ORIGINAL

0000168104

Jason Y. Moyes, No. 025864
Jay I. Moyes, No. 07207
MOYES SELLERS & HENDRICKS LTD.
1850 N. Central Avenue, Suite 1100
Phoenix, Arizona 85004
(602)-604-2139
(602)-604-2106
jasonmoyes@law-msh.com
jimoyes@law-msh.com
Attorneys for White Wing Ranch North, LLC

RECEIVED
2016 JAN 29 P 4: 21
AZ CORP COMMISSION
DOCKET CONTROL

BEFORE THE ARIZONA CORPORATION COMMISSION

COMMISSIONERS

DOUG LITTLE, ACTING CHAIRMAN
BOB STUMP
TOM FORESE
BOB BURNS

Arizona Corporation Commission
DOCKETED
JAN 29 2016
DOCKETED BY

IN THE MATTER OF WHITE WING RANCH NORTH, LLC'S TEN YEAR PLAN	Docket No. E-00000D-15-0001 **NOTICE OF FILING TEN YEAR PLAN**

In accordance with Section 40-360.02 of the Arizona Revised Statutes, White Wing Ranch North, LLC, files its Ten Year Plan for the substation and gen-tie transmission facilities associated with the proposed White Wing Solar Project, including the System Impact Study prepared with respect to such facilities.

////

DATED this 29th day of January, 2016.

MOYES SELLERS & HENDRICKS LTD.

Jason Y. Moyes
Jay I. Moyes
Attorneys for White Wing Ranch North, LLC

Original and 13 copies filed this
29th day of January, 2016:

Docket Control
Arizona Corporation Commission
1200 West Washington Street
Phoenix, Arizona 85007

WHITE WING RANCH NORTH, LLC
Ten Year Plan
For Proposed Transmission Facilities
(in-service as early as 2018)

Line Description	White Wing Solar Project Substation and Gen-tie Line

Size

• Voltage	34.5/500kV step up transformers and approximately 3 miles of 500kV AC gen-tie transmission line from the high side of the step up transformer to the existing Hoodoo Wash Substation adjacent to the Agua Caliente solar facility in Yuma County, AZ.
• Capacity	Gen-tie will only serve an estimated 200MW photovoltaic solar generating facility.
• Point of Origin	A 34.5/500kV substation to be constructed at the White Wing Solar Project, a photovoltaic solar generating facility proposed for development on approximately 1,450 gross acres located north of and adjacent to the existing Agua Caliente solar facility, north of Palomas Road between Avenue 66E and Avenue 68E, Dateland, Yuma County, Arizona.
• Termination Point	The existing Hoodoo Wash Substation.
• Length	Approximately 3 miles, depending upon the final route and location of the new substation within the proposed White Wing Solar Project.
• General Route	TBD. See attached map of proposed routes. The gen-tie line will run generally from the new substation to be located on the White Wing Solar Project, southerly approximately 3 miles directly into the existing Hoodoo Wash Substation.
• Purpose	The new step-up substation and gen-tie line will interconnect the proposed White Wing Solar Project generation with the regional transmission grid at the existing Hoodoo Wash Substation.

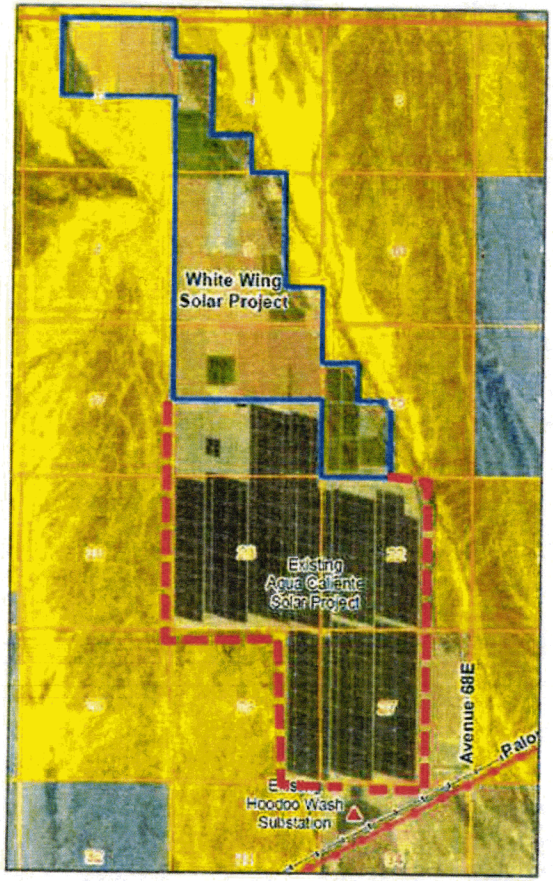
Date

- Estimated Construction Start — TBD [As early as Q-1 of 2017]
- Estimated In-Service — TBD [As early as Q-4 of 2018]
- Is Certificate Necessary? — Yes, for substation and 500kV gen-tie.

System Impact Study: See attached System Impact Study Report prepared for Arizona Public Service Company by Utilities System Efficiencies, Inc.

END

Project Interconnection



White Wing
Solar Project

- Interconnection to existing Hoodoo Wash Substation located south of Agua Caliente solar site
- Line would be routed around east side or west side of the existing Agua Caliente solar project

Q225 White Wing Ranch Solar Generator Interconnection Project

System Impact Study

APS Contract No. 52790

By

Arizona Public Service Company
Transmission Planning

November 12, 2015
Version 1.1

Prepared by
Utility System Efficiencies, Inc.

Q225 SYSTEM IMPACT STUDY

TABLE OF CONTENTS

EXECUTIVE SUMMARY 2
1 Study Description and Assumptions 5
1.1 Post Project Case Modeling 5
1.2 Dynamic Data 8
1.3 Reliability Criteria 8
1.3.1 Power Factor Criteria 8
1.3.2 (Steady State) Power Flow/Post-Transient Criteria 8
1.3.3 Transient Stability Criteria 8
2 Study Methodology 10
2.1 Power Factor Requirements 10
2.2 Power Flow/Post-Transient 10
2.3 Transient Stability 11
3 Results and Findings 12
3.1 Reactive Support 12
3.2 Power Flow/Post-Transient Analysis 12
3.3 Transient Stability Analysis 14
3.4 Short Circuit / Fault Duty Analysis 14
3.5 Results & Findings Summary 15
4 Cost & Construction Time Estimates 16

LIST OF APPENDICES

Appendix A – Power Flow Diagrams
Appendix B – List of Contingencies
Appendix C – Transient Stability Data
Appendix D – Transient Stability Plots
Appendix E – Thermal Loading Summary
Appendix F – Voltage Violations Summary
Appendix G – WATS Voltage Violations Summary

EXECUTIVE SUMMARY

This section summarizes the System Impact Study (SIS) results for a proposed photovoltaic generation interconnection of 200 MW in the Arizona Public Service (APS) operated transmission system. Additional specific details of the proposed interconnection's impact on the surrounding transmission system can be found in the "Results and Findings" section of this report.

Disclaimer

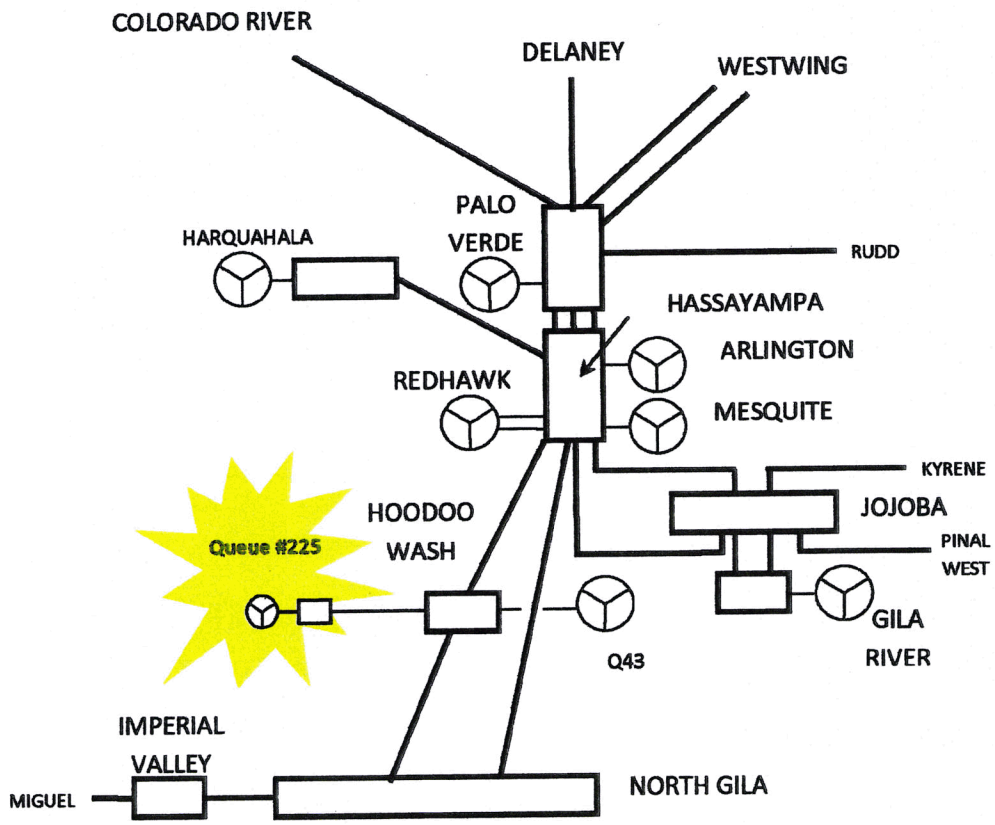
Nothing in this report constitutes an offer of transmission service or confers upon the Interconnection Customer (IC) any right to receive transmission service. APS and other interconnected utilities may not have the Available Transmission Capacity (ATC) to support the interconnection described in this report. It should also be noted that all results for the SIS are highly dependent upon the assumed topology and timing of new projects in the vicinity of the interconnection, which are subject to change.

Throughout the region, utilities have noticed harmonic distortions being created by some renewable generation projects. No studies have been performed to pre-determine if a project will create harmonics, but after the fact evaluations are often performed to evaluate the performance of the generation projects. If harmonics are found to be created by this project and or injected to the transmission system in excess of industry standards, the project will be required to resolve the concern to the satisfaction of the transmission owners at the POI.

Background:

APS, as operating agent of the Hoodoo Wash 500 kV switchyard, received a valid large generator interconnection request for a proposed interconnection to Hoodoo Wash 500 kV switchyard. On behalf of, and with the oversight of APS, Utility System Efficiencies, Inc. (USE) performed a SIS under the APS Tariff. The interconnection request was assigned queue position #225. The Applicant has proposed to add solar photo-voltaic generation with a maximum net output of 200 MW, connecting directly to the Hoodoo Wash 500 kV switchyard in the fourth quarter of 2018.

Figure E.1 illustrates this proposed interconnection and the nearby transmission facilities.



This SIS used the machine parameters and characteristics provided by the Applicant.

Studies consisted of computer-based power flow/post-transient, transient stability, and short-circuit/fault duty analyses. This study modeled the proposed generation interconnection under anticipated 2019 summer peak conditions. Select contingencies which stressed the transmission system were simulated. Power flow/post-transient and transient stability results were monitored for APS, SRP, and other neighboring systems.

System performance criteria used in the study:
The criteria applied in this study are consistent with NERC/WECC Reliability Criteria. For more detailed information on the criteria used for each analysis see section 1.3 "Reliability Criteria."

The APS Open Access Transmission Tariff (OATT) policy regarding power factor requires all Interconnection Customers, with the exception of wind generators, to maintain an acceptable power factor (typically near unity) at the Point of Interconnection (POI), subject to system conditions. The APS OATT also requires Interconnection Customers to be able to achieve +/- 0.95 power factor at the POI, with the maximum "full-output" Var capability available at all outputs. Furthermore, APS requires Interconnection Customers to have dynamic voltage control (operational time of less than 5 seconds) and maintain the voltage as specified by the transmission operator within the limitation of +/- 0.95 power factor, as long as the Project is online and generating. If the Project's equipment is not capable of this type of response, a dynamic reactive device will be required. APS has the right to disconnect the Project if system conditions dictate the need to do so in order to maintain system reliability.

Results:
The results of the SIS indicate that the addition of Q225 does not create any new thermal or fault duty overloads or voltage violations but it does increase existing loadings on some facilities that have shown to

have pre-project excessive loadings and/or fault duties. This is mainly due to the methodology used to dispatch the power to California. Most all of these concerns occur in California and it is assumed a more detailed evaluation is being performed in the CAISO lead interconnection study.

The Western Arizona Transmission System (WATS) technical study group reviewed the results and the only notable comment was that because of the problems shown in California, the Imperial Irrigation District's (IID) affected utility study process would have to be entered into by the generation customer.

The project as designed is not able to meet the power factor requirements at this time. An additional 54.44 MVar of reactive support is necessary to compensate for losses prior to the POI.

Table 1.1: Summary of Project Interconnection Cost and Lead Times

Facility	Costs ($000,000)	Timeline (months)
Q225 Trans. Provider's Interconnection Facilities	1.5	18
Network Upgrades	1.6	18
Deferred Network Upgrades	1.6	N/A
Grand Total	4.7	18

1 Study Description and Assumptions

This section of the report provides details pertaining to the power flow case development and an overview of the major study assumptions. All power flow, transient stability and post-transient study work was completed using General Electric's Positive Sequence Load Flow (GE-PSLF), version 18.1_02.

The study used the 2019 Heavy Summer APS detailed planning case "sm19#28.sav". This case has undergone review and updates by all of the Arizona utilities for planning purposes.

Pre- and post-project base cases were developed. The new generation was offset with schedules to California (78% SCE & 22% LADWP).

Sensitivities were run for the following scenarios. Pre- and Post-project cases were developed for each scenario.

1) Addition of the Delaney-Colorado River 500 kV line
2) Addition of Q219
3) High East of River flows

1.1 *Post Project Case Modeling*

Requestor Q225 was represented in the power flow model as a two units 106.4/102.6 MW connected to 0.55 kV buses. Two transformers step the voltage up from 0.55kV to 34.5kV. The equivalent collector system impedances are modeled and another two transformers step the voltage up from 34.5kV to 500kV. The project was connected via a single 2.0 mile 500kV line to Hoodoo Wash 500kV switchyard. **Figure 1-1** represents the Q225 power flow model.

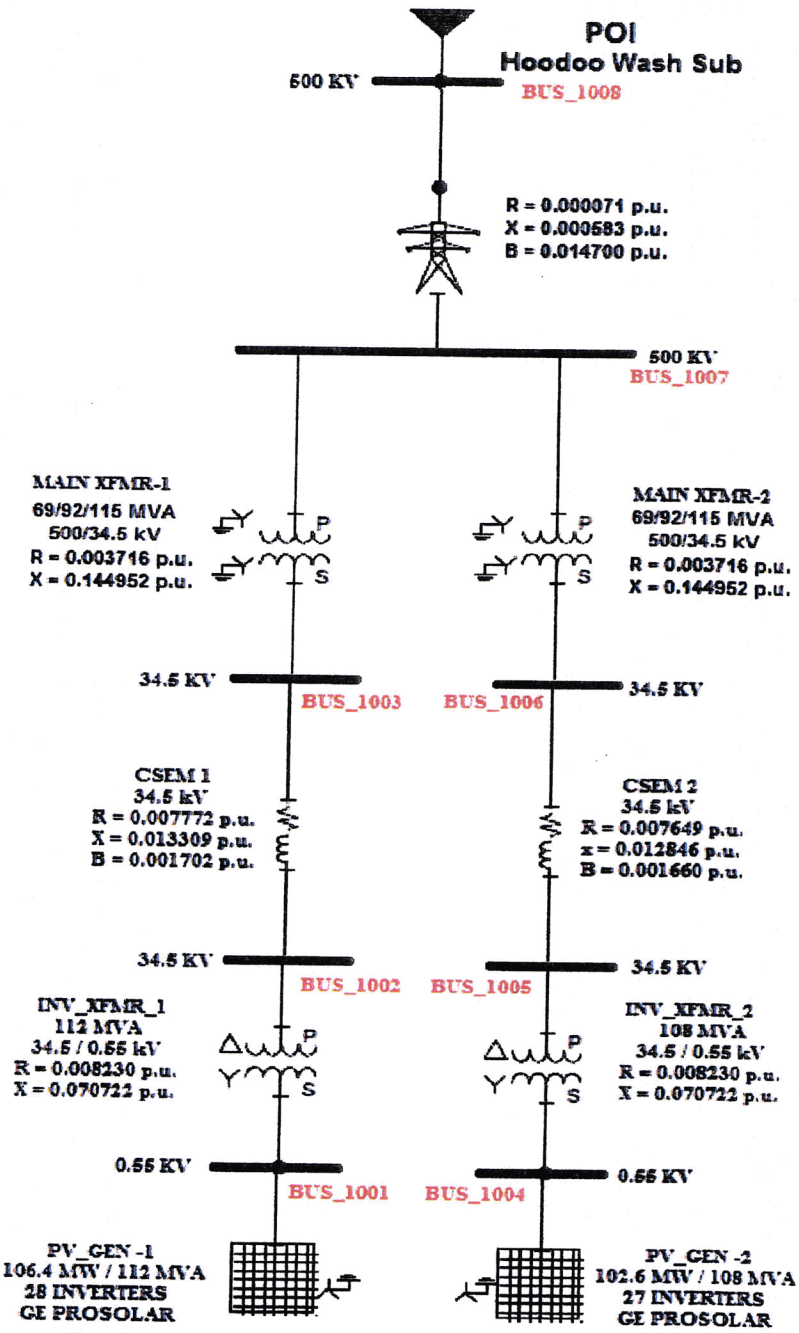


Figure 1-1: Q225 Power Flow Model

<u>Power scheduled to California</u>

- 78% of the power scheduled to SCE
- 22% of the power scheduled to LADWP

Power flow diagrams of the transmission system along with the new generation interconnection are provided in **Appendix A. Table 1.2** summarizes the case attributes for each scenario.

Table 1.2: 2019 Case Attributes

Major Branch Flows	Pre-Project	Post-Project	Increment	Pre-Project DLCR	Post-Project DLCR	Increment	Pre-Project Q219	Post-Project Q219	Increment	Pre-Project EOR	Post-Project EOR	Increment
Path 46 WOR	5,886	6,070	184	5,153	5,316	184	5,886	6,072	184	8,610	8,797	184
Path 49 EOR	3,581	3,621	40	2,884	2,903	19	3,545	3,585	40	10,081	10,085	4
Navajo-Crystal 500 kV	980	1,001	21	942	960	18	840	860	20	1,616	1,642	26
Eldorado-Moenkopi 500 kV	814	836	22	768	788	20	737	759	22	1,690	1,719	29
Navajo-Dugas 500kV	538	520	-18	578	562		366	348		-233	-255	
Moenkopi-Cedar Mountain 500kV	477	456	-21	519	500	-19	329	309	-20	-413	-439	-26
Yavapai-Westwing 500kV	309	289	20	349	331	18	177	158	18	-453	-479	26
Perkins-Mead 500 kV	-39	1	40	-127	-89	38	46	86	40	1,919	1,974	55
Navajo-Moenkopi 500kV	540	537	-3	540	538	-2	267	265	-2	379	376	-3
Four Corners-Moenkopi 500kV	764	768	4	758	762	4	810	814	4	915	920	5
N.Gila-Imperial Valley 500kV	1,382	1,437	55	1,303	1,356	53	1,411	1,464	53	1,941	1,991	50
Hassayampa-N. Gila #2 500kV	658	604	-54	614	560	-54	673	619	-54	1,145	1,089	44
Hassayampa-Hoodoo Wash 500kV	617	530	-87	573	484	-89	632	545	-87	1,151	1,062	-89
Hoodoo Wash-N. Gila 500kV	899	1,012	113	855	967	112	914	1,027	113	1,145	1,256	112
Hassayampa-Palo Verde #1 500kV	642	683	41	676	718	42	691	731	40	973	1,019	46
Palo Verde-Colorado River #1 500kV	1,378	1,417	39	910	937	27	1,417	1,457	40	2,165	2,206	41
Colorado River-Red Bluff #1 500kV	679	698	19	835	859	24	698	717	19	1,057	1,076	19
Colorado River-Red Bluff #2 500kV	679	698	19	835	859	24	698	717	19	1,057	1,076	19
Red Bluff-Devers #1 500kV	678	697	19	833	857	24	697	716	19	1,054	1,073	19
Red Bluff-Devers #2 500kV	678	697	19	833	857	24	697	716	19	1,054	1,073	19
Morgan-Westwing 500kV	189	189	0	270	273	3	241	241	0	-144	-145	1
Palo Verde-Westwing #1 500kV	1,054	1,080	26	1,035	1,060	25	1,121	1,148	27	1,369	1,400	31
Control Area Information												
AZ Load	22,339	22,340		22,339	22,340		22,346	22,348		15,268	15,269	
AZ Losses	787	792		790	794		779	784		569	583	
AZ Generation	28,634	28,840		28,637	28,842		28,633	28,840		25,160	25,395	
AZ Exports	5,508	5,708		5,508	5,708		5,508	5,708		9,323	9,543	
Case	1	2		3	4		5	6		7	8	

1.2 Dynamic Data

Appendix C provides the transient stability model used in this study, and the details of these assumptions. Modeling for the new generation utilized machine characteristics provided by the Applicant. Dynamic data file "19hs21.dyd" was obtained from APS Transmission Planning. A stability plot of the flat run simulation is also provided in **Appendix D**.

1.3 Reliability Criteria

In general, an evaluation of the system reliability investigates the system's thermal loading capability, voltage performance (not too high or low), and transient stability (the system should not oscillate excessively and generators should remain synchronized). The evaluation of these criteria must be conducted for credible 'emergency' conditions, such as loss of a single or double circuit line, a transformer, or a generator. Performance of the transmission system and neighboring Control Areas were measured against the Western Electricity Coordinating Council (WECC) Reliability Standards and the North American Electric Reliability Corporation (NERC) Planning Standards described in the following subsections. The criteria for Category A (TPL-001, "All lines in service"), Category B (TPL-002, single element outage), and Category C (TPL-003, multiple element outage) conditions were explicitly applied both internally (within APS system) and to external Balancing Areas (where appropriate).

1.3.1 Power Factor Criteria

The study applies APS power factor criteria states that a generator must be capable of providing dynamic reactive support within the range of +/-0.95 power factor at the POI.

1.3.2 (Steady State) Power Flow/Post-Transient Criteria

Normal conditions

- All line loading must be less than 100% of the continuous (normal) thermal ratings.
- All transformer loading must be less than 100% of the continuous (normal) ratings.

Contingency Conditions

- For any contingency, no transmission element will be loaded above the emergency rating.
- Depending upon the type of analysis and applied case/sensitivity, applicable criteria for system performance will be identified. In some instances, resulting local circuit overloads and/or voltage deviations may be deemed acceptable per local criteria; as long as the local system's post-contingency performance does not result in cascading outages.
- Established loading limits and voltage performance for other neighboring utilities will be monitored.
- Voltage deviations at any bus must be no more than 5% for N-1 contingencies and no more than 10% for N-2.

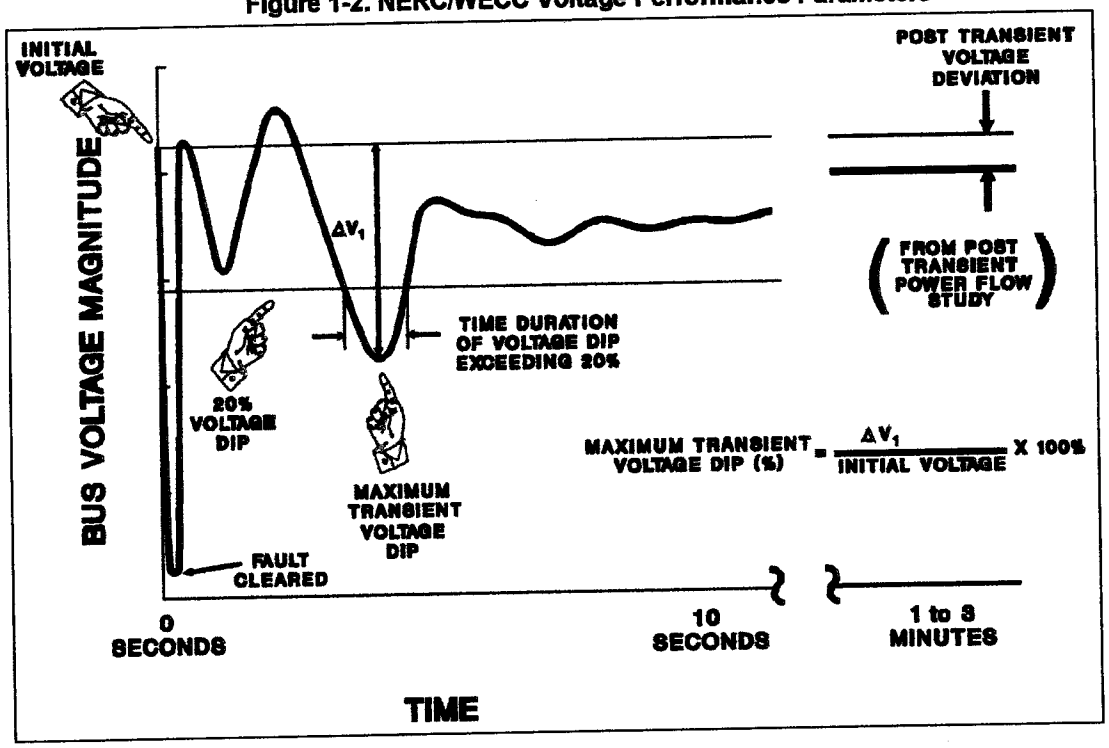
1.3.3 Transient Stability Criteria

The SIS applies reliability criteria contained within the WECC disturbance-performance table of allowable effects on other systems. **Table 1.3** and **Figure 1-2** are excerpts from the WECC Reliability Criteria.

Table 1.3: WECC Disturbance-Performance Table of Allowable Effects on Other Systems

NERC and WECC Categories	Outage Frequency Associated with the Performance Category (outage/year)	Transient Voltage Dip Standard	Minimum Transient Frequency Standard	Post Transient Voltage Deviation Standard
A System normal	Not Applicable	Nothing in addition to NERC		
B One element out-of-service	≥ 0.33	Not to exceed 25% at load buses or 30% at non-load buses. Not to exceed 20% for more than 20 cycles at load buses.	Not below 59.6Hz for 6 cycles or more at a load bus.	Not to exceed 5% at any bus.
C Two or more elements out-of-service	0.033 – 0.33	Not to exceed 30% at any bus. Not to exceed 20% for more than 40 cycles at load buses.	Not below 59.0Hz for 6 cycles or more at a load bus.	Not to exceed 10% at any bus.
D Extreme multiple-element outages	< 0.033	Nothing in addition to NERC		

Figure 1-2. NERC/WECC Voltage Performance Parameters



2 Study Methodology

This section summarizes the methods used to derive the power factor, power flow, post transient, and transient stability results. **Appendix B** details the contingencies simulated for the study.

2.1 Power Factor Requirements

The APS Open Access Transmission Tariff (OATT) policy regarding power factor requires all Interconnection Customers, with the exception of wind generators, to maintain an acceptable power factor (typically near unity) at the Point of Interconnection (POI), subject to system conditions. The APS OATT also requires Interconnection Customers to be able to achieve +/- 0.95 power factor at the POI, with the maximum "full-output" Var capability available at all outputs. Furthermore, APS requires Interconnection Customers to have dynamic voltage control (operational time of less than 5 seconds) and maintain the voltage as specified by the transmission operator within the limitation of +/- 0.95 power factor, as long as the Project is online and generating. If the Project's equipment is not capable of this type of response, a dynamic reactive device will be required. APS has the right to disconnect the Project from the power grid if system conditions dictate the need to do so in order to maintain system reliability.
The method for determining whether or not the generator meets these requirements is to first record the pre-project POI bus voltage. Next, model the generator with zero reactive capabilities at full output. Any shunt devices are turned off. Two synchronous condensers are added to the case with infinite reactive capability. One is at the terminal bus of the unit regulating the bus voltage to 1.0 pu. The other is one bus away from the POI regulating the POI to the pre-project voltage level. The amount of plant losses can be determined by recording the MVAR flow at the POI and adding that to the sum of the synchronous condenser output. Based on the maximum output of the plant, determine the minimum reactive capabilities required to meet the +/-0.95 power factor range. The sum of the two numbers determines the maximum amount of reactive support the project must provide.

2.2 Power Flow/Post-Transient

Power flow analysis considers a snapshot in time, focused on the first few minutes following an outage, where the transformer tap changers, SVDs and, the phase shifters have not adjusted, and all the system generation reacts by governor control to balance the system during each contingency scenario. All power flow/Post-Transient analysis was conducted with version 18.1_02 of General Electric's PSLF/PSDS/SCSC software. Power flow/Post-Transient results are monitored and reported for APS and other neighboring systems, including WAPA.

Power flow/Post-Transient analysis is used to evaluate the thermal and voltage performance of the system under Category A (TPL-001, all elements in service) and Category B (TPL-002, N-1, single contingency) conditions and Category C (TPL-002, N-2, multiple elements contingency) disturbances. The applicable WECC reliability planning criteria is listed below.

- Changes in bus voltages from pre- to post-contingency must be less than 5% for single contingencies.
- All equipment loadings must be below their normal ratings under normal conditions.
- All equipment loadings must be below their emergency ratings for single contingencies.
- Depending upon the type of analysis and applied case/sensitivity, applicable criteria for system performance will be identified. In some instances, resulting local circuit overloads and/or voltage deviations may be deemed acceptable per local criteria; as long as the local system's post-contingency performance does not result in cascading outages.

Thermal loading is reported when a modeled transmission element is loaded over 98% of its appropriate MVA rating modeled in the power flow database.

Transmission voltage violations for Category A (TPL-001, no contingency) conditions are reported where per unit voltages are less than 0.95 or greater than 1.05. For Category B outages (TPL-002, N-1) the voltage violations are reported when the post-contingency voltage deviation is greater than 5%. For Category C outages (TPL-003, N-2) the voltage violations are reported when the post-contingency voltage deviation is greater than 10%.

2.3 *Transient Stability*

Transient stability analysis is a time-based simulation that assesses the performance of the power system during (and shortly following) a contingency. Transient stability studies were performed to verify the system stability following a critical fault on the system. Prior to finalization of the power flow and dynamic data set, a flat–run is run to ensure true power system behavior is not masked by any remote dynamic modeling anomalies.

Transient stability analysis was performed based on WECC Disturbance-Performance Criteria for selected system contingencies. Initial transient stability contingencies are simulated out to 11 seconds to ensure a damped system performance. All simulated faults are assumed to be three-phase, unless otherwise noted. **Table 2.1** identifies the breaker clearing times for faults on different voltage levels.

Table 2.1 Breaker Clearing Times

Voltage Level	Breaker clearing times
69 kV	7-cycles
115/161 kV	6-cycles
230 kV	5-cycles
500 kV	4-cycles

All transient stability simulations were conducted using version 18.1_02 of General Electric's PSLF/PSDS/SCSC software.

The Worst Condition Analysis (WCA) tool, available in the PSDS software package, tracks and records the transient stability behavior of all output channels contained within the binary output file of a transient stability simulation. The monitoring of channel output was initiated two cycles after fault clearing, to ensure that all post-fault stability behavior would be captured. System damping was assessed visually with the aid of stability plots.

Parameters Monitored to Evaluate System Stability Performance:

Rotor Angle

Rotor angle plots provide a measure for determining how the proposed generation unit would swing with respect to other generating units in the area. This information is used to determine if a machine would remain in synchronism or go out-of-step from the rest of the system following a disturbance.

Bus Voltage

Bus voltage plots, in conjunction with the relative rotor angle plots, provide a means of detecting out-of-step conditions. The bus voltage plots are useful in assessing the magnitude and duration of post-disturbance voltage dips and peak-to-peak voltage oscillations. Bus voltage plots also give an indication of system damping and the level to which voltages are expected to recover in the steady state conditions.

Bus Frequency

Bus frequency plots provide information on magnitude and duration of post-fault frequency swings with the new project(s) in service. These plots indicate the extent of possible over-frequency or under-frequency, which can occur due to an area's imbalance between load and generation.

Other plotted Parameters

- Generator Active Power Output
- Generator Reactive Power Output

3 Results and Findings

This section provides the results obtained by applying the previous assumptions and methodology. It illustrates all findings associated with the power flow/post-transient and transient stability.

3.1 Reactive Support

The project does not satisfy the minimum power factor requirement. The project online at 200 MW requires a minimum of +/-65.74 MVAR capability at the POI to meet the +/-0.95 power factor requirement. The calculated plant losses are 57.4 MVAR. The aggregated inverter dynamic capability is +/-68.7 MVAR. The resultant capability at the POI is 11.3 MVAR. An additional 54.44 MVar of reactive support is required to meet the APS power factor requirement. A static capacitor bank can be added to compensate for the reactive losses.

3.2 Power Flow/Post-Transient Analysis

The power flow and post-transient analysis focuses on high load and generation conditions for summer of 2019. The Pre-Project cases are used as a baseline to measure the impact of the new generation.

Contingencies are then applied to the cases. A list of contingencies that were simulated is provided in **Appendix B.** Power flow plots from the Pre-Project and Post-Project cases are included in **Appendix A.**

Thermal Results

2019 Heavy Summer Case

Results indicate that there are multiple pre-project violations for this scenario. The addition of the Q225 project does not exacerbate any of the APS violations. There are lines in IID and SCE that have pre-project overloads and due to the method used to dispatch the power to California the loadings did increase slightly post-project. APS believes that these issues should be identified and remedied in the CAISO Cluster Study process and the IID affected utility study. A complete summary of the violations can be found in **Appendix E.**

2019 Heavy Summer Case w/Delaney-Colorado River 500kV Line

Results indicate that there are multiple pre-project violations for this scenario. The addition of the Q225 project does not exacerbate any of the APS violations. There are lines in IID and SCE that have pre-

project overloads and due to the method used to dispatch the power to California the loadings did increase slightly post-project. APS believes that these issues should be identified and remedied in the CAISO Cluster Study process and the IID affected utility study. A complete summary of the violations can be found in **Appendix E**.

2019 Heavy Summer Case w//Q219

Results indicate that there are multiple pre-project violations for this scenario. The addition of the Q225 project does not exacerbate any of the APS violations. There are lines in IID and SCE that have pre-project overloads and due to the method used to dispatch the power to California the loadings did increase slightly post-project. APS believes that these issues should be identified and remedied in the CAISO Cluster Study process and the IID affected utility study . A complete summary of the violations can be found in **Appendix E**.

2019 Case with High East of River Flows

Results indicate that there are multiple pre-project violations for this scenario. The addition of the Q225 project does exacerbate 3 of the APS violations but this is due to the method used to dispatch the power to California.

There are also lines in IID and SDG&E that have pre-project overloads and due to the method used to dispatch the power to California the loadings did increase slightly post-project. APS believes that these issues should be identified and remedied in the CAISO Cluster Study process and the IID affected utility study. A complete summary of the violations can be found in **Appendix E**.

Voltage Results

2019 Heavy Summer Case

Results indicate that there are both pre-project and post-project voltage violations for multiple contingencies in the Southwest. The addition of the Q225 project does not exacerbate the violations and in many cases the violations are reduced. A complete summary of the violations can be found in **Appendix F**.

2019 Heavy Summer Case w/Delaney-Colorado River 500kV Line

Results indicate that there are both pre-project and post-project voltage violations for multiple contingencies in the Southwest. The addition of the Q225 project does not exacerbate the violations and in many cases the violations are reduced. A complete summary of the violations can be found in **Appendix F**.

2019 Heavy Summer Case w//Q219

Results indicate that there are both pre-project and post-project voltage violations for multiple contingencies in the Southwest. The addition of the Q225 project does not exacerbate the violations and in many cases the violations are reduced. A complete summary of the violations can be found in **Appendix F**.

2019 Case with High East of River Flows

Results indicate that there are both pre-project and post-project voltage violations for multiple contingencies in the Southwest. While some of the violations look as though they are exacerbated by the addition of the Q225 project this is merely a symptom of the methodology used to dispatch the power to California. A complete summary of the violations can be found in **Appendix F**.

3.3 Transient Stability Analysis

One-Hundred-Sixty-Three (163) outages were selected for transient stability evaluation. As referenced in the Reliability Criteria section of this report, the system should meet the following transient stability performance criteria for a NERC/WECC Category 'B' disturbance (N-1):

- Transient voltage dip should not be below 25% at any load busses or 30% at any non-load busses at any time.
- The duration of a transient voltage dip greater than 20% should not exceed 20 cycles at load busses.
- The minimum transient frequency should not fall below 59.6 Hz for more than 6 cycles at load busses.

Appendix D contains transient stability plots of selected contingencies that provide a representative illustration of the transmission system's Post-Project voltage response.

Results indicate that there are four contingencies that cause transient stability violations in the pre- and post-project cases. These are known issues to APS and the addition of Q225 does not exacerbate the violation.

3.4 Short Circuit / Fault Duty Analysis

Short circuit analysis of the proposed generator was performed by APS, using the CAPE program and parameters supplied by the Applicant. Fault duties were calculated for both single-phase –to-ground and three-phase faults at substation busses in the immediate surrounding area before and after the proposed generator installation. The model also included the 2020 system representation which included the Hassayampa-North Gila 500kv line, the North Gila-Orchard 230kv project, the Hassayampa-Pinal West 500kV cutin to Jojoba, the Pinal West-Tortolita 500kV line and some local 69kv planned upgrades. The results presented here assume a "worst-case" scenario. The interconnection of the Q225 project does not cause any existing substation breakers to exceed their rating.

Some fault duty problems do exist at the Palo Verde/Hassayampa facilities and this project's impact upon the unknown new solution at the Palo Verde/Hassayampa may result in some required mitigation from this project. As the Transmission Operator and Planning Coordinator for Palo Verde and Hassayampa SRP, in coordination with the other participants, is in the process of performing a detailed analysis. At this point of time, they believe that any conclusions with regard of fault duties at Palo Verde and Hassayampa are premature. The interconnector Q225 is to be aware that high costs associated with mitigation of short circuit problems are probable and might be imposed on the interconnector. **Table 3.1** summarizes the results of the Short-Circuit analysis.

Table 3.1 Short Circuit Results

					Q225 (Hoodoo Wash 500kv Project)						
	Pre-Project				Post-Project						
Station	TPH (kA)	THEV X/R	SLG (kA)	THEV X/R	TPH (kA)	Inc (kA)	THEV X/R	SLG (kA)	Inc (kA)	THEV X/R	Min Brkr. Rating (kA)
Palo Verde 500 kV	60.5	28.0	64.6	20.2	60.6	0.1	28.1	64.7	0.1	20.2	63
Hassayampa 500 kV	60.6	28.3	63.9	19.5	60.7	0.1	28.4	64.1	0.2	19.5	63
Hoodoo Wash 500 kV	15.8	16.1	10.7	12.0	16.1	0.3	16.4	12.3	1.6	14.4	63
N.Gila 500 kV	15.7	15.2	9.6	9.1	15.9	0.2	15.2	9.9	0.3	9.1	40
N.Gila 230 kV	10.5	24.8	10.1	17.3	10.5	0	24.9	10.1	0	17.5	TBD
N.Gila 69 kV	20.1	9.3	22.4	10.4	20.1	0	9.3	22.4	0	10.4	31.5
Gila 161 kV	6.4	6.0	5.2	6.4	6.4	0	6.0	5.2	0	6.4	
Orchard 230 kV	7.5	15.5	6.9	12.5	7.5	0	15.5	6.9	0	12.5	TBD
Yucca 69 kV	31.1	14.1	35.9	13.5	31.1	0	14.1	35.9	0	13.5	40
Kyrene 500 kV	24.6	19.2	22.1	13.3	24.6	0	19.2	22.1	0	13.3	40

3.5 Results & Findings Summary

The results of the SIS indicate that the addition of Q225 does not create any overloads or voltage violations but it does increase existing loadings. This is mainly due to the methodology used to dispatch the power to California. The project as designed is not able to meet the power factor requirements at this time. An additional 54.44 MVar of reactive support is necessary to compensate for losses prior to the POI.

4 Cost & Construction Time Estimates

The cost estimates represent good faith estimates necessary to interconnect to the system. Not included in these estimates are the additional reactive needs of the project, nor any costs associated with the generator tie line after it leaves the switchyard, nor any potential obligations associated with Palo Verde and Hassayampa fault duty concerns. The non-binding, good faith cost and time estimates are tabulated below. The substation costs will consist of Network Upgrades, Deferred Network Upgrades and Transmission Providers Interconnection Facilities. Facility additions will generally consist of one new 500kV breaker, three new 500kV switches and the part of the generator tie line that is within the switchyard property. Deferred facilities will consist of one new 500kV breaker and two 500kV switches.

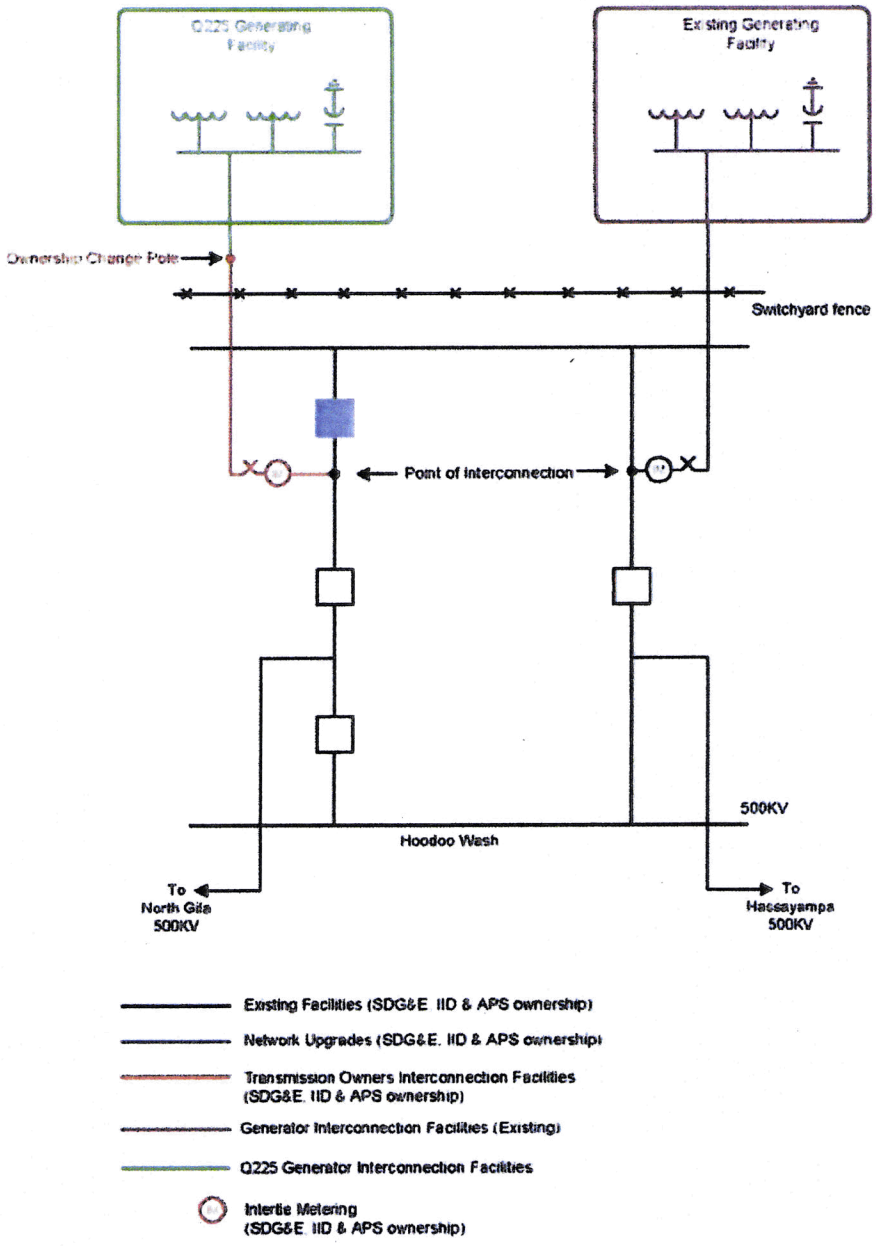
Table 4.1

Q225 Estimates				
Equipment Description	**Design Time (MO.)**	**Construction Time (MO.)**	**Network Upgrades ($000,000)**	**Transmission Providers Interconnection Facilities ($000,000)**
Hoodoo Wash: 500kV Switchyard Upgrades				
Transmission Provider's Interconnection Facilities	18	6	N/A	1.5
Network Upgrades	18	6	1.6	N/A
Deferred Network Upgrades	N/A	N/A	1.6	N/A
Palo Verde/Hassayampa: 500kV Switchyard				
Fault Duty Mitigation	Unknown	Unknown	Unknown	Unknown
Totals	**18**	**6**	**3.2**	**1.5**
Total Cost = $4,700,000 [1]				

[1] Shown costs do not include a potential future obligation to participate in fault duty mitigation at the Palo Verde and Hassayampa switchyards.

The Hoodoo Wash switchyard was designed to ultimately be a breaker-and-a-half layout. However, until there are a minimum of five terminations APS can operate the switchyard as a ring bus. With the existing three terminations and the Q225 project the switchyard will be operated as a 4 breaker ring. At the time a fifth termination is connected at the switchyard the ring bus will be required to become the full breaker-and-a-half layout. The additions required at the switchyard to convert from the four breaker ring to the full breaker-and-a-half layout are two new 500kV breakers and associated equipment. One of the new breakers will be the responsibility of the Q225 project. While there is no specific timeline for these costs, the Q225 project will be responsible for the cost to add one breaker and associated switches to expand the switchyard at time it is required. The estimated costs for the additions to the switchyard needed for the breaker-and-a-half of the switchyard are included in **Table 1.1** and **Table 4.1** and are shown in the line item designated as Deferred Network Upgrades. APS will provide notice to the Interconnection Customer at the time the requirement to convert the switchyard to a breaker-and-a-half layout is determined

Figure 4-1. Hoodoo Wash Switchyard



List of Acronyms

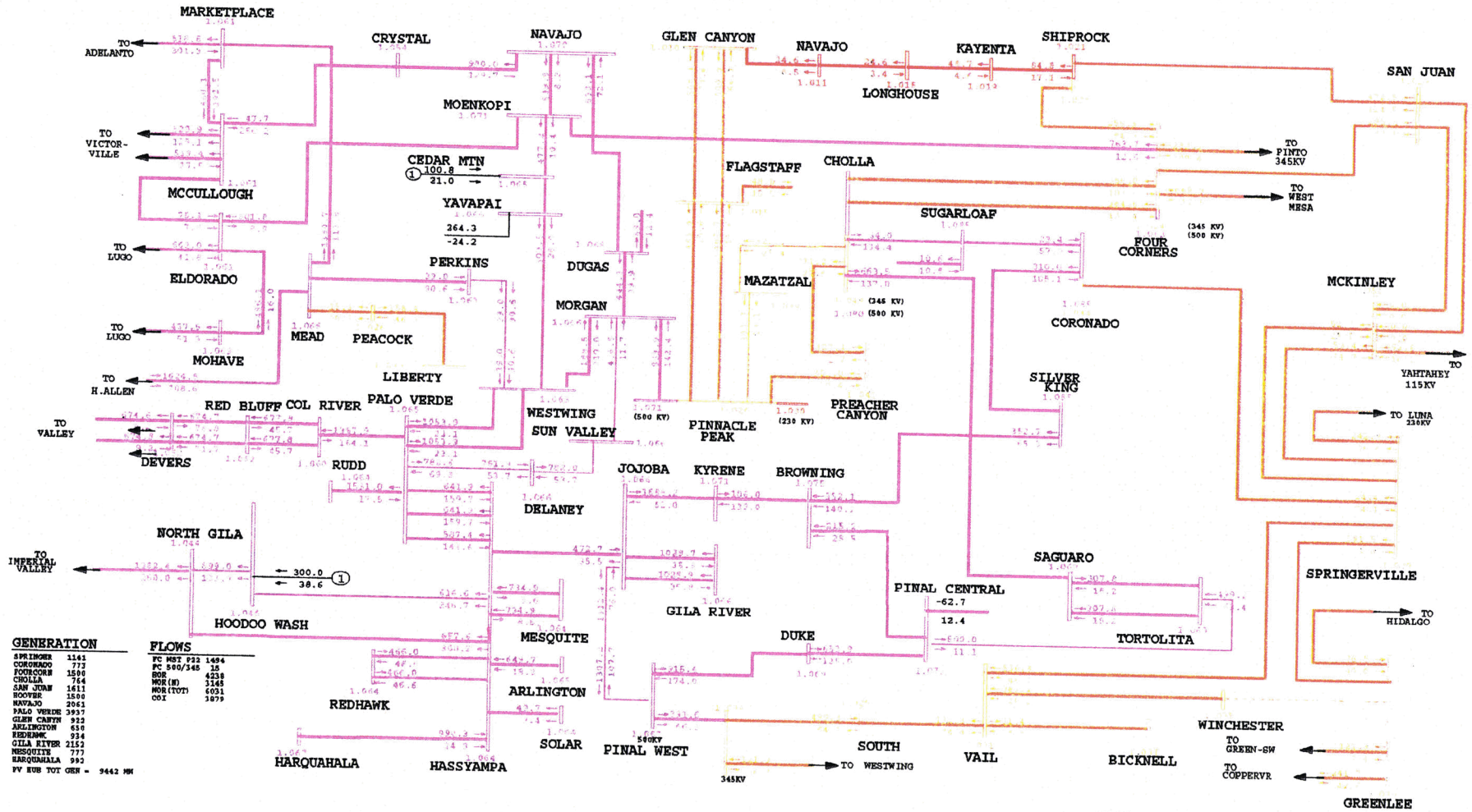
ACC	**Arizona Corporation Commission**
ACSS	Aluminum Conductor Steel Supported
ANPP	Arizona Nuclear Power Project
APS	Arizona Public Service
ATC	Available Transfer Capability
CAISO	California Independent System Operator Corporation
CAWCD	Central Arizona Water Conservation District
CCVT	Coupling Capacitor Voltage Transformer
COD	Commercial Operation Date
CSP	Concentrated Solar Power
CT	Combustion Turbine or Current Transformer
EPE	El Paso Electric
ER	Energy Resource
ERIS	Energy Resource Interconnection Service
FaS	Facilities Study
FERC	Federal Energy Regulatory Commission
FeS	Feasibility Study
GT	Gas Turbine
IC	Interconnection Customer
IID	Imperial Irrigation District
IR	Interconnection Request
LADWP	Los Angeles Department of Water and Power
LGIA	Large Generator Interconnection Agreement
NEC	Navopache Electric Cooperative
NERC	North American Electric Reliability Corporation
NR	Network Resource
NRIS	Network Resource Interconnection Service
NTUA	Navajo Tribal Utility Authority
OASIS	Open Access Same Time Information System
OATT	Open Access Transmission Tariff
PG&E	Pacific Gas & Electric
PNM	Public Service Company of New Mexico
POI	Point Of Interconnection
PPA	Purchase Power Agreement
PSLF/PSDS/SCSC	Positive Sequence Load Flow/Positive Sequence Dynamic Simulation/Short-Circuit Saturation Curve
PST	Phase-Shifting Transformer
PV	Photovoltaic
RAS	Remedial Action Scheme (also known as SPS)
RFP	Request for Proposal

SCE	Southern California Edison Company
SDG&E	San Diego Gas & Electric Company
SIS	System Impact Study
SLG fault	Single Line-to-Ground fault
SPS	Special Protection System (also known as RAS)
SRP	Salt River Project
SSVEC	Sulphur Springs Valley Electric Cooperative, Inc.
SVC	Static VAR Compensator
SVD	Static VAR Device
SWTC	Southwest Transmission Cooperative
TEP	Tucson Electric Power
TPIF	Transmission Provider's Interconnection Facilities
WAPA	Western Area Power Administration
WECC	Western Electricity Coordinating Council

Appendix A

POWER FLOW PLOTS

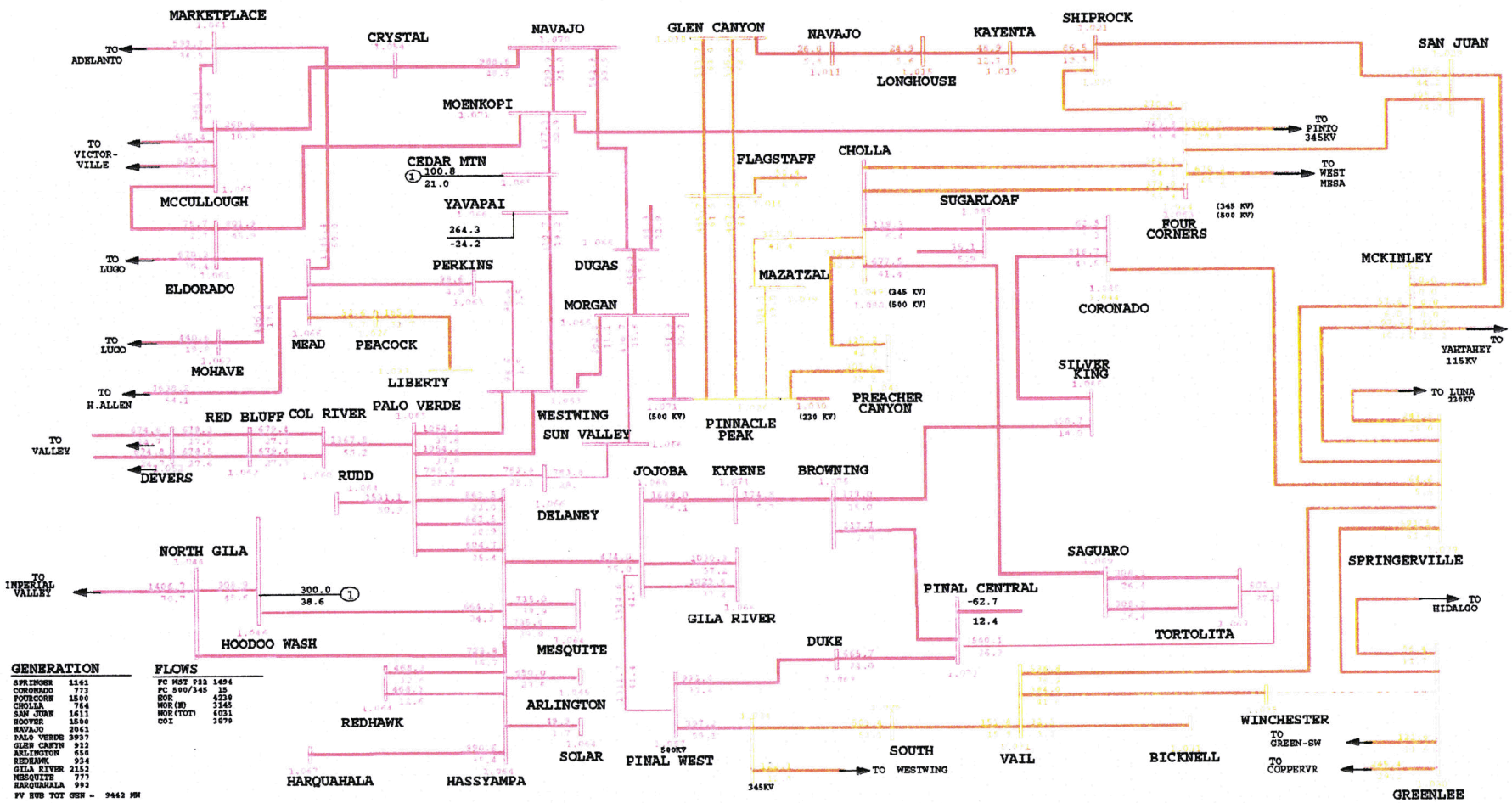
Plot	Description
Plot # 001	2019 Heavy Summer Pre-Project: Normal Conditions (MW/MVAR)
Plot # 002	2019 Heavy Summer Pre-Project: Normal Conditions (MVA/%Rate)
Plot # 003	2019 Heavy Summer Post-Project – Q225: Normal Conditions (MW/MVAR)
Plot # 004	2019 Heavy Summer Post-Project – Q225: Normal Conditions (MVA/%Rate)
Plot # 005	2019 Heavy Summer Pre-Project w/Delaney-CR: Normal Conditions (MW/MVAR)
Plot # 006	2019 Heavy Summer Pre-Project w/Delaney-CR: Normal Conditions (MVA/%Rate)
Plot # 007	2019 Heavy Summer Post-Project w/Delaney-CR – Q225: Normal Conditions (MW/MVAR)
Plot # 008	2019 Heavy Summer Post-Project w/Delaney-CR – Q225: Normal Conditions (MVA/%Rate)
Plot # 009	2019 Heavy Summer Pre-Project w/Q219: Normal Conditions (MW/MVAR)
Plot # 010	2019 Heavy Summer Pre-Project w/Q219: Normal Conditions (MVA/%Rate)
Plot # 011	2019 Heavy Summer Post-Project w/Q219 – Q225: Normal Conditions (MW/MVAR)
Plot # 012	2019 Heavy Summer Post-Project w/Q219 – Q225: Normal Conditions (MVA/%Rate)
Plot # 013	2019 Heavy Summer Pre-Project High EOR: Normal Conditions (MW/MVAR)
Plot # 014	2019 Heavy Summer Pre-Project High EOR: Normal Conditions (MVA/%Rate)
Plot # 015	2019 Heavy Summer Post-Project High EOR - Q225: Normal Conditions (MW/MVAR)
Plot # 016	2019 Heavy Summer Post-Project High EOR - Q225: Normal Conditions (MVA/%Rate)
Plot # 017	2019 Heavy Summer Incremental Case 1vs2: Normal Conditions (MW/MVAR)
Plot # 018	2019 Heavy Summer Incremental Case 3vs4: Normal Conditions (MW/MVAR)
Plot # 019	2019 Heavy Summer Incremental Case 5vs6: Normal Conditions (MW/MVAR)
Plot # 020	2019 Heavy Summer Incremental Case 7vs8: Normal Conditions (MW/MVAR)



EHV SYSTEM

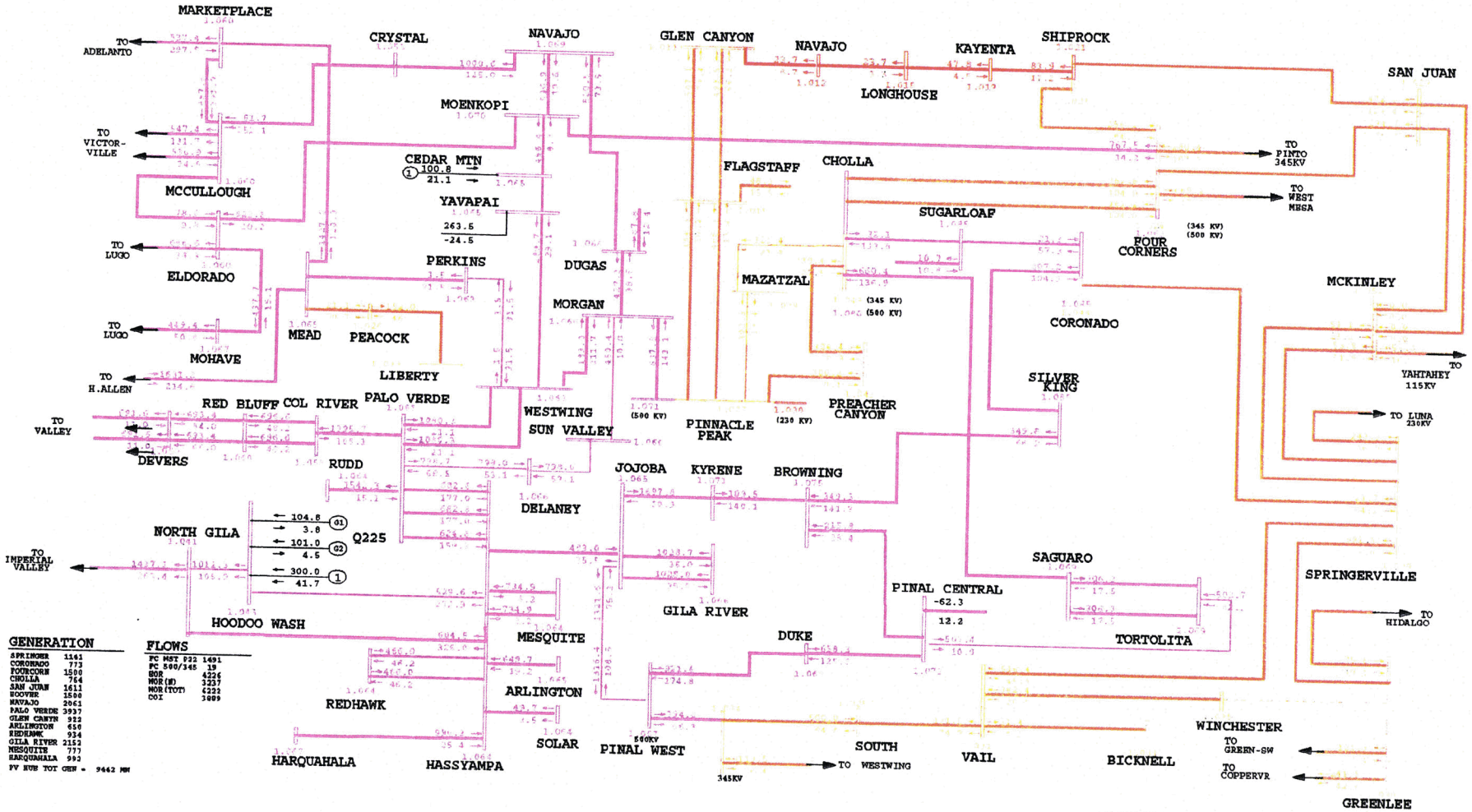
General Electric International, Inc. PSLF Program Wed Aug 05 17:06:05 2015 01_19HS_PRE.sav

2019 HS Case, Q225 System Impact Study Case 1: Pre-Project AZ Plng. Case sm19#28, USE updated	Q225 200MW to the Hoodoo Wash 500 kV bus Plot #001 - Normal Conditions	MW/MVAR Rating = 1



General Electric International, Inc. PSLF Program Wed Aug 05 17:06:06 2015 01_19HS_PRE.sav

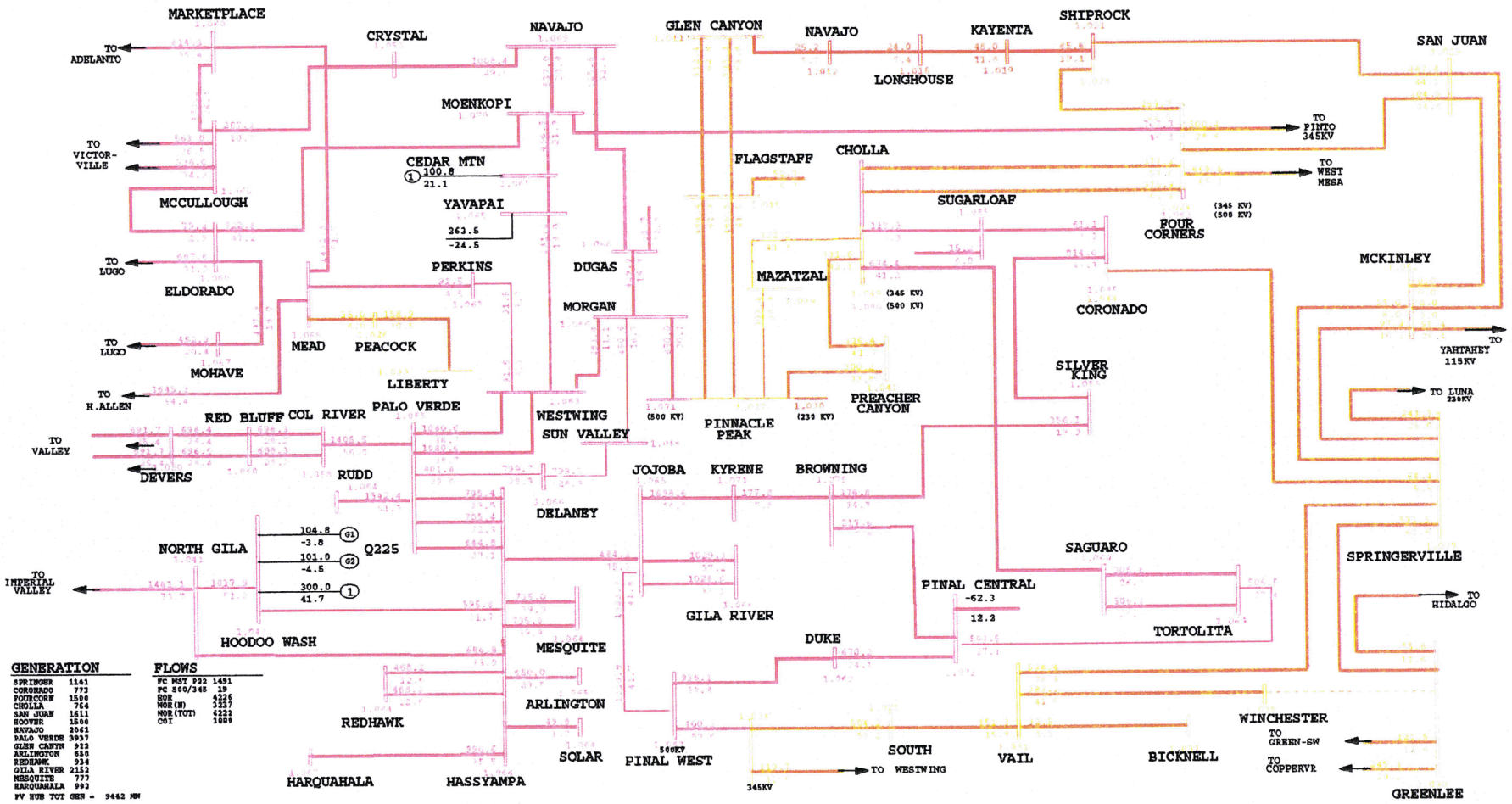
	2019 HS Case, Q225 System Impact Study	Q225 200MW to the Hoodoo Wash 500 kV bus	MVA/%rate
	Case 1: Pre-Project	Plot #002 - Normal Conditions	Rating = 1
	AZ Plng. Case sm19#28, USE updated		



EHV SYSTEM

General Electric International, Inc. PSLF Program Wed Aug 05 17:06:06 2015 02_19HS_PST.sav

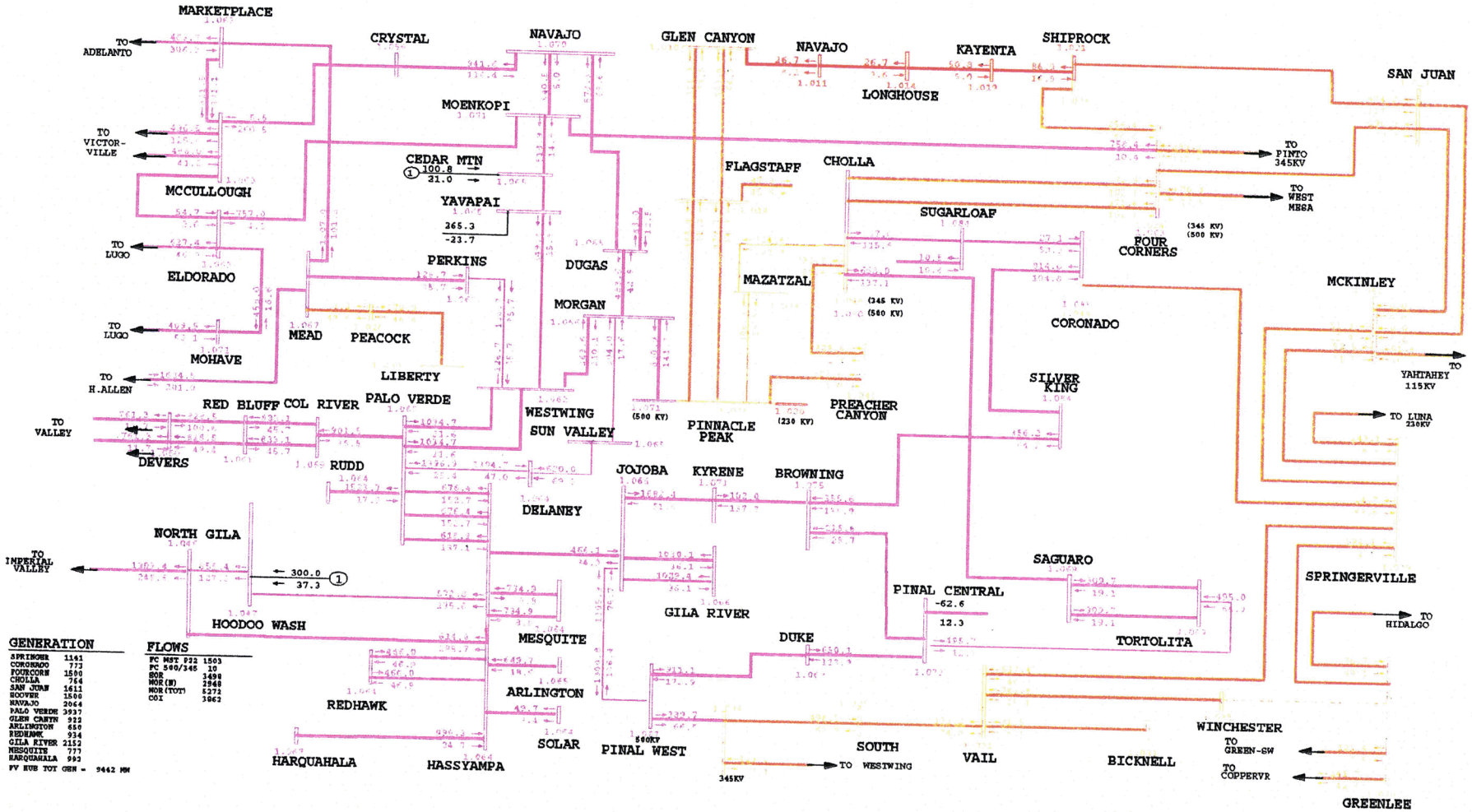
2019 HS Case, Q225 System Impact Study Case 2: Post-Project AZ Plng. Case sm19#28, USE updated	Q225 200MW to the Hoodoo Wash 500 kV bus Plot #003 - Normal Conditions - Q225	MW/MVAR Rating = 1



EHV SYSTEM

General Electric International, Inc. PSLF Program Wed Aug 05 17:06:07 2015 02_19HS_PST.sav

