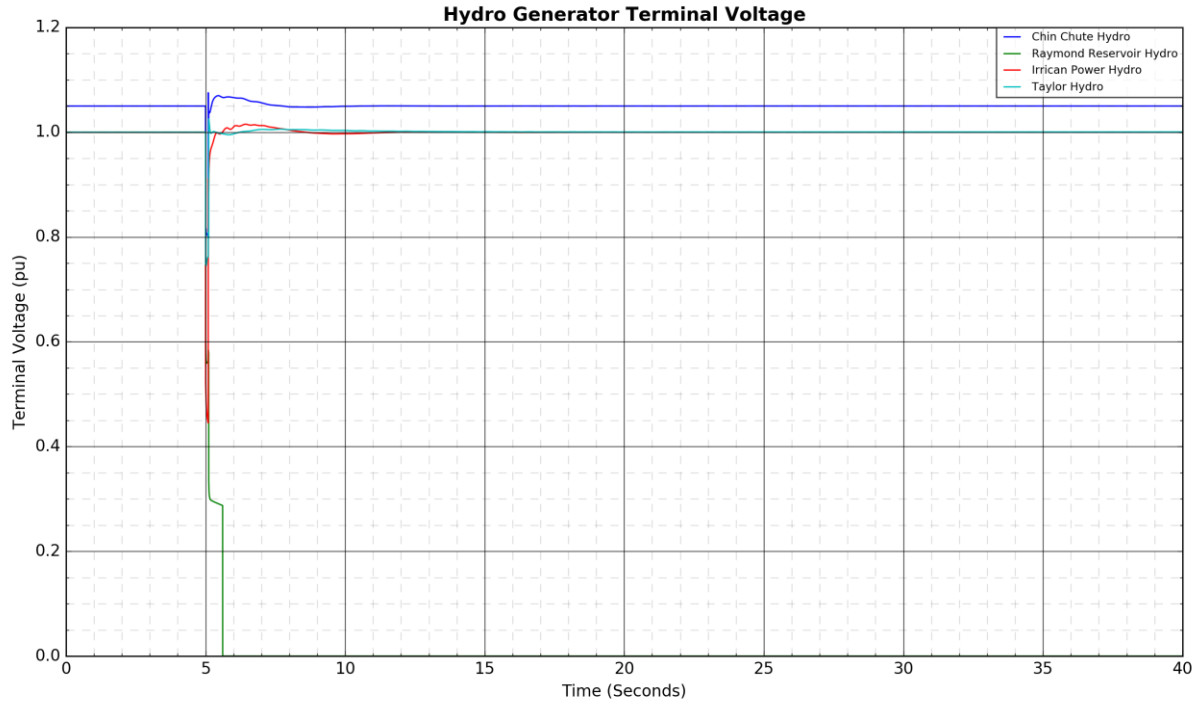


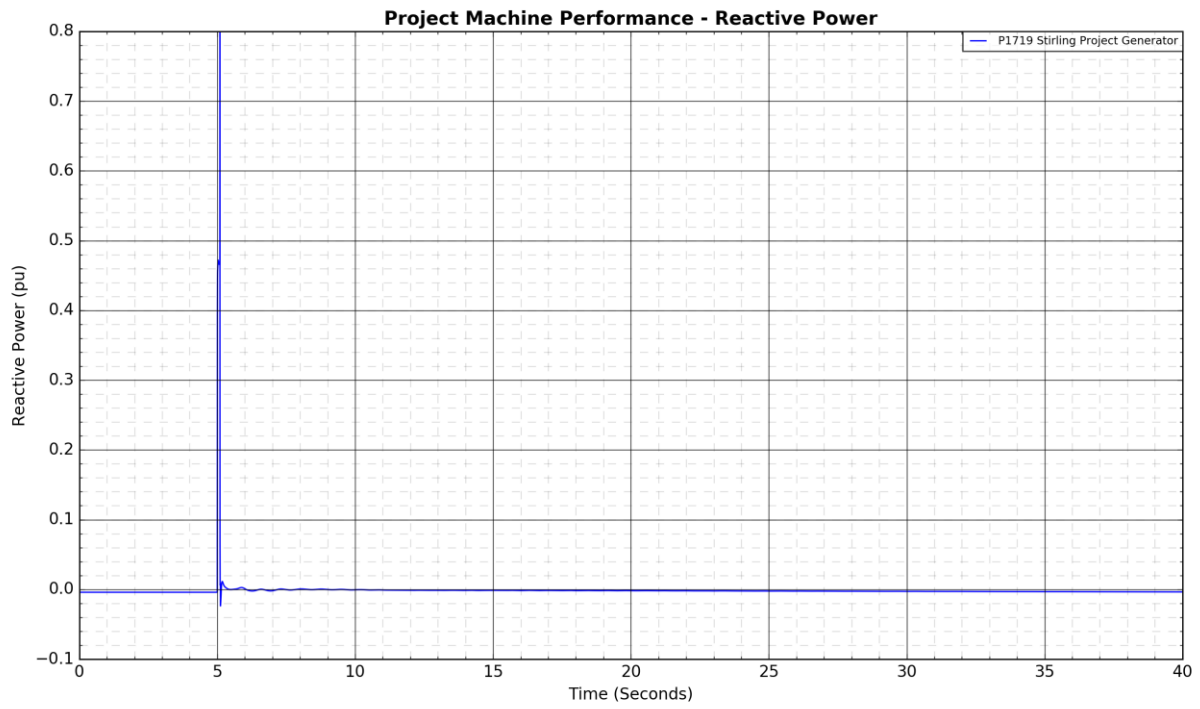
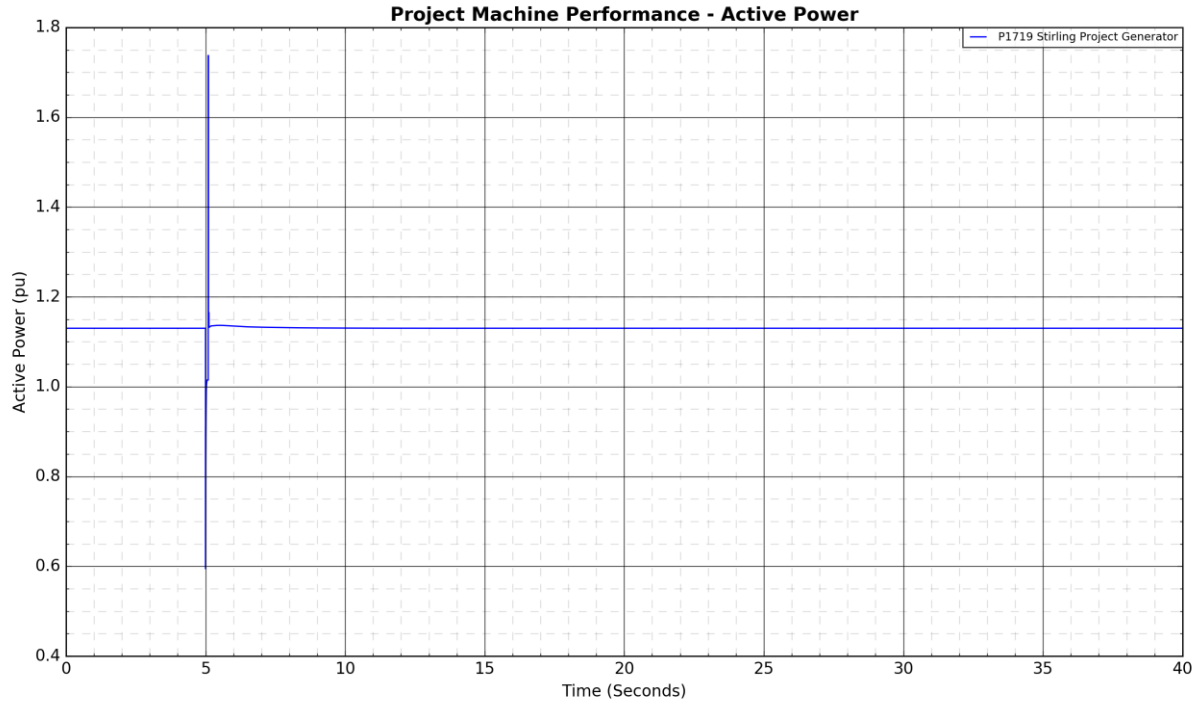


Engineering Connection Assessment Results: Stirling Wind Project Connection

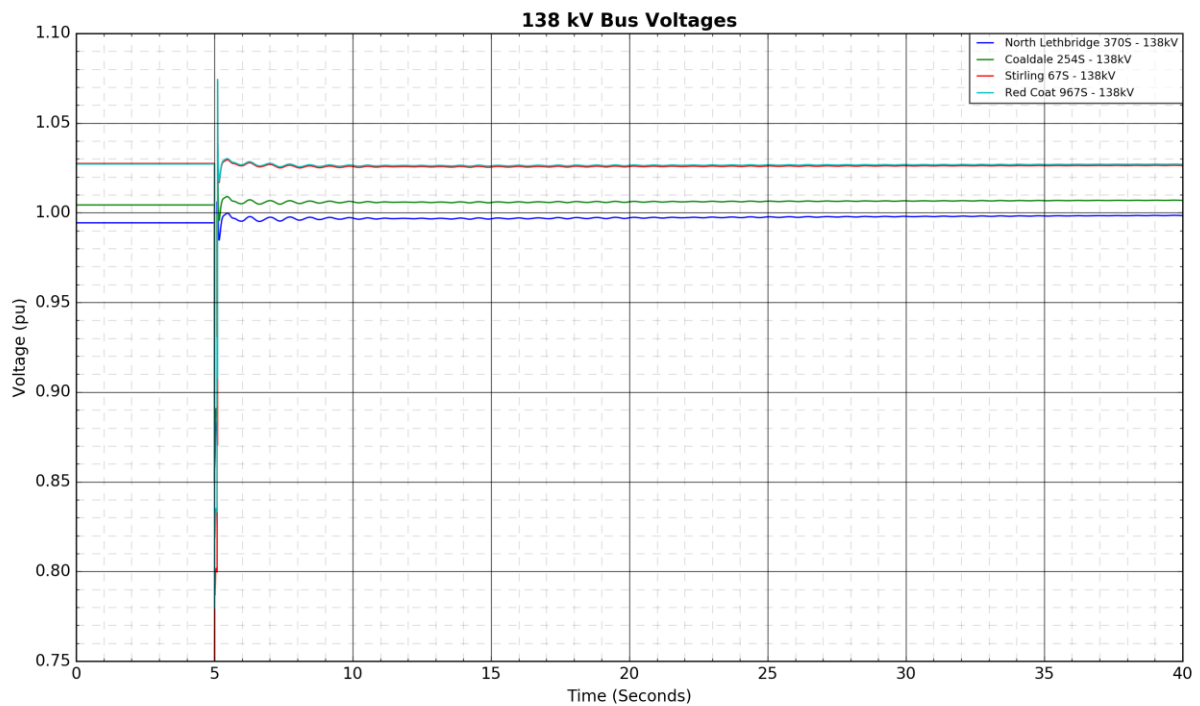
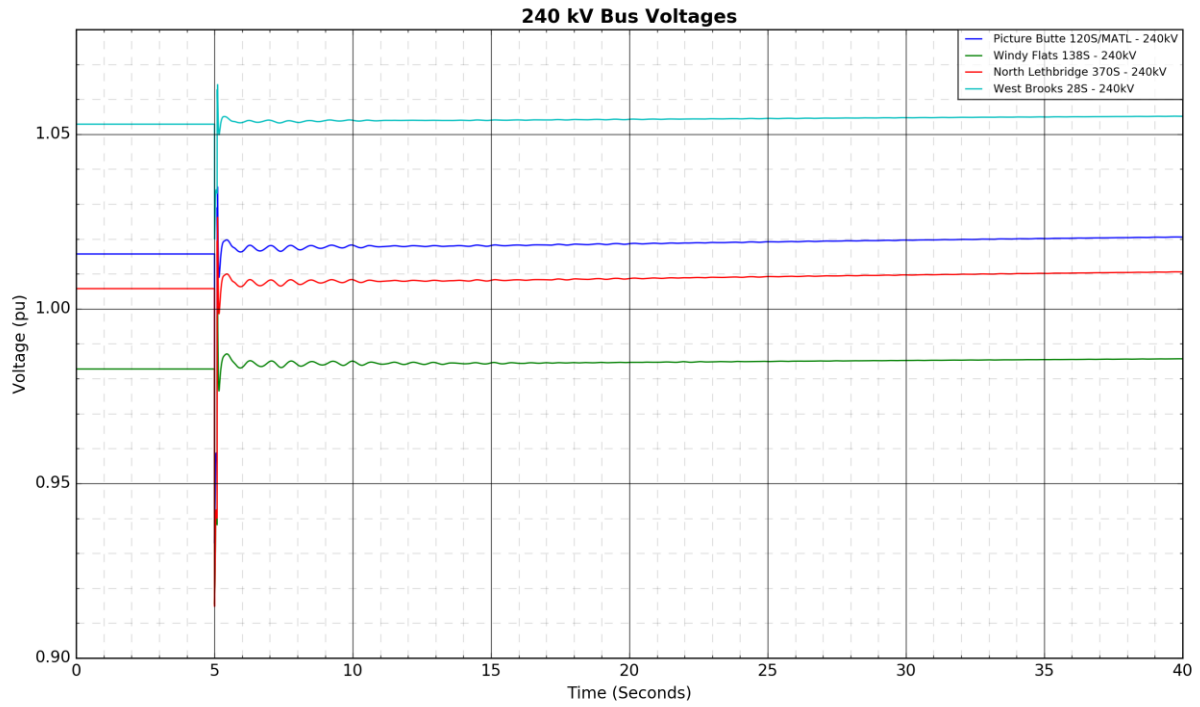


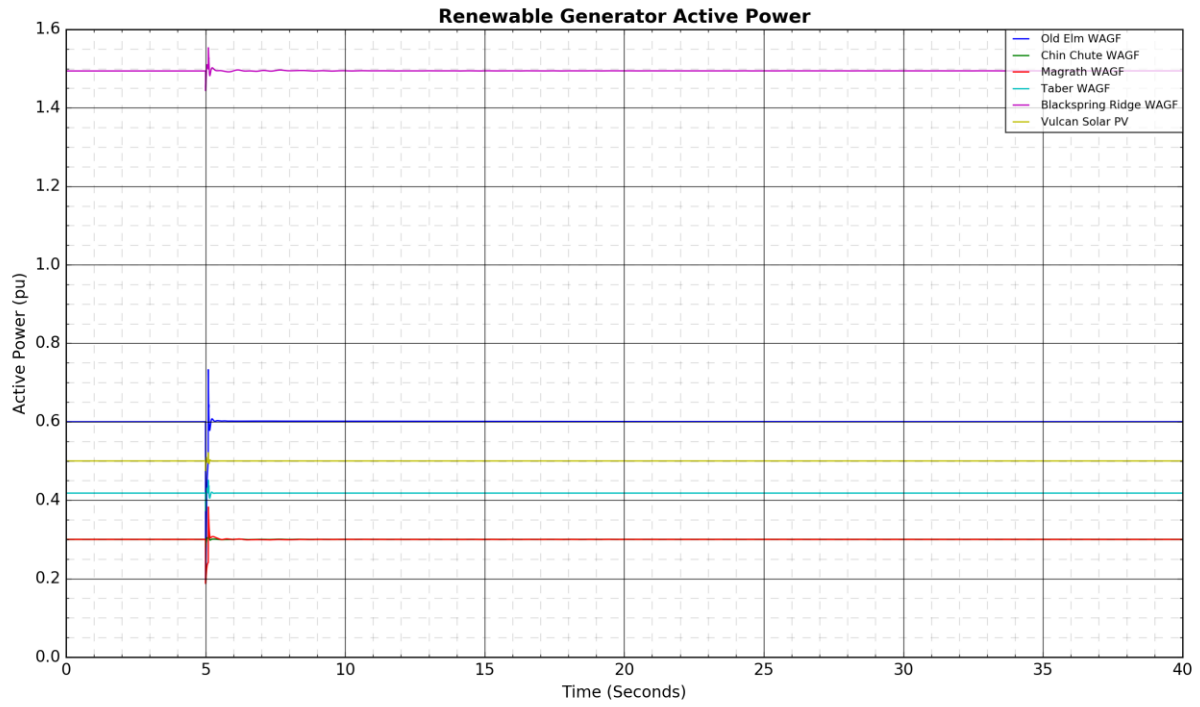
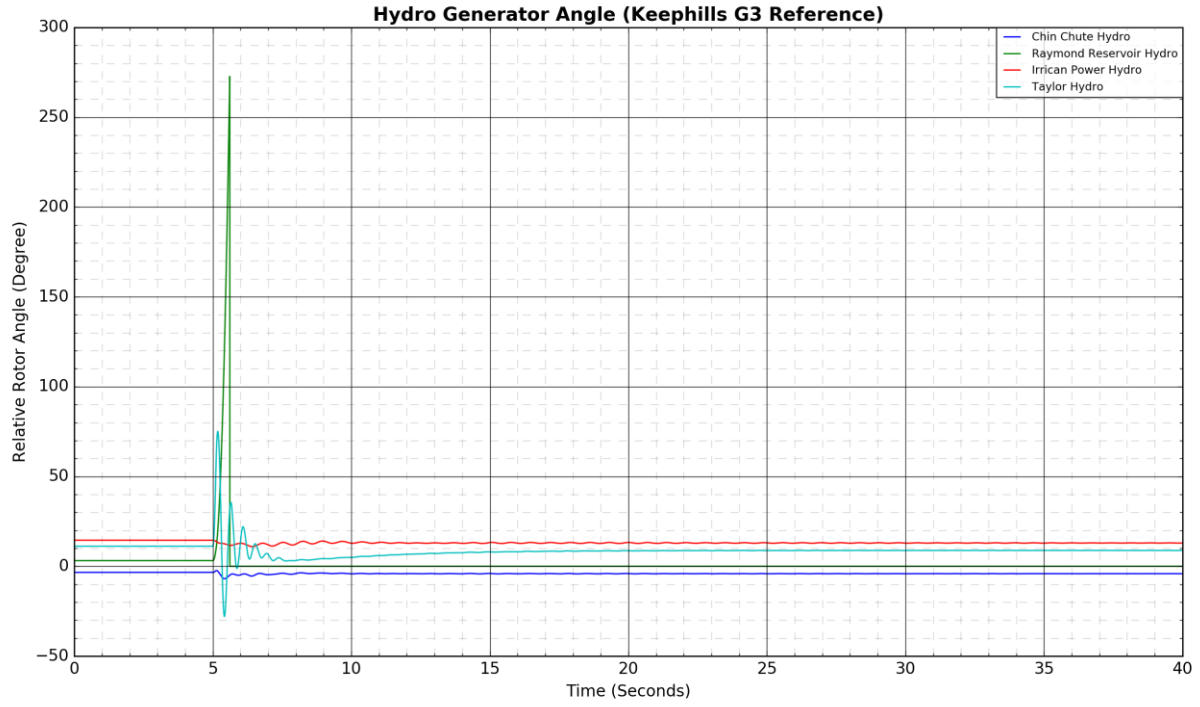




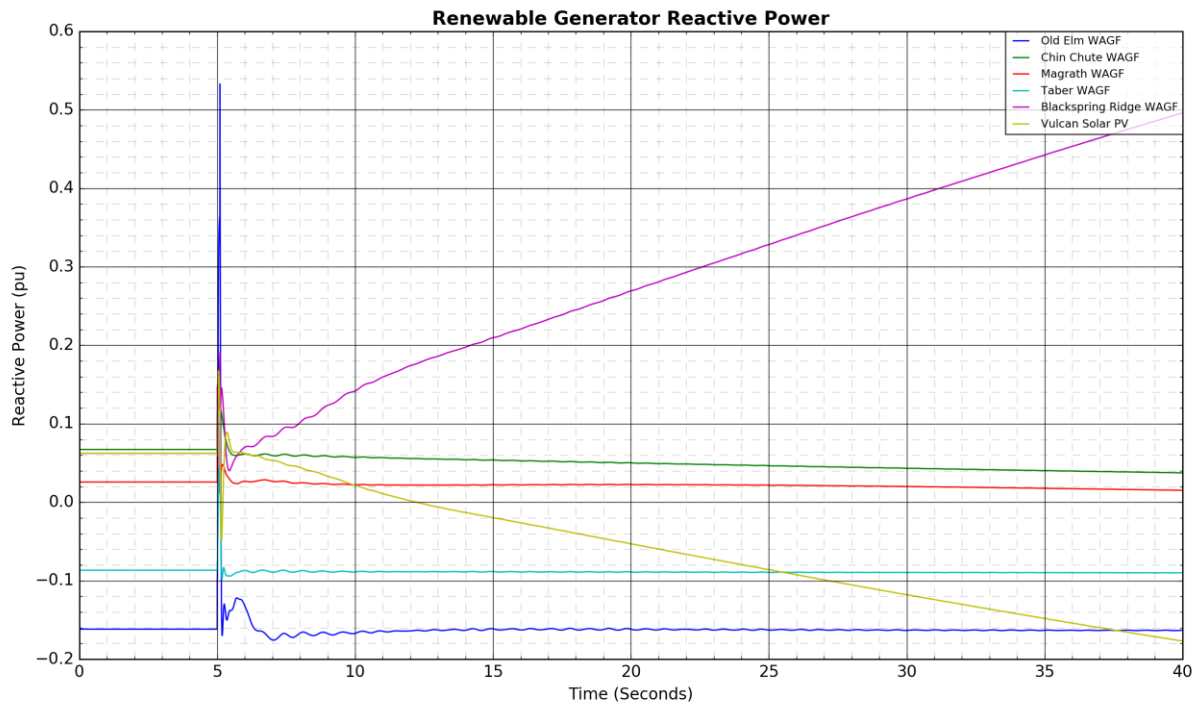
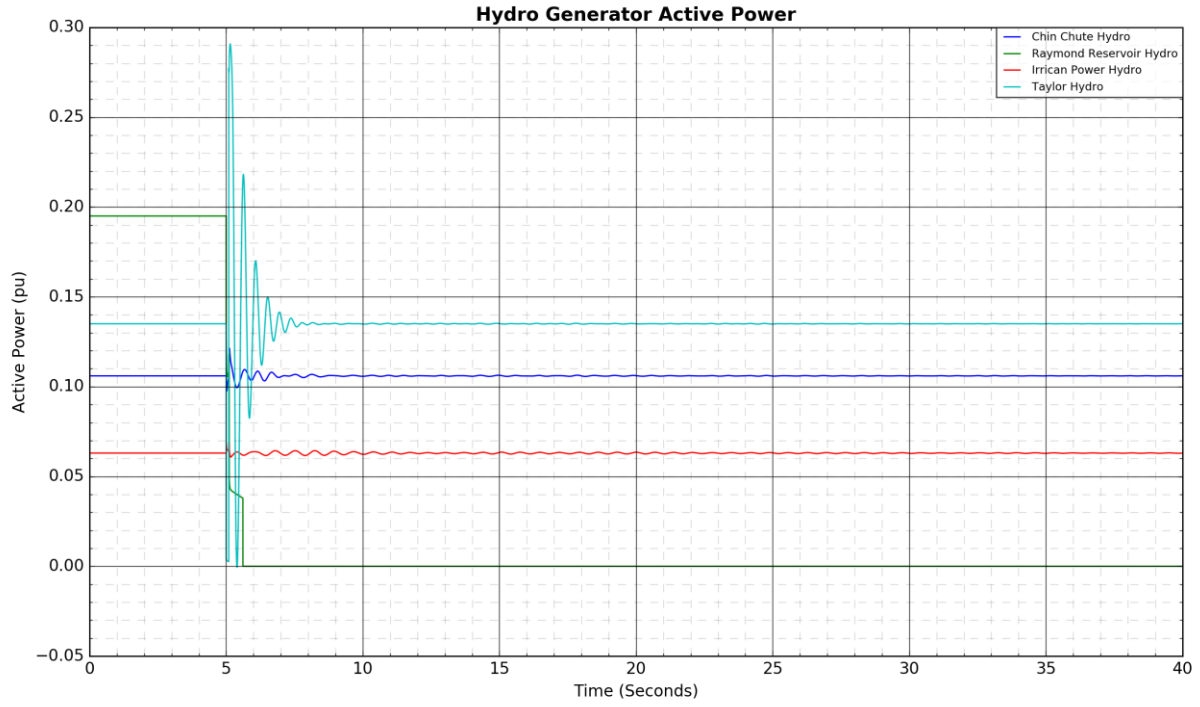


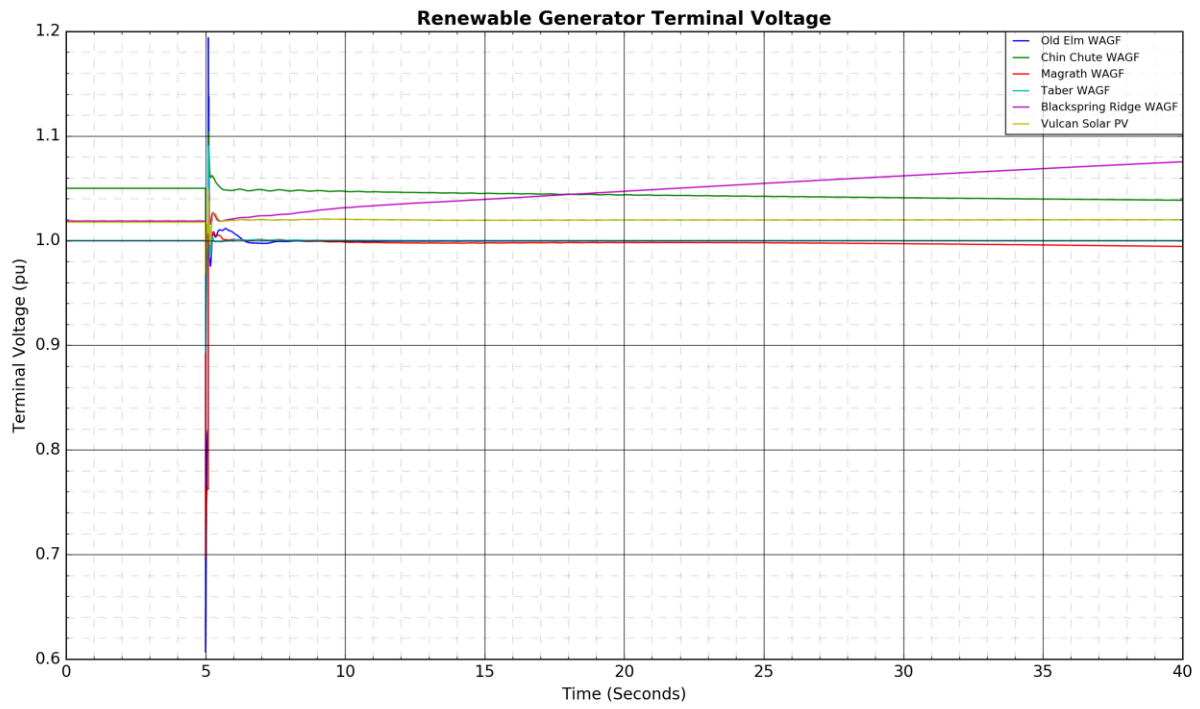
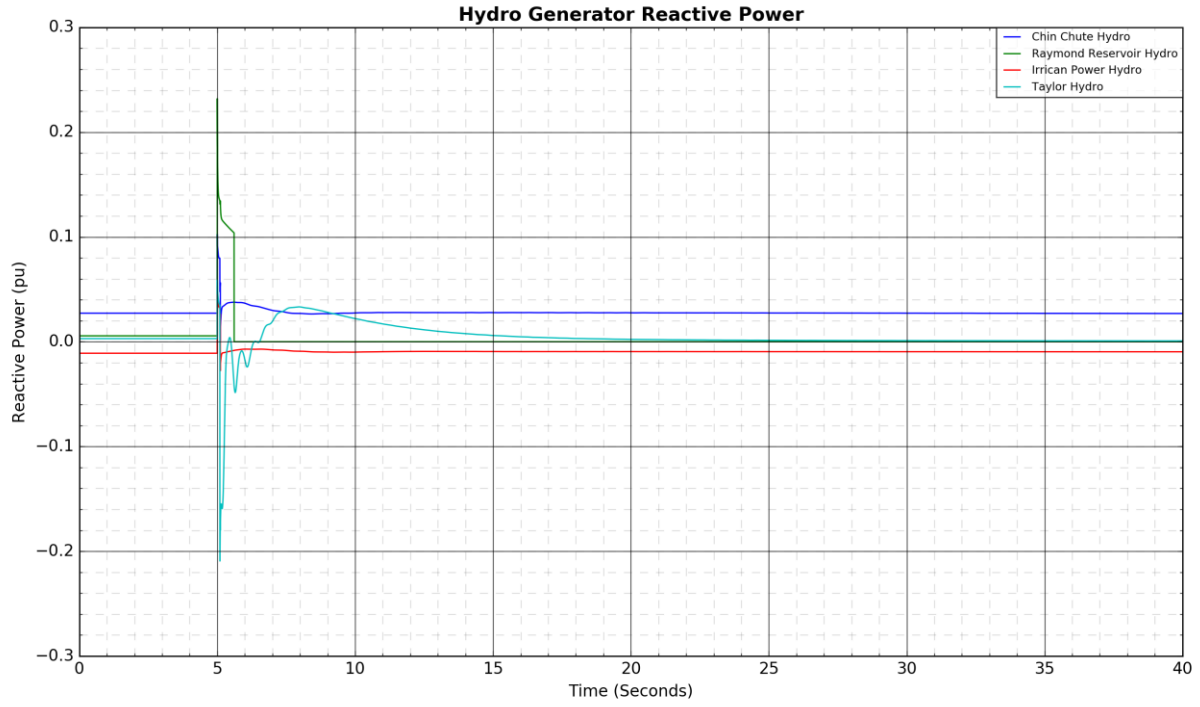
**Figure A4-32: 225L Stirling 67S to Raymond Reservoir 313S T-Tap to Magrath 225S:
Fault Near Magrath 225S**

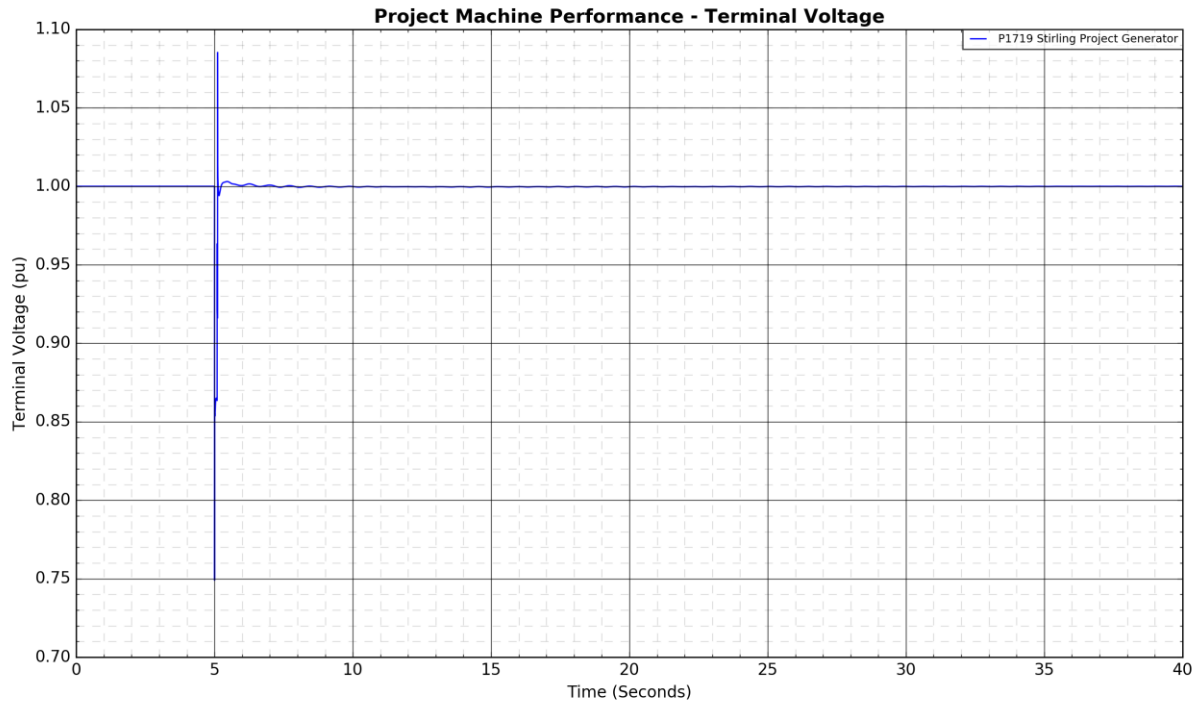
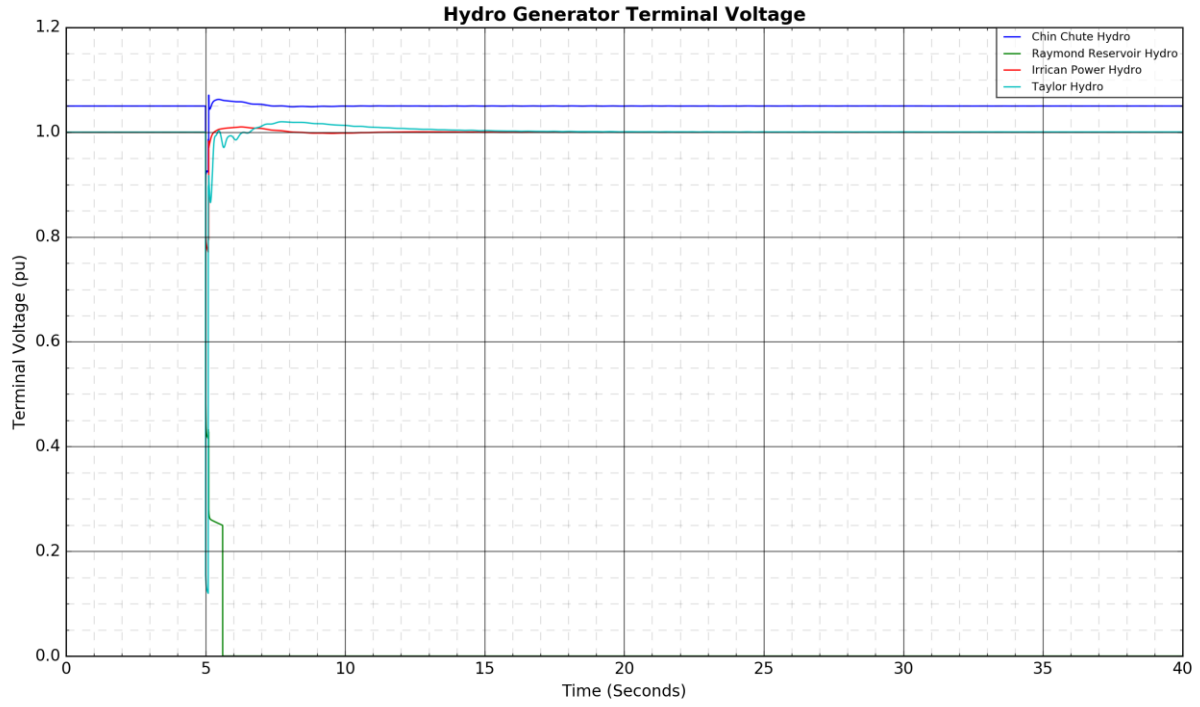




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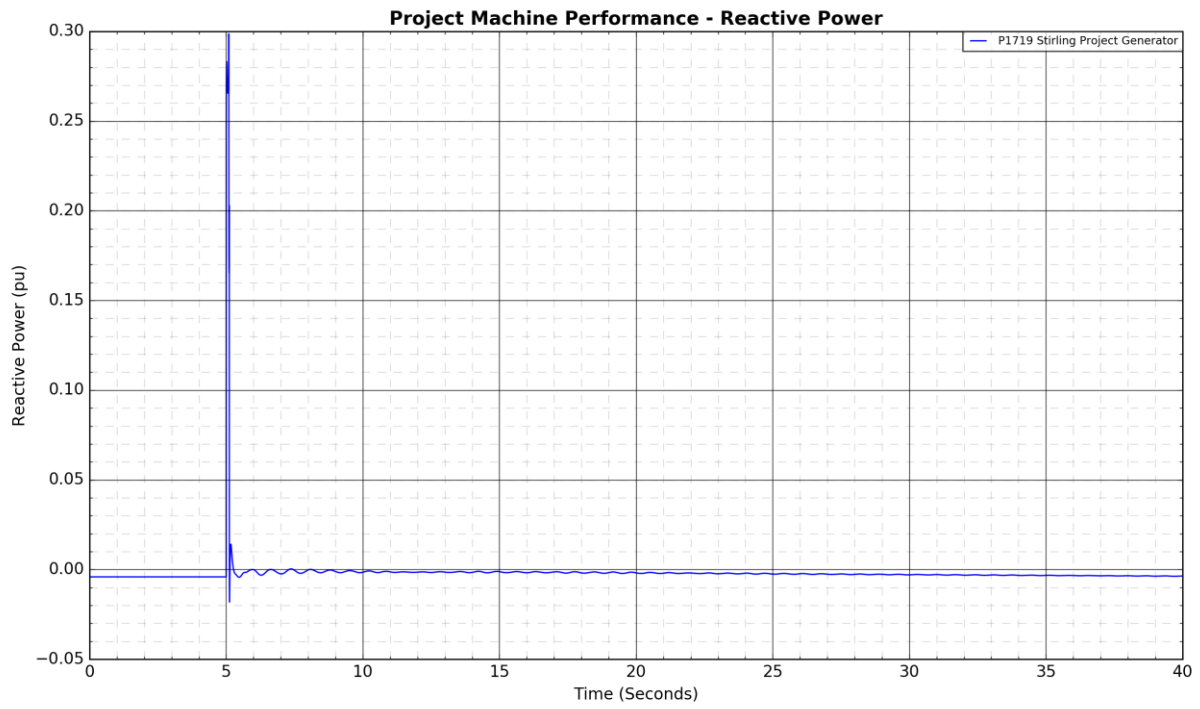
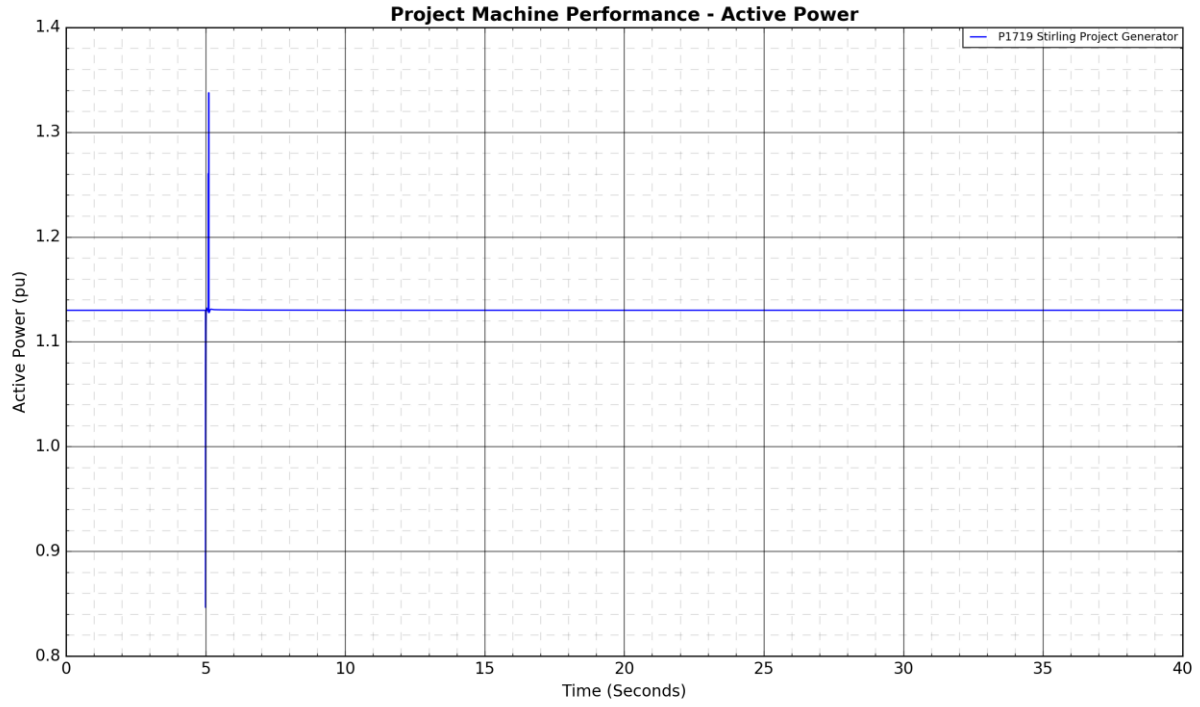
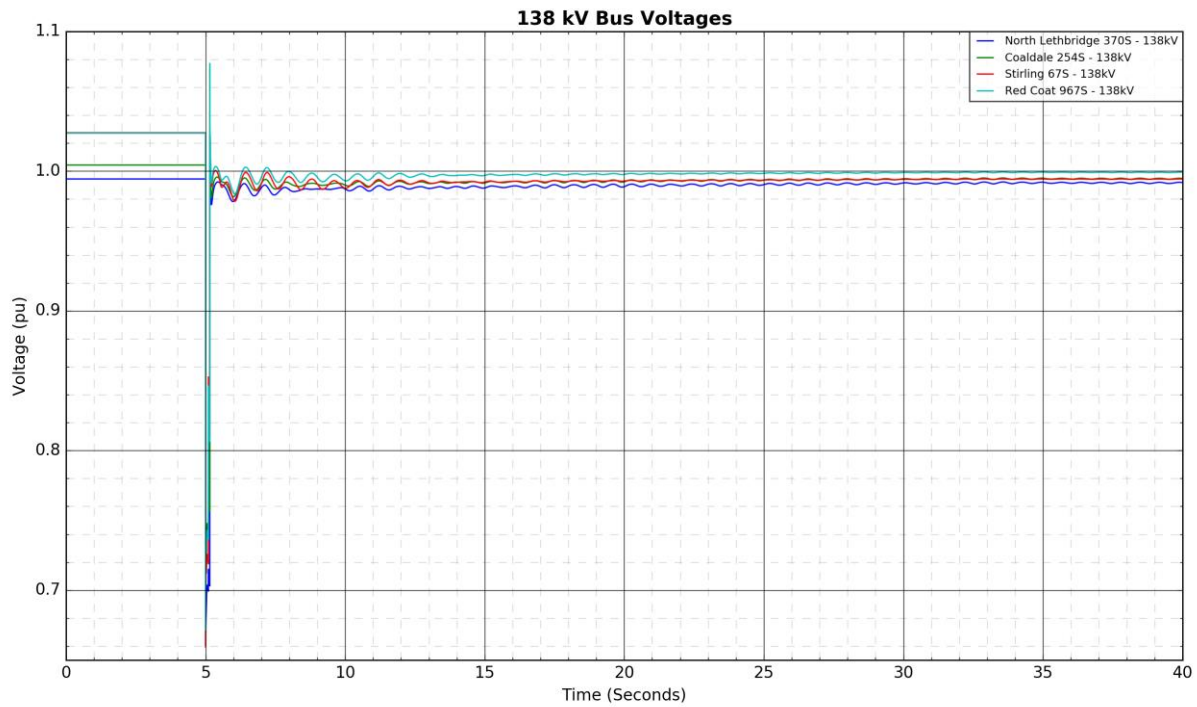
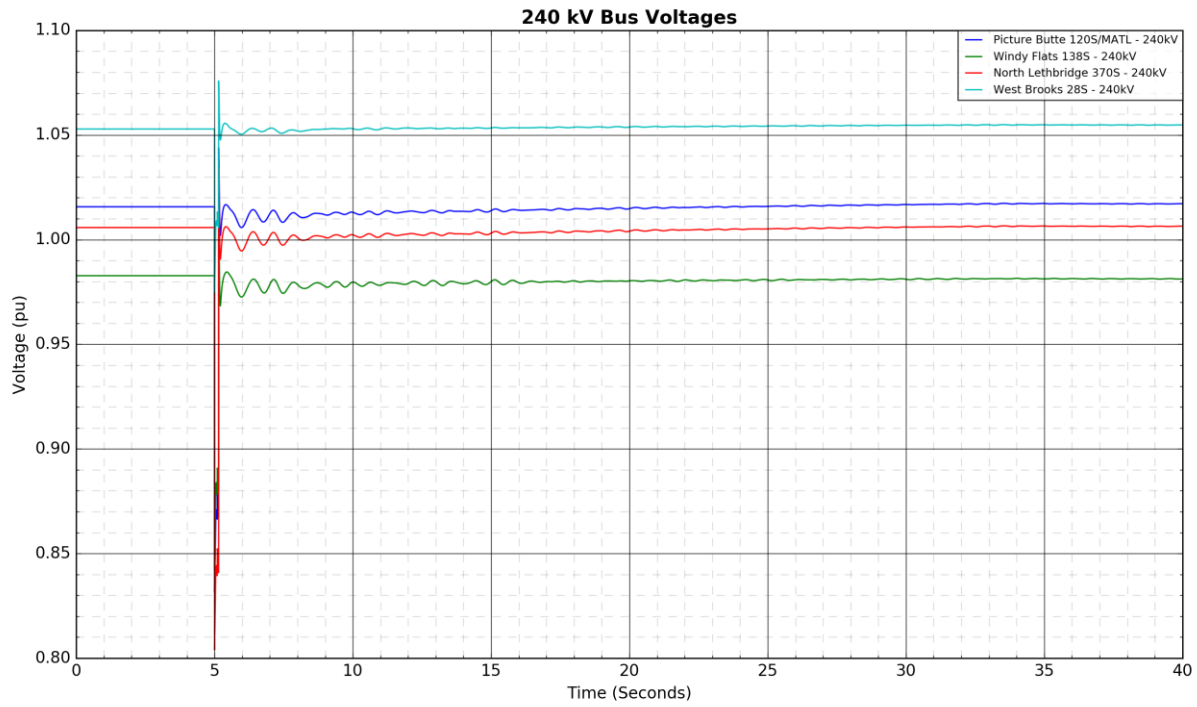
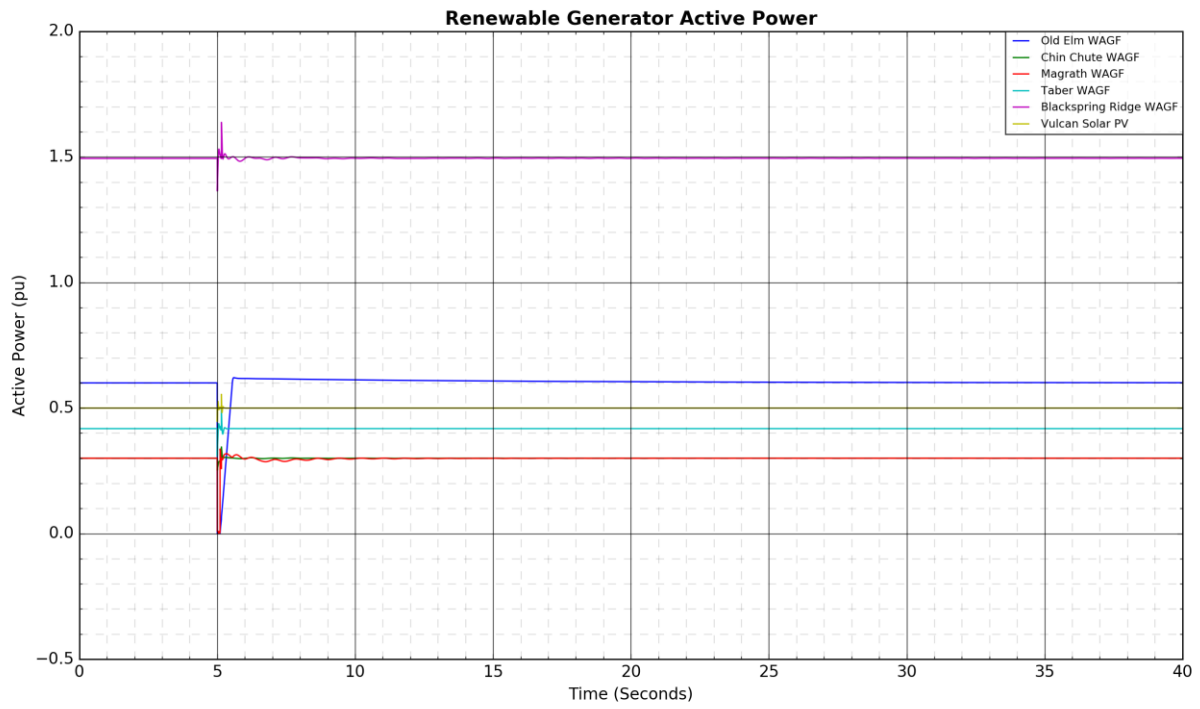
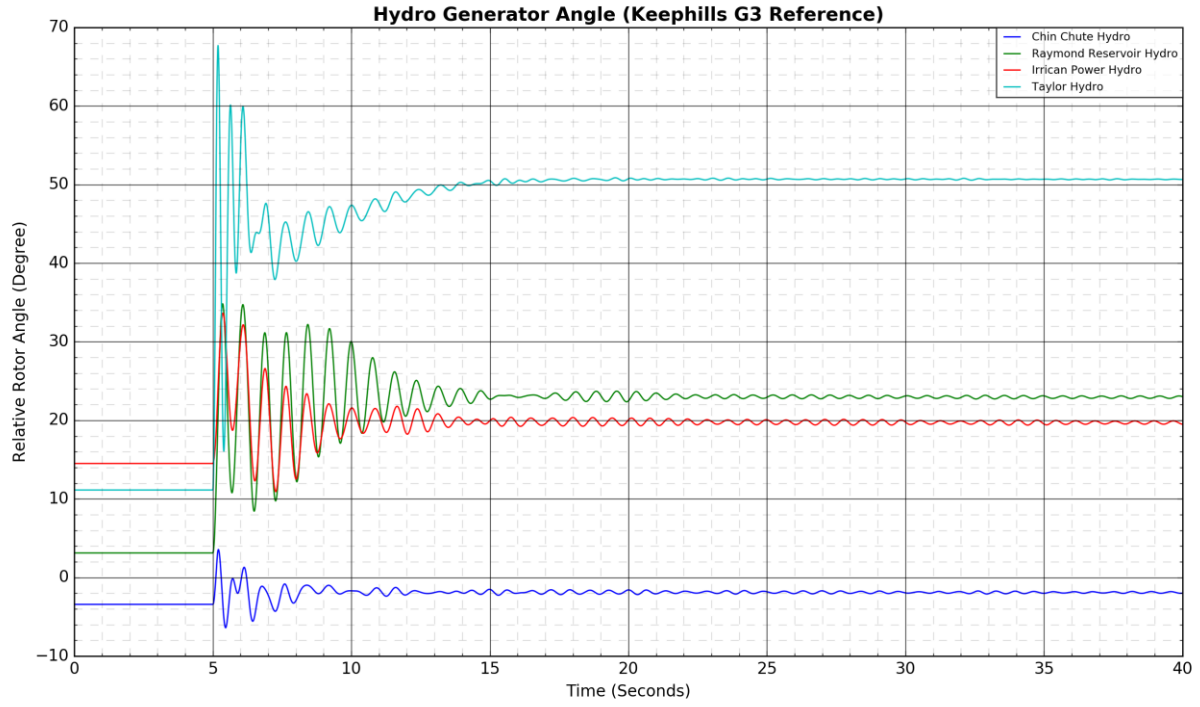
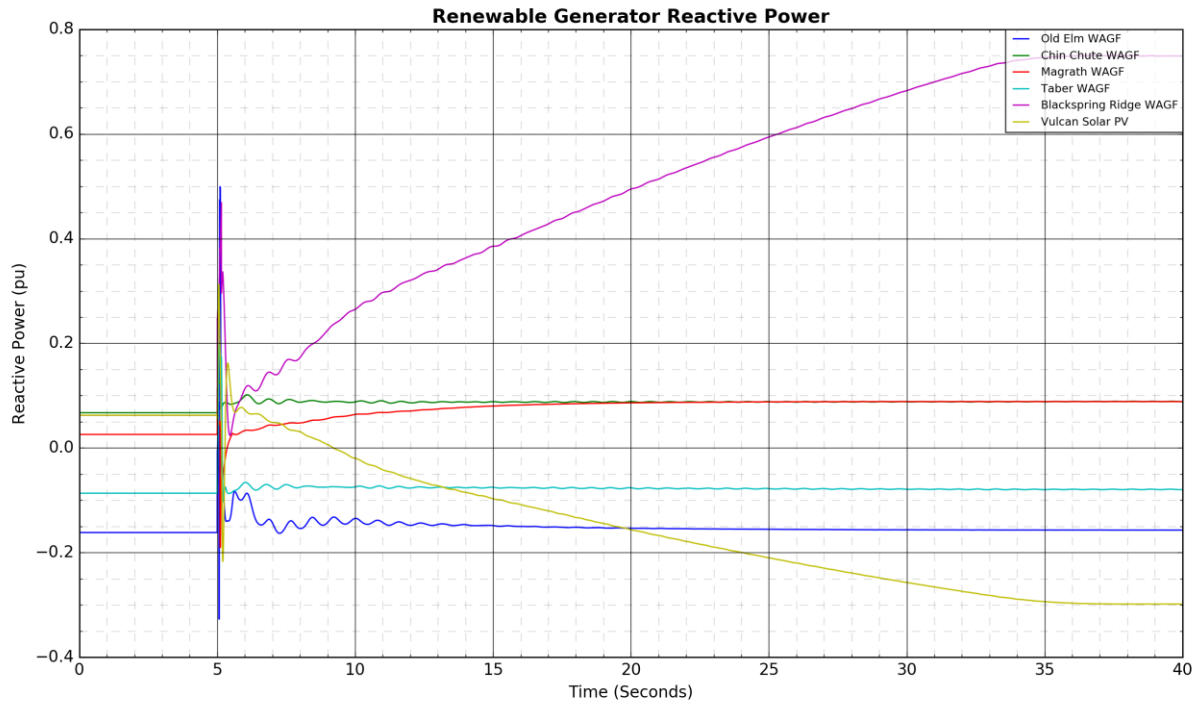
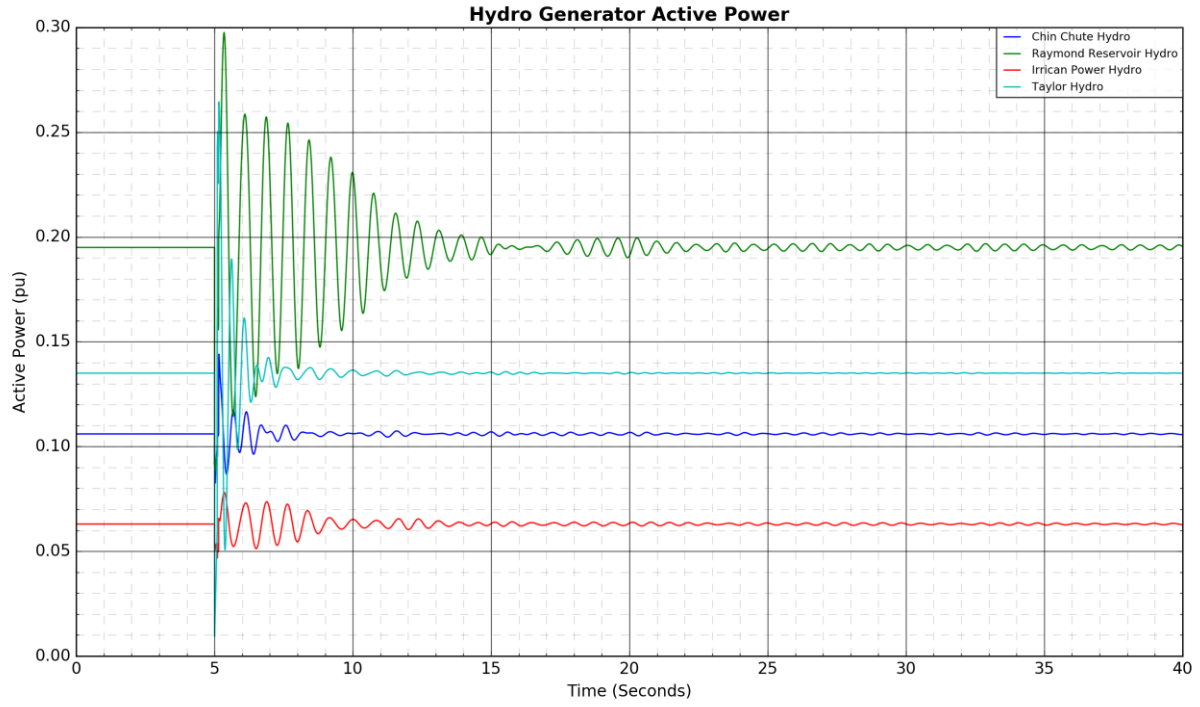


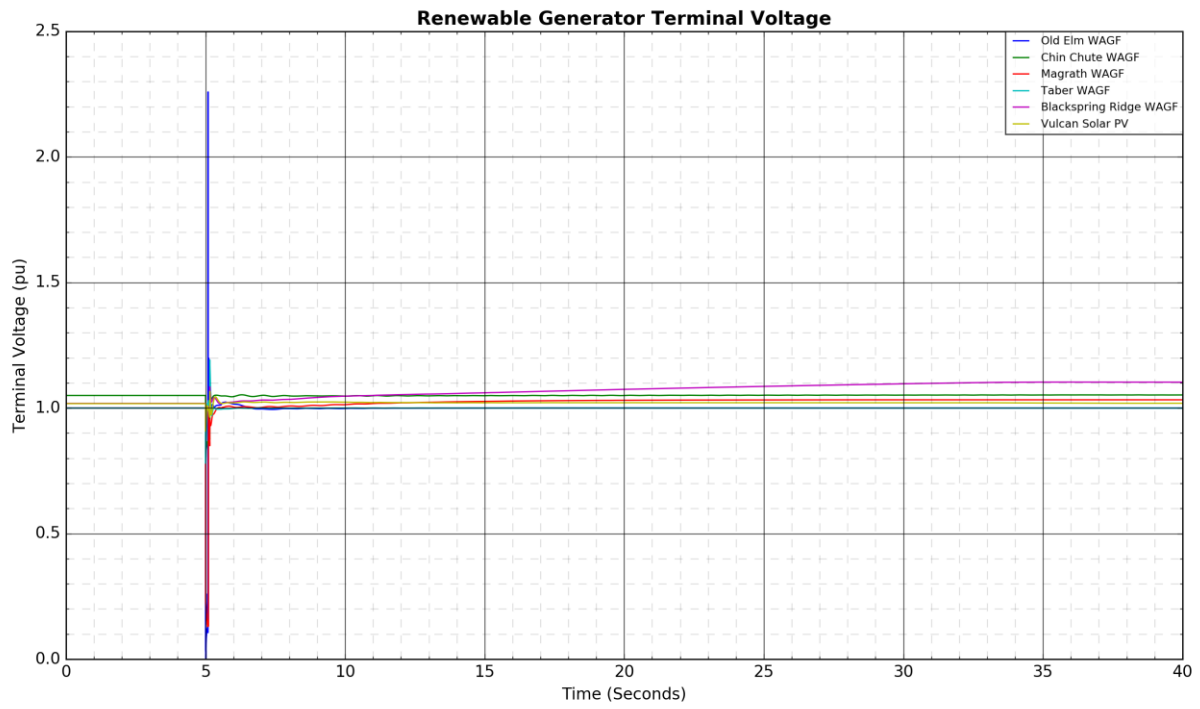
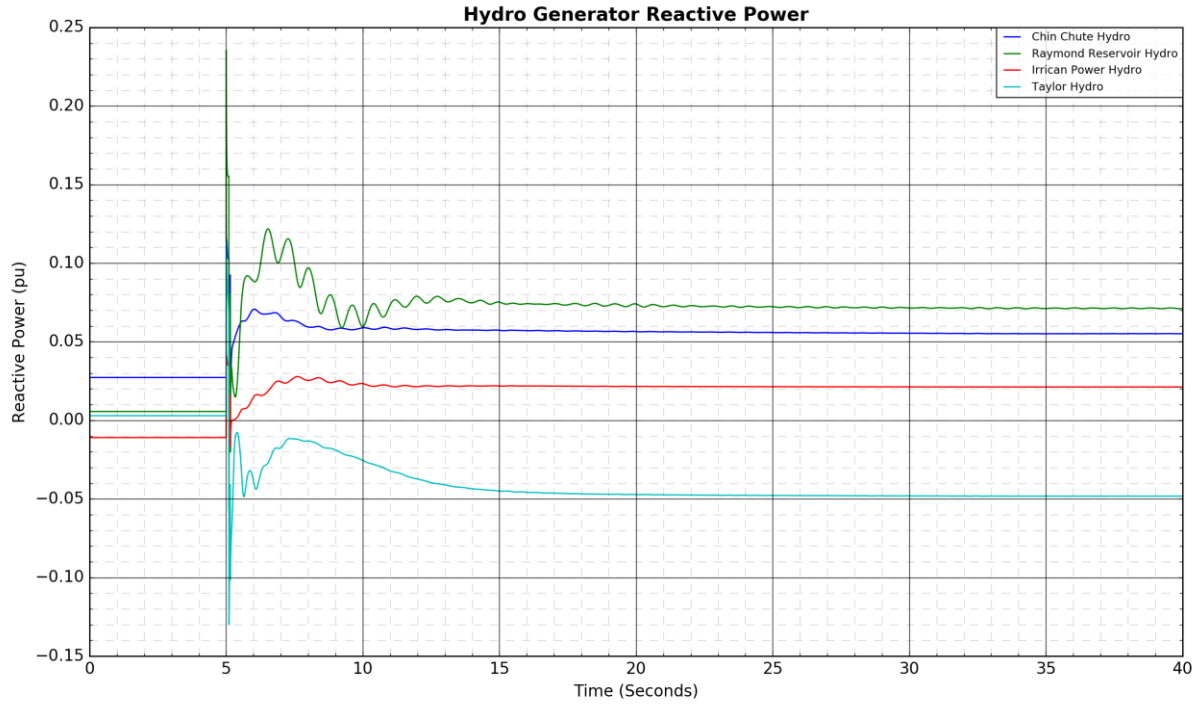
Figure A4-33: 863L Magrath 225S to Riverbend 618S: Fault Near Magrath 225S

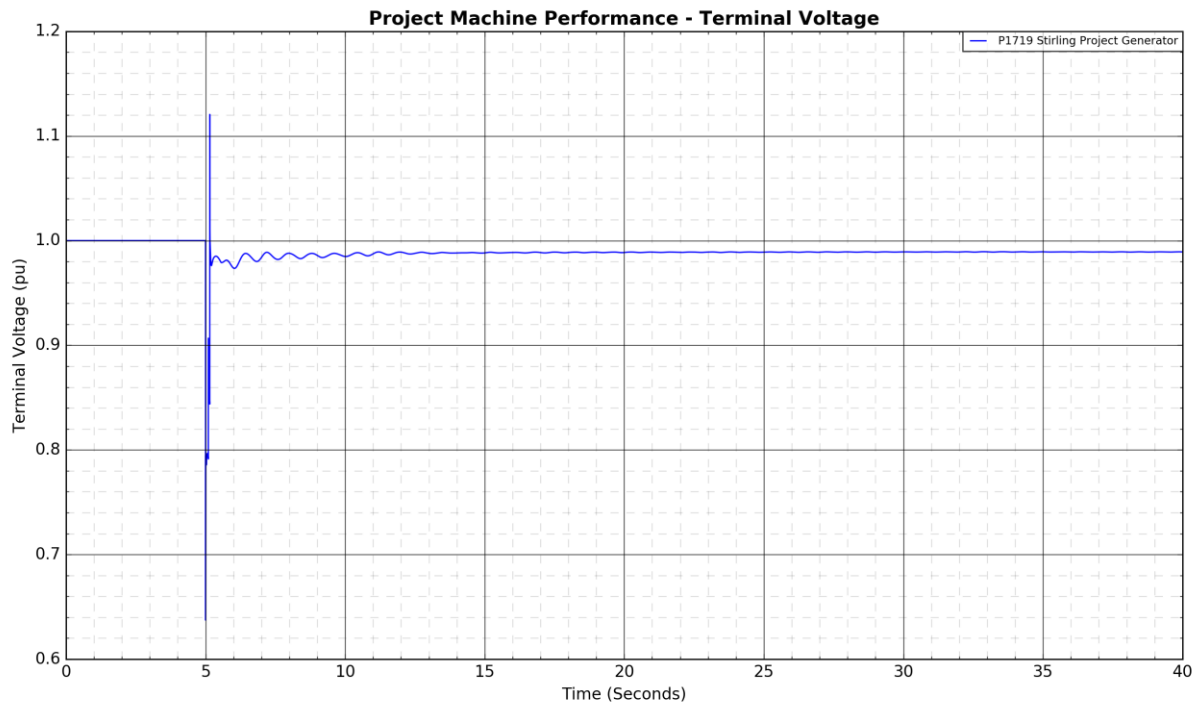
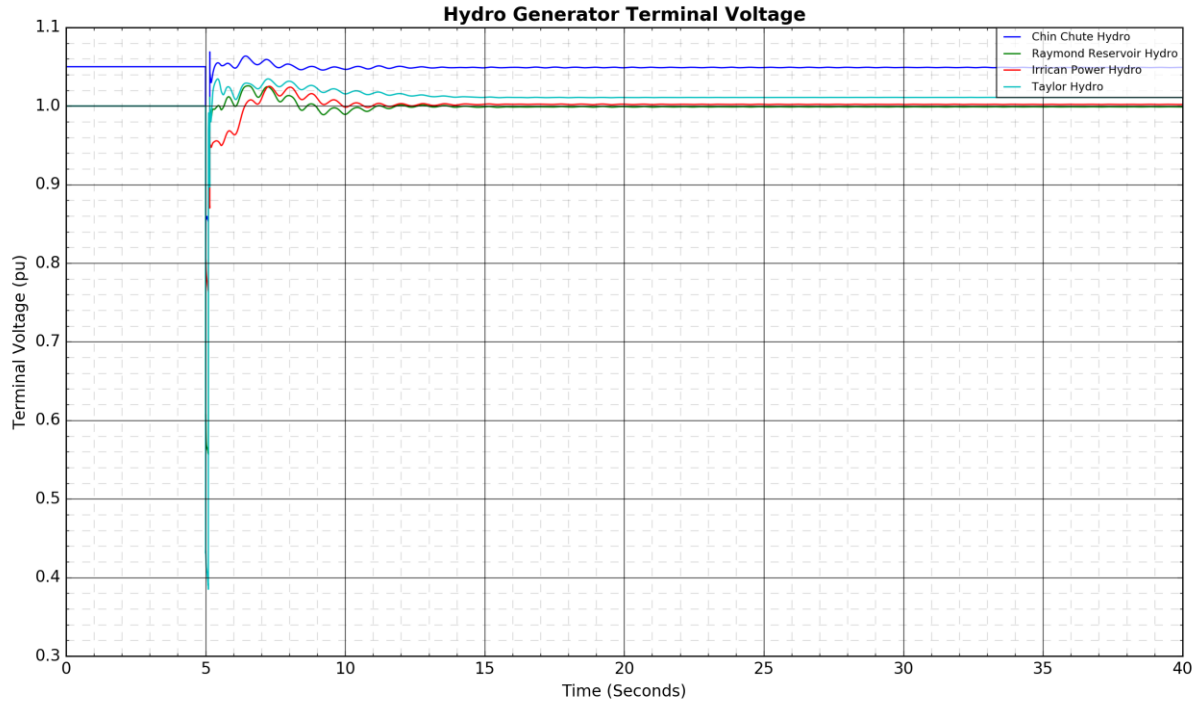




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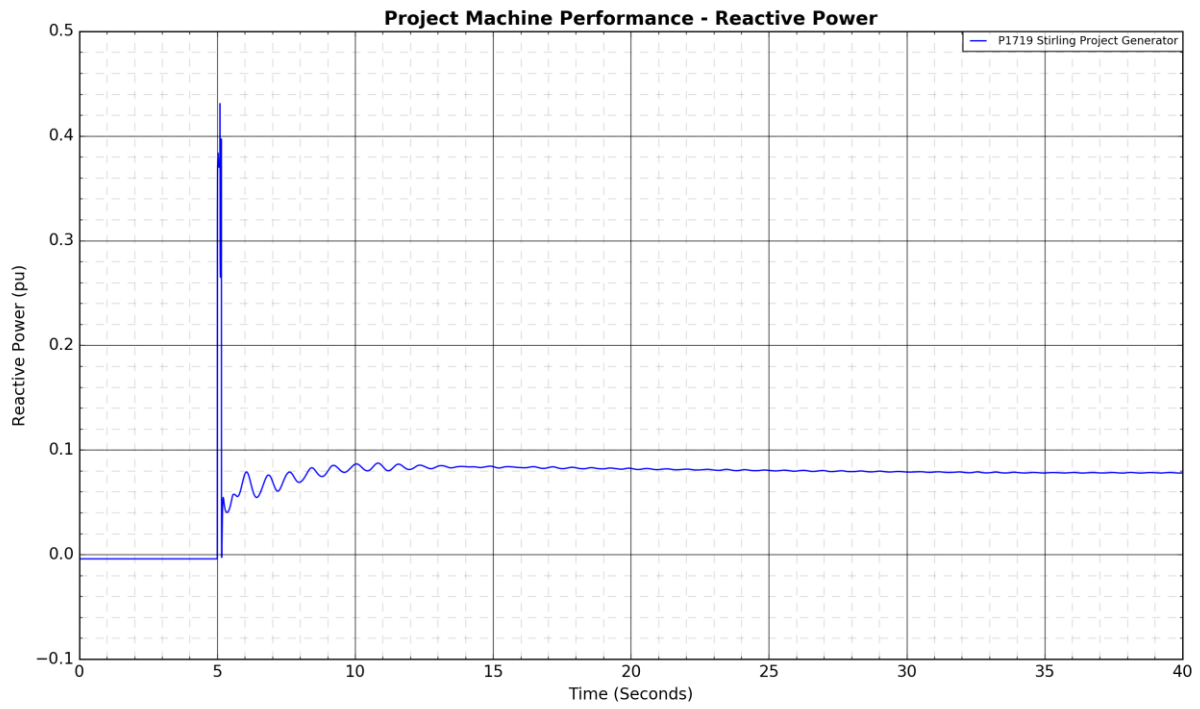
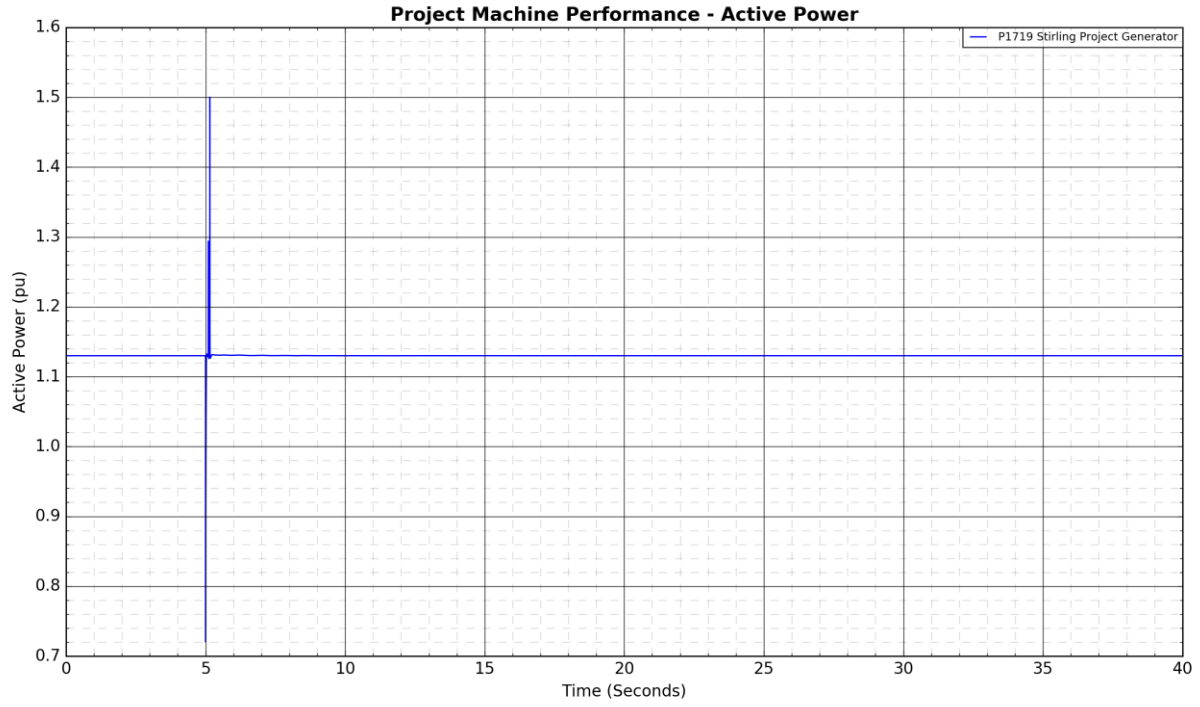
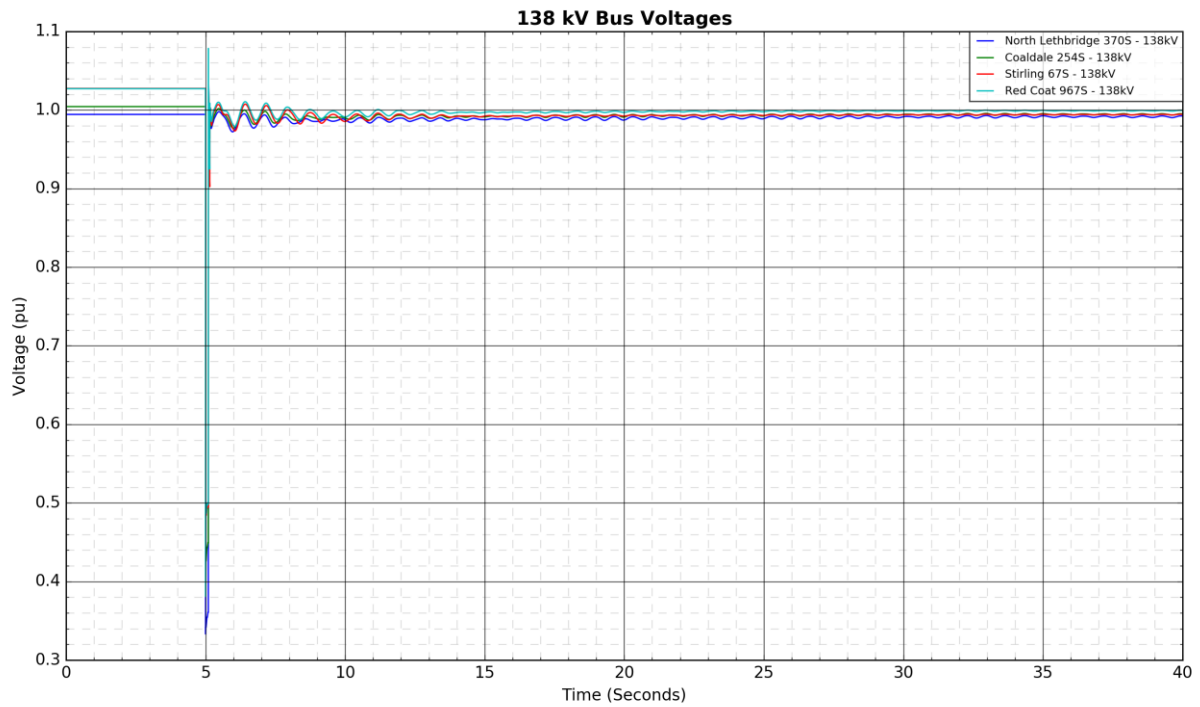
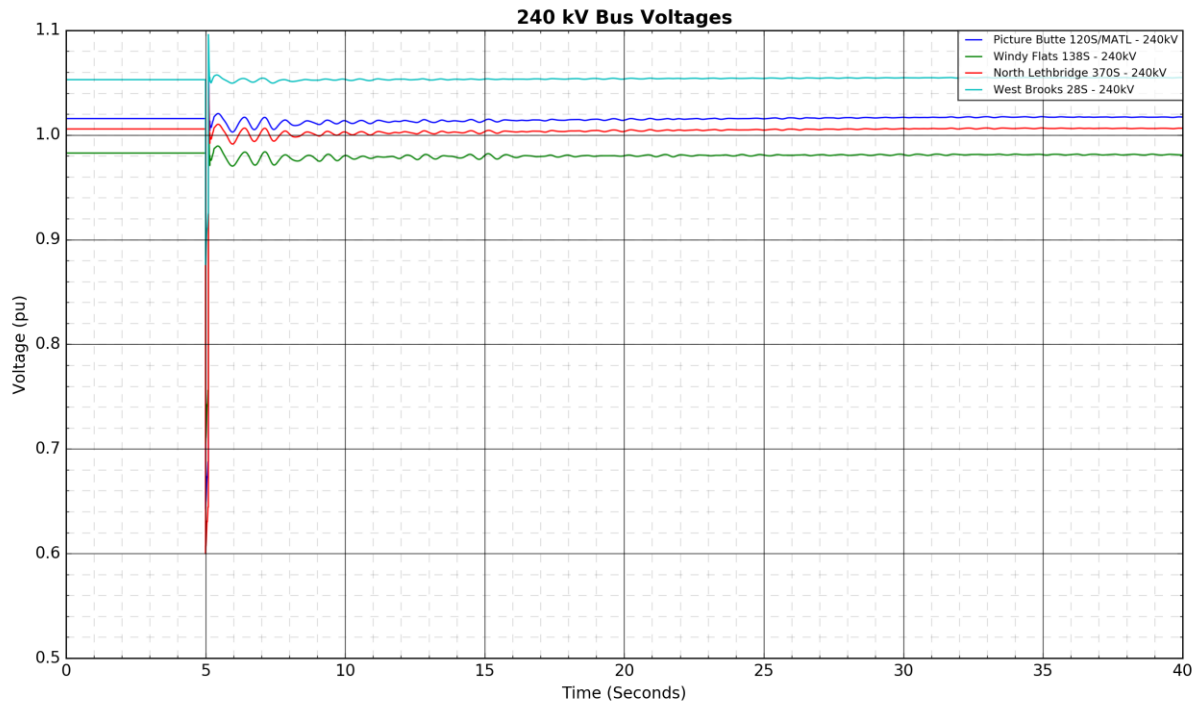
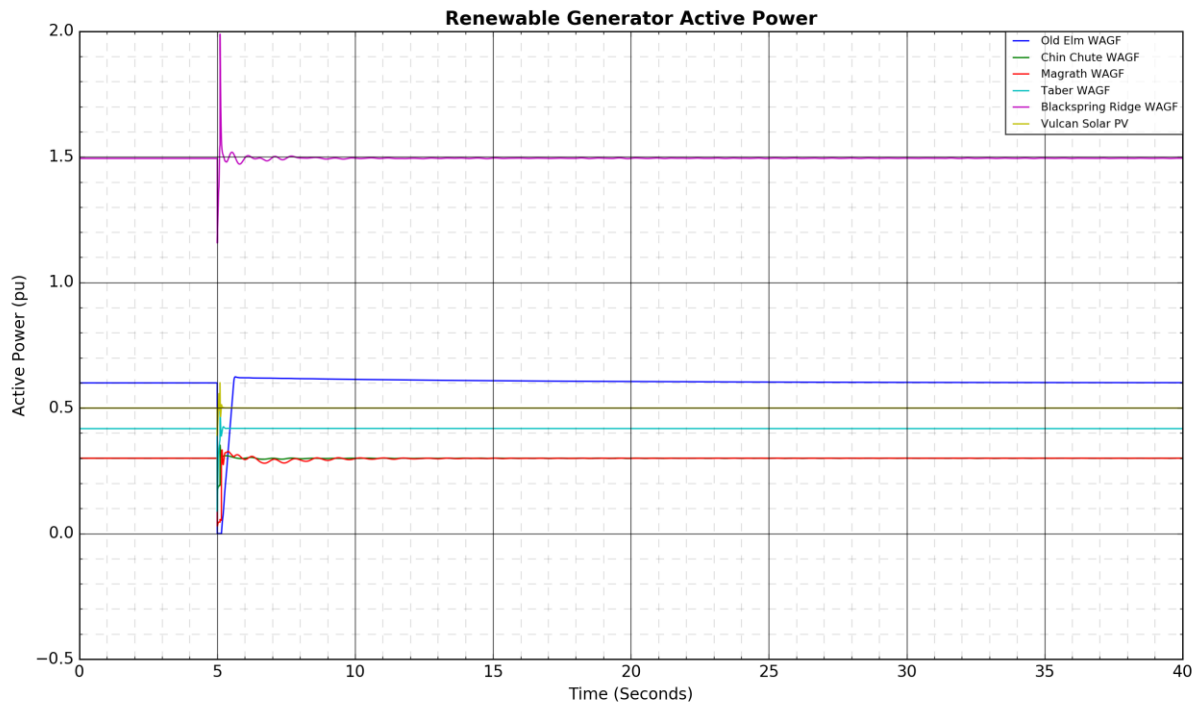
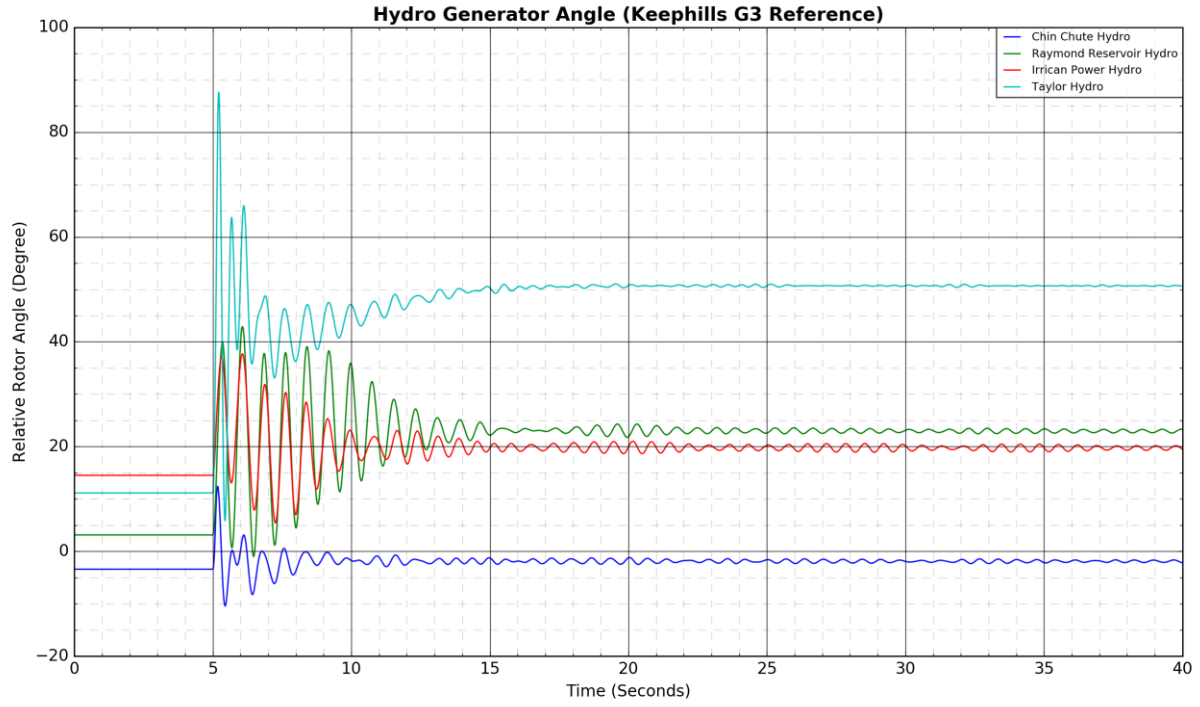
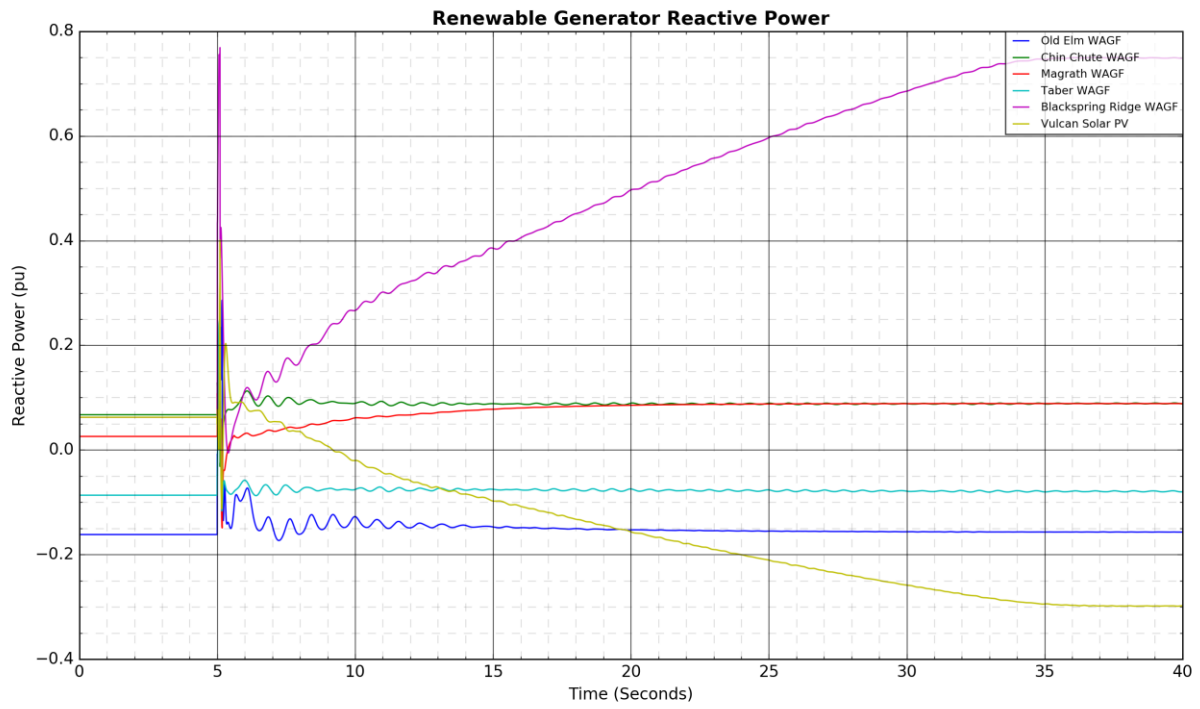
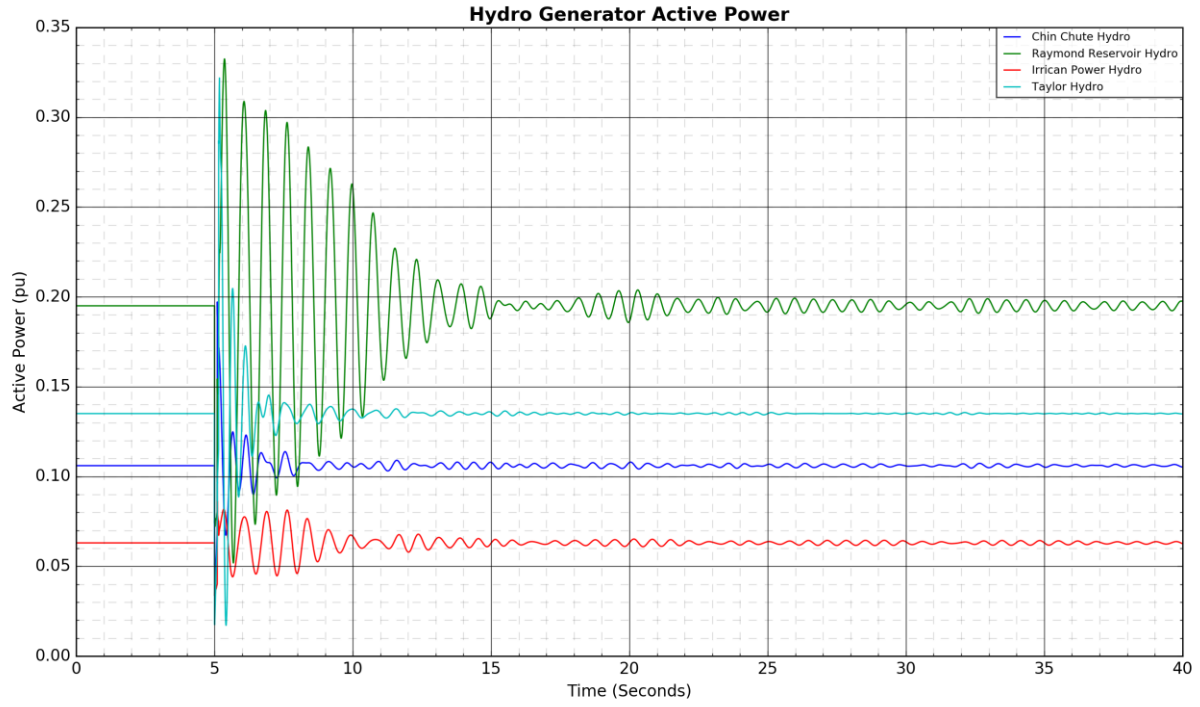


Figure A4-34: 863L Magrath 225S to Riverbend 618S: Fault Near Riverbend 618S

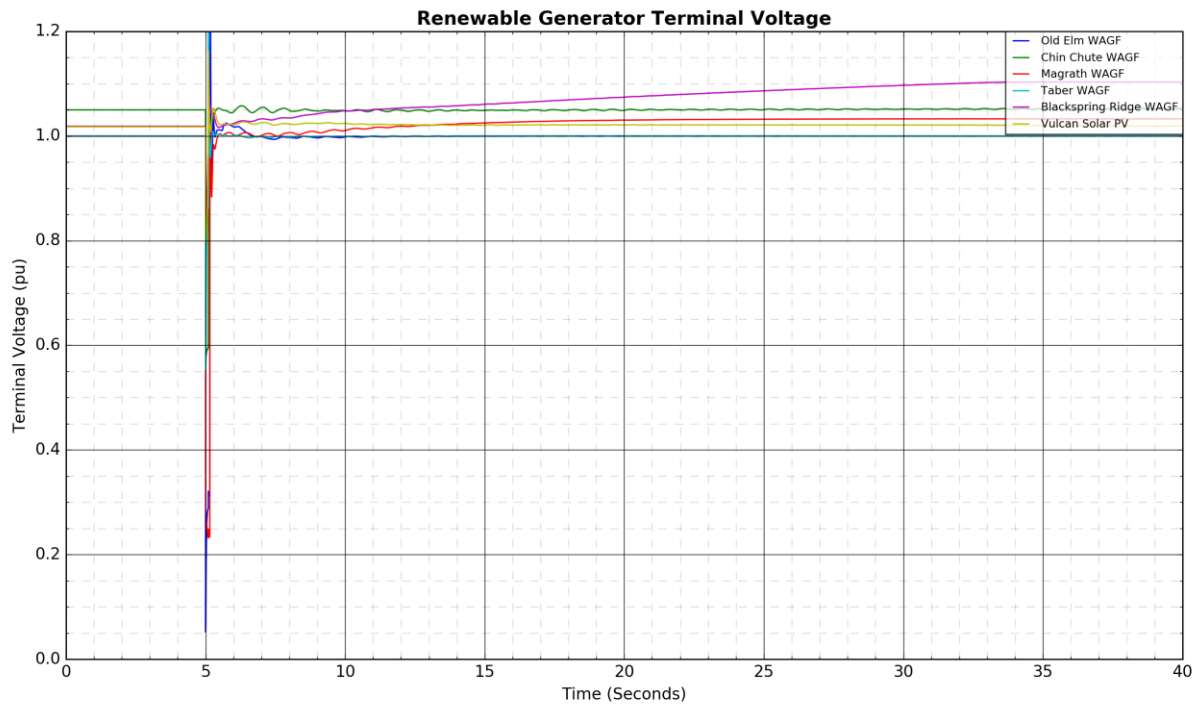
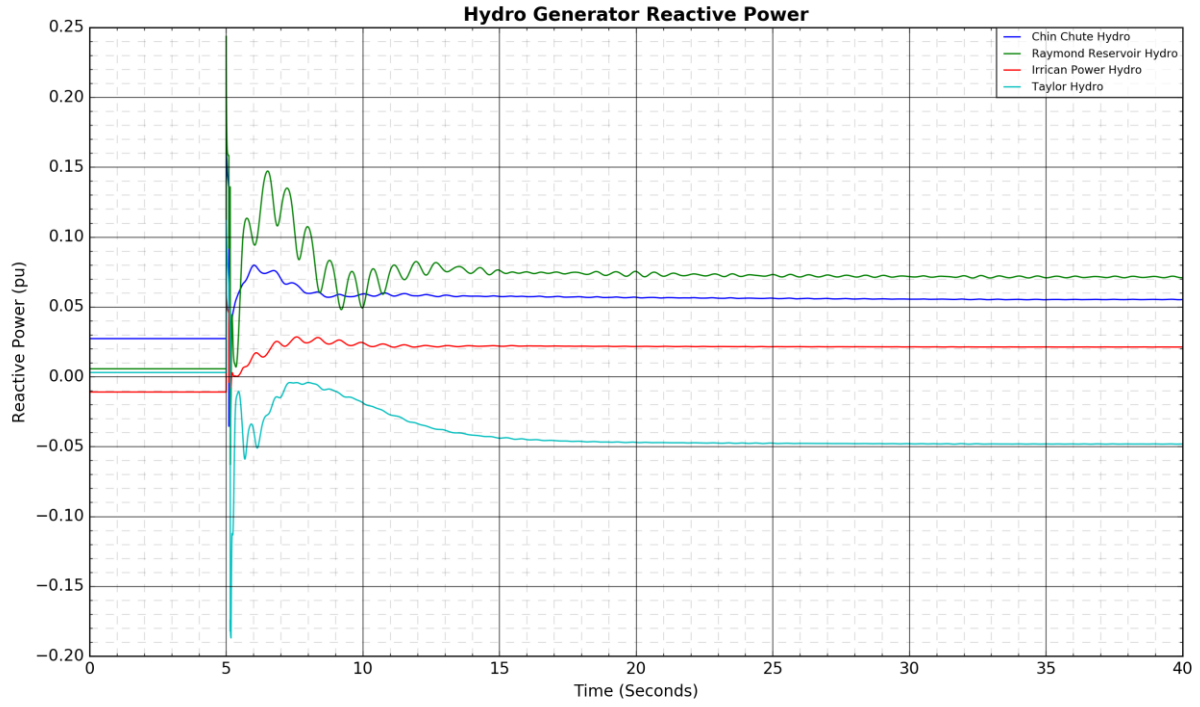


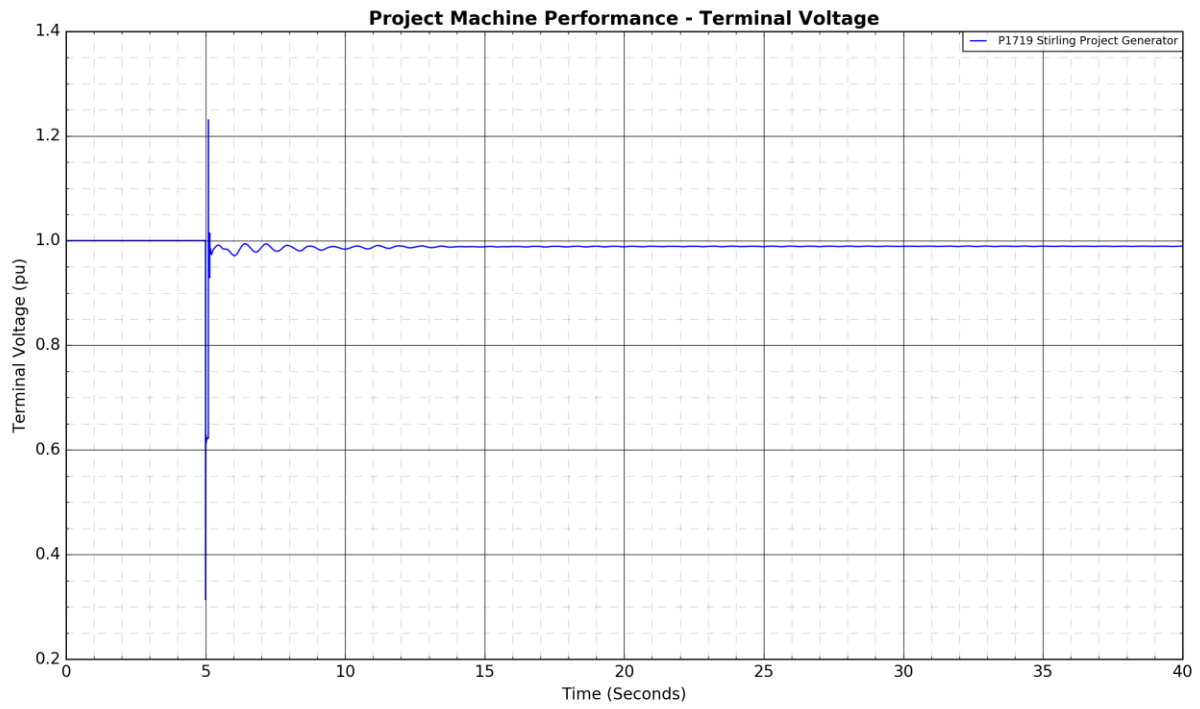
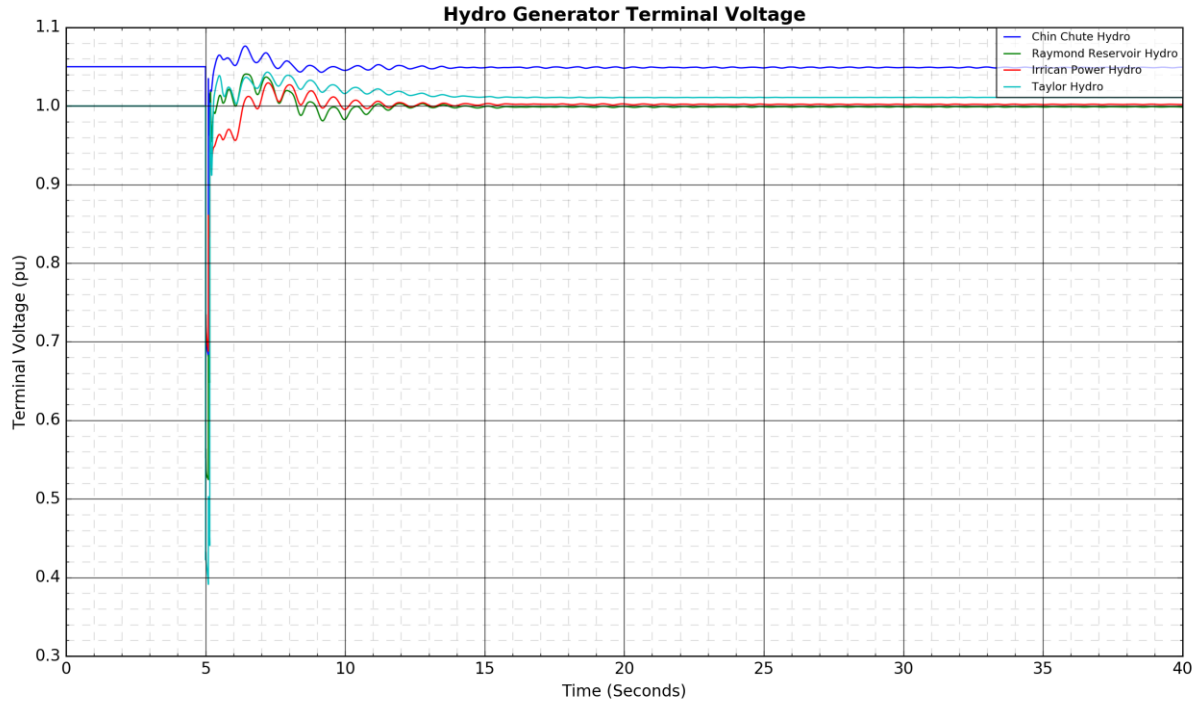


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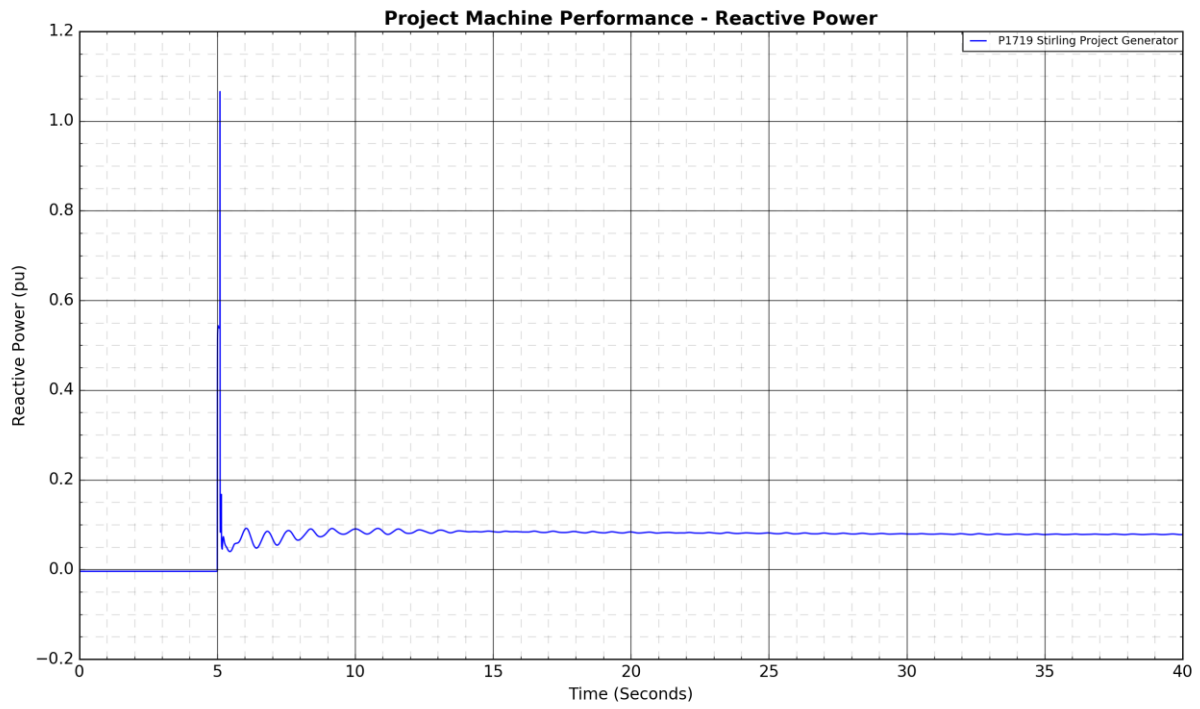
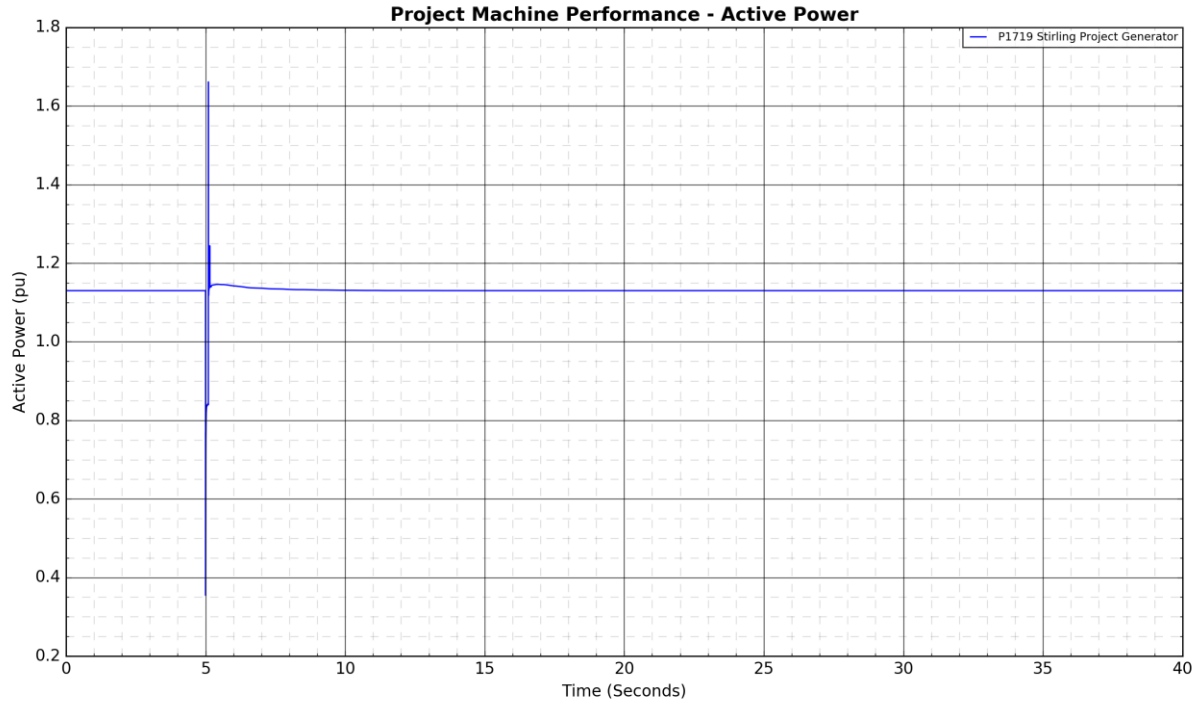
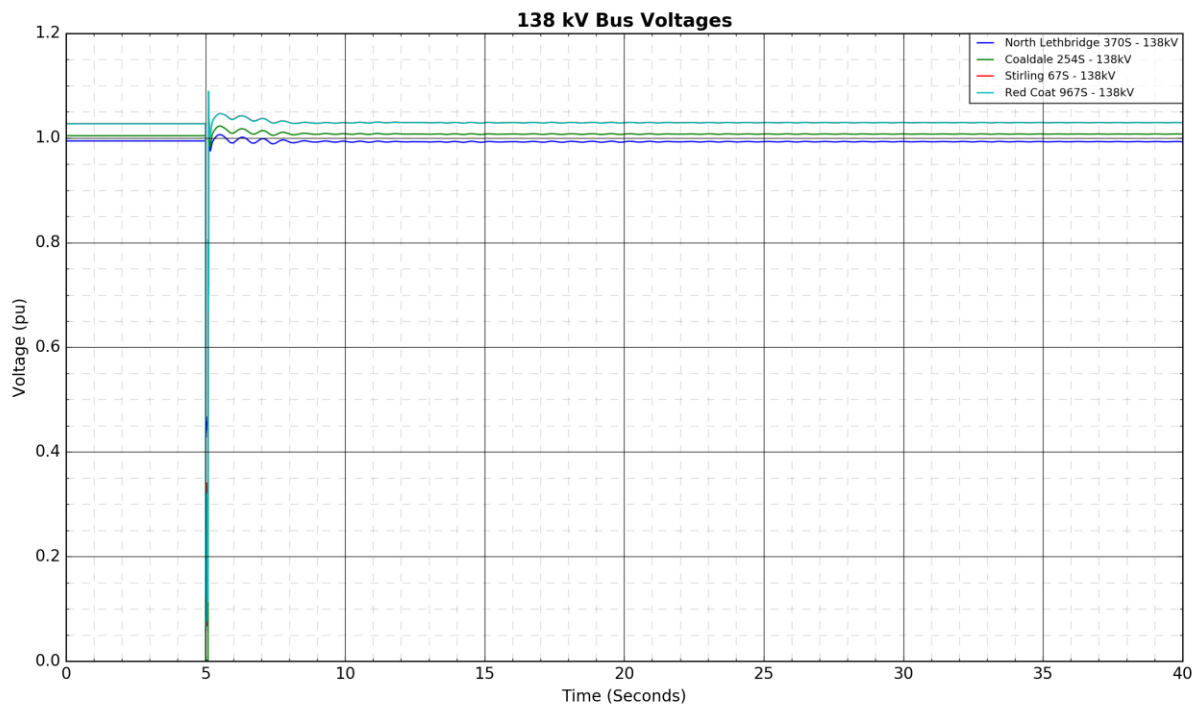
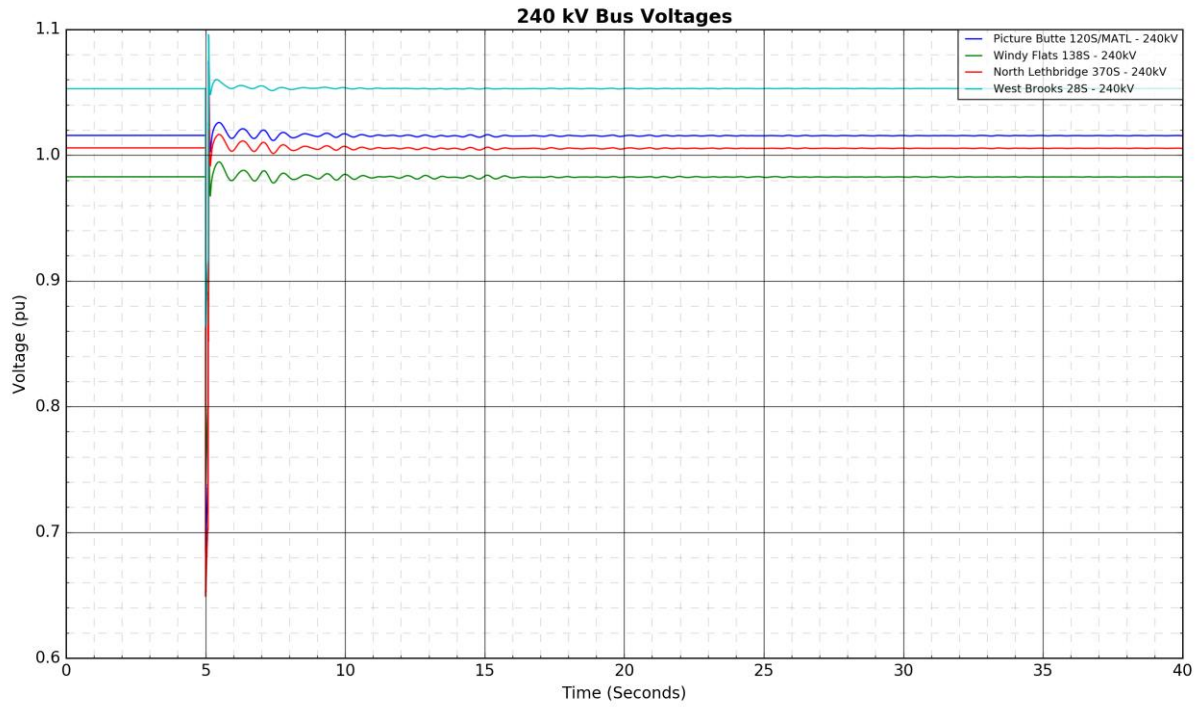
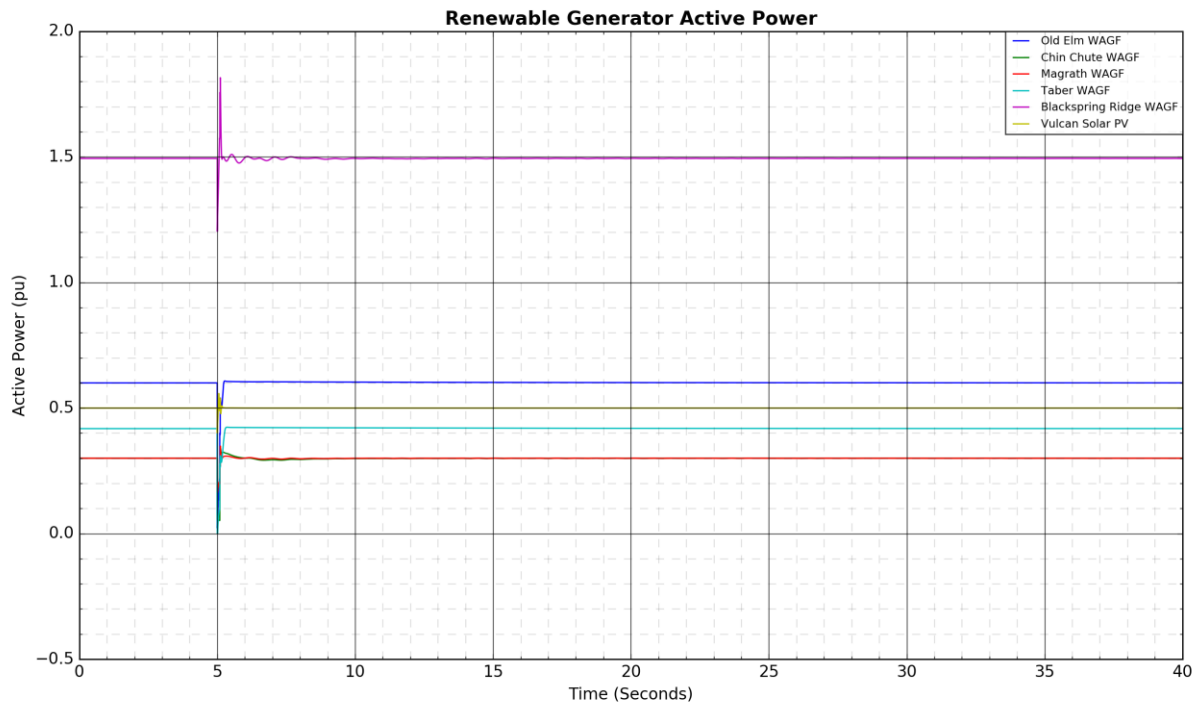
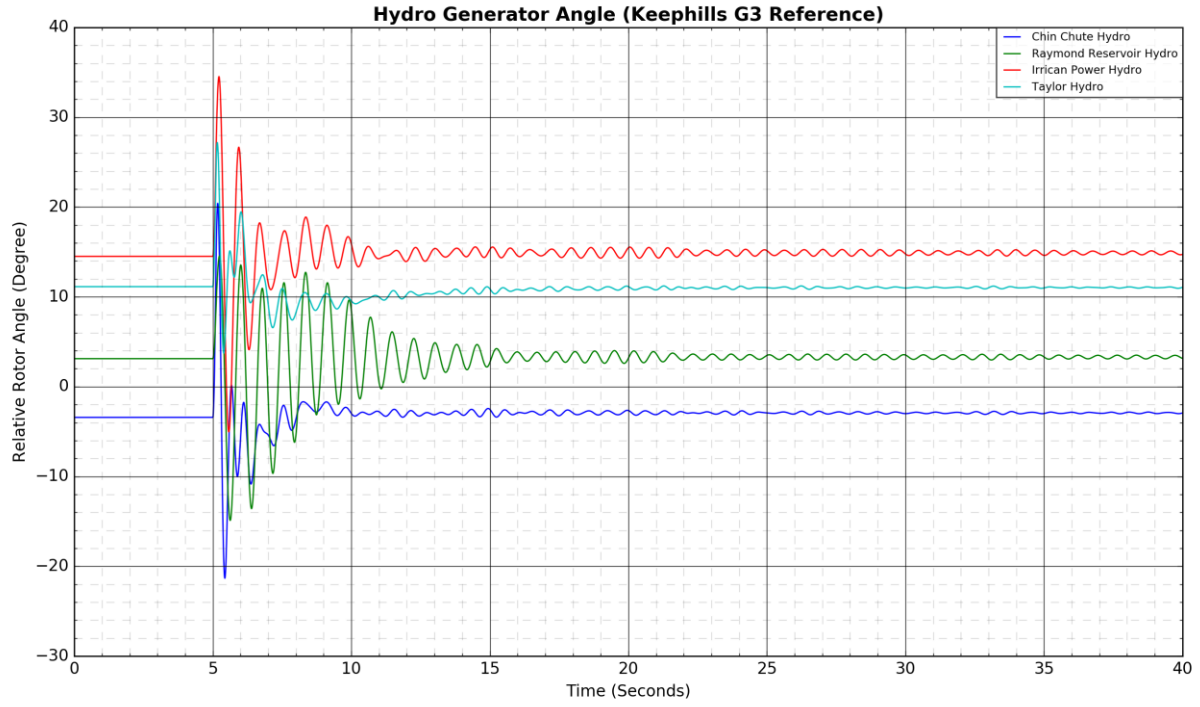
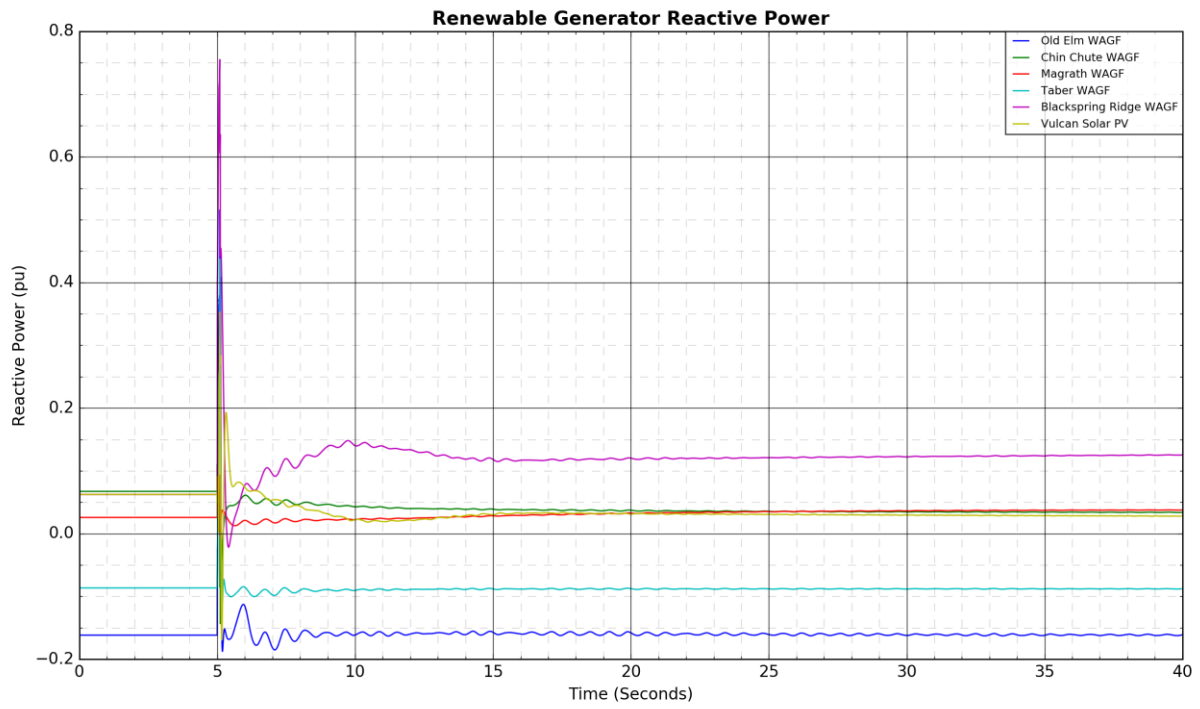
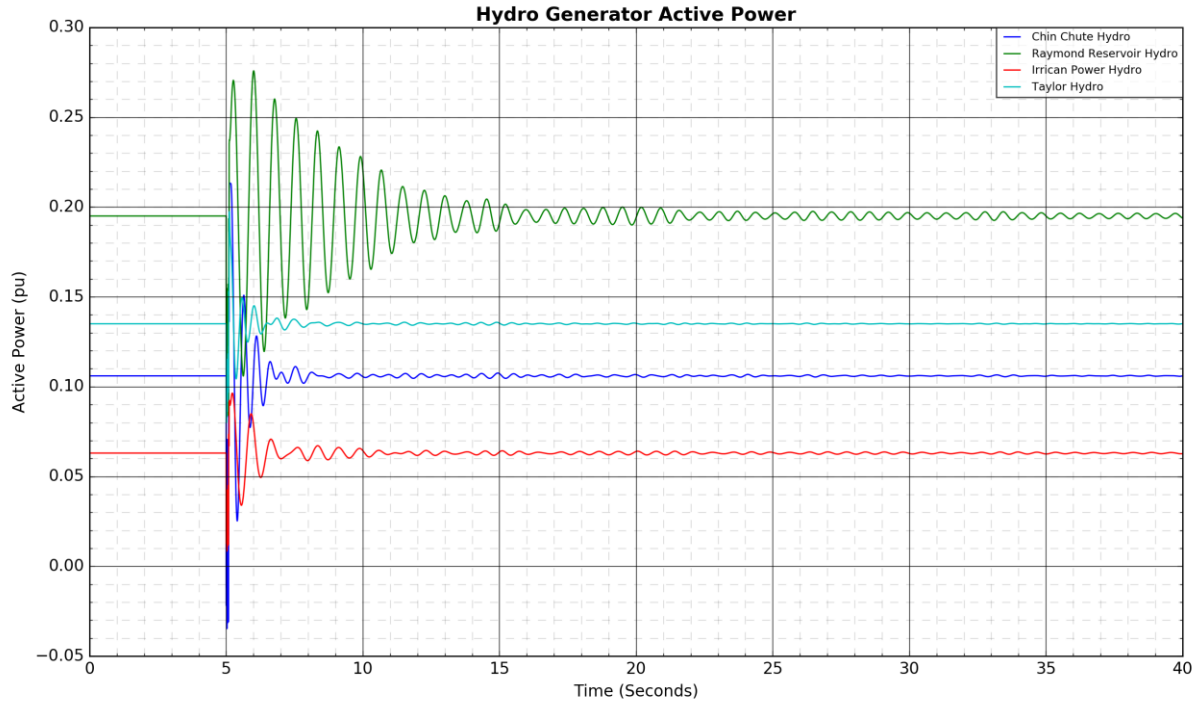


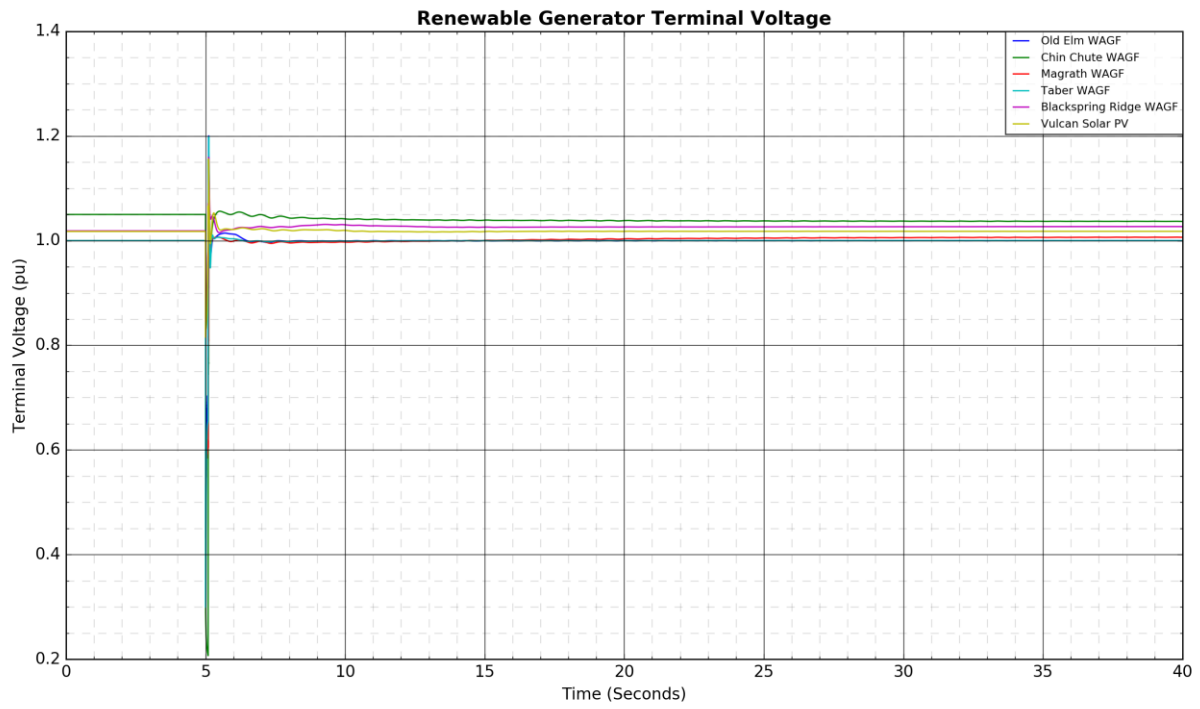
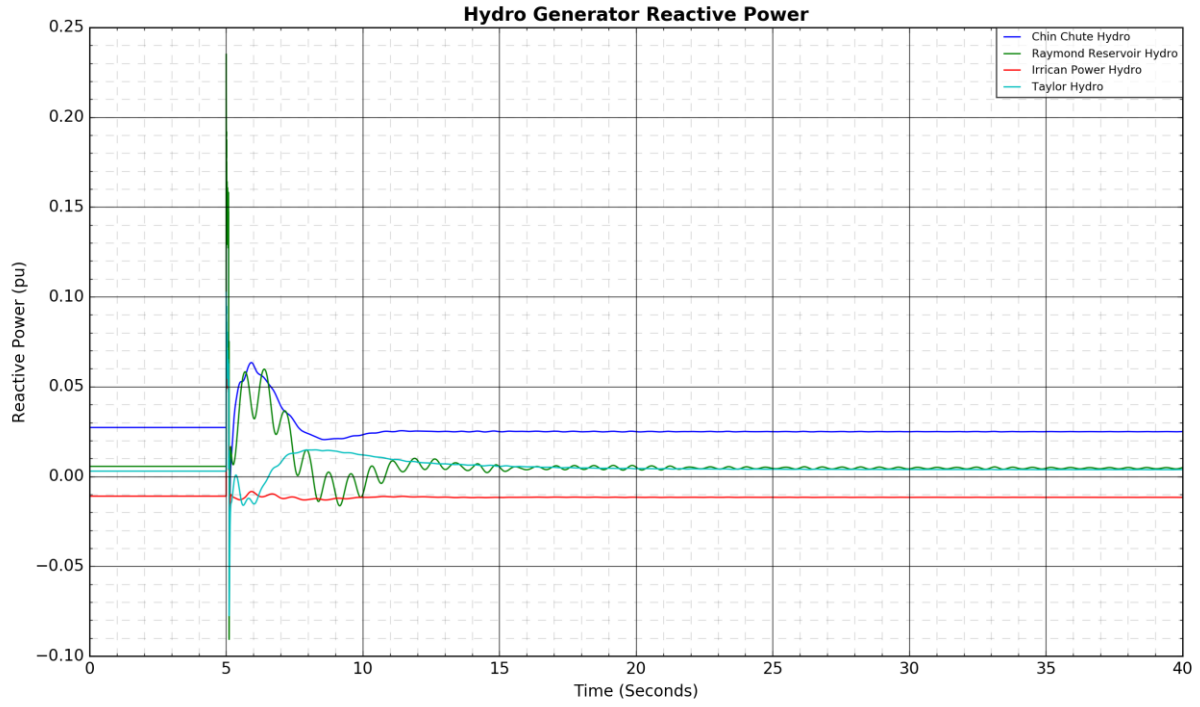
Figure A4-35: 170L Coaldale 254S to North Lethbridge 370S: Fault Near Coaldale 254S

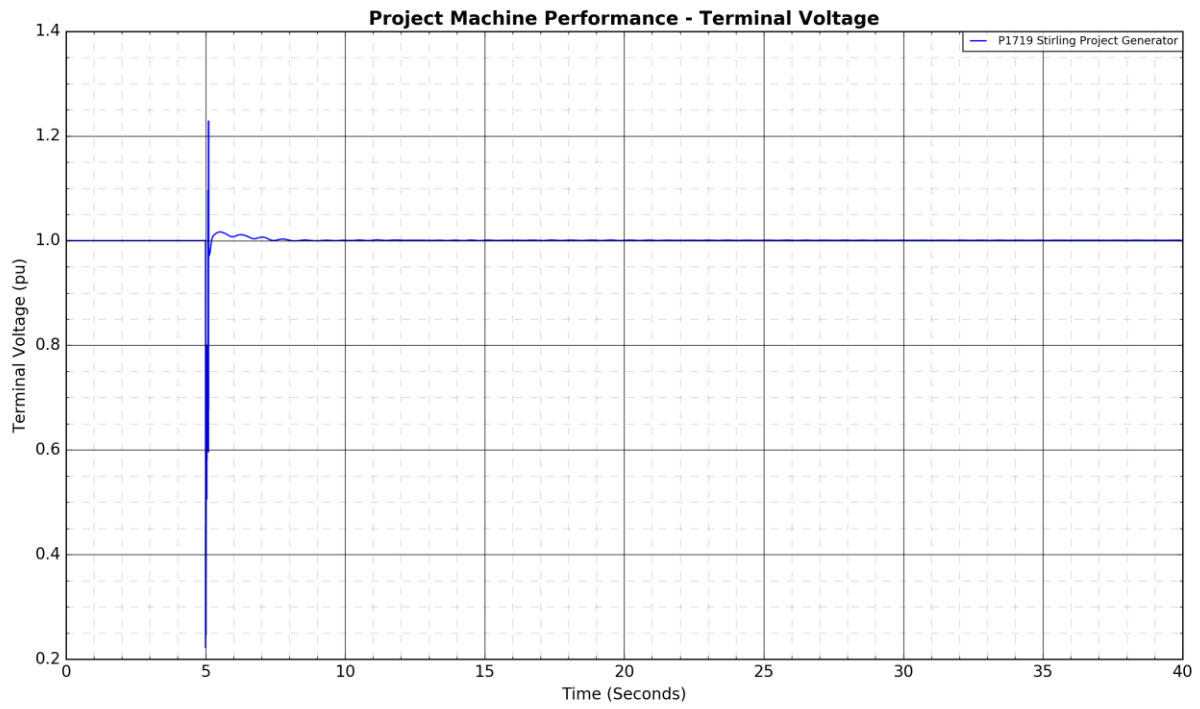
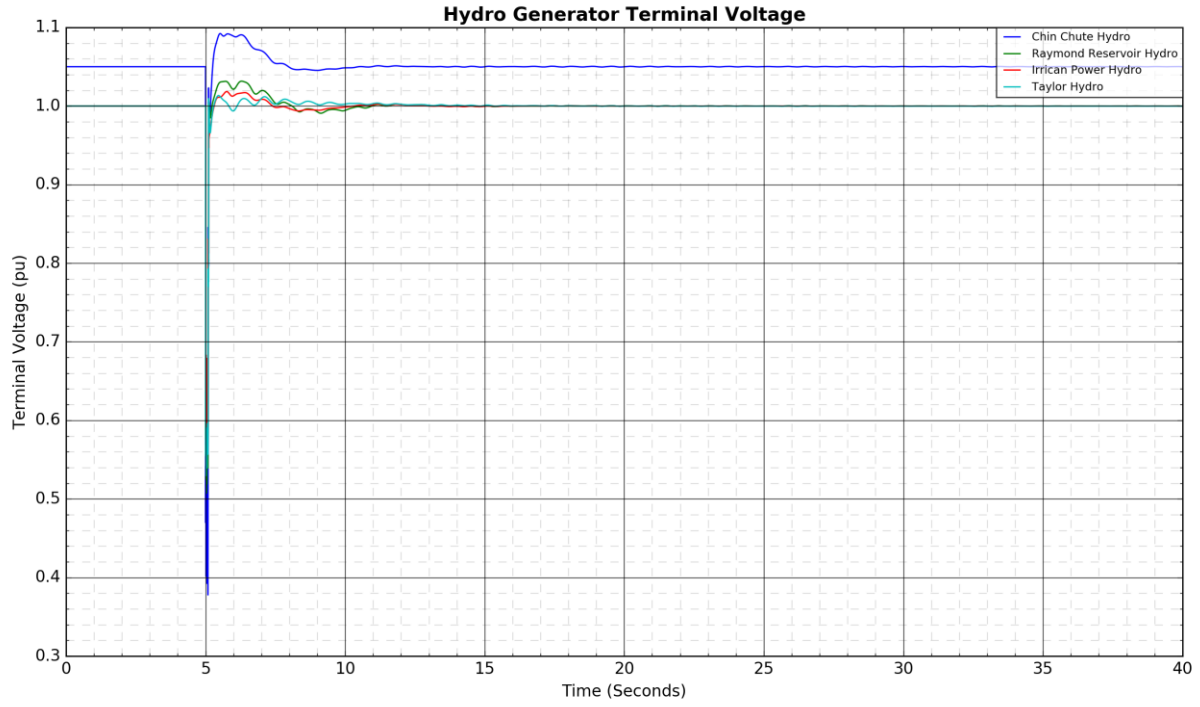




