GENERATOR INTERCONNECTION

SYSTEM IMPACT STUDY REPORT

for integration of the proposed

800 MW [redacted] PROJECT

(GI #616)

to the

IDAHO POWER COMPANY ELECTRICAL SYSTEM

in

TWIN FALLS COUNTY, IDAHO

for

[redacted], [redacted]

REPORT v.2

July 18, 2022

Revision History

Date	Revision	Initials	Summary of Changes
06/30/2022	0	MDH	System Impact Study Initial Report GI #616
06/30/2022	1	MDH	SIS Initial Report GI #616 – Addressing Comments Received
07/18/2022	2	MDH	SIS Revised to include GI Customer’s Comments

Table of Contents

List of Tables

1.0 INTRODUCTION

[redacted], [redacted] has contracted with Idaho Power Company ("Transmission Provider") to perform a Generator Interconnection System Impact Study (SIS) for the integration of the proposed 800 MW [redacted] (Project). The Project's location is in Idaho Power Company's (IPC's) Southern Region in Twin Falls County, Idaho. The project is Generation Interconnect (GI) queue reference number 616 (GI #616). The project has chosen in the System Impact Study to be studied as an Energy Resource Interconnection Service (ERIS).

Energy Resource Interconnection Service and/or Network Resource Interconnection Service in and of themselves do not convey transmission service. In addition to Network Upgrades identified in the Interconnection System Impact Study:

- For Energy Resource Interconnection Service, the Interconnection Customer's ability to inject its Large Generating Facility output beyond the Point of Interconnection will depend on the existing capacity of Transmission Provider's Transmission System at such time as a transmission service request is made that would accommodate such delivery. The provision of firm Point-to-Point Transmission Service or Network Integration Transmission Service may require the construction of additional Network Upgrades.

The Project has applied to connect to the Idaho Power's transmission system for an injection of 800 MW at a single Point of Interconnection (POI) at 345kV at Idaho Power Company's (IPCo's) new Rogerson Switching Station (RGSS) 345kV ring-bus. Because the proposed interconnection is on WECC Path 16 Idaho-Sierra, Nevada Energy (NVE) is an Affected Party.

This report documents the basis for and the results of this System Impact Study for the GI #616 Generation Interconnection Customer. The report describes the Project, the determination of the Project interconnection requirements, and estimated costs for integration of the Project to the Transmission Provider transmission system. This report satisfies the SIS requirements of the Idaho Power Tariff. This report will be reviewed by NVE.

2.0 SUMMARY

The system impact of interconnecting the 800 MW [redacted] project, GI #616, to Idaho Power's Rogerson Switching Station 345kV bus was evaluated. GI #616 can be interconnected to the Idaho Power transmission system with the identified transmission system upgrades and approximate 575 MW Project generation tripping by a Remedial Action Scheme (RAS) for loss of the Rogerson Switching Station-Midpoint 345kV line.

The GI #616 Project is a combined Wind and Battery Energy Storage System (BESS) and it has been assumed that the BESS will be charged via the wind output. [redacted], [redacted] will need to demonstrate the operating procedures and control measures which prevents the BESS from being charged via IPC's transmission system. However, if the intent is also to be able to charge the BESS via IPC's transmission system, [redacted], [redacted] will need to make an IPC Large Load Service request.

Interconnection Facilities for GI #616 [redacted] project:

- New Rogerson Switching Station POI 345kV Line Terminal
- 345kV 35 MVAr Shunt Reactor

For planned outages of the Rogerson Switching Station-Idaho-NV-Humboldt 345kV line, the project will be required to slightly curtail to avoid overloading the Rogerson Switching Station-Midpoint 345 kV line's steady-state nominal rating, and post-contingency following a forced outage to bring the loading on the Rogerson Switching Station-Midpoint 345 kV line within its nominal rating. Opening the Rogerson Switching Station-Midpoint 345kV line, overloads the Rogerson Switching Station-Idaho-NV-Humboldt 345kV line's nominal and emergency ratings. Six contingencies result in opening the Rogerson Switching Station-Midpoint 345 kV line, one contingency resulted in significant reliability violations. This was due to tripping the Jackpot Solar 120 MW project. Five other contingencies failed to solve due to voltage collapse in the NVE system. This required approximately 350 MW of Project generation tripping by RAS to mitigate these six contingencies. However, with tripping only 350 MW of Project generation by RAS, it was transient stability oscillatory which is unacceptable. Mitigation required at least 575 MW of Project generation tripping to be transient stability stable and damped. A joint study (Idaho Power, Nevada Energy, and [redacted], [redacted]) will be required to determine the final functionality/requirements/specifications of the GI #616 Generation Tripping RAS for loss of the Rogerson Switching Station-Midpoint 345kV line. In addition, electromagnetic transient (EMT) studies may be required.

The total conceptual cost estimate for ERIS to interconnect the [redacted] project, GI #616, as requested to the 345kV bus at Idaho Power's Rogerson Switching Station transmission station is **$9,223,122** as detailed in Section 9.0. Costs for the GI #616 Generation Tripping RAS were not included in this estimate until its functionality/requirements/specifications are fully known.

The cost estimate includes direct equipment and installation labor costs, indirect labor costs and general overheads, and a contingency allowance. These are cost estimates only and final charges to the customer will be based on the actual construction costs incurred. It should be noted that the preliminary cost estimate does not include the cost of the customer's equipment to construct the generation facility.

For potential operating requirements, see Section 12.0 Description of Operating Requirements.

3.0 SCOPE OF INTERCONNECTION SYSTEM IMPACT STUDY

The Interconnection SIS was performed and prepared in accordance with Idaho Power Standard Generator Interconnection Procedures, to provide a preliminary evaluation of the system impact of the interconnection of the proposed generating project to the Idaho Power transmission system. As listed in the Interconnection SIS agreement, the Interconnection SIS report provides the following information:

- identification of any circuit breaker short circuit capability limits exceeded because of the interconnection,
- identification of any thermal overload or voltage limit violations resulting from the interconnection, and
- identification of any instability or inadequately damped response to system disturbances resulting from the interconnection; and
- description and non-binding estimated cost of facilities required to interconnect the Large Generating Facility to the transmission system and to address the identified short circuit and power flow issues.

Generation projects in the Generator Interconnect queue prior to this project could impact the cost of interconnection. A current list of projects in Idaho Power's queue can be found in the Generation Interconnection folder located on the Idaho Power OASIS web site at the link shown below:

http://www.oasis.oati.com/ipco/index.html

4.0 CONTINGENT FACILITIES

IPC projects queue GI #530, GI #549, GI #551, GI #557, GI #567, GI #570, GI #588, GI #590, GI #604, GI #605, and GI #613 are senior queued projects in the affected area of IPC's transmission system. Idaho Power studied GI #616 with all Network Upgrades identified for senior queued projects as in-service. Changes to senior queued projects including withdrawal from the queue, may trigger a restudy associated with GI #616.

GI #616 Energy Resource Interconnection Service, ERIS, at the Rogerson Switching Station 345kV Bus POI is not contingent upon upgrades associated with any senior queued project.

5.0 DESCRIPTION OF PROPOSED GENERATING PROJECT

[redacted] project, GI #616, proposes to interconnect to the Idaho Power transmission system at 345kV with a total injection of 800 MW (maximum project output). The POI is the 345kV bus at IPCo's Rogerson Switch Station transmission station. The Project is a combined wind and BESS generation project. The project's requested in-service date is December 1, 2025.

Table 1: Project Specifications

POI Location	Project to be located in Twin Falls County approximately [redacted] to [redacted] miles southwest of Twin Falls, ID near [redacted], [redacted]
Number and Type of Generators	(276) GE 3.03-140 WTG – Wind (156) – BESS
Individual Generator Nameplate Rating	Wind 3.03 MW BESS 3.334 MW
Total Output Power Rating	836.3 MW Wind 520.2 MW BESS
Rated Power Factor	0.95
Transmission Lines	One 10.1 miles 345kV Line (Project to POI) Four 230kV Lines with lengths from 3.7 to 13.5 miles Four 34.5kV Collector Equivalent Circuits
Transformers	Two Station 3-phase 345/230kV 296/393/491 MVA Z = 7.0%, X/R = 45 A Plant 3-phase 230/34.5kV 150/200/250 MVA Z = 7.0%, X/R = 33 B Plant 3-phase 230/34.5kV 140/186/233 MVA Z = 7.0%, X/R = 33 C Plant 3-phase 230/34.5kV 140/186/233 MVA Z = 7.0%, X/R = 33 D Plant 3-phase 230/34.5kV 135/180/225 MVA Z = 7.0%, X/R = 33 A Plant GSU 3-phase 34.5/0.69kV 271.8 MVA Z = 6.9%, X/R = 7.5 B Plant GSU 3-phase 34.5/0.69kV 234.5 MVA Z = 6.9%, X/R = 7.5 C Plant GSU 3-phase 34.5/0.69kV 234.5 MVA Z = 6.9%, X/R = 7.5 D Plant GSU 3-phase 34.5/0.69kV 217.5 MVA Z = 6.9%, X/R = 7.5
Interconnection Voltage	345kV

6.0 DESCRIPTION OF INTERCONNECTION TRANSMISSION FACILITIES

Preliminary power flow analysis indicated that interconnection of an 800 MW injection at the POI will require the following transmission system improvements: 345kV bus expansion to install a new line bay at the POI.

6.1 Transmission Line Facilities

The Project will be inserted in the Rogerson Switching Station 345kV ring-bus.

6.2 Substation Facilities

The substation yard will need to be expanded and the new Rogerson Switching Station 345 kV bus work extended to make room for a new line bay with one new 345kV power circuit breaker, associated switches, protective relaying systems, SCADA, communications, and a Generation Interconnection metering package.