	2019 HS Case, Q225 System Impact Study Case 2: Post-Project AZ Plng. Case sm19#29, USE updated	Q225 200MW to the Hoodoo Wash 500 kV bus Plot #004 - Normal Conditions - Q225	MVA/%rate Rating = 1



EHV SYSTEM

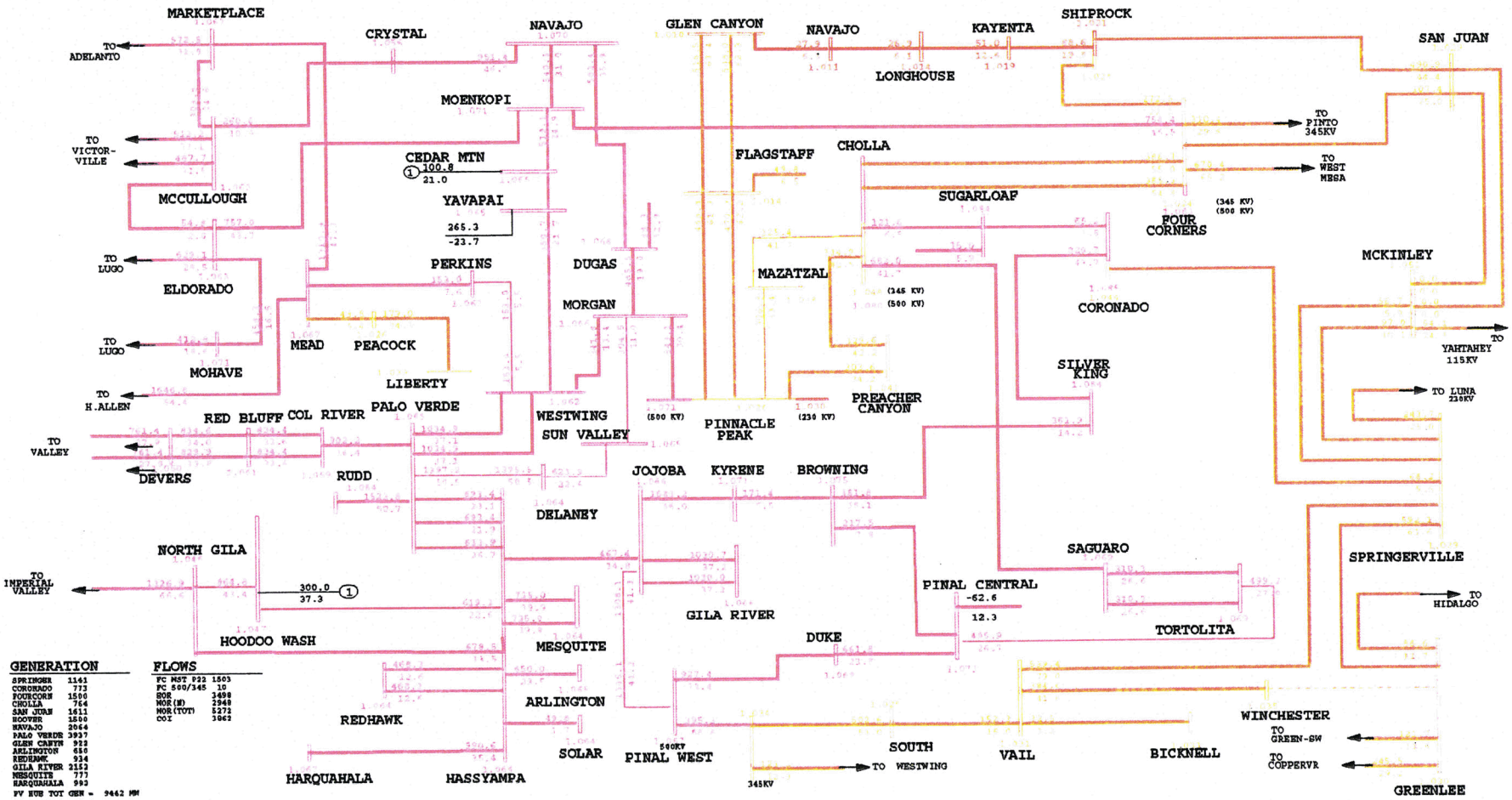
General Electric International, Inc. PSLF Program Wed Aug 05 17:06:08 2015 03_19HS_PRE_dlcr.sav

2019 HS Case, Q225 System Impact Study
Case 3: Pre-Project-Delaney-CR
AZ Plng. Case sm19#28, USE updated

Q225 200MW to the Hoodoo Wash 500 kV bus
Plot #005 - Normal Conditions w/DLCR

MW/MVAR

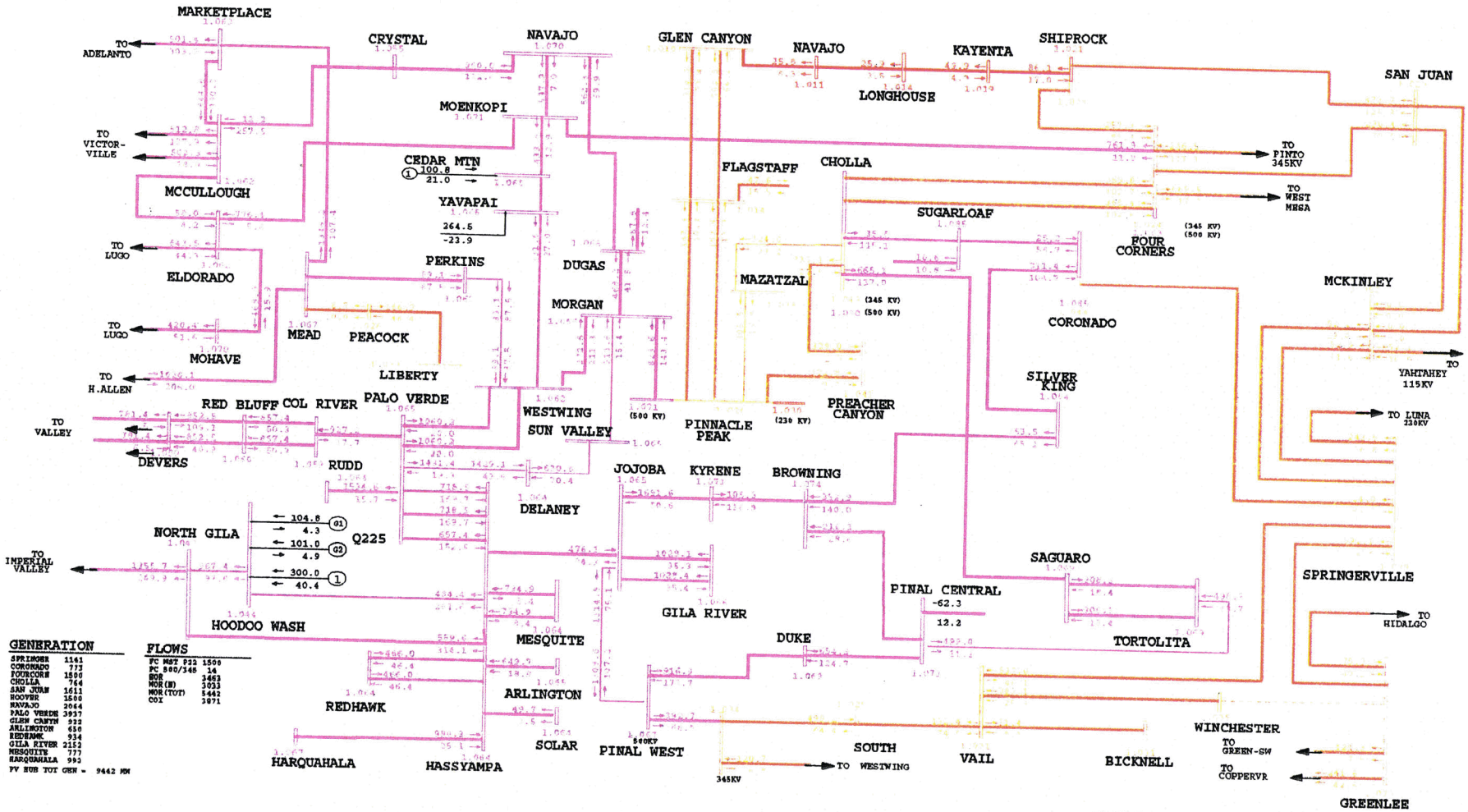
Rating = 1



EHV SYSTEM

General Electric International, Inc. PSLF Program Wed Aug 05 17:06:08 2015 03_19HS_PRE_dlcr.sav

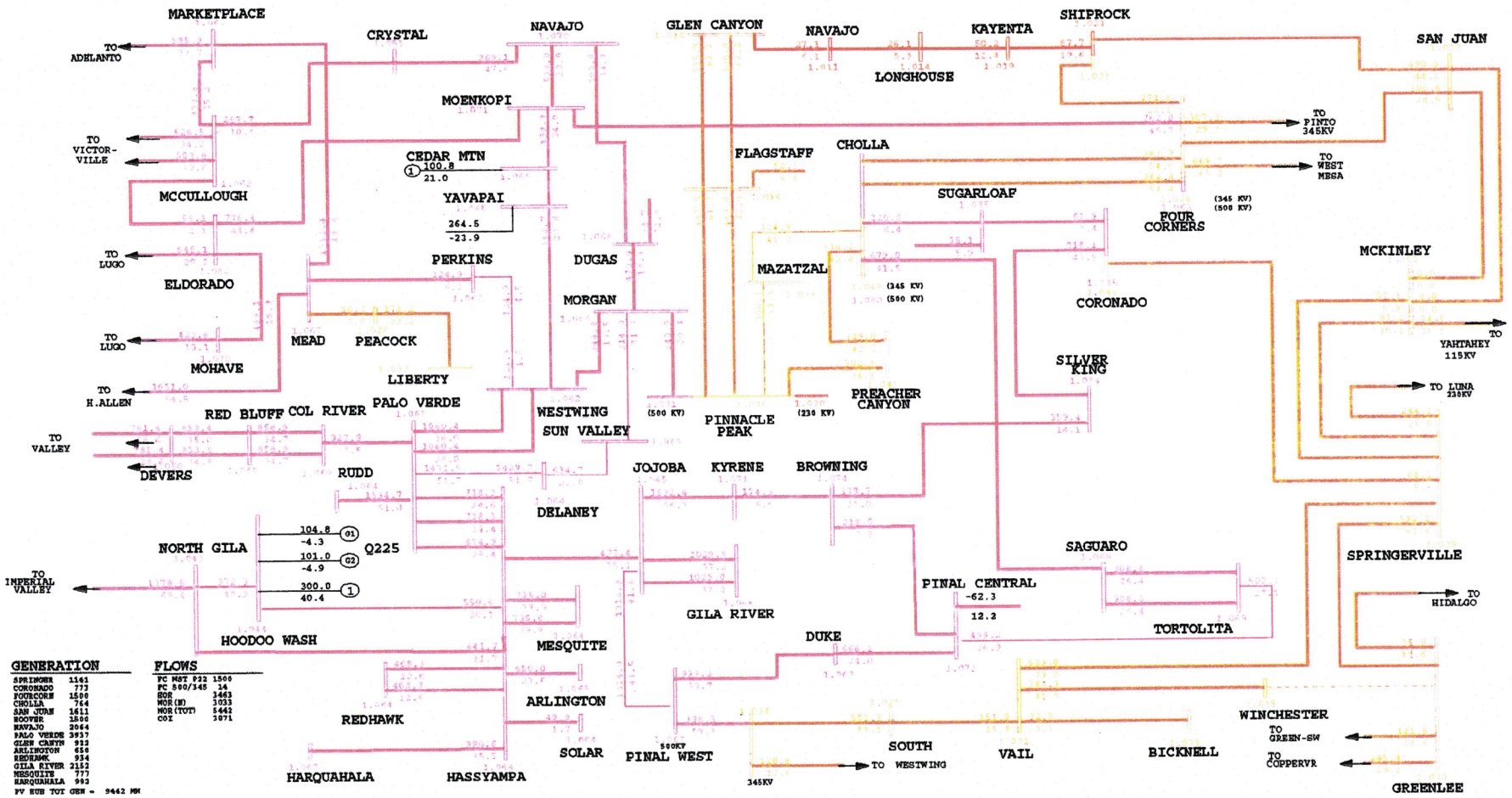
	2019 HS Case, Q225 System Impact Study Case 3: Pre-Project-Delaney-CR AZ Plng. Case sm19#28, USE updated	Q225 200MW to the Hoodoo Wash 500 kV bus Plot #006 - Normal Conditions w/DLCR	MVA/%rate Rating = 1



EHV SYSTEM

General Electric International, Inc. PSLF Program Wed Aug 05 17:06:09 2015 04_19HS_PST_dlcr.sav

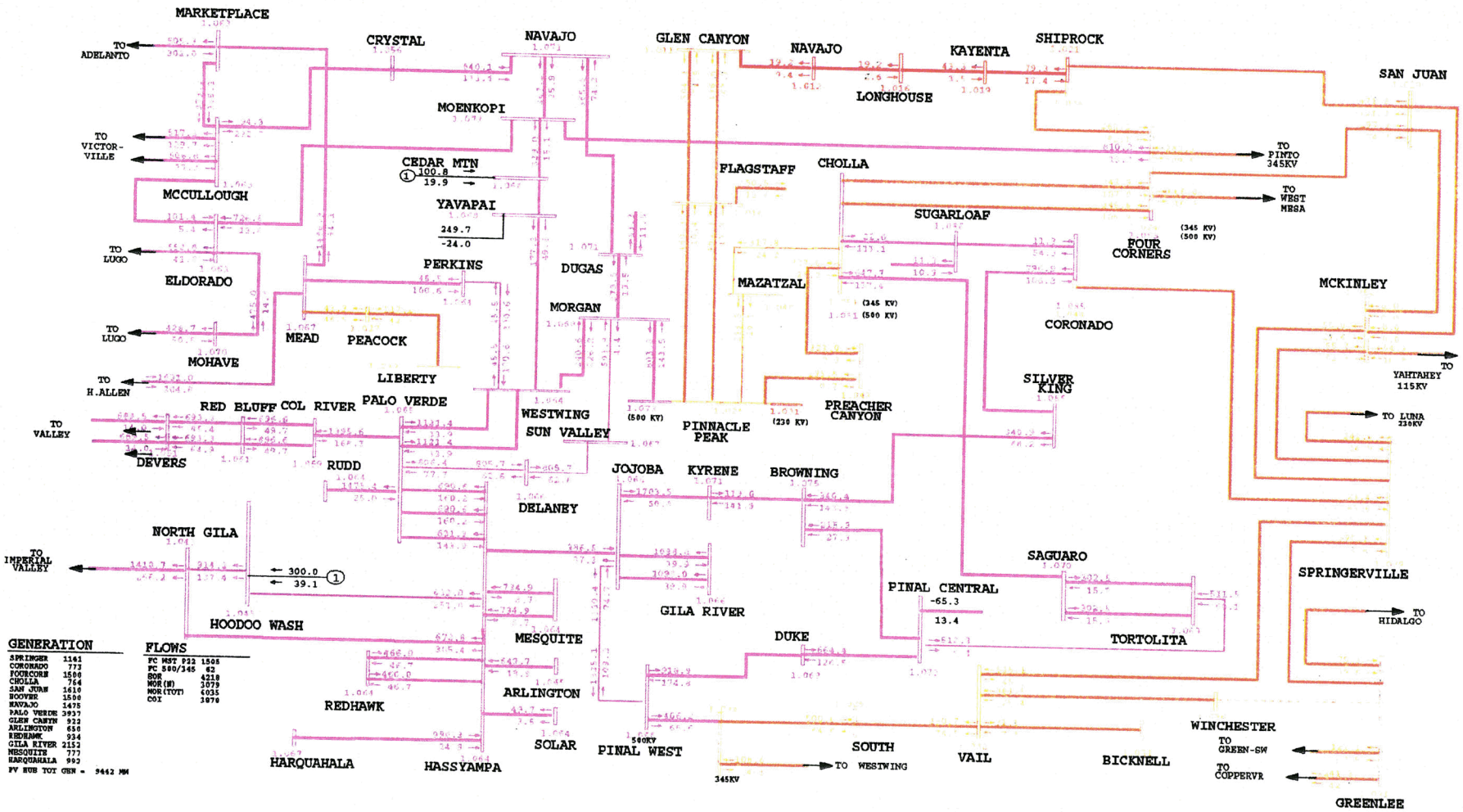
2019 HS Case, Q225 System Impact Study Case 4: Post-Project-Delaney-CR AZ Plng. Case sm19#28, USE updated	Q225 200MW to the Hoodoo Wash 500 kV bus Plot #007 - Normal Conditions w/DLCR - Q225	MW/MVAR Rating = 1



EHV SYSTEM

General Electric International, Inc. PSLF Program Wed Aug 05 17:06:10 2015 04_19HS_PST_dlcr.sav

	2019 HS Case, Q225 System Impact Study Case 4: Post-Project-Delaney-CR AZ Plng. Case sm19#28, USE updated	Q225 200MW to the Hoodoo Wash 500 kV bus Plot #008 - Normal Conditions w/DLCR - Q225	MVA/%rate Rating = 1



EHV SYSTEM

General Electric International, Inc. PSLF Program Wed Aug 05 17:06:10 2015 05_19HS_PRE_Q219.sav

2019 HS Case, Q225 System Impact Study

Case 5: Pre-Project w/Q219

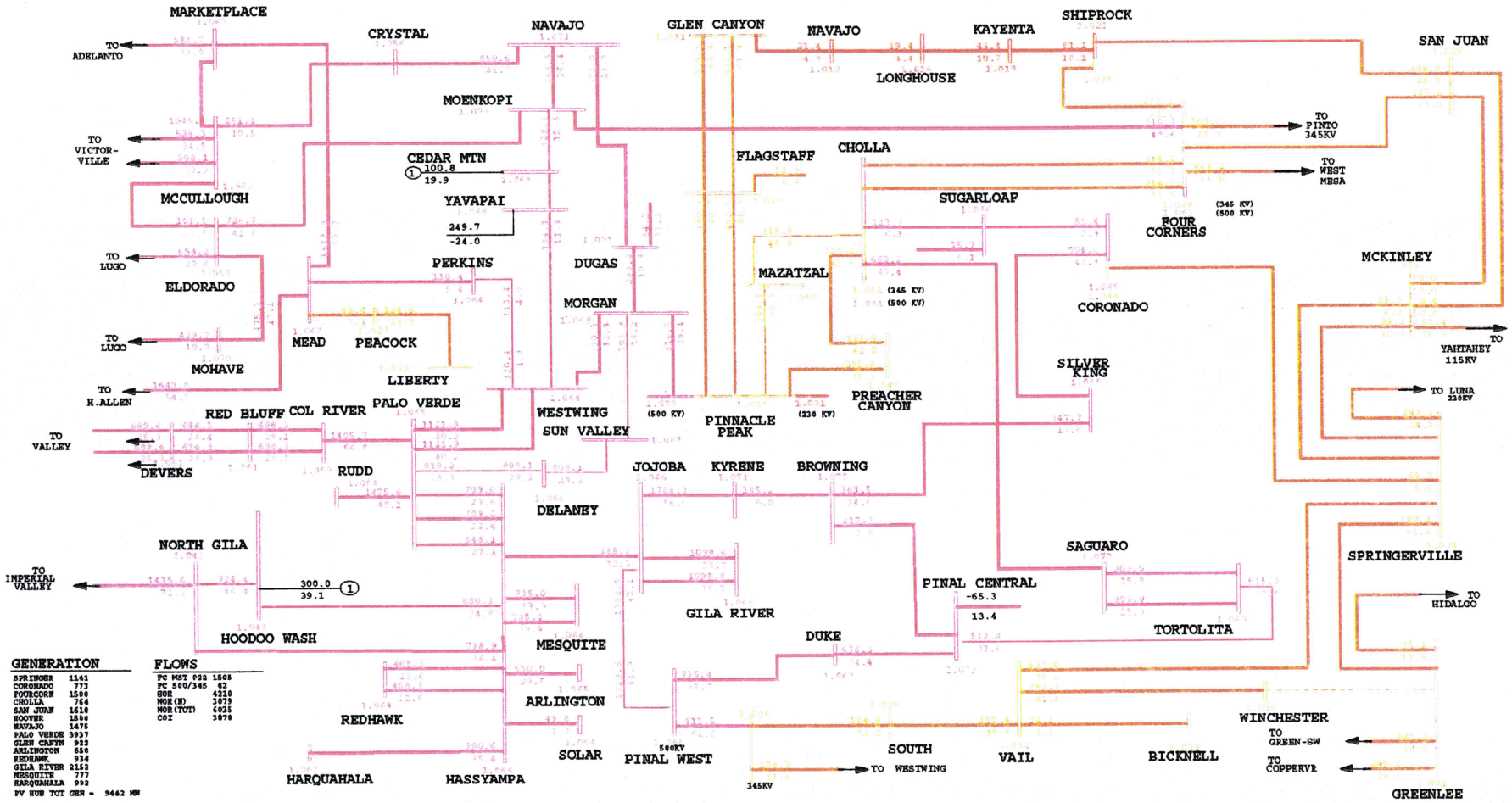
AZ Plng. Case sm19#28, USE updated

Q225 200MW to the Hoodoo Wash 500 kV bus

Plot #009 - Normal Conditions w/Q219

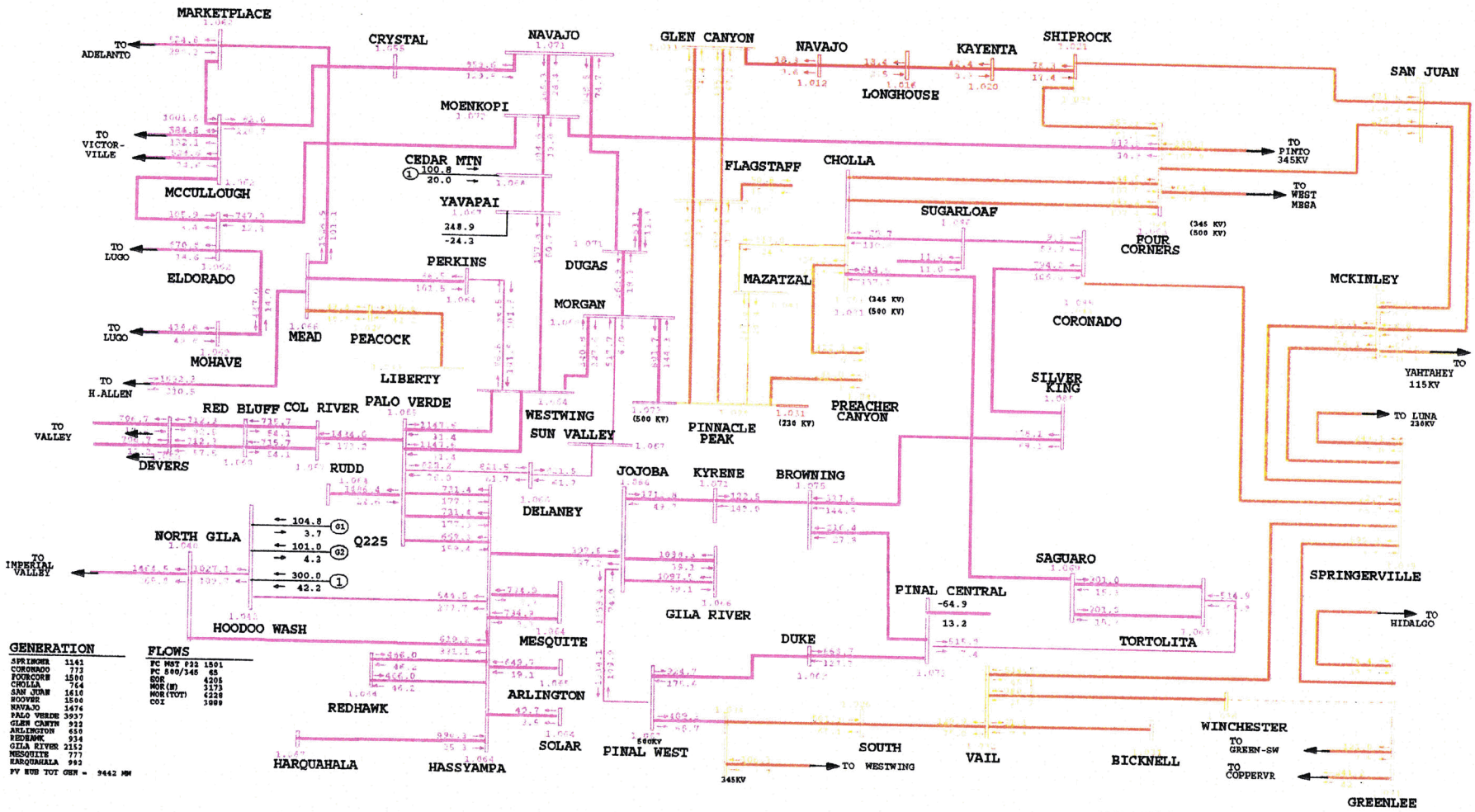
MW/MVAR

Rating = 1



General Electric International, Inc. PSLF Program Wed Aug 05 17:06:11 2015 05_19HS_PRE_Q219.sav

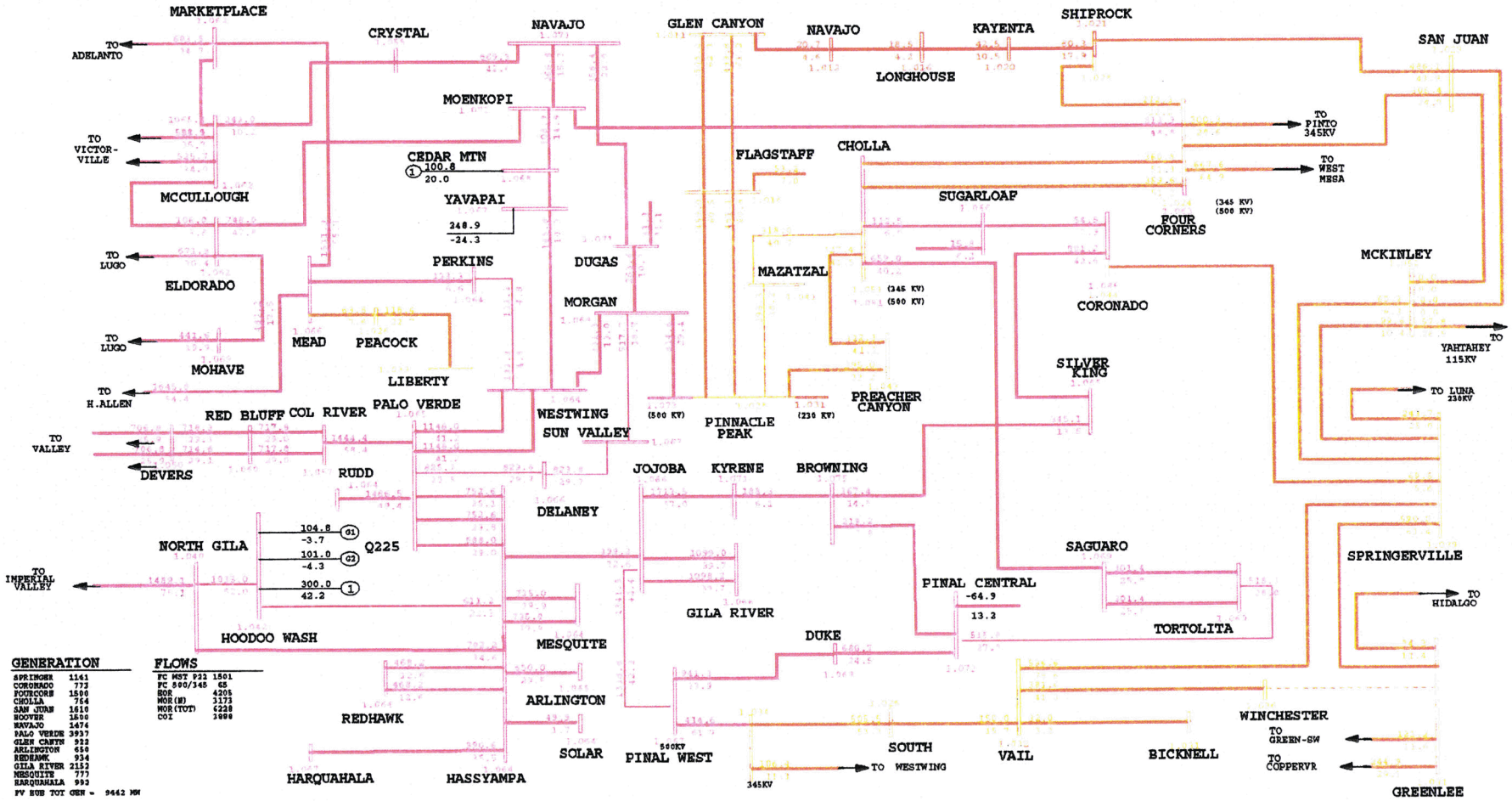
	2019 HS Case, Q225 System Impact Study Case 5: Pre-Project w/Q219 AZ Plng. Case sm19#28, USB updated	Q225 200MW to the Hoodoo Wash 500 kV bus Plot #010 - Normal Conditions w/Q219	MVA/%rate Rating = 1



EHV SYSTEM

General Electric International, Inc. PSLF Program Wed Aug 05 17:06:11 2015 06_19HS_PST_Q219.sav

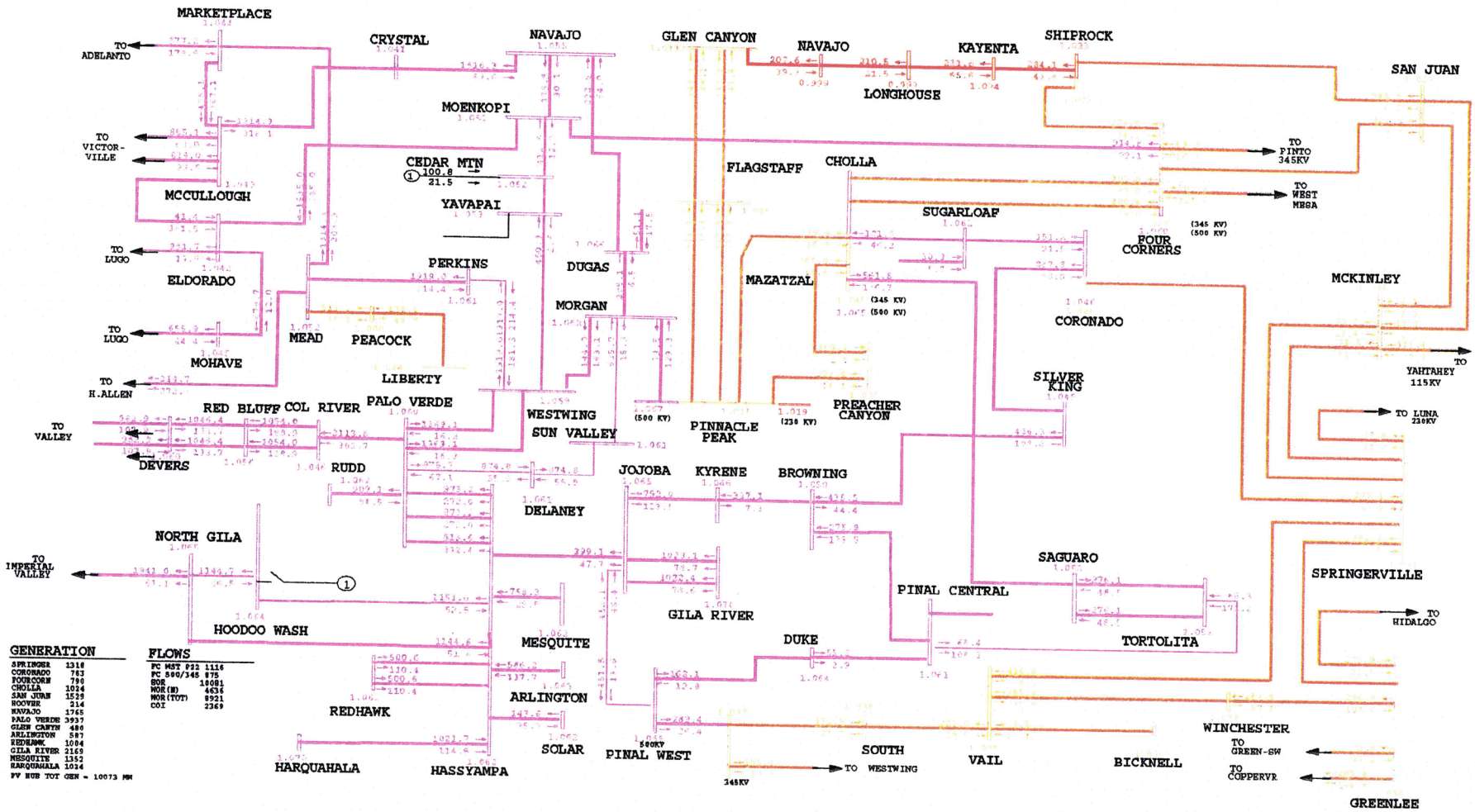
	2019 HS Case, Q225 System Impact Study Case 6: Post-Project w/Q219 AZ Plng. Case sm19#28, USE updated	Q225 200MW to the Hoodoo Wash 500 kV bus Plot #011 - Normal Conditions w/Q219 - Q225	MW/MVAR Rating = 1



EHV SYSTEM

General Electric International, Inc. PSLF Program Wed Aug 05 17:06:12 2015 06_19HS_PST_Q219.sav

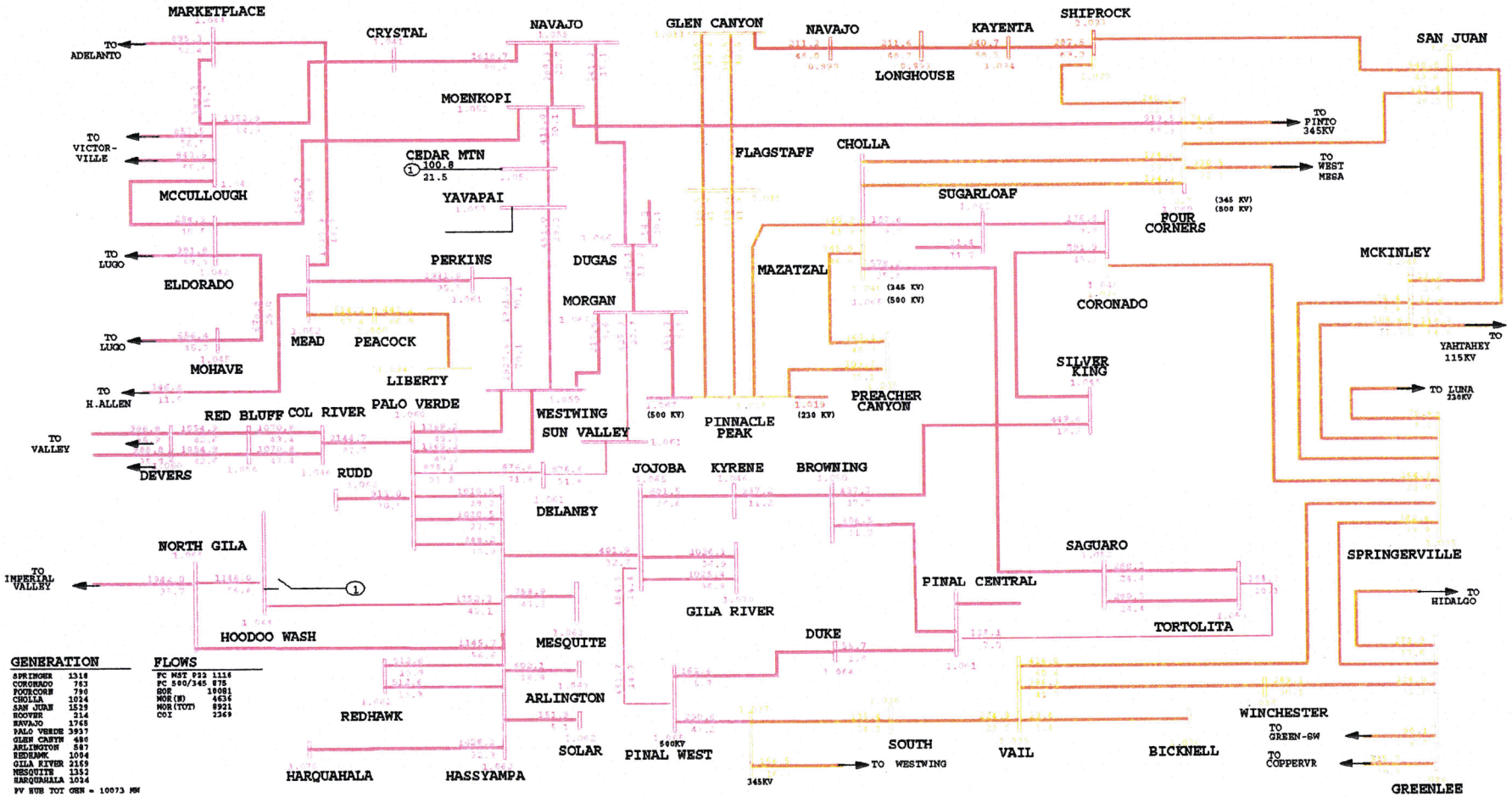
	2019 HS Case, Q225 System Impact Study Case 6: Post-Project w/Q219 AZ Plng. Case sm19#28, USE updated	Q225 200MW to the Hoodoo Wash 500 kV bus Plot #012 - Normal Conditions w/Q219 - Q225	MVA/%rate Rating = 1



EHV SYSTEM

General Electric International, Inc. PSLF Program Wed Aug 05 17:06:12 2015 07_19HS_PRE_eor.sav

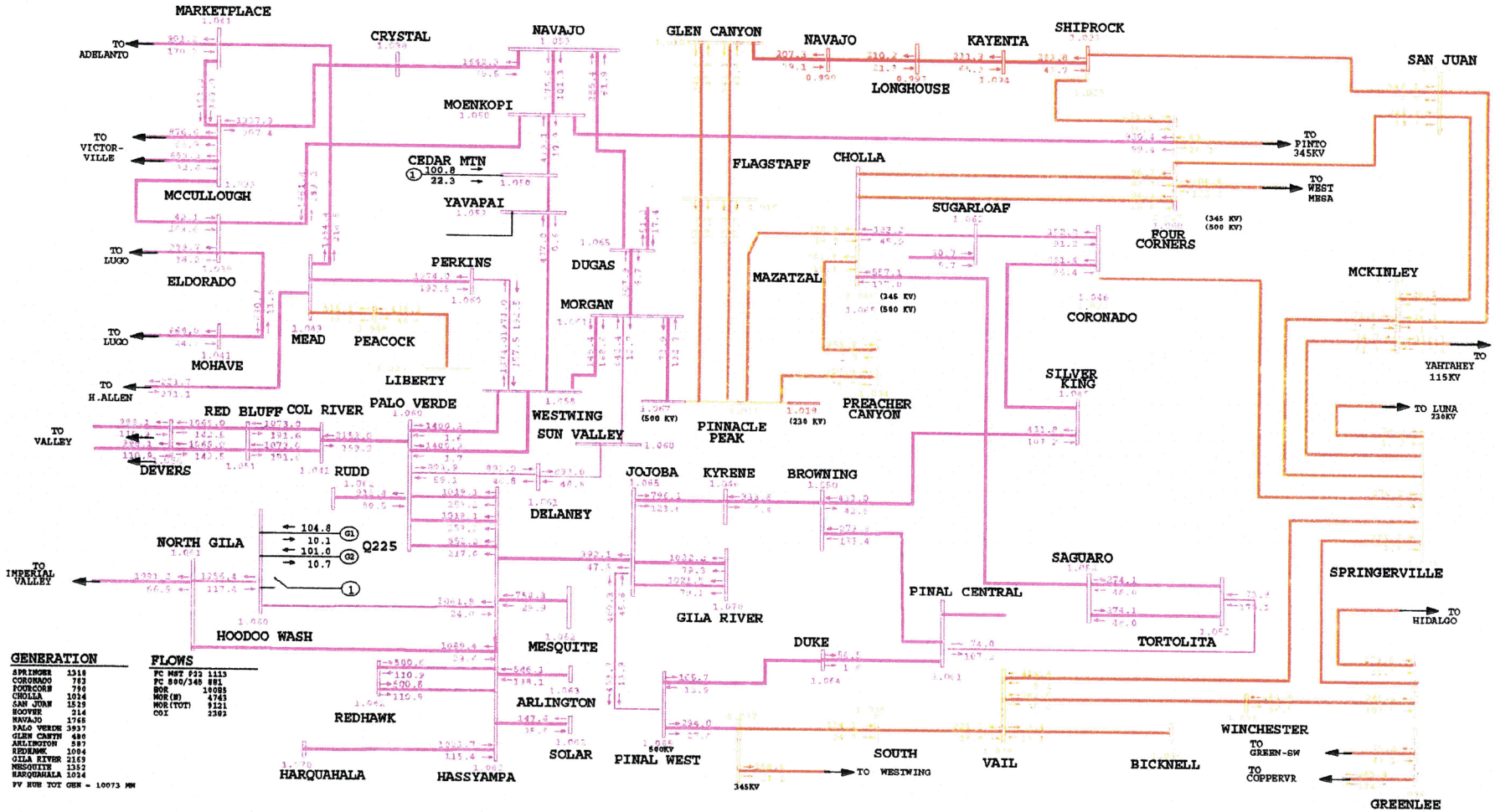
	HANG2 Phase 2 Study Case 7: Pre-Project EOR	Q225 200MW to the Hoodoo Wash 500 kV bus Plot #013 - Normal Conditions High EOR	MW/MVAR Rating = 1



EHV SYSTEM

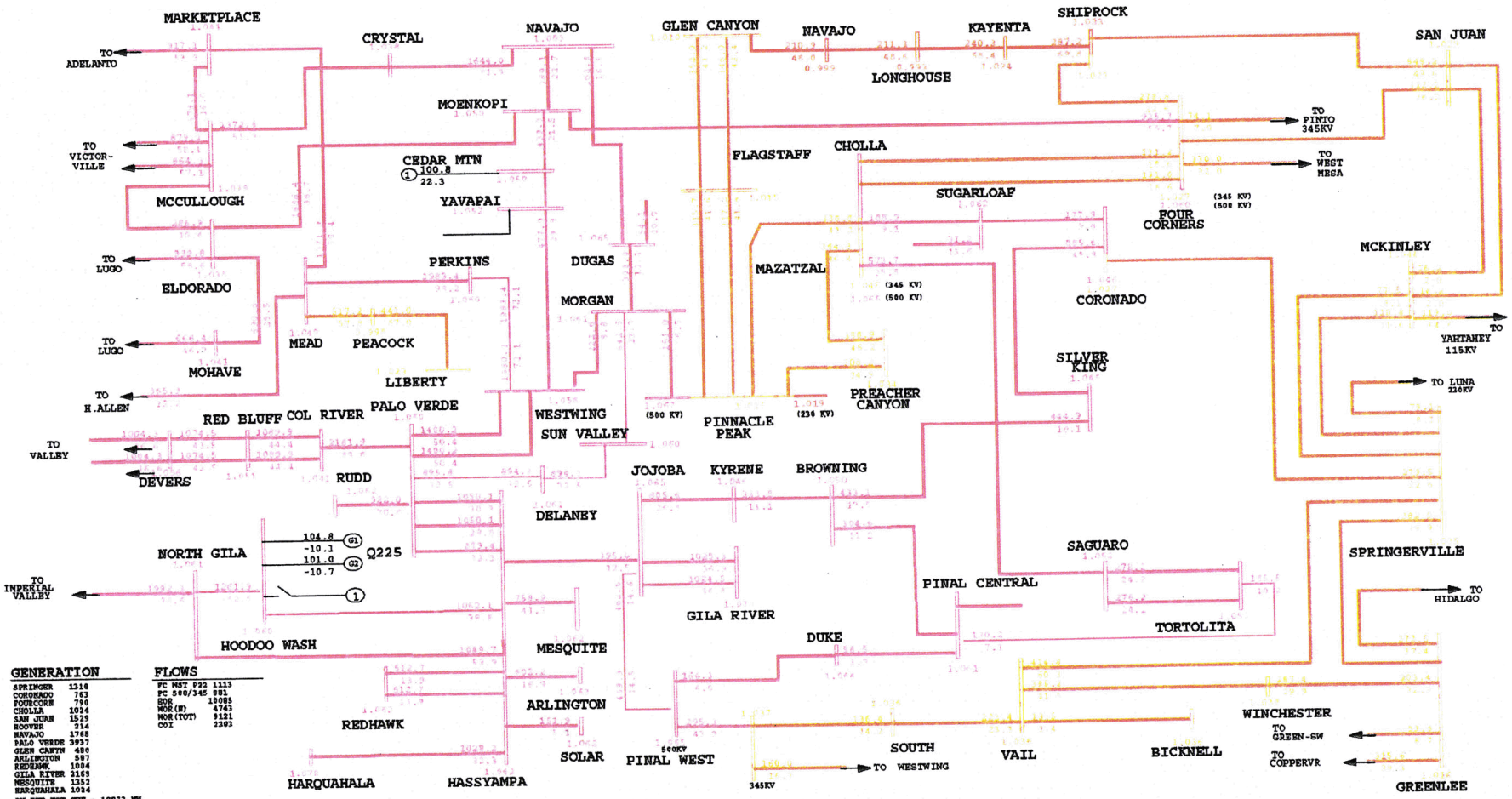
General Electric International, Inc. PSLF Program Wed Aug 05 17:06:13 2015 07_19HS_PRE_eor.sav

	HANG2 Phase 2 Study Case 7: Pre-Project EOR	Q225 200MW to the Hoodoo Wash 500 kV bus Plot #014 - Normal Conditions High EOR	MVA/%rate Rating = 1



General Electric International, Inc. PSLF Program Wed Aug 05 17:06:13 2015 08_19HS_PST_eor.sav

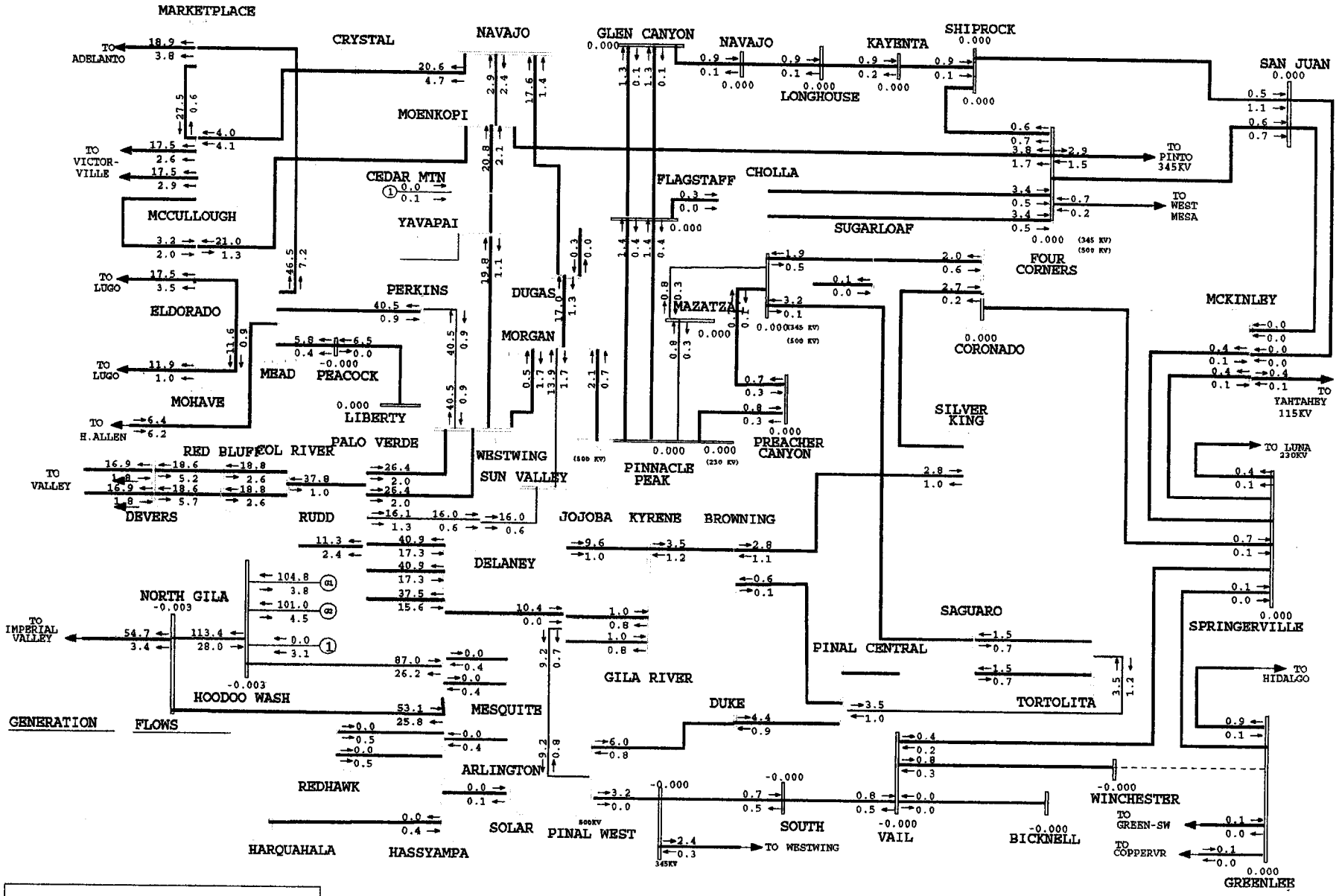
	HANG2 Phase 2 Study Case 8: Post-Project - EOR	Q225 200MW to the Hoodoo Wash 500 kV bus Plot #015 - Normal Conditions High EOR - Q225	MW/MVAR Rating = 1



EHV SYSTEM

General Electric International, Inc. PSLF Program Wed Aug 05 17:06:14 2015 08_19HS_PST_eor.sav

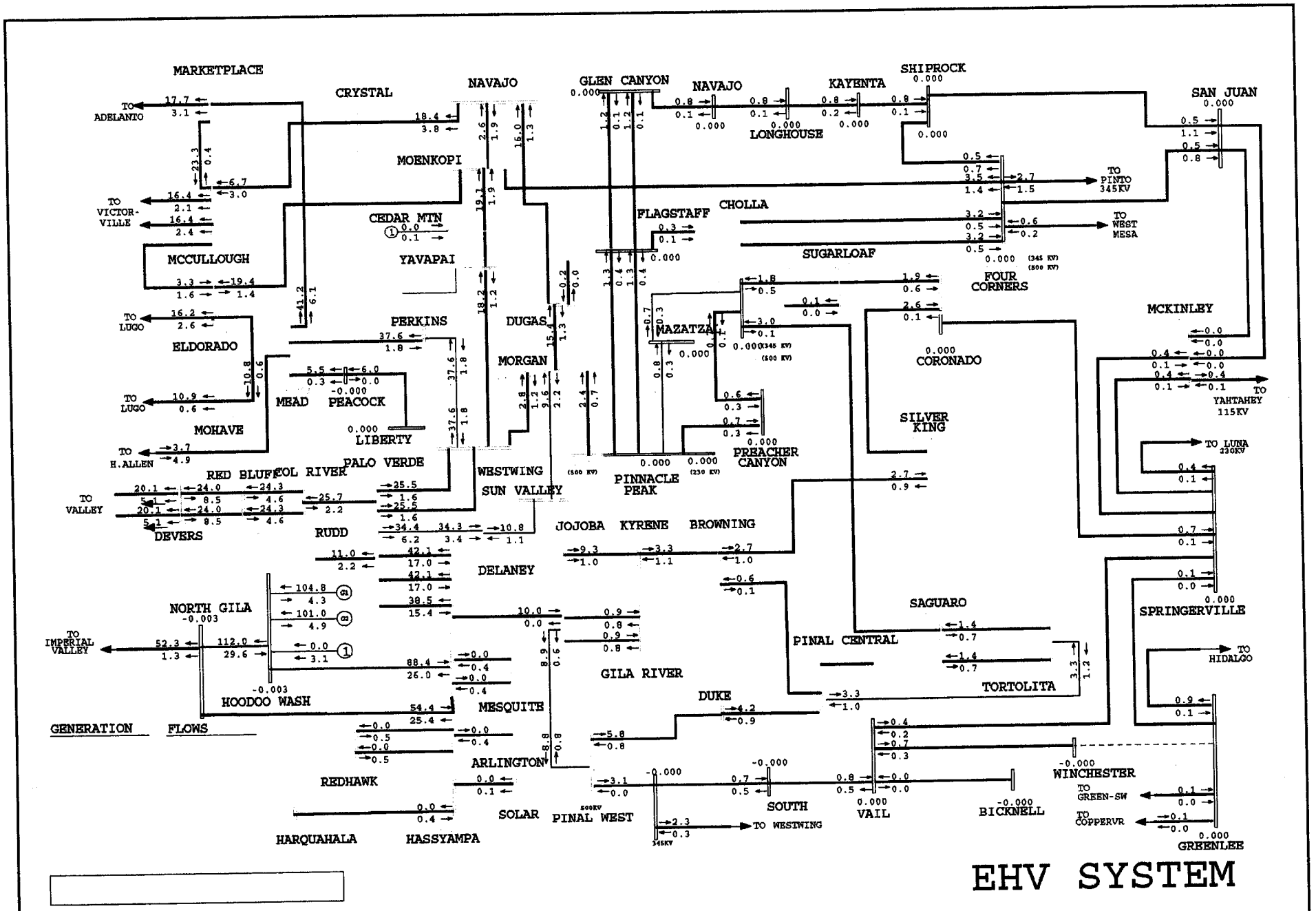
	HANG2 Phase 2 Study Case 8: Post-Project - EOR	Q225 200MW to the Hoodoo Wash 500 kV bus Plot #016 - Normal Conditions High EOR - Q225	MVA/%rate Rating = 1



EHV SYSTEM

General Electric International, Inc. PSLF Program Fri Jun 19 22:15:18 2015 ehv_2015.drw

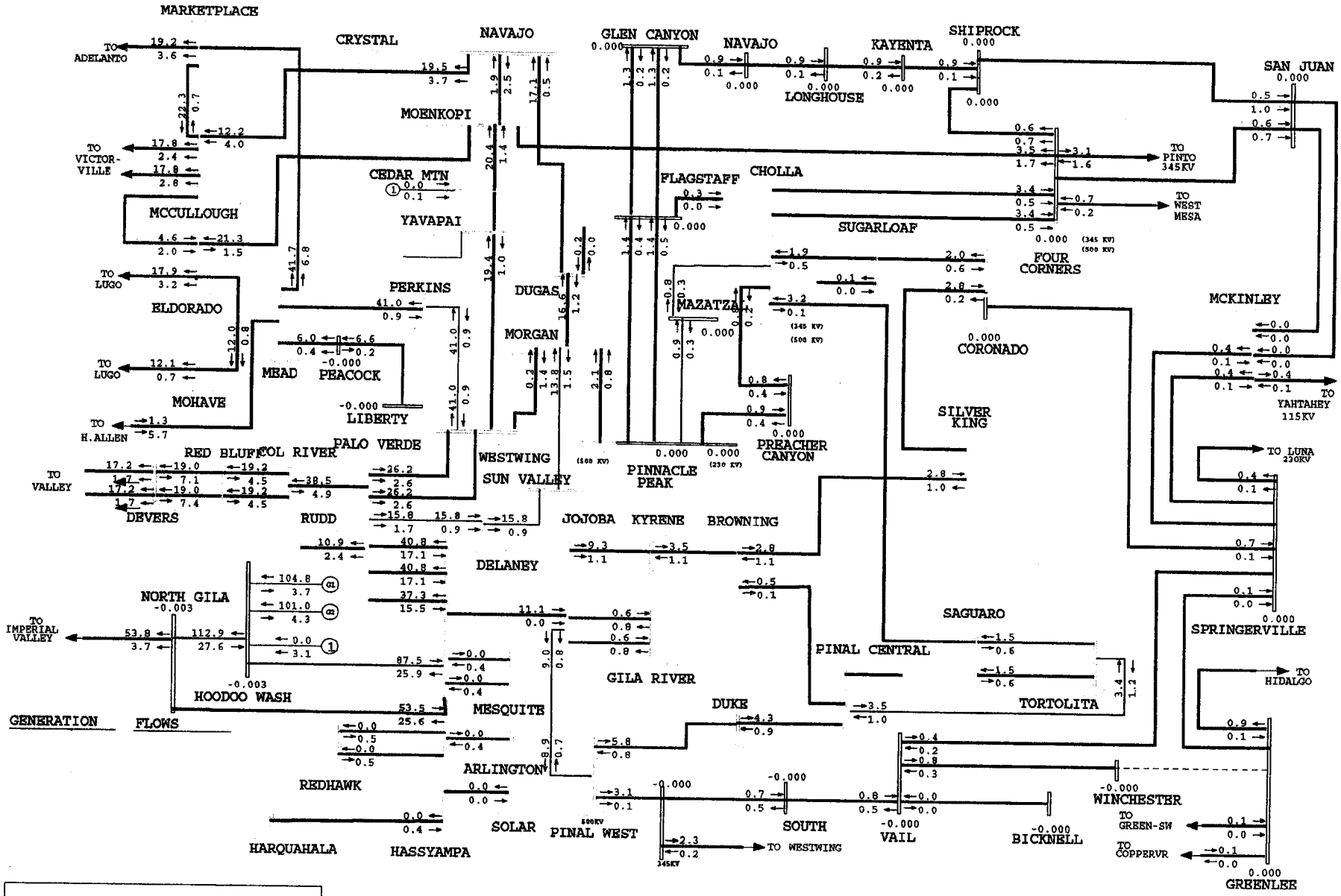
2019 HS Case, Q225 System Impact Study Case 2: Post-Project	AZ Plng. Case sm19#28, USE updated Q225 200MW to the Hoodoo Wash 500 kV bus Plot #17 - 2019 Heavy Summer Incremental Case 1vs2: Normal Conditions (MW/MVAR)	MW/MVAR Rating = 1



EHV SYSTEM

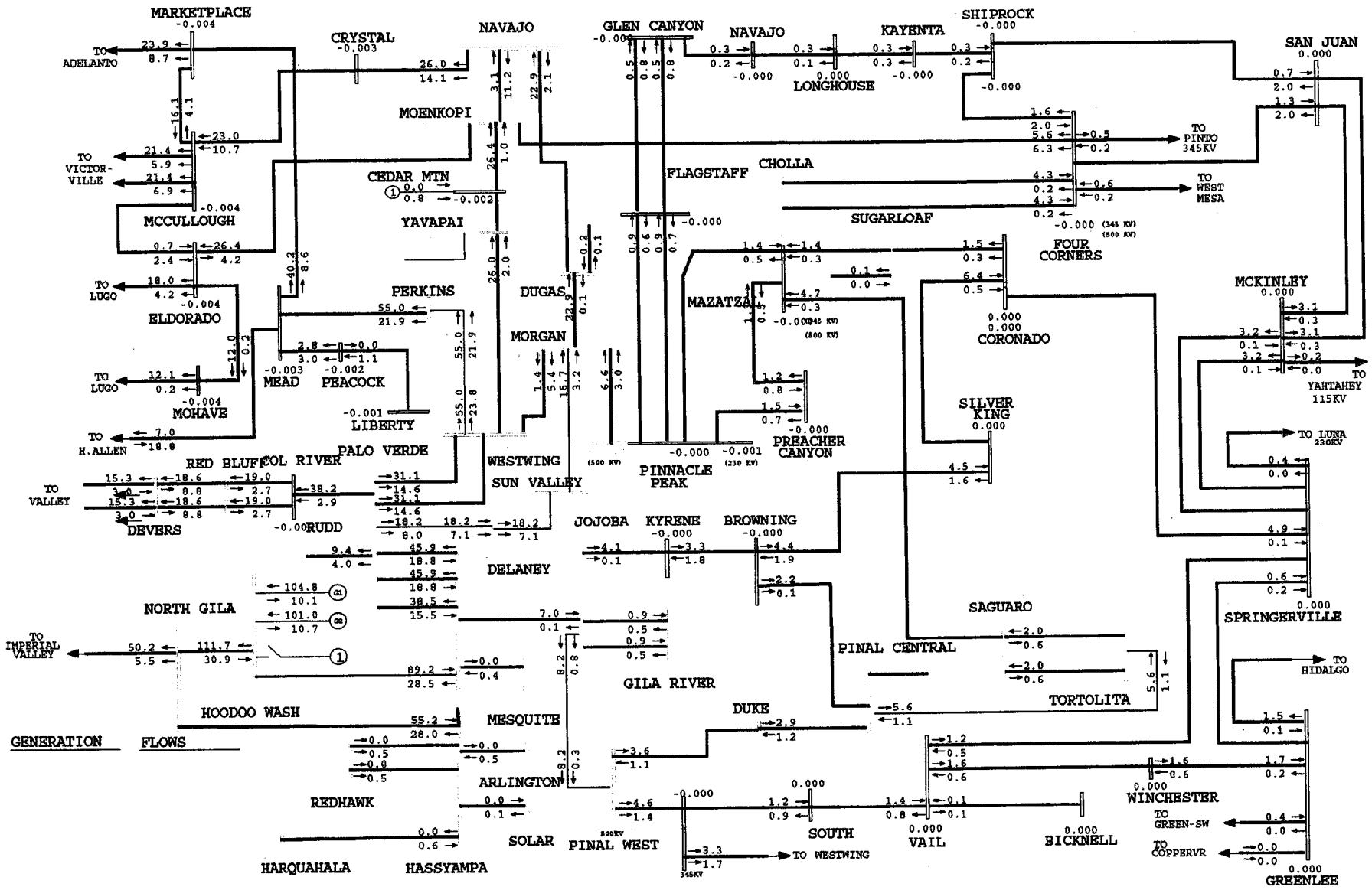
General Electric International, Inc. PSLF Program Fri Jun 19 22:11:05 2015 ehv_2015.drw

	2019 HS Case, Q225 System Impact Study	AZ Plng. Case sm19#28, USE updated	MW/MVAR
		Q225 200MW to the Hoodoo Wash 500 kV bus	test.drw
	Case 4: Post-Project	Plot #18 - 2019 Heavy Summer Incremental Case 3vs4: Normal Conditions (MW/MVAR)	Rating = 1



General Electric International, Inc. PSLF Program Fri Jun 19 22:11:43 2015 ehv_2015.drw

	2019 HS Case, Q225 System Impact Study Case 6: Post-Project w/Q219	AZ Plng. Case sm19#28, USE updated Q225 200MW to the Hoodoo Wash 500 kV bus Plot #19 - 2019 Heavy Summer Incremental Case 5vs6: Normal Conditions (MW/MVAR)	MW/MVAR test.drw Rating = 1



EHV SYSTEM

General Electric International, Inc. PSLF Program Fri Jun 19 22:12:21 2015 ehv_2015_eor.drw

HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

Plot #20 - 2019 Heavy Summer Incremental Case 7vs8: Normal Conditions (MW/MVAR)

MW/MVAR
test.drw
Rating = 1

Appendix B

Contingency List

TPL-002 (Category B) Outages
500 kV Lines

1. N-1 N.GILA-IMPERIAL VALLEY 500kV Line 1
    - 3 phase fault at N.Gila 500kV cleared in 4 cycles
2. N-1 PALO VERDE-COLORADO RIVER 500kV Line 1
    - 3 phase fault at Palo Verde 500kV cleared in 4 cycles
3. N-1 COLORADO RIVER-RED BLUFF 500kV Line 1
    - 3 phase fault at Colorado River 500kV cleared in 4 cycles
4. N-1 RED BLUFF-DEVERS 500kV Line 1
    - 3 phase fault at Red Bluff 500kV cleared in 4 cycles
5. N-1 PALO VERDE-DELANEY 500kV Line 1
    - 3 phase fault at Delaney 500kV cleared in 4 cycles
6. N-1 MORGAN-SUN VALLEY 500kV Line 1 (when modeled)
    - 3 phase fault at Sun Valley 500kV cleared in 4 cycles
7. N-1 CRYSTAL-MCCULLOUGH 500kV Line 1
    - 3 phase fault at Crystal 500kV cleared in 4 cycles
8. N-1 CORONADO-SILVERKG 500KV Line 1 (incl. SPS)
    - 3 phase fault at Coronado 500kV cleared in 4 cycles
    - Insert 2 caps at PP, Papago, or Rogers in 15 cycles
    - Drop Coronado Unit 2 in 90 cycles
9. N-1 FOURCORN-MOENKOPI 500KV Line 1
    - 3 phase fault at Four Corners 500kV cleared in 4 cycles
    - 10% fault damping on Four Corners Units 4 & 5
10. N-1 DELANEY-SNVLY 500KV Line 1
    - 3 phase fault at Sun Valley 500kV cleared in 4 cycles
11. N-1 HASSYAMP-JOJOBA 500KV Line 1
    - 3 phase fault at Jojoba 500kV cleared in 4 cycles
12. N-1 HASSAYAMPA-HOODOO WASH 500KV Line 1
    - 3 phase fault at Hassayampa 500kV cleared in 4 cycles
13. N-1 HOODOO WASH-N.GILA 500KV Line 1
    - 3 phase fault at Hoodoo Wash 500kV cleared in 4 cycles
14. N-1 HASSAYAMPA-N.GILA 500KV Line 2
    - 3 phase fault at Hassayampa 500kV cleared in 4 cycles
15. N-1 JOJOBA-PINAL_W 500KV Line 1
    - 3 phase fault at Hassayampa 500kV cleared in 4 cycles
16. N-1 JOJOBA-KYRENE 500KV Line 1
    - 3 phase fault at Kyrene 500kV cleared in 4 cycles
17. N-1 KYRENE-BROWNING 500KV Line 1
    - 3 phase fault at Kyrene 500kV cleared in 4 cycles
18. N-1 MEAD-PERKINS 500KV Line 1
    - 3 phase fault at Perkins 500kV cleared in 4 cycles
19. N-1 MOENKOPI-ELDORDO 500KV Line 1
    - 3 phase fault at Moenkopi 500kV cleared in 4 cycles
20. N-1 MOENKOPI-CEDAR MOUNTAIN 500KV Line 1

- 3 phase fault at Cedar Mountain 500kV cleared in 4 cycles

21. N-1 CEDAR MOUNTAIN-YAVAPAI 500KV Line 1
    - 3 phase fault at Cedar Mountain 500kV cleared in 4 cycles
22. N-1 NAVAJO-CRYSTAL 500KV Line 1
    - 3 phase fault at Navajo 500kV cleared in 4 cycles
23. N-1 NAVAJO-DUGAS 500KV Line 1
    - 3 phase fault at Dugas 500kV cleared in 4 cycles
24. N-1 DUGAS-MORGAN 500KV Line 1
    - 3 phase fault at Morgan 500kV cleared in 4 cycles
25. N-1 MORGAN-WESTWING 500KV Line 1
    - 3 phase fault at Westwing 500kV cleared in 4 cycles
26. N-1 PALOVRDE-RUDD 500KV Line 1
    - 3 phase fault at Palo Verde 500kV cleared in 4 cycles
27. N-1 PALO VERDE-WESTWING 500KV Line 1 or 2
    - 3 phase fault at Palo Verde 500kV cleared in 4 cycles
28. N-1 YAVAPAI-WESTWING 500KV Line 1
    - 3 phase fault at Westwing 500kV cleared in 4 cycles
29. N-1 IMPERIAL VALLEY-MIGUEL 500KV Line 1 (W SPS)
    - 3 phase fault at Imperial Valley 500kV cleared in 4 cycles
    - Trip IV Gen Units 1-3 and INTB CT and ST in 8 cycles
    - Trip Otay Mesa-Tijuana 230kV line in 120 cycles
30. N-1 JOJOBA-GILARIVR 500KV Line 1
    - 3 phase fault at Gila River 500kV cleared in 4 cycles
31. N-1 BROWNING-SILVER KING 500Kv Line 1
    - 3 phase fault at Browning 500kV cleared in 4 cycles
32. N-1 PINAL_W-DUKE 500kV Line 1
    - 3 phase fault at Duke 5200 kV cleared in 4 cycles
33. N-1 DUKE-PINAL CENTRAL 500kV Line 1
    - 3 phase fault at Pinal Central 500 kV cleared in 4 cycles
34. N-1 PINAL CENTRAL-TORTOLITA 500kV Line 1
    - 3 phase fault at Pinal Central 500kV cleared in 4 cycles
35. N-1 TORTOLITA-SAGUARO 500kV Line 1 or 2
    - 3 phase fault at Saguaro 500 kV cleared in 4 cycles
36. N-1 MORGAN-PINNACLE PEAK 500kV Line 1
    - 3 phase fault at Morgan 500kV cleared in 4 cycles
37. N-1 CHOLLA-SAGUARO 500kV Line 1
    - 3 phase fault at Saguaro 500kV cleared in 4 cycles

TPL-002 (Category B) Outages
345 kV Lines

38. N-1 CHOLLA-PREACHER CANYON 345kV Line 1
    - 3 phase fault at Preacher Canyon 345kV cleared in 4 cycles
39. N-1 PREACHER CANYON-PINNACLE PEAK 345kV Line 1
    - 3 phase fault at Pinnacle Peak 345kV cleared in 4 cycles

- Drop Pinnacle Peak 345/230 kV Xfmr 4

40. N-1 CHOLLA-MAZATZAL 345kV Line 1
    - 3 phase fault at Mazatzal 345kV cleared in 4 cycles
41. N-1 MAZATZAL-PINNACLE PEAK 345kV Line 1
    - 3 phase fault at Pinnacle Peak 345kV cleared in 4 cycles
    - Drop Pinnacle Peak 345/230 kV Xfmr 7
42. N-1 LIBERTY-PEACOCK 345kV Line 1
    - 3 phase fault at Liberty 345kV cleared in 4 cycles
43. N-1 PEACOCK-MEAD 345kV Line 1
    - 3 phase fault at Peacock 345kV cleared in 4 cycles