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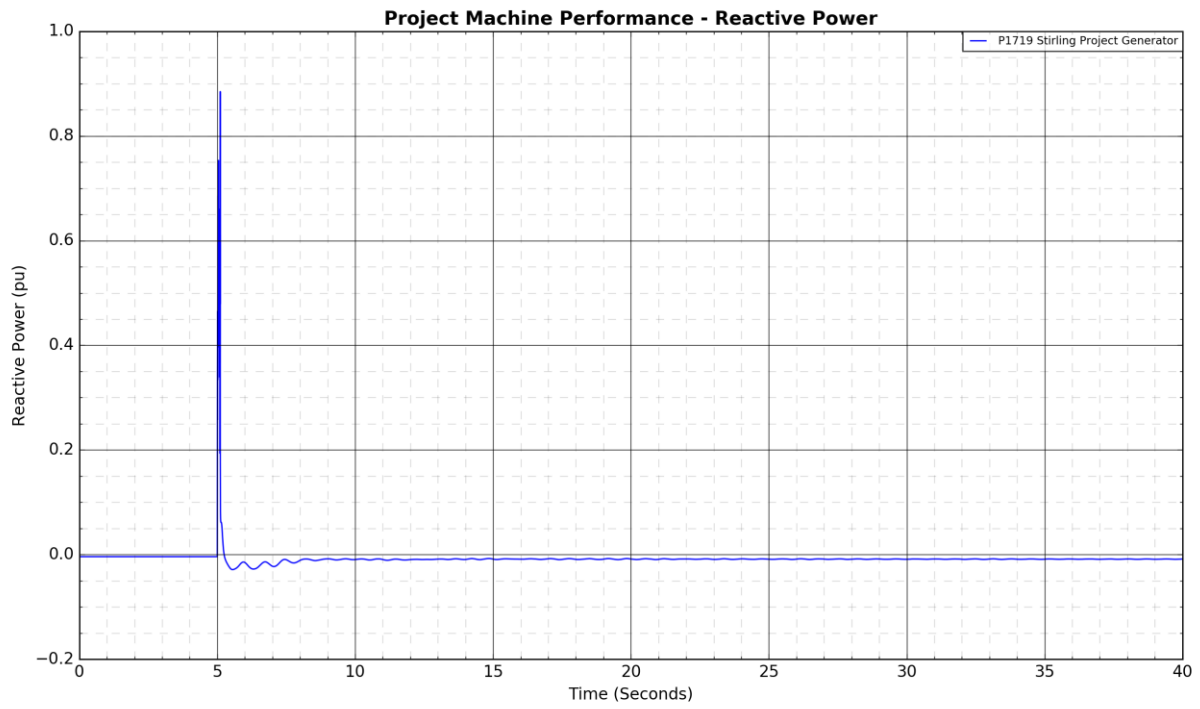
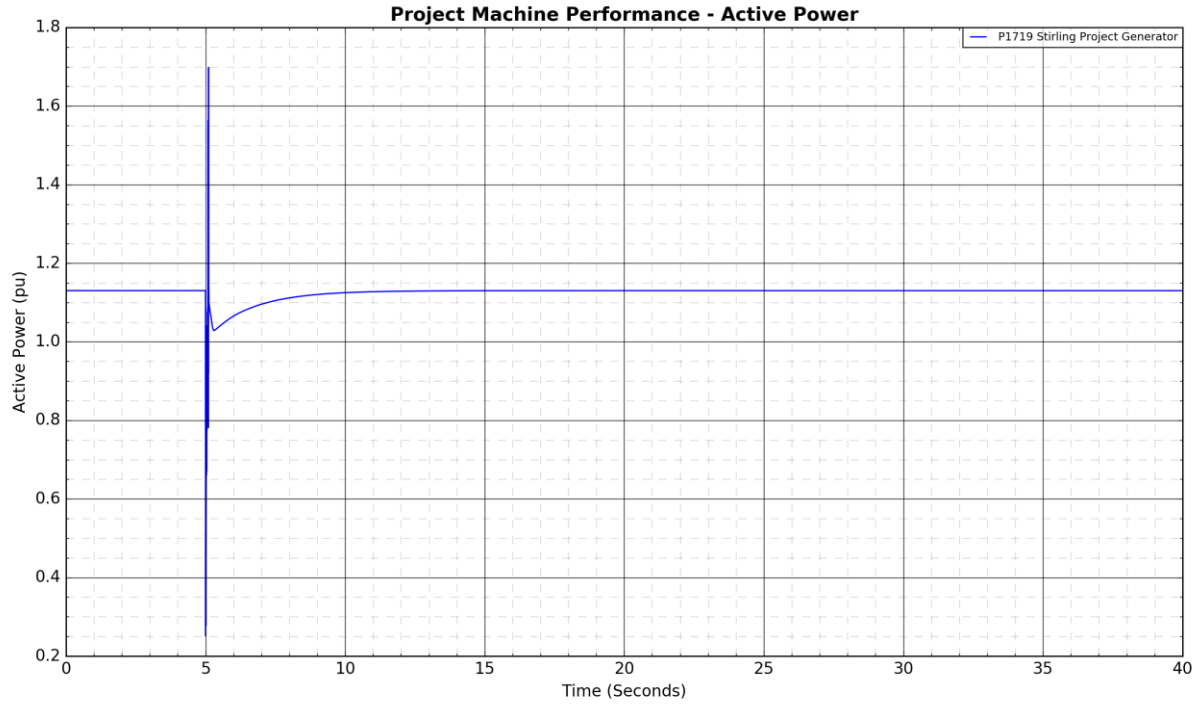
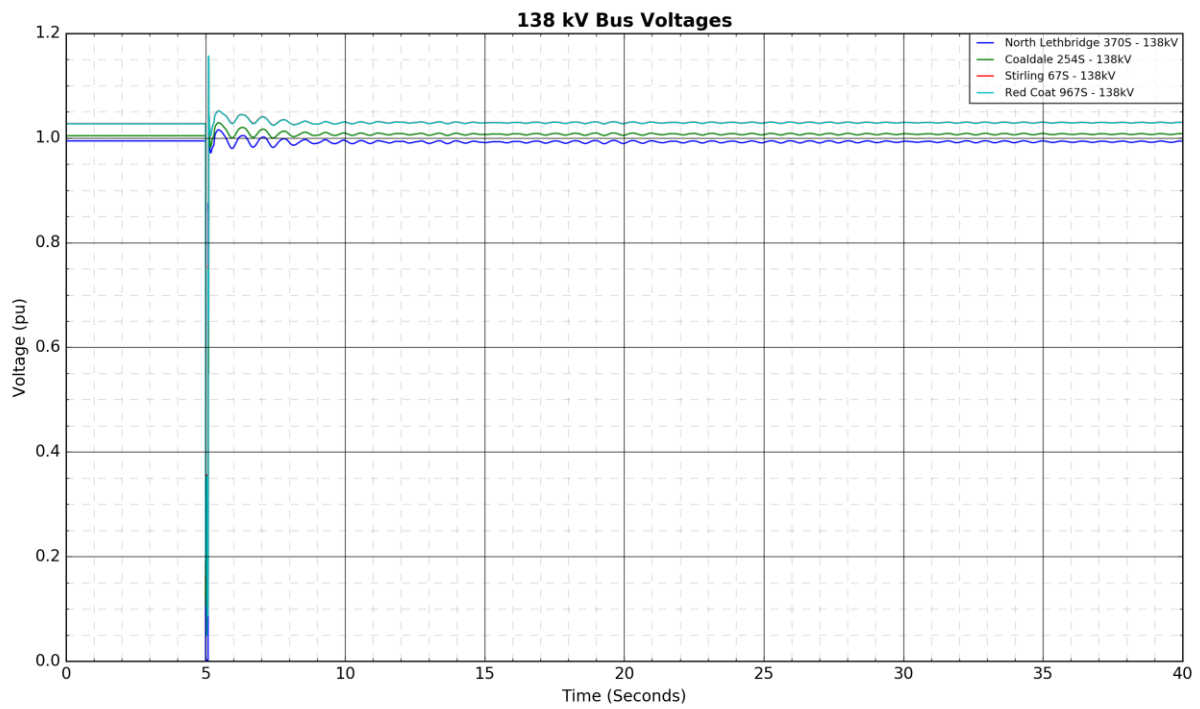
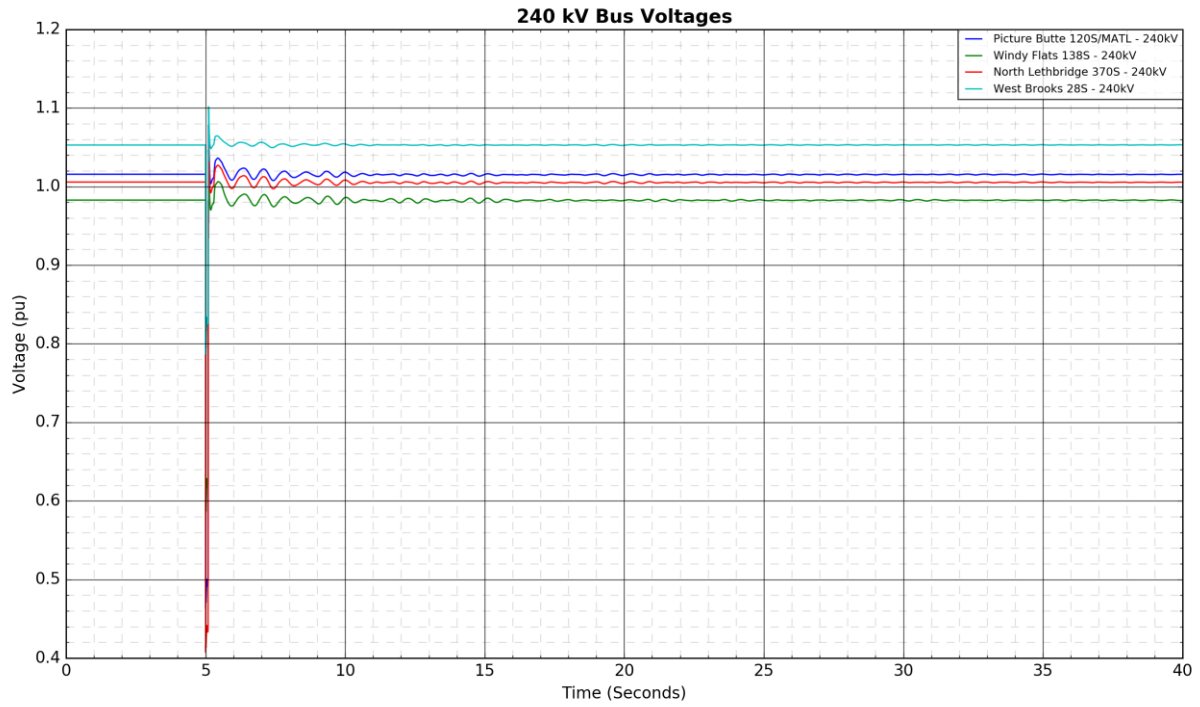
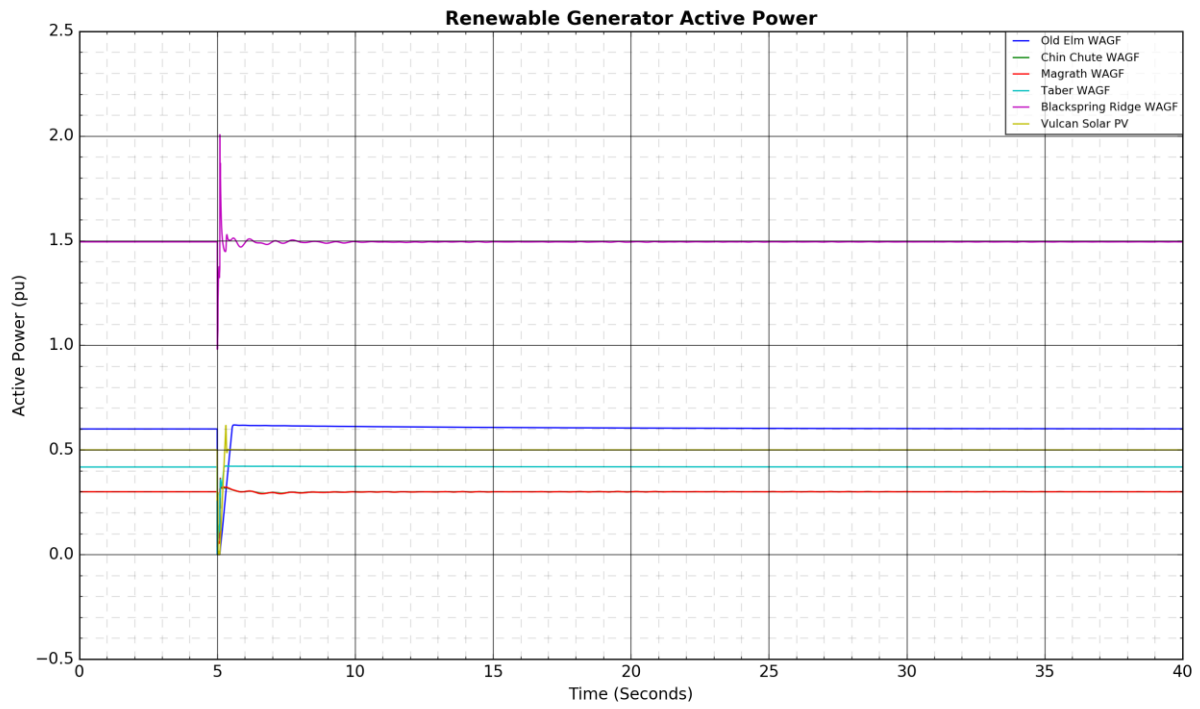
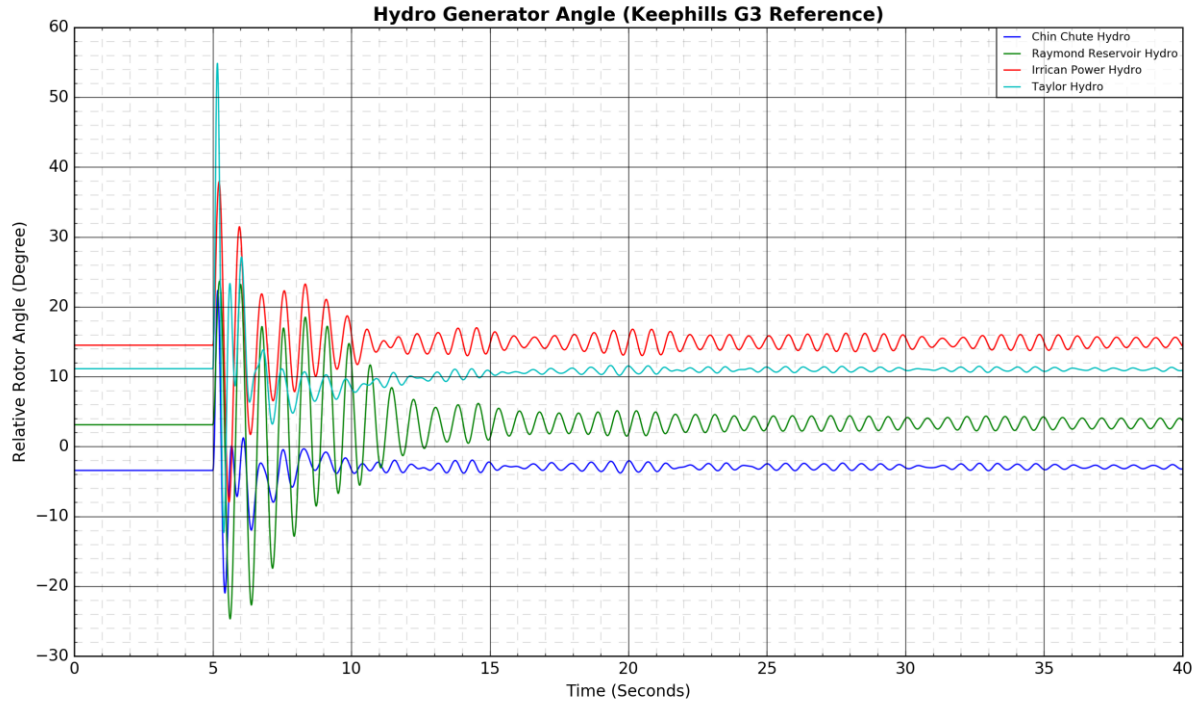
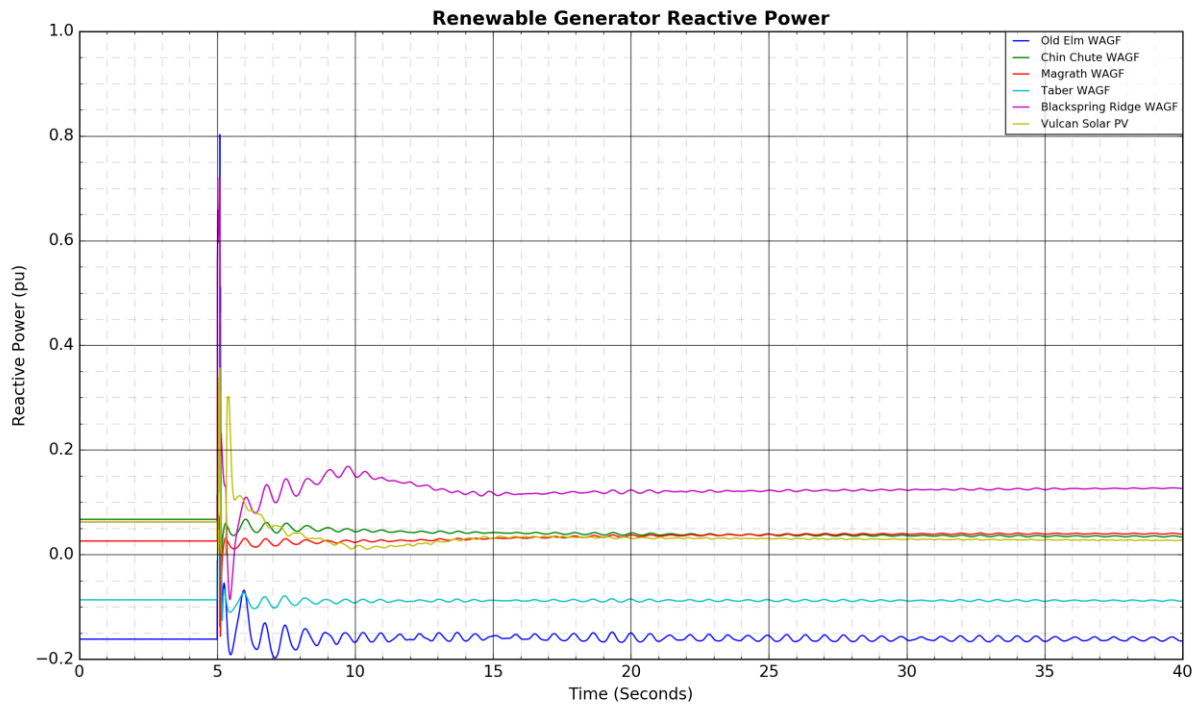
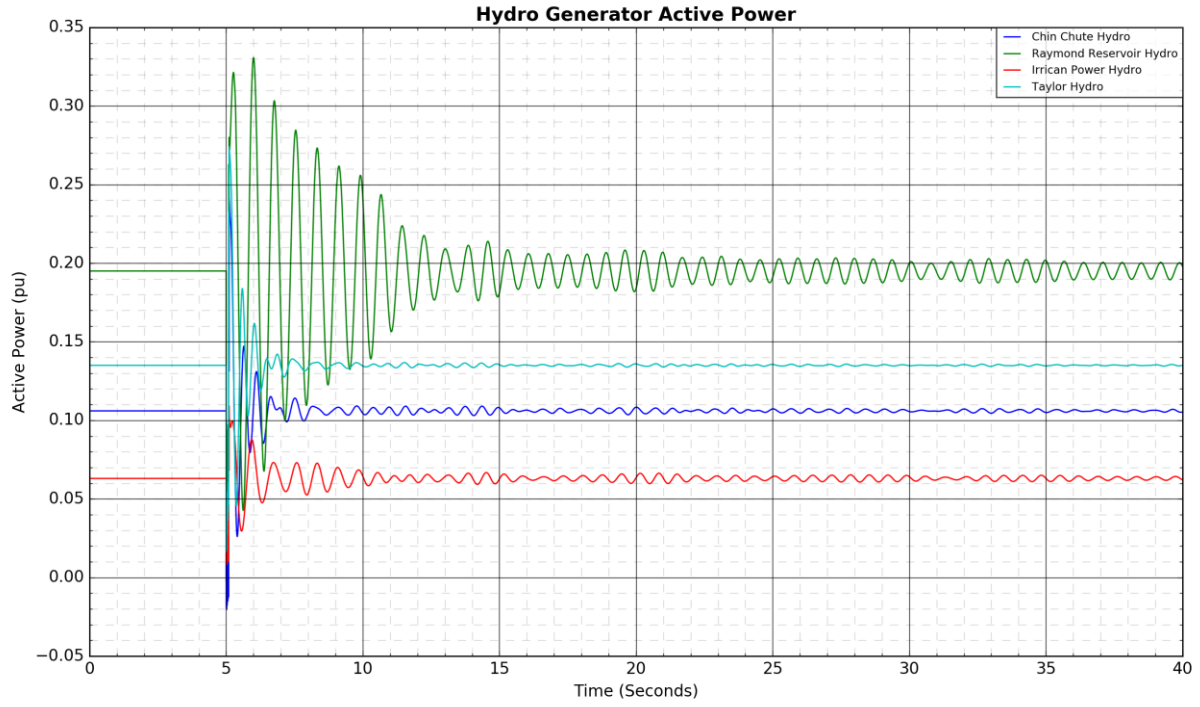


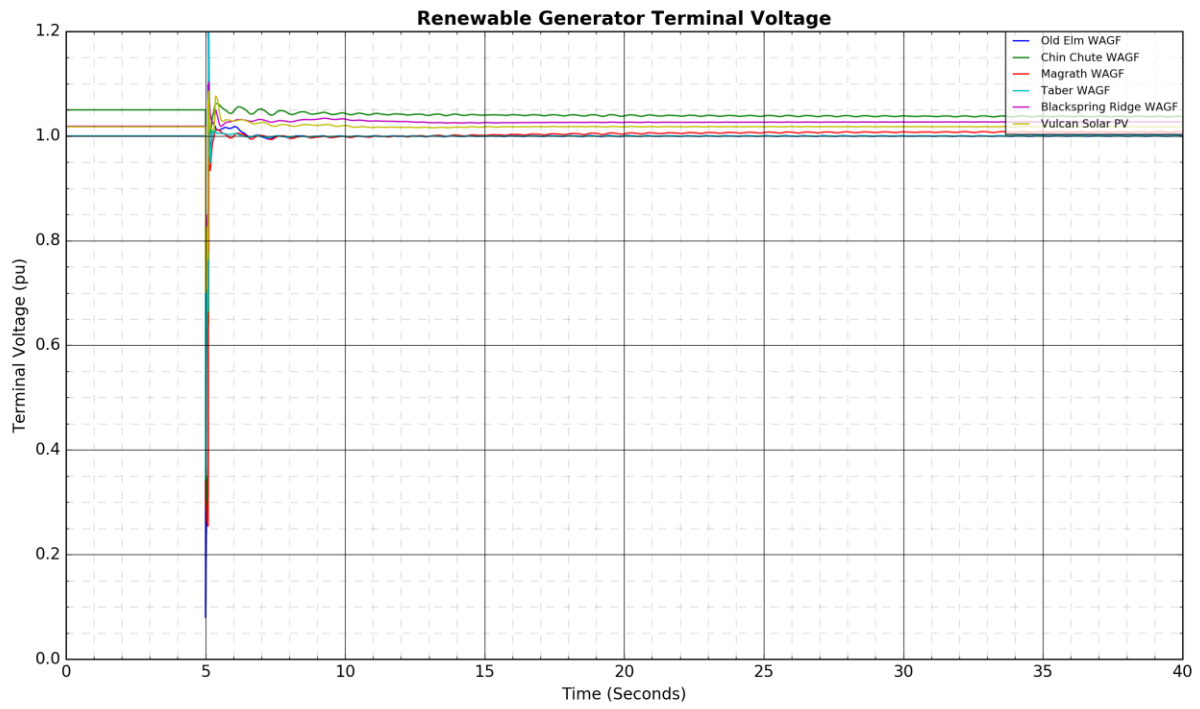
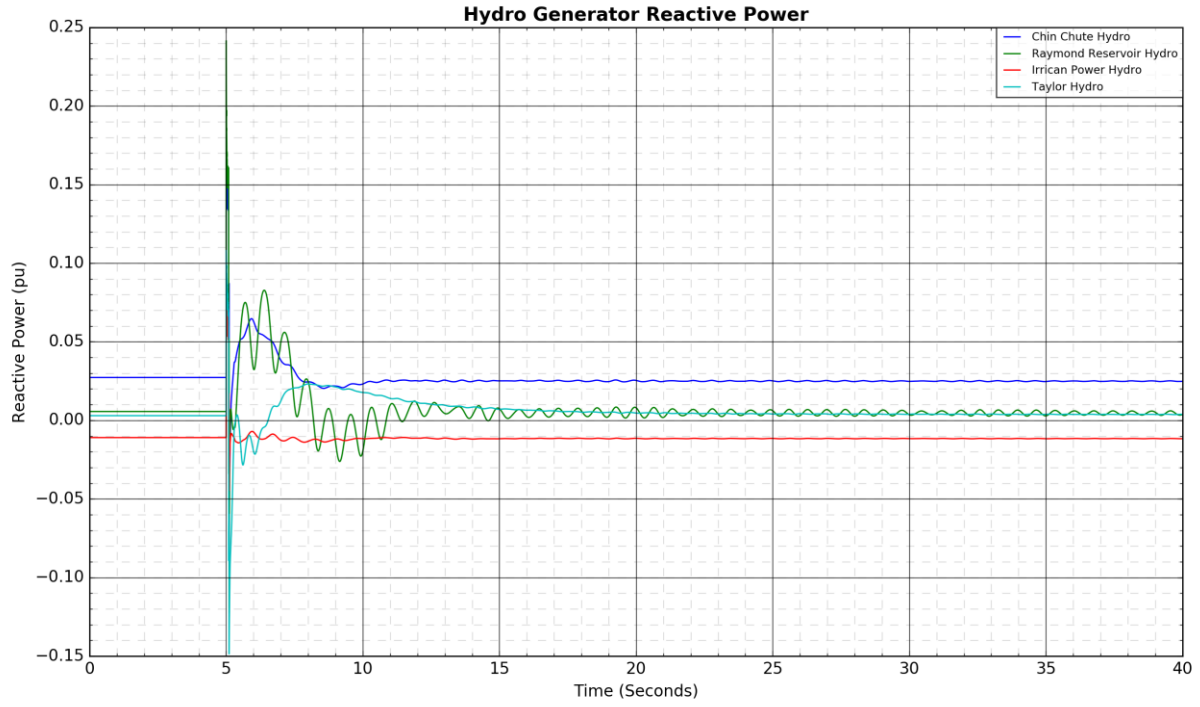
Figure A4-36: 170L Coaldale 254S to North Lethbridge 370S: Fault Near North Lethbridge 370S

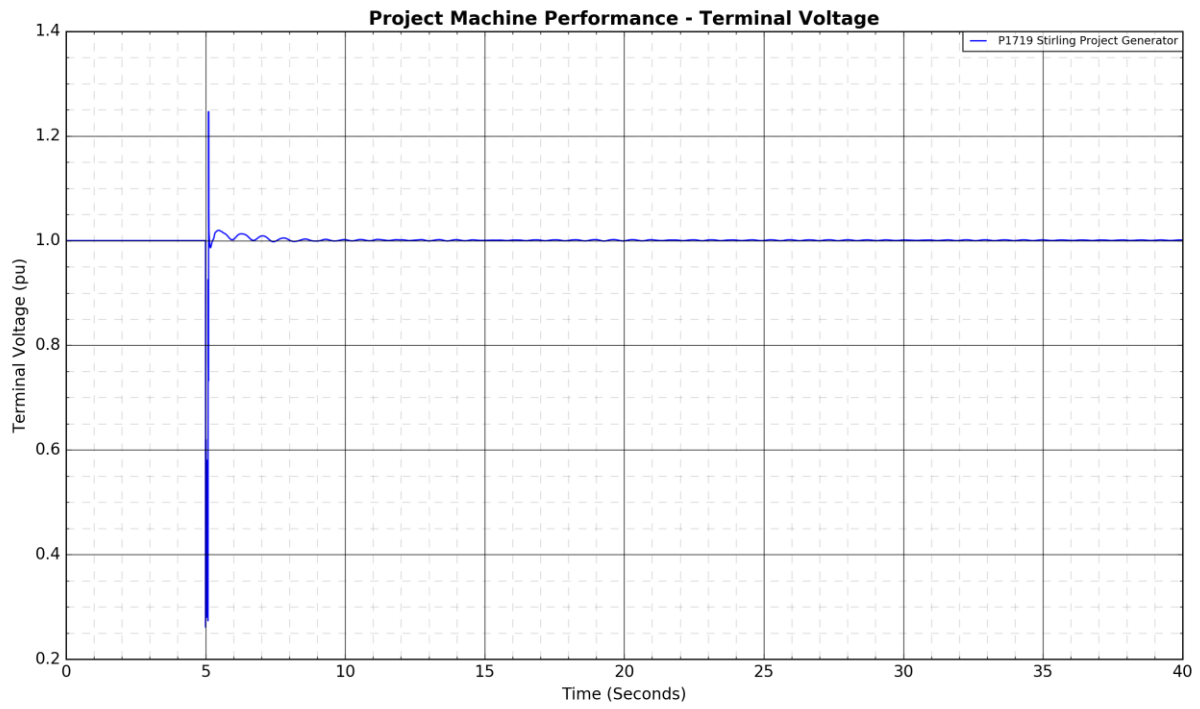
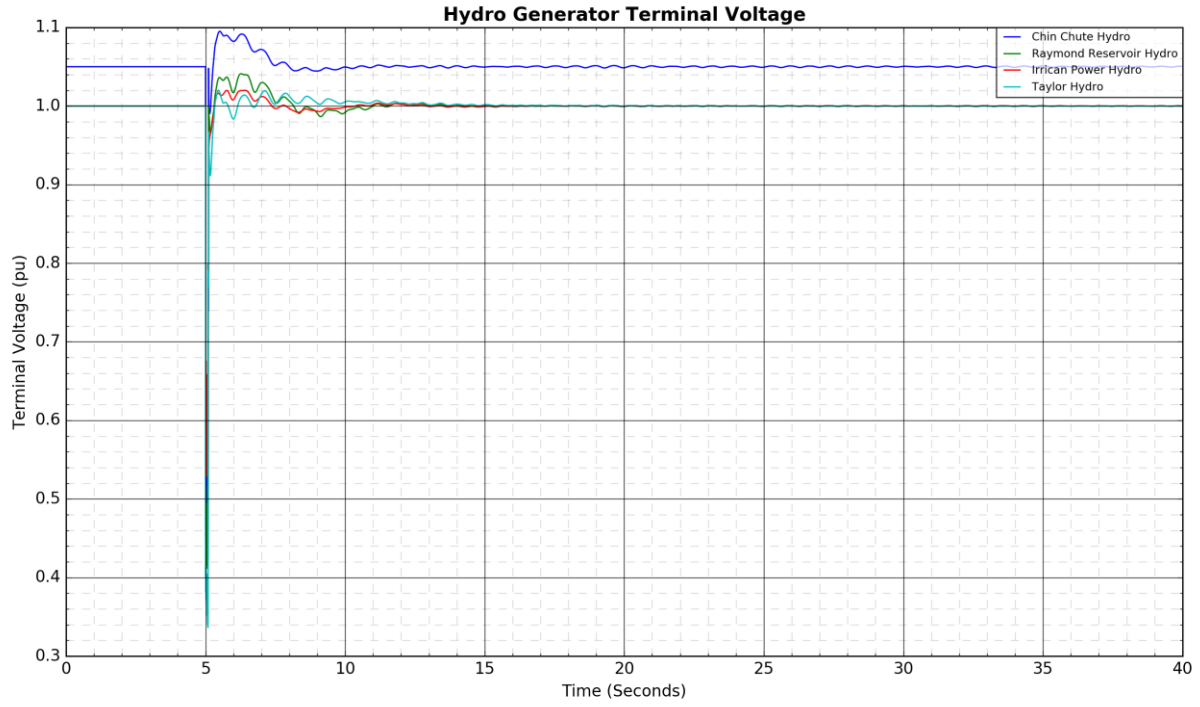






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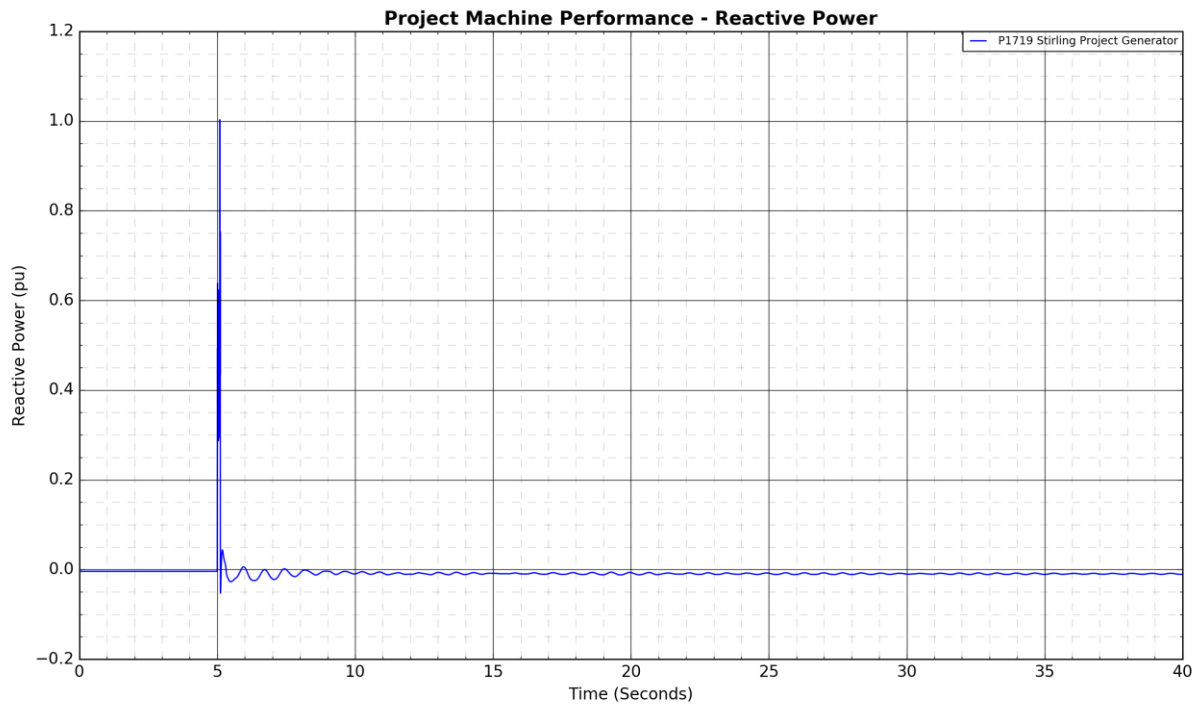
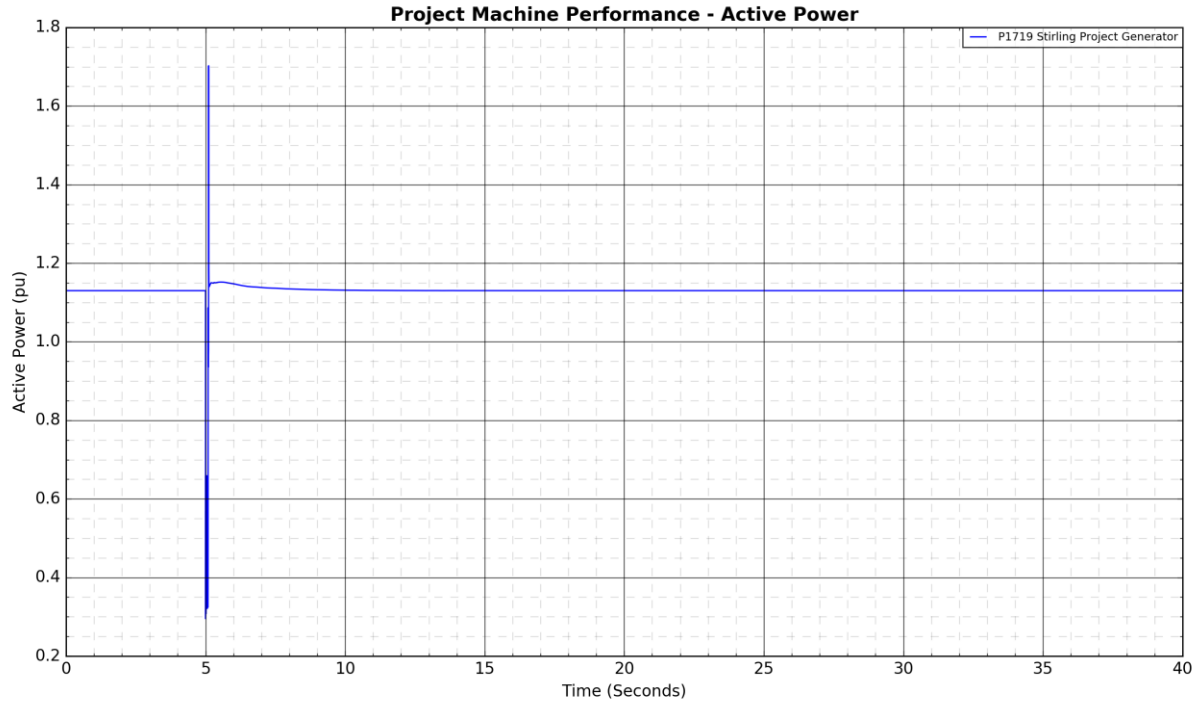
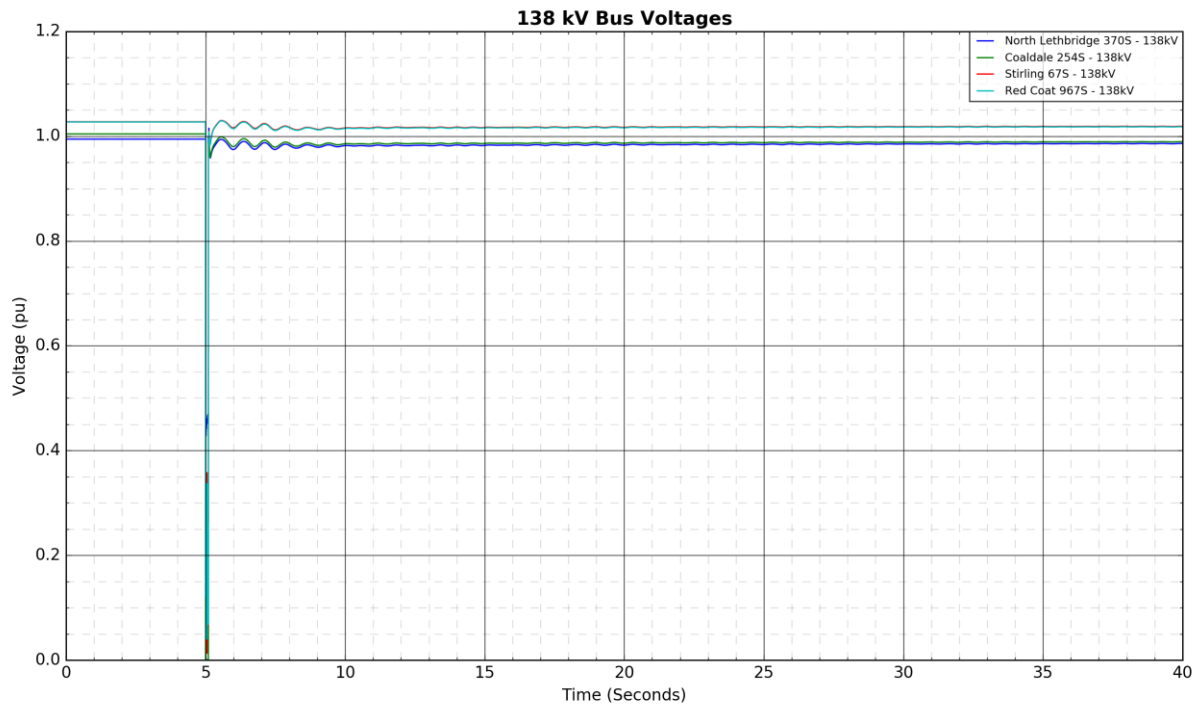
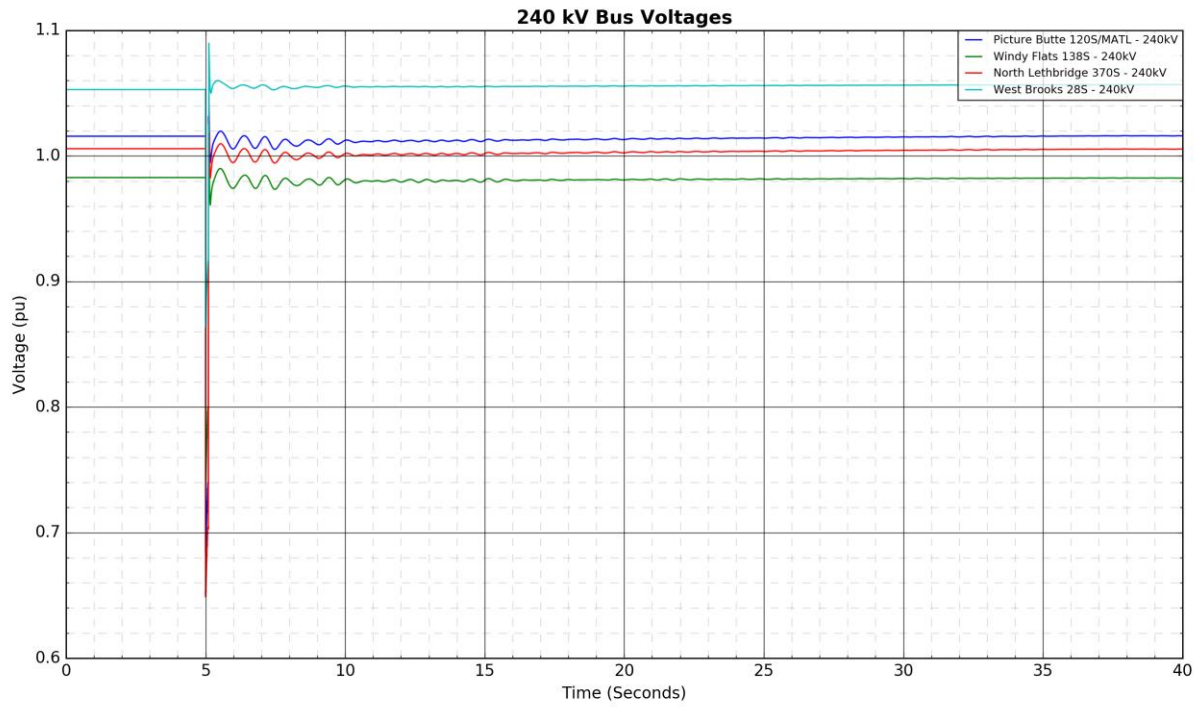
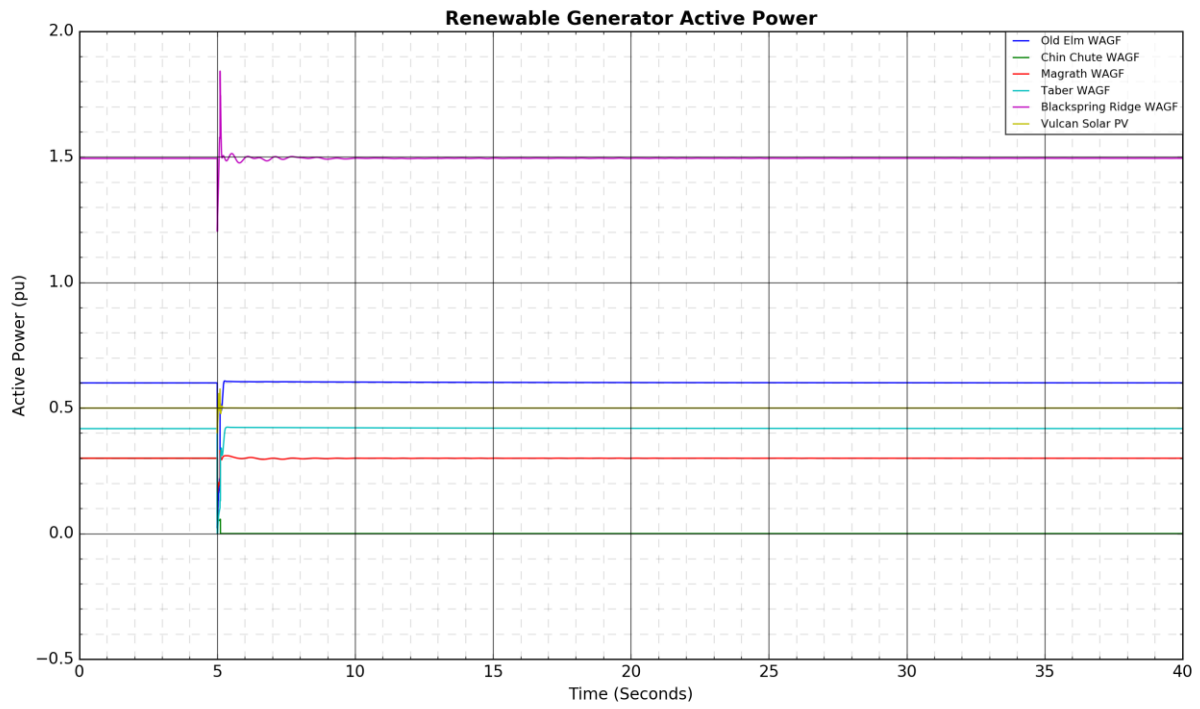
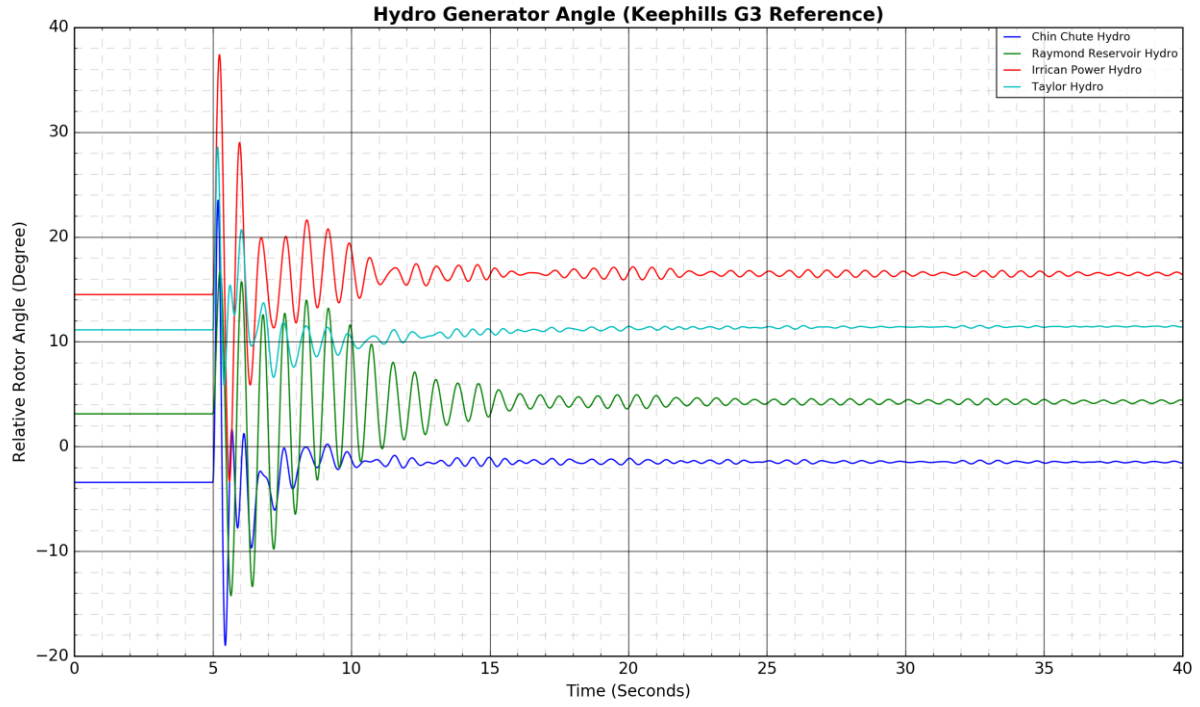
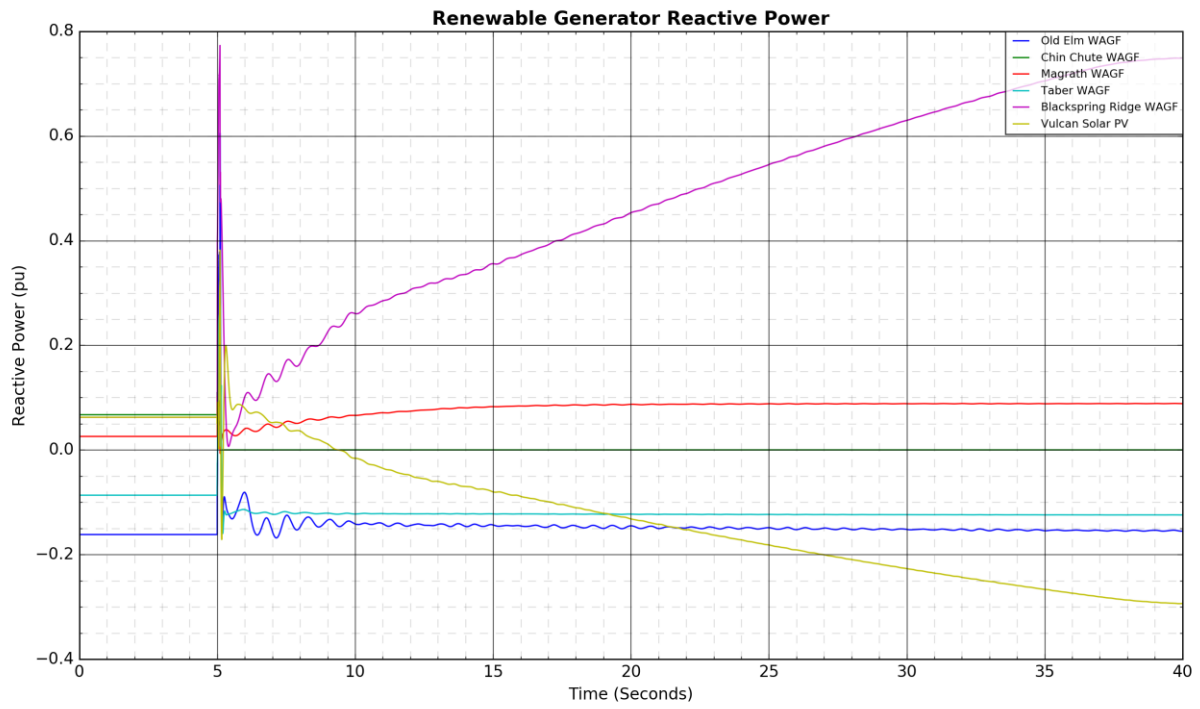
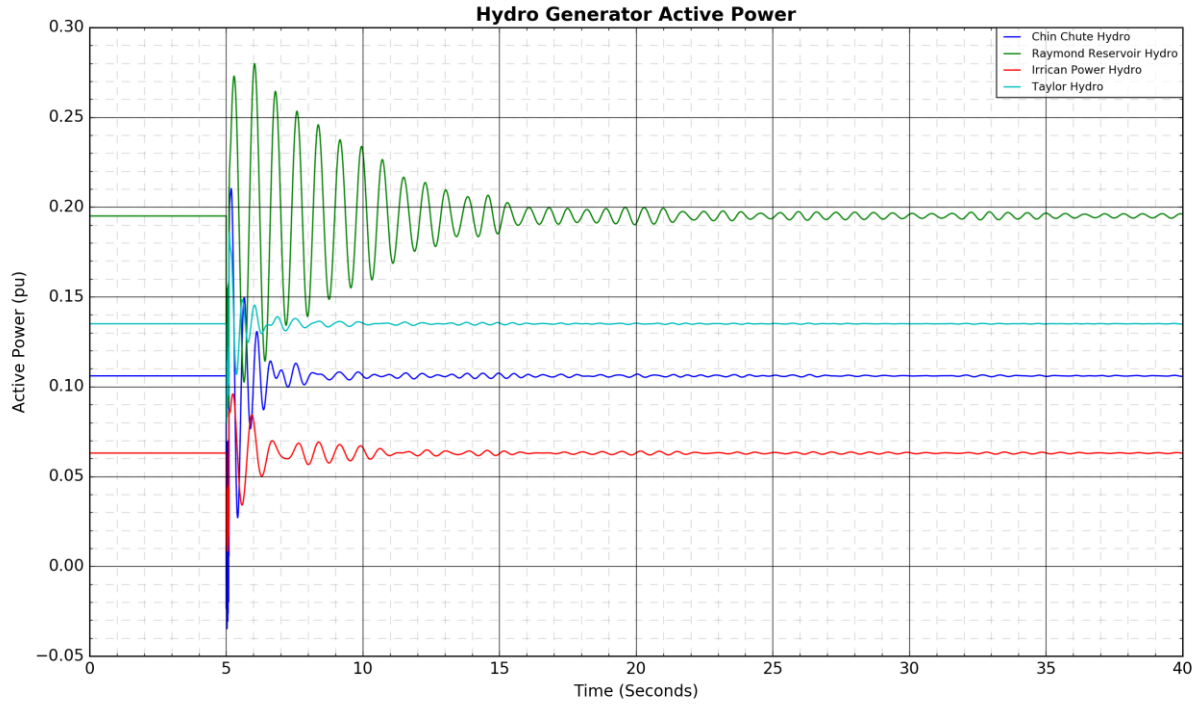


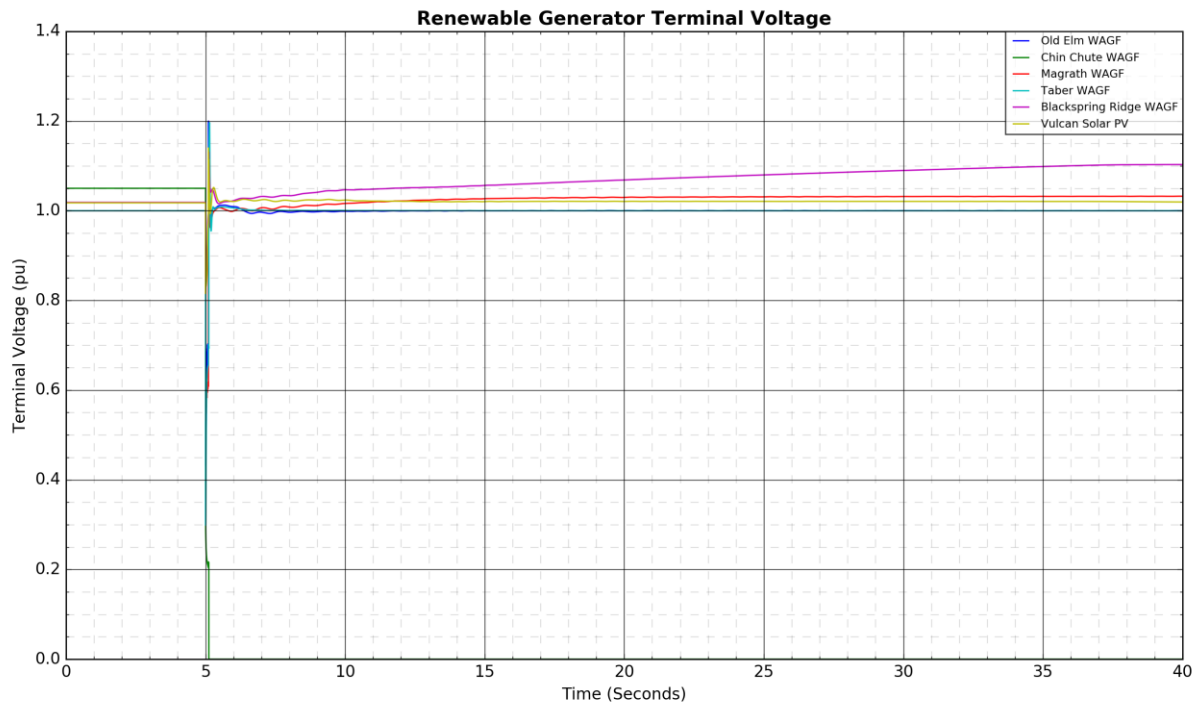
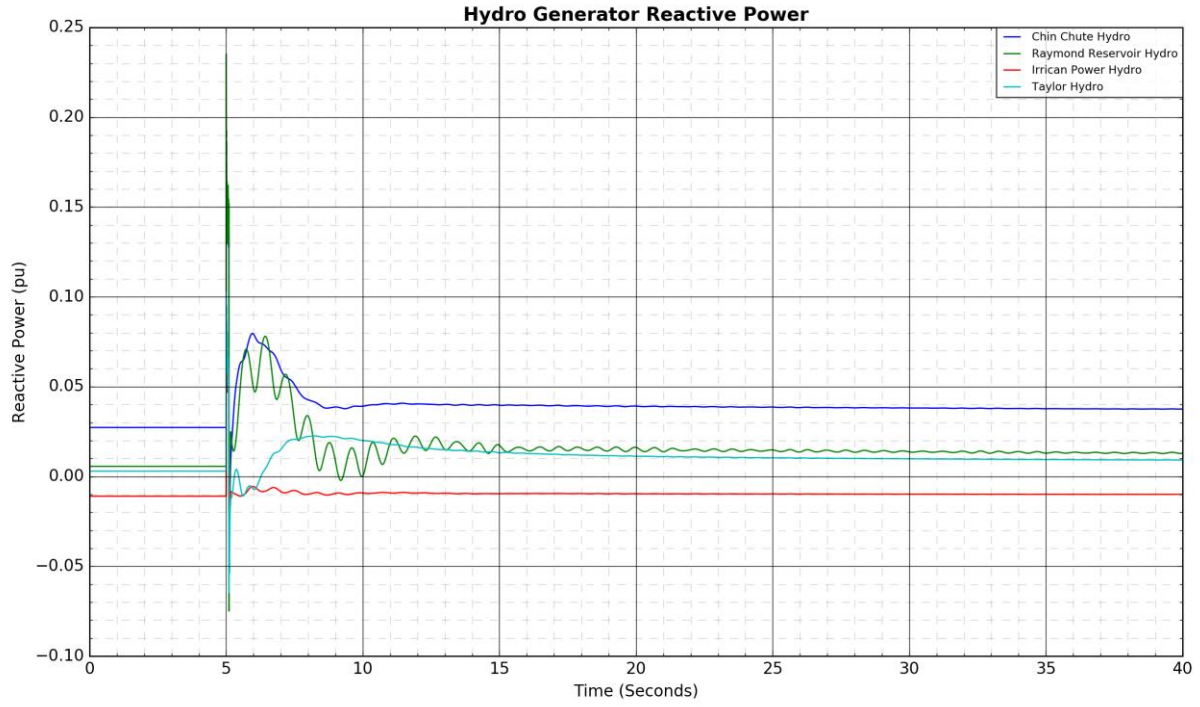
Figure A4-37: 172L Coaldale 254S to Taber 83S: Fault Near Coaldale 254S

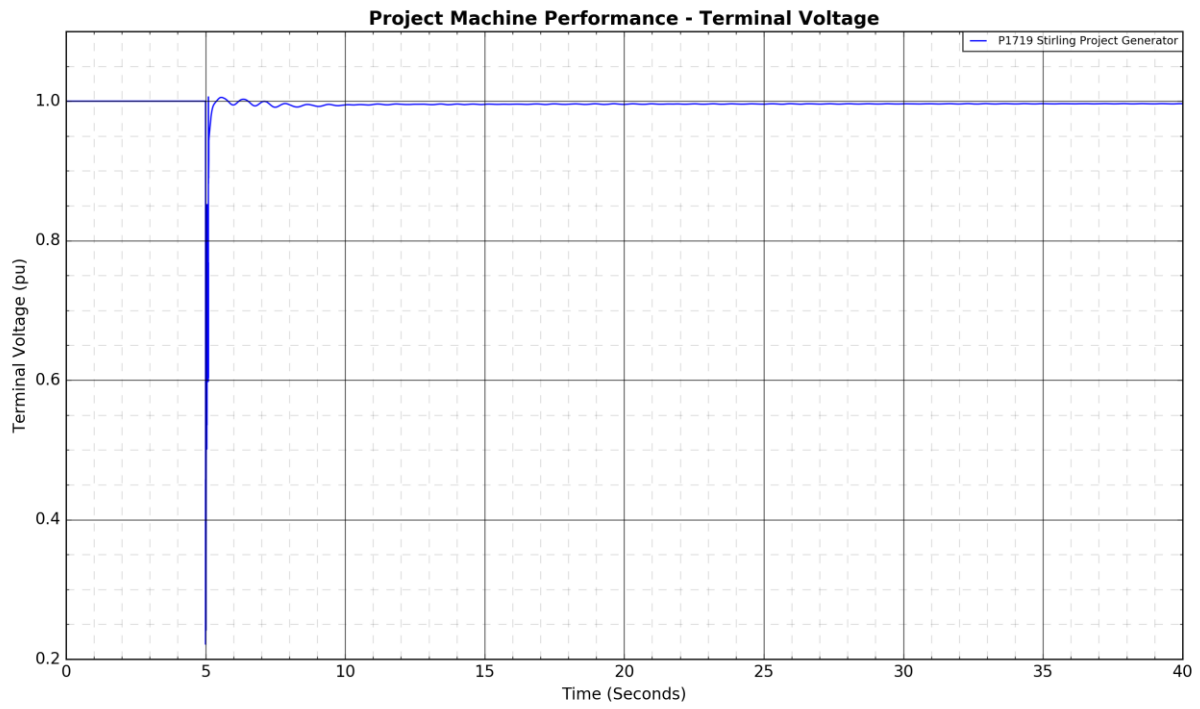
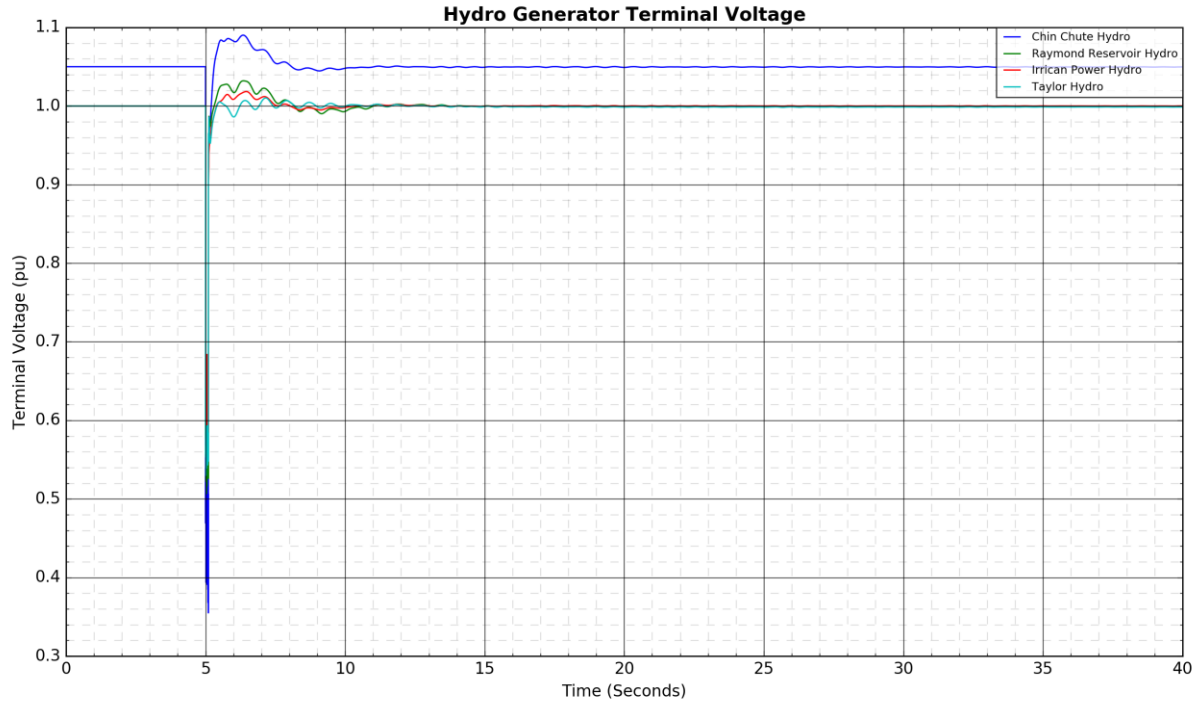




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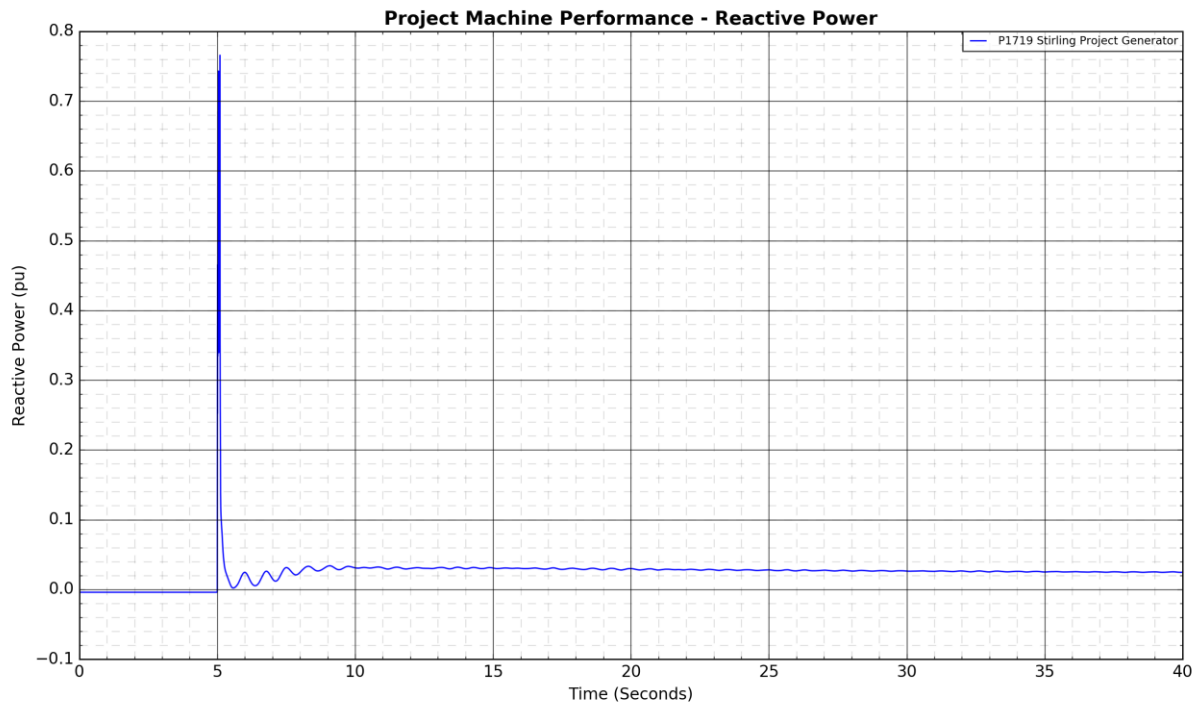
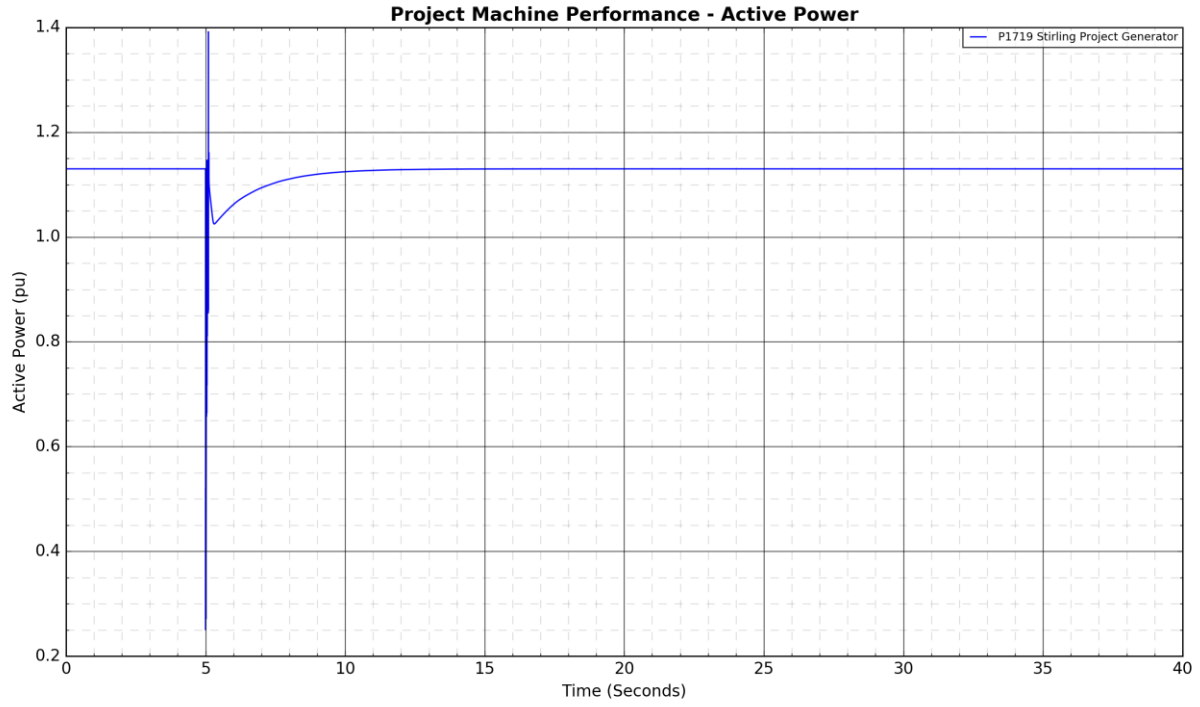
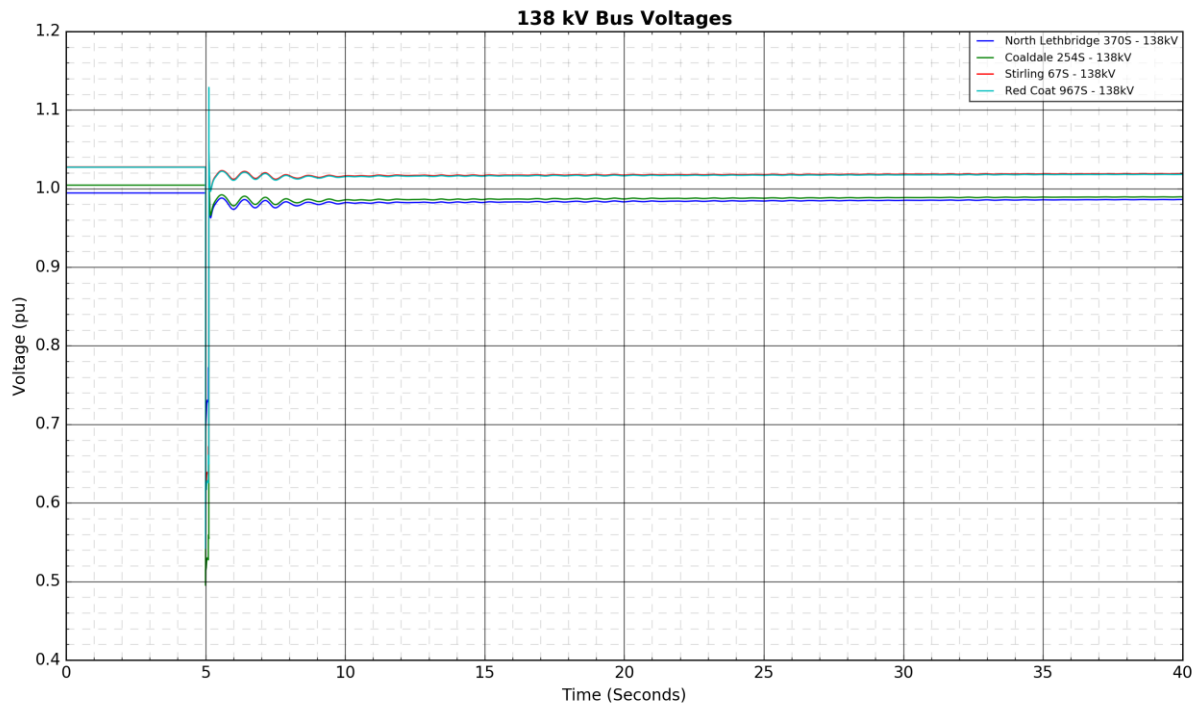
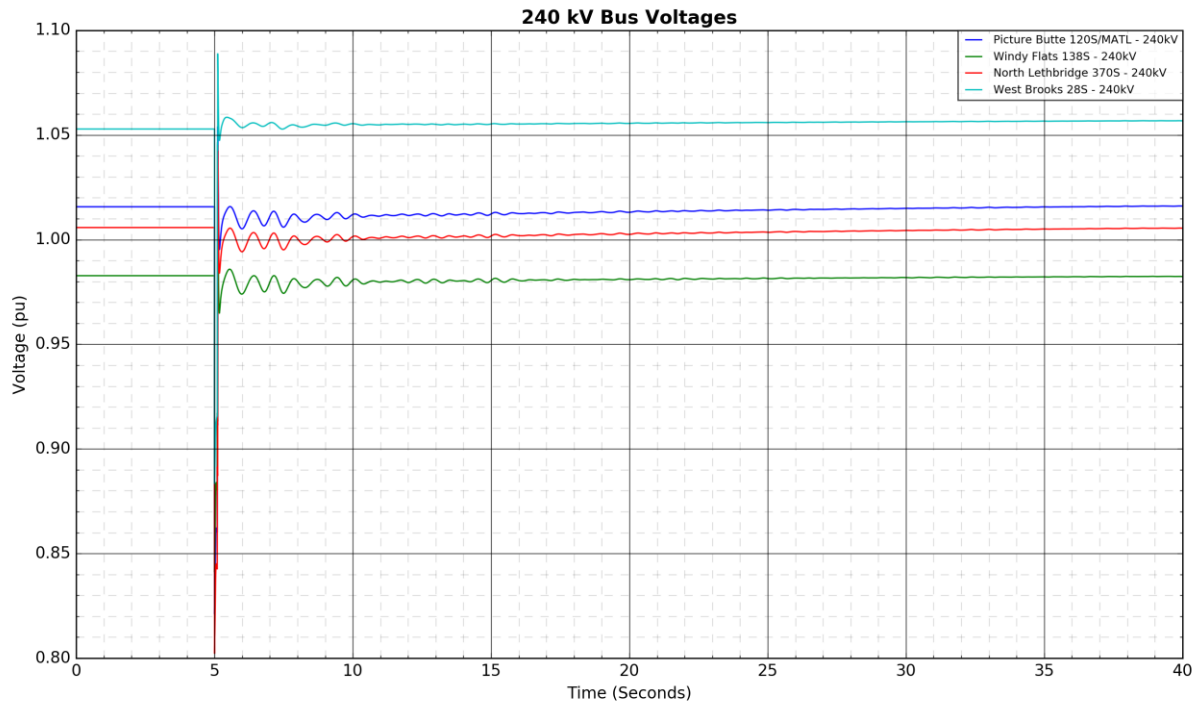
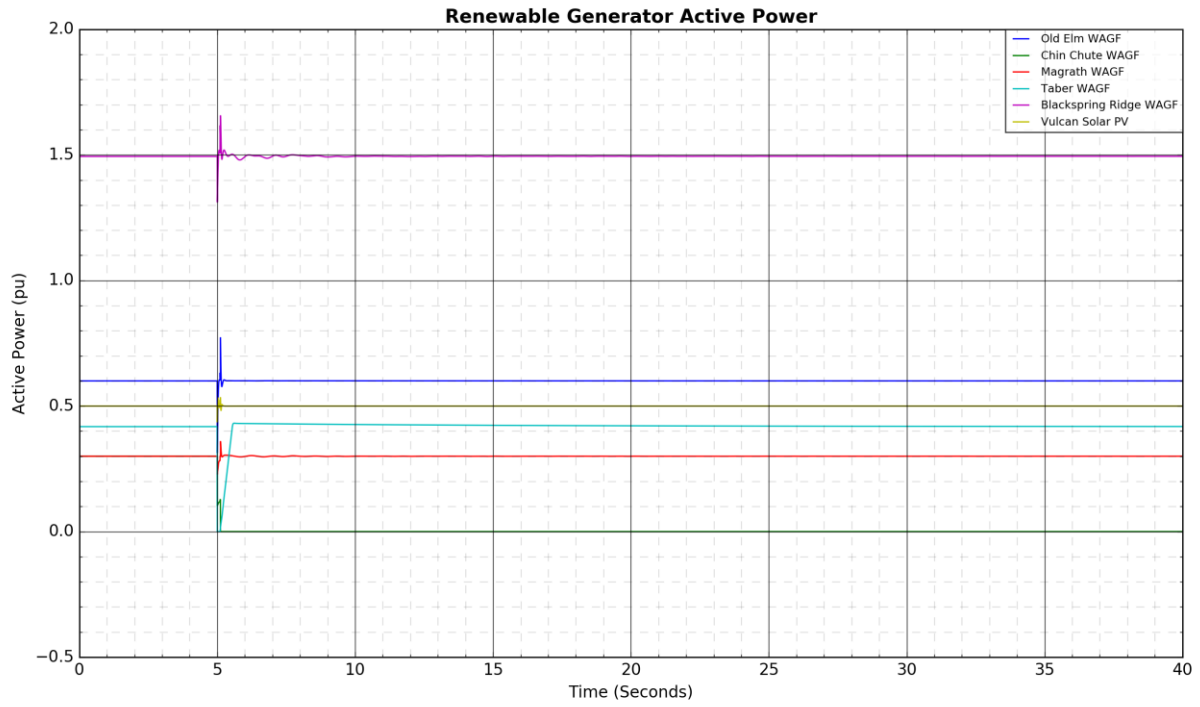
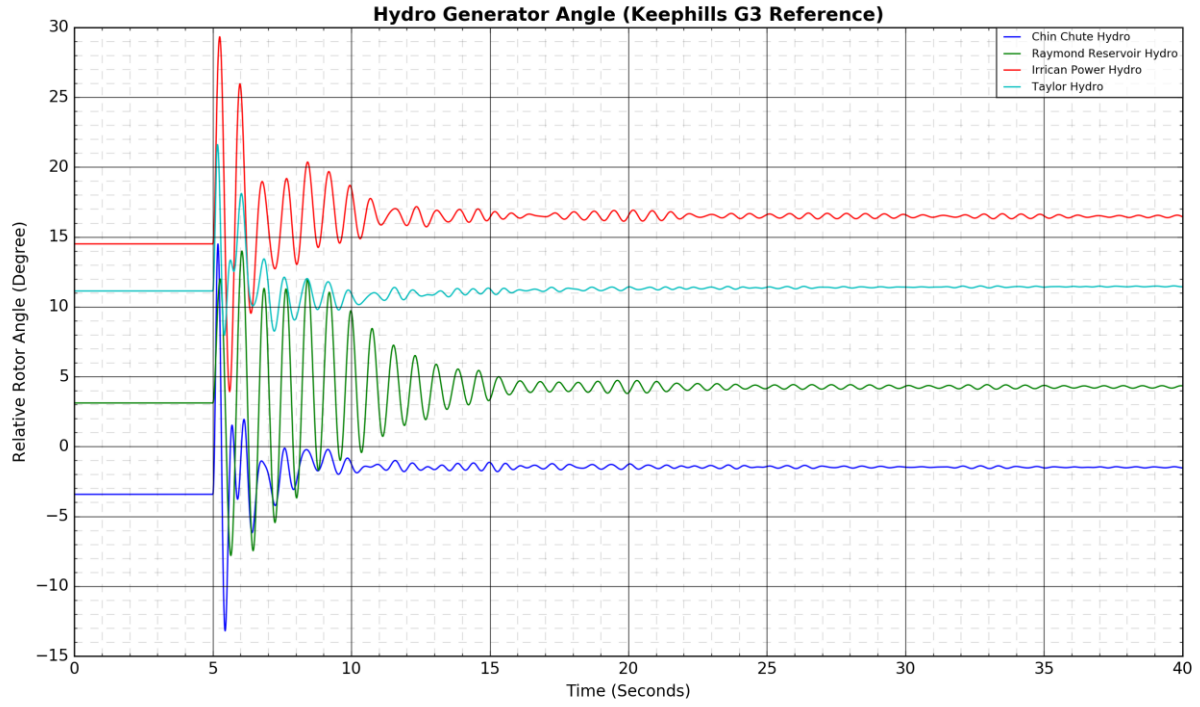
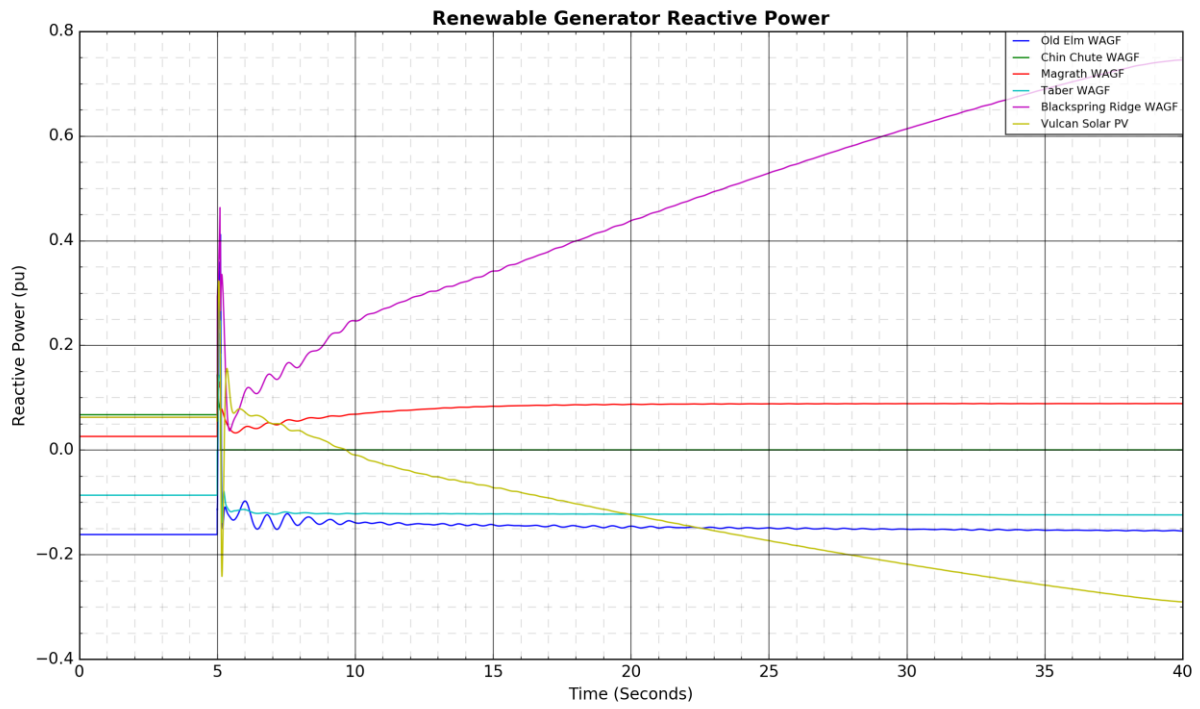
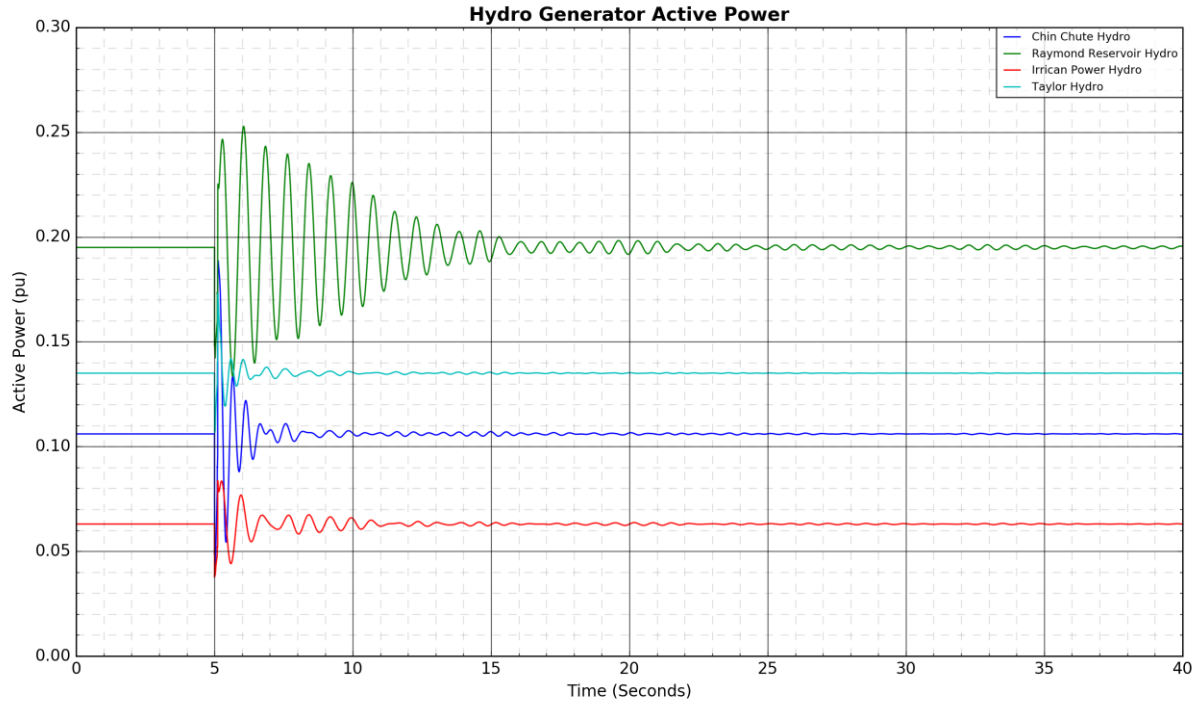


Figure A4-38: 172L Coaldale 254S to Taber 83S: Fault Near Taber 83S

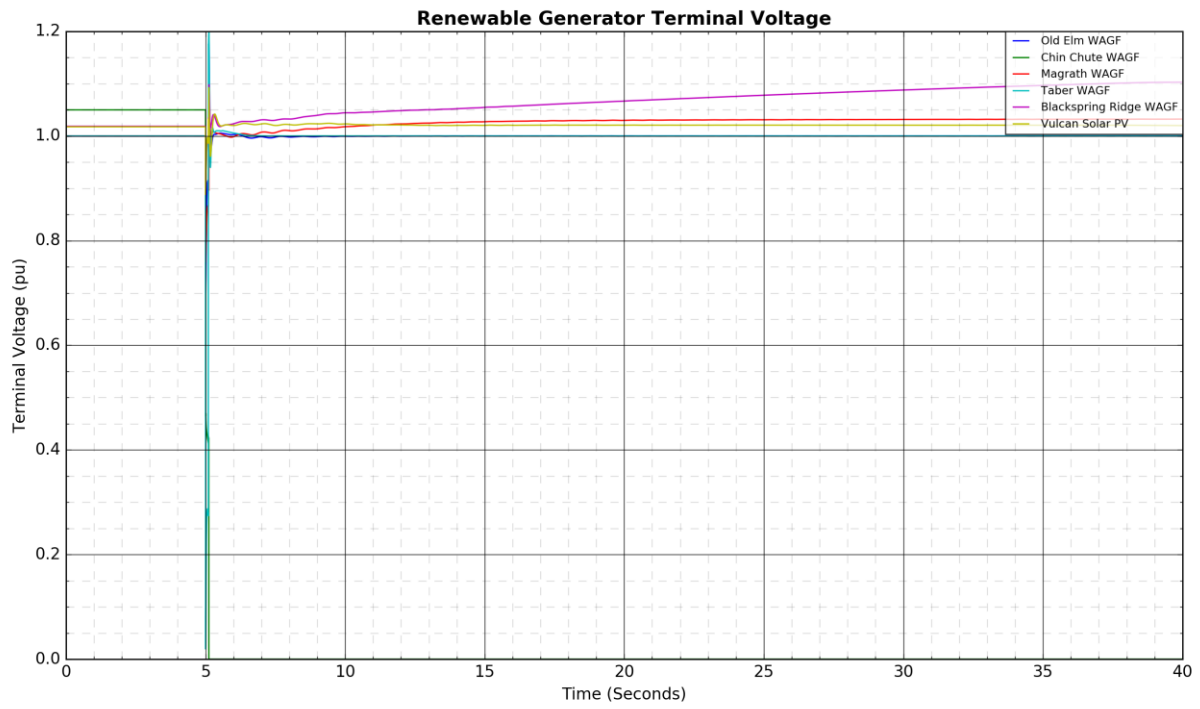
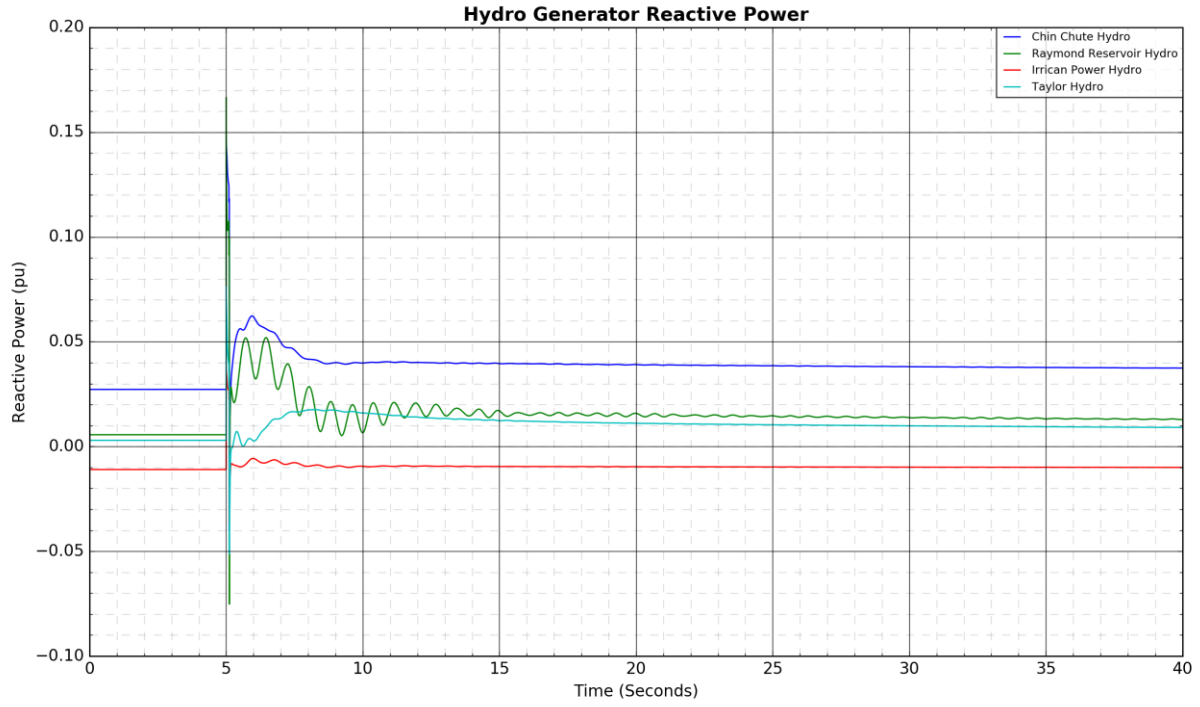


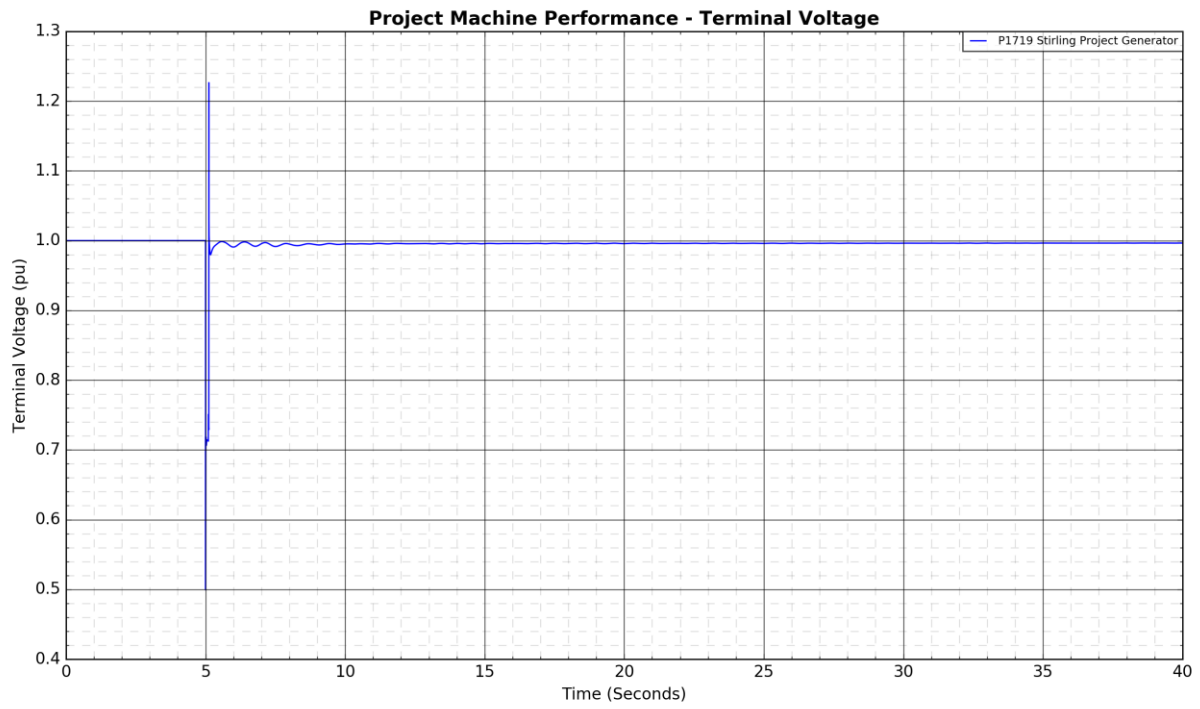
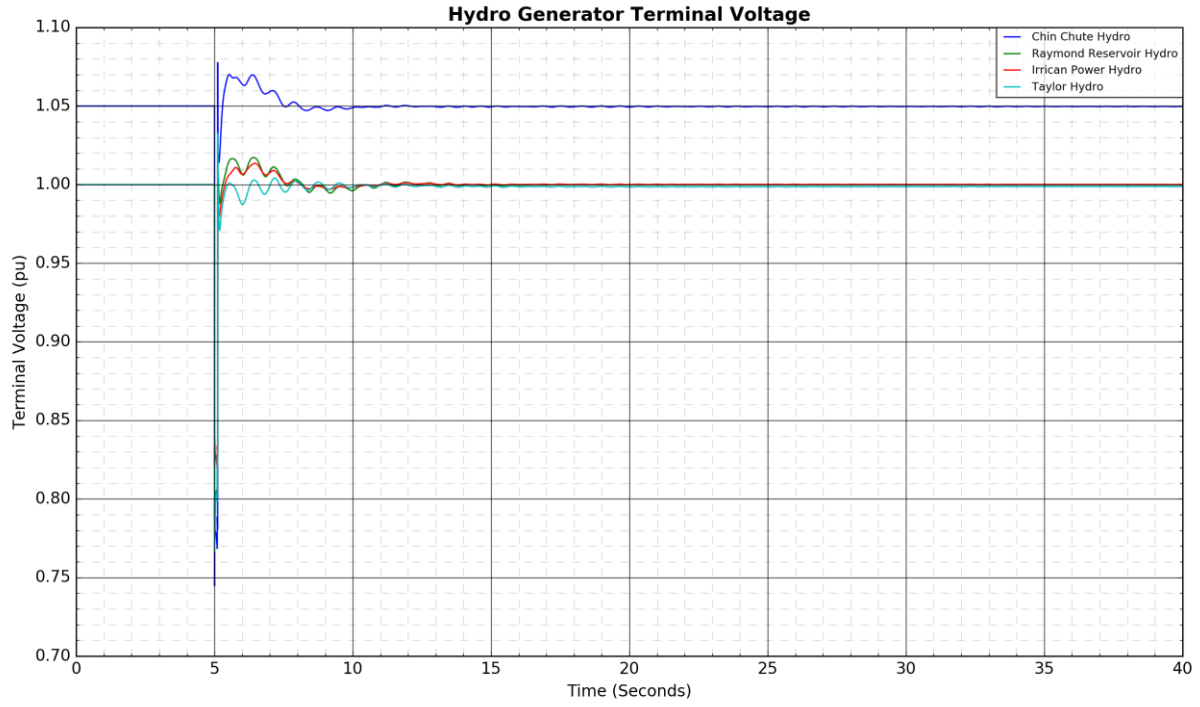


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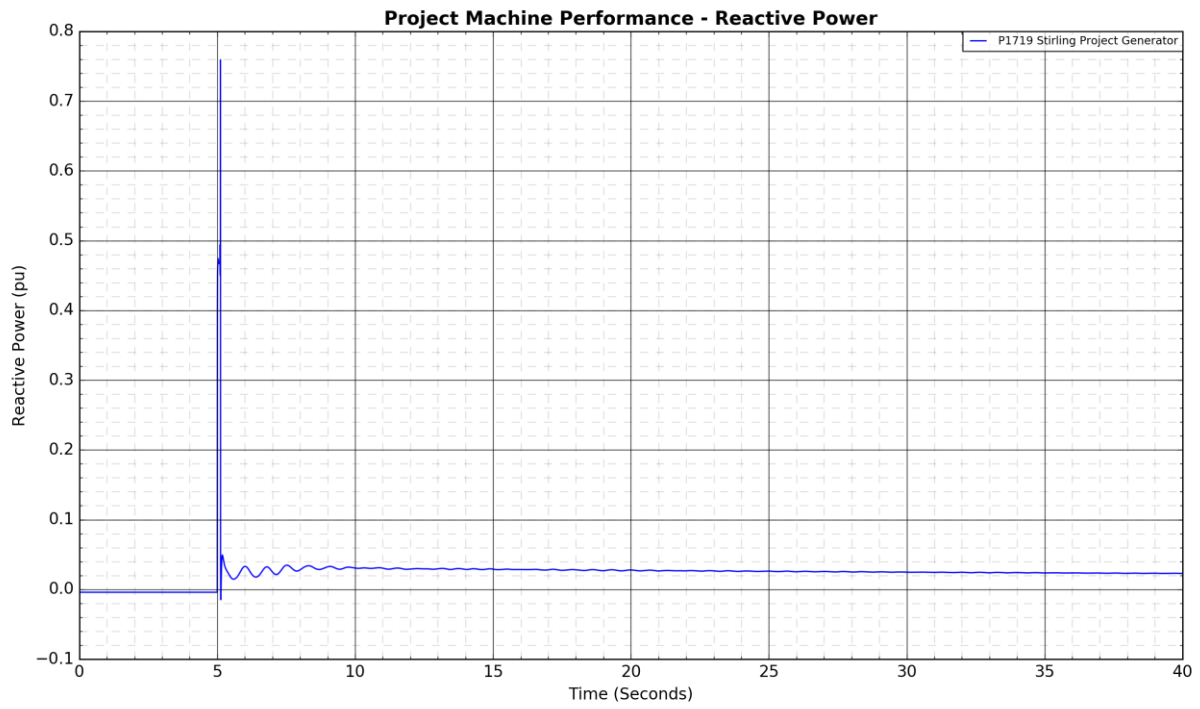
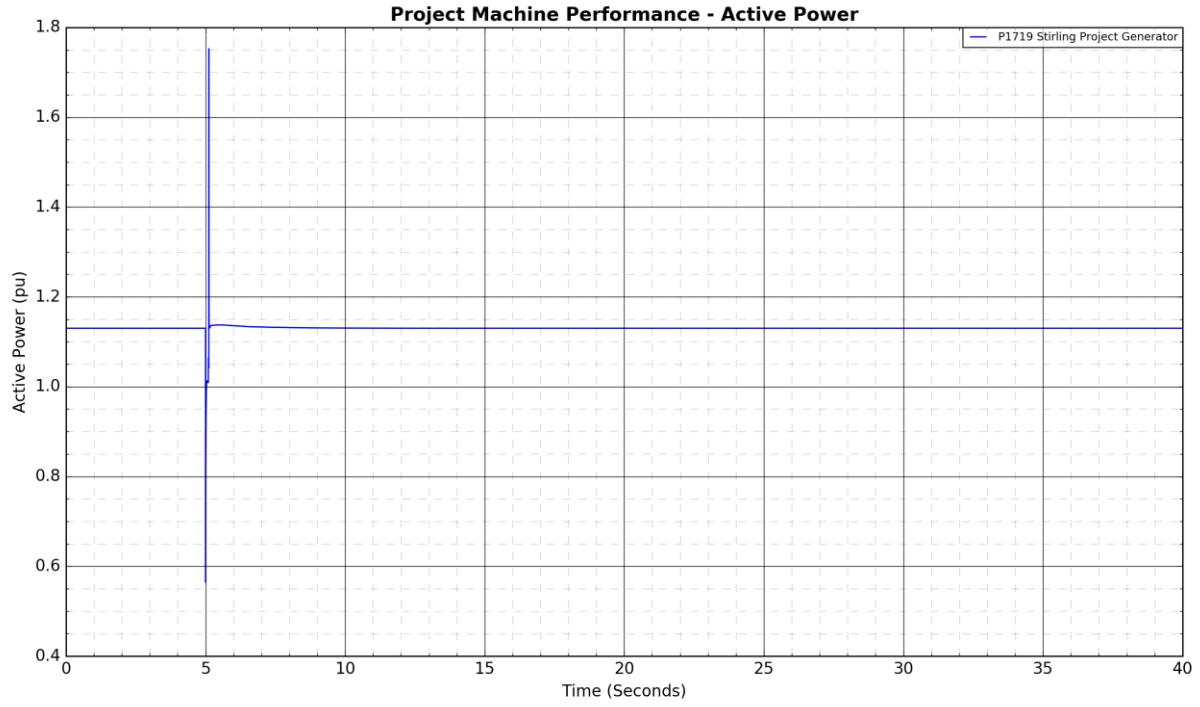
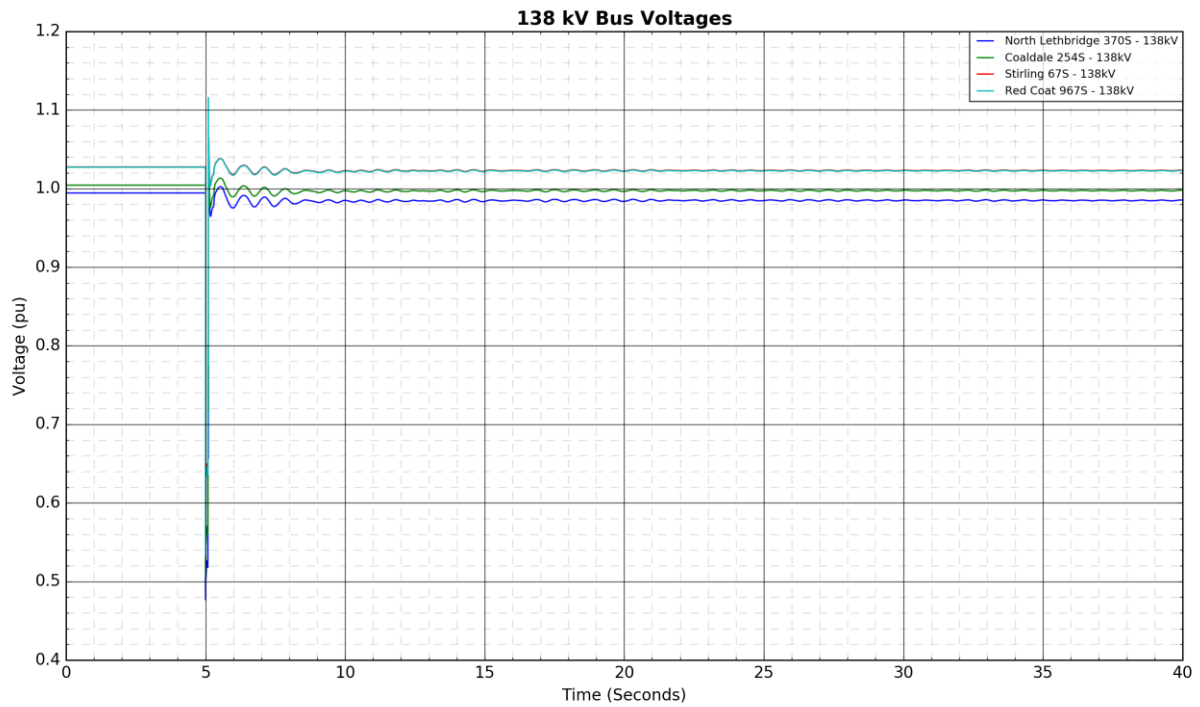
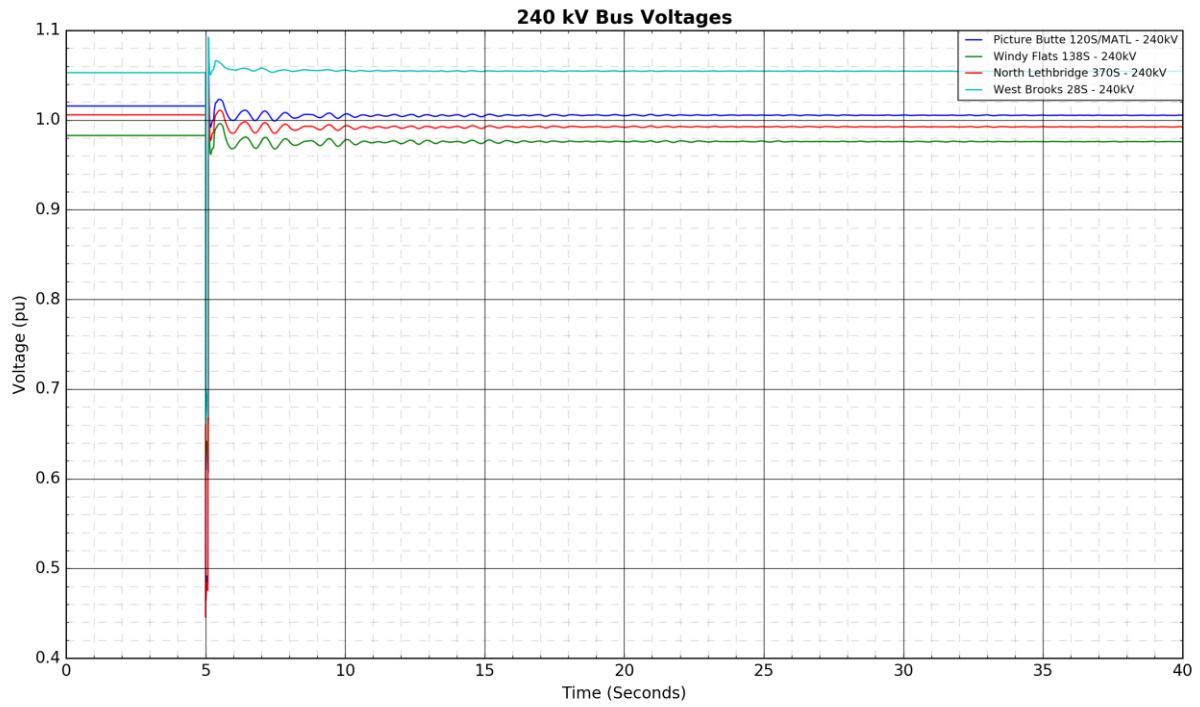
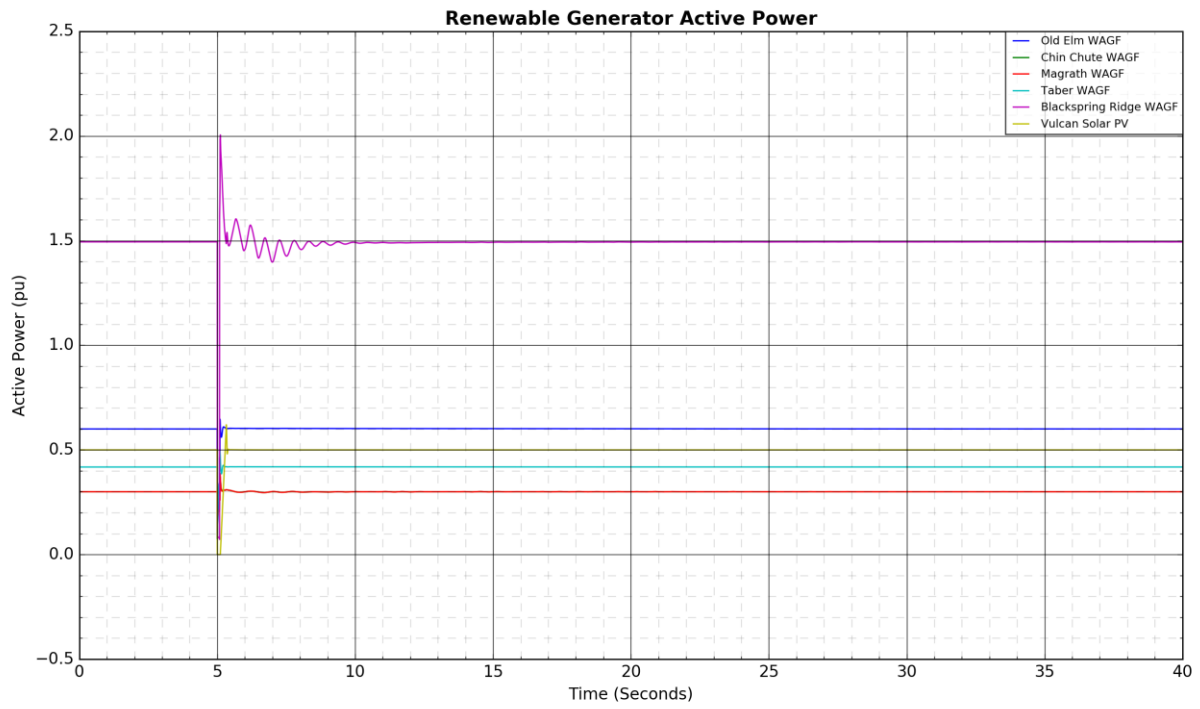
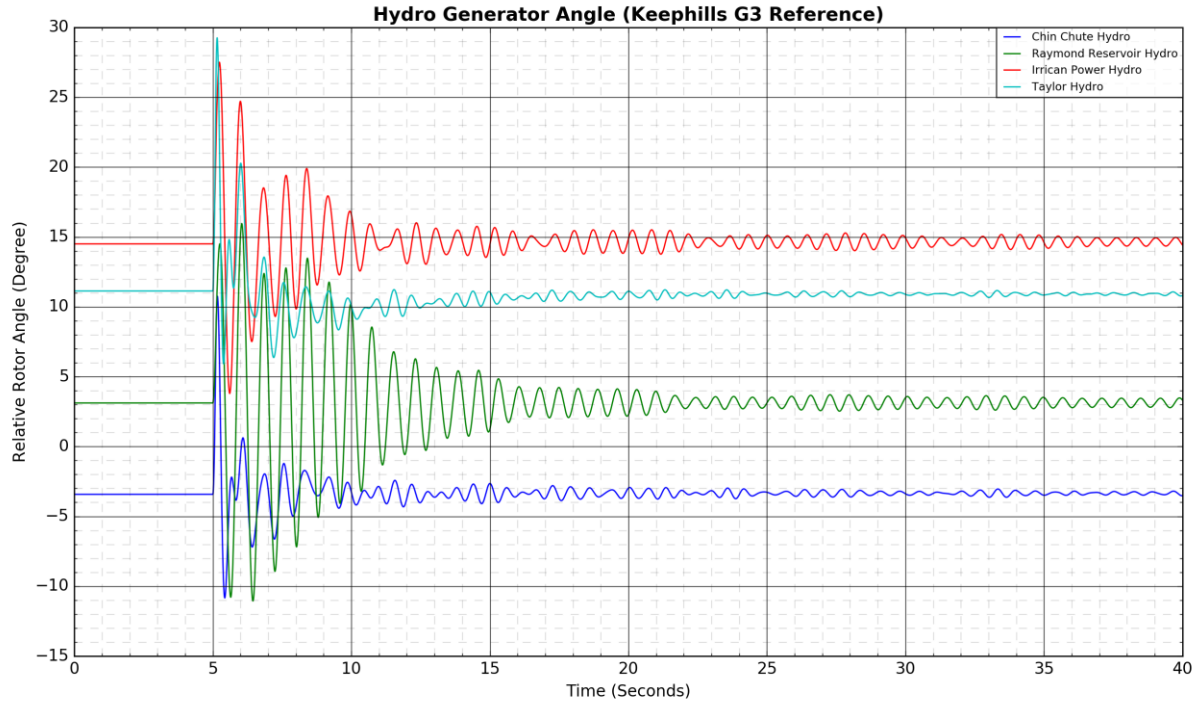
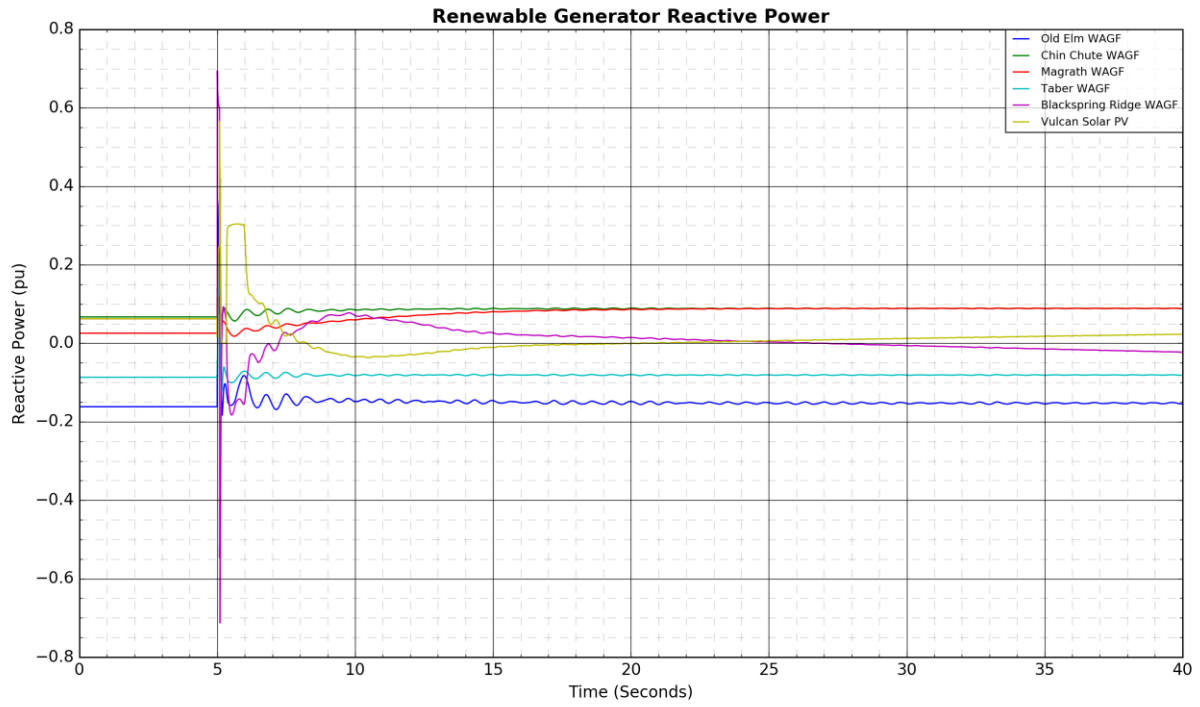
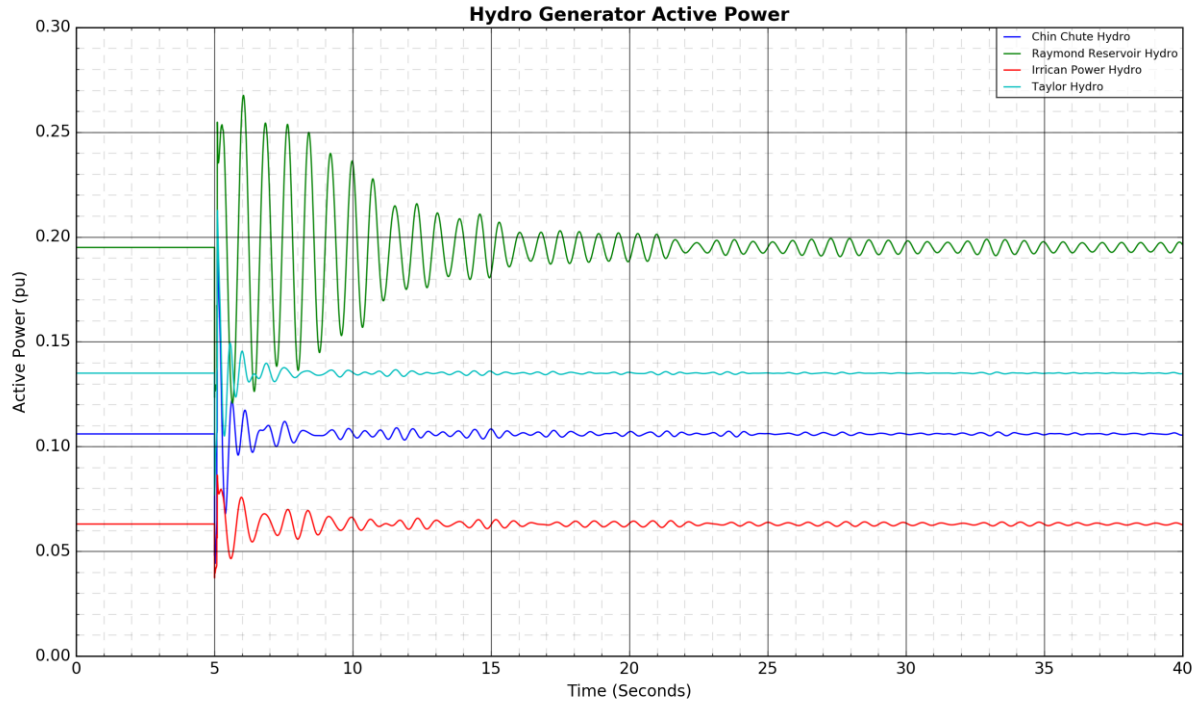


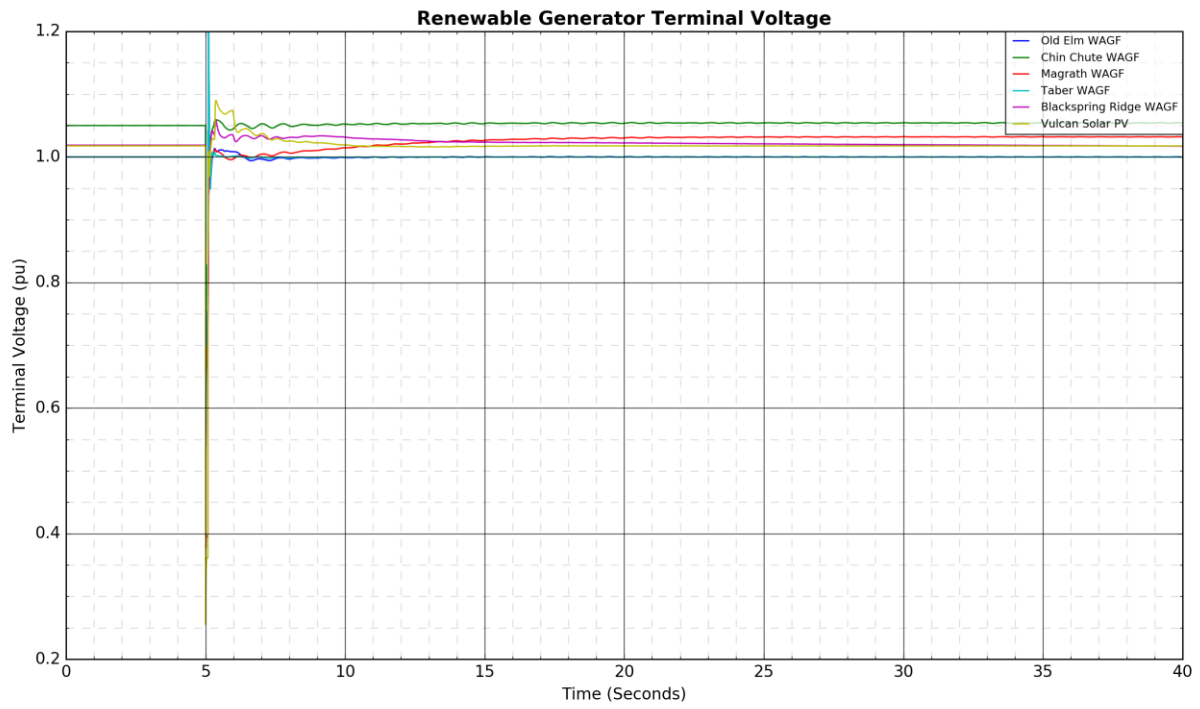
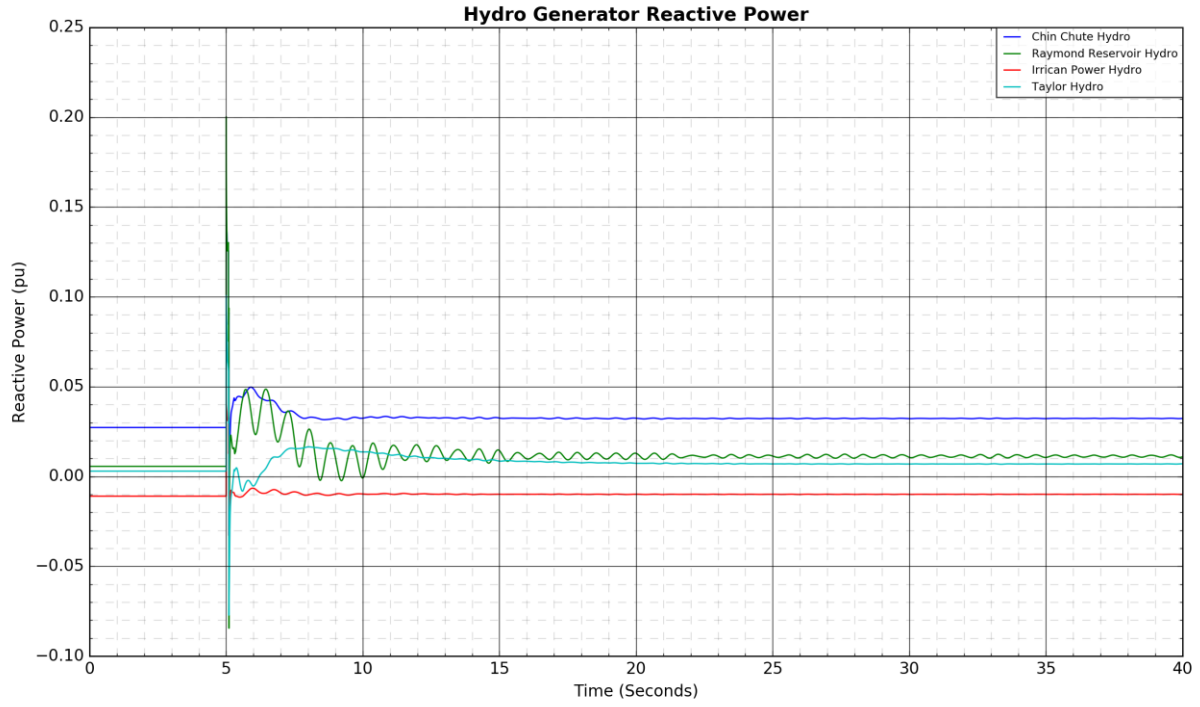
Figure A4-39: 1041L Travers 554S to North Lethbridge 370S: Fault Near Travers 554S

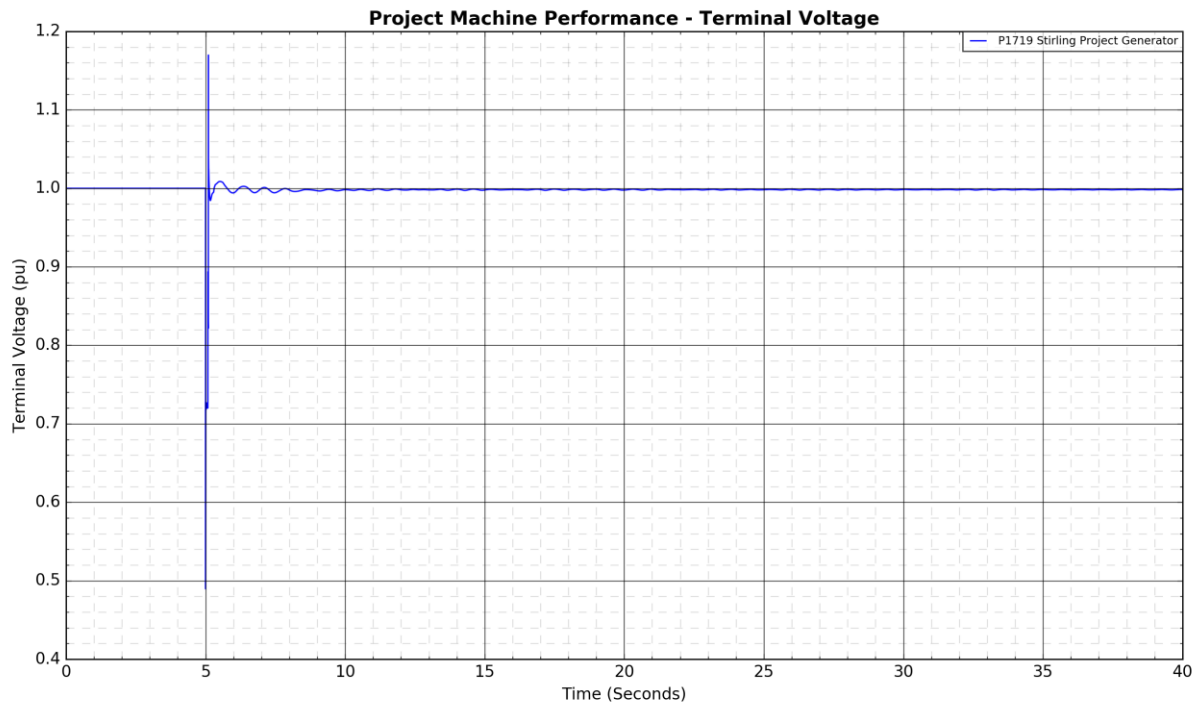
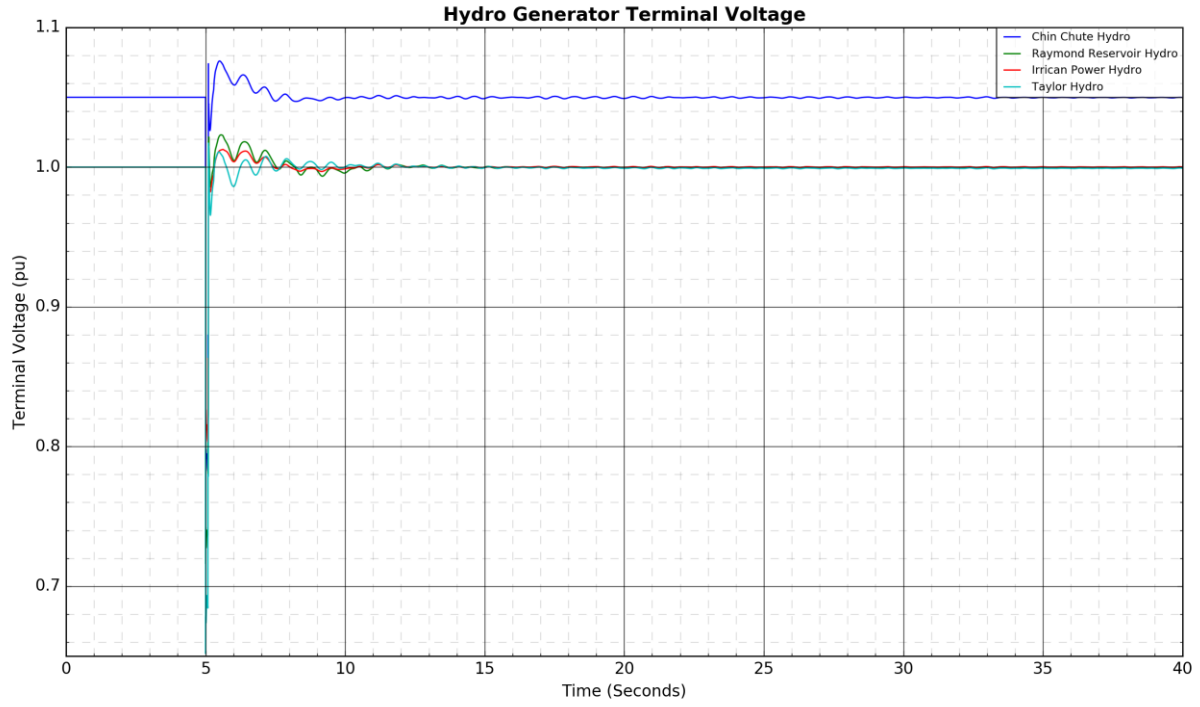




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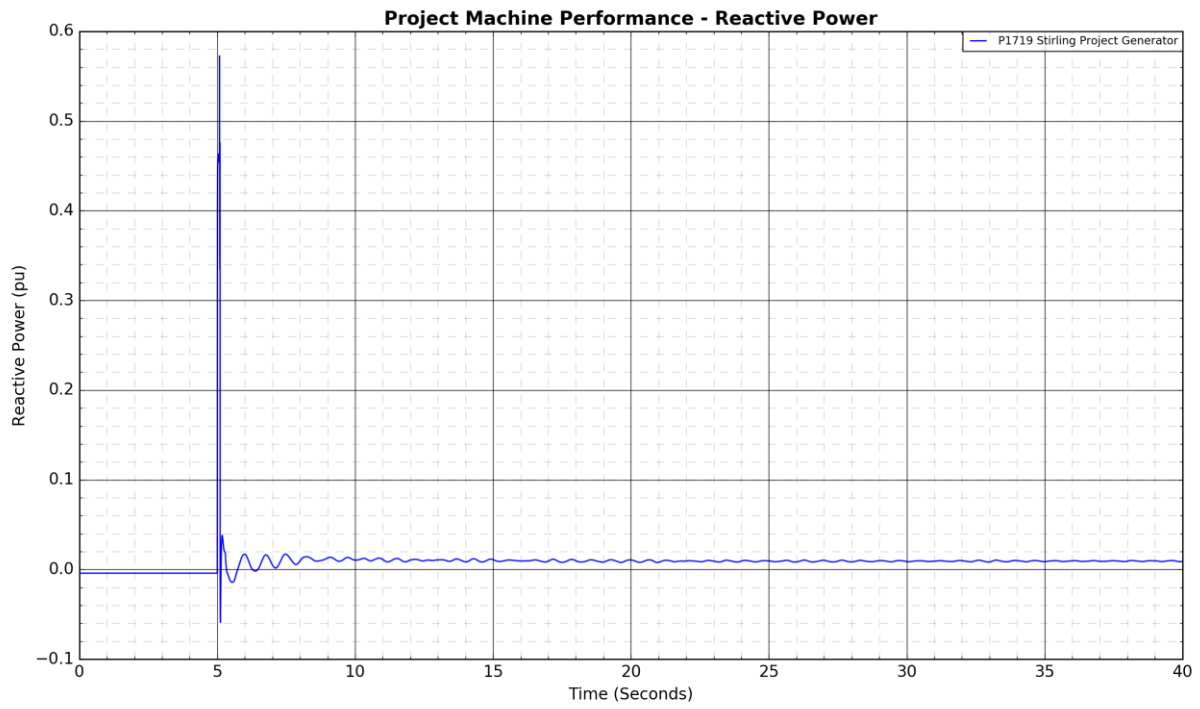
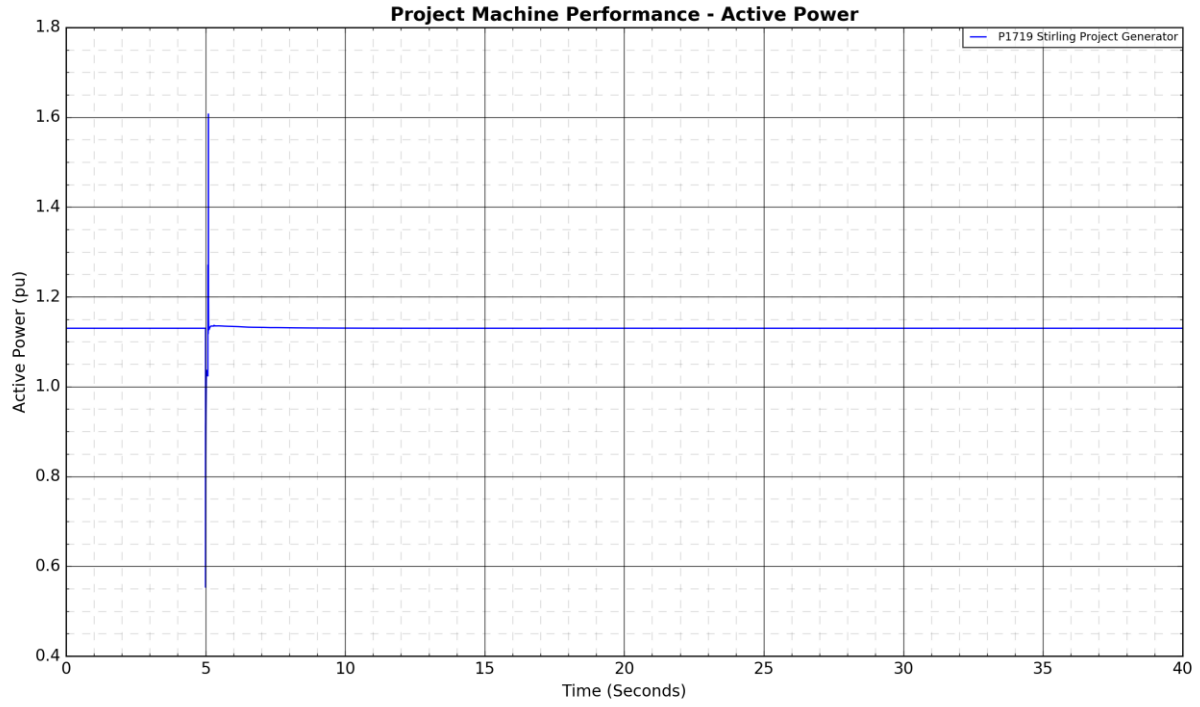
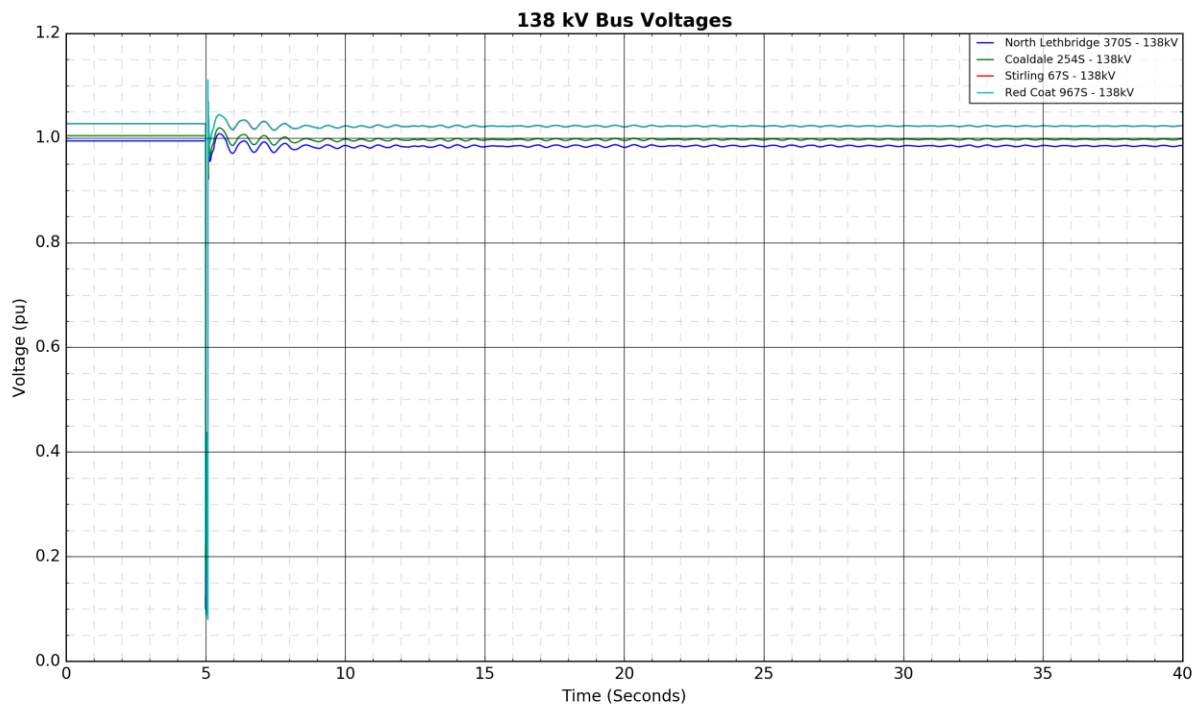
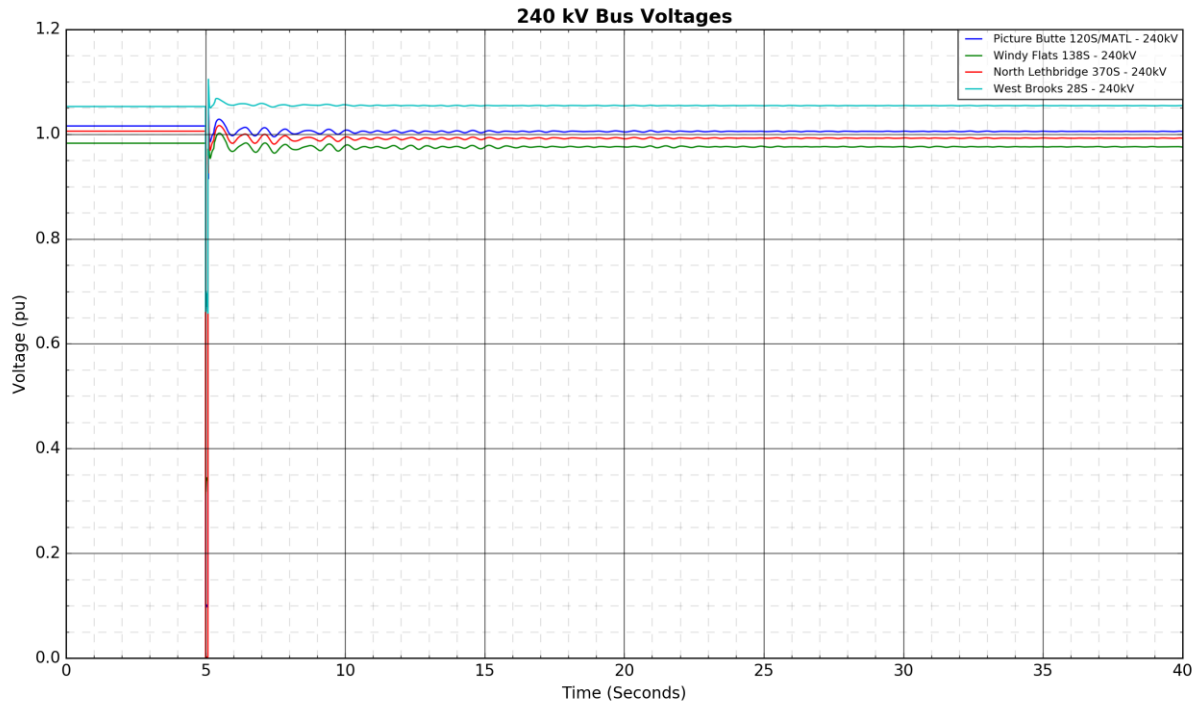
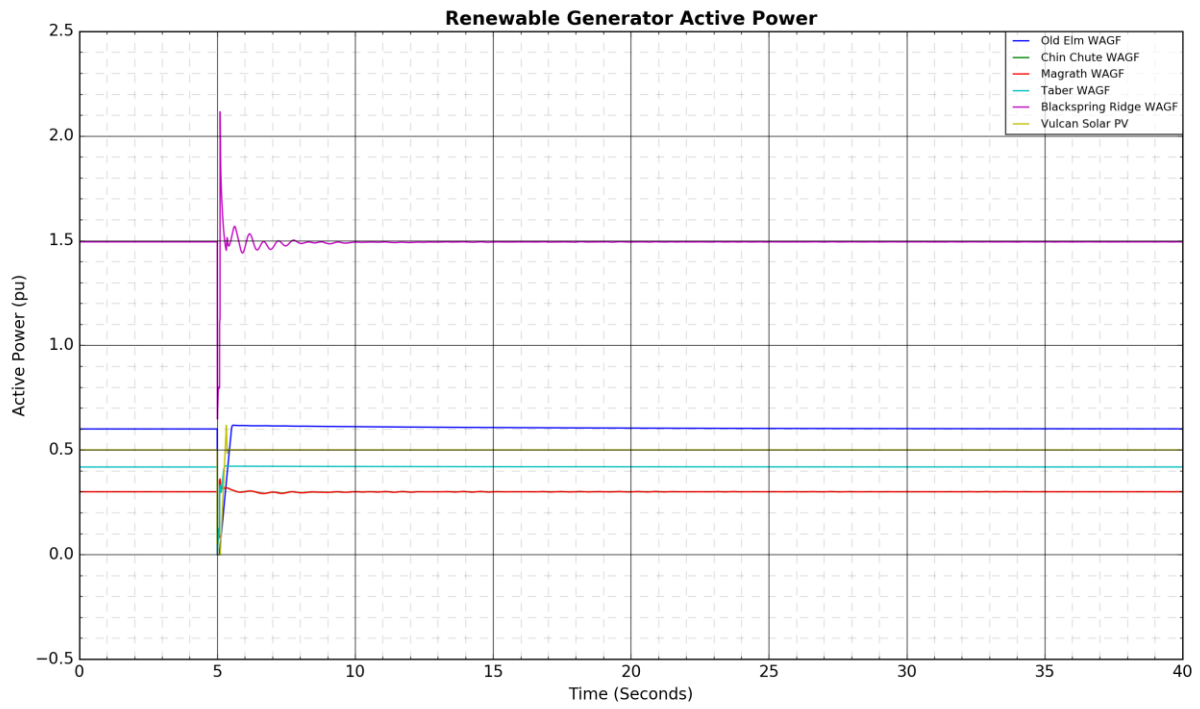
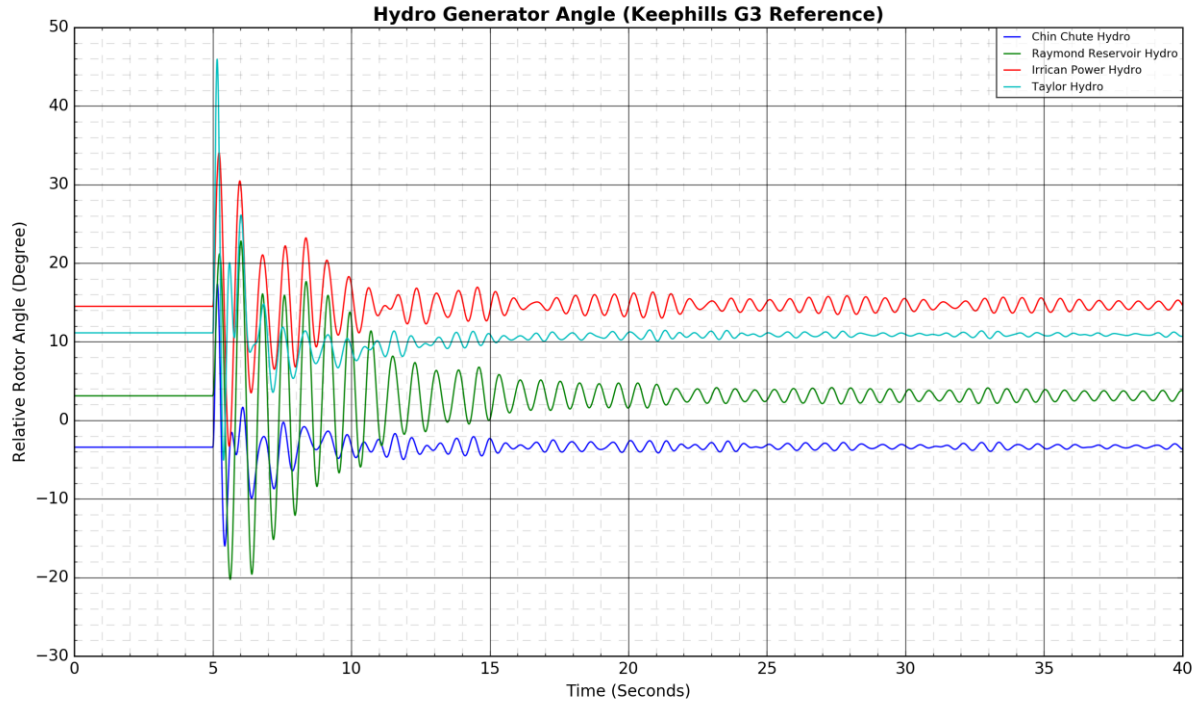
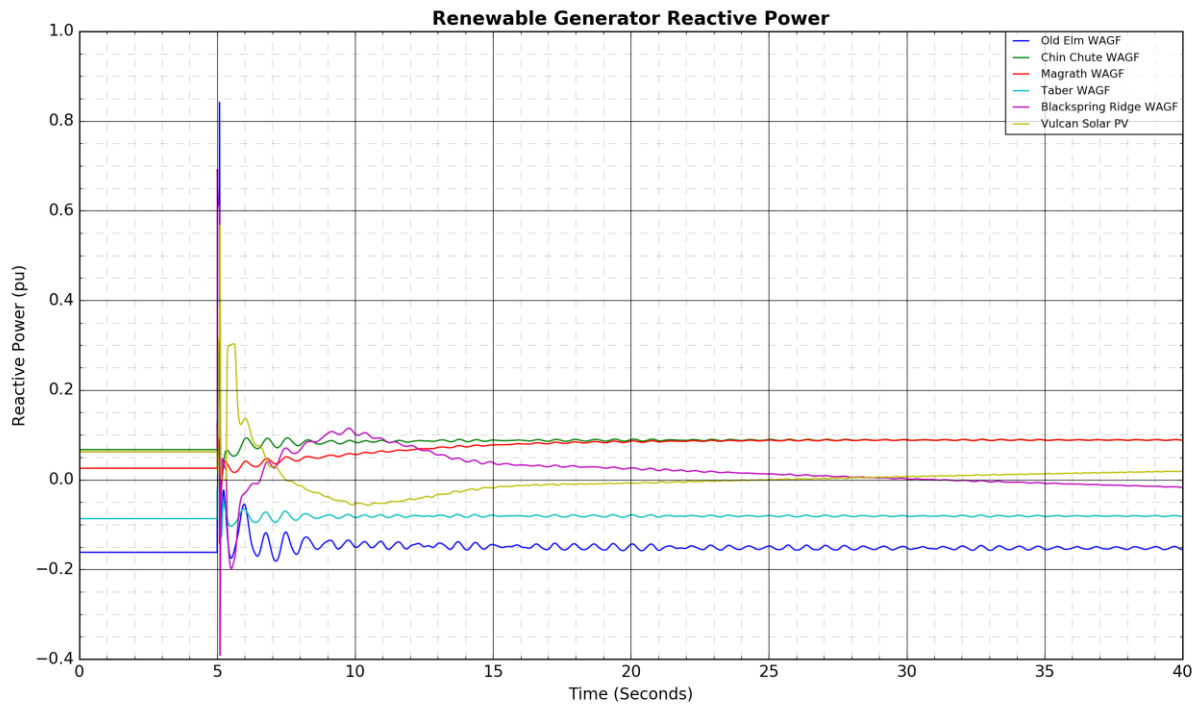
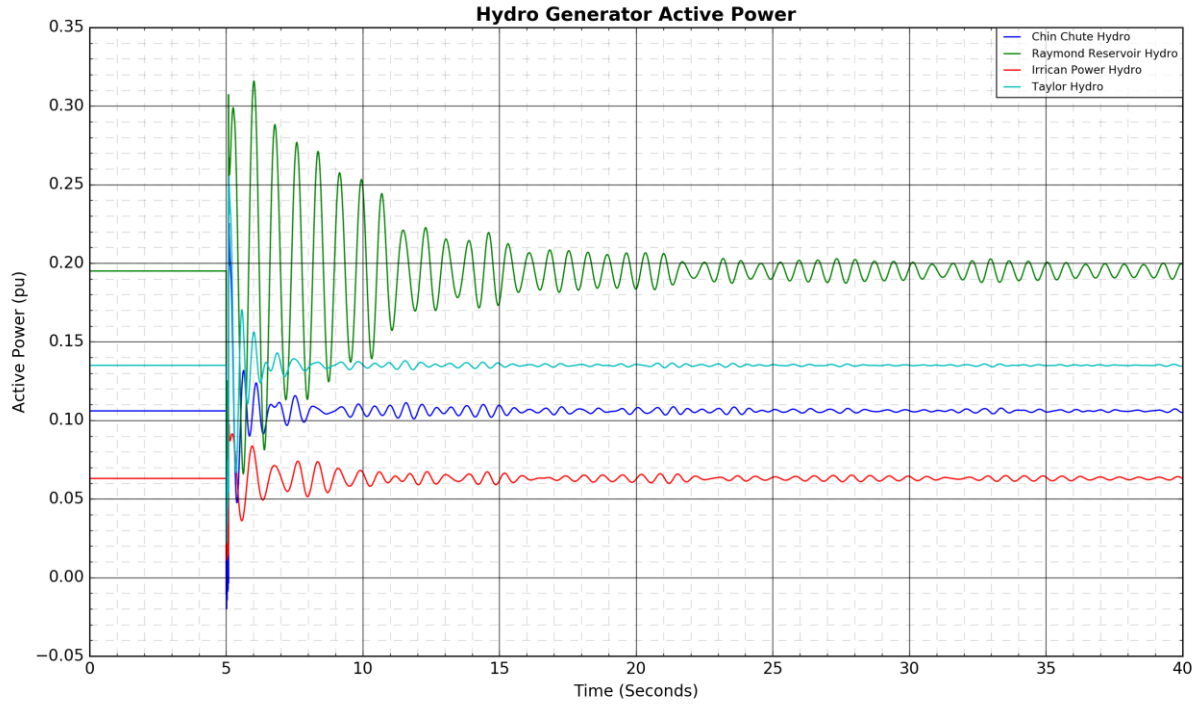
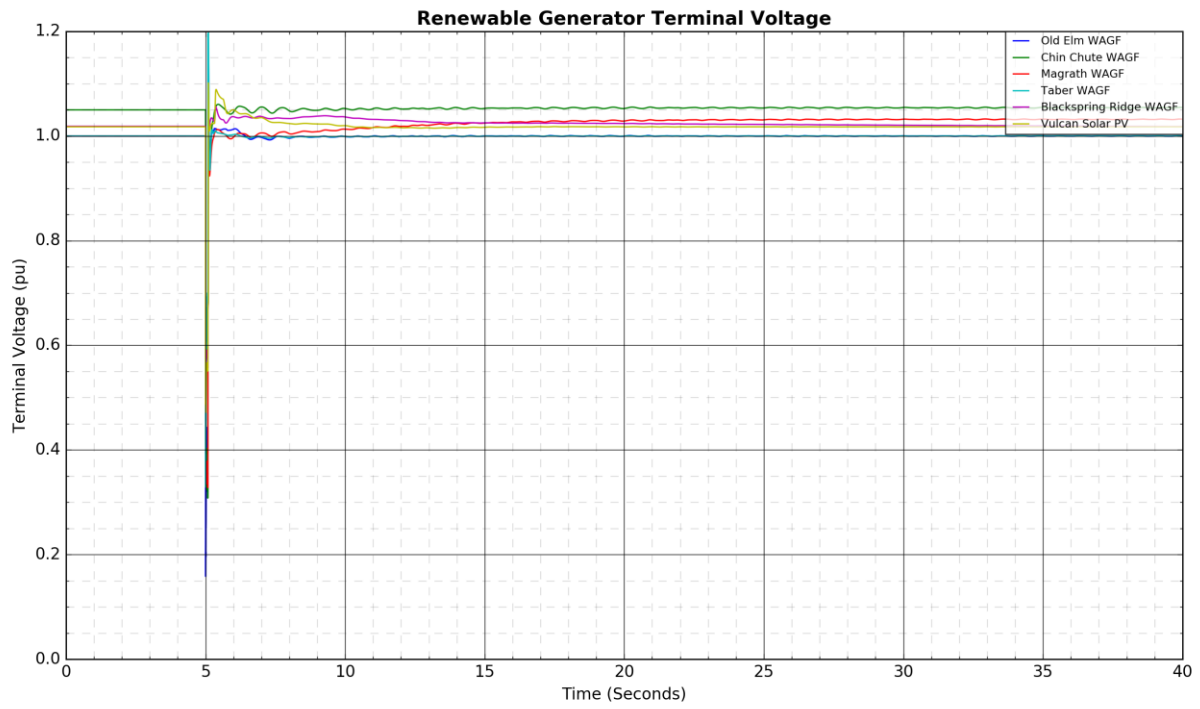
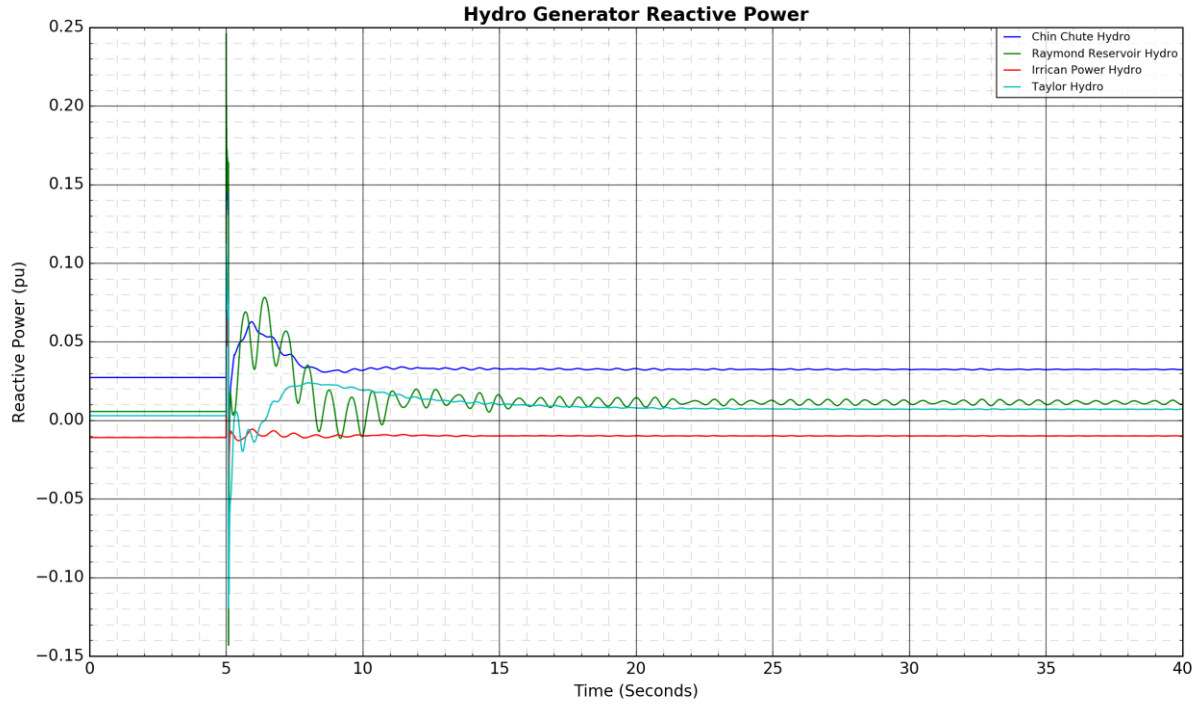