Prior to the proposed GI #616 interconnection, Rogerson Switching Station (RGSS) 345kV voltage performance was very marginal for the loss of Midpoint (MPSN)-RGSS 345kV line with Jackpot Solar (GI #502, GI #503, GI #513, GI #514, GI #517, and GI #523) and GI #549 off-line. The addition of GI #616 project with its 345kV and 230kV transmission collector network will require an approximate 35 MVAr 345kV shunt reactor to mitigate GI #616 transmission collector network charging.

6.3 Grounding Requirements

For 345kV line protection, the Transmission Provider's System Protection Department utilizes permissive, and line differential protection schemes integrated with our existing digital communication infrastructure. Digital communication infrastructure for the interconnection customer's 345kV line terminal will be the responsibility of said interconnection customer.

The project single line does not indicate the winding configuration on the 345kV side of the 345/230kV transformers. Idaho Power requires a wye grounded connection on the high side and delta included in the transformer to create a solid ground path for the transmission system. This can be achieved with autotransformers with a delta tertiary which is a source of ground current, other configurations can and do exist.

Grounding requirements and acceptability criteria are found in Appendix A.

6.4 System Protection Assessment

Short Circuit details at POI interconnection location:

Studies indicate that there is adequate load and short circuit interrupting capability on the Transmission Provider's existing 345kV breakers after this project is interconnected.

Fault duty at the POI 345kV bus with and without generation.

Fault Study (Baseline w/o additional gen)			
Location	**SLG (A)**	**LTL (A)**	**3PH (A)**
RGSS 345kV Bus	5644.7	5866.0	5220.4

Fault Study (with GI #616)			
Location	**SLG (A)**	**LTL (A)**	**3PH (A)**
RGSS 345kV Bus	6491.4	7016.8	6500.9

7.0 DESCRIPTION OF POWER FLOW CASES

PowerWorld simulator software was used to evaluate the WECC 2023 Heavy Summer base case (23HS3a) simulating the Idaho Power transmission system with nominal flows/transfers consistent with a heavy summer peak load condition. Idaho Power's Midpoint West path was modeled at a nominal flow ~1050 MW W-E, the WECC Path 17 Borah West was modeled at a nominal flow of ~900 MW W-E; and the WECC Path 16 Idaho-Sierra was modeled at a nominal flow of ~475 MW N-S The original WECC Base Case was modified to add Jackpot Solar, IPCo senior GI queue projects (GI #530, GI #549, GI #551, GI #557, GI #567, GI #570, GI #588, GI #604, GI #605, and GI #613) in the affected area, and the [redacted] project, GI #616.

The levels of flow represented in the study cases are intended to capture potential impact of the Project on the existing transmission system.

8.0 POWER FLOW STUDY RESULTS

Power Flow Analysis was performed on the cases described above. The base cases were used to simulate the impact of the Project interconnection during normal and contingency operating conditions (TPL-001). Mitigation of any adverse changes in loading or voltage from pre- to post-Project was identified.

The contingencies simulated include:

- All transformers and transmission lines in the local area of the proposed Project.
- The proposed project.

The results of the power flow studies were evaluated using WECC/NERC planning standards and Idaho Power planning standards. The power flow analysis related evaluation criteria that were used are summarized below:

- All transmission facilities must remain within their thermal limits.
- Pre-contingency bus voltages within the study area must be between 0.95 per unit and 1.05 per unit.
- Maximum voltage deviation allowed at all buses under contingency conditions will be 8% for N-1 (NERC Category B).

Power flow solution was achieved for each of the N-1/N-2 outages simulated. Key findings from the power flow analysis are as follows:

- Overloading. There were no significant thermal violations on IPCo or NVE transmission systems in the power flow analysis.
    - For P2-3_BF RGSS 301A contingency (MPSN-RGSS 345kV line and Jackpot Solar (120 MW)), overloads occurred on all four GI #616 collector network 230/34.5kV transformers (101.1% - 104.4%).
- Voltage Deviation.
    - For P2-3_BF RGSS 301A contingency (MPSN-RGSS 345kV line and Jackpot Solar (120 MW)), one voltage deviation violation occurred in the NVE's transmission system.
- Voltage Violations.
    - ForP2-3_BF RGSS 302A contingency (MPSN-RGSS 345kV line and Jackpot Solar (120 MW)), 42 voltage violations occurred in the NVE's transmission system.
- Unsolved Contingencies.
    - L_MPSN_RGSS_345
    - P2-3_BF_MPSN 302A Internal Fault (MPSN-RGSS 345kV line and MPSN-KPRT 345kV line)
    - P2-3_BF_MPSN 303A Internal Fault (MPSN-RGSS 345kV line and MPSN T342 345/230kV transformer)
    - P2-3_BF RGSS 301A contingency (MPSN-RGSS 345kV line and GI #549 (100 MW))
    - P7_MPSN_RGSS_345 & HUNT-MPSN_230 CS (Common Structure)

From this power flow/contingency analysis, approximate 250^+ MW Project generation tripping by a Remedial Action Scheme (RAS) was required to resolve the one unacceptable and five unsolved contingencies for loss of the Rogerson Switching Station-Midpoint 345kV line. The RAS will be required for ERIS integration. And 350+ MW of generation tripping most likely will be required when both the Newmont and Valmy units are modeled off-line (unavailable for dynamic reactive support) from a sensitivity study performed. A joint study (Idaho Power, Nevada Energy, and [redacted], [redacted]) will be required to determine the final functionality/requirements/specifications of the GI #616 Generation Tripping RAS for loss of the Rogerson Switching Station-Midpoint 345kV line.

9.0 COST ESTIMATE

In Table 2 below a summary is provided of the facilities and conceptual costs required to facilitate the ERIS of [redacted] project, GI #616:

GI #616 [redacted] Project **Energy Resource Interconnection Service Facilities**	
Direct Assigned:	**Cost**
Approximately 33% of a new RGSS 345kV Line Terminal for GI #616 Standard one-breaker 345kV line terminal with revenue metering	$987,761
GI #616 Generation Tripping Remedial Action Scheme	Costs Not Included
Network Assigned:	
Approximately 67% of a new RGSS 345kV Line Terminal for GI #616 Standard one-breaker 345kV line terminal with revenue metering	$1,975,521
RGSS 345kV 35MVAr Shunt Reactor 35 MVAr 345kV shunt reactor, 345kV breaker, 345kV air-break switch, protection, etc.	$4,270,593
Subtotal	**$7,233,821**
Contingencies (~20.0%) (1)	$1,446,764
Subtotal	**$8,680,585**
Overheads (~6.25%) (2)	$542,537
ERIS – Total Estimated Cost (3)	**$9,223,122**

Table 2: Conceptual Cost Estimate

(1) Contingency is added to cover the unforeseen costs in the estimate. These costs can include unidentified design components, material cost increases, labor estimate shortfalls, etc.

(2) Overhead costs cover the indirect costs associated with the Project.

(3) This cost estimate includes direct equipment, material, labor, overheads, and contingency as shown.

- Note that these estimates do not include the cost of the customer's equipment/facilities or required communication circuits for SCADA, PMU, and metering.
- Note that the overhead rates are subject to change during the year.

- These are estimated costs only and final charges to the customer will be based on the actual construction costs incurred.
- These are non-binding conceptual level cost estimates that will be further refined upon the request and completion of the Facility Study.

The schedule for designing, procuring, and constructing facilities will be developed and optimized during the Facility Study should the generation interconnection customer choose to move to that study phase of the interconnection process.

10.0 VOLTAGE STABILITY ANALYSIS

A Voltage Stability study was performed using the WECC 2023 Heavy Summer base case (23HS3a) with Path 16 N-S stressed 525 MW (105%) respectively. And the total generation of the three projects (Jackpot Solar, GI #549, and GI #614) was increased to 1070 MW (105%). All contingencies, including the previously identified one unacceptable and five unsolved contingencies with 250 MW of generation tripping modeled, solved successfully so there were no Voltage Stability issues found for the Project.

11.0 TRANSIENT STABILITY ANALYSIS

The WECC 2023 Heavy Summer base case (23HS3a) and PowerWorld Simulator version 22 analysis tool were used to perform the transient stability analysis.

The following three transient stability simulations were run:

- 4-cycle 3-Phase Fault, Loss of Rogerson Switching Station-Midpoint 345kV Line w/ 350 MW Generation Tripping @ 15 cycle
- 4-cycle 3-Phase Fault, Loss of Rogerson Switching Station-Midpoint 345kV Line w/ 575 MW Generation Tripping @ 15 cycle
- 4-cycle 3-Phase Fault, Loss of Rogerson Switching Station-Humboldt 345kV Line

From the post-transient power flow analysis, loss of the Rogerson Switching Station-Midpoint 345kV line required approximately 350 MW of Project generation tripping to obtain acceptable results. For the transient stability analysis, the loss of the Rogerson Switching Station-Midpoint 345kV line was simulated with a 4-cycle 3-phase fault with a conservative total RAS generation tripping time of 15-cycles. The 350 MW generation tripped assumed tripping two GI #616 230kV lines with their respective set of wind and BESS generation. However, with tripping only 350 MW of Project generation by RAS, its performance was transient stability oscillatory unacceptable.

With tripping another GI #616 230kV line with its respective wind and BESS generation ~ 575 MW of total generation, the simulation was stable and damped, but with a highly questionable MW response from the only two remaining wind and BESS generation plants.

The 4-cycle 3-phase fault loss of the Rogerson Switching Station-Humboldt 345kV line simulation was stable and damped. During the simulation, the Hill Top 230kV shunt reactor was automatically tripped, and the Warner 115kV shunt capacitor was automatically inserted.