TPL-002 (Category B) Outages
230 kV Lines

44. N-1 OCOTILLO-PINNACLE PEAK 230KV Line 1
    - 3 phase fault at Ocotillo 230kV cleared in 5 cycles
45. N-1 OCOTILLO-CACTUS 230KV Line 1
    - 3 phase fault at Ocotillo 230kV cleared in 5 cycles
46. N-1 CACTUS-PINNACLE PEAK 230KV Line 1
    - 3 phase fault at Cactus 230kV cleared in 5 cycles
47. N-1 OCOTILLO-KYRENE 230KV Line 1
    - 3 phase fault at Ocotillo 230kV cleared in 5 cycles
48. N-1 OCOTILLO-LINCOLN STREET 230KV Line 1
    - 3 phase fault at Ocotillo 230kV cleared in 5 cycles
49. N-1 LINCOLN STREET-COUNTRY CLUB 230KV Line 1
    - 3 phase fault at Lincoln Street 230kV cleared in 5 cycles
50. N-1 LINCOLN STREET-WEST PHOENIX 230KV Line 1
    - 3 phase fault at Lincoln Street 230kV cleared in 5 cycles
51. N-1 COUNTRY CLUB-MEADOWBROOK 230KV Line 1
    - 3 phase fault at Country Club 230kV cleared in 5 cycles
52. N-1 MEADOWBROOK-SUNNYSLOPE 230KV Line 1
    - 3 phase fault at Meadowbrook 230kV cleared in 5 cycles
53. N-1 SUNNYSLOPE-LONE PEAK 230KV Line 1
    - 3 phase fault at Sunnyslope 230kV cleared in 5 cycles
54. N-1 LONE PEAK-PINNACLE PEAK 230KV Line 1
    - 3 phase fault at Pinnacle Peak 230kV cleared in 5 cycles
55. N-1 LONE PEAK-REACH 230KV Line 1
    - 3 phase fault at Reach 230kV cleared in 5 cycles
56. N-1 PINNACLE PEAK-REACH 230KV Line 1
    - 3 phase fault at Pinnacle Peak 230kV cleared in 5 cycles
57. N-1 WEST PHOENIX-WHITE TANKS 230KV Line 1
    - 3 phase fault at West Phoenix 230kV cleared in 5 cycles
58. N-1 WEST PHOENIX-RUDD 230KV Line 1
    - 3 phase fault at West Phoenix 230kV cleared in 5 cycles
59. N-1 RUDD-WHITE TANKS 230KV Line 1

- 3 phase fault at Rudd 230kV cleared in 5 cycles

60. N-1 WHITE TANKS-El SOL 230KV Line 1
    - 3 phase fault at White Tanks 230kV cleared in 5 cycles
61. N-1 AGUA FRIA-El SOL 230KV Line 1
    - 3 phase fault at Agua Fria 230kV cleared in 5 cycles
62. N-1 AGUA FRIA-GLENDALE 230KV Line 1
    - 3 phase fault at Glendale 230kV cleared in 5 cycles
63. N-1 AGUA FRIA-ALEXANDER 230KV Line 1
    - 3 phase fault at Agua Fria 230kV cleared in 5 cycles
64. N-1 ALEXANDER-DEER VALLEY 230KV Line 1
    - 3 phase fault at Alexander 230kV cleared in 5 cycles
65. N-1 PINNACLE PEAK-DEER VALLEY 230KV Line 1
    - 3 phase fault at Pinnacle Peak 230kV cleared in 5 cycles
66. N-1 WESTWING-DEER VALLEY 230KV Line 1
    - 3 phase fault at Deer Valley 230kV cleared in 5 cycles
67. N-1 EL SOL-SURPRISE 230KV Line 1
    - 3 phase fault at El Sol 230kV cleared in 5 cycles
68. N-1 WESTWING-SURPRISE 230KV Line 1
    - 3 phase fault at Westwing 230kV cleared in 5 cycles
69. N-1 KYRENE-PAPAGO BUTTES 230KV Line 1
    - 3 phase fault at Kyrene 230kV cleared in 5 cycles
70. N-1 PAPAGO BUTTES-PINNACLE PEAK 230KV Line 1
    - 3 phase fault at Pinnacle Peak 230kV cleared in 5 cycles
71. N-1 BRANDOW-PAPAGO BUTTES 230KV Line 1
    - 3 phase fault at Papago Buttes 230kV cleared in 5 cycles
72. N-1 BRANDOW-KYRENE 230KV Line 1
    - 3 phase fault at Kyrene 230kV cleared in 5 cycles
73. N-1 KYRENE-CORBELL 230KV Line 1
    - 3 phase fault at Kyrene 230kV cleared in 5 cycles
74. N-1 KYRENE-SCHRADER 230KV Line 1
    - 3 phase fault at Kyrene 230kV cleared in 5 cycles
75. N-1 KYRENE-KNOX 230KV Line 1
    - 3 phase fault at Kyrene 230kV cleared in 5 cycles
76. N-1 KNOX-SANTA ROSA 230KV Line 1
    - 3 phase fault at Knox 230kV cleared in 5 cycles
77. N-1 KYRNE-ANDERSON 230KV Line 1
    - 3 phase fault at Kyrene 230kV cleared in 5 cycles
78. N-1 LIBERTY-LONE BUTTE 230KV Line 1
    - 3 phase fault at Liberty 230KV cleared in 5 cycles
79. N-1 LIBERTY-PHXWAPA 230KV Line 1
    - 3 phase fault at Liberty 230KV cleared in 5 cycles
80. N-1 LIBERTY-RUDD 230KV Line 1
    - 3 phase fault at Liberty 230KV cleared in 5 cycles

81. N-1 LIBERTY-WESTWING 230KV Line 1
    - 3 phase fault at Liberty 230KV cleared in 5 cycles
82. N-1 PANDA-JOJOBA-TS4-LIBERTY-PALM VALLEY 230KV Line 1
    - 3 phase fault at Palm Valley 230kV cleared in 5 cycles
83. N-1 RUDD-PLMVLY 230KV Line 1
    - 3 phase fault at Palm Valley 230kV cleared in 5 cycles
84. N-1 BUCKEYE-LIBERTY 230KV Line 1
    - 3 phase fault at Liberty 230kV cleared in 5 cycles
    - Close the Buckey-Buckey2 230kV line (if necessary for PT)
85. N-1 SUN VALLEY-TRILBY WASH 230KV Line 1
    - 3 phase fault at Sun Valley 230kV cleared in 5 cycles
86. N-1 TRILBY WASH-TS2-PALM VALLEY 230KV Line 1
    - 3 phase fault at Trilby Wash 230kV cleared in 5 cycles
87. N-1 SUN VALLEY-HASSYAMPA TAP 230KV Line 1
    - 3 phase fault at Sun Valley 230kV cleared in 5 cycles
88. N-1 LIBERTY-HASSYAMP TAP 230KV Line 1
    - 3 phase fault at Hassyampa Tap 230KV cleared in 5 cycles

TPL-002 (Category B) Outages
Transformers

89. N-1 PINNACLE PEAK (S) 500/230KV XFMR 1
    - 3 phase fault at Pinnacle Peak East 230KV cleared in 5 cycles
90. N-1 PINNACLE PEAK (S) 500/230KV XFMR 2
    - 3 phase fault at Pinnacle Peak West 230KV cleared in 5 cycles
91. N-1 PINNACLE PEAK (N) 500/230KV XFMR 3
    - 3 phase fault at Pinnacle Peak North 230KV cleared in 5 cycles
92. N-1 PINNACLE PEAK 345/230KV XFMR 4
    - 3 phase fault at Pinnacle Peak North 230KV cleared in 5 cycles
93. N-1 PINNACLE PEAK (S) 345/230KV XFMR 7
    - 3 phase fault at Pinnacle Peak 230KV cleared in 5 cycles
    - Pinnacle Peak-Mazatzal 345 kV Line in 5 cycles
94. N-1 PINNACLE PEAK (S) 345/230KV XFMR 14
    - 3 phase fault at Pinnacle Peak 230KV cleared in 5 cycles
95. N-1 PINNACLE PEAK (S) 230/69KV XFMR 3
    - 3 phase fault at Pinnacle Peak 230KV cleared in 5 cycles
96. N-1 PINNACLE PEAK (S) 230/69KV XFMR 6
    - 3 phase fault at Pinnacle Peak 230KV cleared in 5 cycles
97. N-1 PINNACLE PEAK (S) 230/69KV XFMR 17
    - 3 phase fault at Pinnacle Peak 230KV cleared in 5 cycles
98. N-1 CACTUS 230/69KV XFMR 6
    - 3 phase fault at Cactus 230KV cleared in 5 cycles
99. N-1 LINCOLN STREET 230/69KV XFMR 10
    - 3 phase fault at Lincoln Street 230KV cleared in 5 cycles
100. N-1 WEST PHOENIX 230/69KV XFMR 10

- 3 phase fault at West Phoenix 230KV cleared in 5 cycles

101. N-1 WEST PHOENIX 230/69KV XFMR 14
    - 3 phase fault at West Phoenix 230KV cleared in 5 cycles
102. N-1 WEST PHOENIX 230/69KV XFMR 16
    - 3 phase fault at West Phoenix 230KV cleared in 5 cycles
103. N-1 COUNTRY CLUB 230/69KV XFMR 6
    - 3 phase fault at Country Club 230KV cleared in 5 cycles
104. N-1 MEADOWBROOK 230/69KV XFMR 9
    - 3 phase fault at Meadowbrook 230KV cleared in 5 cycles
105. N-1 SUNNYSLOPE 230/69KV XFMR 1
    - 3 phase fault at Sunnyslope 230KV cleared in 5 cycles
106. N-1 LONEPEAK 230/69KV XFMR 1
    - 3 phase fault at Lonepeak 230KV cleared in 5 cycles
107. N-1 REACH 230/69KV XFMR 2
    - 3 phase fault at Reach 230KV cleared in 5 cycles
108. N-1 WESTWING 500/230KV XFMR 4
    - 3 phase fault at Westwing W 230KV cleared in 5 cycles
109. N-1 WESTWING 500/345KV XFMR 7
    - 3 phase fault at Westwing 345KV cleared in 4 cycles
110. N-1 GILA RIVER 500/230KV XFMR
    - 3 phase fault at Gila River 500kV cleared in 4 cycles
111. N-1 JOJOBA 500/230KV XFMR 1 (when Modeled)
    - 3 phase fault at Jojoba 500 kV cleared in 4 cycles
112. N-1 OCOTILLO 230/69KV XFMR 1

    3 phase fault at Ocotillo 230kv cleared in 5 cycles
113. N-1 SNVLY 500/230KV XFMR
    - 3 phase fault at Sun Valley 500kV cleared in 4 cycles
114. N-1 TRILBY WASH 230/69KV XFMR
    - 3 phase fault at Trilby Wash 230kV cleared in 5 cycles
115. N-1 PALM VALLEY 230/69KV XFMR 1
    - 3 phase fault at Palm Valley 230kV cleared in 5 cycles
116. N-1 RUDD 500/230KV XFMR 1A/1B
    - 3 phase fault at Rudd 500kV cleared in 4 cycles
117. N-1 BUCKEYE 230/69KV XFMR 1
    - 3 phase fault at Buckeye 230KV cleared in 5 cycles
    - Open Buckeye 230/69 kV XFMR 2
    - Trip the Buckeye-Liberty 230 kV Line
118. N-1 WESTWING (E) 500/230KV XFMR 1
    - 3 phase fault at Westwing E 230kV cleared in 5 cycles
    - Close E-W Bus Tie
119. N-1 MORGAN 500/230KV XFMR 1
    - 3 phase fault at Raceway 230kV cleared in 4 cycles
120. N-1 KYRENE 500/230KV XFMR 6
    - 3 phase fault at Kyrene 500kV cleared in 4 cycles

121. N-1 KYRENE 500/230KV XFMR 7
    - 3 phase fault at Kyrene 500kV cleared in 4 cycles
122. N-1 KYRENE 500/230KV XFMR 8
    - 3 phase fault at Kyrene 500kV cleared in 4 cycles
123. N-1 GILA RIVER 500/230KV XFMR 1
    - 3 phase fault at Panda 230KV cleared in 5 cycles
124. N-1 GILA BEND 230/69KV XFMR 1
    - 3 phase fault at Gila Bend 230KV cleared in 5 cycles
125. N-1 N.GILA 500/69 kV XFMR 1
    - 3 phase fault at N.Gila 500kV cleared in 4 cycles
126. N-1 N.Gila 500/230kV XFMR
    - 3 phase fault at N.Gila 500kV cleared in 4 cylces

TPL-002 (Category B) Outages
Generators

127. N-1 Q225
    - no fault trip
128. N-1 PALO VERDE Unit 2
    - no fault trip

TPL-003 (Category C) Outages
500kV Lines

129. N-2 JOJOBA-GILA RIVER 1 & 2 500 kV Lines
    - 3 phase fault at Jojoba 500 kV cleared in 4 cycles (C3)
    - Gila River SPS Action: Open the Gila River Transformer at 12 cycles dropping all Gila River gen
130. N-2 DUKE-PINAL C 500 kV & TEST TRACK-ED5 230 kV Lines
    - 3 phase fault at Duke 500 kV cleared in 4 cycles
131. N-2 DUKE-PINAL C 500 kV & DESERT BASIN-PINAL C 230 kV Lines
    - 3 phase fault at Pinal Central 500 kV cleared in 4 cycles
132. N-2 PINAL C-BROWNING 500 kV & PINAL C-RANDOLPH 230 kV Lines
    - 3 phase fault at Pinal Central 500 kV cleared in 4 cycles
133. N-2 PINAL CENTRAL-BROWNING 500 kV & RANDOLPH-ABEL 230 kV Lines
    - 3 phase fault at Pinal Central 500 kV cleared in 4 cycles
134. N-2 PINAL CENTRAL-BROWNING 500 kV & ABEL-DINOSAUR 230 kV Lines
    - 3 phase fault at Browning 500 kV cleared in 4 cycles
135. N-2 PINAL C-BROWNING 500 kV & DINOSAUR-BROWNING 230 kV Lines
    - 3 phase fault at Browning 500 kV cleared in 4 cycles
136. N-2 Palo Verde Unit 1 & Palo Verde-Westwing 500 kV Line 1
    - SLG fault at Palo Verde 500 kV cleared in 10 cycles (C6)
137. N-2 Palo Verde-Westwing 500 kV Line 1 & Westwing 500/230 kV Xfmr 10
    - SLG fault at Westwing 500 kV cleared in 10 cycles (C7)
138. N-1 Hassayampa-Palo Verde 500 kV Line 2 with delayed clearing
    - SLG fault at Hassayampa 500 kV cleared in 10 cycles (C8)
139. N-1 Palo Verde-Westwing 500 kV Line 2 with delayed clearing

- SLG fault at Palo Verde 500 kV cleared in 10 cycles (C8)

140. N-1 Jojoba-Kyrene 500 kV Line with delayed clearing
    - SLG fault at Jojoba 500 kV cleared in 10 cycles (C8)
141. N-2 Palo Verde-Hassayampa 500 kV Lines 1 & 2
    - 3 phase fault at Palo Verde 500 kV cleared in 4 cycles (C5)
142. N-2 Colorado River-Red Bluff 500 kV Lines 1 & 2
    - 3 phase fault at Colorado River 500 kV cleared in 4 cycles (C5)
143. N-2 Red Bluff-Devers 500 kV Lines 1 & 2
    - 3 phase fault at Red Bluff 500 kV cleared in 4 cycles (C5)
144. N-2 IPP DC Bi-pole
    - No Fault DC Outage
    - Trip Intermountain and Adelanto shunt caps in 4 cycles
    - Trip Intermountain Units 1 & 2 in 10.2 cycles
145. N-1-1 Palo Verde-Westwing & Palo Verde-Colorado River 500 kV Lines
    - (C3) PT only
146. N-1-1 Palo Verde-Colorado River & Palo Verde-Hassayampa 500 kV Lines
    - (C3) PT only
147. N-1-1 Palo Verde-Colorado River & Palo Verde-Rudd 500 kV Lines
    - (C3) PT only
148. N-1-1 Palo Verde-Westwing & Palo Verde-Rudd 500 kV Lines
    - (C3) PT only
149. N-1-1 Palo Verde-Hassayampa & Palo Verde-Rudd 500 kV Lines
    - (C3) PT only
150. N-1-1 Hassayampa-Jojoba & Jojoba-Kyrene 500 kV Lines
    - (C3) PT only
151. N-1-1 Jojoba-Kyrene & Palo Verde-Rudd 500 kV Lines
    - (C3) PT only
152. N-1-1 Hassayampa-North Gila 2 & North Gila-Hoodoo Wash 500 kV Lines
    - (C3) PT only
153. N-1-1 Hassayampa-North Gila 2 & Hassayampa-Hoodoo Wash 500 kV Lines
    - (C3) PT only
154. N-1-1 Morgan-Pinnacle Peak 500 kV line & Raceway-Morgan 230 kV line
    - (C3) PT only
155. N-1-1 Morgan-Pinnacle Peak 500 kV line & Morgan 500/230 kV Xfmr
    - (C3) PT only
156. N-2 MORGAN-PINNACLE PEAK 500 Kv Line & RACEWAY-AVERY 230kV Line
    - (C5) PT only
157. N-2 DUKE-PINAL CENTRAL 500 Kv Line & TEST TRACK-ED5 230 Kv Line
    - (C5) PT only
158. N-2 DUKE-PINAL CENTRAL 500 Kv Line & DESERT BASIN-PINAL CENTRAL 230 Kv Line
    - (C5) PT only
159. N-2 PINAL CENTRAL-BROWNING 500 Kv Line & PINAL CENTRAL-RANDOLPH 230

Kv Line

- (C5) PT only

160. N-2 PINAL CENTRAL-BROWNING 500 Kv Line & RANDOPLH-ABEL 230 Kv Line
    - (C5) PT only
161. N-2 PINAL CENTRAL-BROWNING 500 Kv Line & ABEL-DINOSAUR 230 Kv Line
    - (C5) PT only
162. N-2 PINAL CENTRAL-BROWNING 500 Kv Line & DINOSAUR-BROWNING 230 Kv Line
    - (C5) PT only

TPL-003 (Category C) Outages
230kV Lines

163. N-2 OCOTILLO-CACTUS & OCOTILLO-PINNACLE PEAK 230KV Lines
    - 3 phase fault at Ocotillo 230 kV cleared in 5 cycles
164. N-2 CACTUS-PINNACLE PEAK & OCOTILLO-PINNACLE PEAK 230KV Lines
    - 3 phase fault at Pinnacle Peak 230 kV cleared in 5 cycles
165. N-2 WEST PHOENIX-RUDD & WEST PHOENIX-WHITE TANKS 230 KV Lines
    - 3 phase fault at West Phoenix 230 kV cleared in 5 cycles
166. N-2 RUDD-WHITE TANKS & WEST PHOENIX-WHITE TANKS 230KV Lines
    - 3 phase fault at White Tanks 230 kV cleared in 5 cycles
167. N-2 RUDD-ORME #1 & #2 230 KV Lines
    - 3 phase fault at Rudd 230 kV cleared in 5 cycles
168. N-2 PINNACLE PEAK-ROGERS #1 & #2 230KV Lines
    - 3 phase fault at Pinnacle Peak 230 kV cleared in 5 cycles
169. N-2 ORME-ANDERSON #1 & #2 230KV Lines
    - 3 phase fault at Orme 230 kV cleared in 5 cycles
170. N-2 PINNACLE PEAK-BRANDOW #2 & PINNACLE PEAK-OCOTILLO 230KV Lines
    - 3 phase fault at Pinnacle Peak 230 kV cleared in 5 cycles
171. N-2 PINNACLE PEAK-CACTUS & PINNACLE PEAK-BRANDOW #1 230KV Lines
    - 3 phase fault at Pinnacle Peak 230 kV cleared in 5 cycles
172. N-2 KYRENE-KNOX & KYRENE-OCOTILLO 230KV Lines
    - 3 phase fault at Kyrene 230 kV cleared in 5 cycles
173. N-2 KNOX-SANTA ROSA & KYRENE-OCOTILLO 230KV Lines
    - 3 phase fault at Kyrene 230 kV cleared in 5 cycles
174. N-2 KYRENE-BRANDOW & KYRENE-PAPAGO BUTTES 230KV Lines
    - 3 phase fault at Kyrene 230 kV cleared in 5 cycles
175. N-2 KYRENE-CORBELL & KYRENE-SCHRADER 230KV Lines
    - 3 phase fault at Kyrene 230 kV cleared in 5 cycles

TPL-004 (Category D) Outages
500kV Lines

176. N-2 PALO VERDE-WESTWING 500 kV Lines 1 & 2
    - 3 phase fault at Palo Verde 500 kV cleared in 4 cycles
177. N-2 PALO VERDE-RUDD & PALO VERDE-WESTWING #2 500 kV Lines
    - 3 phase fault at Palo Verde 500 kV cleared in 4 cycles

178. N-2 JOJOBA-KYRENE & JOJOBA-PINAL W 500 kV Lines (D7)
    - 3 phase fault at Jojoba 500 kV cleared in 4 cycles

179. N-2 HASSAYAMPA-JOJOBA 500 kV Lines 1 & 2 (D7)
    - 3 phase fault at Jojoba 500 kV cleared in 4 cycles

180. Simultaneous Outage of PALO VERDE UNITS 1 & 2
    - No Fault Outage of Palo Verde Units 1 and 2
    - Drop APS load at Marinette and Papago (45 MW)
    - Drop SRP load at Zimmerman, Corbell, Shaw, Apache (75 MW)

Appendix C

Transient Stability Data

regc_a	
Mva	15
Lvplsw	1.0
Rrpwr	10
Brkpt	0.9
Zerox	0.4
Lvpl1	1.22
Vtmax	1.2
Lvpnt1	0.8
Lvpnt0	0.4
Qmin	-1.3
Accel	0.7

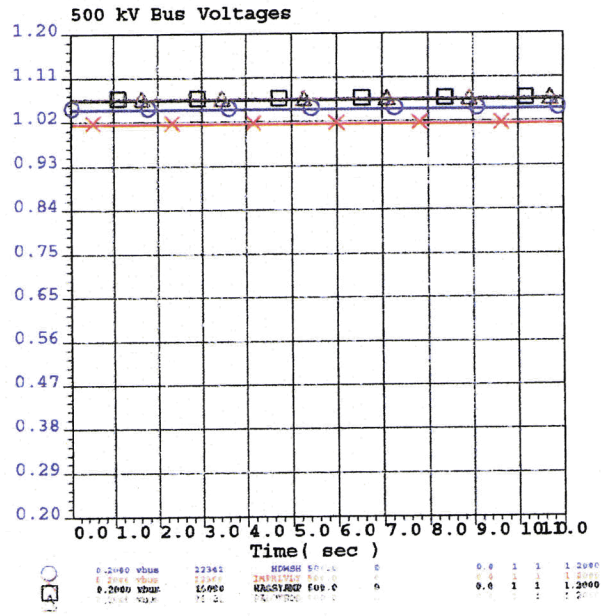
reec_b	
Mvab	112
Vdip	-99
Vup	99
Trv	0.02
Dbd1	-0.05
Dbd2	0.05
Kqv	0
Iqh1	1.25
Iql1	-1.05
Vref0	1.01
Tp	0.05
Qmax	0.31225
Qmin	-0.31225
Vmax	1.01
Vmin	0.9
Kqp	1
Kqi	0
Kvp	1
Kvi	0
Tiq	0.02
Dpmax	99
Dpmin	-99
Pmax	1.0
Pmin	0
Imax	1.0
Tpord	0.02
Pfflag	0.0
Vflag	1.0
Qflag	0.0
Pqflag	0.0

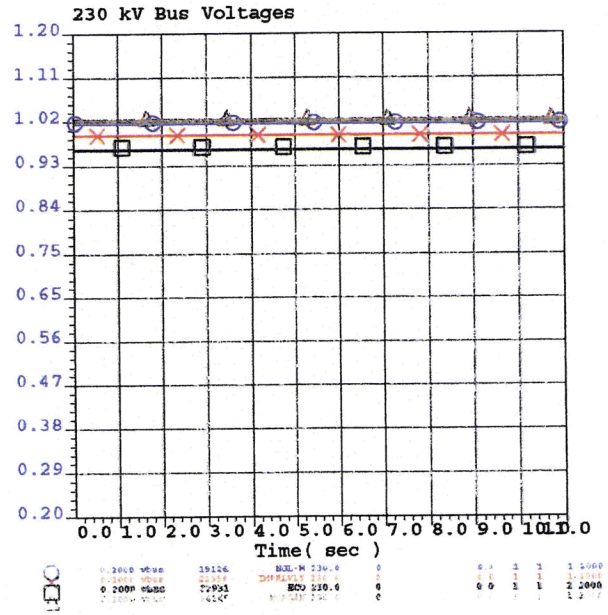
Repc_a	
Mvab	108
Tfltr	0.02
Kp	4.0
Ki	0.10
Tft	0.0
Tfv	0.02
Refflg	1.0
Vfrz	-1.0
R	0.0
Xc	0.0
Kc	0.0
Vcmpflg	1.0
Emax	0.1
Emin	-0.1
Dbd	0.0
Qmax	0.31225
Qmin	-0.31225
Kpg	0.1
Kig	0.05
Tp	0.25
Fdbd1	0.0
Fdbd2	0.0
Femax	999
Femin	-999
Pmax	999
Pmin	-999
Tlag	0.1
Ddn	20
Dup	0.0
Frqflg	0.0
Outflag	0.0

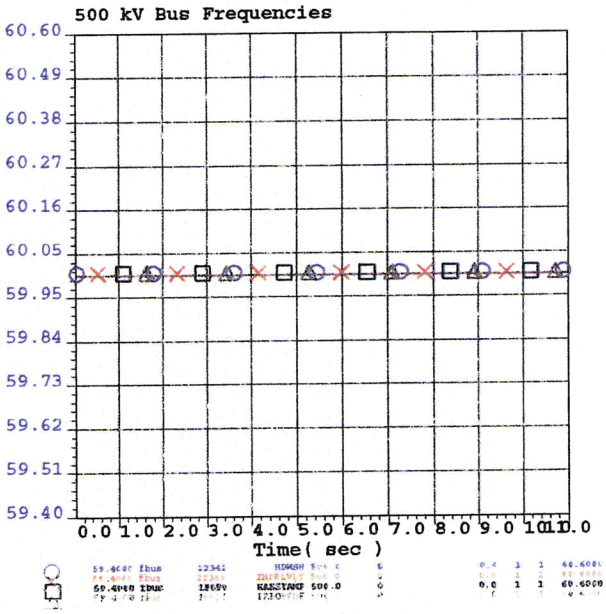
Appendix D

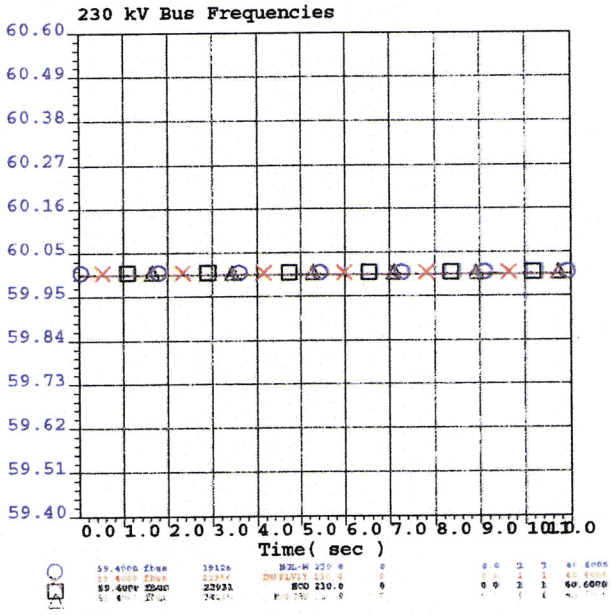
TRANSIENT STABILITY PLOTS

Q225 Transient Stability Plots







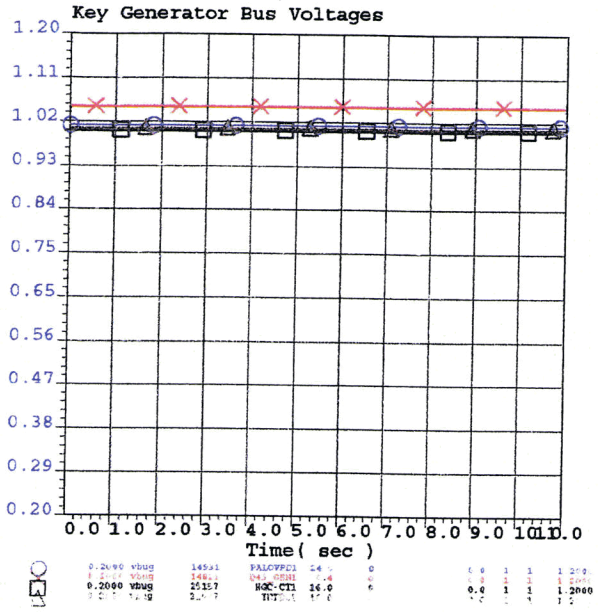


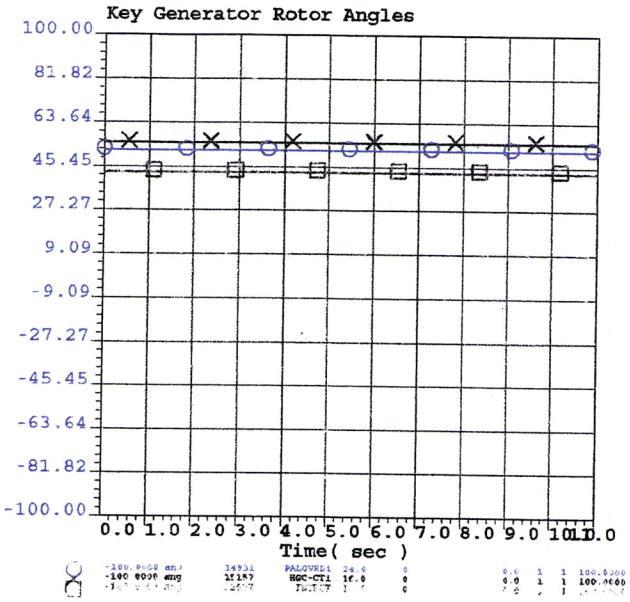
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

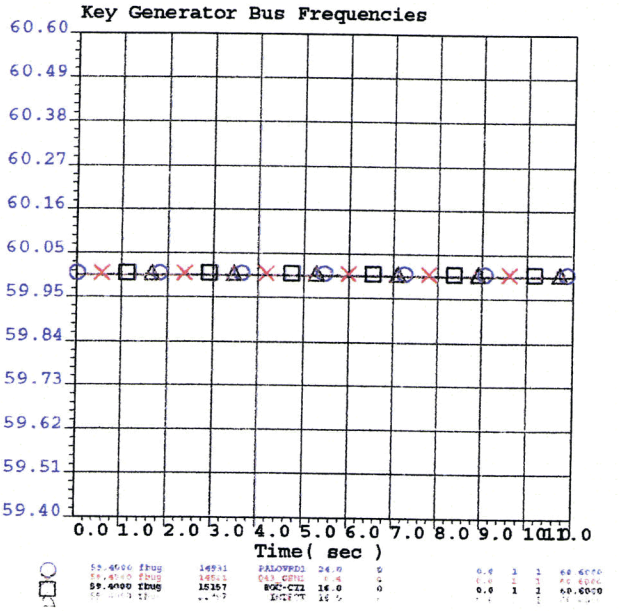
02_19HS_PST_000-N-0_FLAT_RUN.chf

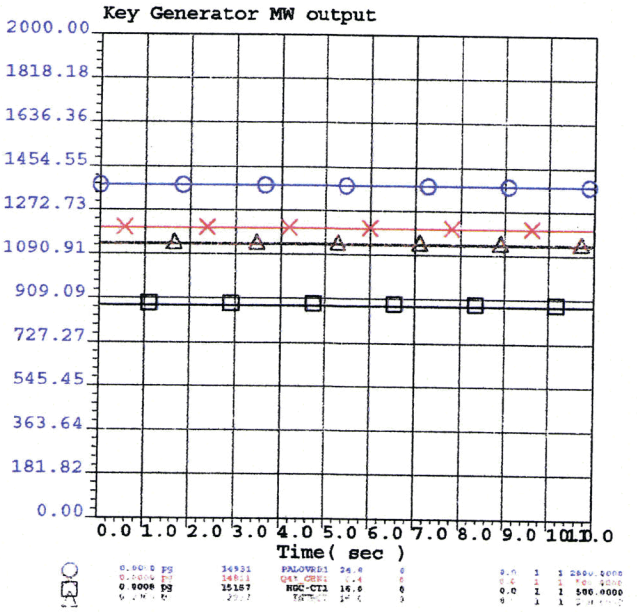
Thu Jun 04 16:52:30 2015

Q225 Transient Stability Plots



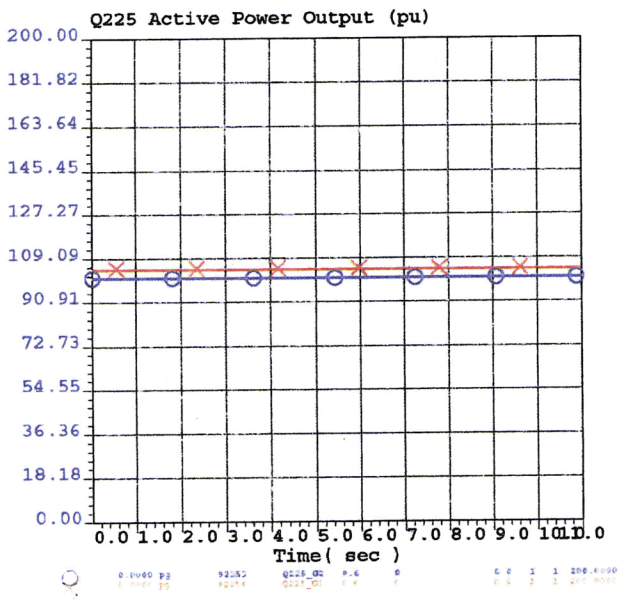


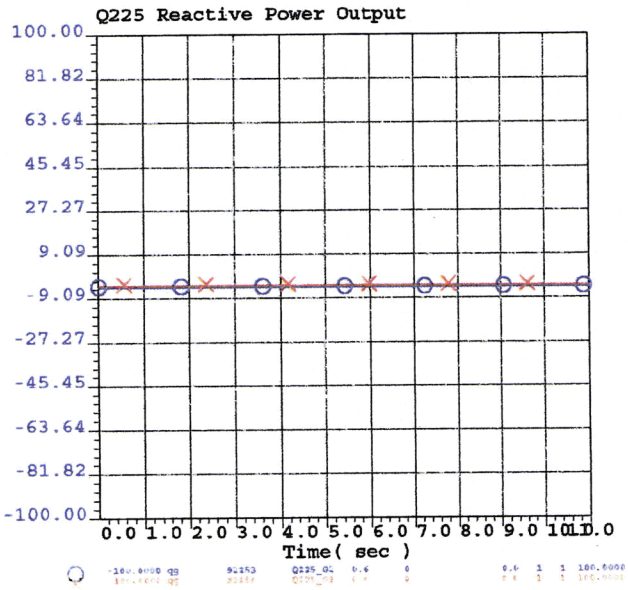


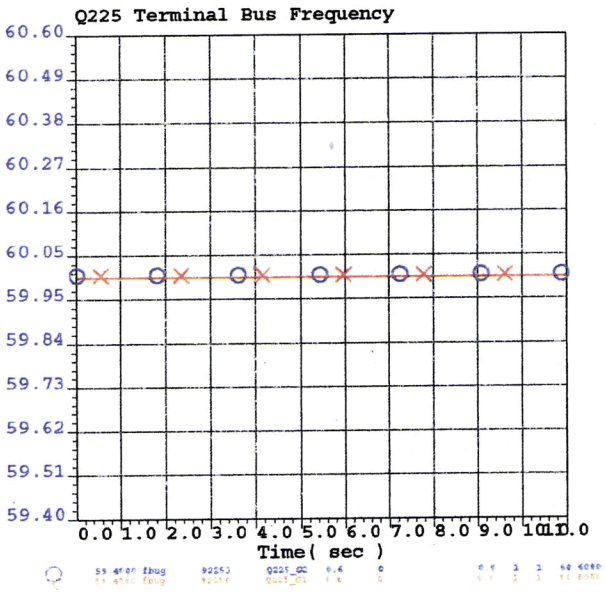


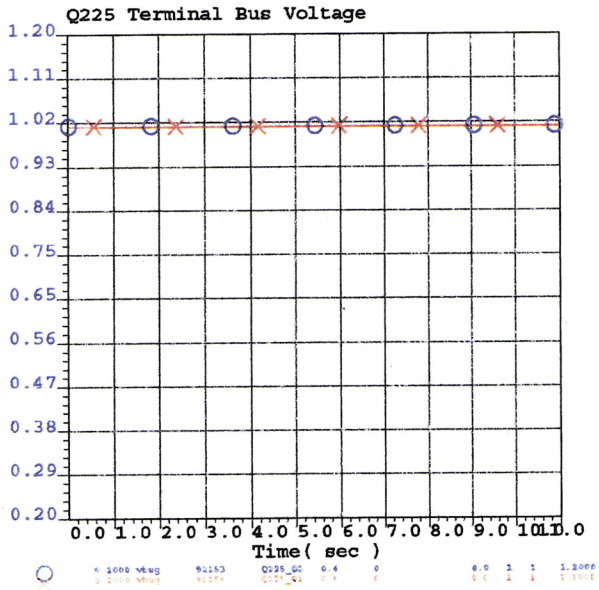
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







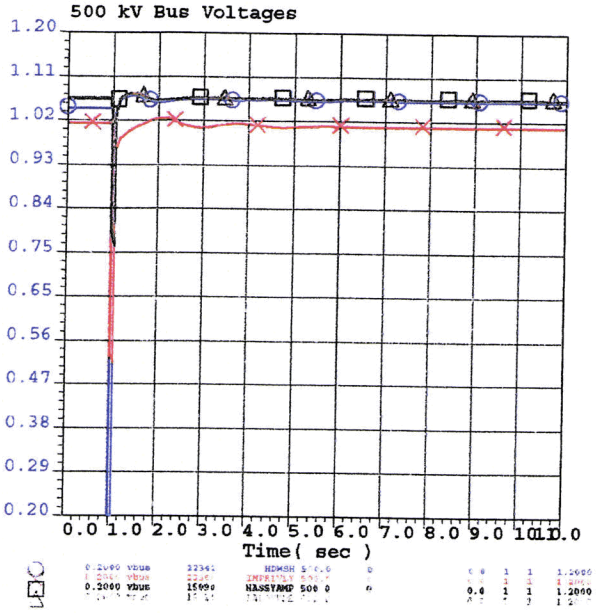


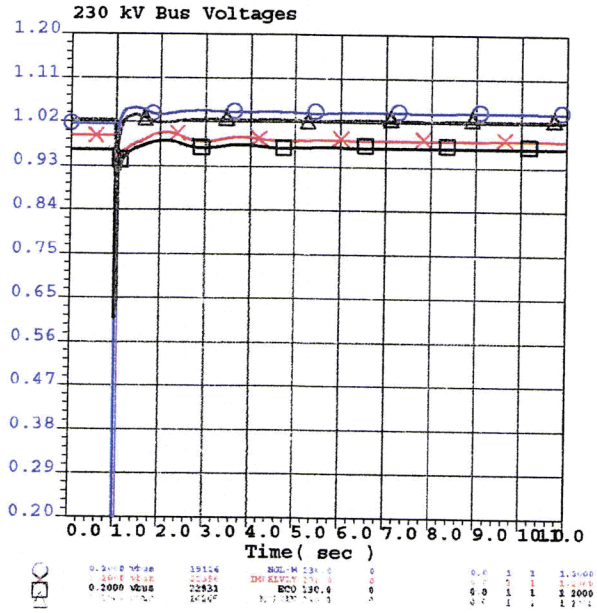
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

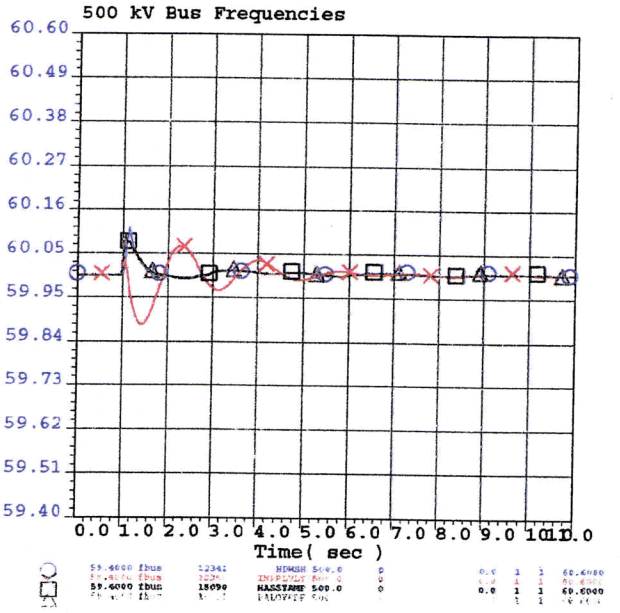
02_19HS_PST_000-N-0_FLAT_RUN.chf

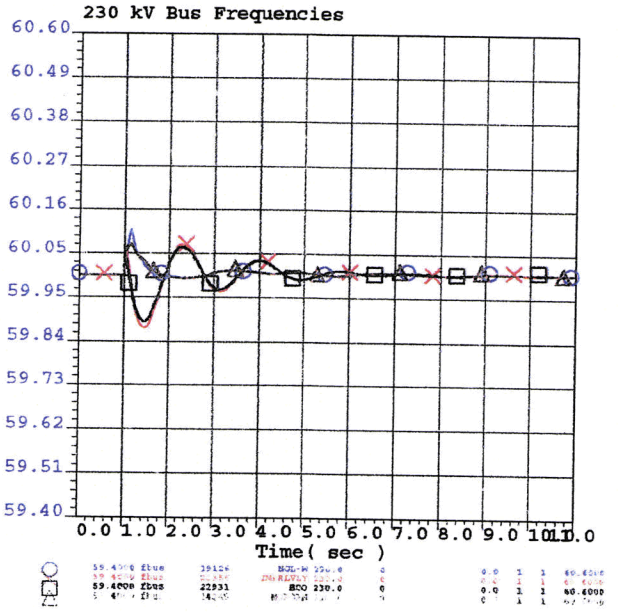
Thu Jun 04 16:52:30 2015

Q225 Transient Stability Plots







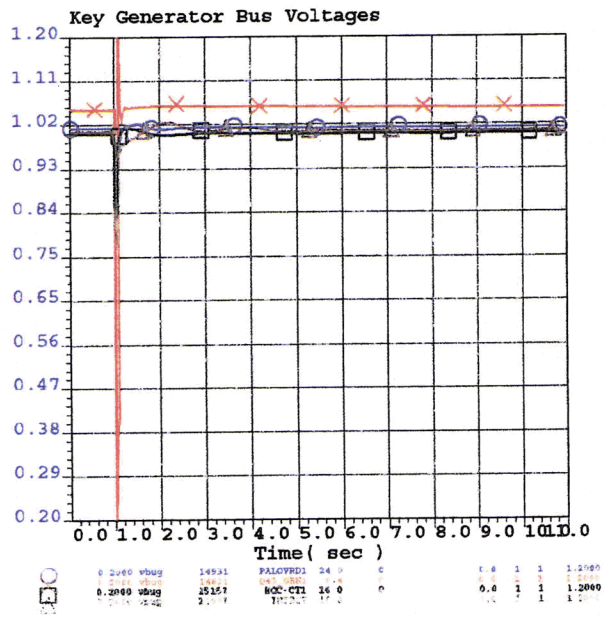


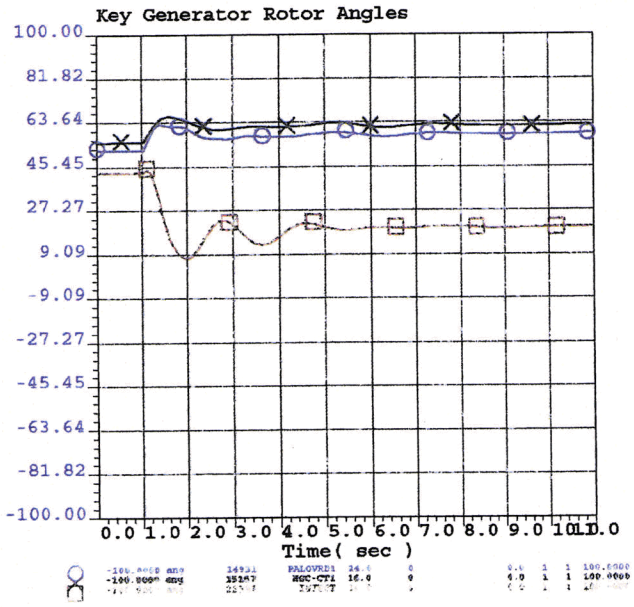
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

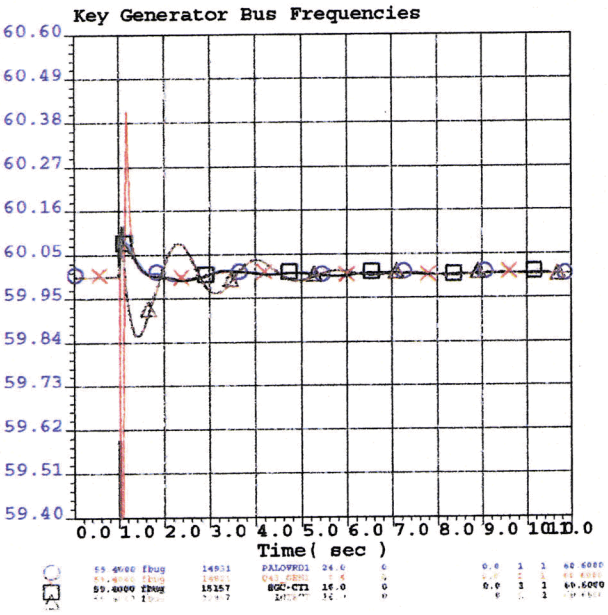
02_19HS_PST_001_NGI-IV_500_1.chf

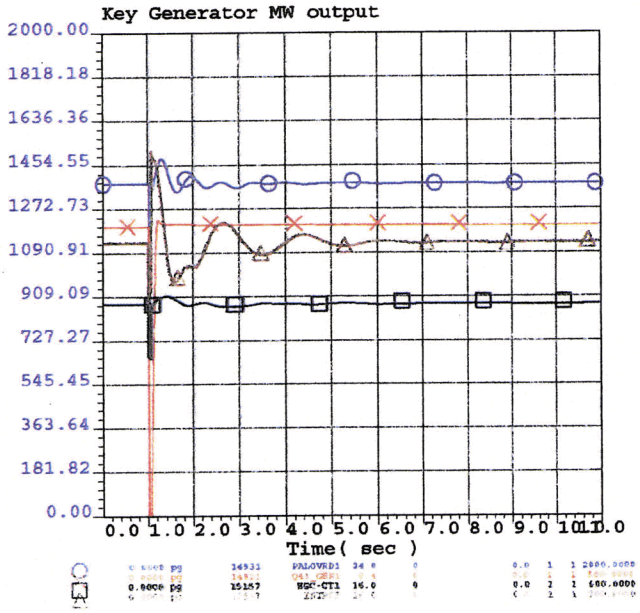
Thu Jun 04 16:52:31 2015

Q225 Transient Stability Plots







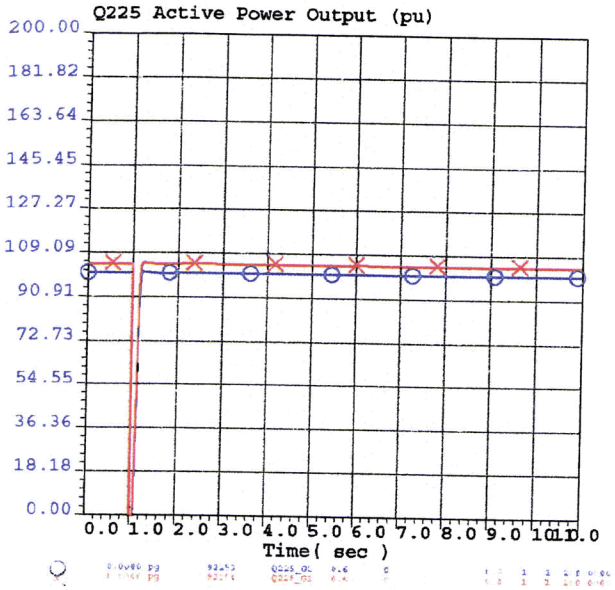


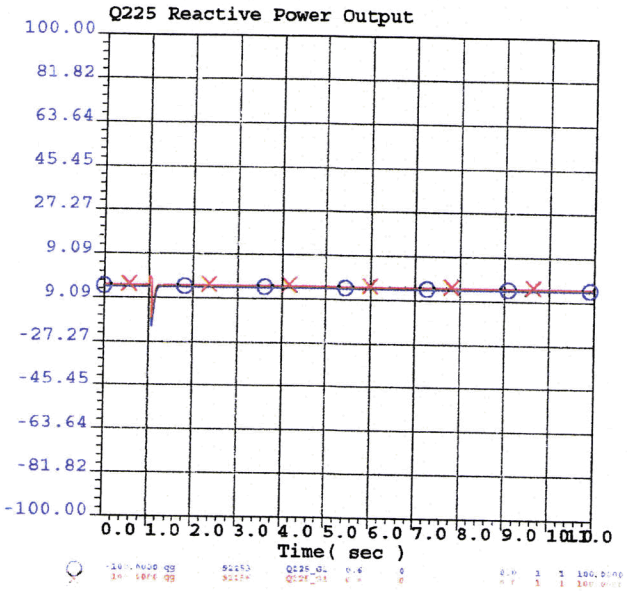
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

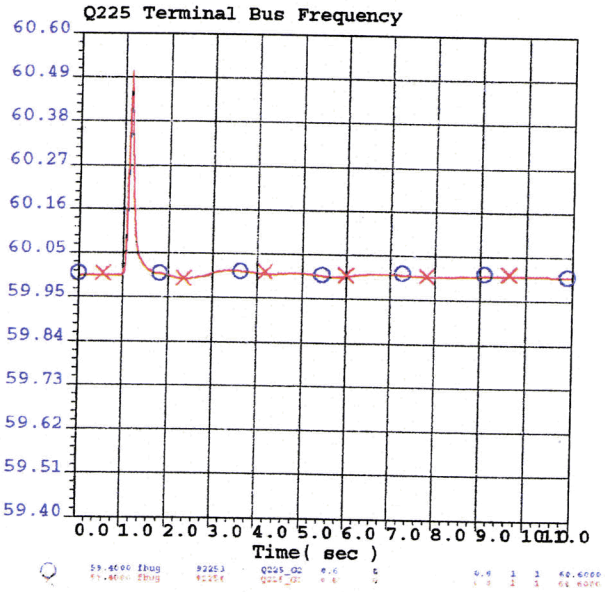
02_19HS_PST_001_NGI-IV_500_1.chf

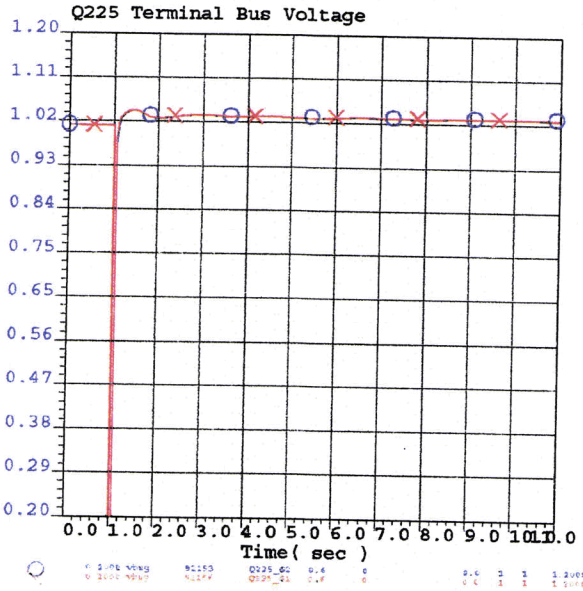
Thu Jun 04 16:52:32 2015

Q225 Transient Stability Plots



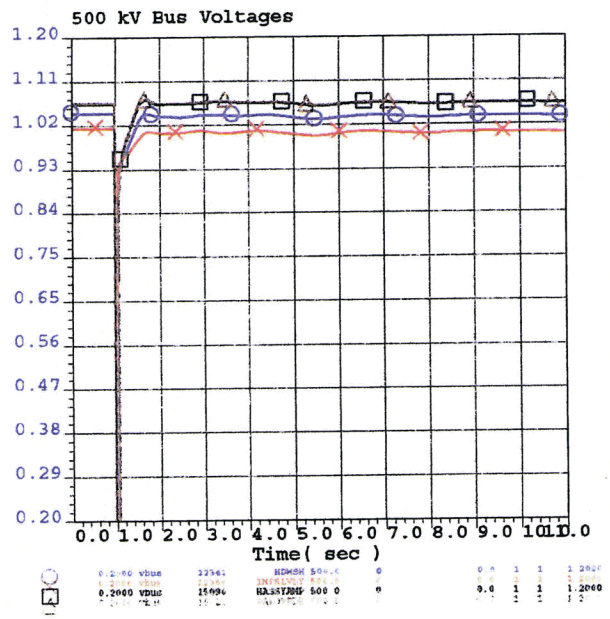


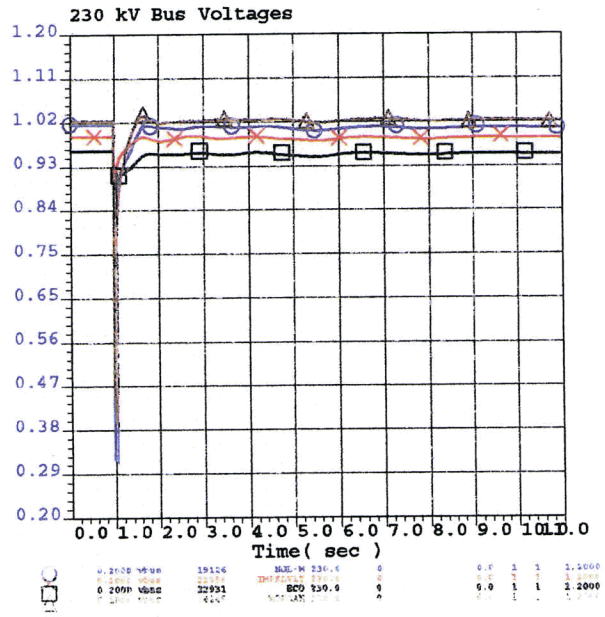


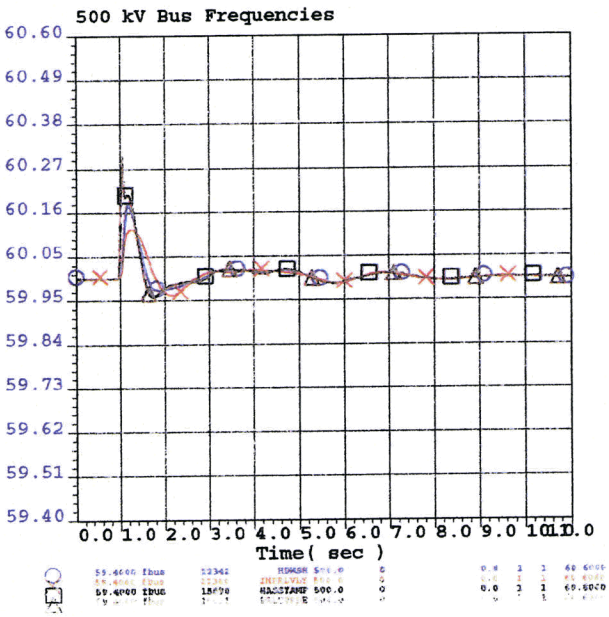


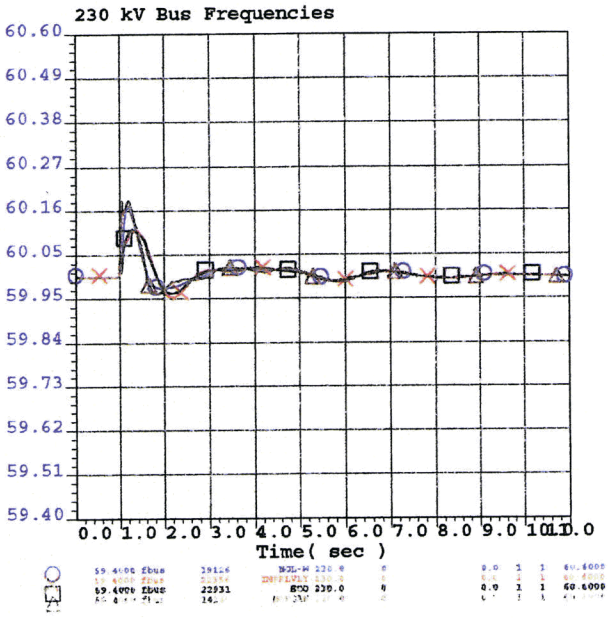
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







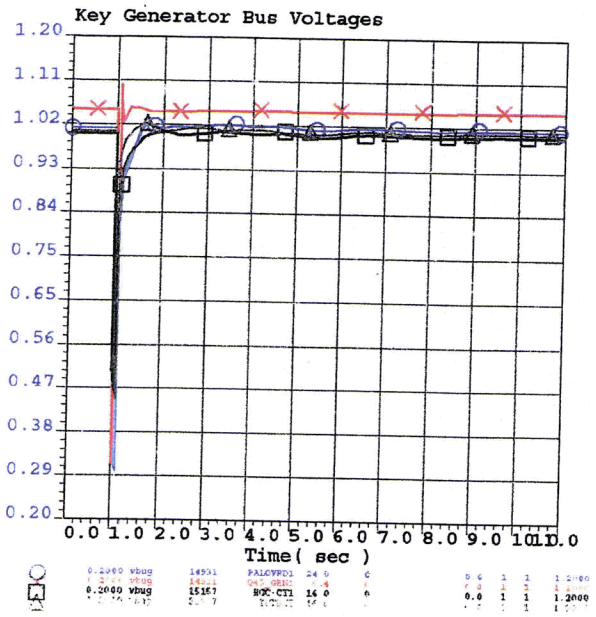


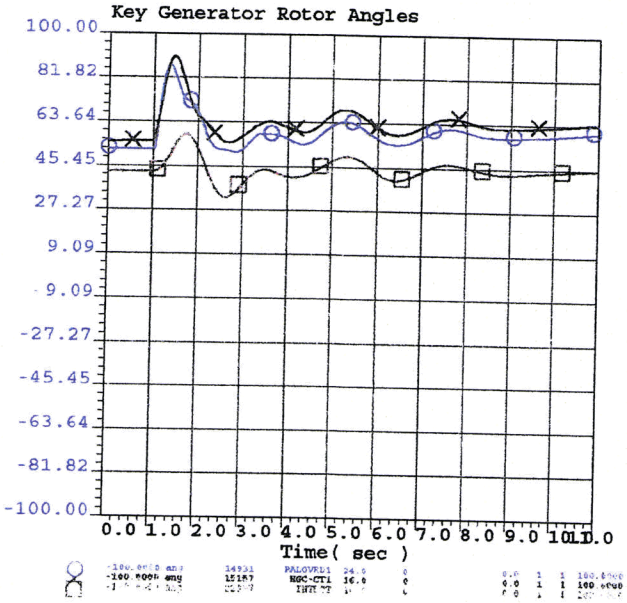
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

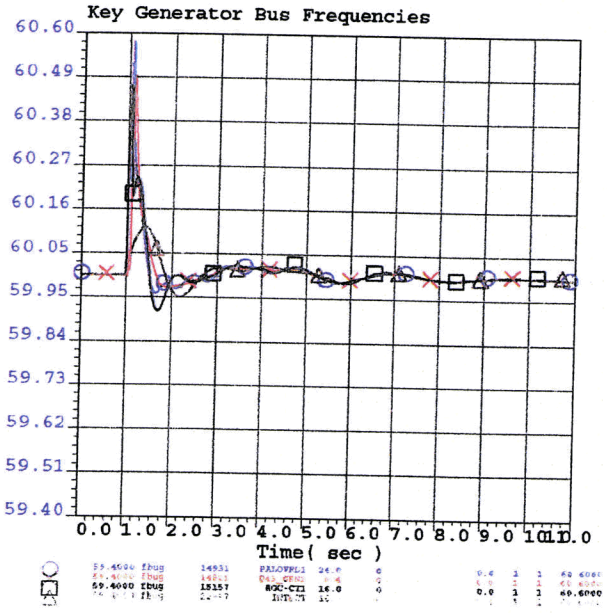
02_19HS_PST_002_PV-CR.chf

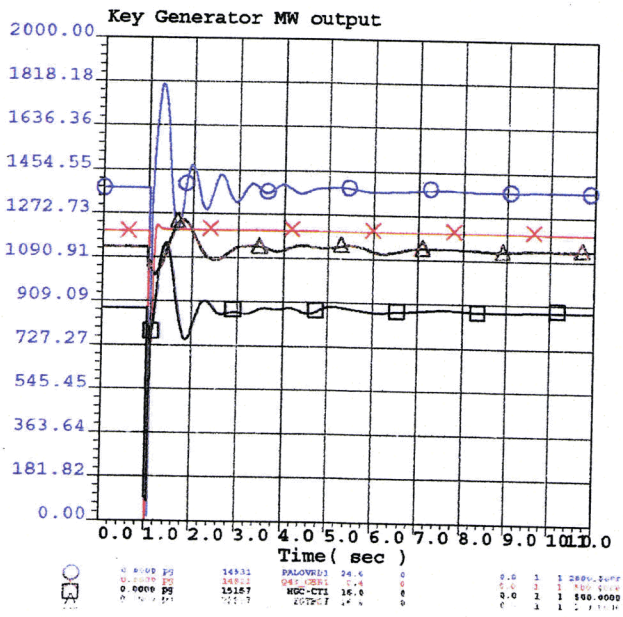
Thu Jun 04 16:52:33 2015

Q225 Transient Stability Plots



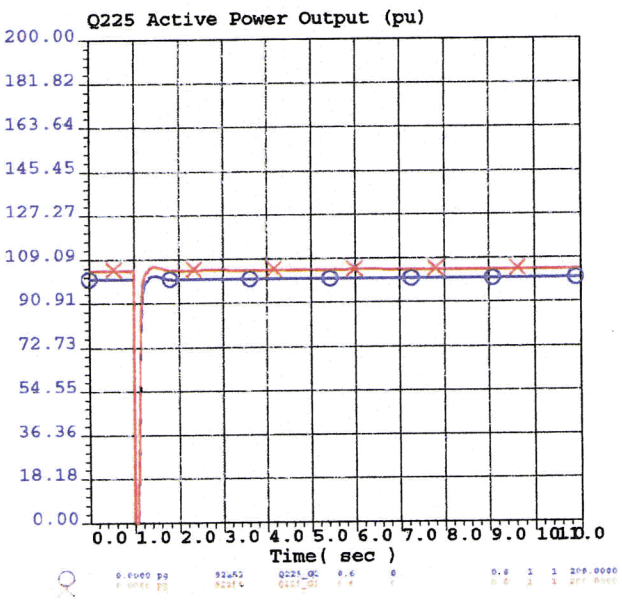


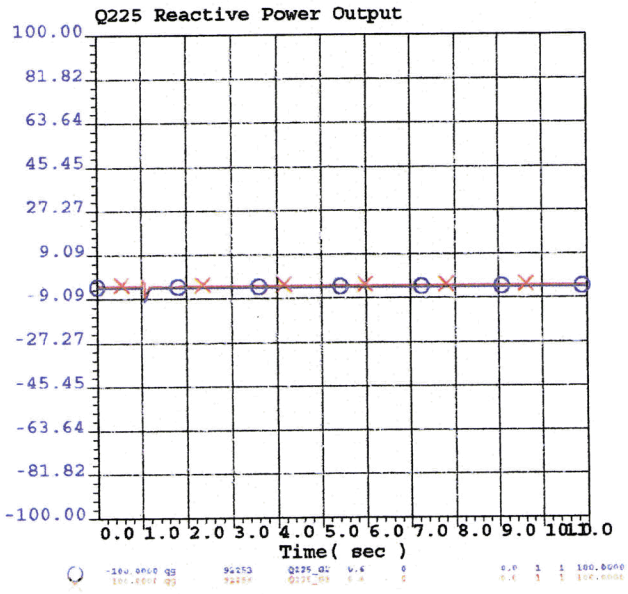


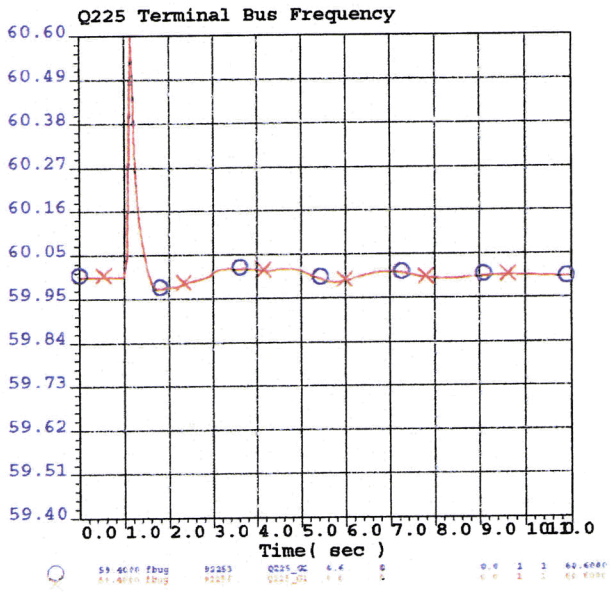


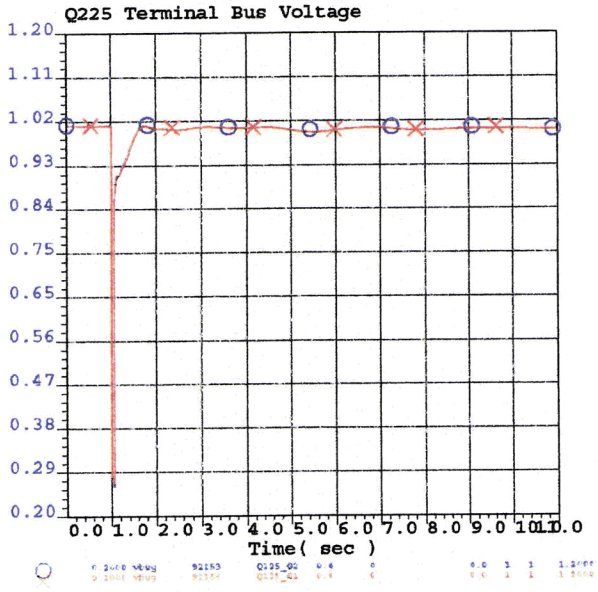
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







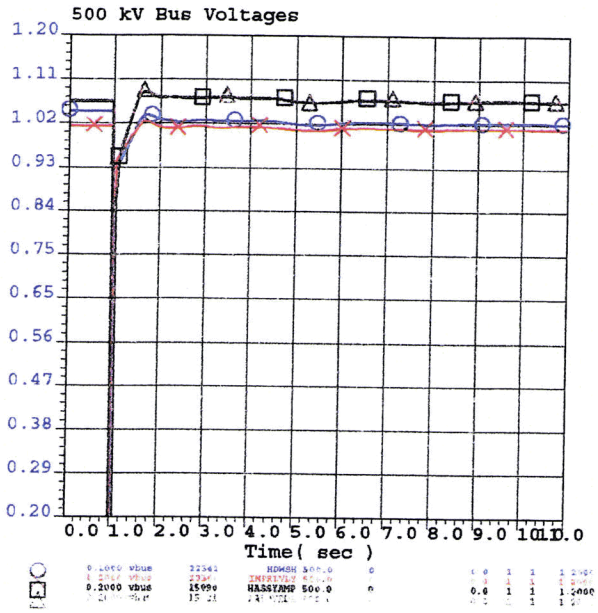


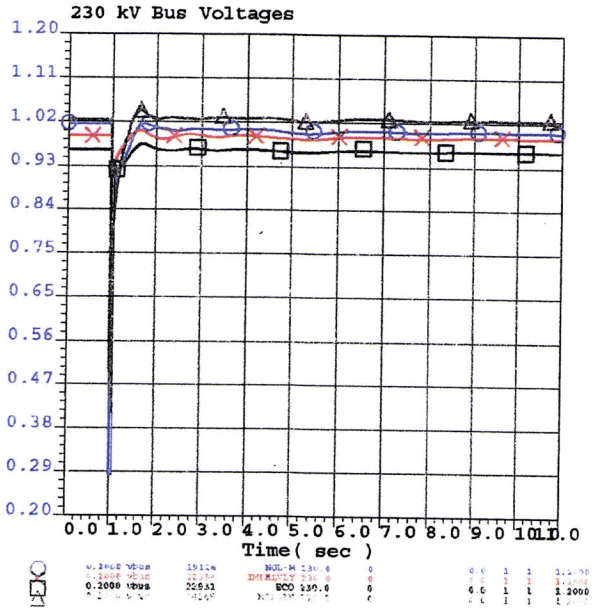
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