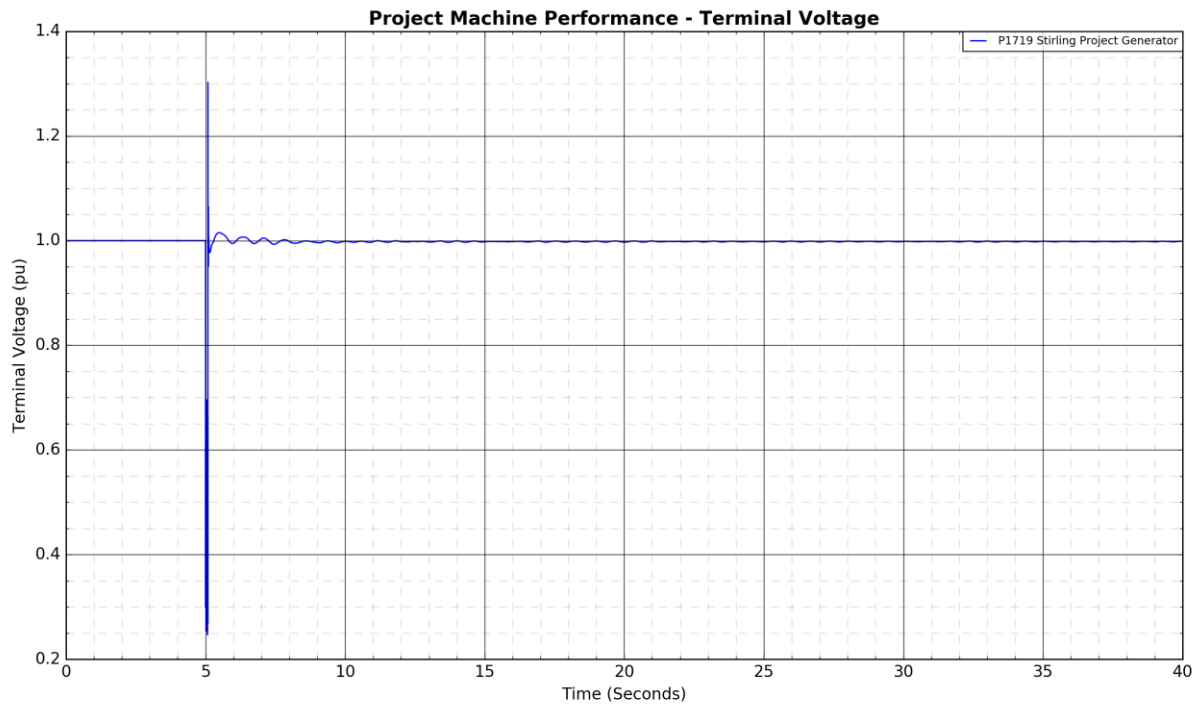
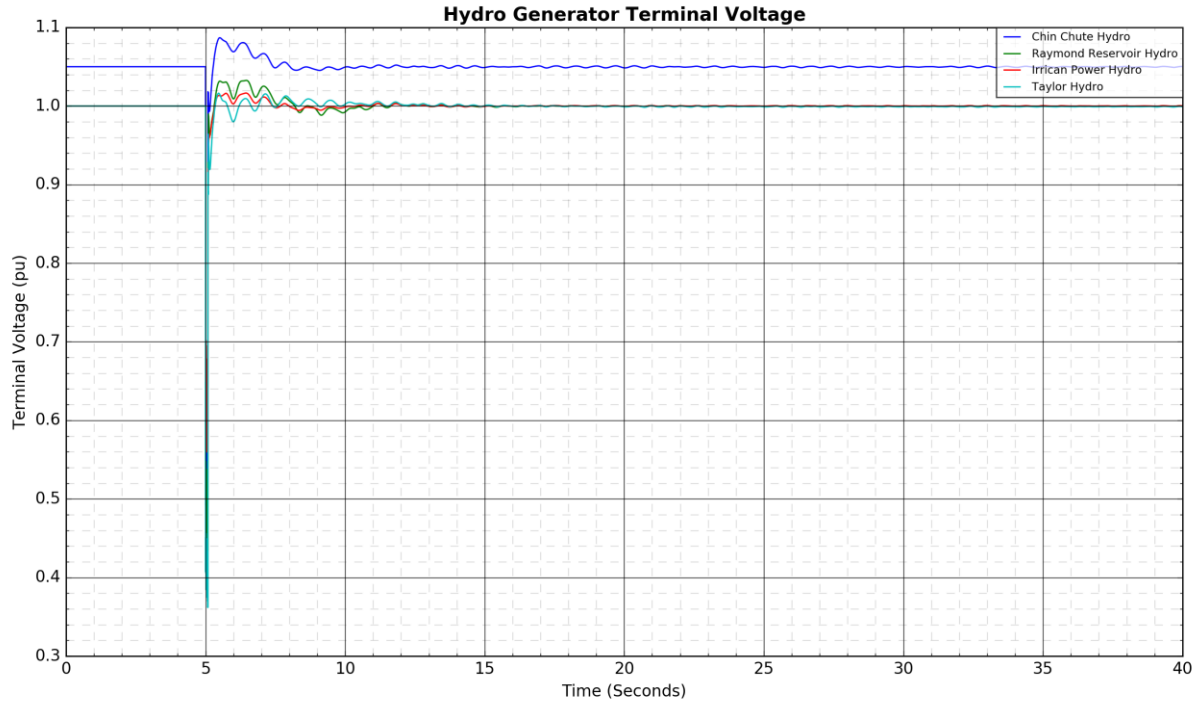
Figure A4-40: 1041L Travers 554S to North Lethbridge 370S: Fault Near North Lethbridge 370S











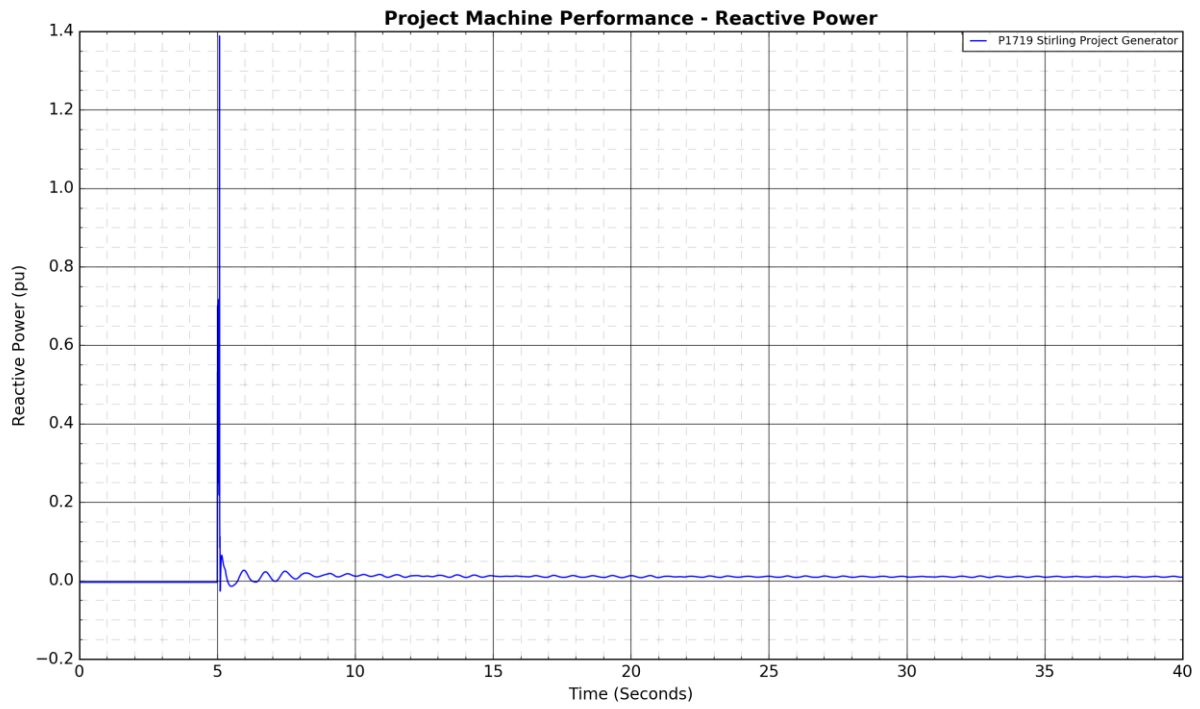
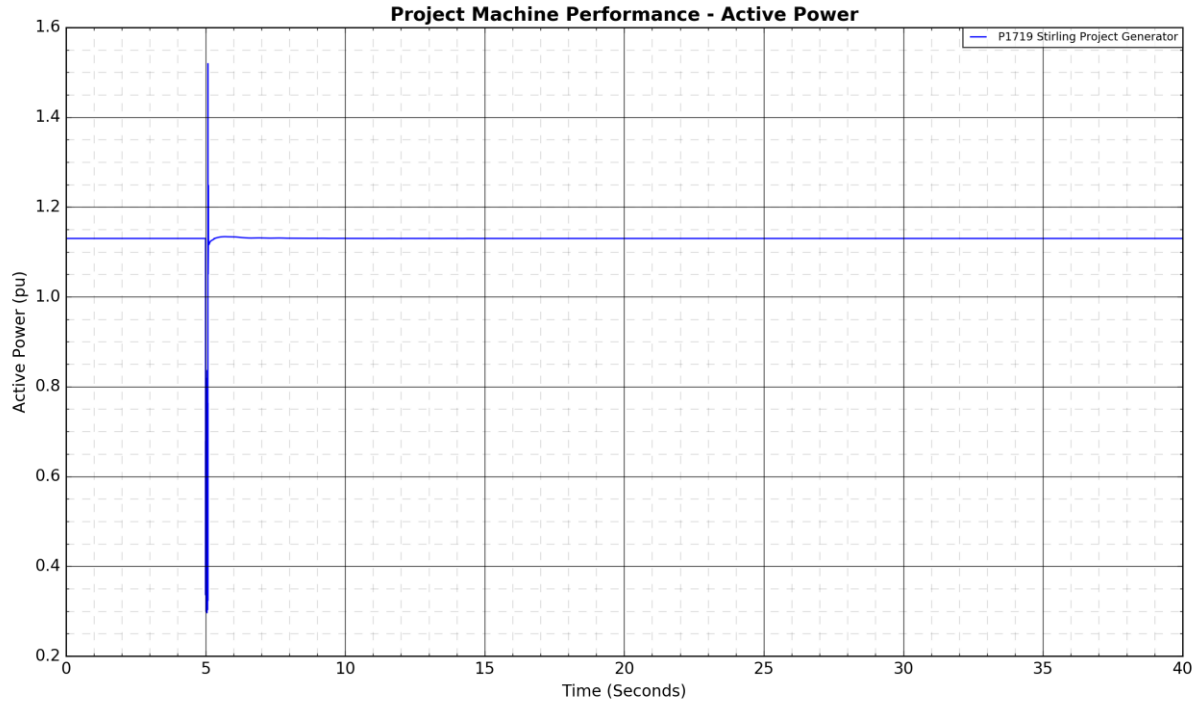
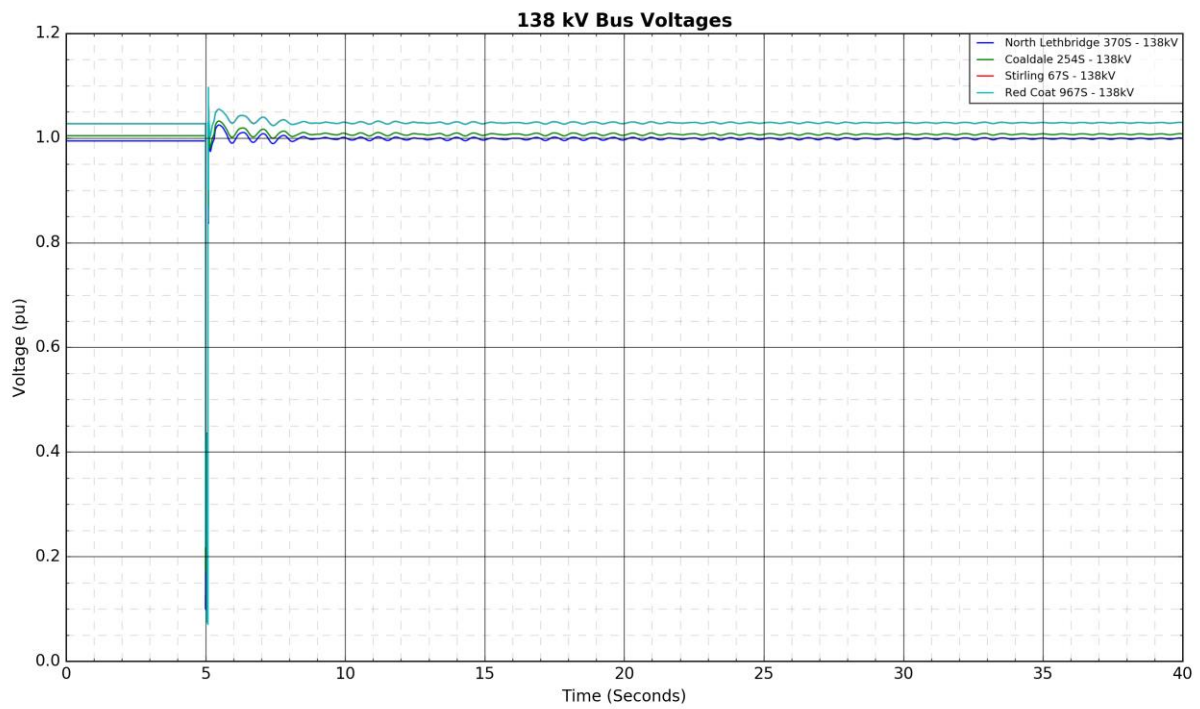
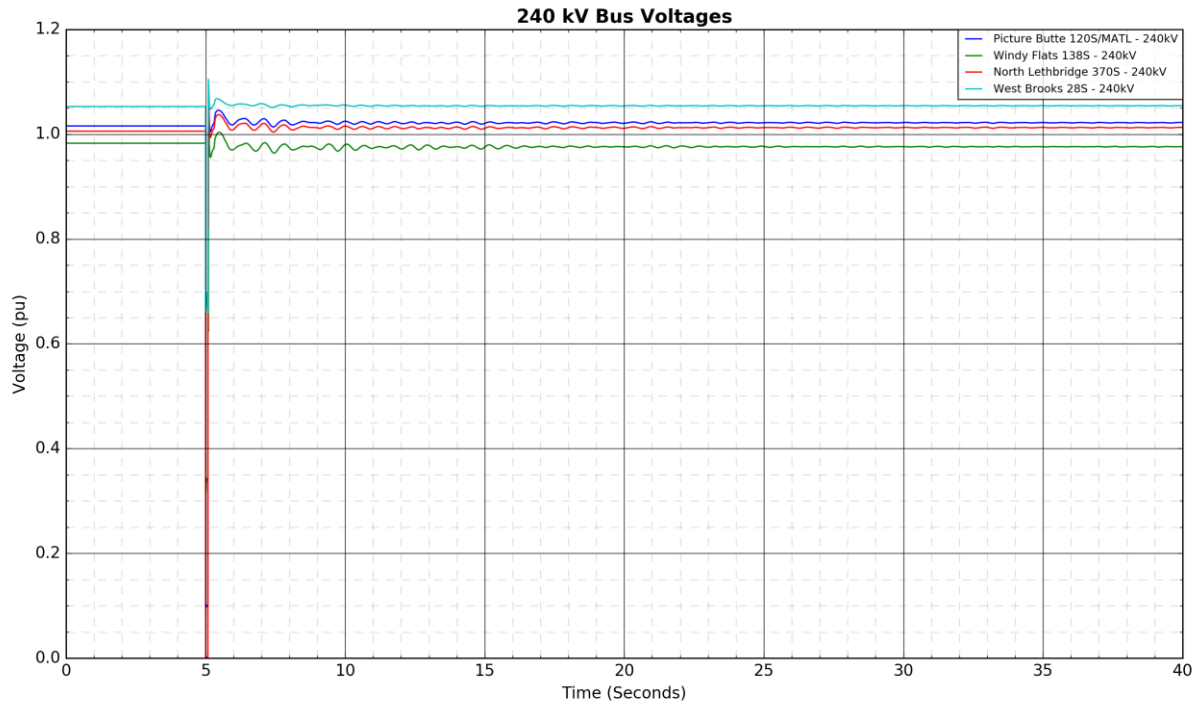
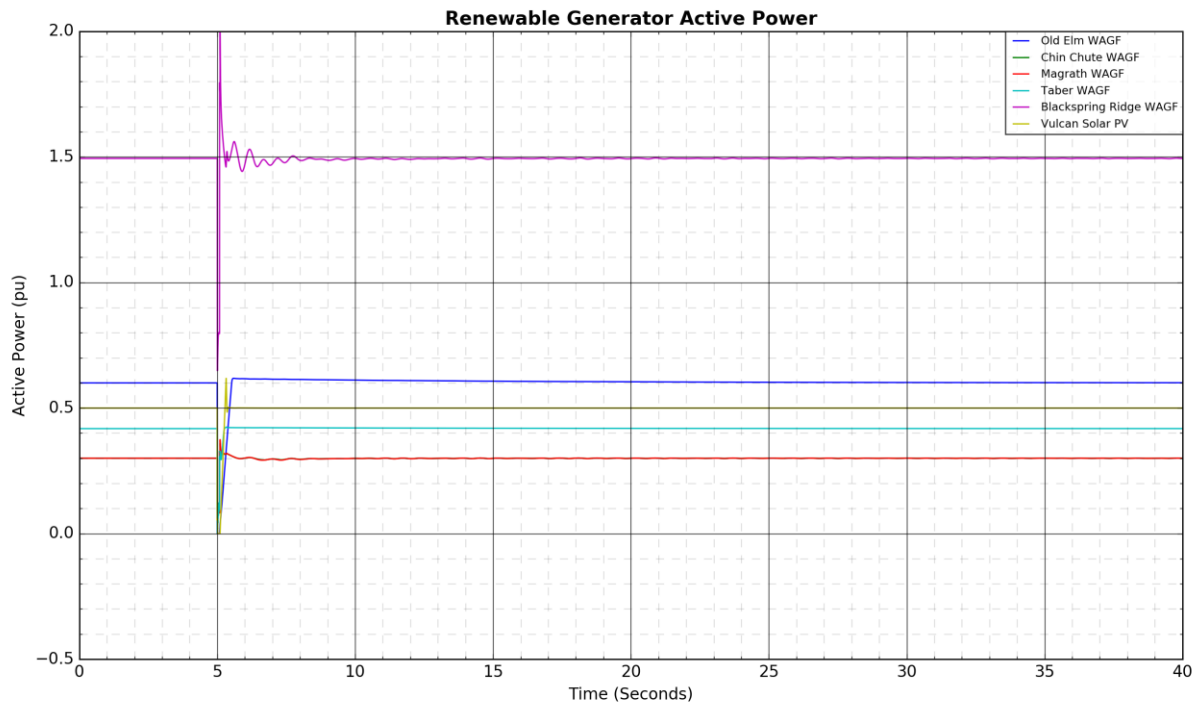
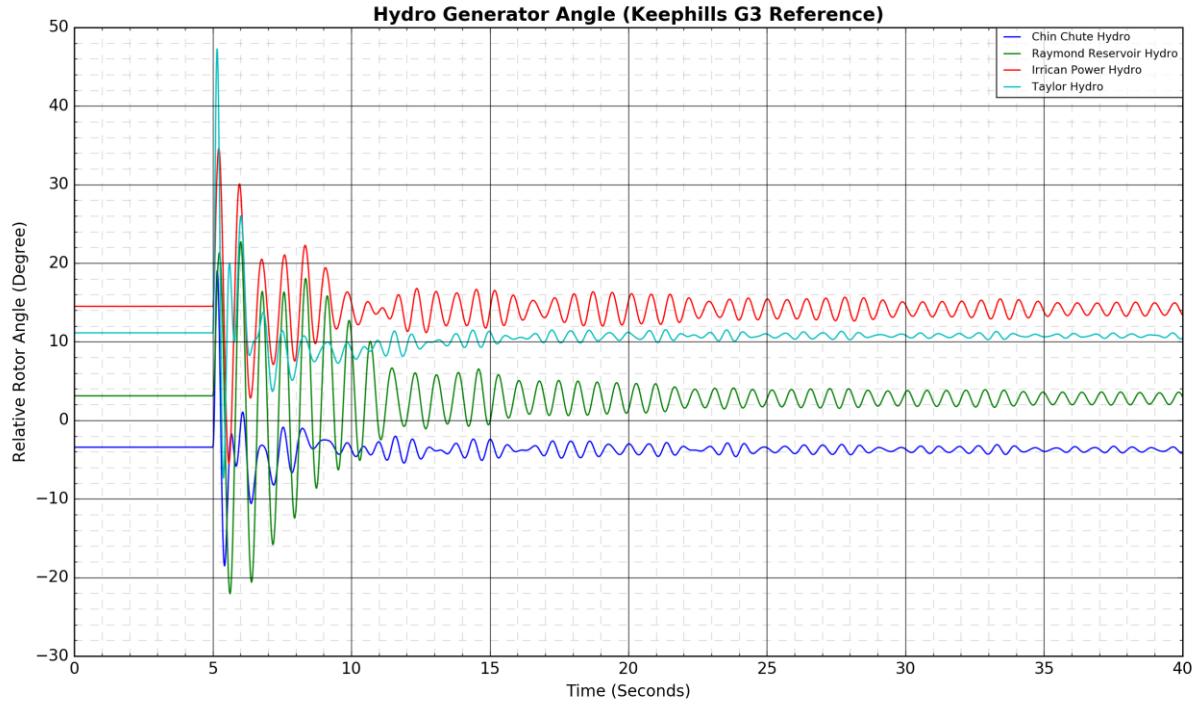
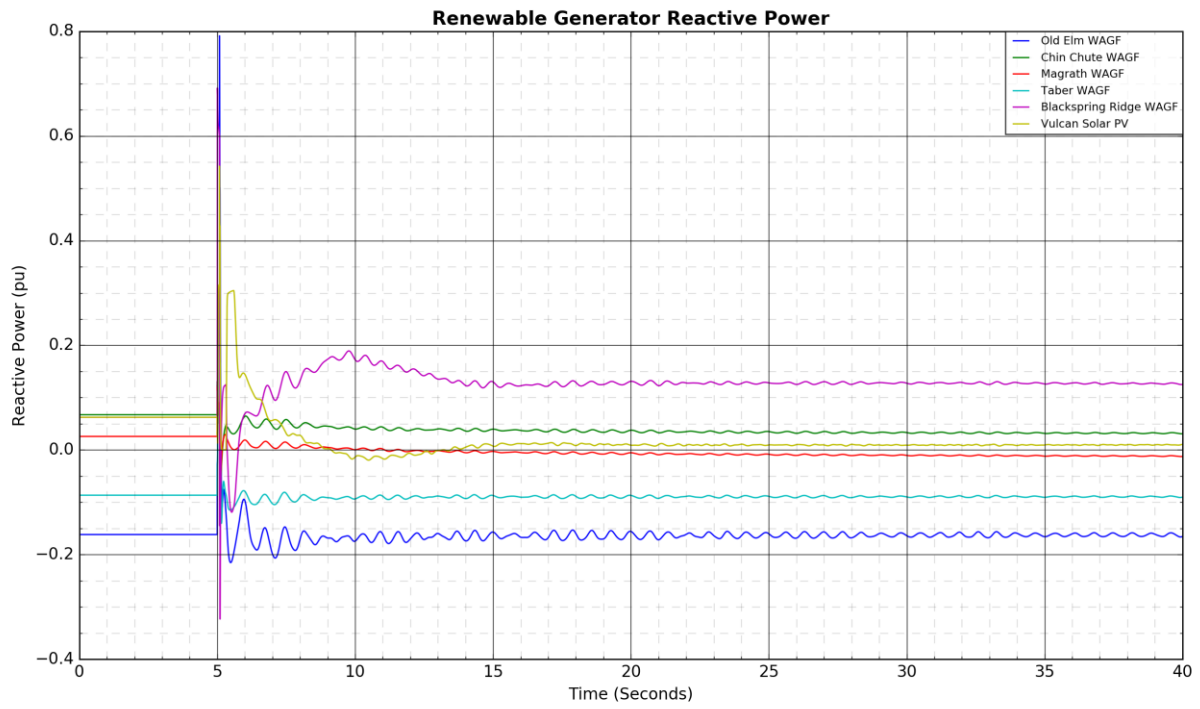
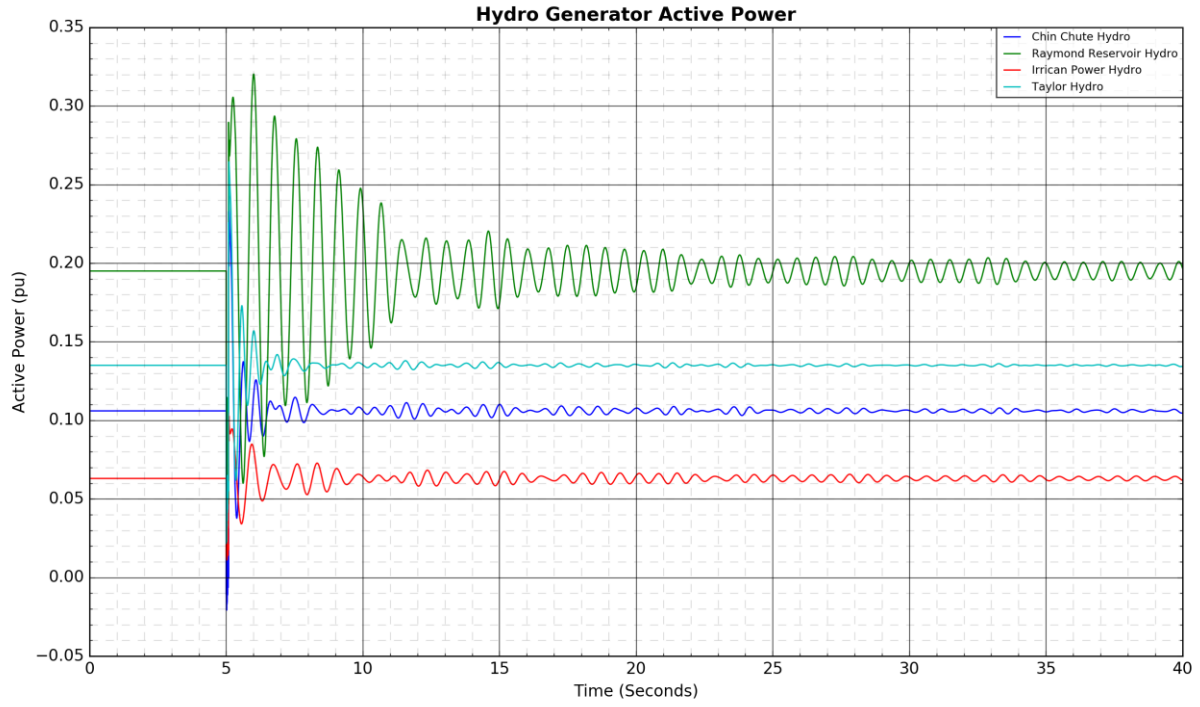


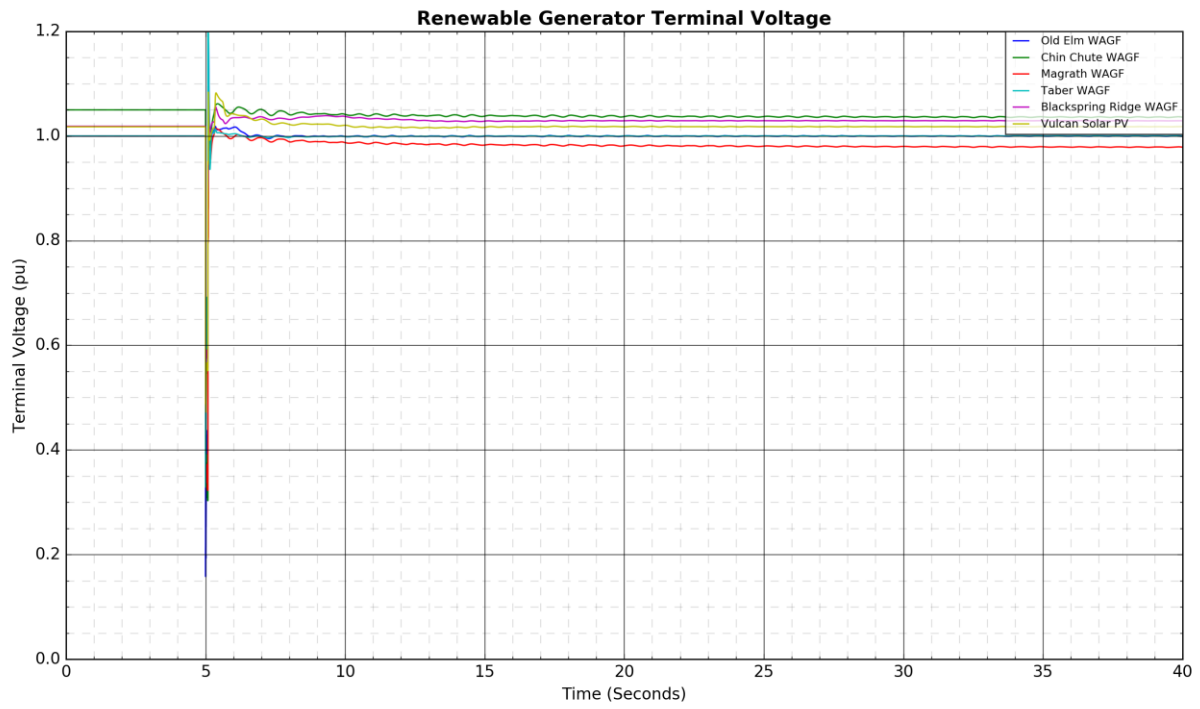
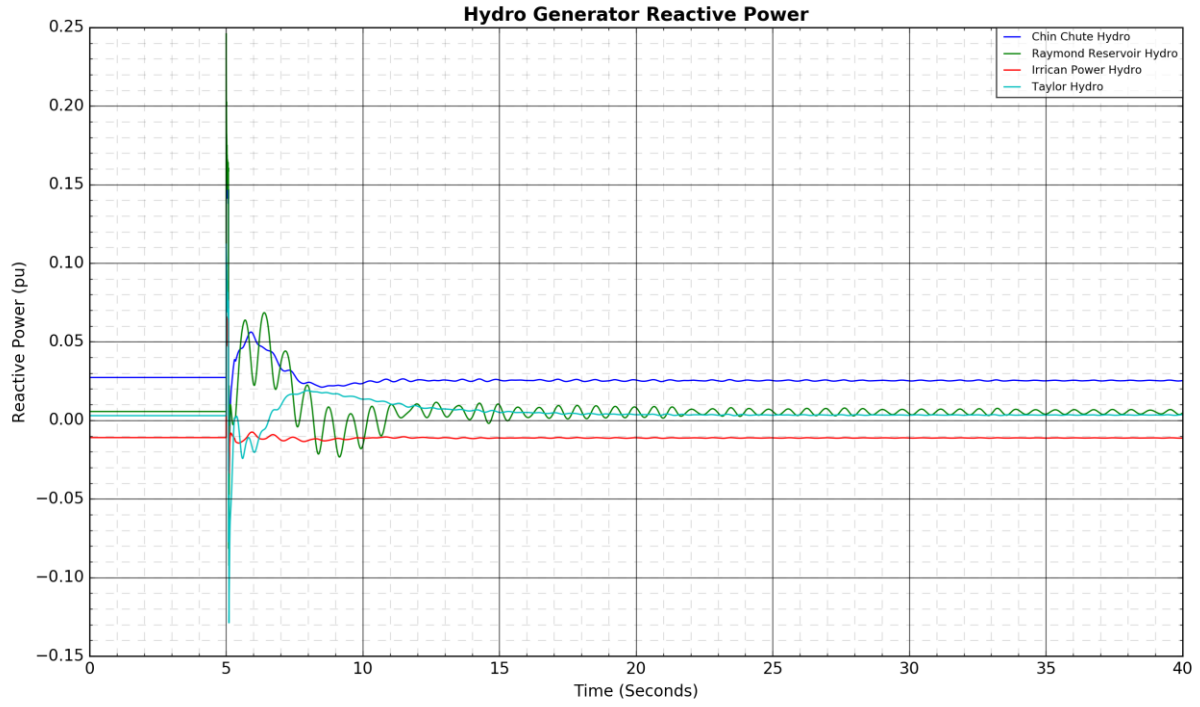
Figure A4-41: 968L North Lethbridge 370S to Windy Flats 138S: Fault Near North Lethbridge 370S

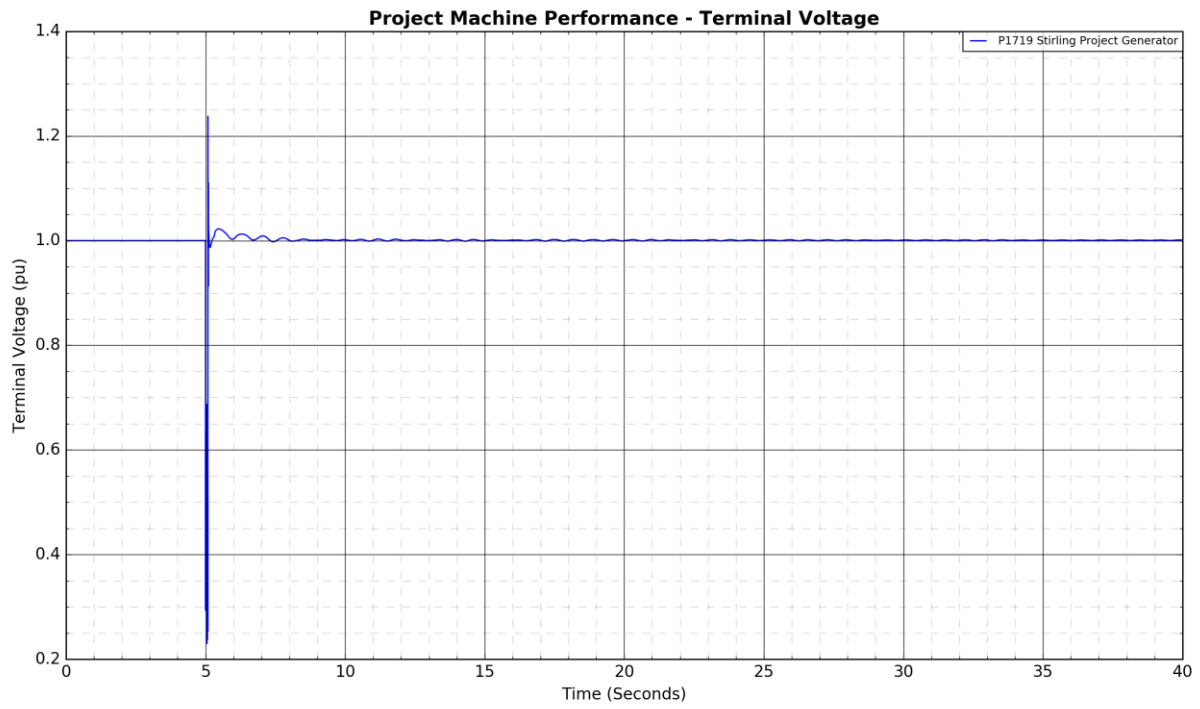
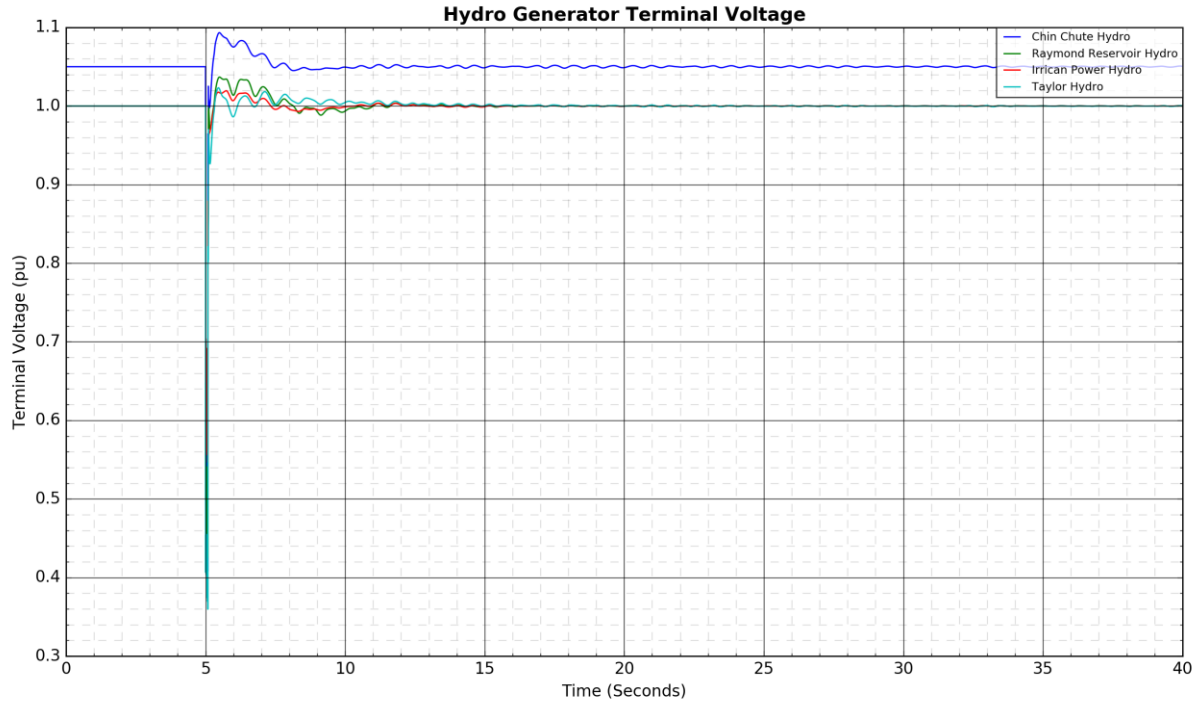




Engineering Connection Assessment Results: Stirling Wind Project Connection







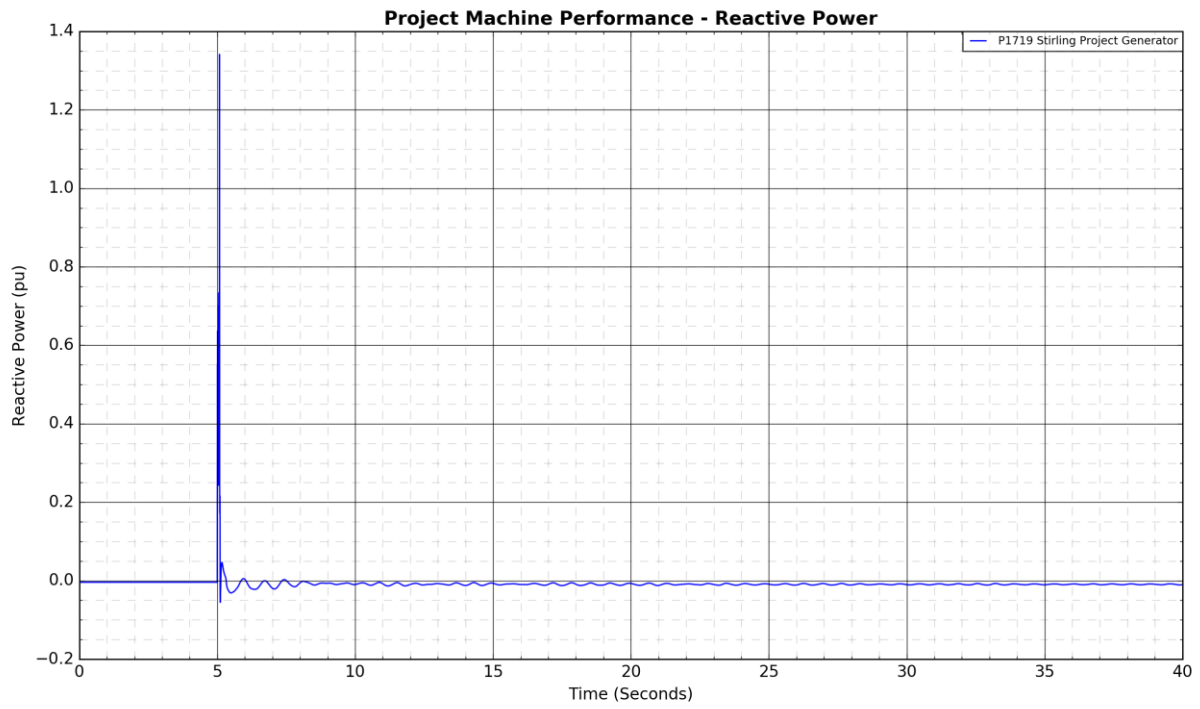
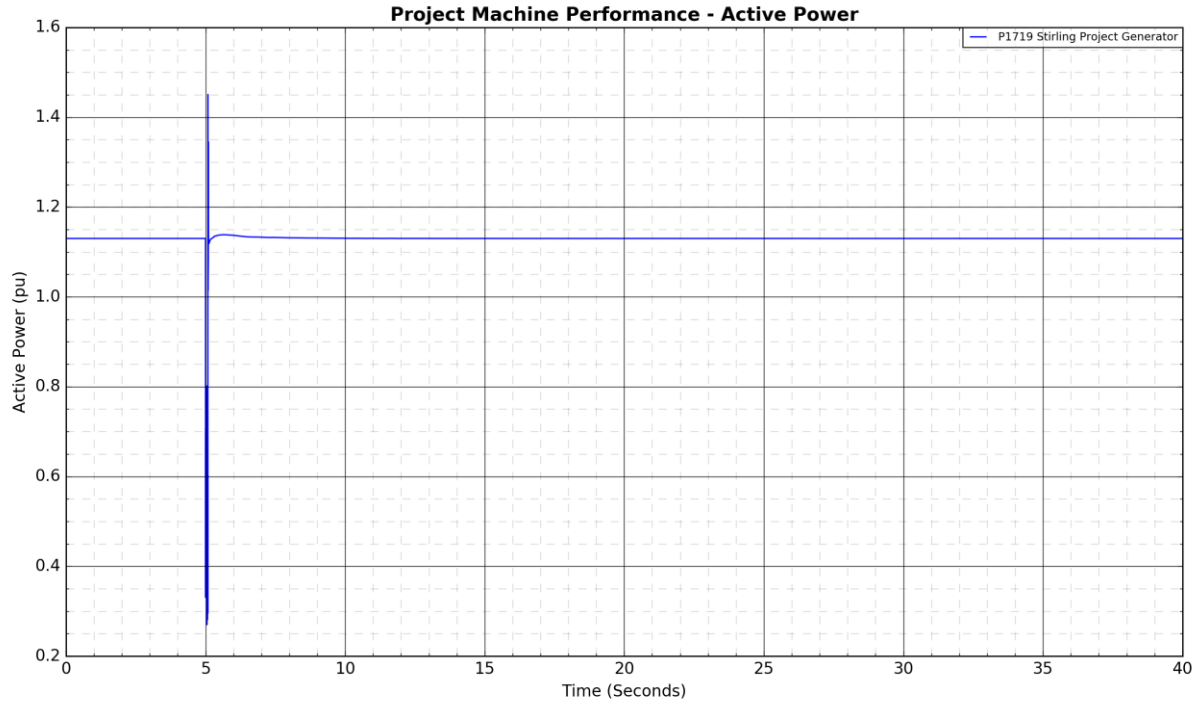
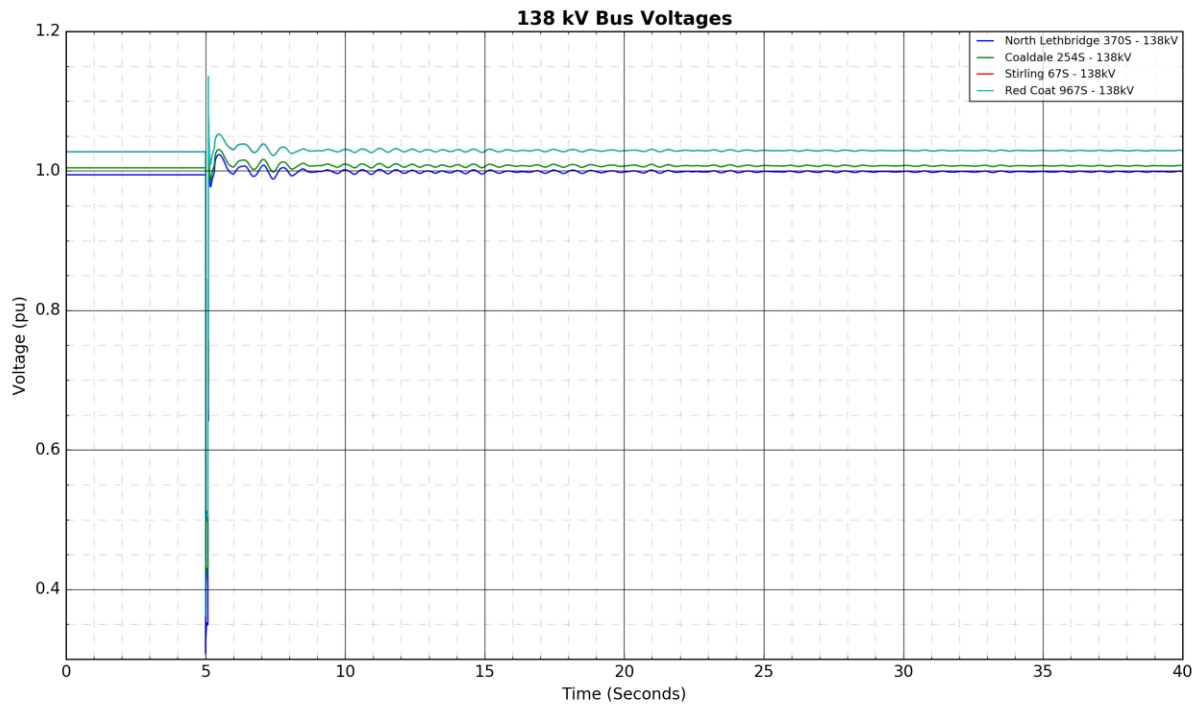
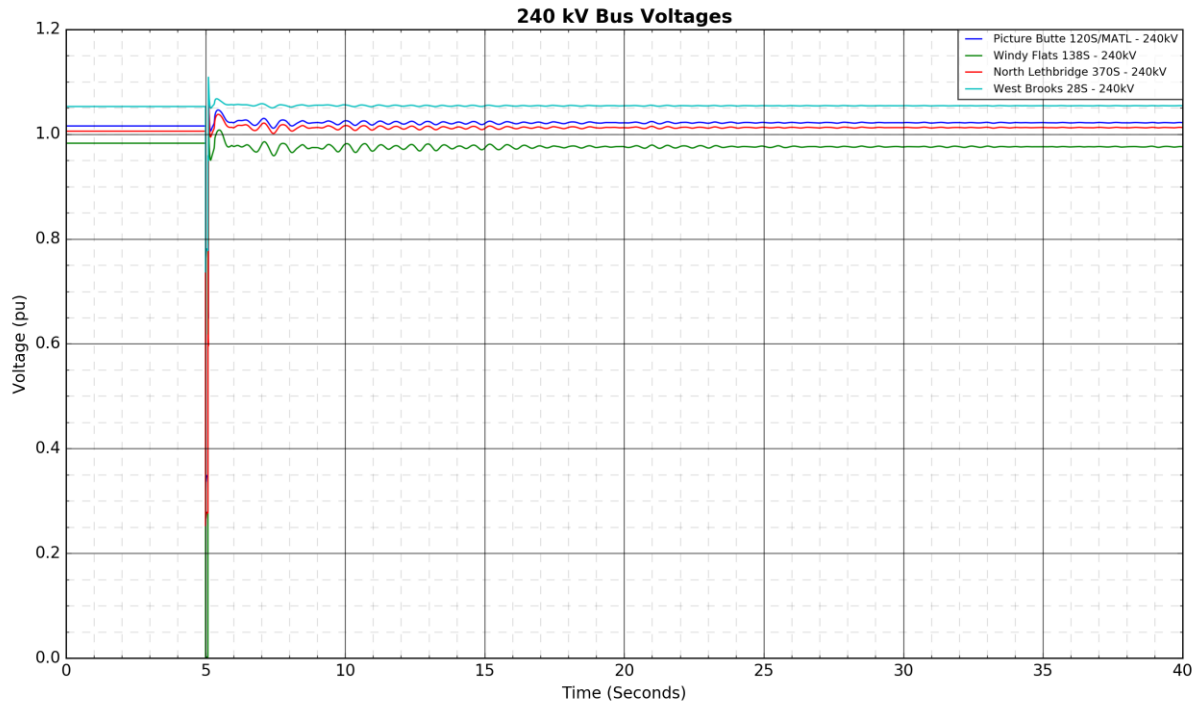
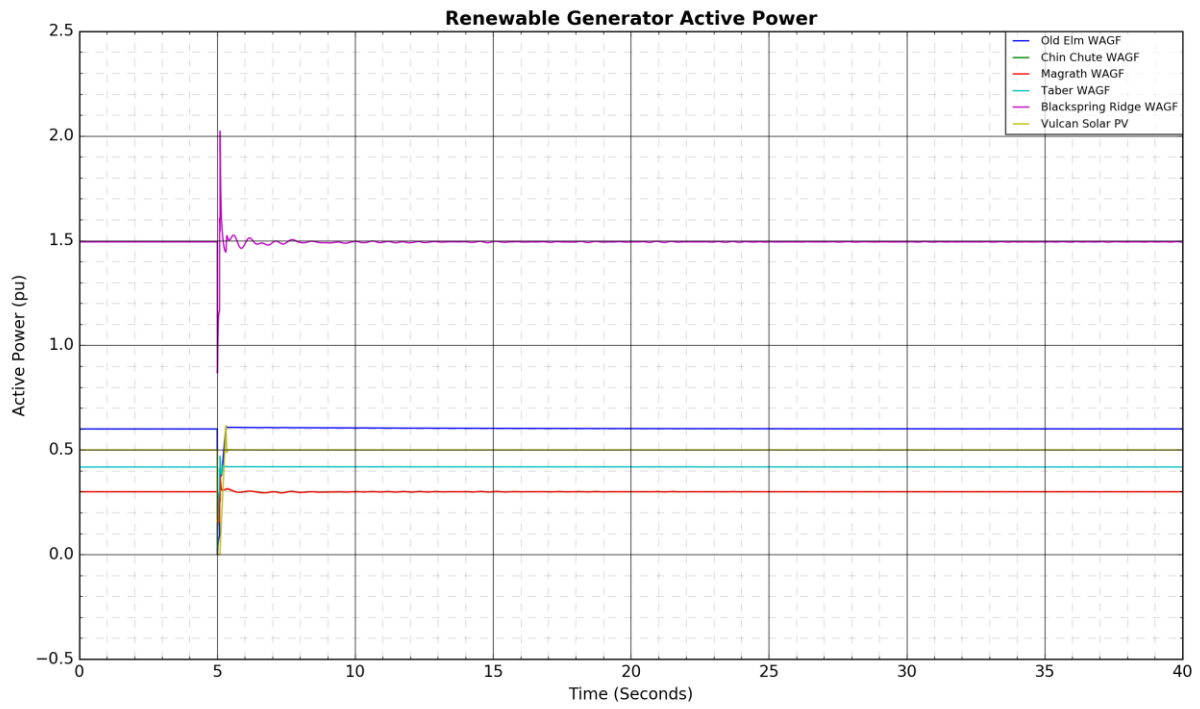
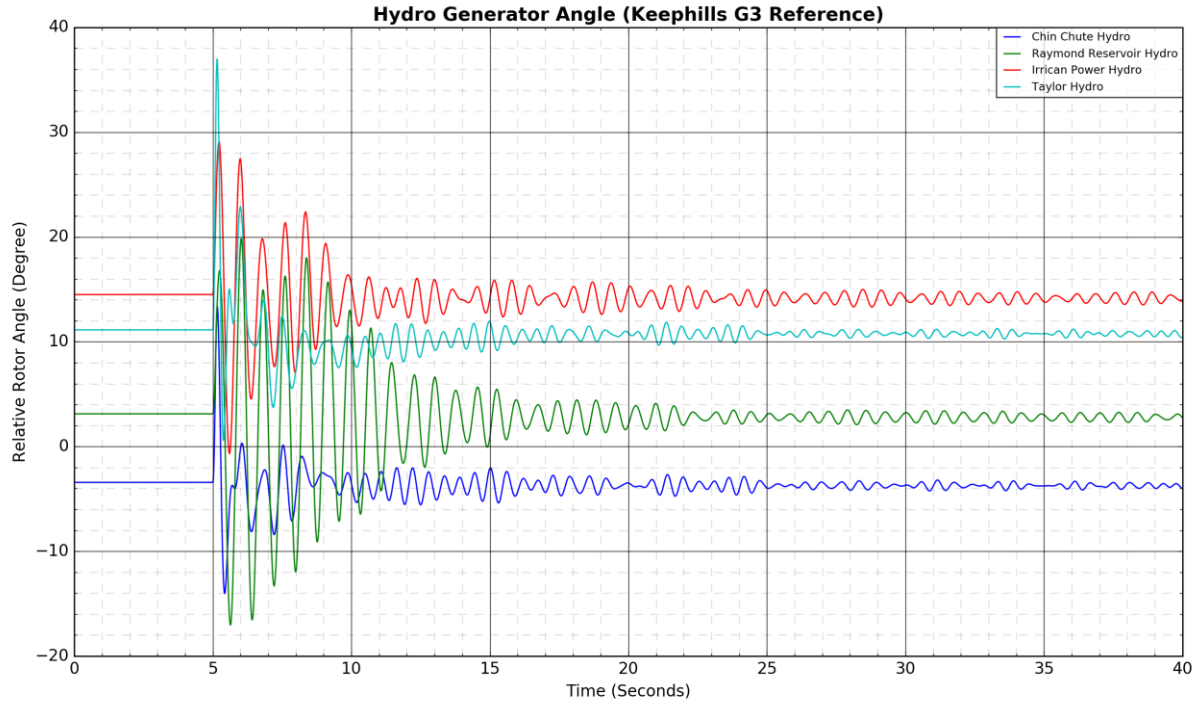
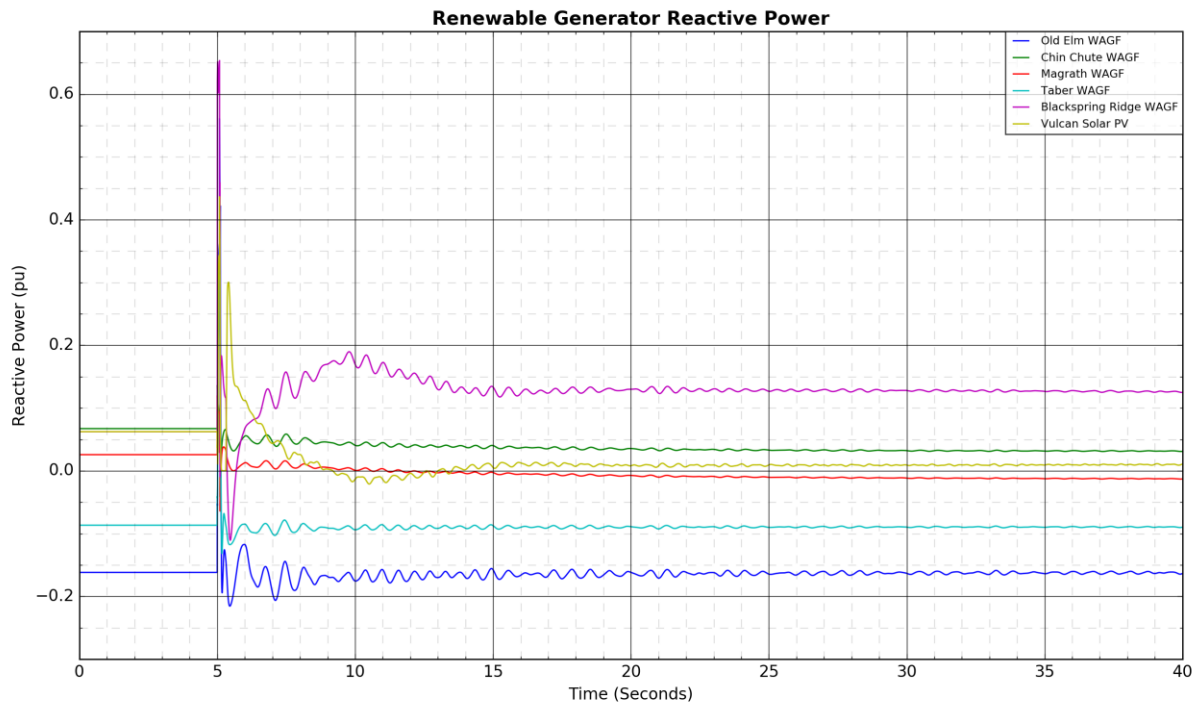
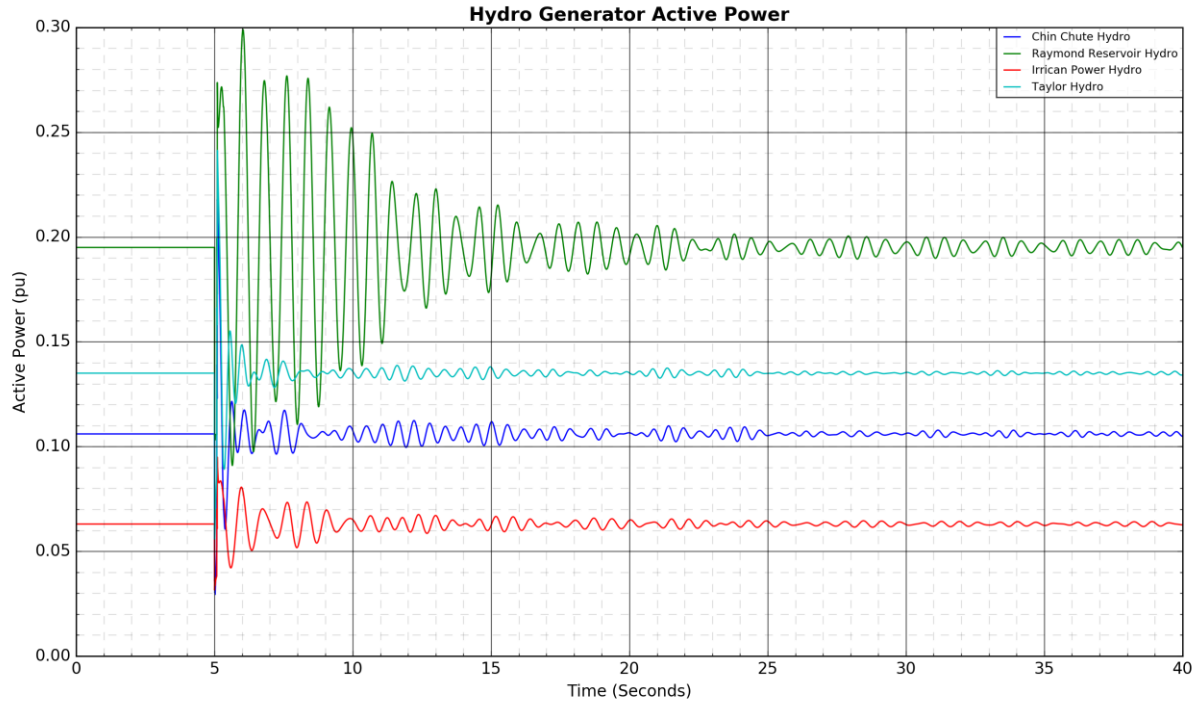


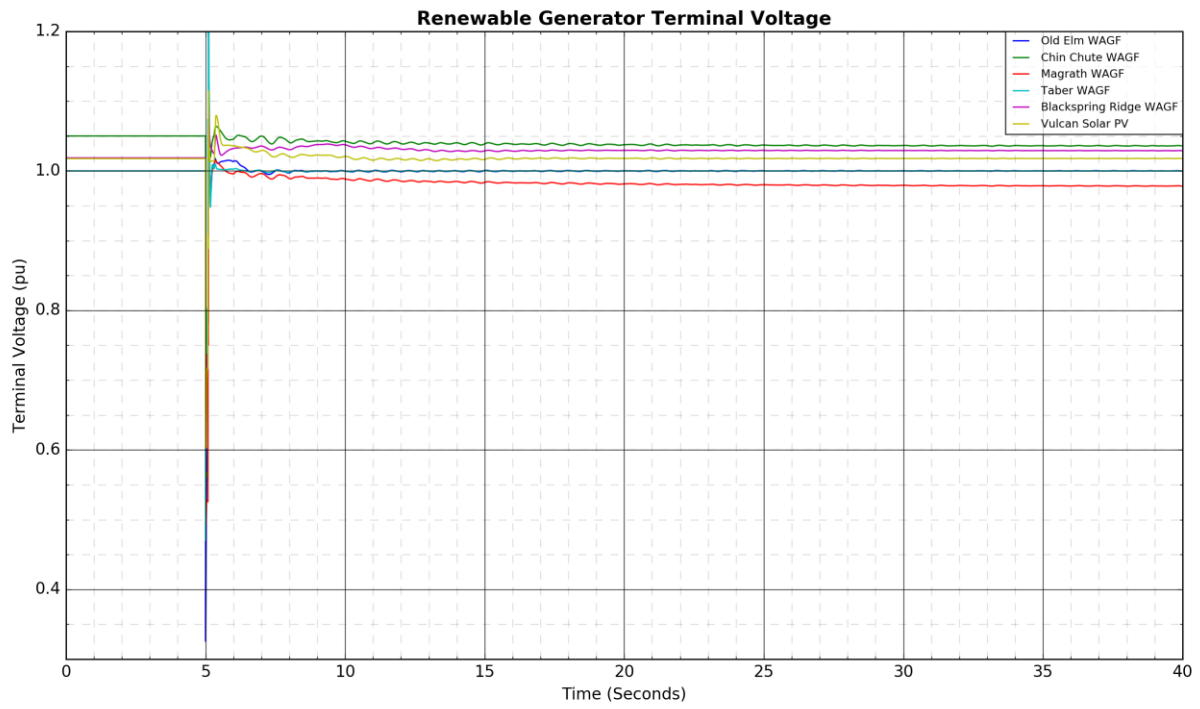
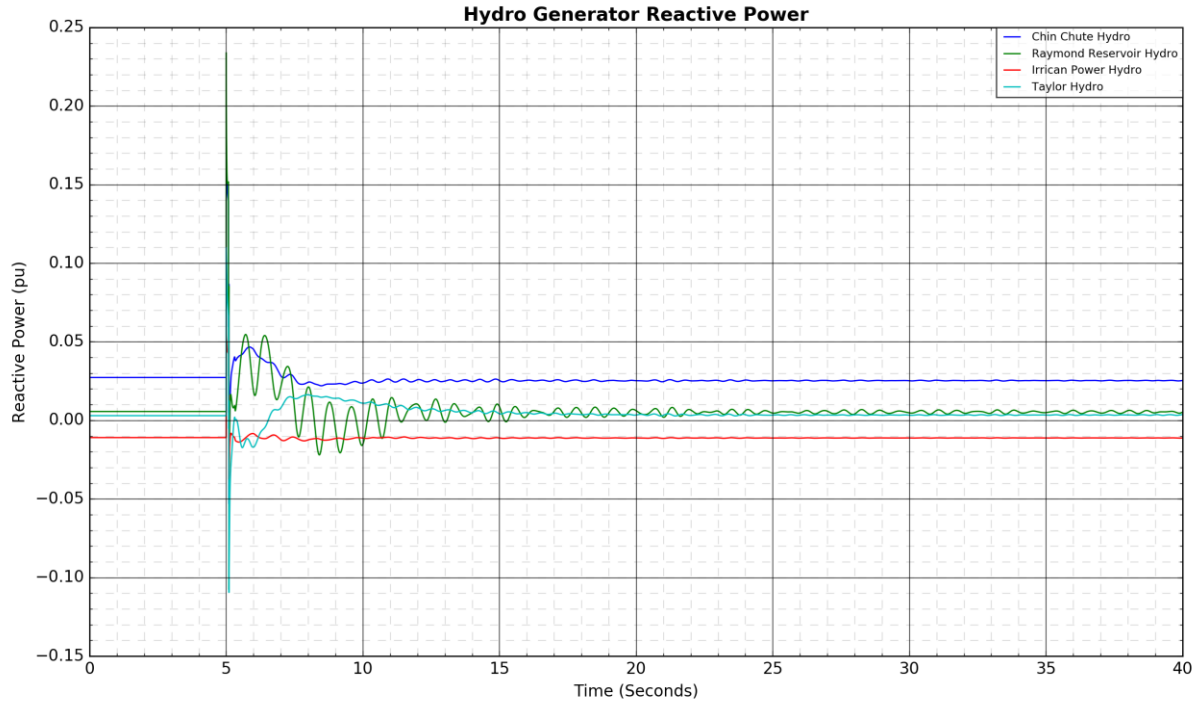
Figure A4-42: 968L North Lethbridge 370S to Windy Flats 138S: Fault Near Windy Flats 138S

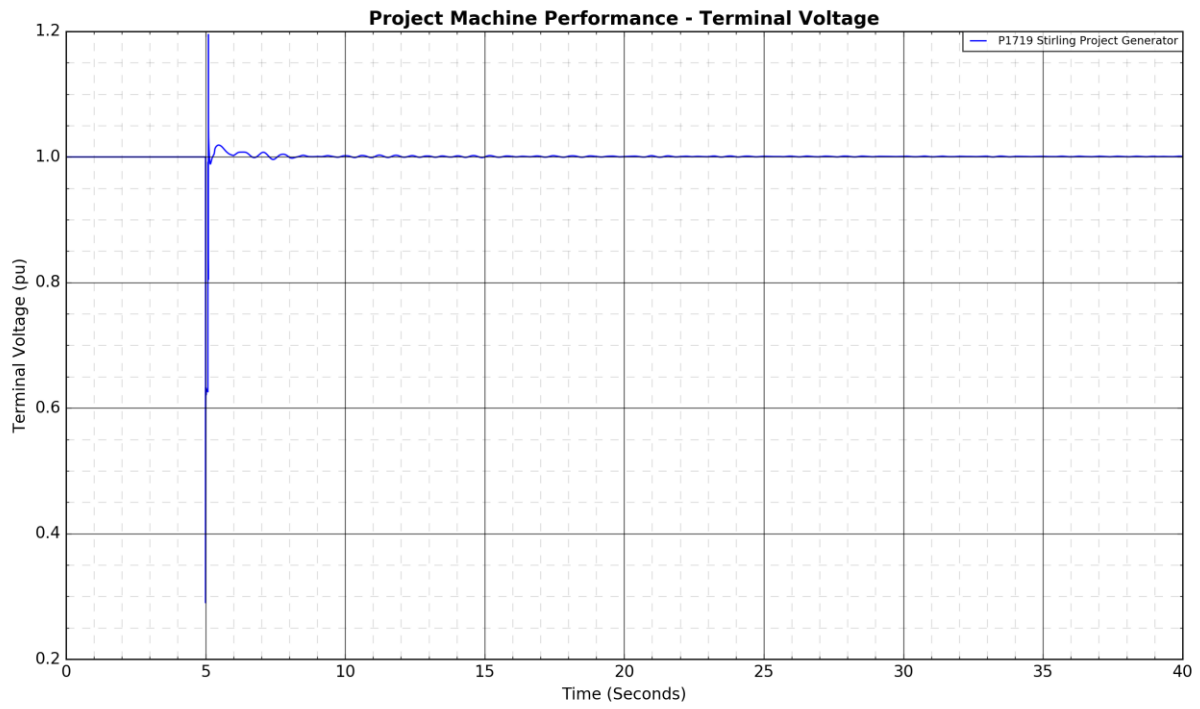
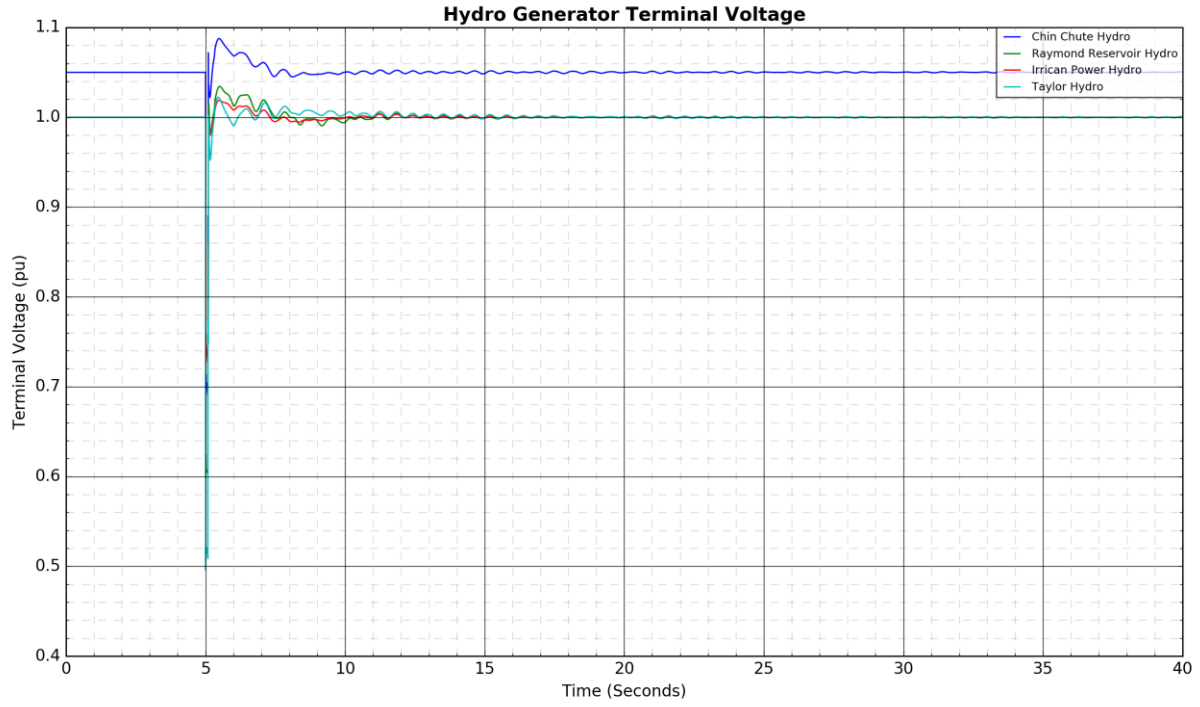


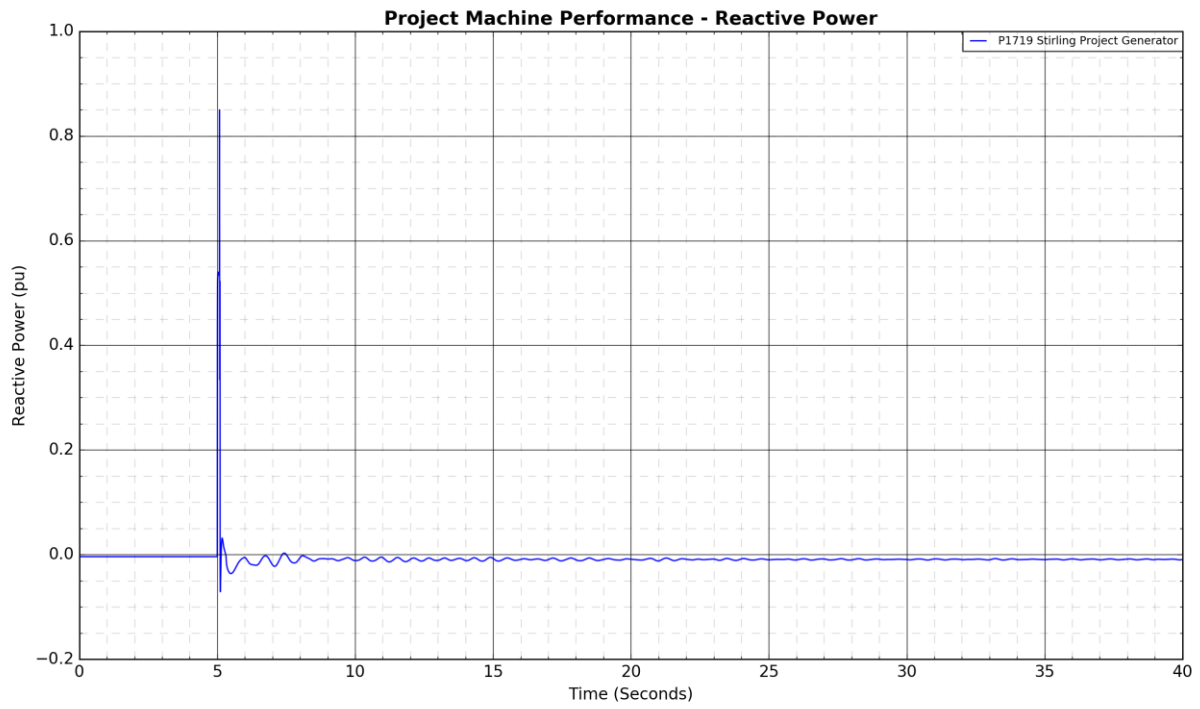
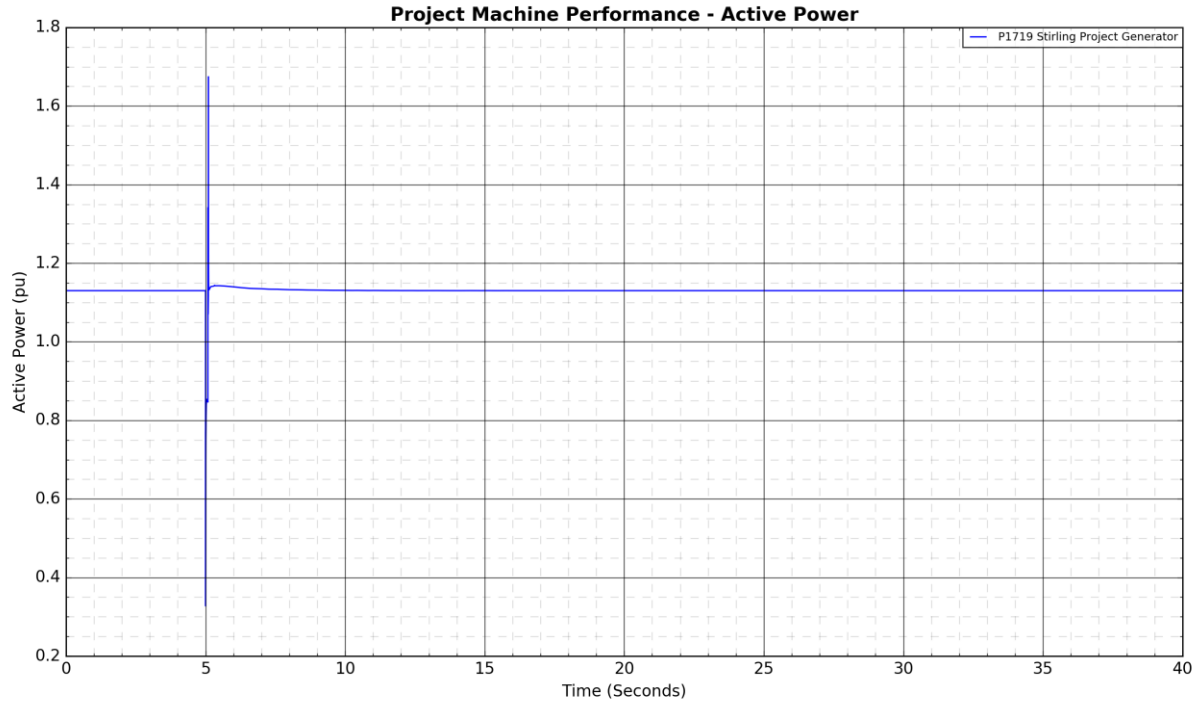


Engineering Connection Assessment Results: Stirling Wind Project Connection



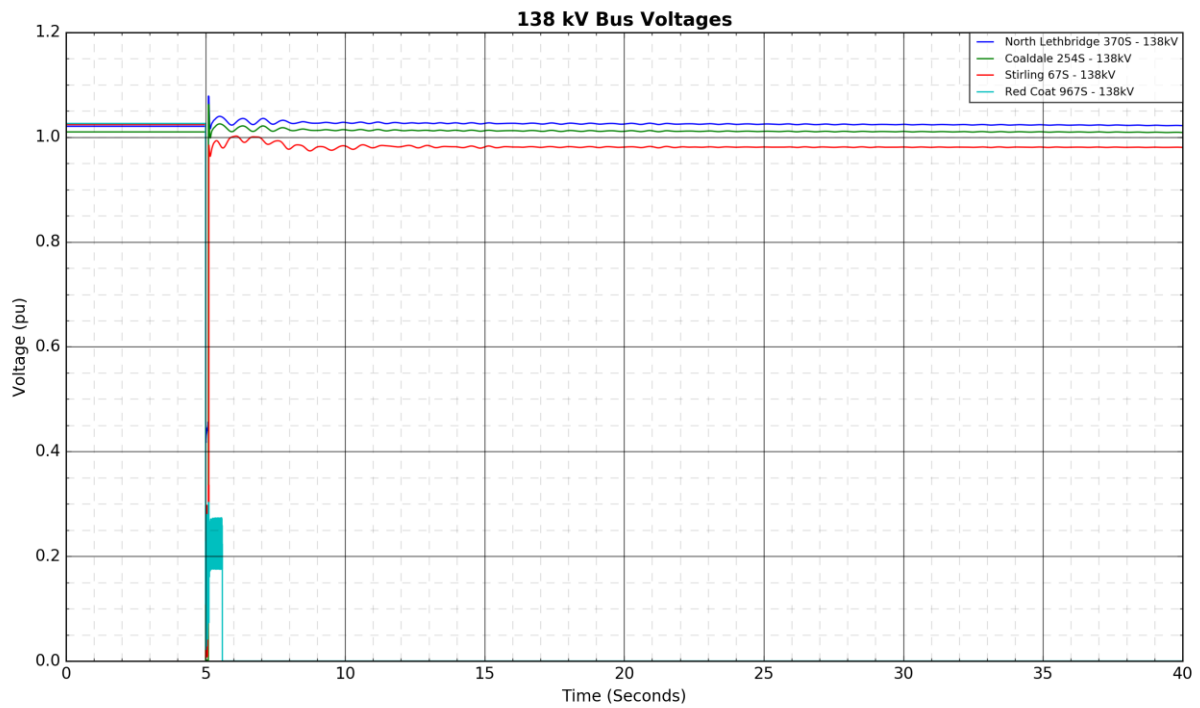
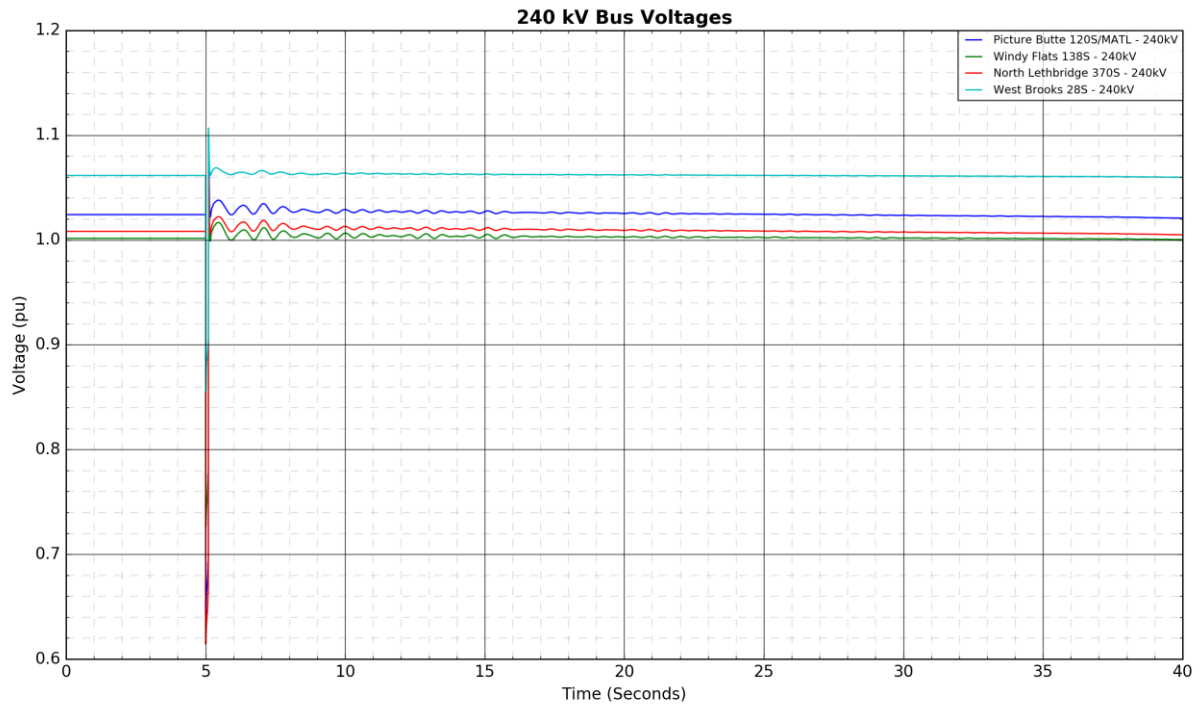


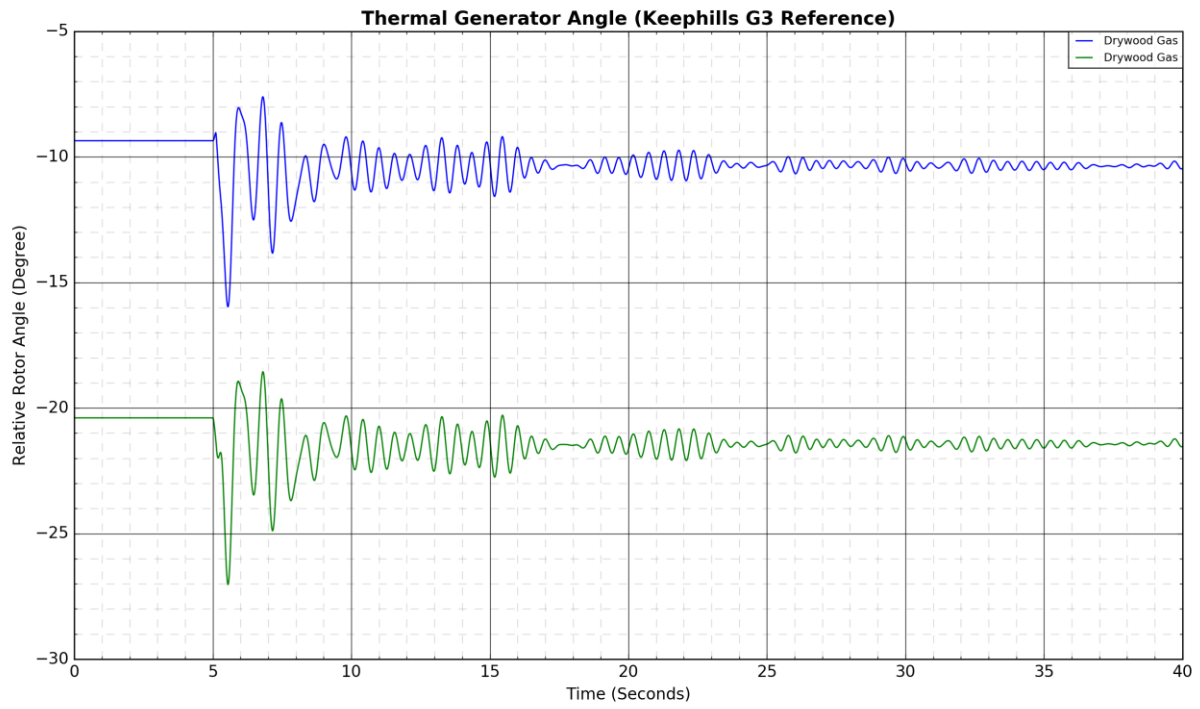
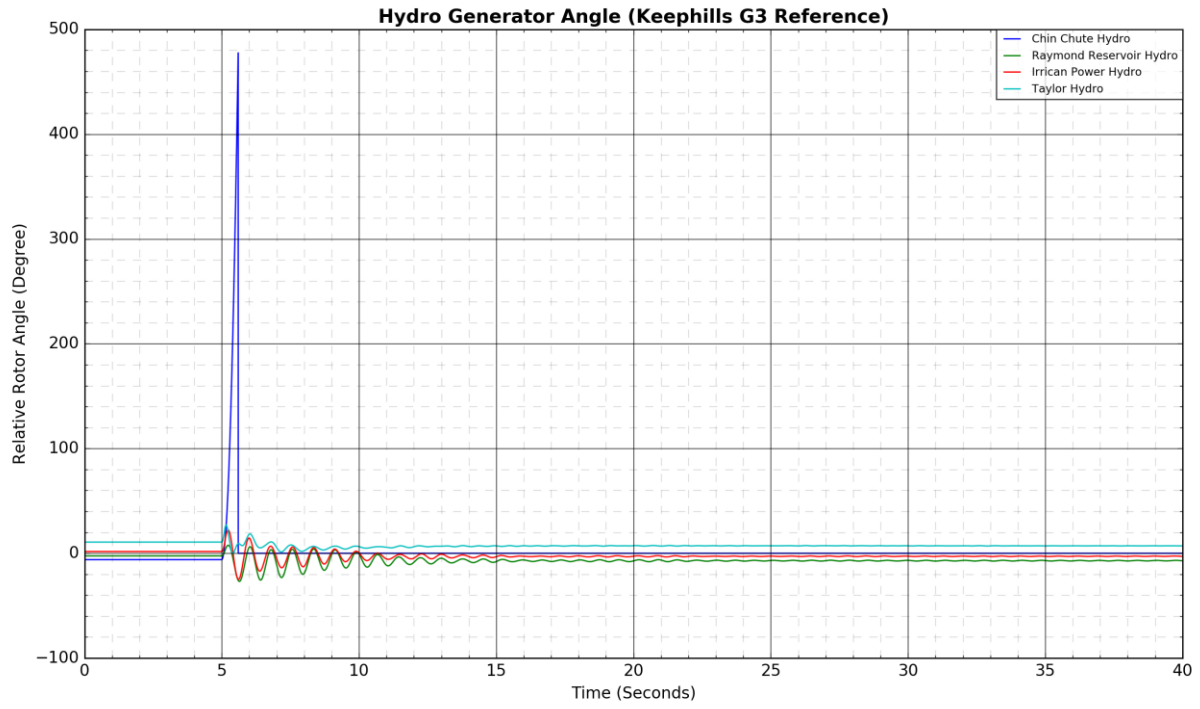




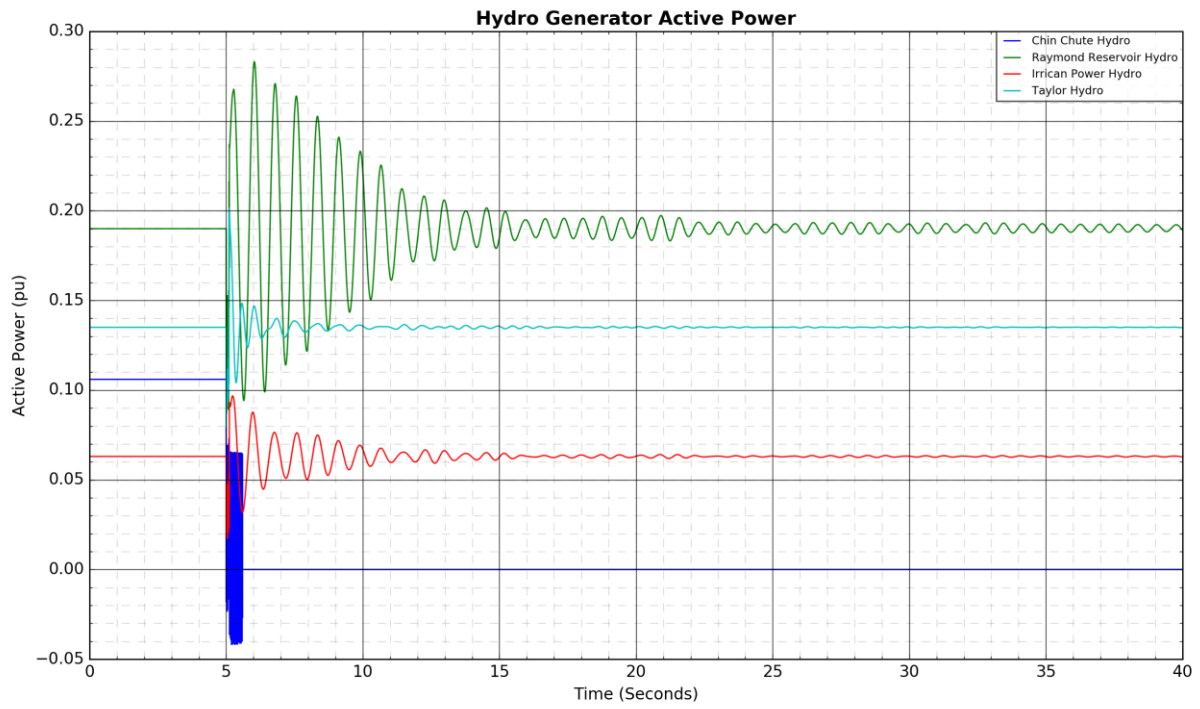
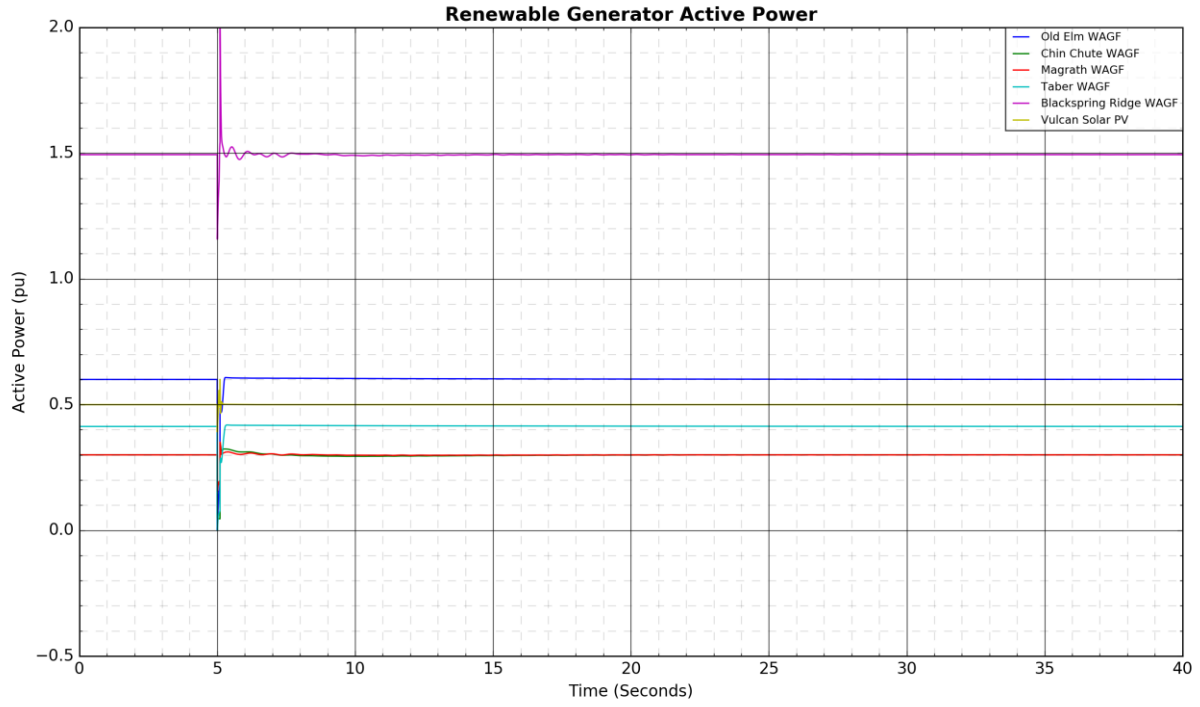
4. Stability Results 2019 Summer Peak - Case Post

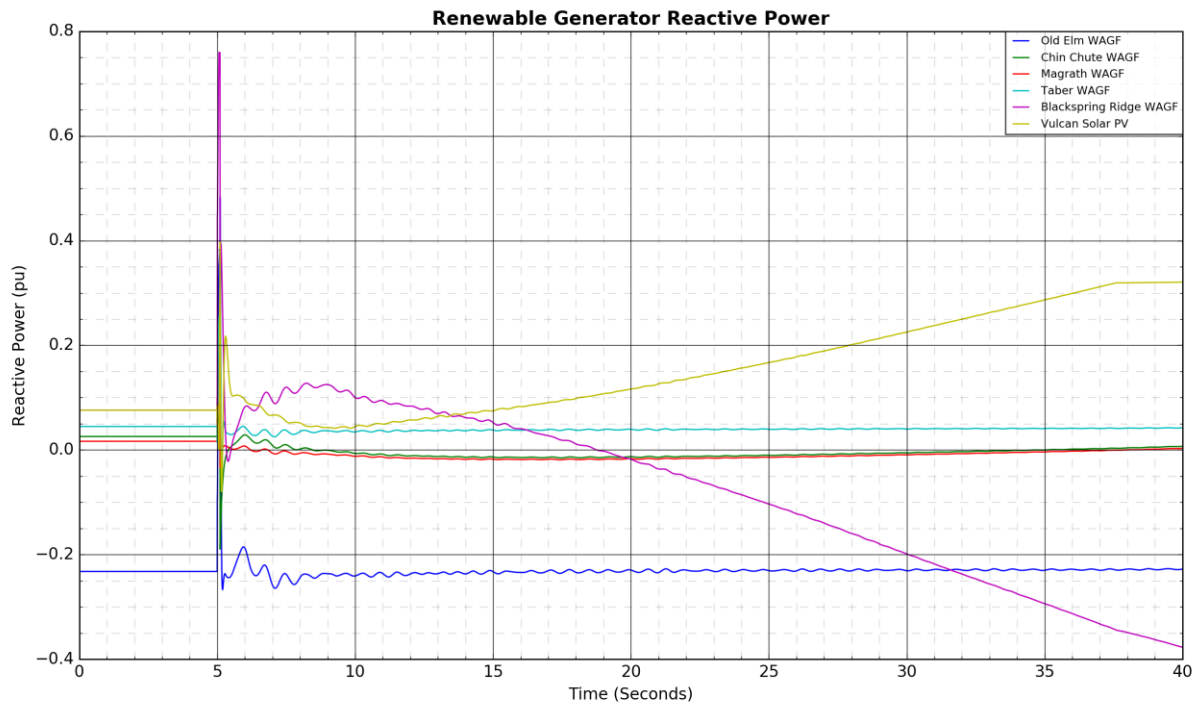
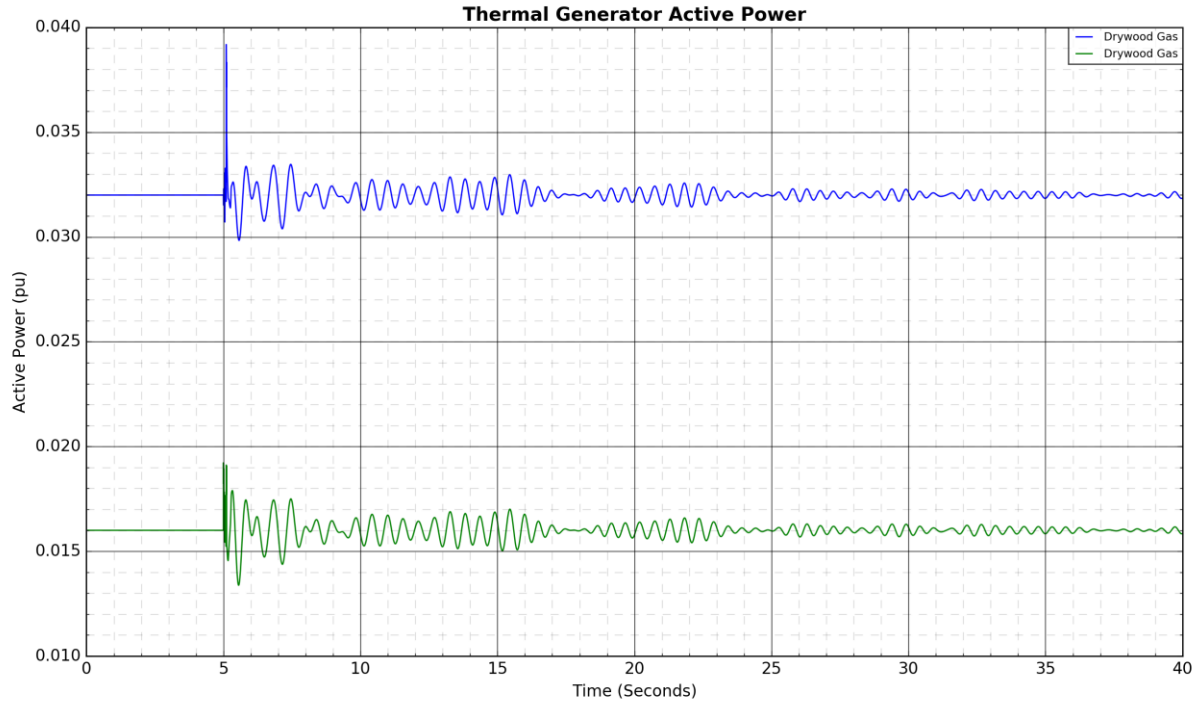
Figure A4-43: 820L Coaldale 254S to Chin Chute 315S T-Tap to Red Coat 967S T-Tap to Stirling 67S: Fault Near Coaldale 254S

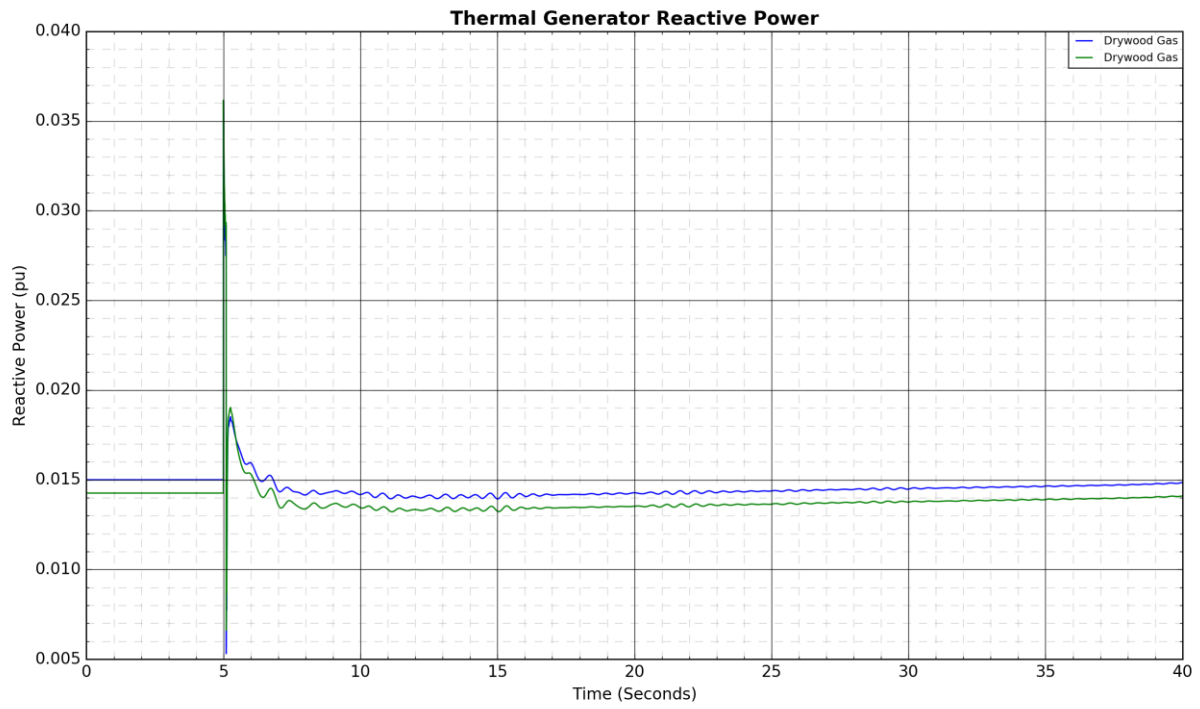
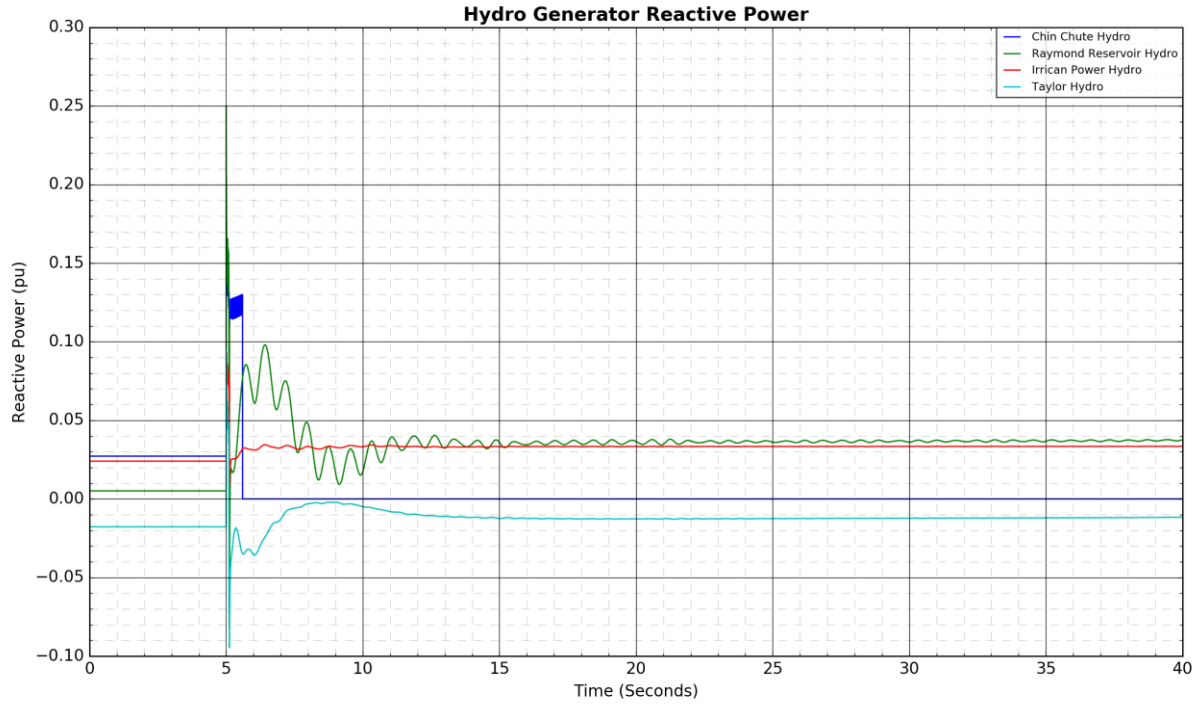


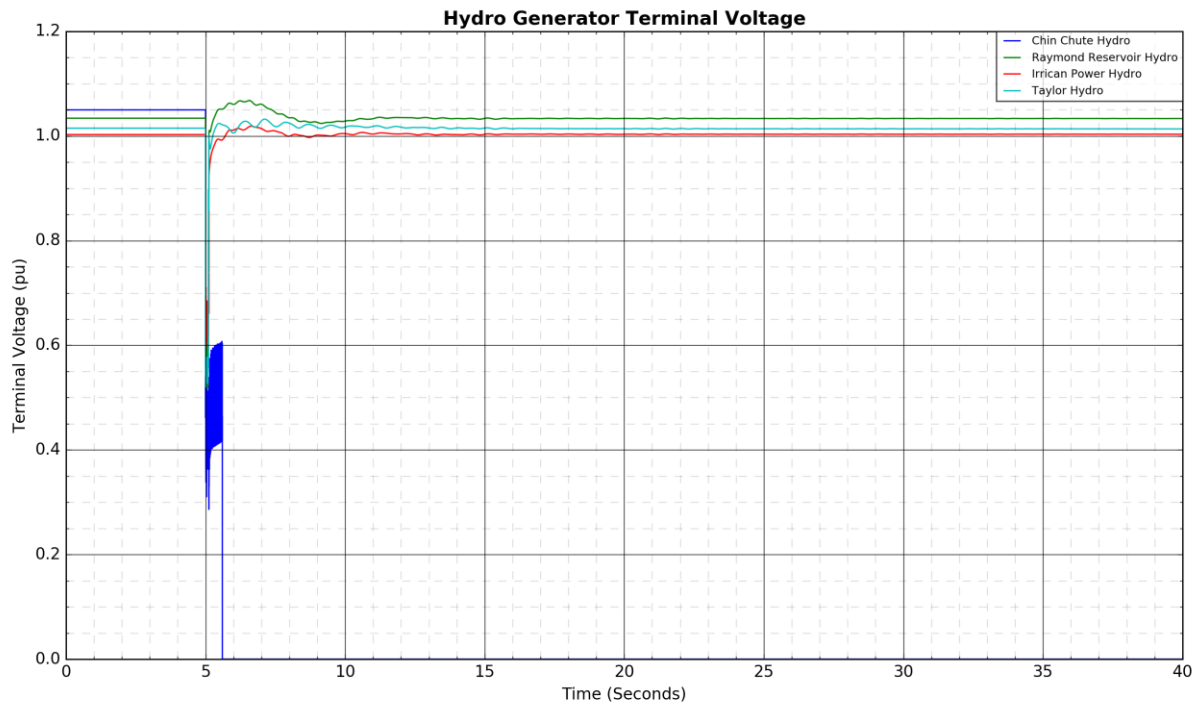
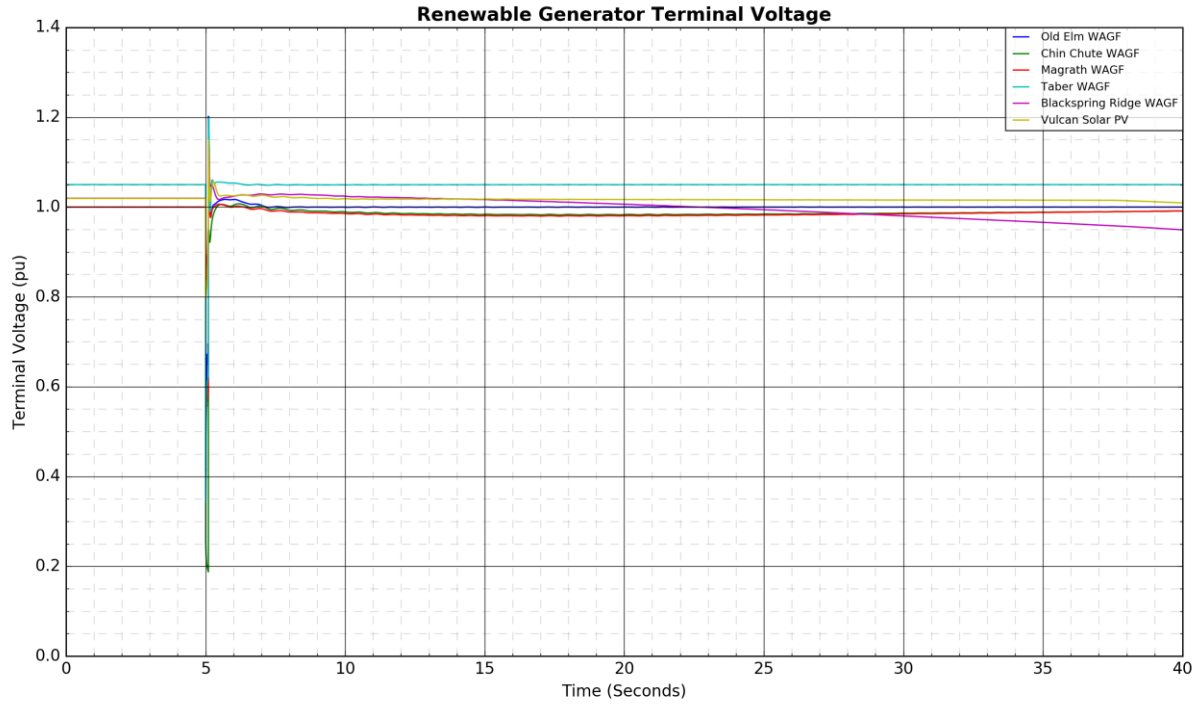


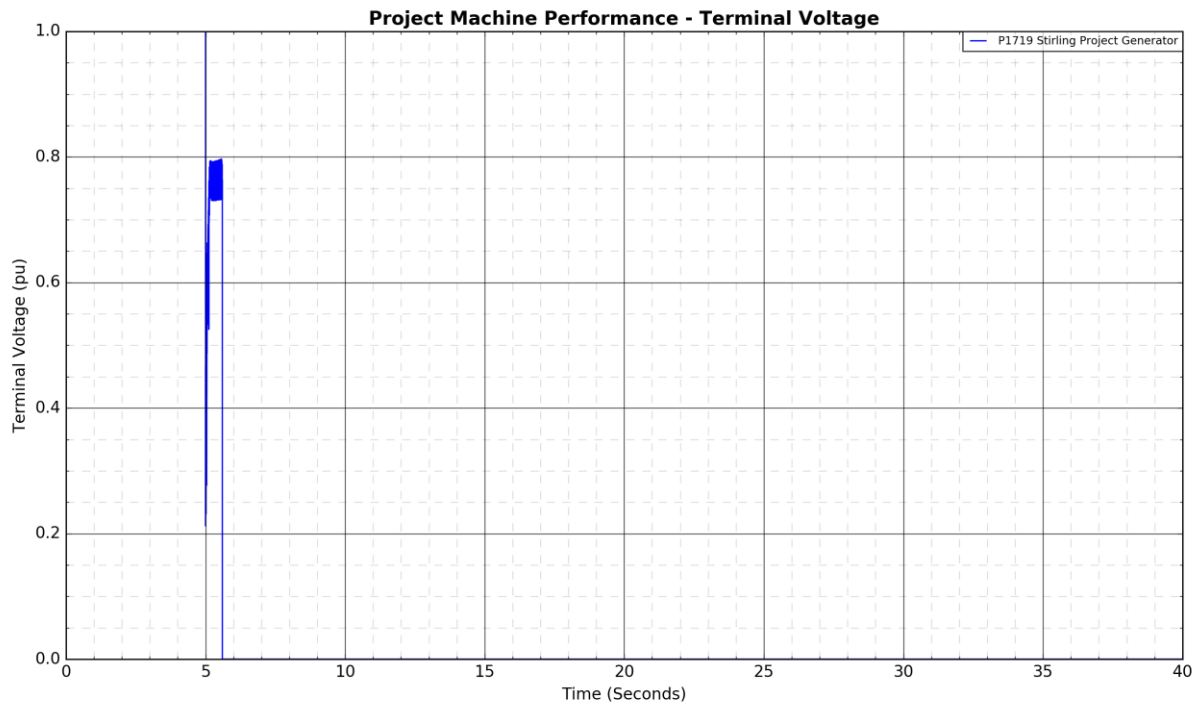
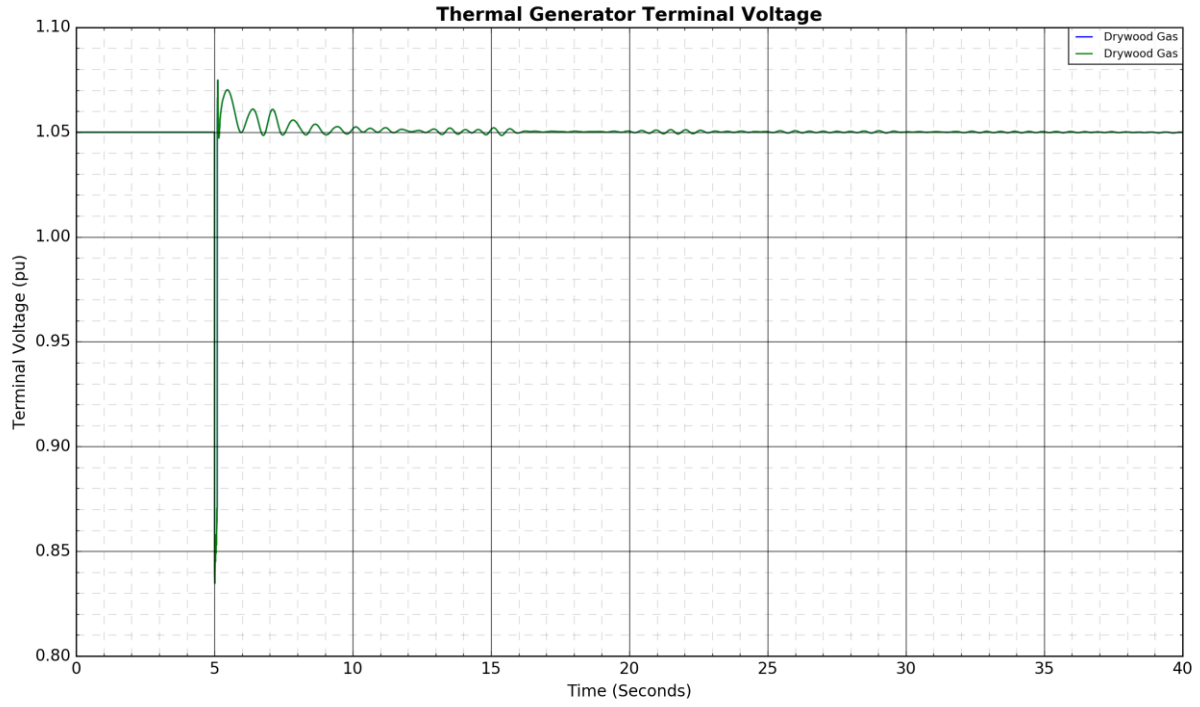
Engineering Connection Assessment Results: Stirling Wind Project Connection











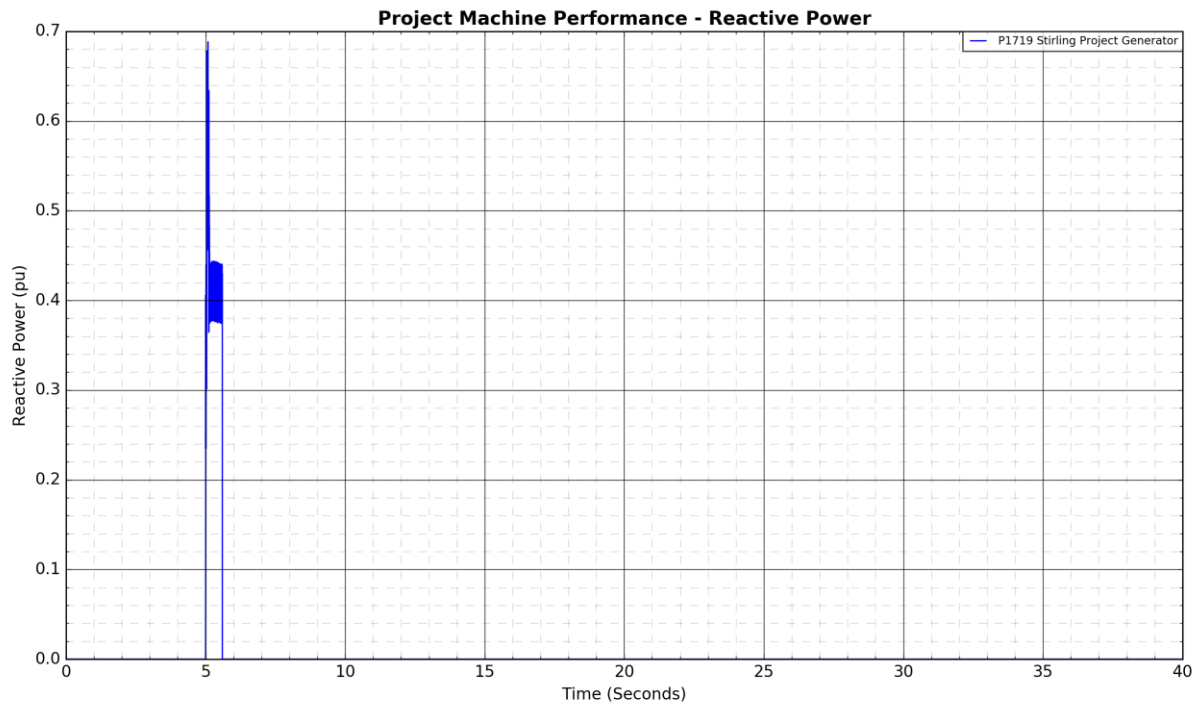
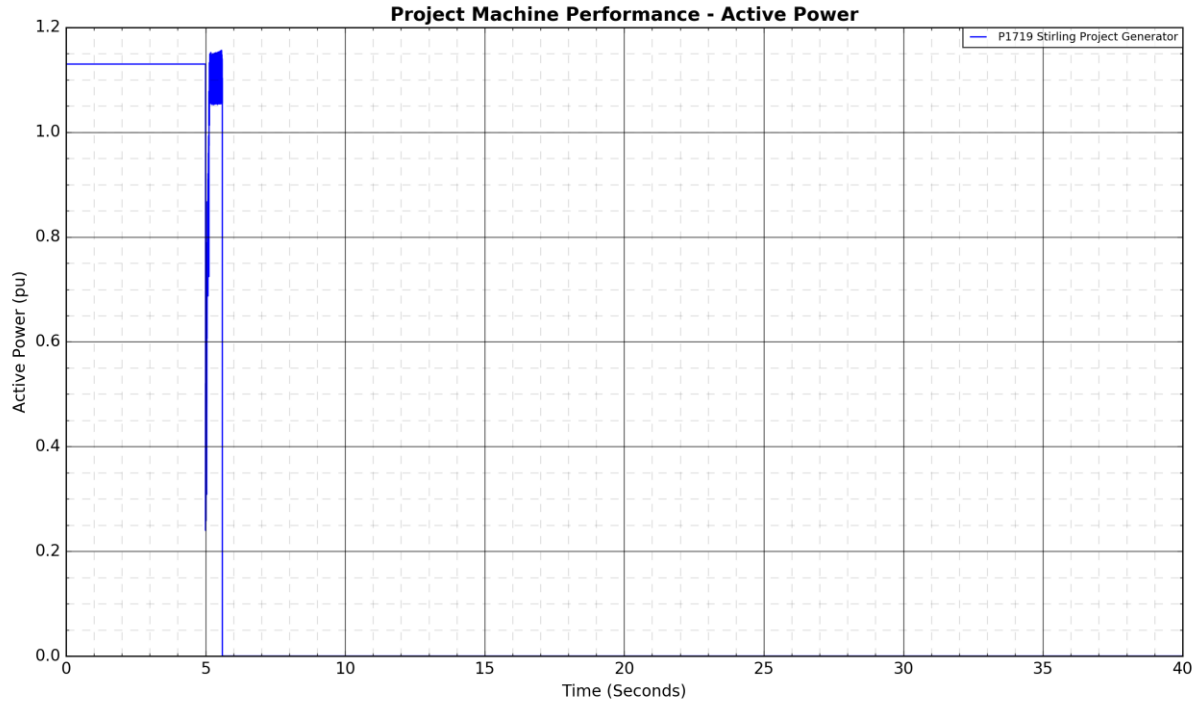
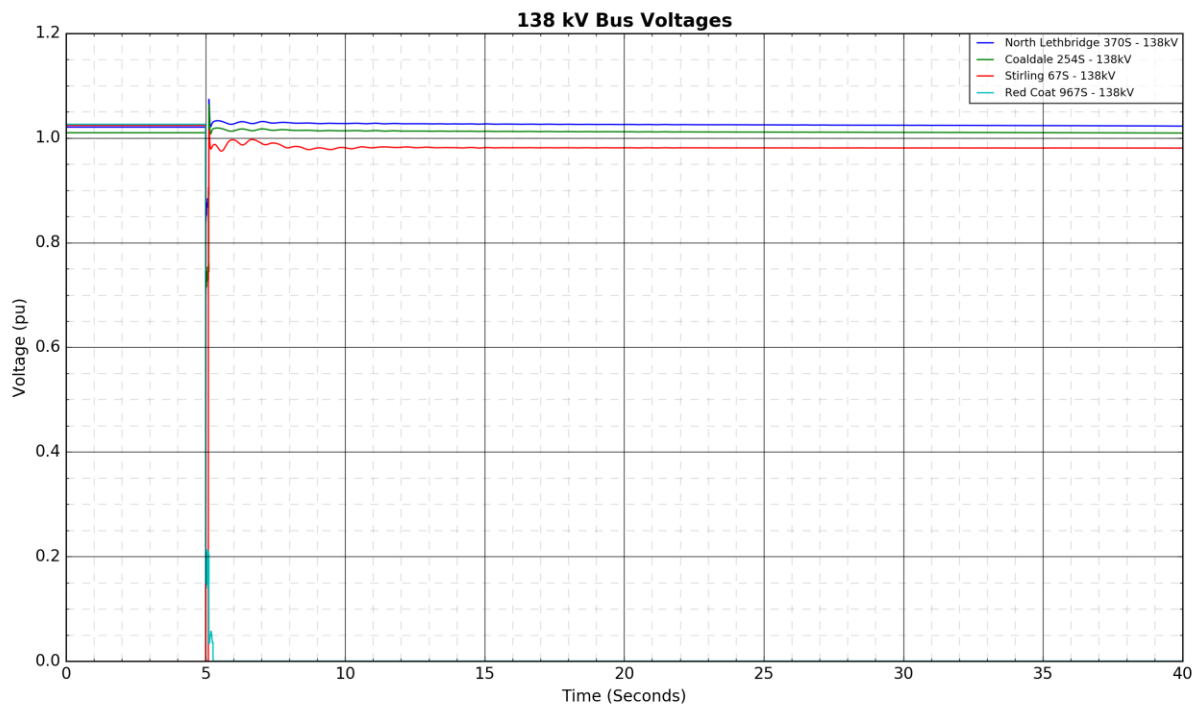
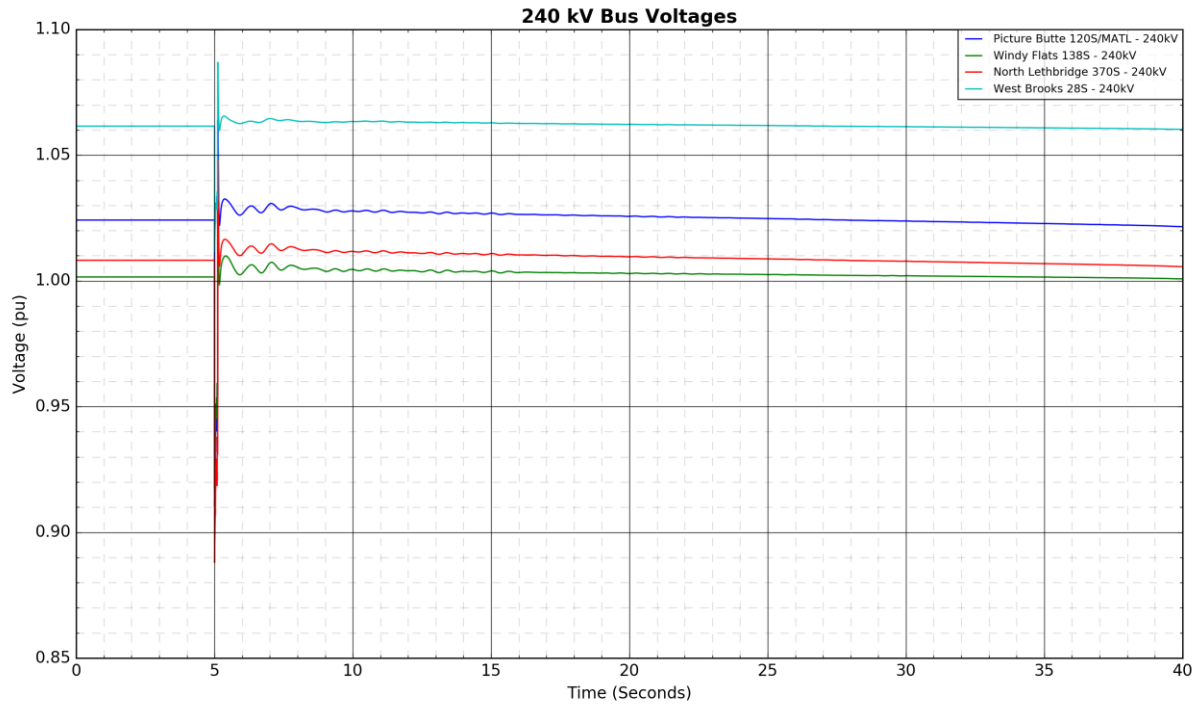
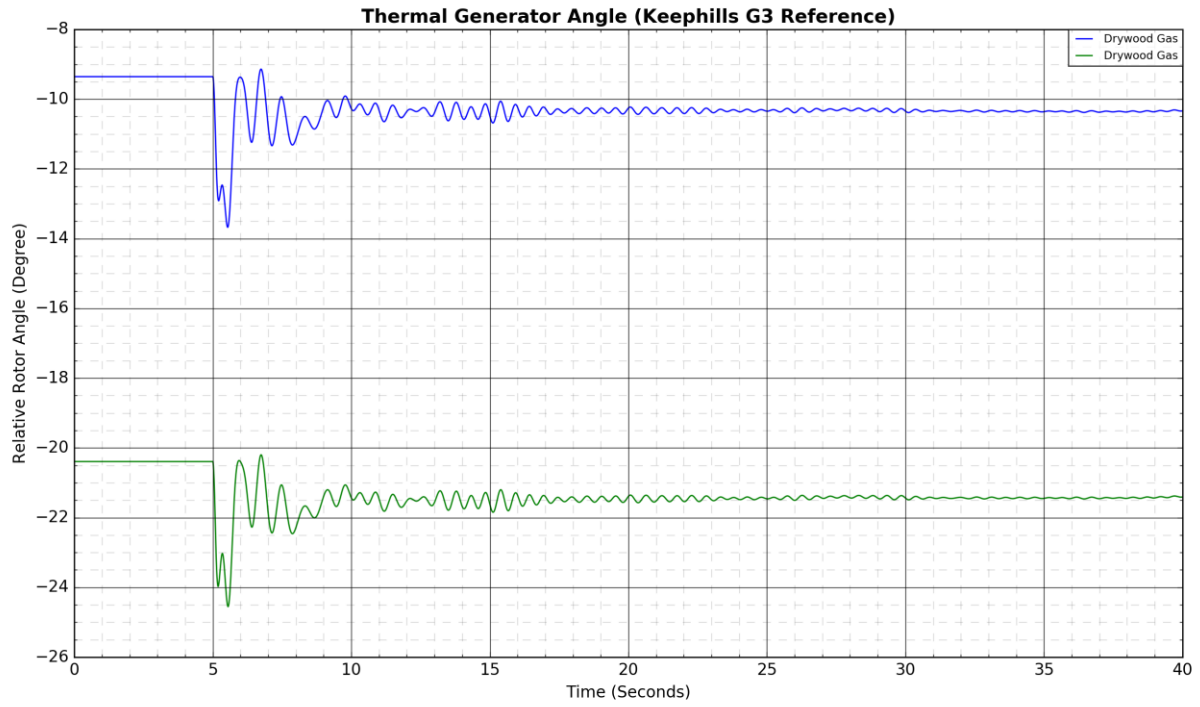
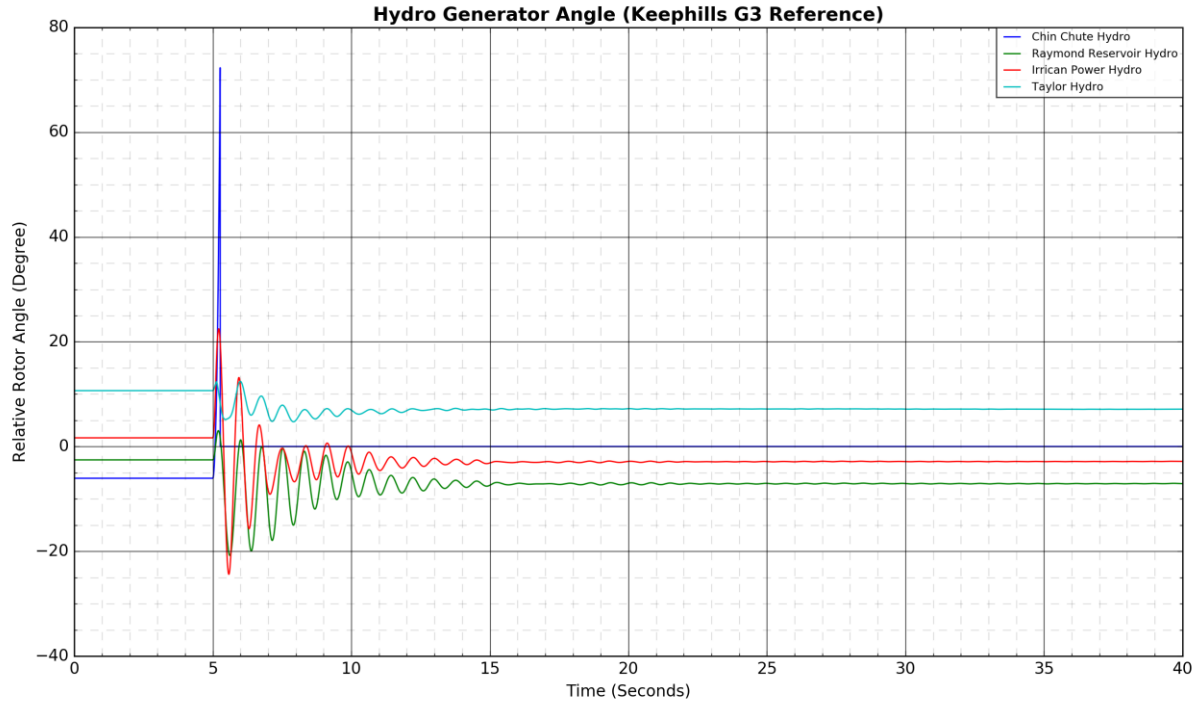
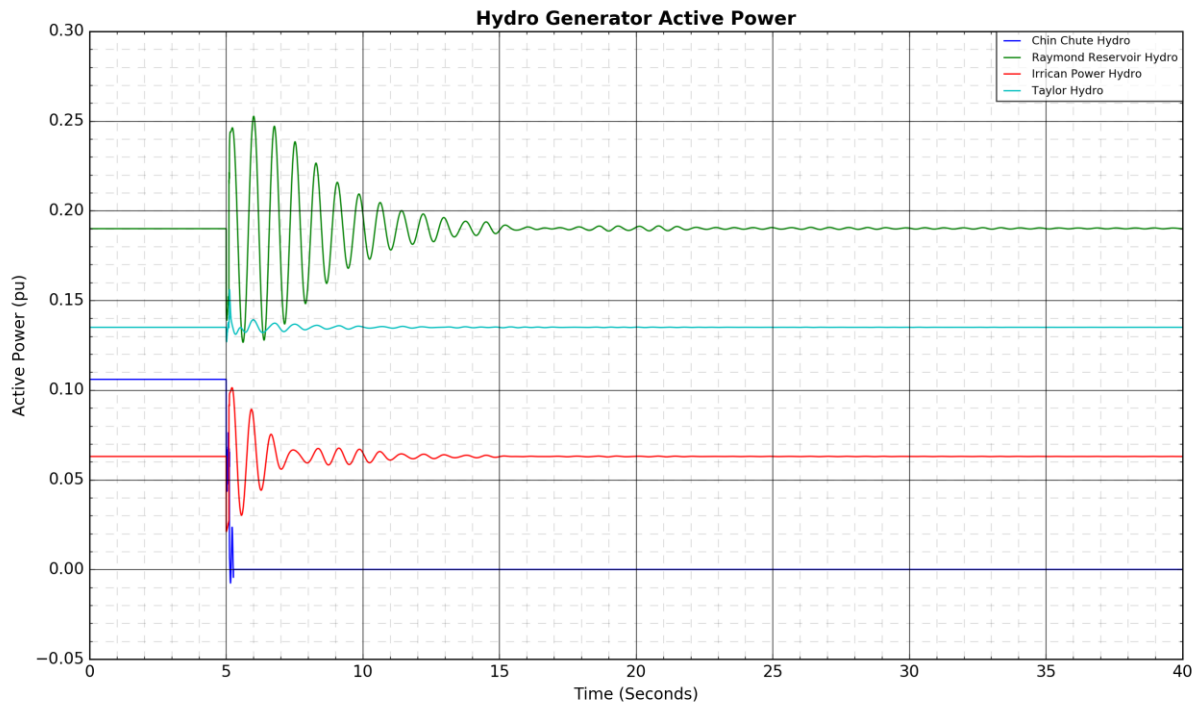
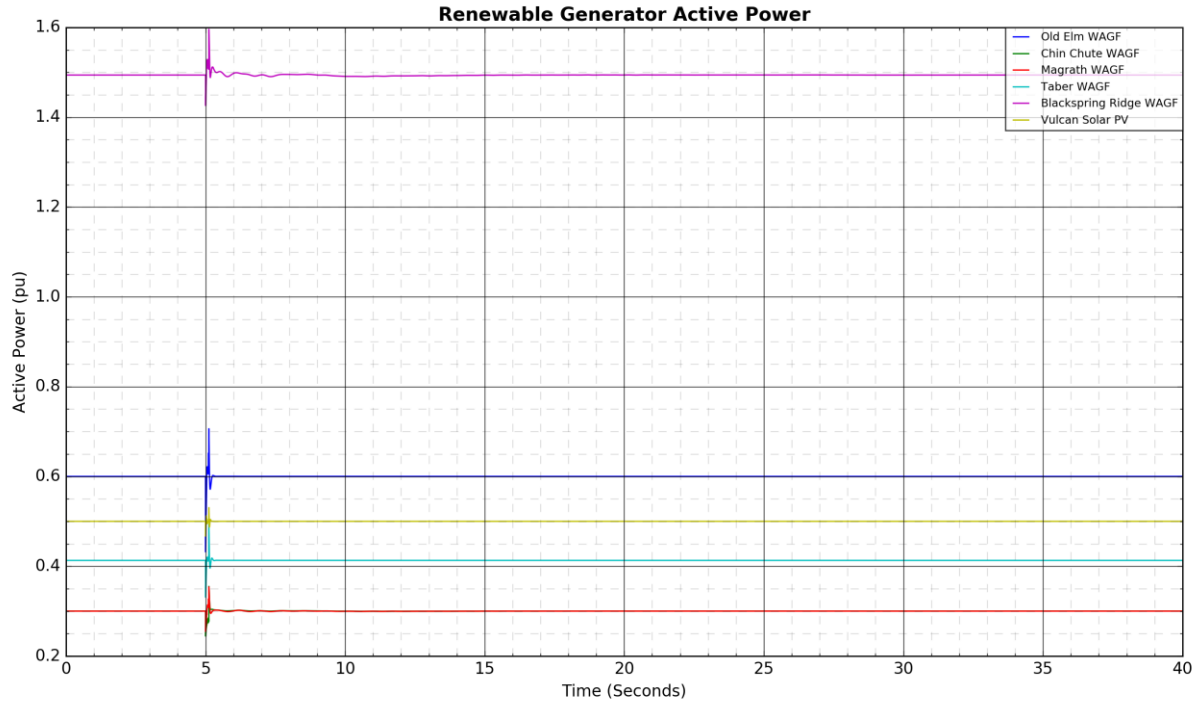
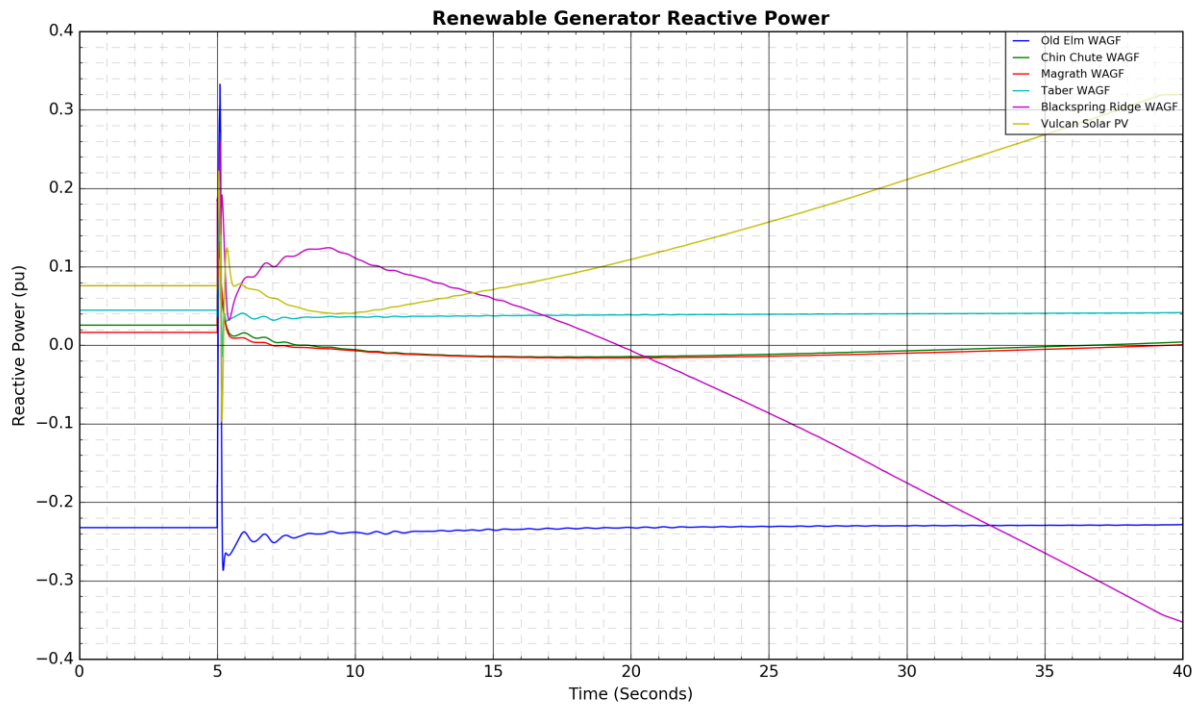
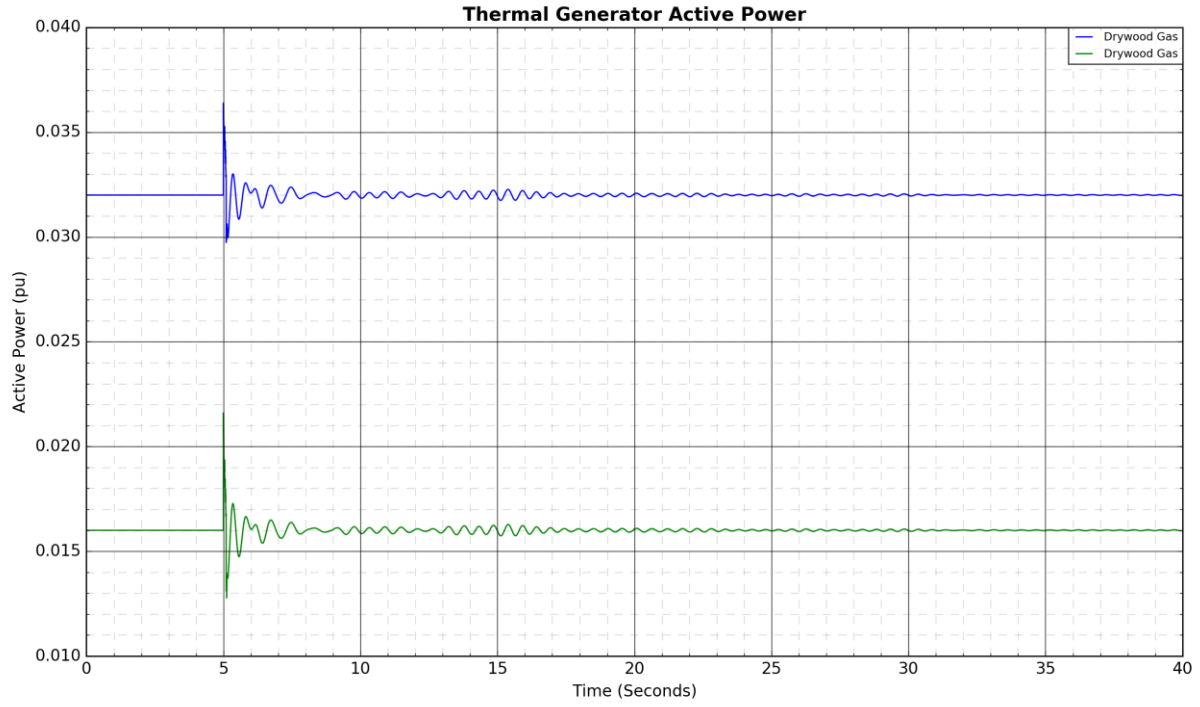