For these three transient stability simulations, plots have been included in Appendix B – Transient Stability Plots.

A joint study (Idaho Power, Nevada Energy, and [redacted], [redacted]) will be required to determine the final functionality/requirements/specifications of the GI #616 Generation Tripping RAS for loss of the Rogerson Switching Station-Midpoint 345kV line.

It is the responsibility (per NERC Standards) of the Generator Owner to ensure the modeling data utilized accurately reflects inverter operations, and to provide updates to Idaho Power if testing or real-time observations indicate a need.

12.0 DESCRIPTION OF OPERATING REQUIREMENTS

The installed reactive power capability of the Project must have a power factor operating range of 0.95 leading to 0.95 lagging at the POI over the range of real power output. At full output of 800 MW, the Project would need to be able to provide approximately +/- 263 MVAr reactive support plus the reactive energy consumed by the customer's own facilities.

The Project will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power's Grid Operations. The Project is required to install a plant controller for managing the real and reactive power output of the 800 MW Project at the POI.

The Project is required to comply with the applicable Voltage and Current Distortion Limits found in IEEE Standard 519-1992 *IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems*.

Additional operating studies will be required for prior planned and/or forced outages of the Midpoint-Rogerson Switching Station, Humboldt-Coyote Creek, and Valmy-Coyote Creek 345kV lines. Because the N-1-1 outages of the Midpoint-Rogerson Switching Station 345kV line and the Humboldt-Coyote Creek 345kV line or the Valmy-Coyote Creek 345kV line will strand the Humboldt-Rogerson Switching Station 345kV line and the three Rogerson Switching Station generation projects on NVE's underlying 120kV transmission network. Most likely outcome of this analysis is only a minimal amount of generation can remain on-line when one of these three 345kV lines is out-of-service.

13.0 CONCLUSIONS

The requested interconnection of the [redacted] project, GI #616, to Idaho Power's Rogerson Switching Station 345kV ring-bus was studied.

The Project can be interconnected to the existing Rogerson Switching Station 345kV ring-bus with the identified transmission/station system upgrades and approximate 575 MW Project generation tripping RAS for loss of the Rogerson Switching Station-Midpoint 345kV line. The results from the power flow, short-circuit, voltage stability, and transient stability analyses confirm that the interconnection of the Project with the identified upgrades/RAS should not have a significant impact on the local transmission system.

Interconnection requirements detailed in Section 9.0 totaling **$9,223,122** are required to interconnect the Project for Energy Resource Interconnection Service at the proposed Rogerson Switching Station 345kV Bus POI.

Generator interconnection service (either as an Energy Resource Interconnection Service or a Network Resource Interconnection Service) does not in any way convey any right to deliver electricity to any specific customer or point of delivery.

APPENDIX A

A-1.0 Method of Study

The SIS plan inserts the Project up to the maximum requested injection into the selected Western Electric Coordinating Council (WECC) power flow case and then, using Power World Simulator or GE's Positive Sequence Load Flow (PSLF) analysis tool, the impacts of the new resource on PacifiCorp's transmission system (lines, transformers, etc.) within the study area are analyzed. The WECC and Idaho Power reliability criteria and Idaho Power operating procedures were used to determine the acceptability of the configurations considered. For distribution feeder analysis, Idaho Power utilizes Advantica's SynerGEE Software.

A-2.0 Acceptability Criteria

The following acceptability criteria were used in the power flow analysis to determine under which system configuration modifications may be required:

> The continuous rating of equipment is assumed to be the normal thermal rating of the equipment. This rating will be as determined by the manufacturer of the equipment or as determined by Idaho Power and PacifiCorp. Less than or equal to 100% of continuous rating is acceptable.
>
> Idaho Power's Voltage Operating Guidelines were used to determine voltage requirements on the system; this specifies, in part, that distribution voltages, under normal operating conditions, are to be maintained within plus or minus 5% (0.05 per unit) of nominal everywhere on the feeder. Therefore, voltages greater than or equal to 0.95 pu voltage and less than or equal to 1.05 pu voltage are acceptable.
>
> Voltage flicker during starting or stopping the generator is limited to 5% as measured at the POI, per Idaho Power's T&D Advisory Information Manual.
>
> Idaho Power's Reliability Criteria for System Planning was used to determine proper transmission system operation.
>
> All customer generation must meet IEEE 519 and ANSI C84.1 Standards.
>
> All other applicable national and Idaho Power standards and prudent utility practices were used to determine the acceptability of the configurations considered.
>
> The stable operation of the system requires an adequate supply of volt-amperes reactive (VAr) to maintain a stable voltage profile under both steady-state and dynamic system conditions. An inadequate supply of VArs will result in voltage decay or even collapse under the worst conditions.

Equipment/line/path ratings used will be those that are in use at the time of the study or that are represented by Idaho Power or PacifiCorp upgrade projects that are either currently under construction or whose budgets have been approved for construction in the near future. All other potential future ratings are outside the scope of this study. Future transmission changes may, however, affect current facility ratings used in the study.

A-3.0 Grounding Guidance

Idaho Power requires interconnected transformers to limit their ground fault current to 20 amps at the POI.

A-4.0 Electrical System Protection Guidance

Idaho Power requires electrical system protection per Requirements for Generation Interconnections found on the Idaho Power Web site,

http://www.idahopower.com/pdfs/BusinessToBusiness/facilityRequirements.pdf

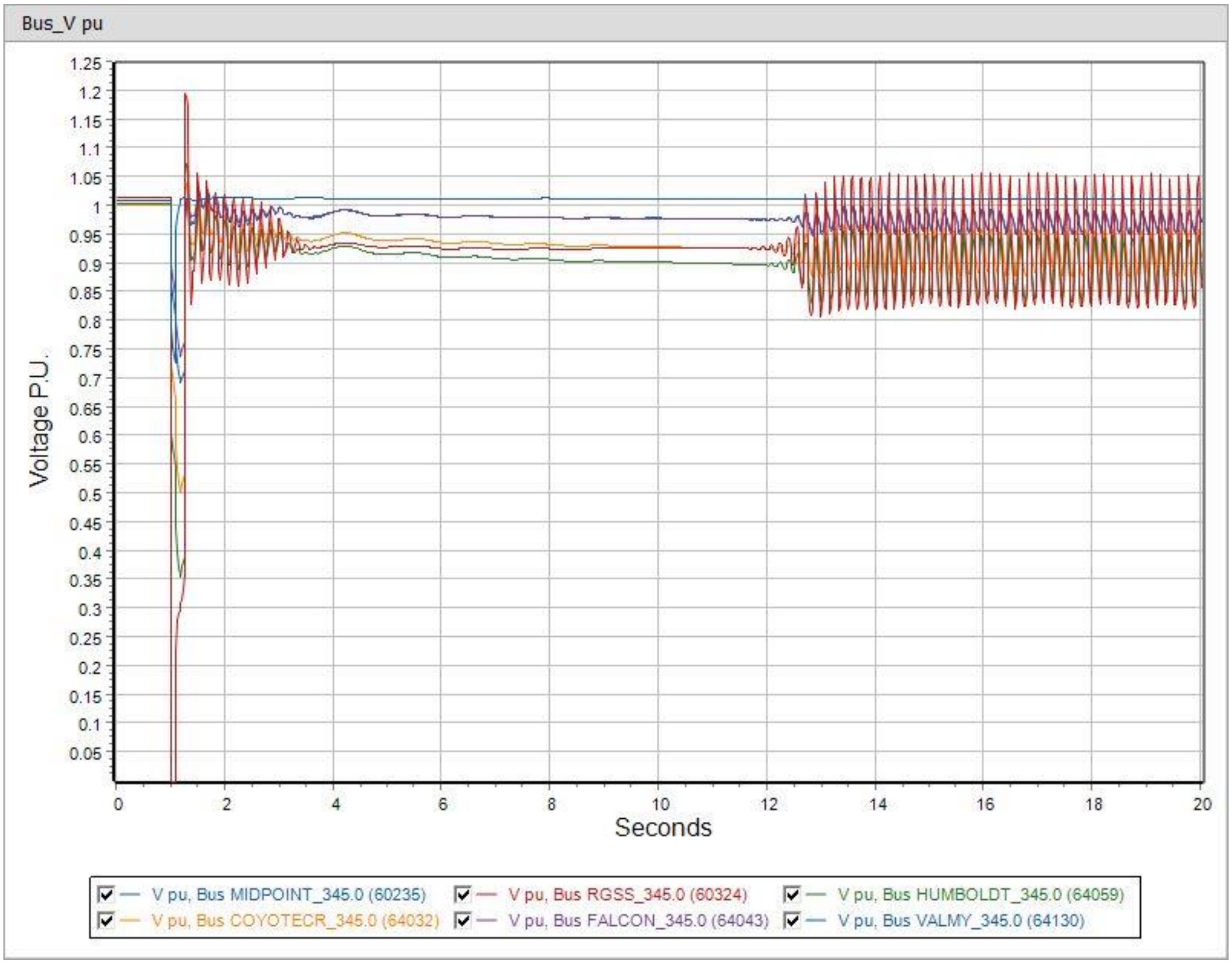
A-5.0 WECC Coordinated Off-Nominal Frequency Load Shedding and Restoration Requirements