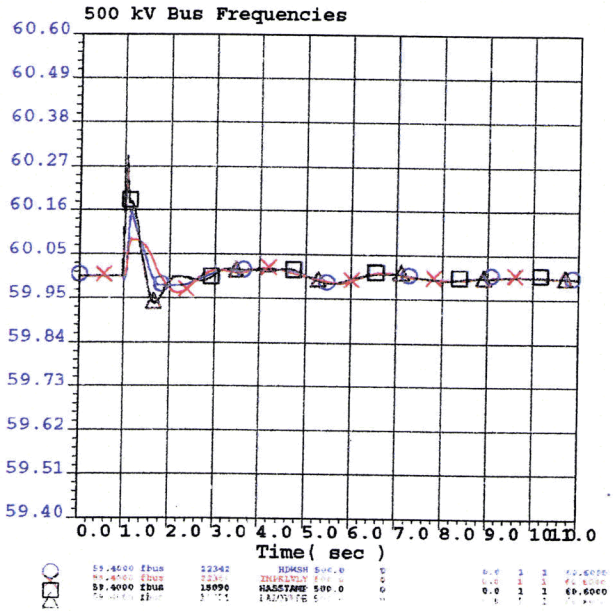
02_19HS_PST_002_PV-CR.chf

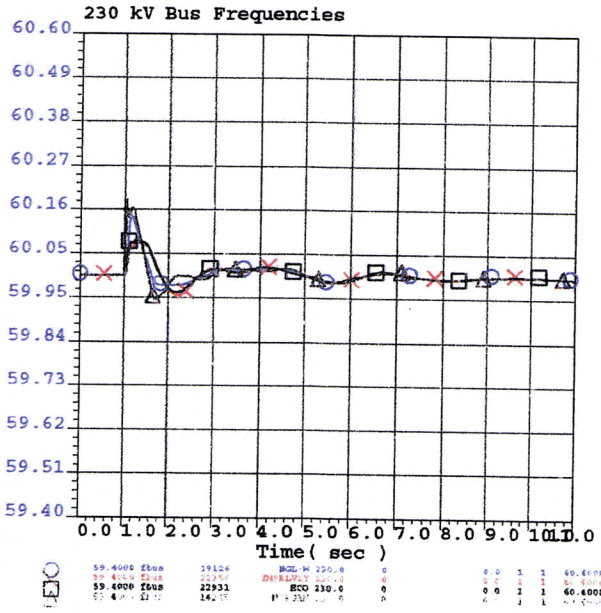
Thu Jun 04 16:52:33 2015

Q225 Transient Stability Plots



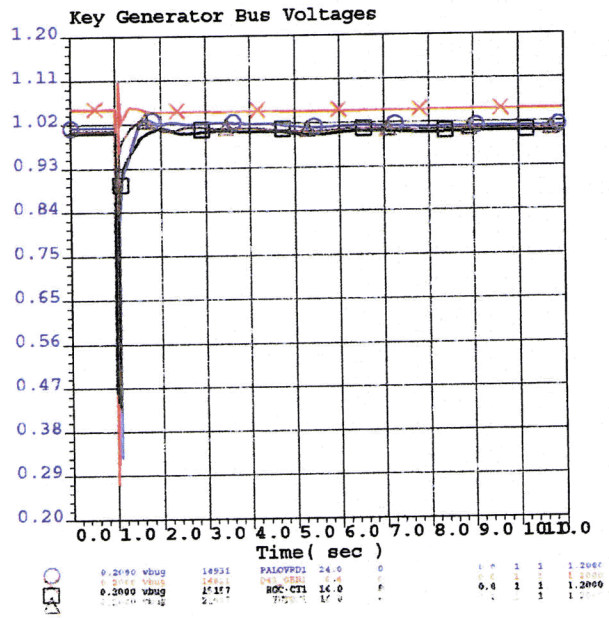


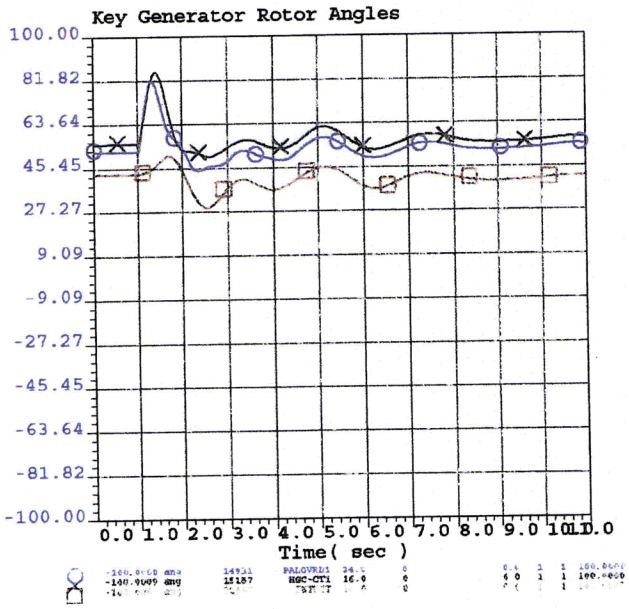


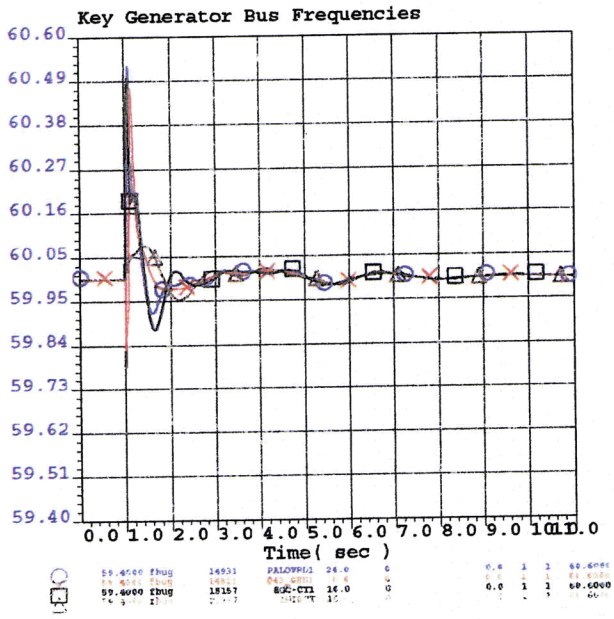


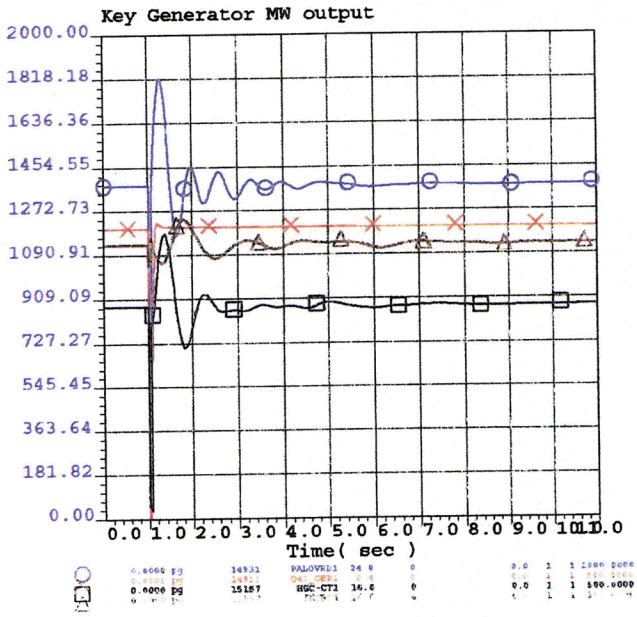
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







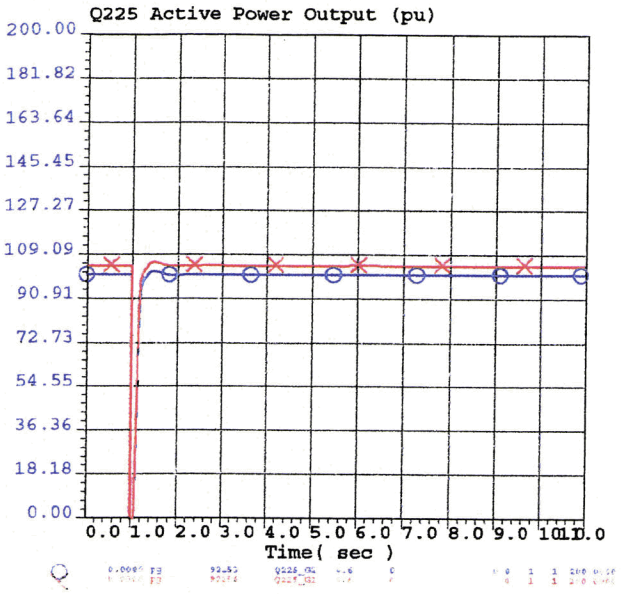


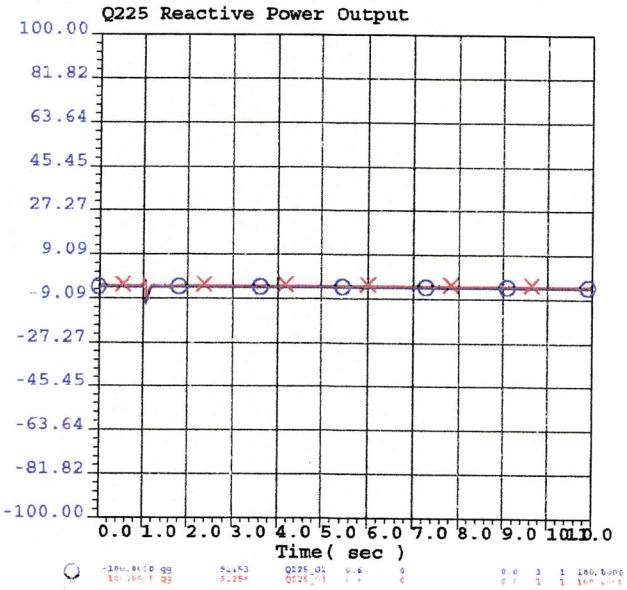
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

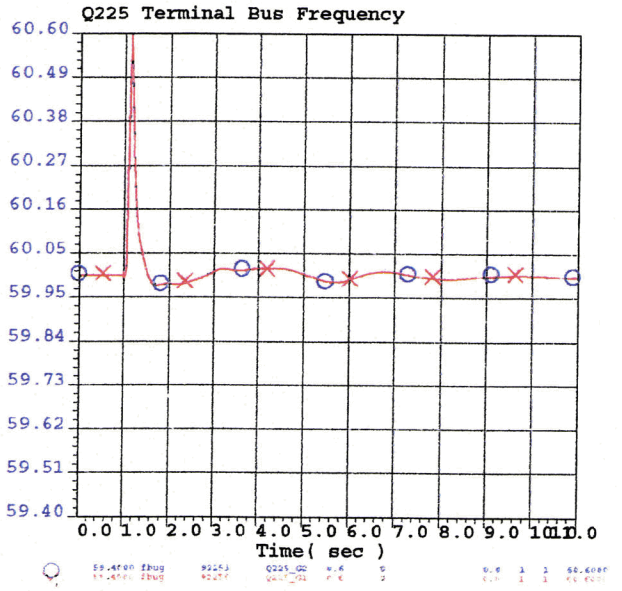
02_19HS_PST_012_HAS-HDW.chf

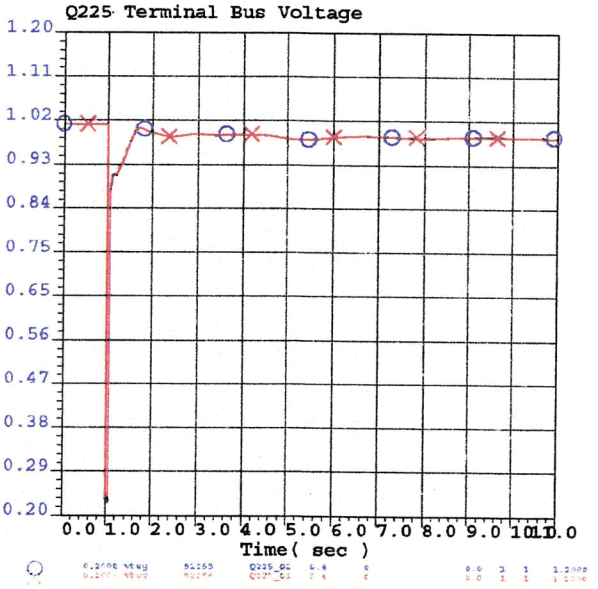
Thu Jun 04 16:52:48 2015

Q225 Transient Stability Plots







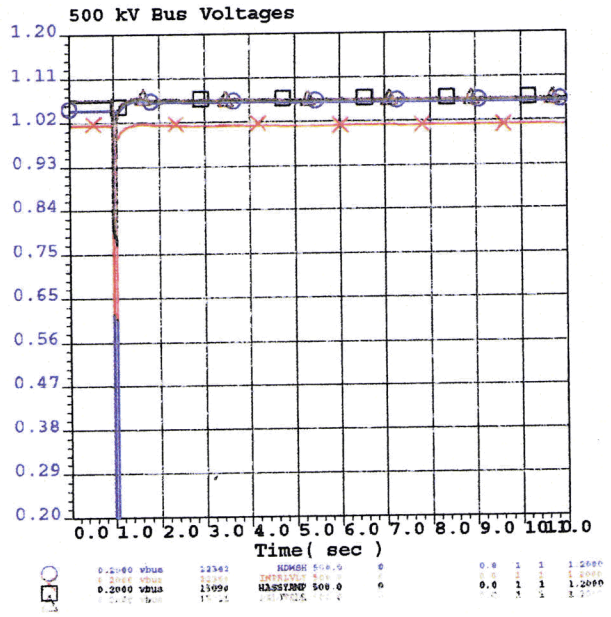


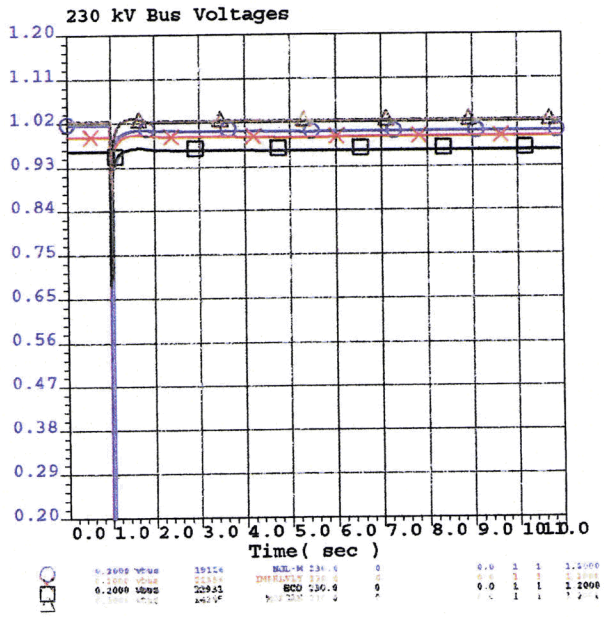
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

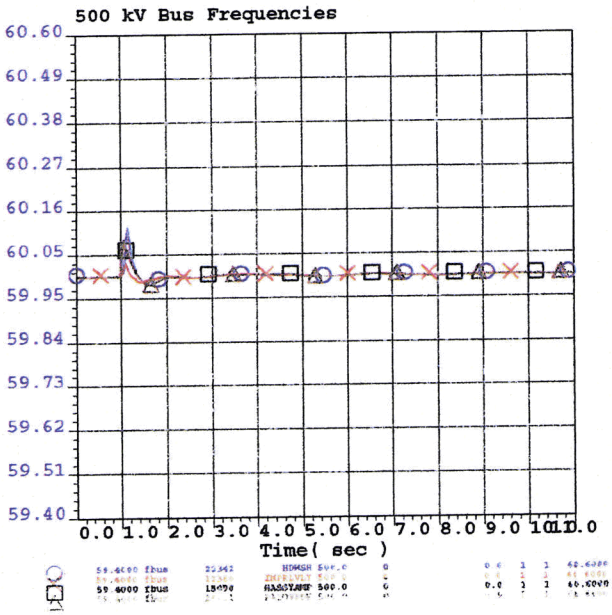
02_19HS_PST_012_HAS-HDW.chf

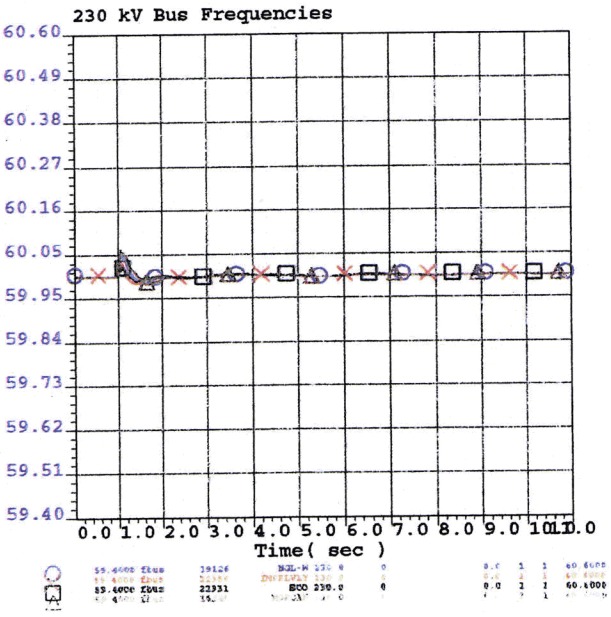
Thu Jun 04 16:52:48 2015

Q225 Transient Stability Plots







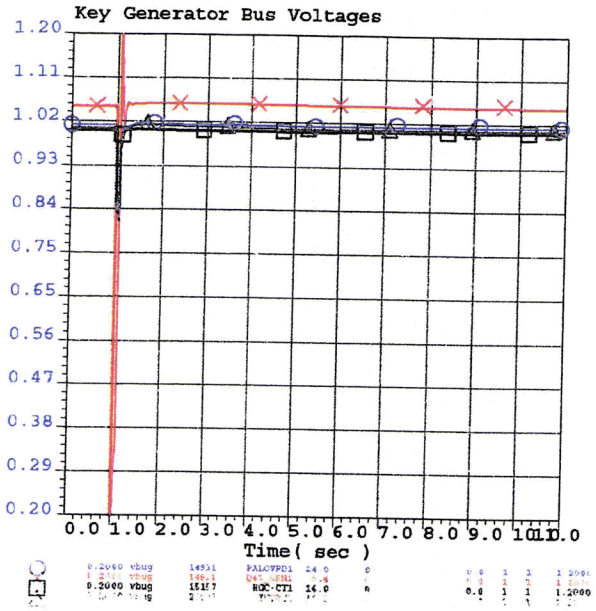


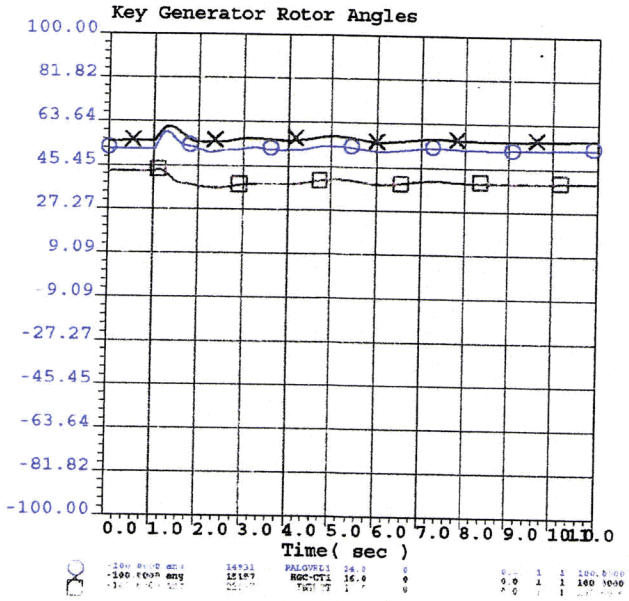
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

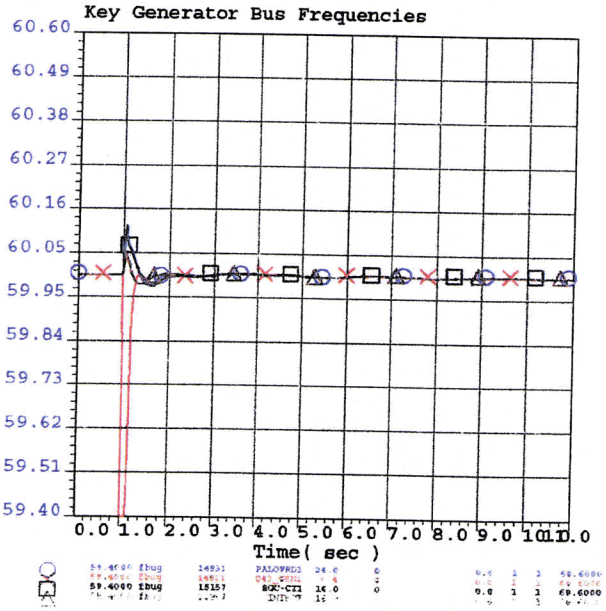
02_19HS_PST_013_HDW-NG.chf

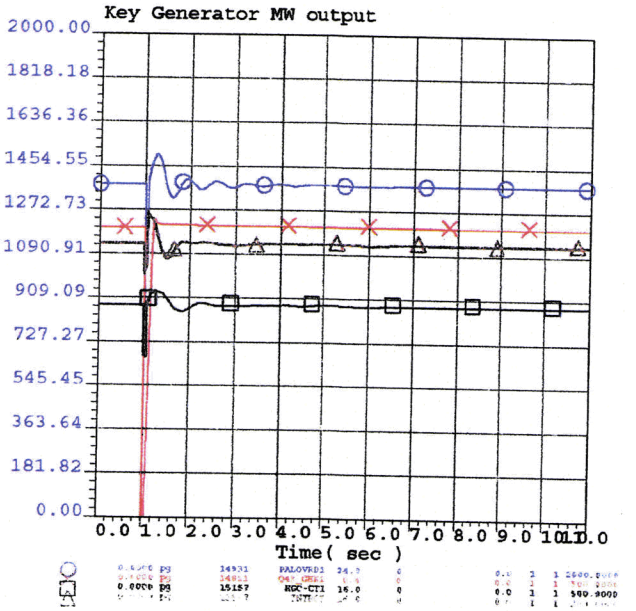
Thu Jun 04 16:52:50 2015

Q225 Transient Stability Plots



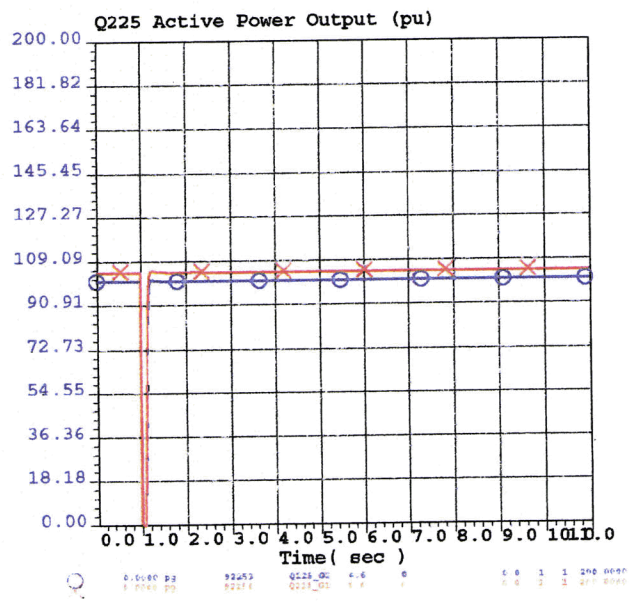


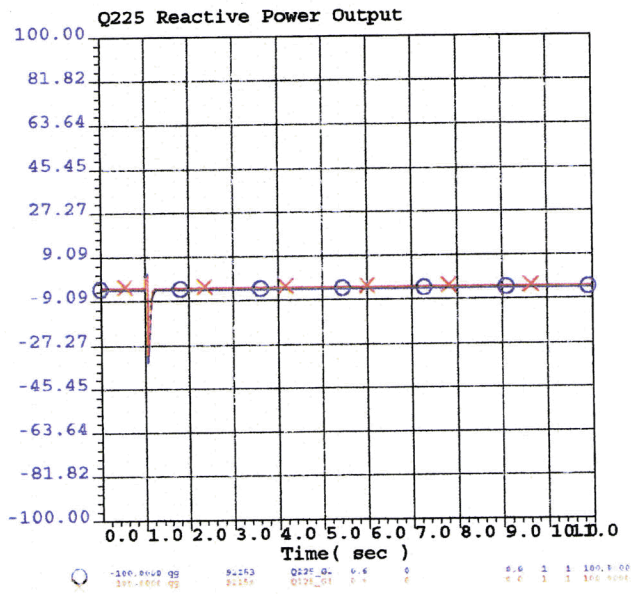


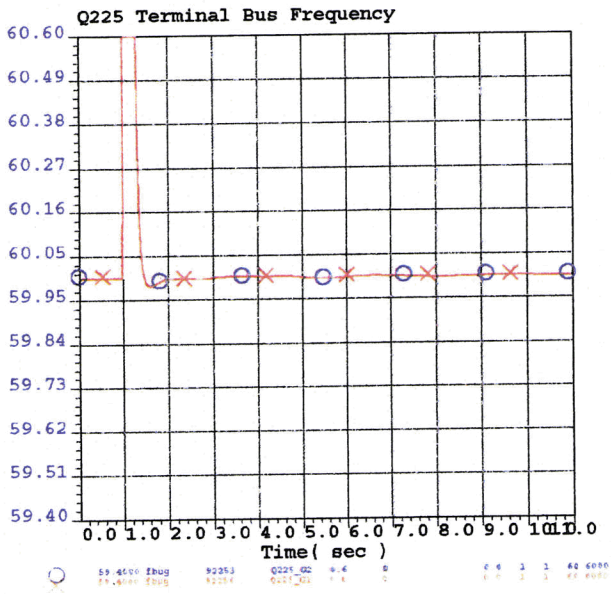


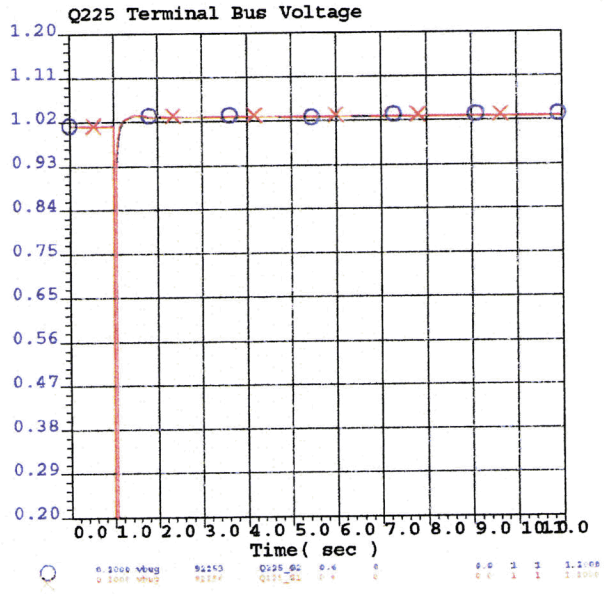
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







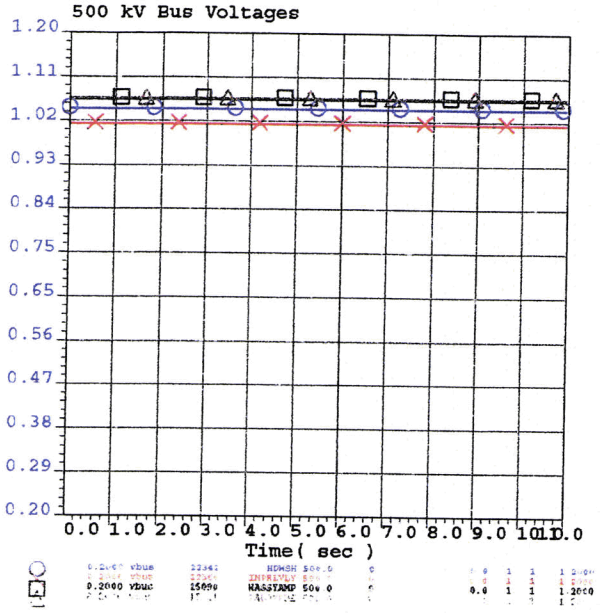


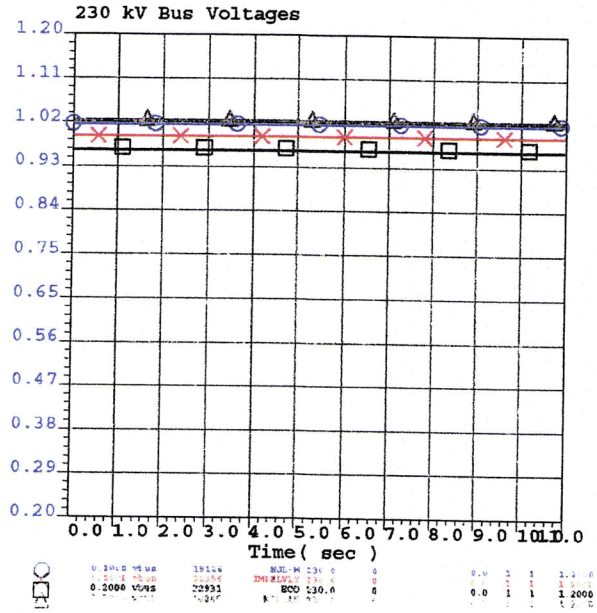
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

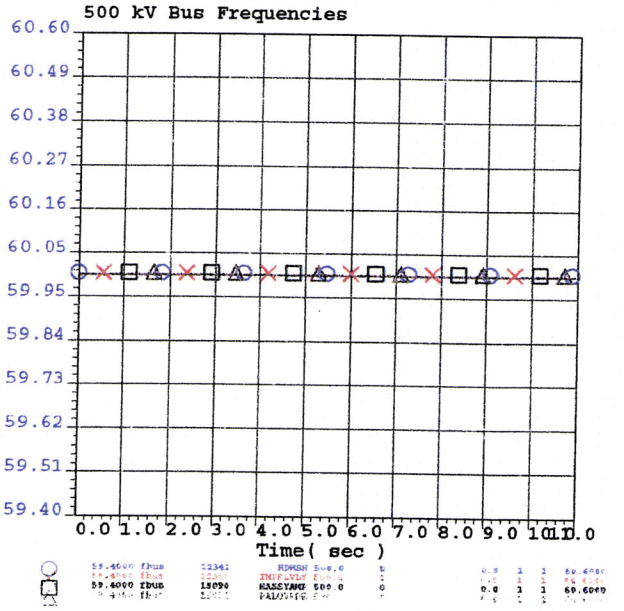
02_19HS_PST_013_HDW-NG.chf

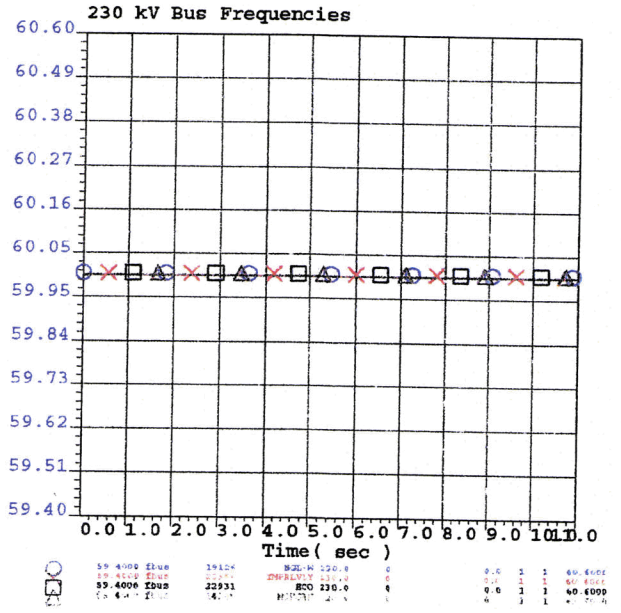
Thu Jun 04 16:52:50 2015

Q225 Transient Stability Plots



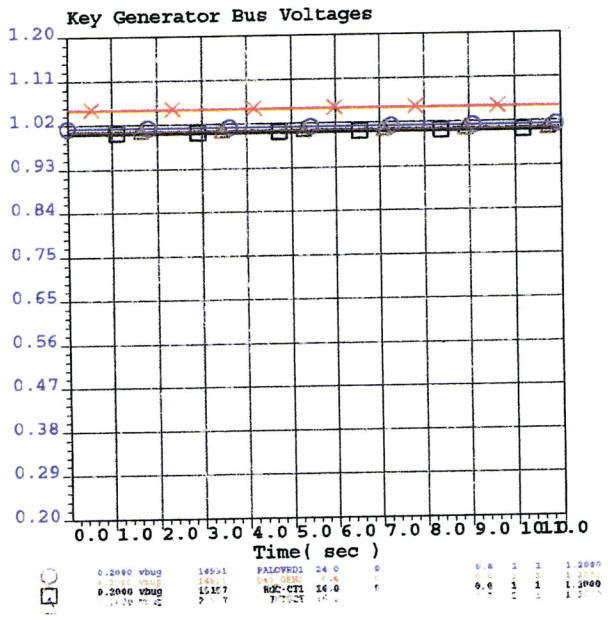


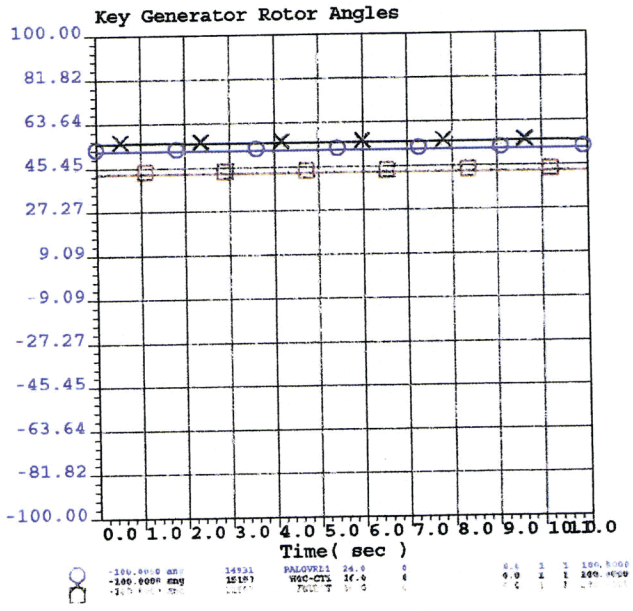


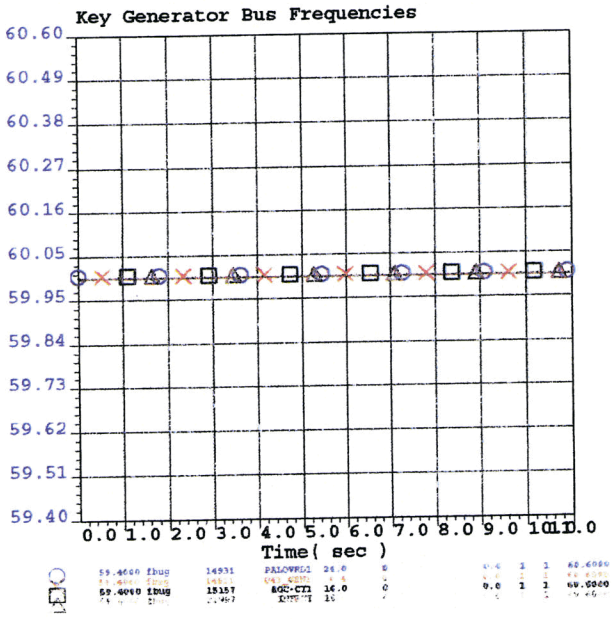


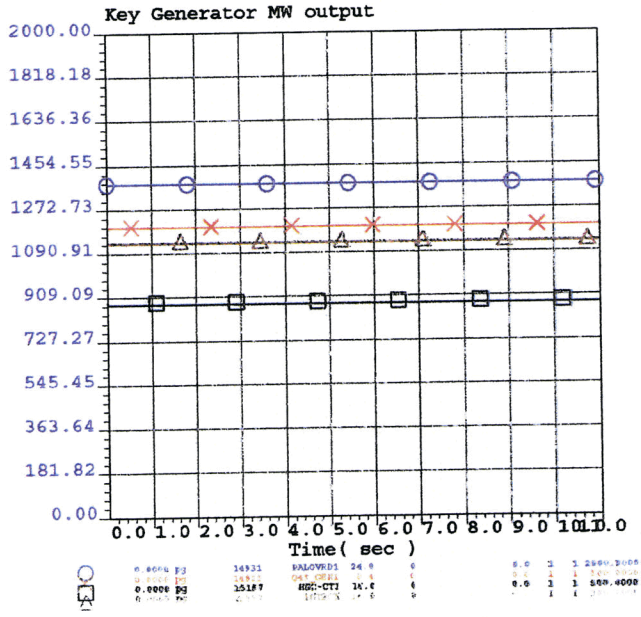
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







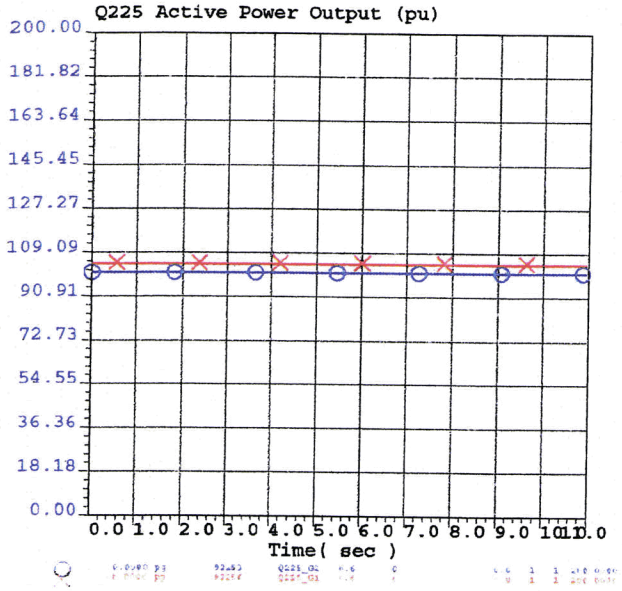


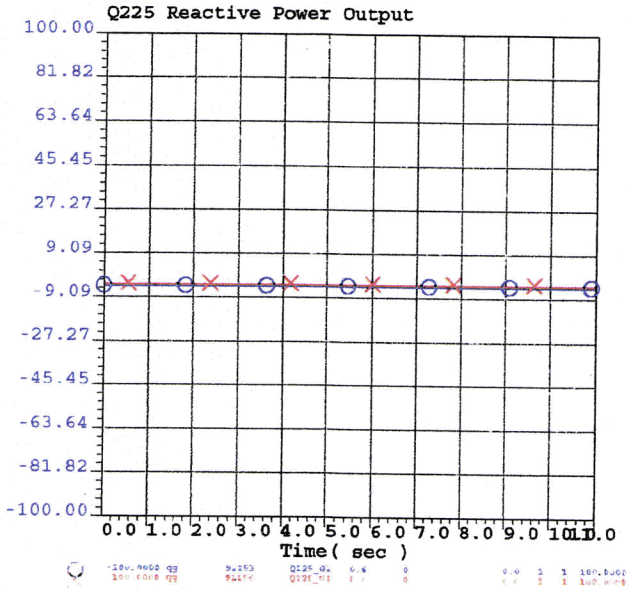
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

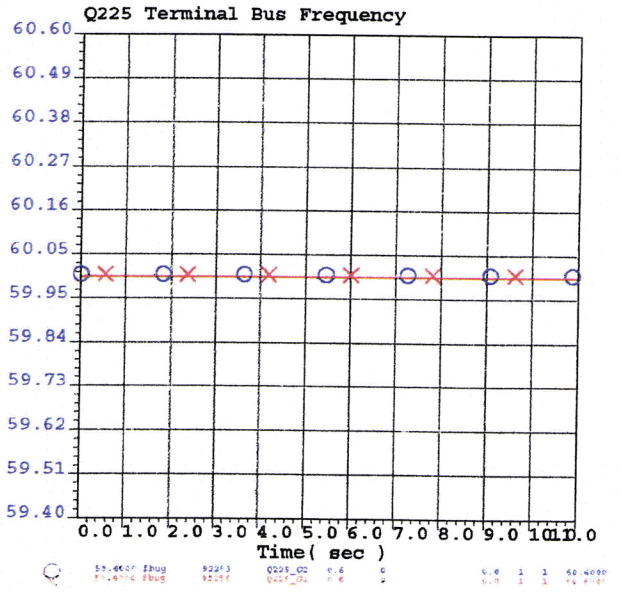
02_19HS_PST_127_Q225_1.chf

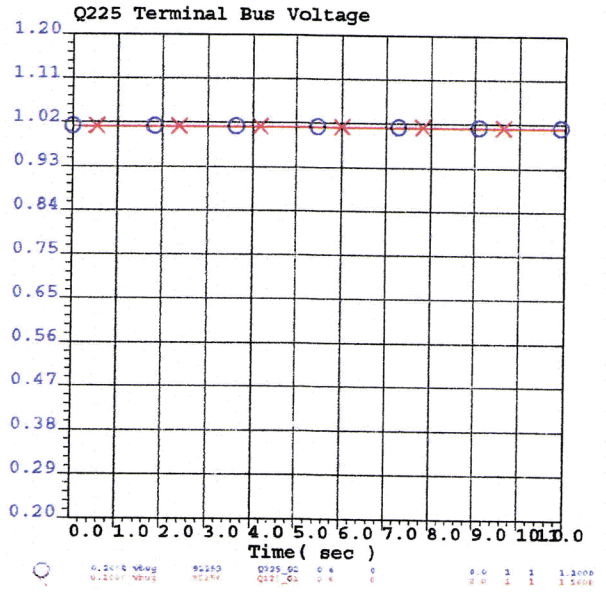
Thu Jun 04 16:55:41 2015

Q225 Transient Stability Plots



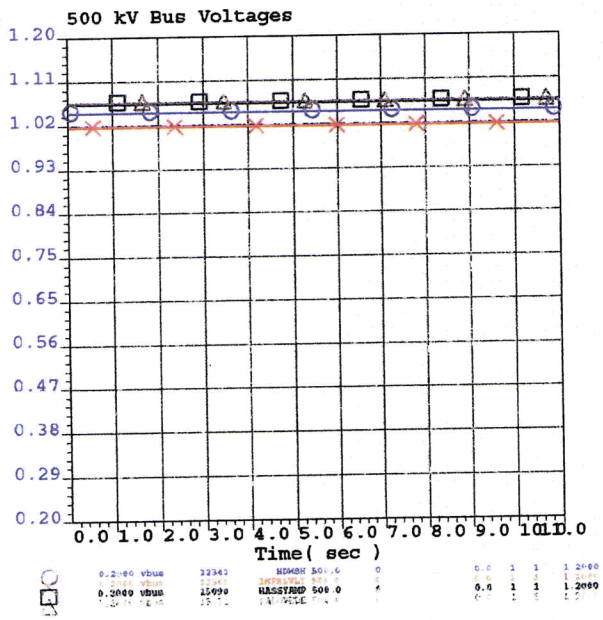


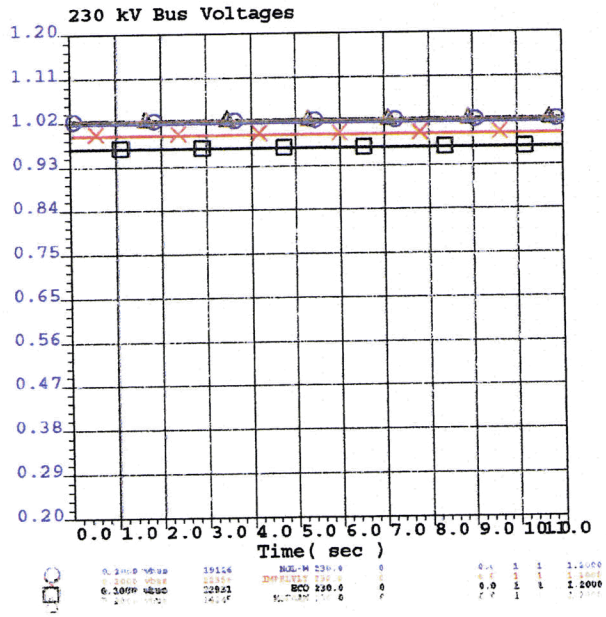


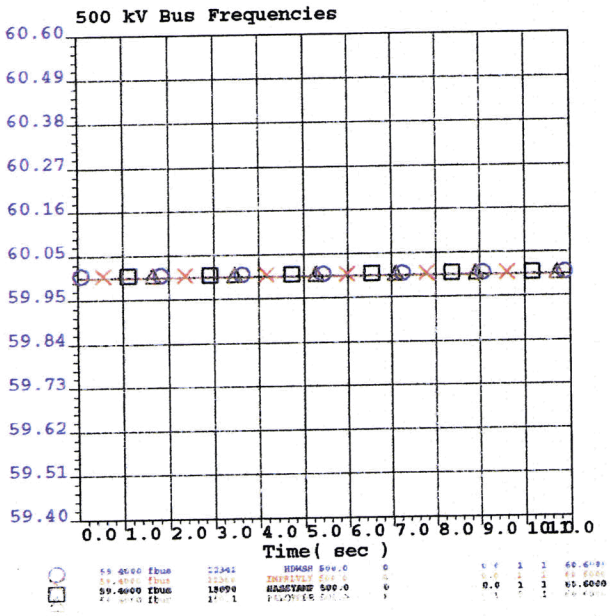


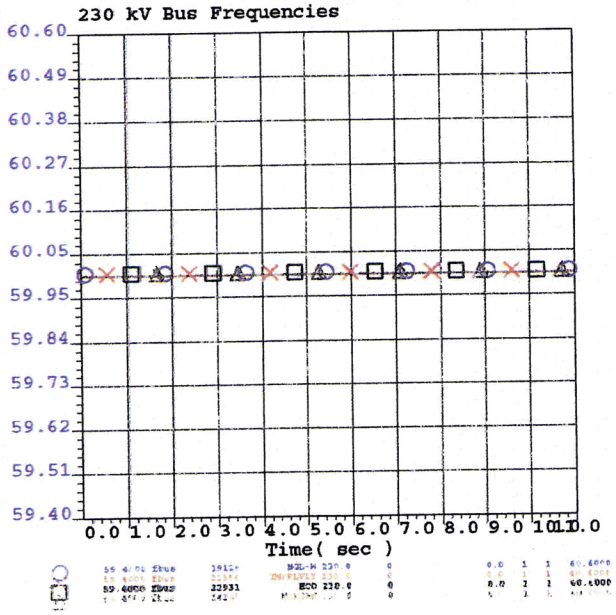
2019 HS Case, Q225 System Impact Study
Case 2: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







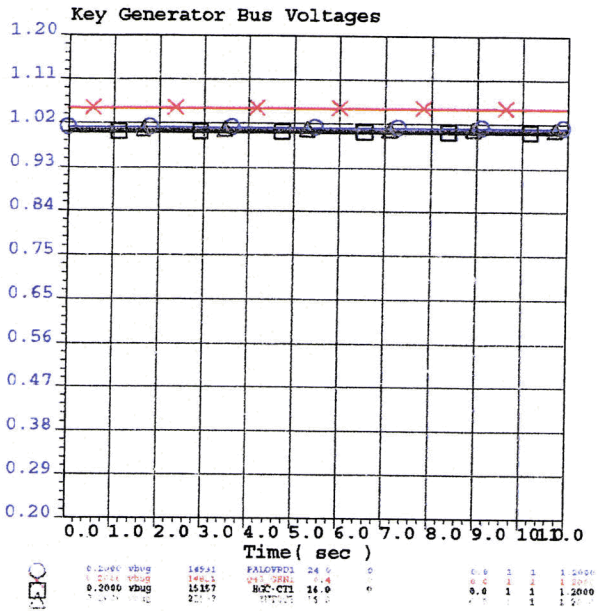


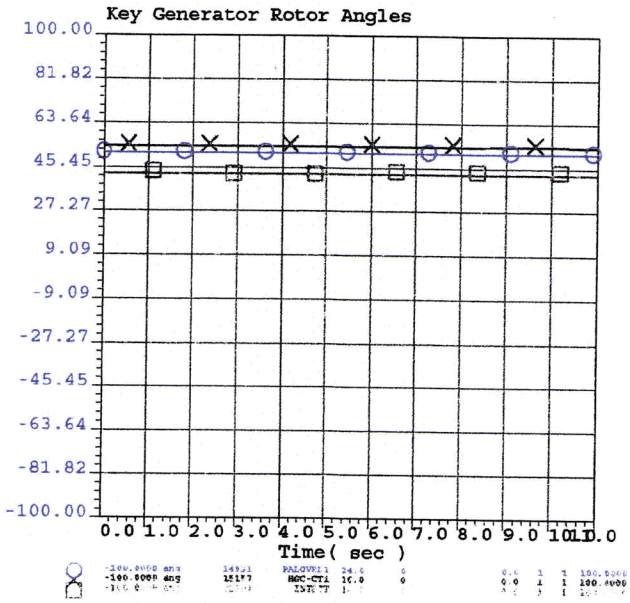
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

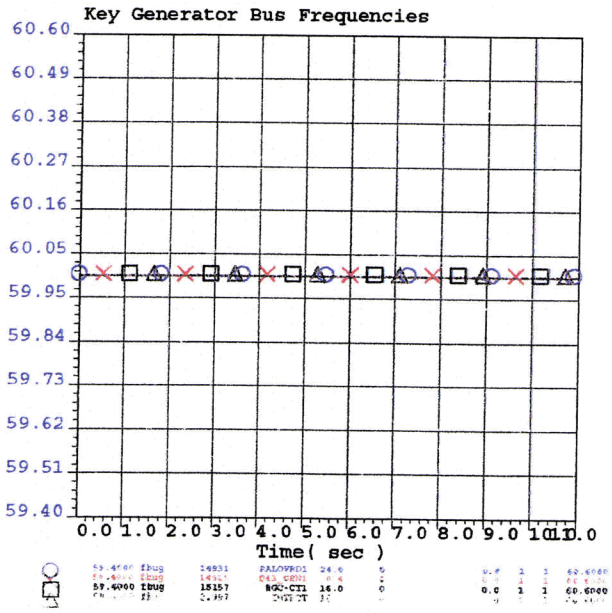
04_19HS_PST_DLCR_000-N-0_FLAT_RUN.chf

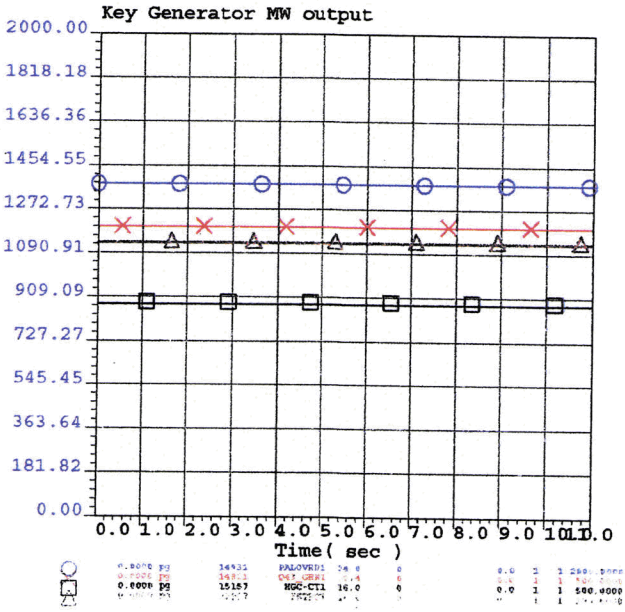
Thu Jun 04 16:56:35 2015

Q225 Transient Stability Plots



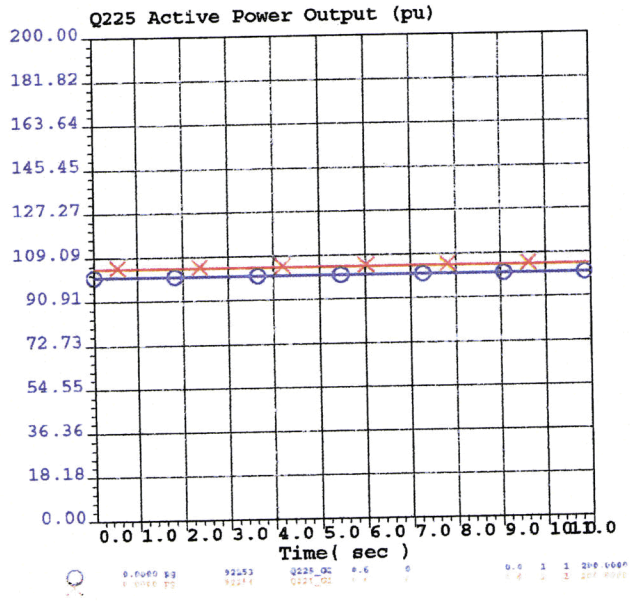


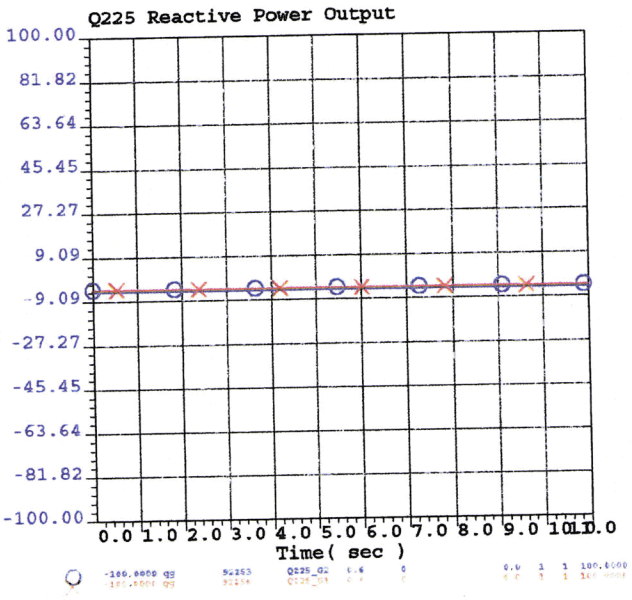


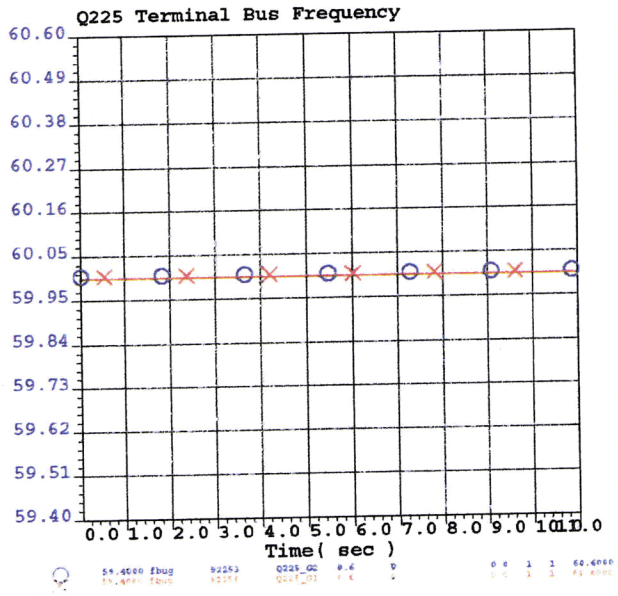


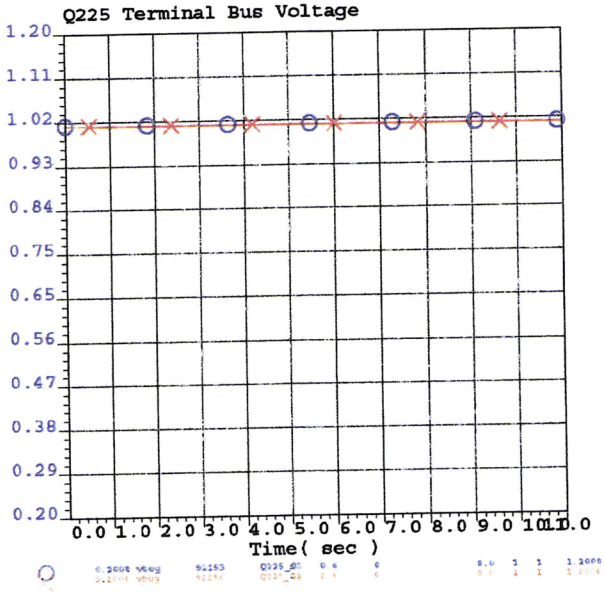
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







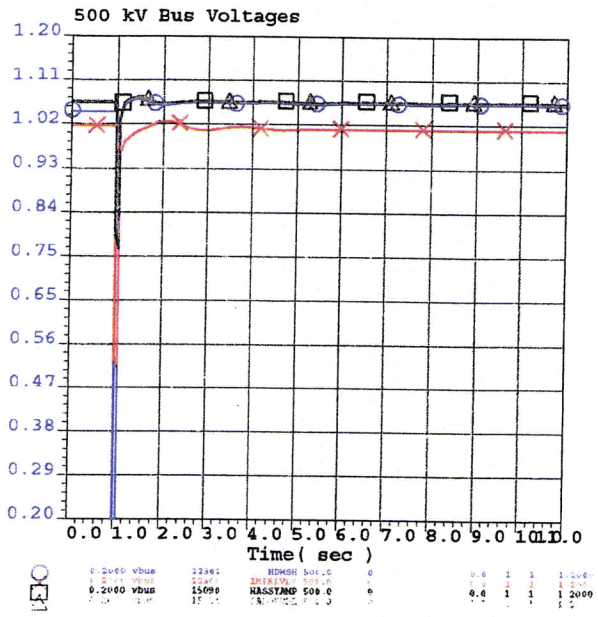


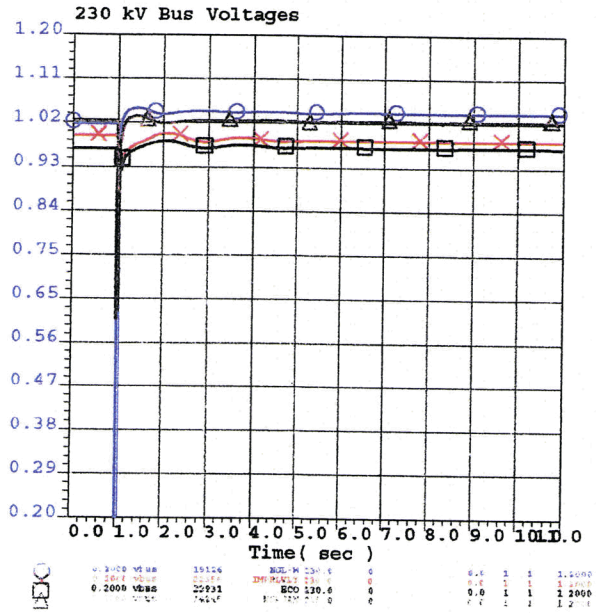
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

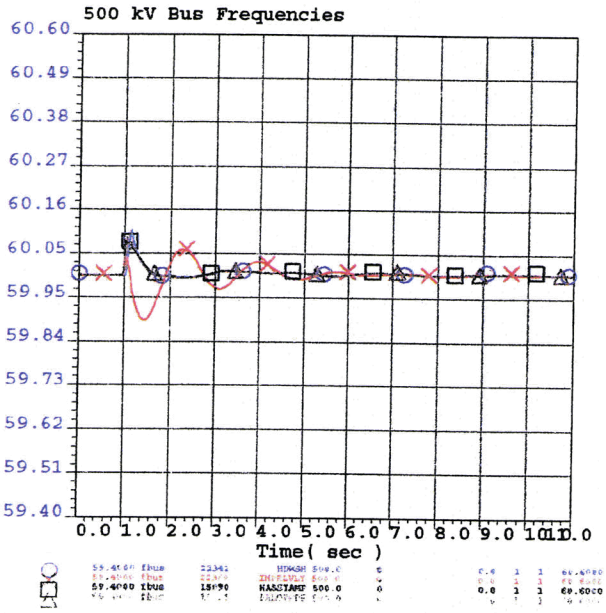
04_19HS_PST_DLCR_000-N-0_FLAT_RUN.chf

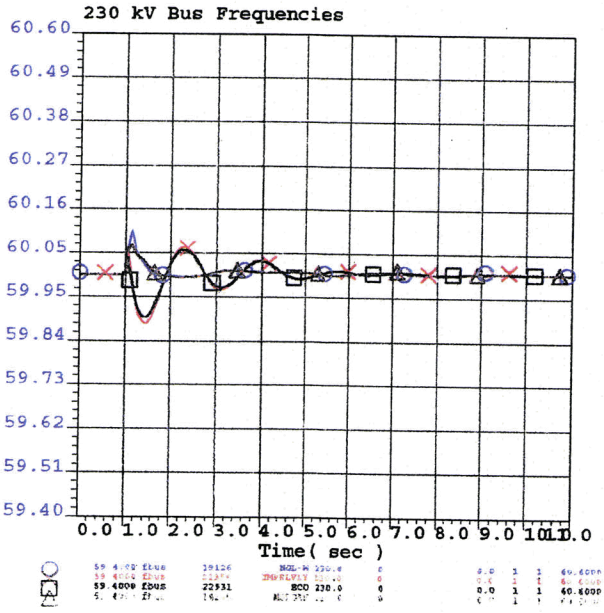
Thu Jun 04 16:56:35 2015

Q225 Transient Stability Plots







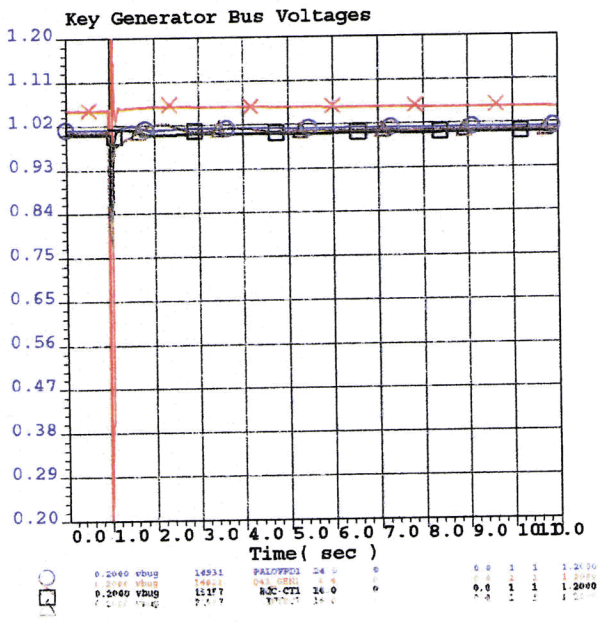


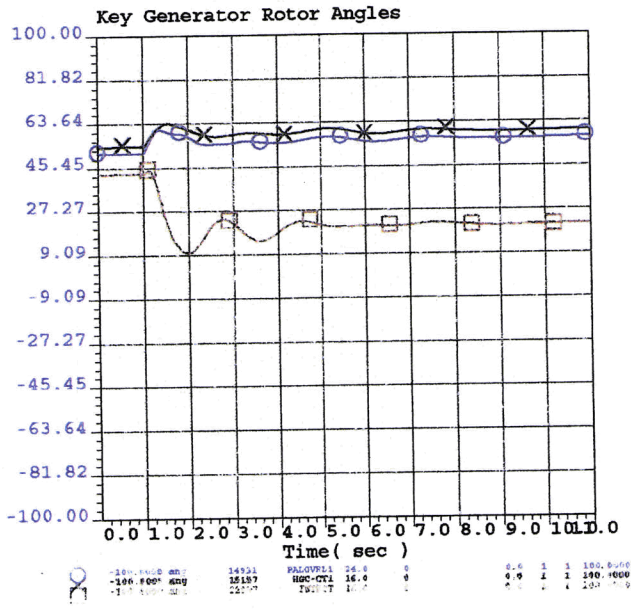
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

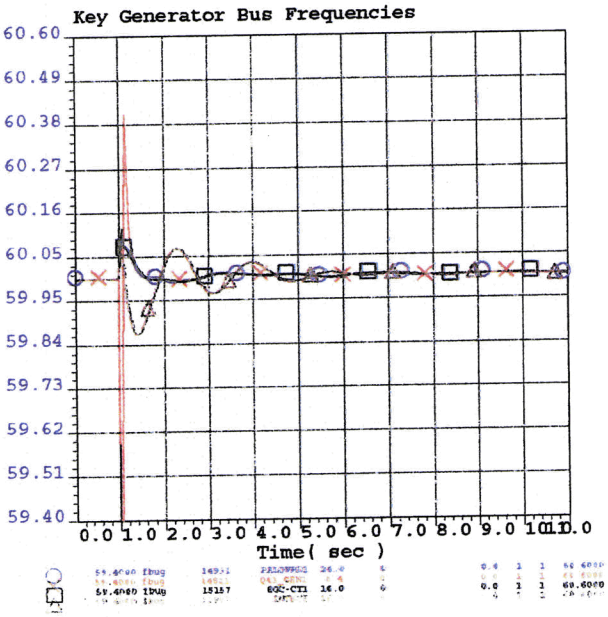
04_19HS_PST_DLCR_001_NGI-IV_500_1.chf

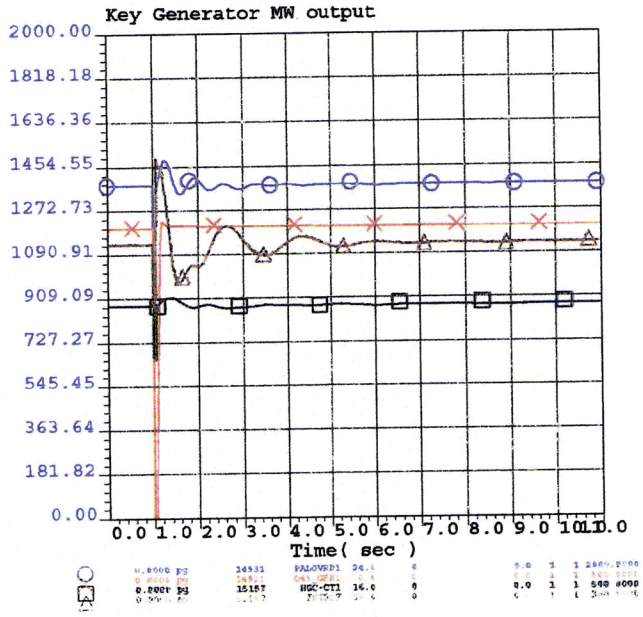
Thu Jun 04 16:56:37 2015

Q225 Transient Stability Plots



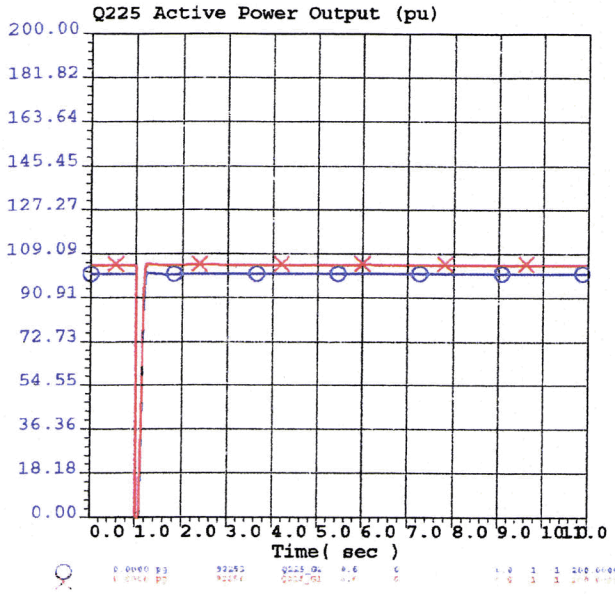


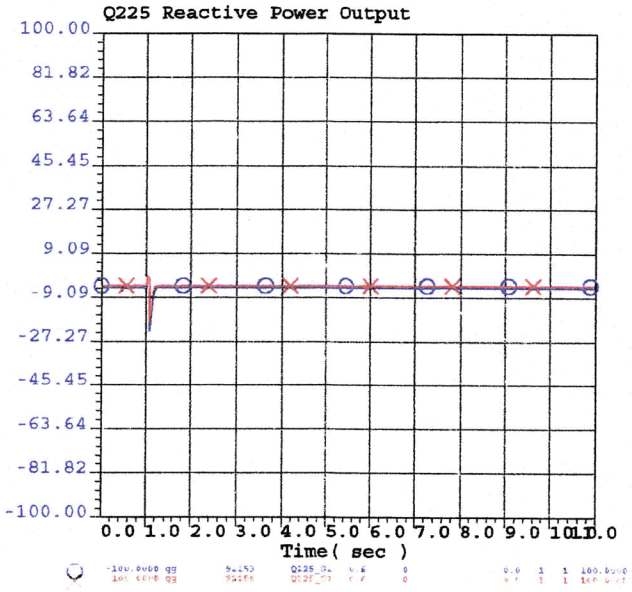


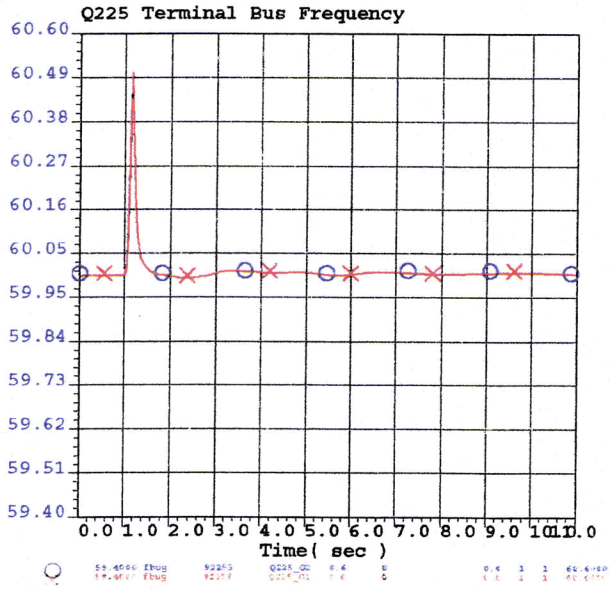


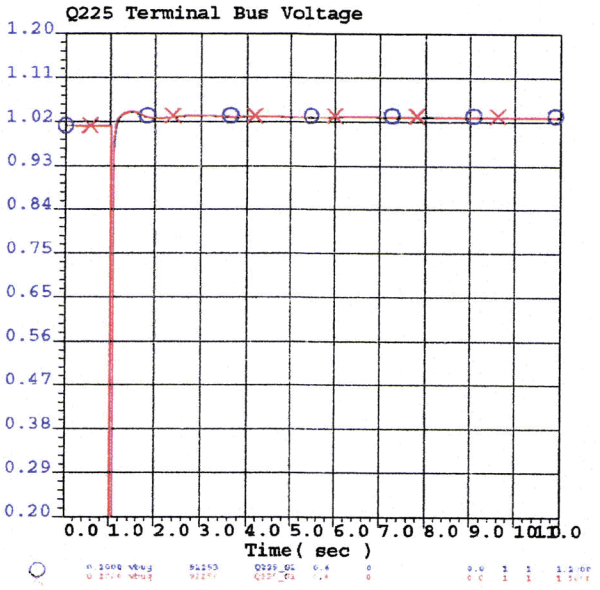
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