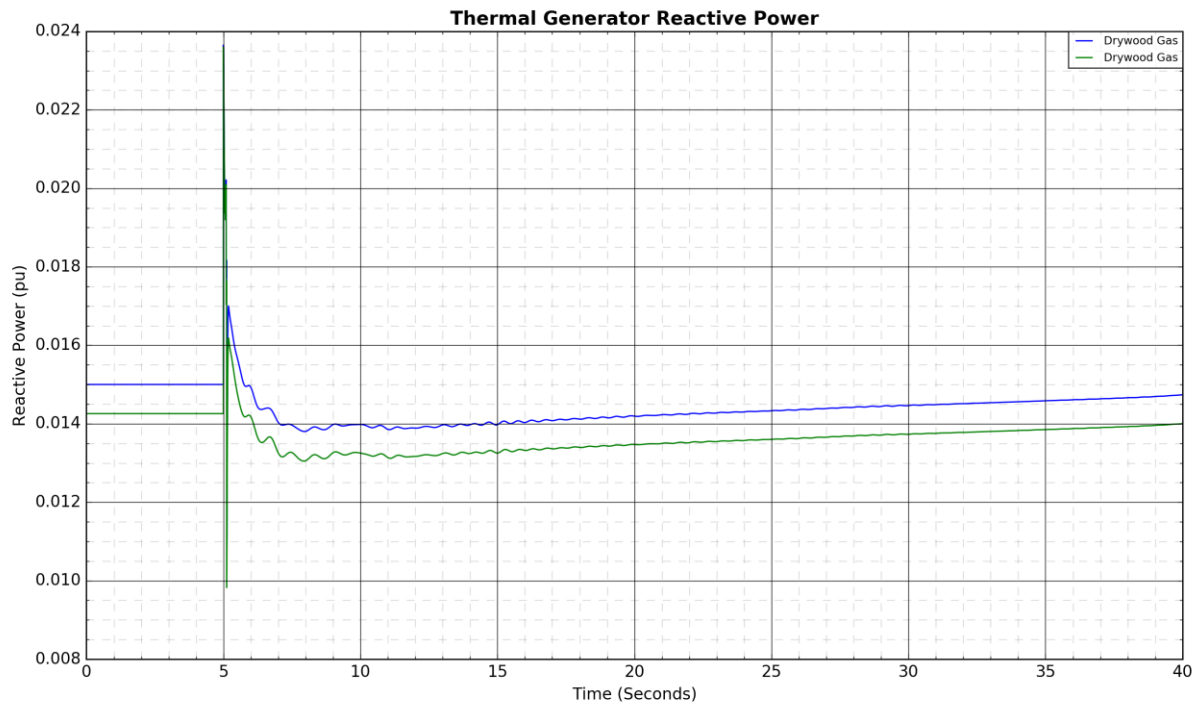
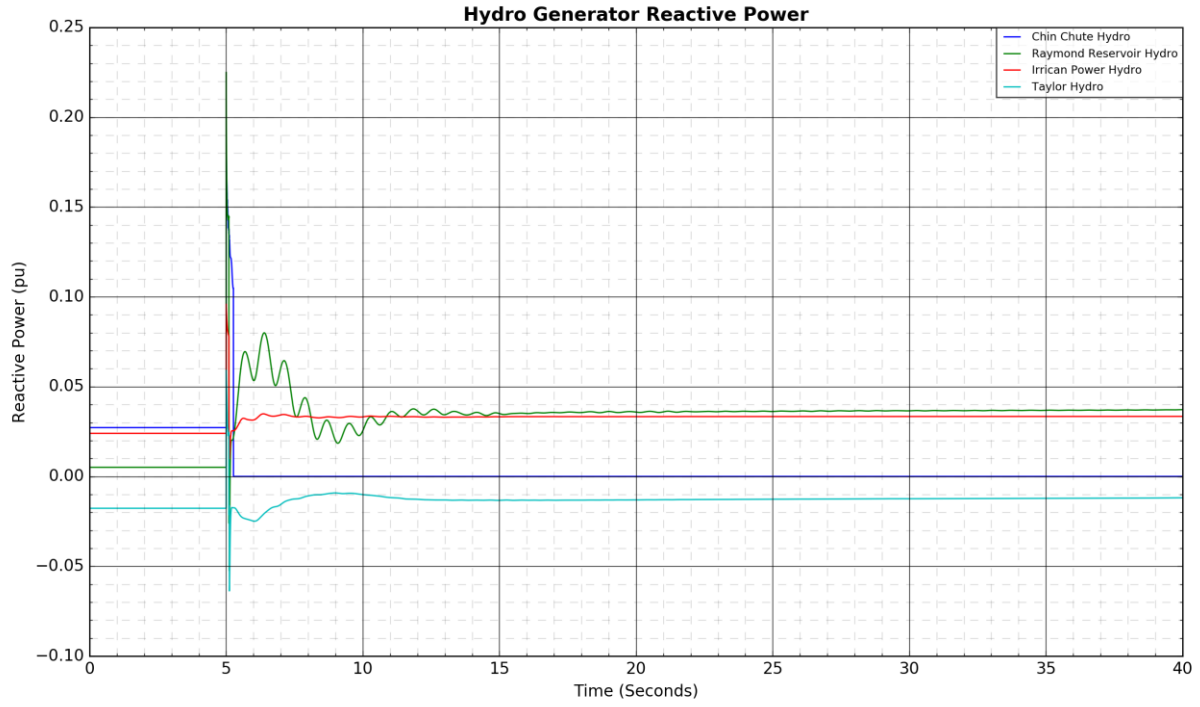
Figure A4-44: 820L Coaldale 254S to Chin Chute 315S T-Tap to Red Coat 967S T-Tap to Stirling 67S: Fault Near Stirling 67S

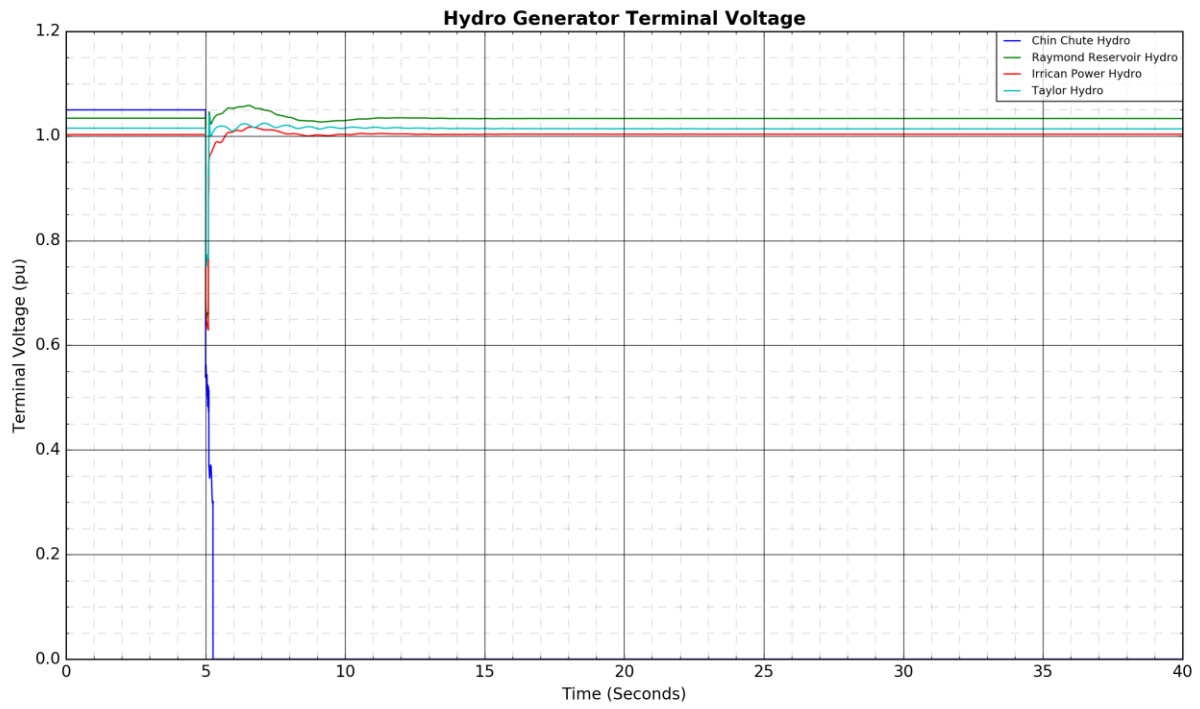
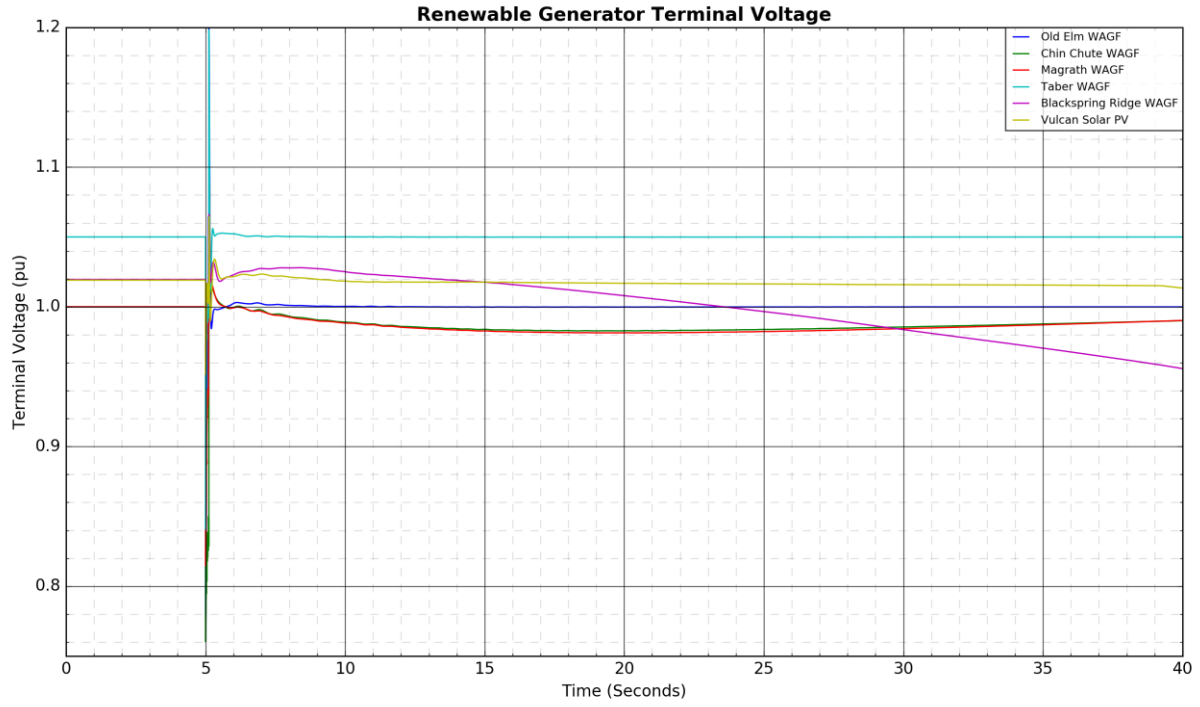


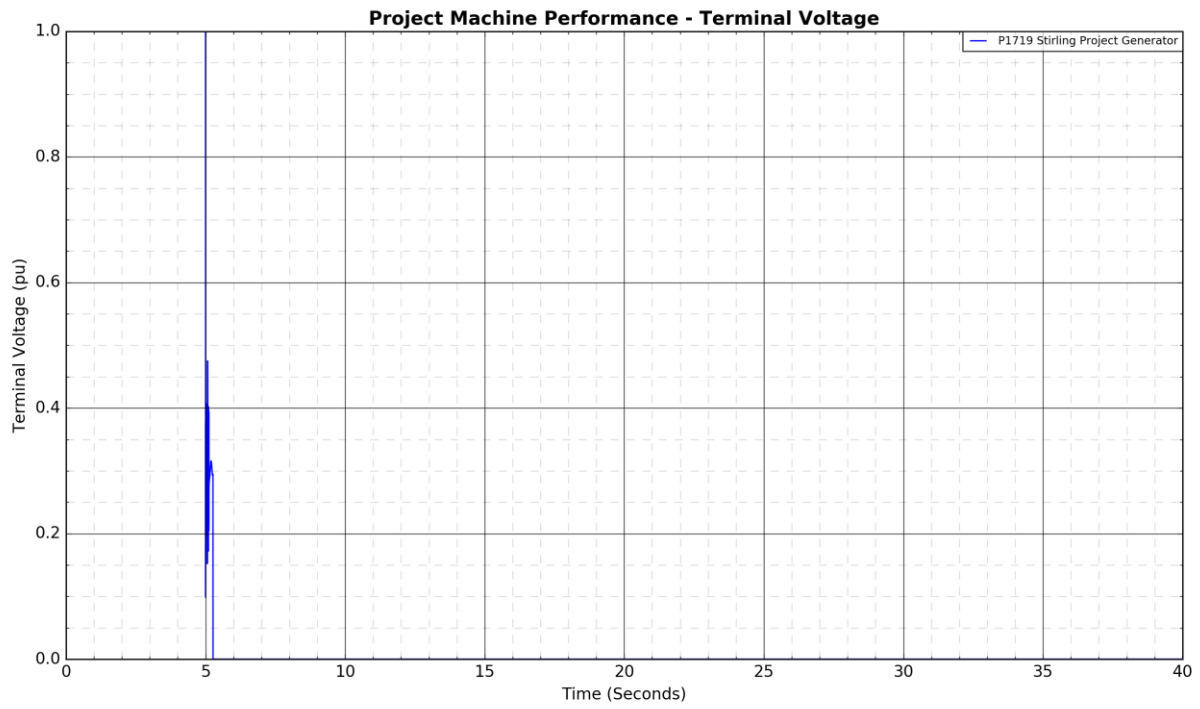
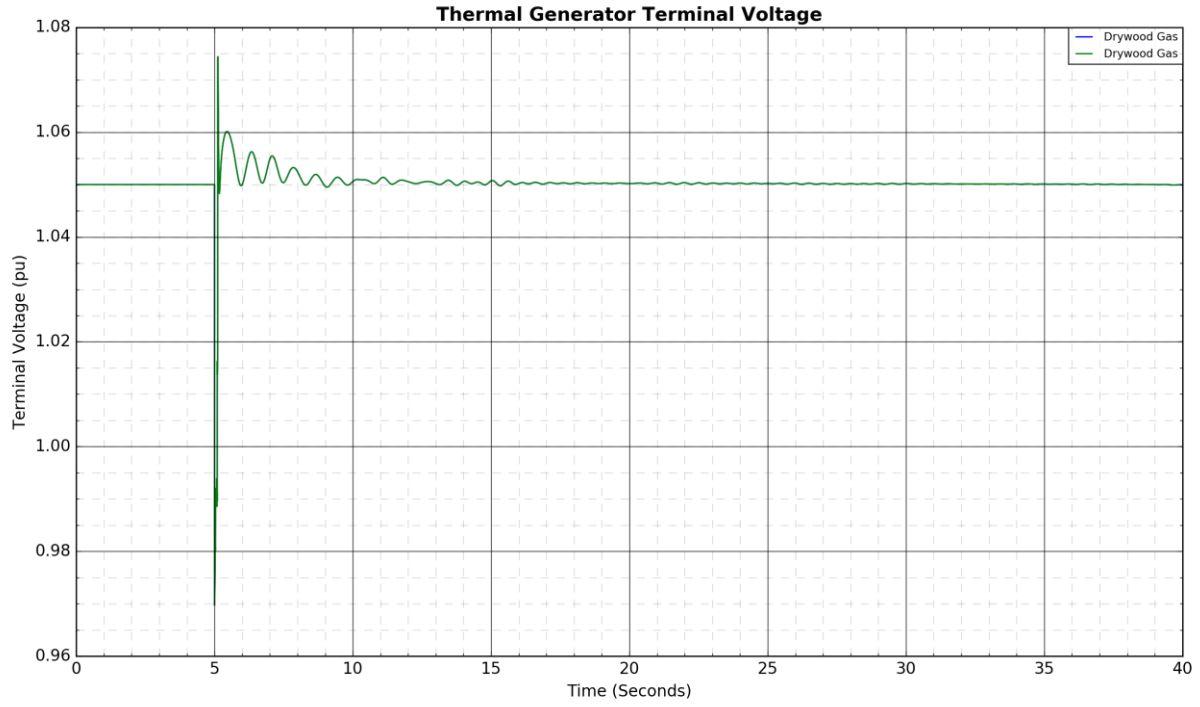


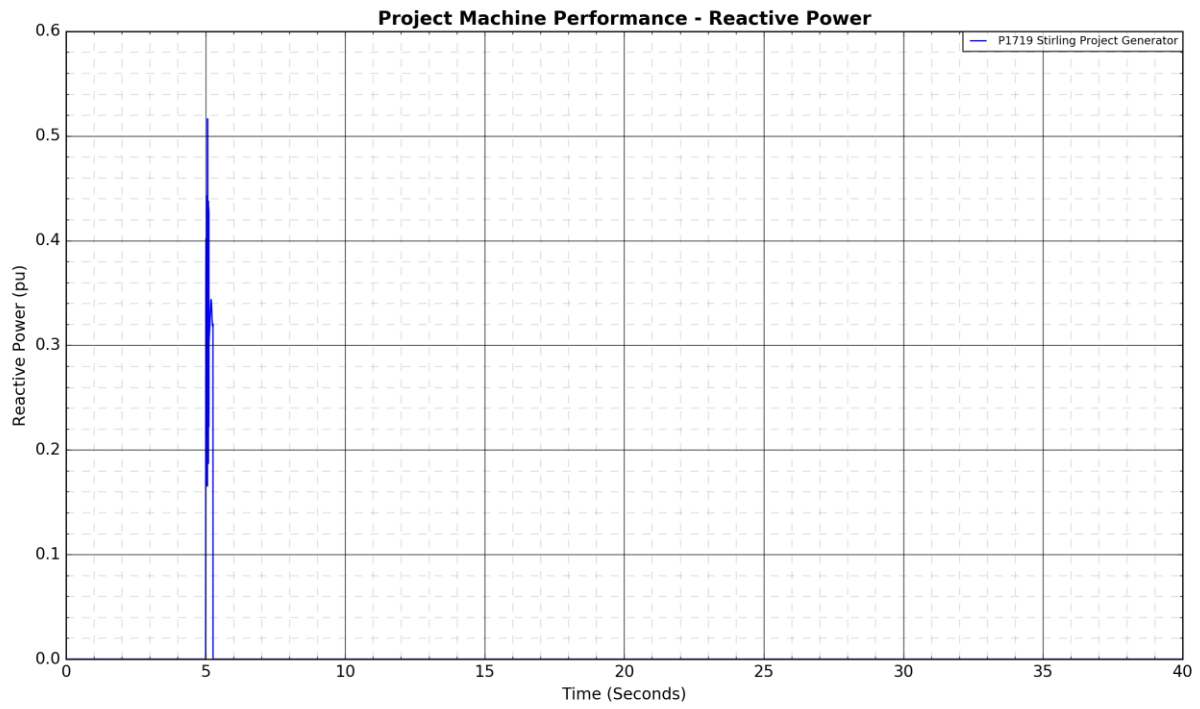
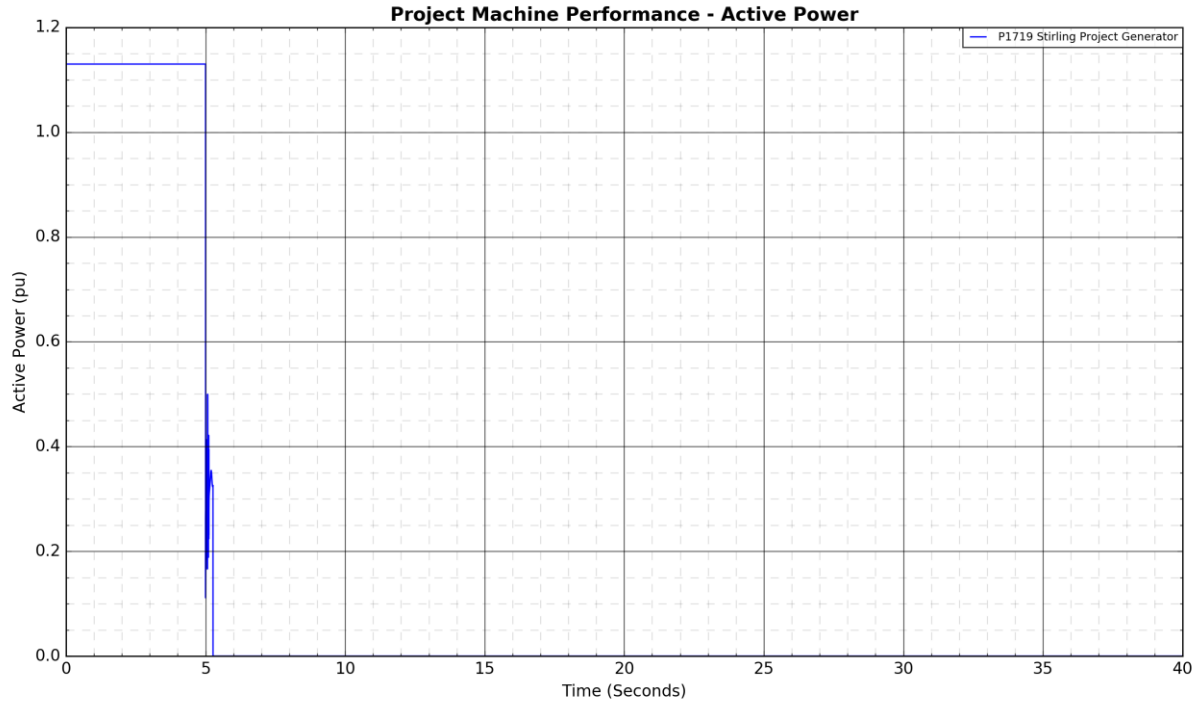






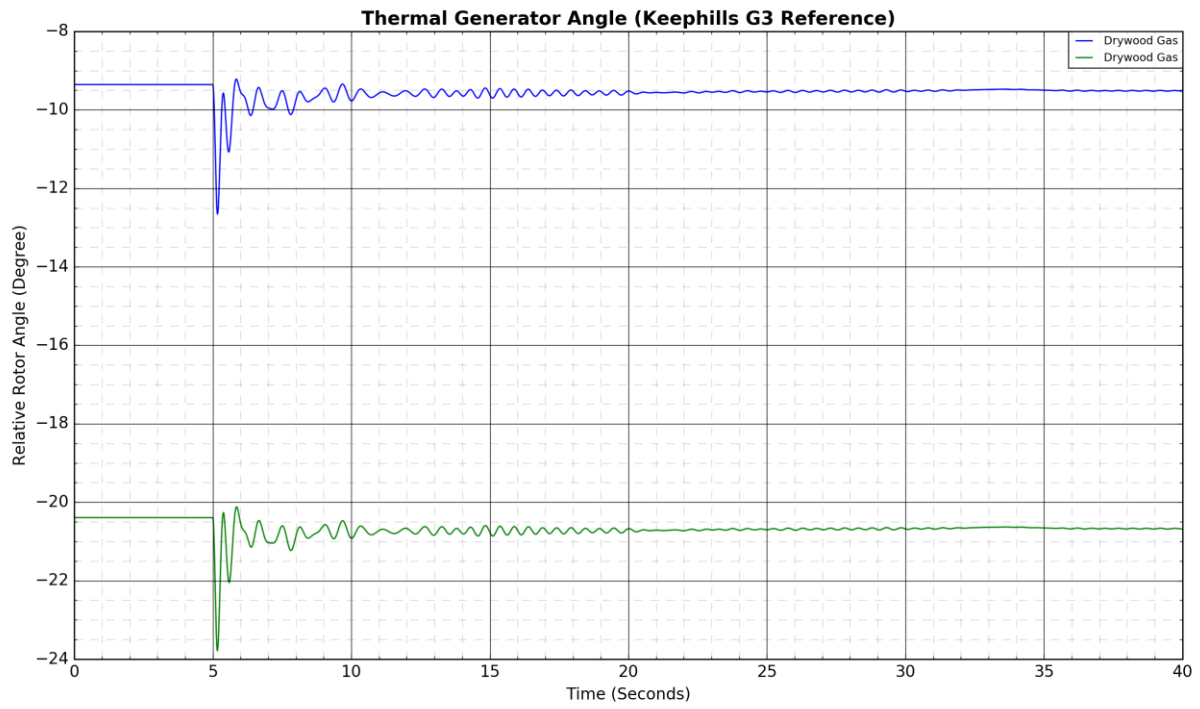
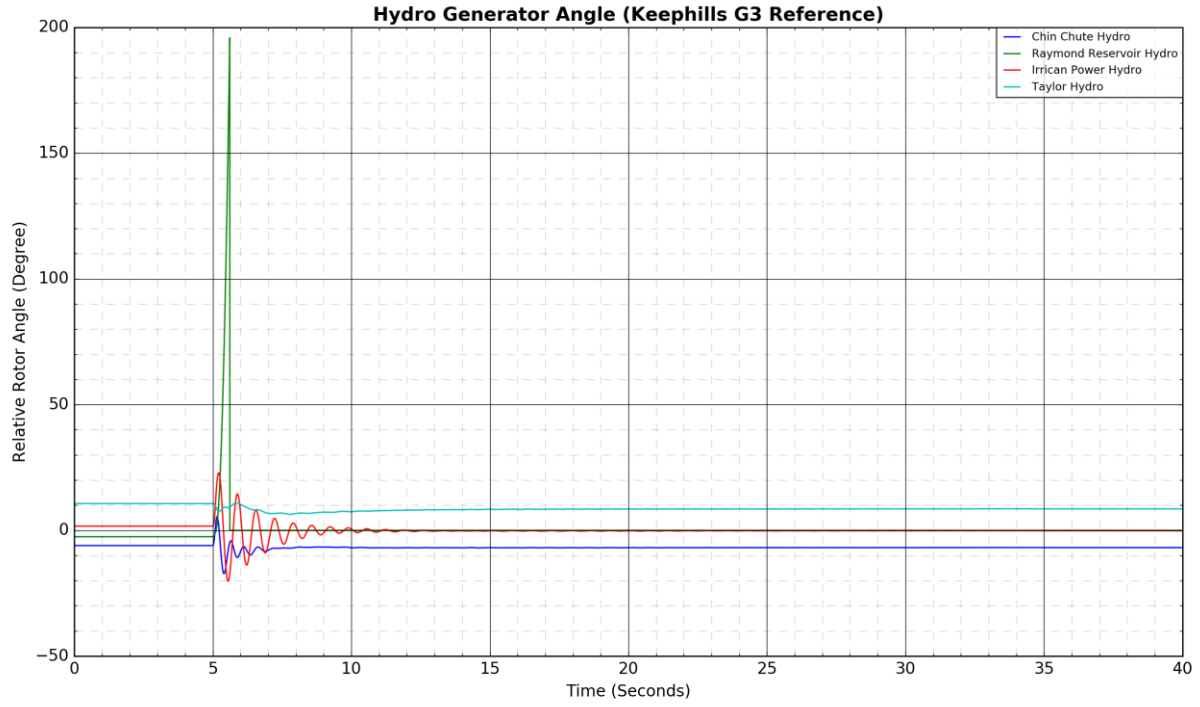


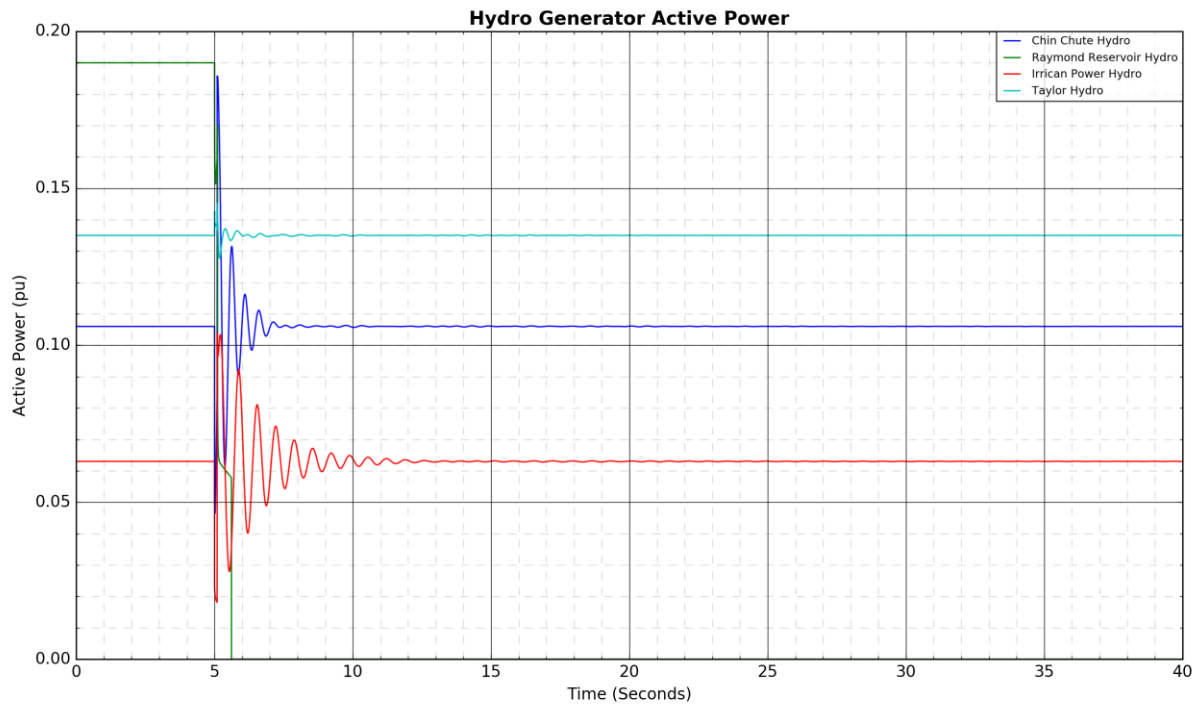
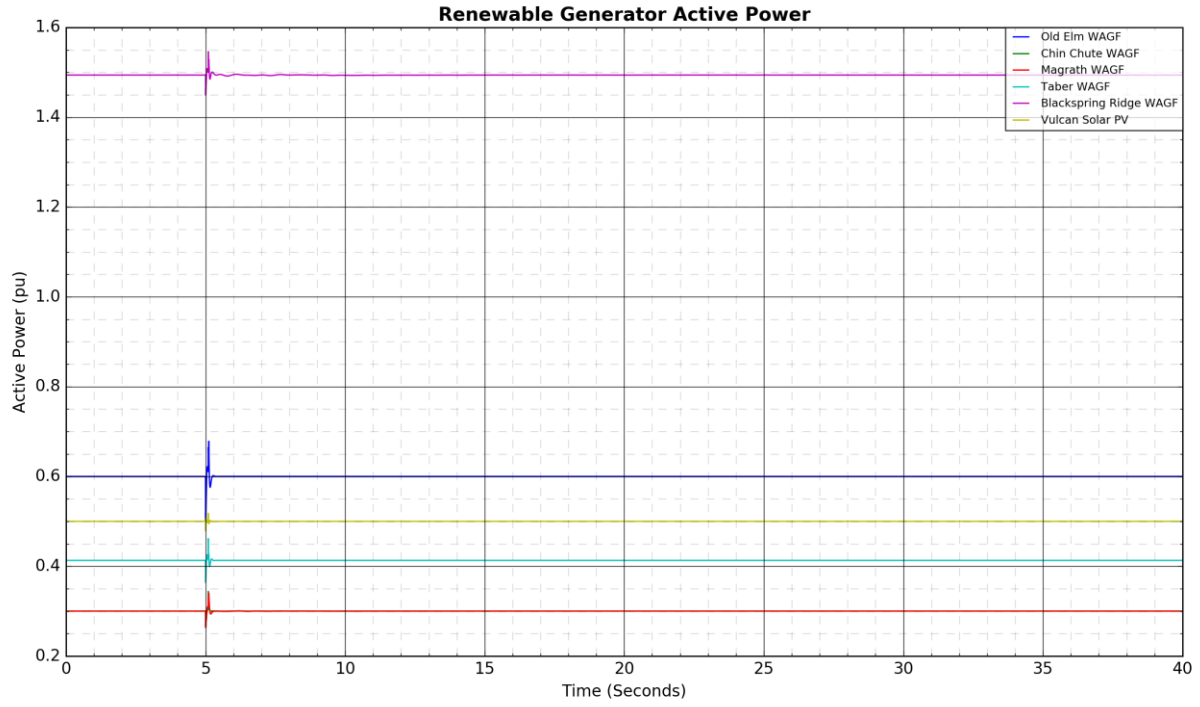




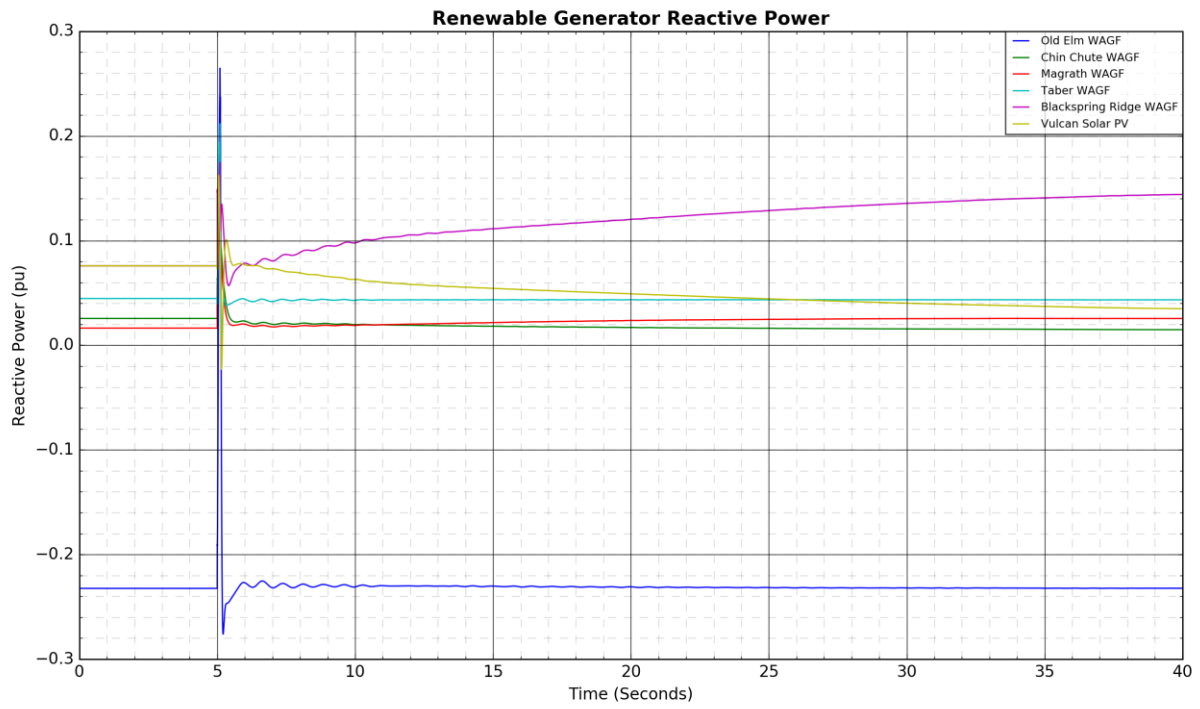
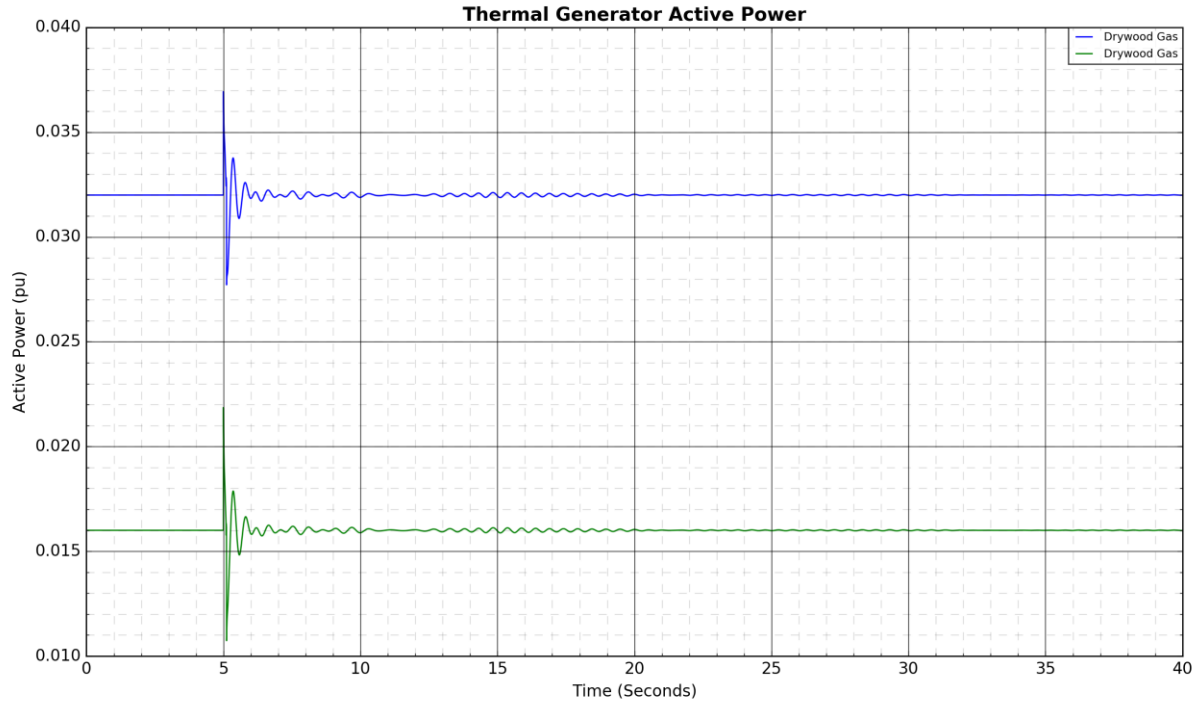
**Figure A4-45: 225L Stirling 67S to Raymond Reservoir 313S T-Tap to Magrath 225S:
Fault Near Stirling 67S**

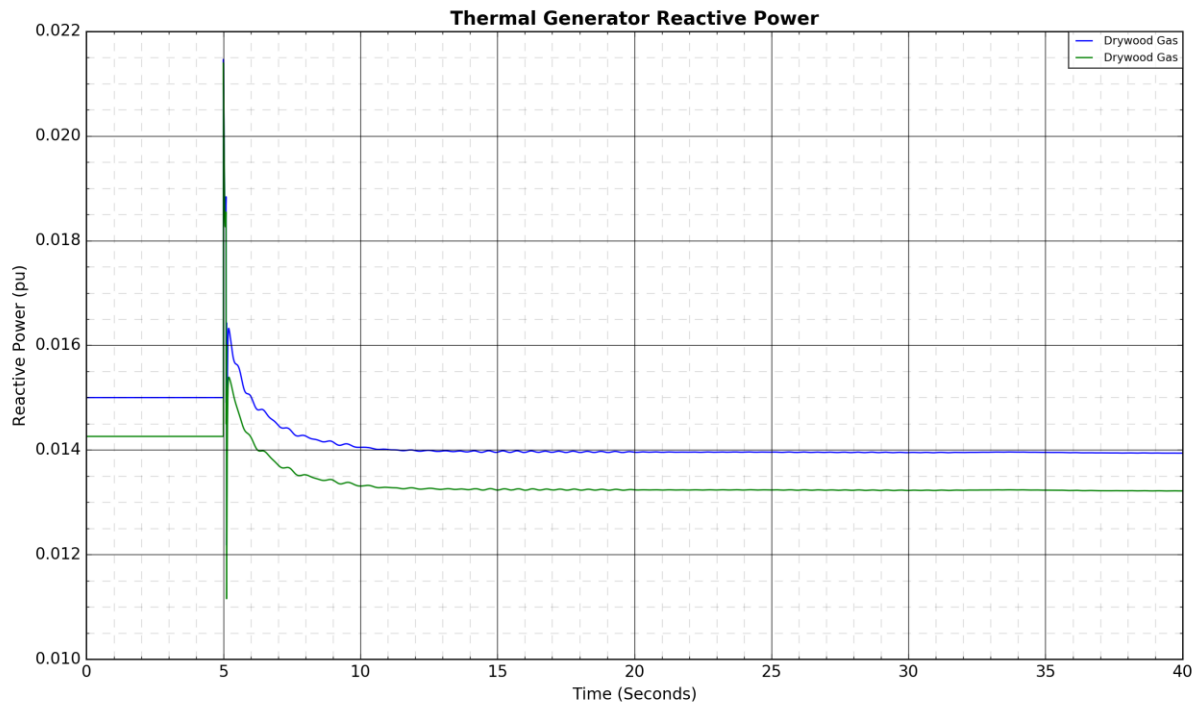
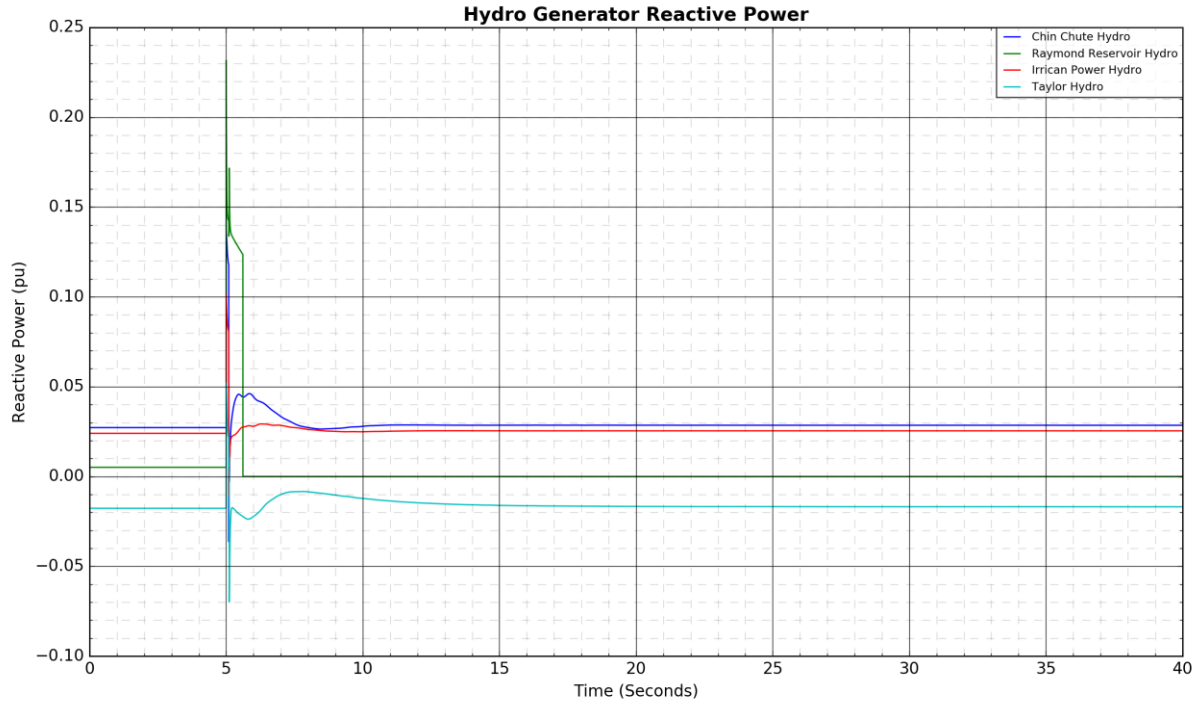


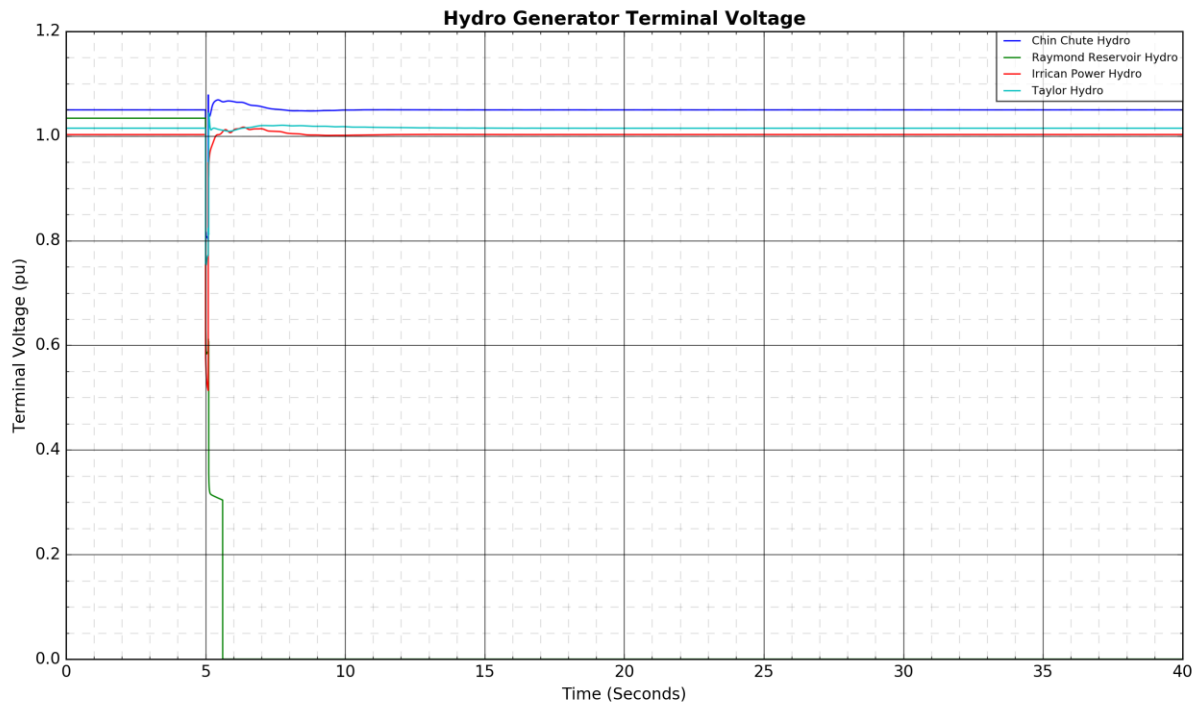
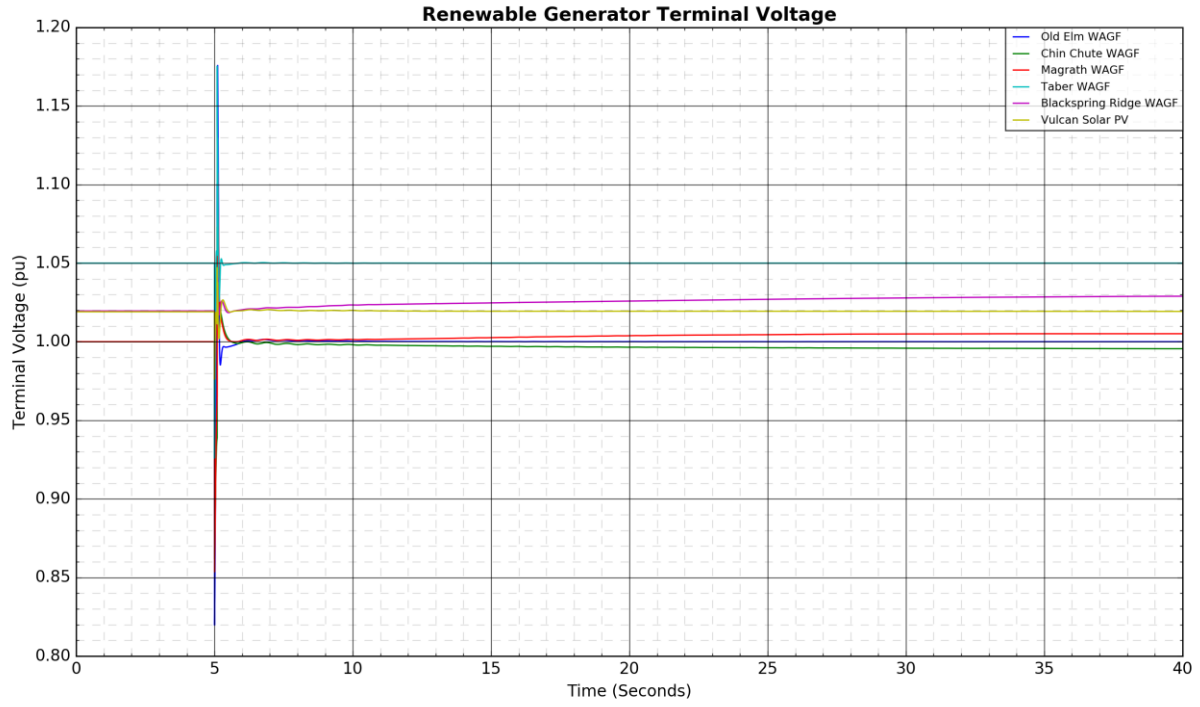


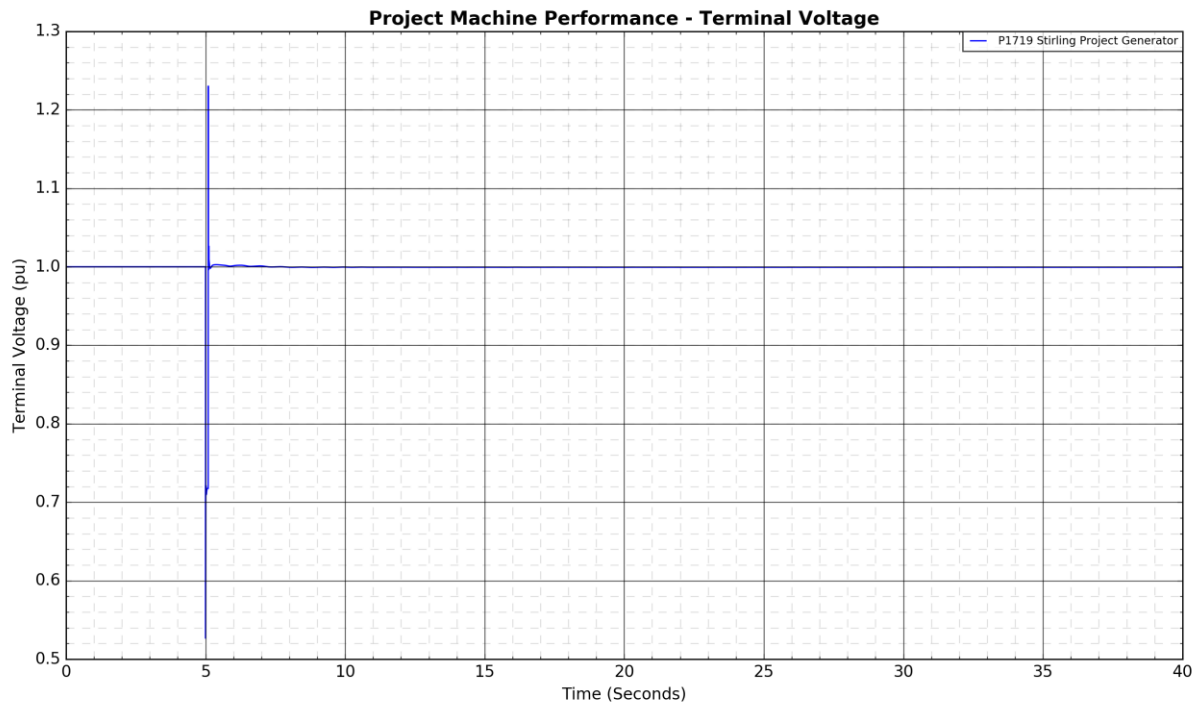
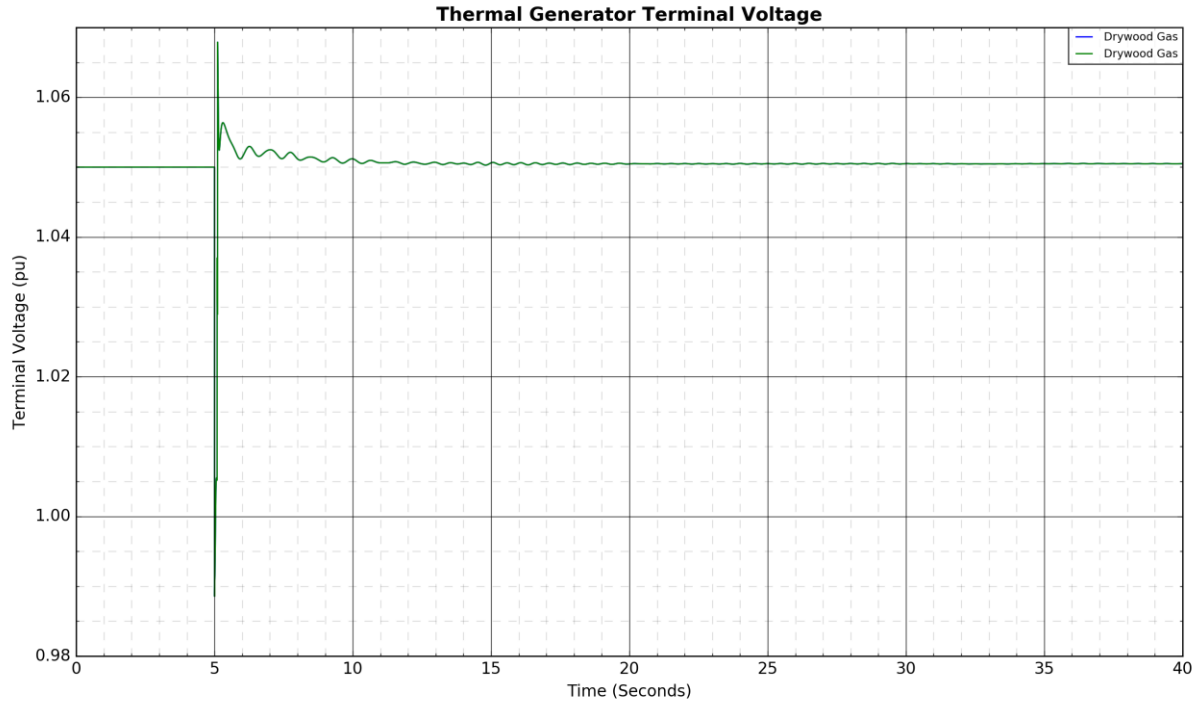


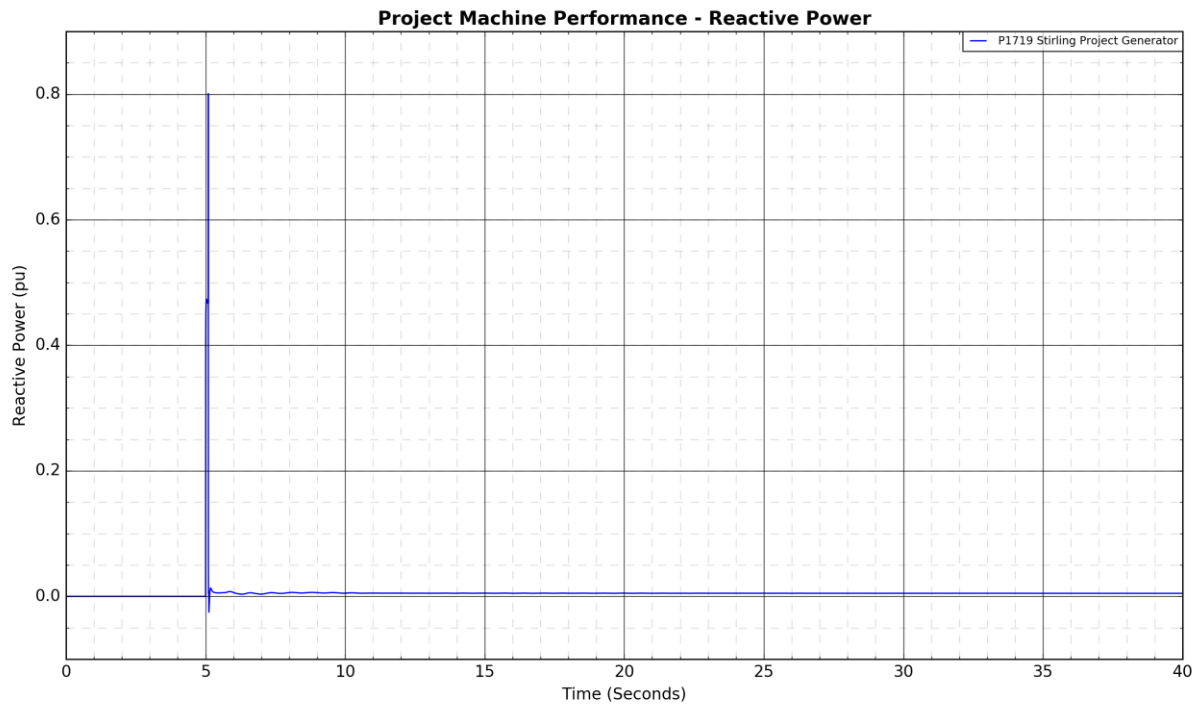
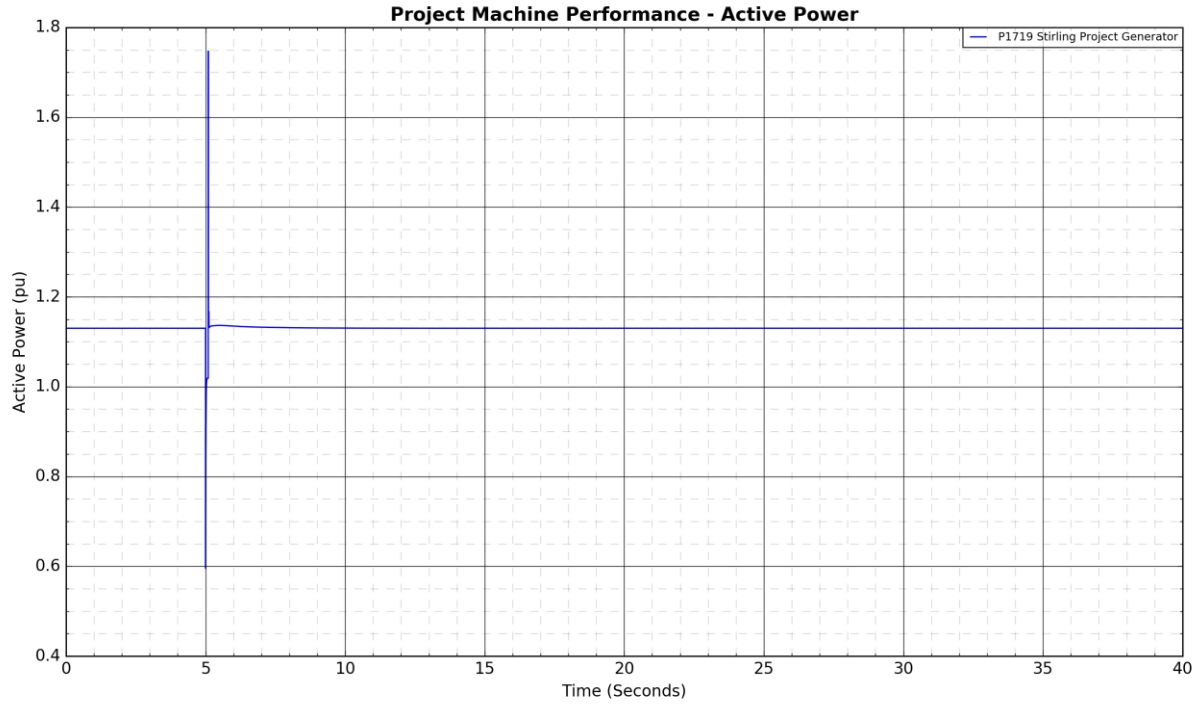
Engineering Connection Assessment Results: Stirling Wind Project Connection



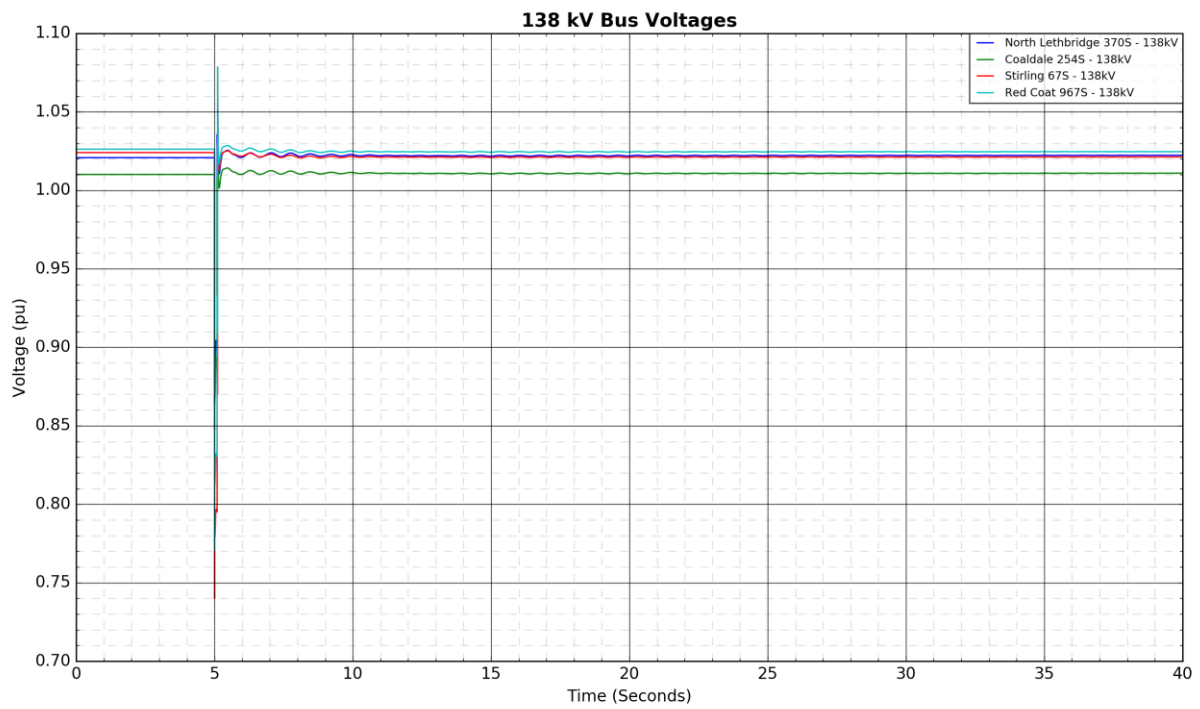
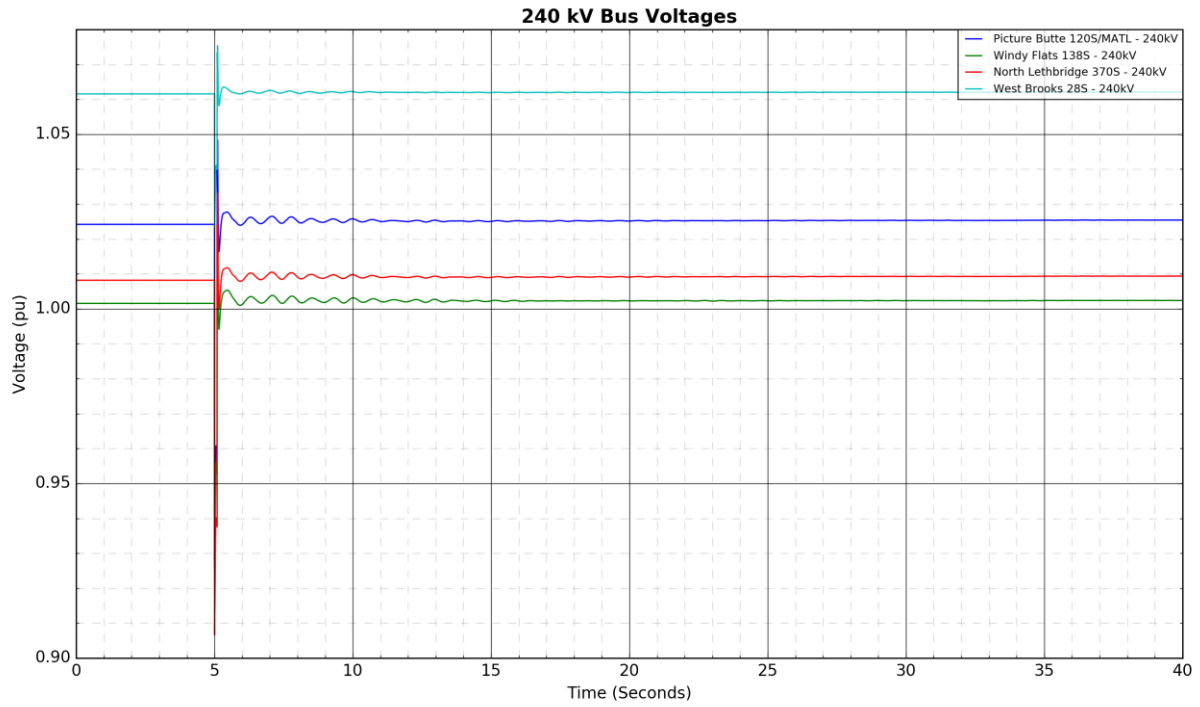


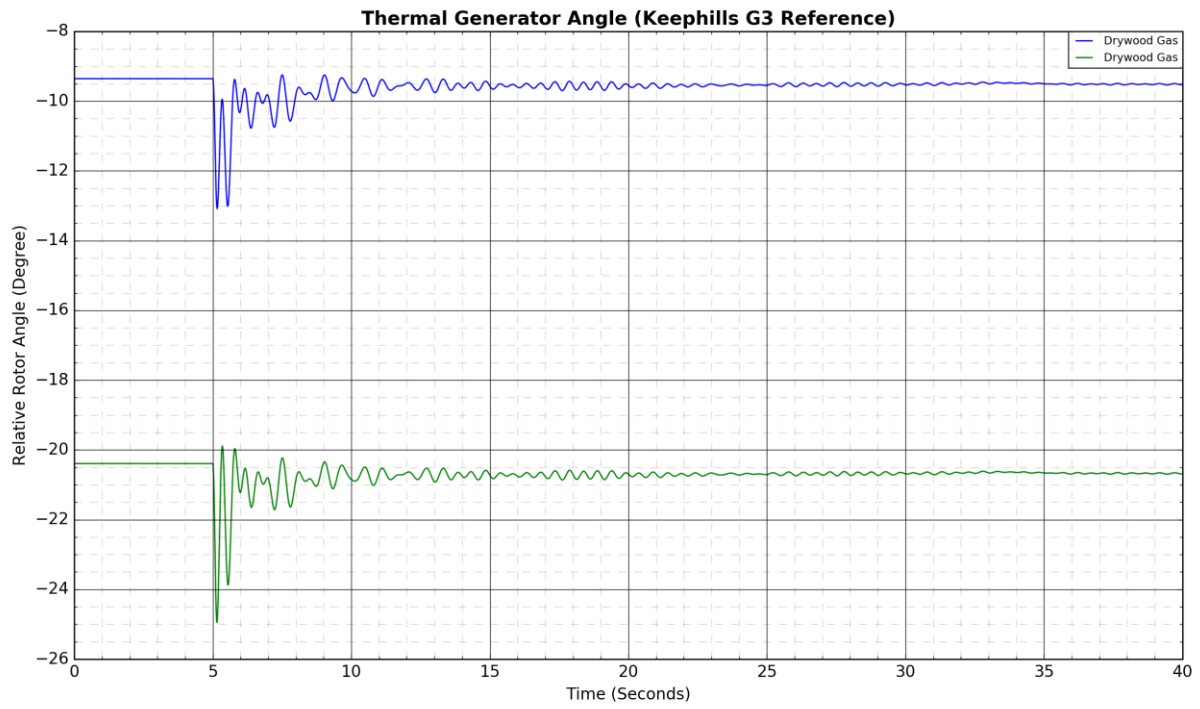
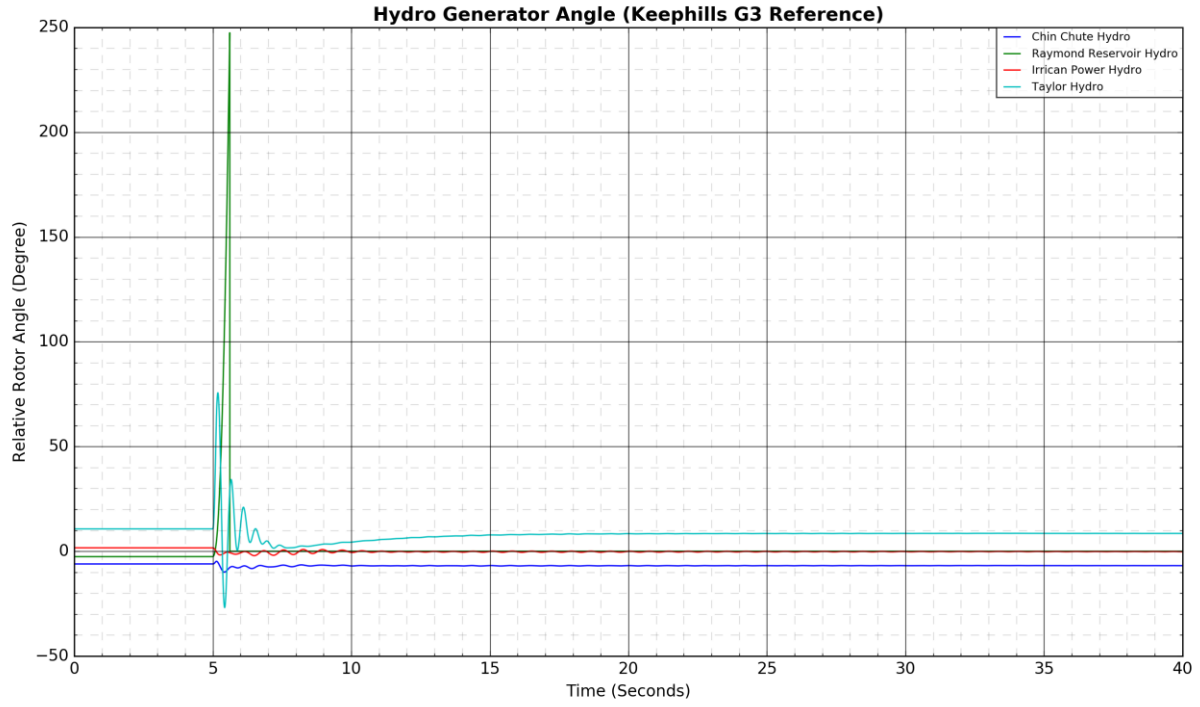


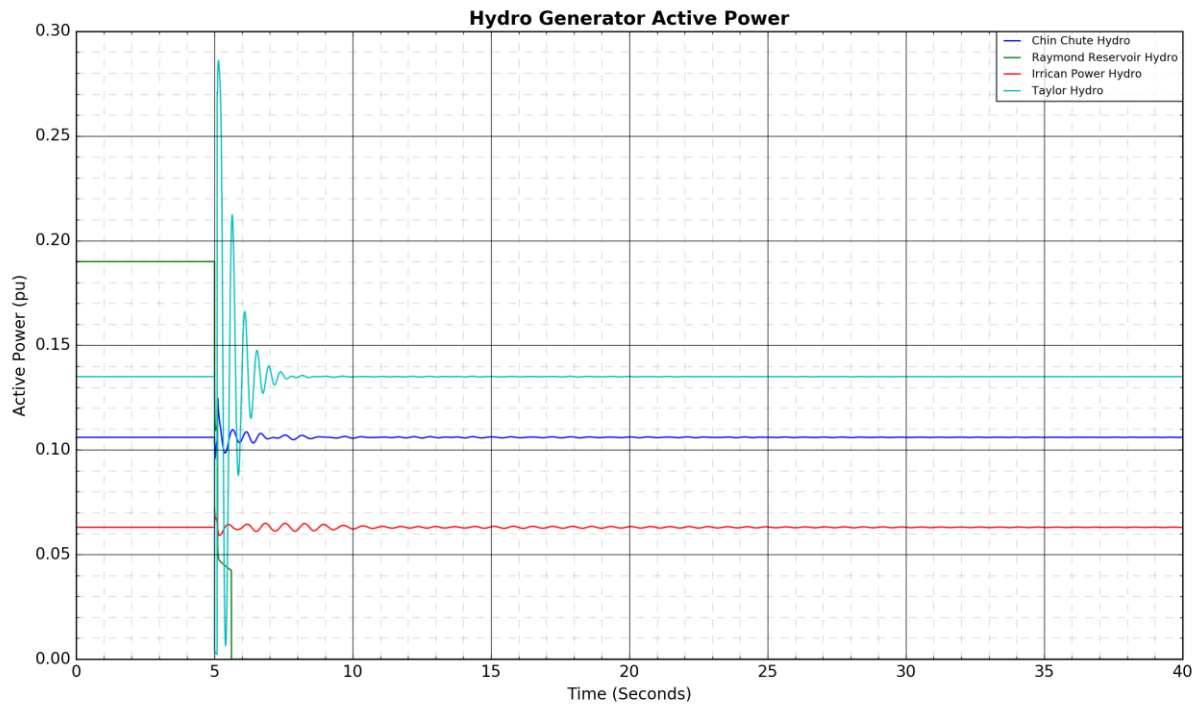
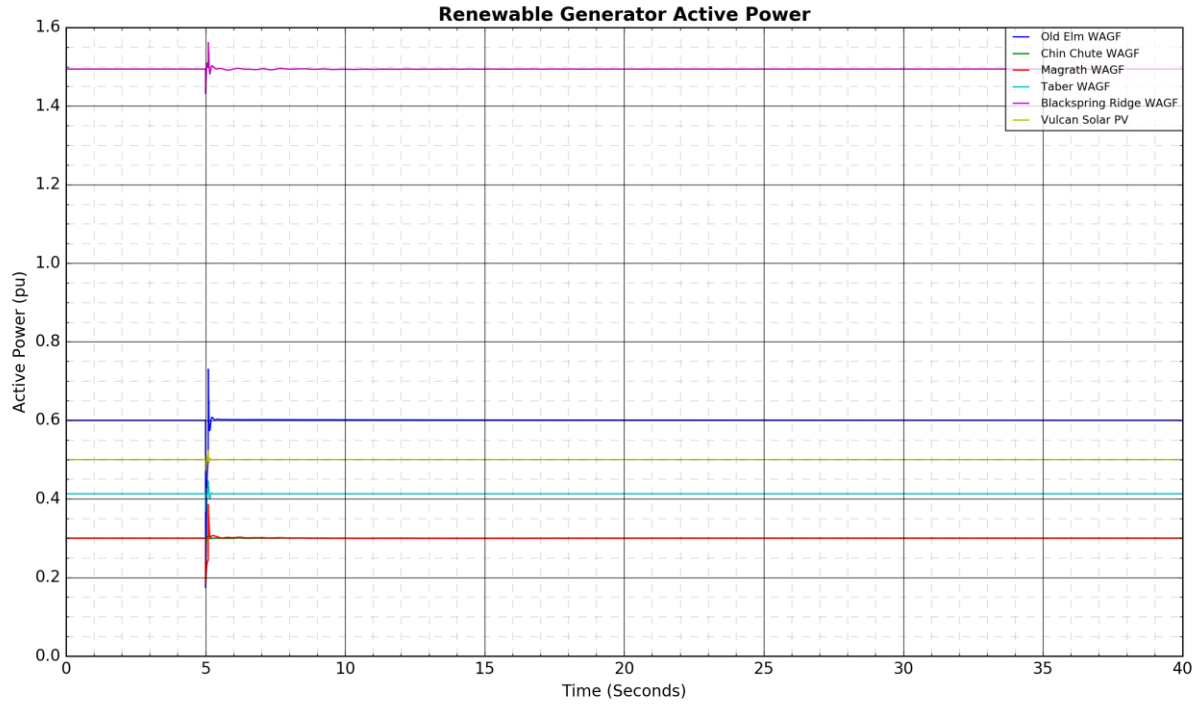


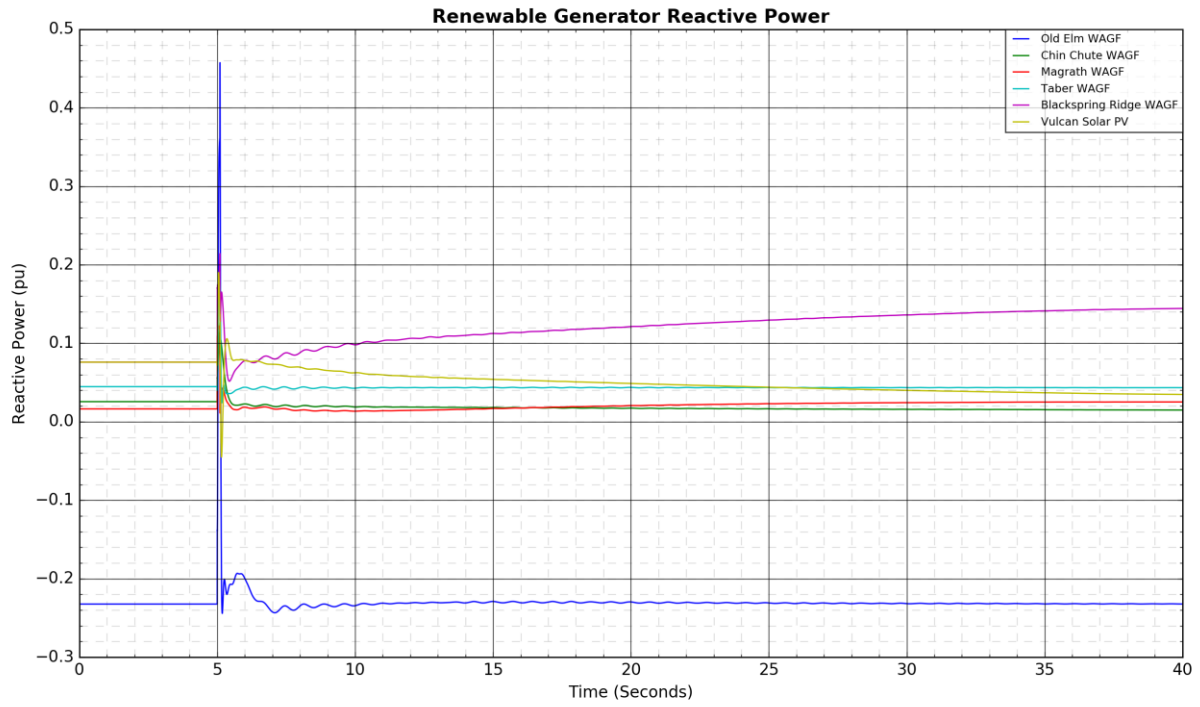
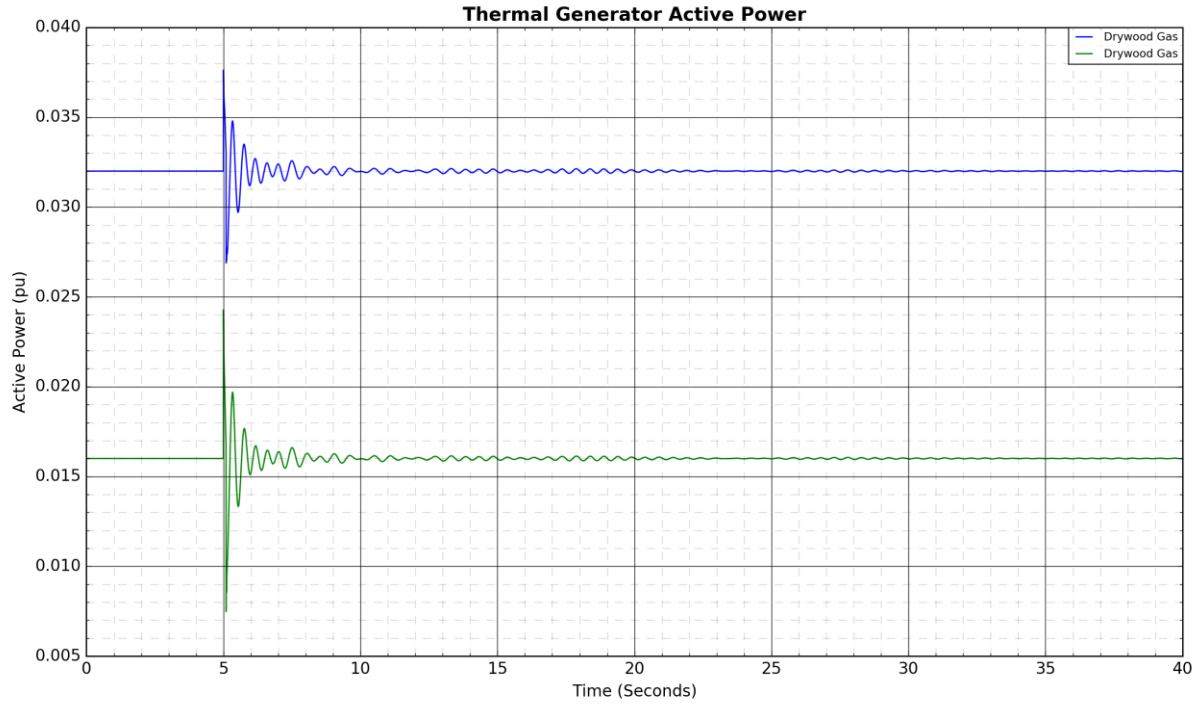


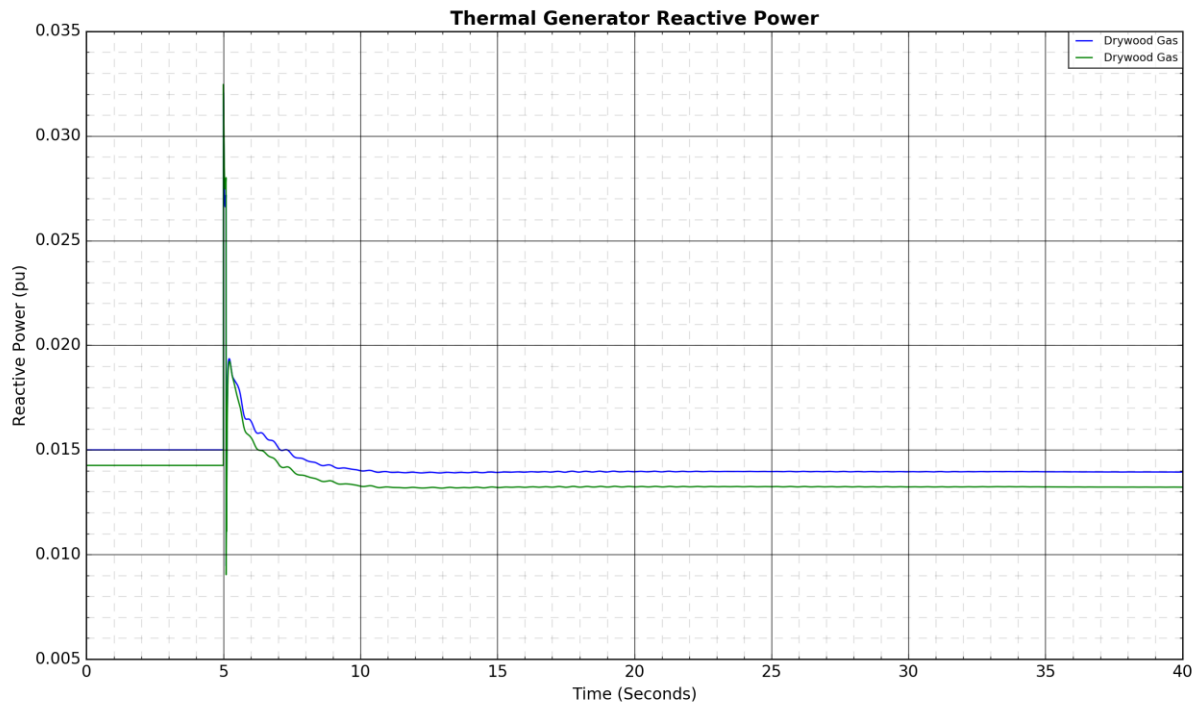
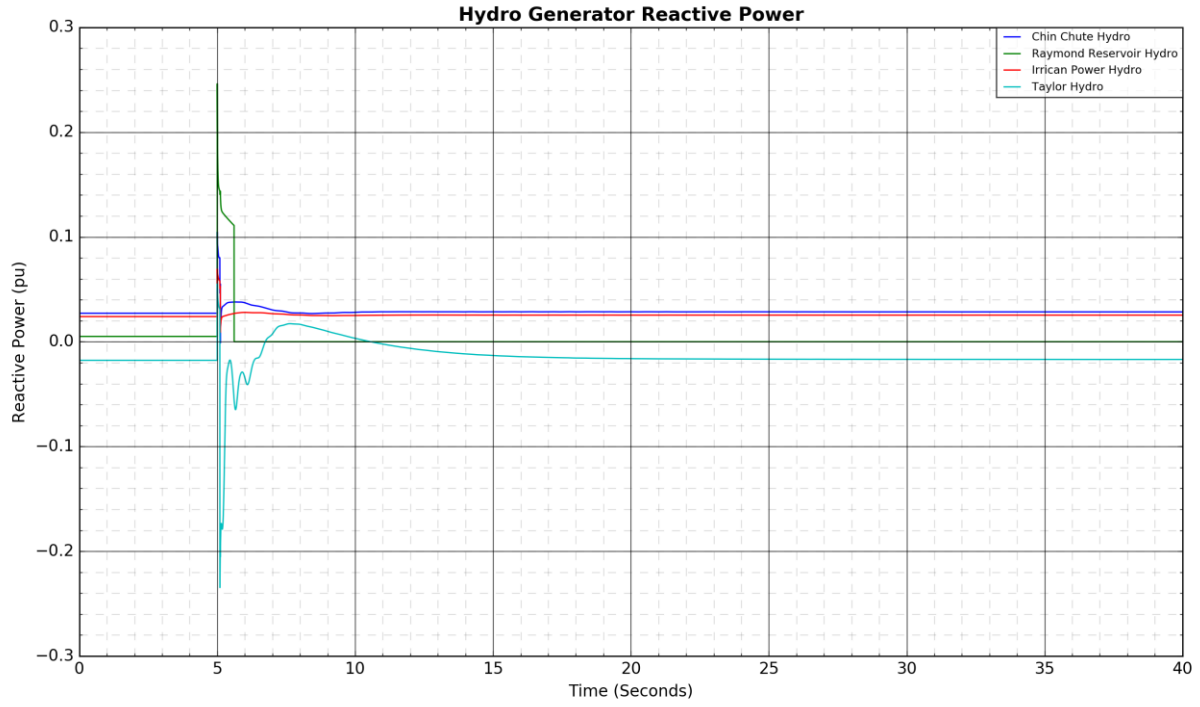
**Figure A4-46: 225L Stirling 67S to Raymond Reservoir 313S T-Tap to Magrath 225S:
Fault Near Magrath 225S**

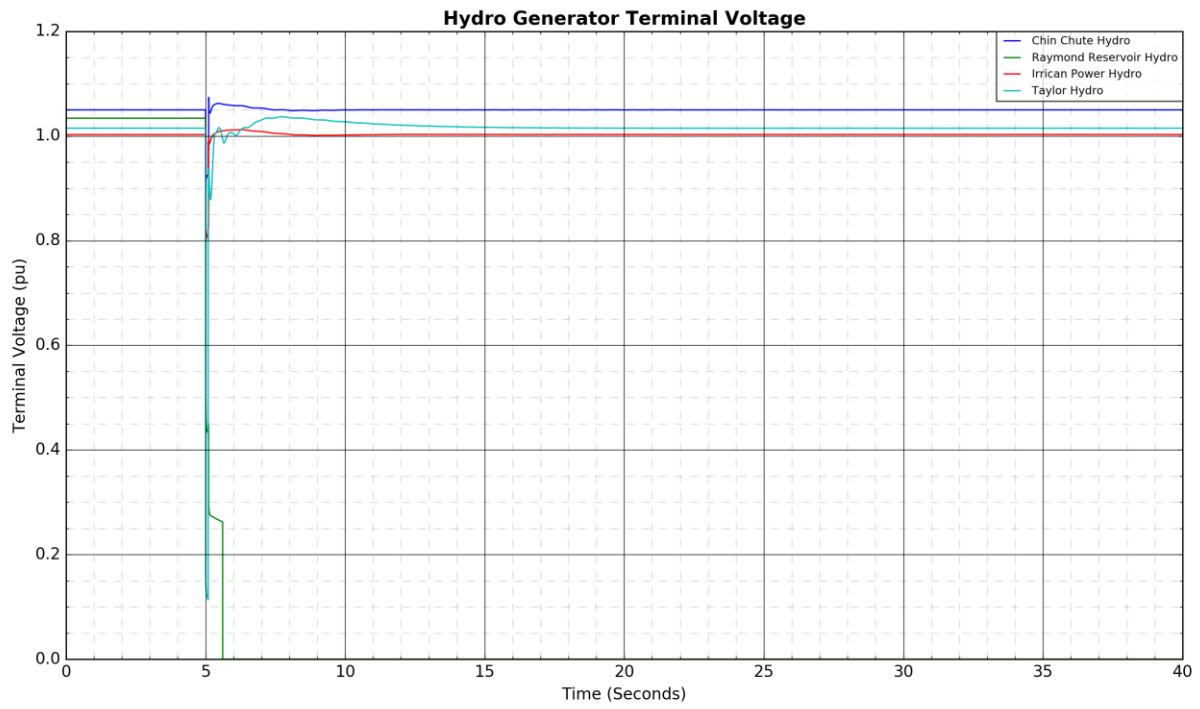
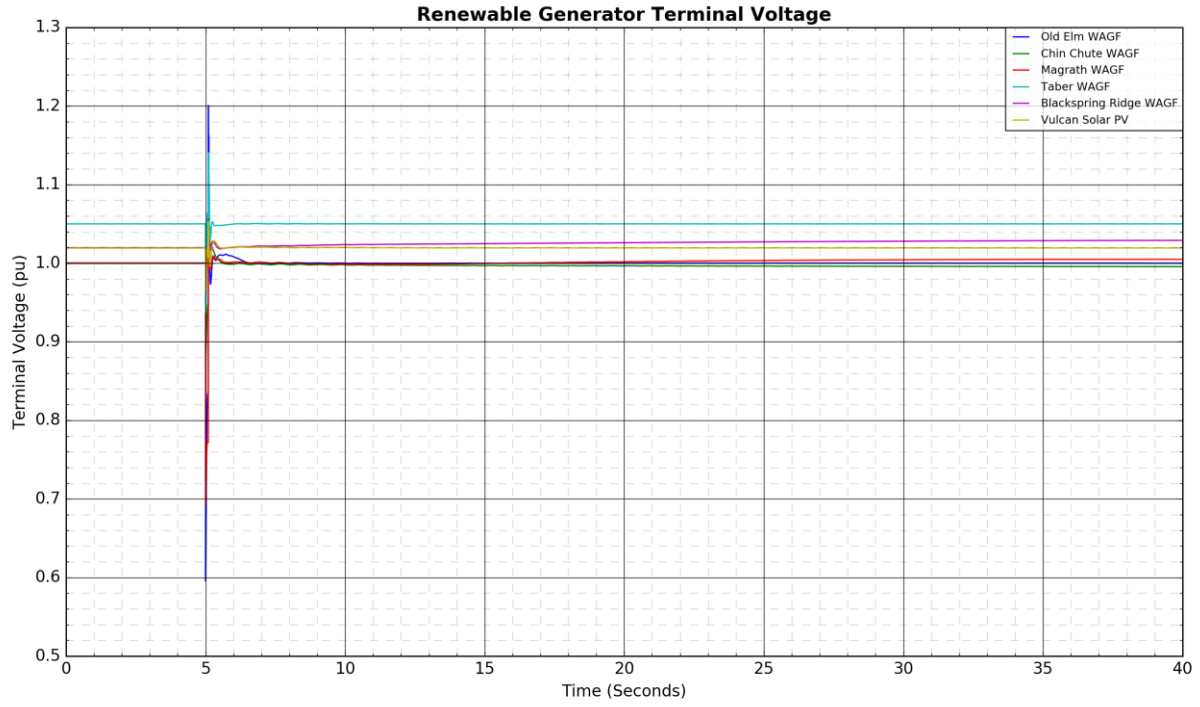


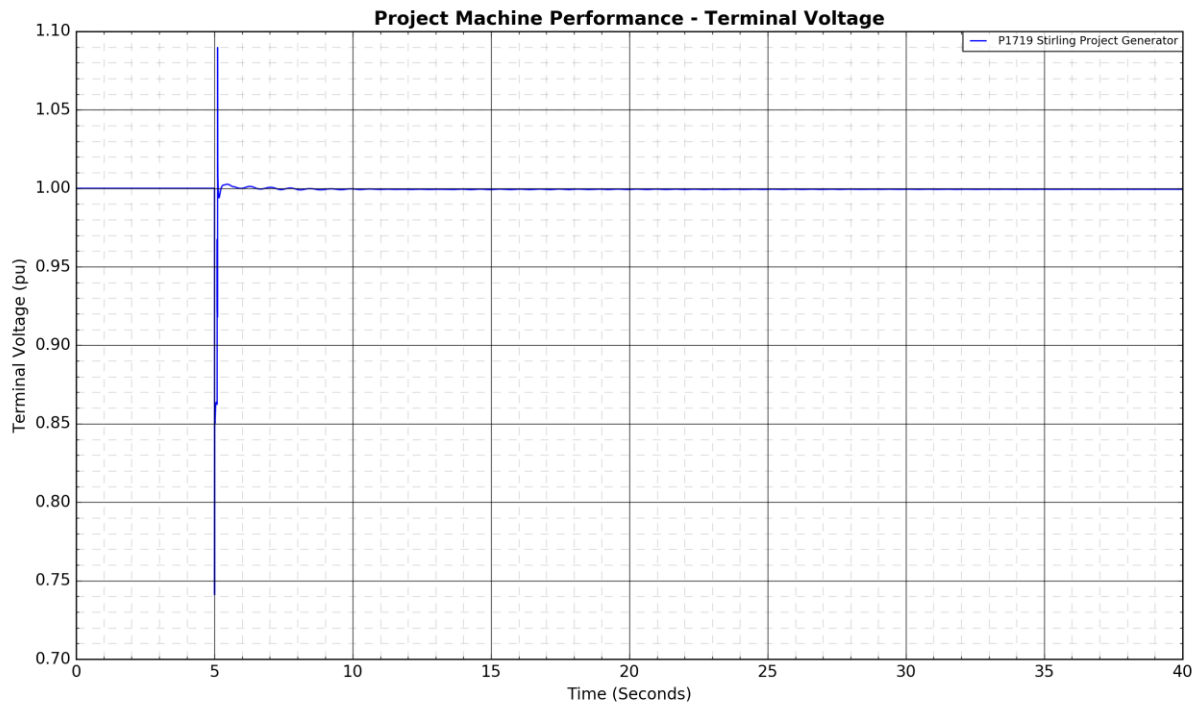
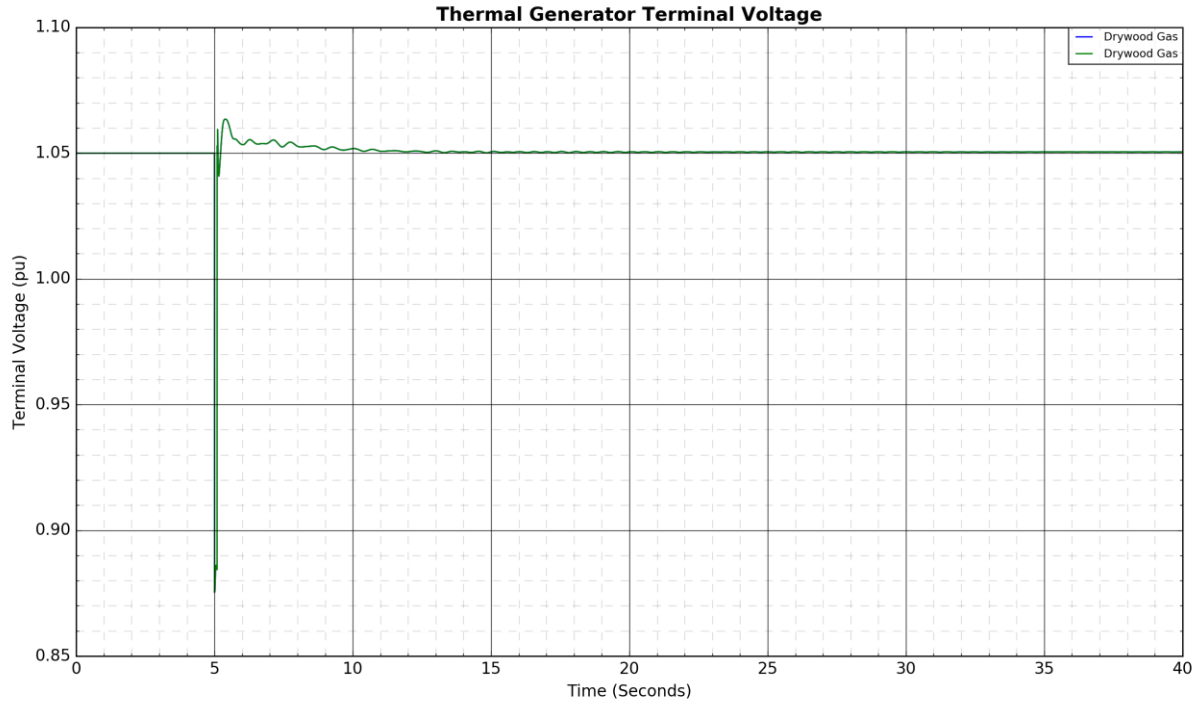












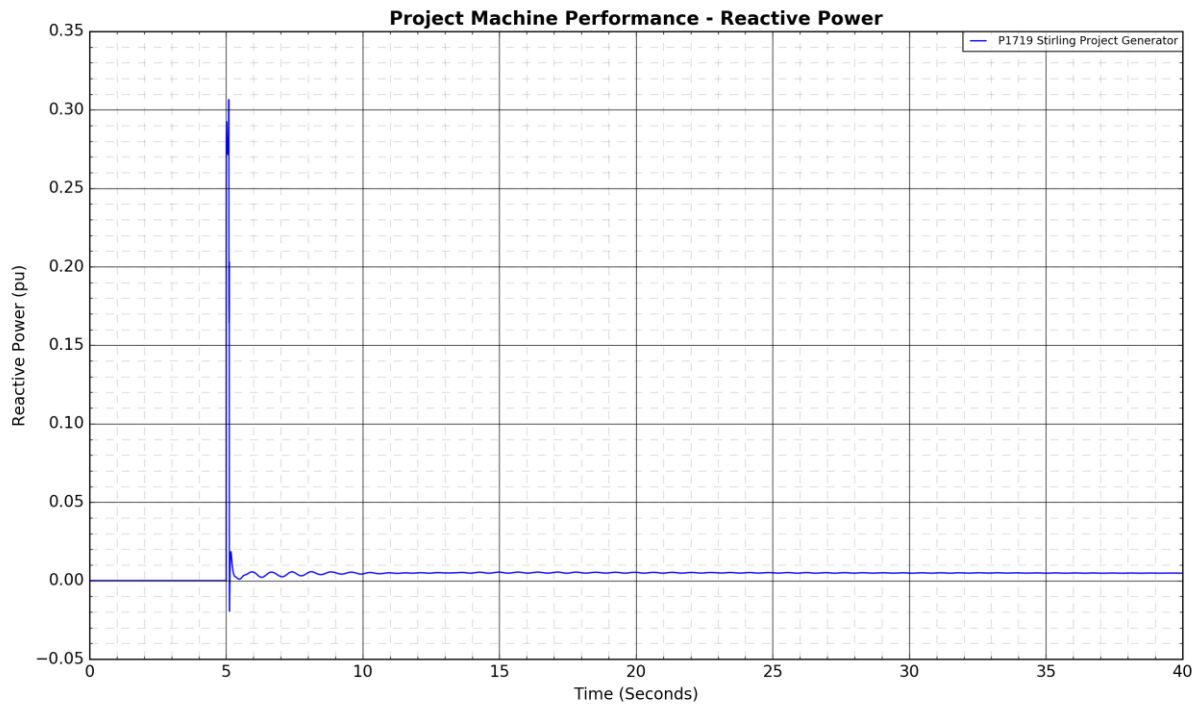
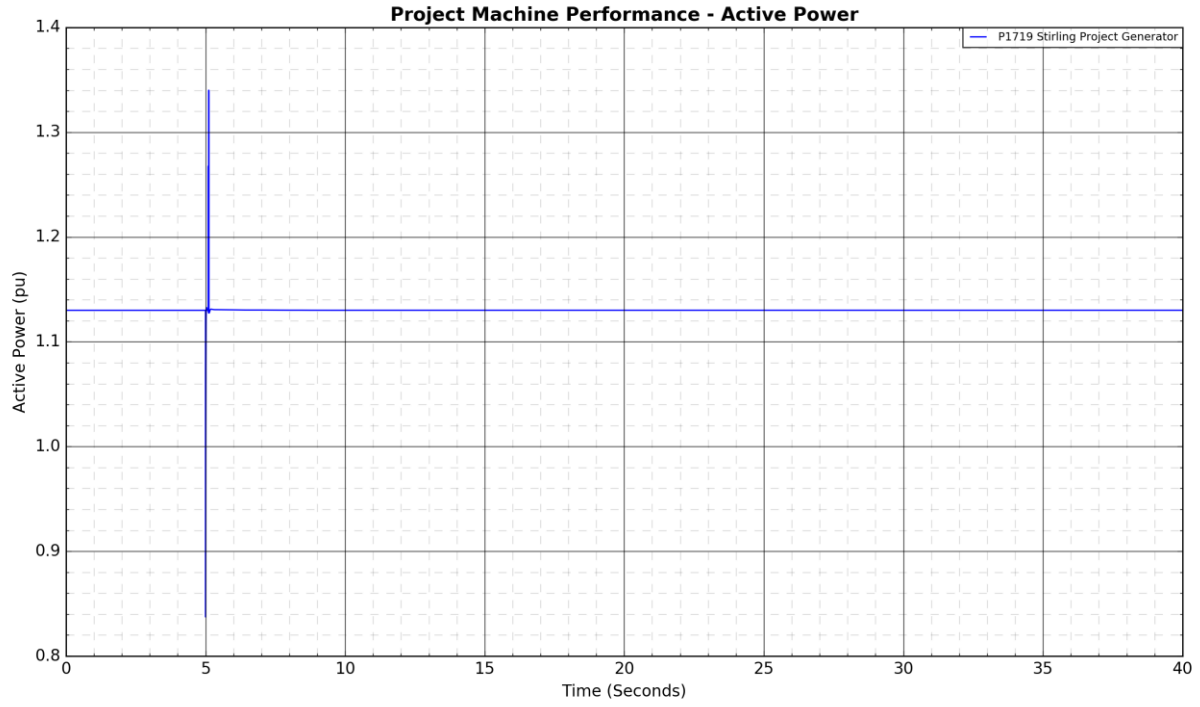
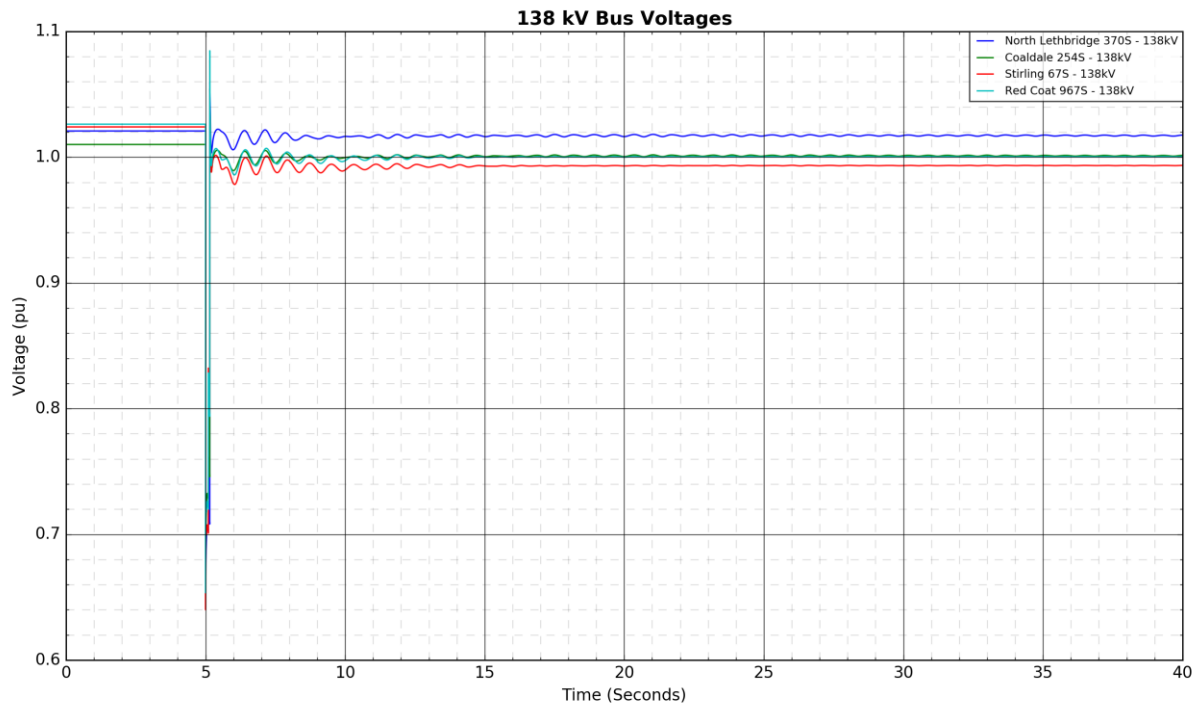
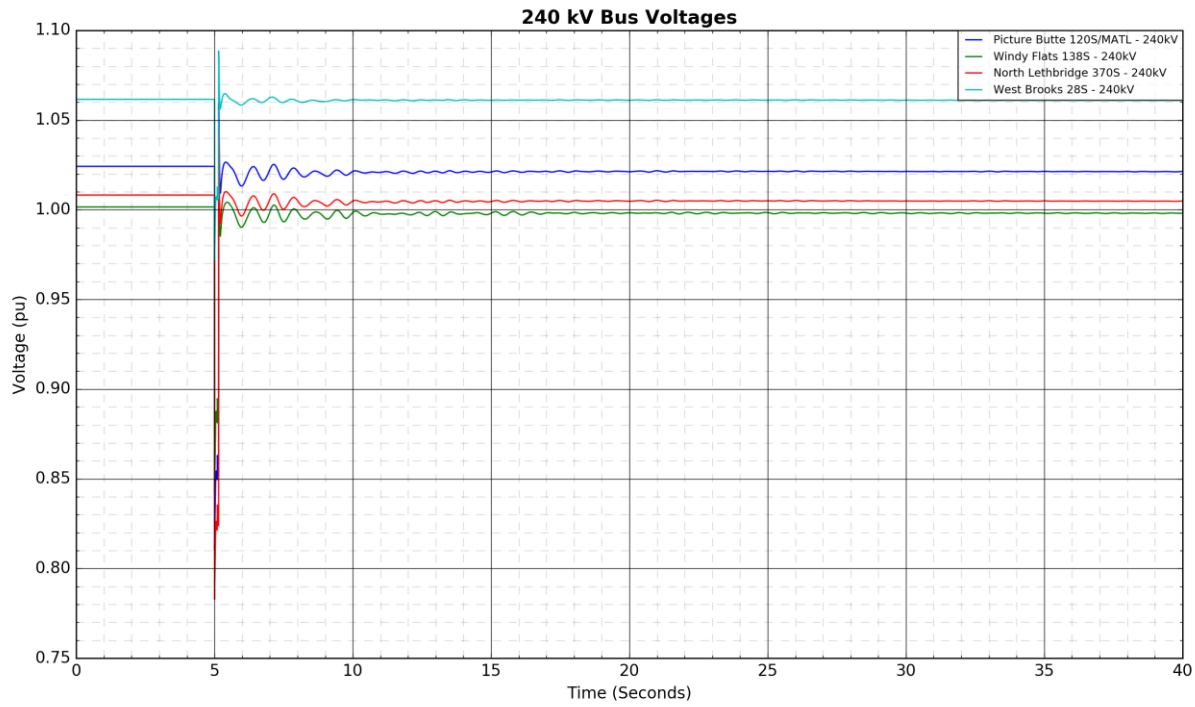
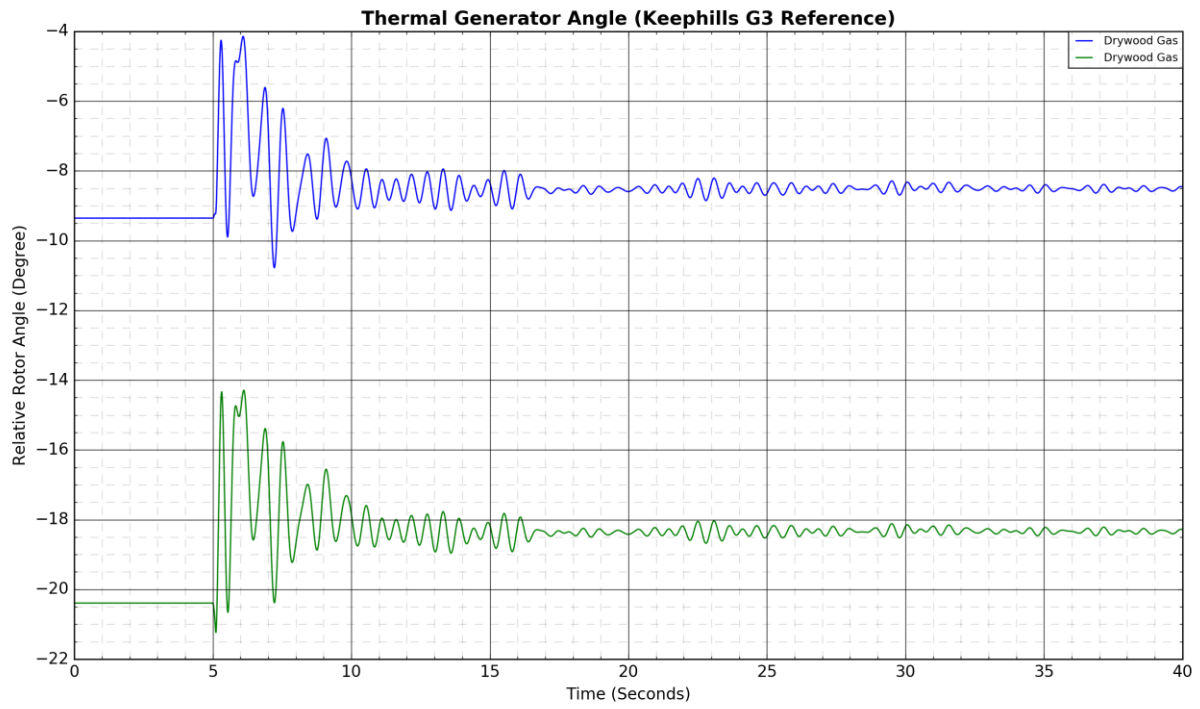
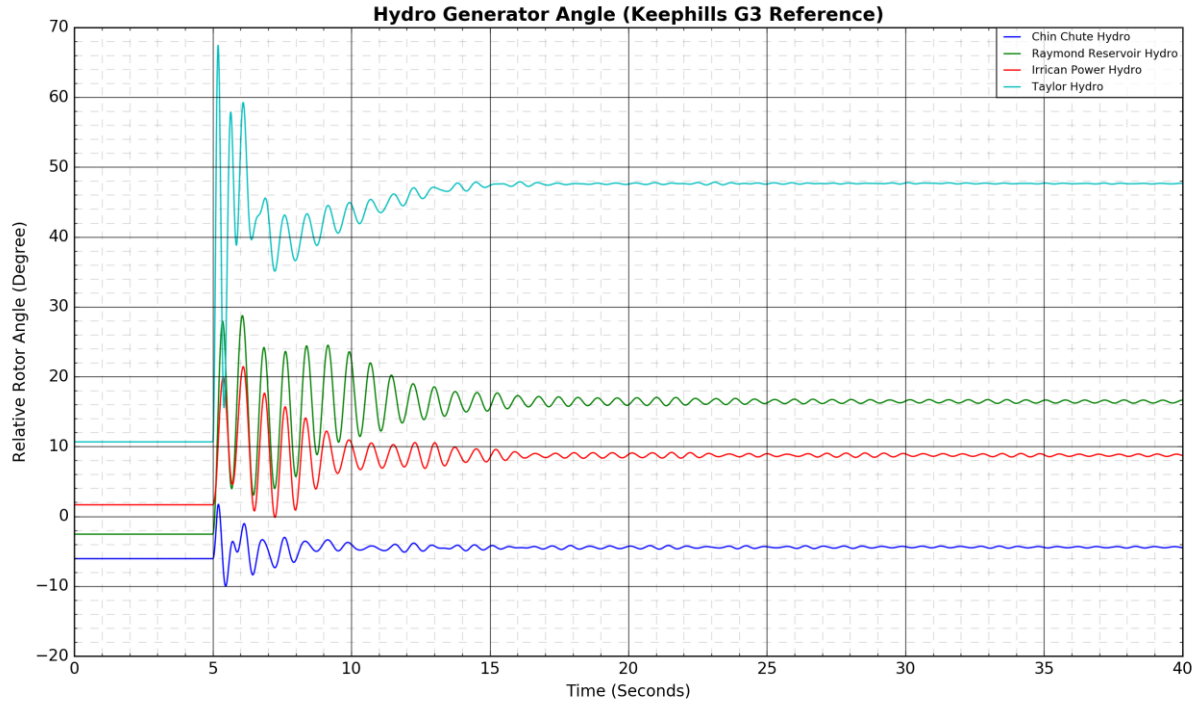
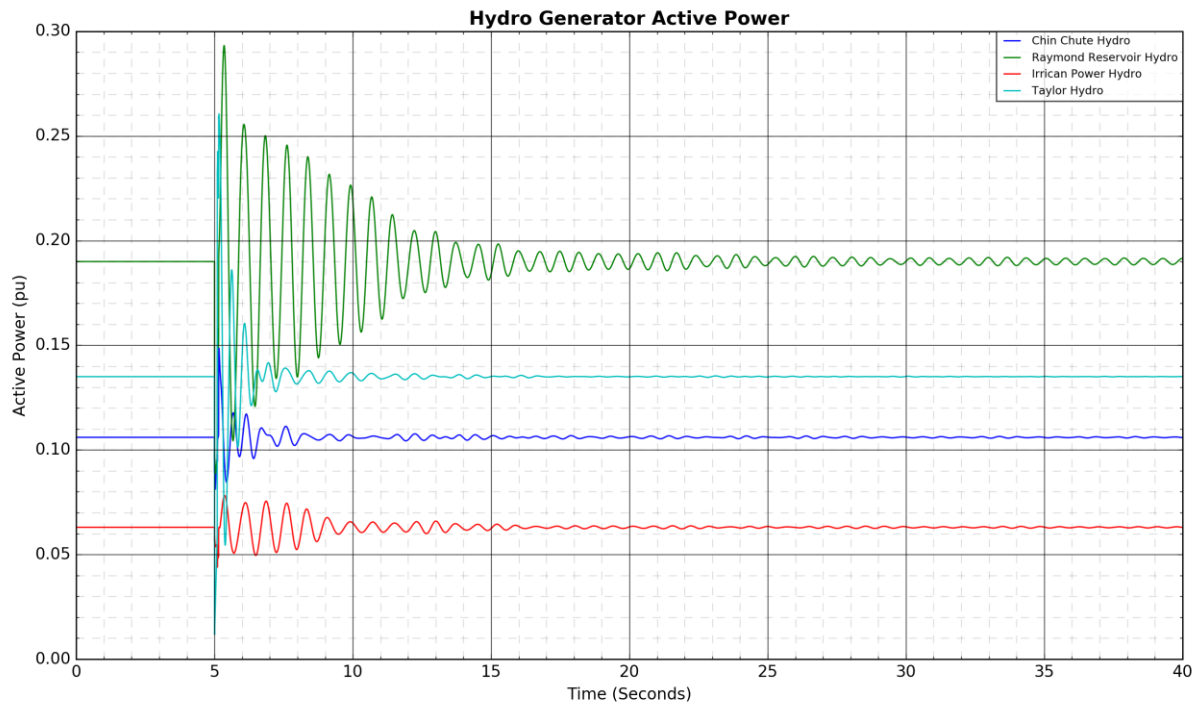
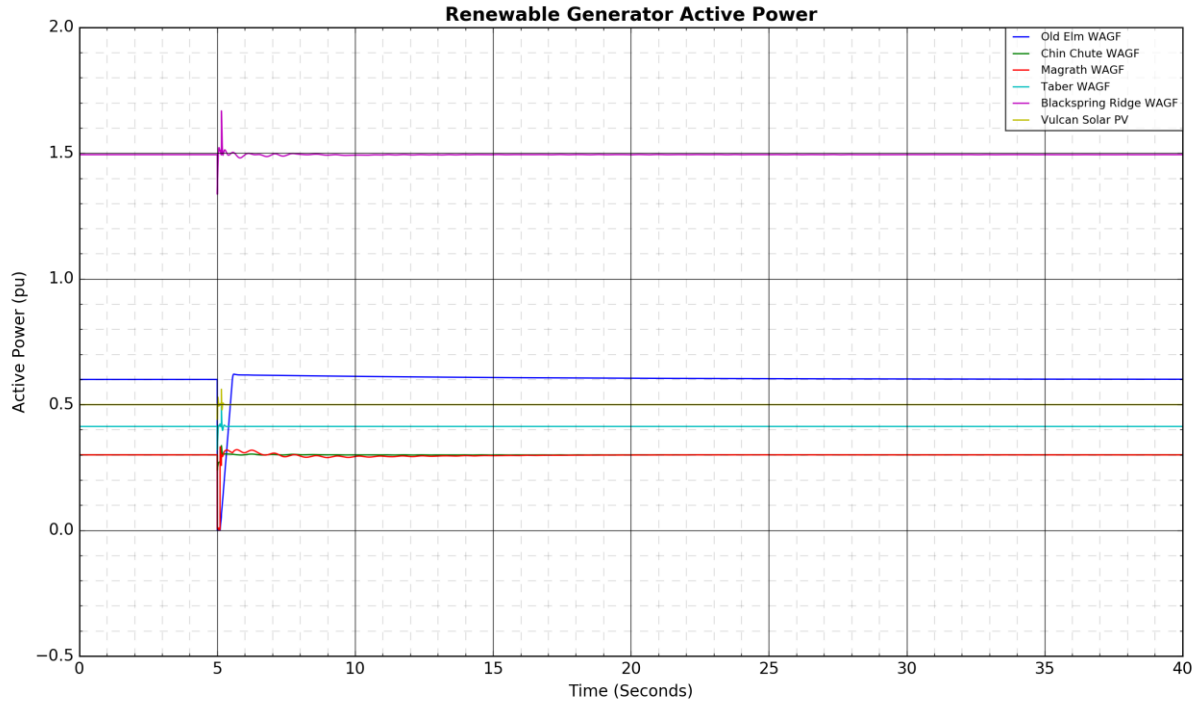


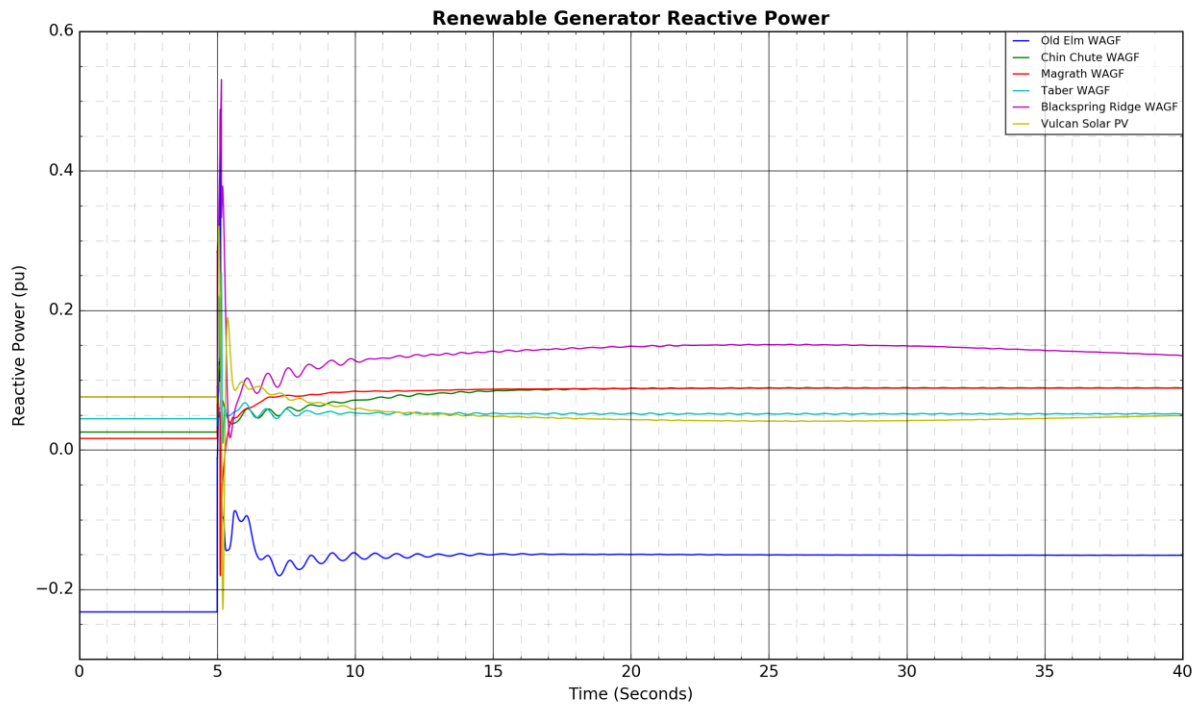
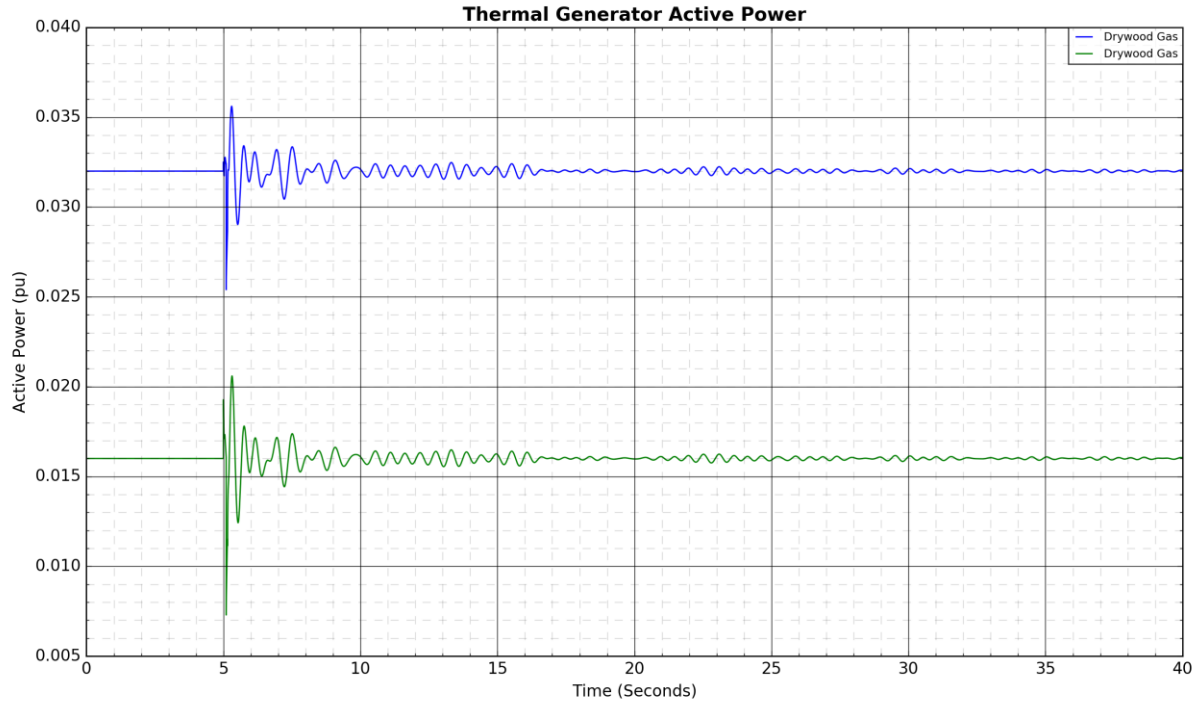
Figure A4-47: 863L Magrath 225S to Riverbend 618S: Fault Near Magrath 225S

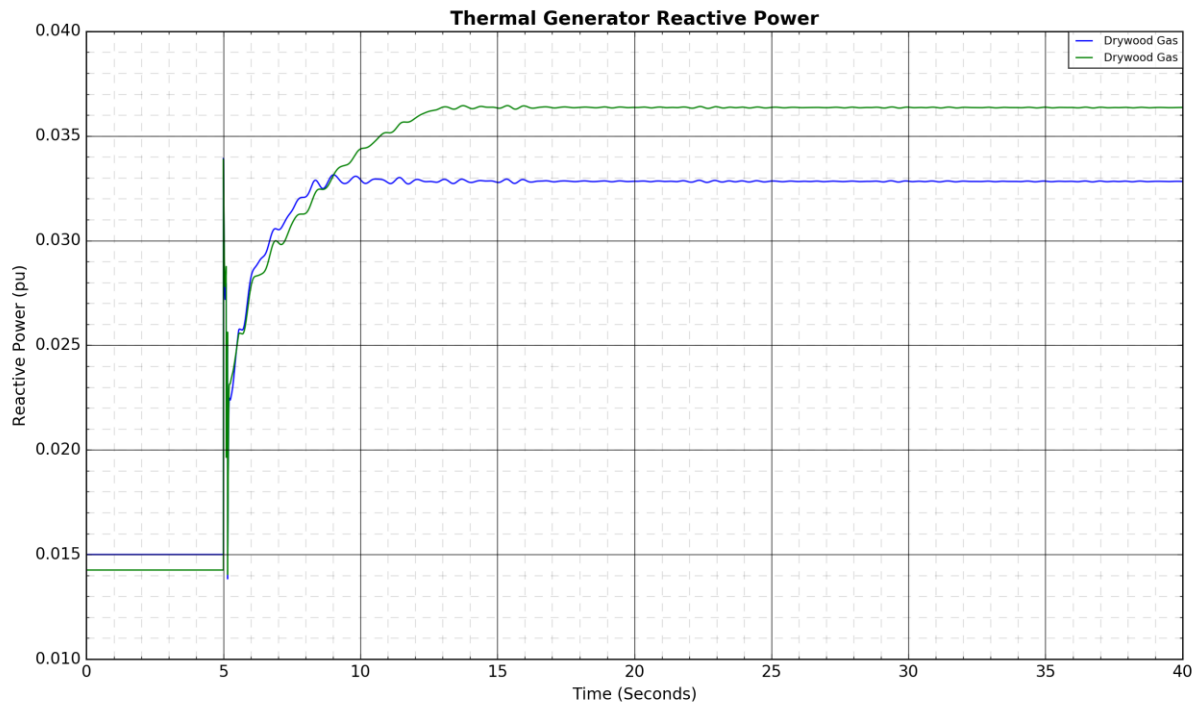
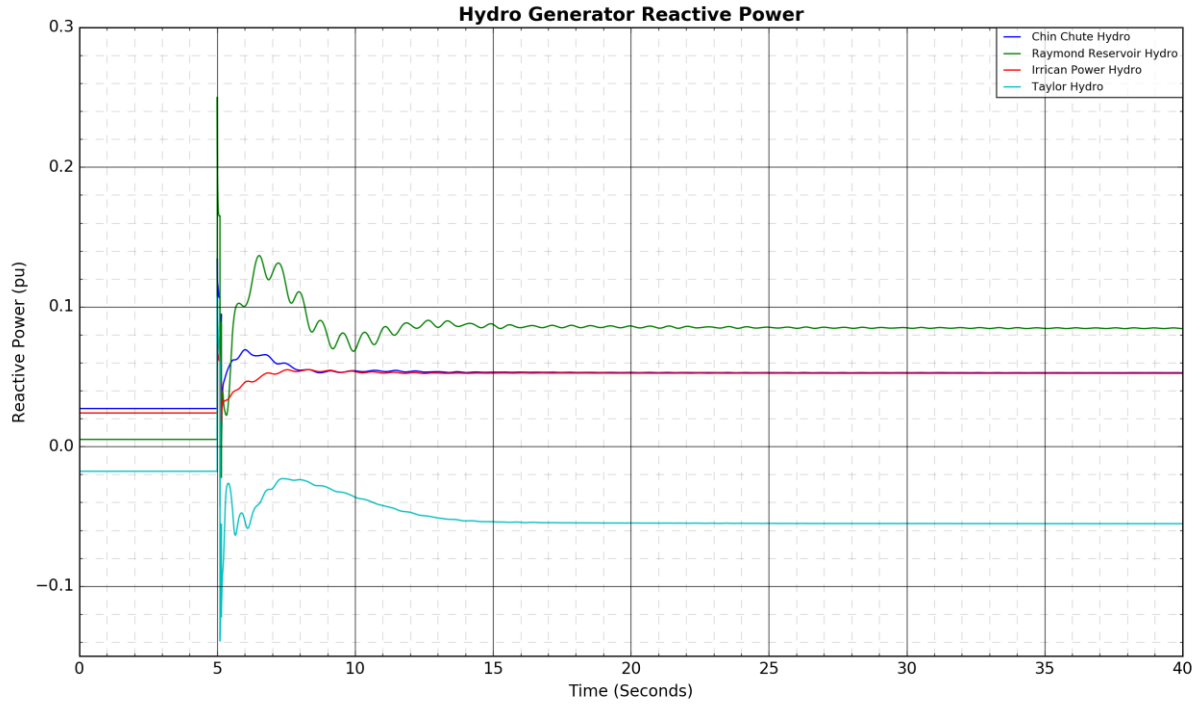


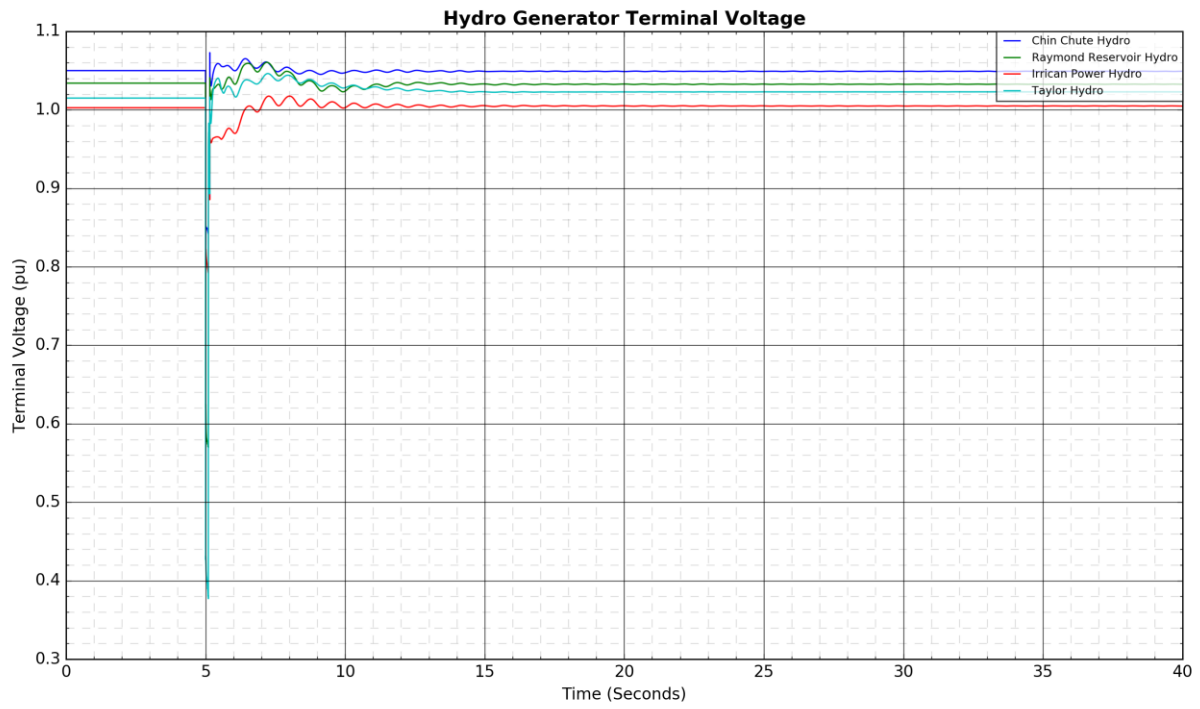
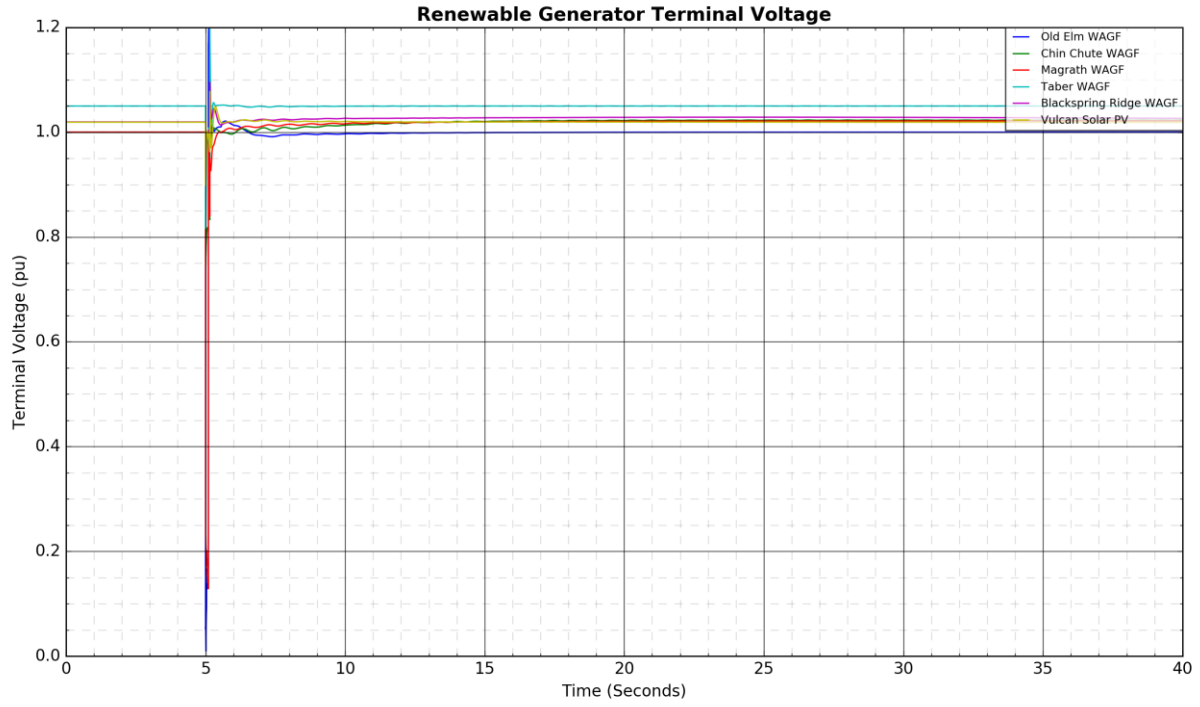


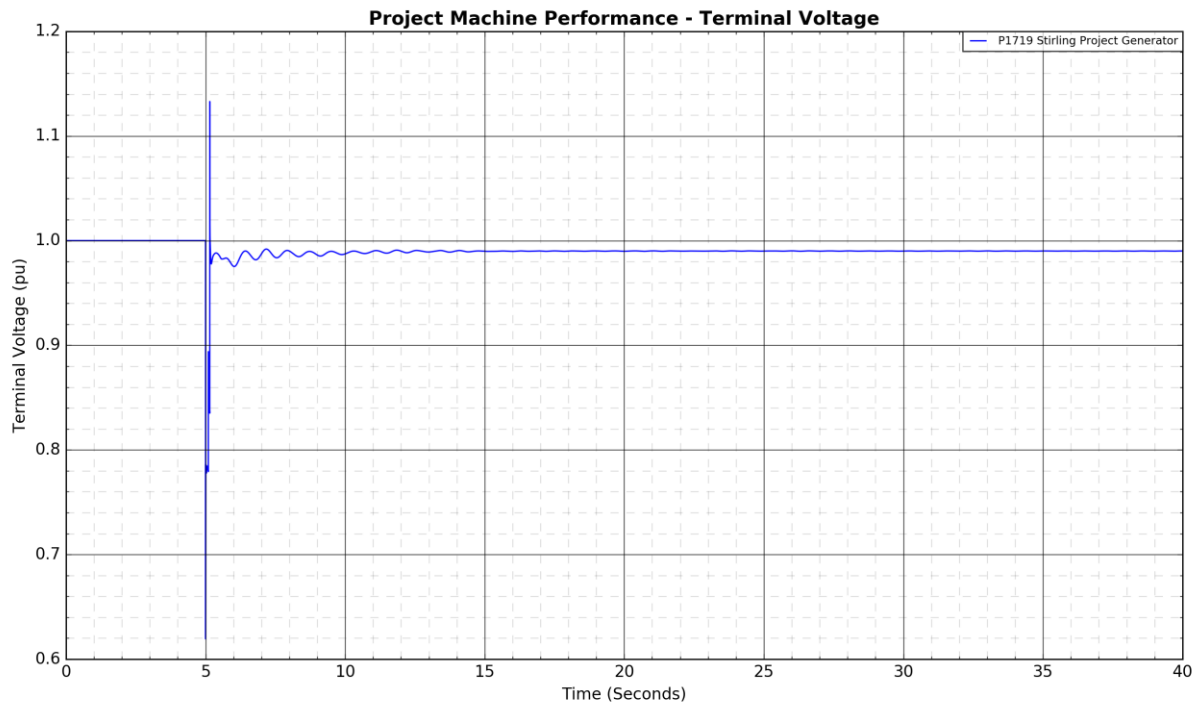
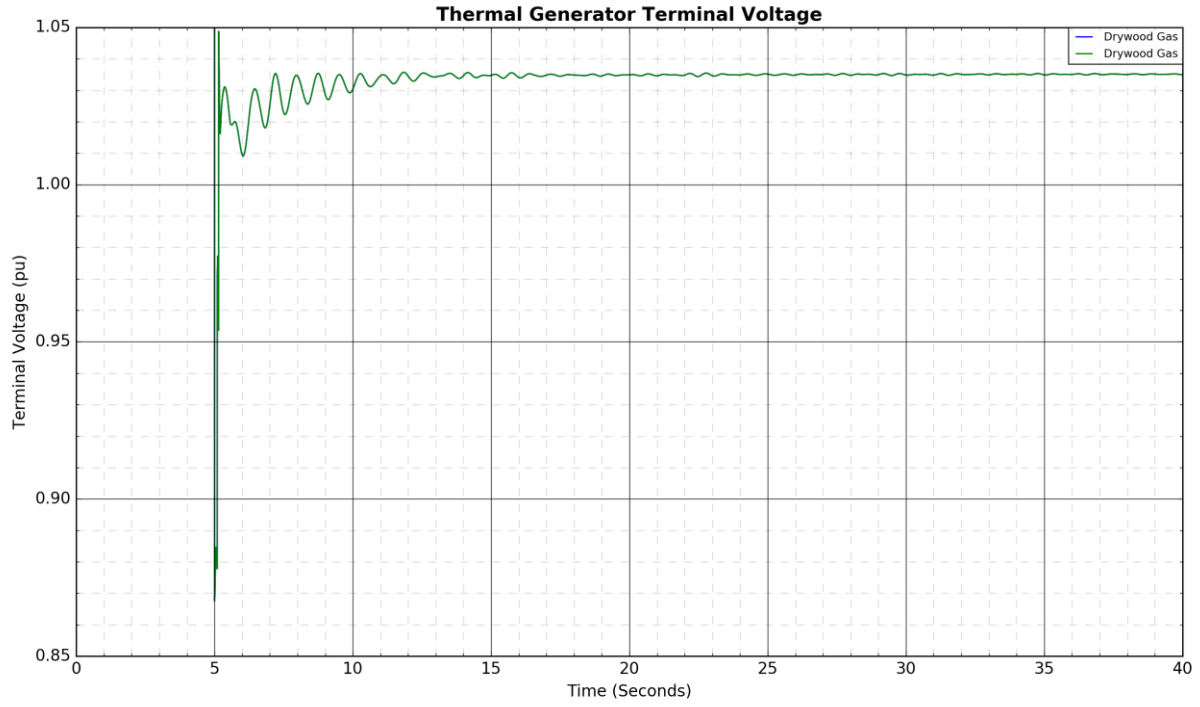
Engineering Connection Assessment Results: Stirling Wind Project Connection