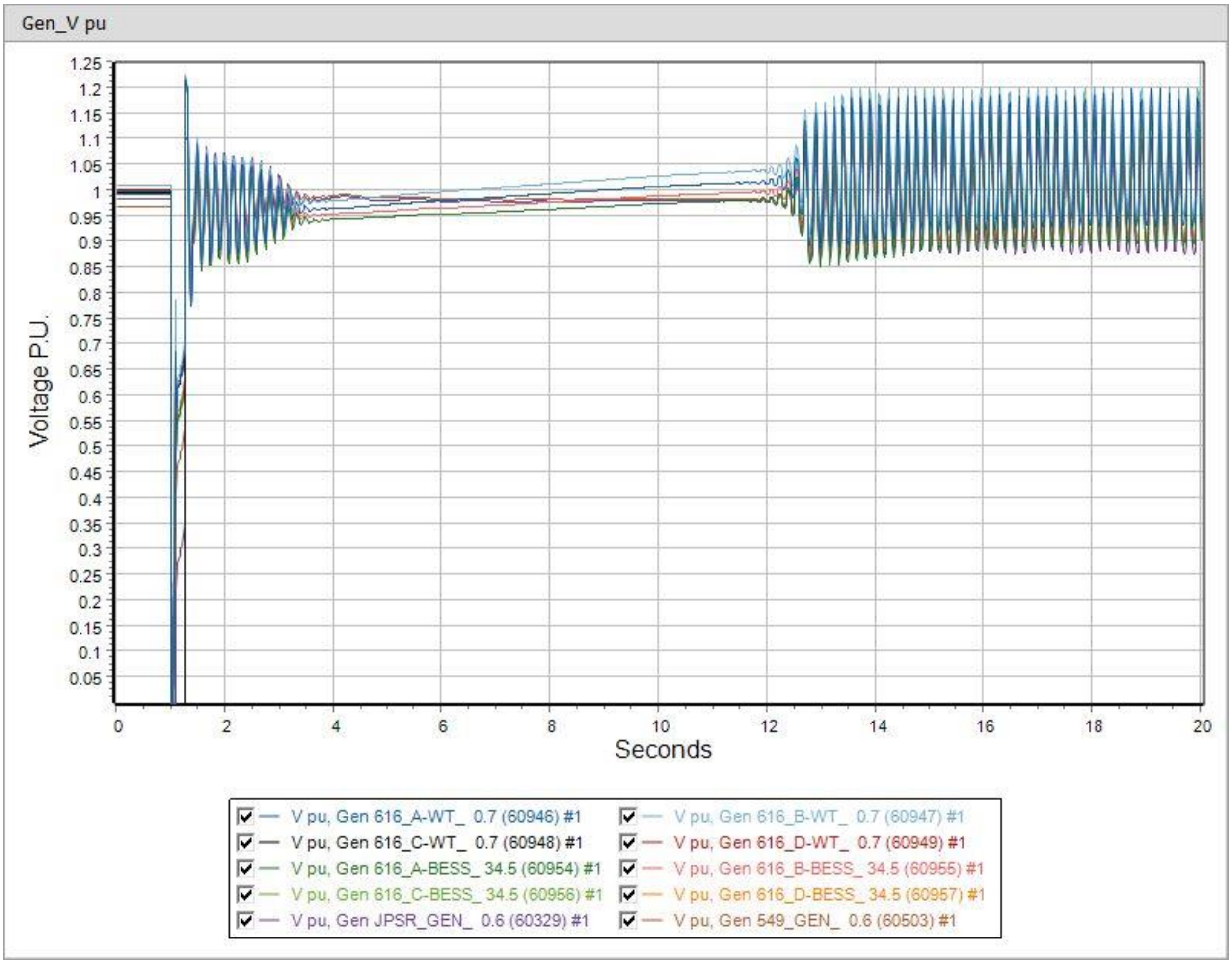
Idaho Power requires frequency operational limits to adhere to WECC Under-frequency and Over-frequency Limits per the WECC Coordinated Off-Nominal Frequency Load Shedding and Restoration Requirements available upon request.

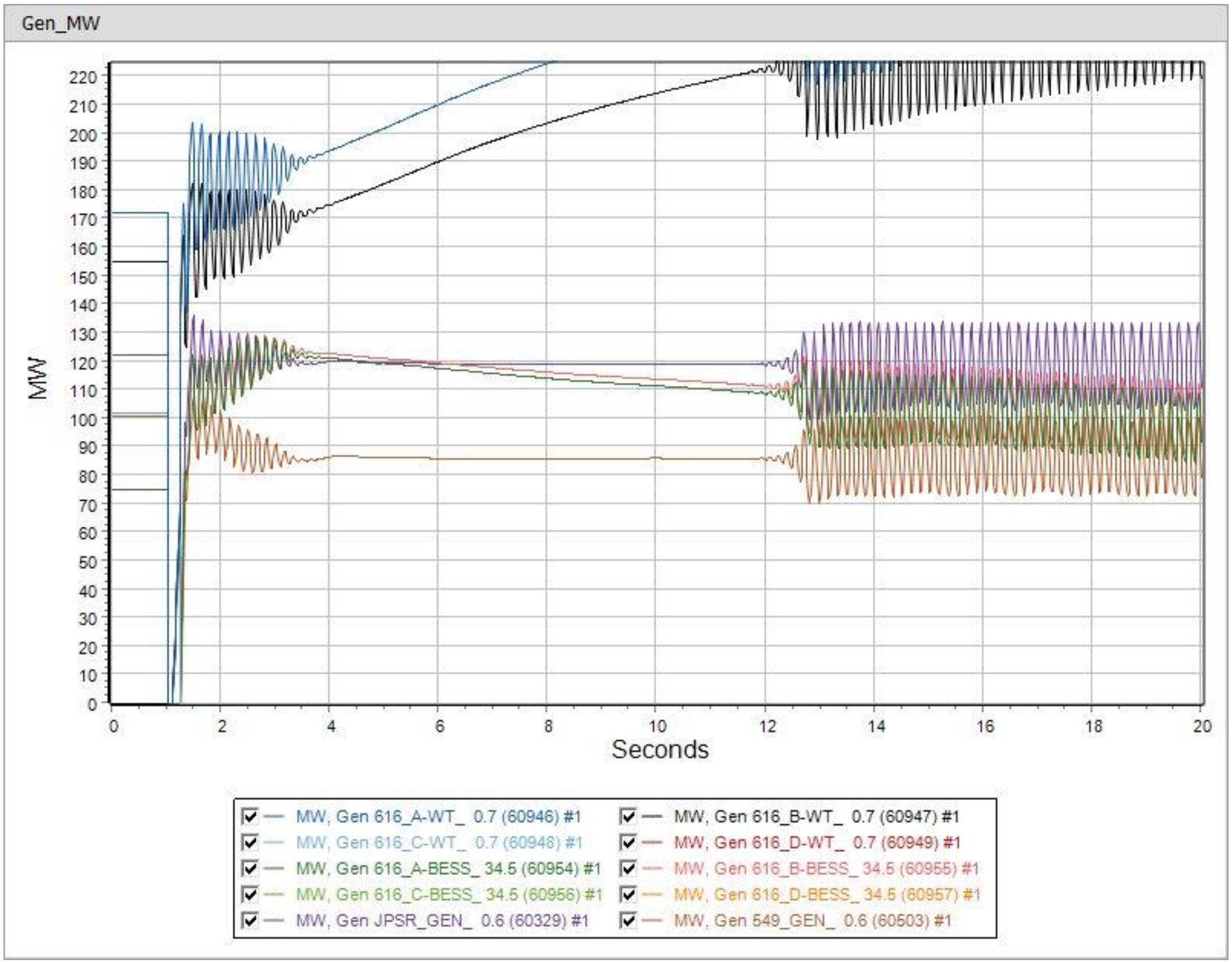
http://www.idahopower.com/pdfs/BusinessToBusiness/facilityRequirements.pdf

APPENDIX B – TRANSIENT STABILITY PLOTS

B-1.0 4-Cycle 3-Ph Loss of RGSS-MPSN 345kV Line w/ 350 MW Gen. Tripping




Gen_V pu
Voltage P.U.
Seconds
V pu, Gen 616_A-WT_ 0.7 (60946) #1
V pu, Gen 616_B-WT_ 0.7 (60947) #1
V pu, Gen 616_C-WT_ 0.7 (60948) #1
V pu, Gen 616_D-WT_ 0.7 (60949) #1
V pu, Gen 616_A-BESS_ 34.5 (60954) #1
V pu, Gen 616_B-BESS_ 34.5 (60955) #1
V pu, Gen 616_C-BESS_ 34.5 (60956) #1
V pu, Gen 616_D-BESS_ 34.5 (60957) #1
V pu, Gen JPSR_GEN_ 0.6 (60329) #1
V pu, Gen 549_GEN_ 0.6 (60503) #1