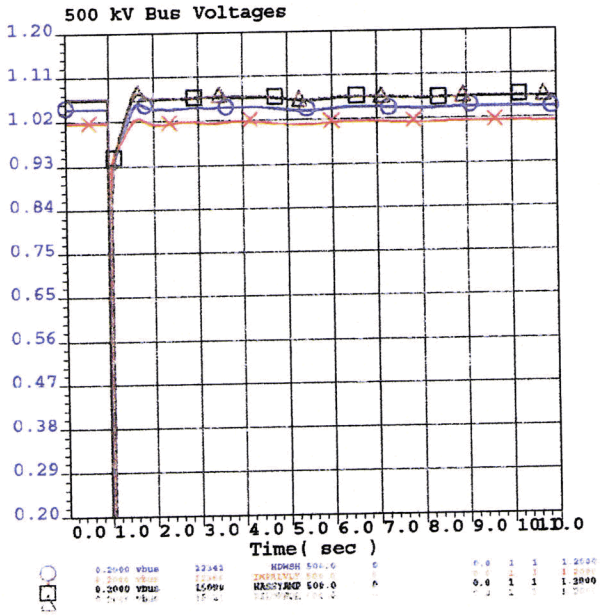


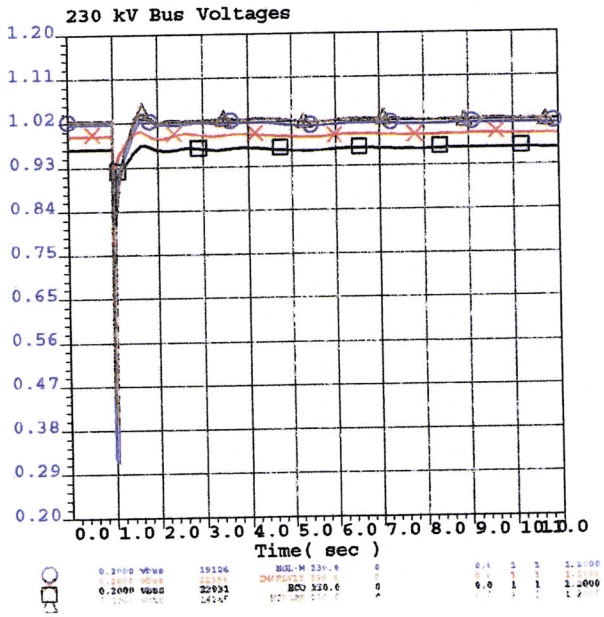
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

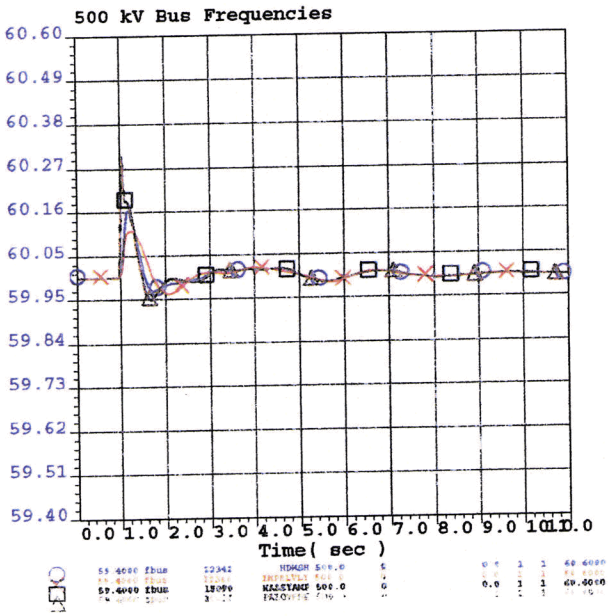
04_19HS_PST_DLCR_001_NGI-IV_500_1.chf

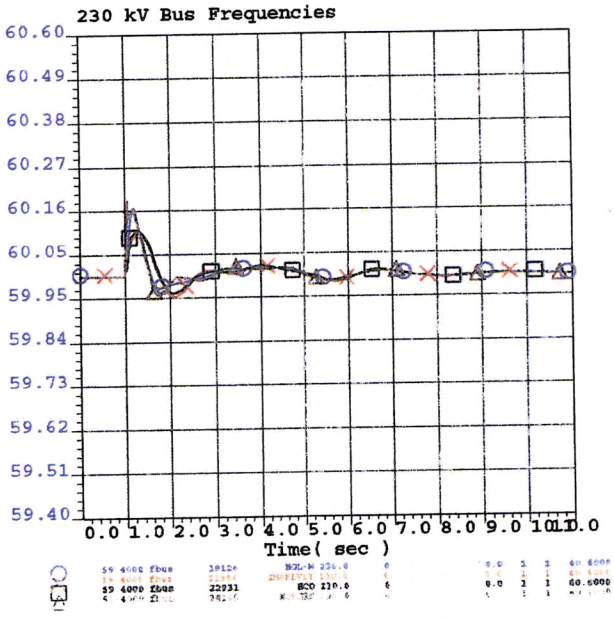
Thu Jun 04 16:56:37 2015

Q225 Transient Stability Plots







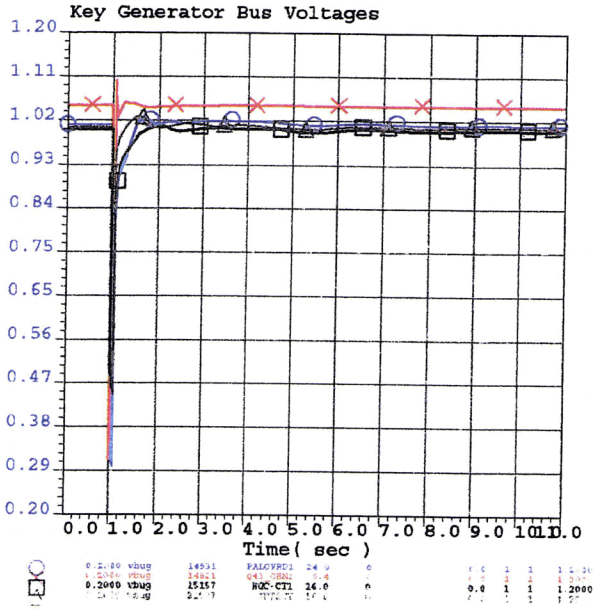


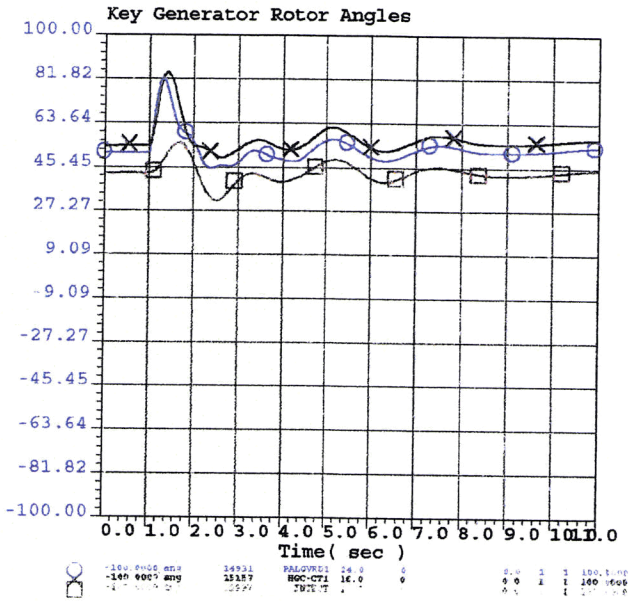
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

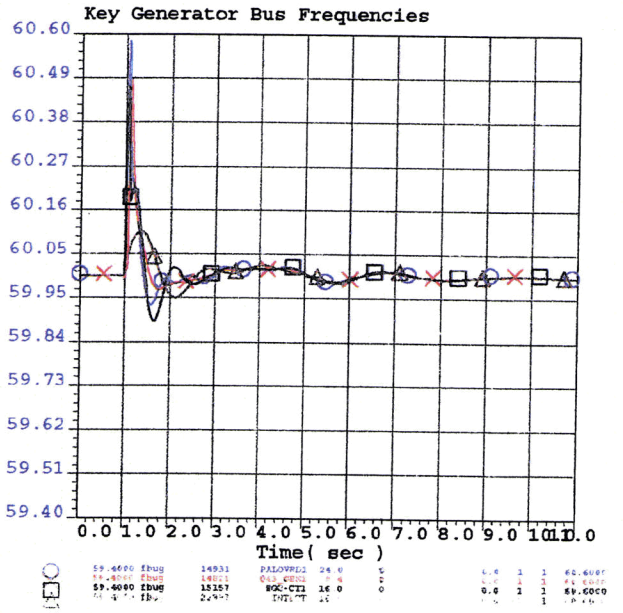
04_19HS_PST_DLCR_002_PV-CR.chf

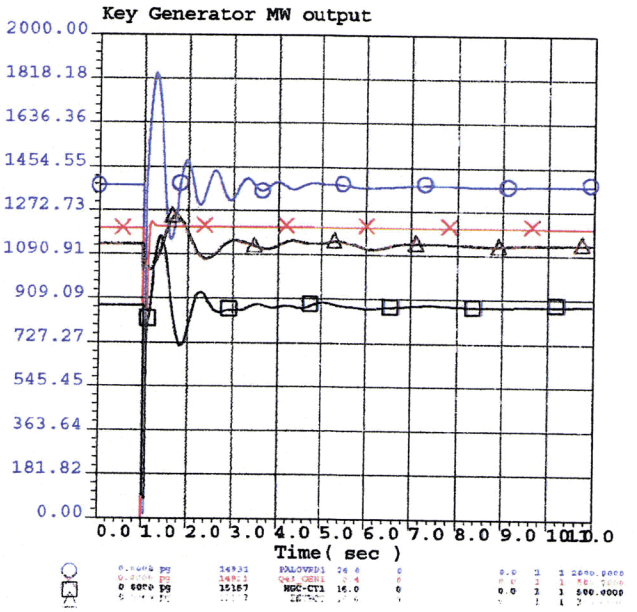
Thu Jun 04 16:56:38 2015

Q225 Transient Stability Plots



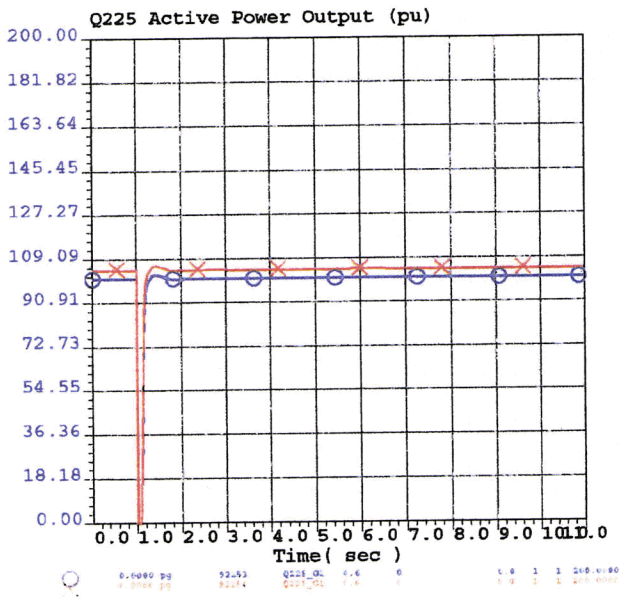


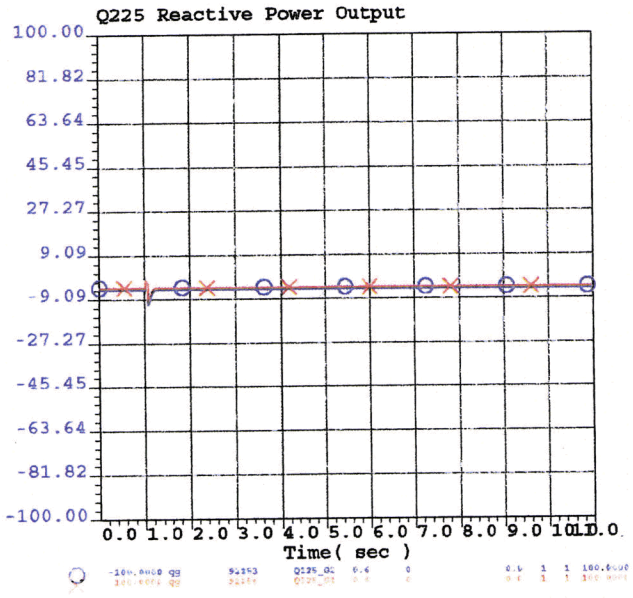


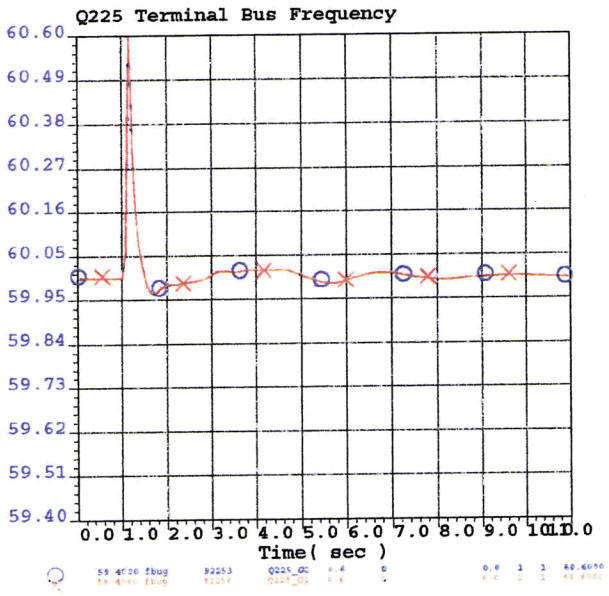


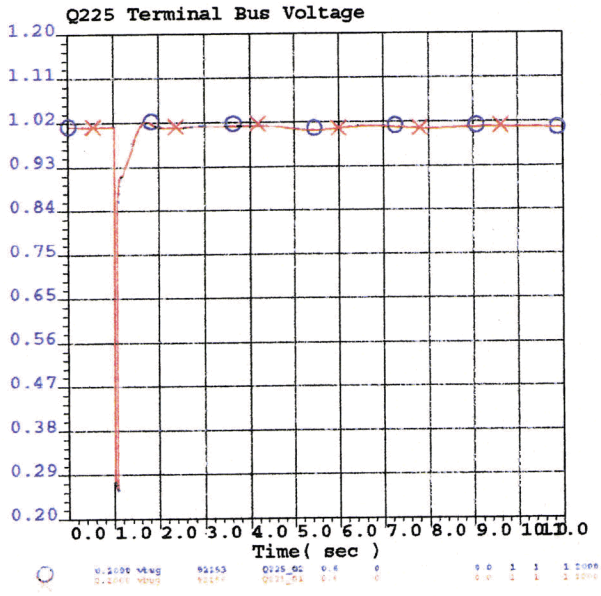
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







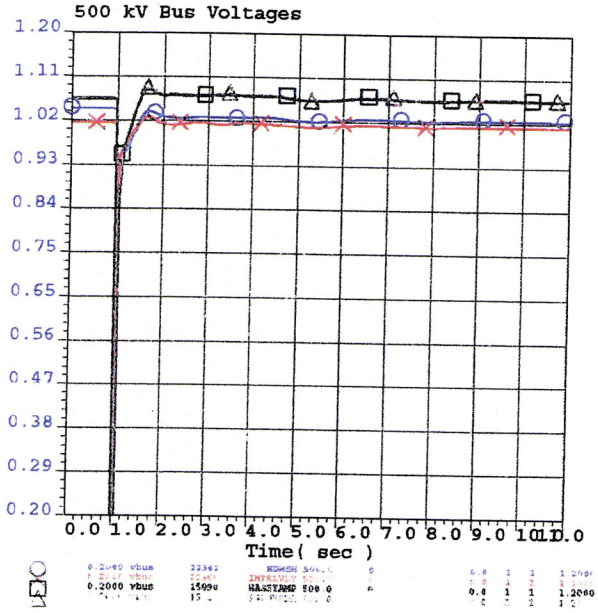


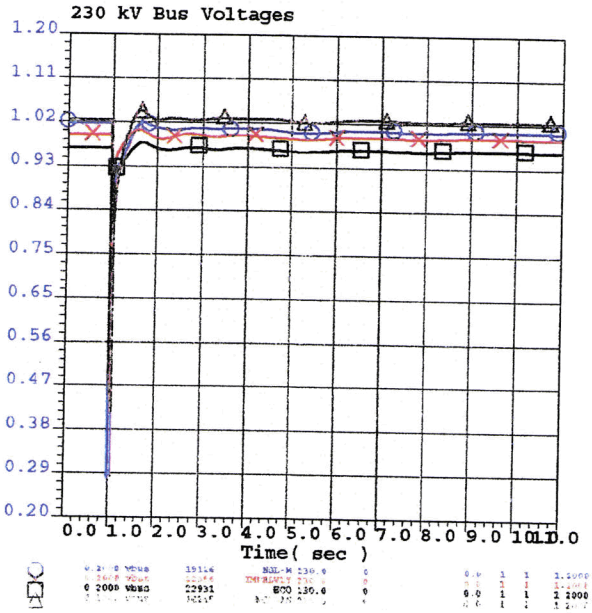
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

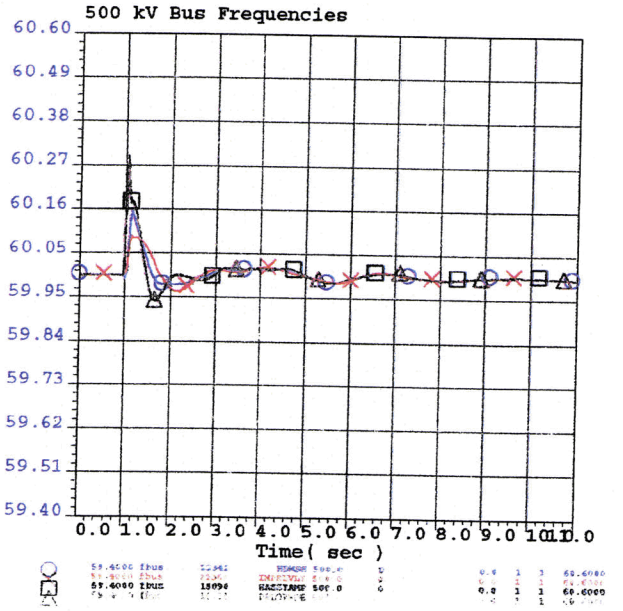
04_19HS_PST_DLCR_002_PV-CR.chf

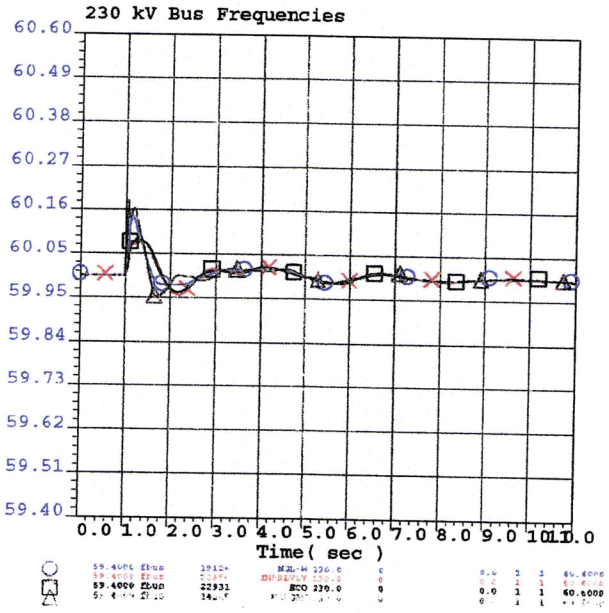
Thu Jun 04 16:56:38 2015

Q225 Transient Stability Plots



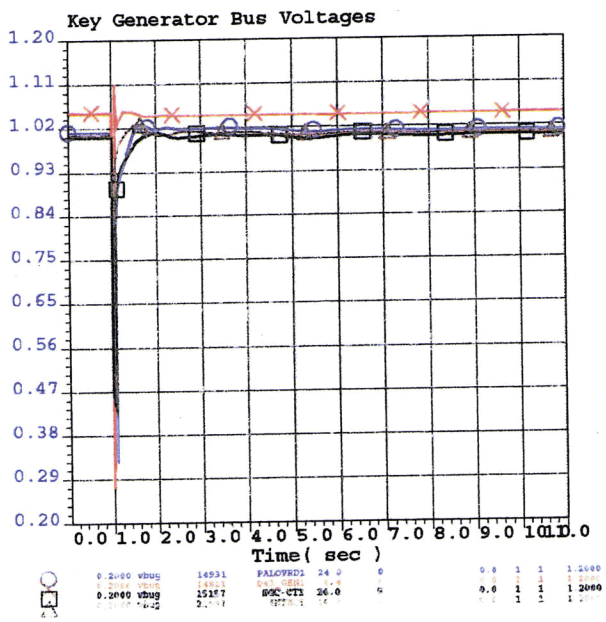


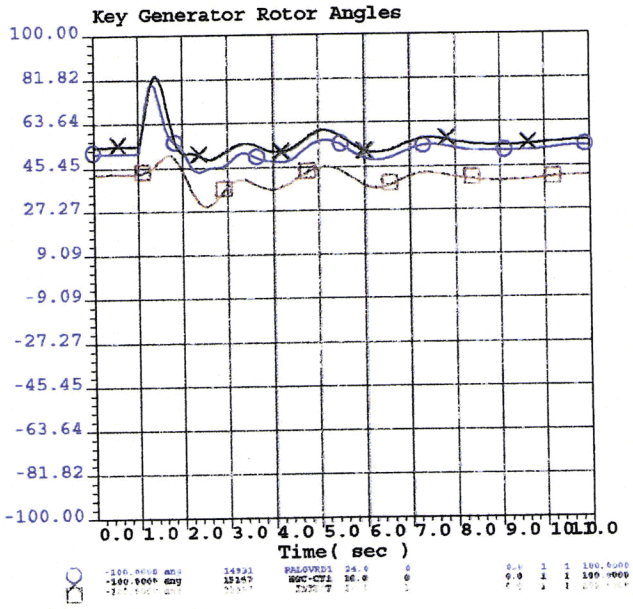


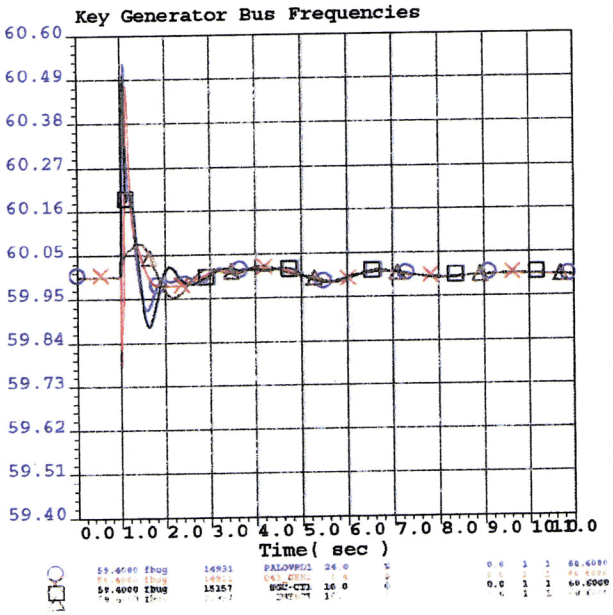


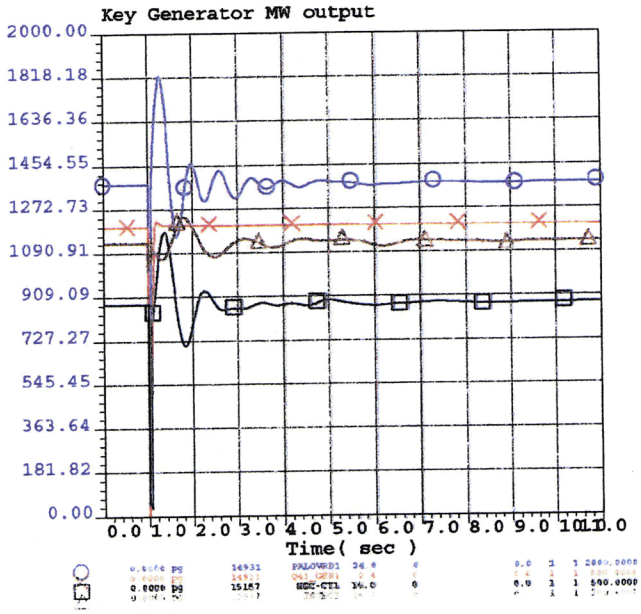
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







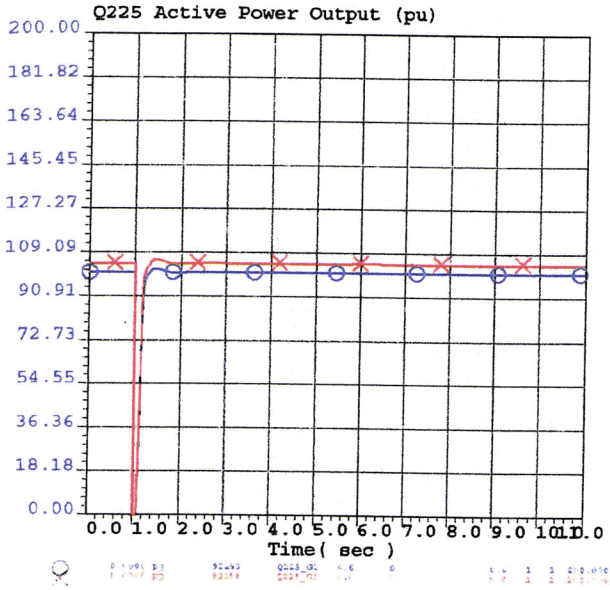


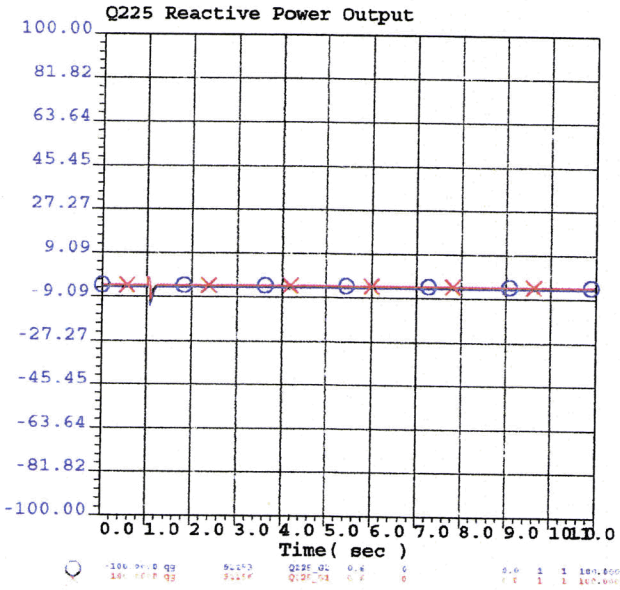
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

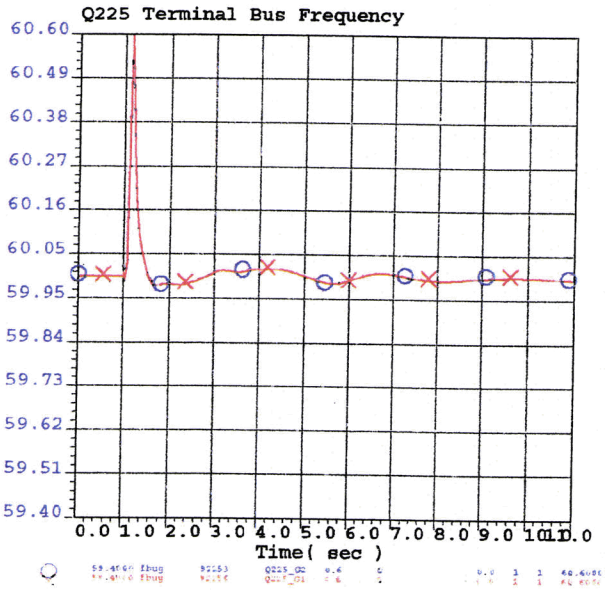
04_19HS_PST_DLCR_012_HAS-HDW.chf

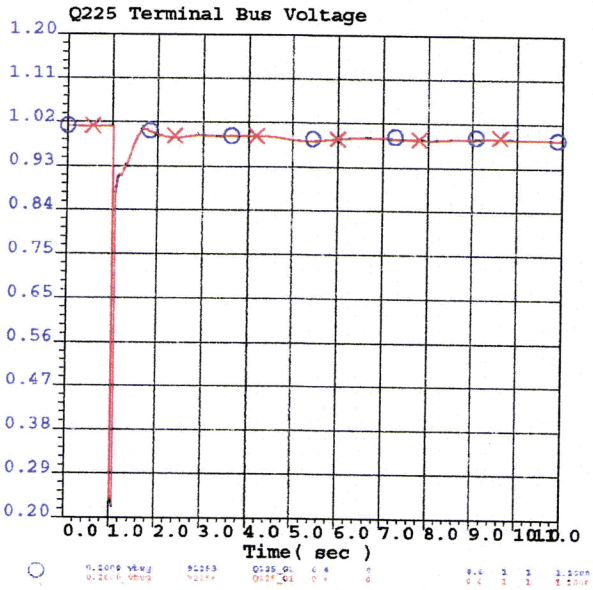
Thu Jun 04 16:56:53 2015

Q225 Transient Stability Plots



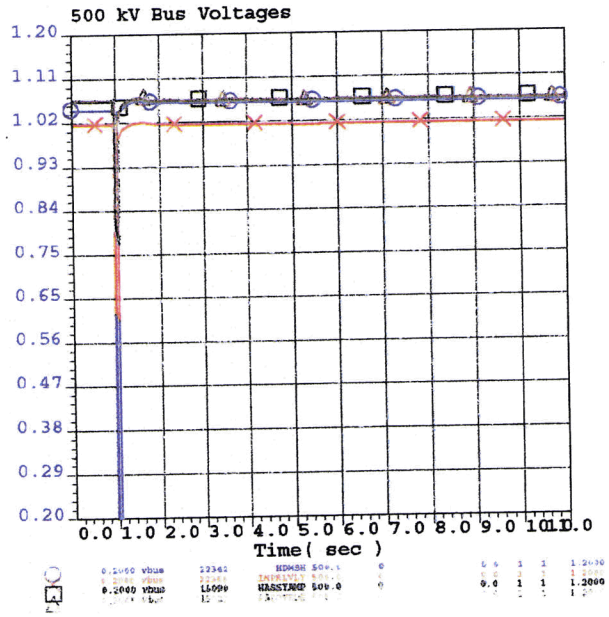


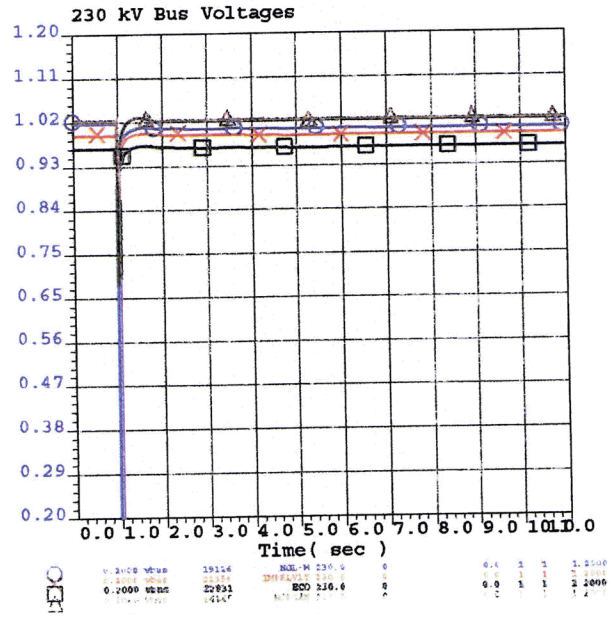


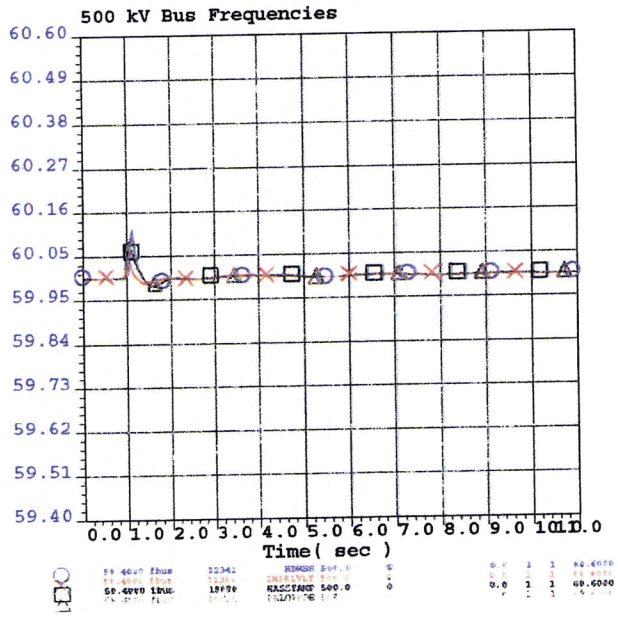


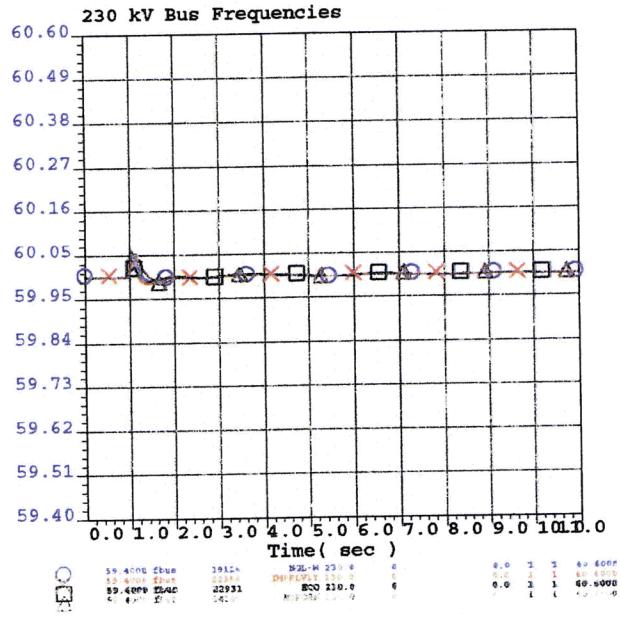
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







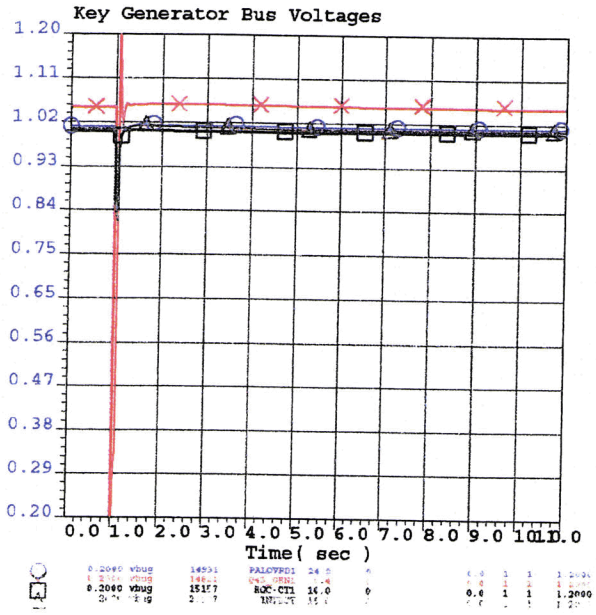


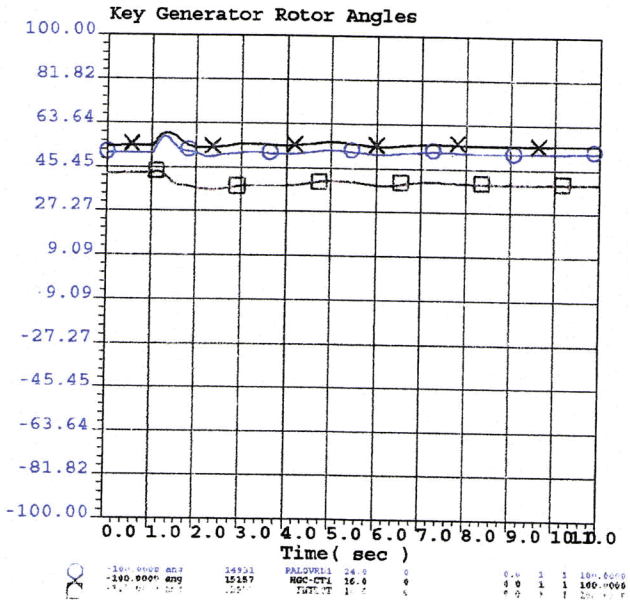
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

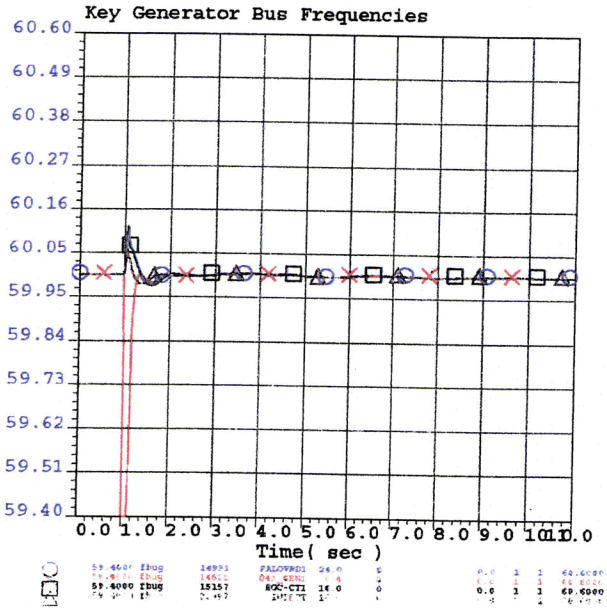
04_19HS_PST_DLCR_013_HDW-NG.chf

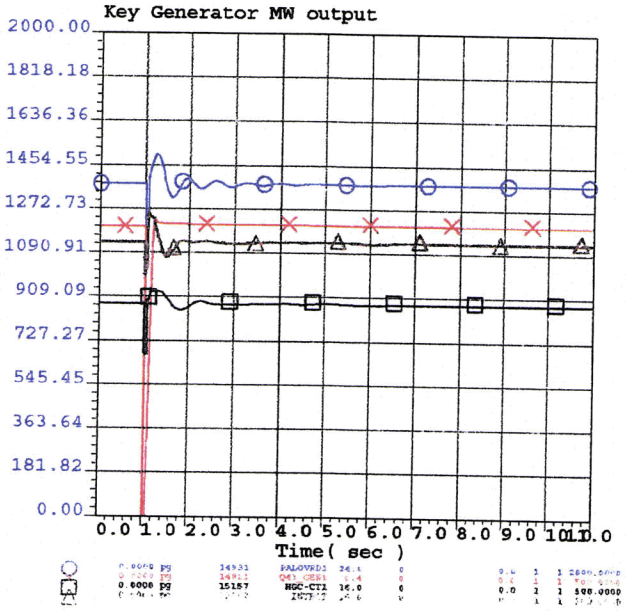
Thu Jun 04 16:56:55 2015

Q225 Transient Stability Plots



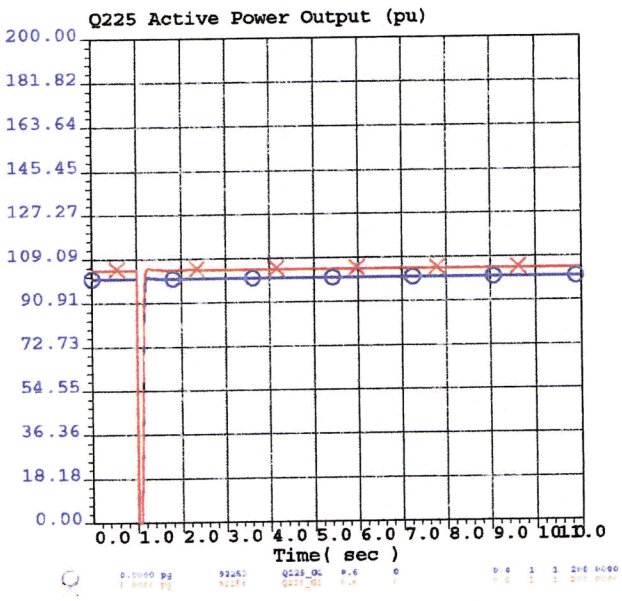


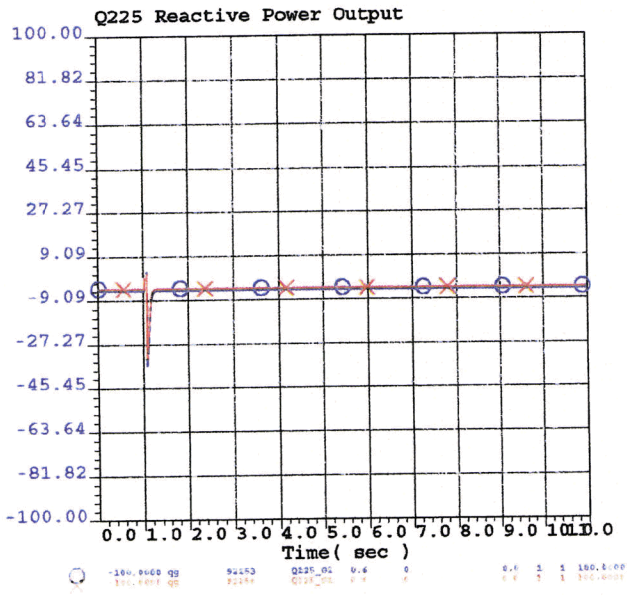


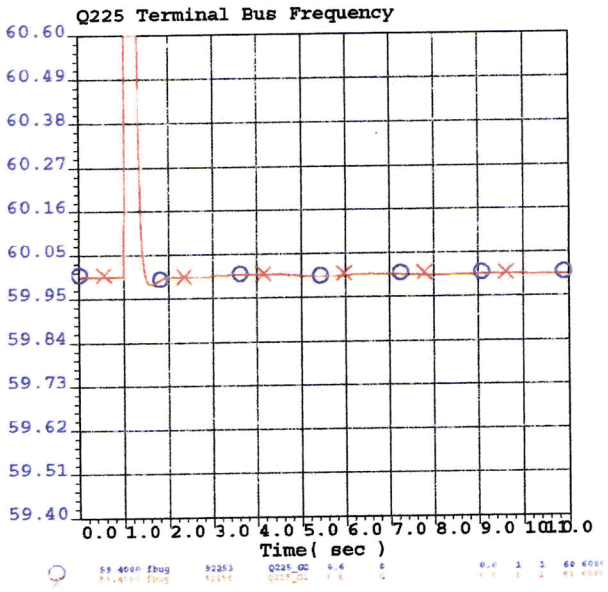


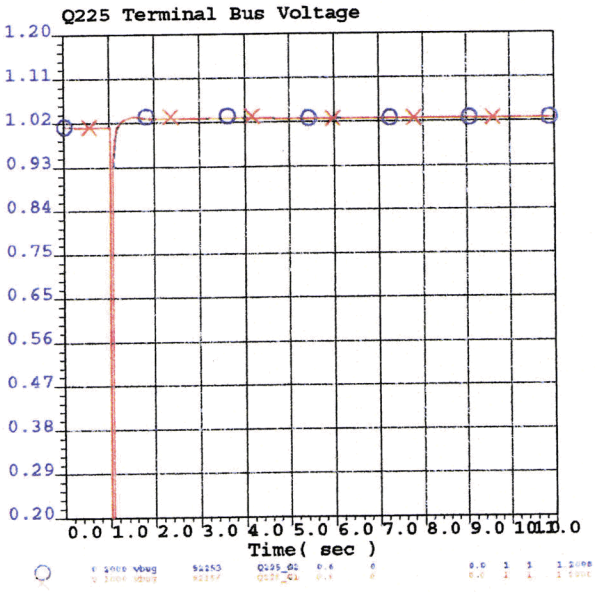
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







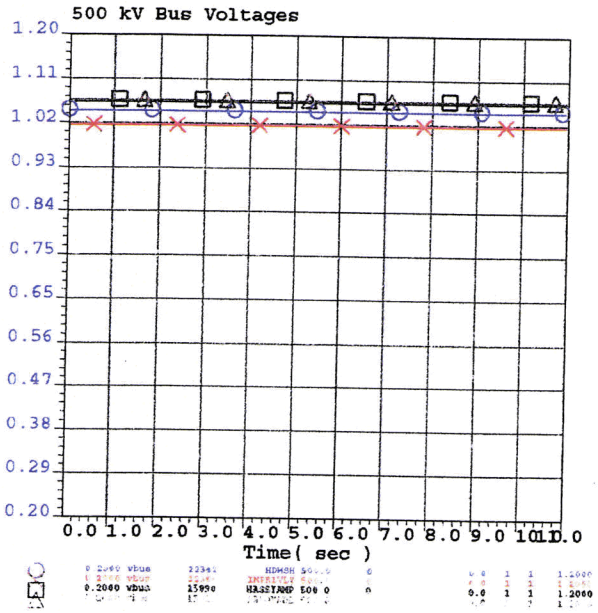


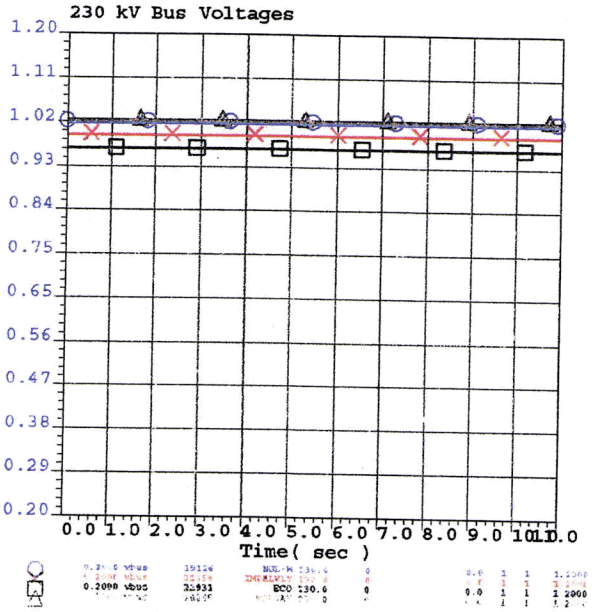
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

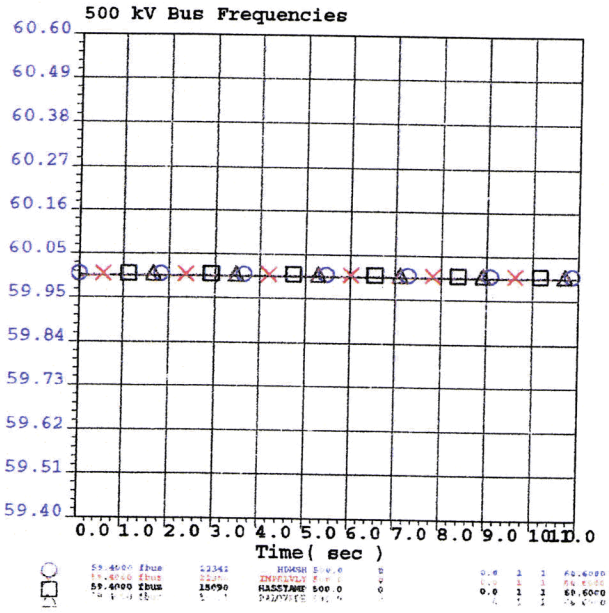
04_19HS_PST_DLCR_013_HDW-NG.chf

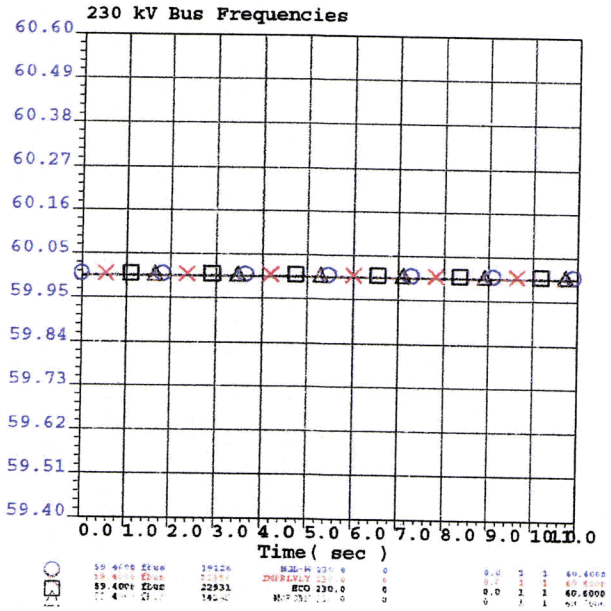
Thu Jun 04 16:56:55 2015

Q225 Transient Stability Plots



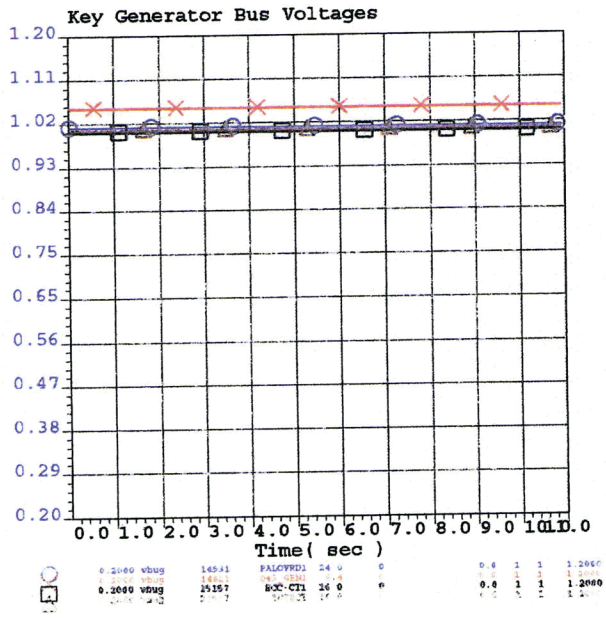


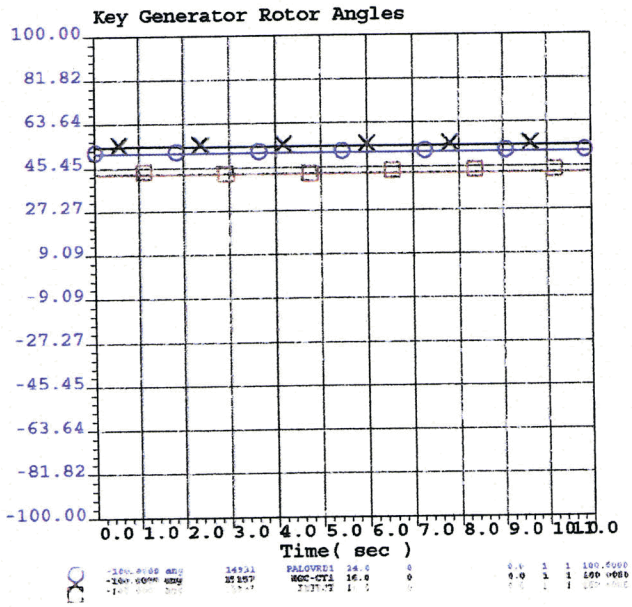


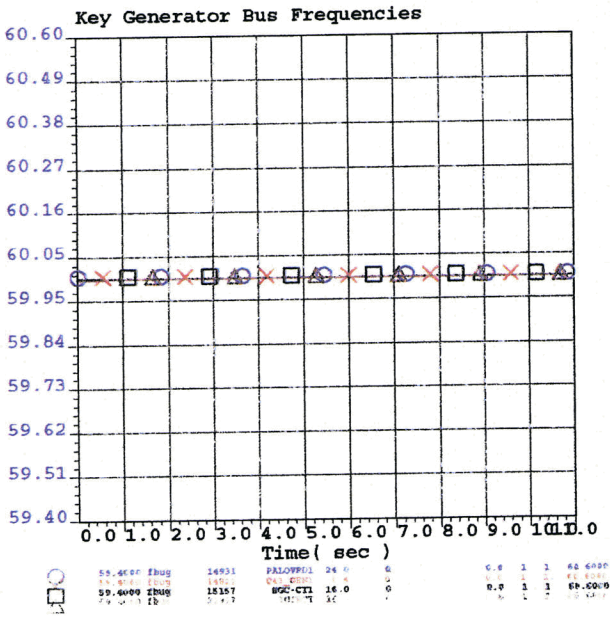


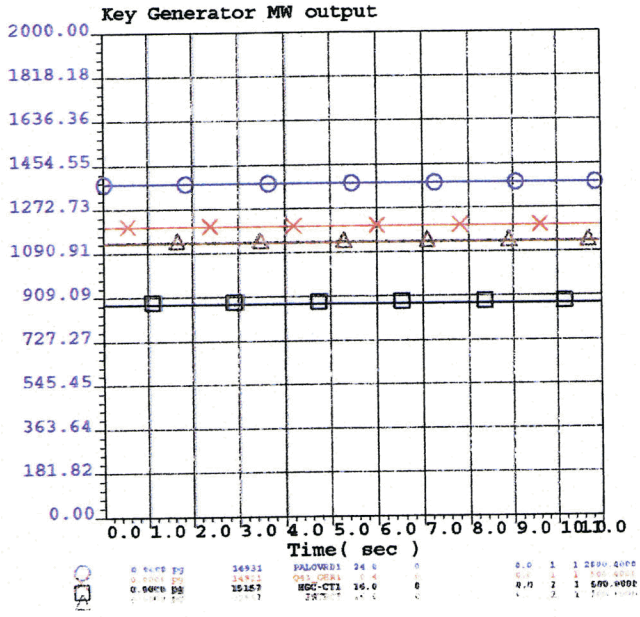
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







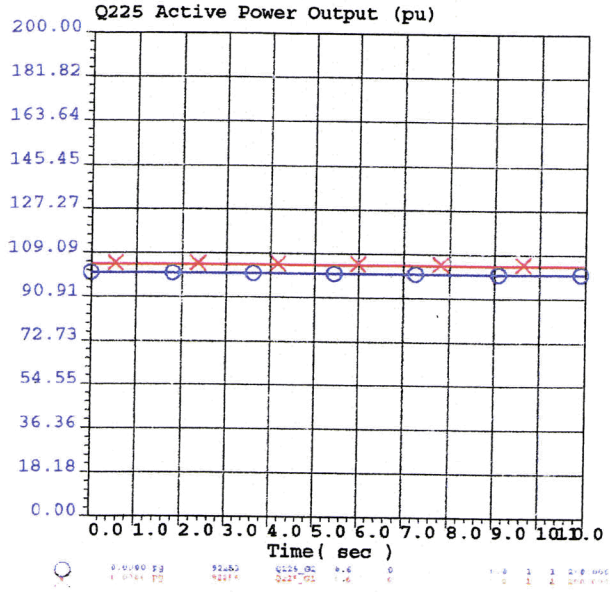


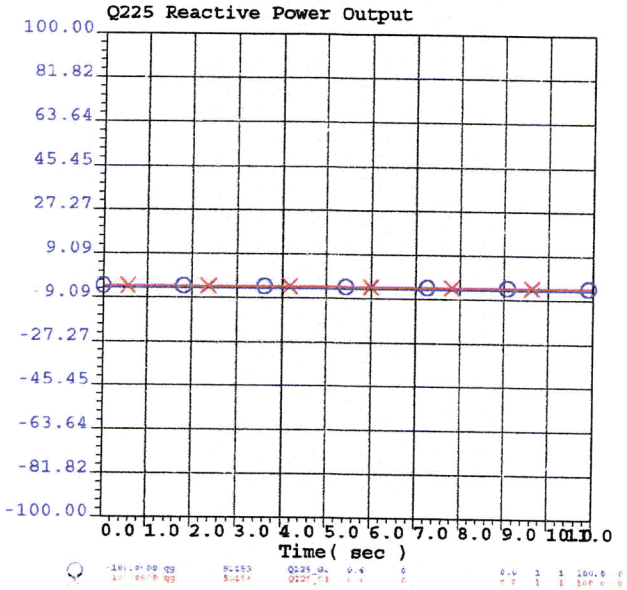
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

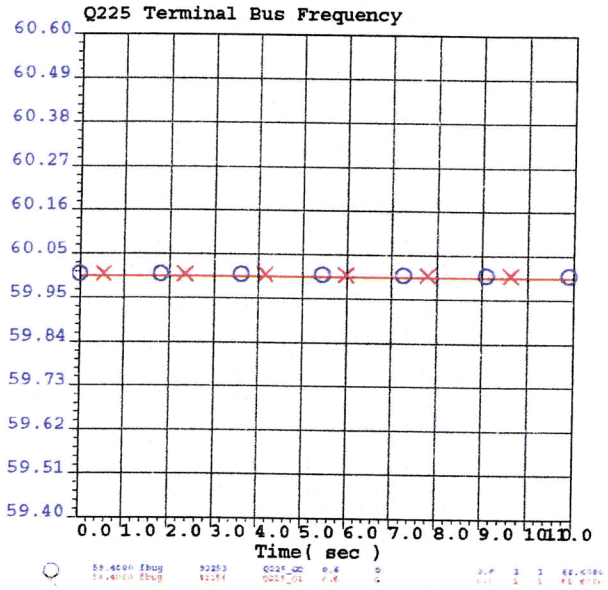
04_19HS_PST_DLCR_127_Q225_1.chf

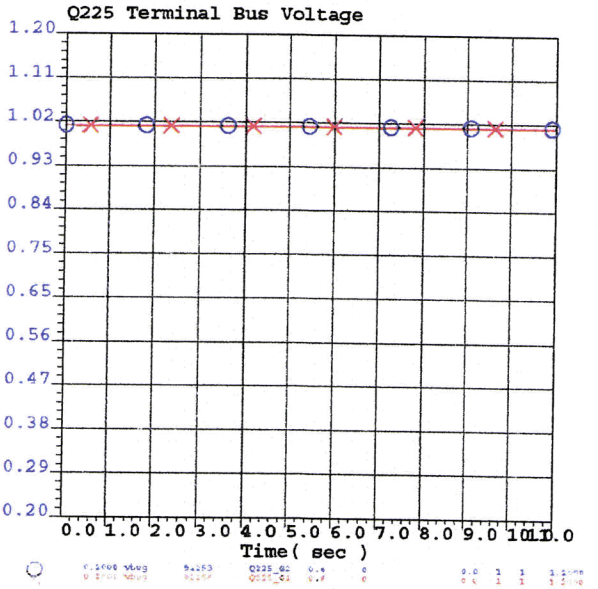
Thu Jun 04 16:59:46 2015

Q225 Transient Stability Plots



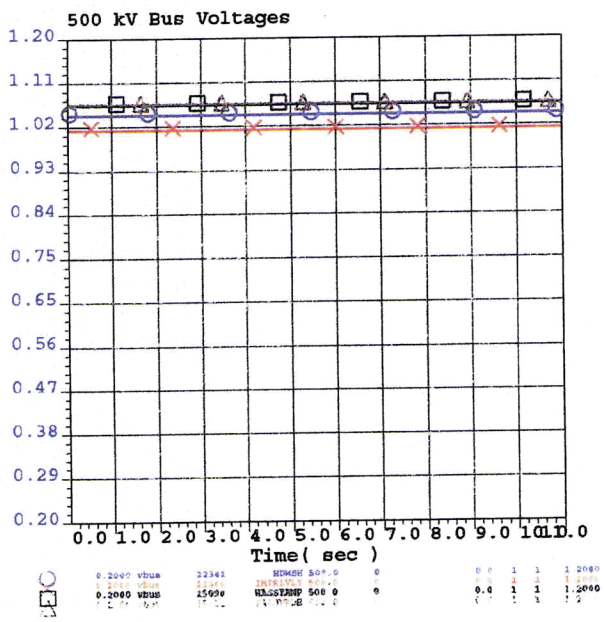


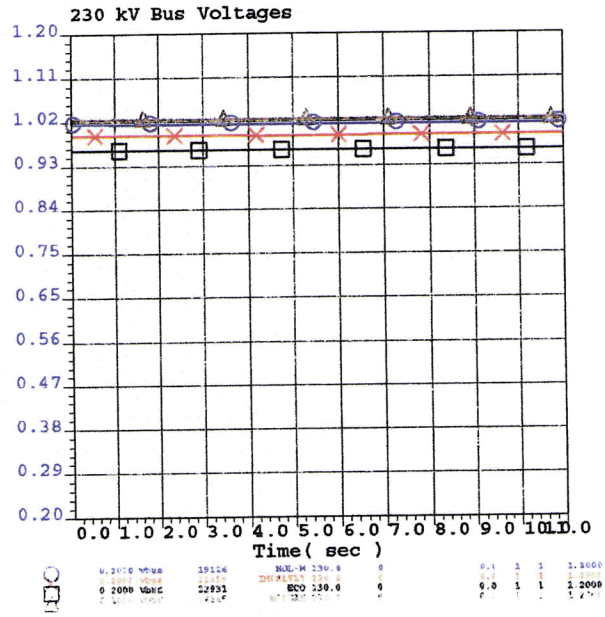


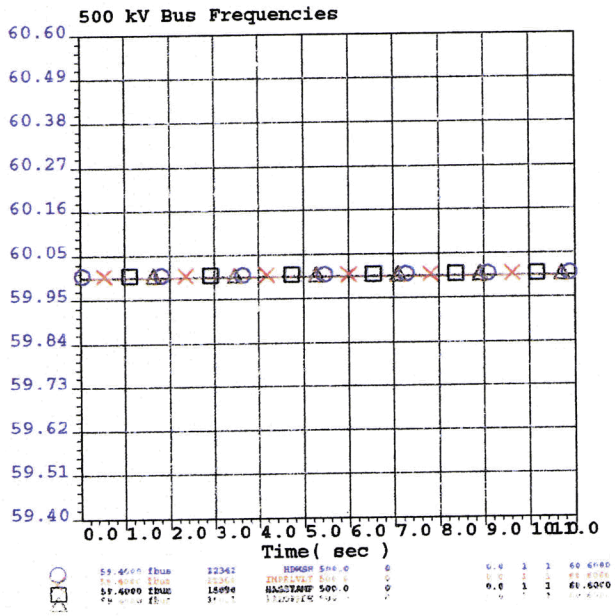


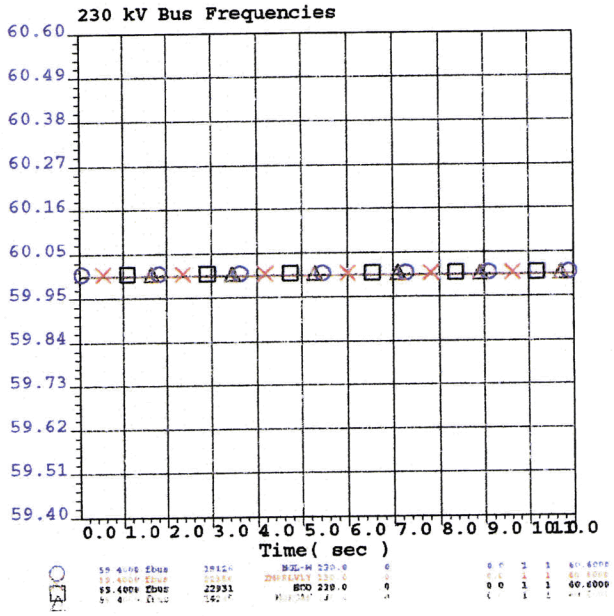
2019 HS Case, Q225 System Impact Study
Case 4: Post-Project
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots









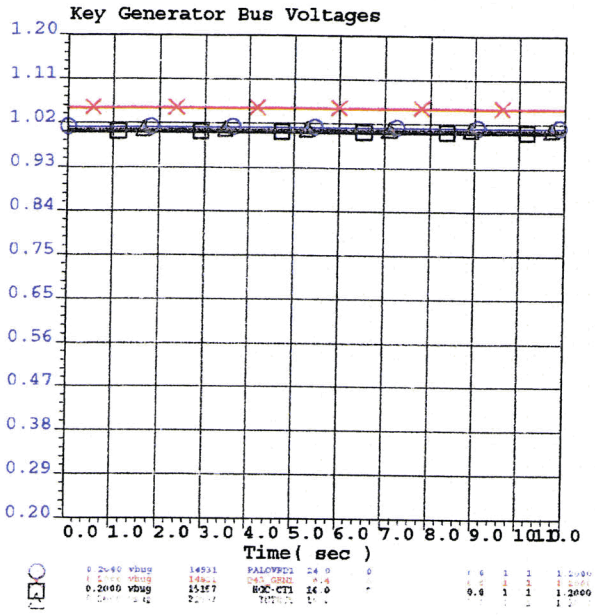
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

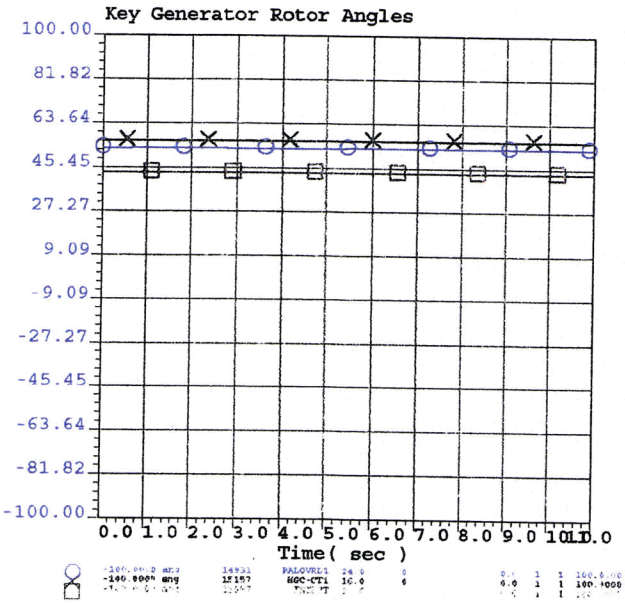
06_19HS_PST_Q219_000-N-0_FLAT_RUN.chf

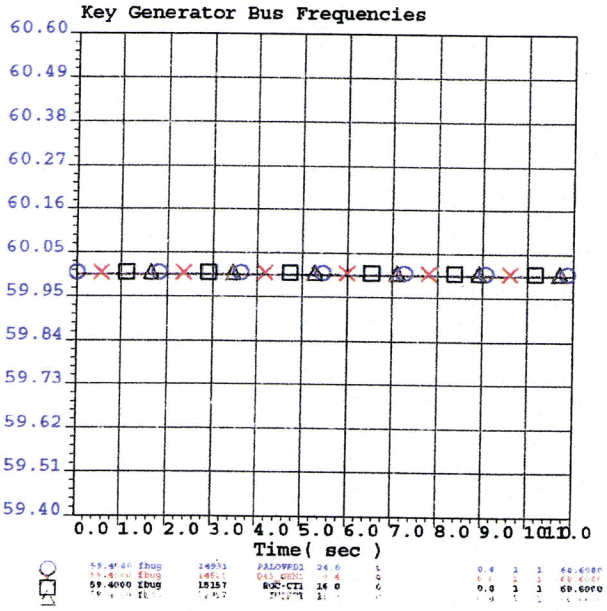
-

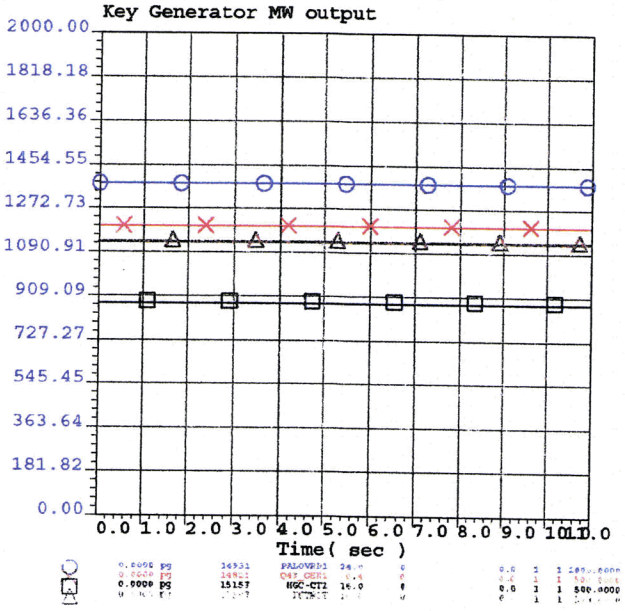
Thu Jun 04 17:00:40 2015

Q225 Transient Stability Plots



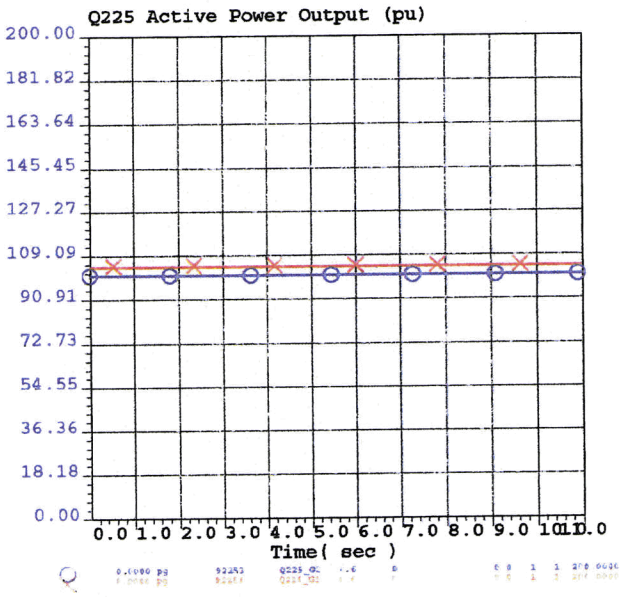


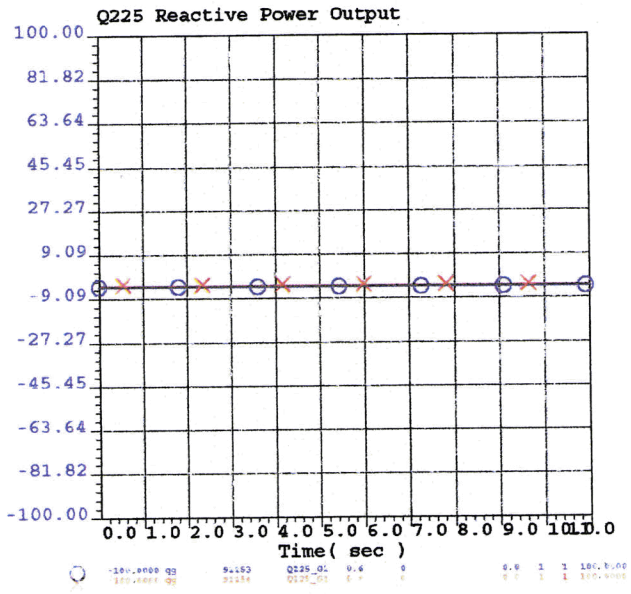


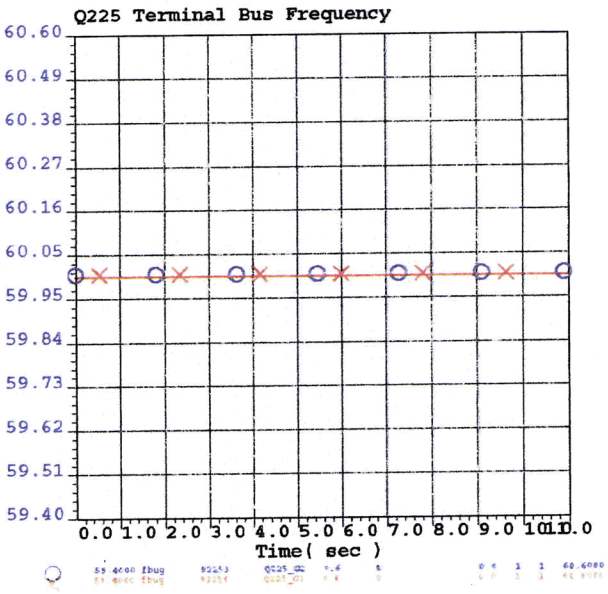


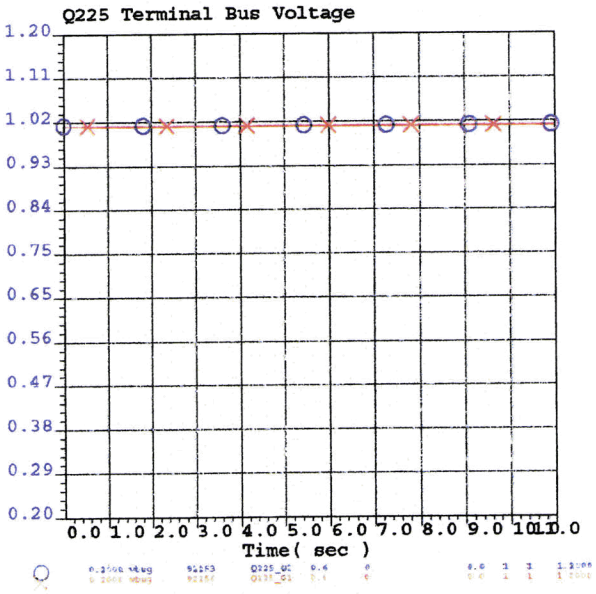
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