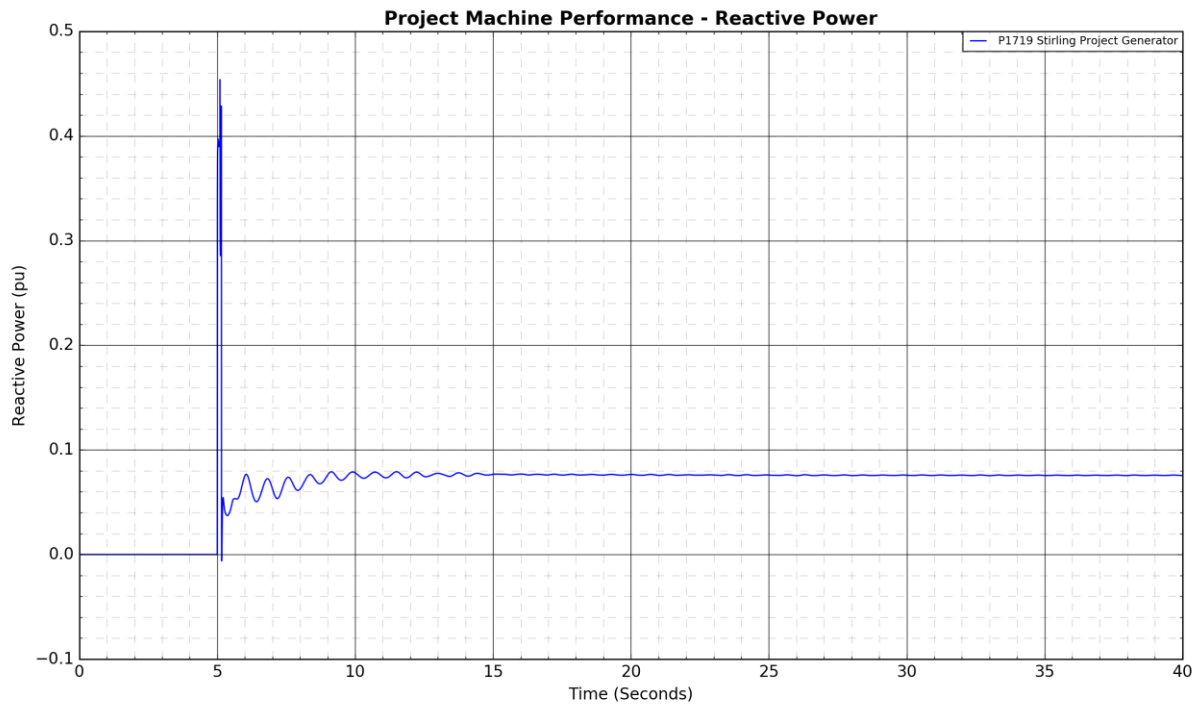
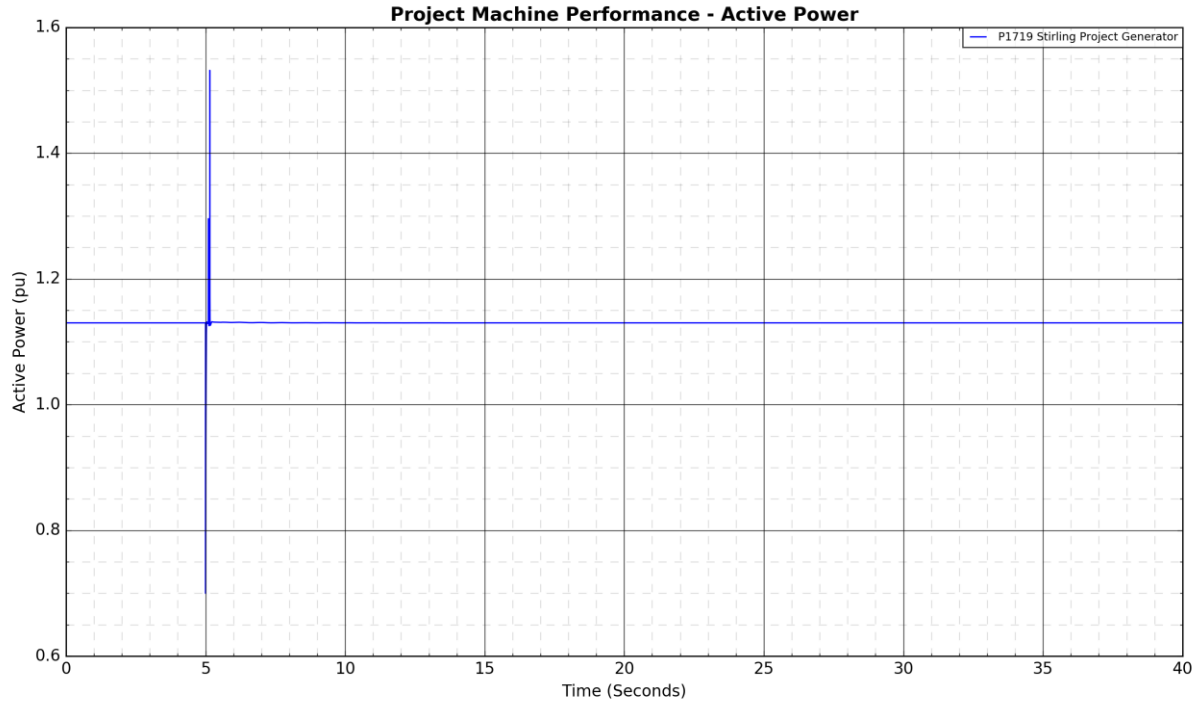
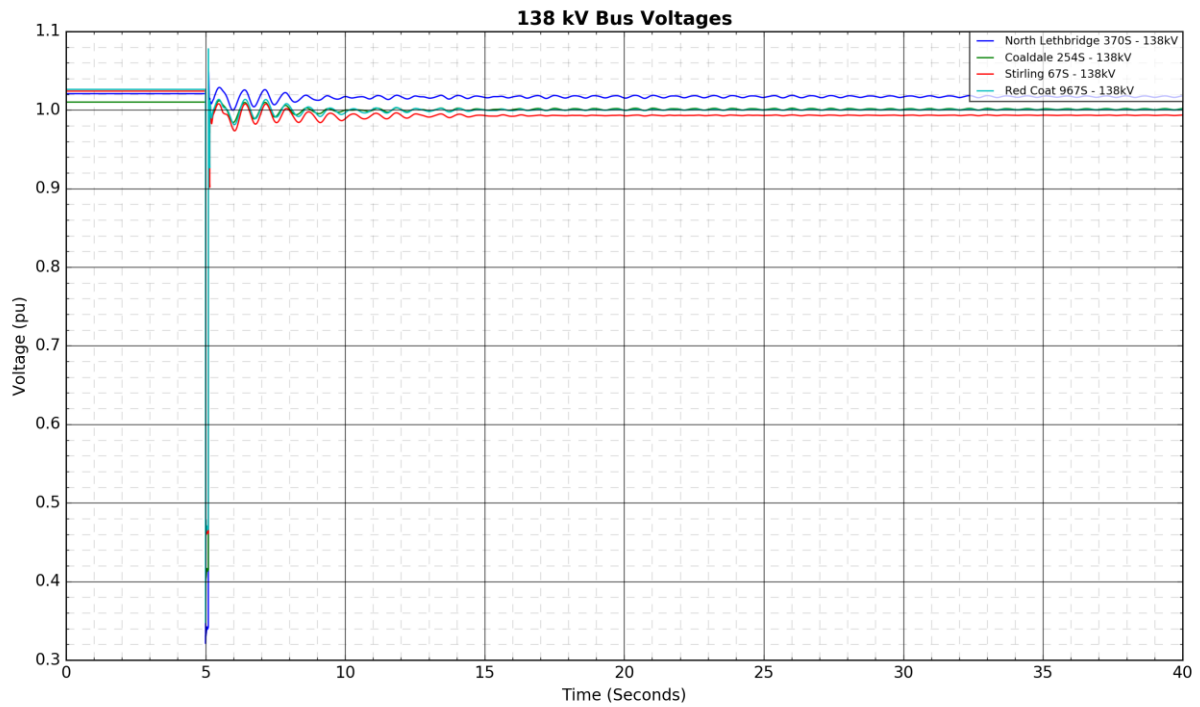
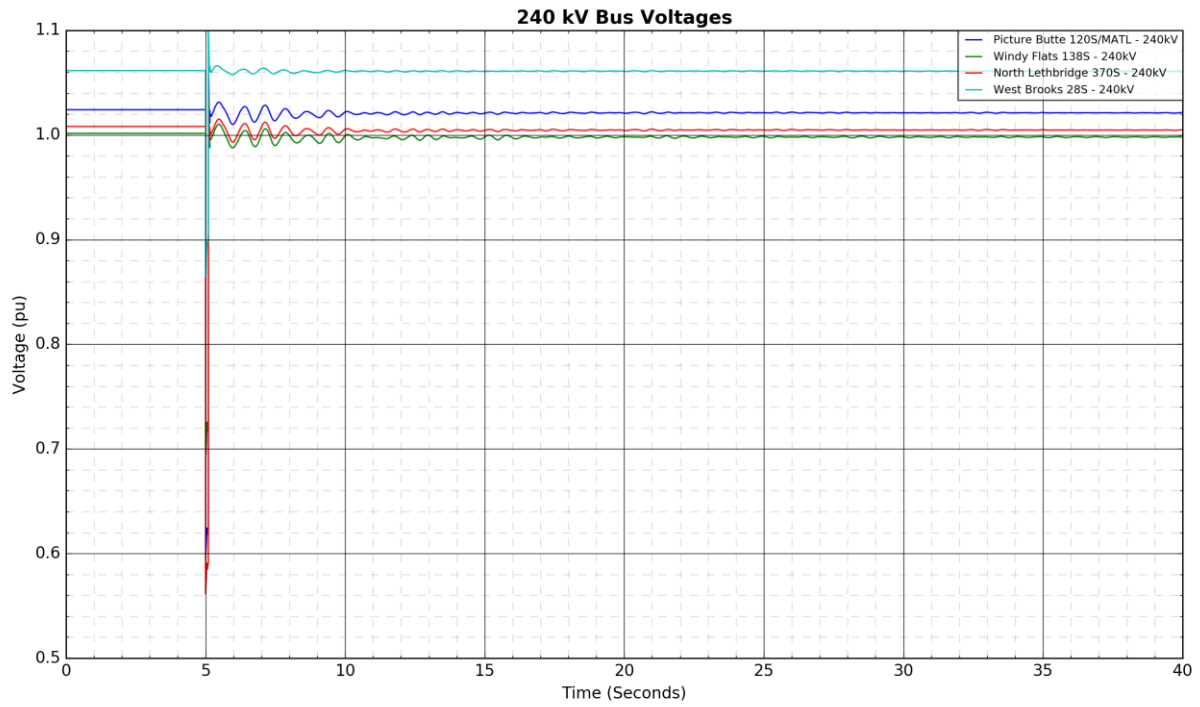
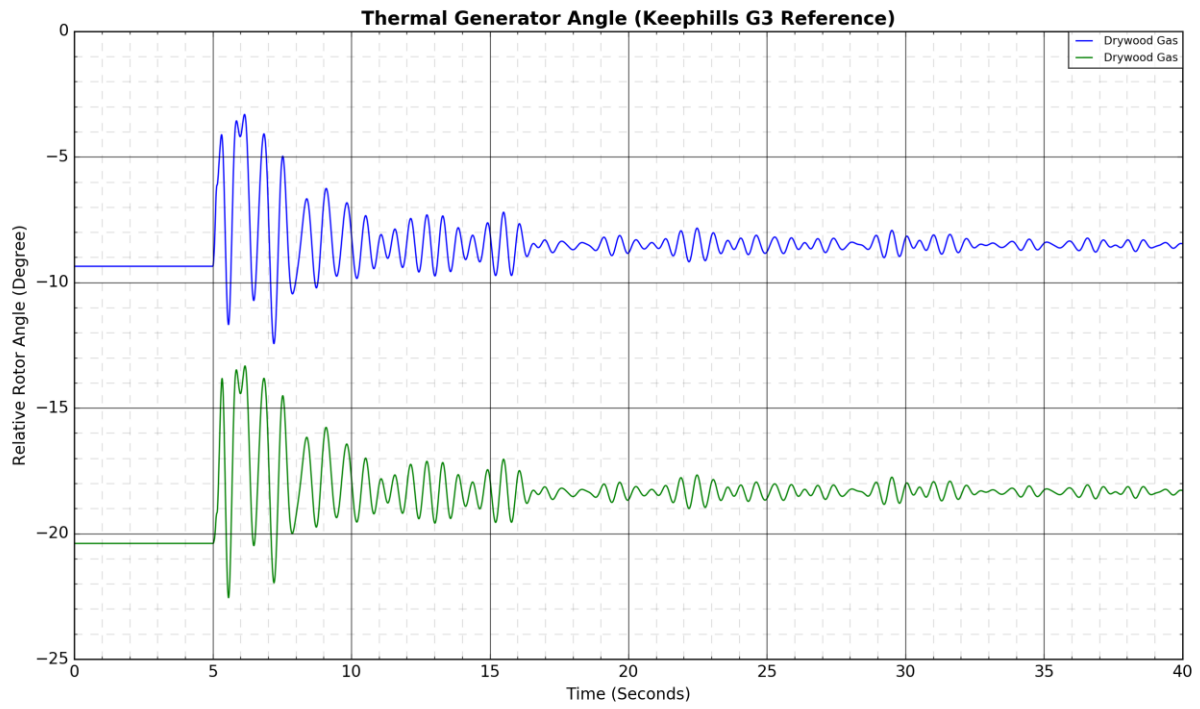
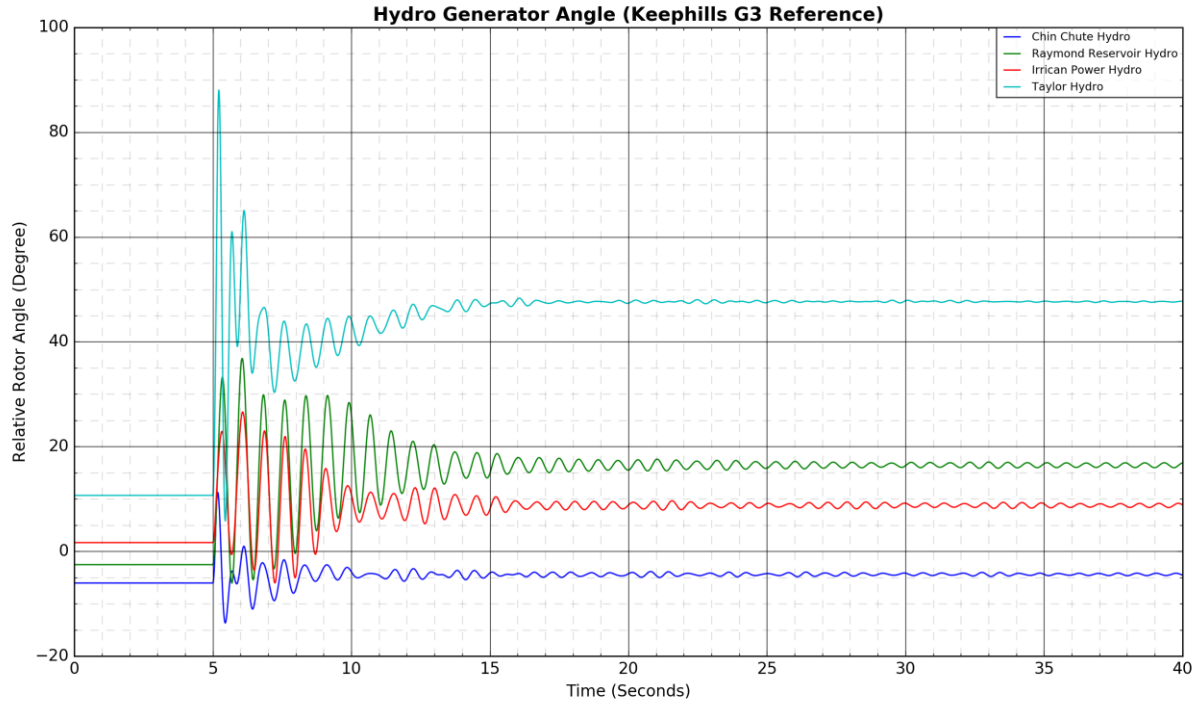
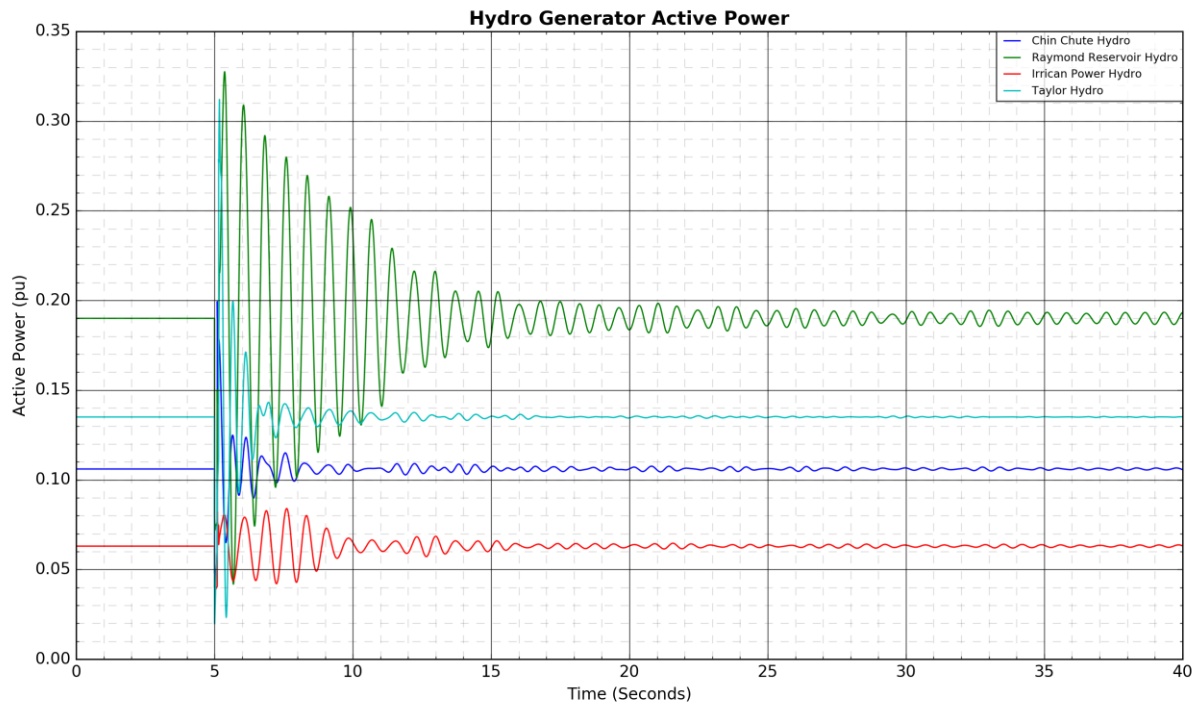
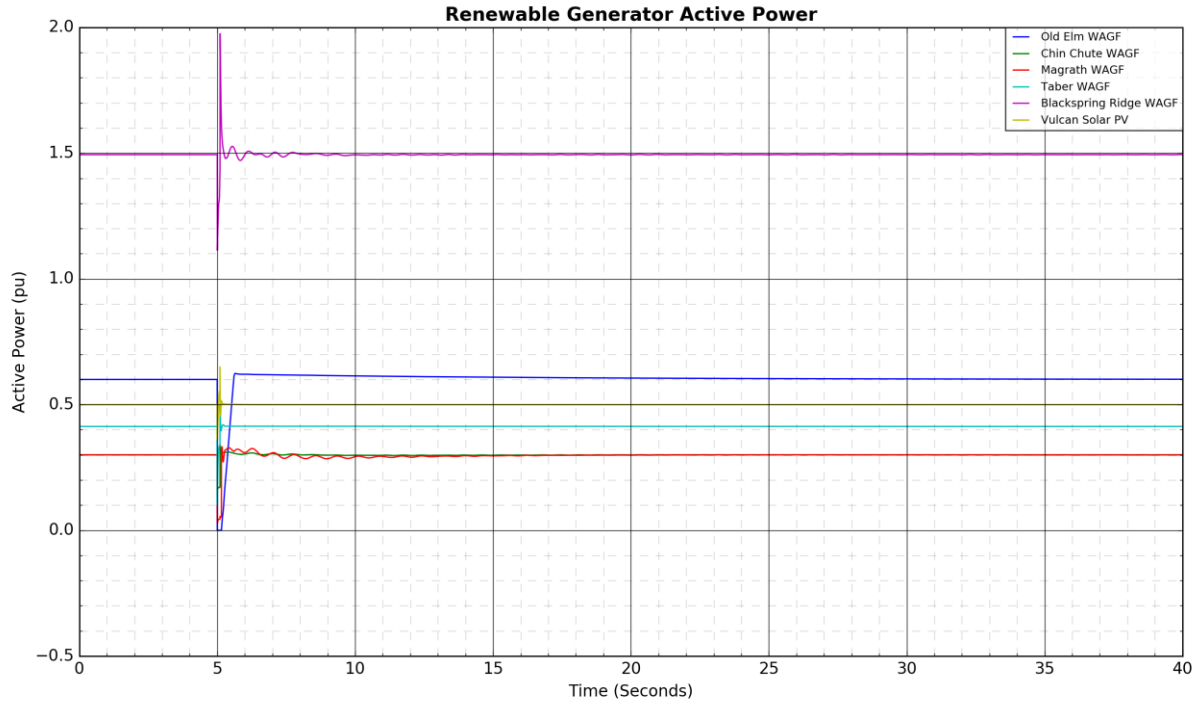
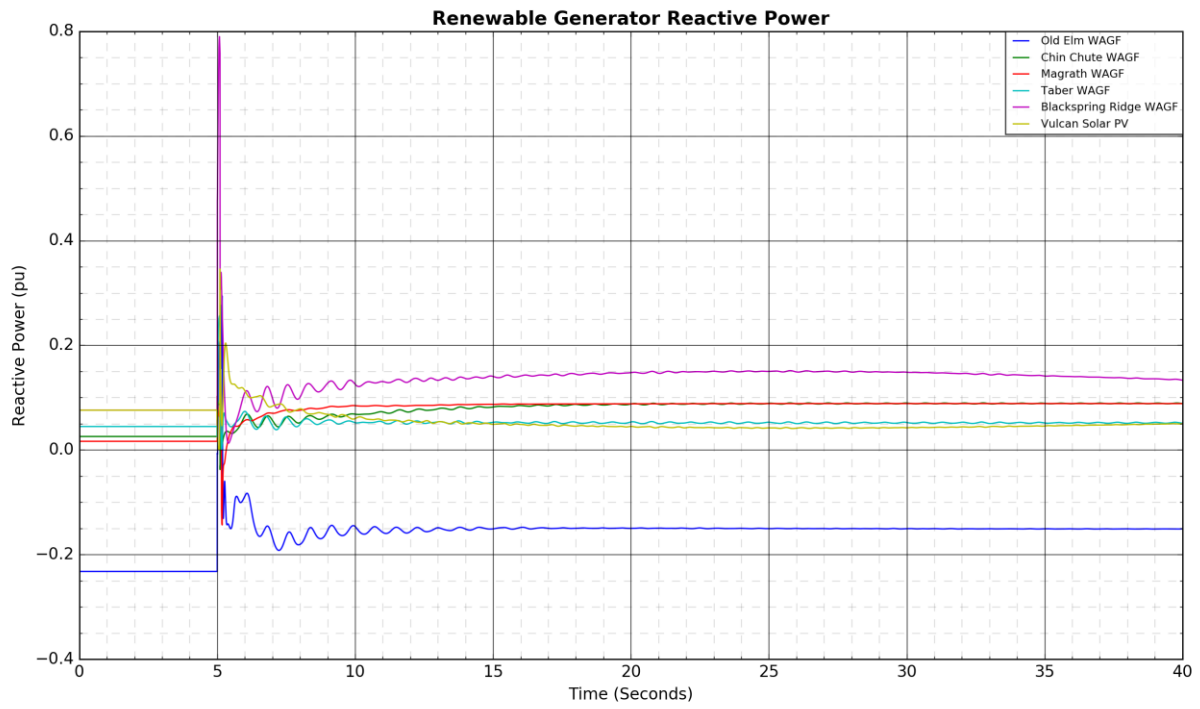
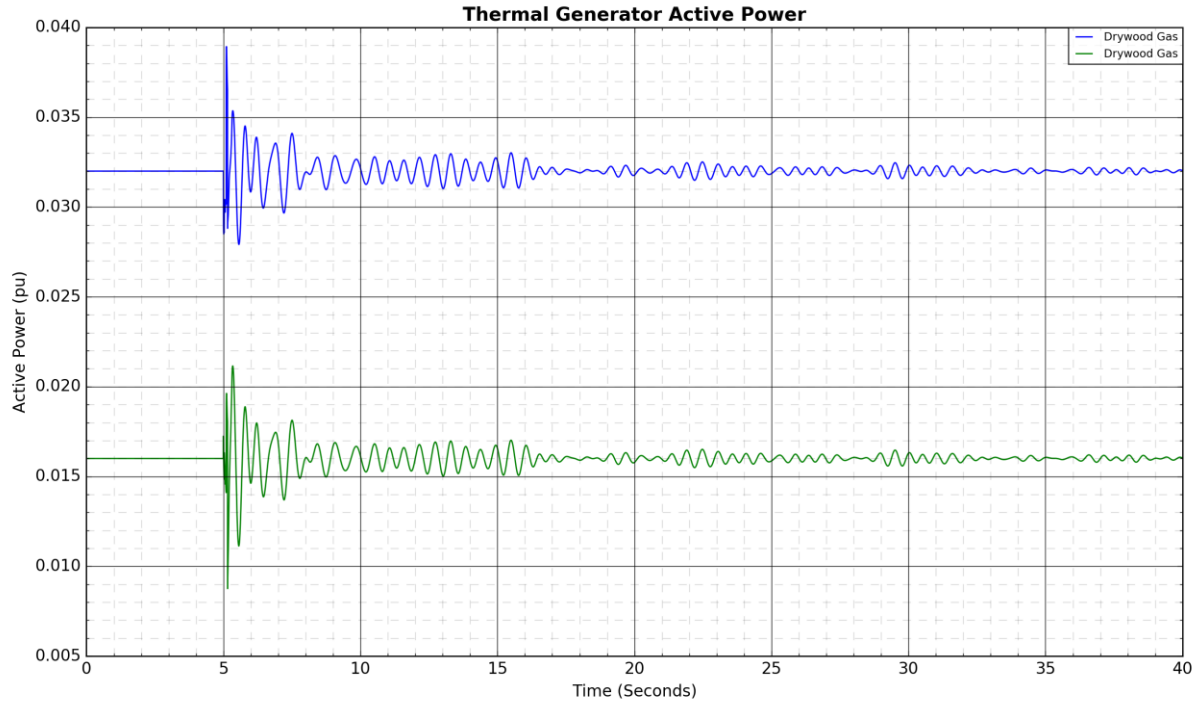


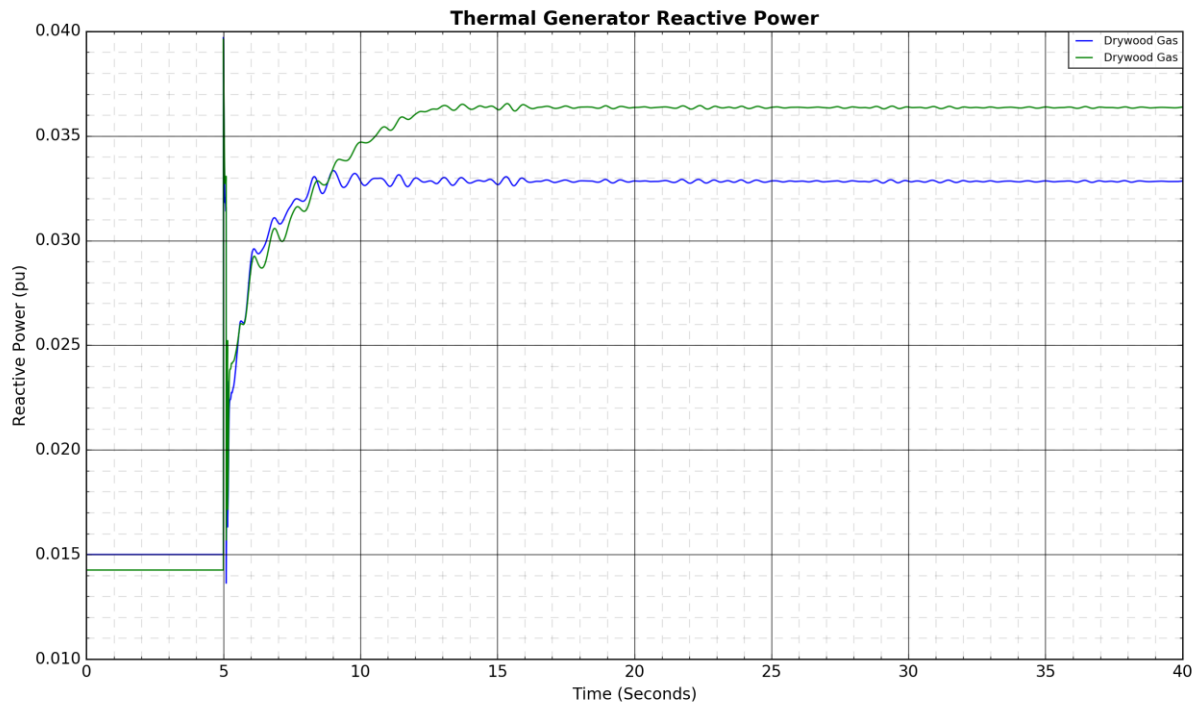
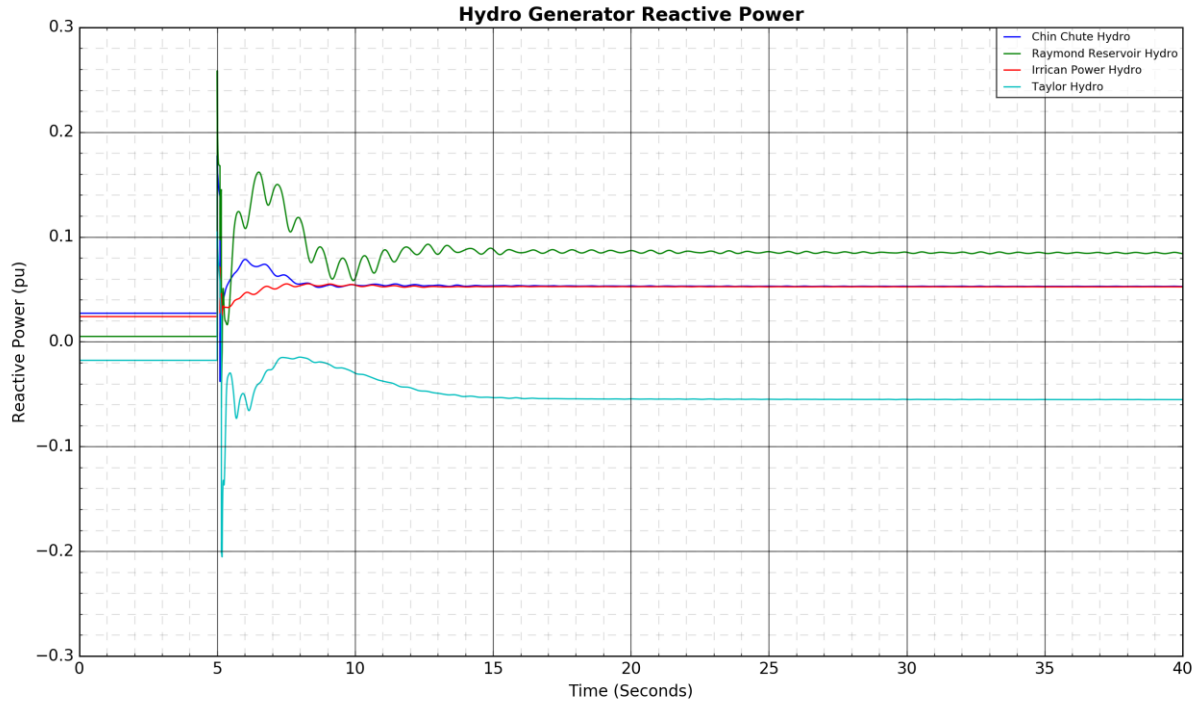
Figure A4-48: 863L Magrath 225S to Riverbend 618S: Fault Near Riverbend 618S

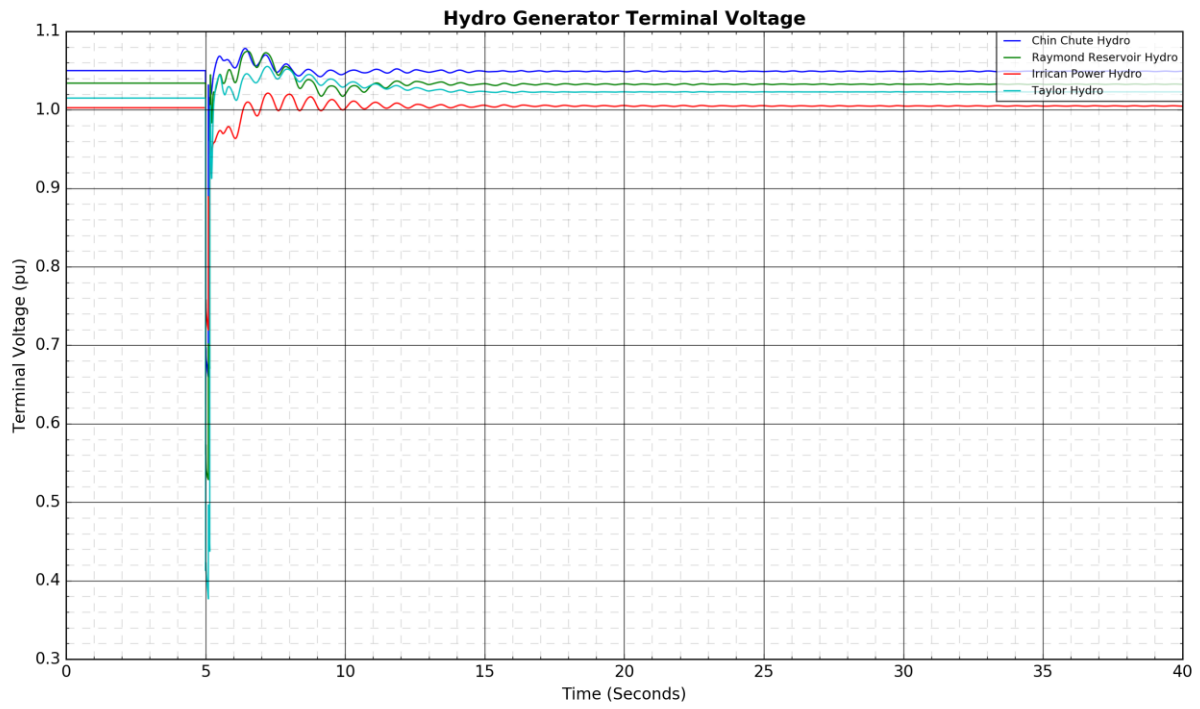
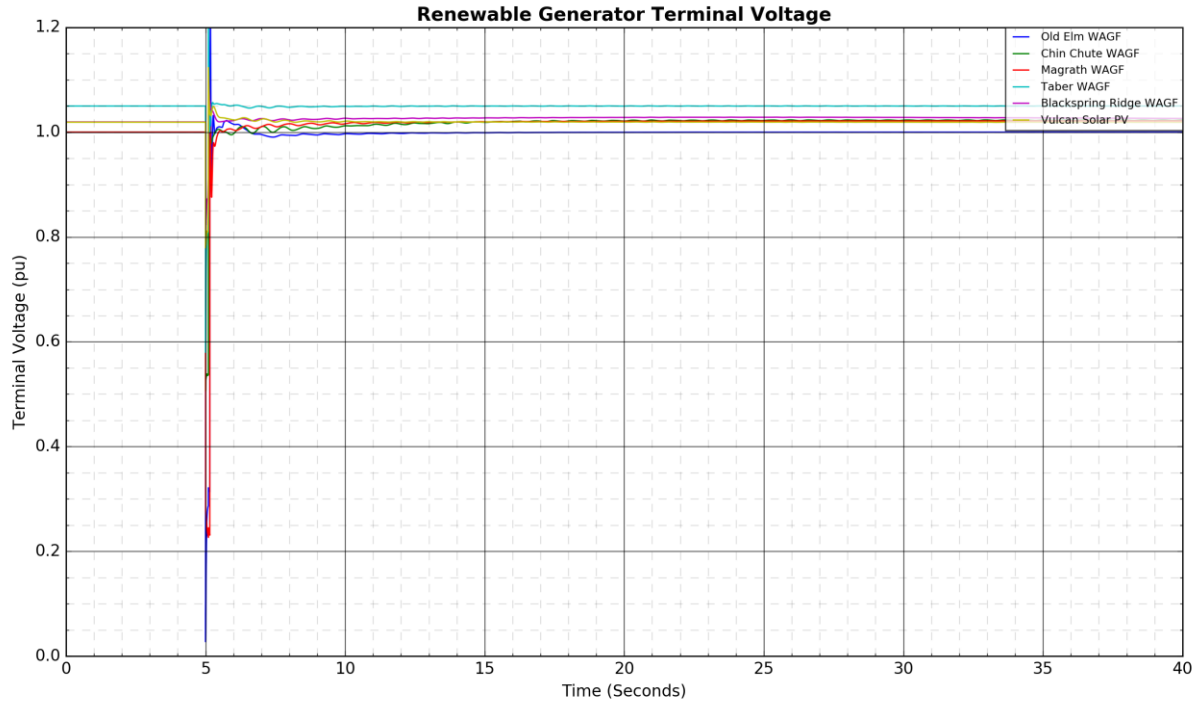


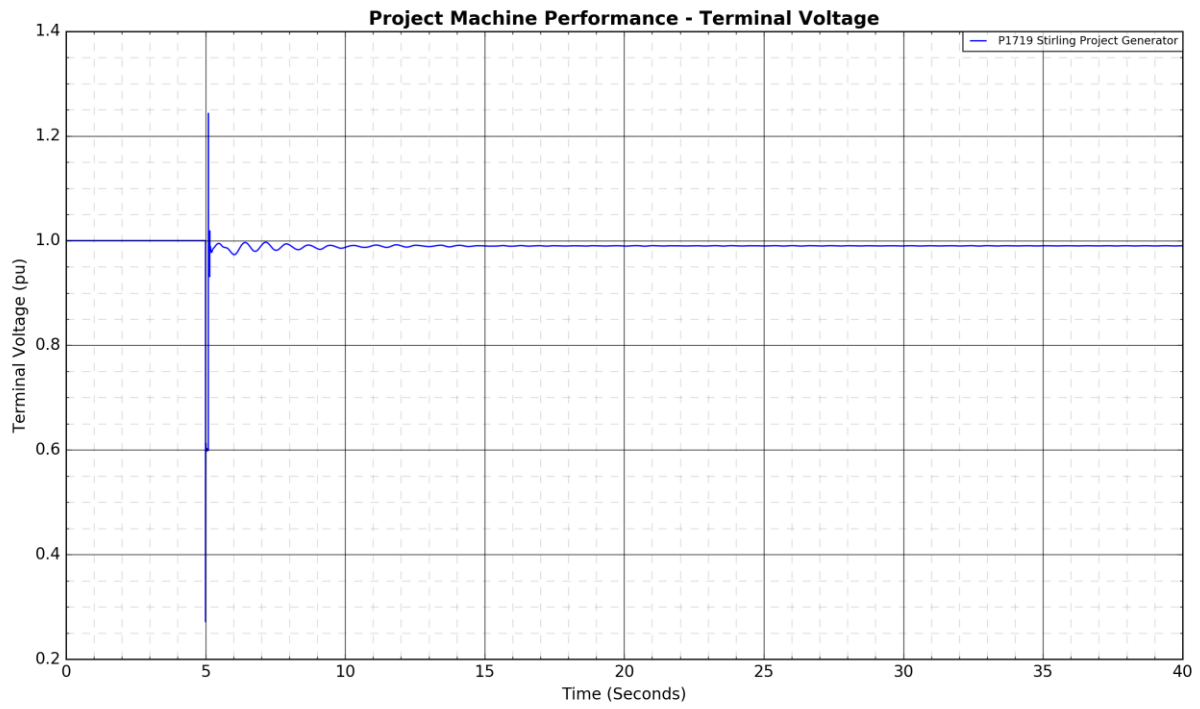
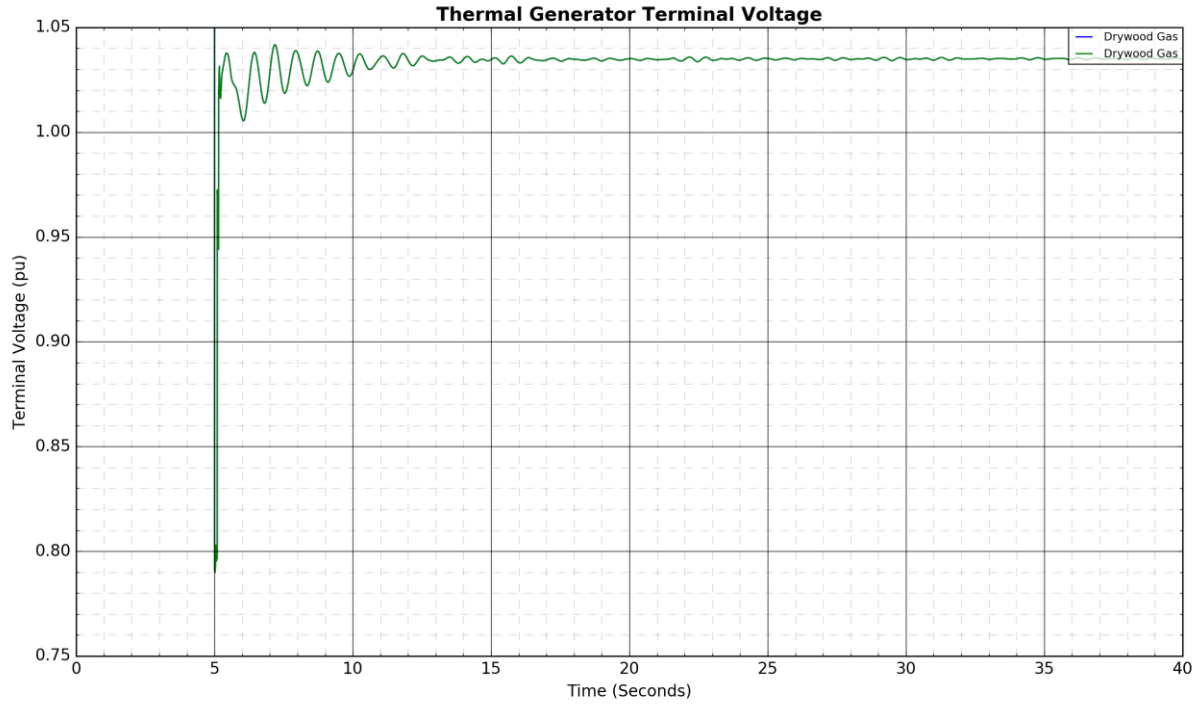












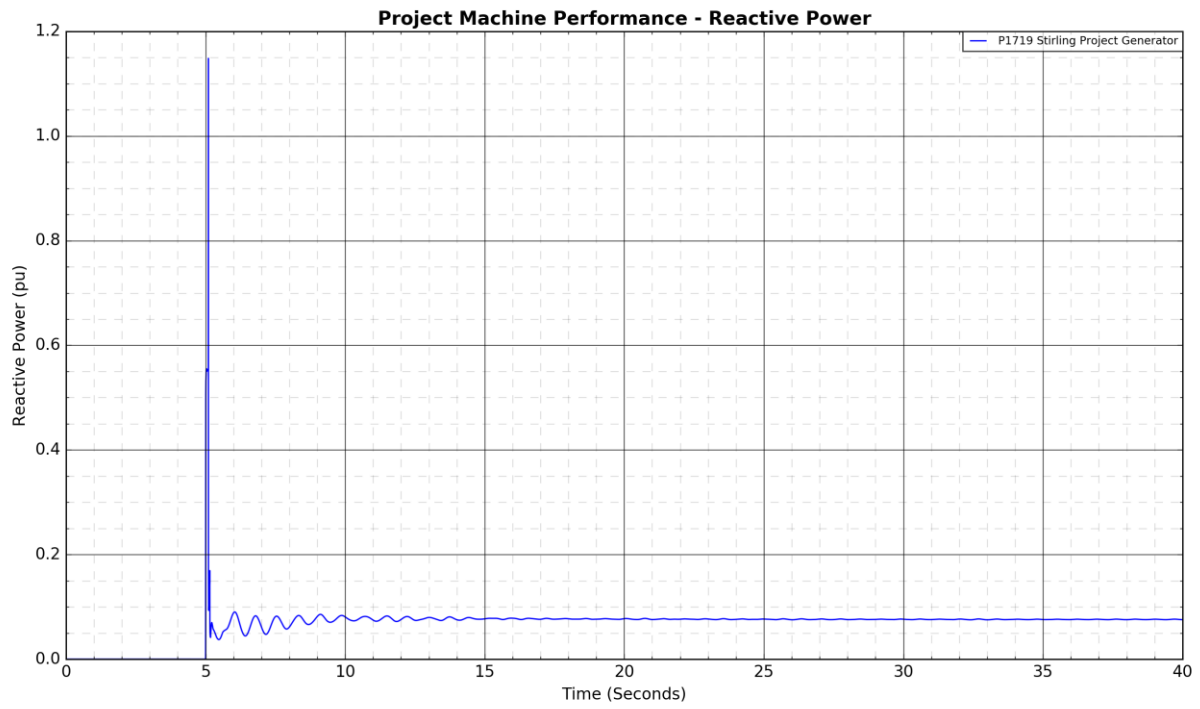
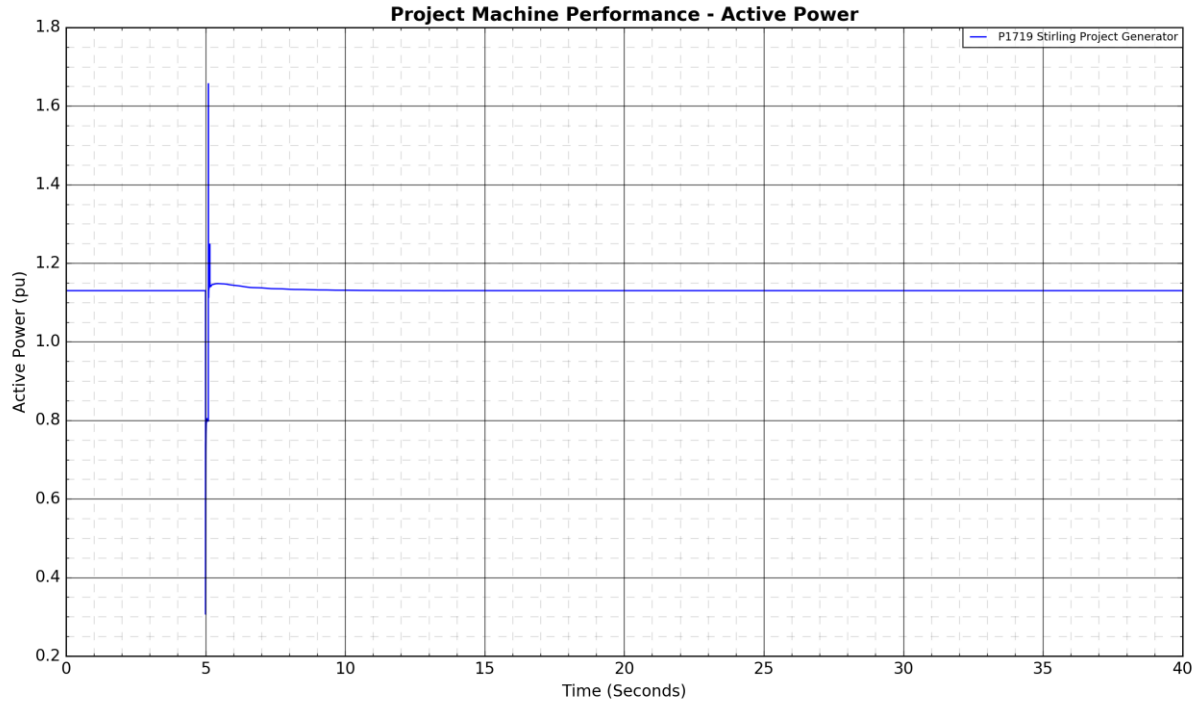
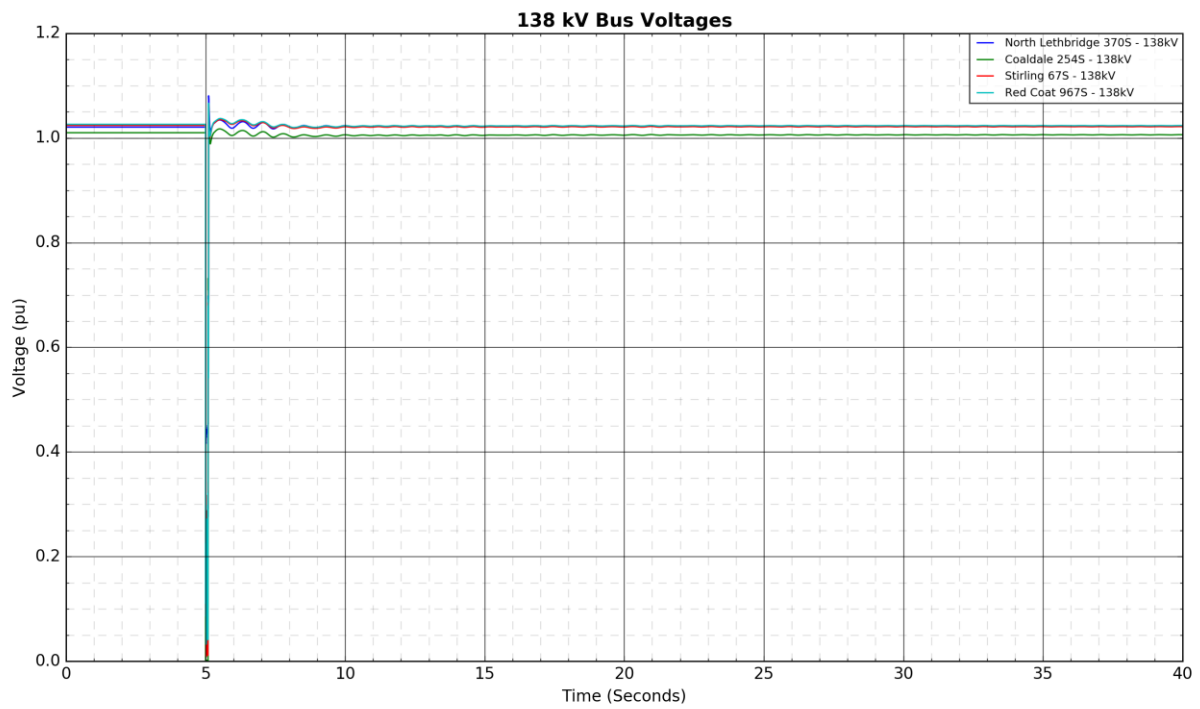
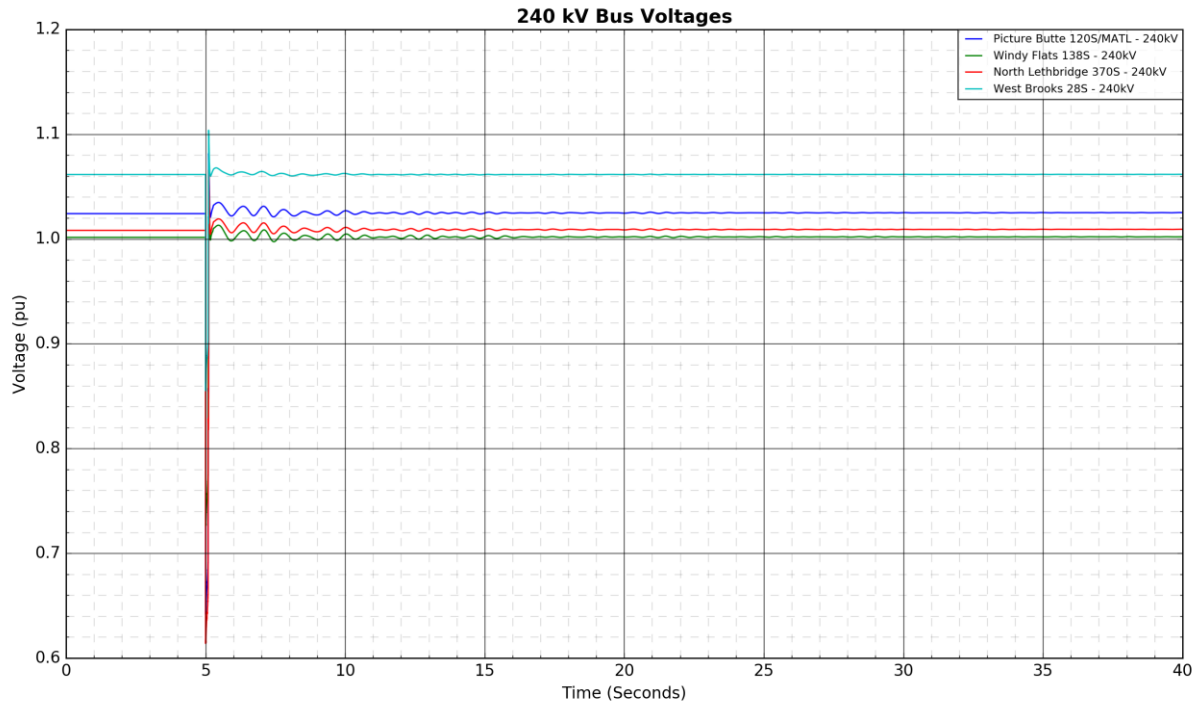
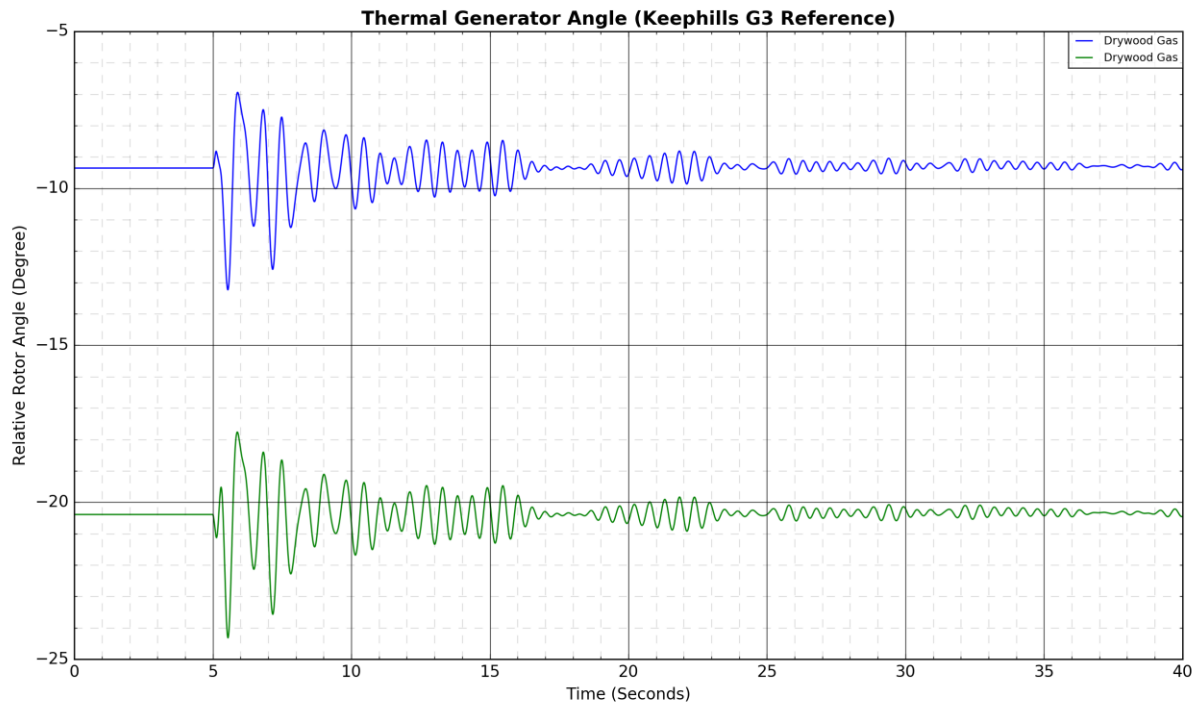
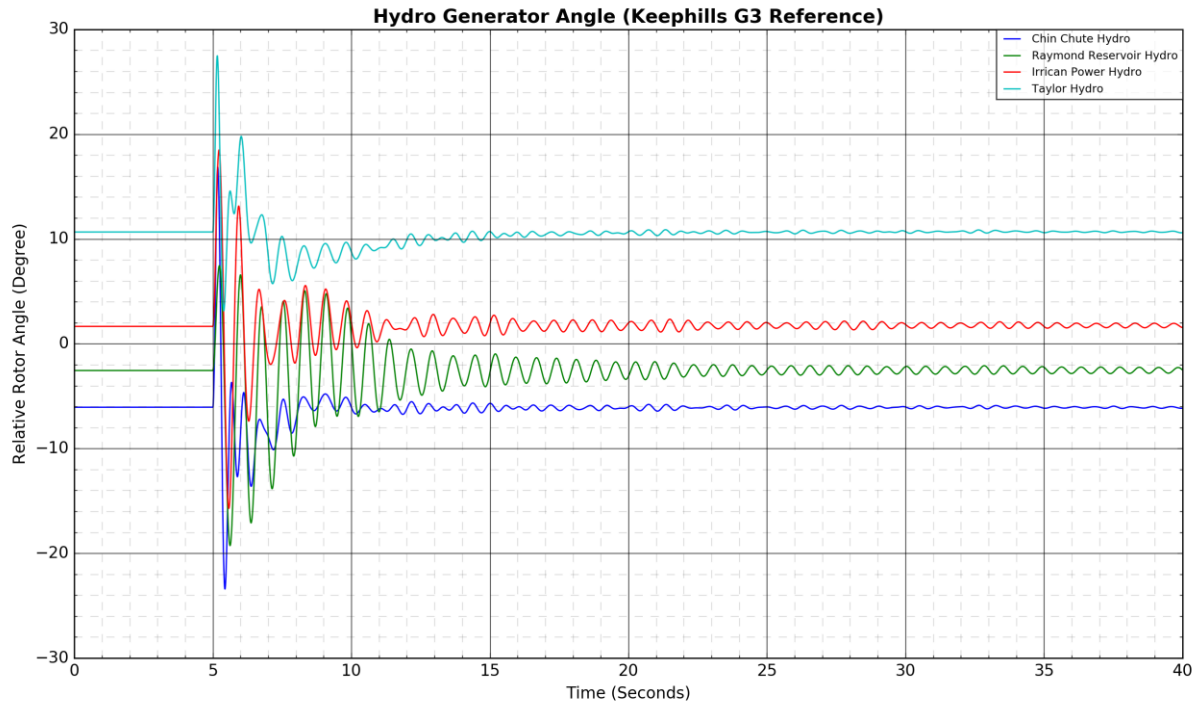
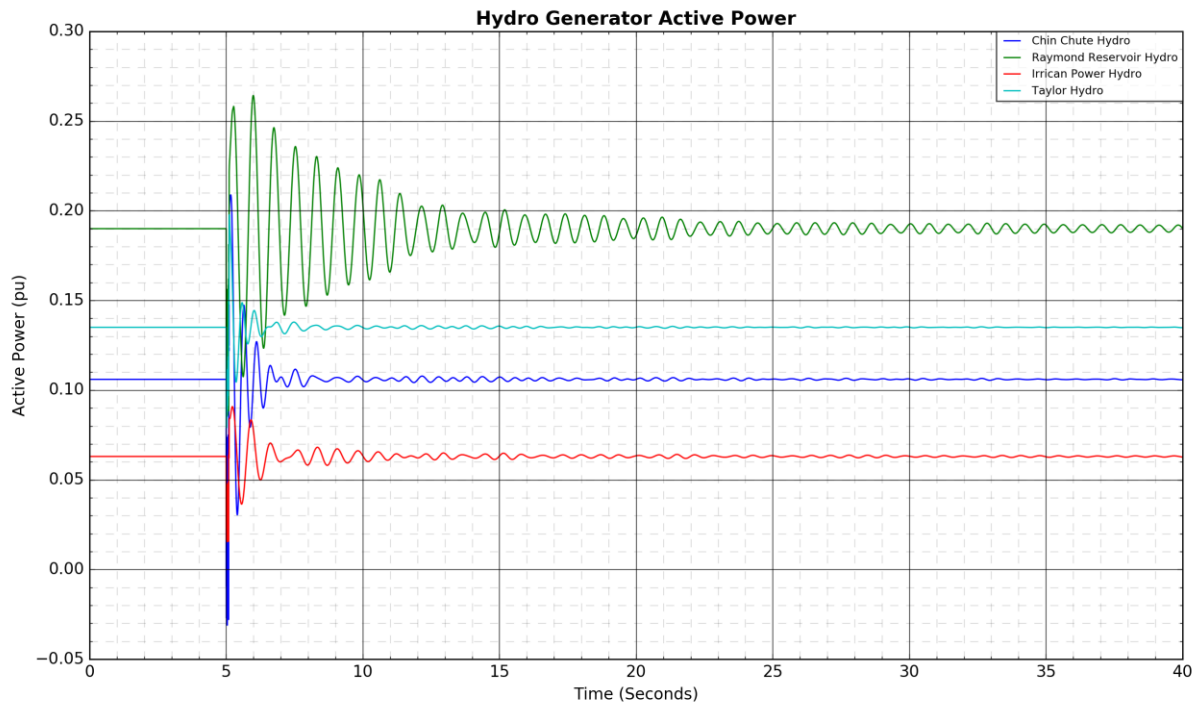
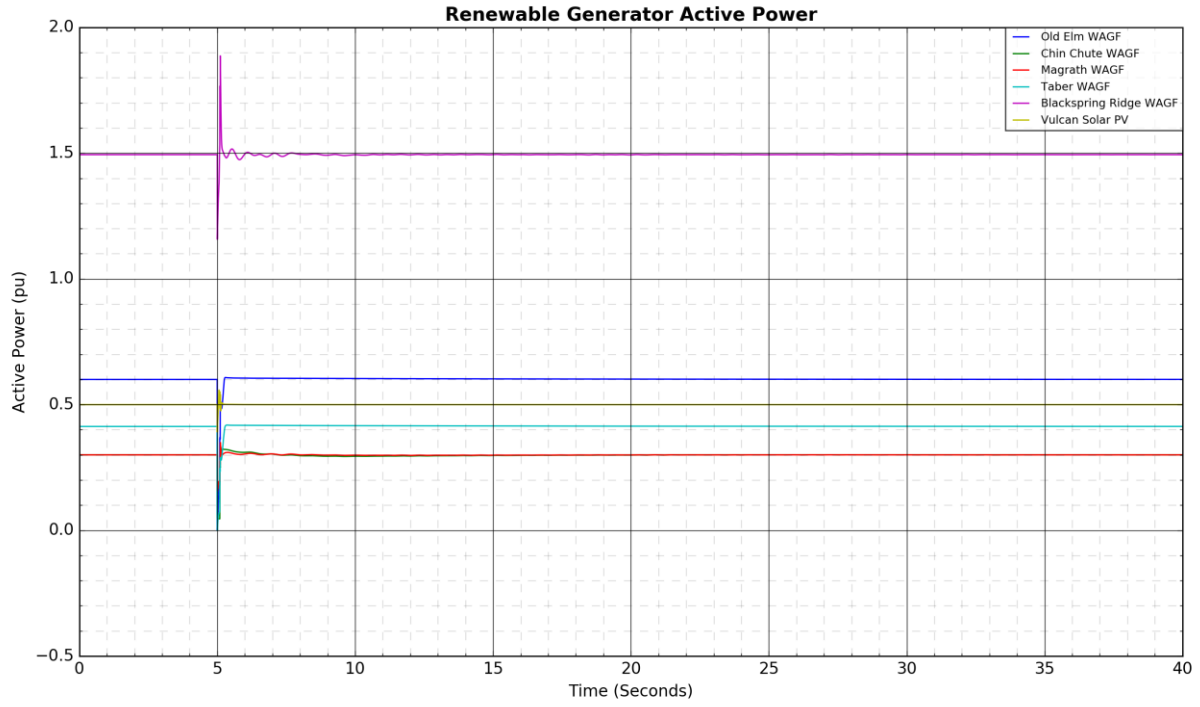


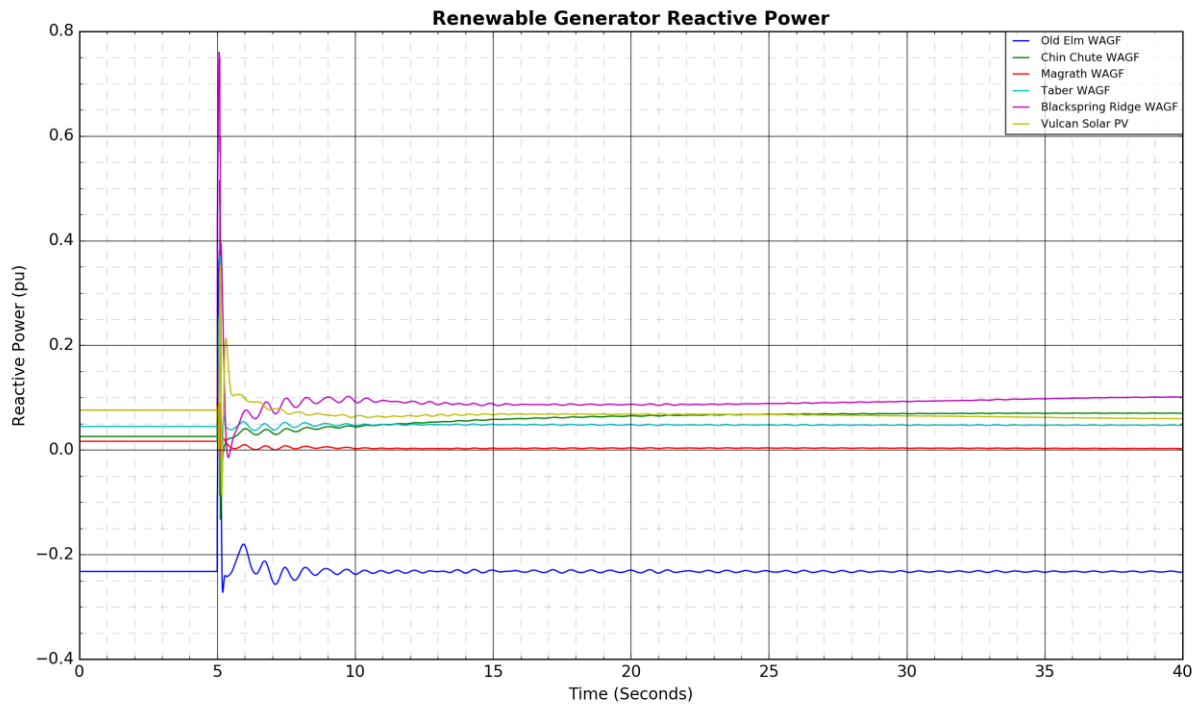
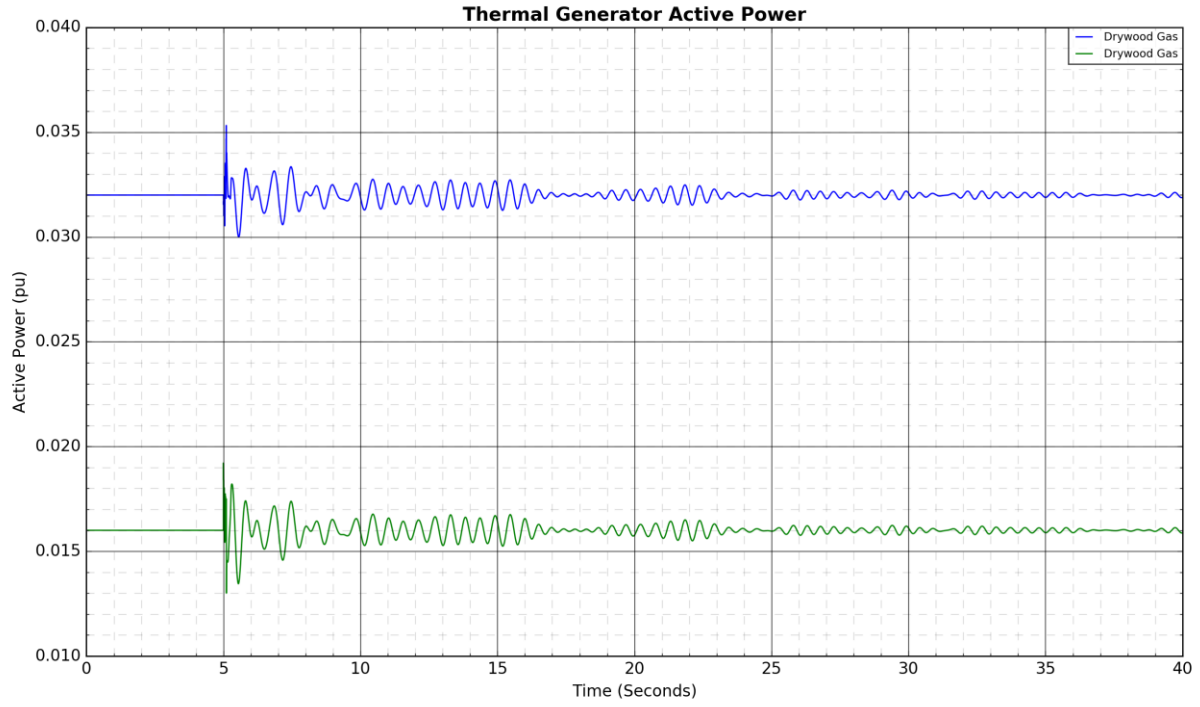
Figure A4-49: 170L Coaldale 254S to North Lethbridge 370S: Fault Near Coaldale 254S

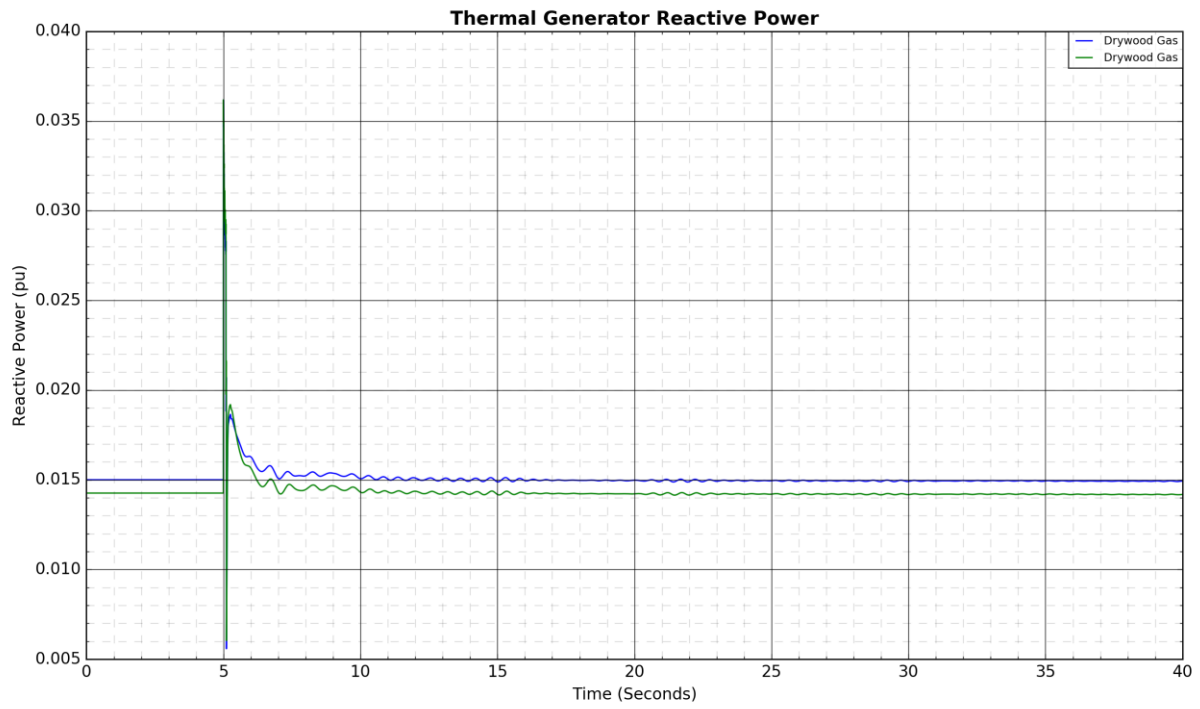
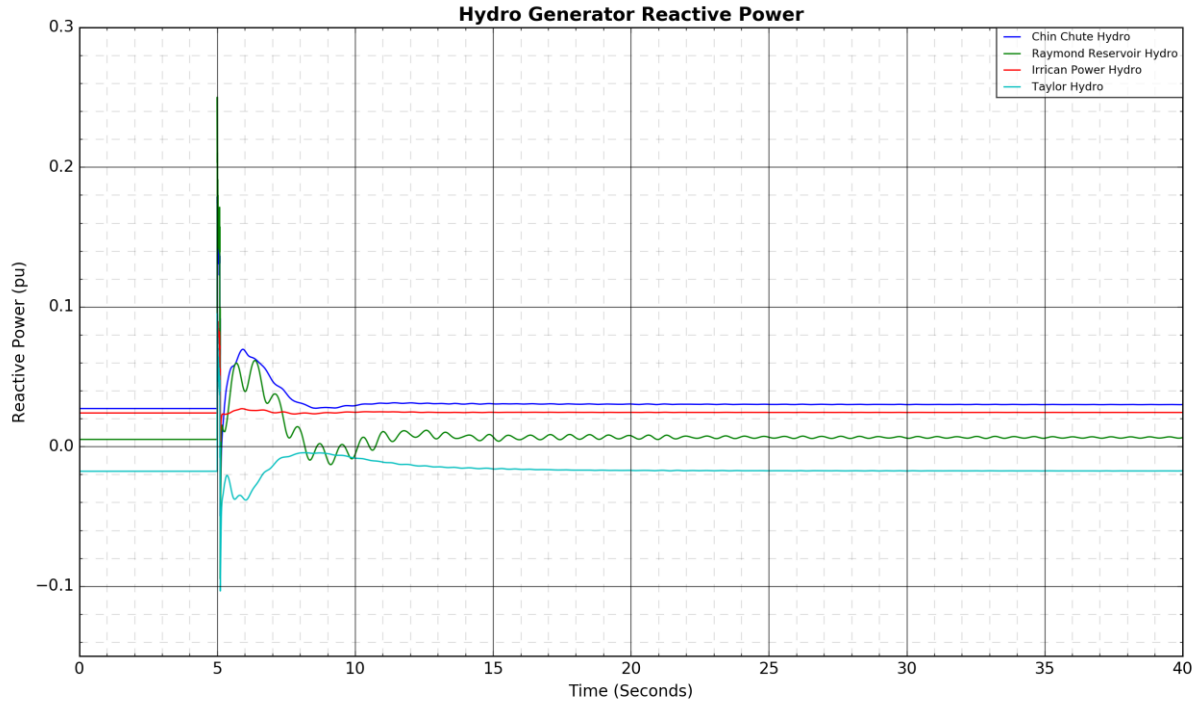


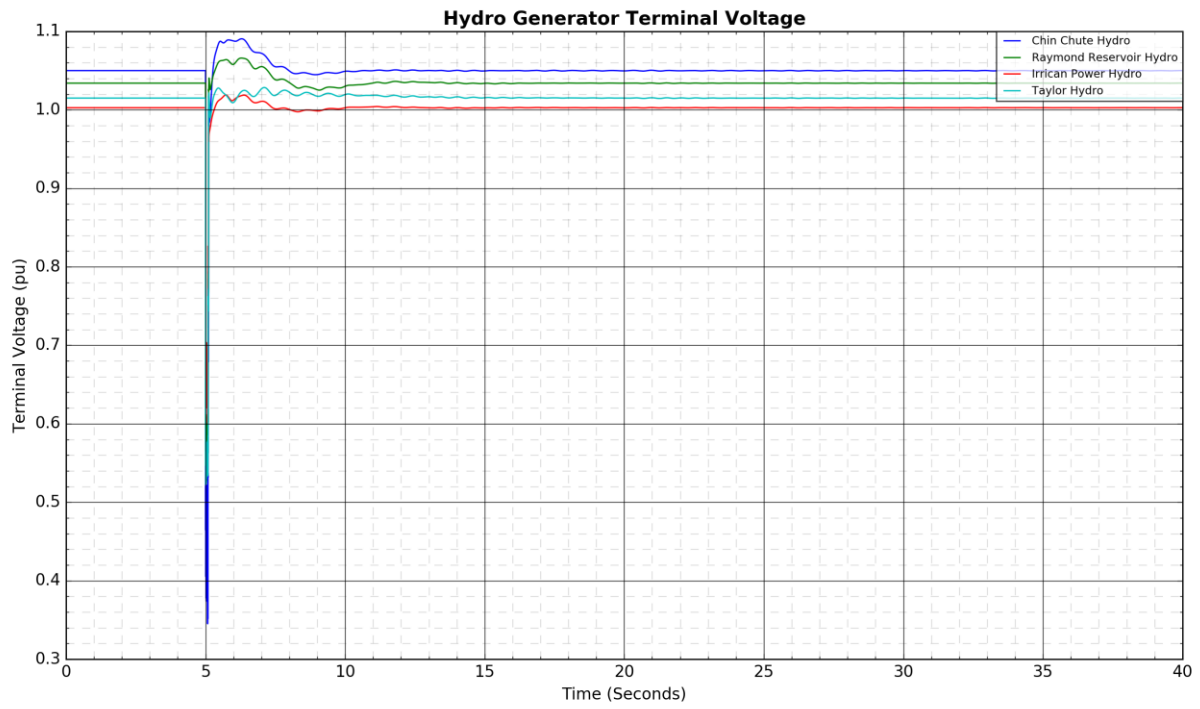
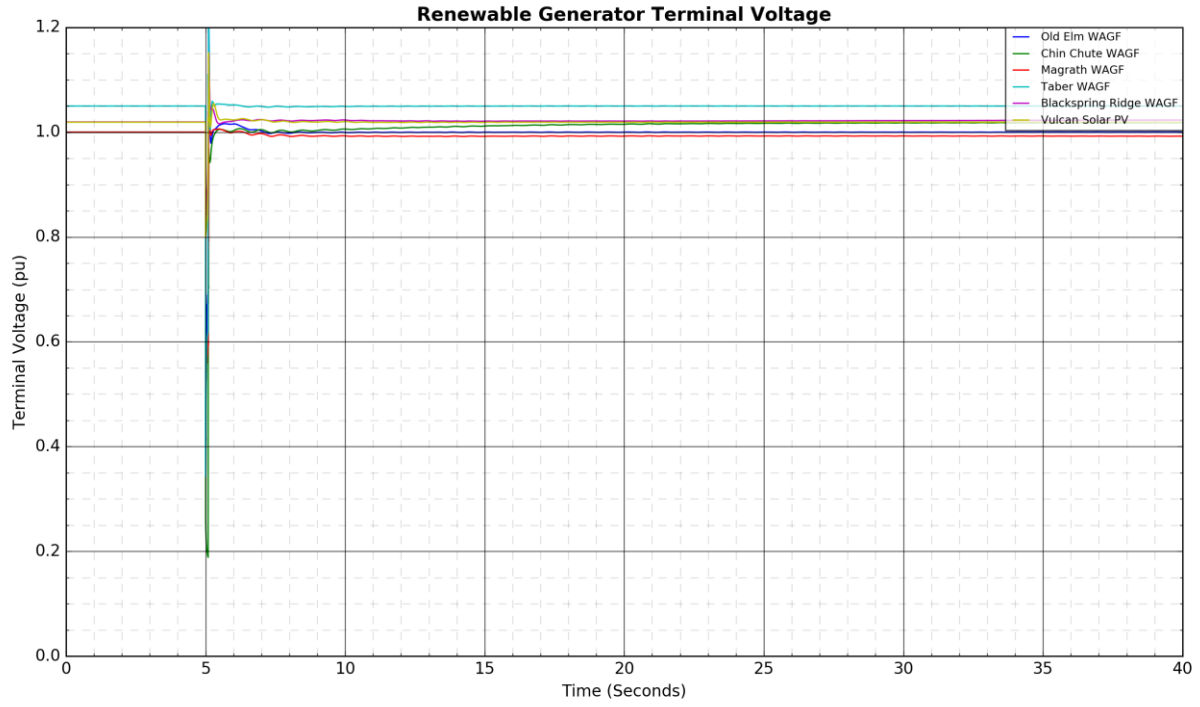


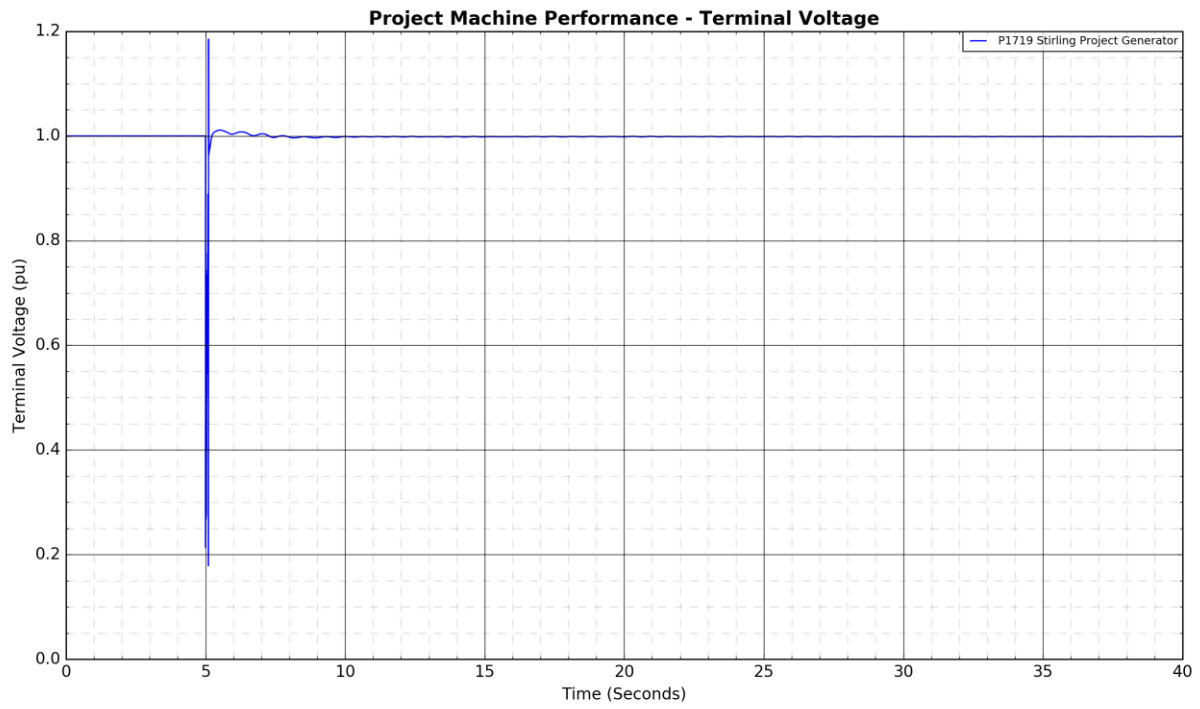
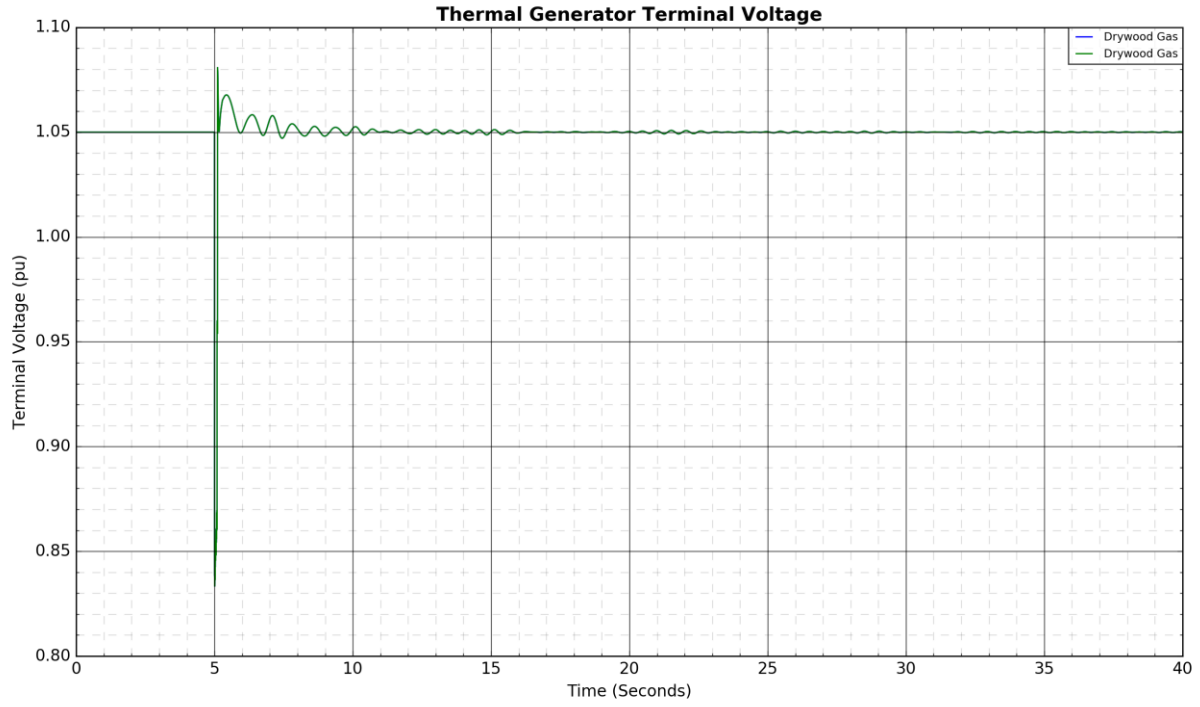
Engineering Connection Assessment Results: Stirling Wind Project Connection











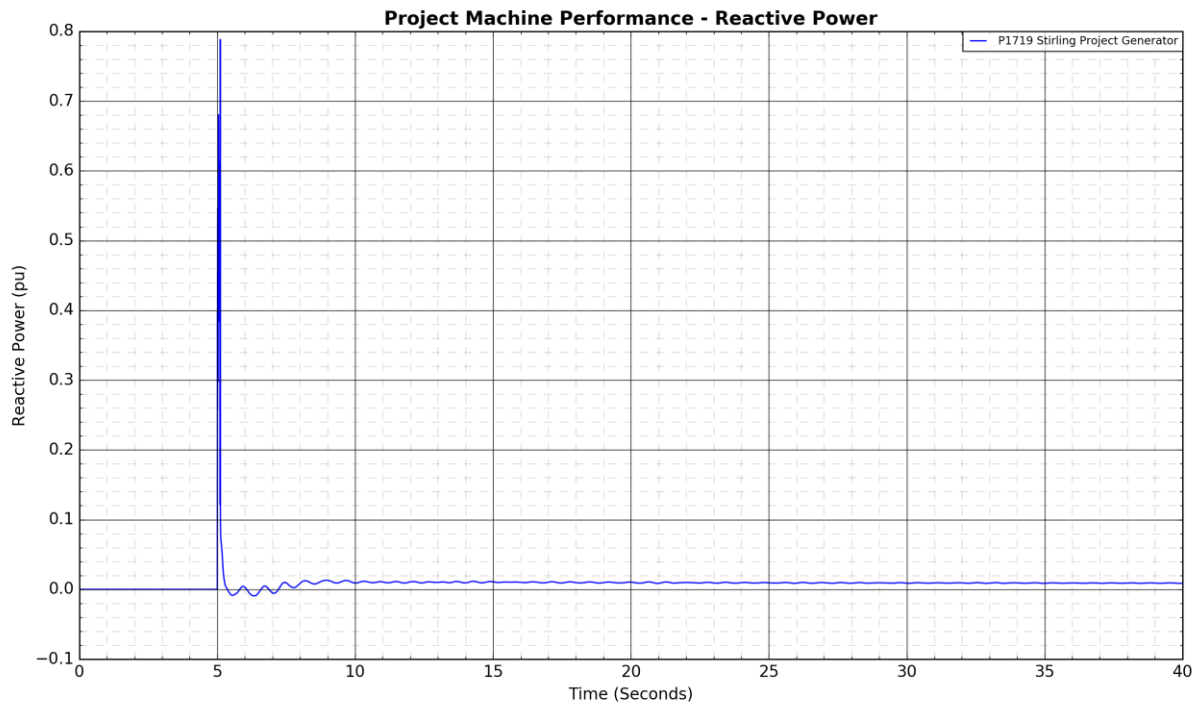
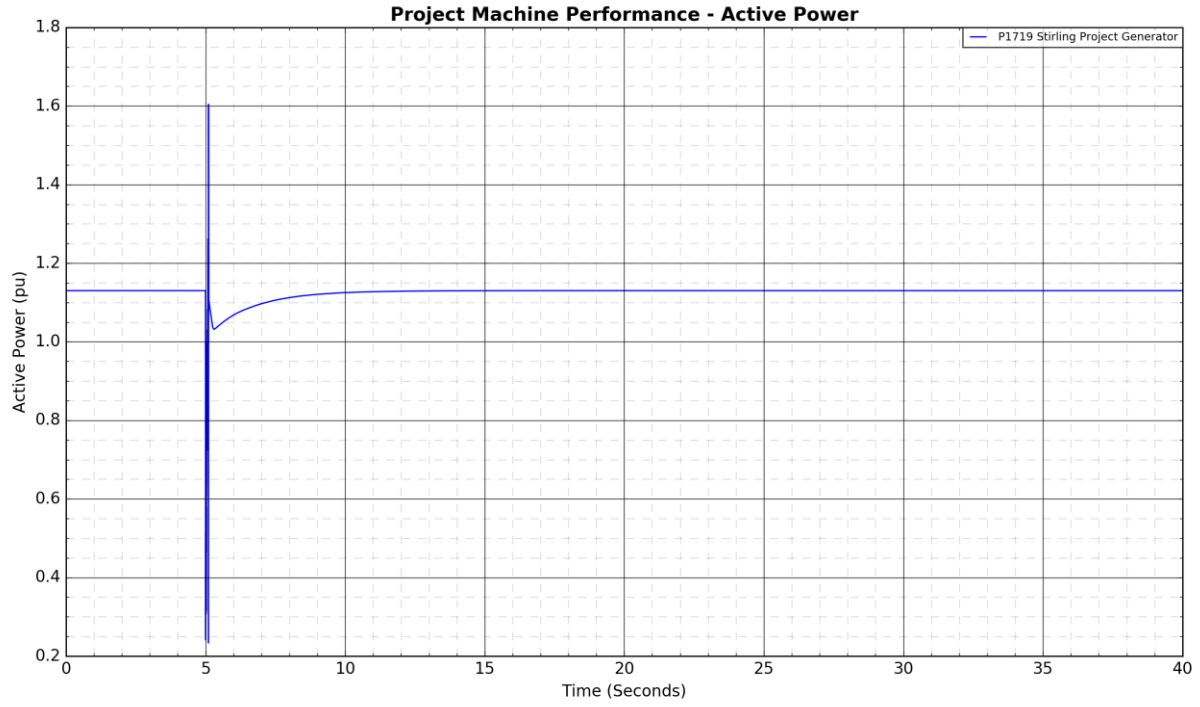
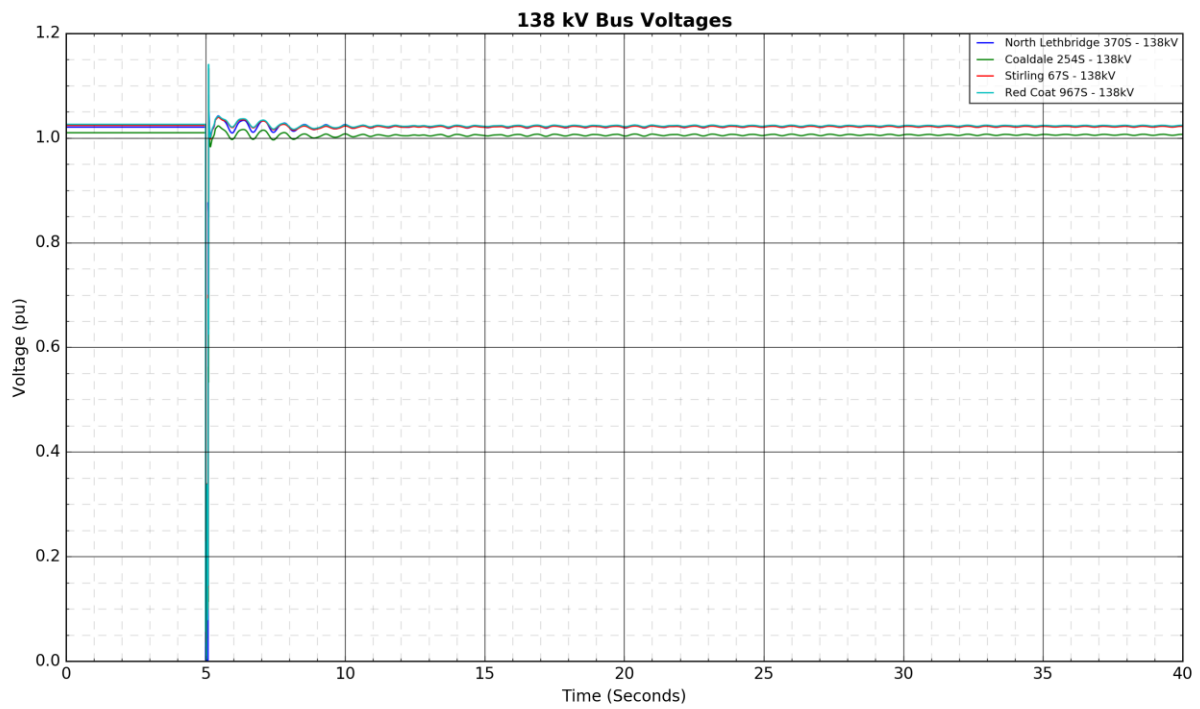
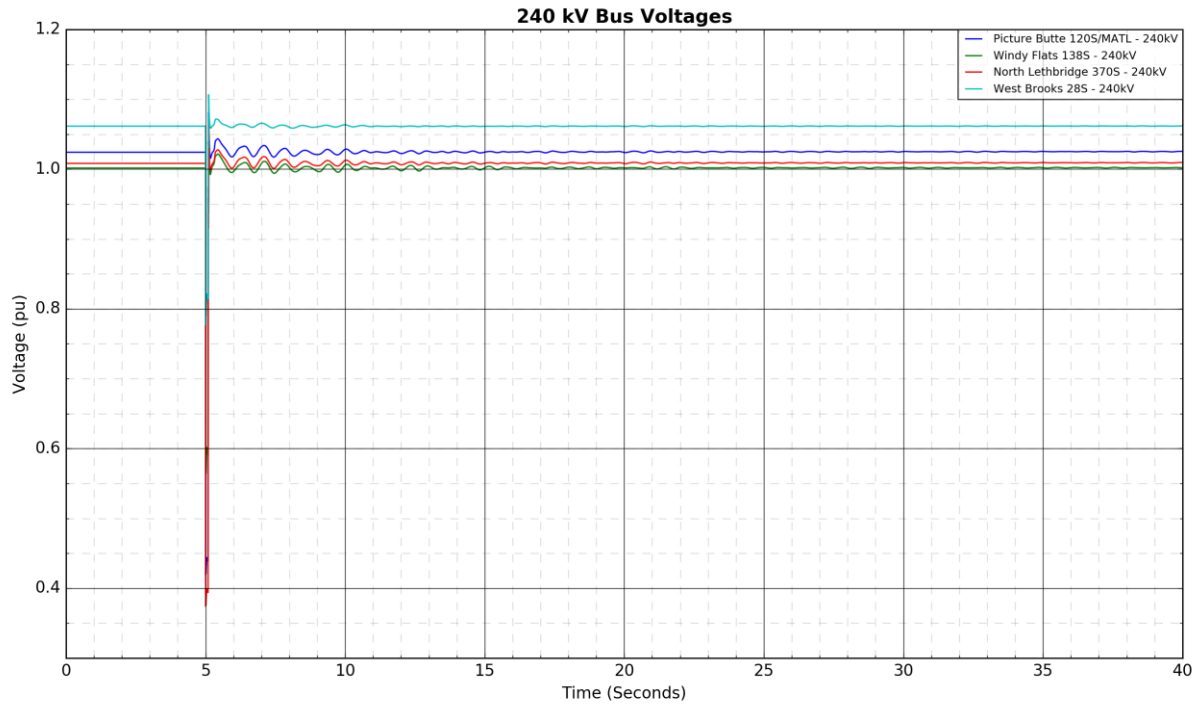
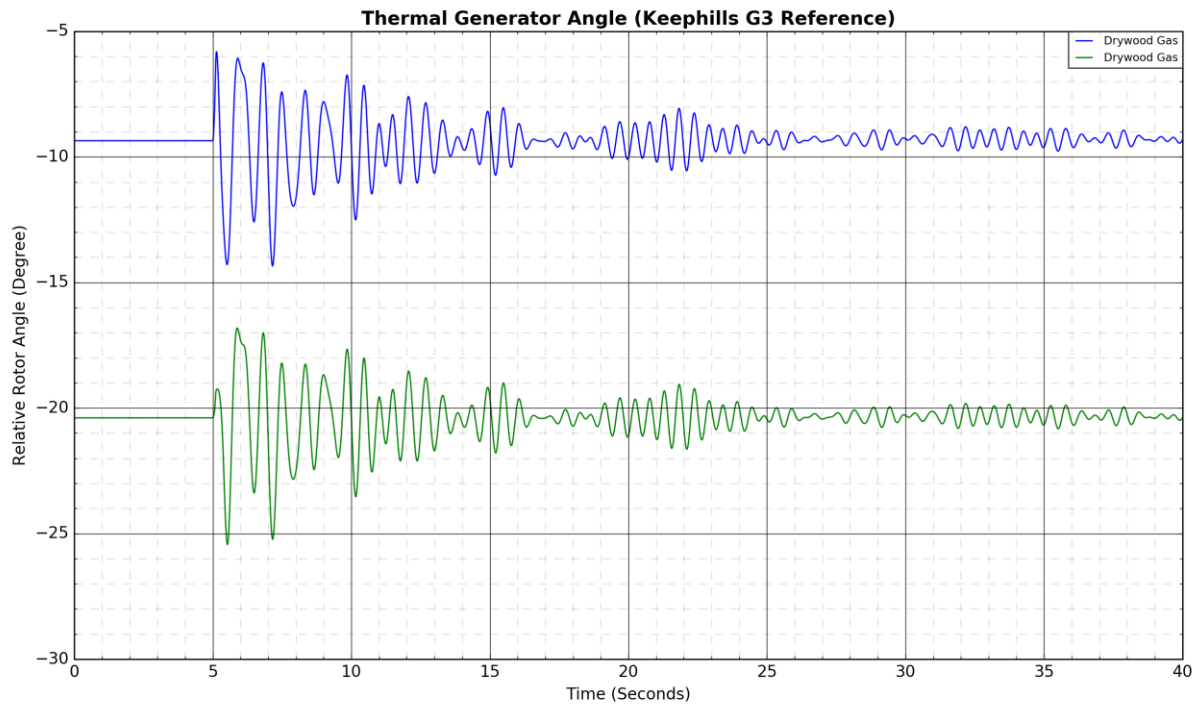
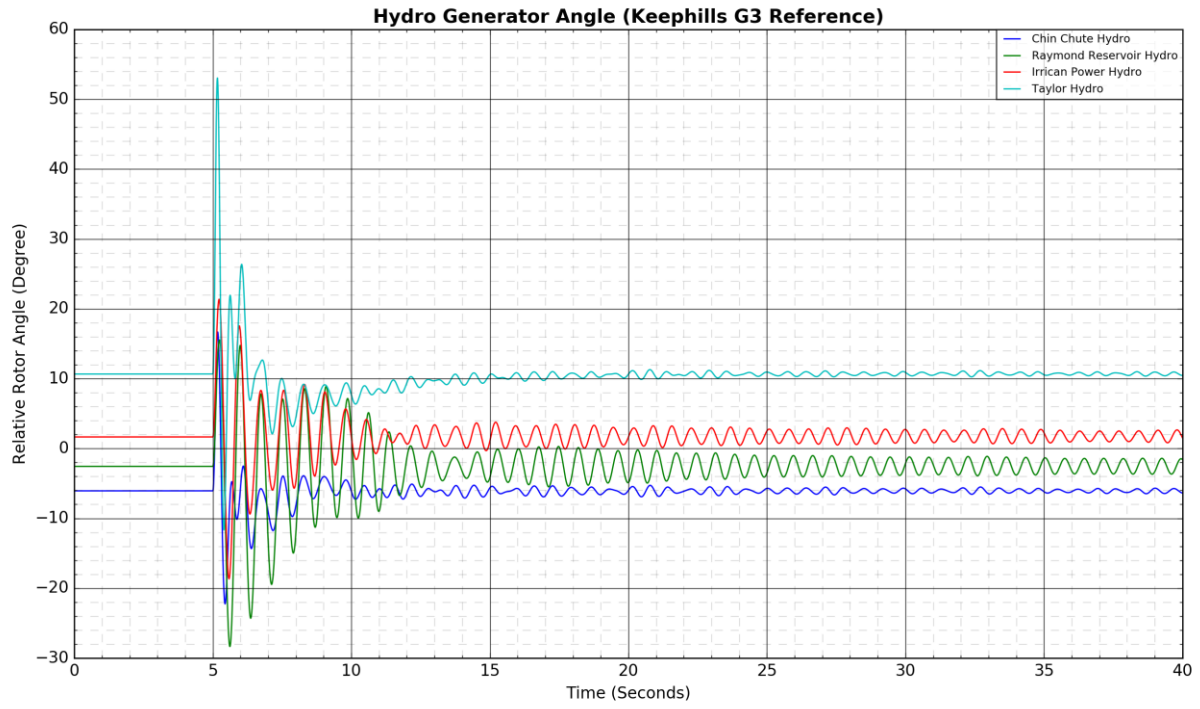
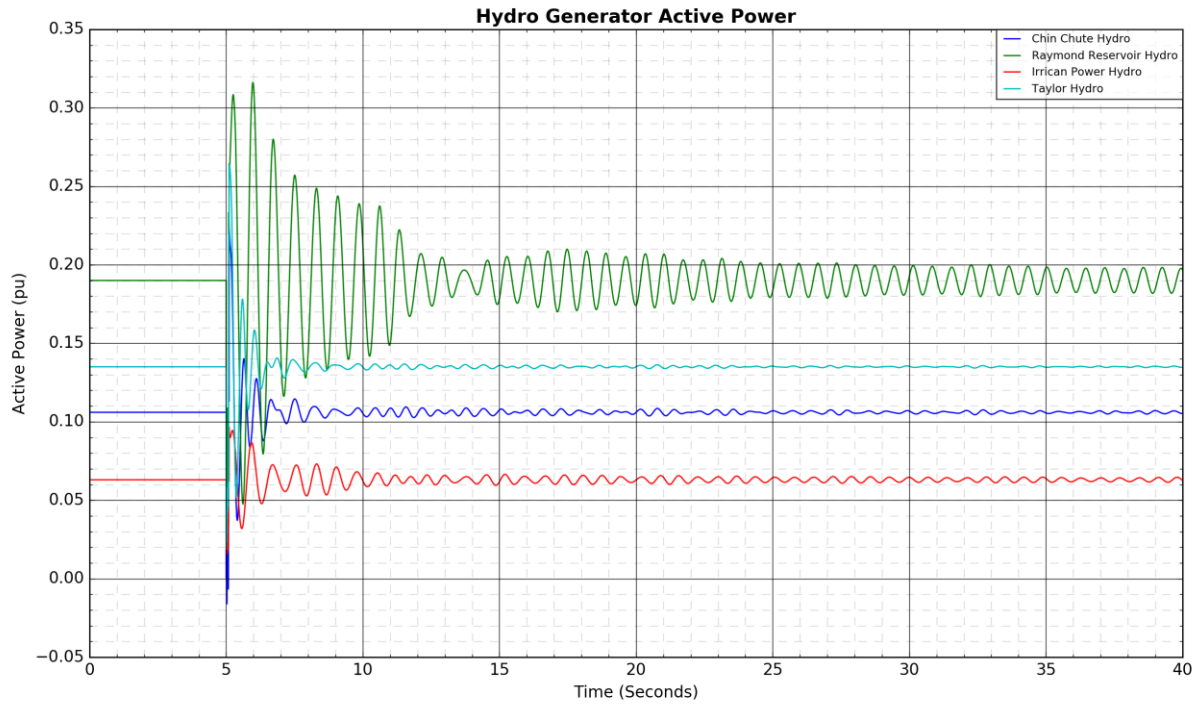
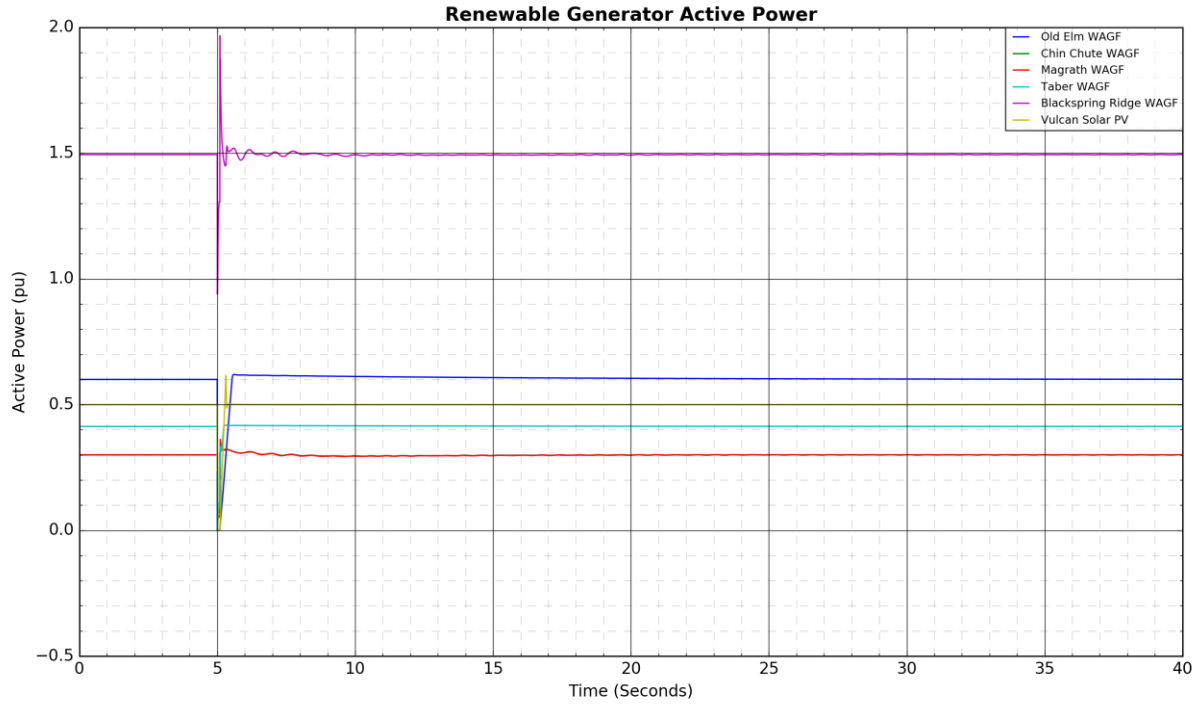


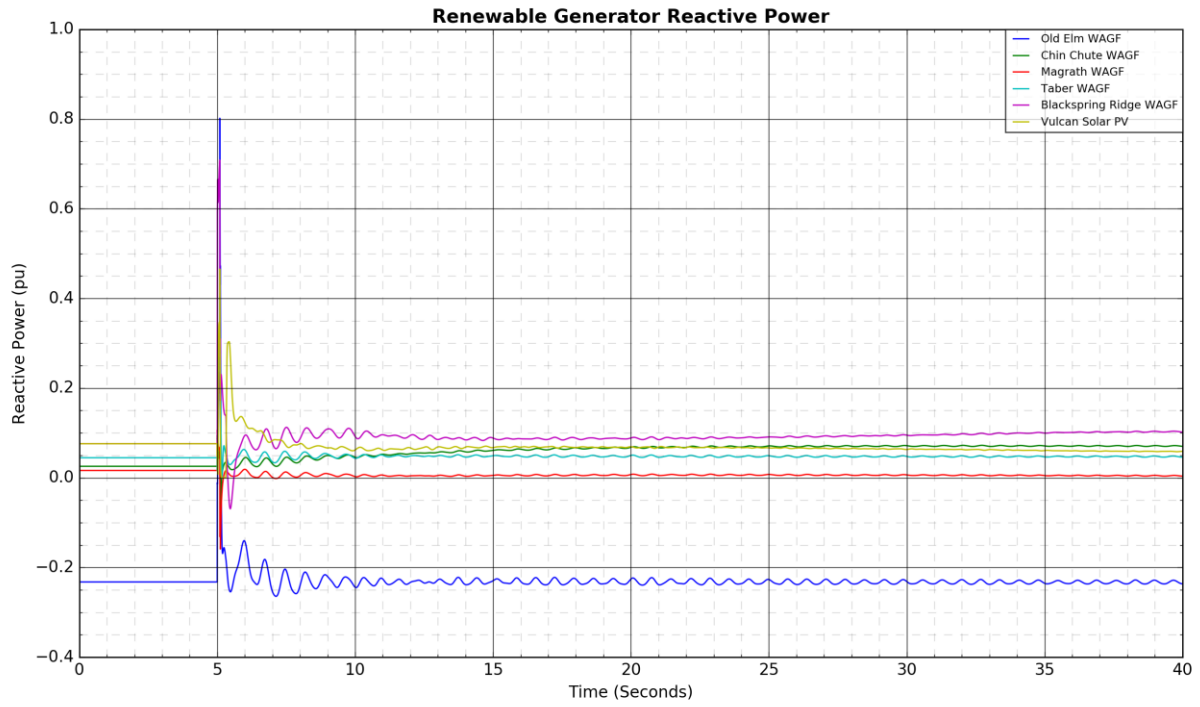
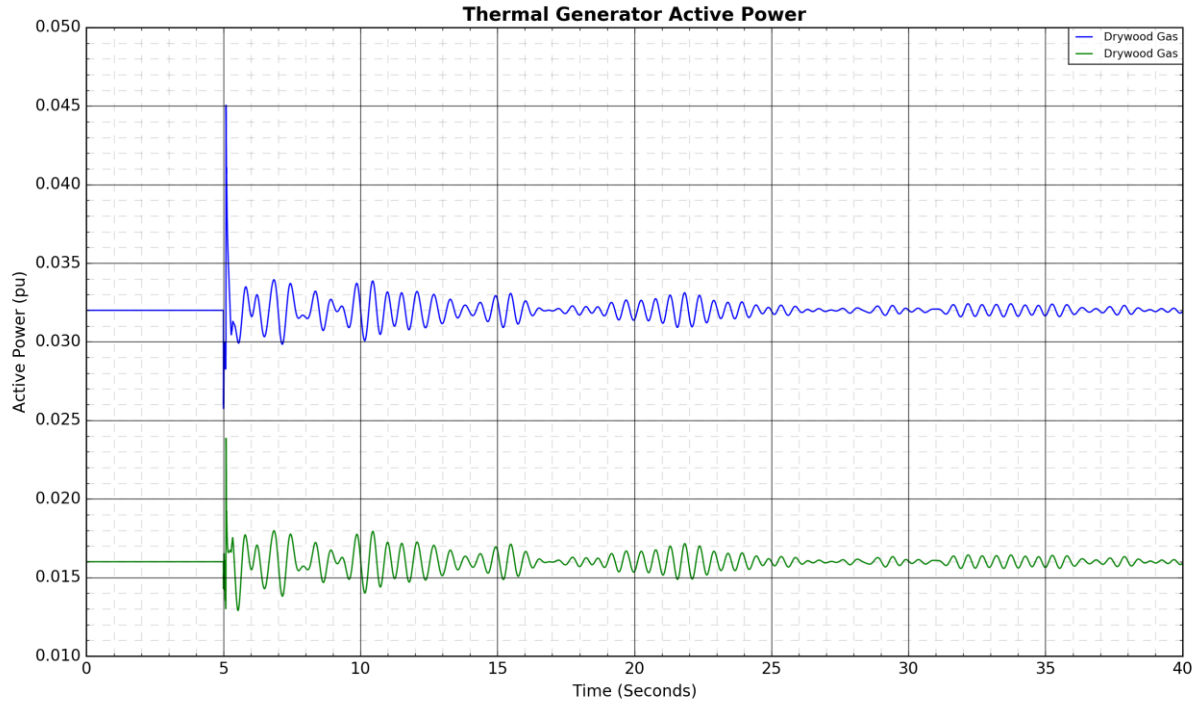
Figure A4-50: 170L Coaldale 254S to North Lethbridge 370S: Fault Near North Lethbridge 370S

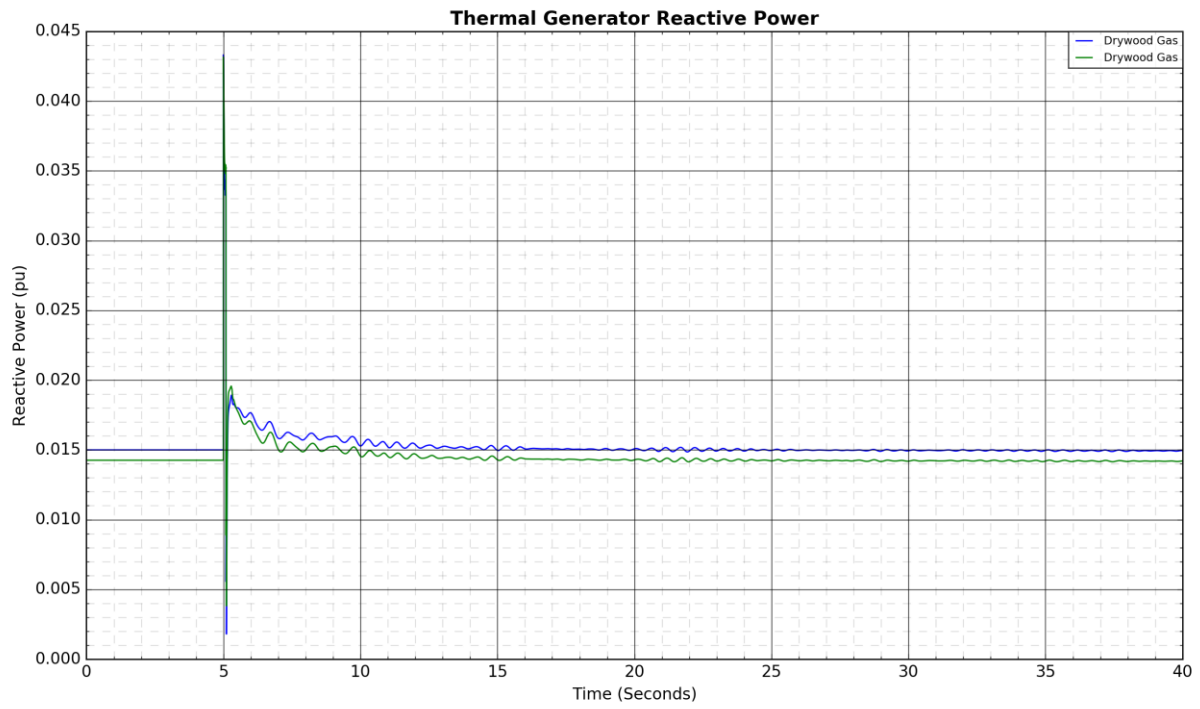
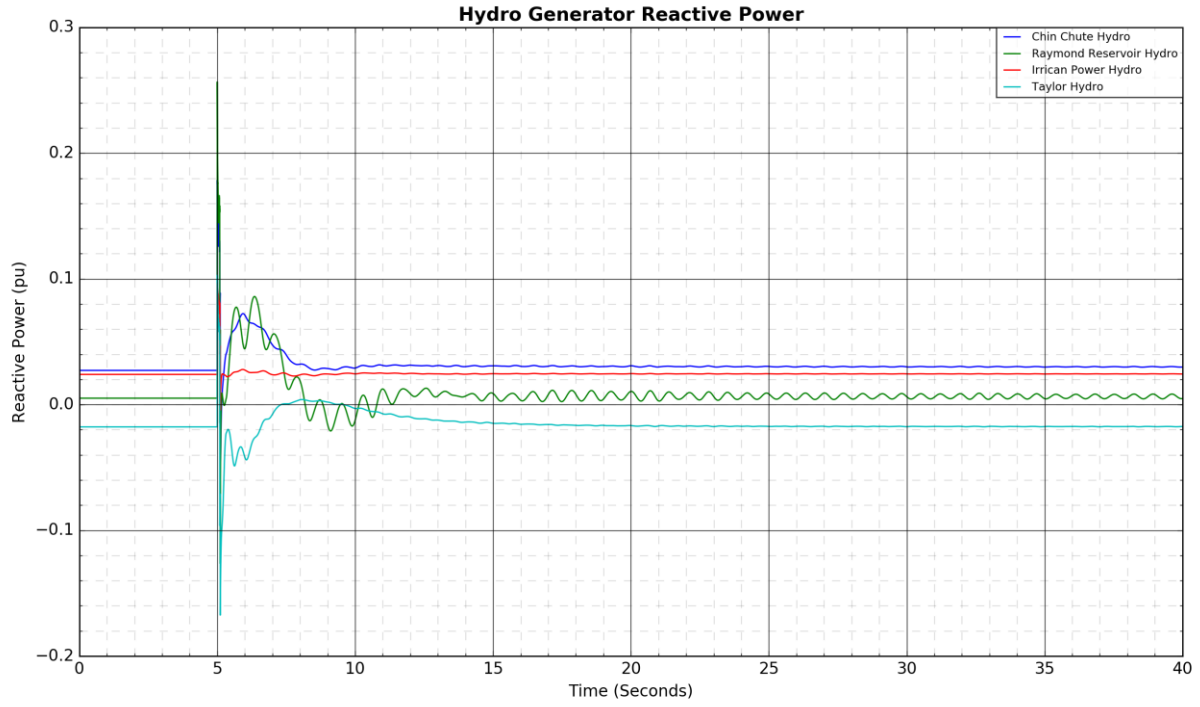


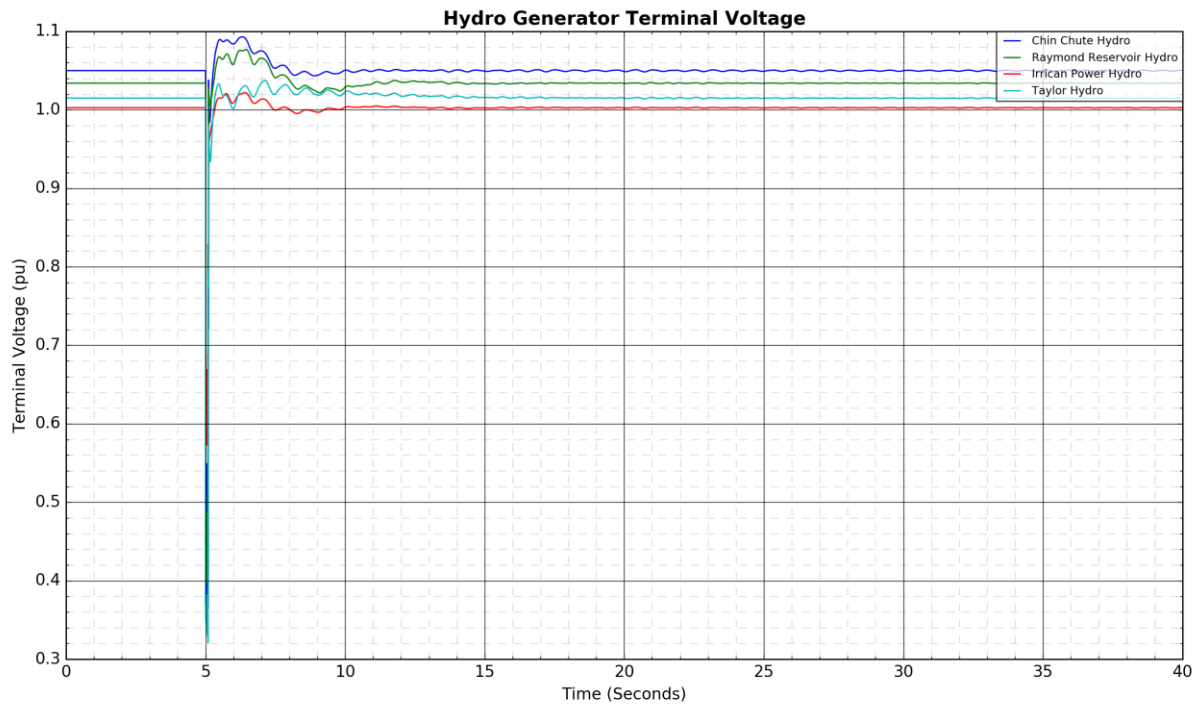
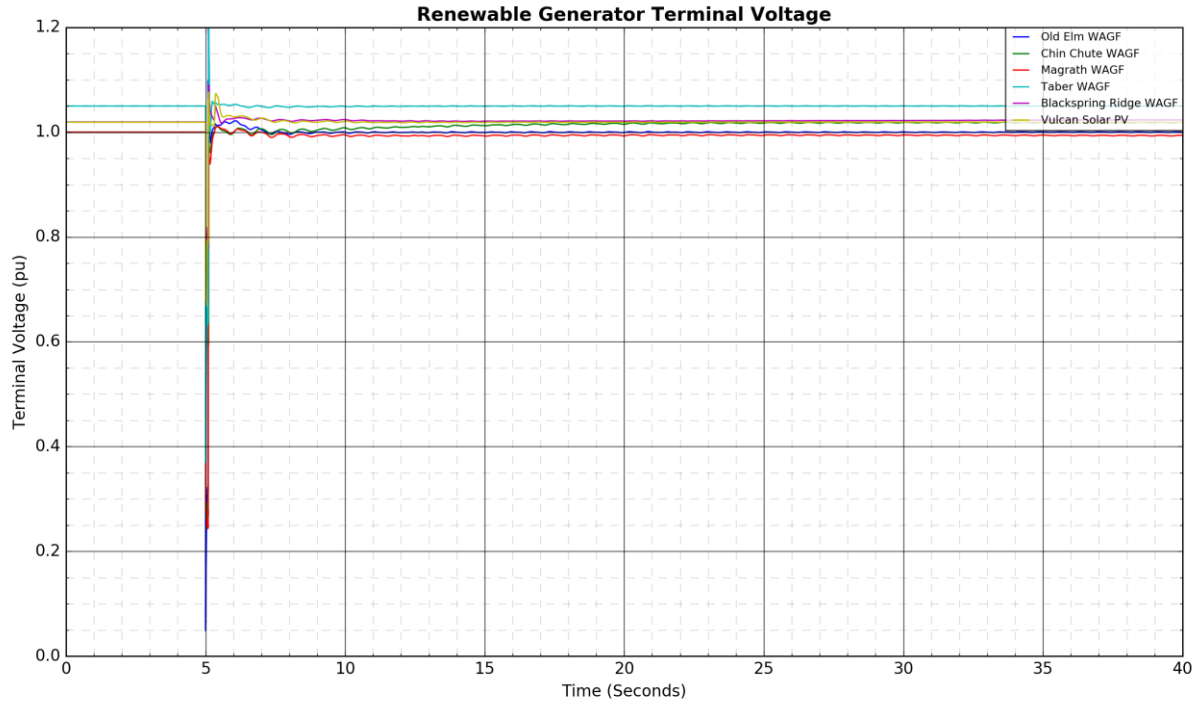


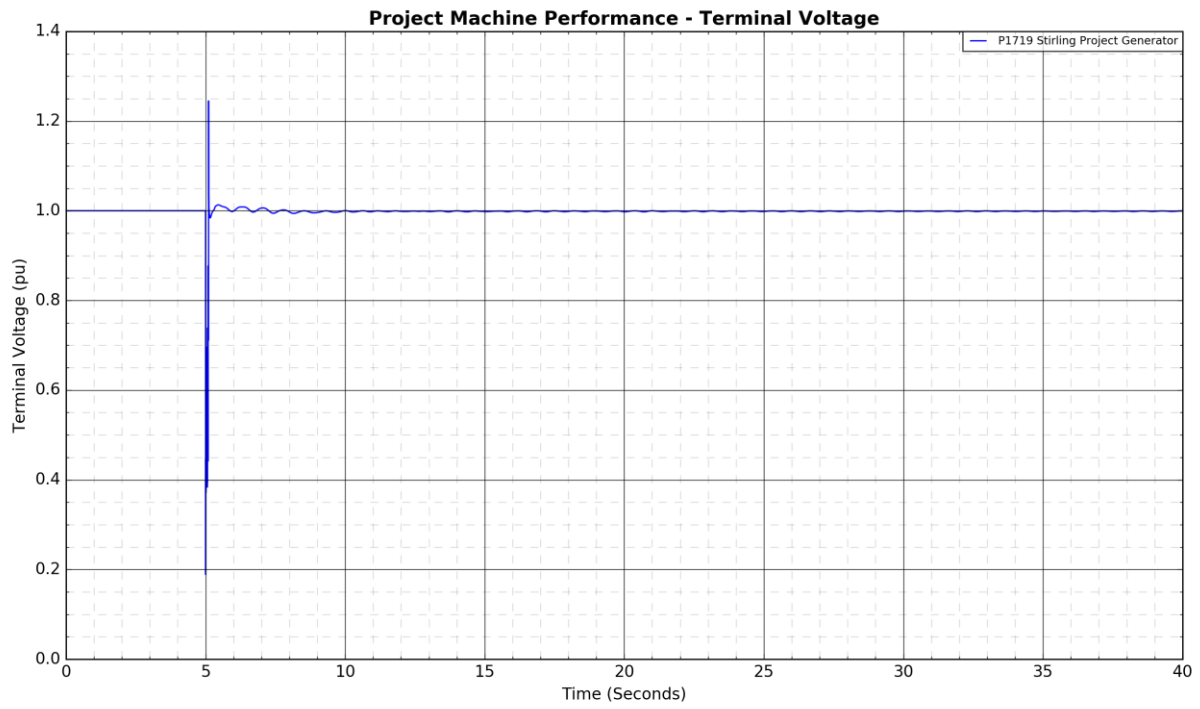
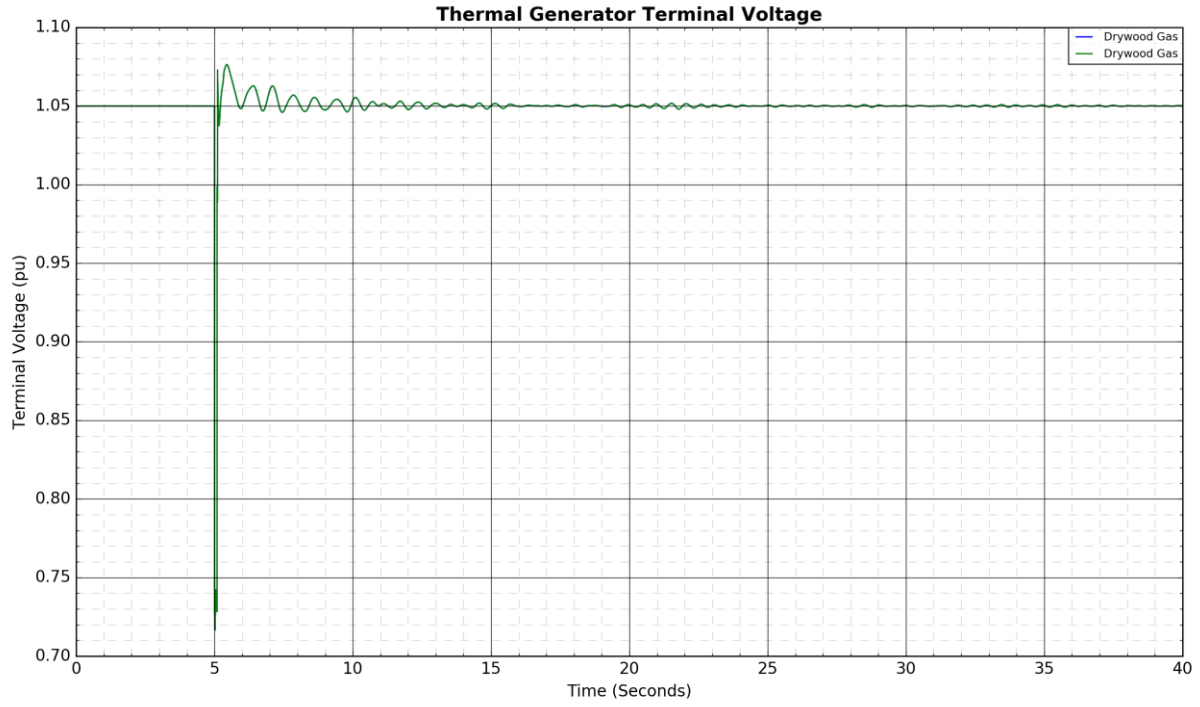
Engineering Connection Assessment Results: Stirling Wind Project Connection