Gen_MW
MW
Seconds
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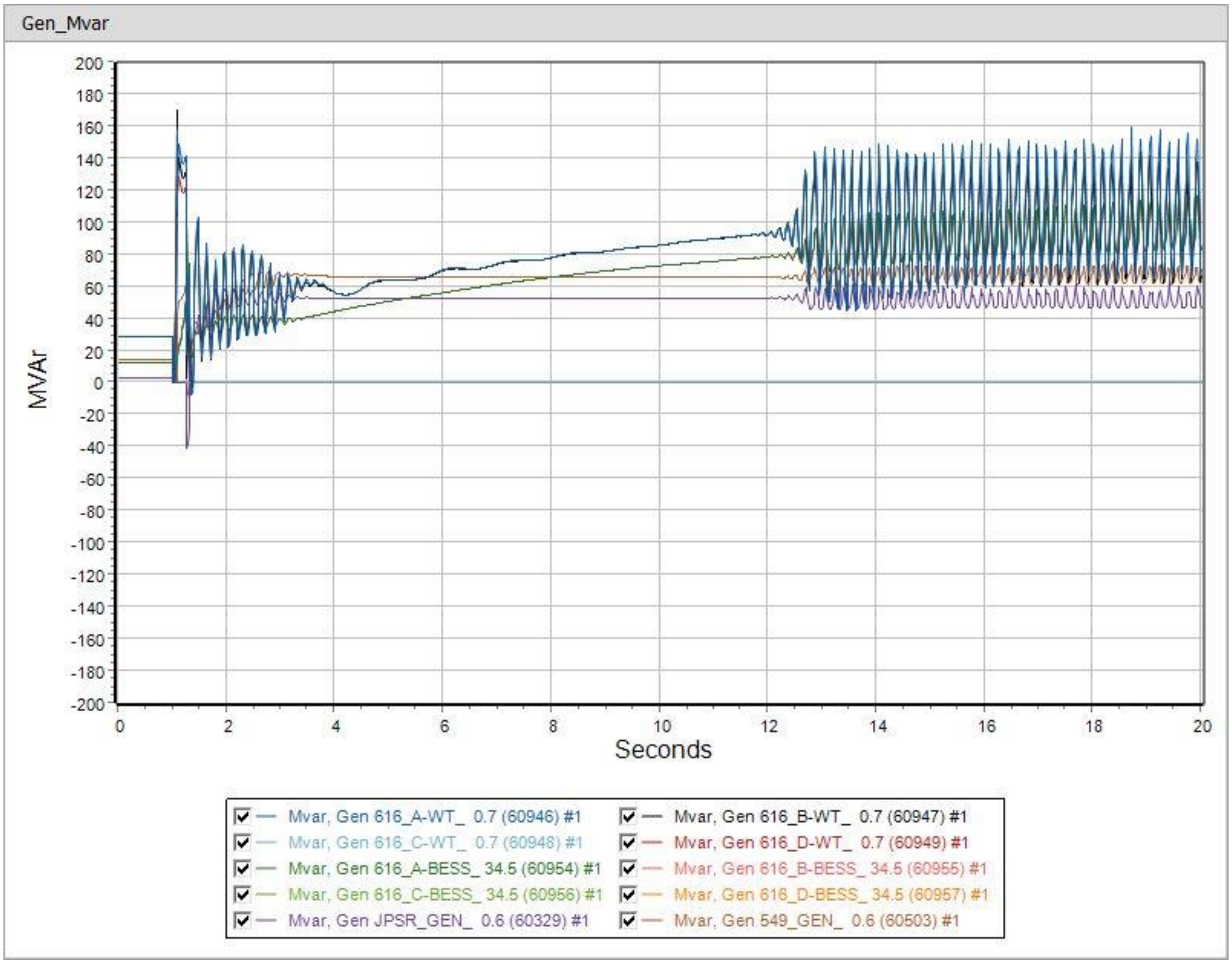
MW, Gen 616_B-WT_ 0.7 (60947) #1
MW, Gen 616_C-WT_ 0.7 (60948) #1
MW, Gen 616_D-WT_ 0.7 (60949) #1
MW, Gen 616_A-BESS_ 34.5 (60954) #1
MW, Gen 616_B-BESS_ 34.5 (60955) #1
MW, Gen 616_C-BESS_ 34.5 (60956) #1
MW, Gen 616_D-BESS_ 34.5 (60957) #1
MW, Gen JPSR_GEN_ 0.6 (60329) #1
MW, Gen 549_GEN_ 0.6 (60503) #1