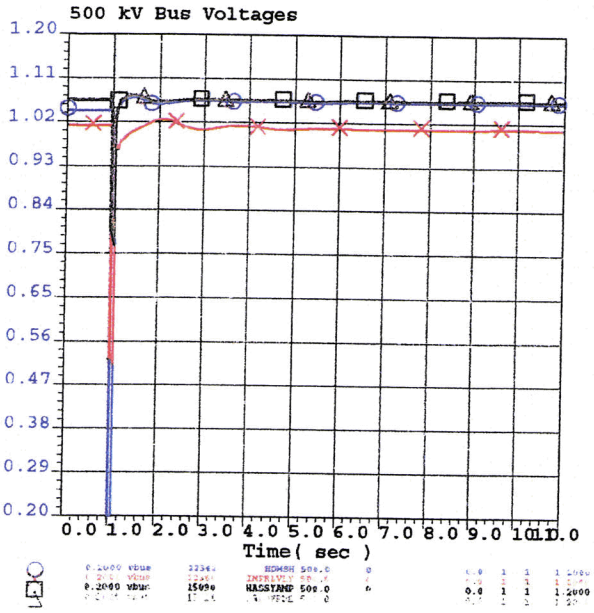


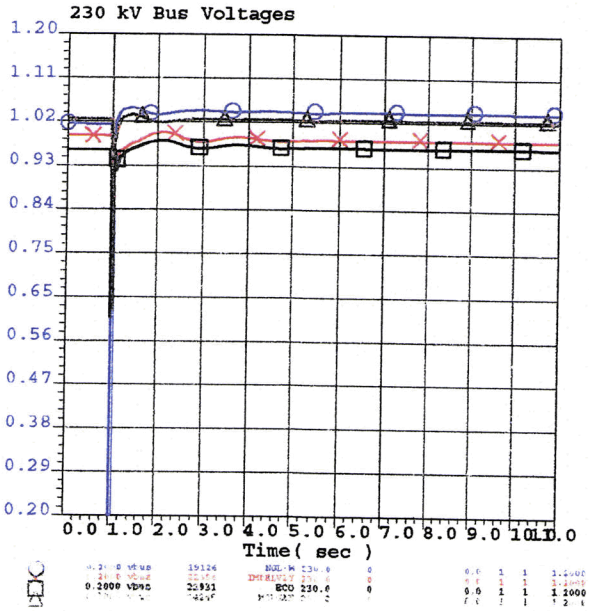
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

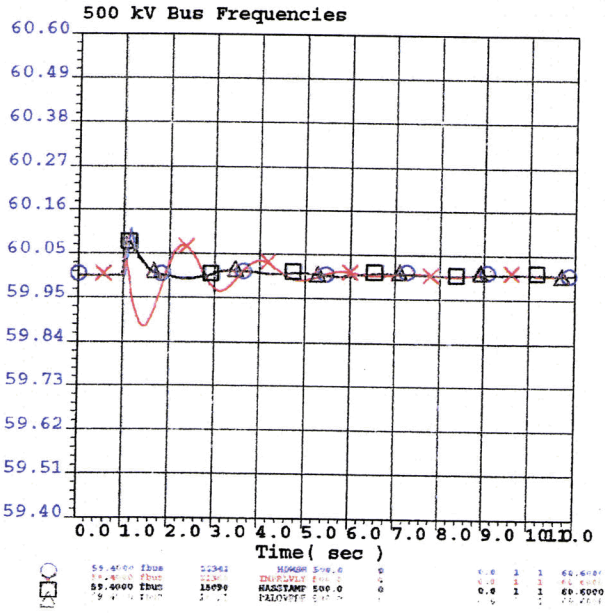
06_19HS_PST_Q219_000-N-0_FLAT_RUN.chf

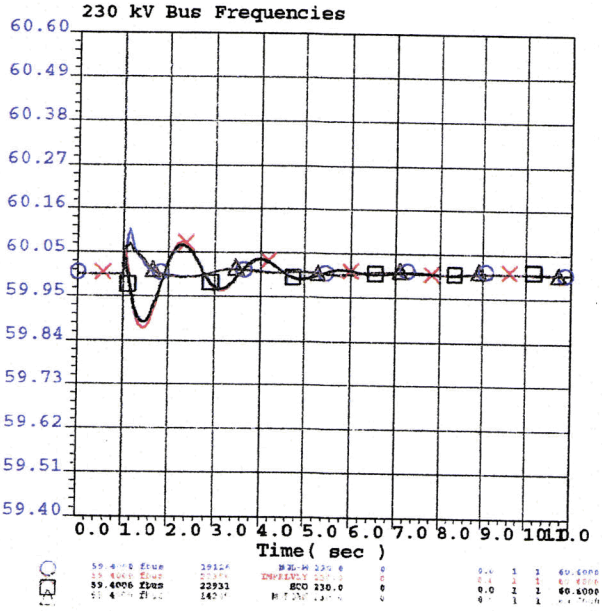
Thu Jun 04 17:00:40 2015

Q225 Transient Stability Plots



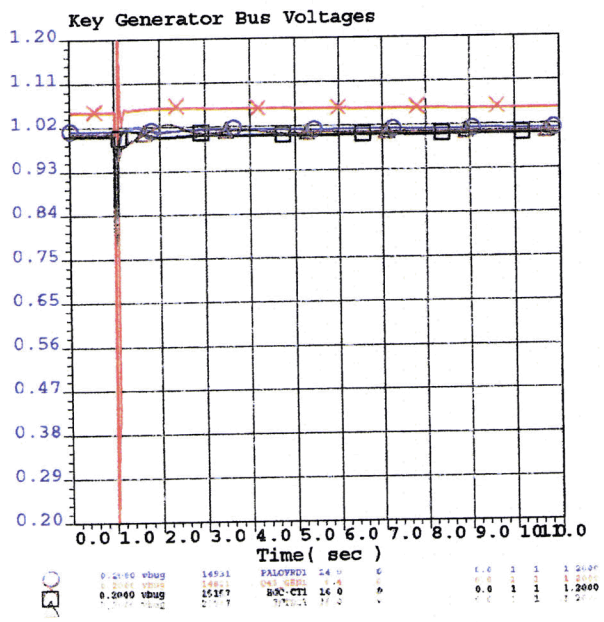


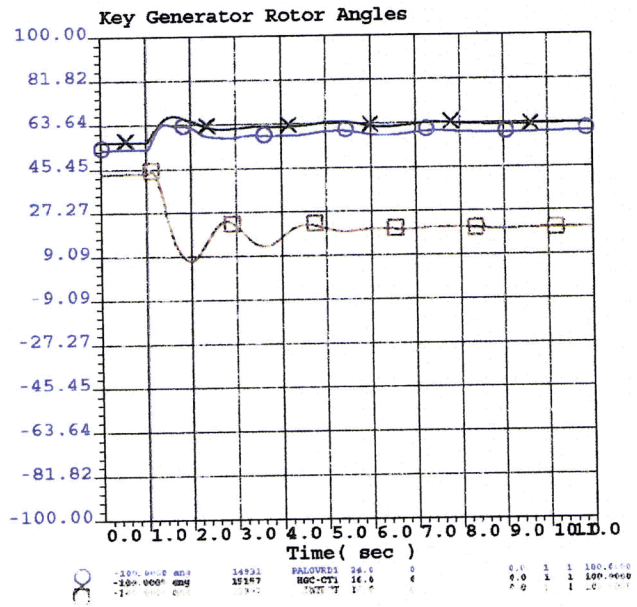


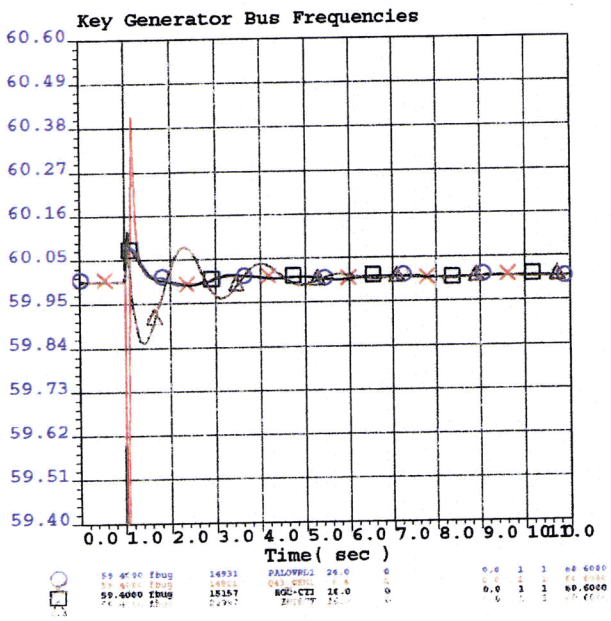


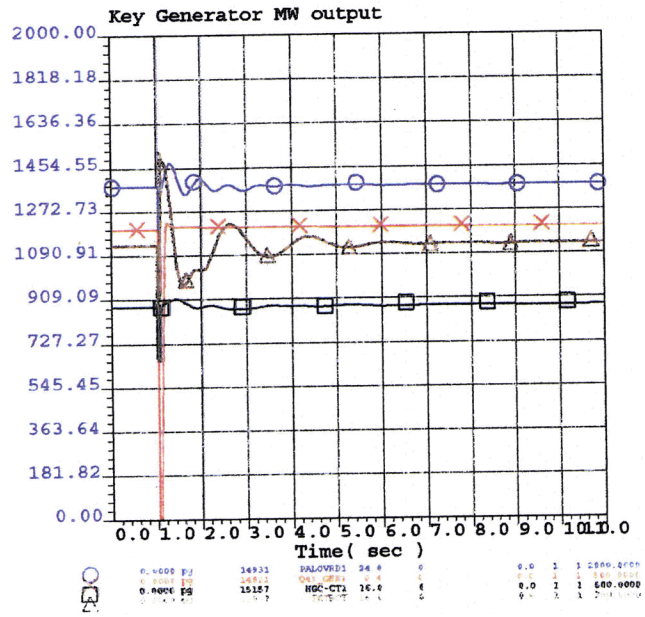
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







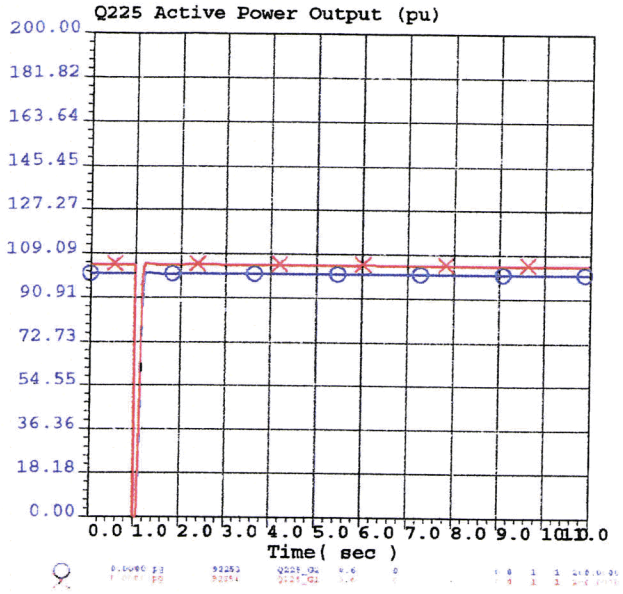


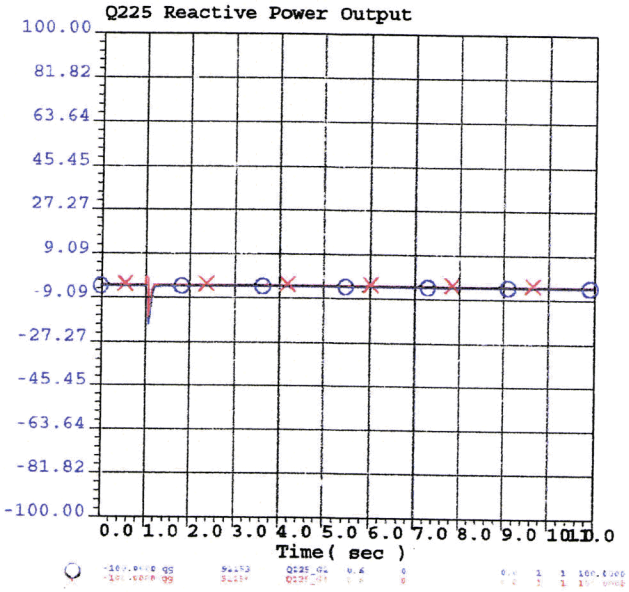
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

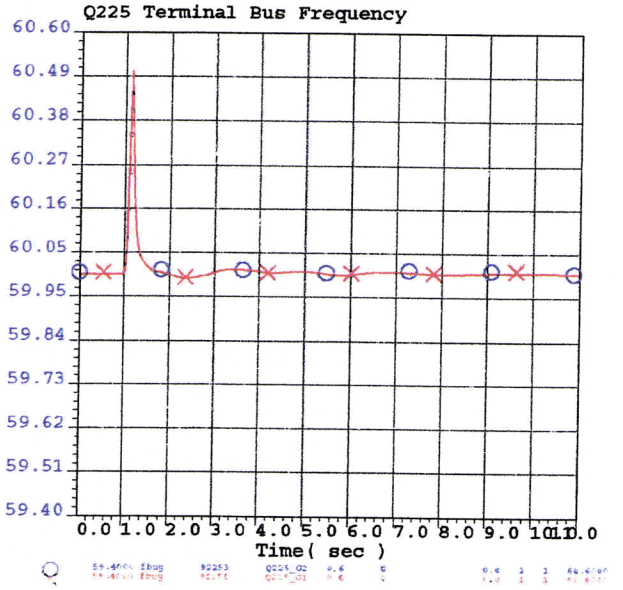
06_19HS_PST_Q219_001_NGI-IV_500_1.chf

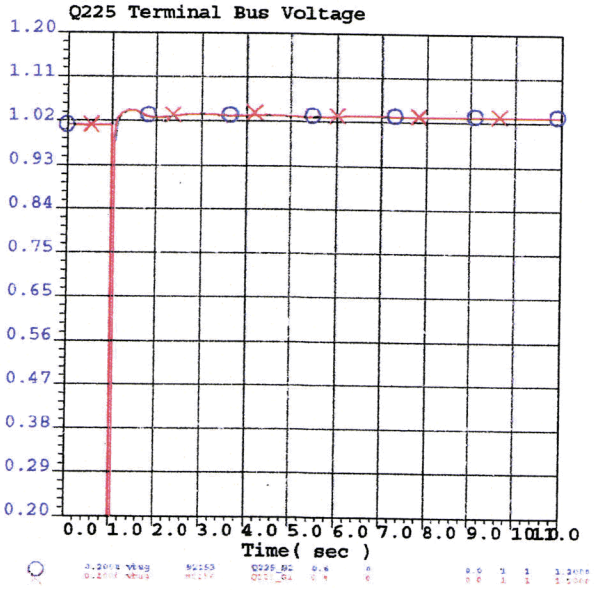
Thu Jun 04 17:00:41 2015

Q225 Transient Stability Plots







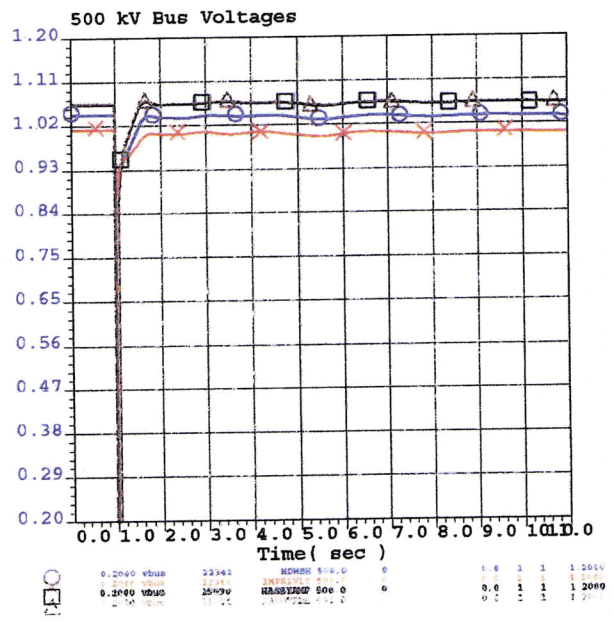


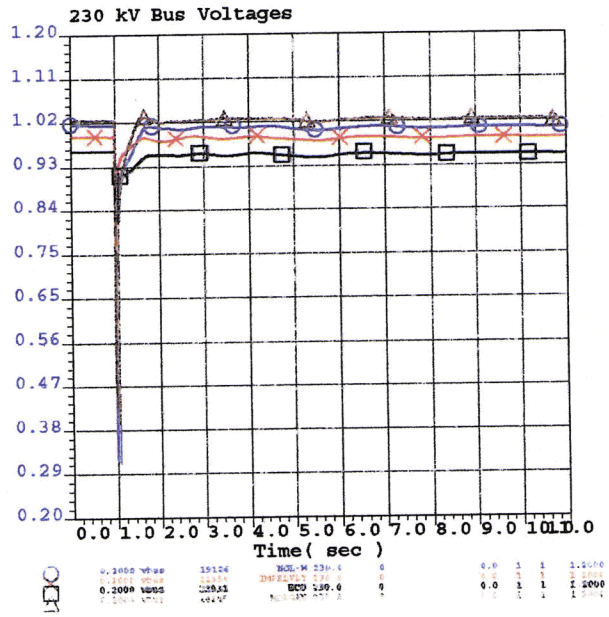
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

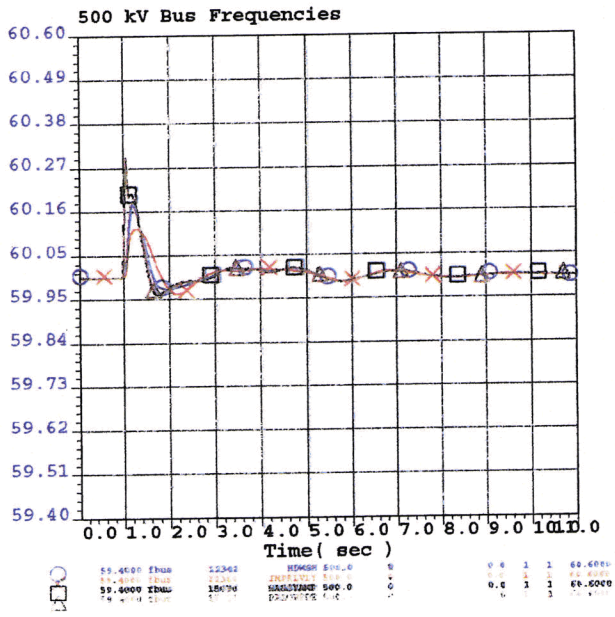
06_19HS_PST_Q219_001_NGI-IV_500_1.chf

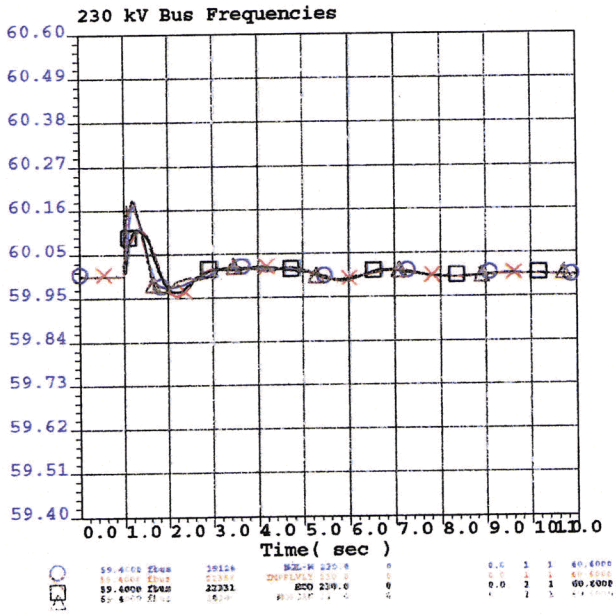
Thu Jun 04 17:00:42 2015

Q225 Transient Stability Plots







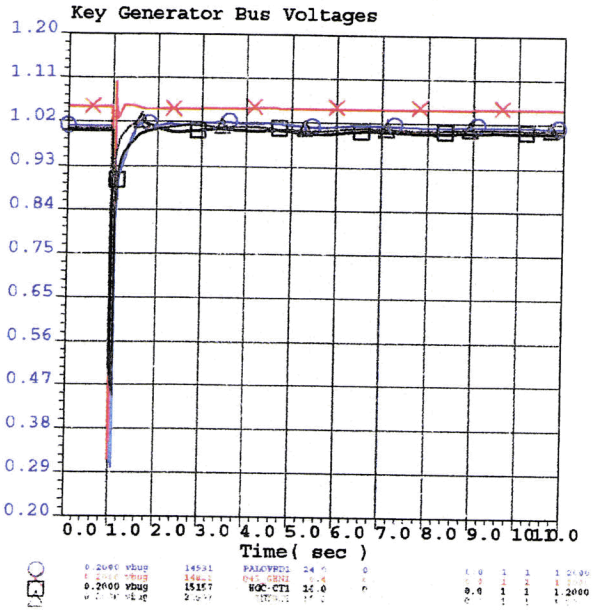


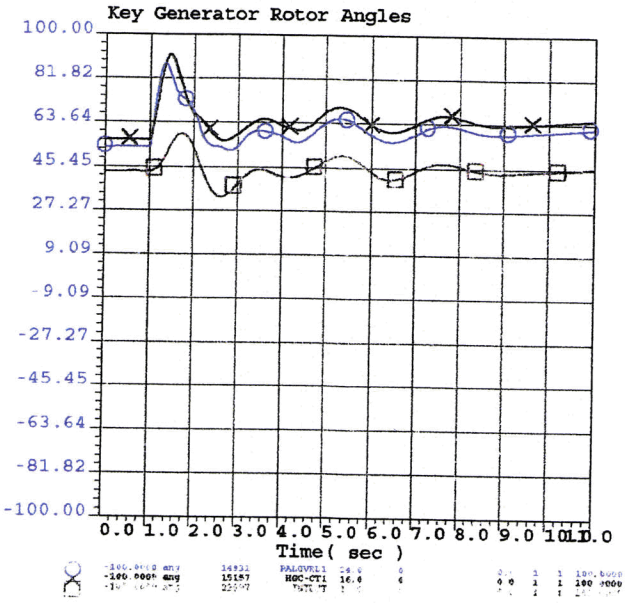
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

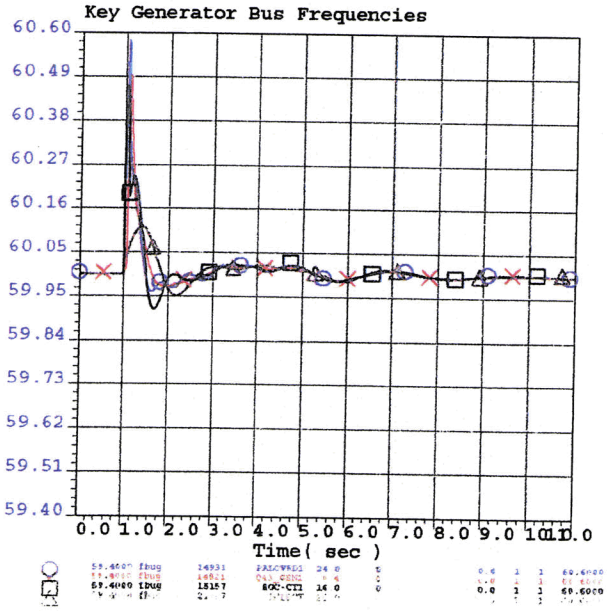
06_19HS_PST_Q219_002_PV-CR.chf

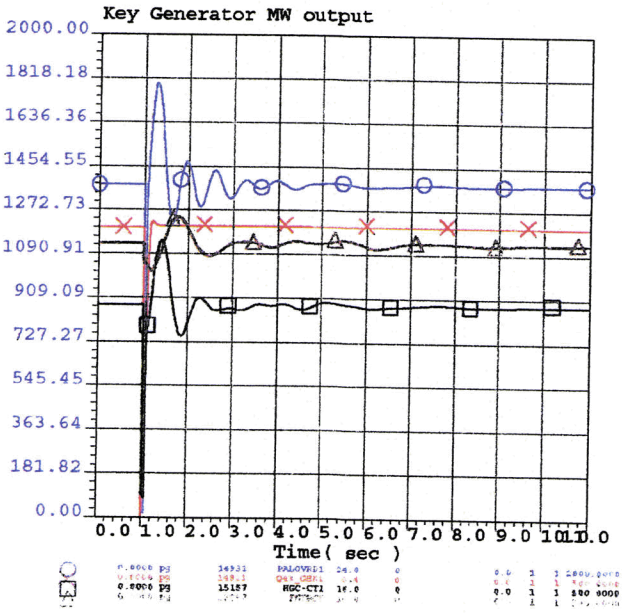
Thu Jun 04 17:00:43 2015

Q225 Transient Stability Plots



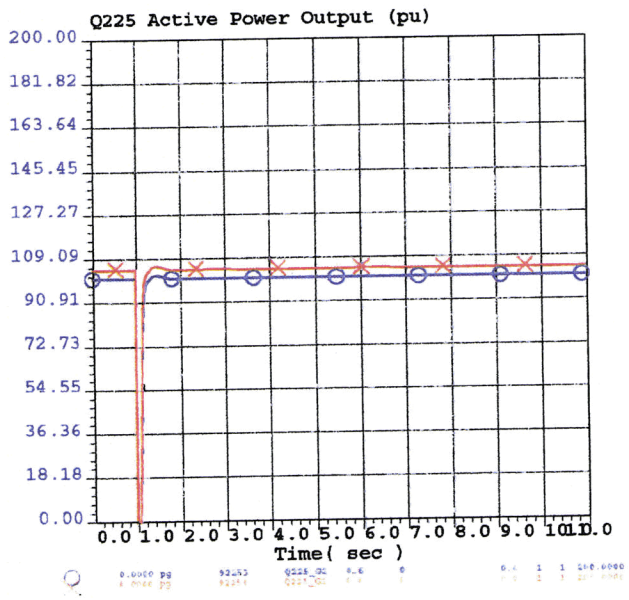


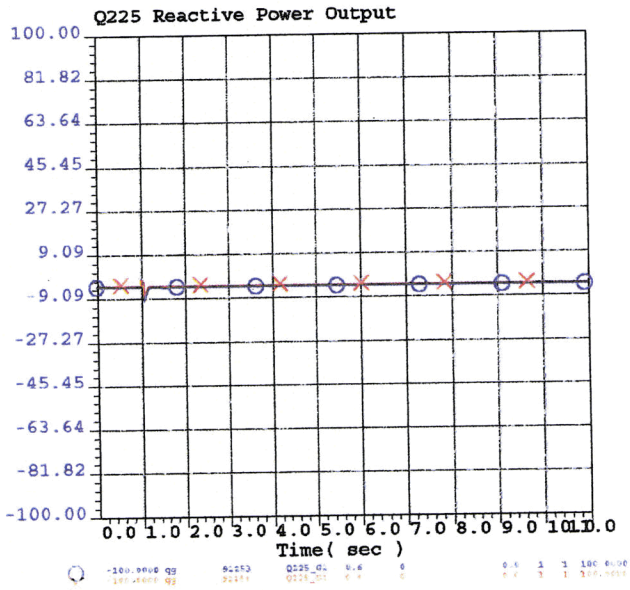


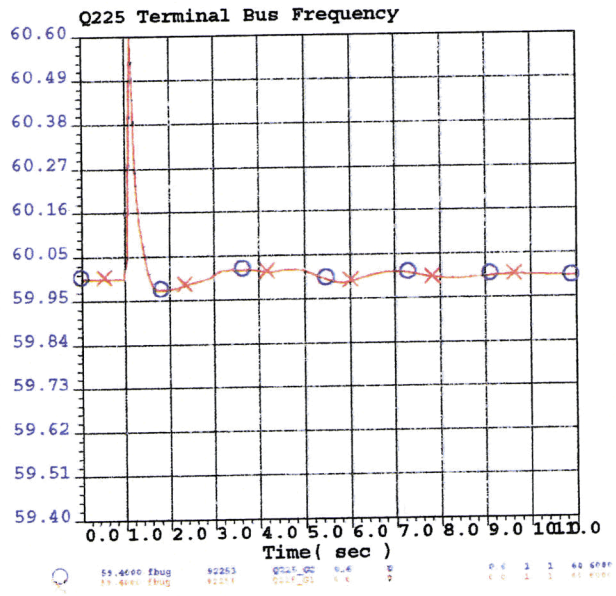


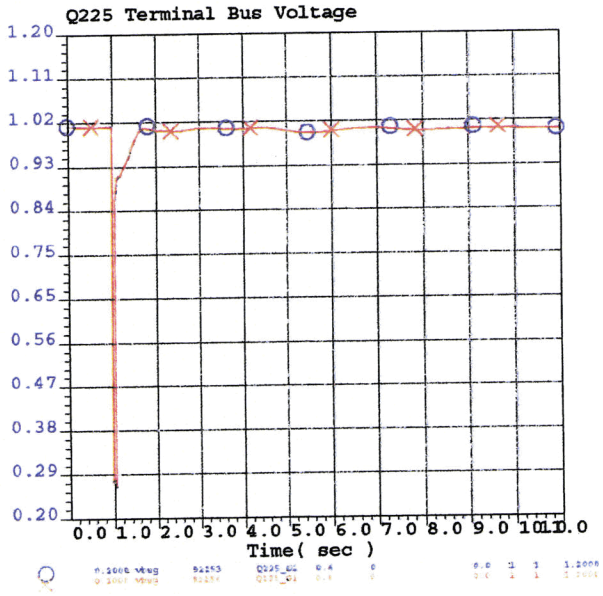
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







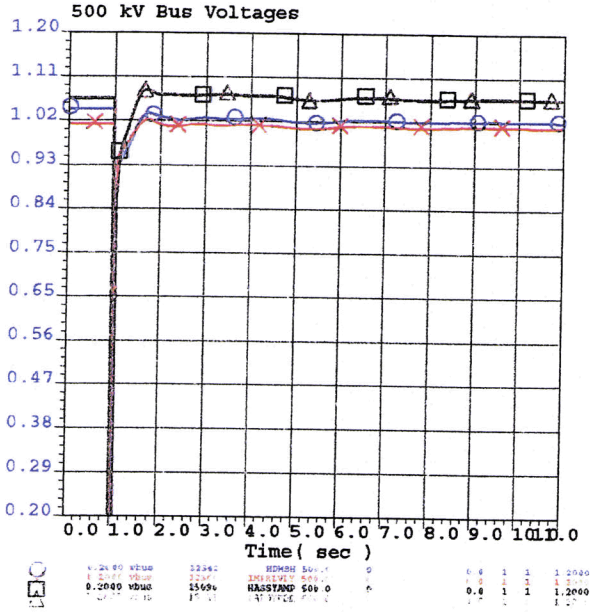


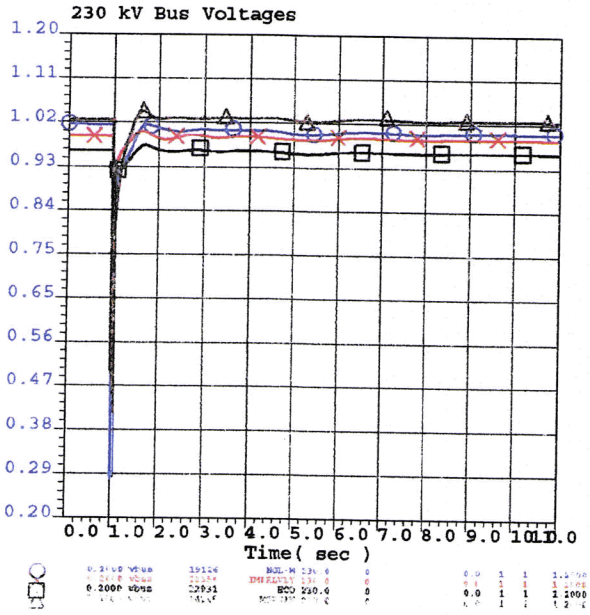
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

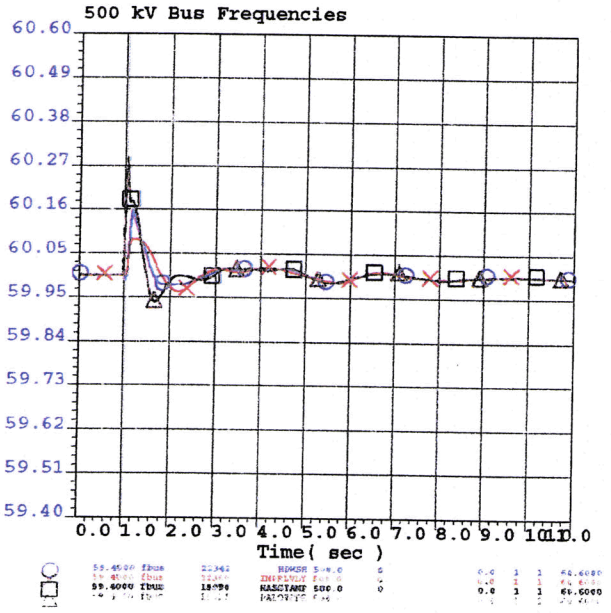
06_19HS_PST_Q219_002_PV-CR.chf

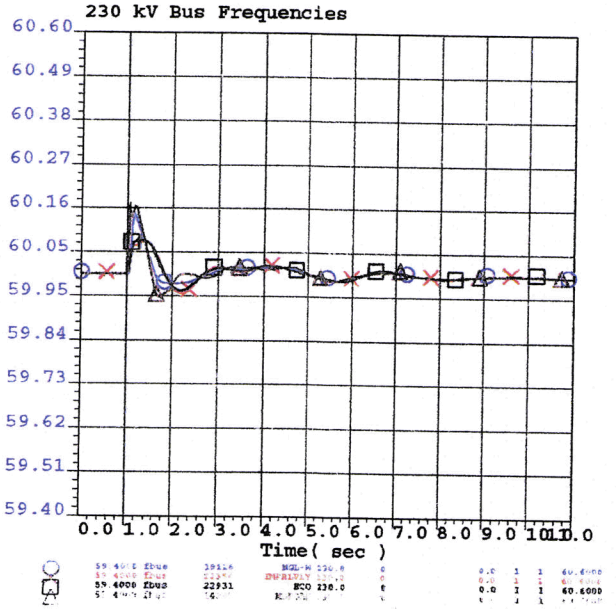
Thu Jun 04 17:00:43 2015

Q225 Transient Stability Plots



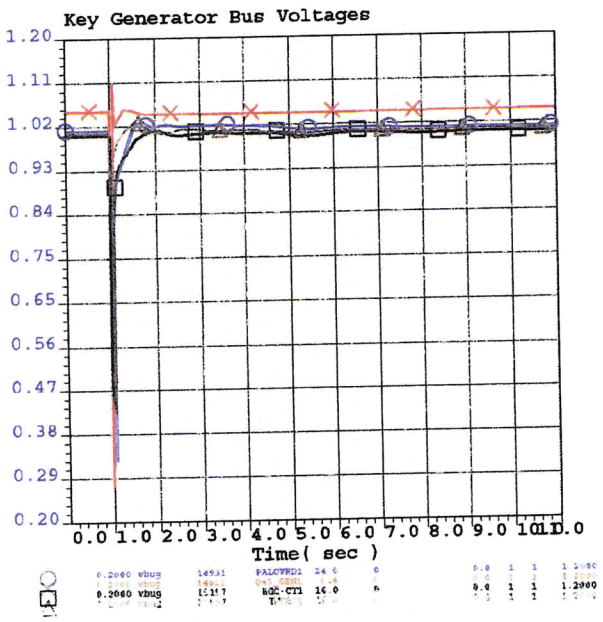


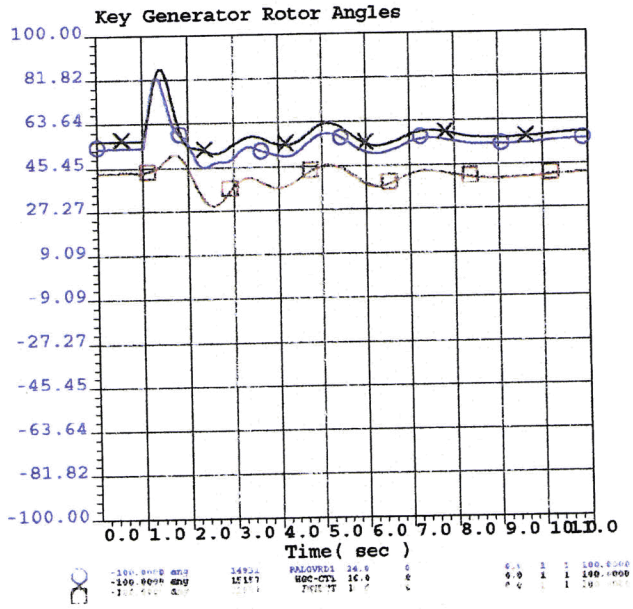


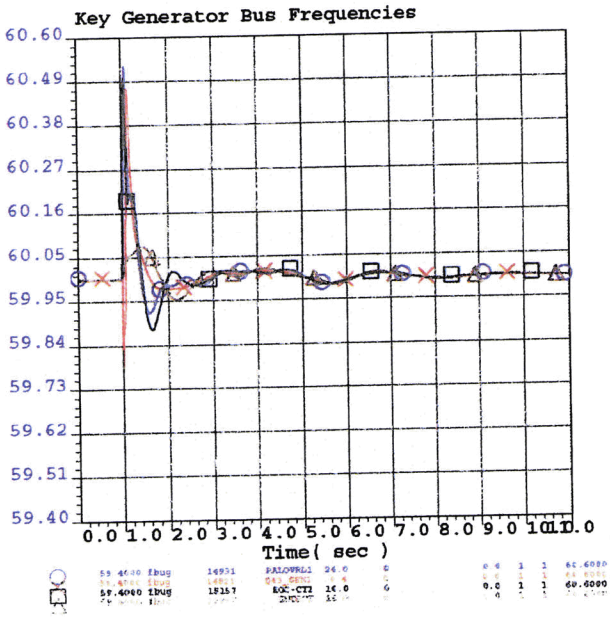


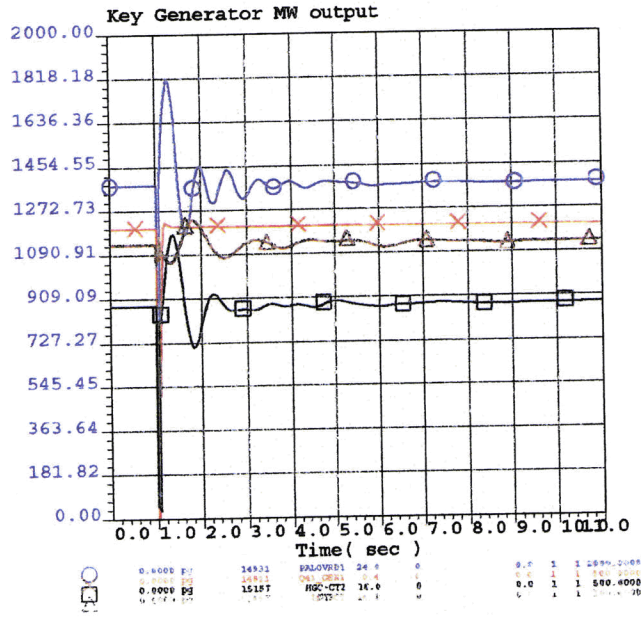
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







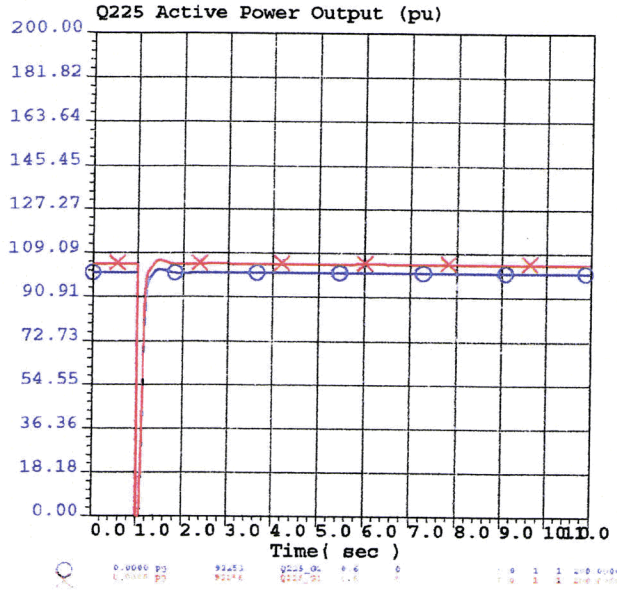


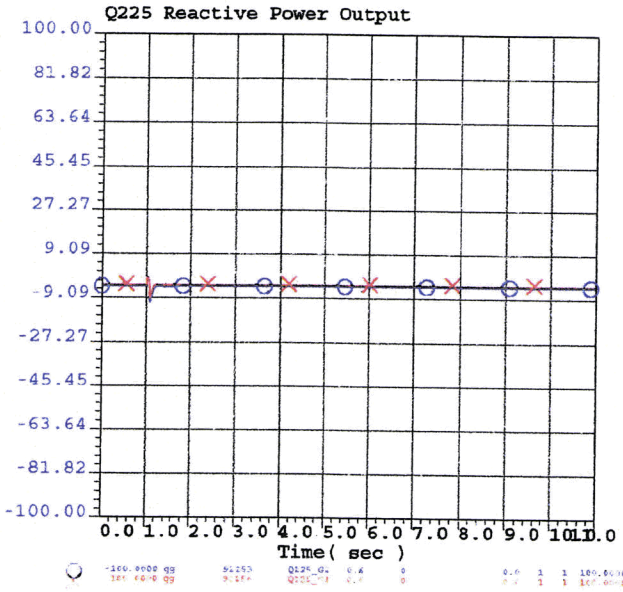
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

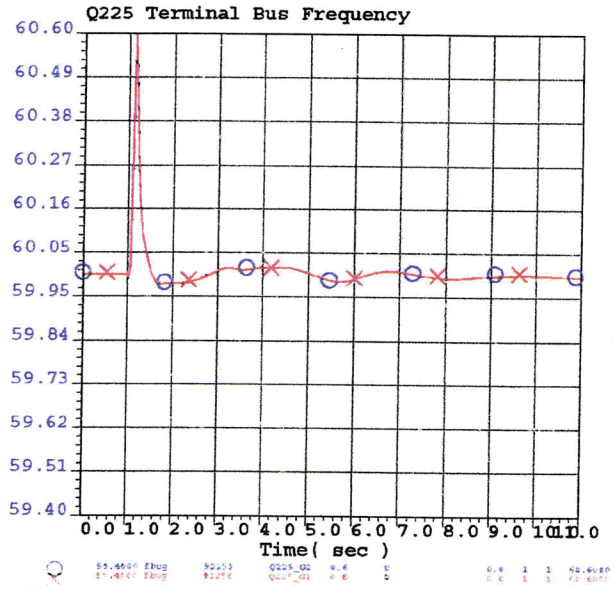
06_19HS_PST_Q219_012_HAS-HDW.chf

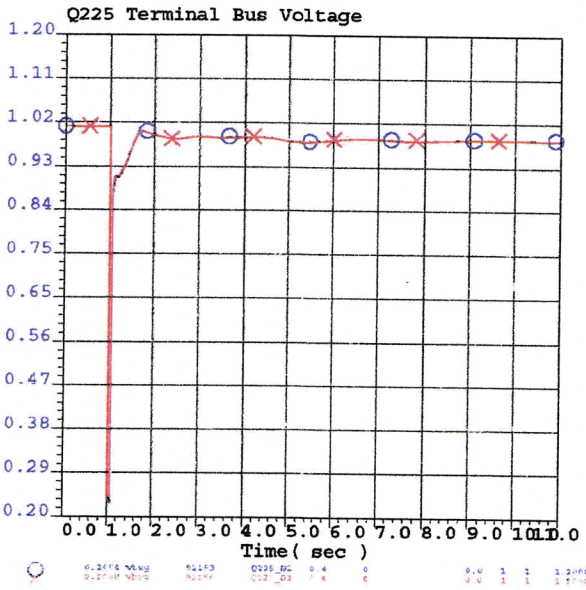
Thu Jun 04 17:00:58 2015

Q225 Transient Stability Plots







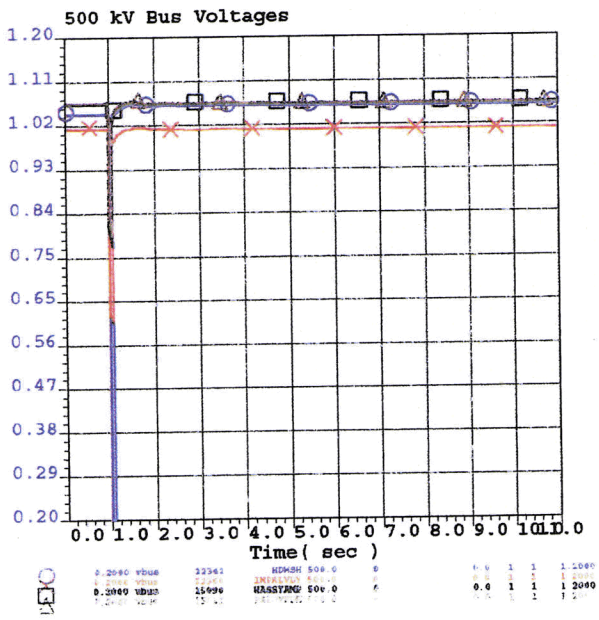


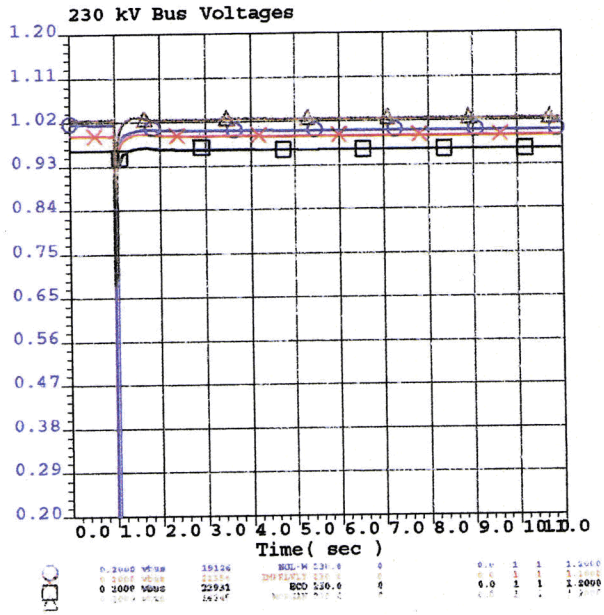
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

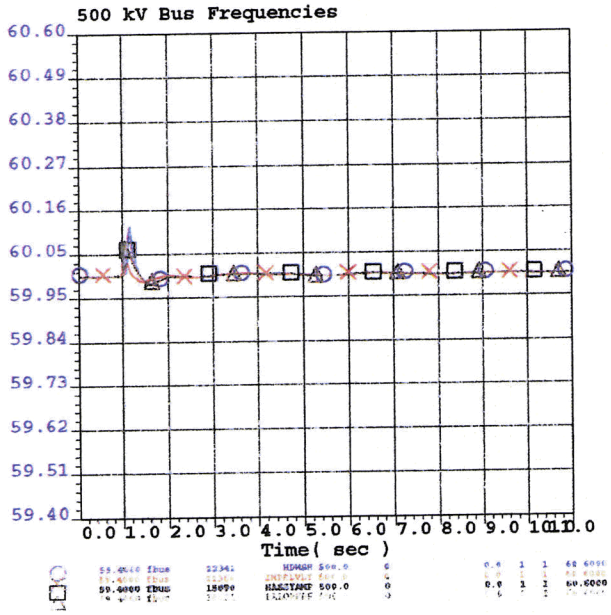
06_19HS_PST_Q219_012_HAS-HDW.chf

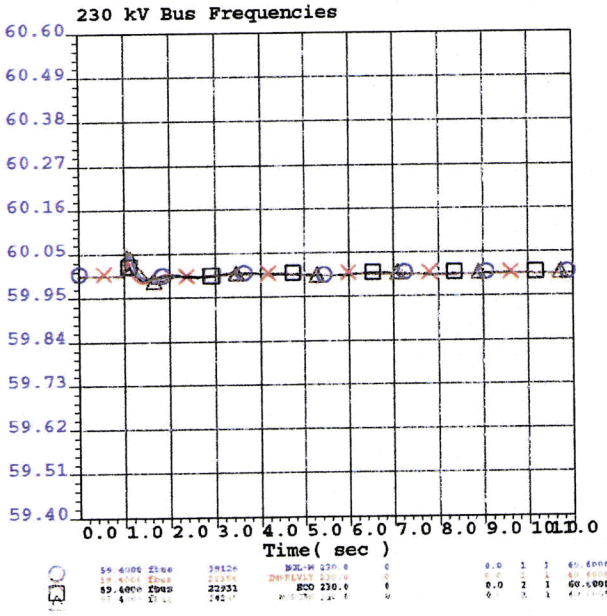
Thu Jun 04 17:00:58 2015

Q225 Transient Stability Plots







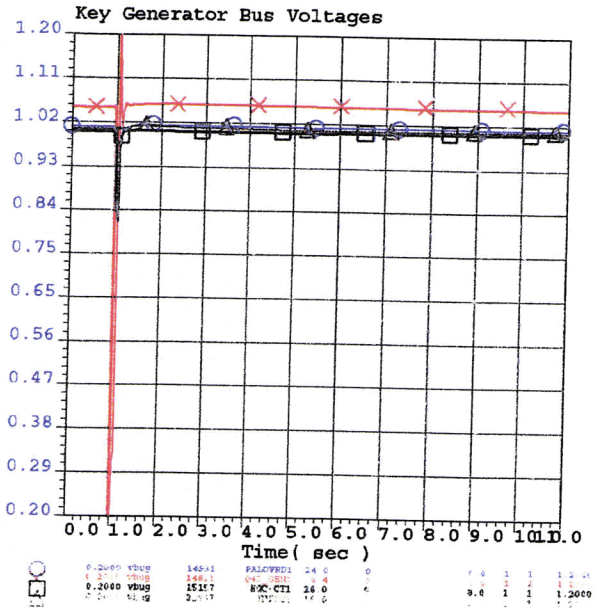


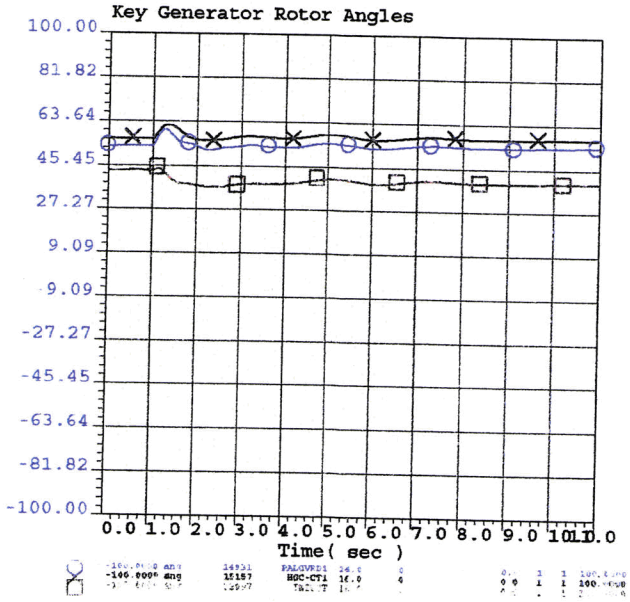
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

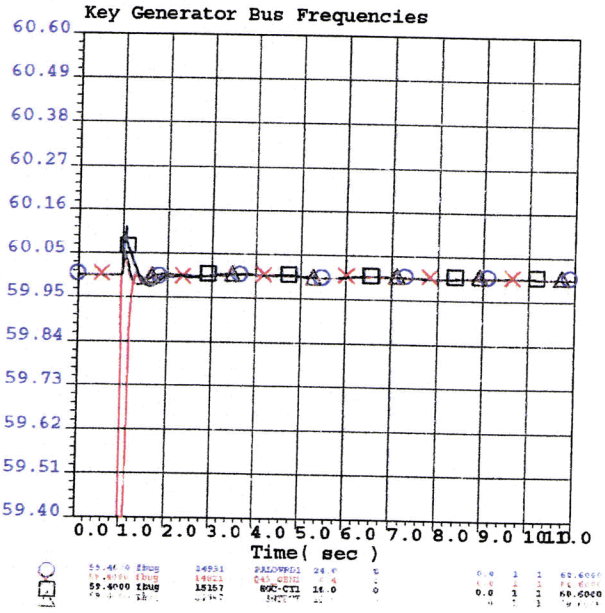
06_19HS_PST_Q219_013_HDW-NG.chf

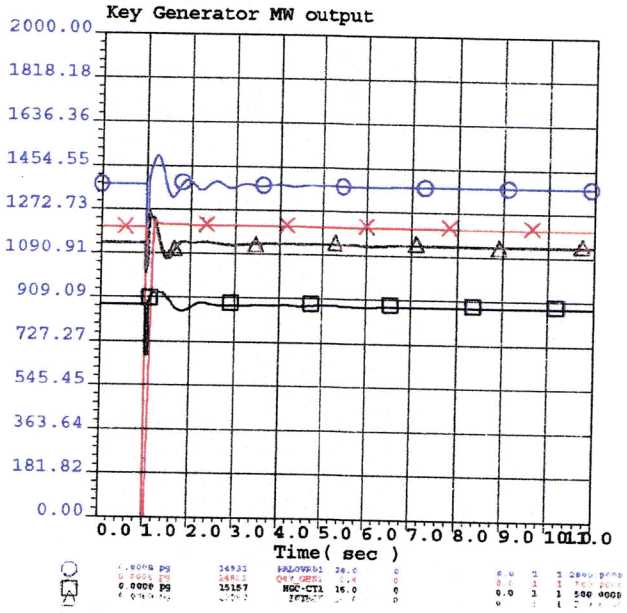
Thu Jun 04 17:01:00 2015

Q225 Transient Stability Plots



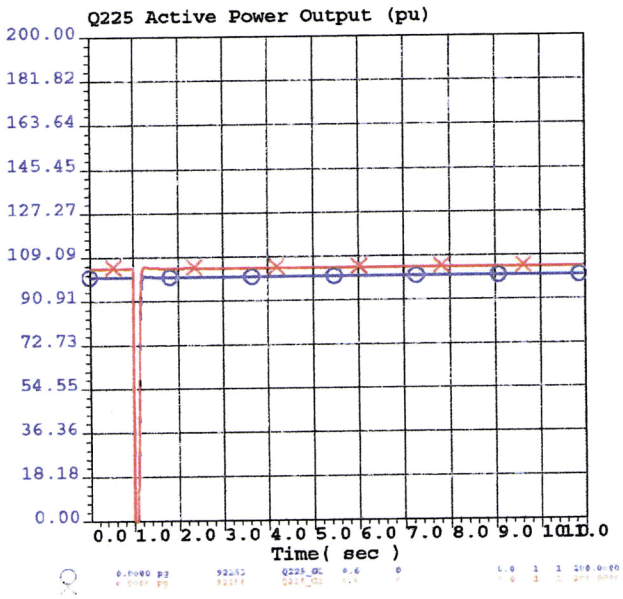


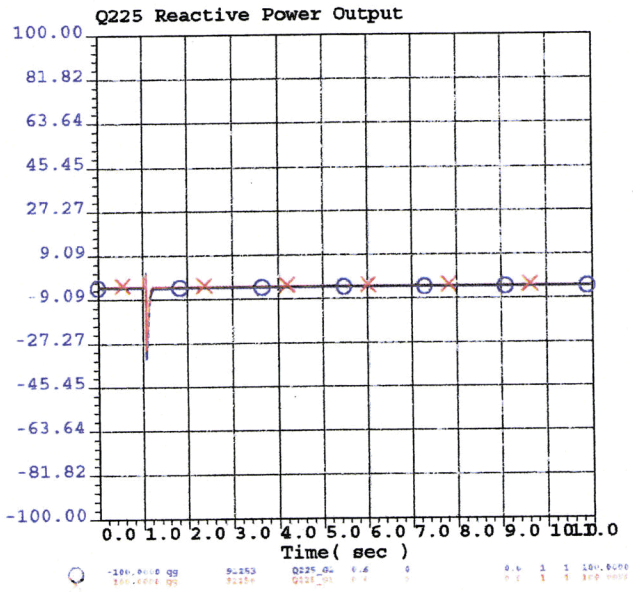


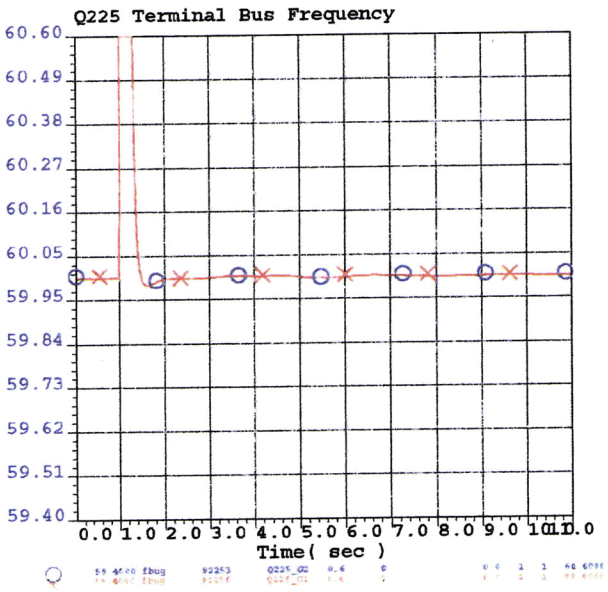


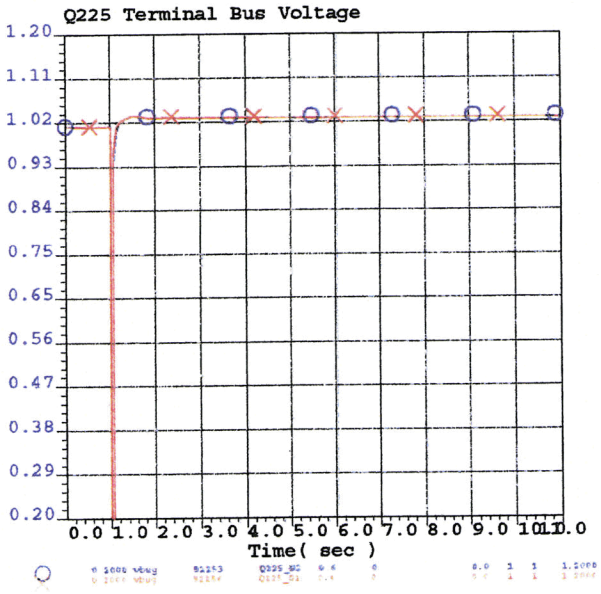
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







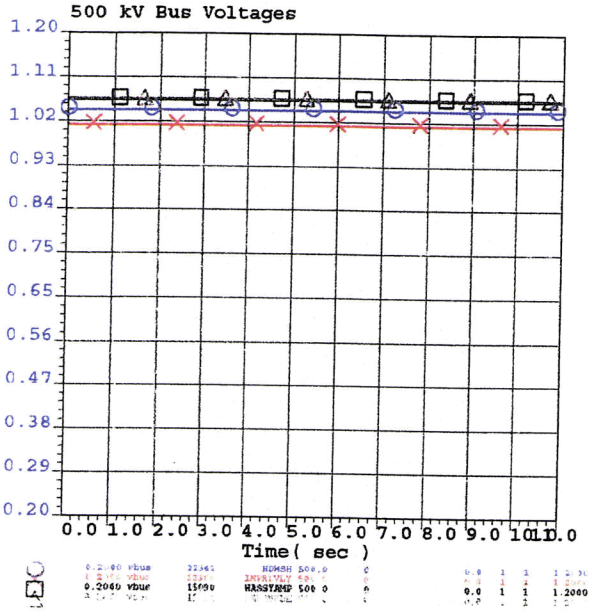


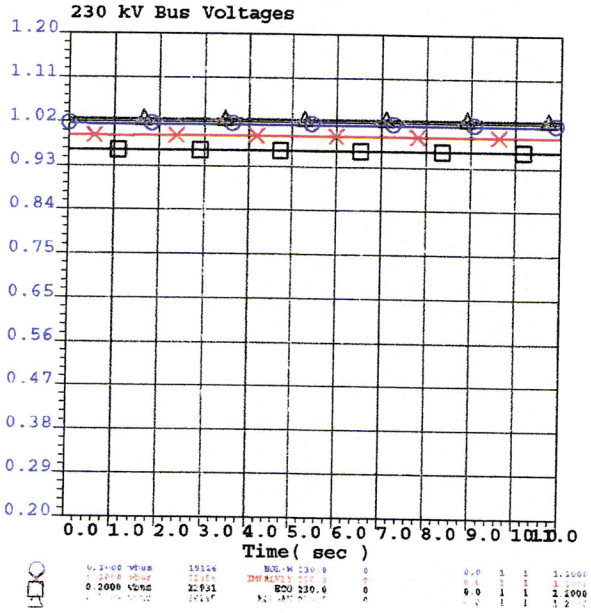
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

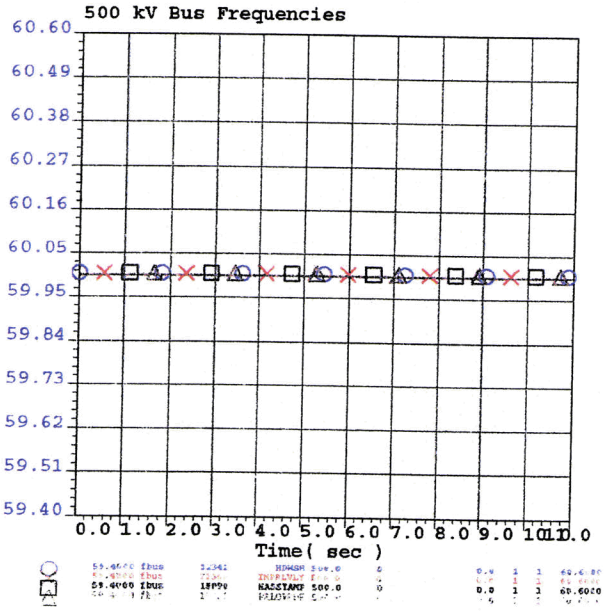
06_19HS_PST_Q219_013_HDW-NG.chf

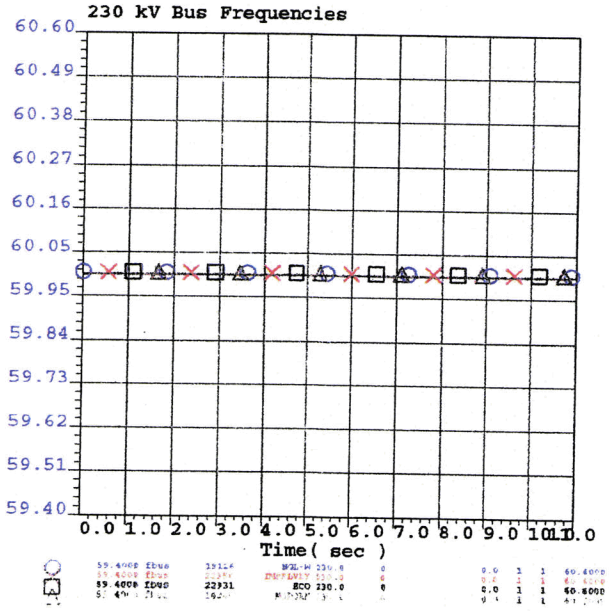
Thu Jun 04 17:01:00 2015

Q225 Transient Stability Plots



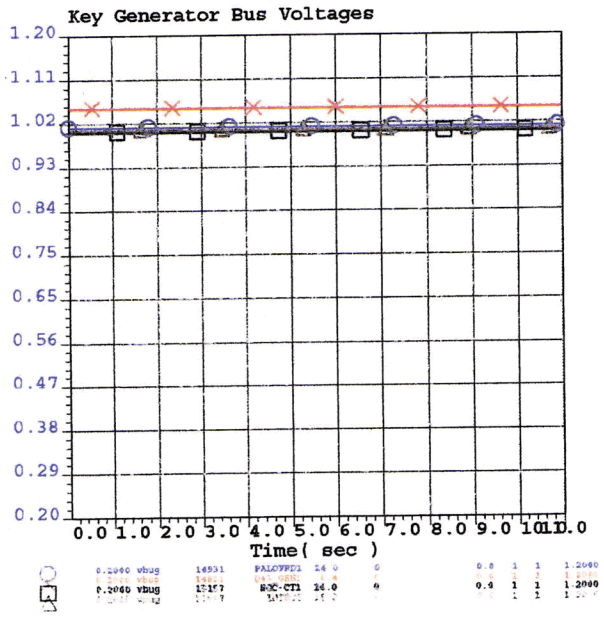


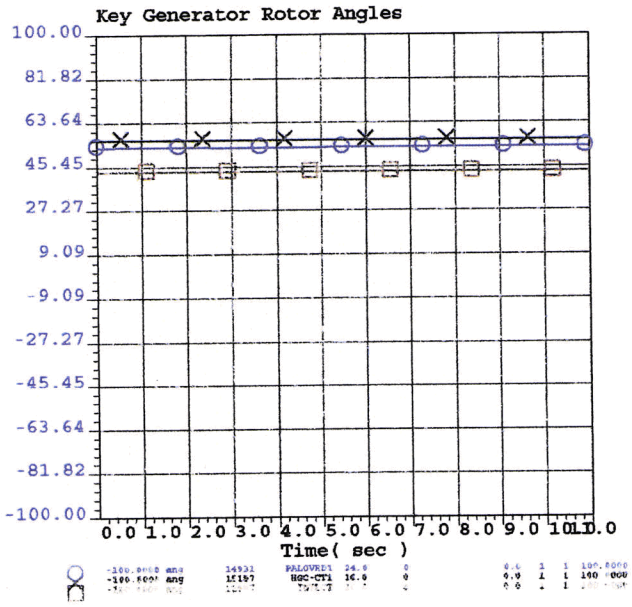


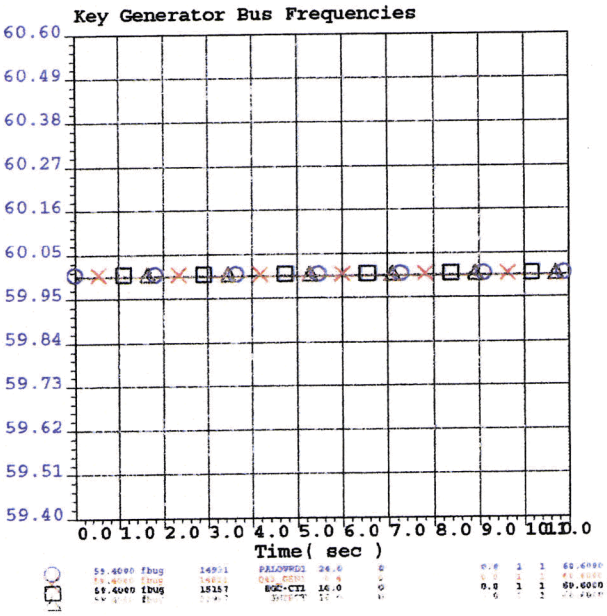


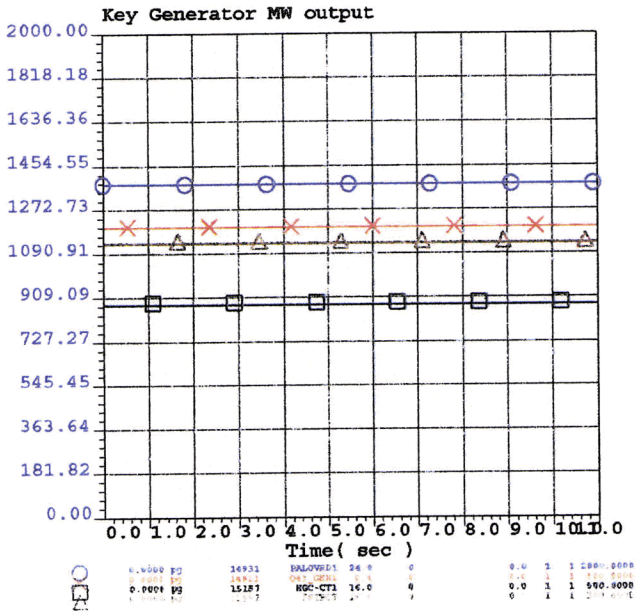
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