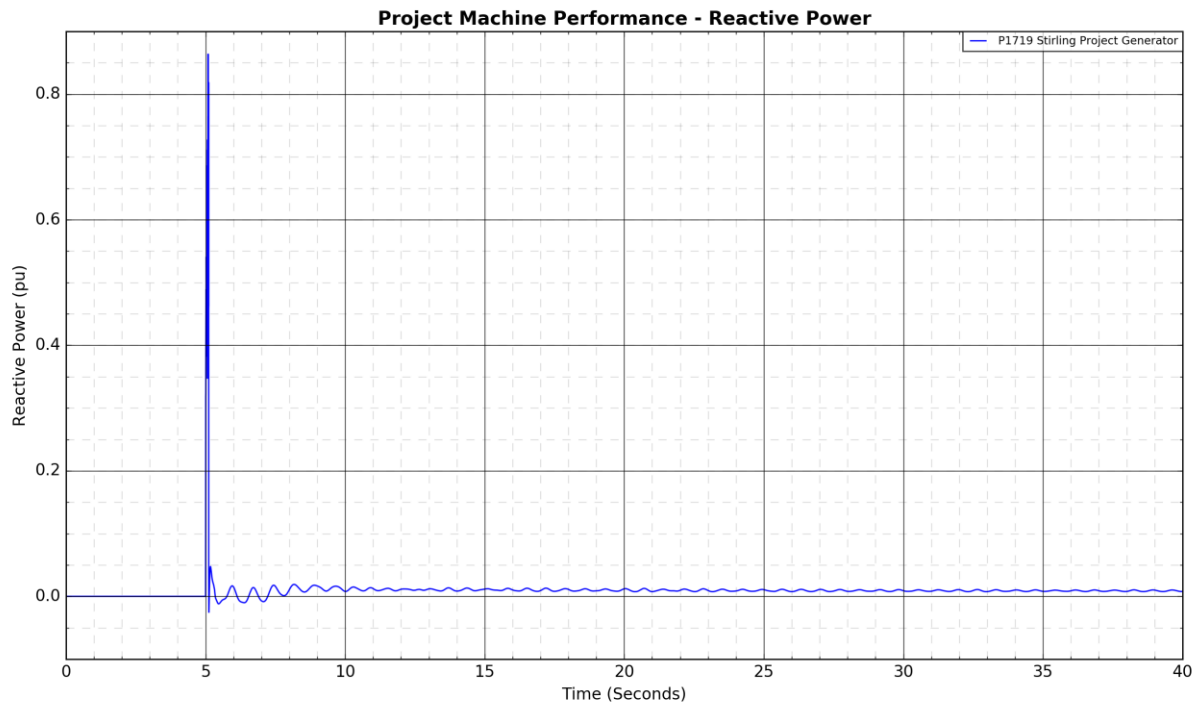
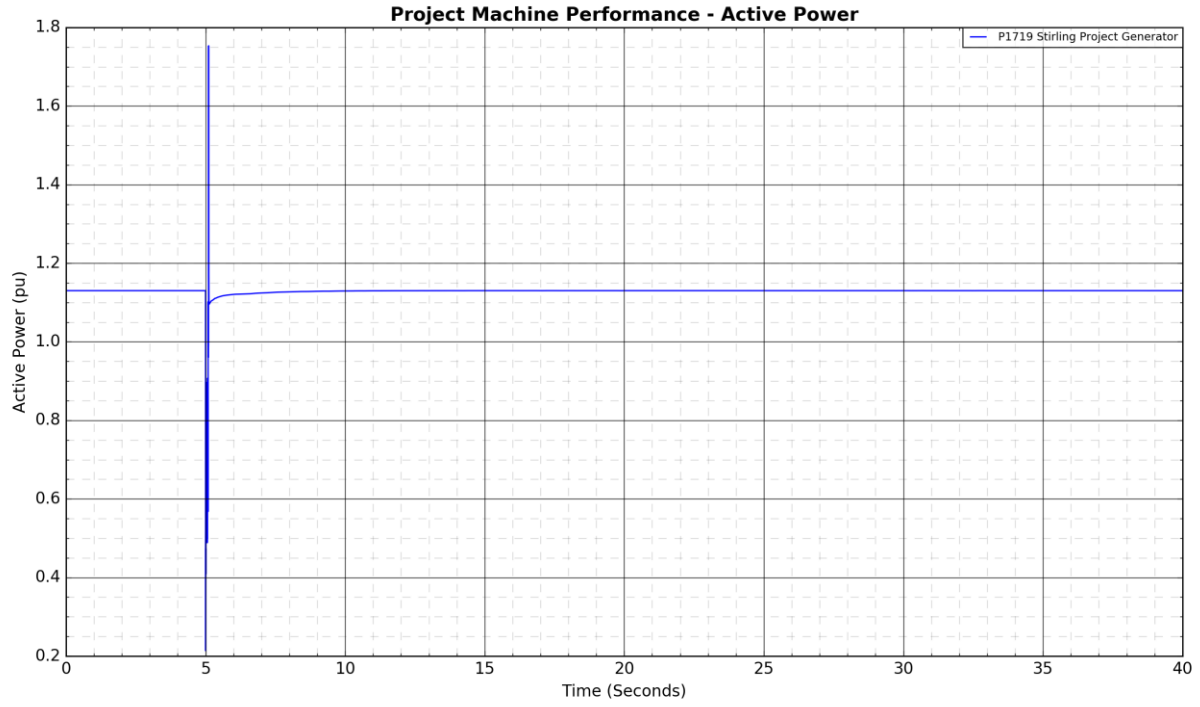
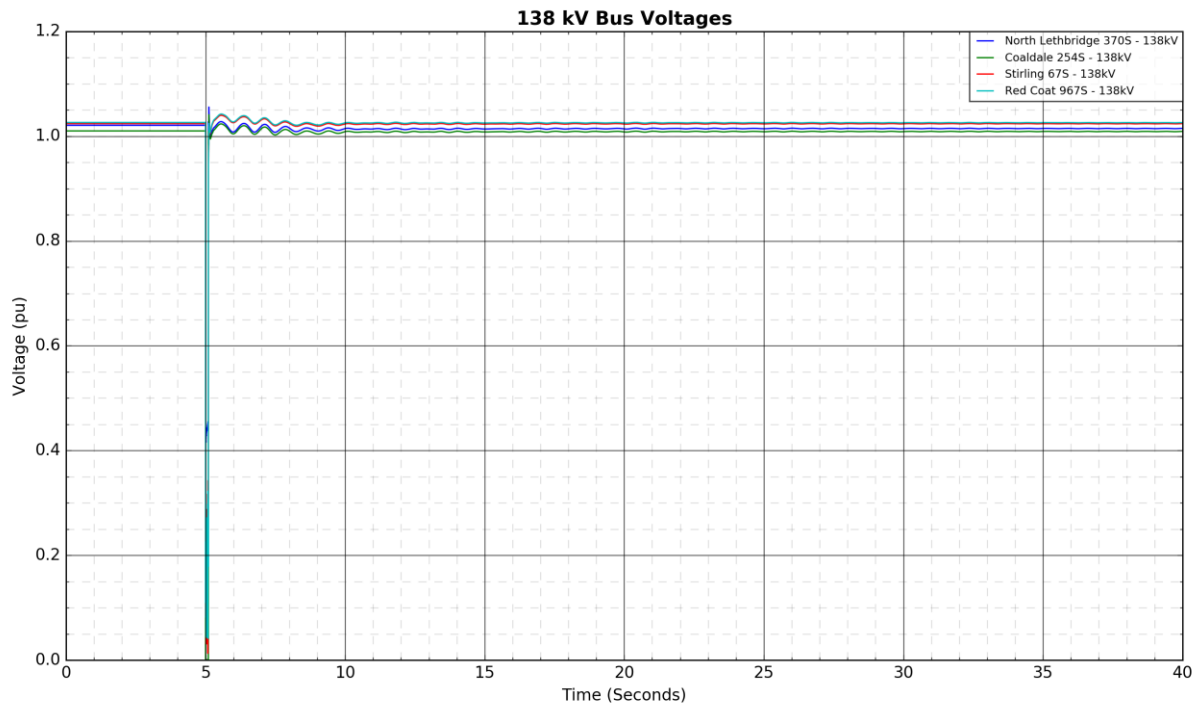
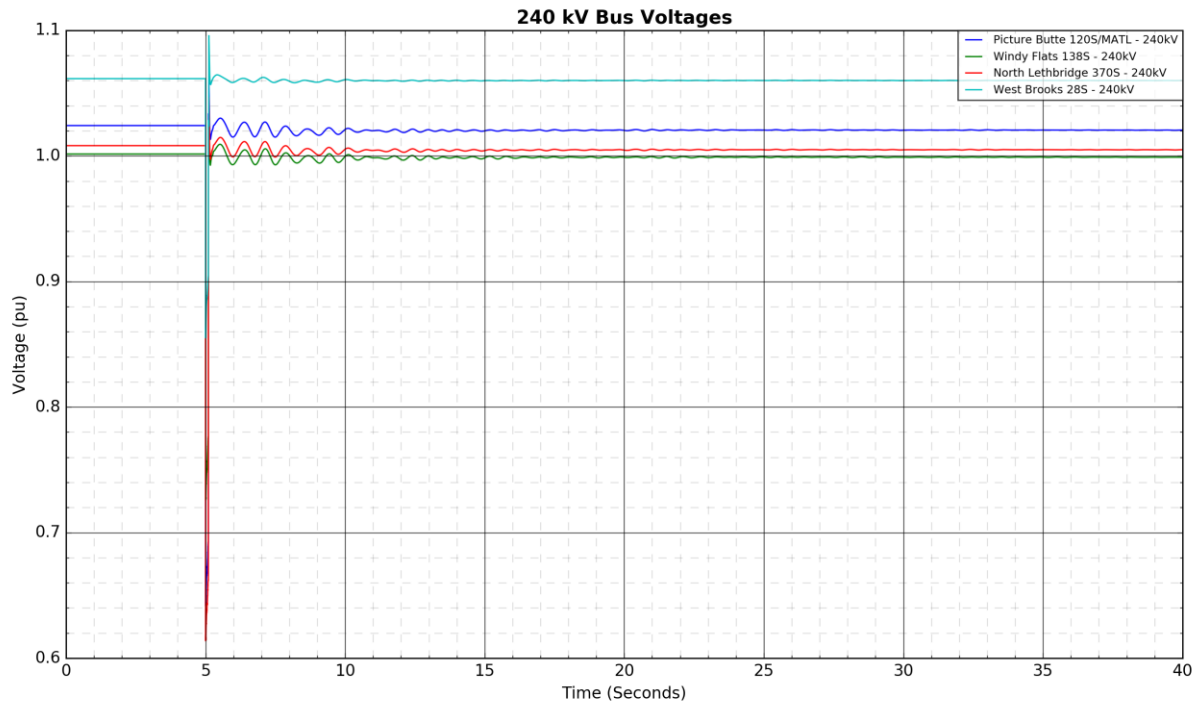
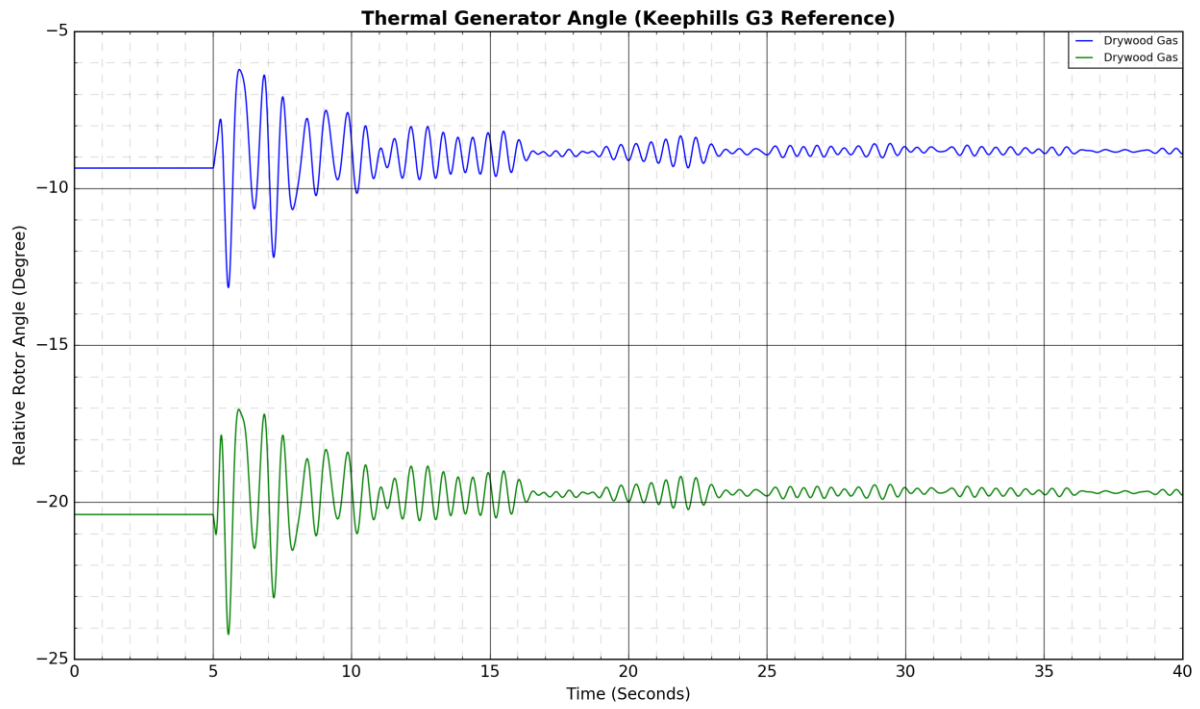
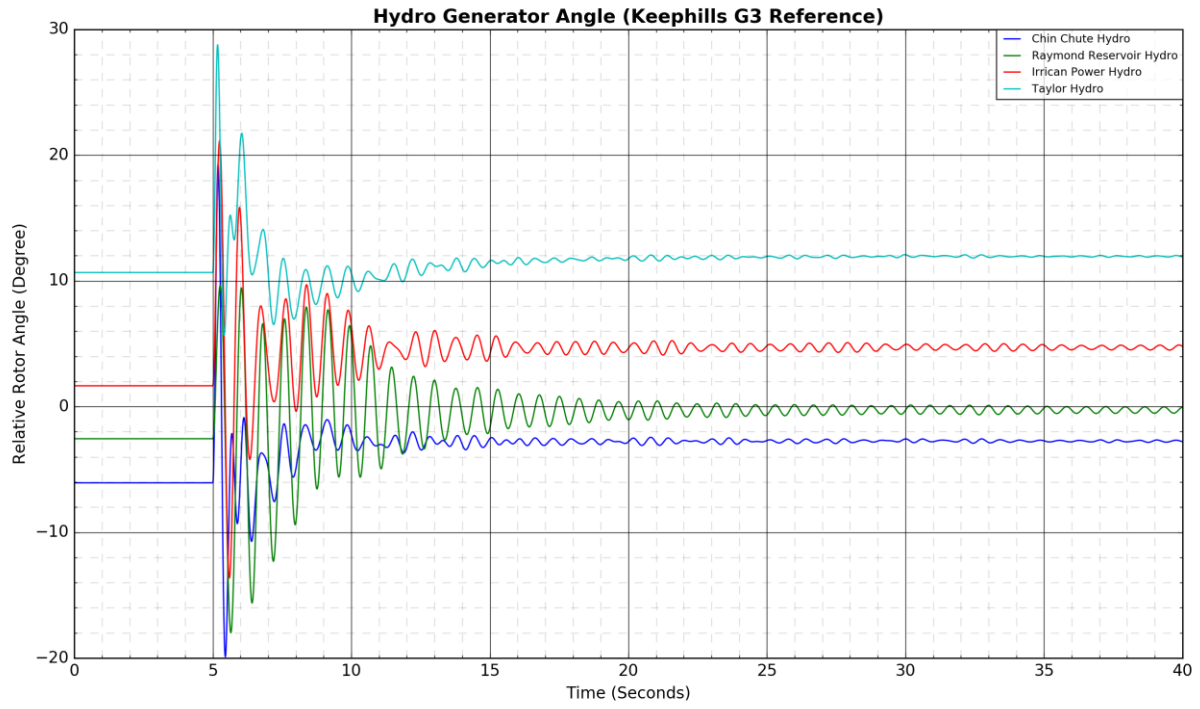
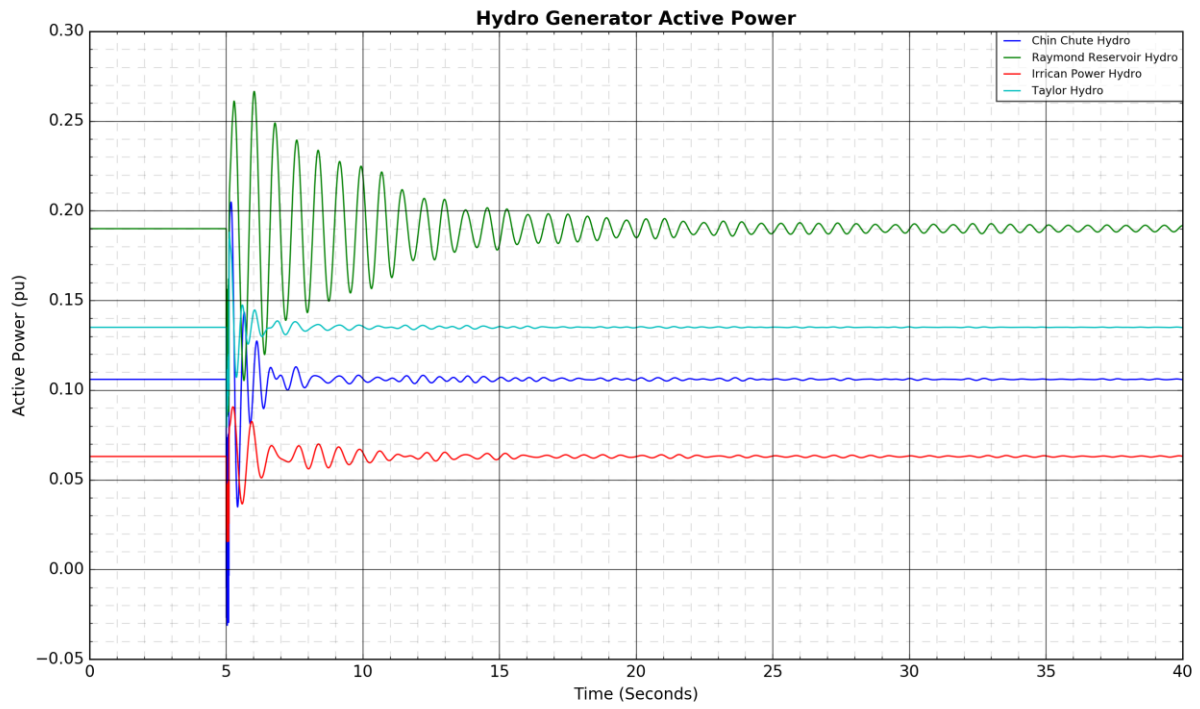
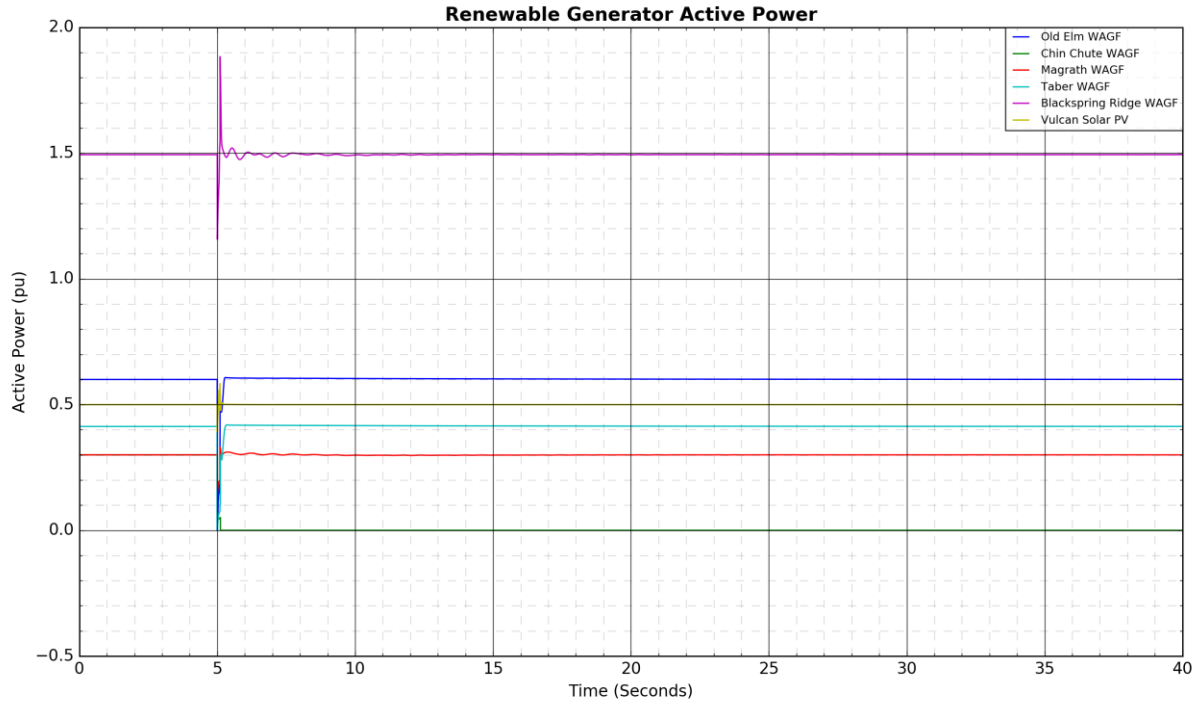


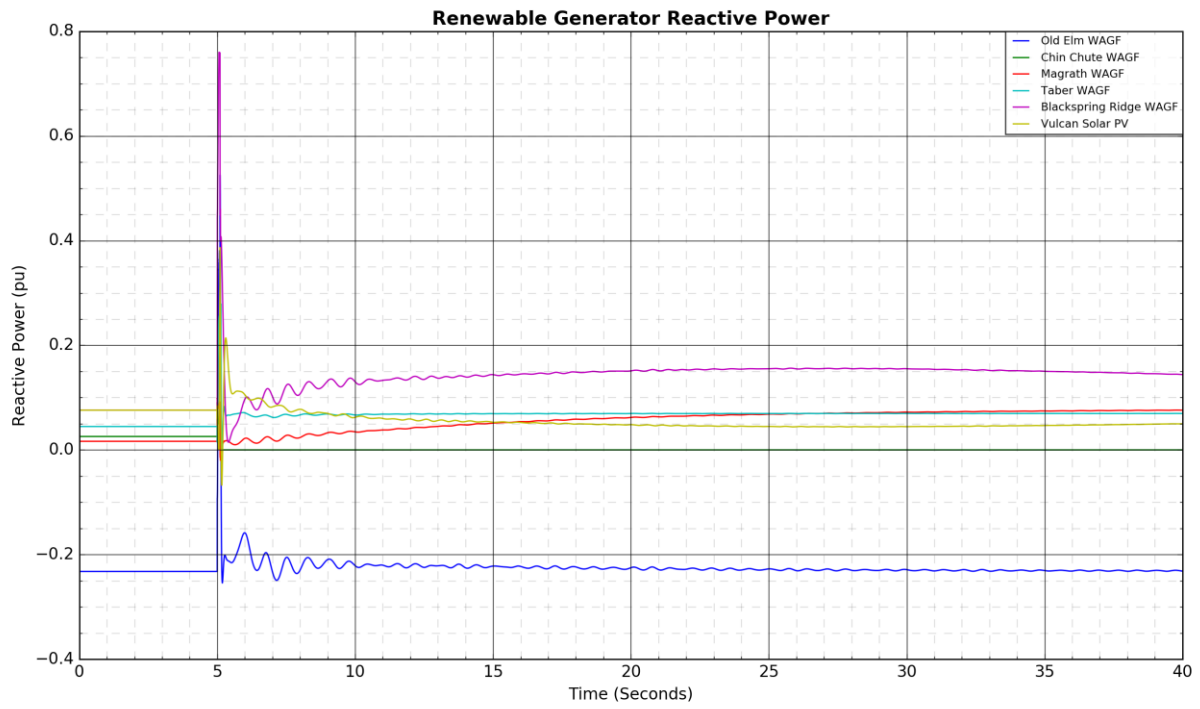
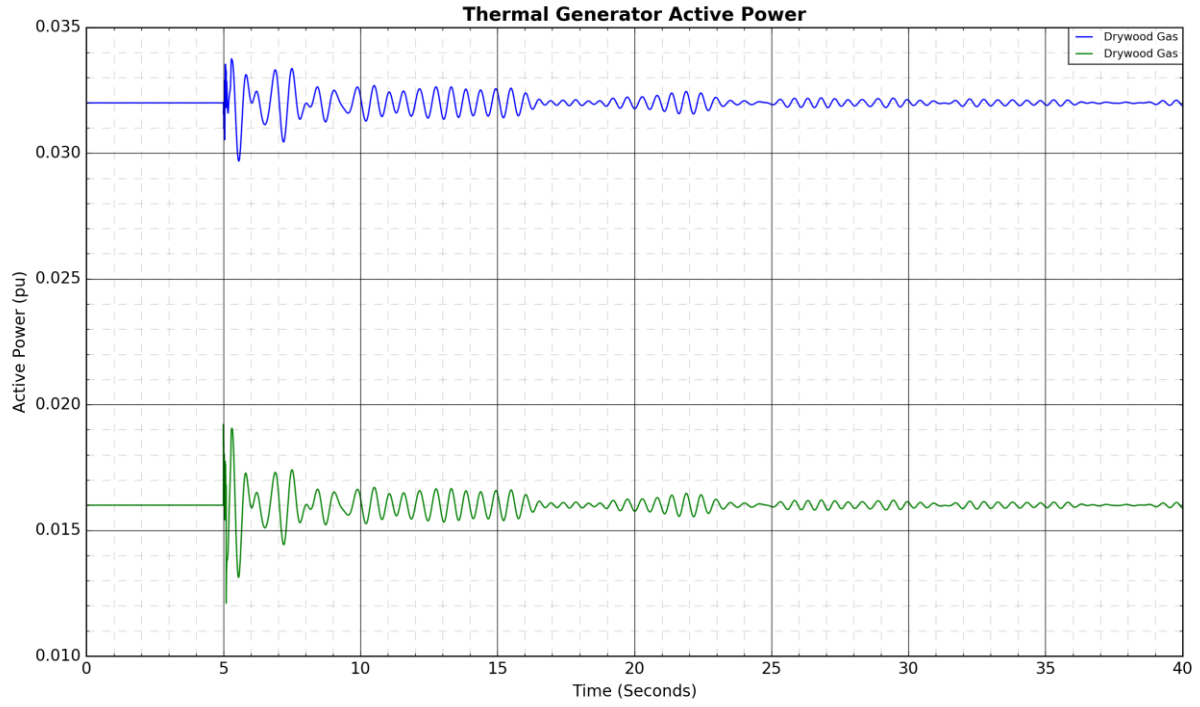
Figure A4-51: 172L Coaldale 254S to Taber 83S: Fault Near Coaldale 254S

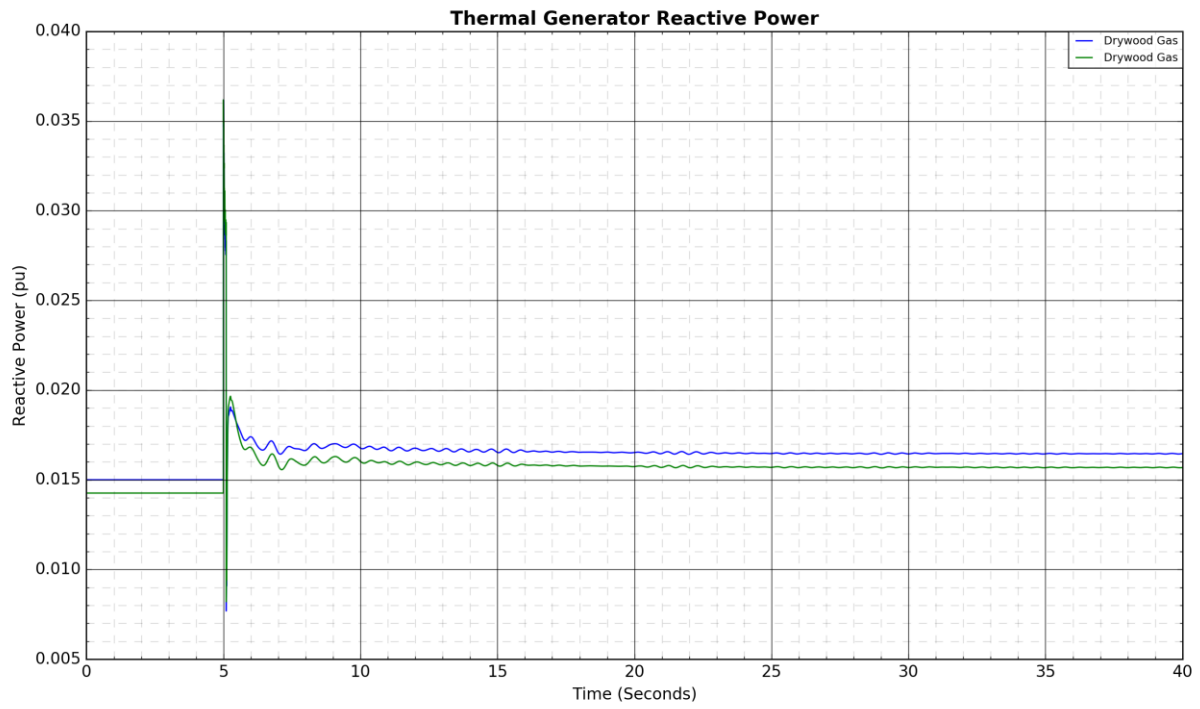
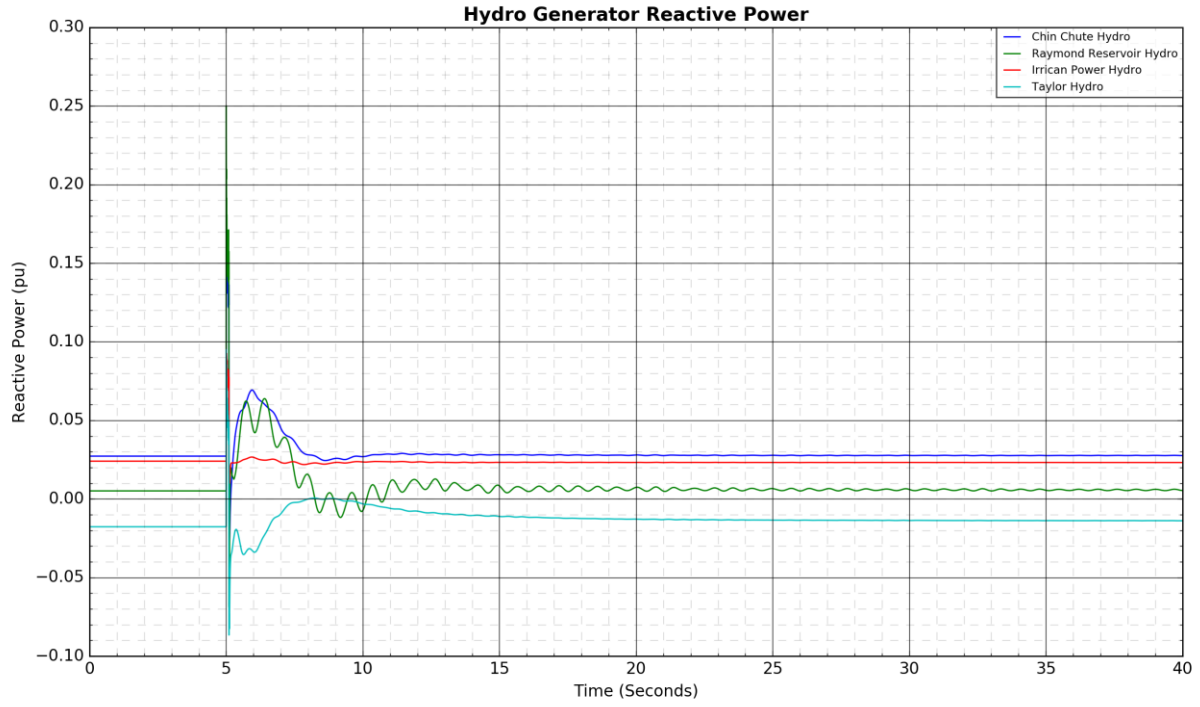


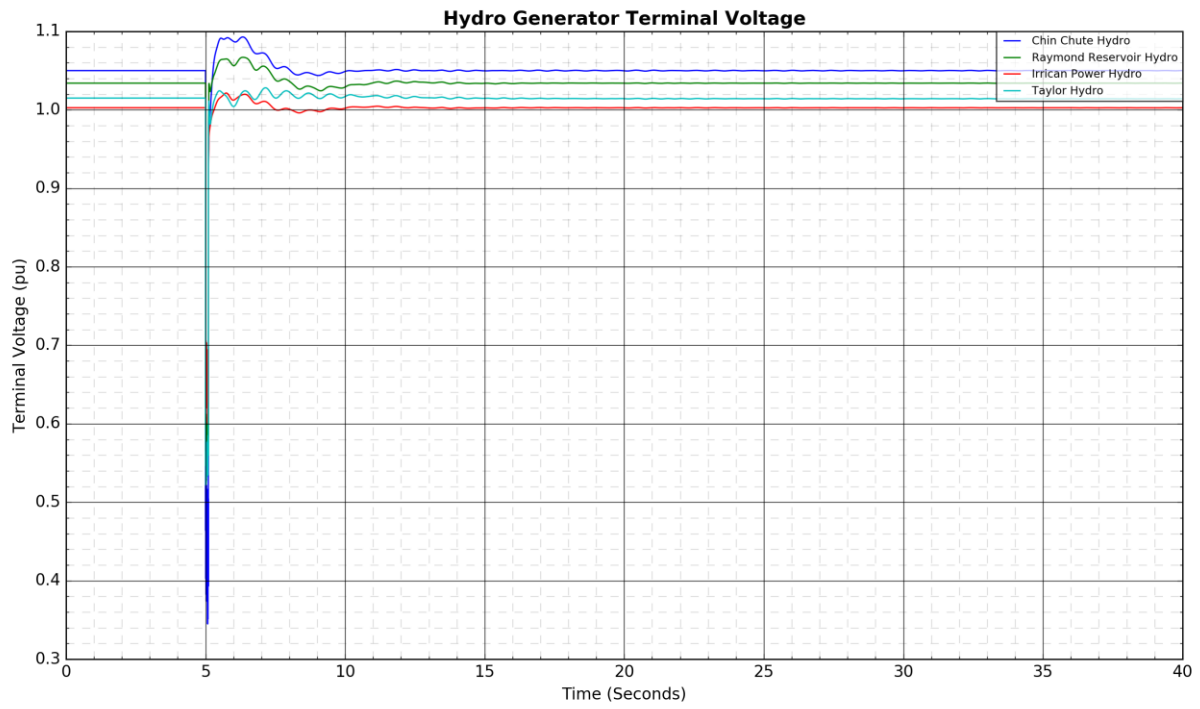
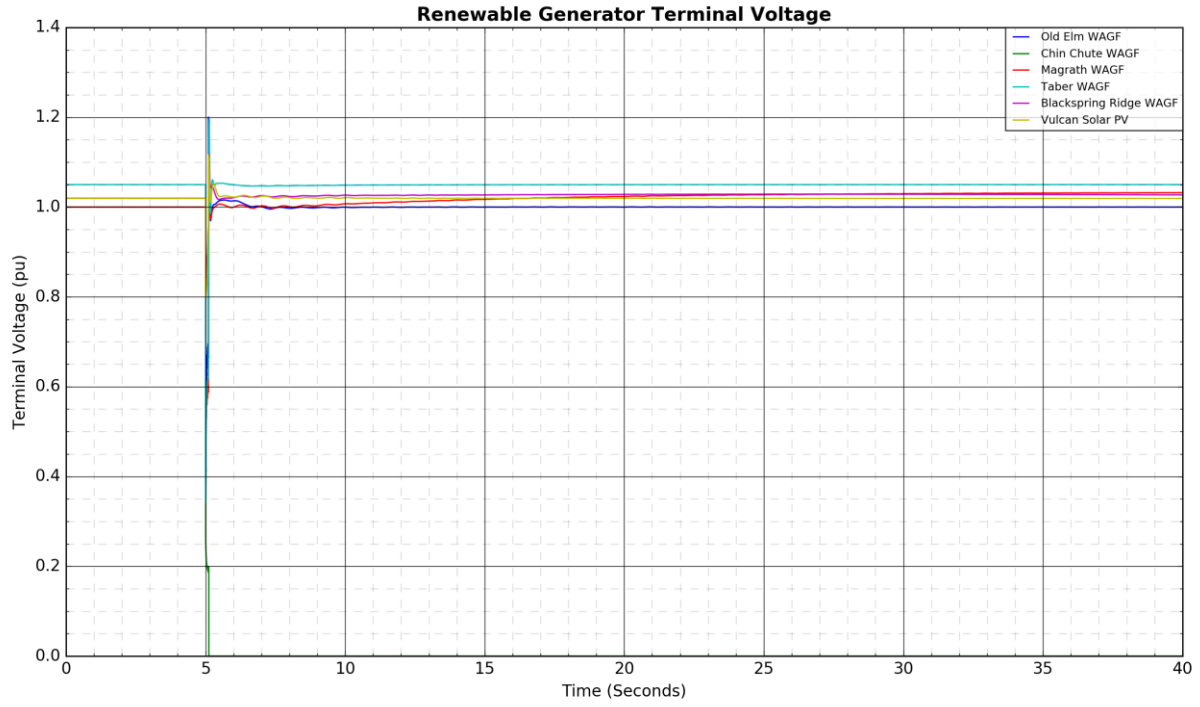


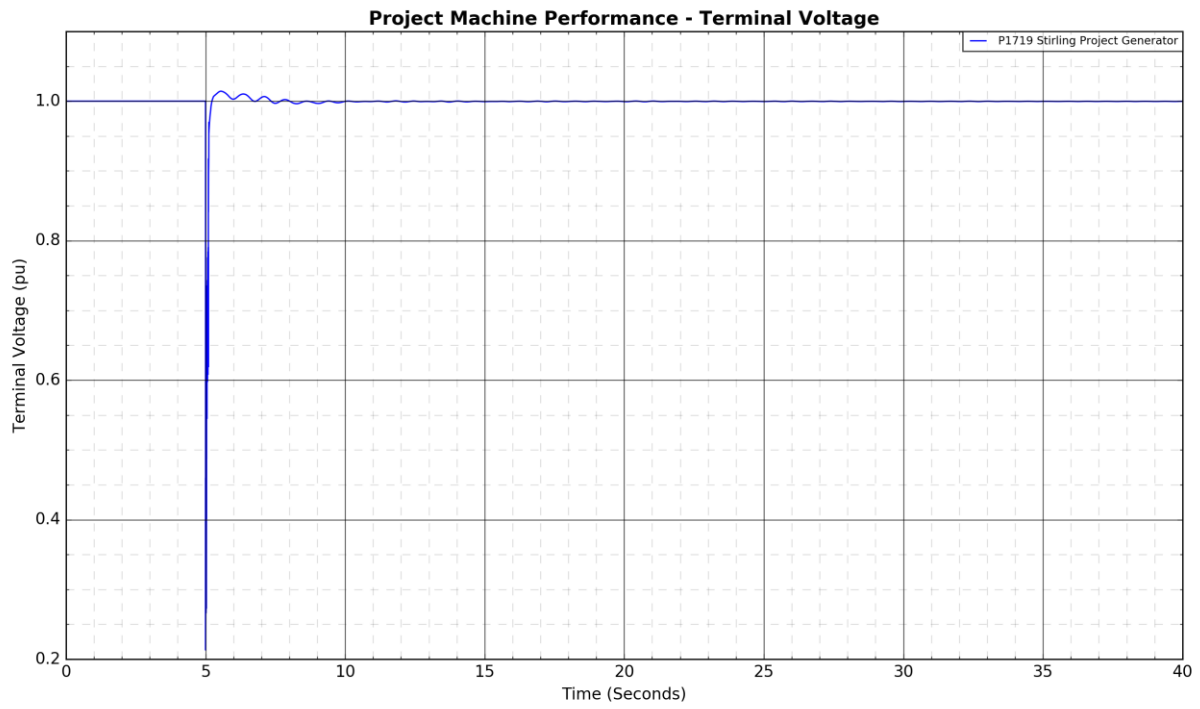
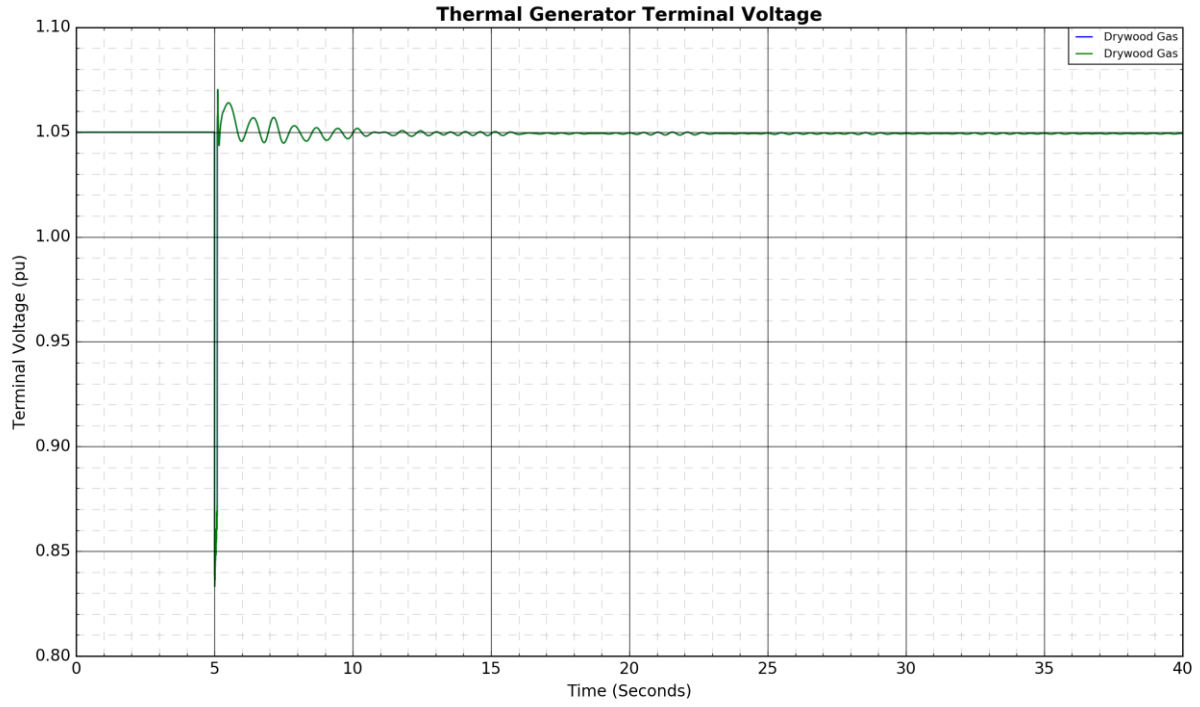
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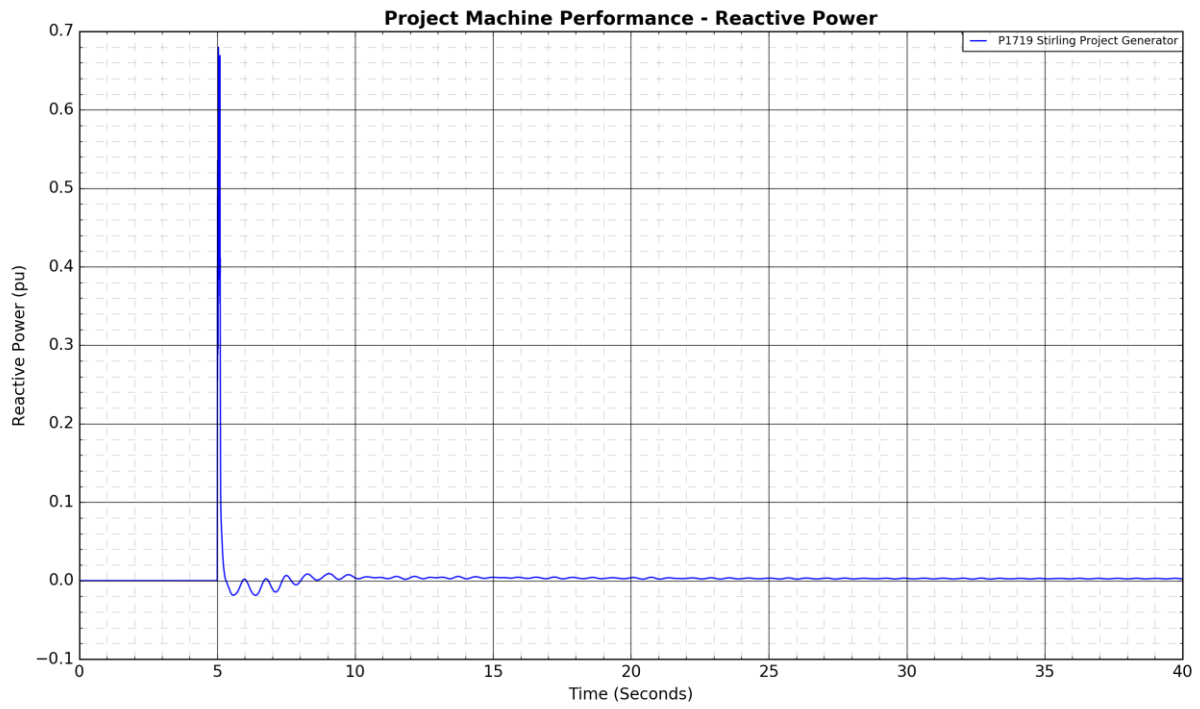
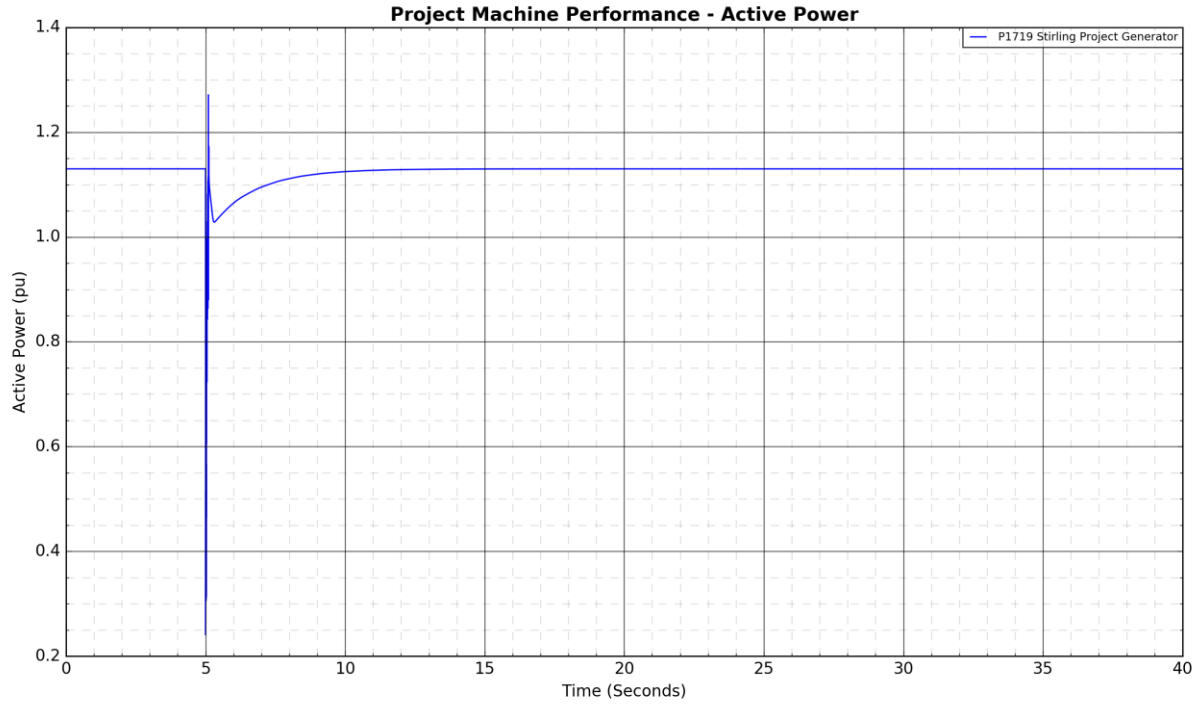
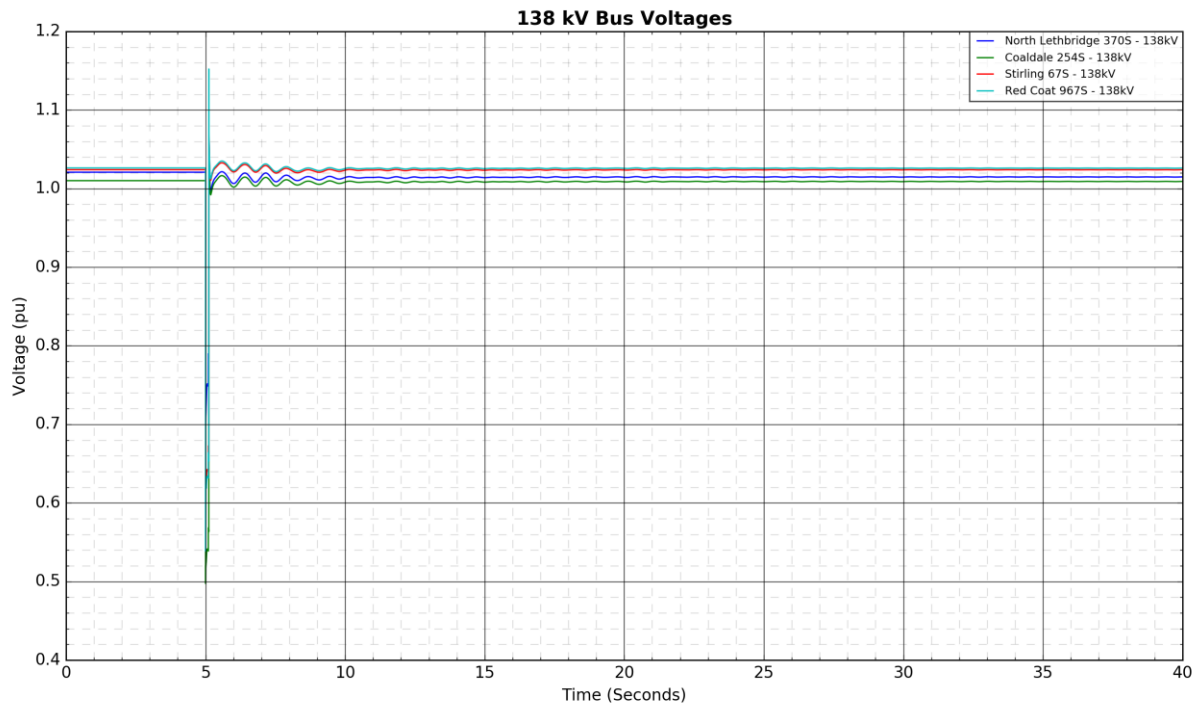
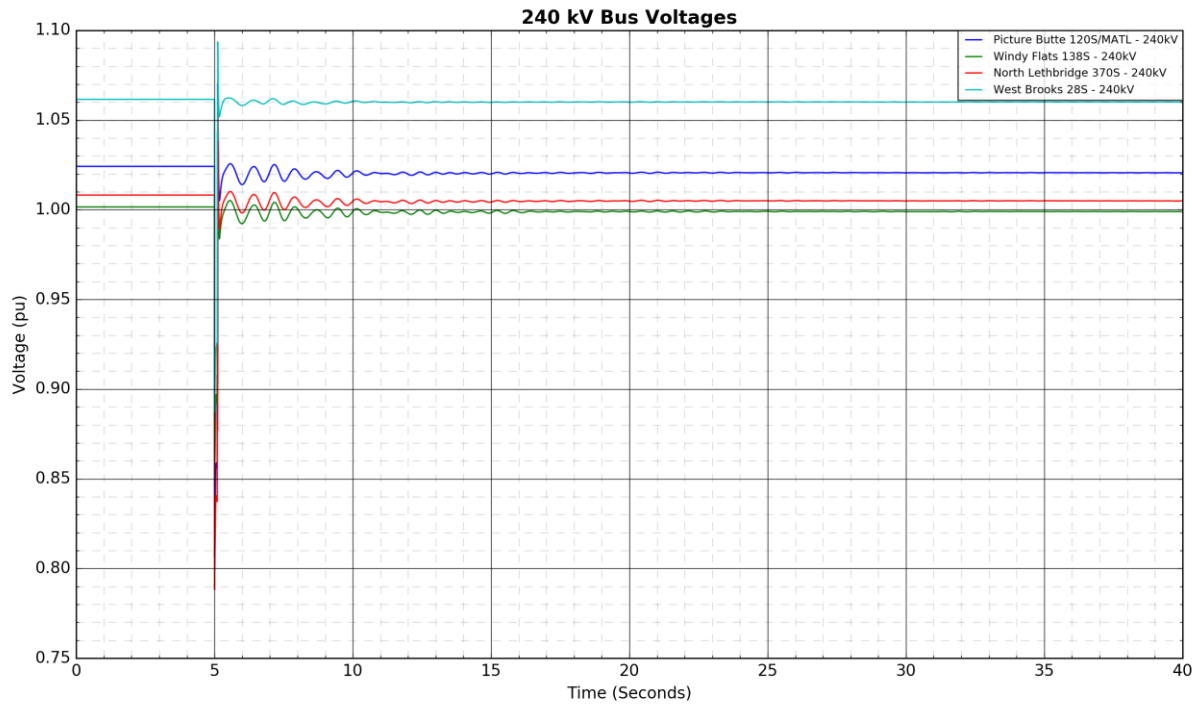
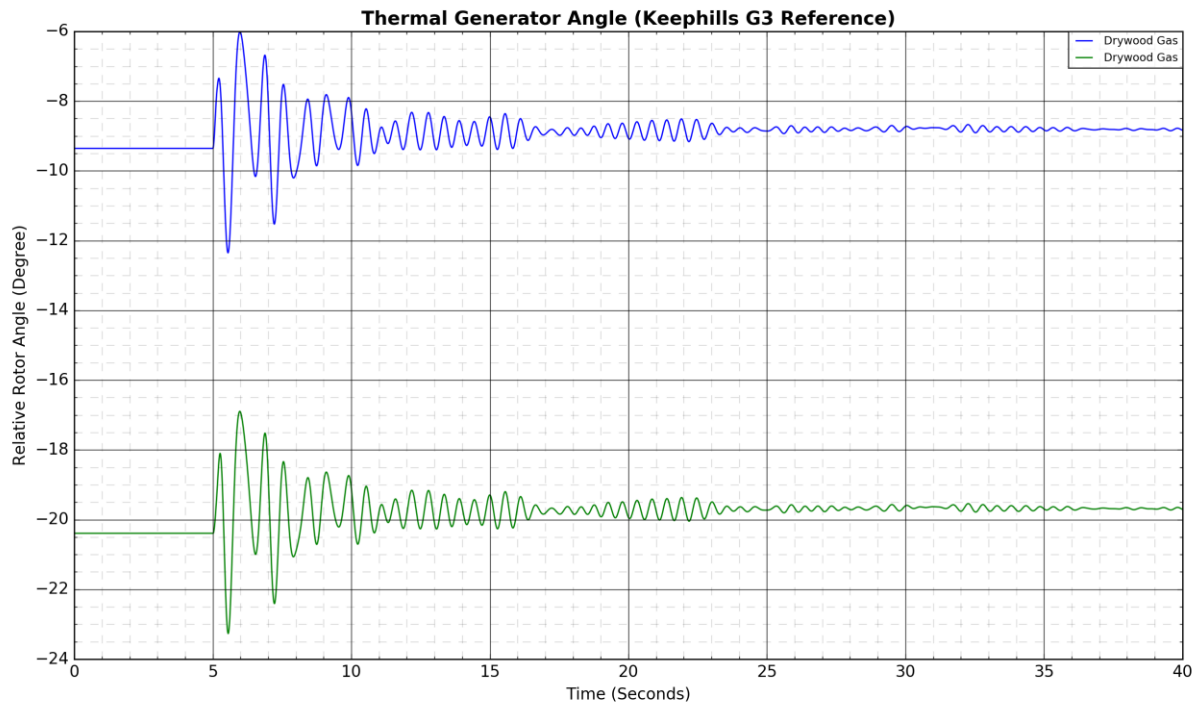
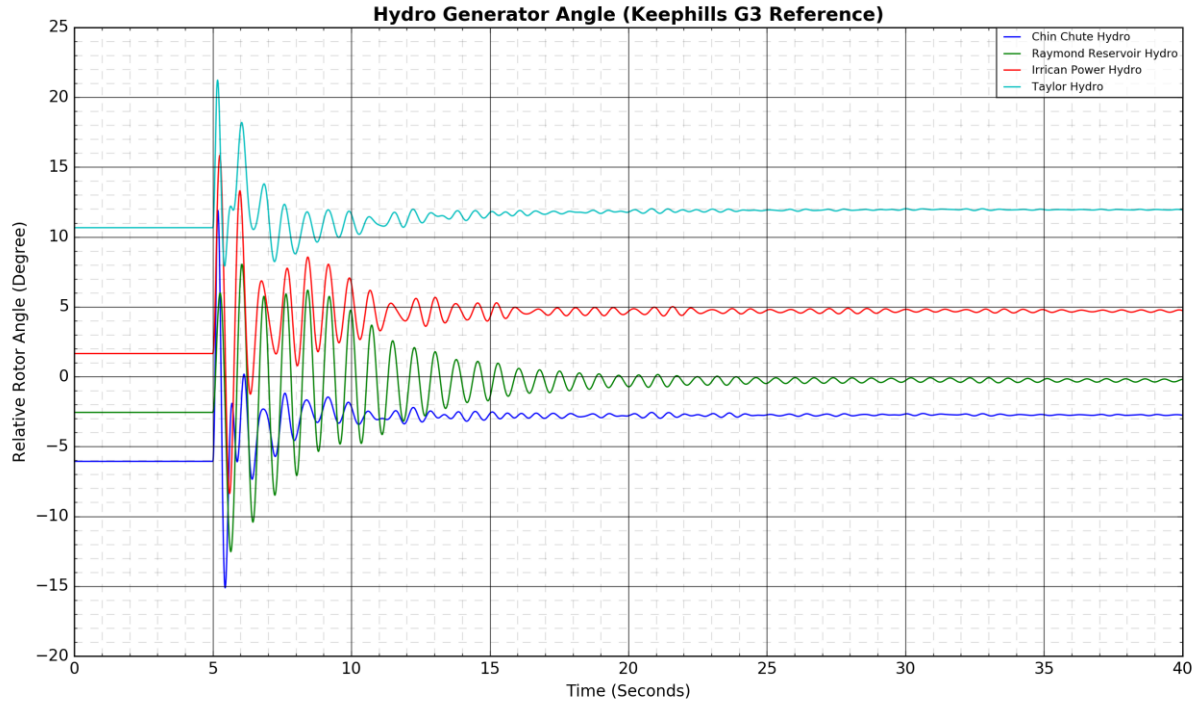
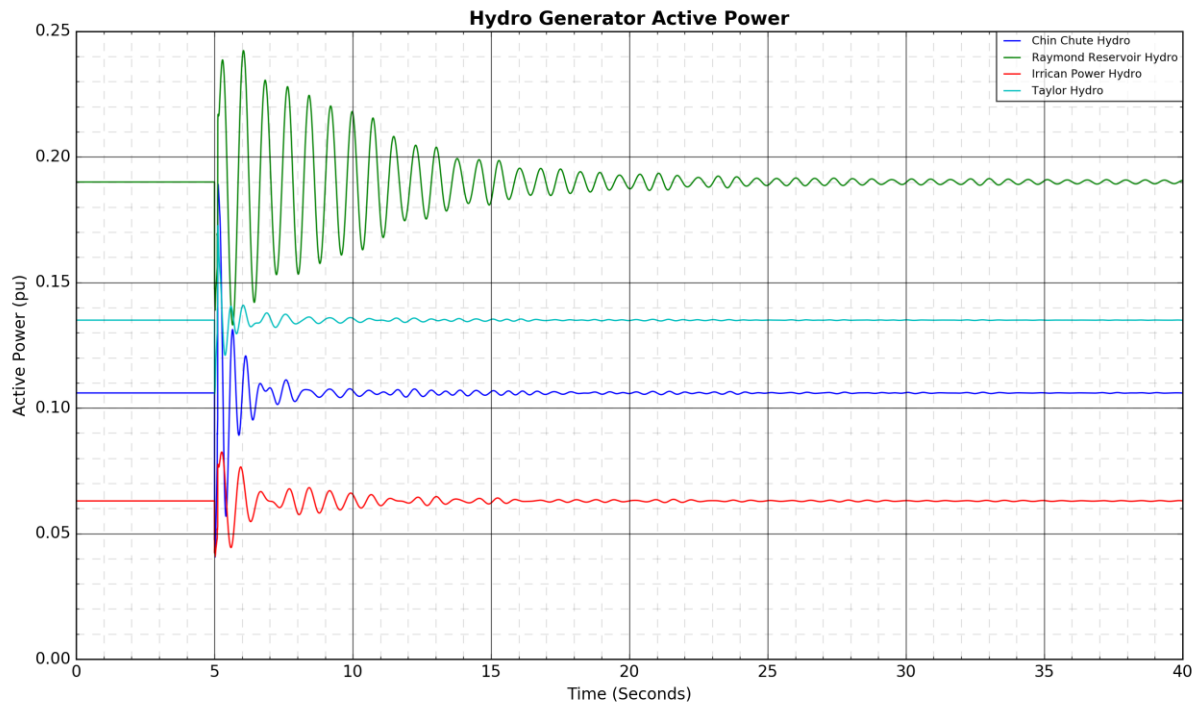
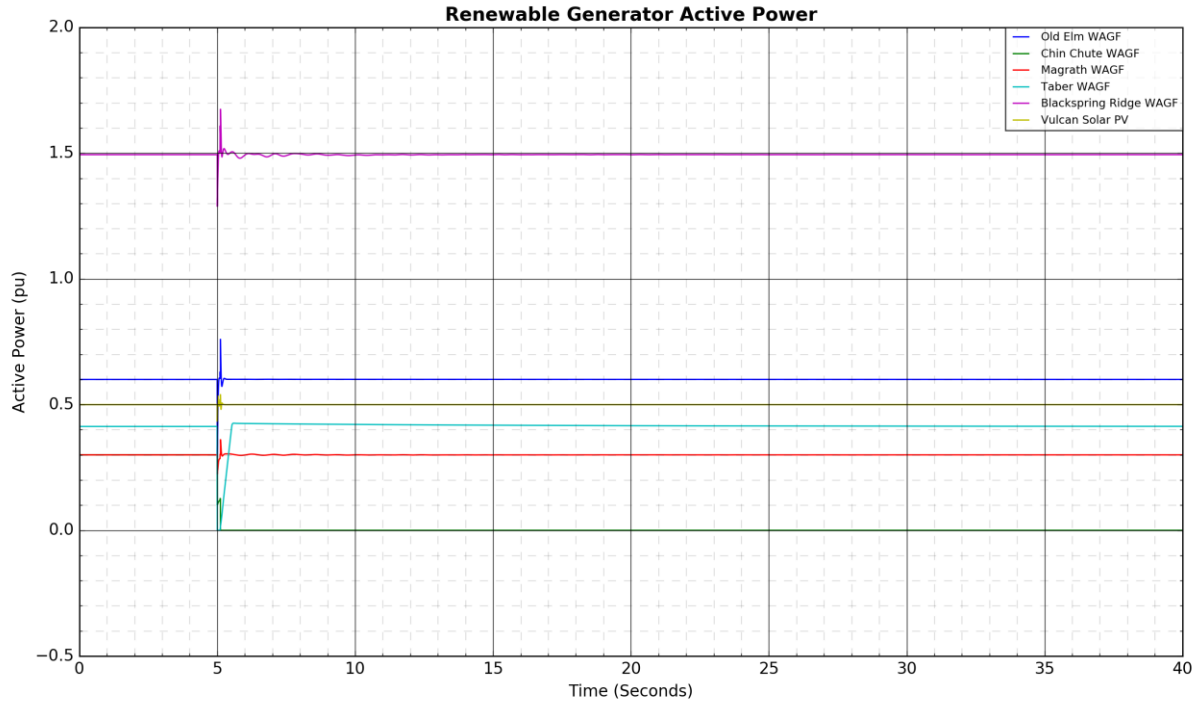


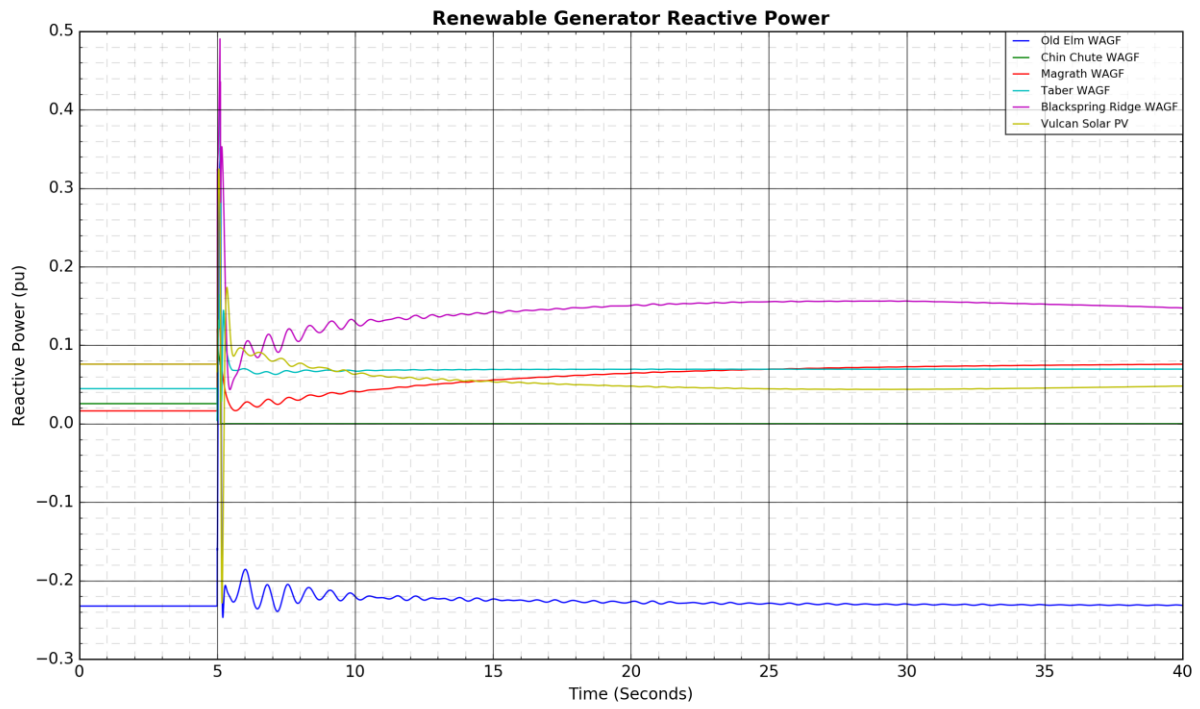
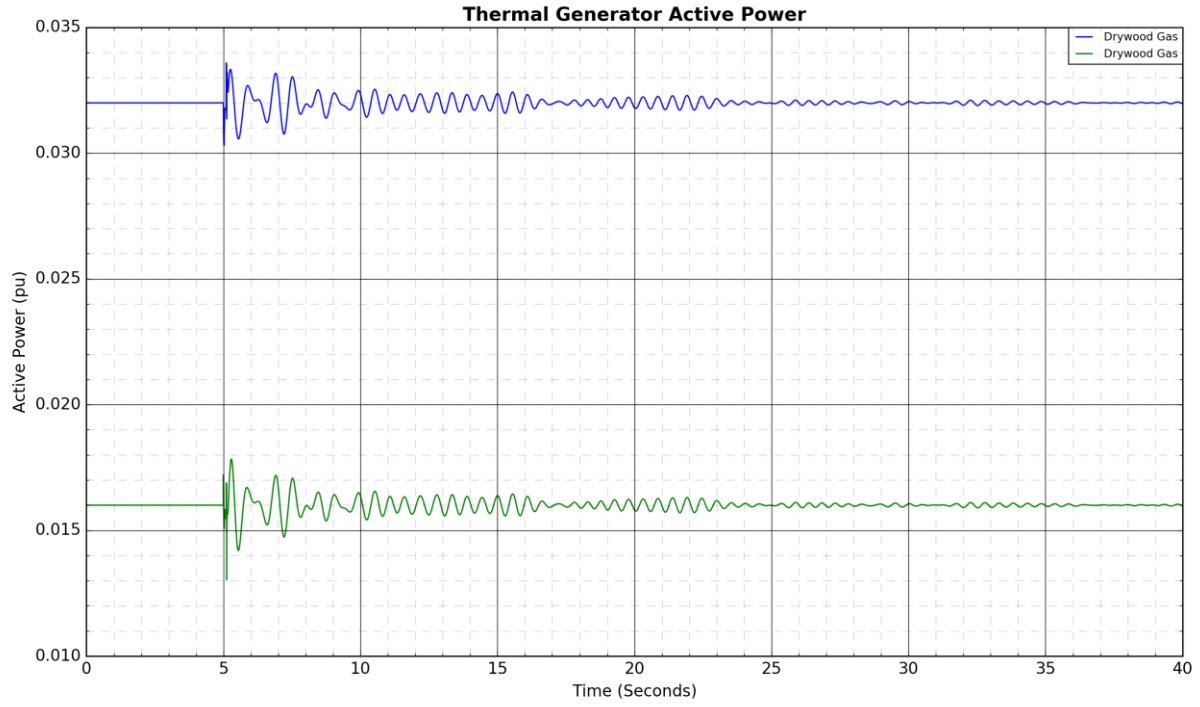
Figure A4-52: 172L Coaldale 254S to Taber 83S: Fault Near Taber 83S

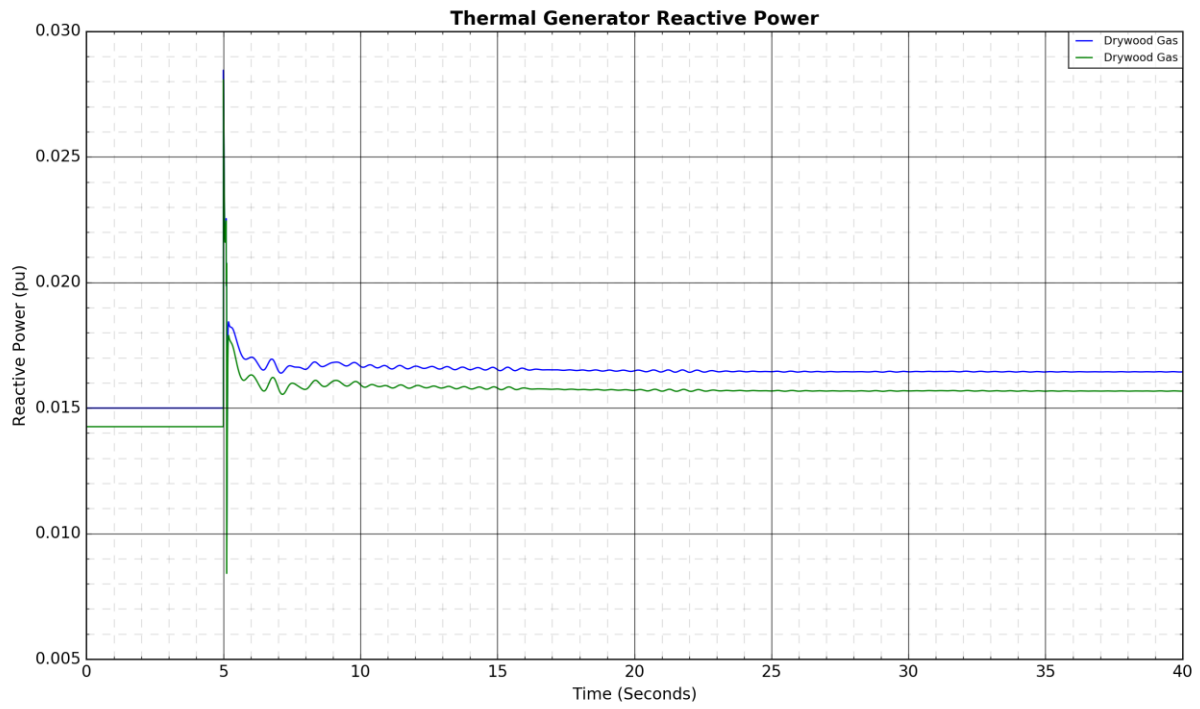
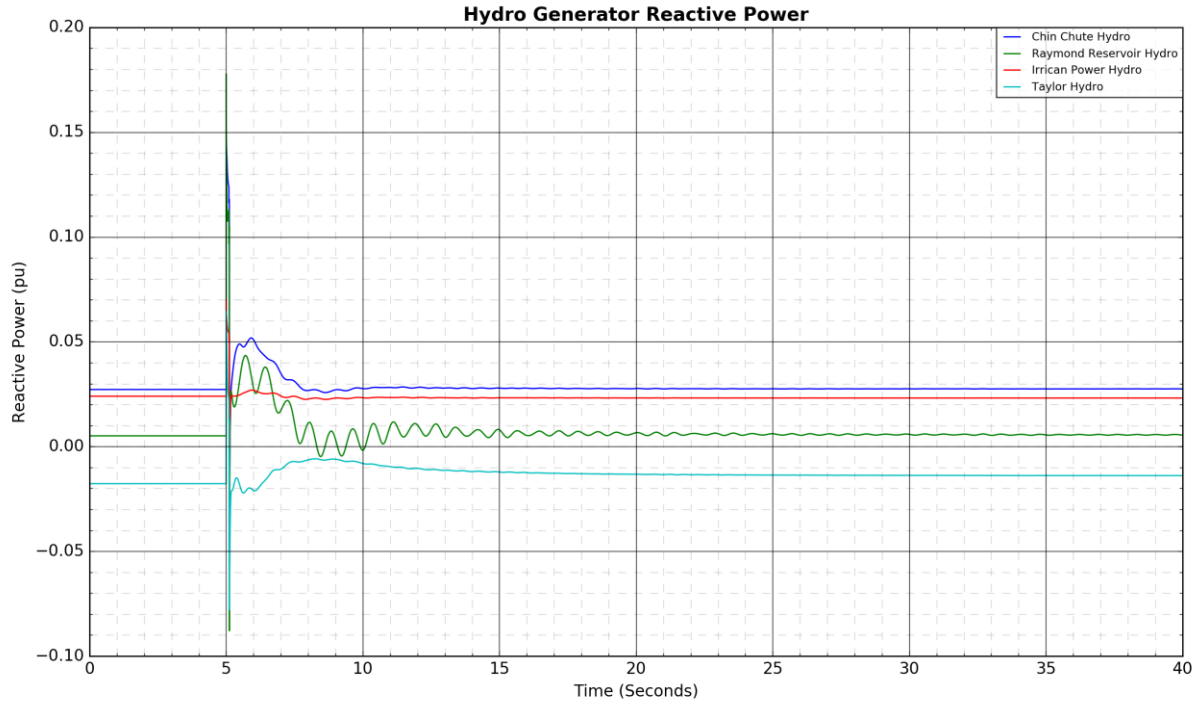


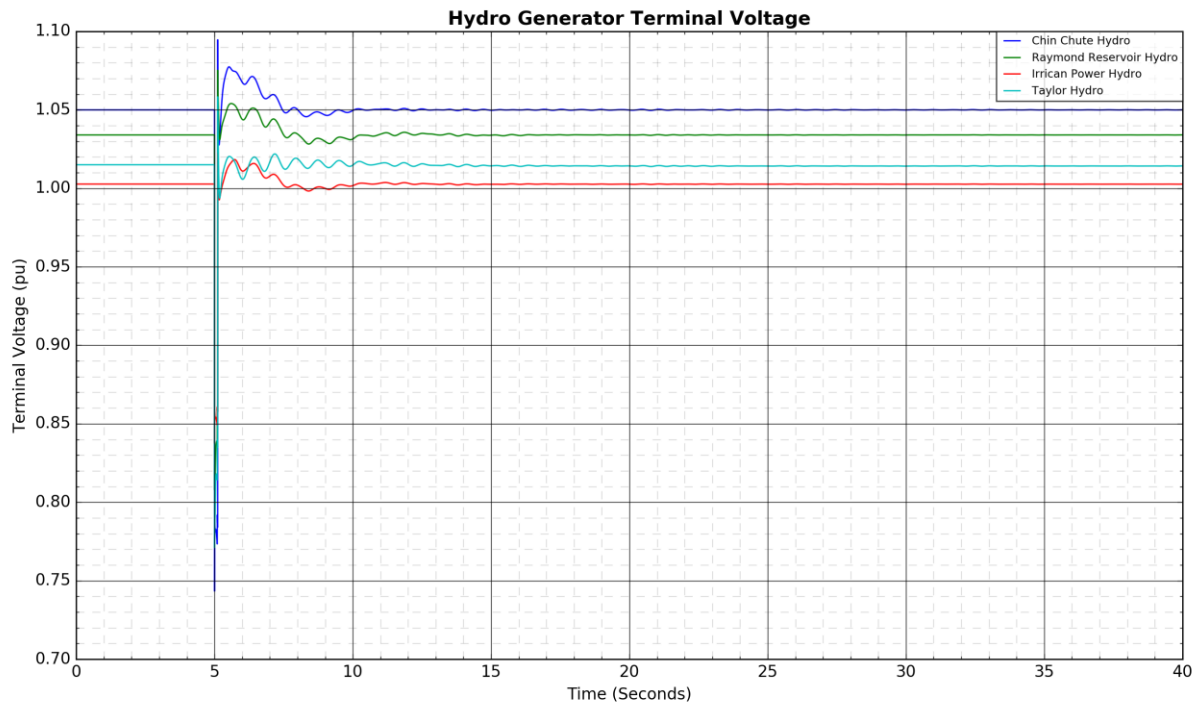
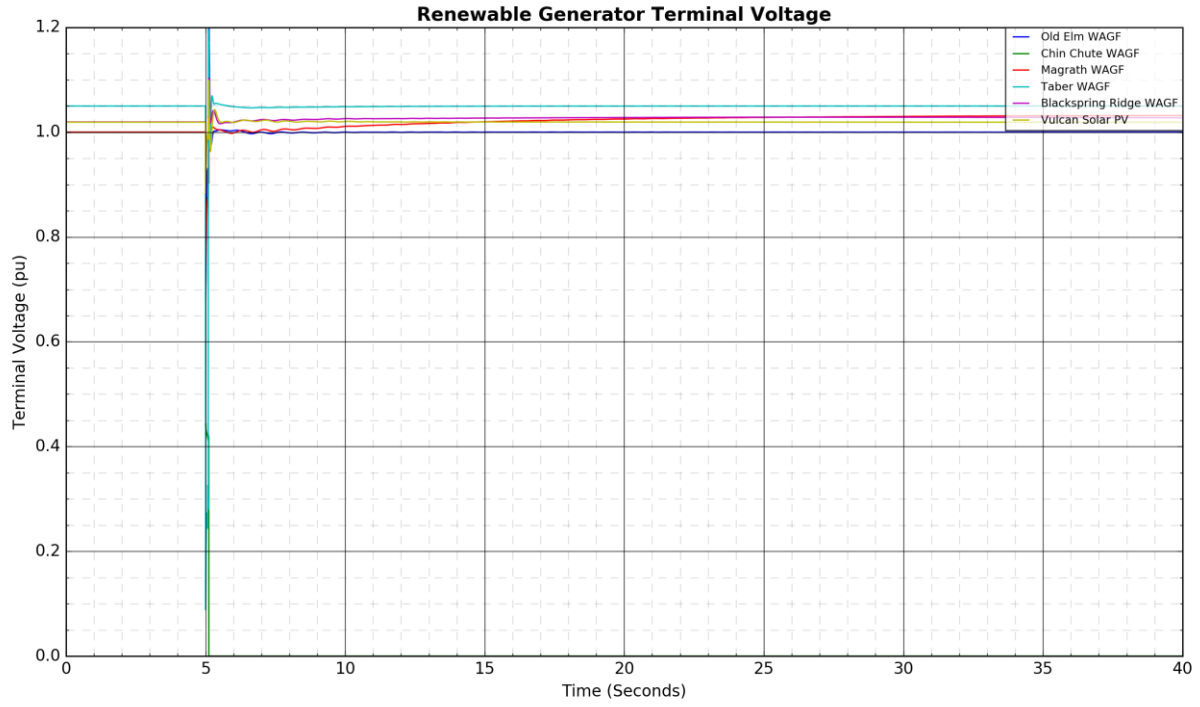


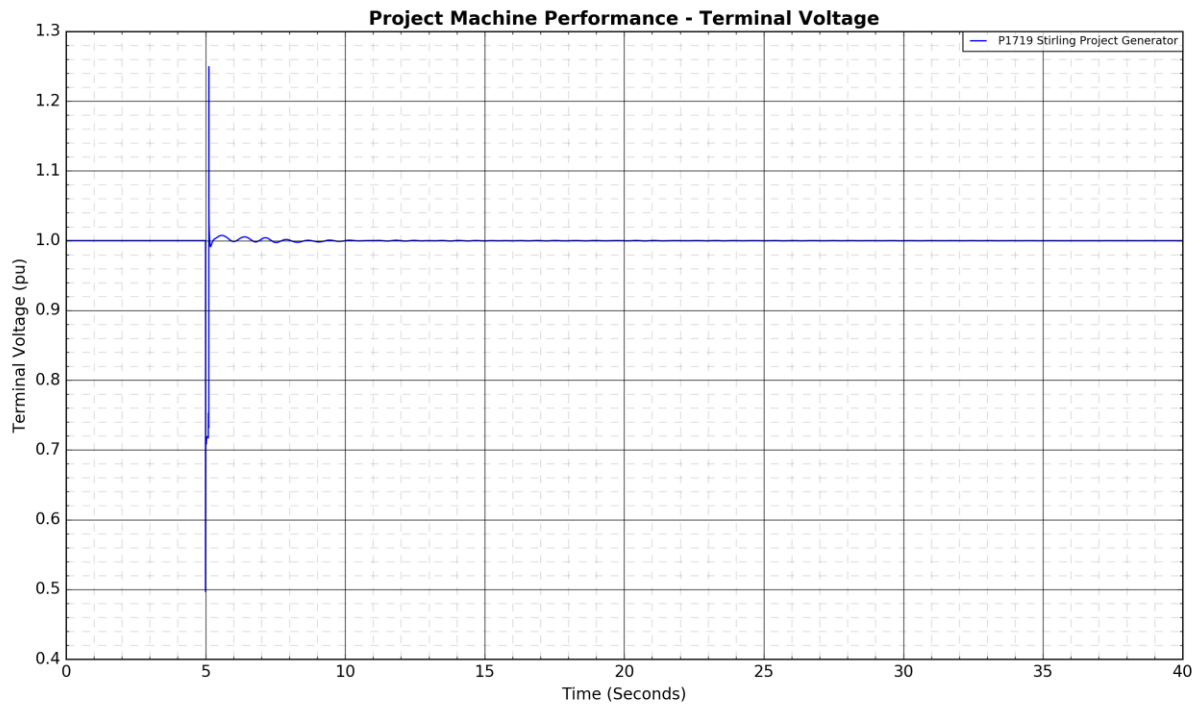
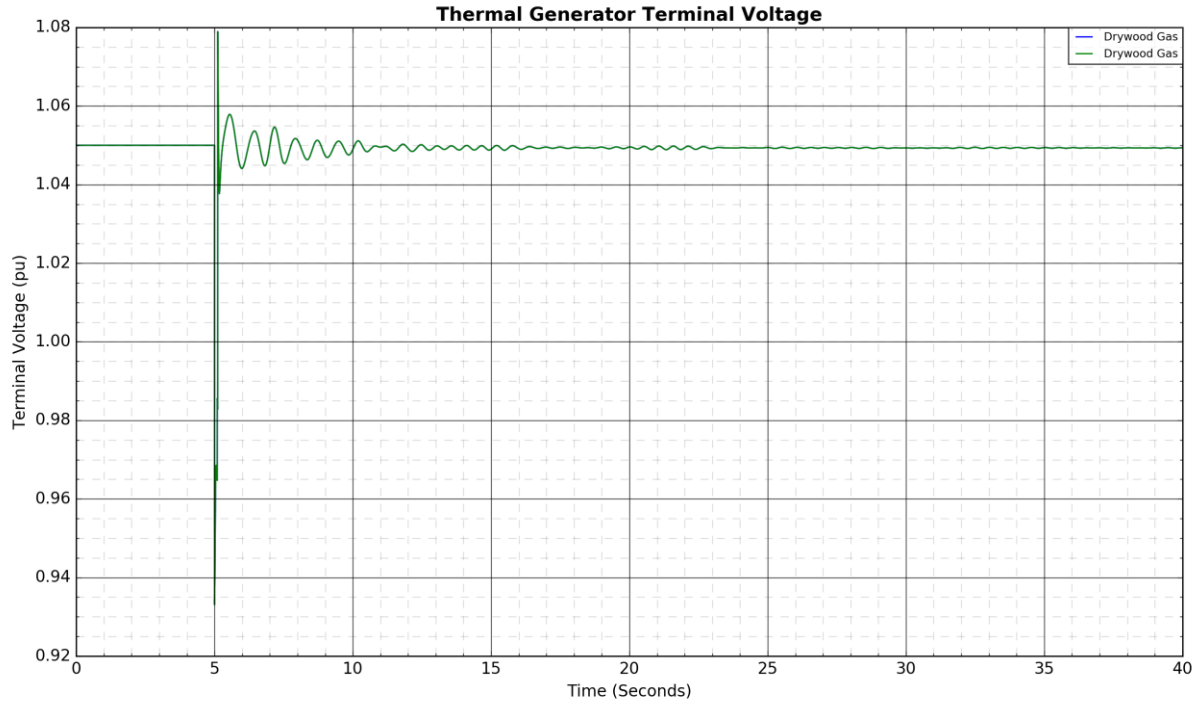


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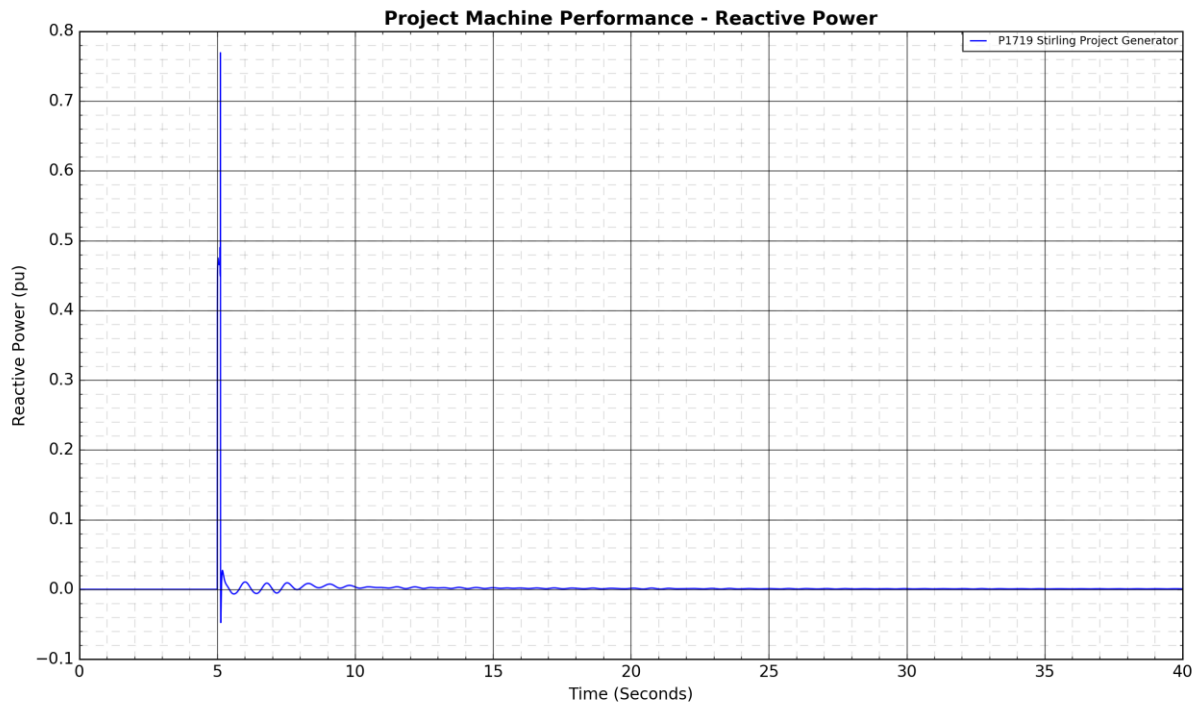
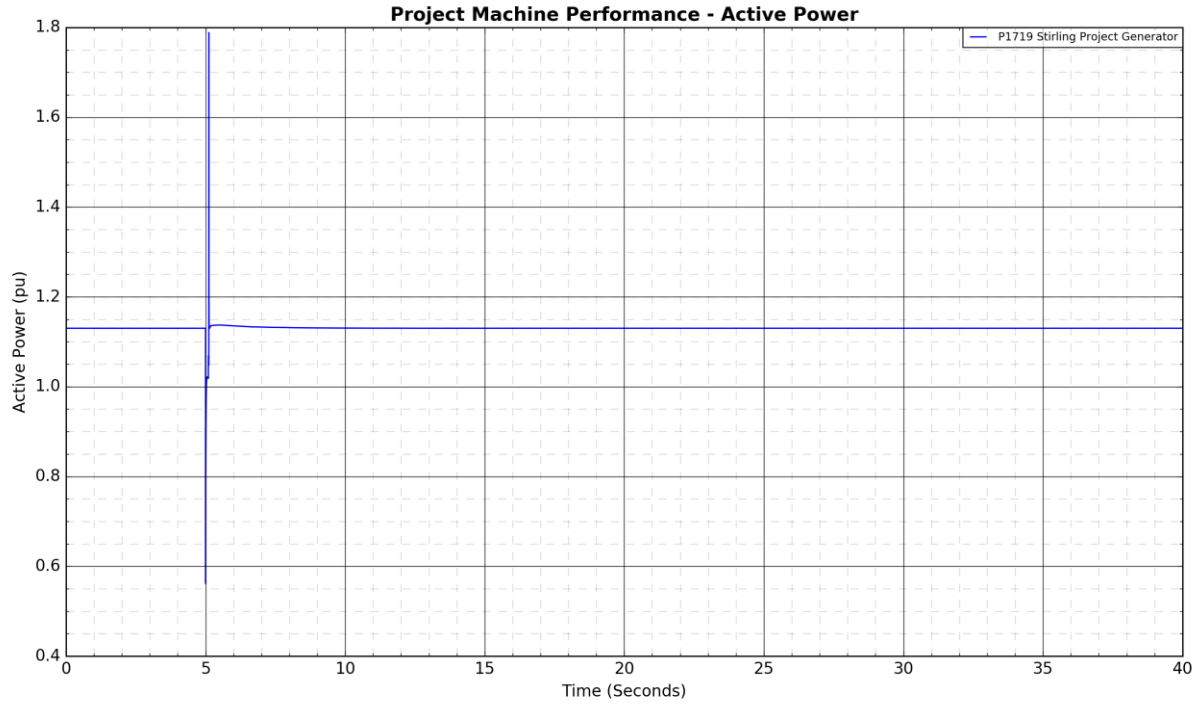
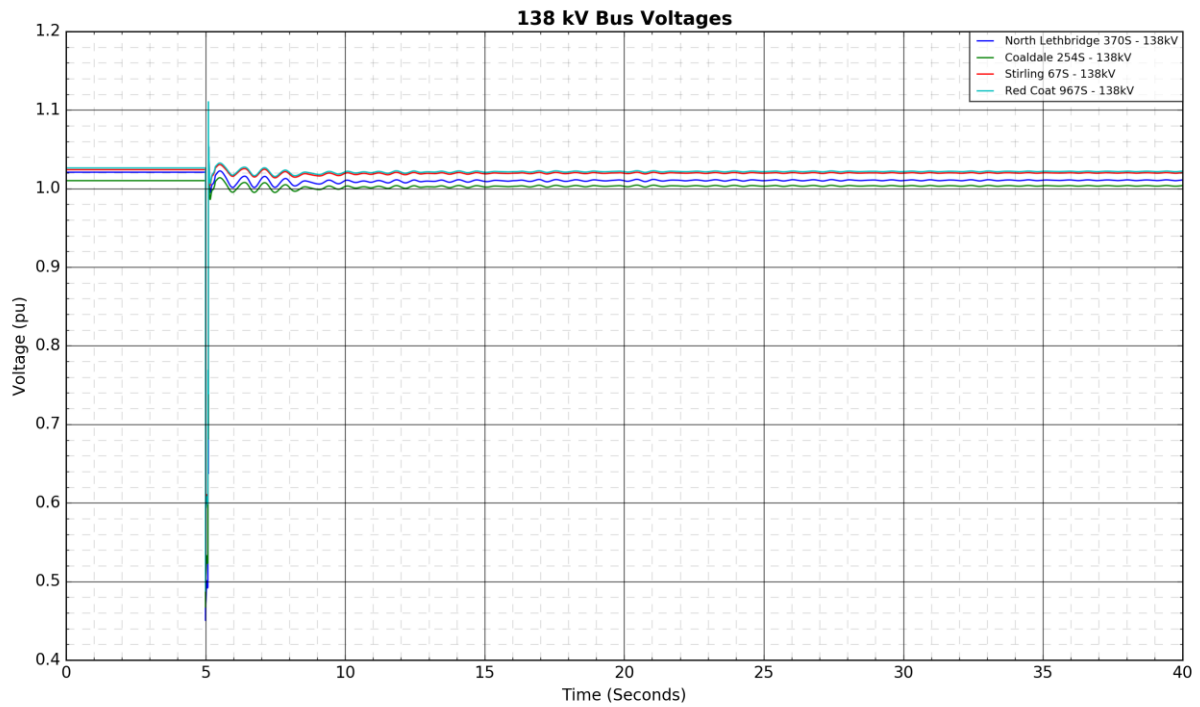
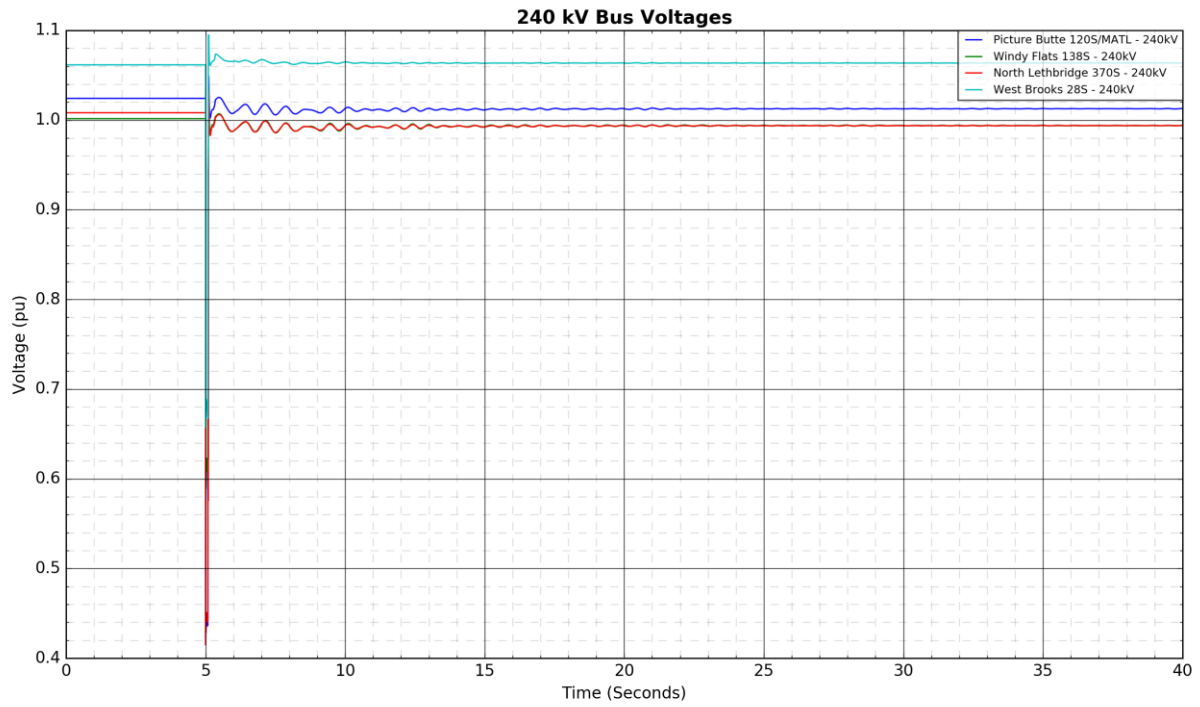
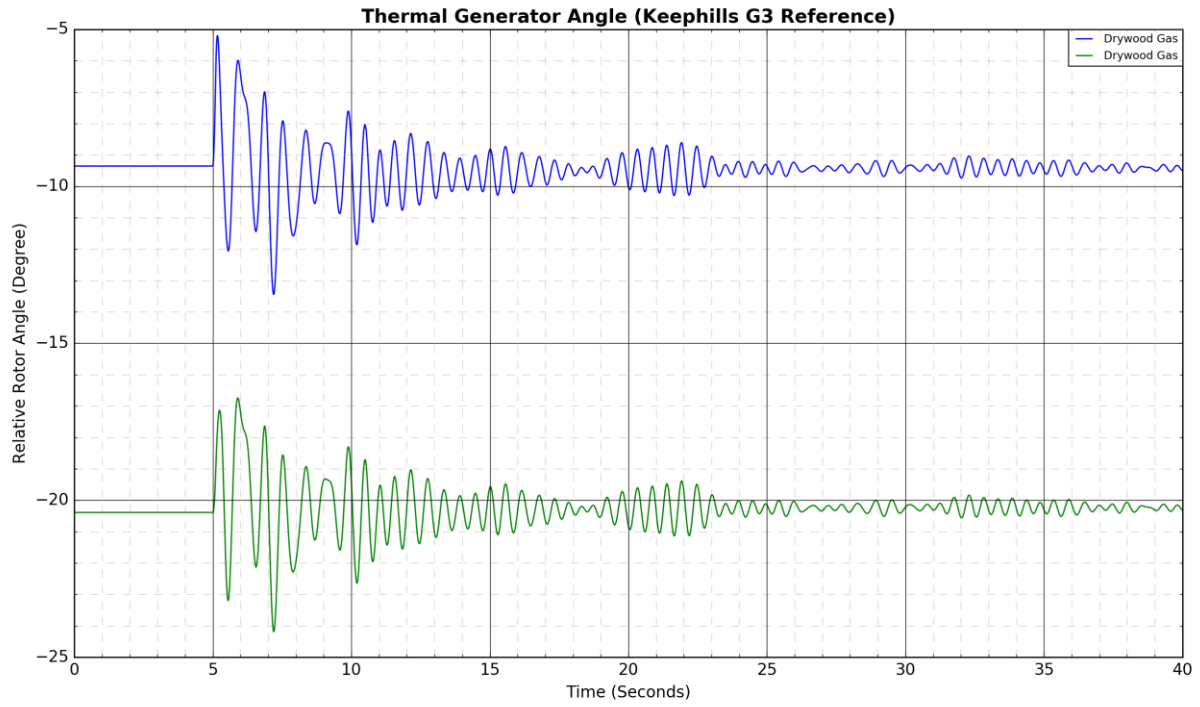
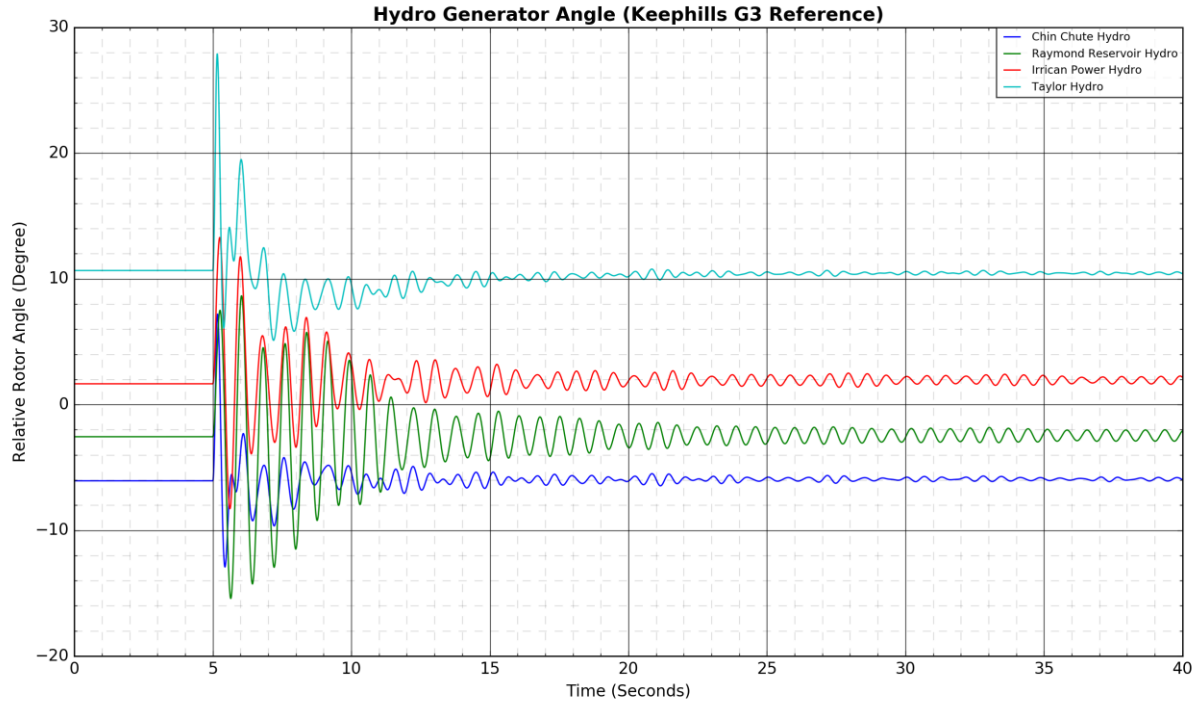
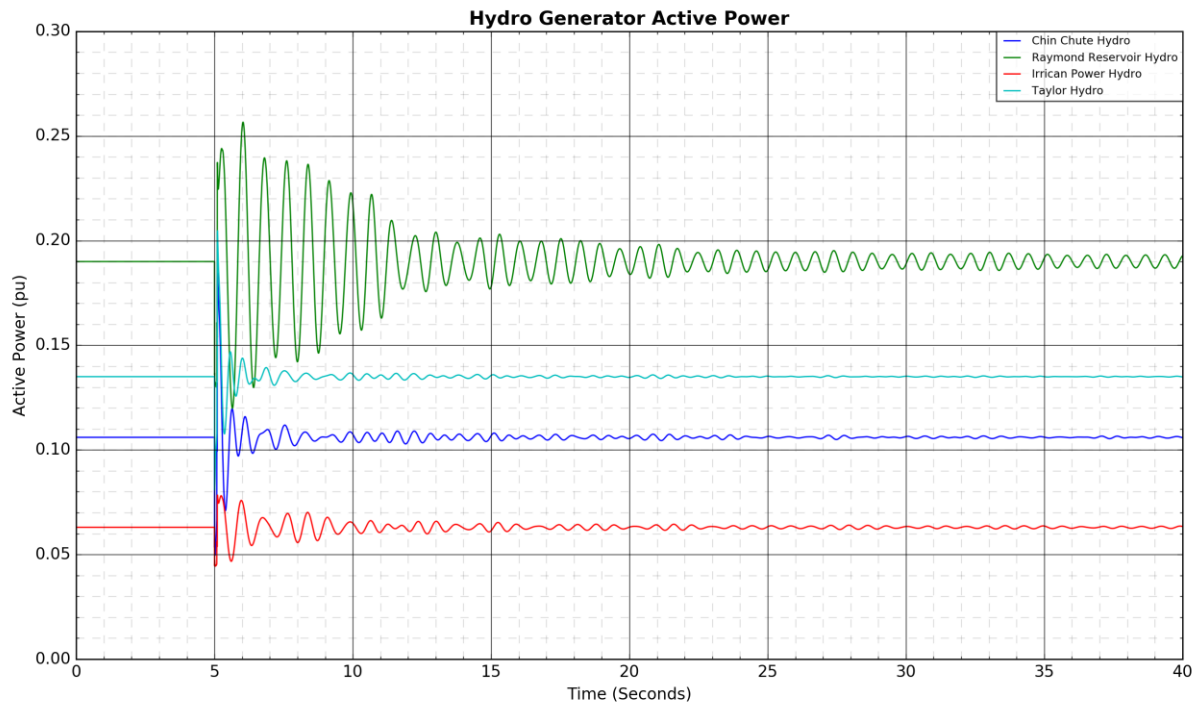
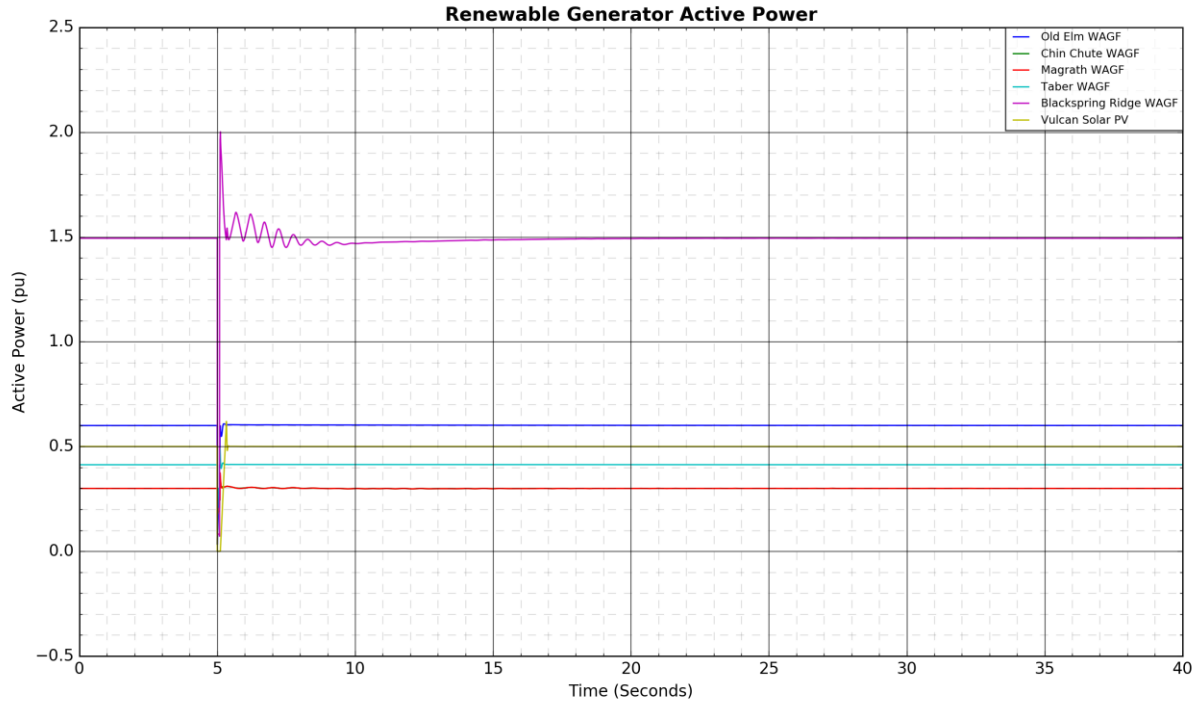


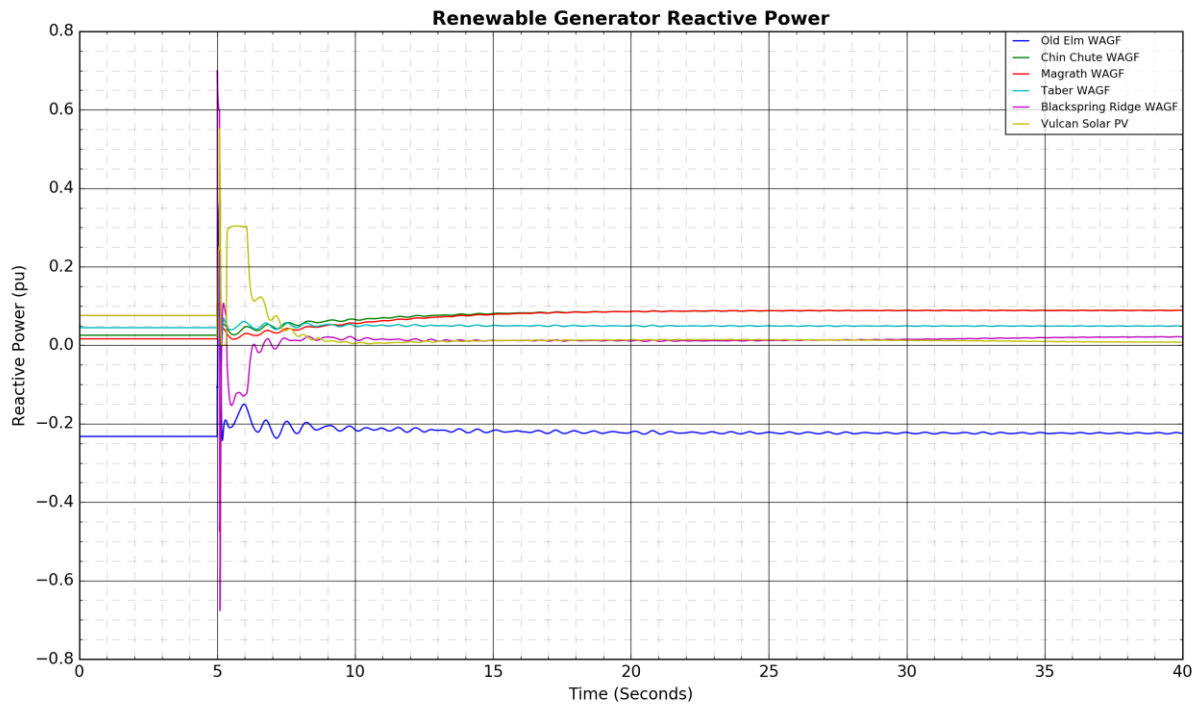
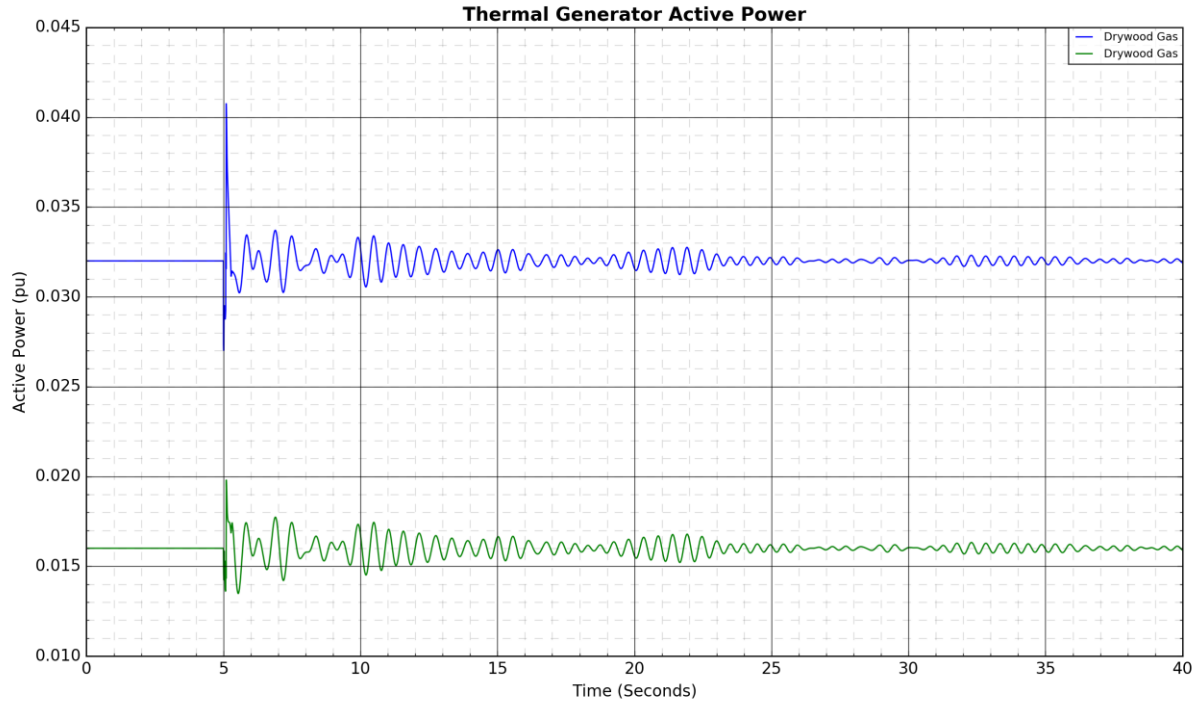
Figure A4-53: 1041L Travers 554S to North Lethbridge 370S: Fault Near Travers 554S

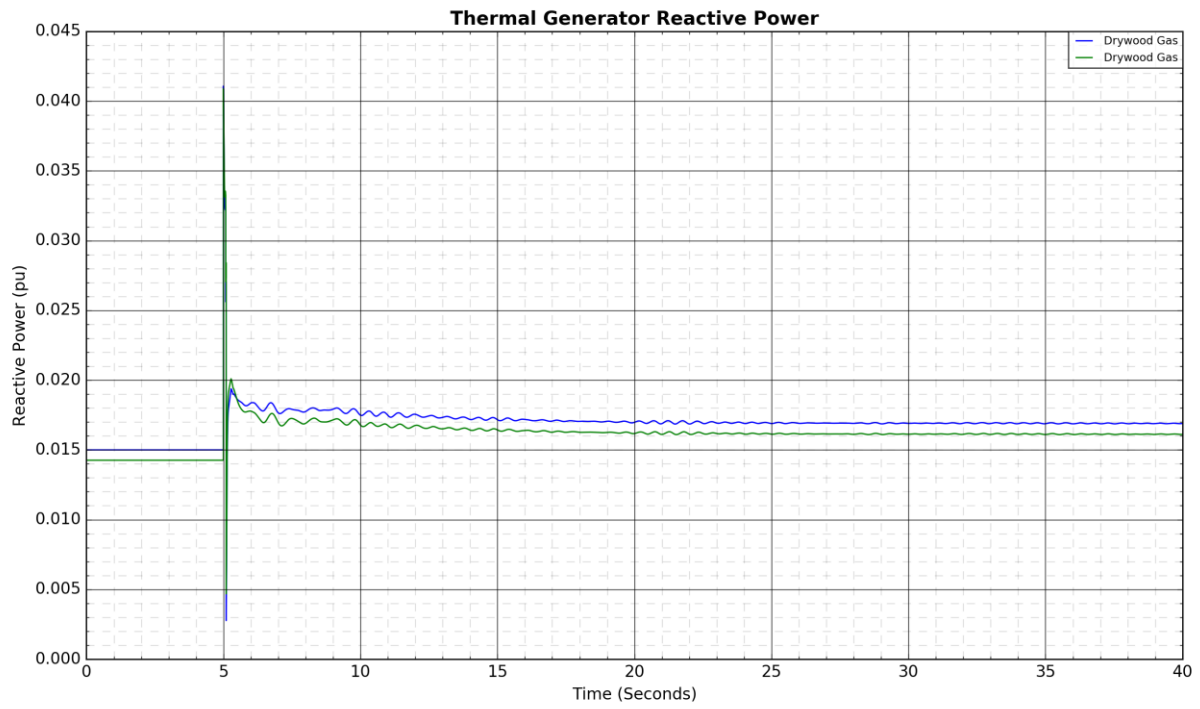
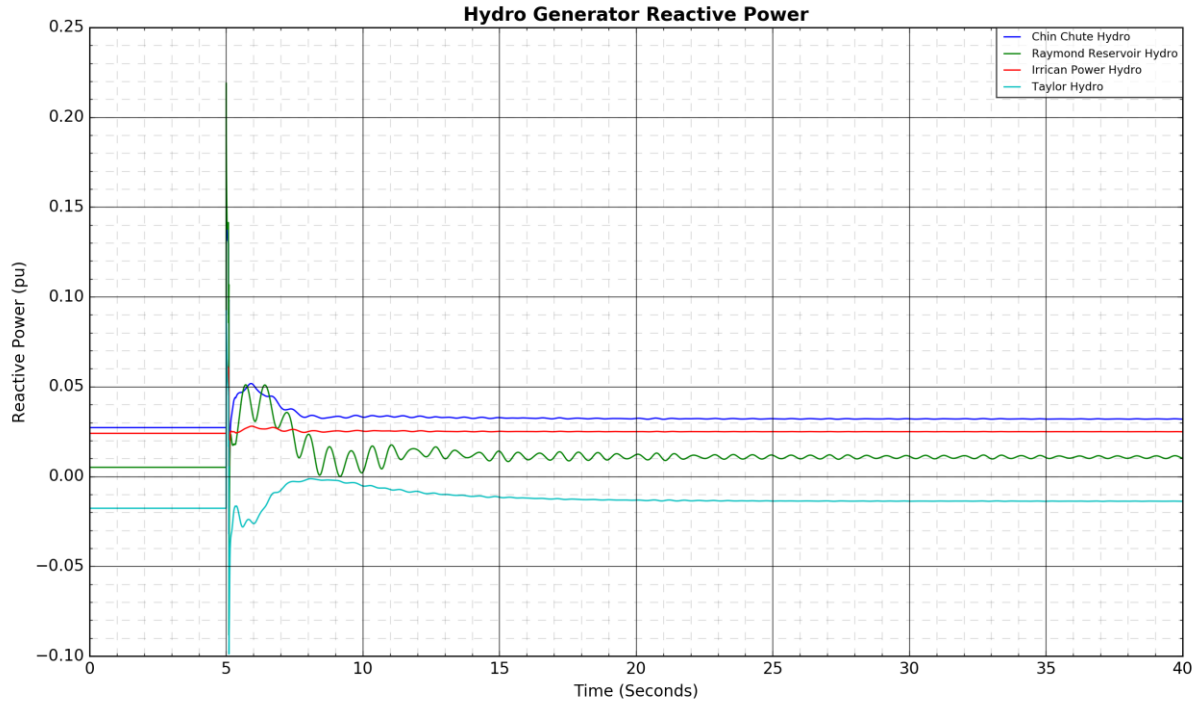


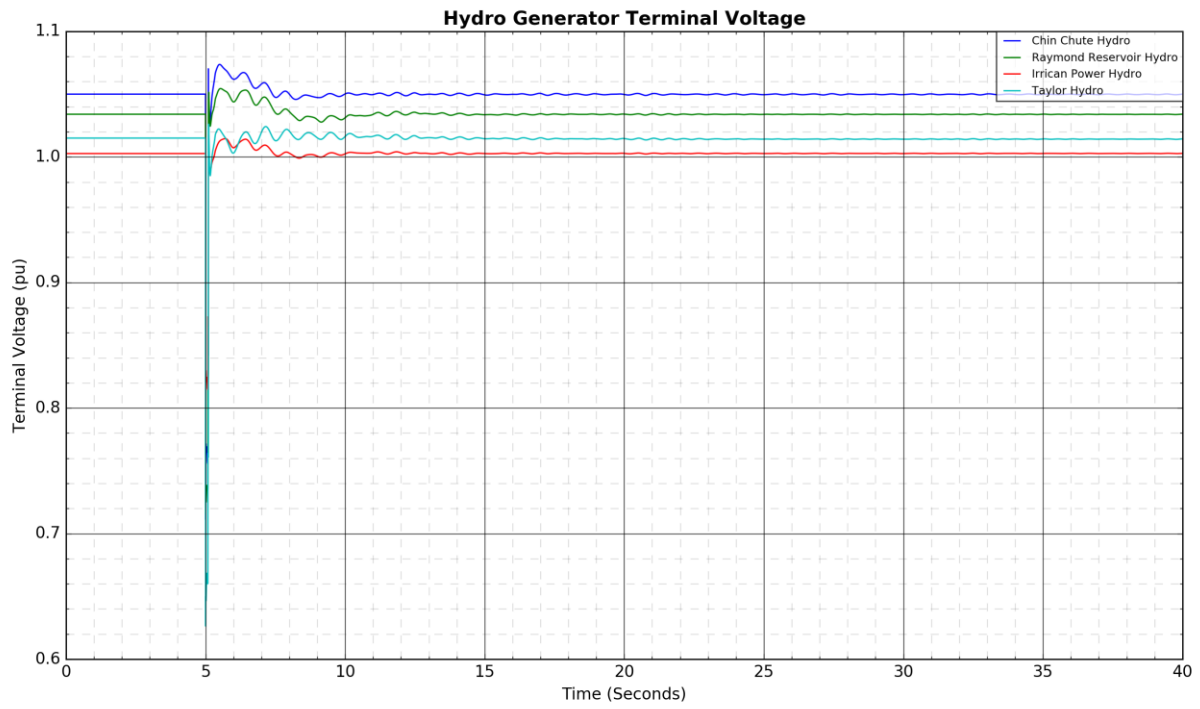
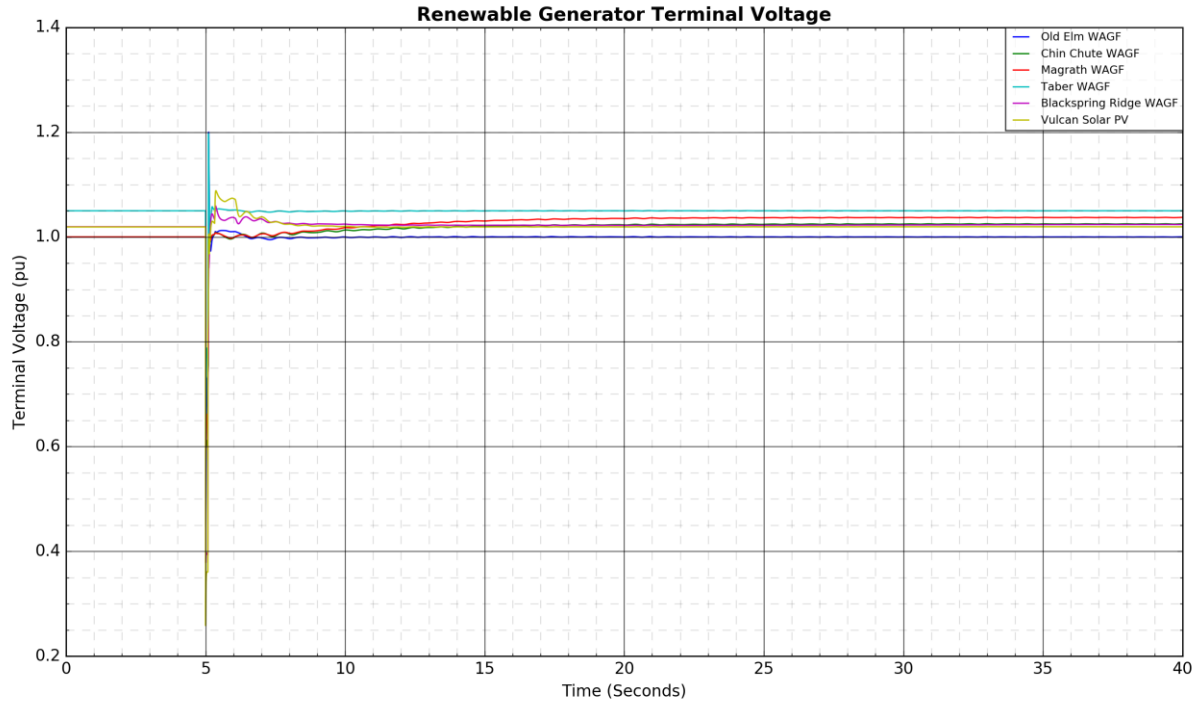


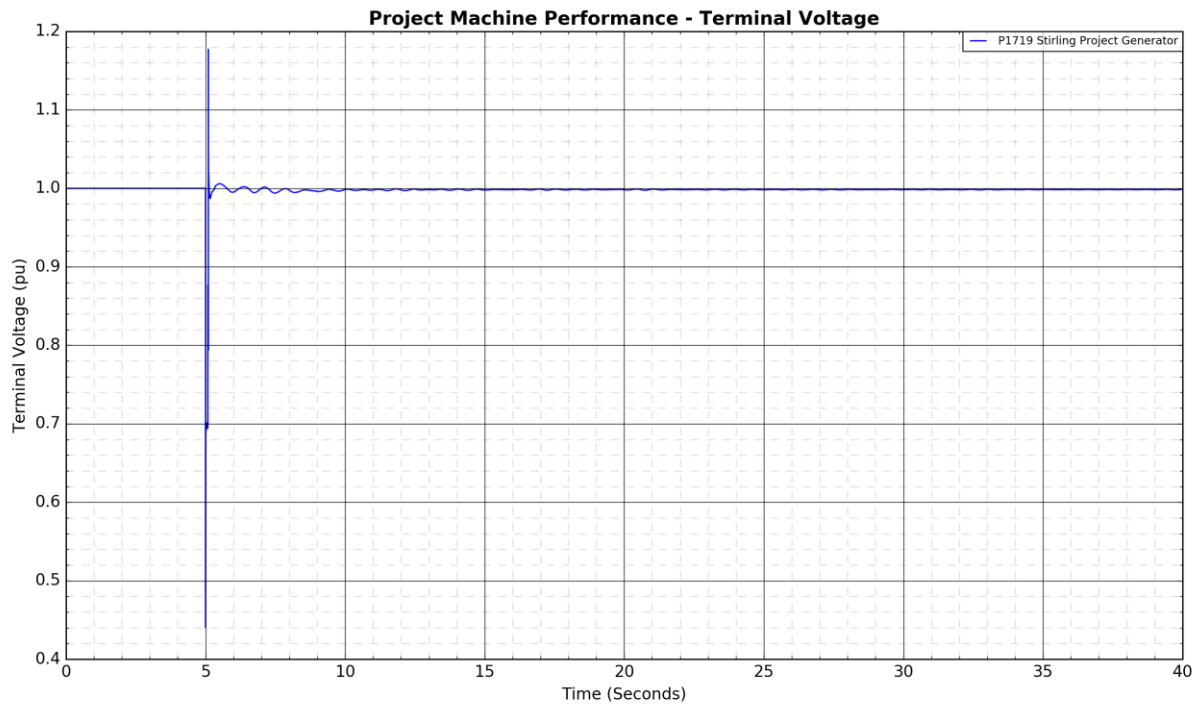
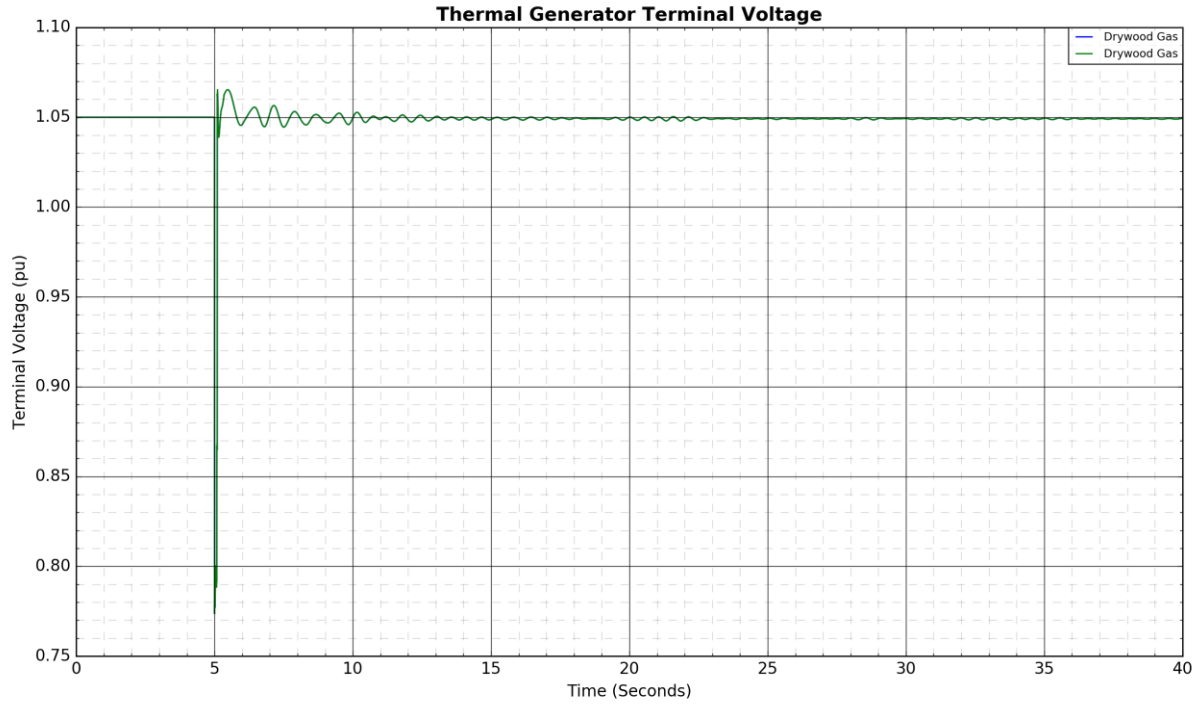
Engineering Connection Assessment Results: Stirling Wind Project Connection











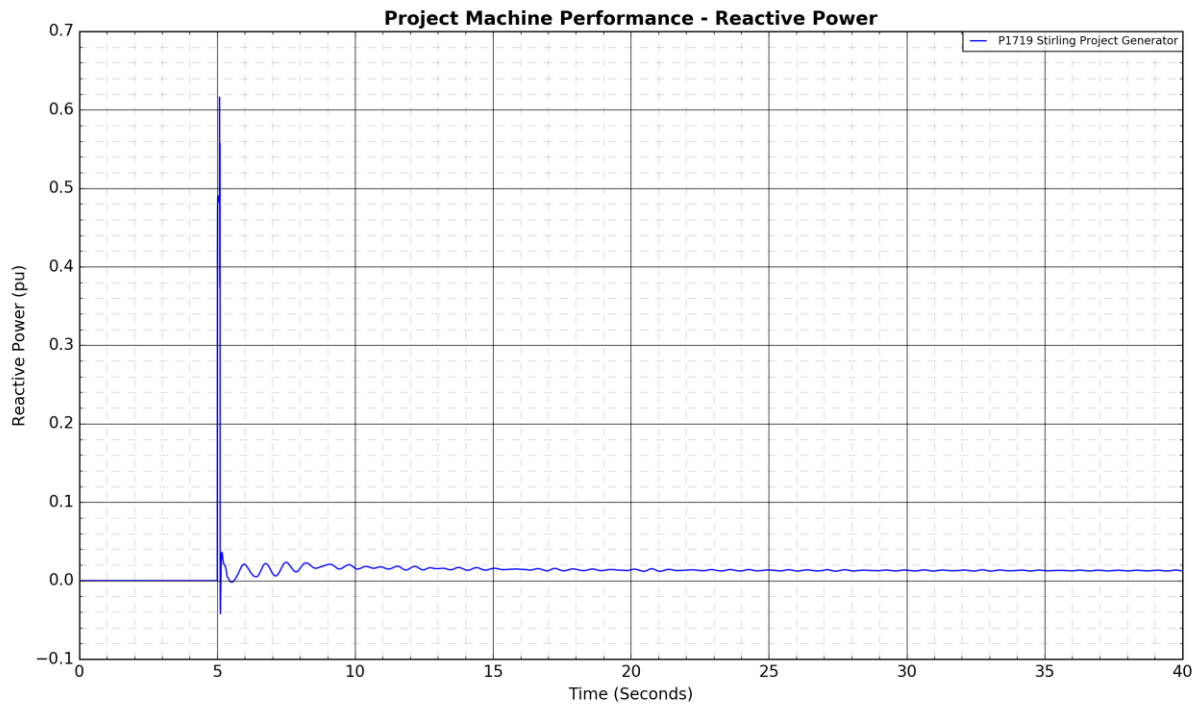
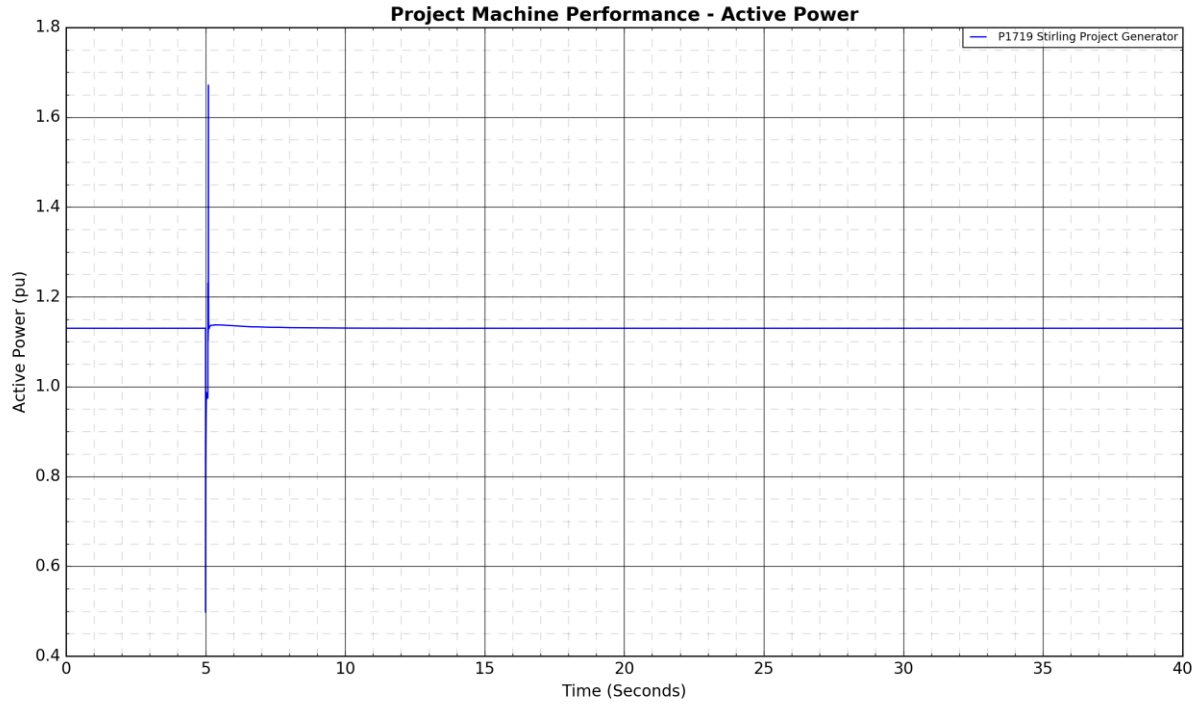
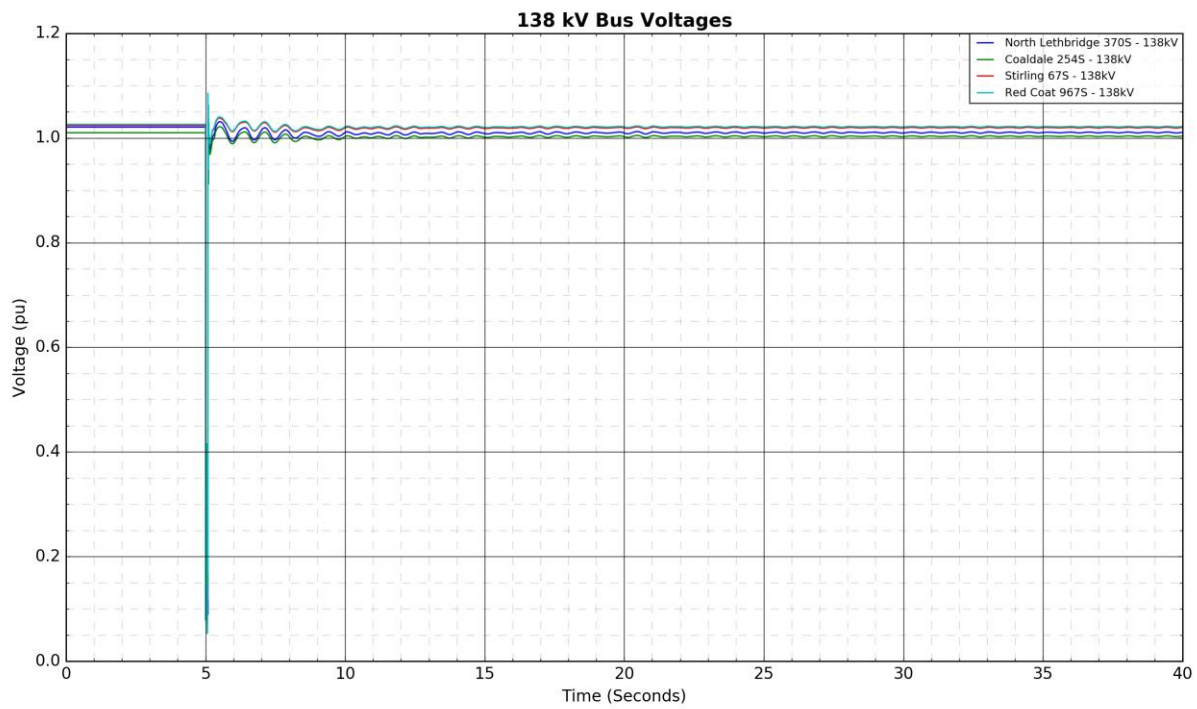
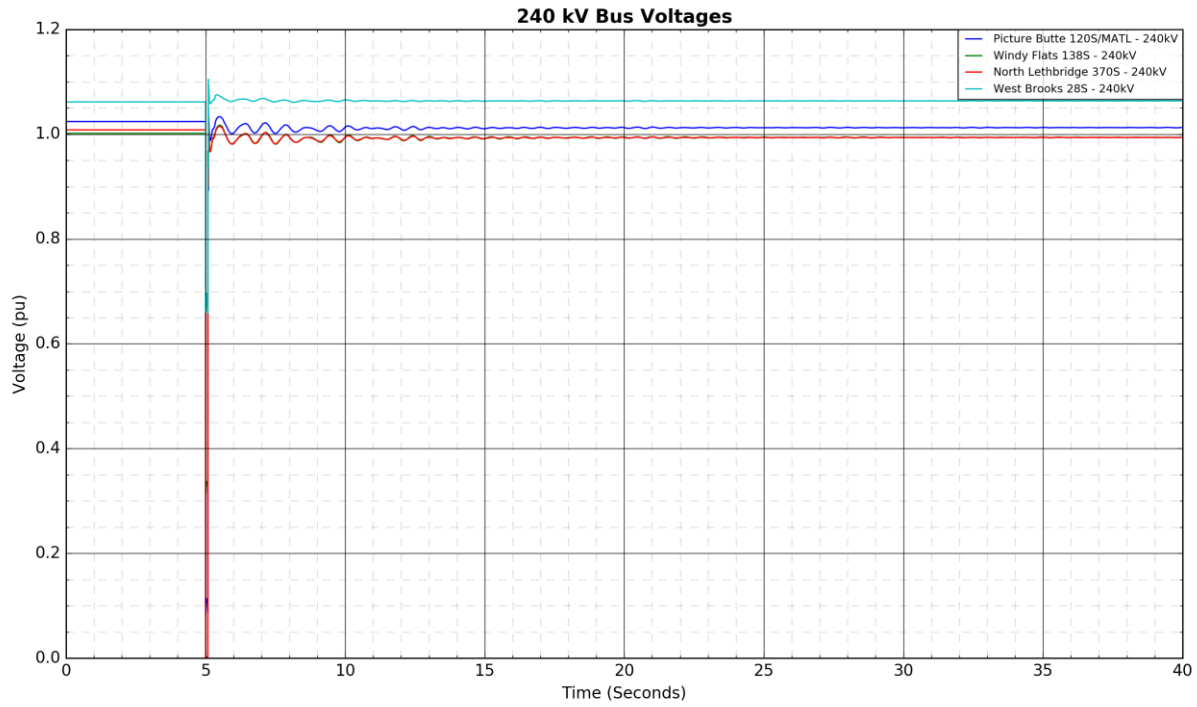
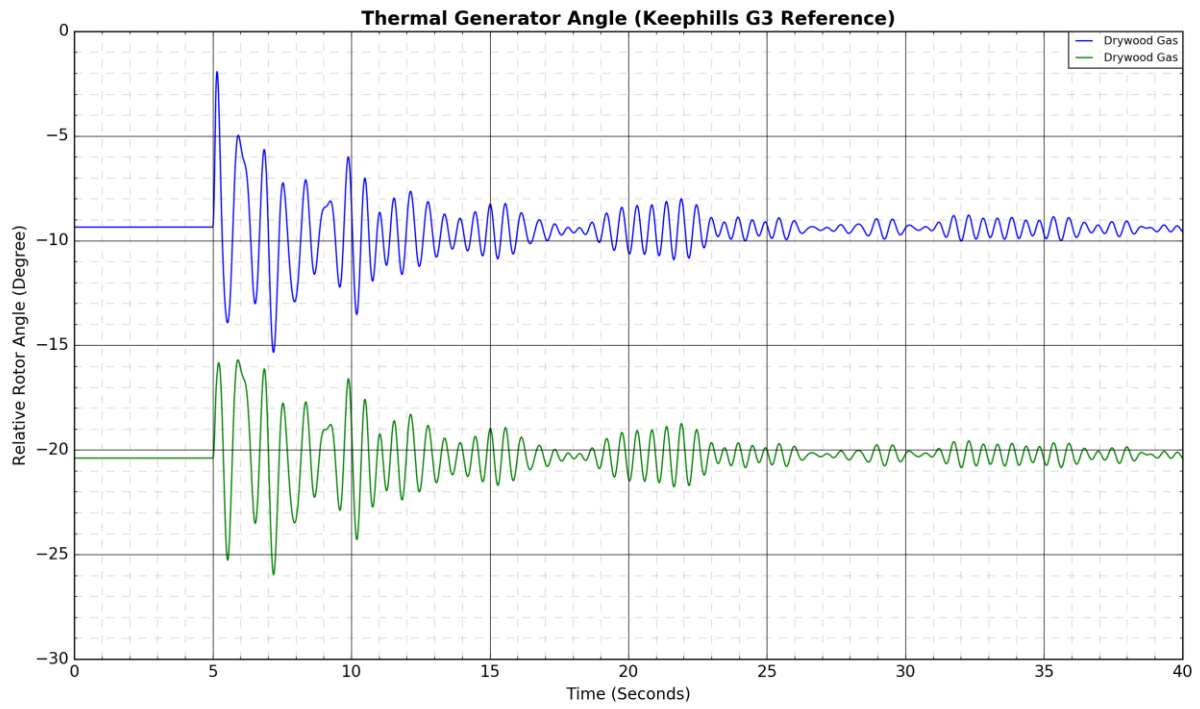
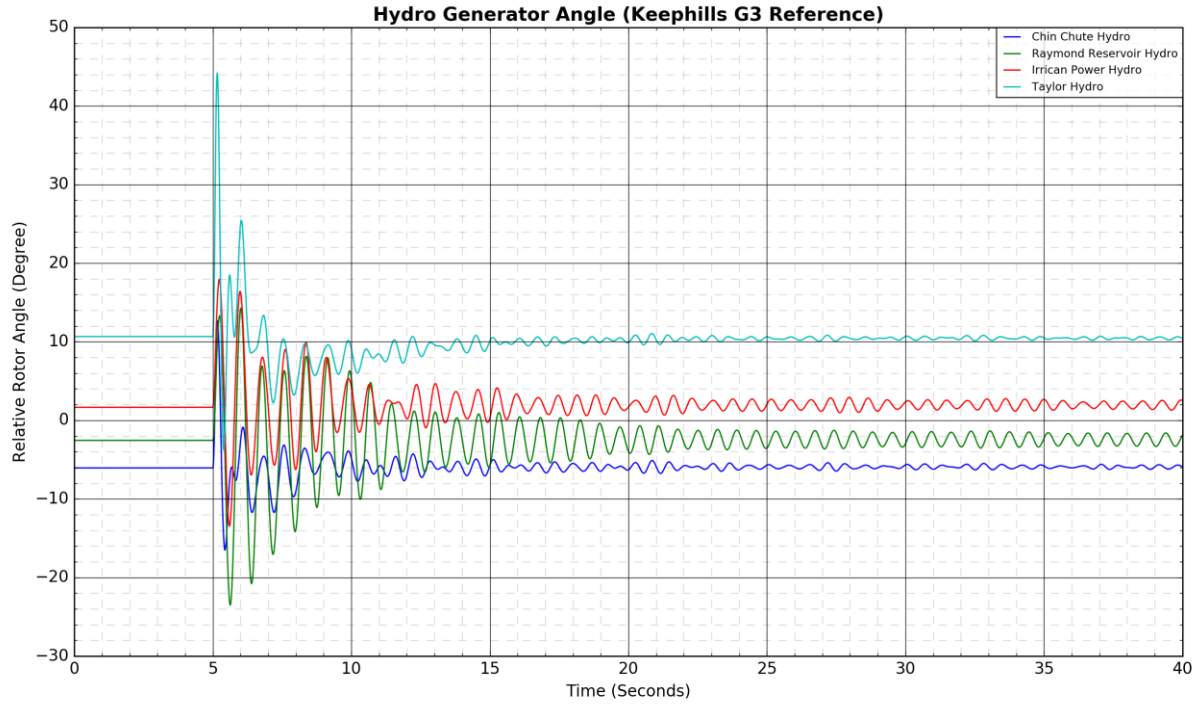
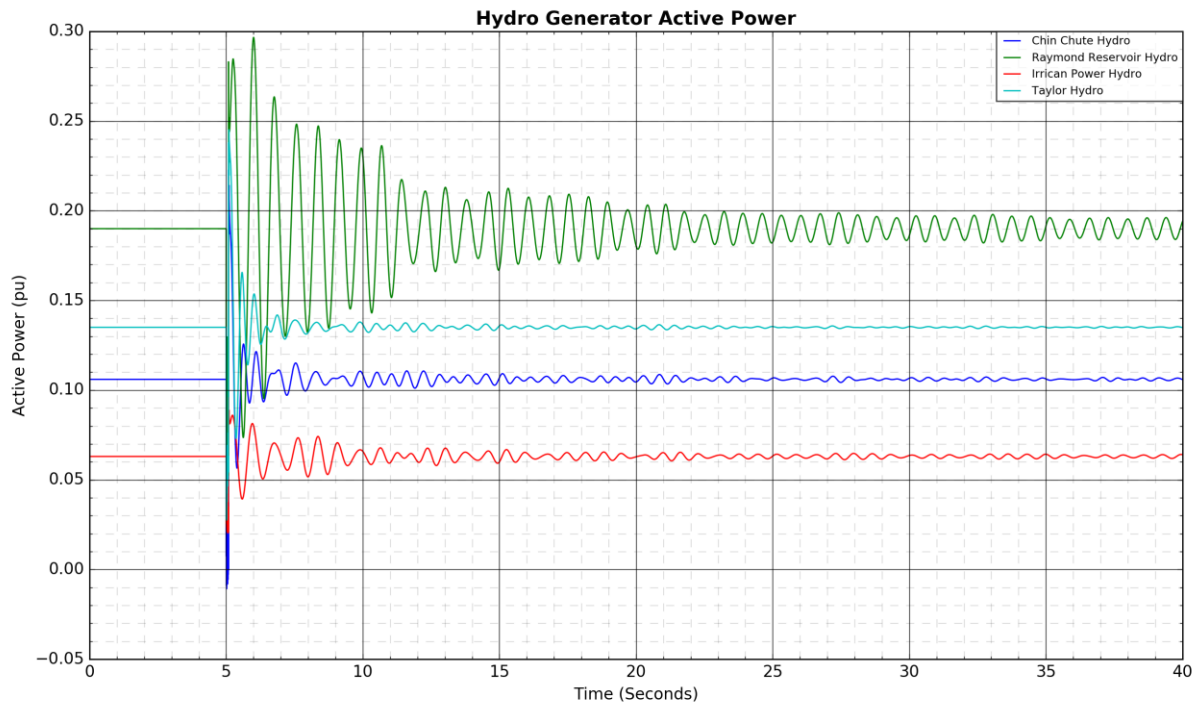
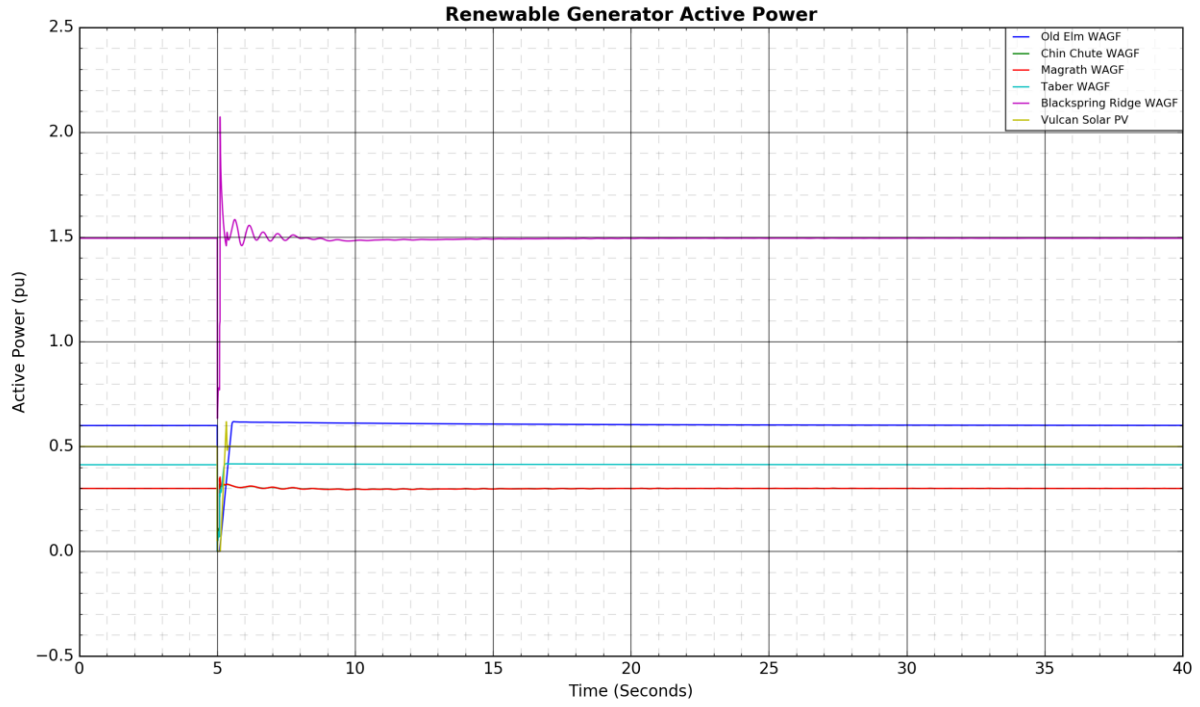