Gen_Mvar
MVAr
Seconds
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
0
2
4
6
8
10
12
14
16
18
20
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Mvar, Gen 616_B-WT_ 0.7 (60947) #1
Mvar, Gen 616_C-WT_ 0.7 (60948) #1
Mvar, Gen 616_D-WT_ 0.7 (60949) #1
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Mvar, Gen 616_C-BESS_ 34.5 (60956) #1
Mvar, Gen 616_D-BESS_ 34.5 (60957) #1
Mvar, Gen JPSR_GEN_ 0.6 (60329) #1
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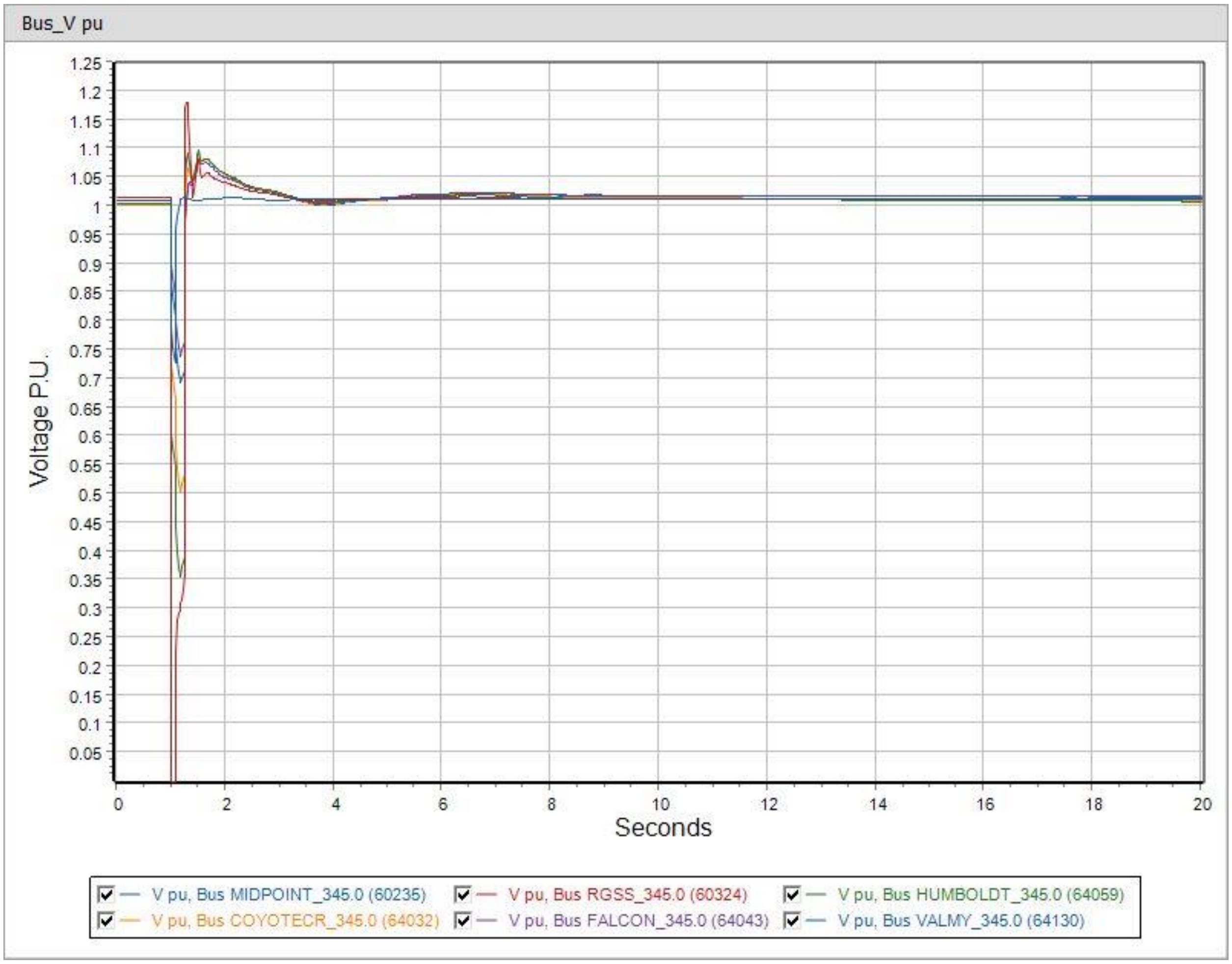
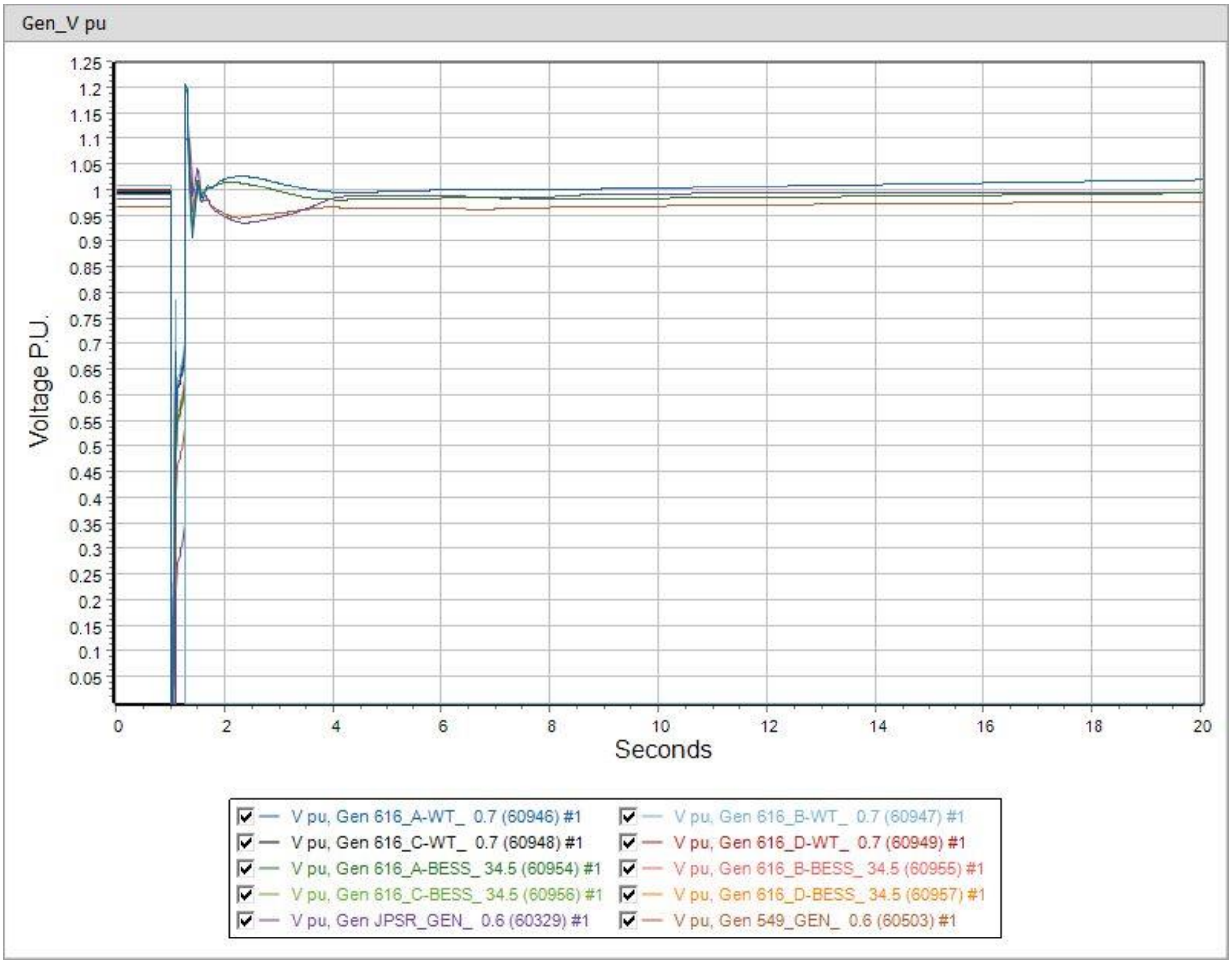
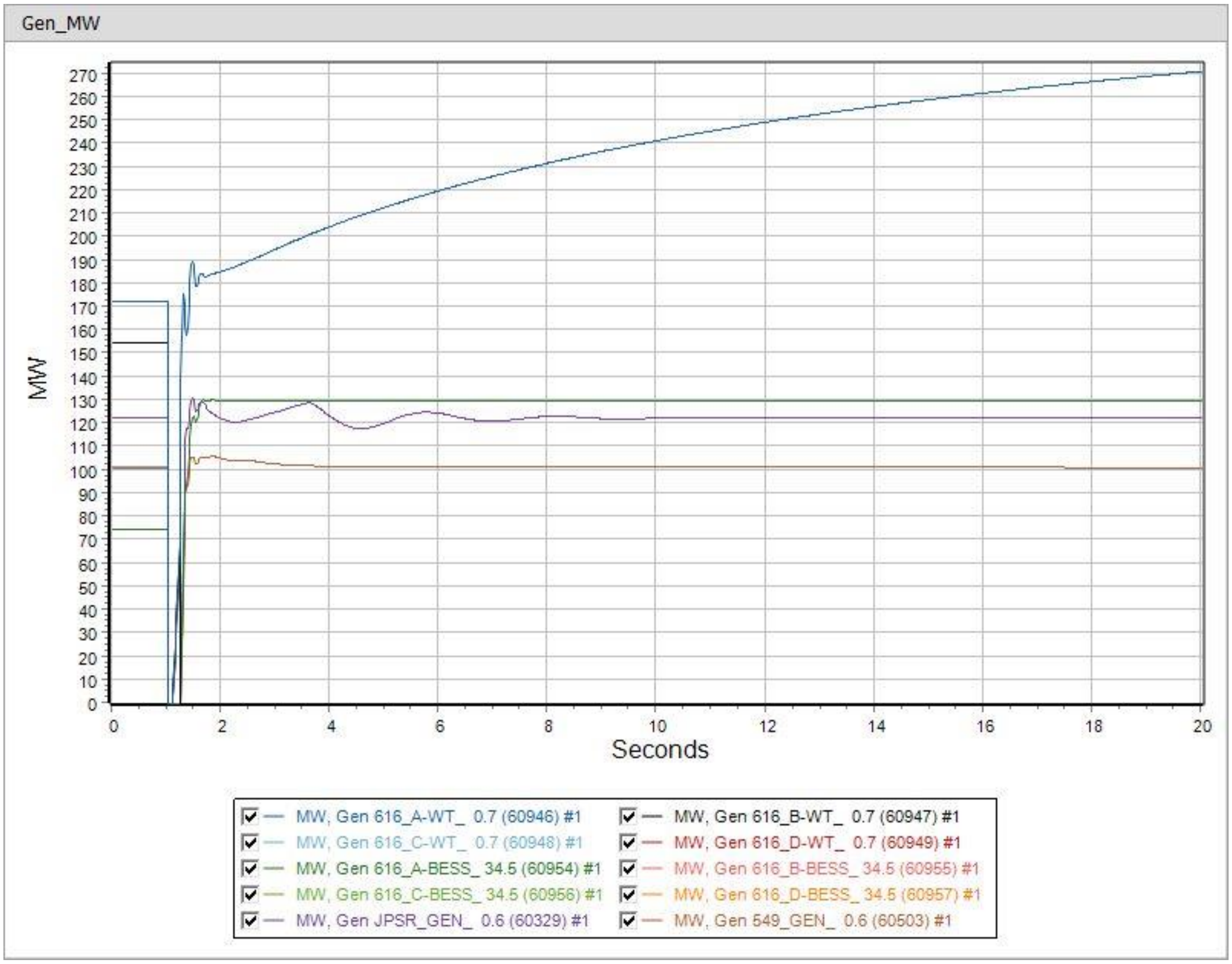
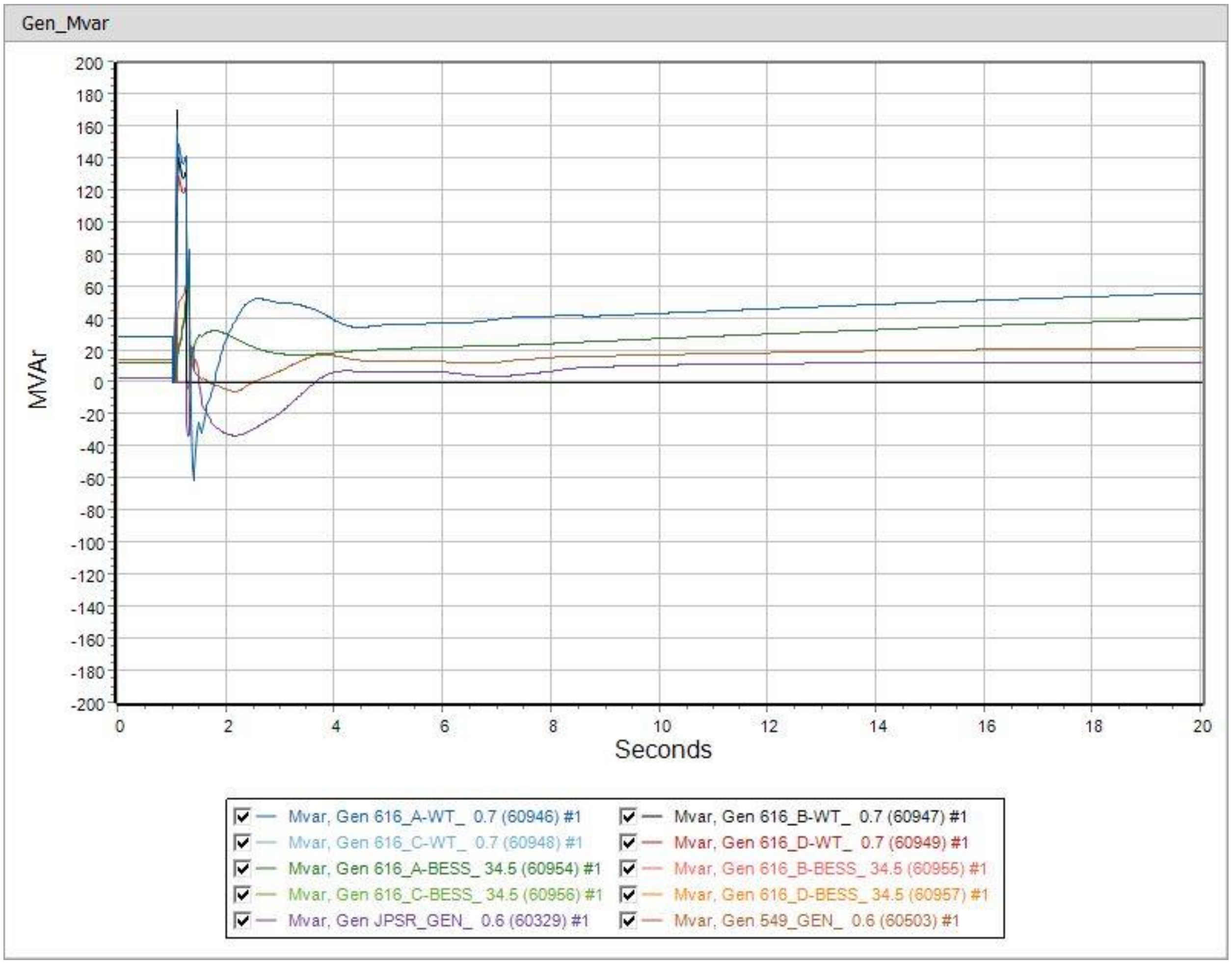
B-2.0 4-Cycle 3-Ph Loss of RGSS-MPSN 345kV Line w/ 575 MW Gen. Tripping