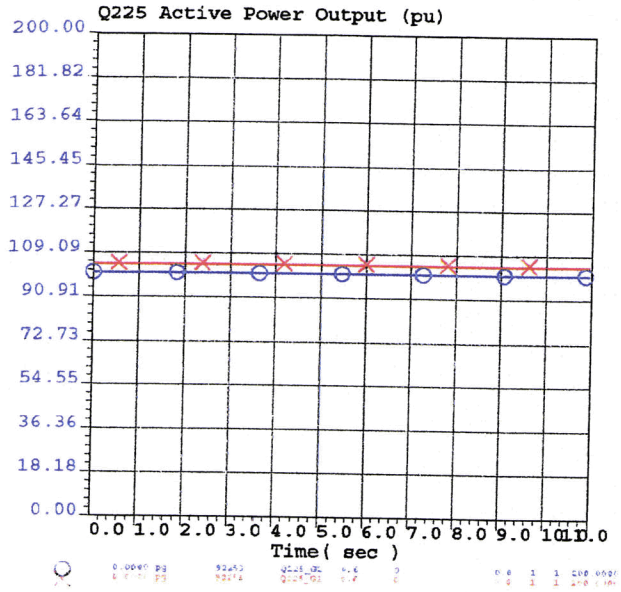


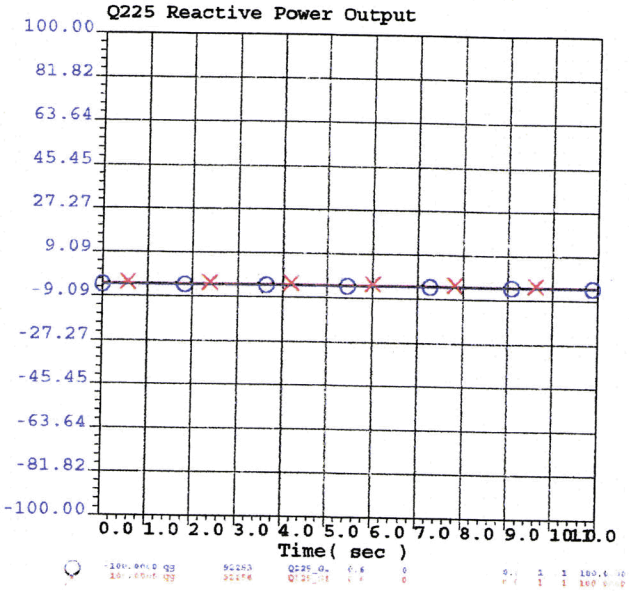
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

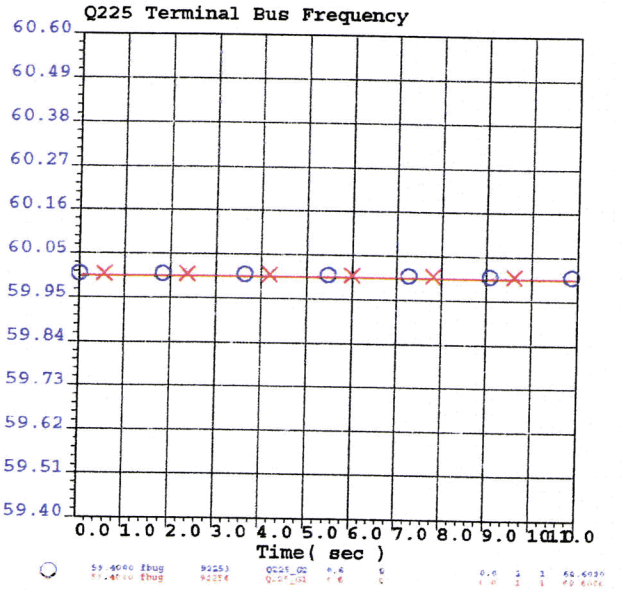
06_19HS_PST_Q219_127_Q225_1.chf

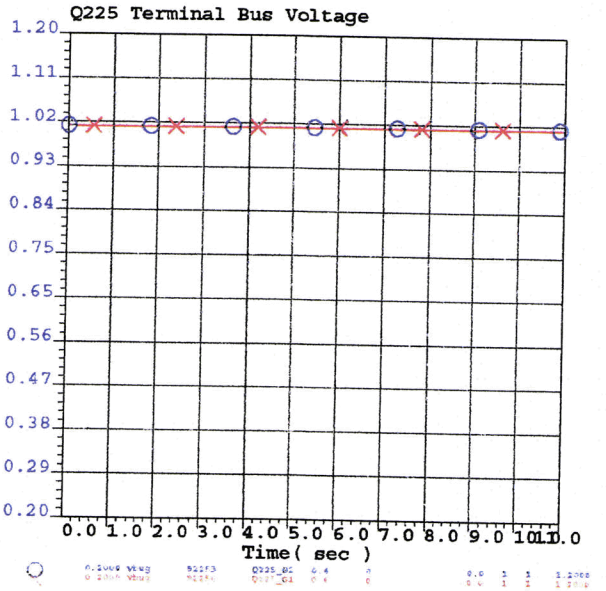
Thu Jun 04 17:03:51 2015

Q225 Transient Stability Plots



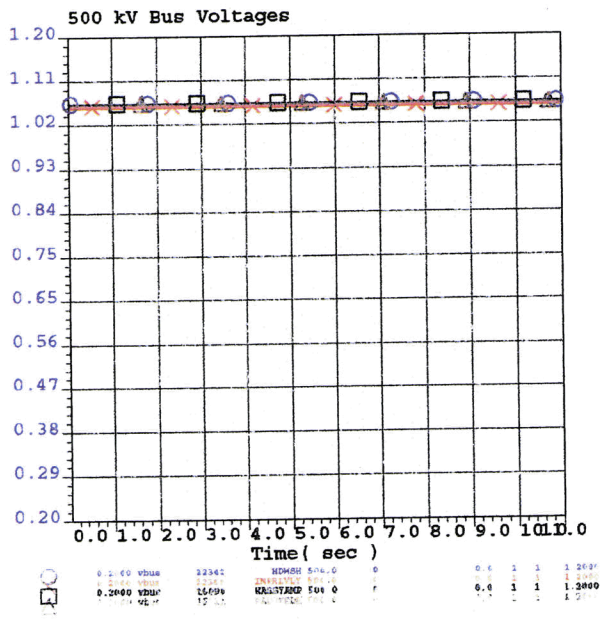


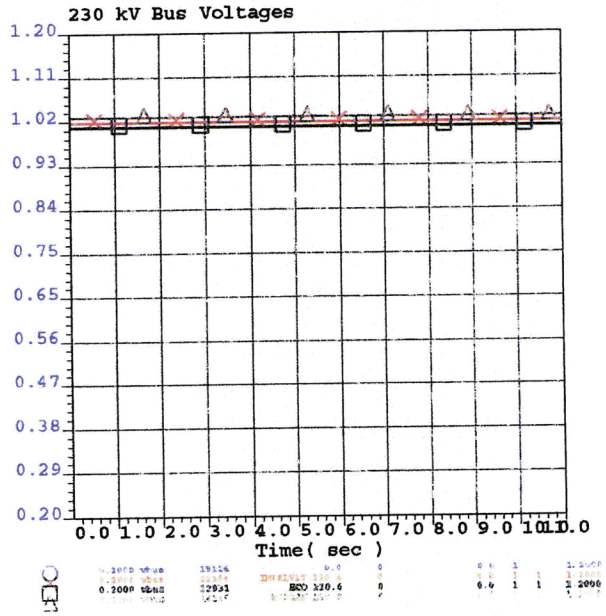


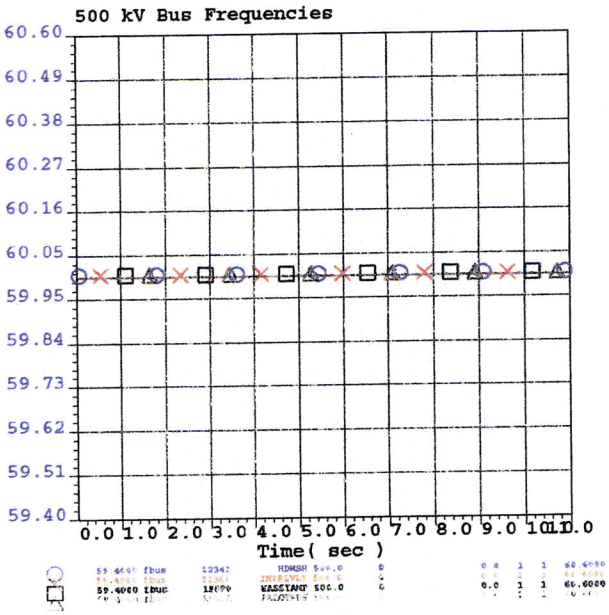


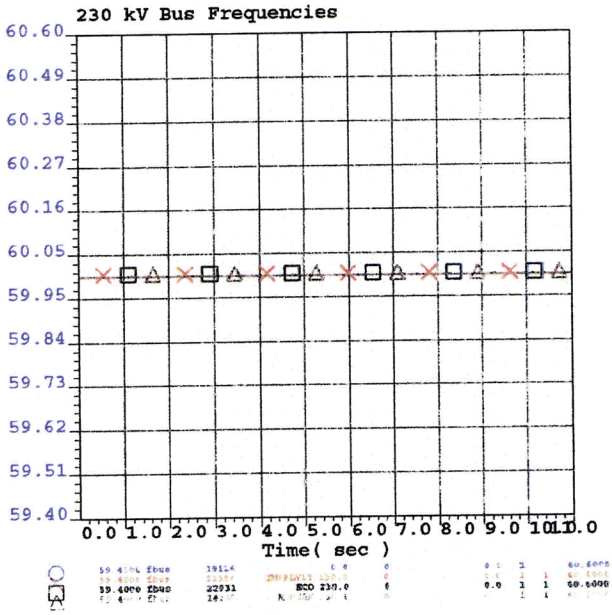
2019 HS Case, Q225 System Impact Study
Case 6: Post-Project w/Q219
AZ Plng. Case sm19#28, USE updated
Q225 200MW to the Hoodoo Wash 500 kV bus

Q225 Transient Stability Plots







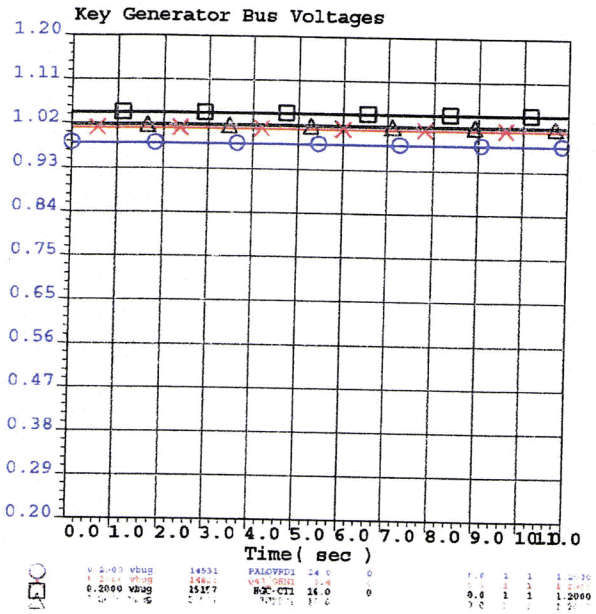


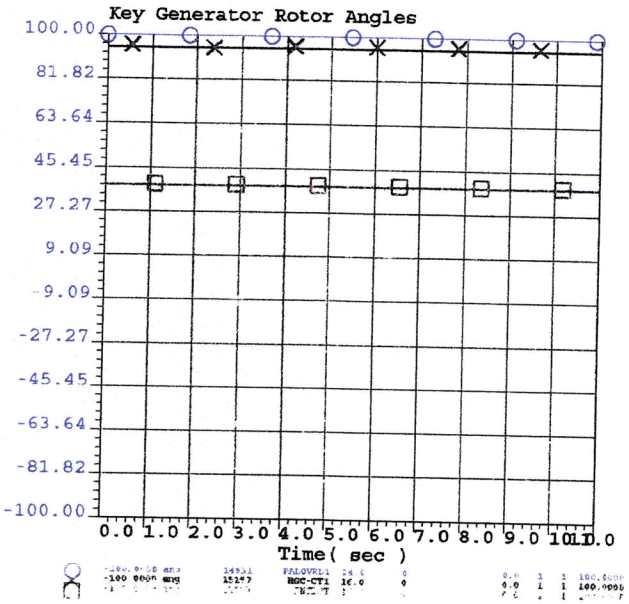
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

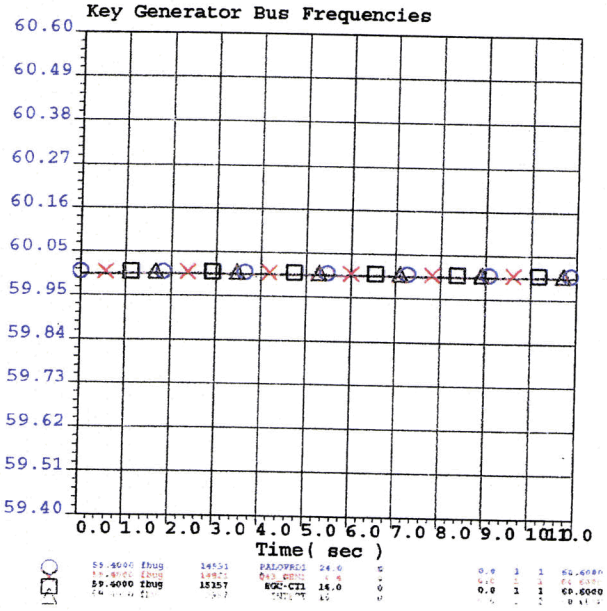
08_19HS_PST_eor_000-N-0_FLAT_RUN.chf

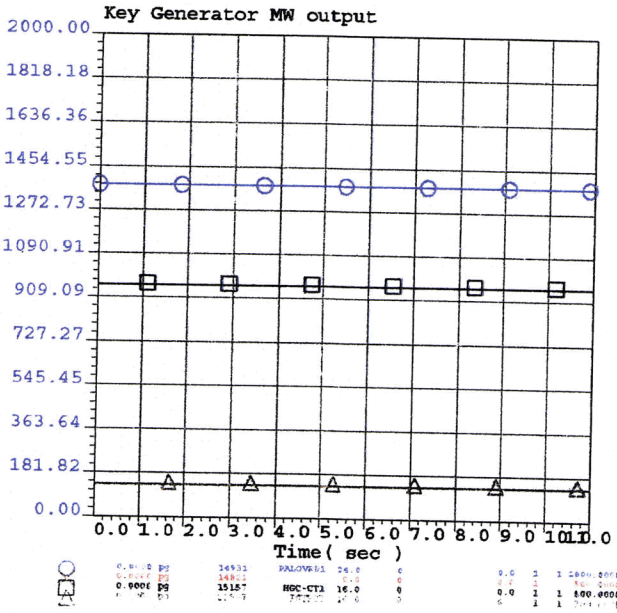
Thu Jun 11 10:33:21 2015

Q225 Transient Stability Plots



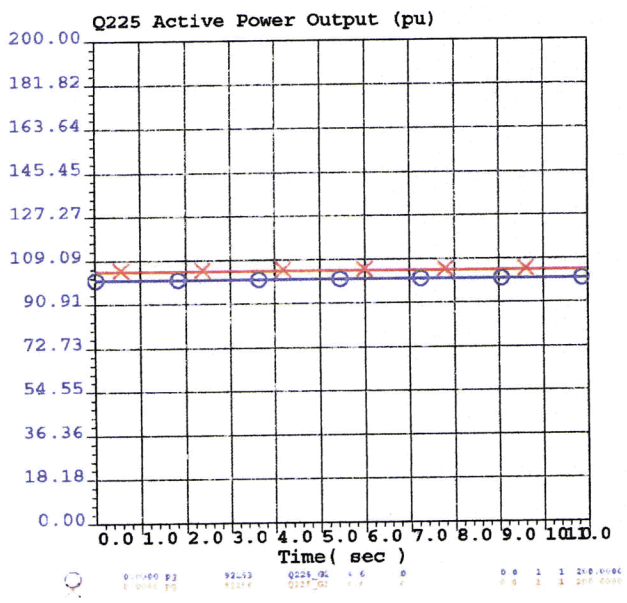


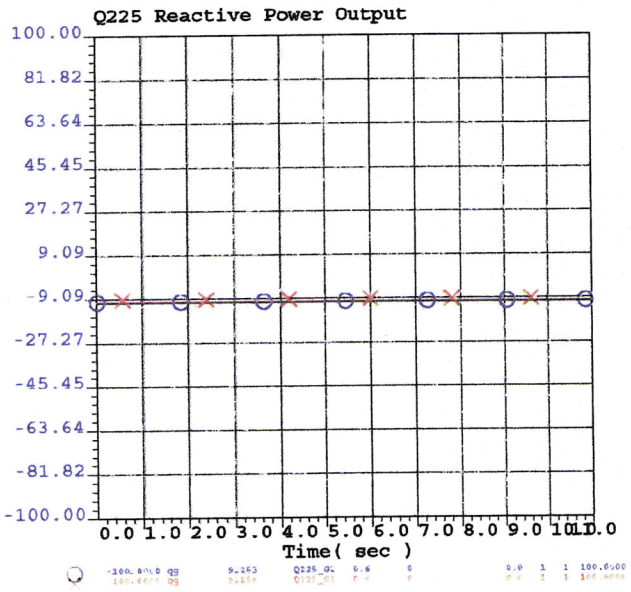


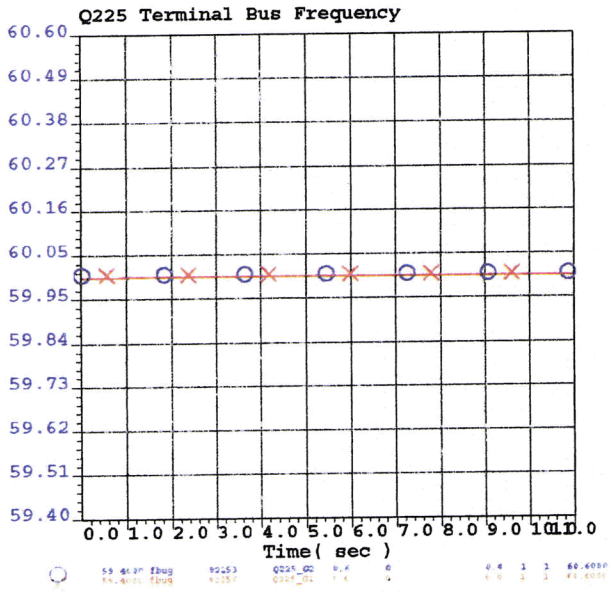


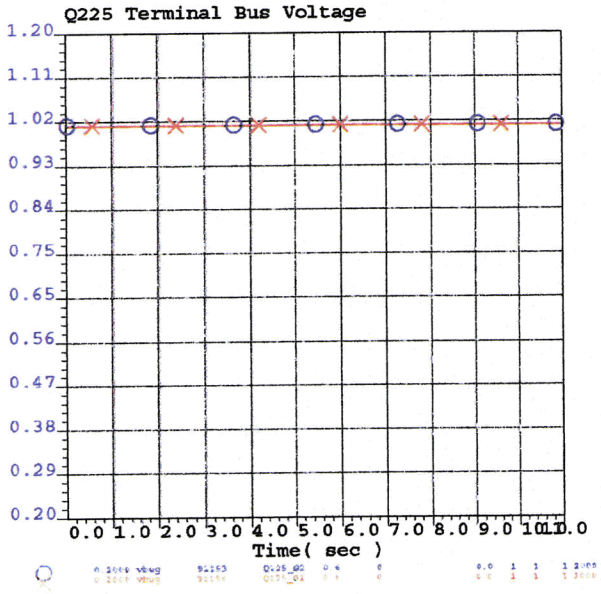
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

Q225 Transient Stability Plots







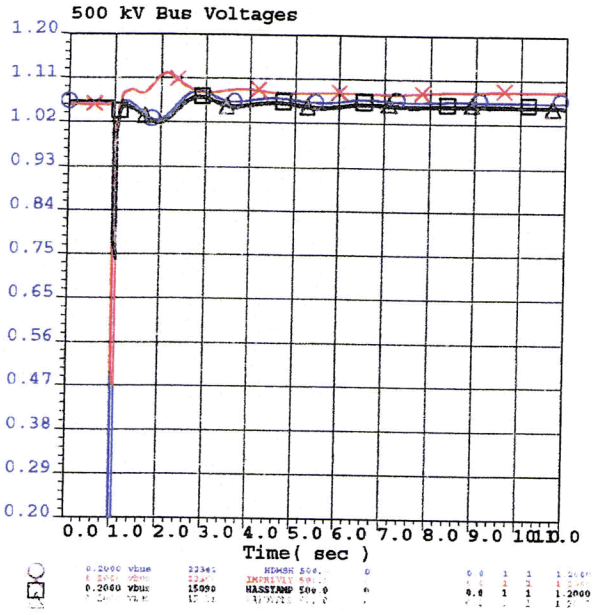


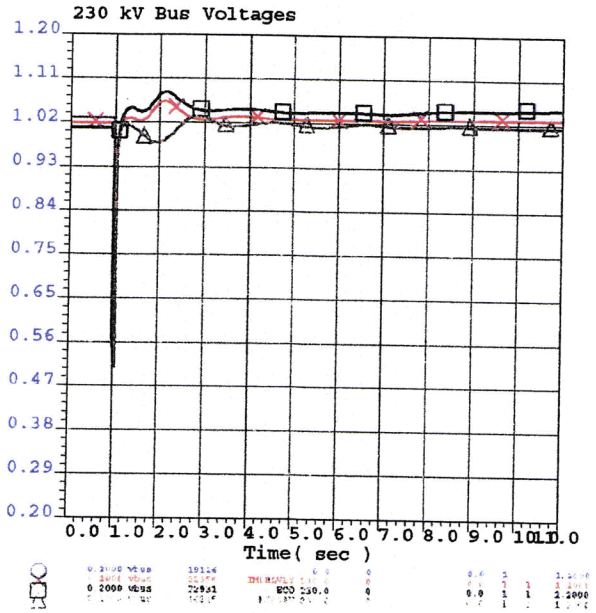
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

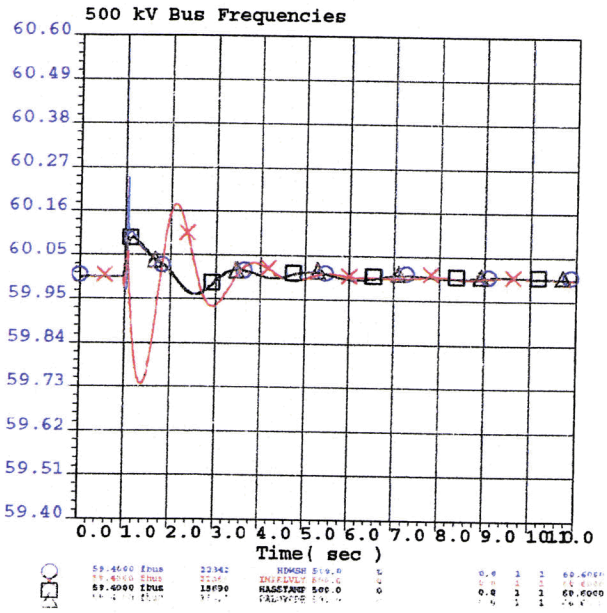
08_19HS_PST_eor_000-N-0_FLAT_RUN.chf

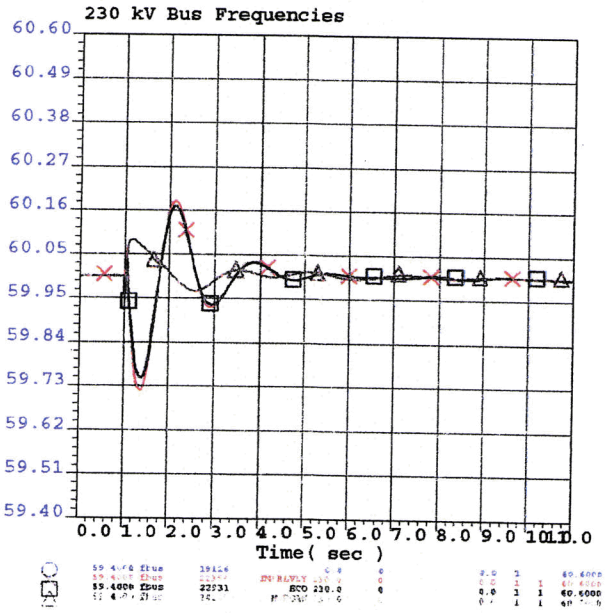
Thu Jun 11 10:33:21 2015

Q225 Transient Stability Plots



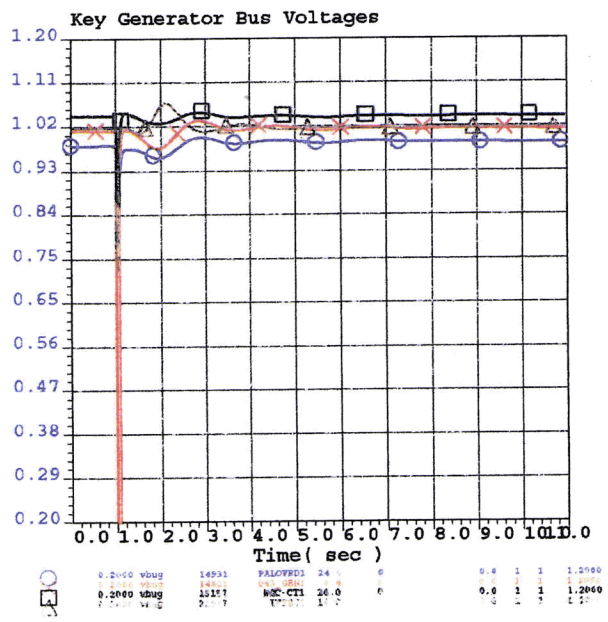


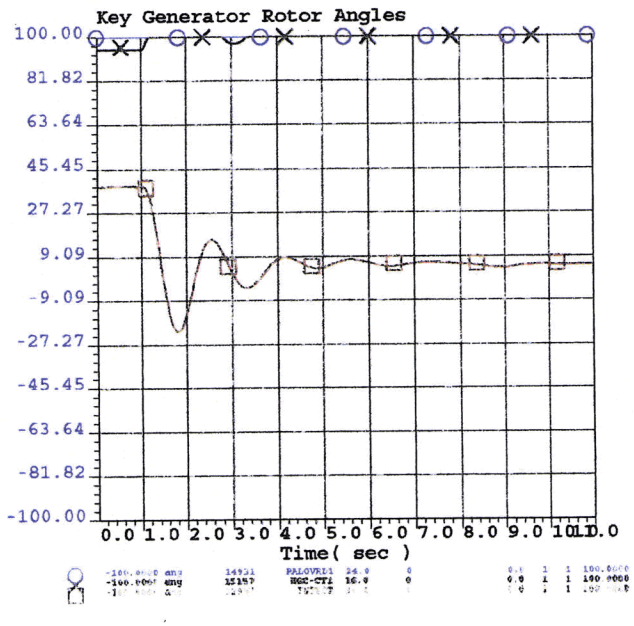


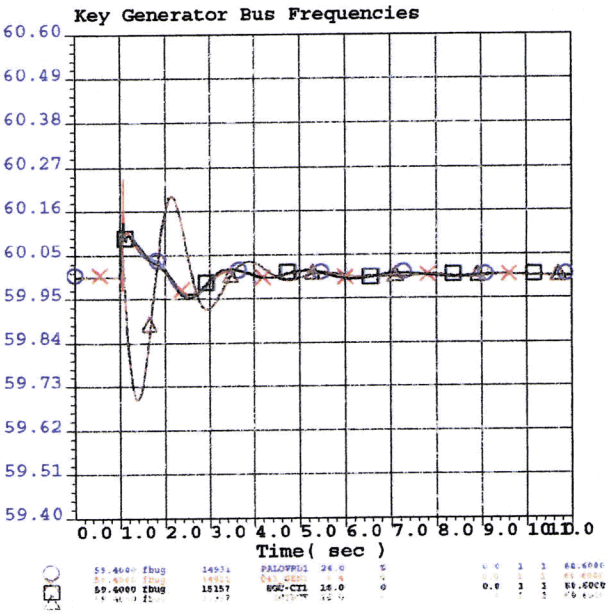


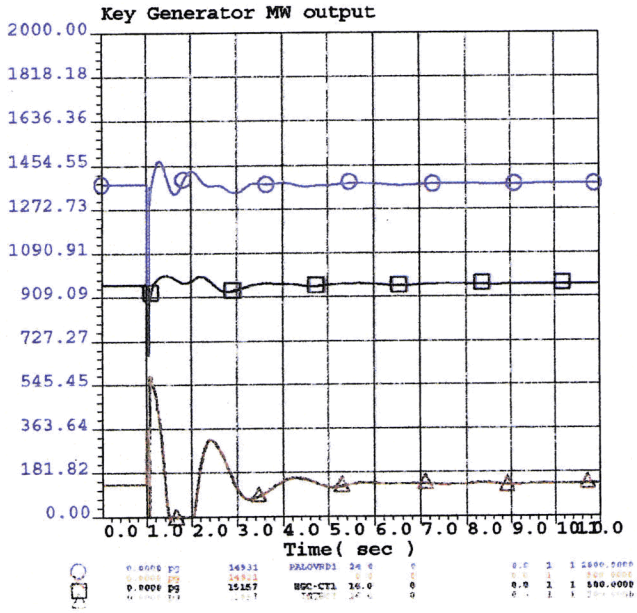
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

Q225 Transient Stability Plots







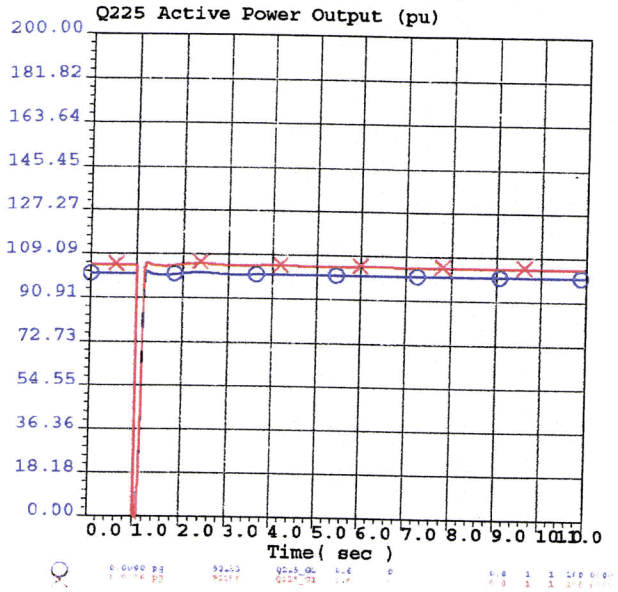


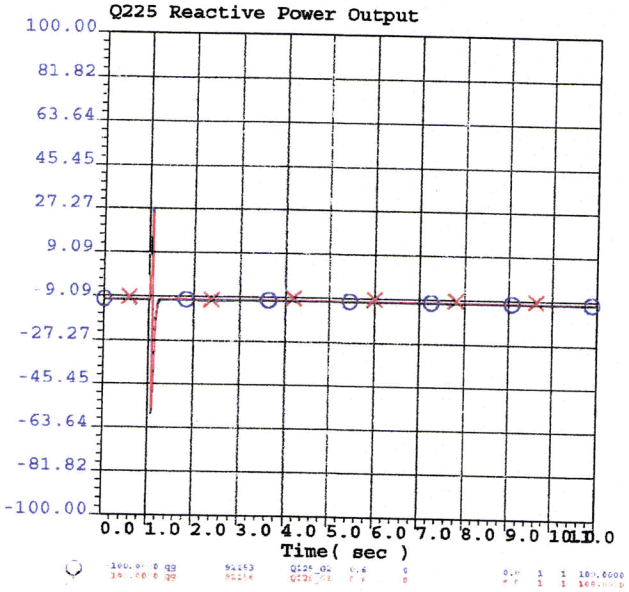
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

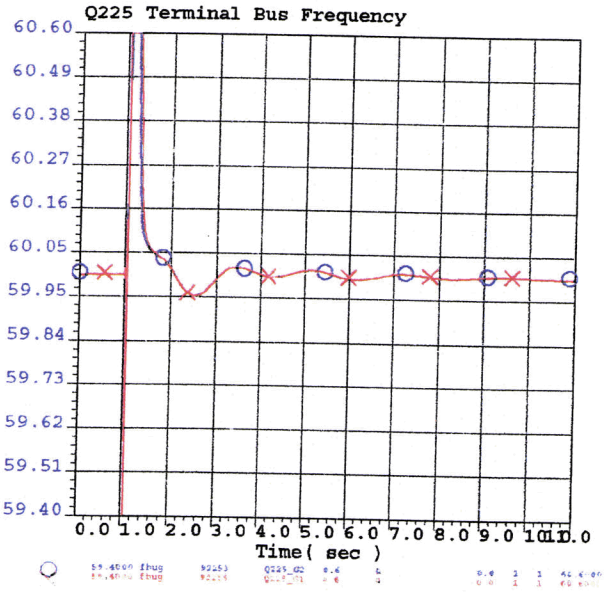
08_19HS_PST_eor_001_NGI-IV_500_1.chf

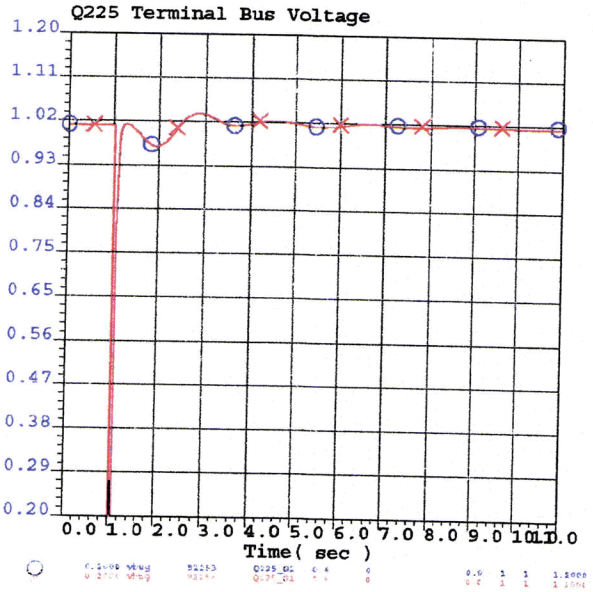
Thu Jun 11 10:33:22 2015

Q225 Transient Stability Plots



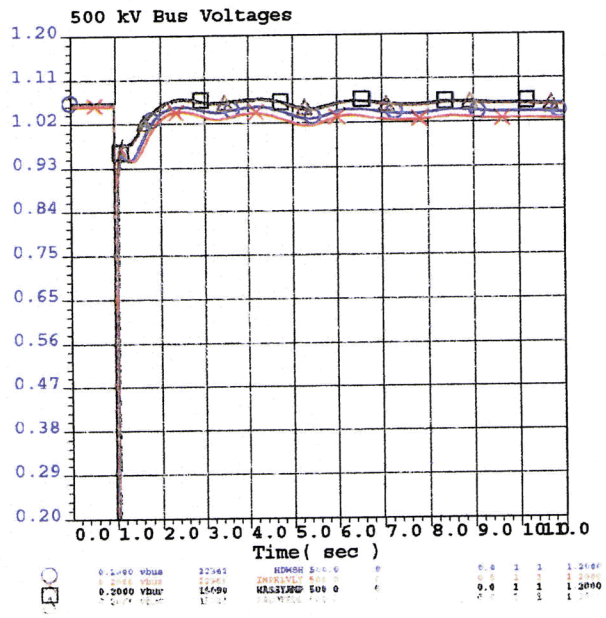


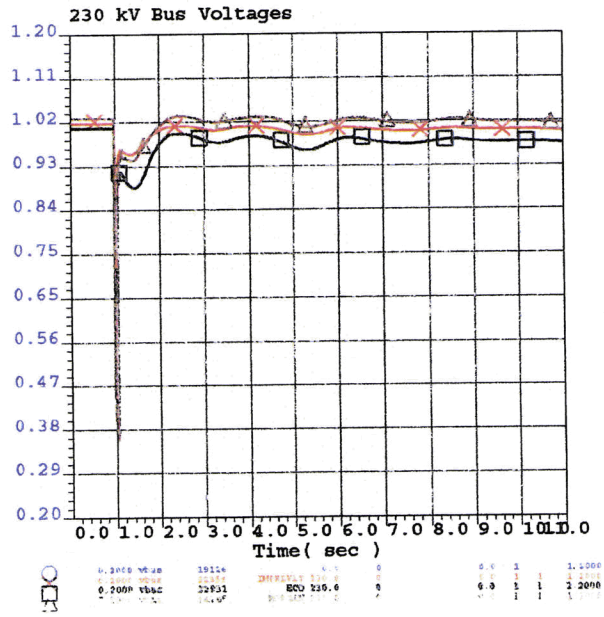


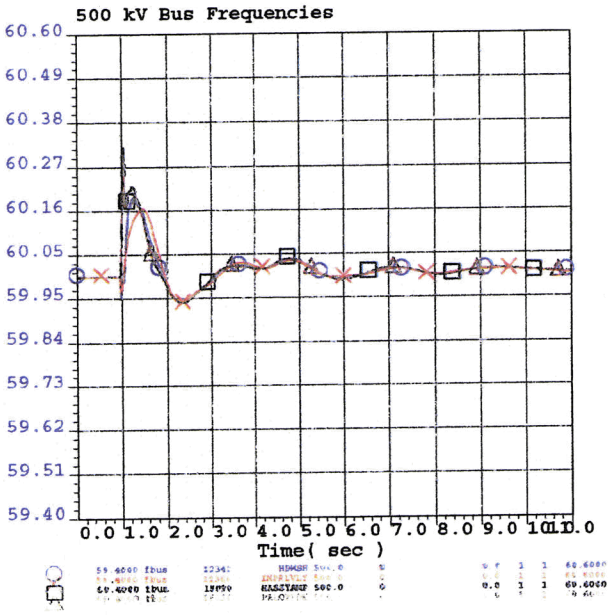


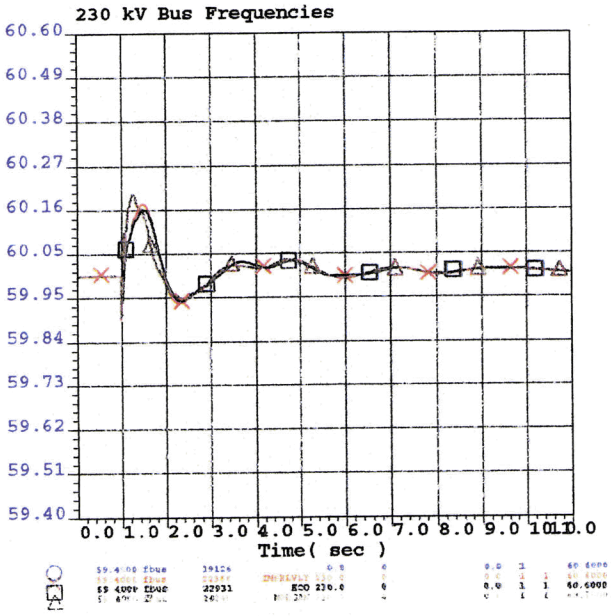
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

Q225 Transient Stability Plots







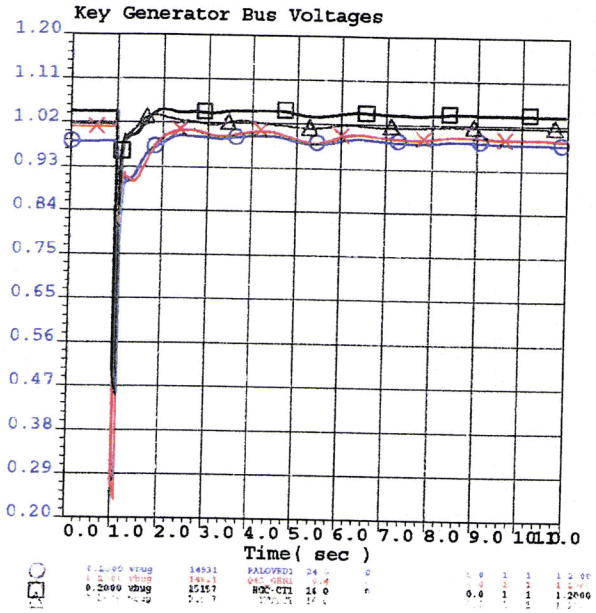


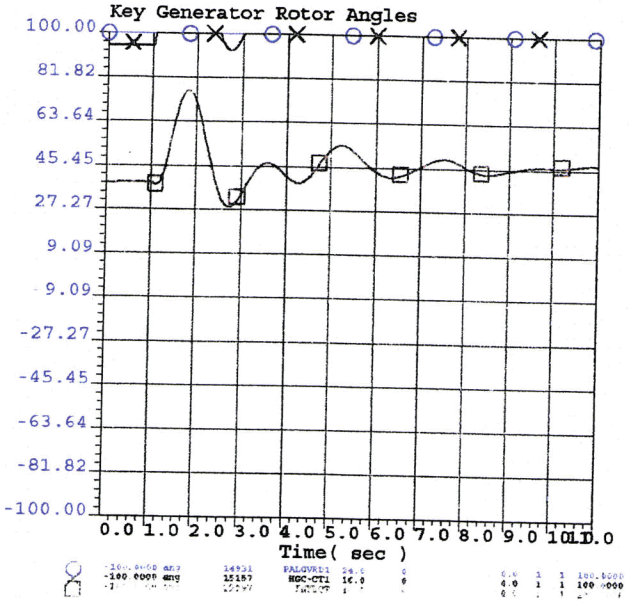
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

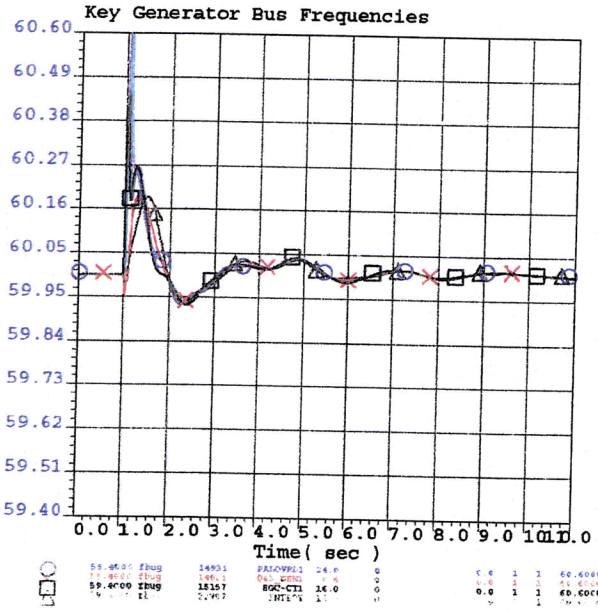
08_19HS_PST_eor_002_PV-CR.chf

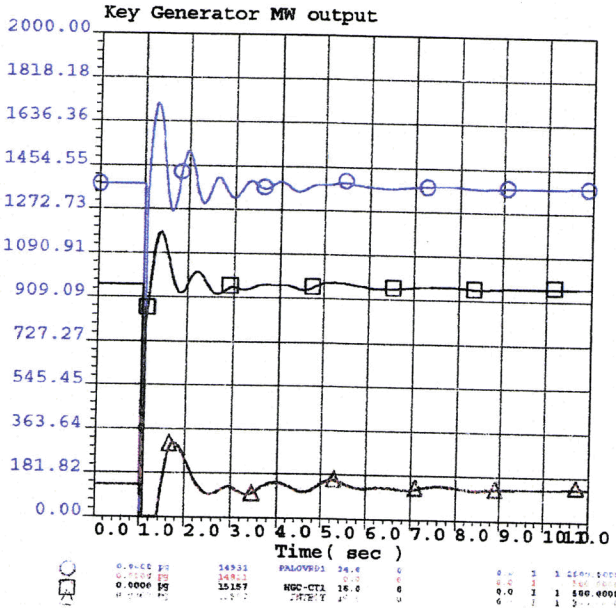
Thu Jun 11 10:33:24 2015

Q225 Transient Stability Plots



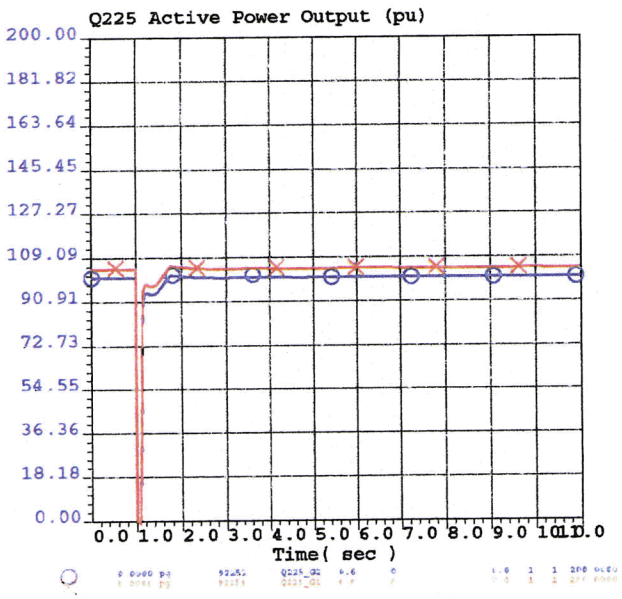


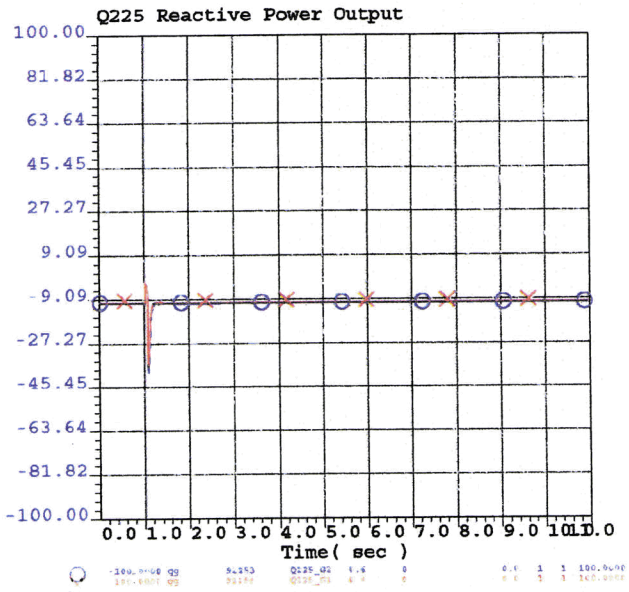


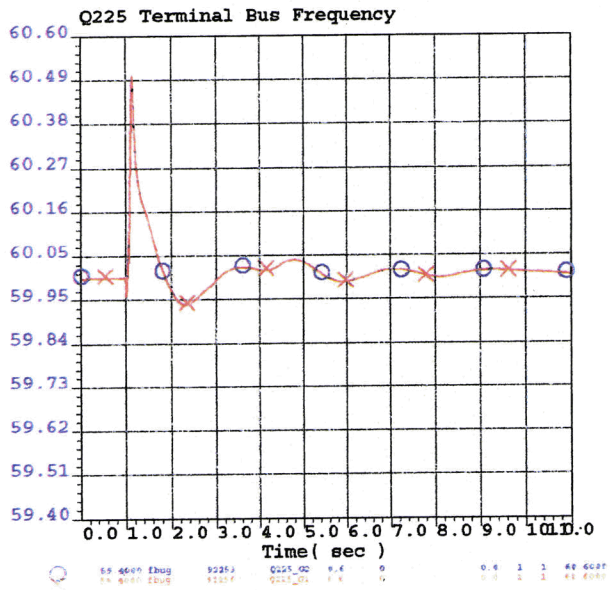


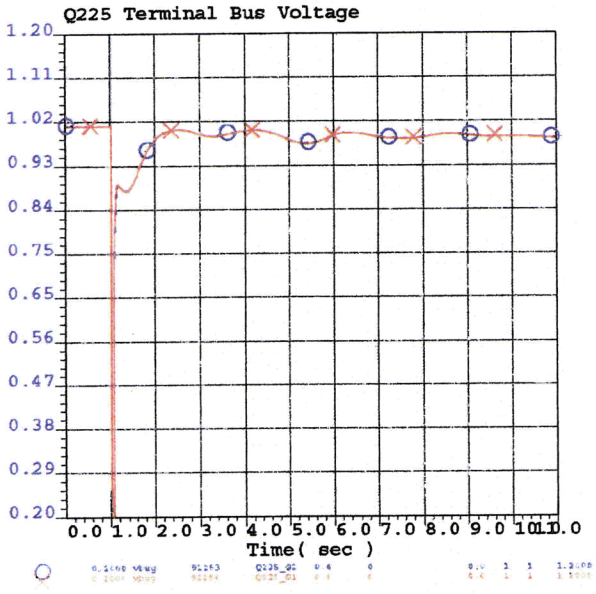
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

Q225 Transient Stability Plots







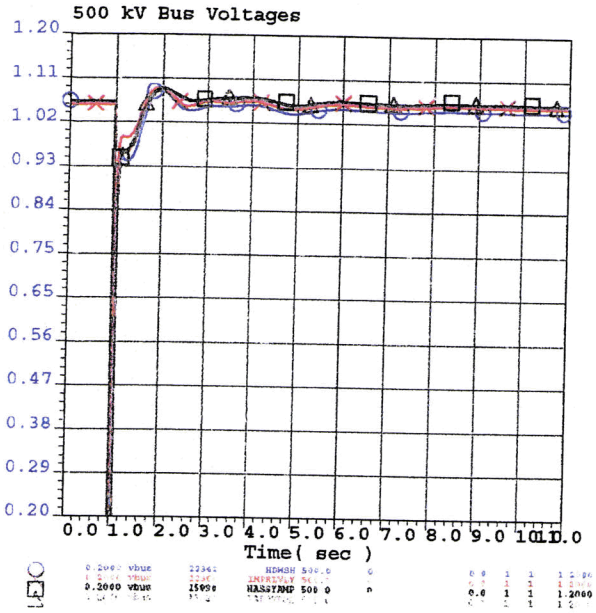


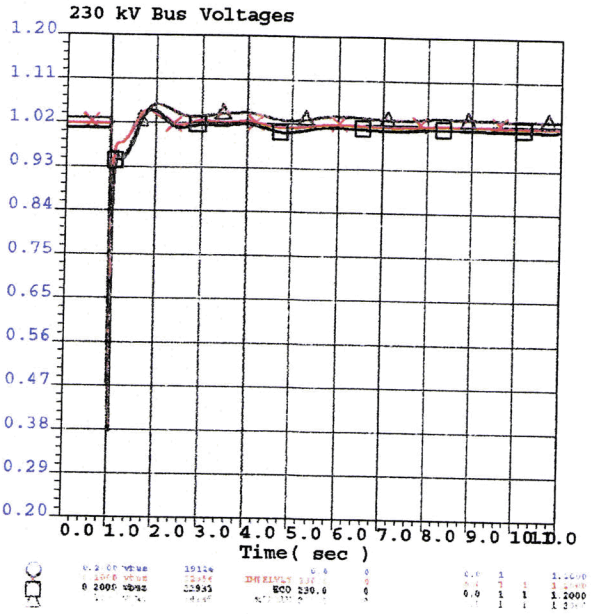
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

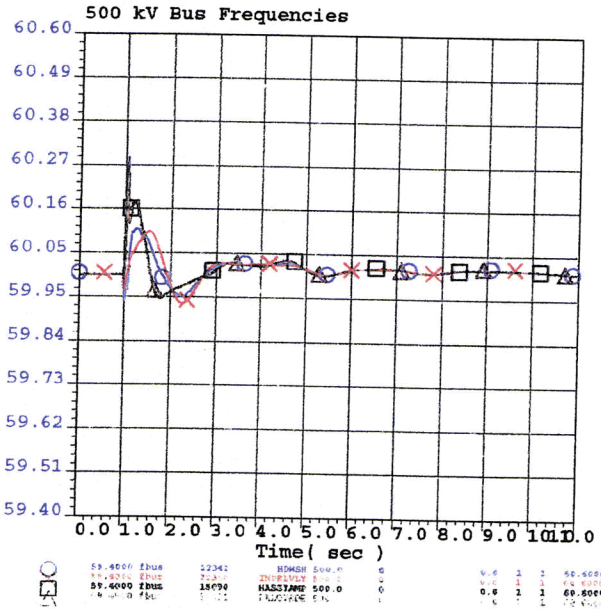
08_19HS_PST_eor_002_PV-CR.chf

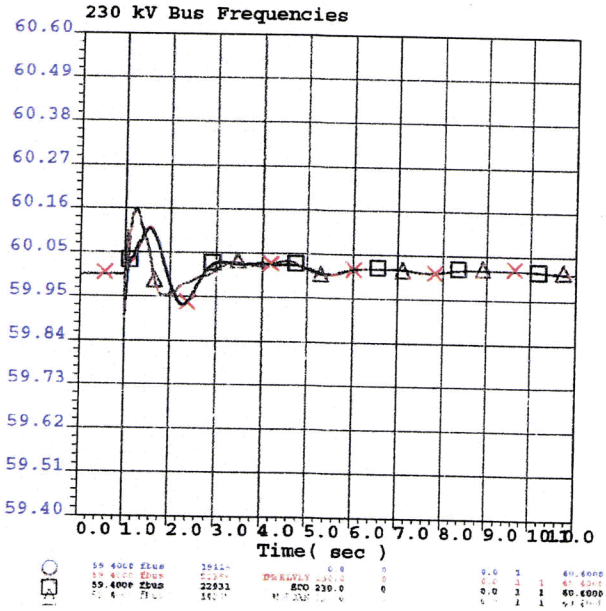
Thu Jun 11 10:33:24 2015

Q225 Transient Stability Plots



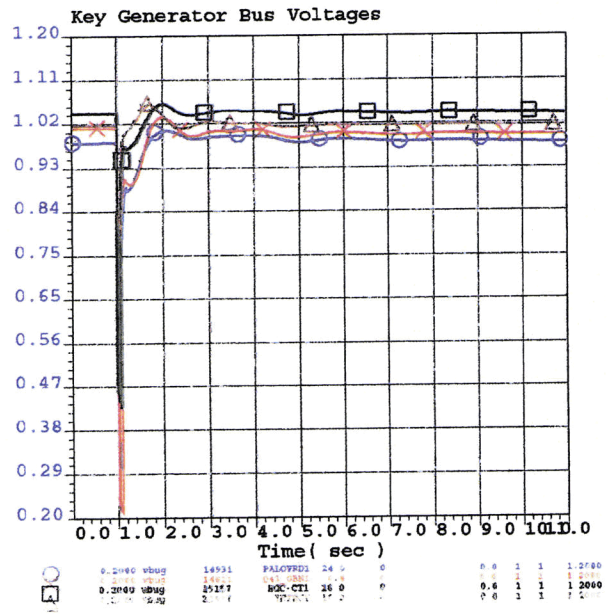


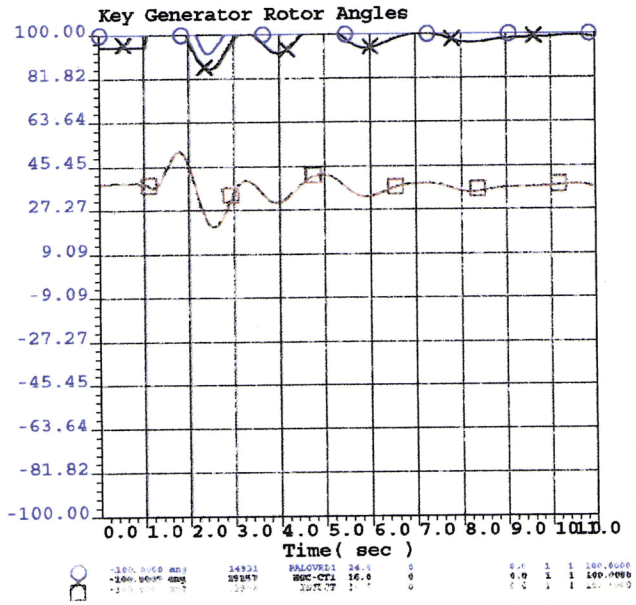


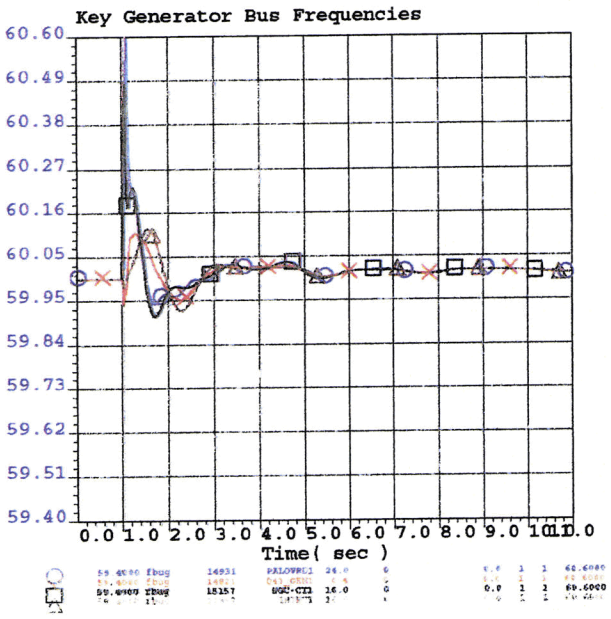


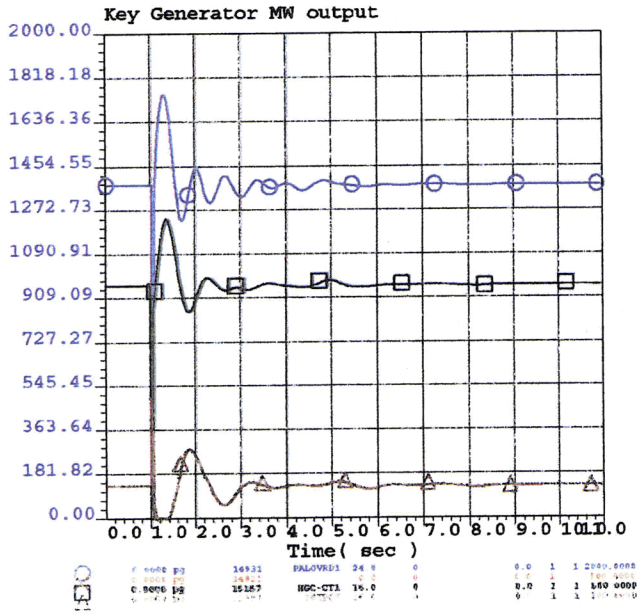
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

Q225 Transient Stability Plots







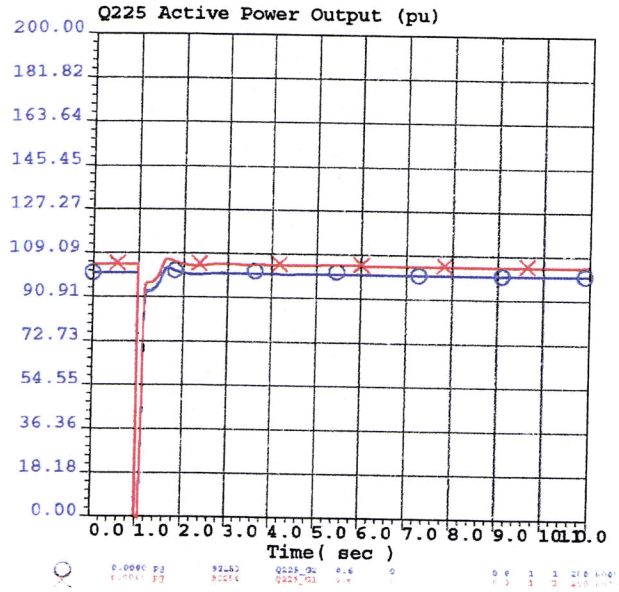


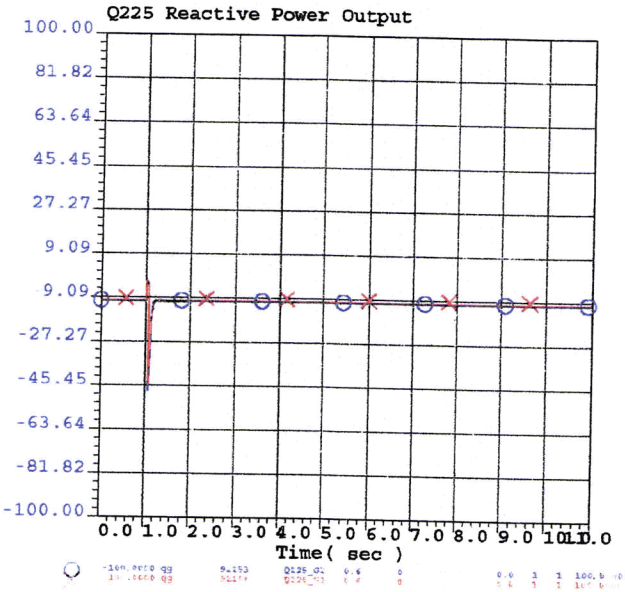
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

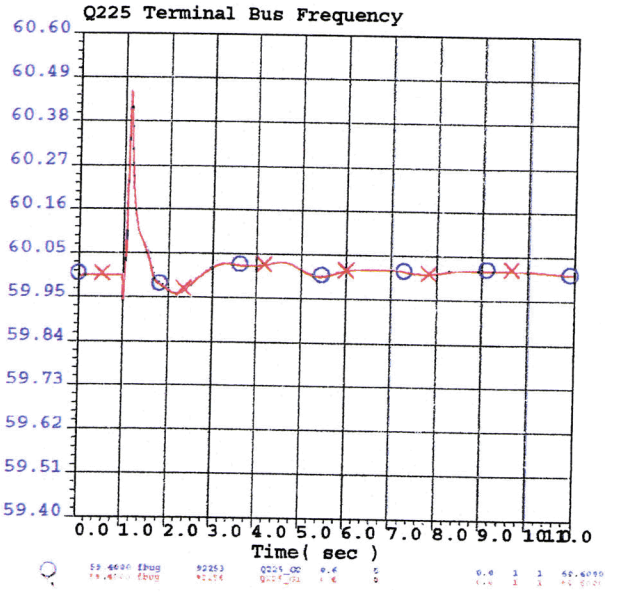
08_19HS_PST_eor_012_HAS-HDW.chf

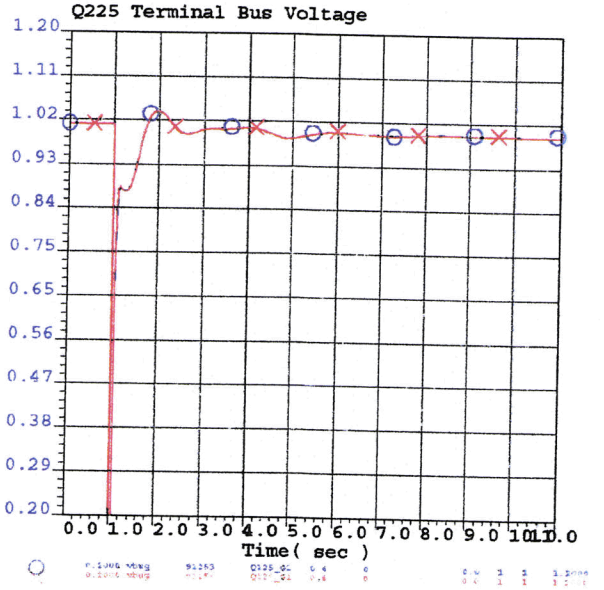
Thu Jun 11 10:33:40 2015

Q225 Transient Stability Plots



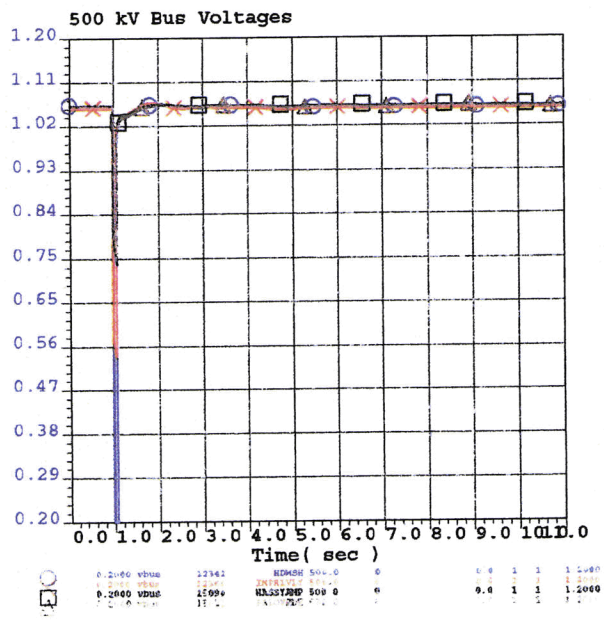


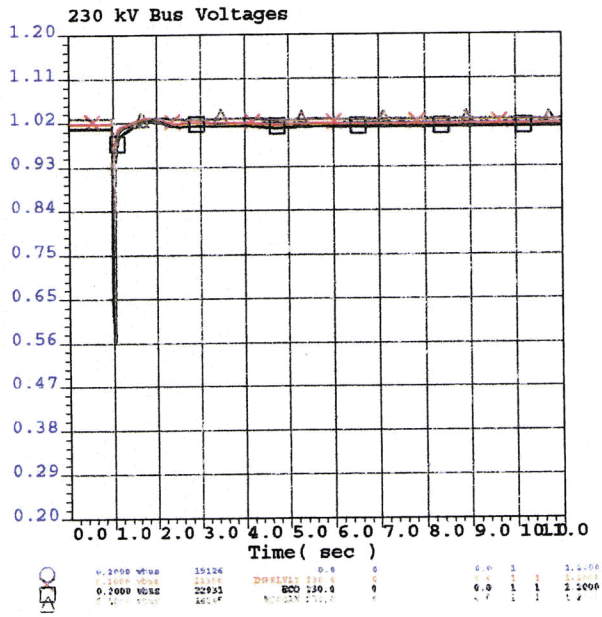


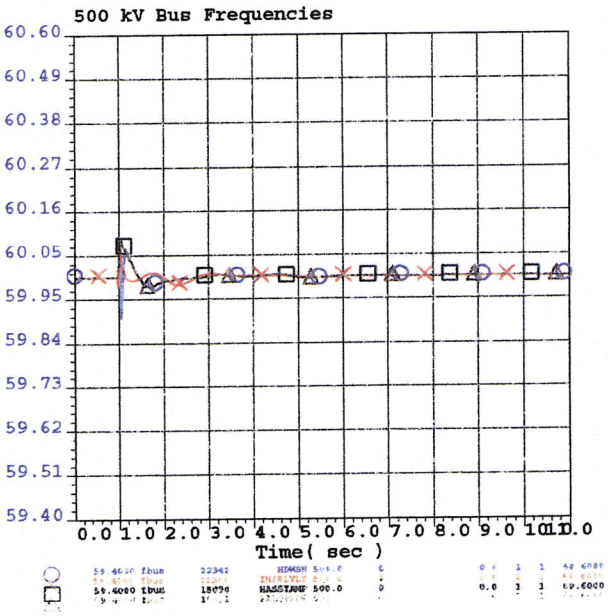


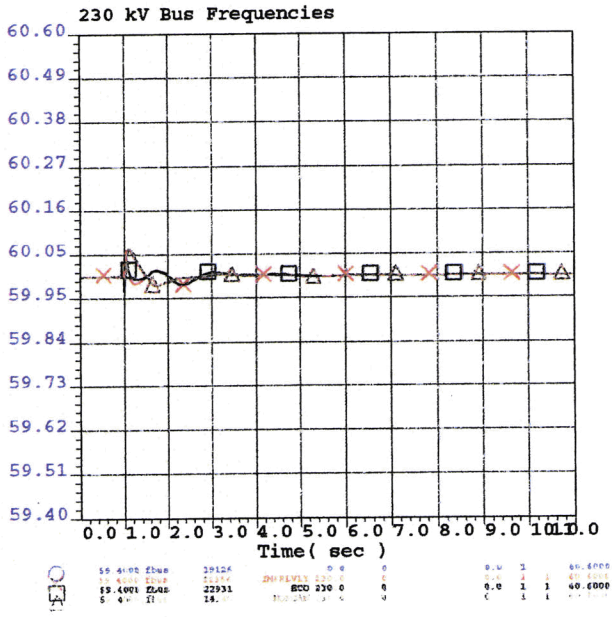
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

Q225 Transient Stability Plots







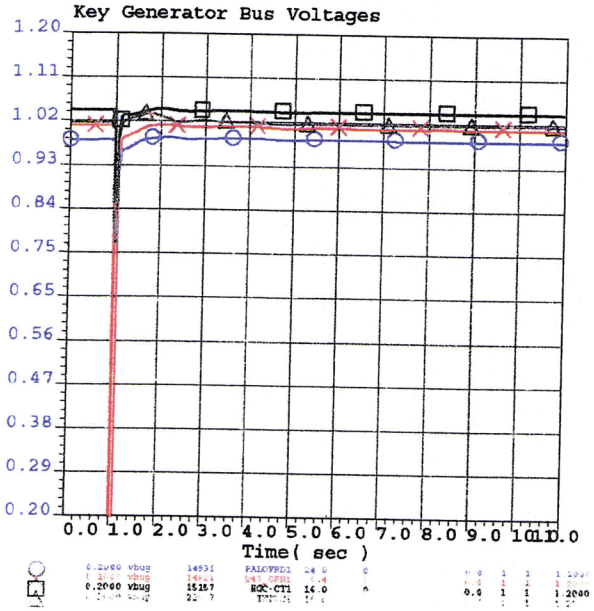


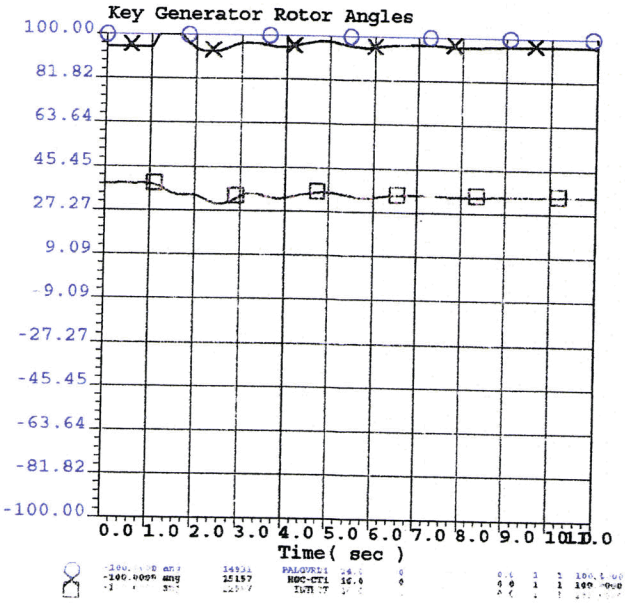
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