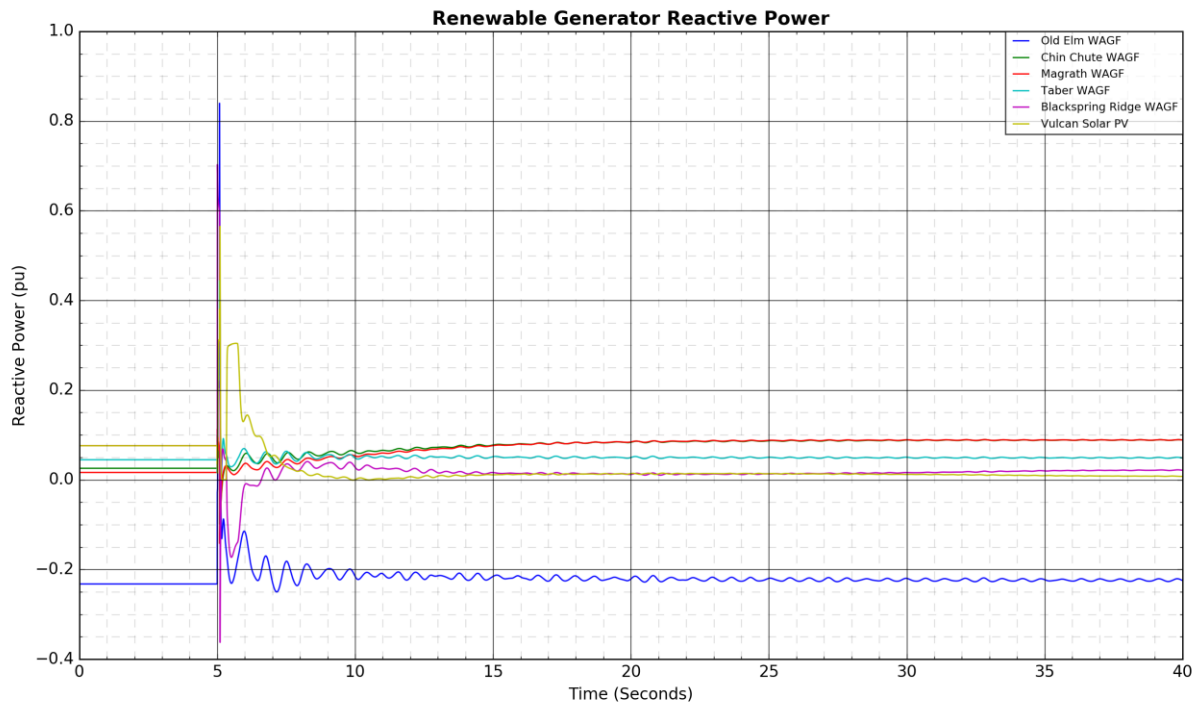
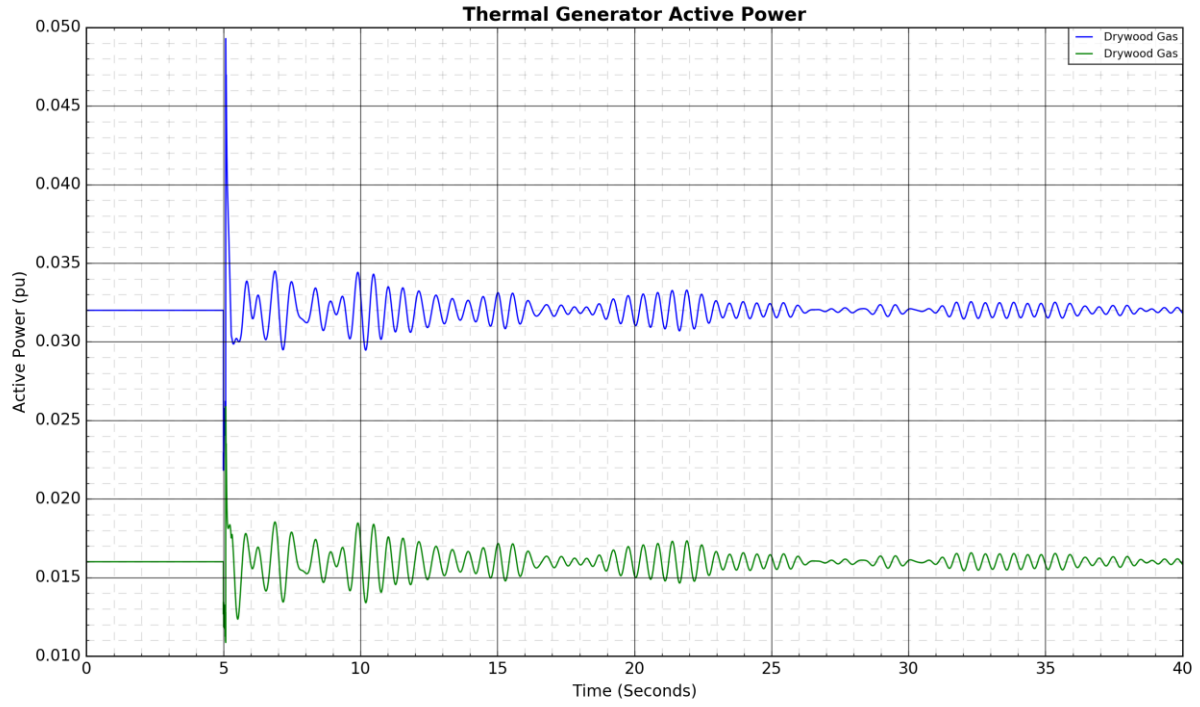
Figure A4-54: 1041L Travers 554S to North Lethbridge 370S: Fault Near North Lethbridge 370S

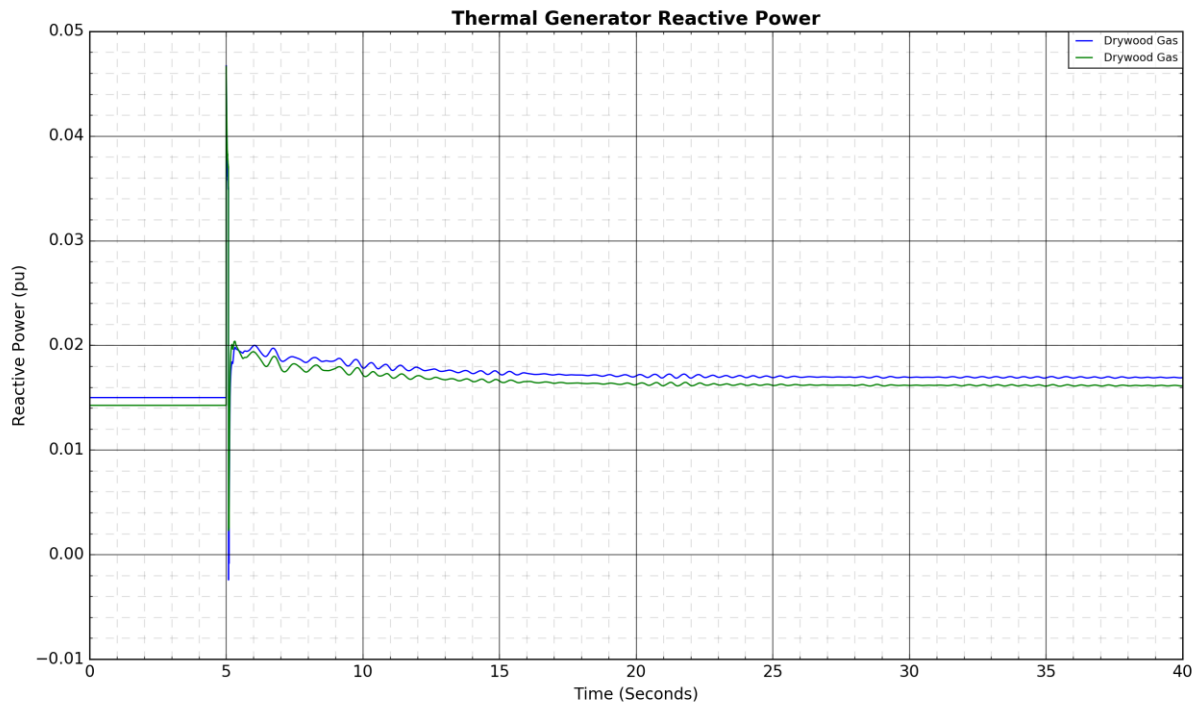
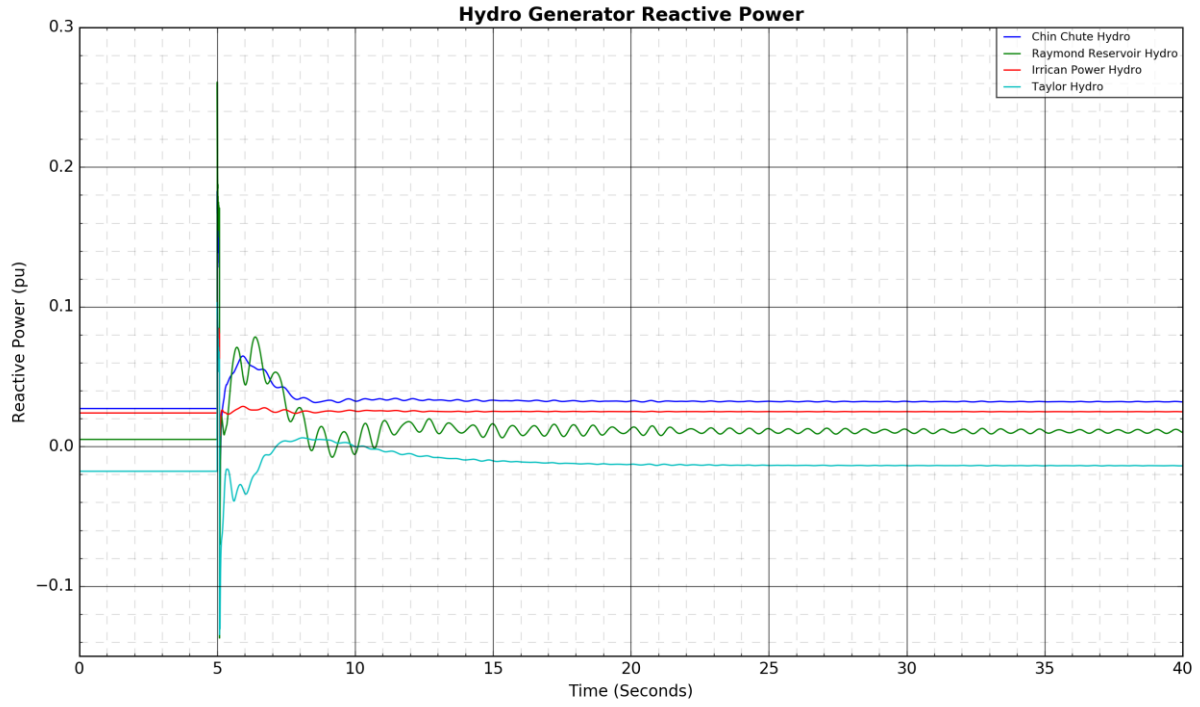


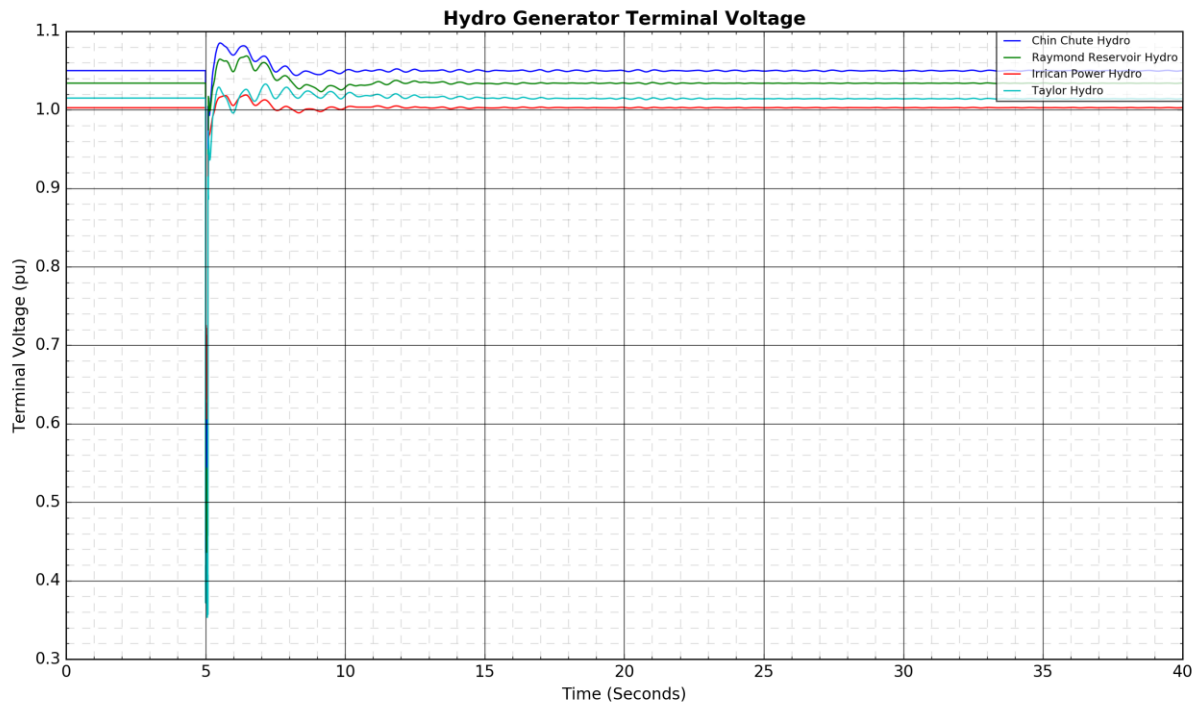
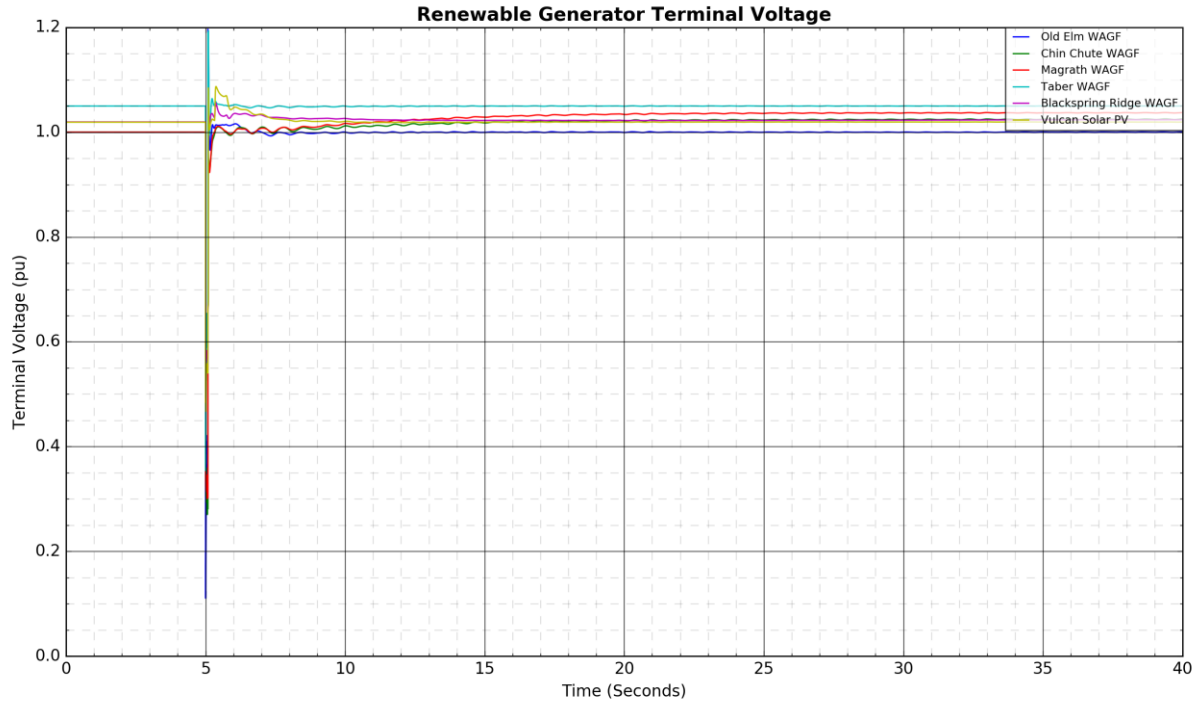


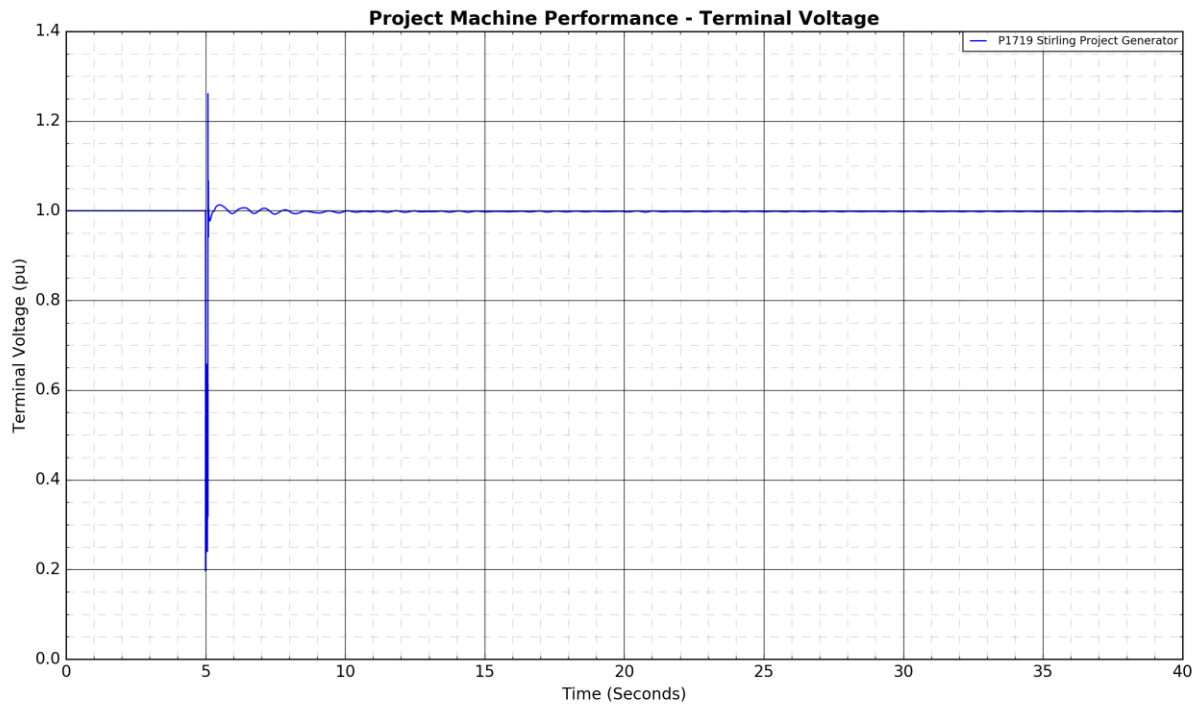
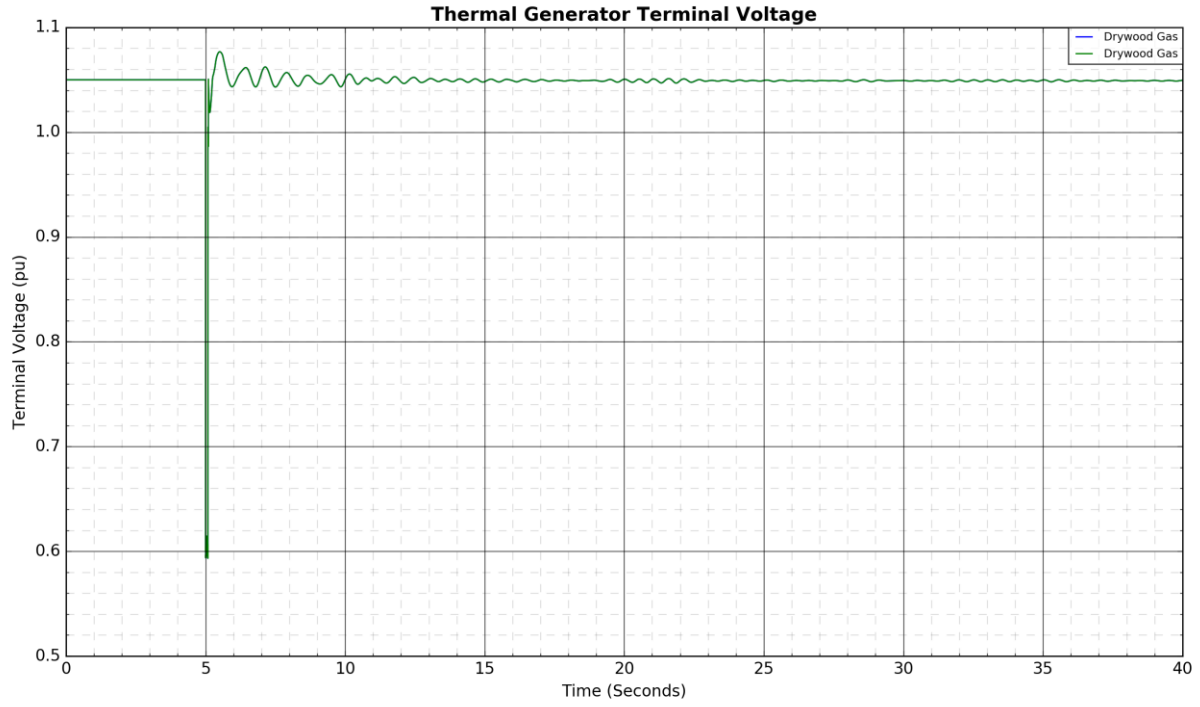


Engineering Connection Assessment Results: Stirling Wind Project Connection









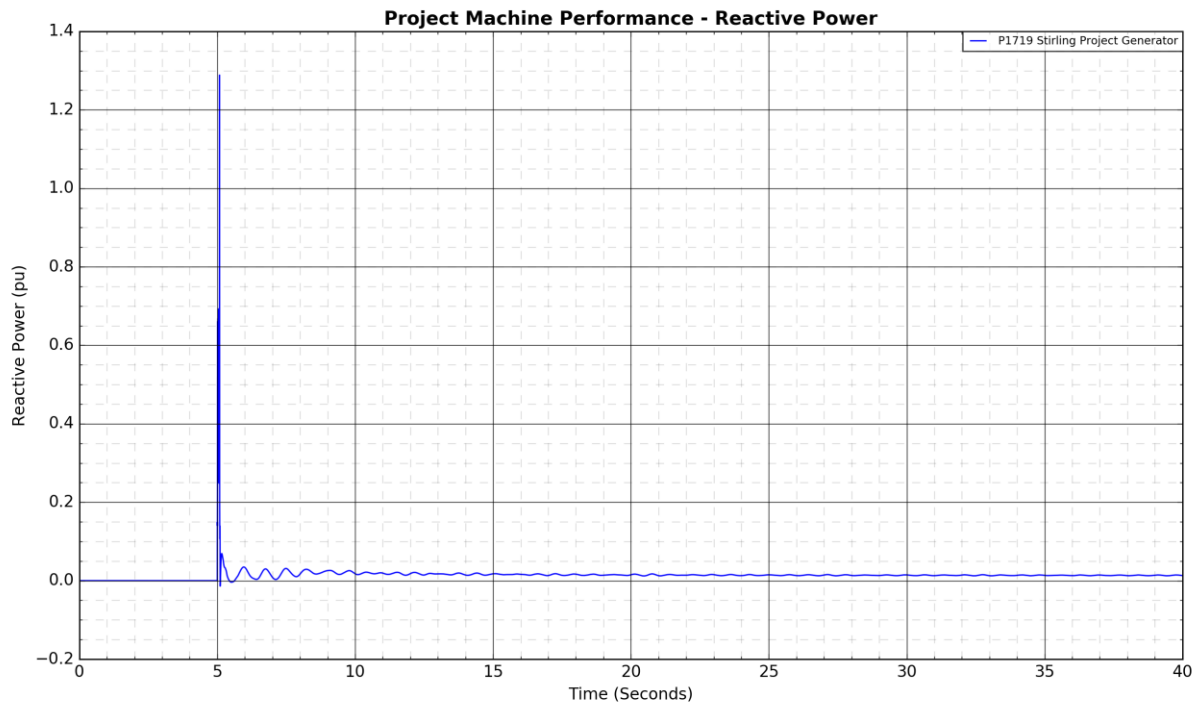
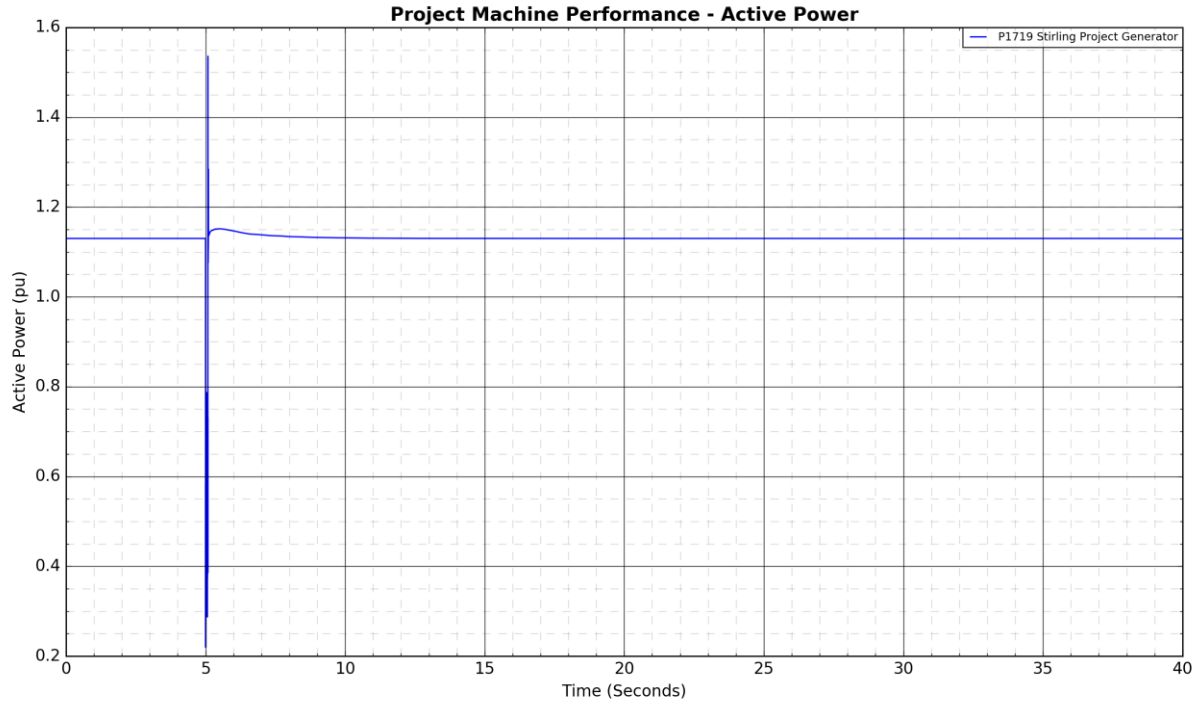
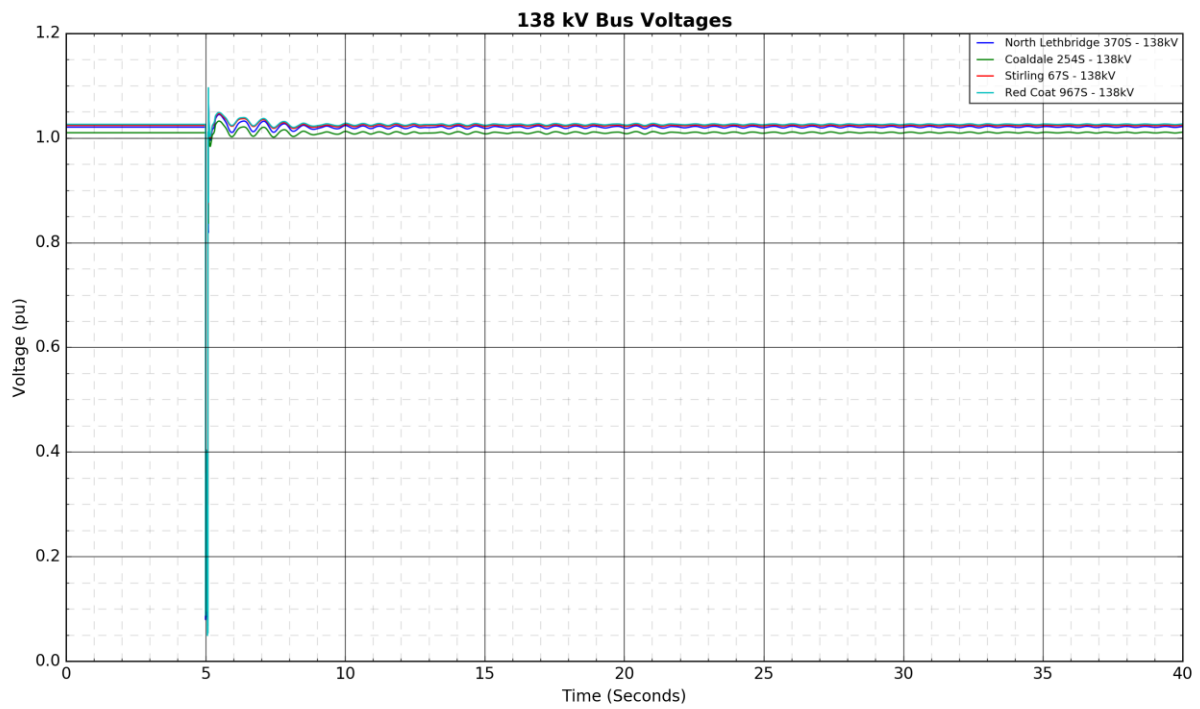
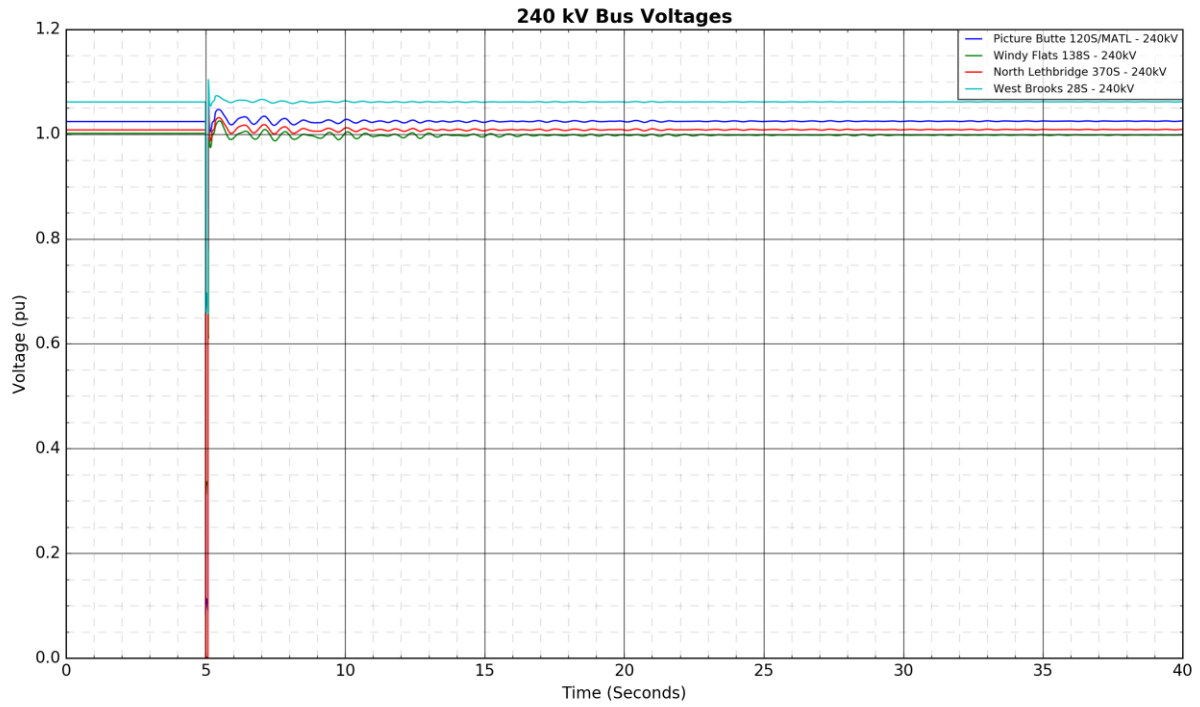
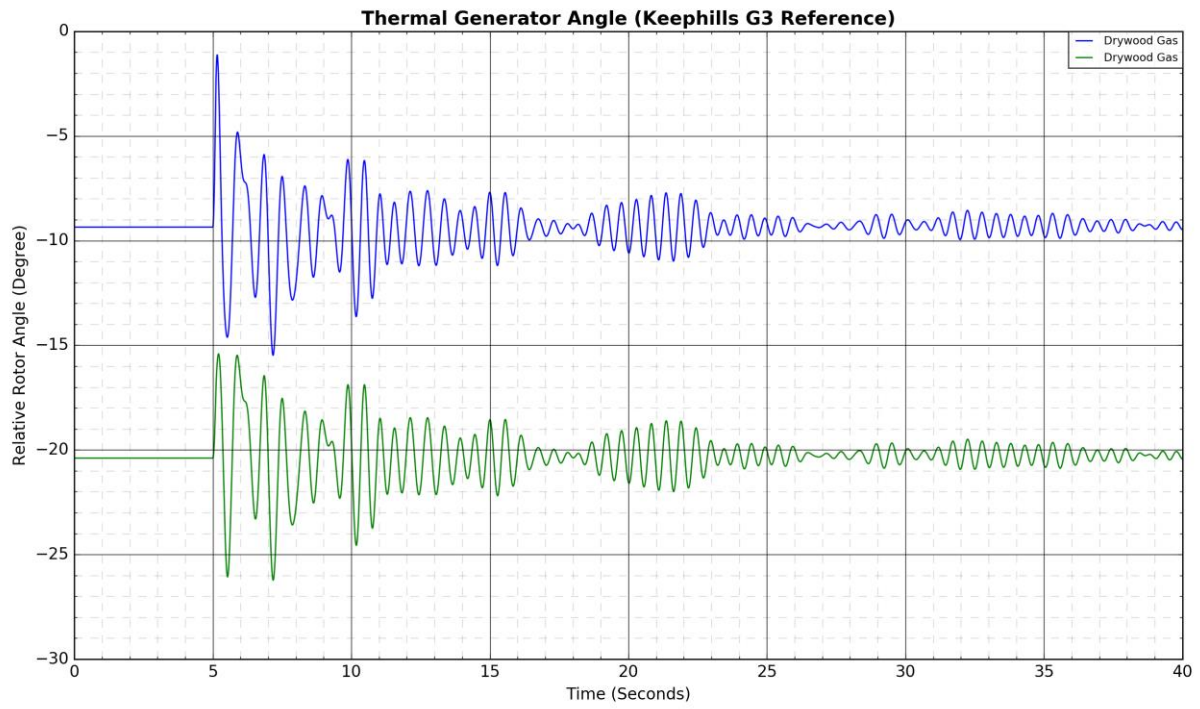
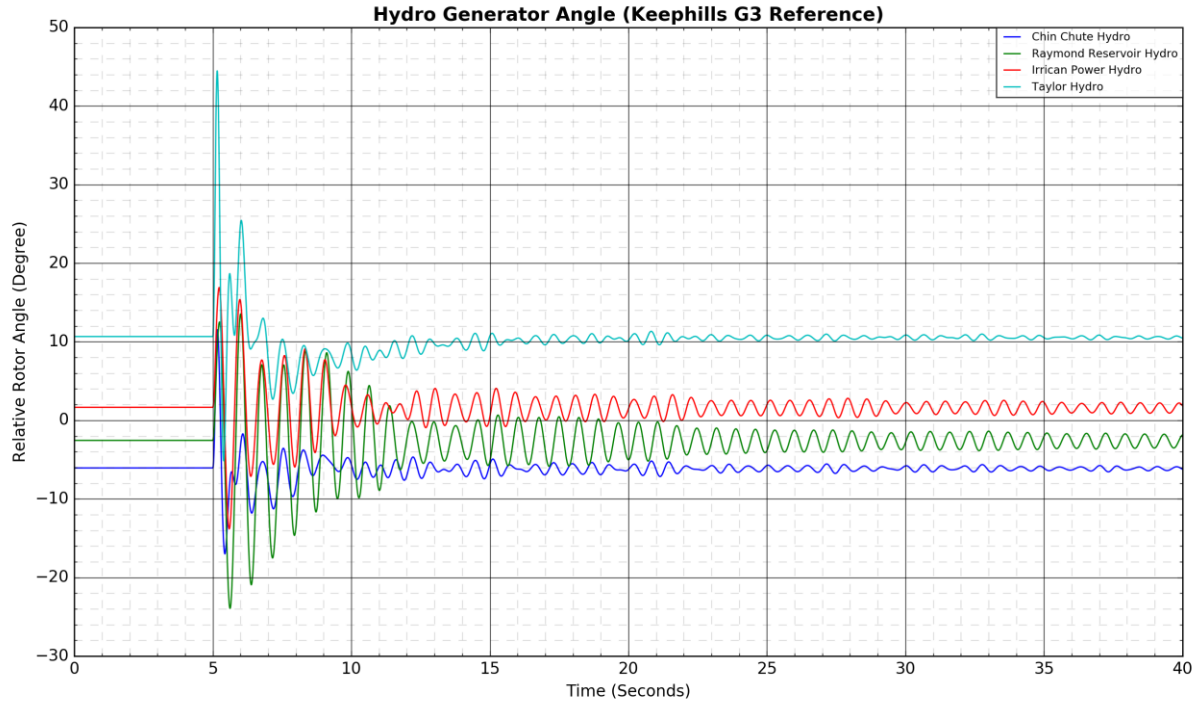
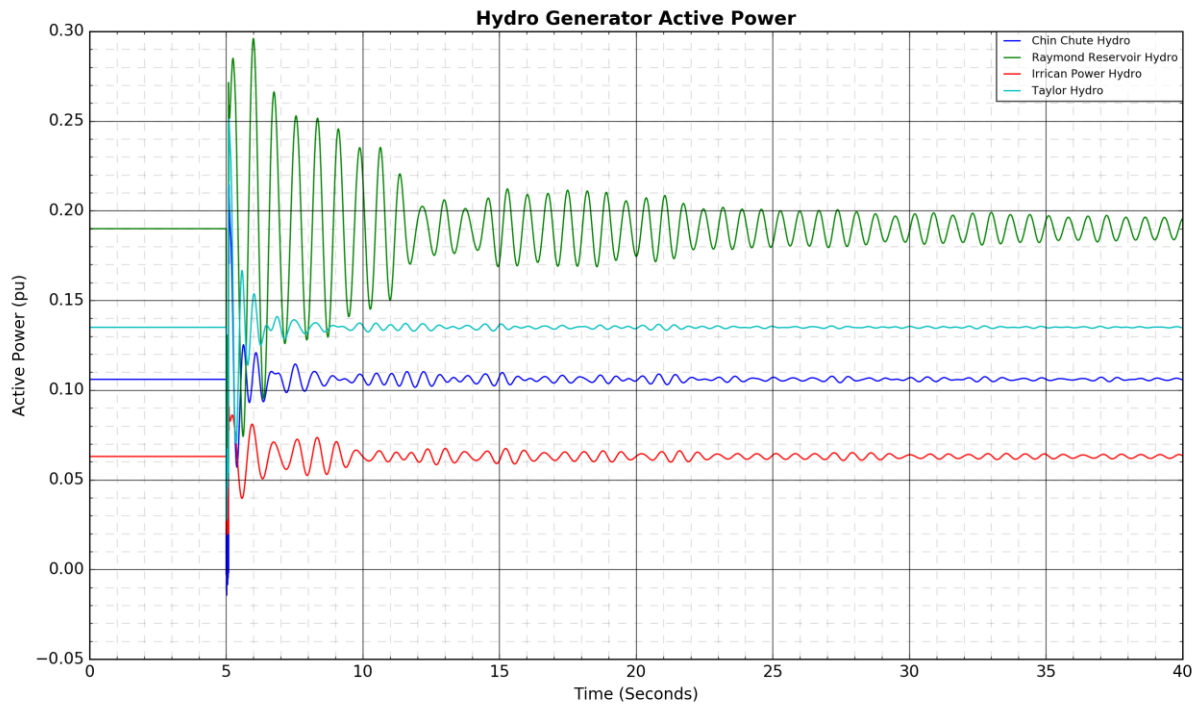
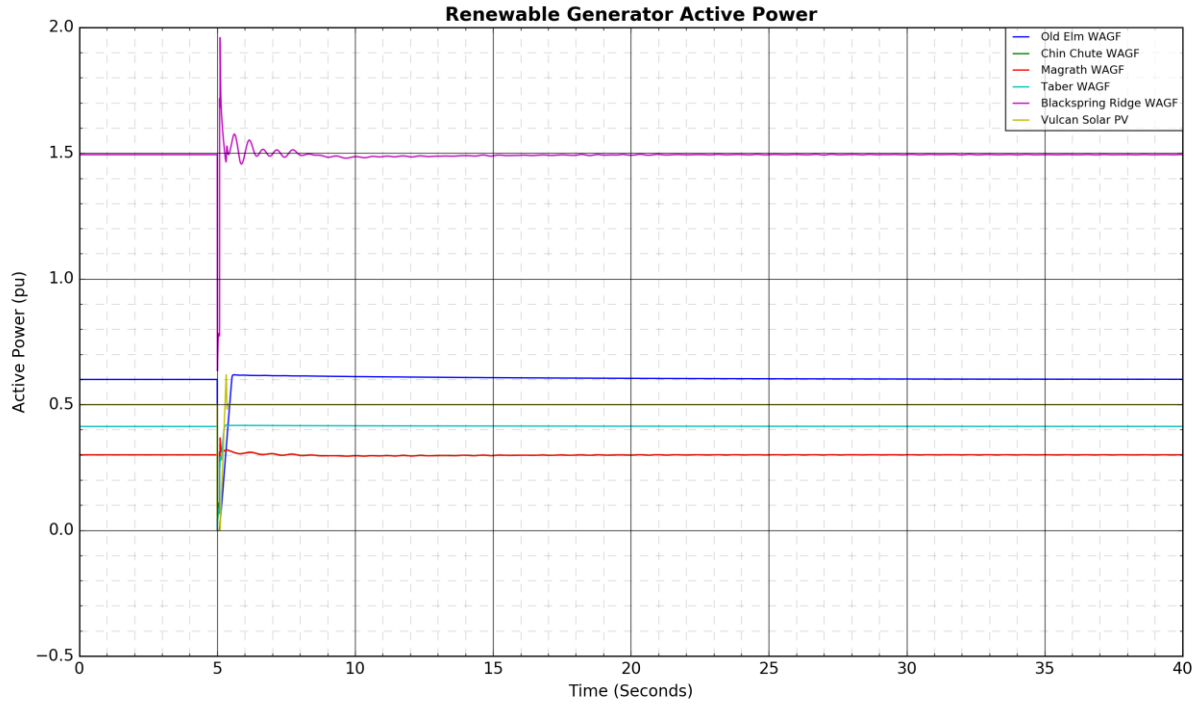
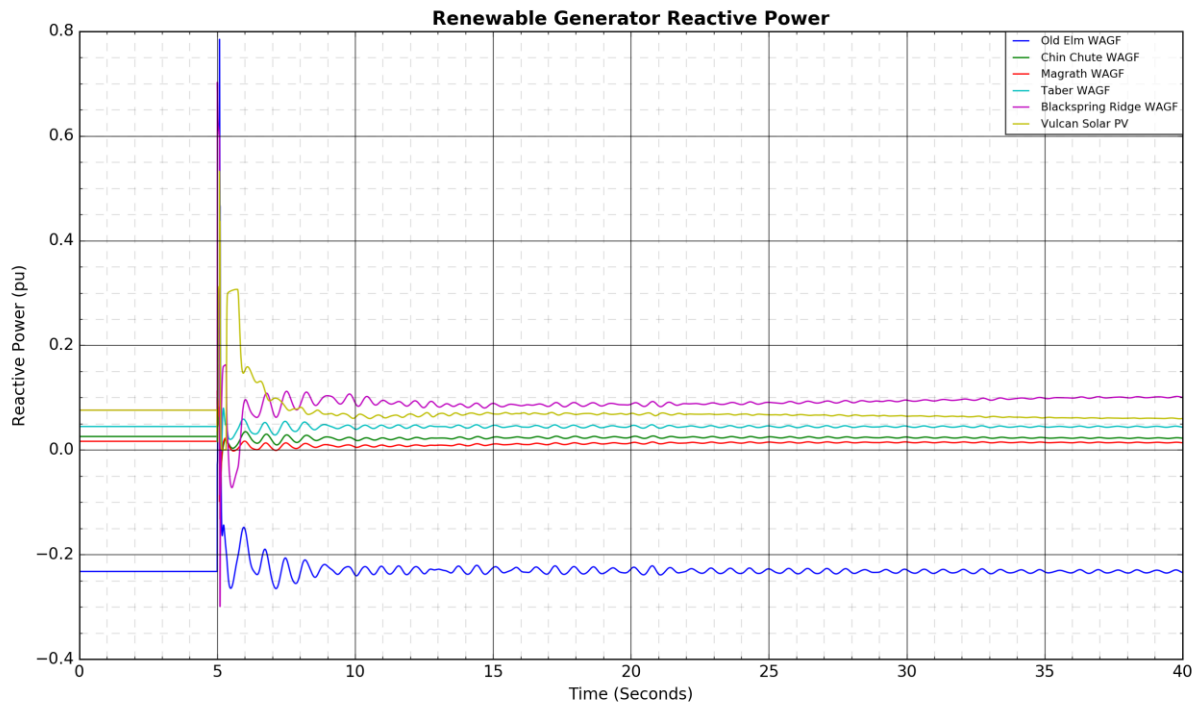
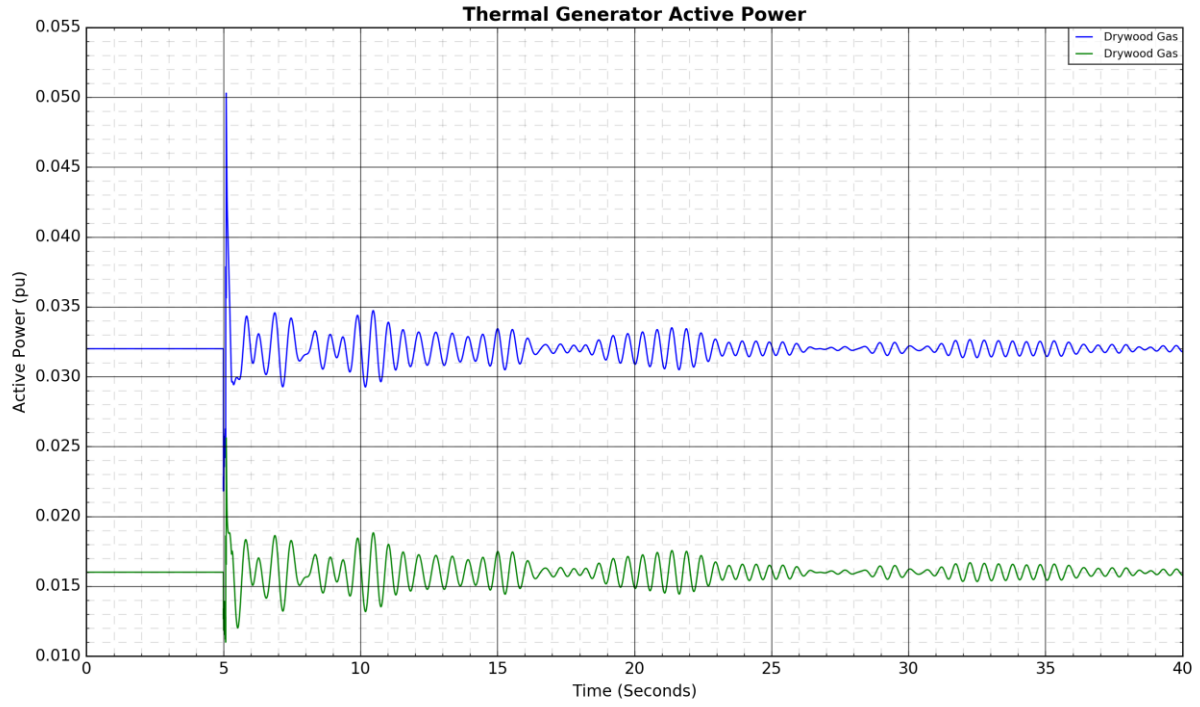


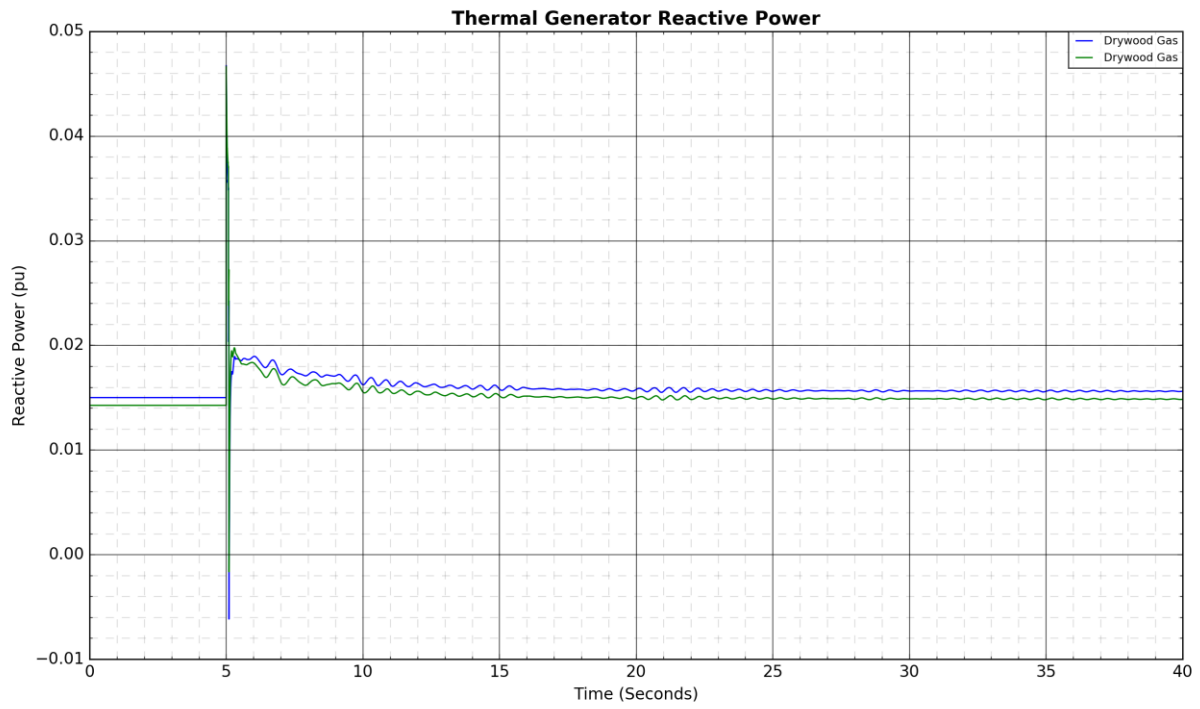
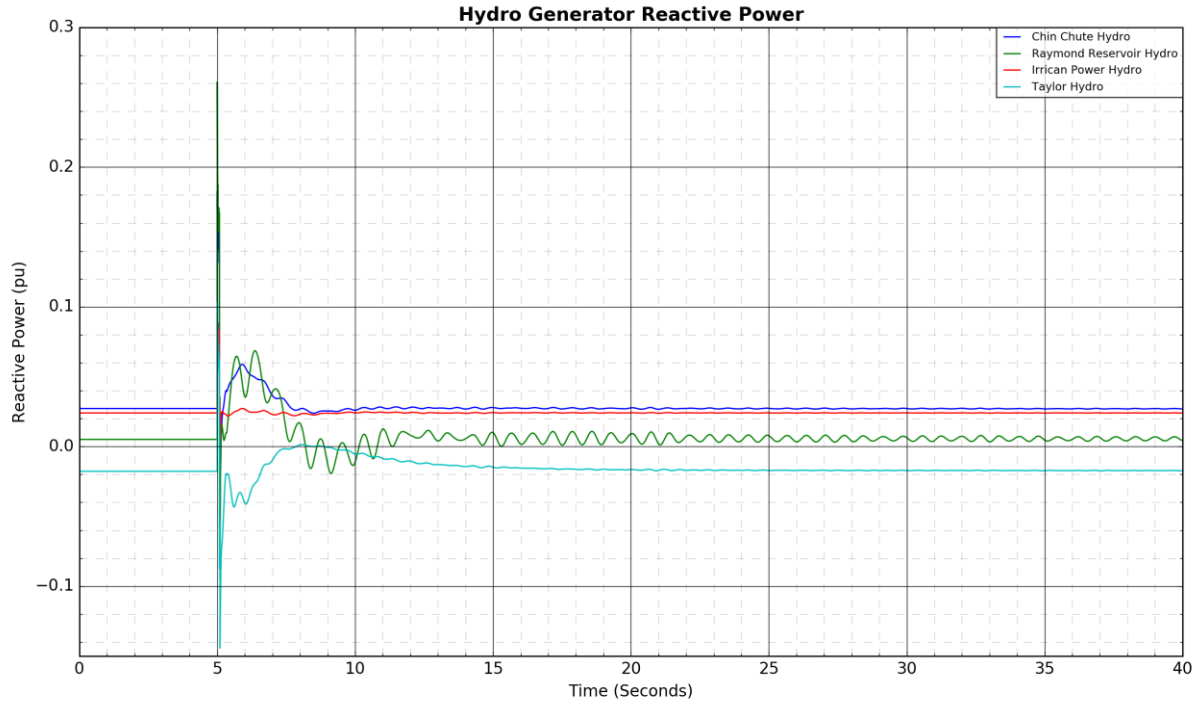
Figure A4-55: 968L North Lethbridge 370S to Windy Flats 138S: Fault Near North Lethbridge 370S

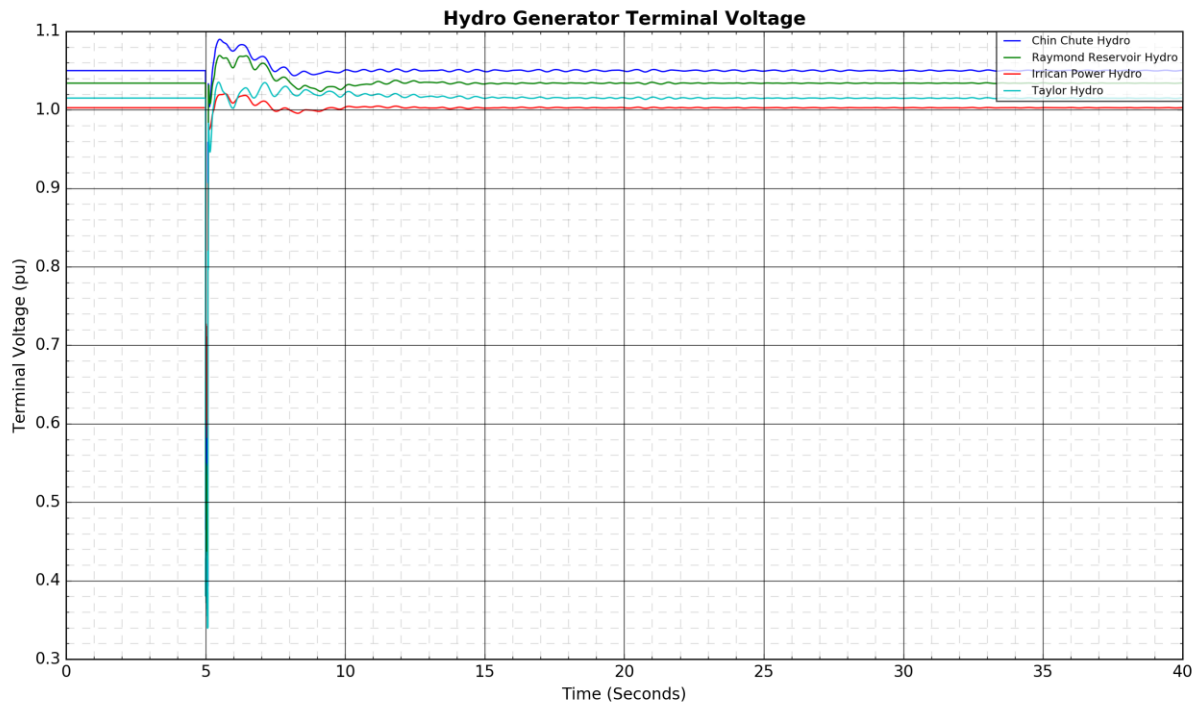
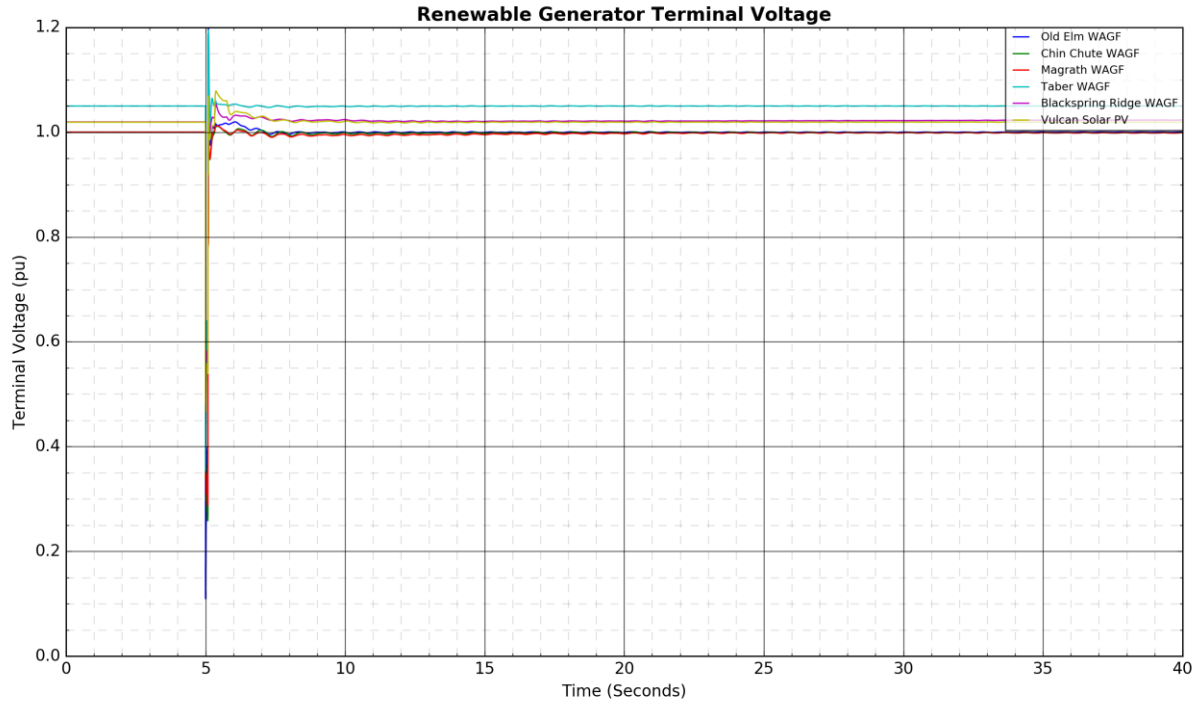


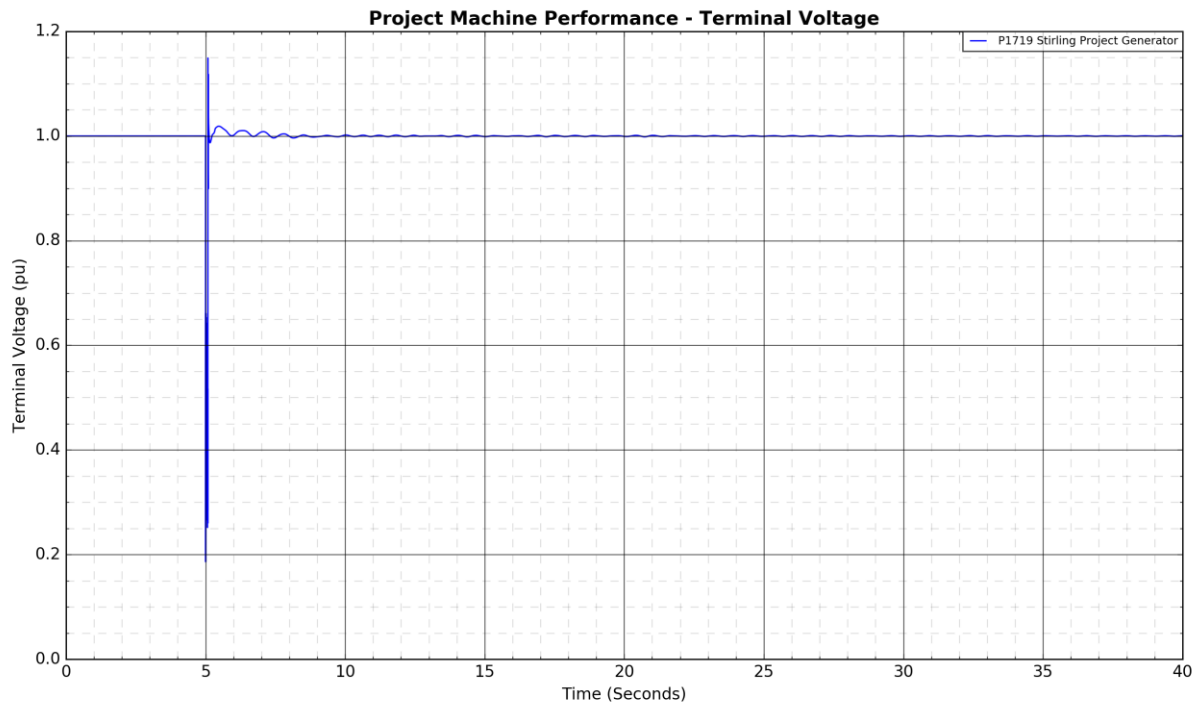
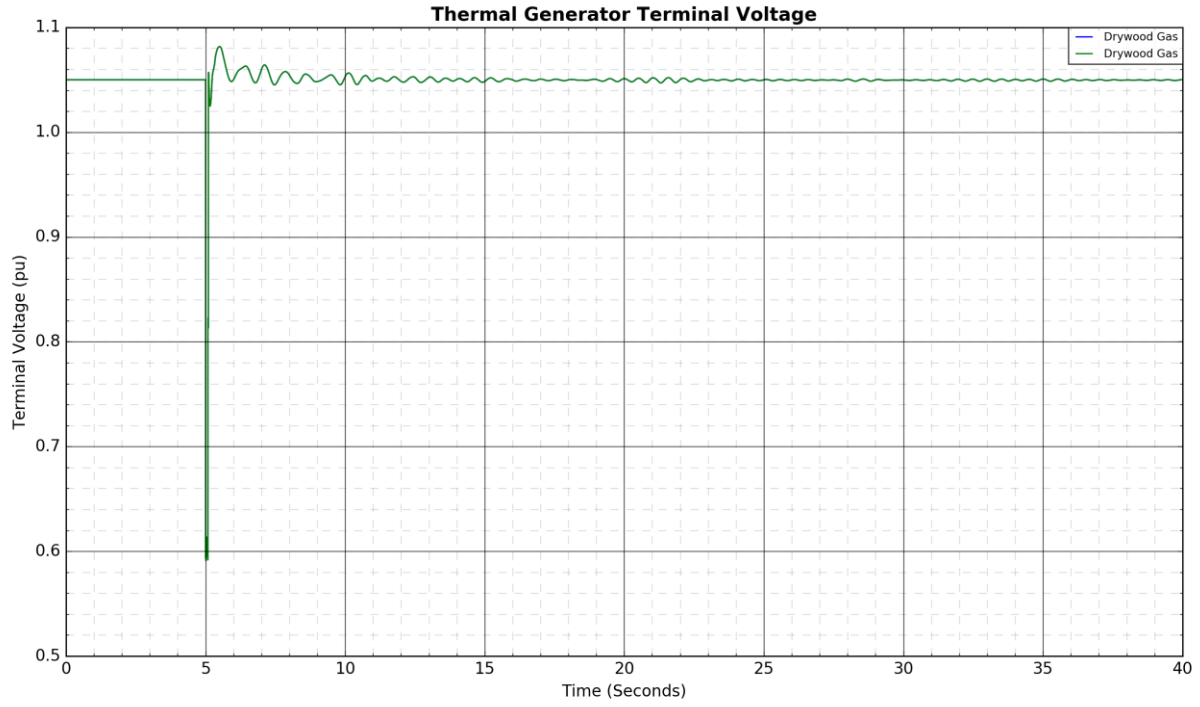












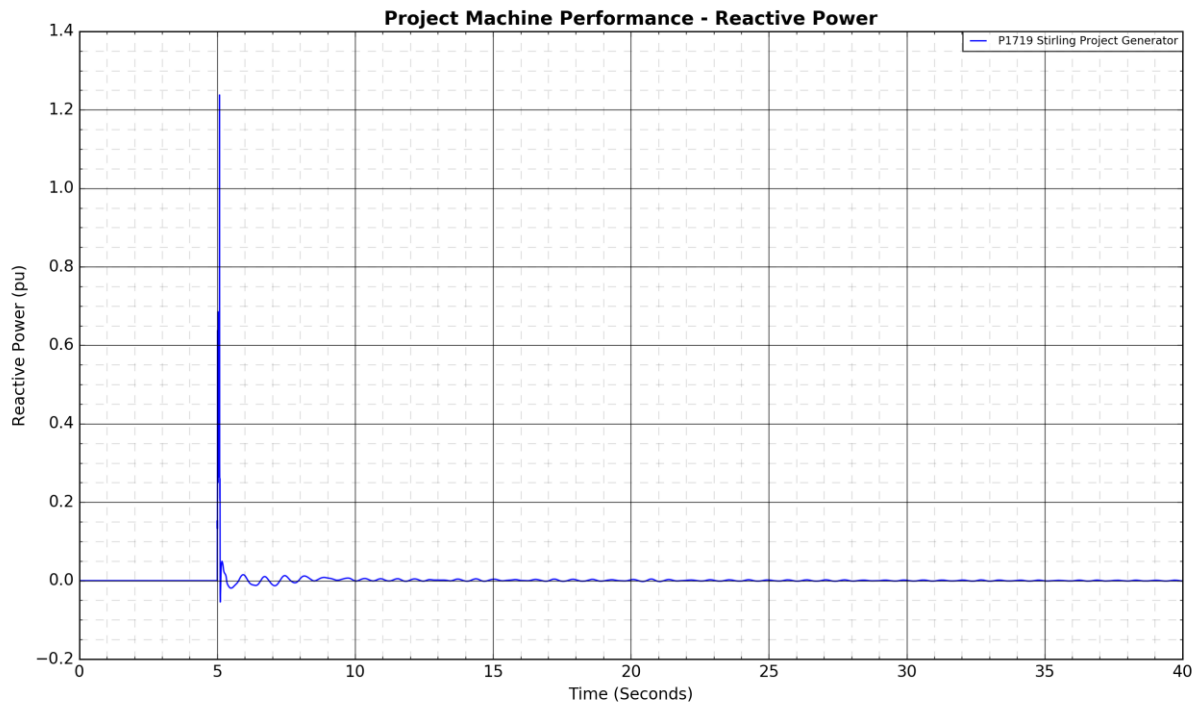
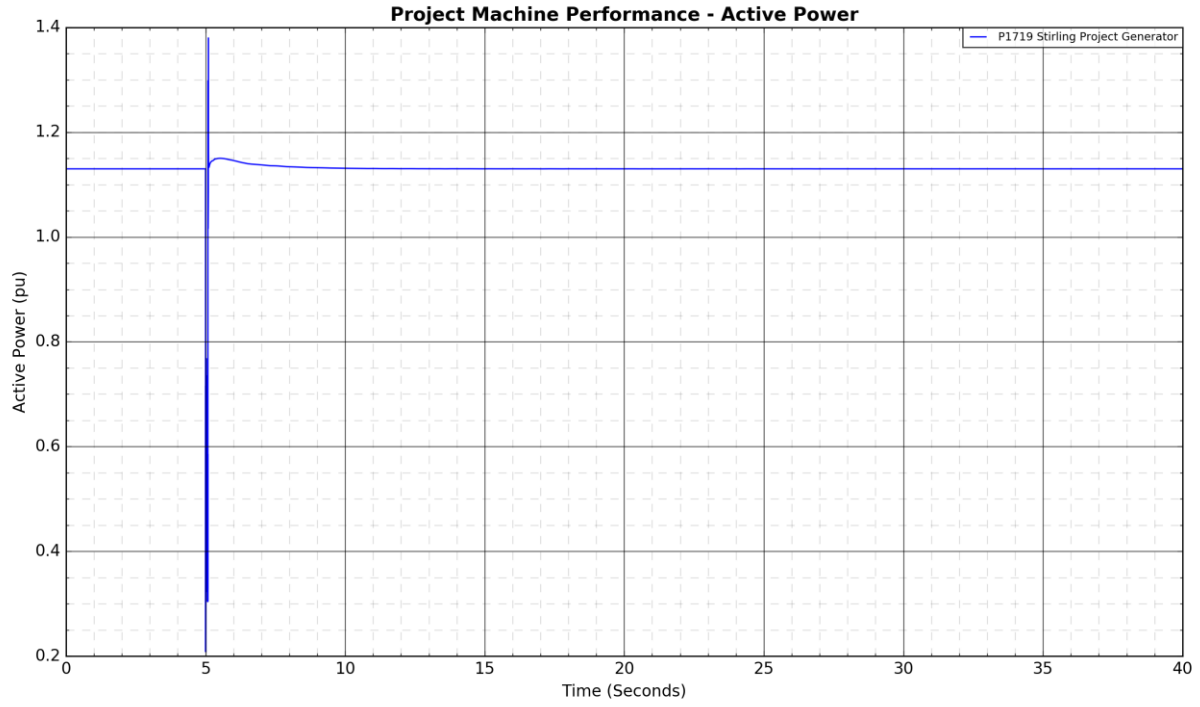
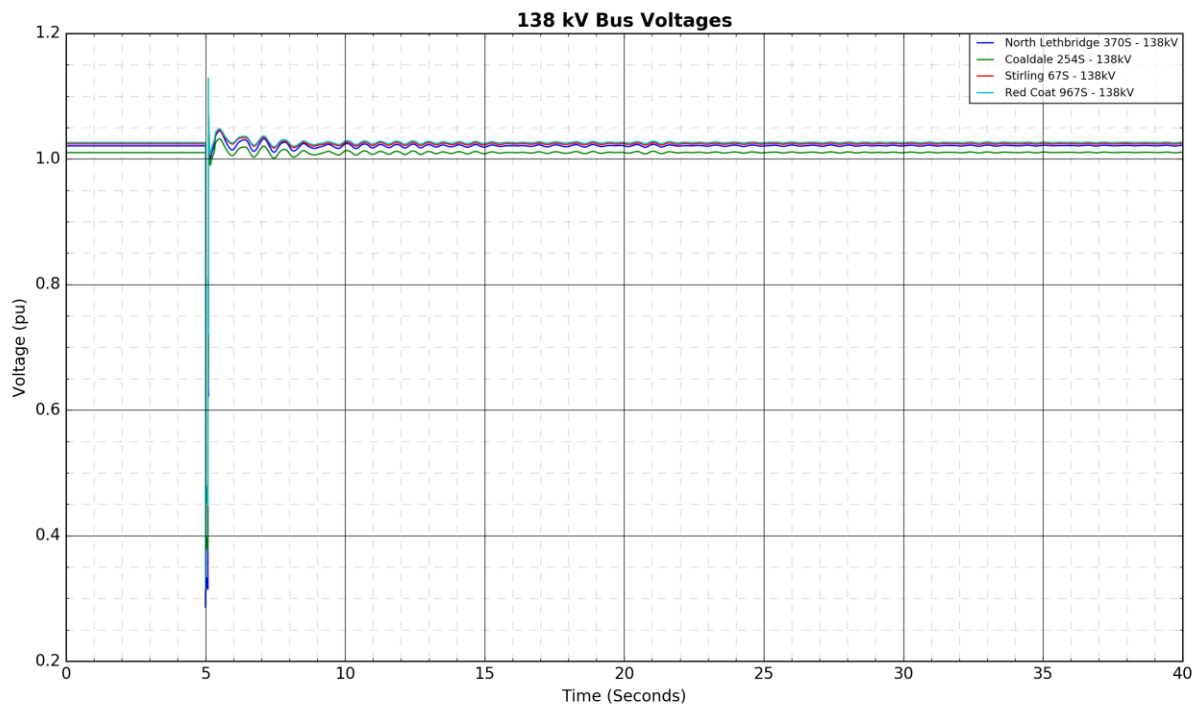
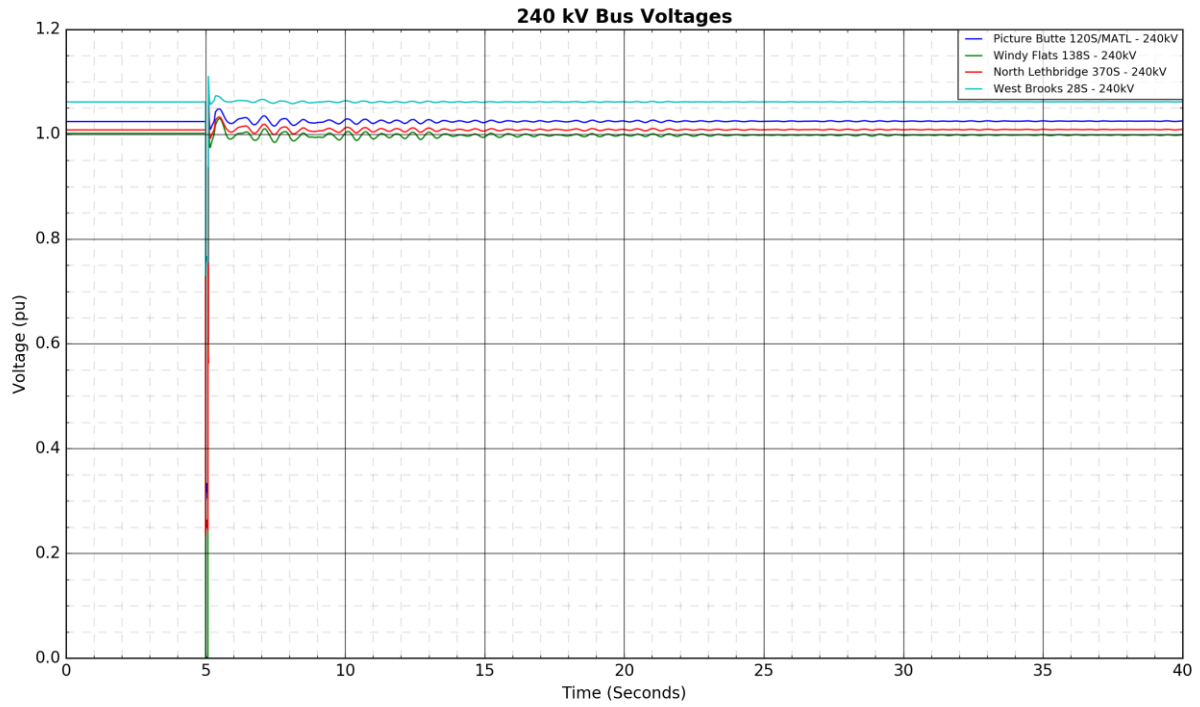
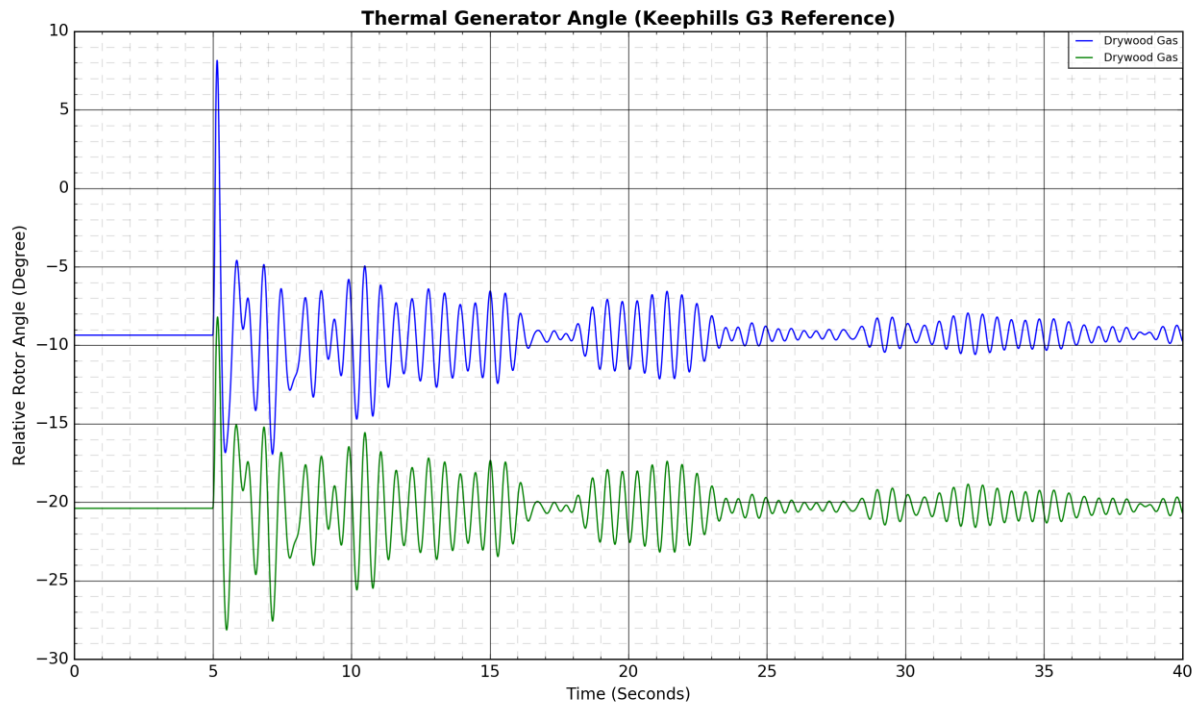
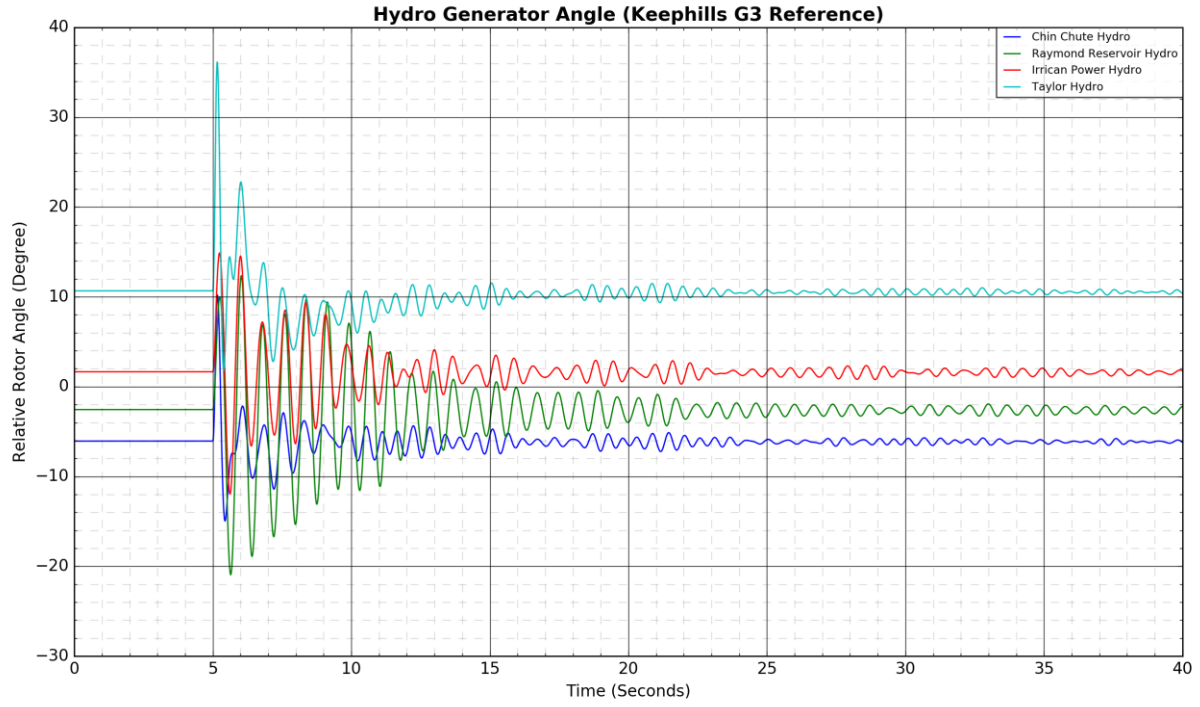
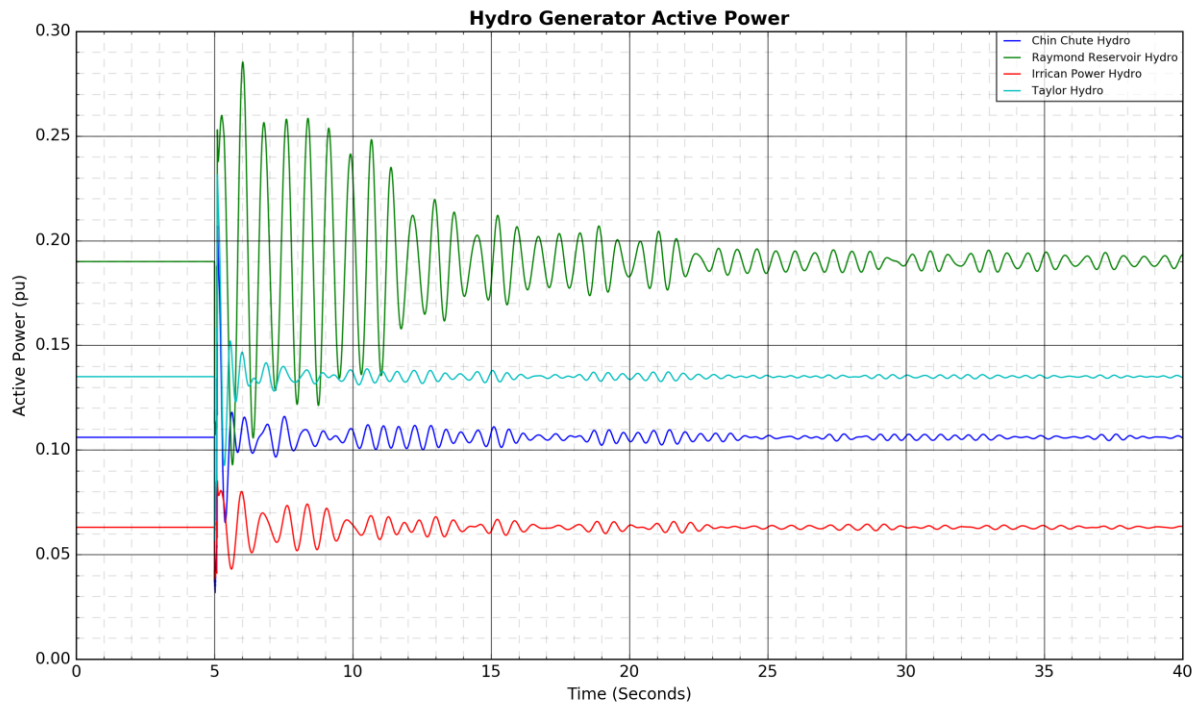
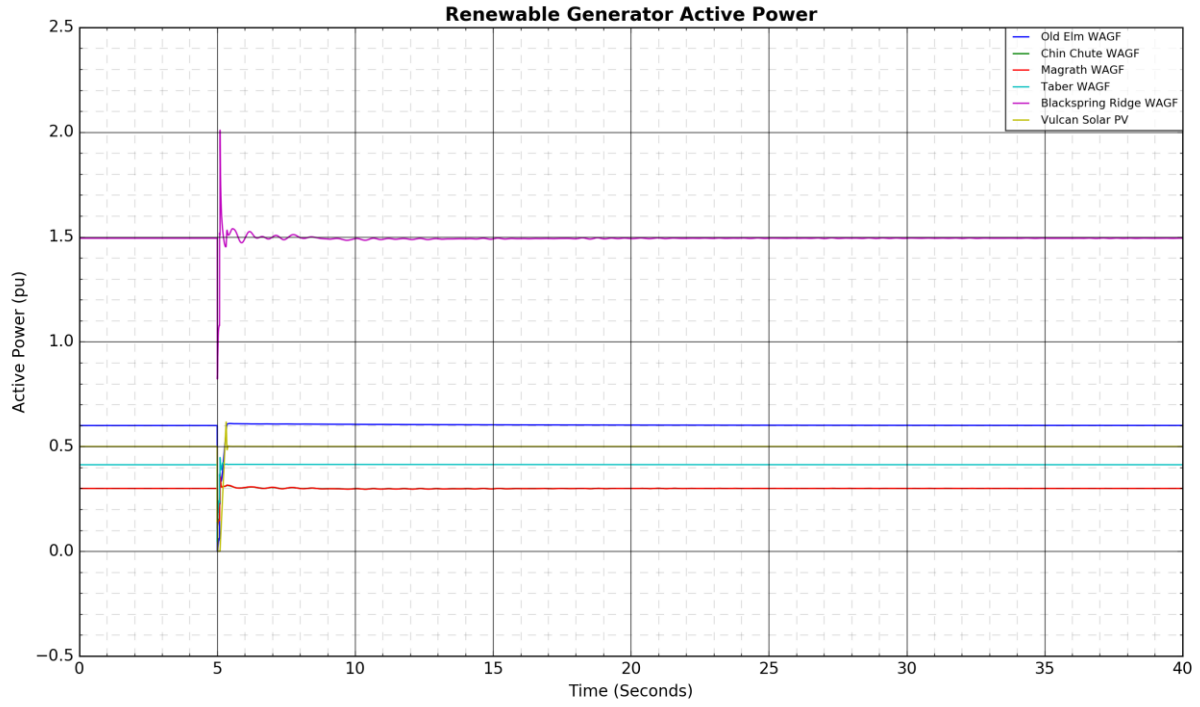


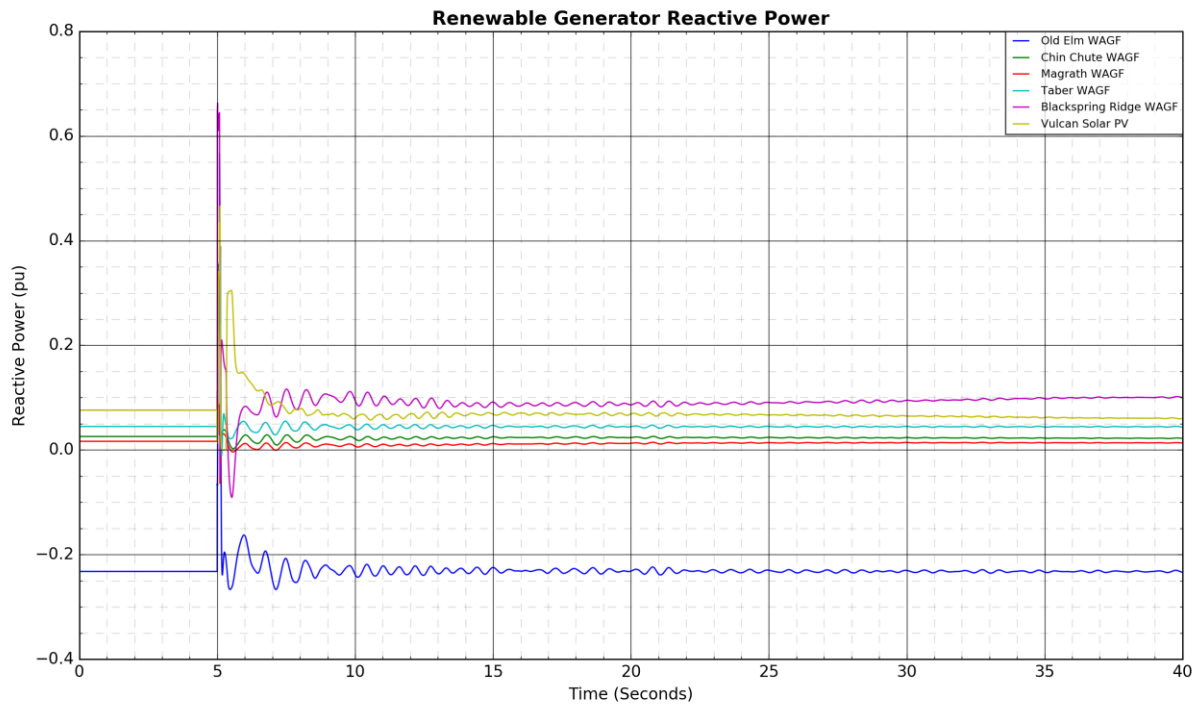
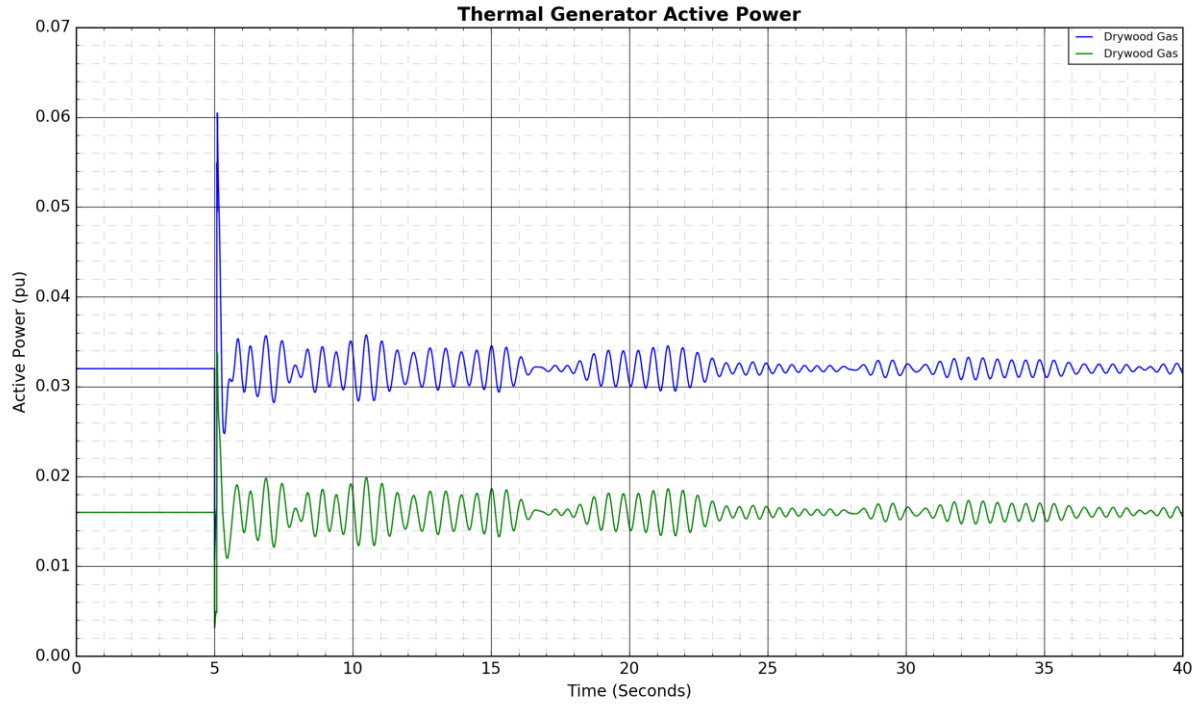
Figure A4-56: 968L North Lethbridge 370S to Windy Flats 138S: Fault Near Windy Flats 138S

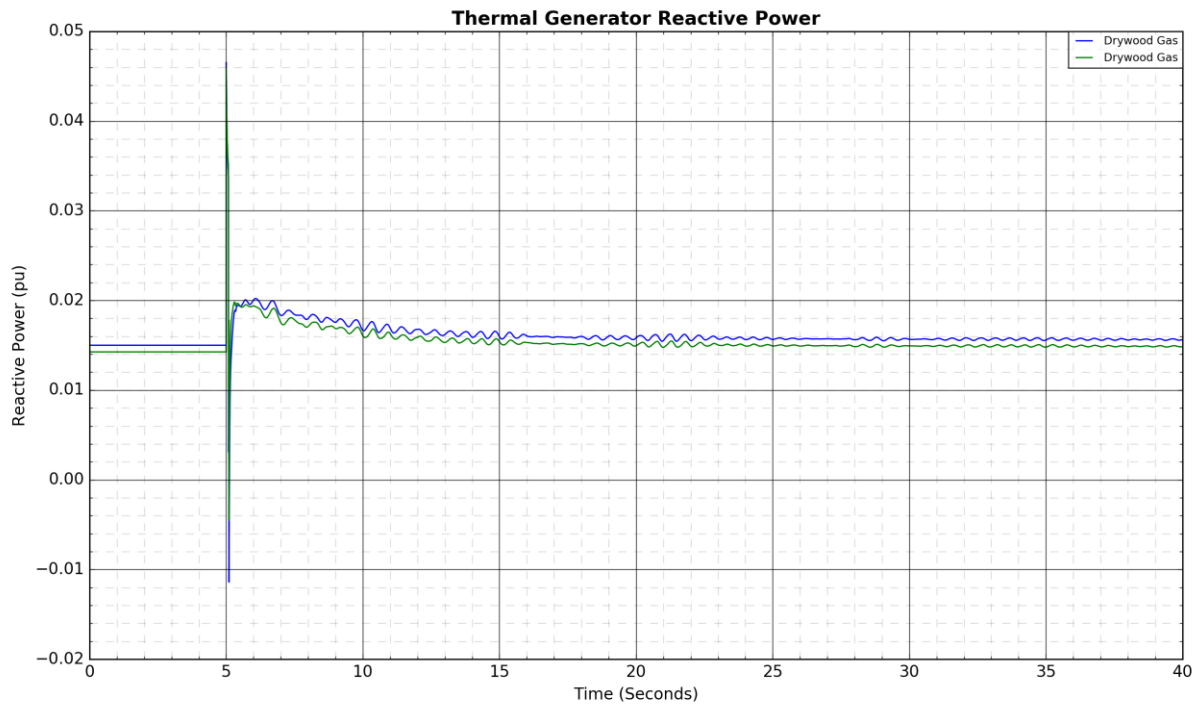
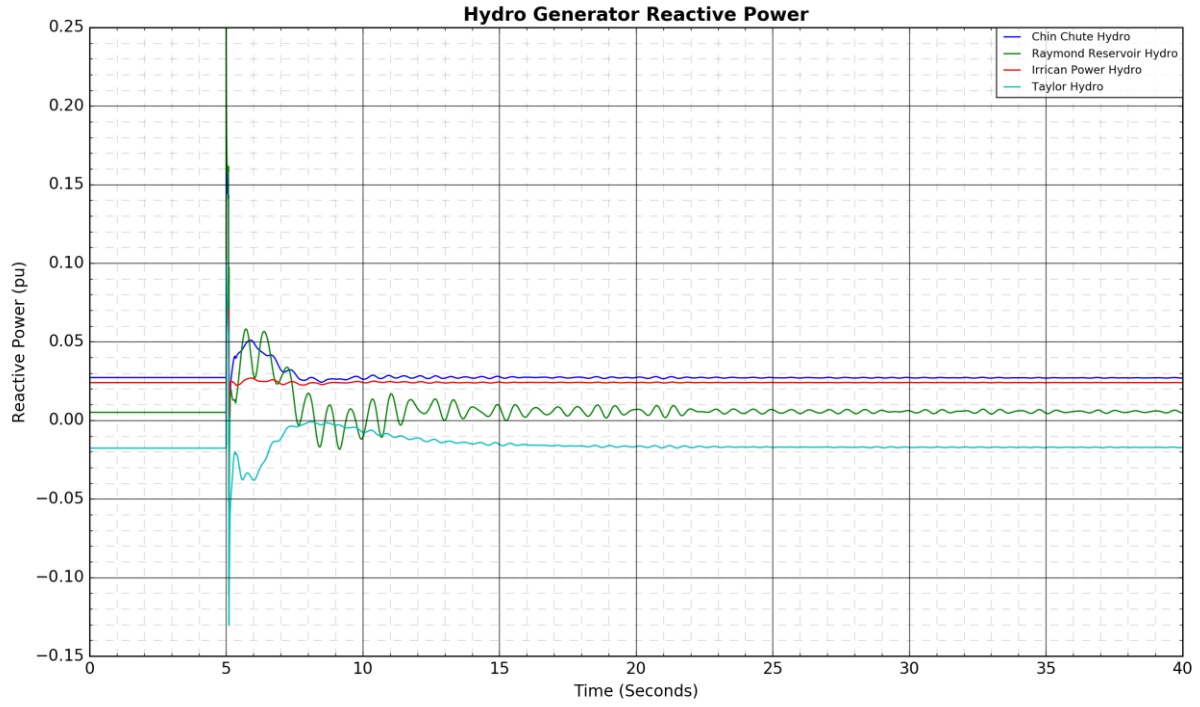


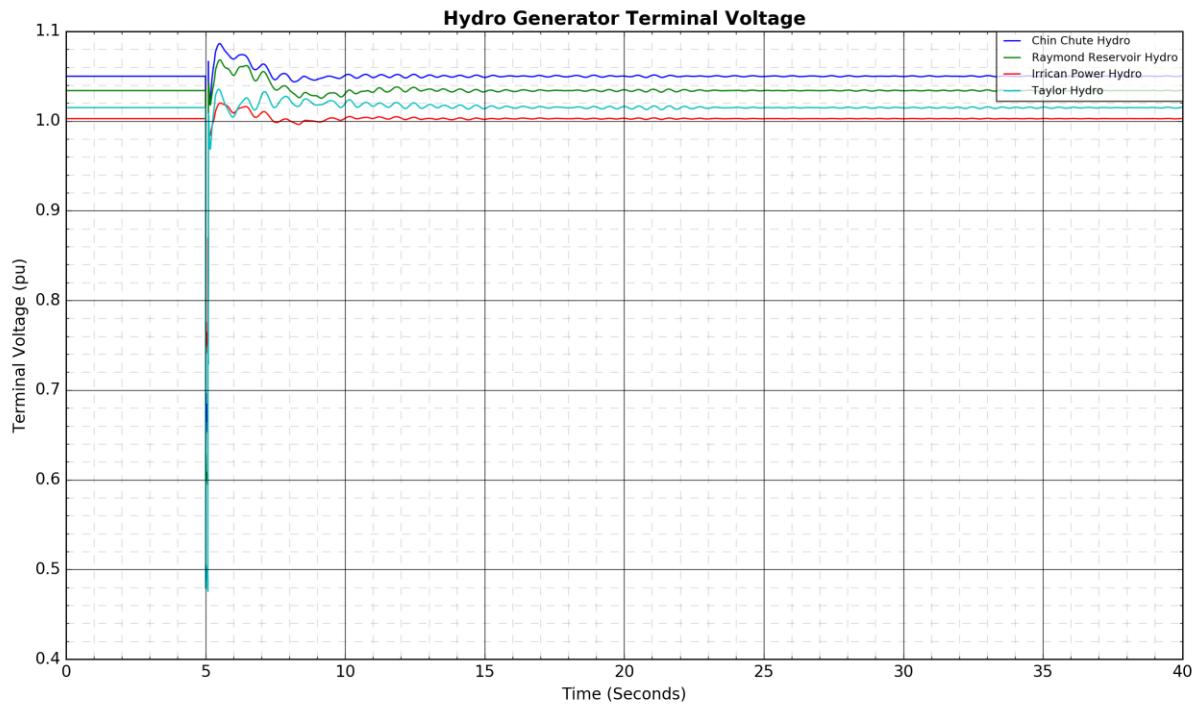
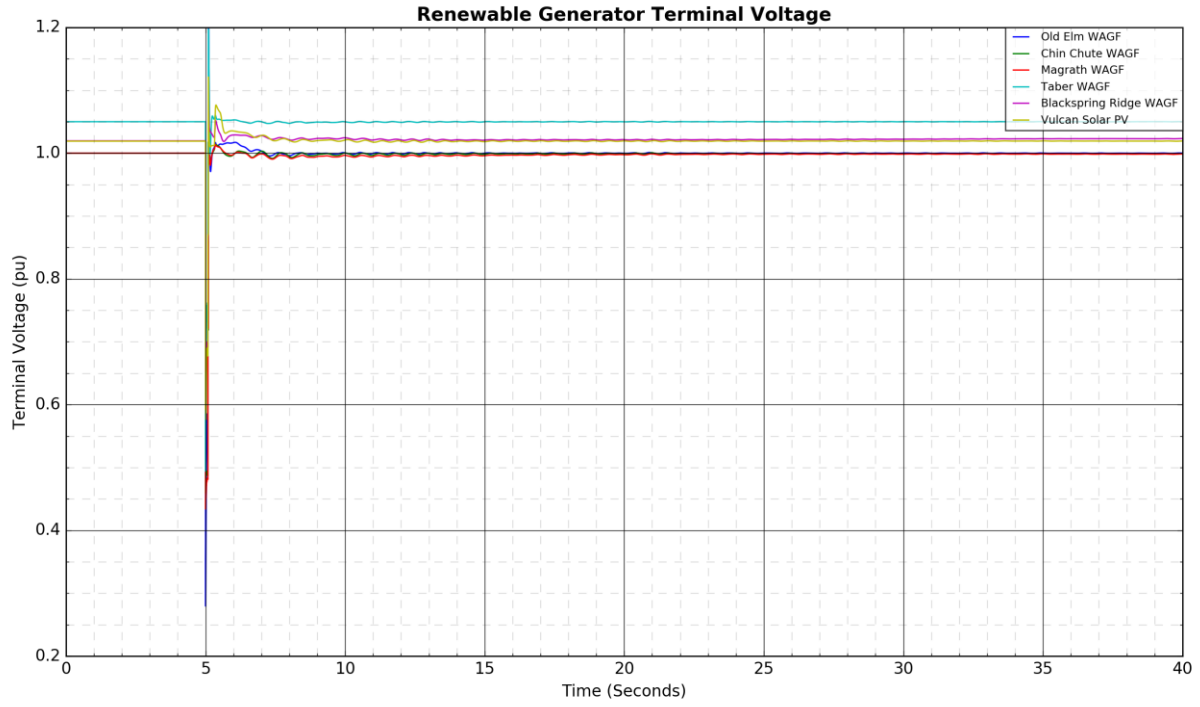


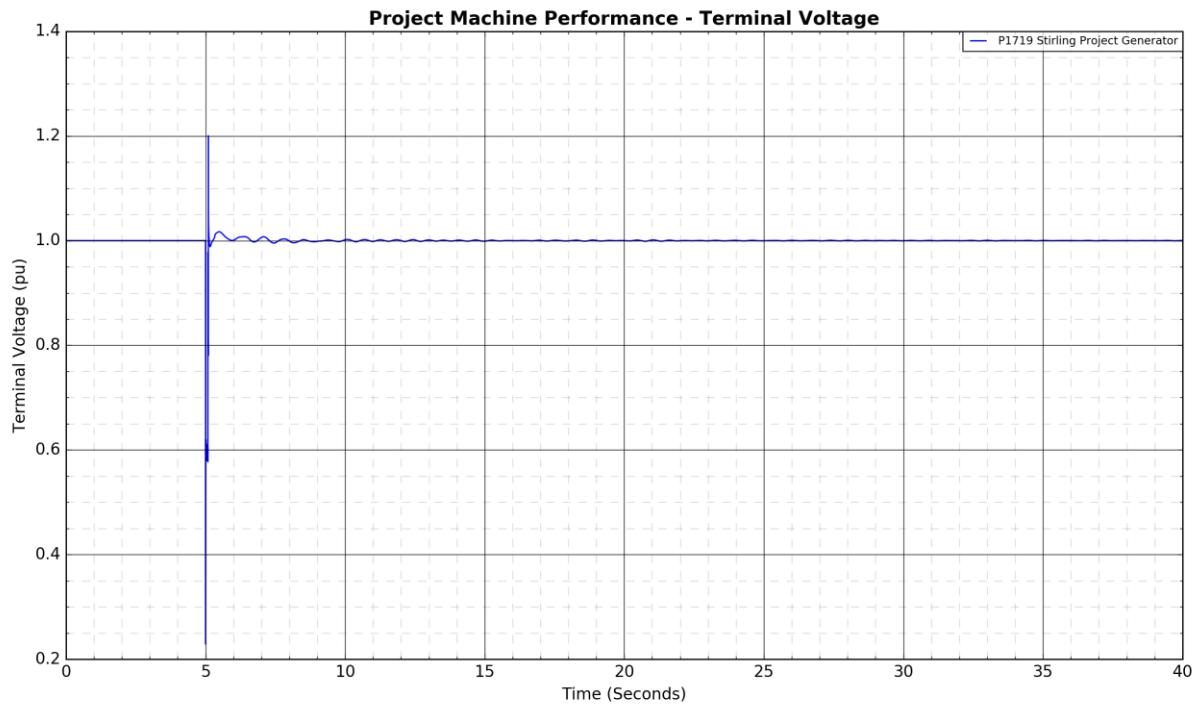
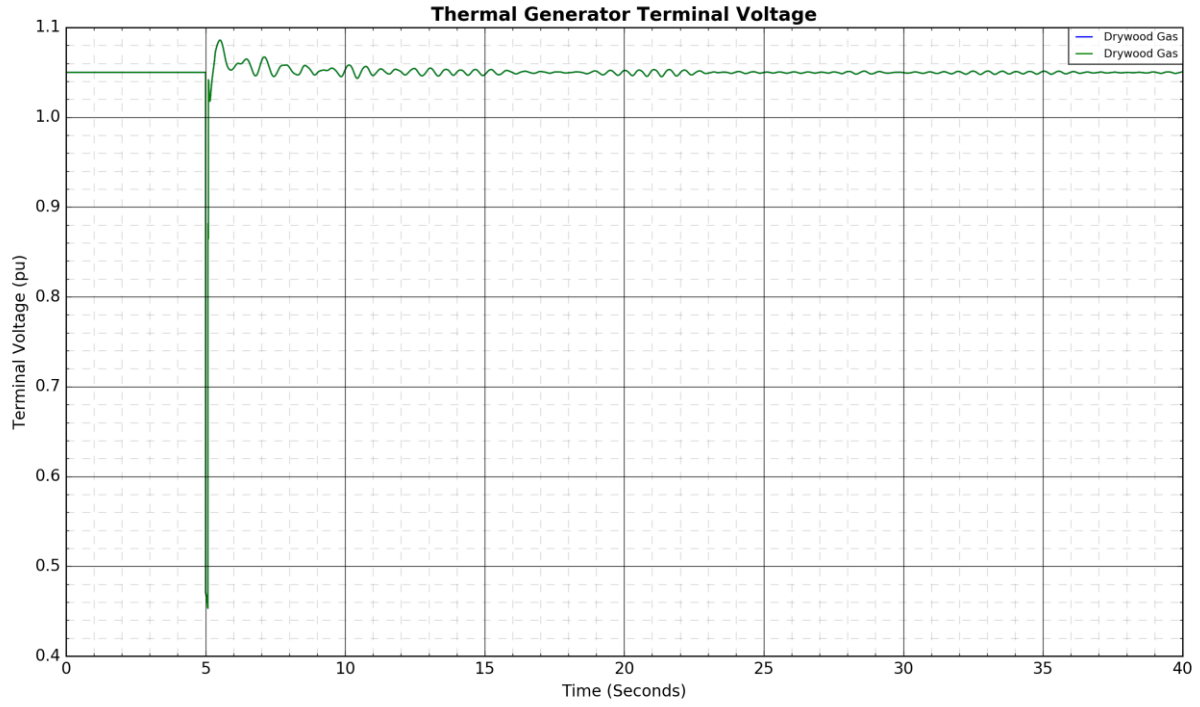
Engineering Connection Assessment Results: Stirling Wind Project Connection

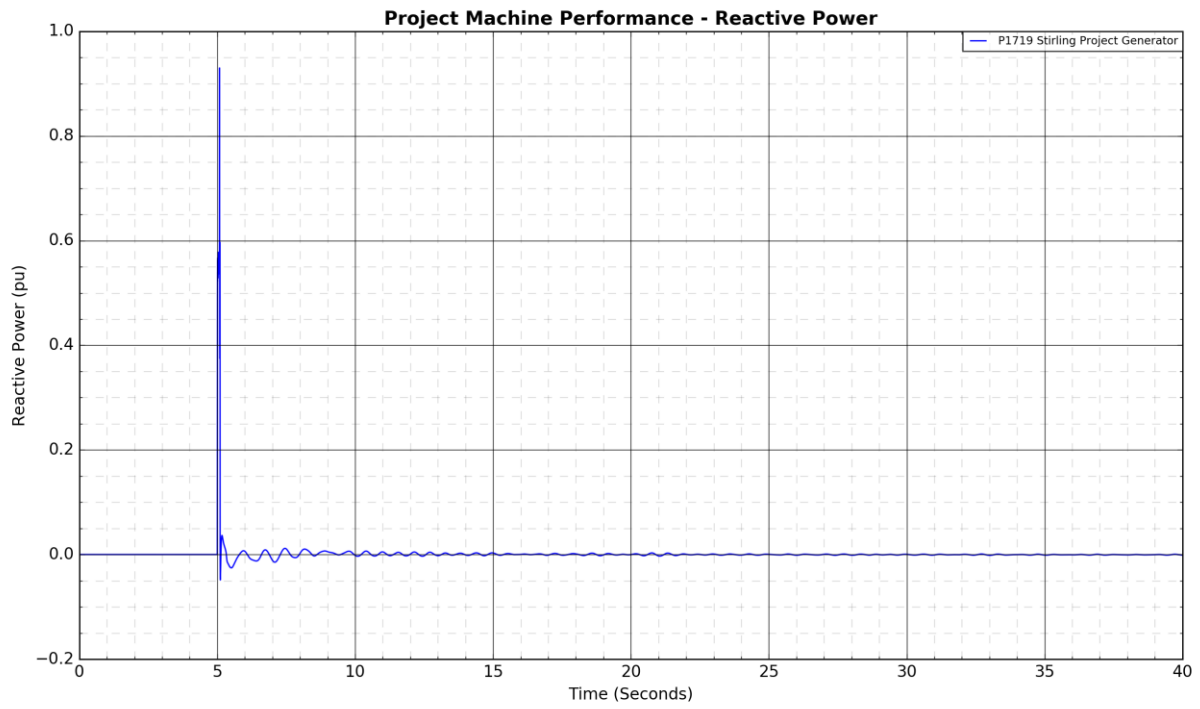
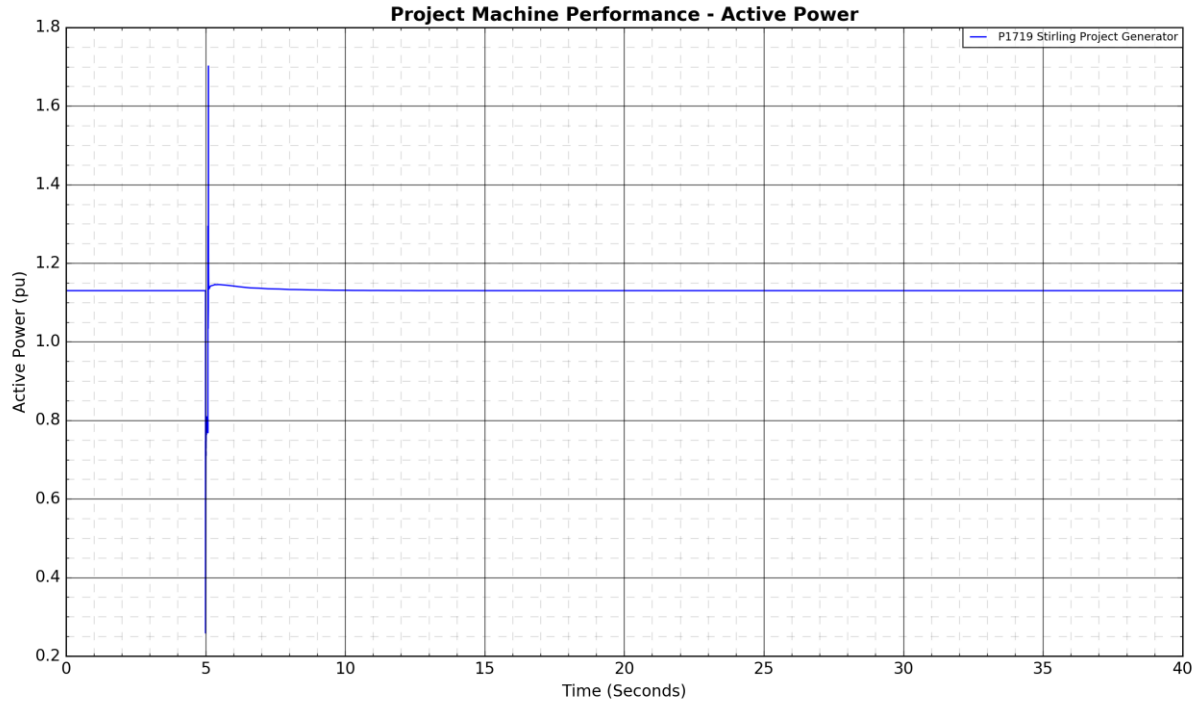












Attachment A5

**Dynamic Data and Assumptions of All Equipment
Proposed for Connection**

Attachment A6

Post-Mitigation Power Flow Diagrams

Engineering Connection Assessment Results: Stirling Wind Project Connection

List of Figures

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Figure Number
2019 Summer Light Post-Project	146L_162L (Drywood 415S - Glenwood 229S)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-1
	225L (Glenwood 229S - Spring Coulee 385S)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-2
	225L (Spring Coulee 385S - Magrath 225S)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-3
	940L (North Lethbridge 370S - Picture Butte 120S)	172L (Taber 83S - Hillridge Tap)	Figure A6-4
		1036L (Travers 554S - Milo 356S)	
	207L (Coalbanks 111S - North Lethbridge 370S)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-5
	823L (Macdonald 146S - Lakeview 593S)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-6
	824L (Lakeview 593S - Riverbend 618S)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-7
		725AL (Riverbend 618S - Riverbend Tap)	
	725L (Coalbanks 111S - Riverbend 618S Tap - Riverbend 618S - Bowron 674S)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-8
	508L (Warner 344S - Stirling 67S)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-9
	607L (Fincastle 336S - Conrad Tap)	172L (Taber 83S - Hillridge Tap)	Figure A6-10
		820L (Coaldale 254S - Chin Chute Tap)	
	1005L (Picture Butte 120S - Milo 356S)	172L (Taber 83S - Hillridge Tap)	Figure A6-11
		1036L (Travers 554S - Milo 356S)	
	863L (Magrath 225S - Riverbend 618S)	162L (Drywood 415S - Glenwood 229S)	Figure A6-12
		225L (Glenwood 229S - Spring Coulee 385S)	
		225L (Spring Coulee 385S - Magrath 225S)	
		67ST2 (Stirling 67S Transformer T2)	
		225L (Stirling 67S - Raymond Reservoir Tap)	
		820L (Coaldale 254S - Chin Chute Tap)	
		225ST1 (Magrath 225S Transformer T1)	
		225L (Magrath 225S - Raymond Reservoir Tap)	
	820L (Chin Chute Tap - Red Coat Tap)		
	1036L (Travers 554S - Milo 356S)	172L (Taber 83S - Hillridge Tap)	Figure A6-13
		172L (Coaldale 254S - Hillridge Tap)	
		820L (Coaldale 254S - Chin Chute Tap)	
	139ST1 (Hillridge 139S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-14
	146ST1 (Macdonald 146S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-15
	593ST1 (Lakeview 593S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-16
		725AL (Riverbend 618S - Riverbend Tap)	
	415ST2 (Drywood 415S Transformer T2)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-17
229ST1 (Glenwood 229S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-18	
385ST1 (Spring Coulee 385S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-19	
134S_G1_G2 (Taber Wind Farm 134S)	172L (Taber 83S - Hillridge Tap)	Figure A6-20	
	820L (Coaldale 254S - Chin Chute Tap)		
225ST1 (Magrath 225S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-21	
	820L (Chin Chute Tap - Red Coat Tap)		
618ST1 (Riverbend 618S Transformer T1)	162L (Drywood 415S - Glenwood 229S)	Figure A6-22	
	225L (Glenwood 229S - Spring Coulee 385S)		
	225L (Spring Coulee 385S - Magrath 225S)		
	67ST2 (Stirling 67S Transformer T2)		
	225L (Stirling 67S - Raymond Reservoir Tap)		
820L (Coaldale 254S - Chin Chute Tap)			

Engineering Connection Assessment Results: Stirling Wind Project Connection

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Figure Number
		225ST1 (Magrath 225S Transformer T1)	
		225L (Magrath 225S - Raymond Reservoir Tap)	
		820L (Chin Chute Tap - Red Coat Tap)	
2019 Summer Peak Post-Project	180L (Fort Macleod 15S - East Stavely 928S)	172L (Taber 83S - Hillridge Tap)	Figure A6-23
	180L (Vulcan 255S - East Stavely 928S)	172L (Taber 83S - Hillridge Tap)	Figure A6-24
	161L (Vulcan 255S - Queenstown 504S)	172L (Taber 83S - Hillridge Tap)	Figure A6-25
	1041L (North Lethbridge 370S - Travers 554S)	172L (Taber 83S - Hillridge Tap)	Figure A6-26
	607L (Fincastle 336S - Conrad Tap)	172L (Taber 83S - Hillridge Tap)	Figure A6-27
		172L (Coaldale 254S - Hillridge Tap)	
	1005L (Picture Butte 120S - Milo 356S)	172L (Taber 83S - Hillridge Tap)	Figure A6-28
		1036L (Travers 554S - Milo 356S)	
	863L (Magrath 225S - Riverbend 618S)	162L (Drywood 415S - Glenwood 229S)	Figure A6-29
		225L (Glenwood 229S - Spring Coulee 385S)	
		225L (Spring Coulee 385S - Magrath 225S)	
		67ST2 (Stirling 67S Transformer T2)	
		225L (Stirling 67S - Raymond Reservoir Tap)	
		820L (Coaldale 254S - Chin Chute Tap)	
		225ST1 (Magrath 225S Transformer T1)	
		225L (Magrath 225S - Raymond Reservoir Tap)	
	1036L (Travers 554S - Milo 356S)	172L (Taber 83S - Hillridge Tap)	Figure A6-30
		172L (Coaldale 254S - Hillridge Tap)	
	254ST2 (Coaldale 254S Transformer T2)	172L (Taber 83S - Hillridge Tap)	Figure A6-31
	146ST1 (Macdonald 146S Transformer T1)	172L (Taber 83S - Hillridge Tap)	Figure A6-32
	593ST1 (Lakeview 593S Transformer T1)	172L (Taber 83S - Hillridge Tap)	Figure A6-33
		725AL (Riverbend 618S - Riverbend Tap)	
	674ST1 (Bowron 674S Transformer T1)	172L (Taber 83S - Hillridge Tap)	Figure A6-34
	336ST1 (Fincastle 336S Transformer T1)	172L (Taber 83S - Hillridge Tap)	Figure A6-35
	255ST1 (Vulcan 255S Transformer T1)	172L (Taber 83S - Hillridge Tap)	Figure A6-36
	134S_G1_G2 (Taber Wind Farm 134S)	172L (Taber 83S - Hillridge Tap)	Figure A6-37
		172L (Coaldale 254S - Hillridge Tap)	
	225ST1 (Magrath 225S Transformer T1)	820L (Coaldale 254S - Chin Chute Tap)	Figure A6-38
	618ST1 (Riverbend 618S Transformer T1)	162L (Drywood 415S - Glenwood 229S)	Figure A6-39
		225L (Glenwood 229S - Spring Coulee 385S)	
225L (Spring Coulee 385S - Magrath 225S)			
67ST2 (Stirling 67S Transformer T2)			
225L (Stirling 67S - Raymond Reservoir Tap)			
820L (Coaldale 254S - Chin Chute Tap)			
225ST1 (Magrath 225S Transformer T1)			
225L (Magrath 225S - Raymond Reservoir Tap)			
820L (Chin Chute Tap - Red Coat Tap)			

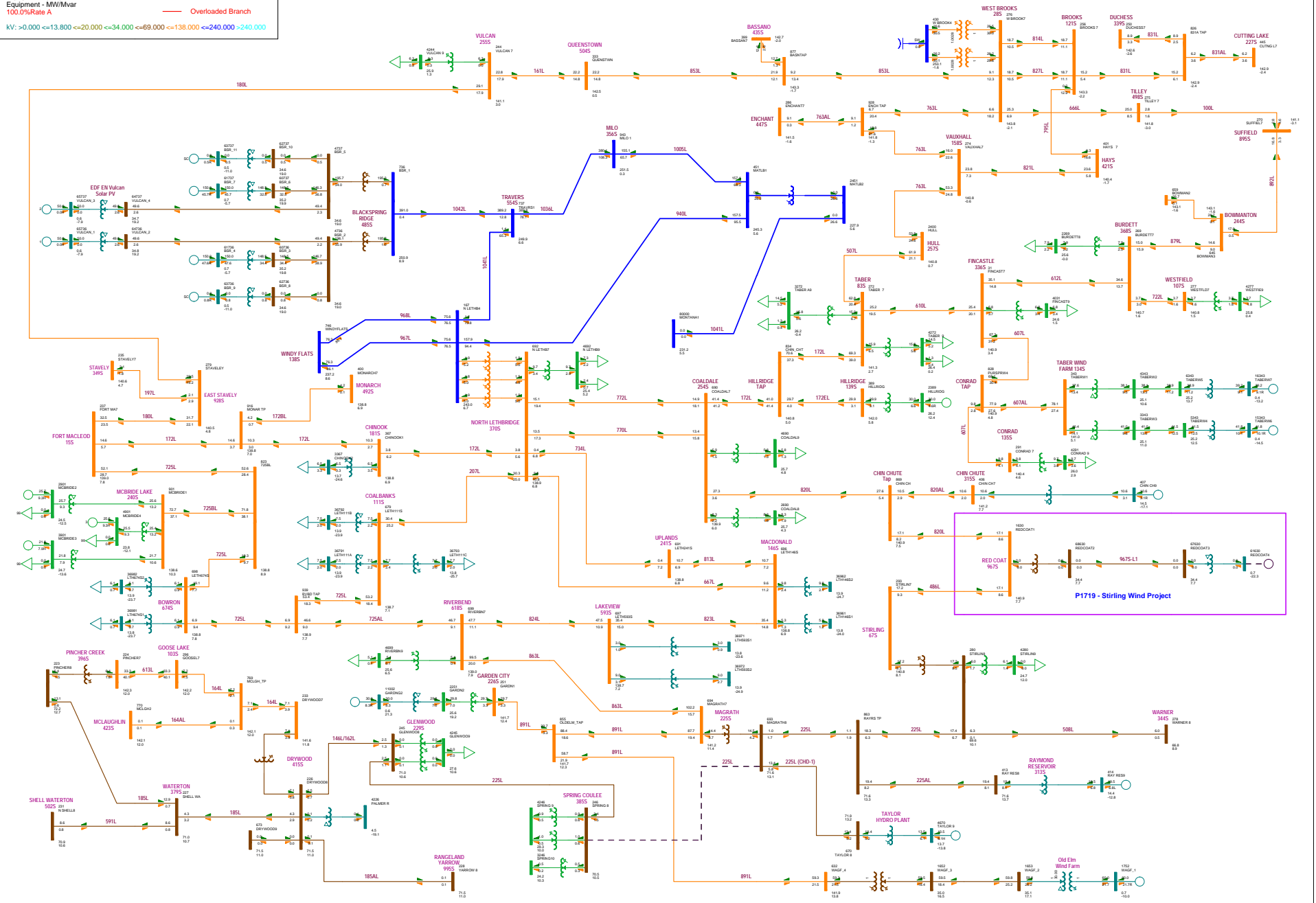
Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MWMvar
 Equipment - MWMvar
 100.0%Rate A

----- Contingency / Outage

----- Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

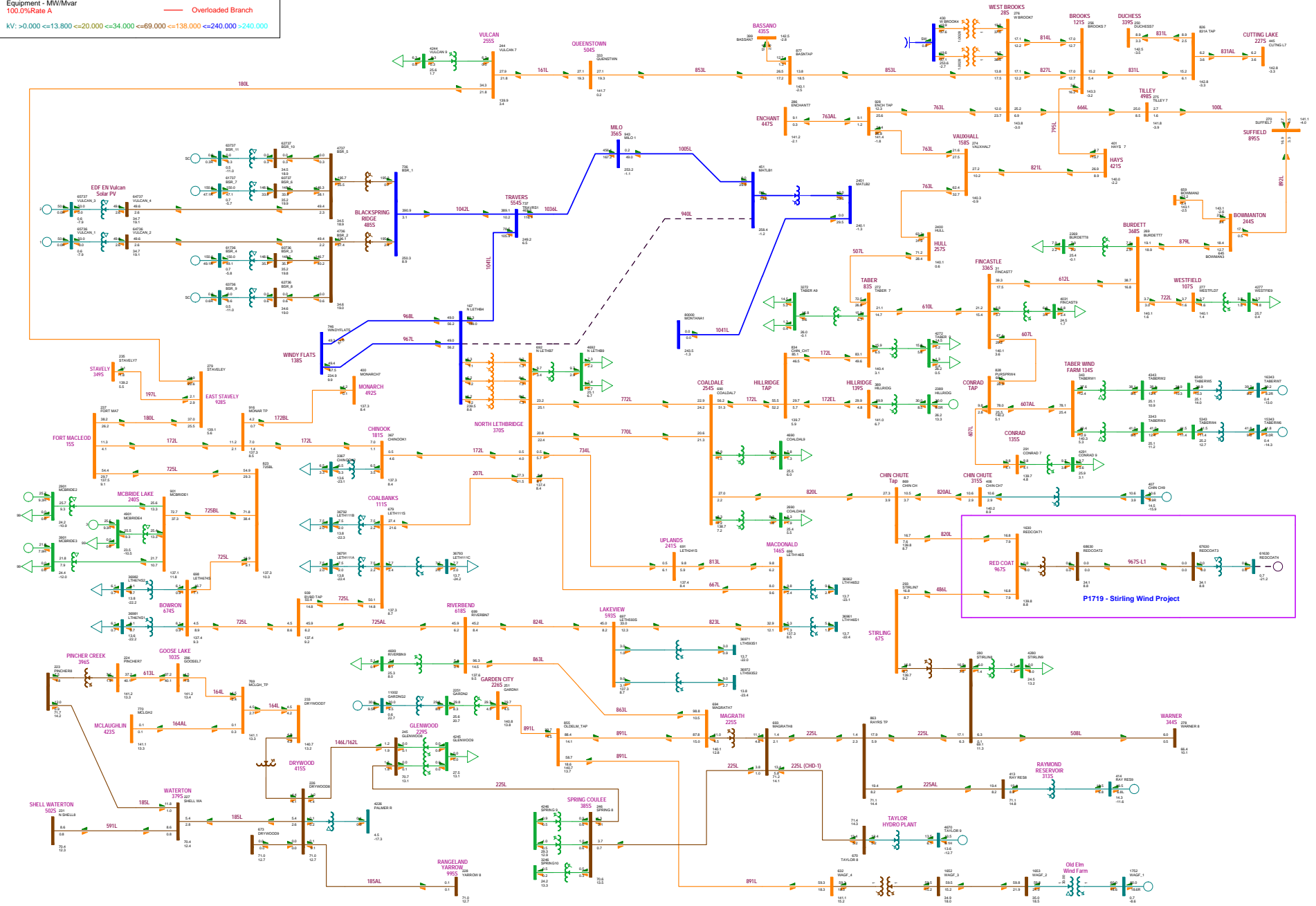


Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MWM/Mvar
 Equipment - MWM/Mvar
 100.0%Rate A

----- Contingency / Outage
 ——— Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000



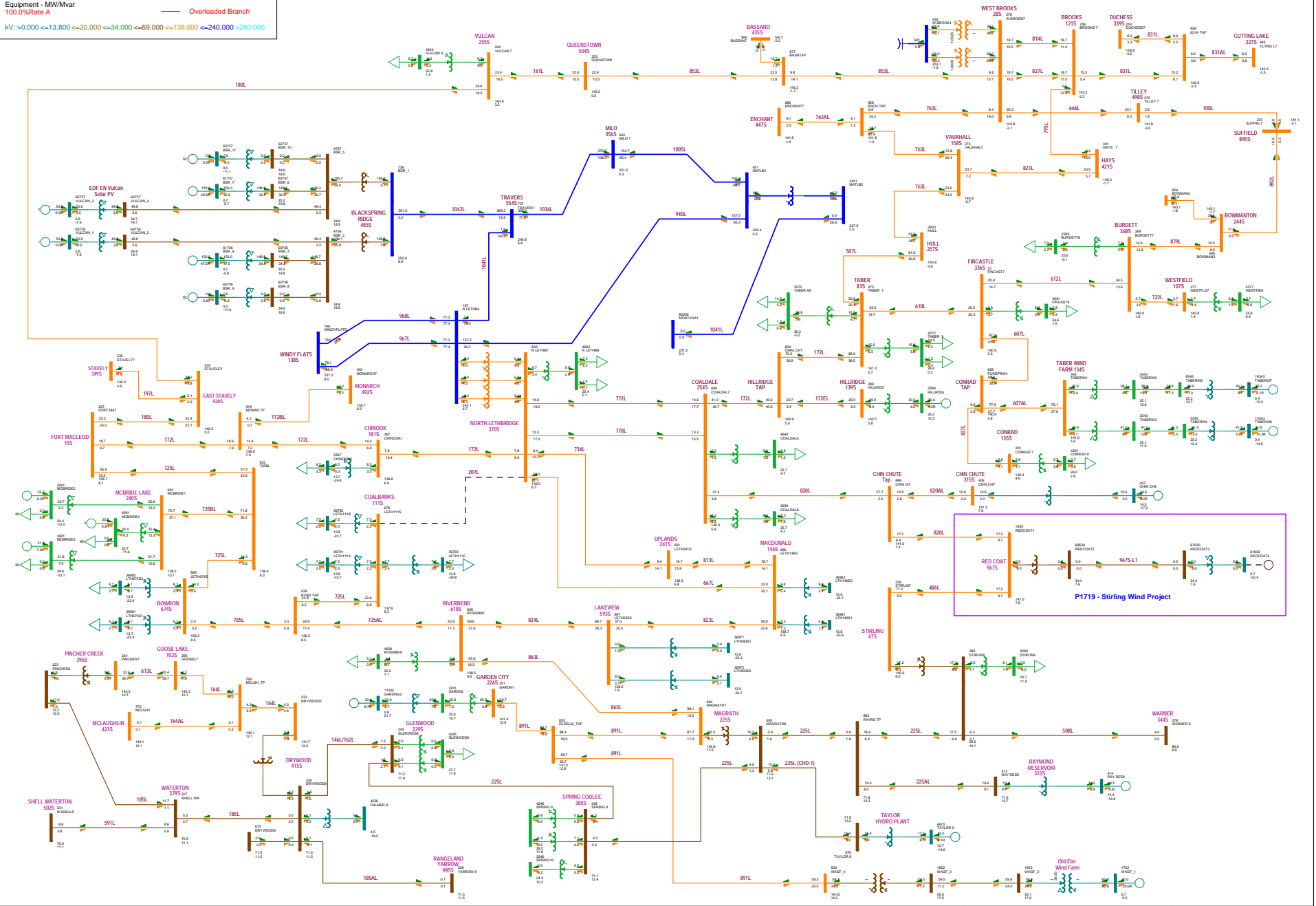
Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MVA/Mvar
Equipment - MVA/Mvar
100.0%Rate A

----- Contingency / Outage

----- Overloaded Branch

kV:>0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

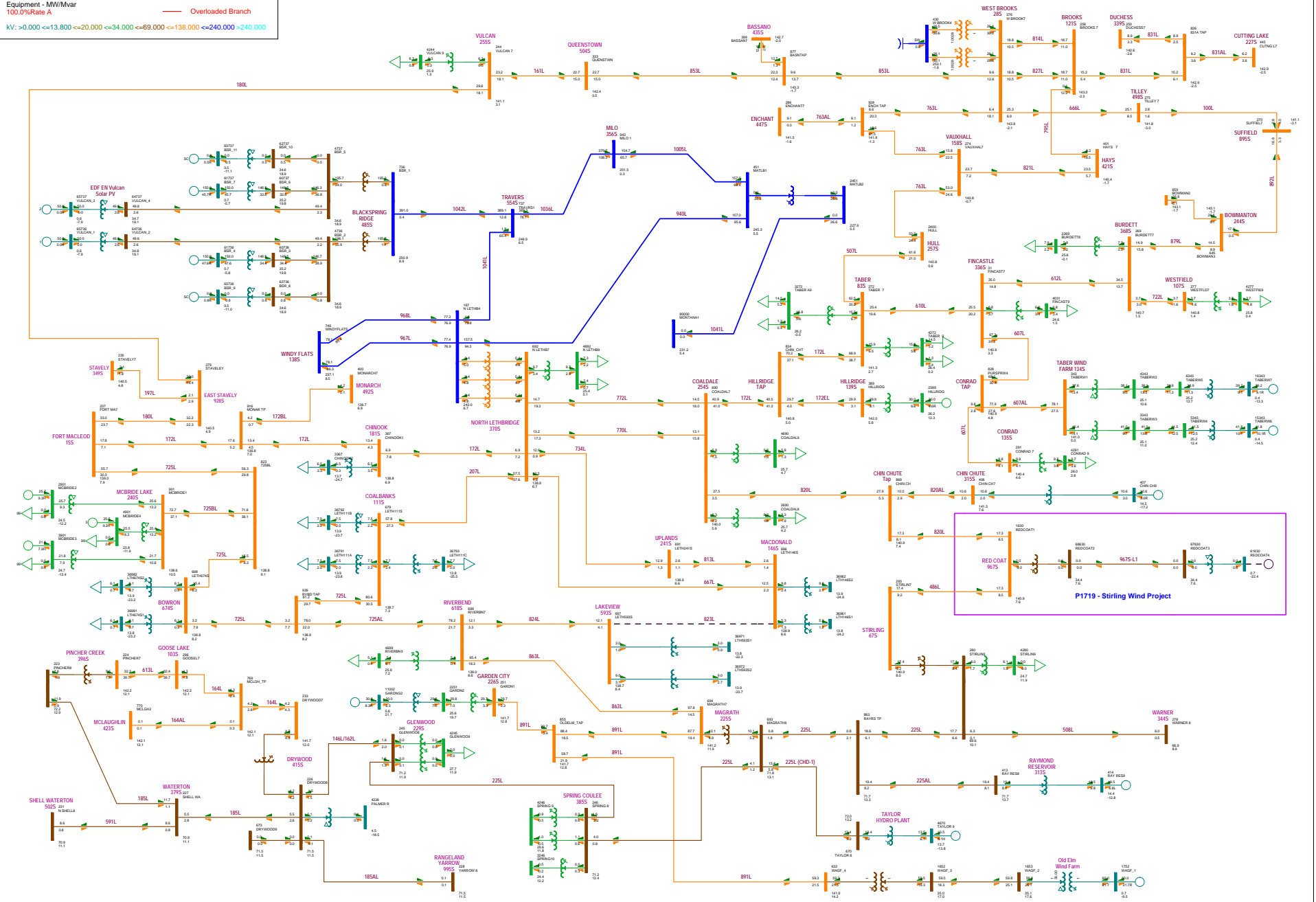


Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage- 3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000



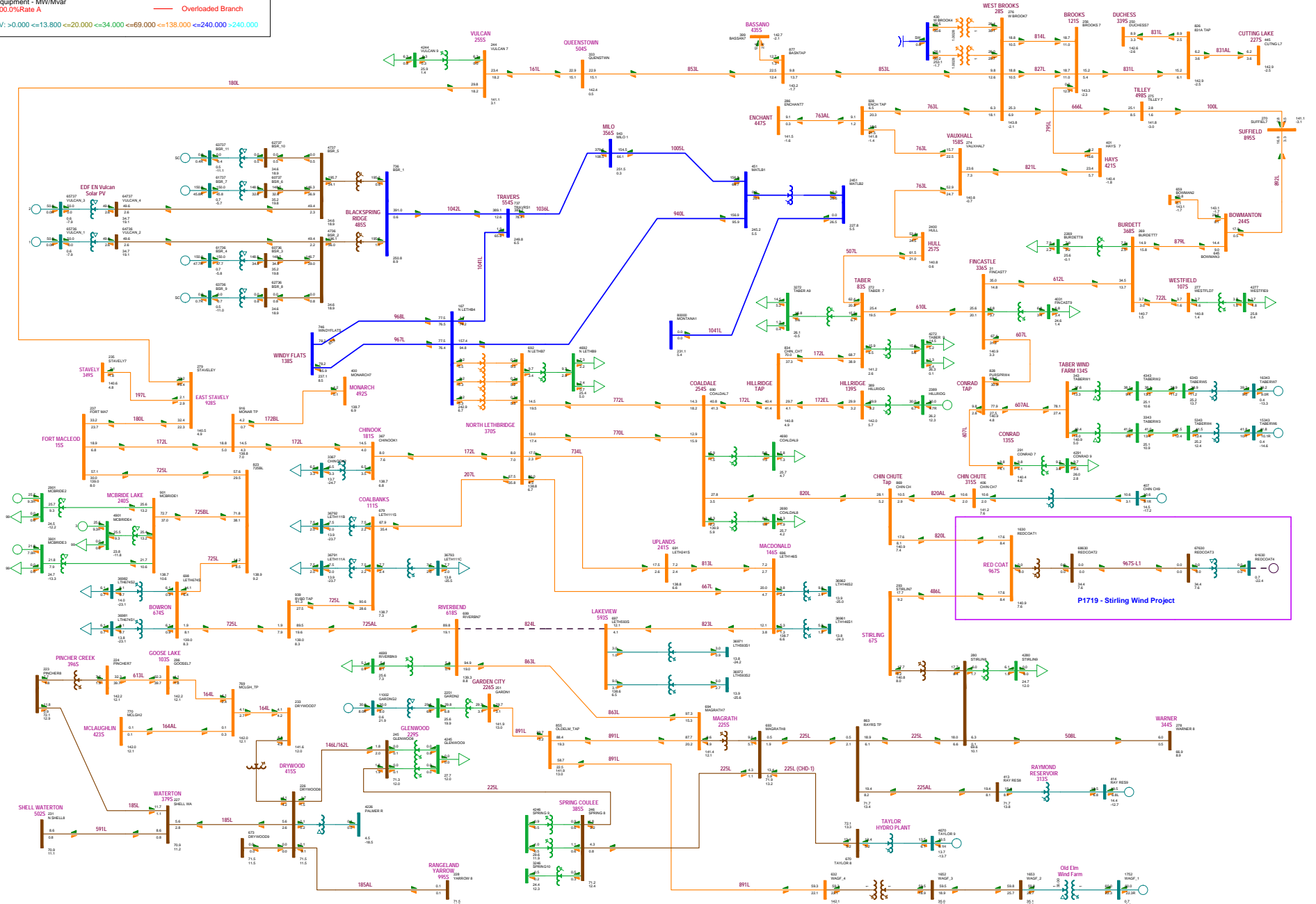
Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

----- Contingency / Outage

----- Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000



P1719 - Stirling Wind Project

967S-L1

967S-L1

967S-L1

967S-L1

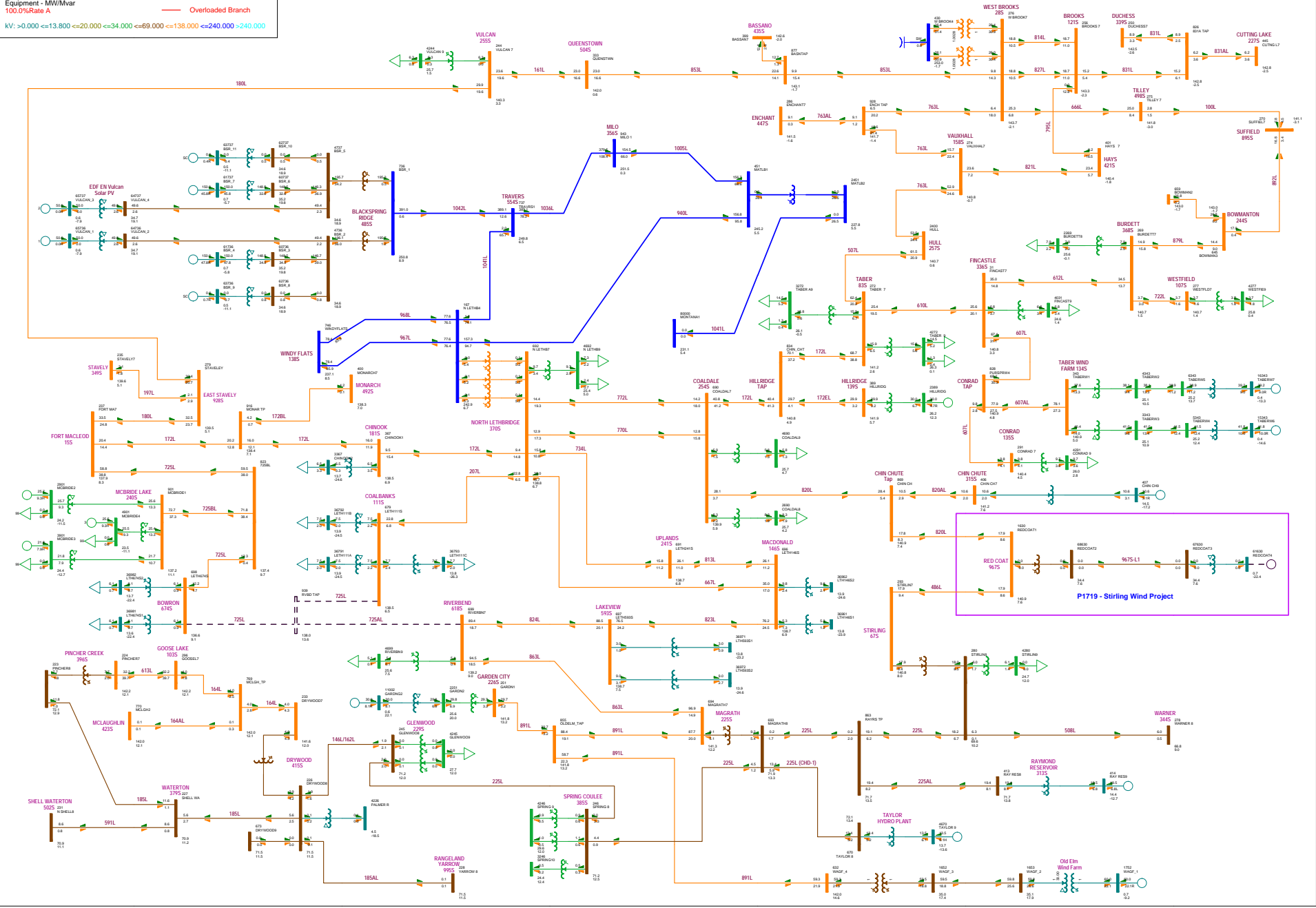
967S-L1

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MVA/Mvar
 Equipment - MVA/Mvar
 100.0%Rate A

----- Contingency / Outage
 Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