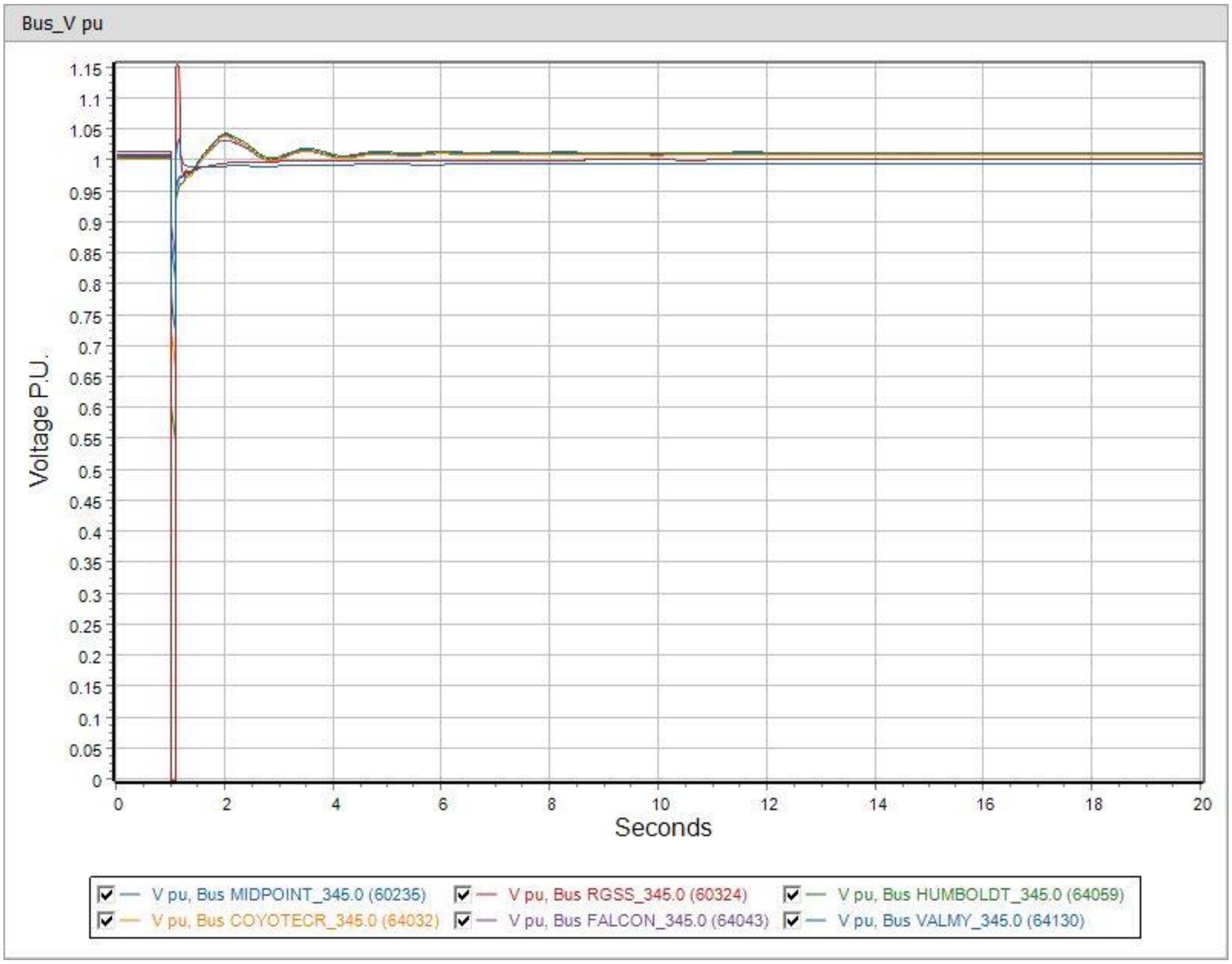
Gen_V pu
Voltage P.U.
Seconds
V pu, Gen 616_A-WT_ 0.7 (60946) #1
V pu, Gen 616_B-WT_ 0.7 (60947) #1
V pu, Gen 616_C-WT_ 0.7 (60948) #1
V pu, Gen 616_D-WT_ 0.7 (60949) #1
V pu, Gen 616_A-BESS_ 34.5 (60954) #1
V pu, Gen 616_B-BESS_ 34.5 (60955) #1
V pu, Gen 616_C-BESS_ 34.5 (60956) #1
V pu, Gen 616_D-BESS_ 34.5 (60957) #1
V pu, Gen JPSR_GEN_ 0.6 (60329) #1
V pu, Gen 549_GEN_ 0.6 (60503) #1

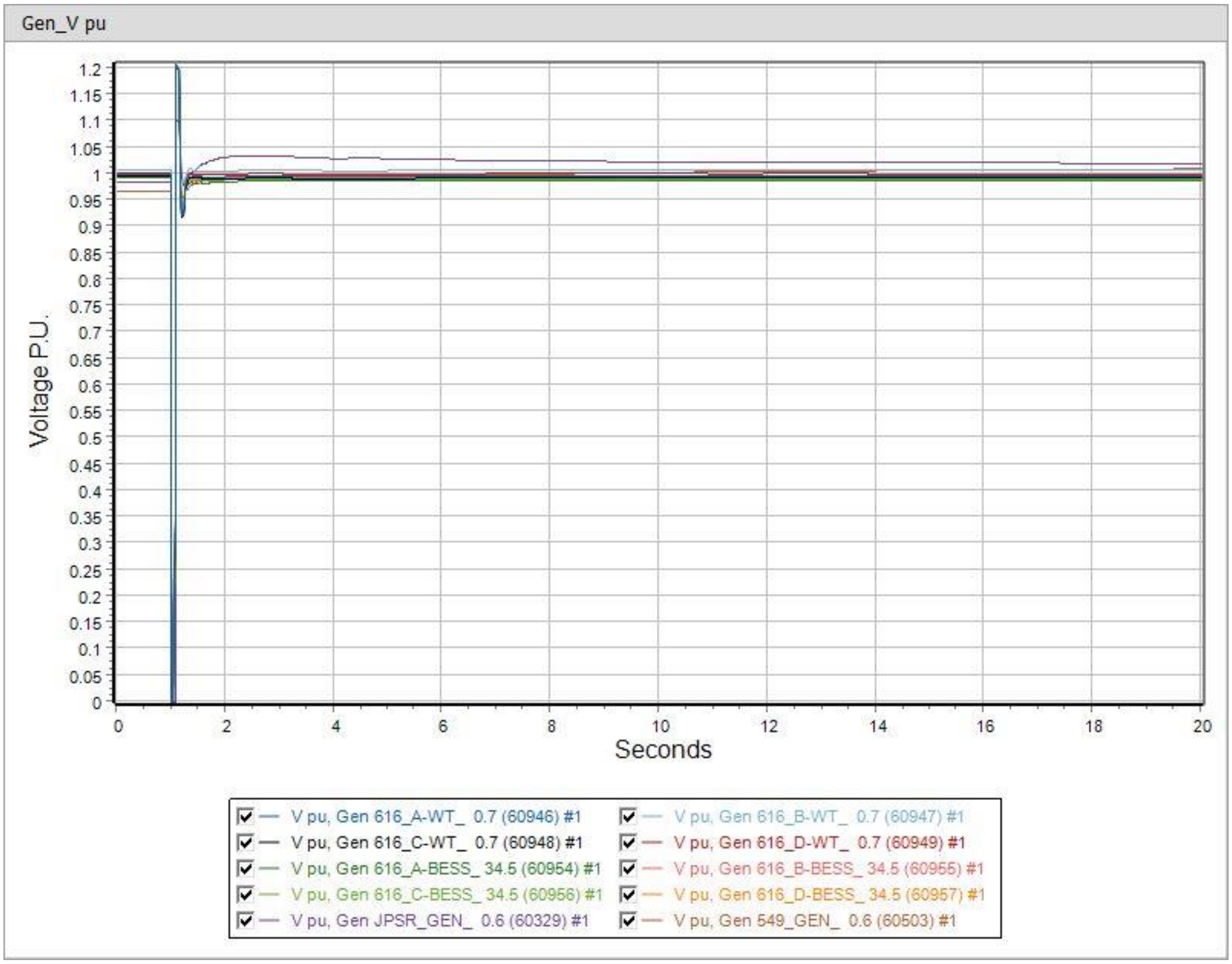

Gen_MW
MW
Seconds
0
2
4
6
8
10
12
14
16
18
20
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
MW, Gen 616_A-WT_ 0.7 (60946) #1
MW, Gen 616_B-WT_ 0.7 (60947) #1
MW, Gen 616_C-WT_ 0.7 (60948) #1
MW, Gen 616_D-WT_ 0.7 (60949) #1
MW, Gen 616_A-BESS_ 34.5 (60954) #1
MW, Gen 616_B-BESS_ 34.5 (60955) #1
MW, Gen 616_C-BESS_ 34.5 (60956) #1
MW, Gen 616_D-BESS_ 34.5 (60957) #1
MW, Gen JPSR_GEN_ 0.6 (60329) #1
MW, Gen 549_GEN_ 0.6 (60503) #1

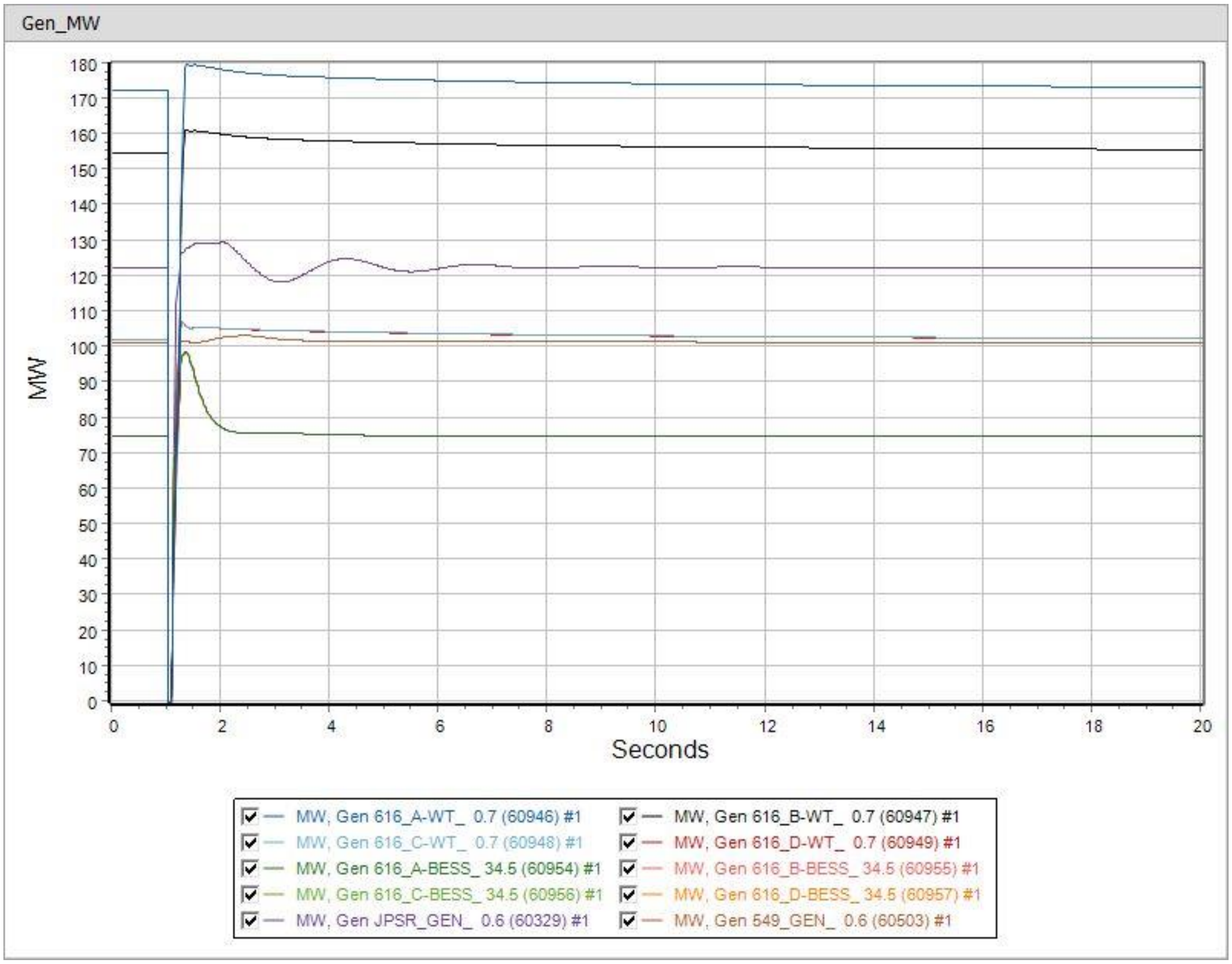


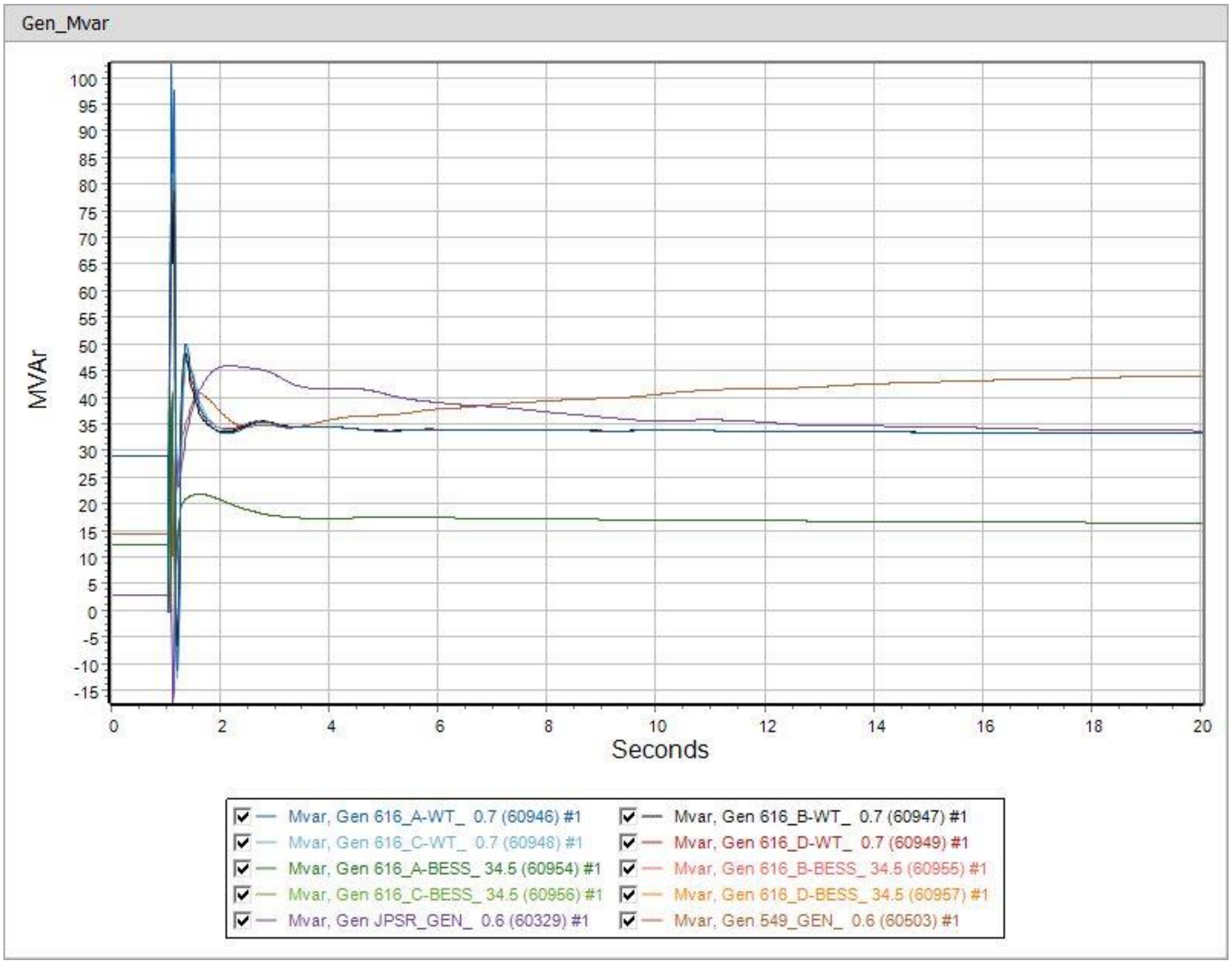
Gen_Mvar
MVAr
Seconds
Mvar, Gen 616_A-WT_ 0.7 (60946) #1
Mvar, Gen 616_B-WT_ 0.7 (60947) #1
Mvar, Gen 616_C-WT_ 0.7 (60948) #1
Mvar, Gen 616_D-WT_ 0.7 (60949) #1
Mvar, Gen 616_A-BESS_ 34.5 (60954) #1
Mvar, Gen 616_B-BESS_ 34.5 (60955) #1
Mvar, Gen 616_C-BESS_ 34.5 (60956) #1
Mvar, Gen 616_D-BESS_ 34.5 (60957) #1
Mvar, Gen JPSR_GEN_ 0.6 (60329) #1
Mvar, Gen 549_GEN_ 0.6 (60503) #1

B-3.0 4-Cycle 3-Ph Loss of RGSS-HMBT 345kV Line




Gen_V pu
Voltage P.U.
Seconds
V pu, Gen 616_A-WT_ 0.7 (60946) #1
V pu, Gen 616_B-WT_ 0.7 (60947) #1
V pu, Gen 616_C-WT_ 0.7 (60948) #1
V pu, Gen 616_D-WT_ 0.7 (60949) #1
V pu, Gen 616_A-BESS_ 34.5 (60954) #1
V pu, Gen 616_B-BESS_ 34.5 (60955) #1
V pu, Gen 616_C-BESS_ 34.5 (60956) #1
V pu, Gen 616_D-BESS_ 34.5 (60957) #1
V pu, Gen JPSR_GEN_ 0.6 (60329) #1
V pu, Gen 549_GEN_ 0.6 (60503) #1


Gen_MW
MW
Seconds
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
MW, Gen 616_A-WT_ 0.7 (60946) #1
MW, Gen 616_B-WT_ 0.7 (60947) #1
MW, Gen 616_C-WT_ 0.7 (60948) #1
MW, Gen 616_D-WT_ 0.7 (60949) #1
MW, Gen 616_A-BESS_ 34.5 (60954) #1
MW, Gen 616_B-BESS_ 34.5 (60955) #1
MW, Gen 616_C-BESS_ 34.5 (60956) #1
MW, Gen 616_D-BESS_ 34.5 (60957) #1
MW, Gen JPSR_GEN_ 0.6 (60329) #1
MW, Gen 549_GEN_ 0.6 (60503) #1


Gen_Mvar
MVAr
Seconds
Mvar, Gen 616_A-WT_ 0.7 (60946) #1
Mvar, Gen 616_B-WT_ 0.7 (60947) #1
Mvar, Gen 616_C-WT_ 0.7 (60948) #1
Mvar, Gen 616_D-WT_ 0.7 (60949) #1
Mvar, Gen 616_A-BESS_ 34.5 (60954) #1
Mvar, Gen 616_B-BESS_ 34.5 (60955) #1
Mvar, Gen 616_C-BESS_ 34.5 (60956) #1
Mvar, Gen 616_D-BESS_ 34.5 (60957) #1
Mvar, Gen JPSR_GEN_ 0.6 (60329) #1
Mvar, Gen 549_GEN_ 0.6 (60503) #1