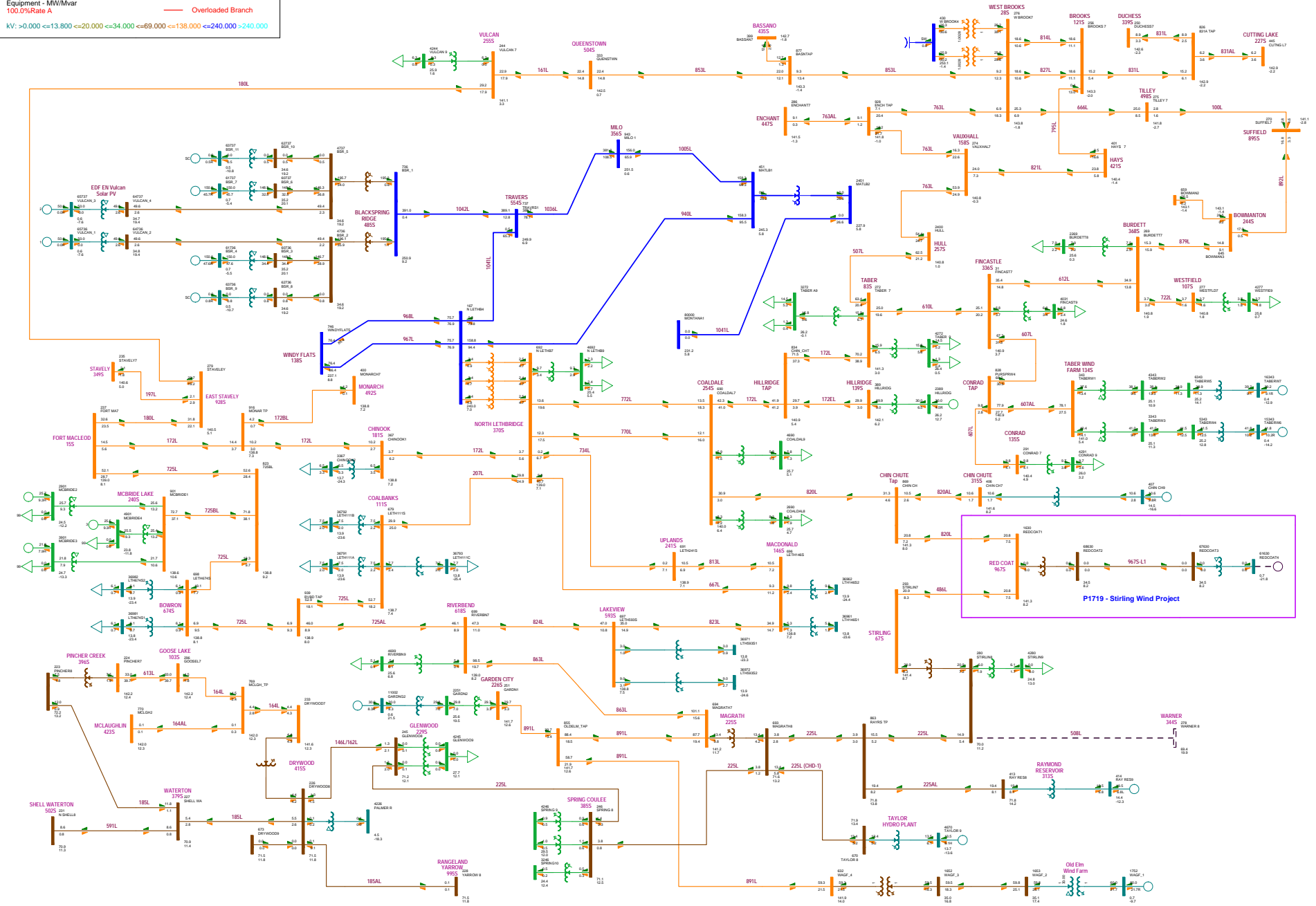


Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage

----- Overloaded Branch

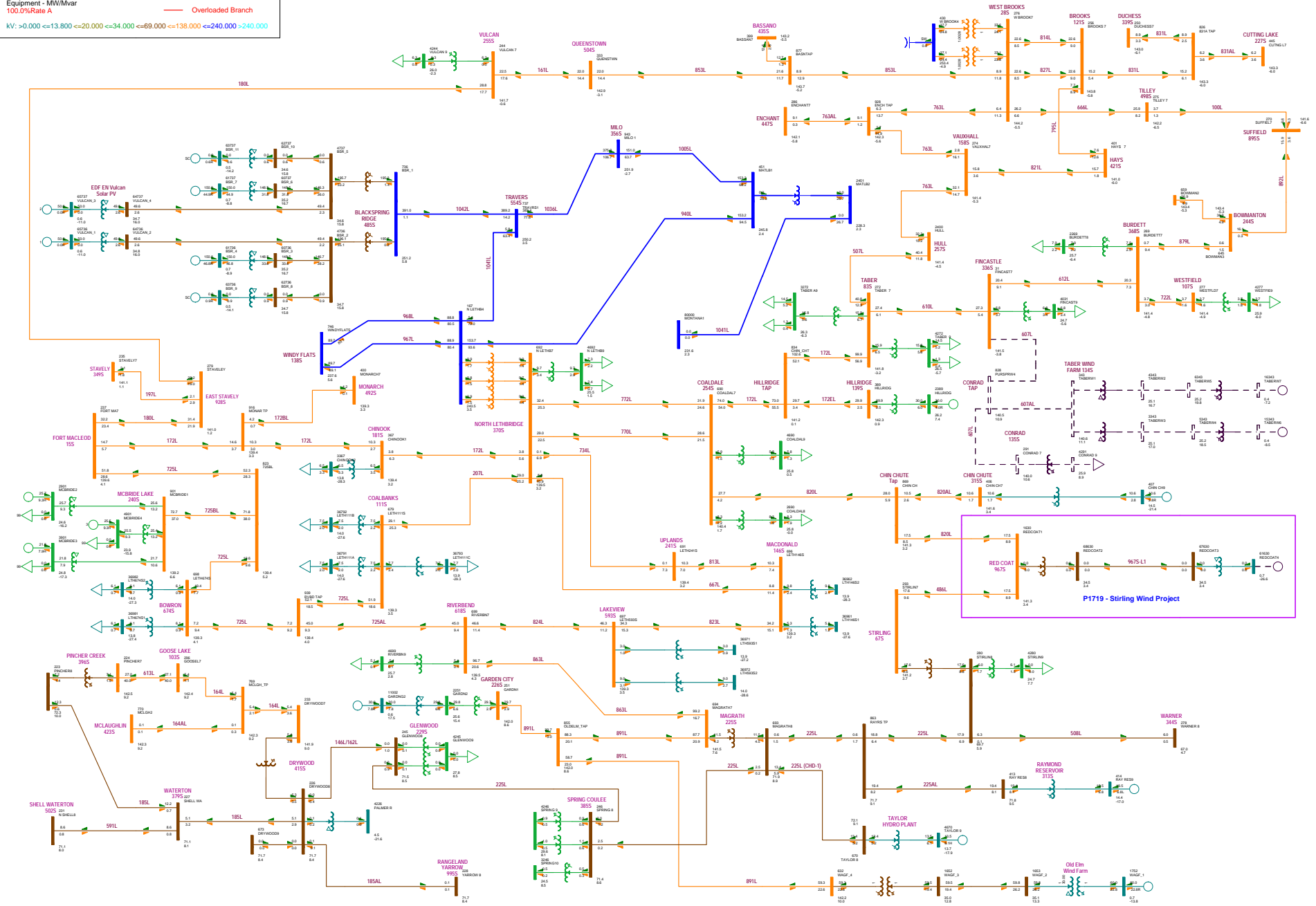


Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MWM/Mvar
 Equipment - MWM/Mvar
 100.0%Rate A

----- Contingency / Outage
 ——— Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

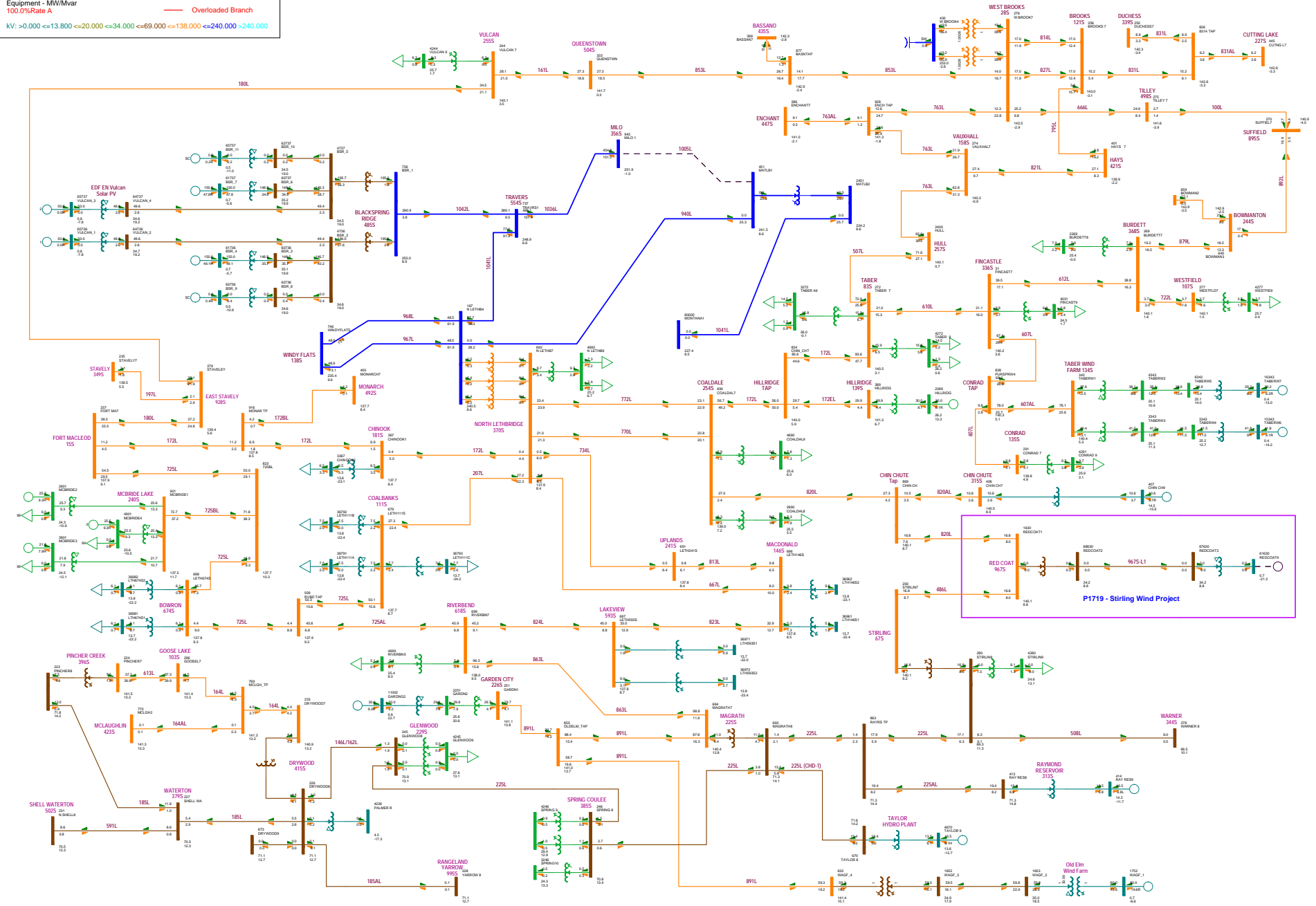


Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MVA/Mvar
Equipment - MVA/Mvar
100.0%Rate A
kV >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

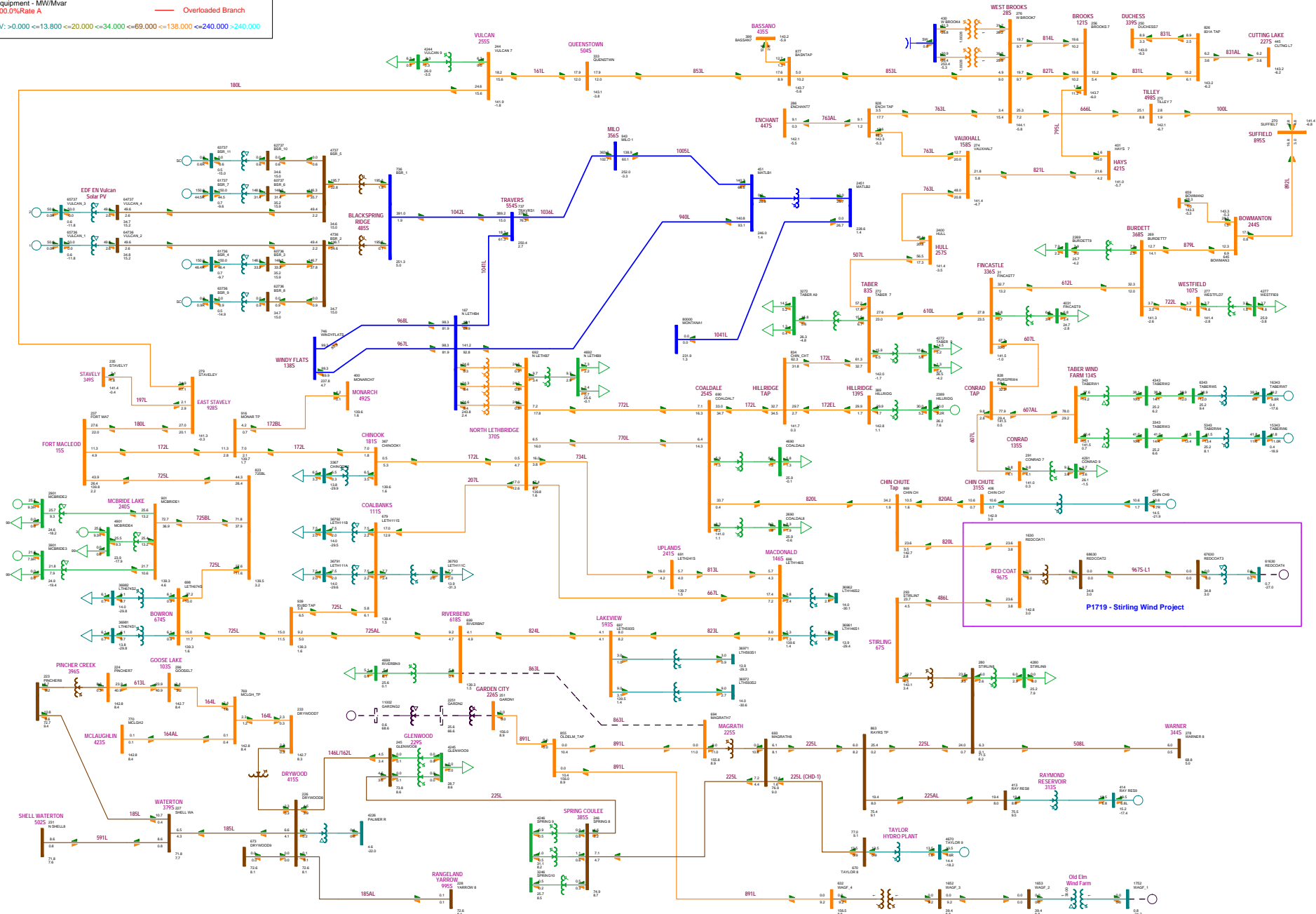
----- Contingency / Outage

----- Overloaded Branch



Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 967S

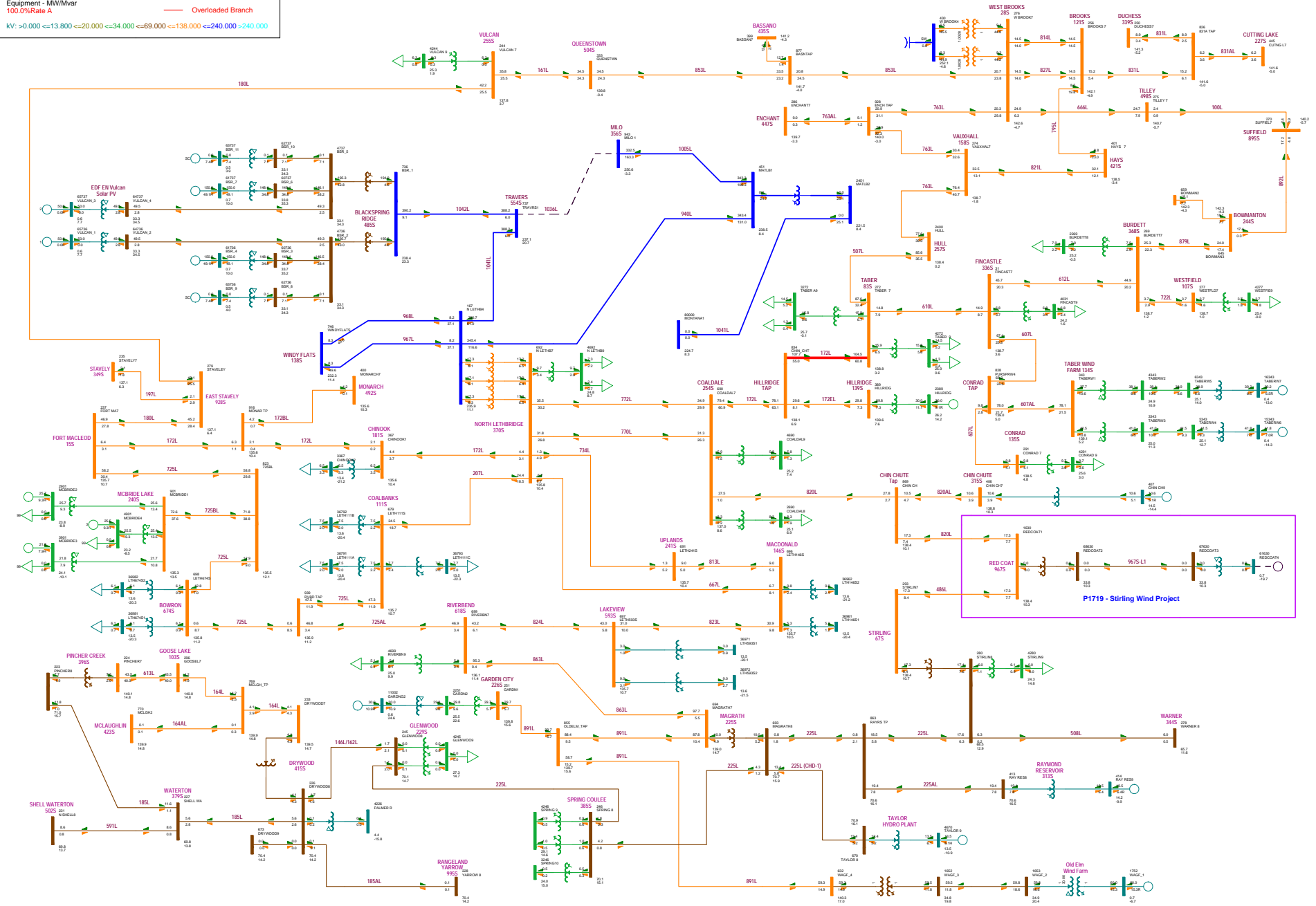
Bus - Base voltage (kV) - - - - - Contingency / Outage
 Branch - M/Mvar ——— Overloaded Branch
 Equipment - M/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000



Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage
----- Overloaded Branch

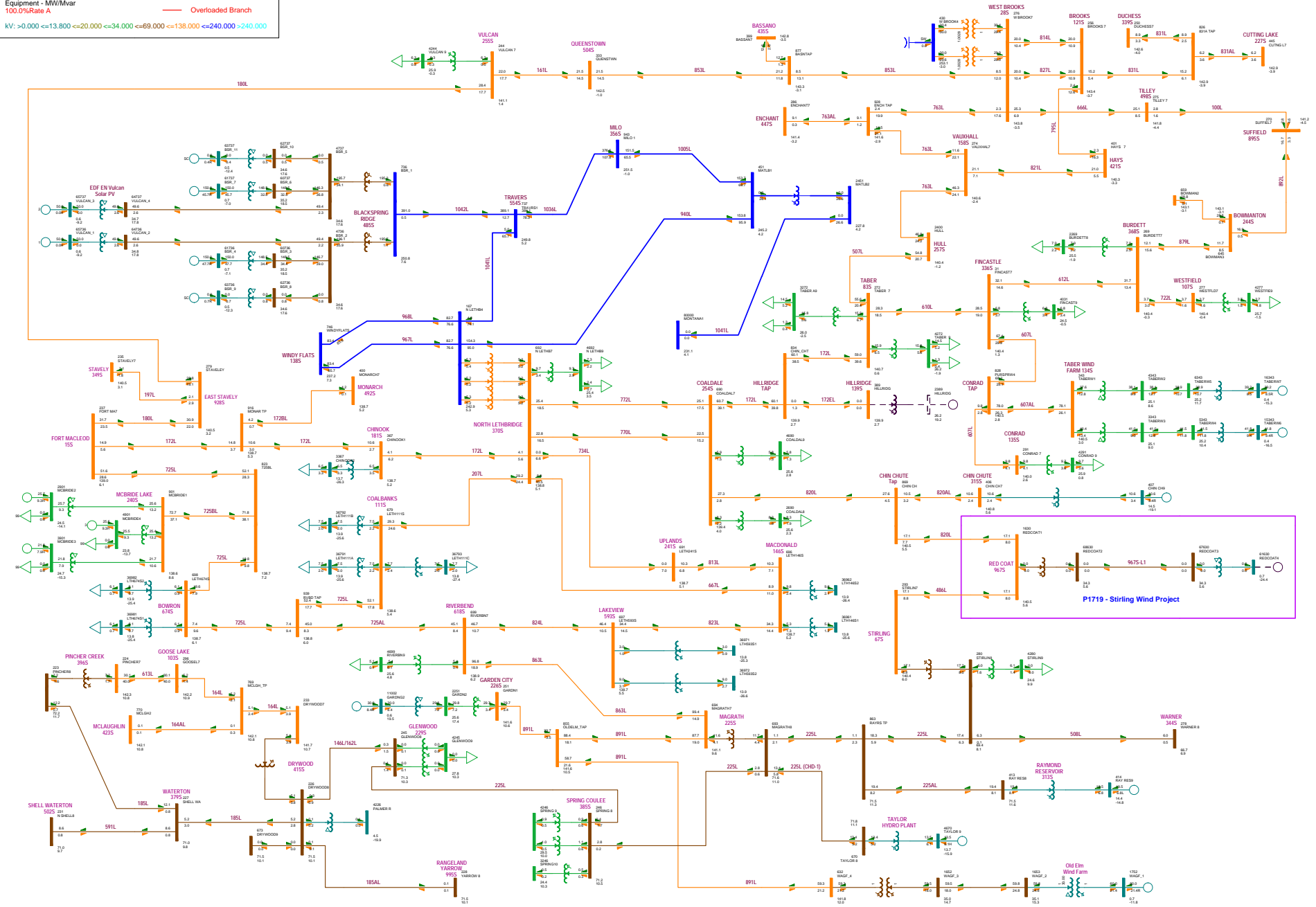


Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MWM/Mvar
 Equipment - MWM/Mvar
 100.0%Rate A

----- Contingency / Outage
 Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000



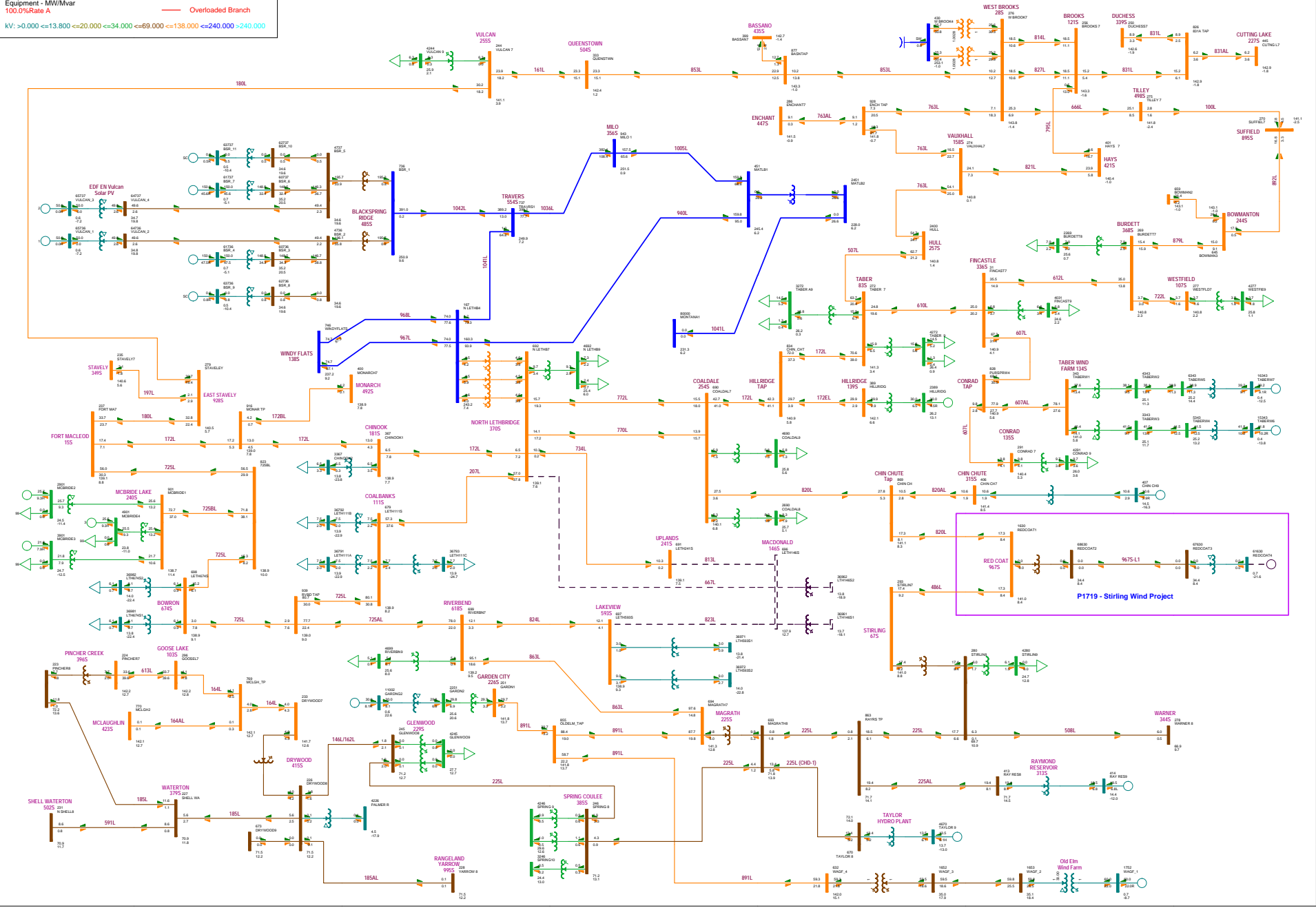
P1719 - Stirling Wind Project

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

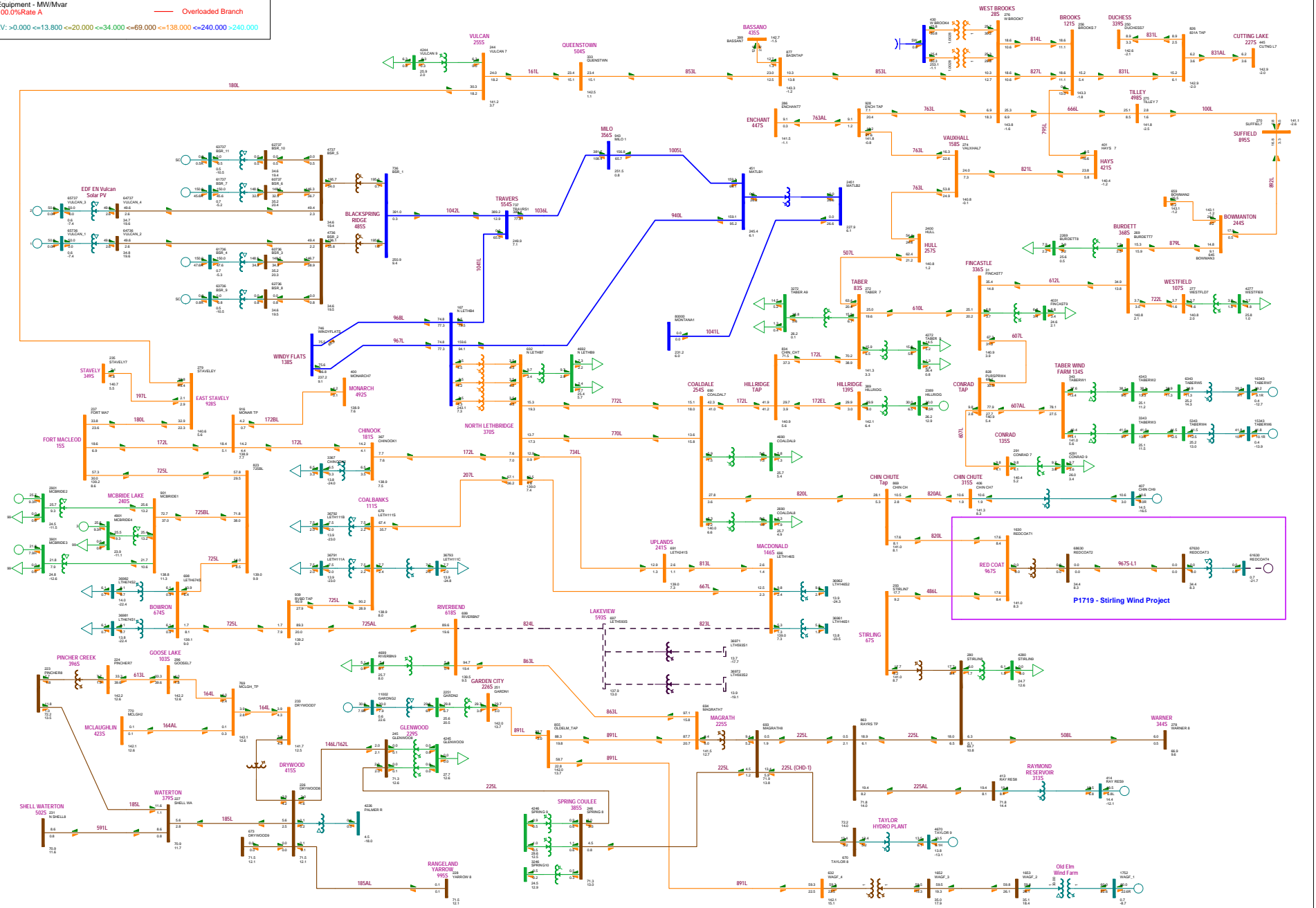


Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 ----- Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

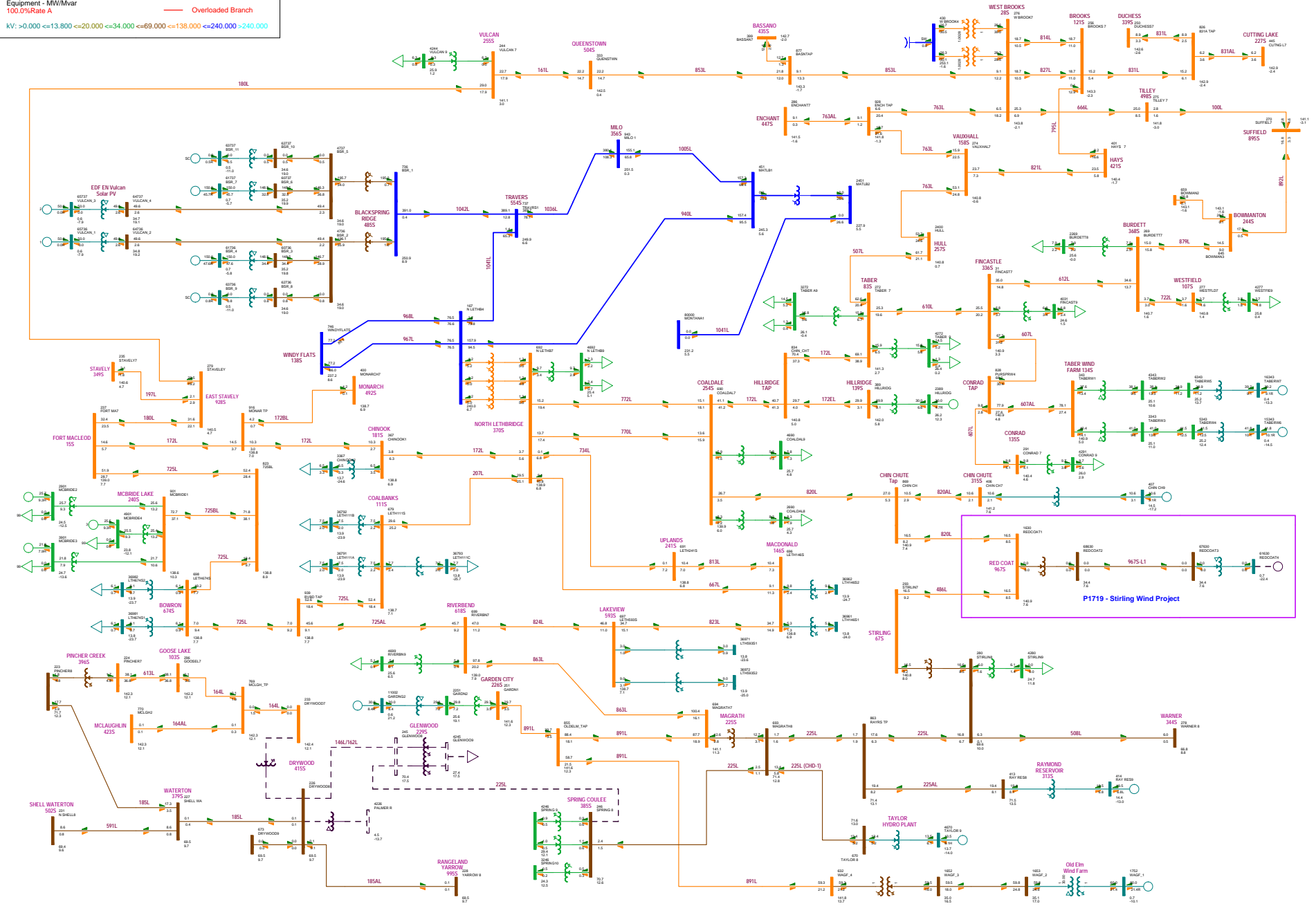


Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 — Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000



RED COAT 967S

967S-L1

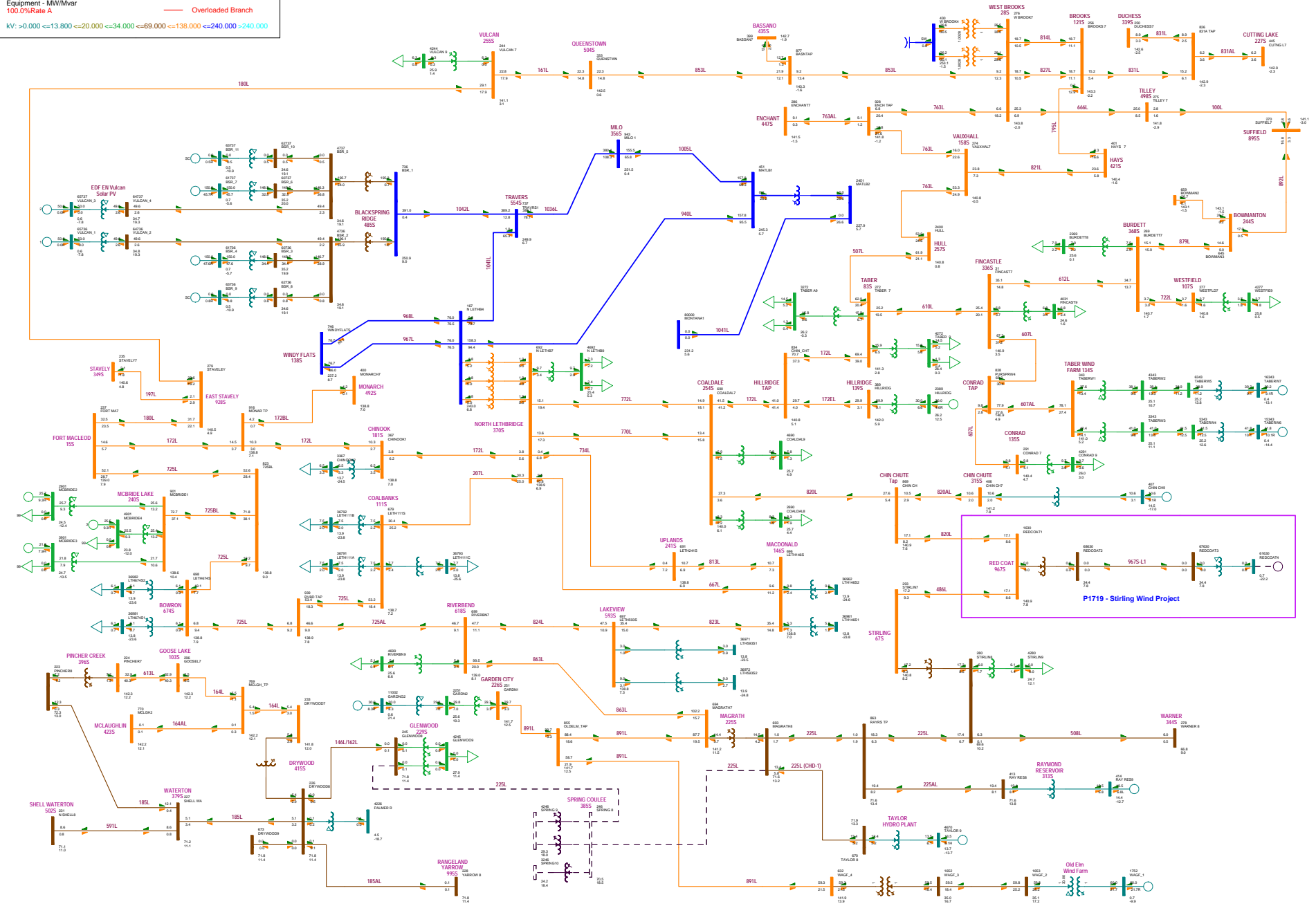
P1719 - Stirling Wind Project

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

----- Contingency / Outage
----- Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

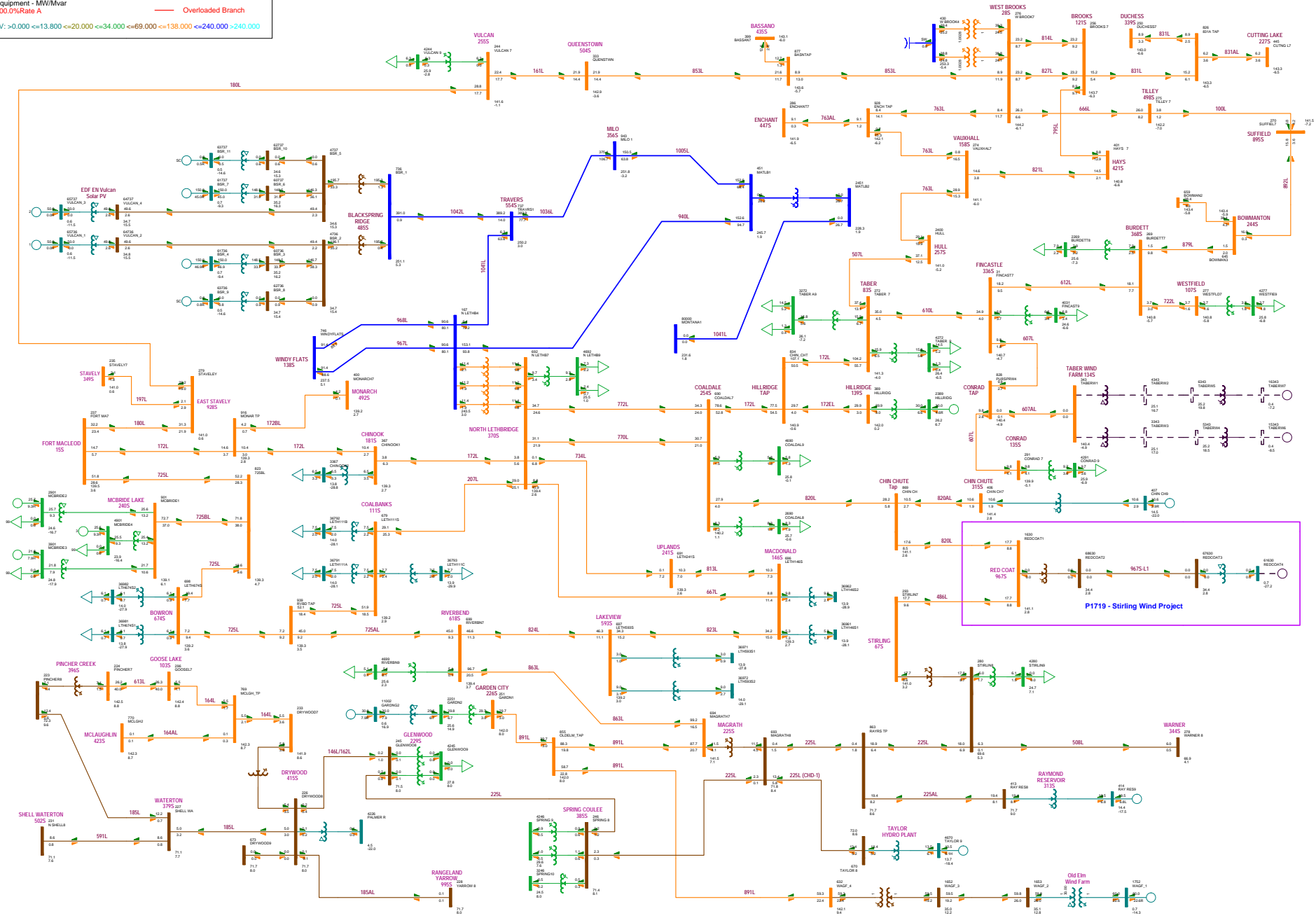


Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 9675

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A

----- Contingency / Outage
--- Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

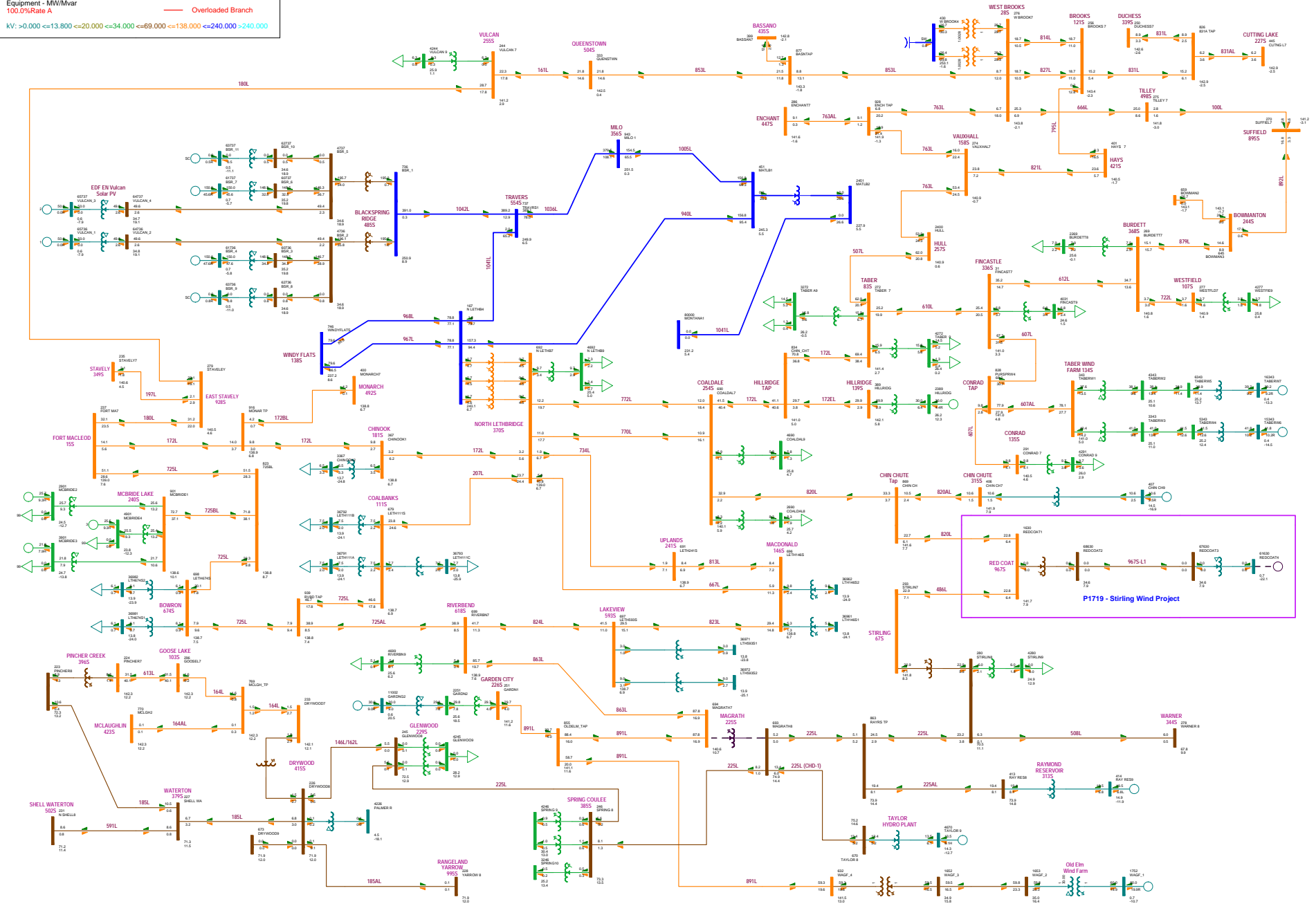


Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage-3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 — Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

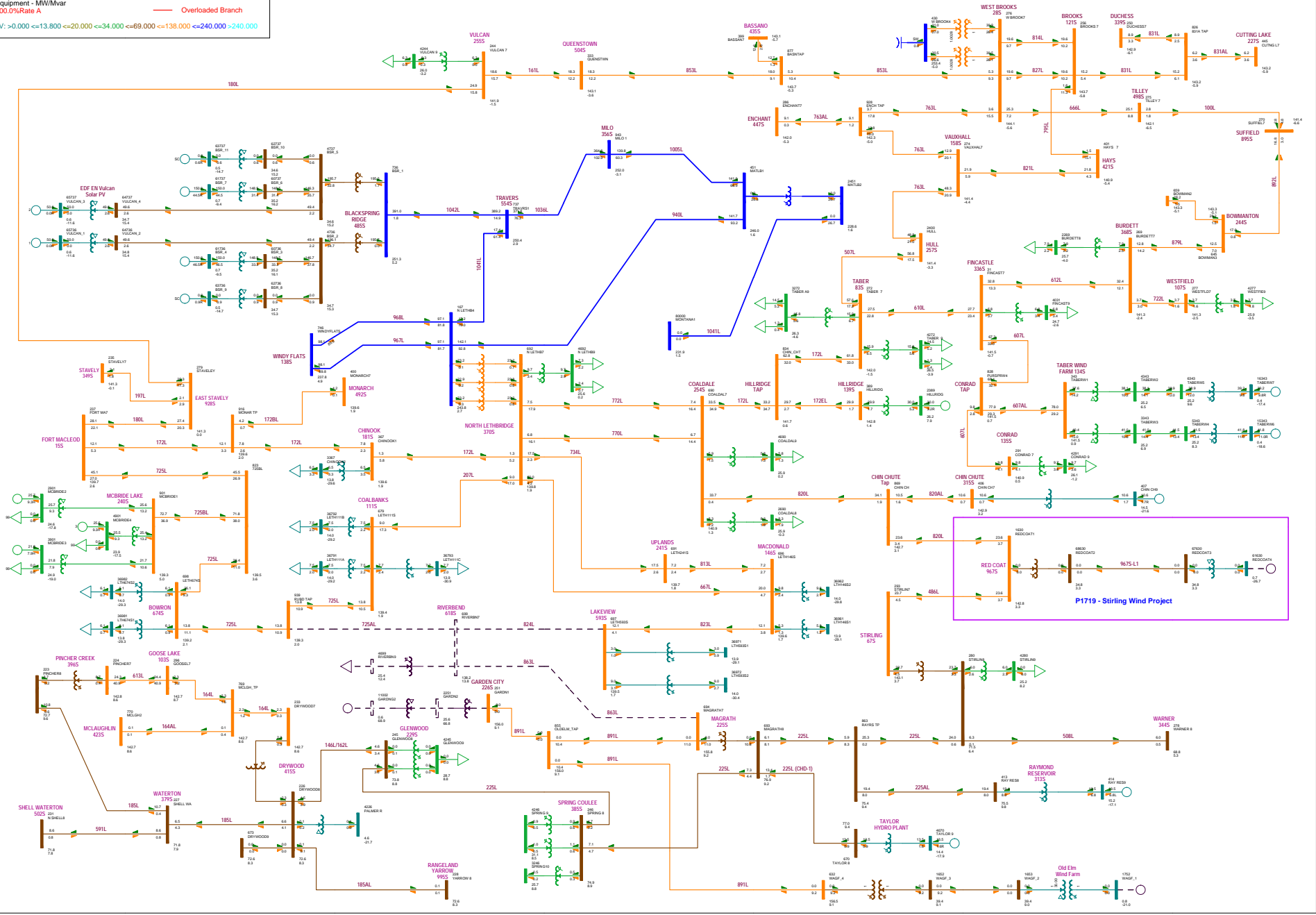


Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage-3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MWM/Mvar
Equipment - MWM/Mvar
100.0%Rate A

----- Contingency / Outage
----- Overloaded Branch

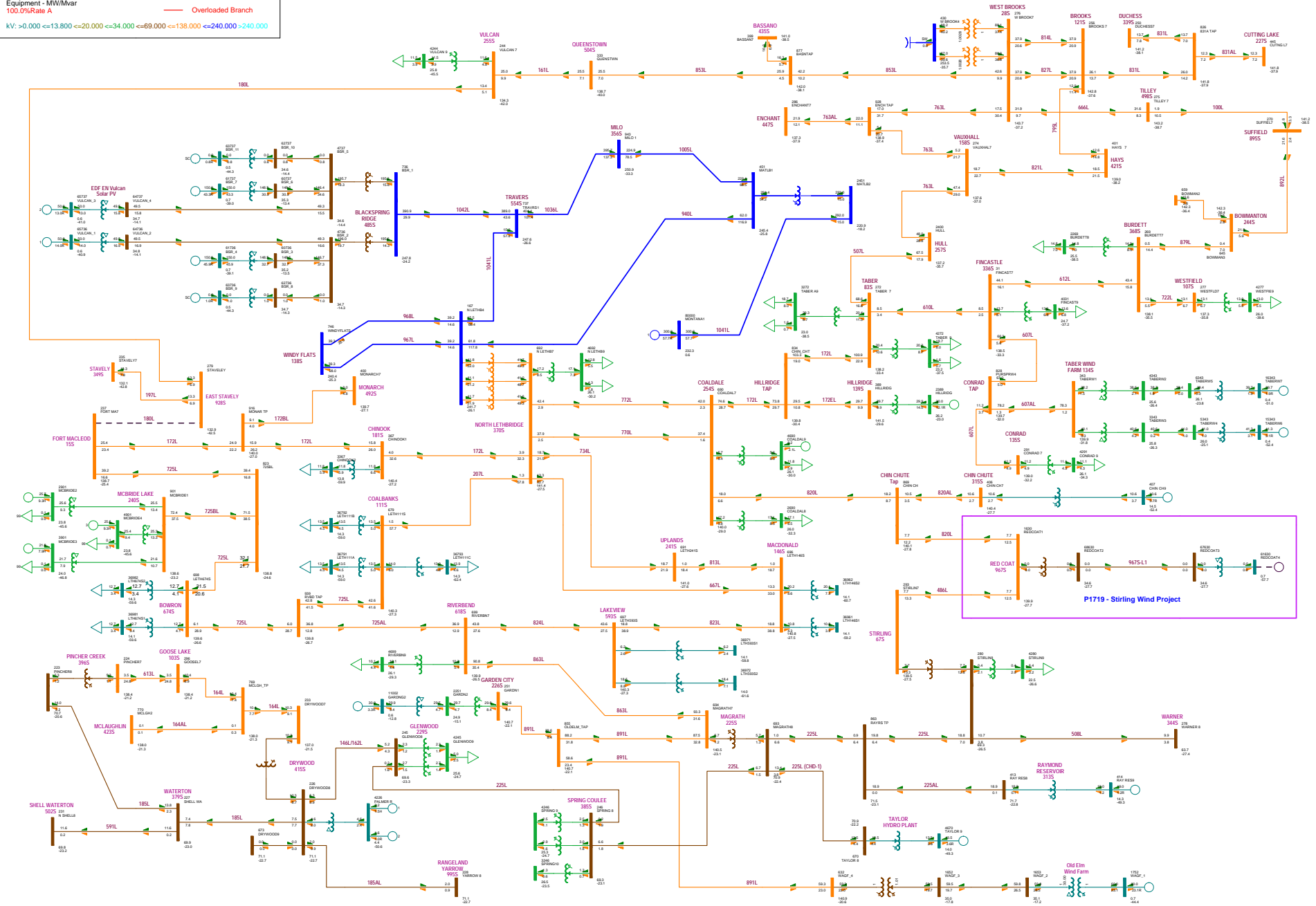
kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000



Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 967S

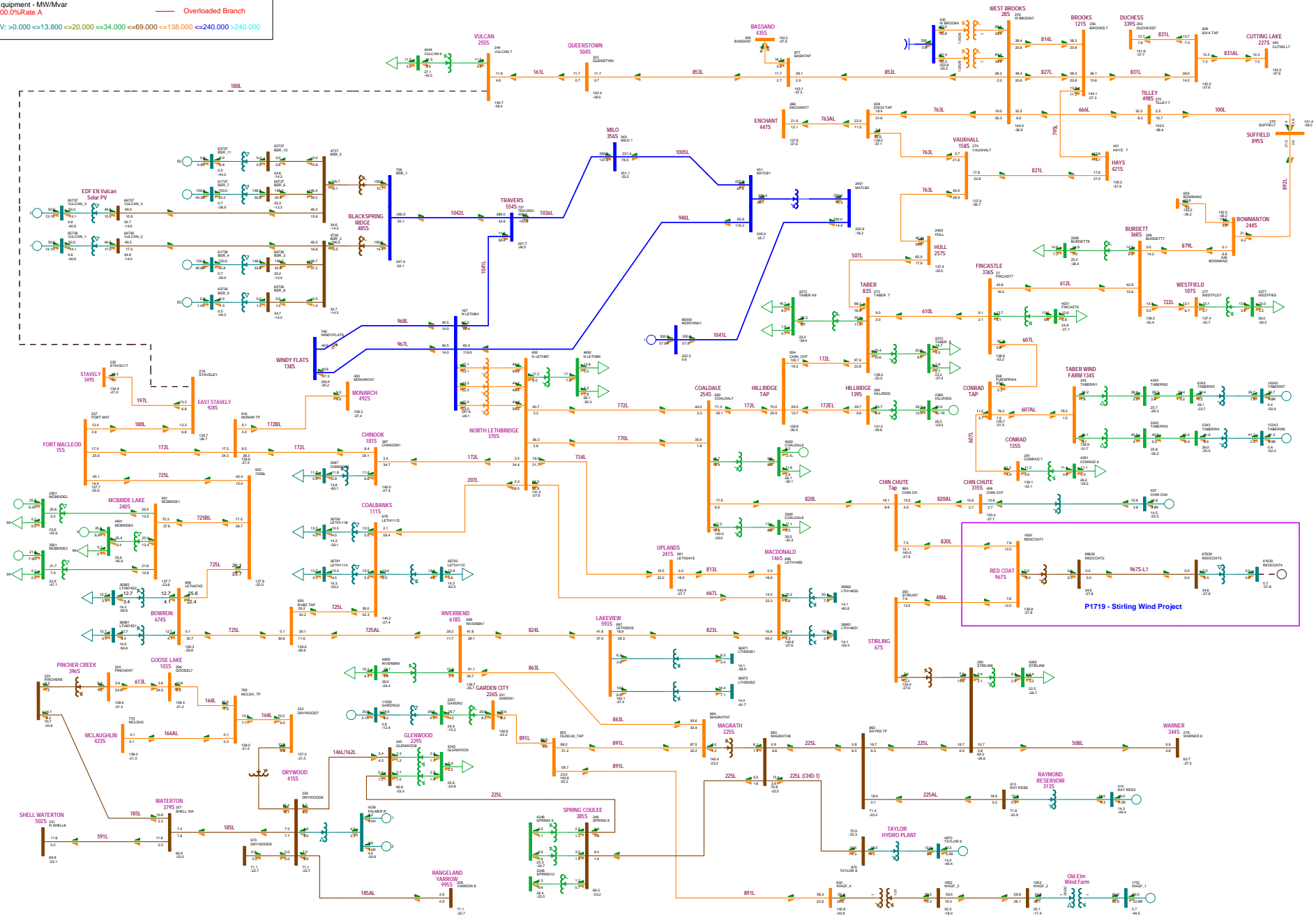
Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage
----- Overloaded Branch



Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage- 3
 Facility: RED COAT 967S

Bus - Base voltage (kV) Contingency / Outage
 Branch - MW/Mvar --- Overloaded Branch
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

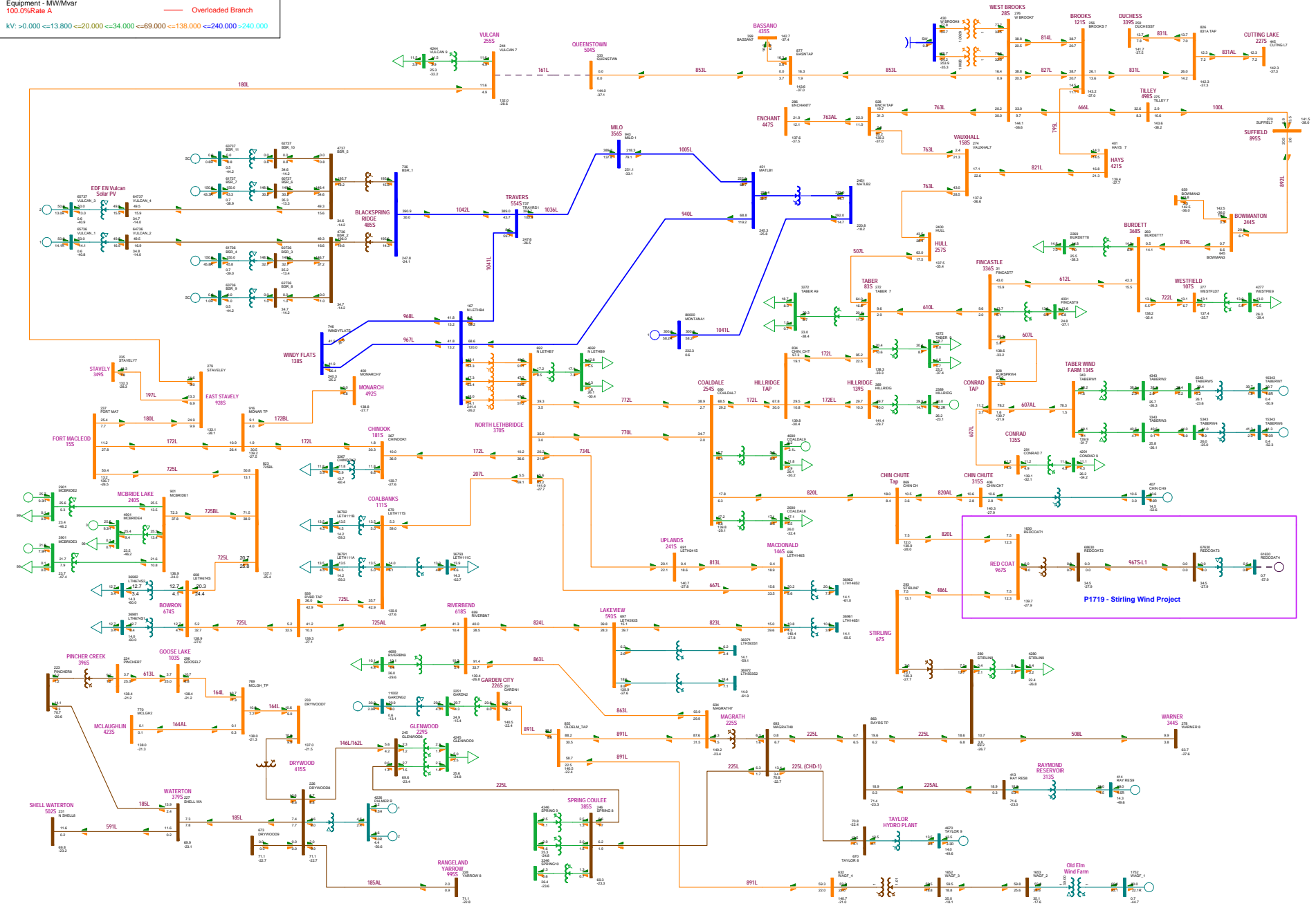


P1719 - Stirling Wind Project

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage- 3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage
 ----- Overloaded Branch



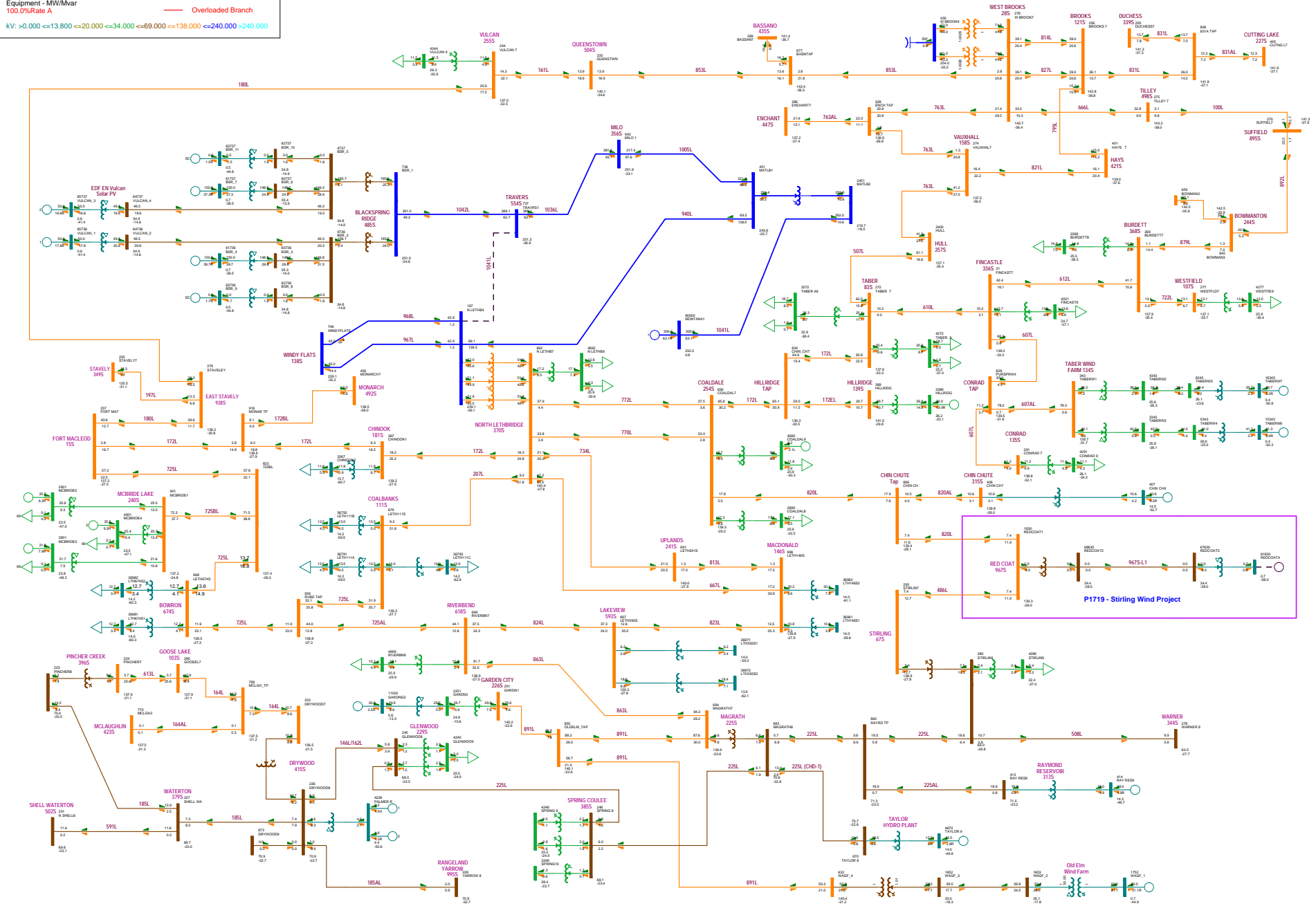
P1719 - Stirling Wind Project

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage- 3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage

----- Overloaded Branch

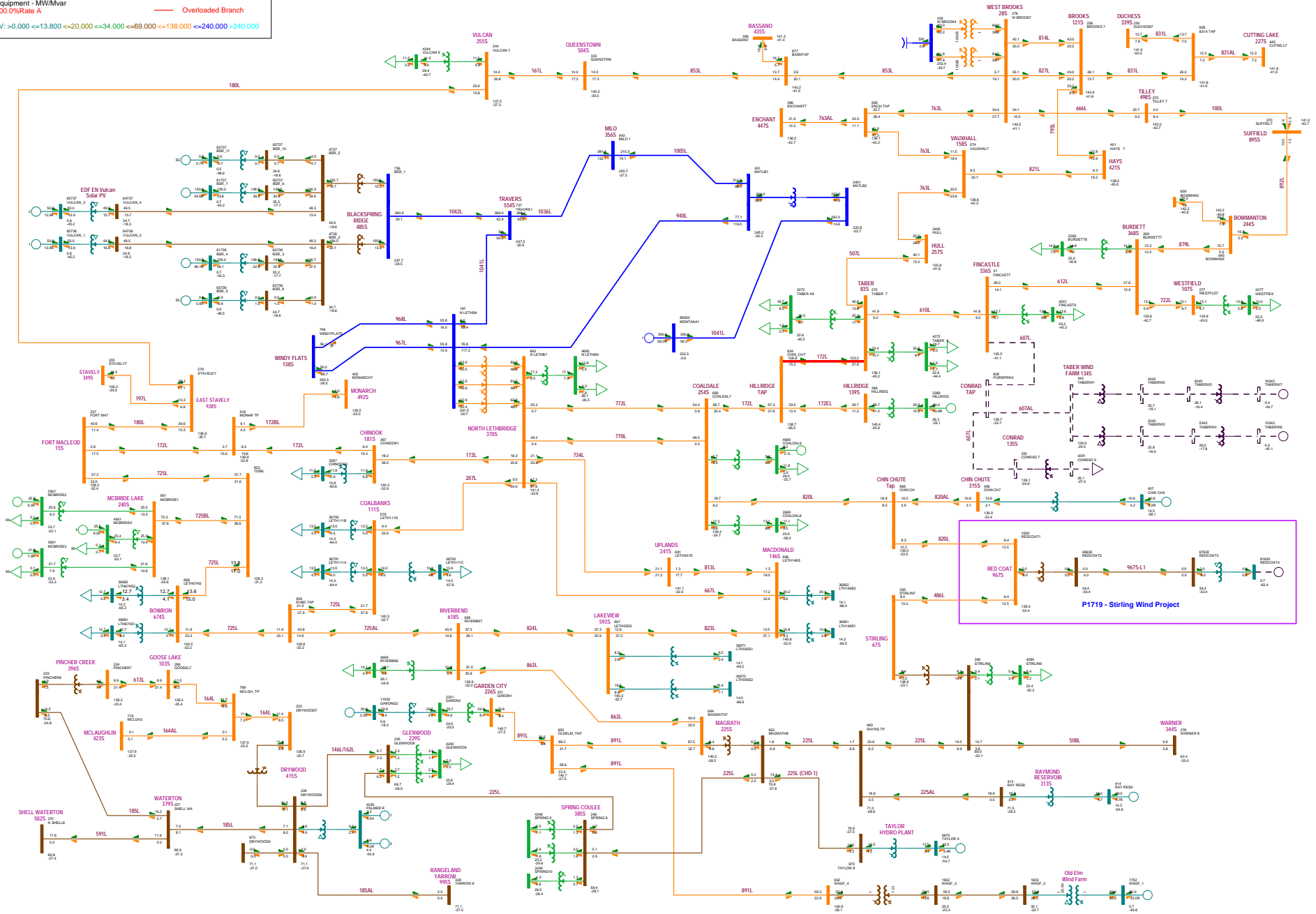


P1719 - Stirling Wind Project

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 967S

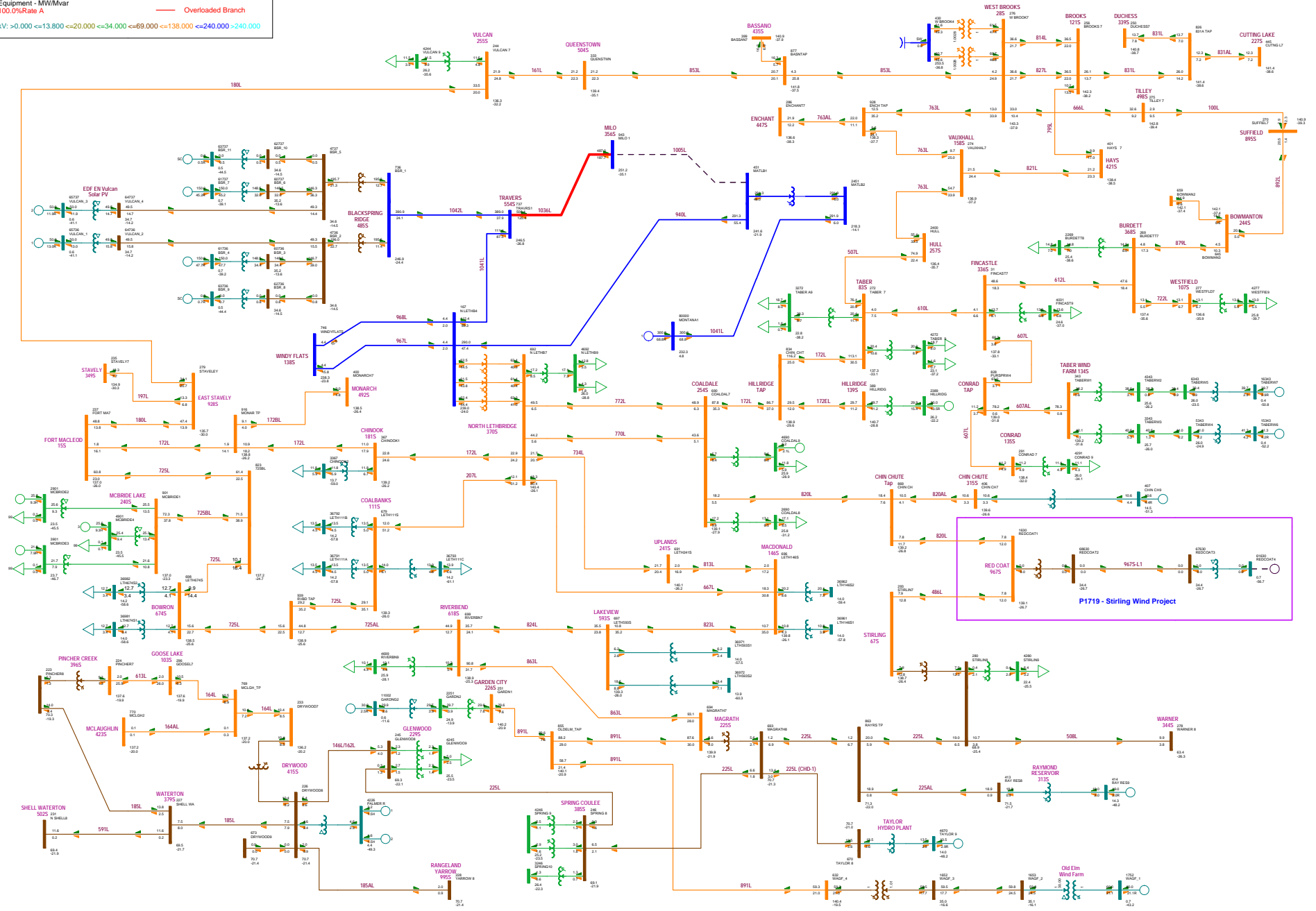
Bus - Base voltage (kV)
Branch - MWMvar
Equipment - MWMvar
100.0%Rate A
KV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage
----- Overloaded Branch



Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 967S

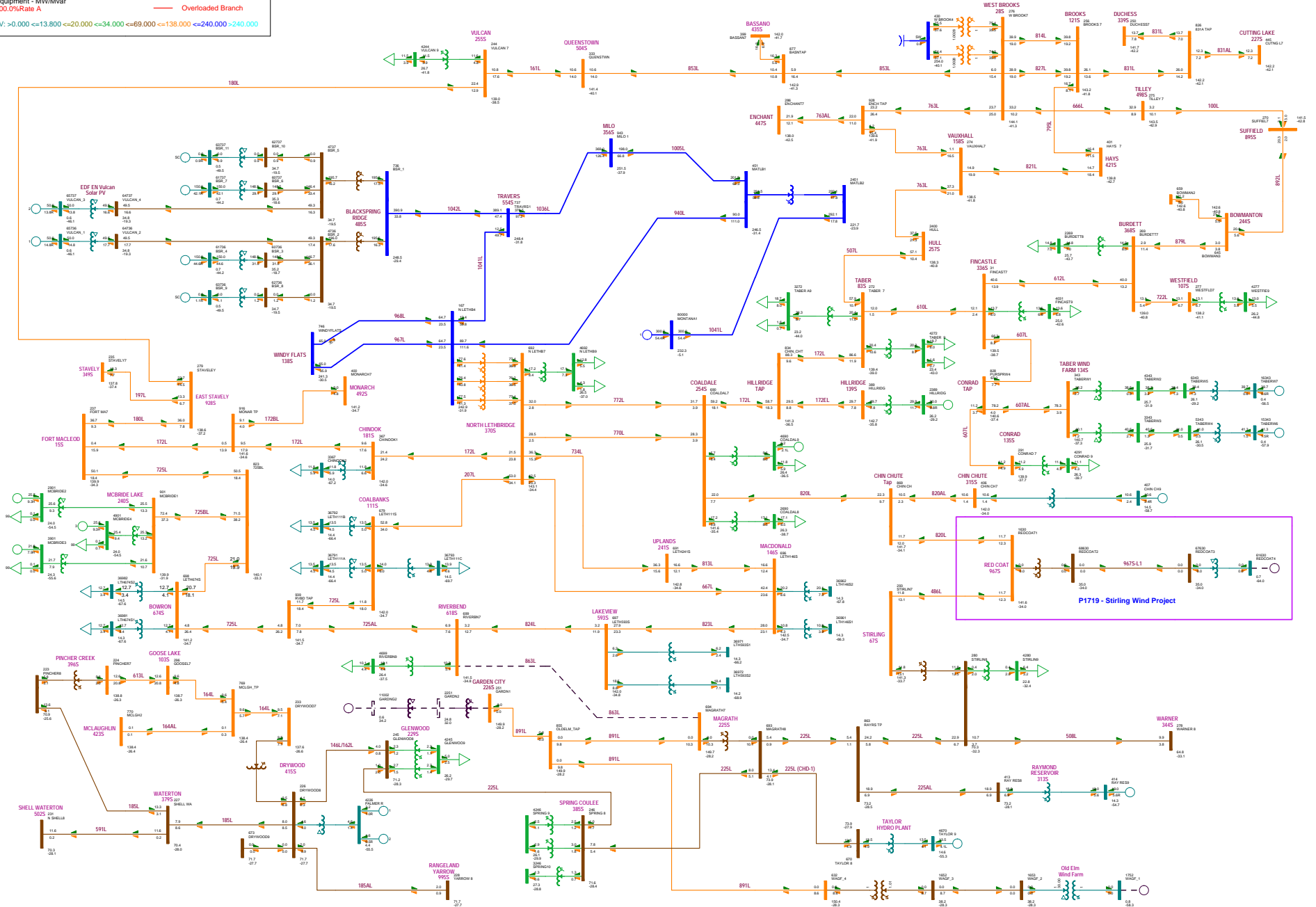
Bus - Base voltage (kV) ----- Contingency / Outage
 Branch - MW/Mvar ----- Overloaded Branch
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000



Stirling Wind Project Ltd
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Bus - Base voltage (kV)
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100.0%Rate A
KV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage
----- Overloaded Branch

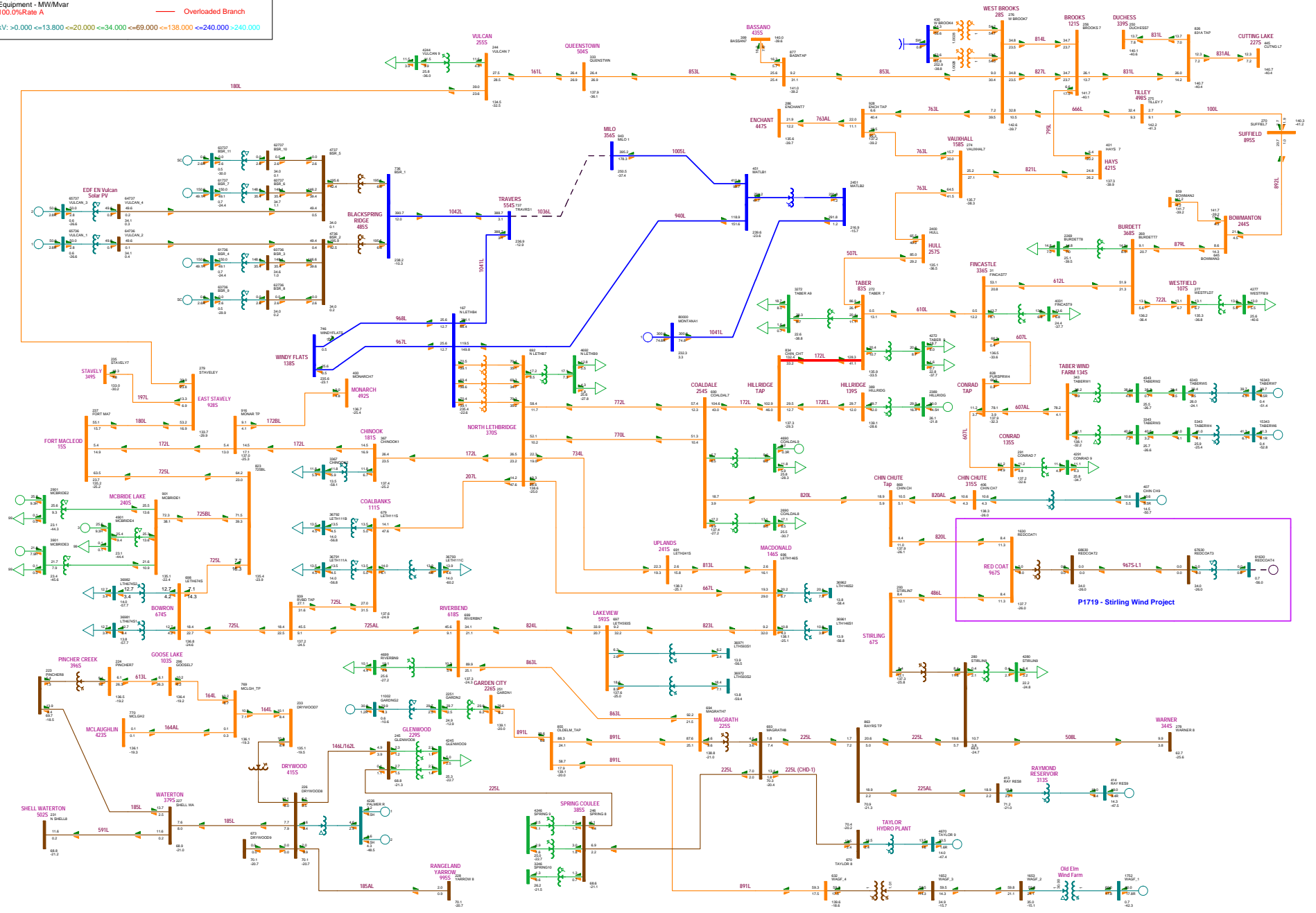


P1719 - Stirling Wind Project

Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

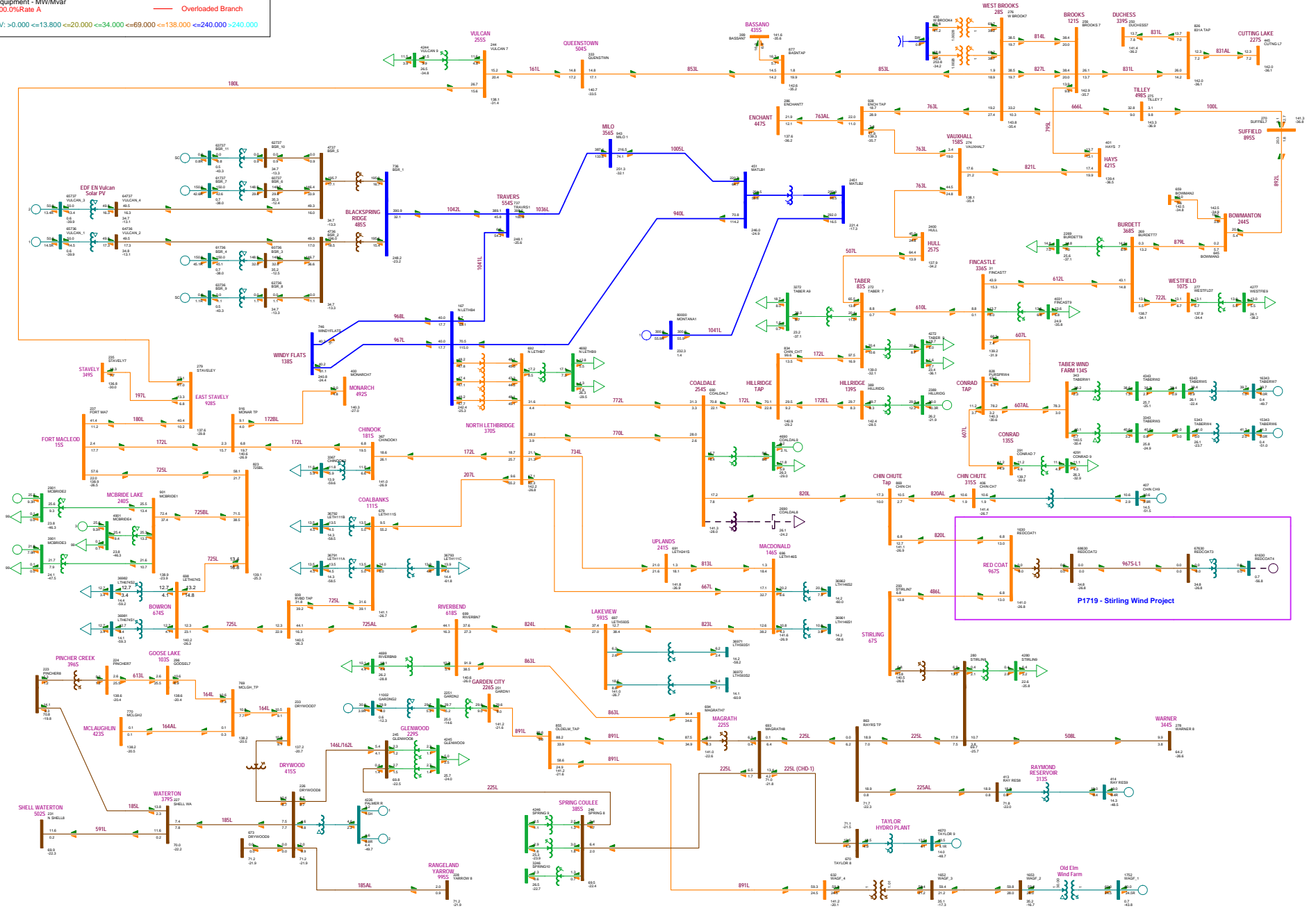
----- Contingency / Outage
 ----- Overloaded Branch



Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 967S

Bus - Base voltage (kV)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

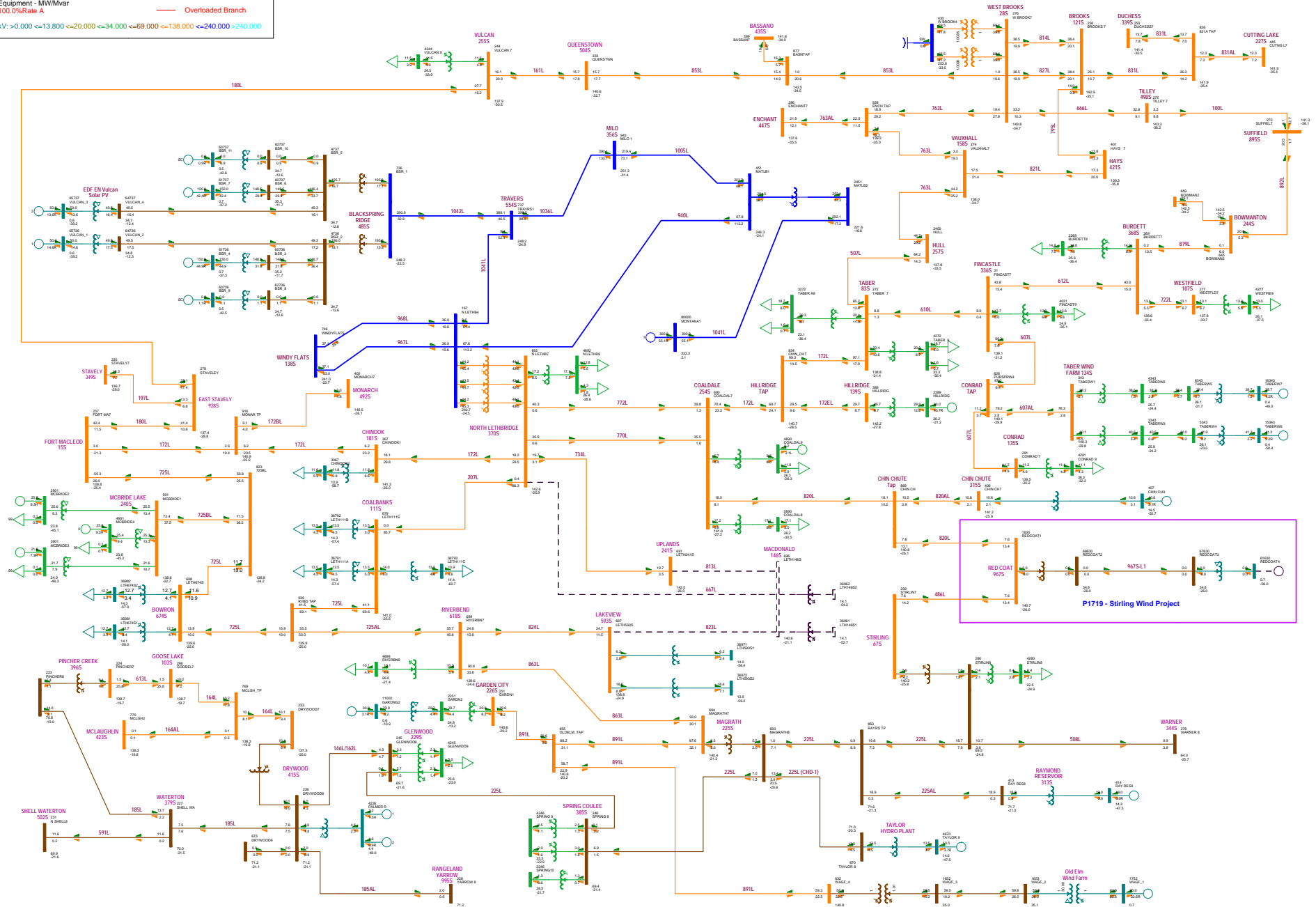
----- Contingency / Outage
----- Overloaded Branch



Stirling Wind Project Ltd
 Stirling Wind Project Conner
 AESO Project Number: P1719 Stage- 3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

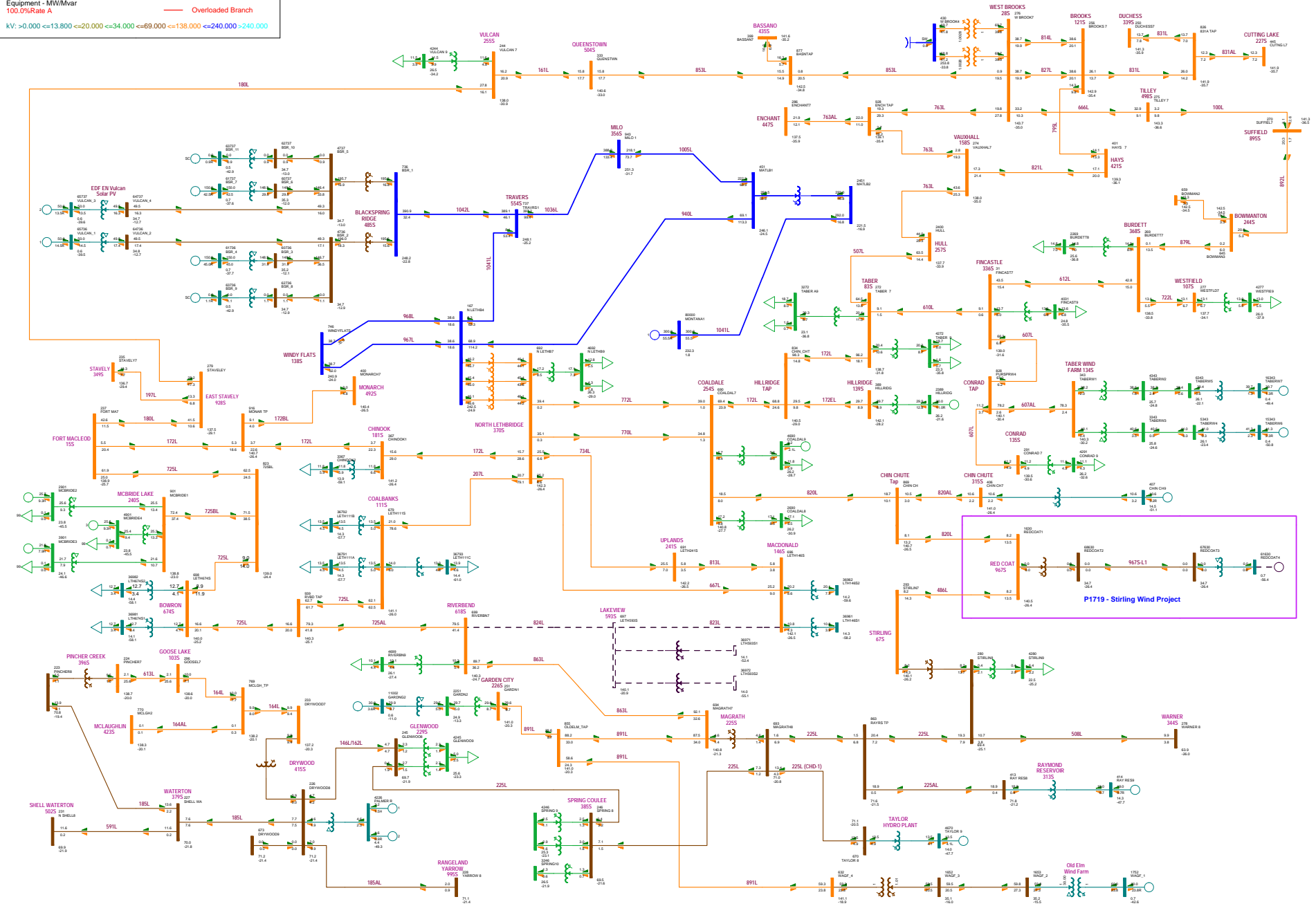
----- Contingency / Outage
 ----- Overloaded Branch



Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage- 3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage
 ----- Overloaded Branch



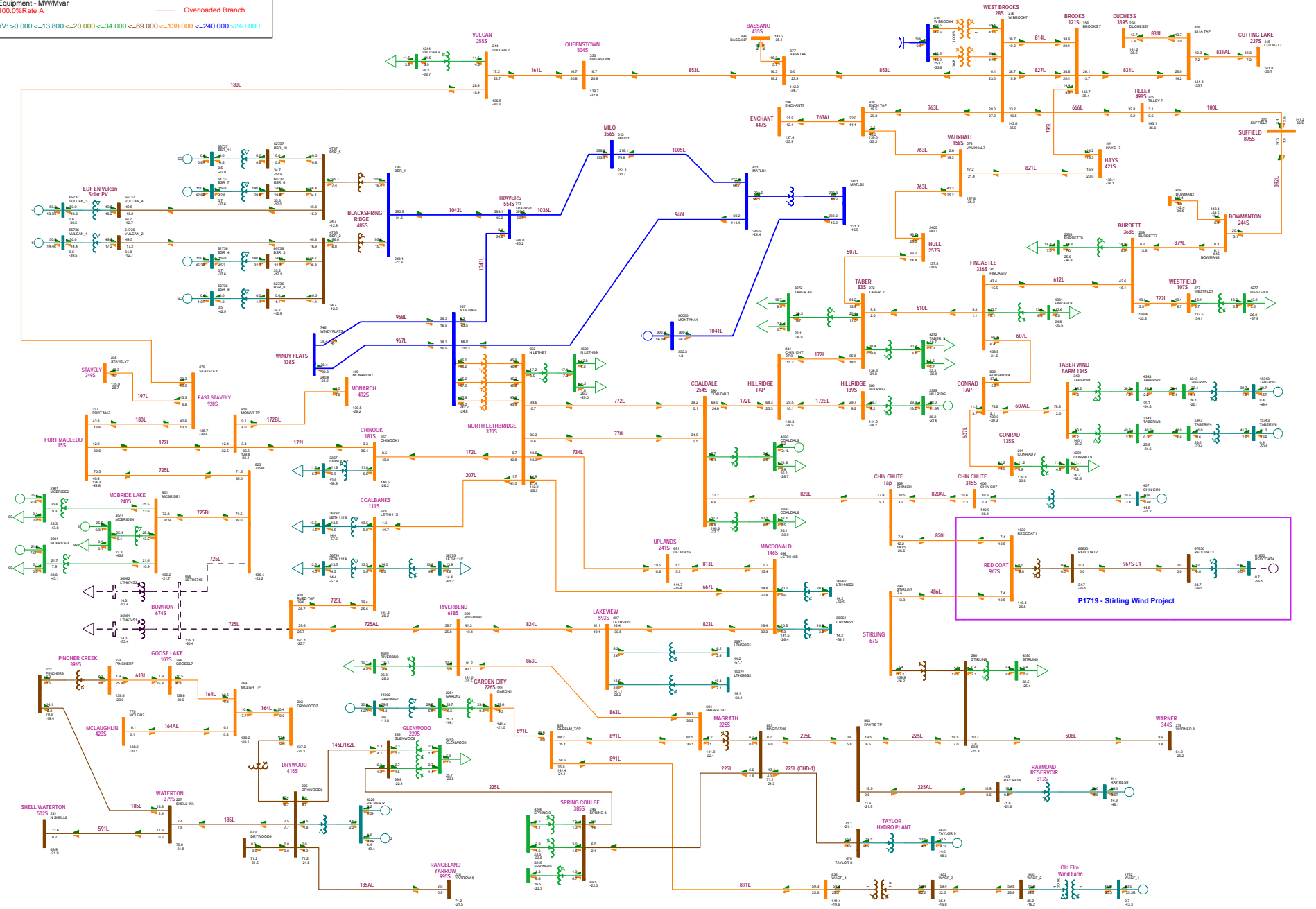
Stirling Wind Project Ltd
Stirling Wind Project Connection
AESO Project Number: P1719 Stage- 3
Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MWMvar
 Equipment - MWMvar
 100.0%Rate A

----- Contingency / Outage

----- Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

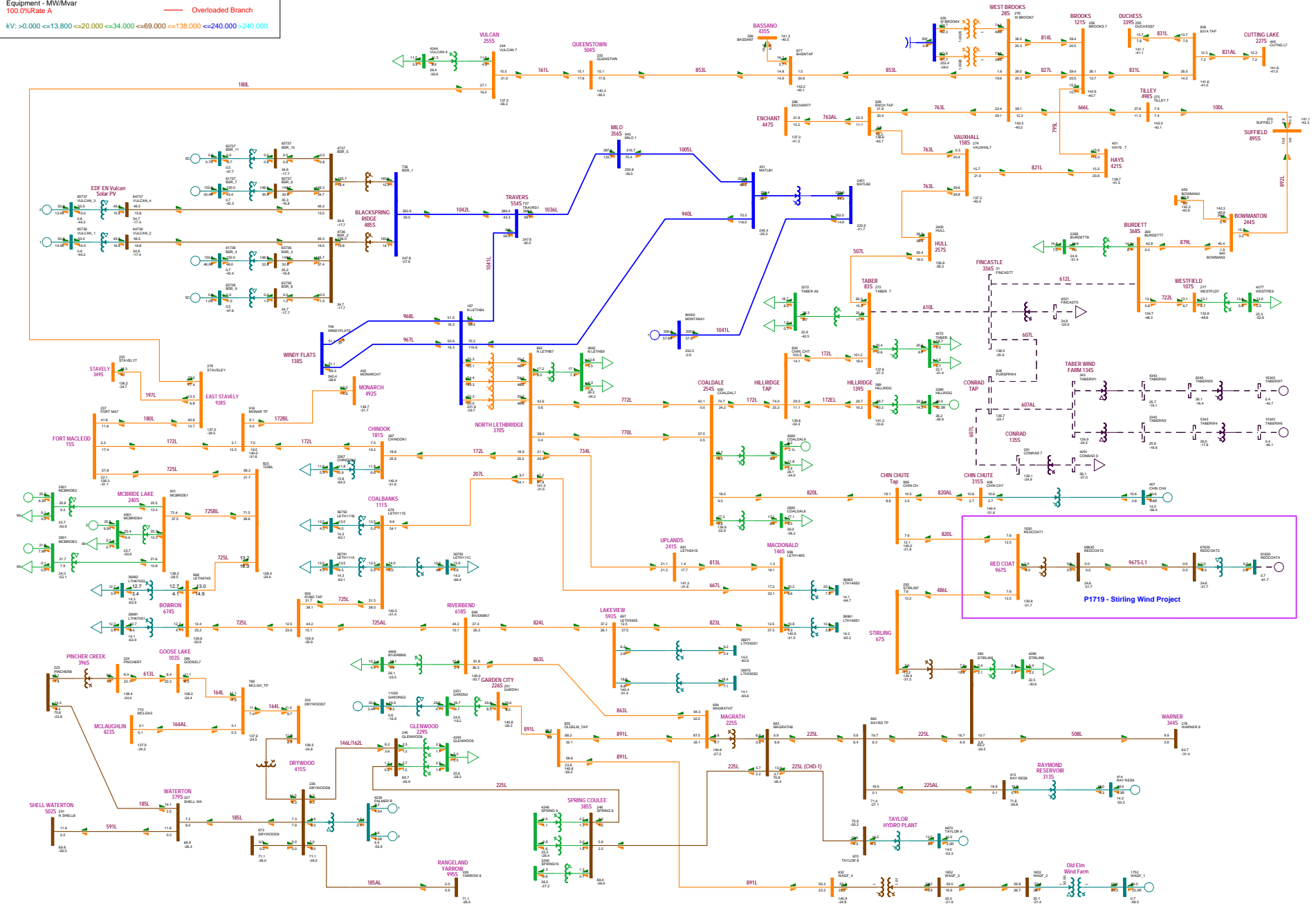


Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage- 3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 Overloaded Branch

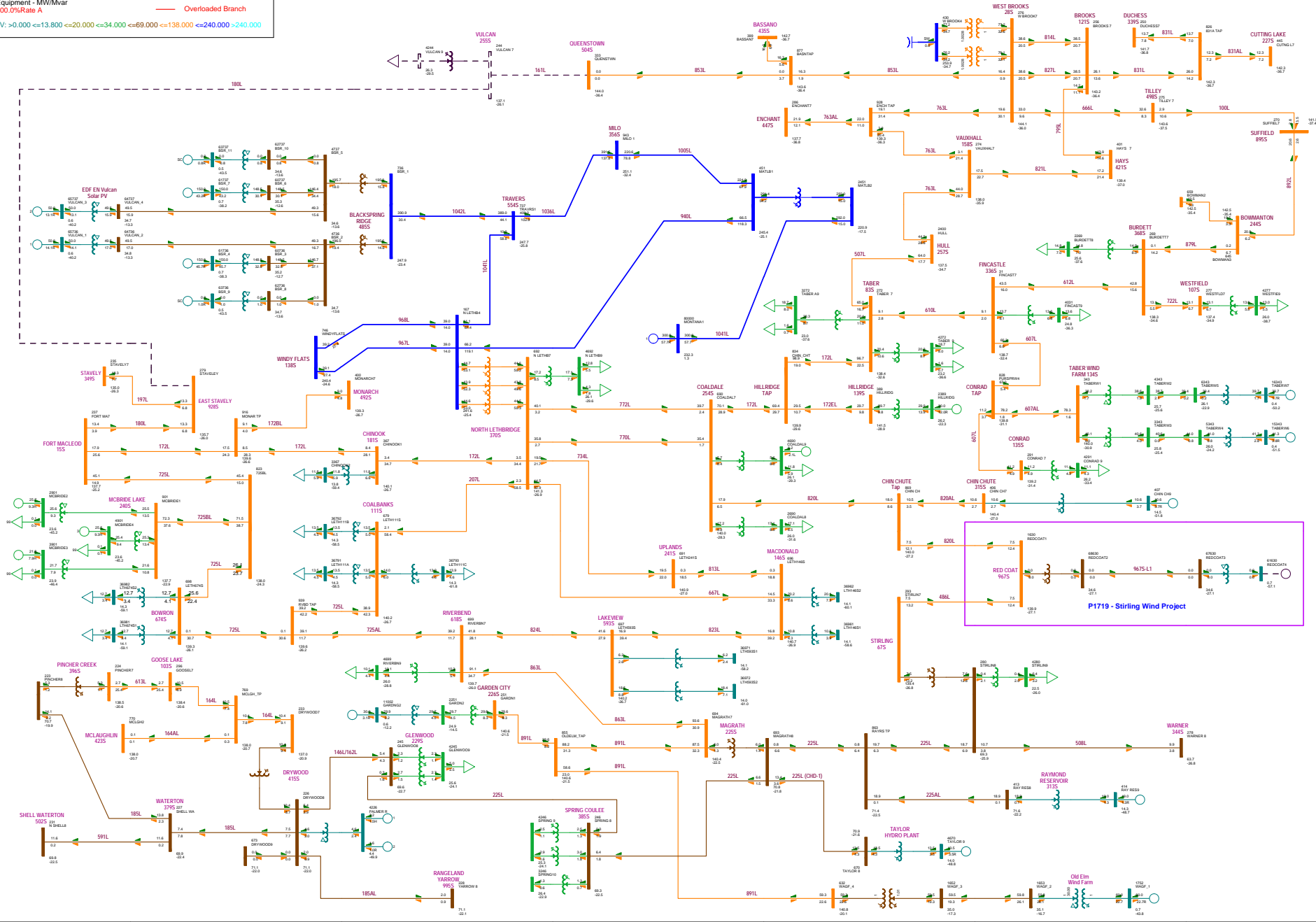
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P1719 - Stirling Wind Project

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage- 3
 Facility: RED COAT 967S

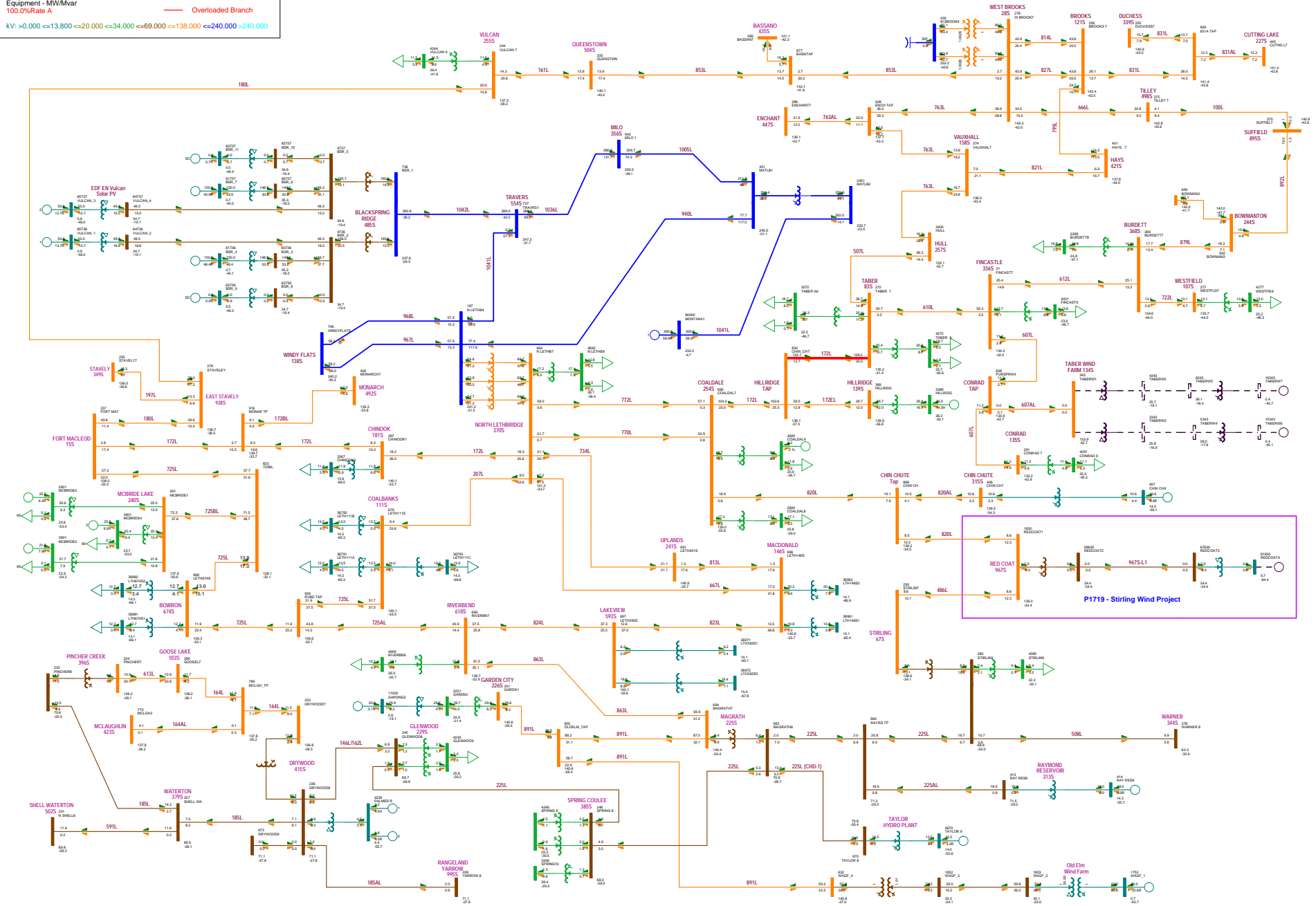
Bus - Base voltage (kV) ----- Contingency / Outage
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A
 KV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000



Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage- 3
 Facility: RED COAT 9675

Bus - Base voltage (kV)
 Branch - MWMvar
 Equipment - MWMvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage
 ----- Overloaded Branch

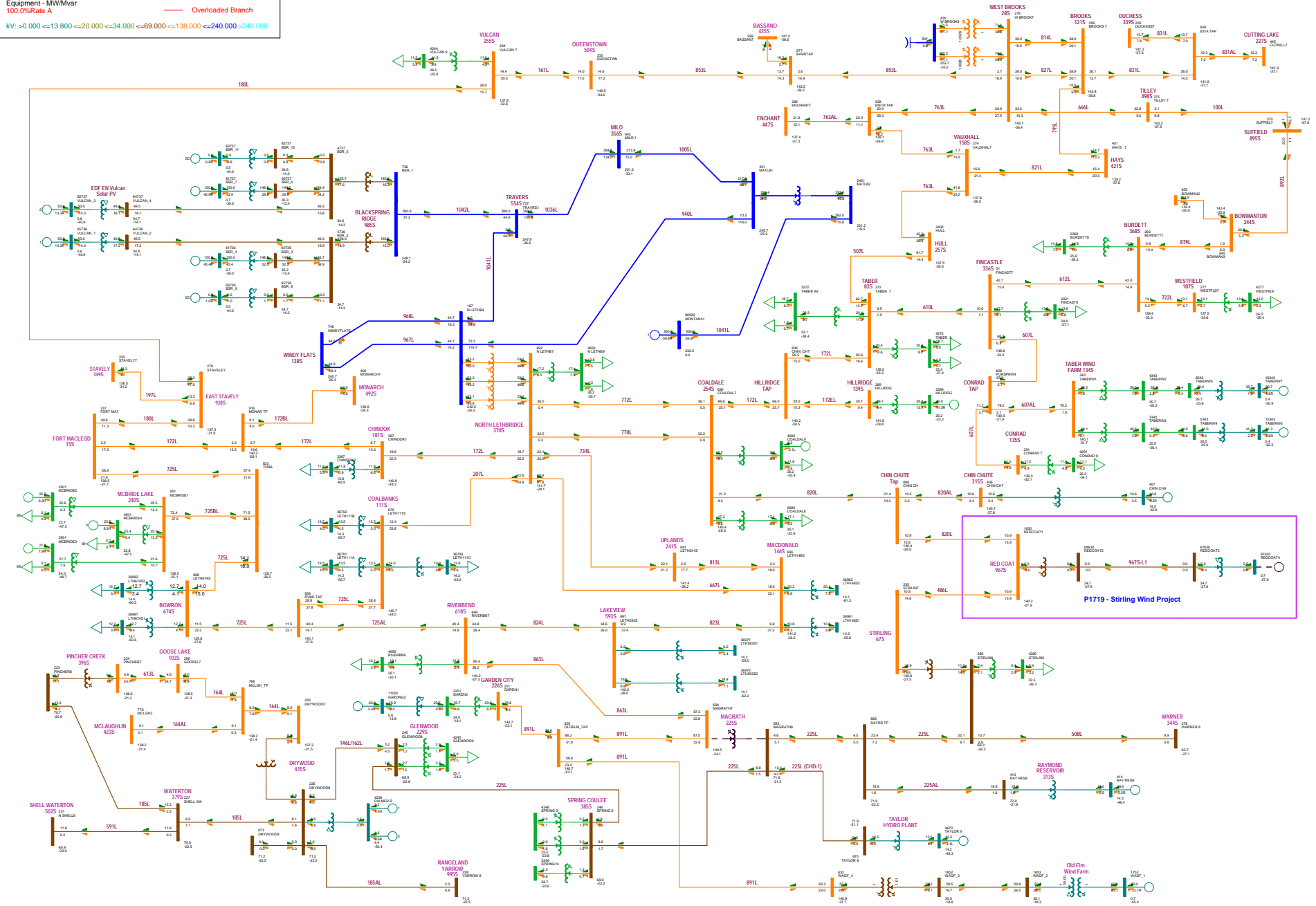


P1719 - Stirling Wind Project

Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage- 3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MWMvar
 Equipment - MWMvar
 100.0%Rate A
 kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000

----- Contingency / Outage
 ----- Overloaded Branch

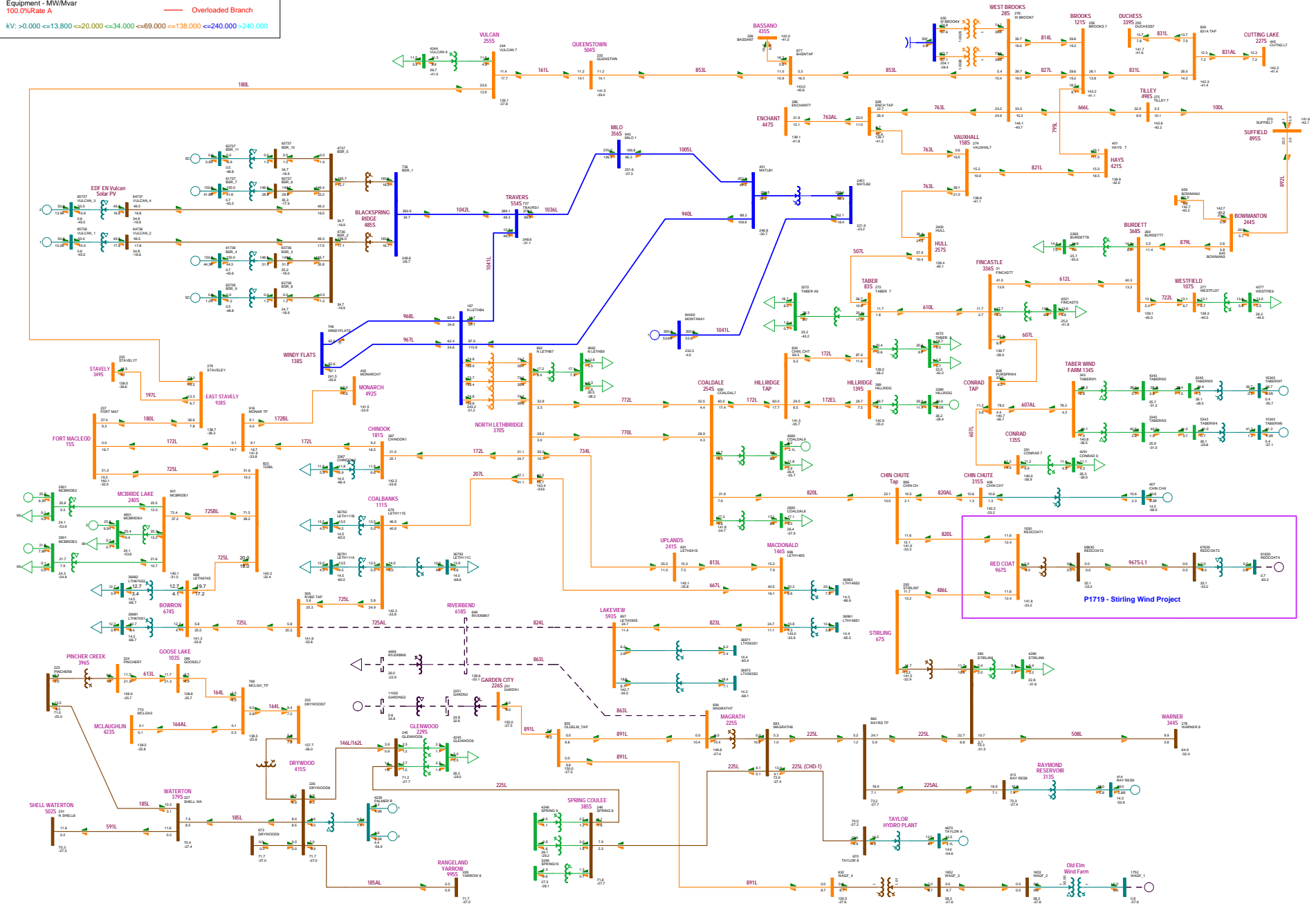


Stirling Wind Project Ltd
 Stirling Wind Project Connection
 AESO Project Number: P1719 Stage- 3
 Facility: RED COAT 967S

Bus - Base voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 100.0%Rate A

----- Contingency / Outage
 Overloaded Branch

kV: >0.000 <=13.800 <=20.000 <=34.000 <=69.000 <=138.000 <=240.000 >240.000



Attachment A7

Constraint Effective Factors

Table A7-1: Generator Type

Generating Facility Name and Unit Number	Chin Chute	Hillridge	Coaldale	Blackspring Ridge #1	Blackspring Ridge #2	Vulcan #1	Vulcan #2	Drywood	Taber	Raymond Reservoir	Irrican Power	Old Elm	Taylor Hydro	Garden City	Red Coat
Type	Hydro	Wind	Gas	Wind	Wind	Solar	Solar	Gas	Wind	Hydro	Hydro	Wind	Hydro	Wind	Wind

Table A7-2: Constraint Effective Factors under N-1 Contingencies for Post-Project Scenarios

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Generating Facility Name and Unit Number														
			Chin Chute	Hillridge	Coaldale	Blackspring Ridge #1	Blackspring Ridge #2	Vulcan #1	Vulcan #2	Drywood	Taber	Raymond Reservoir	Irrican Power	Old Elm	Taylor Hydro	Garden City	Red Coat
	146L_162L (Drywood 415S To Glenwood 229S)	820L (Coaldale 254S to Chin Chute Tap)	88.5%	-2.3%	-	-0.1%	-0.1%	-0.1%	-0.1%	-	-1.6%	37.7%	65.7%	5.7%	19.7%	5.7%	83.0%
	225L (Glenwood 229S To Spring Coulee 385S)	820L (Coaldale 254S to Chin Chute Tap)	89.1%	-1.9%	-	0.0%	0.0%	0.0%	0.0%	-	-1.3%	40.0%	66.4%	6.8%	22.9%	6.9%	83.5%
	225L_2 (Spring Coulee 385S To Magrath 225S)	820L (Coaldale 254S to Chin Chute Tap)	89.2%	-1.9%	-	0.0%	0.0%	0.0%	0.0%	-	-1.3%	39.9%	66.4%	6.8%	22.8%	6.9%	83.6%
	940L (North Lethbridge 370S To MATL B1)	172L (Taber 83S to Hillridge Tap)	20.3%	35.2%	-	1.7%	1.6%	1.7%	1.6%	-	-44.0%	14.0%	16.2%	11.0%	12.3%	11.4%	18.6%
	940L (North Lethbridge 370S To MATL B1)	1036L (Travers 554S to Milo 356S)	21.1%	17.8%	-	58.3%	58.5%	59.3%	59.8%	-	8.3%	22.2%	20.2%	24.8%	23.9%	25.2%	20.3%
	207L (Coalbanks 111S To North Lethbridge 370S)	820L (Coaldale 254S to Chin Chute Tap)	88.7%	-2.3%	-	-0.1%	-0.1%	-0.1%	-0.1%	-	-1.6%	38.3%	66.0%	6.7%	20.4%	6.8%	83.1%
	823L (Macdonald 146S To Lakeview 593S)	820L (Coaldale 254S to Chin Chute Tap)	88.6%	-2.3%	-	-0.1%	-0.1%	-0.1%	-0.1%	-	-1.6%	38.1%	65.9%	6.6%	20.2%	6.7%	83.1%
	824L (Lakeview 593S To Riverbend 618S)	820L (Coaldale 254S to Chin Chute Tap)	88.6%	-2.3%	-	-0.1%	-0.1%	-0.1%	-0.1%	-	-1.6%	38.1%	65.9%	6.6%	20.2%	6.6%	83.1%
	824L (Lakeview 593S To Riverbend 618S)	725AL (Riverbend 618S to Riverbend Tap)	6.9%	0.5%	-	-0.4%	-0.4%	-0.4%	-0.4%	-	0.2%	42.6%	19.0%	78.9%	58.8%	80.6%	7.6%
	725L (Coalbanks 111S to Riverbend 618S Tap to Riverbend 618S To Bowron 674S)	820L (Coaldale 254S to Chin Chute Tap)	88.7%	-2.3%	-	-0.1%	-0.1%	-0.1%	-0.1%	-	-1.6%	38.4%	66.1%	7.1%	20.6%	7.2%	83.2%
	508L (Warner 344S To Stirling 67S)	820L (Coaldale 254S to Chin Chute Tap)	88.5%	-2.3%	-	-0.1%	-0.1%	-0.1%	-0.1%	-	-1.6%	37.7%	65.5%	5.7%	19.8%	5.7%	82.8%
	607L (Fincastle 336S To Conrad Tap)	172L (Taber 83S to Hillridge Tap)	18.5%	33.6%	-	1.2%	1.2%	1.2%	1.2%	-	-	12.2%	14.5%	9.0%	10.4%	9.5%	16.9%
	607L (Fincastle 336S To Conrad Tap)	820L (Coaldale 254S to Chin Chute Tap)	88.6%	-2.3%	-	-0.1%	-0.1%	-0.1%	-0.1%	-	-	37.7%	65.8%	5.6%	19.6%	5.7%	83.0%
	1005L (Picture Butte 120S To Milo 356S)	172L (Taber 83S to Hillridge Tap)	20.2%	35.1%	-	1.8%	1.8%	1.8%	1.8%	-	-44.1%	14.0%	16.1%	11.0%	12.3%	11.4%	18.6%
	1005L (Picture Butte 120S To Milo 356S)	1036L (Travers 554S to Milo 356S)	20.9%	17.7%	-	57.7%	57.4%	58.8%	58.7%	-	8.3%	22.0%	20.1%	24.6%	23.8%	25.0%	20.2%
	863L (Magrath 225S to Riverbend 618S)	162L (Drywood 415S to Glenwood 229S)	3.9%	1.2%	-	0.2%	0.2%	0.2%	0.2%	-	0.9%	17.6%	9.3%	21.2%	24.1%	21.9%	4.2%
	863L (Magrath 225S to Riverbend 618S)	225L (Glenwood 229S to Spring Coulee 385S)	5.5%	1.7%	-	0.3%	0.3%	0.3%	0.3%	-	1.3%	24.5%	13.5%	29.7%	32.3%	30.5%	6.0%
	863L (Magrath 225S to Riverbend 618S)	225L (Spring Coulee 385S to Magrath 225S)	7.5%	2.4%	-	0.4%	0.4%	0.4%	0.4%	-	1.7%	33.4%	19.1%	40.8%	42.9%	41.7%	8.2%
	863L (Magrath 225S to Riverbend 618S)	67ST2 (Stirling 67S Transformer T2)	-4.2%	-1.3%	-	-0.2%	-0.2%	-0.2%	-0.2%	-	-1.0%	49.3%	82.9%	28.8%	32.0%	29.7%	-4.5%
	863L (Magrath 225S to Riverbend 618S)	225L (Stirling 67S to Raymond Reservoir Tap)	-6.4%	-2.0%	-	-0.3%	-0.3%	-0.3%	-0.3%	-	-1.5%	70.7%	-16.1%	46.0%	48.5%	47.0%	-7.0%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Generating Facility Name and Unit Number														
			Chin Chute	Hillridge	Coaldale	Blackspring Ridge #1	Blackspring Ridge #2	Vulcan #1	Vulcan #2	Drywood	Taber	Raymond Reservoir	Irrican Power	Old Elm	Taylor Hydro	Garden City	Red Coat
P1719_2019SL_Post.sav	863L (Magrath 225S to Riverbend 618S)	820L (Coaldale 254S to Chin Chute Tap)	95.0%	-1.3%	-	-0.2%	-0.2%	-0.2%	-0.2%	-	-0.9%	46.3%	78.8%	26.5%	29.7%	27.4%	89.2%
	863L (Magrath 225S to Riverbend 618S)	225ST1 (Magrath 225S Transformer T1)	0.0%	0.0%	-	0.0%	0.0%	0.0%	0.0%	-	0.0%	0.0%	0.1%	96.8%	0.0%	98.7%	0.0%
	863L (Magrath 225S to Riverbend 618S)	225L (Magrath 225S to Raymond Reservoir Tap)	-7.5%	-2.4%	-	-0.4%	-0.4%	-0.4%	-0.4%	-	-1.7%	-33.4%	-19.0%	55.0%	56.7%	56.0%	-8.2%
	863L (Magrath 225S to Riverbend 618S)	820L (Chin Chute Tap to Red Coat Tap)	-4.1%	-1.3%	-	-0.2%	-0.2%	-0.2%	-0.2%	-	-0.9%	47.4%	80.5%	27.3%	30.5%	28.1%	91.1%
	1036L (Travers 554S To Milo 356S)	172L (Taber 83S to Hillridge Tap)	20.5%	36.1%	-	6.4%	6.3%	6.5%	6.5%	-	-43.4%	14.1%	16.3%	11.1%	12.4%	11.5%	18.8%
	1036L (Travers 554S To Milo 356S)	172L (Coaldale 254S to Hillridge Tap)	21.3%	-63.9%	-	6.8%	6.8%	6.9%	6.9%	-	-44.7%	14.7%	17.1%	11.6%	12.9%	12.0%	19.6%
	1036L (Travers 554S To Milo 356S)	820L (Coaldale 254S to Chin Chute Tap)	88.5%	-2.3%	-	0.0%	0.0%	0.0%	0.0%	-	-1.6%	37.7%	65.8%	5.7%	19.6%	5.8%	82.9%
	139ST1 (Hillridge 139S Transformer T1)	820L (Coaldale 254S to Chin Chute Tap)	88.5%	-	-	-0.1%	-0.1%	-0.1%	-0.1%	-	-1.6%	37.6%	65.7%	5.6%	19.6%	5.7%	82.9%
	146ST1 (Macdonald 146S Transformer T1)	820L (Coaldale 254S to Chin Chute Tap)	88.6%	-2.3%	-	-0.1%	-0.1%	-0.1%	-0.1%	-	-1.6%	38.1%	65.9%	6.6%	20.2%	6.7%	83.1%
	593ST1 (Lakeview 593S Transformer T1)	820L (Coaldale 254S to Chin Chute Tap)	88.6%	-2.3%	-	-0.1%	-0.1%	-0.1%	-0.1%	-	-1.6%	38.1%	65.9%	6.6%	20.2%	6.6%	83.1%
	593ST1 (Lakeview 593S Transformer T1)	725AL (Riverbend 618S to Riverbend Tap)	6.9%	0.5%	-	-0.4%	-0.4%	-0.4%	-0.4%	-	0.2%	42.6%	19.0%	78.9%	58.8%	80.6%	7.7%
	415ST2 (Drywood 415S Transformer T2)	820L (Coaldale 254S to Chin Chute Tap)	89.1%	-1.9%	-	0.0%	0.0%	0.0%	0.0%	-	-1.3%	40.0%	66.4%	6.8%	22.9%	6.9%	83.5%
	229ST1 (Glenwood 229S Transformer T1)	820L (Coaldale 254S to Chin Chute Tap)	89.1%	-1.9%	-	0.0%	0.0%	0.0%	0.0%	-	-1.3%	40.0%	66.4%	6.8%	22.9%	6.9%	83.5%
	385ST1 (Spring Coulee 385S Transformer T1)	820L (Coaldale 254S to Chin Chute Tap)	89.2%	-1.9%	-	0.0%	0.0%	0.0%	0.0%	-	-1.3%	39.9%	66.4%	6.8%	22.8%	6.9%	83.6%
	134S_G1_G2 (Taber Wind Farm 134S)	172L (Taber 83S to Hillridge Tap)	18.5%	33.7%	-	1.2%	1.2%	1.2%	1.2%	-	-46.7%	12.2%	14.4%	9.0%	10.4%	9.4%	16.9%
	134S_G1_G2 (Taber Wind Farm 134S)	820L (Coaldale 254S to Chin Chute Tap)	88.6%	-2.3%	-	-0.1%	-0.1%	-0.1%	-0.1%	-	-1.6%	37.7%	65.8%	5.6%	19.6%	5.7%	83.0%
	225ST1 (Magrath 225S Transformer T1)	820L (Coaldale 254S to Chin Chute Tap)	88.5%	-2.3%	-	-0.1%	-0.1%	-0.1%	-0.1%	-	-1.6%	37.7%	65.7%	5.7%	19.7%	5.7%	83.0%
	225ST1 (Magrath 225S Transformer T1)	820L (Chin Chute Tap to Red Coat Tap)	-10.7%	-2.3%	-	-0.1%	-0.1%	-0.1%	-0.1%	-	-1.6%	38.2%	66.5%	5.7%	19.9%	5.8%	84.1%
	618ST1 (Riverbend 618S Transformer T1)	162L (Drywood 415S to Glenwood 229S)	3.9%	1.2%	-	0.2%	0.2%	0.2%	0.2%	-	0.9%	17.6%	9.2%	21.1%	24.1%	21.9%	4.2%
	618ST1 (Riverbend 618S Transformer T1)	225L (Glenwood 229S to Spring Coulee 385S)	5.5%	1.7%	-	0.3%	0.3%	0.3%	0.3%	-	1.3%	24.5%	13.5%	29.7%	32.3%	30.5%	6.0%
	618ST1 (Riverbend 618S Transformer T1)	225L (Spring Coulee 385S to Magrath 225S)	7.5%	2.4%	-	0.4%	0.4%	0.4%	0.4%	-	1.7%	33.4%	19.1%	40.8%	42.9%	41.7%	8.2%
	618ST1 (Riverbend 618S Transformer T1)	67ST2 (Stirling 67S Transformer T2)	-4.2%	-1.3%	-	-0.2%	-0.2%	-0.2%	-0.2%	-	-1.0%	49.3%	82.9%	28.8%	32.0%	29.7%	-4.5%
	618ST1 (Riverbend 618S Transformer T1)	225L (Stirling 67S to Raymond Reservoir Tap)	-6.4%	-2.0%	-	-0.3%	-0.3%	-0.3%	-0.3%	-	-1.5%	70.7%	-16.1%	46.0%	48.5%	47.0%	-7.0%
	618ST1 (Riverbend 618S Transformer T1)	820L (Coaldale 254S to Chin Chute Tap)	95.0%	-1.3%	-	-0.2%	-0.2%	-0.2%	-0.2%	-	-0.9%	46.3%	78.8%	26.5%	29.7%	27.4%	89.2%
618ST1 (Riverbend 618S Transformer T1)	225ST1 (Magrath 225S Transformer T1)	0.0%	0.0%	-	0.0%	0.0%	0.0%	0.0%	-	0.0%	0.0%	0.1%	96.8%	0.0%	98.7%	0.0%	
618ST1 (Riverbend 618S Transformer T1)	225L (Magrath 225S to Raymond Reservoir Tap)	-7.5%	-2.4%	-	-0.4%	-0.4%	-0.4%	-0.4%	-	-1.7%	-33.4%	-19.0%	55.0%	56.7%	56.0%	-8.2%	

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Generating Facility Name and Unit Number														
			Chin Chute	Hillridge	Coaldale	Blackspring Ridge #1	Blackspring Ridge #2	Vulcan #1	Vulcan #2	Drywood	Taber	Raymond Reservoir	Irrican Power	Old Elm	Taylor Hydro	Garden City	Red Coat
	618ST1 (Riverbend 618S Transformer T1)	820L (Chin Chute Tap to Red Coat Tap)	-4.1%	-1.3%	-	-0.2%	-0.2%	-0.2%	-0.2%	-	-0.9%	47.4%	80.5%	27.3%	30.5%	28.1%	91.1%
P1719_2019SP_Post.sav	180L (Fort Macleod 15S To East Stavely 928S)	172L (Taber 83S to Hillridge Tap)	18.4%	33.2%	23.4%	1.2%	1.2%	1.2%	1.2%	4.5%	-46.1%	12.0%	14.9%	9.2%	10.4%	9.7%	16.8%
	180L_2 (Vulcan 255S To East Stavely 928S)	172L (Taber 83S to Hillridge Tap)	18.4%	33.2%	23.4%	1.1%	1.1%	1.2%	1.2%	4.5%	-46.1%	12.0%	14.9%	9.2%	10.5%	9.7%	16.8%
	161L (Vulcan 255S To Queenstown 504S)	172L (Taber 83S to Hillridge Tap)	18.4%	33.1%	23.4%	1.1%	1.1%	1.2%	1.2%	4.5%	-46.1%	12.1%	14.9%	9.2%	10.5%	9.7%	16.8%
	1041L (North Lethbridge 370S To Travers 554S)	172L (Taber 83S to Hillridge Tap)	19.5%	34.1%	24.4%	-2.5%	-2.5%	-2.5%	-2.5%	5.7%	-45.5%	13.1%	16.0%	10.3%	11.5%	10.7%	17.9%
	824L (Lakeview 593S To Riverbend 618S)	725AL (Riverbend 618S to Riverbend Tap)	7.0%	0.6%	0.6%	-0.4%	-0.4%	-0.4%	-0.4%	11.4%	0.3%	43.1%	19.3%	79.2%	59.6%	81.1%	7.6%
	607L (Fincastle 336S To Conrad Tap)	172L (Taber 83S to Hillridge Tap)	17.6%	32.8%	22.8%	1.0%	1.0%	1.0%	1.0%	4.0%	-	11.2%	14.2%	8.3%	9.5%	8.7%	16.0%
	607L (Fincastle 336S To Conrad Tap)	172L (Coaldale 254S to Hillridge Tap)	18.3%	-67.4%	23.4%	1.0%	1.0%	1.0%	1.0%	4.1%	-	11.7%	14.7%	8.6%	9.9%	9.0%	16.7%
	1005L (Picture Butte 120S To Milo 356S)	172L (Taber 83S to Hillridge Tap)	19.6%	34.6%	24.8%	1.4%	1.4%	1.4%	1.4%	5.7%	-45.2%	13.1%	16.0%	10.2%	11.5%	10.7%	17.9%
	1005L (Picture Butte 120S To Milo 356S)	1036L (Travers 554S to Milo 356S)	21.6%	18.0%	22.3%	58.9%	58.6%	59.4%	59.4%	21.2%	8.4%	22.7%	20.8%	24.9%	24.1%	25.3%	20.9%
	863L (Magrath 225S to Riverbend 618S)	162L (Drywood 415S to Glenwood 229S)	3.8%	1.2%	1.4%	0.2%	0.2%	0.2%	0.2%	-6.7%	0.9%	17.3%	8.8%	20.1%	23.5%	20.9%	4.1%
	863L (Magrath 225S to Riverbend 618S)	225L (Glenwood 229S to Spring Coulee 385S)	5.3%	1.7%	1.8%	0.3%	0.3%	0.3%	0.3%	-9.1%	1.3%	23.8%	12.8%	28.2%	31.1%	29.0%	5.7%
	863L (Magrath 225S to Riverbend 618S)	225L (Spring Coulee 385S to Magrath 225S)	7.3%	2.3%	2.5%	0.4%	0.4%	0.4%	0.4%	-12.6%	1.7%	33.0%	18.4%	39.6%	42.0%	40.5%	8.0%
	863L (Magrath 225S to Riverbend 618S)	67ST2 (Stirling 67S Transformer T2)	-4.0%	-1.3%	-1.4%	-0.2%	-0.2%	-0.2%	-0.2%	7.0%	-1.0%	49.7%	82.1%	27.5%	31.4%	28.4%	-4.3%
	863L (Magrath 225S to Riverbend 618S)	225L (Stirling 67S to Raymond Reservoir Tap)	-6.2%	-2.0%	-2.1%	-0.3%	-0.3%	-0.3%	-0.3%	10.7%	-1.5%	71.7%	-15.1%	45.0%	48.3%	46.1%	-6.7%
	863L (Magrath 225S to Riverbend 618S)	820L (Coaldale 254S to Chin Chute Tap)	95.3%	-1.2%	-1.3%	-0.2%	-0.2%	-0.2%	-0.2%	6.5%	-0.9%	46.9%	78.4%	25.3%	29.2%	26.2%	89.6%
	863L (Magrath 225S to Riverbend 618S)	225ST1 (Magrath 225S Transformer T1)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	96.6%	0.0%	98.6%	0.0%
	863L (Magrath 225S to Riverbend 618S)	225L (Magrath 225S to Raymond Reservoir Tap)	-7.3%	-2.3%	-2.5%	-0.4%	-0.4%	-0.4%	-0.4%	12.6%	-1.7%	-33.0%	-18.4%	56.0%	57.6%	57.0%	-8.0%
	863L (Magrath 225S to Riverbend 618S)	820L (Chin Chute Tap to Red Coat Tap)	-3.9%	-1.2%	-1.3%	-0.2%	-0.2%	-0.2%	-0.2%	6.7%	-0.9%	47.9%	80.0%	26.0%	30.0%	26.9%	91.3%
	1036L (Travers 554S To Milo 356S)	172L (Taber 83S to Hillridge Tap)	19.8%	35.1%	24.9%	6.1%	6.1%	6.1%	6.1%	5.7%	-44.6%	13.2%	16.2%	10.3%	11.6%	10.8%	18.1%
	1036L (Travers 554S To Milo 356S)	172L (Coaldale 254S to Hillridge Tap)	20.6%	-65.4%	25.7%	6.4%	6.4%	6.5%	6.5%	6.0%	-46.3%	13.8%	16.8%	10.8%	12.1%	11.2%	18.9%
	254ST2 (Coaldale 254S Transformer T1)	172L (Taber 83S to Hillridge Tap)	17.9%	32.5%	22.6%	1.1%	1.1%	1.1%	1.1%	4.2%	-46.5%	11.6%	14.6%	8.7%	9.9%	9.1%	16.4%
	370ST1 (North Lethbridge 370S Transformer T1)	725AL (Riverbend 618S to Riverbend Tap)	2.4%	1.6%	2.4%	0.3%	0.3%	0.3%	0.3%	1.8%	0.2%	4.6%	2.9%	7.2%	6.0%	7.5%	2.3%
	146ST1 (Macdonald 146S Transformer T1)	172L (Taber 83S to Hillridge Tap)	17.9%	32.6%	22.6%	1.1%	1.1%	1.1%	1.1%	4.3%	-46.4%	11.4%	14.5%	8.4%	9.7%	8.8%	16.4%
	593ST1 (Lakeview 593S Transformer T1)	172L (Taber 83S to Hillridge Tap)	17.9%	32.6%	22.7%	1.1%	1.1%	1.1%	1.1%	4.3%	-46.4%	11.4%	14.5%	8.3%	9.6%	8.7%	16.4%
	593ST1 (Lakeview 593S Transformer T1)	725AL (Riverbend 618S to Riverbend Tap)	6.9%	0.6%	0.6%	-0.4%	-0.4%	-0.4%	-0.4%	11.4%	0.3%	43.2%	19.3%	79.3%	59.6%	81.2%	7.6%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Generating Facility Name and Unit Number														
			Chin Chute	Hillridge	Coaldale	Blackspring Ridge #1	Blackspring Ridge #2	Vulcan #1	Vulcan #2	Drywood	Taber	Raymond Reservoir	Irrican Power	Old Elm	Taylor Hydro	Garden City	Red Coat
	674ST1 (Bowron 674S Transformer T1)	172L (Taber 83S to Hillridge Tap)	18.0%	32.6%	22.7%	1.1%	1.1%	1.1%	1.1%	4.3%	-46.4%	11.7%	14.6%	8.8%	10.0%	9.2%	16.5%
	336ST1 (Fincastle 336S Transformer T1)	172L (Taber 83S to Hillridge Tap)	14.9%	27.5%	19.2%	0.9%	0.9%	0.9%	0.9%	3.5%	-	9.5%	12.0%	7.0%	8.1%	7.4%	13.6%
	255ST1 (Vulcan 255S Transformer T1)	172L (Taber 83S to Hillridge Tap)	18.4%	33.1%	23.4%	1.2%	1.2%	1.2%	1.2%	4.6%	-46.1%	12.1%	15.0%	9.2%	10.5%	9.7%	16.8%
	134S_G1_G2 (Taber Wind Farm 134S)	172L (Taber 83S to Hillridge Tap)	17.6%	32.8%	22.8%	1.0%	1.0%	1.0%	1.0%	4.0%	-47.9%	11.2%	14.2%	8.2%	9.5%	8.7%	16.0%
	134S_G1_G2 (Taber Wind Farm 134S)	172L (Coaldale 254S to Hillridge Tap)	18.3%	-67.5%	23.4%	1.0%	1.0%	1.0%	1.0%	4.1%	-49.5%	11.6%	14.7%	8.6%	9.9%	9.0%	16.7%
	225ST1 (Magrath 225S Transformer T1)	820L (Coaldale 254S to Chin Chute Tap)	88.8%	-2.2%	-2.5%	-0.1%	-0.1%	-0.1%	-0.1%	3.4%	-1.6%	38.1%	66.3%	5.5%	19.2%	5.5%	83.4%
	618ST1 (Riverbend 618S Transformer T1)	162L (Drywood 415S to Glenwood 229S)	3.8%	1.2%	1.3%	0.2%	0.2%	0.2%	0.2%	-6.7%	0.9%	17.3%	8.8%	20.1%	23.5%	20.8%	4.1%
	618ST1 (Riverbend 618S Transformer T1)	225L (Glenwood 229S to Spring Coulee 385S)	5.3%	1.7%	1.8%	0.3%	0.3%	0.3%	0.3%	-9.1%	1.3%	23.8%	12.8%	28.2%	31.1%	29.0%	5.7%
	618ST1 (Riverbend 618S Transformer T1)	225L (Spring Coulee 385S to Magrath 225S)	7.3%	2.3%	2.5%	0.4%	0.4%	0.4%	0.4%	-12.6%	1.7%	33.0%	18.4%	39.6%	42.0%	40.5%	8.0%
	618ST1 (Riverbend 618S Transformer T1)	67ST2 (Stirling 67S Transformer T2)	-4.0%	-1.3%	-1.4%	-0.2%	-0.2%	-0.2%	-0.2%	7.0%	-1.0%	49.7%	82.1%	27.6%	31.4%	28.5%	-4.3%
	618ST1 (Riverbend 618S Transformer T1)	225L (Stirling 67S to Raymond Reservoir Tap)	-6.2%	-2.0%	-2.1%	-0.3%	-0.3%	-0.3%	-0.3%	10.7%	-1.5%	71.7%	-15.1%	45.0%	48.3%	46.2%	-6.7%
	618ST1 (Riverbend 618S Transformer T1)	820L (Coaldale 254S to Chin Chute Tap)	95.2%	-1.2%	-1.3%	-0.2%	-0.2%	-0.2%	-0.2%	6.5%	-0.9%	46.9%	78.5%	25.3%	29.3%	26.3%	89.6%
	618ST1 (Riverbend 618S Transformer T1)	225ST1 (Magrath 225S Transformer T1)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	96.6%	0.0%	98.6%	0.0%
	618ST1 (Riverbend 618S Transformer T1)	225L (Magrath 225S to Raymond Reservoir Tap)	-7.3%	-2.3%	-2.5%	-0.4%	-0.4%	-0.4%	-0.4%	12.6%	-1.7%	-32.9%	-18.4%	56.0%	57.6%	57.0%	-8.0%
	618ST1 (Riverbend 618S Transformer T1)	820L (Chin Chute Tap to Red Coat Tap)	-3.9%	-1.2%	-1.3%	-0.2%	-0.2%	-0.2%	-0.2%	6.7%	-0.9%	48.0%	80.1%	26.1%	30.0%	27.0%	91.3%