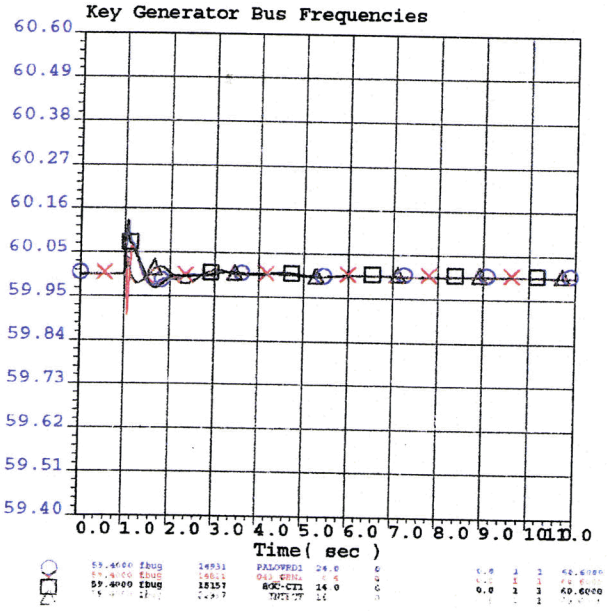
08_19HS_PST_eor_013_HDW-NG.chf

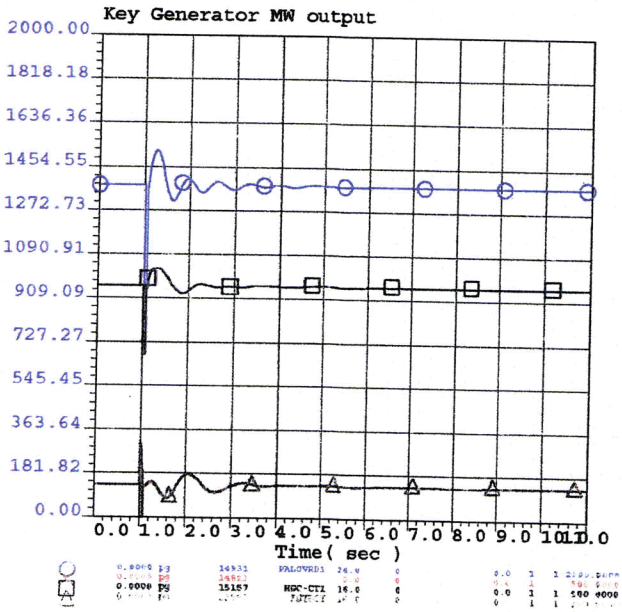
Thu Jun 11 10:33:42 2015

Q225 Transient Stability Plots



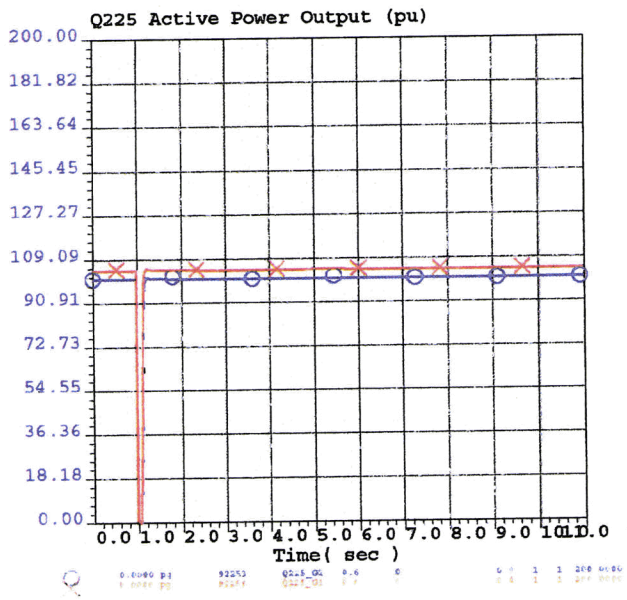


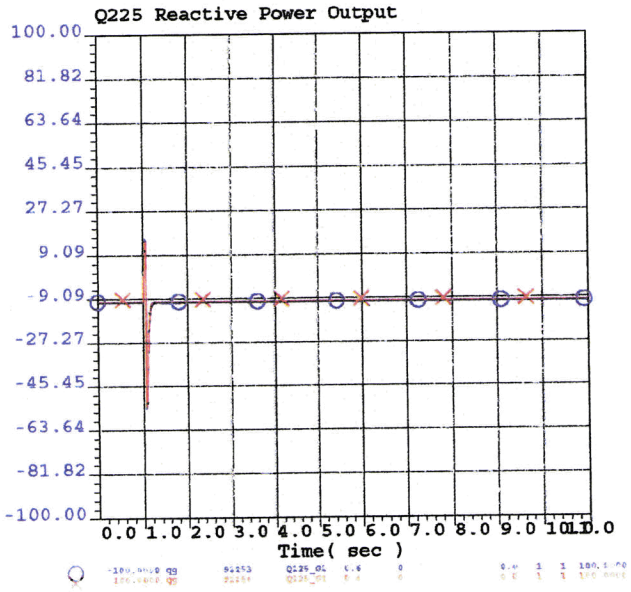


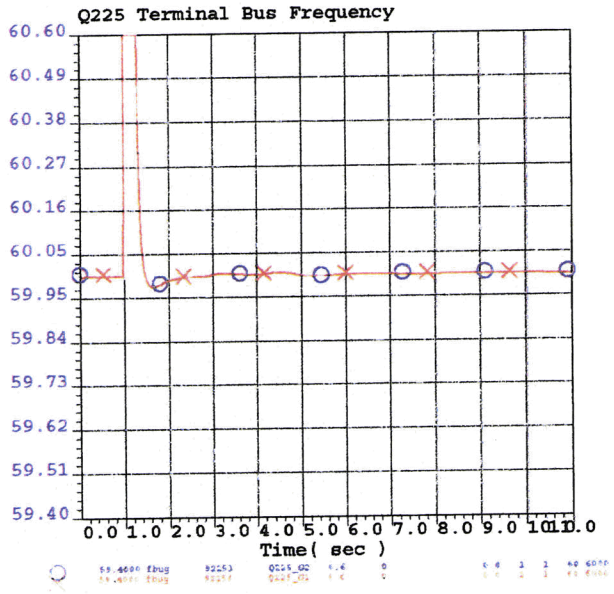


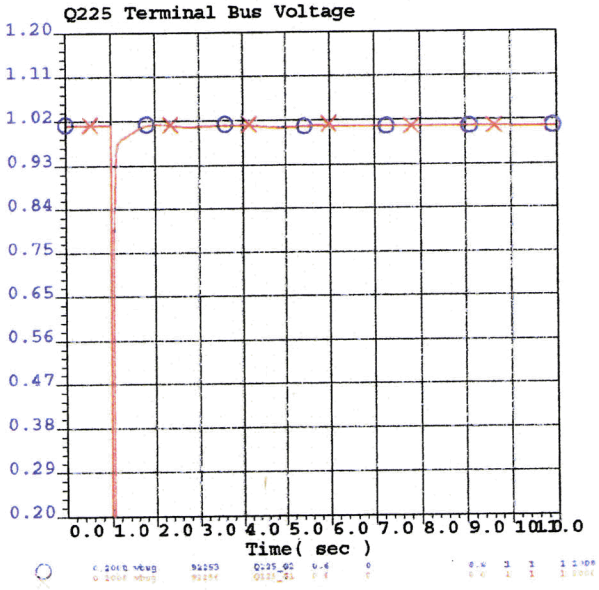
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

Q225 Transient Stability Plots







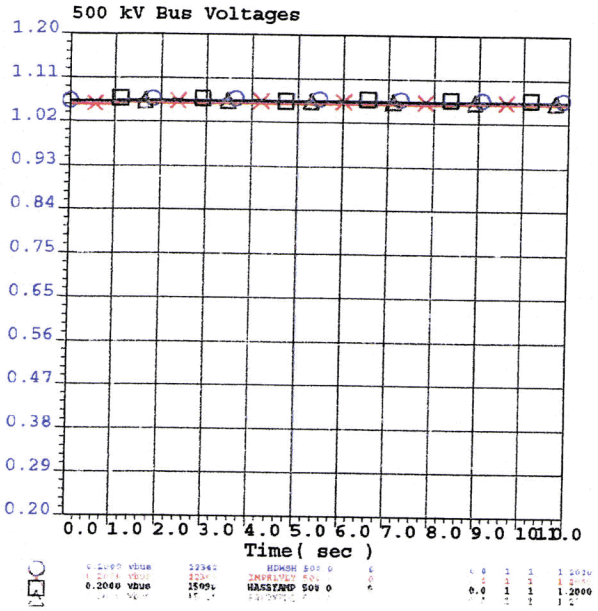


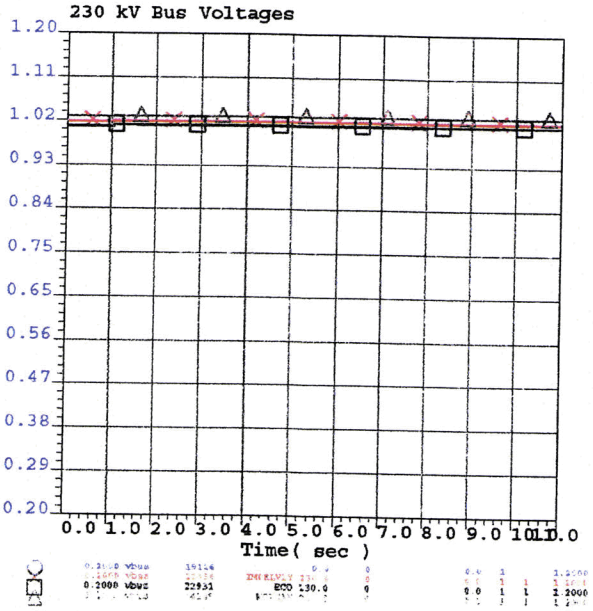
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

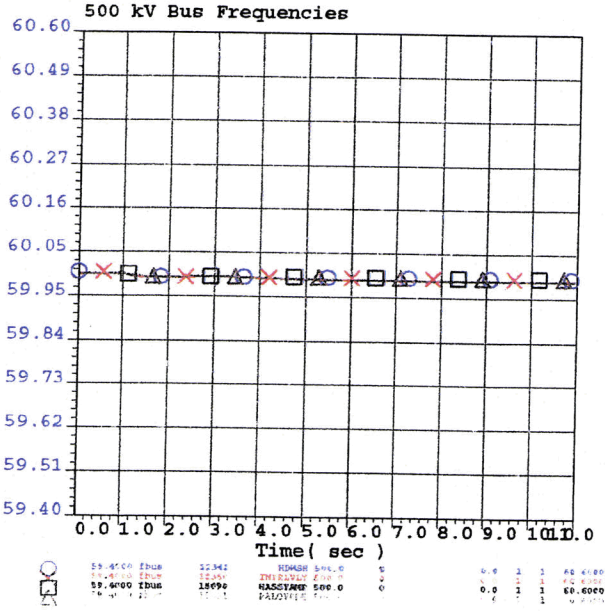
08_19HS_PST_eor_013_HDW-NG.chf

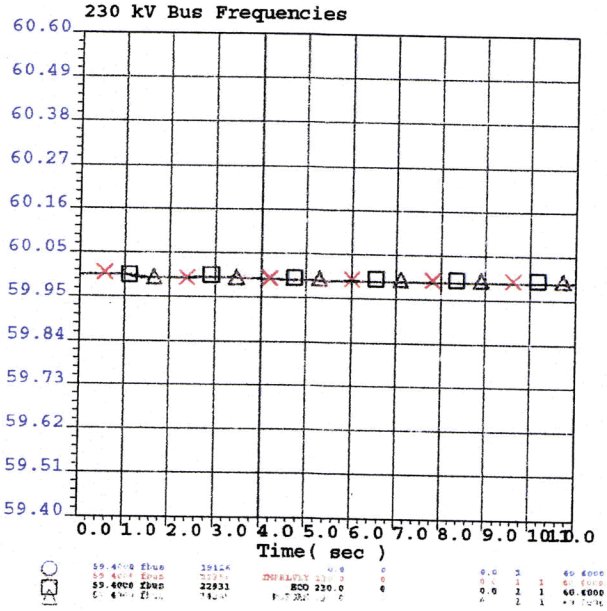
Thu Jun 11 10:33:42 2015

Q225 Transient Stability Plots



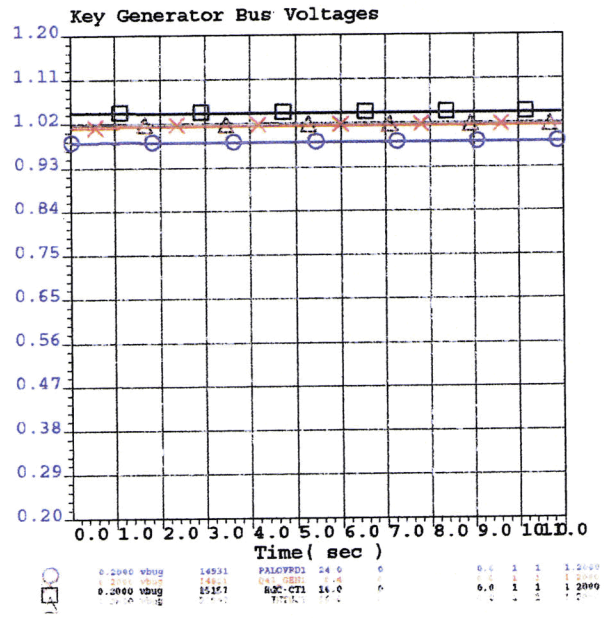


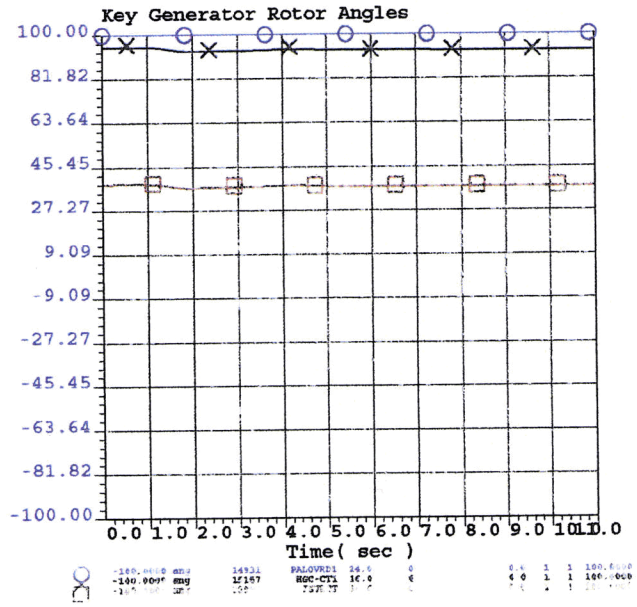


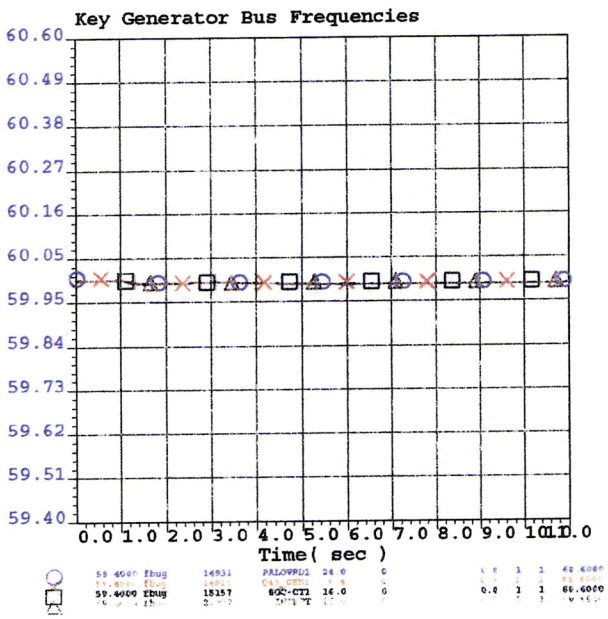


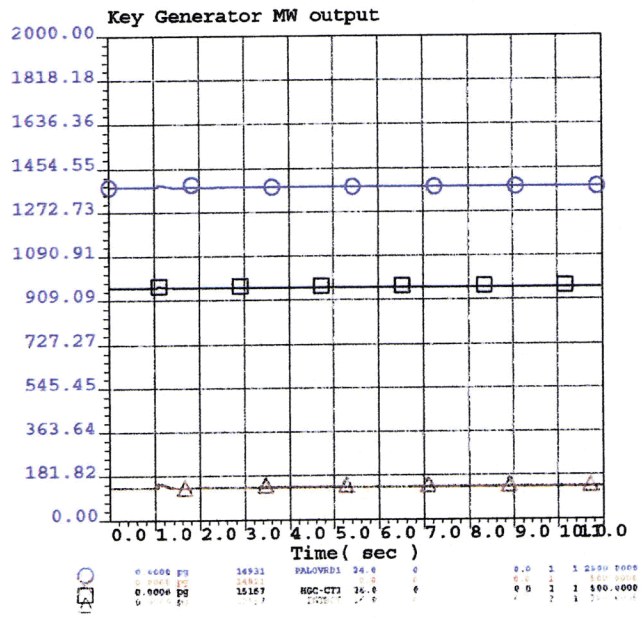
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

Q225 Transient Stability Plots







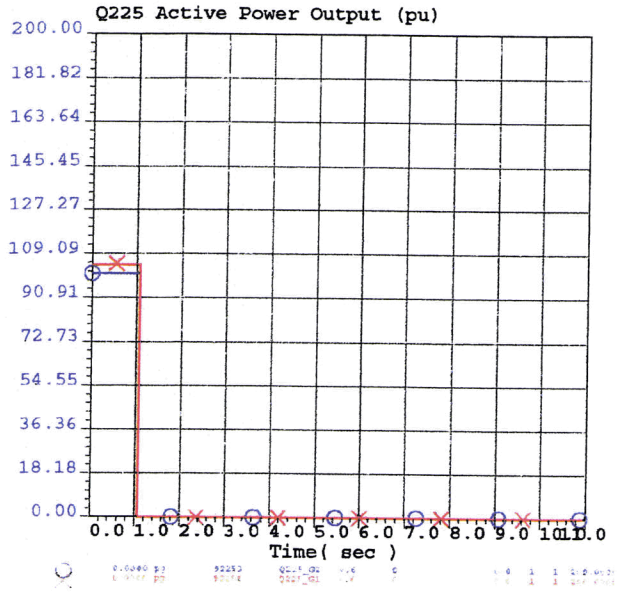


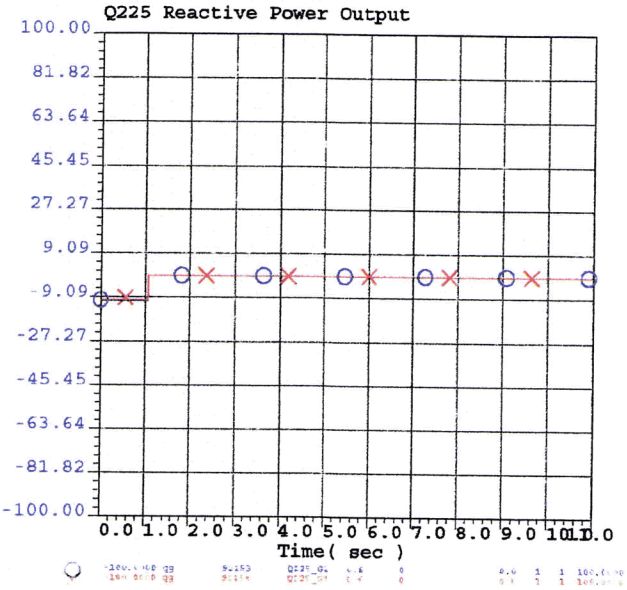
HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

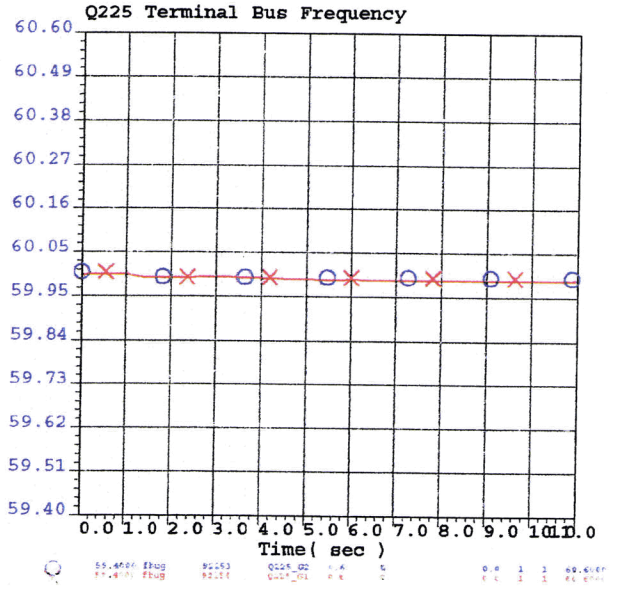
08_19HS_PST_eor_127_Q225_1.chf

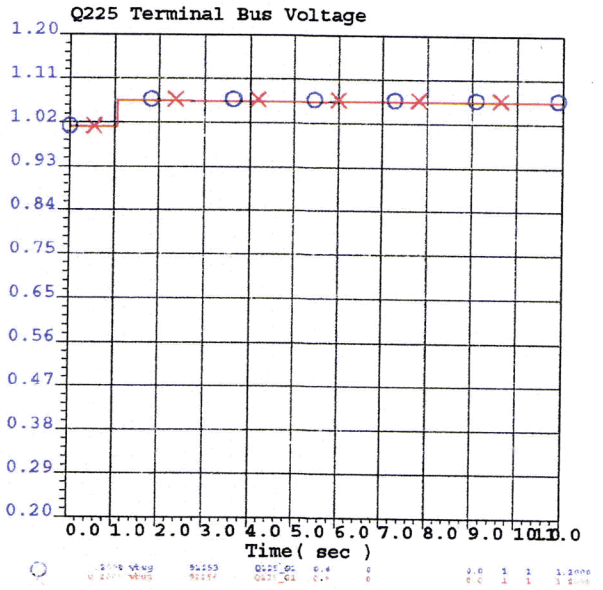
Sat Jun 13 16:58:58 2015

Q225 Transient Stability Plots









HANG2 Phase 2 Study
HANG2 ph 1 non-sim
Case 8: Post-Project

Appendix E

Thermal Results

Area	Circuit	Contingency	01_19HS_PRE	02_19HS_PST	03_19HS_PRE_DLCR	04_19HS_PST_DLCR	05_19HS_PRE_Q219	06_19HS_PST_Q219	07_19HS_PRE_eor	08_19HS_PST_eor
8	DIXIELAN 92.0 RTP1 92.0 #1	002_PV-CR	103%	105%	<90%	<90%	104%	106%	<90%	<90%
		142_CR-RB_500_1_2	103%	105%	102%	105%	104%	106%	<90%	<90%
		143_RB-DV_500_1_2	103%	105%	102%	105%	104%	106%	<90%	<90%
		145_PV-WW_PV-CR_500	105%	107%	<90%	<90%	107%	109%	<90%	<90%
		146_PV-CR_PV-HA_500	103%	105%	<90%	<90%	104%	107%	<90%	<90%
		147_PV-CR_PV-RD_500	105%	107%	<90%	<90%	106%	109%	<90%	<90%
	ELCENTSW 161.0 PILOTKNB 161.0 #1	001_NGI-IV_500_1	<90%	<90%	<90%	<90%	<90%	<90%	101%	105%
	PILOTKNB 92.0 PKNOBD2 100.0 #1	001_NGI-IV_500_1	<90%	<90%	<90%	<90%	<90%	<90%	101%	105%
	PILOTKNB 161.0 PKNOBD2 100.0 #1	001_NGI-IV_500_1	<90%	<90%	<90%	<90%	<90%	<90%	101%	104%
	PILOTKNB 92.0 PKNOBDUM 1.0 #1	001_NGI-IV_500_1	<90%	<90%	<90%	<90%	<90%	<90%	108%	112%
	PILOTKNB 161.0 PKNOBDUM 1.0 #1	001_NGI-IV_500_1	<90%	<90%	<90%	<90%	<90%	<90%	116%	120%
	YUCCA W 69.0 YUCCA1 100.0 #1	001_NGI-IV_500_1	<90%	<90%	<90%	<90%	<90%	<90%	128%	133%
	YUCCA161 161.0 YUCCA1 100.0 #1	001_NGI-IV_500_1	<90%	<90%	<90%	<90%	<90%	<90%	127%	132%
	YUCCA W 69.0 YUCCA2 100.0 #2	001_NGI-IV_500_1	<90%	<90%	<90%	<90%	<90%	<90%	137%	142%
	YUCCA161 161.0 YUCCA2 100.0 #2	001_NGI-IV_500_1	<90%	<90%	<90%	<90%	<90%	<90%	137%	142%
	YUCCA161 161.0 PILOTKNB 161.0 #1	001_NGI-IV_500_1	<90%	<90%	<90%	<90%	<90%	<90%	116%	121%
14	ANDERSON 230.0 KYR-EAST 230.0 #1	167_RD-OR_230_1-2	135%	135%	135%	135%	135%	135%	<90%	<90%
	COLLIER 69.0 OPPORTUN 69.0 #1	167_RD-OR_230_1-2	108%	108%	108%	108%	109%	109%	<90%	<90%
	COTBUKTP 69.0 COTPERTP 69.0 #1	151_JJ-KY_PV-RD_500	97%	97%	97%	97%	101%	101%	<90%	<90%
		166_RD-WT_WP-WT_230	107%	107%	107%	107%	111%	111%	<90%	<90%
		178_JJ-KY_JJ-PW_500	95%	95%	95%	95%	100%	100%	<90%	<90%
	COTBUKTP 69.0 PLMVLY 69.0 #1	151_JJ-KY_PV-RD_500	97%	97%	97%	97%	101%	101%	<90%	<90%
		166_RD-WT_WP-WT_230	107%	107%	107%	107%	111%	111%	<90%	<90%
		178_JJ-KY_JJ-PW_500	95%	95%	95%	95%	100%	100%	<90%	<90%
	CTRYCLUB 230.0 CTRYCLBS 69.0 #1	103_CC_230_69_6	<90%	<90%	<90%	<90%	<90%	<90%	114%	114%
	CTRYCLUB 230.0 LINCSTRT 230.0 #1	166_RD-WT_WP-WT_230	<90%	<90%	<90%	<90%	<90%	<90%	100%	100%
	GILA 69.0 GILA 161.0 #1	001_NGI-IV_500_1	<90%	<90%	<90%	<90%	<90%	<90%	120%	124%
	GILA 69.0 GILA 161.0 #2	001_NGI-IV_500_1	<90%	<90%	<90%	<90%	<90%	<90%	120%	124%
	LIBERTY 230.0 RUDD 230.0 #2	151_JJ-KY_PV-RD_500	95%	95%	95%	95%	116%	116%	<90%	<90%
	LONEPEAK 230.0 LONEPK 7 100.0 #1	106_LP_230_69_1	<90%	<90%	<90%	<90%	<90%	<90%	120%	120%
	LONEPK 7 100.0 LONEPK E 69.0 #1	106_LP_230_69_1	<90%	<90%	<90%	<90%	<90%	<90%	120%	120%
	MOENKOPI 500.0 ELDORDO 500.0 #1	022_NAV-CRY	<90%	<90%	<90%	<90%	<90%	<90%	100%	102%
	PINAL_C 230.0 RANDOLPH 230.0 #1	133_PC-BR_500_RN-AB_230	<90%	<90%	<90%	<90%	<90%	<90%	121%	121%
		134_PC-BR_500_AB-DS_230	<90%	<90%	<90%	<90%	<90%	<90%	102%	102%
		160_PC-BR_500_RD-AB_230	<90%	<90%	<90%	<90%	<90%	<90%	121%	121%
		161_PC-BR_500_AB-DS_230	<90%	<90%	<90%	<90%	<90%	<90%	102%	102%
	PPKWAPA 230.0 ROGSWAPA 230.0 #1	178_JJ-KY_JJ-PW_500	107%	107%	106%	106%	105%	105%	<90%	<90%
	PPKWAPA 230.0 ROGSWAPA 230.0 #2	178_JJ-KY_JJ-PW_500	107%	107%	106%	106%	105%	105%	<90%	<90%
	SUNYSLOP 230.0 SUNYSLP3 100.0 #1	105_SS_230_69_1	<90%	<90%	<90%	<90%	<90%	<90%	129%	129%
	SUNYSLP3 100.0 SUNYSLPE 69.0 #1	105_SS_230_69_1	<90%	<90%	<90%	<90%	<90%	<90%	125%	125%
22	IMPRLVLY 500.0 N.GILA 500.0 #1	145_PV-WW_PV-CR_500	<90%	<90%	<90%	<90%	<90%	<90%	97%	100%
24	J.HINDS 230.0 MIRAGE 230.0 #1	002_PV-CR	100%	101%	<90%	<90%	101%	102%	<90%	<90%
		142_CR-RB_500_1_2	100%	101%	100%	101%	101%	102%	<90%	<90%
		143_RB-DV_500_1_2	100%	101%	100%	101%	101%	102%	<90%	<90%
		145_PV-WW_PV-CR_500	100%	101%	<90%	<90%	101%	102%	<90%	<90%
		146_PV-CR_PV-HA_500	100%	101%	<90%	<90%	101%	102%	<90%	<90%
		147_PV-CR_PV-RD_500	98%	100%	<90%	<90%	99%	101%	<90%	<90%

Appendix F

Voltage Results

Area	Bus	Contingency	01_19HS_PRE	02_19HS_PST	03_19HS_PRE_DLCR	04_19HS_PST_DLCR	05_19HS_PRE_Q219	06_19HS_PST_Q219	07_19HS_PRE_eor	08_19HS_PST_eor
8	RTAP2 92.0	002_PV-CR								5.30%
	RTP3ANZA 92.0	002_PV-CR							5%	5.40%
	SANFELIP 92.0	002_PV-CR								5.30%
14	ARLNGTON 69.0	084_BKY-LBY_230_1	6.30%	6.30%	6.30%	6.30%	6.50%	6.50%		
		117_BK_230_69_1	6.20%	6.20%	6.20%	6.20%	6.50%	6.50%		
	BADGER 69.0	084_BKY-LBY_230_1	6.30%	6.40%	6.30%	6.40%	6.60%	6.60%		
		117_BK_230_69_1	6.30%	6.30%	6.30%	6.30%	6.60%	6.60%		
	BASELIN 69.0	084_BKY-LBY_230_1	6.40%	6.40%	6.40%	6.40%	6.70%	6.70%		
		117_BK_230_69_1	6.40%	6.40%	6.40%	6.40%	6.60%	6.60%		
	BK2 69.0	084_BKY-LBY_230_1	6.20%	6.20%	6.20%	6.20%	6.40%	6.40%		
		117_BK_230_69_1	6.20%	6.20%	6.20%	6.20%	6.40%	6.40%		
	BUCKEYE 69.0	084_BKY-LBY_230_1	7.10%	7.10%	7.10%	7.10%	7.30%	7.30%		
		117_BK_230_69_1	7.00%	7.00%	7.00%	7.00%	7.20%	7.20%		
	BUCKEYE 230.0	084_BKY-LBY_230_1	7.60%	7.60%	7.60%	7.60%	7.80%	7.80%		
	DSRTSKY 69.0	084_BKY-LBY_230_1	6.40%	6.40%	6.40%	6.40%	6.70%	6.70%		
		117_BK_230_69_1	6.40%	6.40%	6.40%	6.40%	6.60%	6.60%		
	HARQUAHA 69.0	084_BKY-LBY_230_1	5.90%	5.90%	5.90%	5.90%	6.20%	6.20%		
		117_BK_230_69_1	5.90%	5.90%	5.90%	5.90%	6.10%	6.10%		
	HARQUATP 69.0	084_BKY-LBY_230_1	5.90%	5.90%	5.90%	5.90%	6.10%	6.20%		
		117_BK_230_69_1	5.90%	5.90%	5.90%	5.90%	6.10%	6.10%		
	K685-BZ 69.0	084_BKY-LBY_230_1	6.50%	6.50%	6.50%	6.50%	6.70%	6.70%		
		117_BK_230_69_1	6.50%	6.50%	6.50%	6.50%	6.70%	6.70%		
	K685-GP 69.0	084_BKY-LBY_230_1	6.40%	6.40%	6.40%	6.40%	6.60%	6.60%		
		117_BK_230_69_1	6.30%	6.30%	6.30%	6.30%	6.50%	6.50%		
	PERYVLTP 69.0	084_BKY-LBY_230_1	6.50%	6.50%	6.50%	6.50%	6.70%	6.80%		
		117_BK_230_69_1	6.50%	6.50%	6.50%	6.50%	6.70%	6.70%		
	PHILPSAZ 69.0	084_BKY-LBY_230_1	6.40%	6.40%	6.40%	6.40%	6.60%	6.60%		
		117_BK_230_69_1	6.30%	6.30%	6.30%	6.30%	6.60%	6.60%		
	PVNGPUMP 69.0	084_BKY-LBY_230_1	6.20%	6.20%	6.20%	6.20%	6.40%	6.50%		
		117_BK_230_69_1	6.20%	6.20%	6.20%	6.20%	6.40%	6.40%		
	ROBBINBT 69.0	084_BKY-LBY_230_1	5.80%	5.80%	5.80%	5.80%	5.90%	5.90%		
		117_BK_230_69_1	5.70%	5.70%	5.70%	5.70%	5.90%	5.90%		
	SADDLEMT 69.0	084_BKY-LBY_230_1	5.30%	5.30%	5.30%	5.30%	5.50%	5.50%		
		117_BK_230_69_1	5.20%	5.20%	5.20%	5.20%	5.50%	5.50%		
	TONOPAH1 69.0	084_BKY-LBY_230_1	6.30%	6.30%	6.30%	6.30%	6.60%	6.60%		
		117_BK_230_69_1	6.30%	6.30%	6.30%	6.30%	6.50%	6.50%		
	TRT TEMP 69.0	084_BKY-LBY_230_1	6.60%	6.60%	6.60%	6.60%	6.80%	6.80%		
		117_BK_230_69_1	6.50%	6.50%	6.50%	6.50%	6.80%	6.80%		
	VALNCIA 69.0	084_BKY-LBY_230_1	6.50%	6.50%	6.50%	6.50%	6.80%	6.80%		
		117_BK_230_69_1	6.50%	6.50%	6.50%	6.50%	6.70%	6.70%		
	WATSON E 69.0	084_BKY-LBY_230_1	6.20%	6.20%	6.20%	6.20%	6.40%	6.40%		
		117_BK_230_69_1	6.20%	6.20%	6.20%	6.20%	6.30%	6.30%		
	WATSON W 69.0	084_BKY-LBY_230_1	6.20%	6.20%	6.20%	6.20%	6.40%	6.40%		
		117_BK_230_69_1	6.20%	6.20%	6.20%	6.20%	6.30%	6.30%		
	WINTERTP 69.0	084_BKY-LBY_230_1	6.30%	6.30%	6.30%	6.30%	6.50%	6.50%		
		117_BK_230_69_1	6.20%	6.20%	6.20%	6.20%	6.50%	6.50%		
	WINTRBRG 69.0	084_BKY-LBY_230_1	6.30%	6.30%	6.30%	6.30%	6.60%	6.60%		
		117_BK_230_69_1	6.30%	6.30%	6.30%	6.30%	6.50%	6.50%		
	ALPINE 69.0	001_NGI-IV_500_1							-5.40%	-5.70%
	ARTESN 69.0	001_NGI-IV_500_1							-5.20%	-5.40%
	B 69.0	001_NGI-IV_500_1							-5.30%	-5.50%
	BARRETT 69.0	001_NGI-IV_500_1							-5.30%	-5.50%
	BARRETTP 69.0	001_NGI-IV_500_1							-5.30%	-5.50%
	BERNARDO 69.0	001_NGI-IV_500_1							-5.20%	-5.30%
	BERNDOTP 69.0	001_NGI-IV_500_1							-5.10%	-5.20%
	BLDCRKTP 69.0	001_NGI-IV_500_1							-5.30%	-5.50%
	BOLDRCRK 69.0	001_NGI-IV_500_1							-5.30%	-5.50%
	BORDER 69.0	001_NGI-IV_500_1							-5.60%	-5.80%
	BORDERTP 69.0	001_NGI-IV_500_1							-5.60%	-5.80%
	BORREGO 12.5	001_NGI-IV_500_1							-5.20%	-5.40%
	BORREGO 69.0	001_NGI-IV_500_1							-5.20%	-5.30%
	BOULEVRD 69.0	001_NGI-IV_500_1								-5.20%
	BOULEVRD 138.0	001_NGI-IV_500_1								-5.20%
	BR GEN H 69.0	001_NGI-IV_500_1							-5.20%	-5.30%
	BR GEN M 34.5	001_NGI-IV_500_1							-5.20%	-5.30%
	BR GEN T 34.5	001_NGI-IV_500_1							-5.20%	-5.30%
	BR GEN1 0.2	001_NGI-IV_500_1							-5.20%	-5.30%
	CABRILLO 69.0	001_NGI-IV_500_1							-5.20%	-5.40%
	CALPK_BD 13.8	001_NGI-IV_500_1							-5.60%	-5.80%
	CALPK_BD 69.0	001_NGI-IV_500_1							-5.60%	-5.80%
	CAMERNTP 69.0	001_NGI-IV_500_1							-5.30%	-5.50%
	CAMERON 69.0	001_NGI-IV_500_1							-5.30%	-5.50%
	CARLTHT2 138.0	001_NGI-IV_500_1							-5.20%	-5.40%
	CARLTNHS 138.0	001_NGI-IV_500_1							-5.30%	-5.50%
	CHCARITA 138.0	001_NGI-IV_500_1							-5.10%	-5.20%
	CHOLLAS 69.0	001_NGI-IV_500_1							-5.60%	-5.80%
	CLAIRMNT 69.0	001_NGI-IV_500_1							-5.30%	-5.40%
	CLAIRMTTP 69.0	001_NGI-IV_500_1							-5.30%	-5.40%
	CORONADO 12.5	001_NGI-IV_500_1							-5.40%	-5.60%
	CORONADO 69.0	001_NGI-IV_500_1							-5.40%	-5.60%

CREELMAN 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
CRESTWD 69.0	001_NGI-IV_500_1								-5.20%	-5.50%
DEL MAR 69.0	001_NGI-IV_500_1								-5.10%	-5.30%
DELMARTP 69.0	001_NGI-IV_500_1								-5.10%	-5.30%
DESCANSO 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
DIVISION 69.0	001_NGI-IV_500_1								-5.40%	-5.70%
DIVISNGT 12.5	001_NGI-IV_500_1								-5.40%	-5.70%
DOUBLET 69.0	001_NGI-IV_500_1								-5.10%	-5.30%
DOUBLET 138.0	001_NGI-IV_500_1									-5.10%
DOUBLTTP 69.0	001_NGI-IV_500_1								-5.10%	-5.30%
DOUBLTTP 138.0	001_NGI-IV_500_1									-5.10%
DUNHILL 69.0	001_NGI-IV_500_1								-5.10%	-5.30%
DUNHILTP 69.0	001_NGI-IV_500_1								-5.10%	-5.30%
EASTGATE 69.0	001_NGI-IV_500_1								-5.20%	-5.30%
EC GEN1 13.8	001_NGI-IV_500_1								-5.50%	-5.80%
EC GEN1 69.0	001_NGI-IV_500_1								-5.50%	-5.80%
EC GEN2 13.8	001_NGI-IV_500_1								-5.50%	-5.80%
EC GEN2 69.0	001_NGI-IV_500_1								-5.50%	-5.80%
ECO 12.0	001_NGI-IV_500_1									-5.20%
ECO 138.0	001_NGI-IV_500_1									-5.20%
ECO 230.0	001_NGI-IV_500_1									-5.20%
ECO 500.0	001_NGI-IV_500_1								-5.50%	-5.80%
EL CAJON 69.0	001_NGI-IV_500_1								-5.50%	-5.80%
ELCAJNGT 12.5	001_NGI-IV_500_1								-5.40%	-5.60%
ELLIOTT 69.0	001_NGI-IV_500_1								-5.20%	-5.30%
ENCNITAS 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
F 69.0	001_NGI-IV_500_1								-5.30%	-5.40%
FENTON 69.0	001_NGI-IV_500_1								-5.30%	-5.40%
FENTONTP 69.0	001_NGI-IV_500_1								-5.20%	-5.40%
FRIARS 138.0	001_NGI-IV_500_1								-5.50%	-5.70%
GARFIELD 69.0	001_NGI-IV_500_1								-5.10%	-5.30%
GENESEE 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
GLENCLIF 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
GLNCLFTP 69.0	001_NGI-IV_500_1								-5.60%	-5.80%
GRANITE 69.0	001_NGI-IV_500_1								-5.60%	-5.80%
GRANITTP 69.0	001_NGI-IV_500_1								-5.40%	-5.60%
GRNT HIL138.0	001_NGI-IV_500_1								-5.50%	-5.80%
IMPRLBCH 69.0	001_NGI-IV_500_1								-5.60%	-5.90%
JAMACHA 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
KEAMDGT2 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
KEAMDGT3 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
KEARN2AB 12.5	001_NGI-IV_500_1								-5.30%	-5.50%
KEARN2CD 12.5	001_NGI-IV_500_1								-5.30%	-5.50%
KEARN3AB 12.5	001_NGI-IV_500_1								-5.30%	-5.50%
KEARN3CD 12.5	001_NGI-IV_500_1								-5.30%	-5.50%
KEARNTL2 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
KEARNTL3 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
KEARNY 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
KETTNER 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
KUMEYAAY 0.7	001_NGI-IV_500_1								-5.20%	-5.50%
KUMEYAAY 34.5	001_NGI-IV_500_1								-5.20%	-5.50%
KUMEYAAY 69.0	001_NGI-IV_500_1								-5.20%	-5.50%
KYOCERA 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
KYOCRATP 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
LA JOLLA 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
LkHodG1 13.8	001_NGI-IV_500_1								-5.00%	-5.20%
LkHodG2 13.8	001_NGI-IV_500_1								-5.00%	-5.20%
Lkhodges 69.0	001_NGI-IV_500_1								-5.00%	-5.20%
LOSCOCHS 69.0	001_NGI-IV_500_1								-5.40%	-5.70%
LOSCOCHS 138.0	001_NGI-IV_500_1								-5.50%	-5.80%
LOVELAND 69.0	001_NGI-IV_500_1								-5.40%	-5.60%
LRKSP_BD 69.0	001_NGI-IV_500_1								-5.60%	-5.80%
LRKSPBD1 13.8	001_NGI-IV_500_1								-5.60%	-5.80%
LRKSPBD2 13.8	001_NGI-IV_500_1								-5.60%	-5.80%
MEF MR1 13.8	001_NGI-IV_500_1								-5.20%	-5.40%
MEF MR2 13.8	001_NGI-IV_500_1								-5.20%	-5.40%
MESA RIM 69.0	001_NGI-IV_500_1								-5.30%	-5.40%
MESAHGTS 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
MIGUEL 12.0	001_NGI-IV_500_1								-5.70%	-5.90%
MIGUEL 69.0	001_NGI-IV_500_1								-5.60%	-5.90%
MIGUEL 138.0	001_NGI-IV_500_1								-5.50%	-5.80%
MIGUEL 230.0	001_NGI-IV_500_1								-5.60%	-5.90%
MIGUEL 500.0	001_NGI-IV_500_1								-5.70%	-6.00%
MIGUEL60 138.0	001_NGI-IV_500_1								-5.50%	-5.80%
MIGUELMP 500.0	001_NGI-IV_500_1								-5.70%	-5.90%
MIGUELTP 69.0	001_NGI-IV_500_1								-5.60%	-5.80%
MIRAMAR 69.0	001_NGI-IV_500_1								-5.30%	-5.50%
MIRAMAR1 69.0	001_NGI-IV_500_1								-5.20%	-5.40%
MIRAMRGT 12.5	001_NGI-IV_500_1								-5.20%	-5.40%
MIRAMRTP 69.0	001_NGI-IV_500_1								-5.20%	-5.30%

MIRASNTO 69.0	001_NGI-IV_500_1							-5.10%	-5.30%
MISSION 69.0	001_NGI-IV_500_1							-5.30%	-5.50%
MISSION 138.0	001_NGI-IV_500_1							-5.20%	-5.40%
MISSION 230.0	001_NGI-IV_500_1								-5.20%
ML60 TAP 138.0	001_NGI-IV_500_1							-5.50%	-5.80%
MONTGMRY 69.0	001_NGI-IV_500_1							-5.50%	-5.70%
MONTGYTP 69.0	001_NGI-IV_500_1							-5.50%	-5.70%
MURRAY 69.0	001_NGI-IV_500_1							-5.40%	-5.70%
NARROWS 69.0	001_NGI-IV_500_1							-5.10%	-5.20%
NATNLCTY 69.0	001_NGI-IV_500_1							-5.50%	-5.70%
NAVSTMTR 69.0	001_NGI-IV_500_1							-5.50%	-5.70%
NOISLMTR 69.0	001_NGI-IV_500_1							-5.40%	-5.60%
NORTHCTY 69.0	001_NGI-IV_500_1							-5.10%	-5.30%
OLD TOWN 69.0	001_NGI-IV_500_1							-5.10%	-5.30%
OMWD 69.0	001_NGI-IV_500_1								-5.00%
OTAY 69.0	001_NGI-IV_500_1							-5.50%	-5.80%
OTAY TP 69.0	001_NGI-IV_500_1							-5.50%	-5.80%
OTAYLAKE 69.0	001_NGI-IV_500_1							-5.60%	-5.80%
OTAYLKTP 69.0	001_NGI-IV_500_1							-5.50%	-5.80%
OY GEN 13.8	001_NGI-IV_500_1							-5.50%	-5.80%
OY GEN 69.0	001_NGI-IV_500_1							-5.50%	-5.80%
PACFCBCH 69.0	001_NGI-IV_500_1							-5.20%	-5.40%
PARADISE 69.0	001_NGI-IV_500_1							-5.60%	-5.80%
PEN_CT1 18.0	001_NGI-IV_500_1							-5.00%	-5.00%
PEN_CT2 18.0	001_NGI-IV_500_1								-5.10%
PEN_ST 18.0	001_NGI-IV_500_1								-5.10%
PENSQTOS 69.0	001_NGI-IV_500_1							-5.10%	-5.20%
PENSQTOS 138.0	001_NGI-IV_500_1								-5.10%
PFC-AVC 0.6	001_NGI-IV_500_1							-5.20%	-5.50%
POINTLMA 69.0	001_NGI-IV_500_1							-5.10%	-5.30%
POMERADO 69.0	001_NGI-IV_500_1							-5.30%	-5.50%
POWAY 69.0	001_NGI-IV_500_1							-5.20%	-5.40%
PRCTRVLY 138.0	001_NGI-IV_500_1							-5.50%	-5.80%
R.CARMEL 69.0	001_NGI-IV_500_1							-5.10%	-5.30%
R.SNTAFE 69.0	001_NGI-IV_500_1							-5.10%	-5.30%
R.SNTTP1 69.0	001_NGI-IV_500_1							-5.10%	-5.30%
ROSCYNTP 69.0	001_NGI-IV_500_1							-5.30%	-5.50%
ROSE CYN 69.0	001_NGI-IV_500_1							-5.30%	-5.50%
SAMPSON 12.5	001_NGI-IV_500_1							-5.40%	-5.60%
SAMPSON 69.0	001_NGI-IV_500_1							-5.30%	-5.60%
SANTEE 138.0	001_NGI-IV_500_1							-5.40%	-5.60%
SANTYSBL 69.0	001_NGI-IV_500_1							-5.40%	-5.60%
SANYSDRO 69.0	001_NGI-IV_500_1							-5.50%	-5.80%
SCRIPPS 69.0	001_NGI-IV_500_1							-5.40%	-5.60%
SILVERST 69.0	001_NGI-IV_500_1							-5.30%	-5.60%
SNCRSMP1 500.0	001_NGI-IV_500_1							-5.40%	-5.70%
SNCRSMP2 500.0	001_NGI-IV_500_1							-5.40%	-5.70%
SOUTHBAY 69.0	001_NGI-IV_500_1							-5.50%	-5.70%
SOUTHBAY 138.0	001_NGI-IV_500_1							-5.50%	-5.80%
SPRNGVLY 69.0	001_NGI-IV_500_1							-5.60%	-5.90%
STREAMVW 69.0	001_NGI-IV_500_1							-5.50%	-5.70%
SUNCREST 230.0	001_NGI-IV_500_1							-5.50%	-5.80%
SUNCREST 500.0	001_NGI-IV_500_1							-5.30%	-5.60%
SUNCRST1 12.0	001_NGI-IV_500_1							-5.40%	-5.70%
SUNCRST2 12.0	001_NGI-IV_500_1							-5.40%	-5.70%
SUNYSIDE 69.0	001_NGI-IV_500_1							-5.60%	-5.80%
SWEETWTR 69.0	001_NGI-IV_500_1							-5.50%	-5.70%
SWTWTRTP 69.0	001_NGI-IV_500_1							-5.50%	-5.70%
SXTAP1 230.0	001_NGI-IV_500_1							-5.20%	-5.40%
SXTAP2 230.0	001_NGI-IV_500_1							-5.40%	-5.60%
SYCAMORE 69.0	001_NGI-IV_500_1							-5.30%	-5.50%
SYCAMORE 138.0	001_NGI-IV_500_1							-5.10%	-5.30%
SYCAMORE 230.0	001_NGI-IV_500_1							-5.60%	-5.80%
TELECYN 138.0	001_NGI-IV_500_1							-5.60%	-5.80%
TOREYPNS 69.0	001_NGI-IV_500_1							-5.10%	-5.30%
UCM 69.0	001_NGI-IV_500_1							-5.10%	-5.30%
URBAN 69.0	001_NGI-IV_500_1							-5.30%	-5.60%
WABASH 69.0	001_NGI-IV_500_1							-5.40%	-5.60%
WARCYNTP 69.0	001_NGI-IV_500_1							-5.10%	-5.30%
WARENCYN 69.0	001_NGI-IV_500_1							-5.10%	-5.30%
COLRIVER 230.0	001_NGI-IV_500_1							5.50%	6.10%
	002_PV-CR							-9.00%	-9.20%
COLRIVER 500.0	001_NGI-IV_500_1							5.50%	6.10%
	002_PV-CR							-9.00%	-9.20%
colrvr1l 13.8	001_NGI-IV_500_1							5.50%	6.10%
	002_PV-CR							-9.00%	-9.20%
COLRVR1T 13.8	001_NGI-IV_500_1							5.50%	6.10%
	002_PV-CR							-9.00%	-9.20%
DESERT 230.0	001_NGI-IV_500_1							5.50%	6.10%
	002_PV-CR							-9.00%	-9.20%

24	DEVERS 500.0	002_PV-CR							-5.40%	-5.50%
	DEVRSVC1 500.0	002_PV-CR							-5.40%	-5.50%
	GENESIS 230.0	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%
	McCOY 230.0	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%
	redblf1U 13.8	001_NGI-IV_500_1								5.40%
		002_PV-CR							-7.70%	-7.90%
	REDBLF1T 13.8	001_NGI-IV_500_1								5.40%
		002_PV-CR							-7.70%	-7.90%
	REDBLUFF 230.0	001_NGI-IV_500_1								5.40%
		002_PV-CR							-7.70%	-7.90%
	REDBLUFF 500.0	001_NGI-IV_500_1								5.40%
		002_PV-CR							-7.70%	-7.90%
	TC08SC28 230.0	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%
	TOT198_9 230.0	001_NGI-IV_500_1								5.40%
		002_PV-CR							-7.70%	-7.90%
	TOT198_L 34.5	001_NGI-IV_500_1								5.40%
		002_PV-CR							-7.70%	-7.90%
	TOT198G1 0.3	001_NGI-IV_500_1								5.40%
		002_PV-CR							-7.70%	-7.90%
	TOT198G2 0.3	001_NGI-IV_500_1								5.40%
		002_PV-CR							-7.70%	-7.90%
	TOT199_L 34.5	001_NGI-IV_500_1								5.40%
		002_PV-CR							-7.70%	-7.90%
	TOT199G1 0.3	001_NGI-IV_500_1								5.40%
		002_PV-CR							-7.70%	-7.90%
	TOT199G2 0.3	001_NGI-IV_500_1								5.40%
		002_PV-CR							-7.70%	-7.90%
	TOT223_G 0.3	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%
	TOT223_L 34.5	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%
	TOT223H1 230.0	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%
	TOT223H2 230.0	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%
	TOT223L1 13.8	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%
	TOT223L2 13.8	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%
	TOT276H1 115.0	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%
	TOT276H2 115.0	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%
	TOT276L1 18.0	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%
	TOT276L2 18.0	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%
	TOT276L3 18.0	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%
	TOT276L4 18.0	001_NGI-IV_500_1							5.50%	6.10%
		002_PV-CR							-9.00%	-9.20%

Appendix G

WATS Voltage Criteria Violations

Pre-Contingency	Case	1	2	3	4	5	6	7	8
APPLICABLE CRITERION	BUS	Pre-Project	Post-Project - Q225	Pre-Project w/Delaney-CR	Post-Project, w/Delaney-CR - Q225	Pre-Project w/Q219	Post-Project, w/Q219 - Q225	Pre-Project High EOR	Post-Project, High EOR - Q225
ARIZONA (except SRP/WALC) 230 KV VOLTAGE LESS THAN 1.000 PU	ORCHRD_230		0.998		0.999318		0.997492		
ARIZONA (except SRP/WALC) 230 KV VOLTAGE LESS THAN 1.000 PU	N.GILA_230	0.998661	0.995904	0.999999	0.997334	0.998095	0.99535		
ARIZONA (except SRP/WALC) 230 KV VOLTAGE LESS THAN 1.000 PU	COPPERVR_230							0.984241	0.984376
ARIZONA (except SRP/WALC) 230 KV VOLTAGE LESS THAN 1.000 PU	FRISCO_230							0.979133	0.979269
ARIZONA (except SRP/WALC) 230 KV VOLTAGE LESS THAN 1.000 PU	PD-MORNC_230							0.977608	0.977744
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	GLENDAL_230	0.993882	0.993351	0.994605	0.994177	0.994303	0.993805		
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	OLIVE_230	0.998084	0.997812	0.998729	0.998542	0.998477	0.99823		
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	RIVER_230	0.989542	0.989078	0.990148	0.989769	0.989886	0.989449		
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	STJOHN_230	0.990065	0.989595	0.990683	0.9903	0.990419	0.989976		
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	CNTURYLD_230	0.992933	0.992385	0.993617	0.993163	0.993308	0.992789		
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	TOLUCA_230	0.997108	0.996427	0.997987	0.997431	0.997619	0.996977		
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	VELASCO_230	0.990629	0.990146	0.991255	0.990858	0.990982	0.990525		
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	ATWATER_230	0.992616	0.992088	0.993318	0.99289	0.993022	0.992526		
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	HOLYWD_E_230	0.992945	0.992272	0.993806	0.993254	0.993444	0.992809		
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	NRTHRDGE_230	0.992154	0.991722	0.992896	0.992567	0.992597	0.992199		
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	TARZANA_230	0.994152	0.993667	0.994882	0.994498	0.994583	0.994131		
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	SYLMAR1_230	0.9882	0.987518	0.989136	0.98858	0.988743	0.988103	0.992884	0.990601
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	BARRENRD_230	0.991749	0.991561	0.99203	0.991879	0.991904	0.991727		
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	HOLYWD_F_230	0.993058	0.992385	0.99392	0.993368	0.993558	0.992923		
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	SYL PF BUS 1_230							0.993743	0.991458
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	SYL PF BUS 2_230							0.992884	0.990601
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	SOLAR2_230	0.99252	0.992335	0.992796	0.992647	0.992673	0.992498		
LADWP 230-500 KV VOLTAGE LESS THAN 1.000 PU	PT230_230	0.989429	0.989268	0.989669	0.989539	0.989561	0.98941		
MWD 230 KV VOLTAGE LESS THAN 0.9875 PU	GENE69 N_69	0.97982	0.979676	0.97974	0.979697	0.980272	0.980117		
MWD 230 KV VOLTAGE LESS THAN 0.9875 PU	GENE69 S_69	0.978958	0.978813	0.978878	0.978835	0.979412	0.979256	0.986216	0.984757
MWD 230 KV VOLTAGE LESS THAN 0.9875 PU	INTK69 N_69	0.97374	0.973594	0.97366	0.973616	0.974196	0.97404		
MWD 230 KV VOLTAGE LESS THAN 0.9875 PU	INTK69 S_69	0.97294	0.972794	0.972859	0.972816	0.973397	0.97324	0.980258	0.978787
NPC 230 KV VOLTAGE LESS THAN 0.985 PU	BELTWAY_230	0.984426	0.983954		0.984632	0.984853	0.984431		
NPC 230 KV VOLTAGE LESS THAN 0.985 PU	DECATUR_230	0.97874	0.978277	0.979326	0.978957	0.979167	0.978747		
NPC 230 KV VOLTAGE LESS THAN 0.985 PU	WESTSIDE_230	0.983867	0.983394	0.984452	0.984076	0.984298	0.983874		
NPC 230 KV VOLTAGE LESS THAN 0.985 PU	MCDONLD_230	0.982528	0.982066	0.983115	0.982747	0.982952	0.982532		
NPC 230 KV VOLTAGE LESS THAN 0.985 PU	SINATRA_230	0.977302	0.976842	0.977886	0.977519	0.977726	0.977307		
SCE 500 KV VOLTAGE LESS THAN 1.036 PU	ALBERHIL_500							1	1
SDG&E 500 KV VOLTAGE LESS THAN 0.998 PU	MIGUEL_500	0.973011	0.969086	0.97609	0.972495	0.971527	0.967592		
SDG&E 500 KV VOLTAGE LESS THAN 0.998 PU	MIGUELMP_500	0.969869	0.966298	0.972676	0.969425	0.968526	0.964943		
SDG&E 500 KV VOLTAGE LESS THAN 0.998 PU	ECO_500	0.997645	0.993742		0.997036	0.996208	0.992297		
SRP 230 KV VOLTAGE LESS THAN 0.990 PU	RS-29_230	0.989649	0.989639	0.98949	0.989484				
SRP WALC	SHIPROCK_13.8	0.957087	0.957143	0.956965	0.957019	0.957176	0.957232		
SYLMAR S 230 KV VOLTAGE LESS THAN 0.990 PU	SYLMAR S_230		0.98972						
WALC = 300 KV VOLTAGE LESS THAN 1.000 PU	MEAD_345	0.98994	0.989415	0.990619	0.990204	0.990061	0.989537	0.978552	0.97601
WALC = 300 KV VOLTAGE LESS THAN 1.000 PU	PEACOCK_345							0.999855	0.998309
WESTWING 230 KV VOLTAGE LESS THAN 1.030 PU	WESTWNGW_230							1.027443	1.026575
WESTWING 230 KV VOLTAGE LESS THAN 1.030 PU	WESTWNGE_230	1.024562	1.024526	1.024334	1.024322	1.02578	1.025711	1.026664	1.025748

Post-Contingency											
		Case	1	2	3	4	5	6	7	8
APPLICABLE CRITERION	Bus	Contingency	Pre-Project	Post-Project - Q225	Pre-Project w/Delaney-CR	Post-Project, w/Delaney-CR - Q225	Pre-Project w/Q219	Post-Project, w/Q219 - Q225	Pre-Project High EOR	Post-Project, High EOR - Q225
ARIZONA (except SRP/WALC) 230 KV VOLTAGE LESS THAN 0.950 PU	BUCKEYE_230	084_BKY-LBY_230_1	0.947679	0.947515	0.947546	0.947402	0.944327	0.944116		
ARIZONA (except SRP/WALC) 230 KV VOLTAGE LESS THAN 0.950 PU	EAGLEYE_230	152_HA-NG_2_NG-HW_500								0.94607
ARIZONA (except SRP/WALC) 230 KV VOLTAGE LESS THAN 0.950 PU	HARCU AZ_230	152_HA-NG_2_NG-HW_500								0.941306
ARIZONA (except SRP/WALC) 230 KV VOLTAGE LESS THAN 0.950 PU	N.GILA_230	029_IV-ECO_500_1		0.900414						
ARIZONA (except SRP/WALC) 230 KV VOLTAGE LESS THAN 0.950 PU	ORCHRD_230	029_IV-ECO_500_1		0.907962						
LADWP 230-500 KV VOLTAGE LESS THAN 0.950 PU	INTERMT_345	144_IPP-Bipole	0.948047	0.948075	0.948022	0.948045	0.948047	0.948072		
LADWP 230-500 KV VOLTAGE LESS THAN 0.950 PU	INTERMTK_345	144_IPP-Bipole	0.948047	0.948075	0.948022	0.948045	0.948047	0.948072		
LADWP 230-500 KV VOLTAGE LESS THAN 0.950 PU	INTERMTY_345	144_IPP-Bipole	0.946582	0.94661	0.946557	0.94658	0.946582	0.946607		
LADWP 230-500 KV VOLTAGE LESS THAN 0.950 PU	VIC KDUM_500	152_HA-NG_2_NG-HW_500								0.943352
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	EAGLEMTN_230	029_IV-ECO_500_1		0.943538						
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	EM LX1_230	029_IV-ECO_500_1		0.938052						
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	EM LX2_230	029_IV-ECO_500_1		0.938052						
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	GENE BK1_230	152_HA-NG_2_NG-HW_500							0.934255	0.923553
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	GENE BK1_230	153_HA-NG_2_HA-HW_500							0.934638	0.939579
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	GENE BK2_230	152_HA-NG_2_NG-HW_500							0.940876	0.930429
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	GENE BK2_230	153_HA-NG_2_HA-HW_500							0.941249	0.946077
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	GENE LX1_230	152_HA-NG_2_NG-HW_500							0.934292	0.923592
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	GENE LX1_230	153_HA-NG_2_HA-HW_500							0.934674	0.939615
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	GENE LX2_230	152_HA-NG_2_NG-HW_500							0.940886	0.93044
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	GENE LX2_230	153_HA-NG_2_HA-HW_500							0.94126	0.946087
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	GENE_230	152_HA-NG_2_NG-HW_500							0.947142	0.936941
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	GENE_230	153_HA-NG_2_HA-HW_500							0.947508	
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	GENE69 N_69	152_HA-NG_2_NG-HW_500							0.932909	0.922197
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	GENE69 N_69	153_HA-NG_2_HA-HW_500							0.933292	0.938237
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	GENE69 S_69	152_HA-NG_2_NG-HW_500							0.918666	0.907406
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	GENE69 S_69	153_HA-NG_2_HA-HW_500							0.919068	0.924256
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	INTK69 N_69	029_IV-ECO_500_1		0.949416						
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	INTK69 N_69	152_HA-NG_2_NG-HW_500							0.928334	0.917552
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	INTK69 N_69	153_HA-NG_2_HA-HW_500							0.92872	0.933697
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	INTK69 S_69	001_NGI-IV_500_1								0.949901
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	INTK69 S_69	002_PV-CR								0.948728
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	INTK69 S_69	029_IV-ECO_500_1		0.948545						
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	INTK69 S_69	142_CR-RB_500_1_2								0.948436
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	INTK69 S_69	143_RB-DV_500_1_2								0.947096
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	INTK69 S_69	145_PV-WW_PV-CR_500							0.949083	0.943972
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	INTK69 S_69	146_PV-CR_PV-HA_500								0.948669
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	INTK69 S_69	147_PV-CR_PV-RD_500								0.949958
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	INTK69 S_69	152_HA-NG_2_NG-HW_500							0.912099	0.900724
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	INTK69 S_69	153_HA-NG_2_HA-HW_500							0.912504	0.917744
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	JH LX1_230	029_IV-ECO_500_1		0.929123						
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	JH LX2_230	029_IV-ECO_500_1		0.929123						
MWD 230 KV VOLTAGE LESS THAN 0.950 PU	TOT198_9_230	029_IV-ECO_500_1		0.909306						
NORTH GILA 500 KV VOLTAGE LESS THAN 1.000 PU	N.GILA_500	029_IV-ECO_500_1		0.932267						
NPC 500 KV VOLTAGE LESS THAN 0.976 PU	LAUGHLIN1_500	152_HA-NG_2_NG-HW_500								0.974014
NPC 500 KV VOLTAGE LESS THAN 0.976 PU	LAUGHLIN2_500	152_HA-NG_2_NG-HW_500								0.974014
PALOVERDE 500 KV VOLTAGE LESS THAN 1.050 PU	PALOVRDE_500	001_NGI-IV_500_1							1.049777	1.048349
PALOVERDE 500 KV VOLTAGE LESS THAN 1.050 PU	PALOVRDE_500	029_IV-ECO_500_1		1.031934						
PALOVERDE 500 KV VOLTAGE LESS THAN 1.050 PU	PALOVRDE_500	145_PV-WW_PV-CR_500							1.049347	1.049267
PALOVERDE 500 KV VOLTAGE LESS THAN 1.050 PU	PALOVRDE_500	147_PV-CR_PV-RD_500							1.049796	1.04974
PALOVERDE 500 KV VOLTAGE LESS THAN 1.050 PU	PALOVRDE_500	152_HA-NG_2_NG-HW_500							1.040204	1.037722
PALOVERDE 500 KV VOLTAGE LESS THAN 1.050 PU	PALOVRDE_500	153_HA-NG_2_HA-HW_500							1.03911	1.040911

SCE 230 KV VOLTAGE LESS THAN 0.900 PU	MIRAGE_230	029_IV-ECO_500_1		0.879567						
SCE 500 KV VOLTAGE LESS THAN 0.966 PU	COLRIVER_500	029_IV-ECO_500_1		0.952795						
SCE 500 KV VOLTAGE LESS THAN 0.966 PU	COLRIVER_500	152_HA-NG_2_NG-HW_500							0.956764	0.939398
SCE 500 KV VOLTAGE LESS THAN 0.966 PU	COLRIVER_500	153_HA-NG_2_HA-HW_500							0.956547	0.958497
SCE 500 KV VOLTAGE LESS THAN 0.966 PU	DEVERS_500	029_IV-ECO_500_1		0.947955						
SCE 500 KV VOLTAGE LESS THAN 0.966 PU	REDBLUFF_500	029_IV-ECO_500_1		0.953793						
SCE 500 KV VOLTAGE LESS THAN 0.966 PU	REDBLUFF_500	152_HA-NG_2_NG-HW_500								0.95774
SDG&E 230 KV VOLTAGE LESS THAN 0.900 PU	C608_230	029_IV-ECO_500_1		0.882271						
SDG&E 230 KV VOLTAGE LESS THAN 0.900 PU	DREW_230	029_IV-ECO_500_1		0.887202						
SDG&E 230 KV VOLTAGE LESS THAN 0.900 PU	DW GEN1_230	029_IV-ECO_500_1		0.887131						
SDG&E 230 KV VOLTAGE LESS THAN 0.900 PU	DW GEN2 TR_230	029_IV-ECO_500_1		0.895674						
SDG&E 230 KV VOLTAGE LESS THAN 0.900 PU	DW GEN2 TR3_230	029_IV-ECO_500_1		0.886237						
SDG&E 230 KV VOLTAGE LESS THAN 0.900 PU	DW GEN2_230	029_IV-ECO_500_1		0.886233						
SDG&E 230 KV VOLTAGE LESS THAN 0.900 PU	DW GEN3&4_230	029_IV-ECO_500_1		0.889224						
SDG&E 230 KV VOLTAGE LESS THAN 0.900 PU	IMPRLVLY_230	029_IV-ECO_500_1		0.88238						
SDG&E 230 KV VOLTAGE LESS THAN 0.900 PU	IV GEN3_230	029_IV-ECO_500_1		0.882216						
SDG&E 230 KV VOLTAGE LESS THAN 0.900 PU	SUNCREST TP1_230	029_IV-ECO_500_1					0.895711			
SDG&E 230 KV VOLTAGE LESS THAN 0.900 PU	SUNCREST TP2_230	029_IV-ECO_500_1					0.895711			
SDG&E 230 KV VOLTAGE LESS THAN 0.900 PU	SUNCREST_230	029_IV-ECO_500_1					0.899139			
SDG&E 230 KV VOLTAGE LESS THAN 0.900 PU	SYCAMORE TP1_230	029_IV-ECO_500_1				0.899264	0.894108			
SDG&E 230 KV VOLTAGE LESS THAN 0.900 PU	SYCAMORE TP2_230	029_IV-ECO_500_1				0.899264	0.894108			
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	HDWSH_500	029_IV-ECO_500_1		0.93934						
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	MIGUEL_500	029_IV-ECO_500_1	0.944174			0.942793	0.938129			
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	MIGUEL_500	142_CR-RB_500_1_2						0.944768		
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	MIGUEL_500	145_PV-WW_PV-CR_500		0.942582						
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	MIGUEL_500	145_PV-WW_PV-CR_500						0.939355		
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	MIGUEL_500	146_PV-CR_PV-HA_500						0.944871		
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	MIGUEL_500	147_PV-CR_PV-RD_500		0.942591						
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	MIGUEL_500	147_PV-CR_PV-RD_500						0.940073		
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	MIGUELMP_500	002_PV-CR						0.944342		
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	MIGUELMP_500	029_IV-ECO_500_1	0.934493		0.941011	0.933128	0.928516			
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	MIGUELMP_500	142_CR-RB_500_1_2						0.943922		
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	MIGUELMP_500	143_RB-DV_500_1_2						0.944245		
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	MIGUELMP_500	145_PV-WW_PV-CR_500		0.942096				0.939055		
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	MIGUELMP_500	146_PV-CR_PV-HA_500						0.944153		
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	MIGUELMP_500	147_PV-CR_PV-RD_500		0.942147				0.93976		
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	N.GILA_500	029_IV-ECO_500_1		0.932267						
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	SNCRSMP1_500	029_IV-ECO_500_1	0.929111		0.938208	0.927777	0.922667	0.931108		
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	SNCRSMP2_500	029_IV-ECO_500_1	0.929111		0.938208	0.927777	0.922667	0.931108		
SDG&E 500 KV VOLTAGE LESS THAN 0.945 PU	SUNCREST_500	029_IV-ECO_500_1	0.936729		0.9446	0.935539	0.931455	0.936132		
SRP WALC	BLYTHE_161	029_IV-ECO_500_1		0.920865						
SRP WALC	NGL-W_230	029_IV-ECO_500_1		0.90896						
WALC = 300 KV VOLTAGE LESS THAN 0.950 PU	MEAD_345	001_NGI-IV_500_1							0.947216	0.9409
WALC = 300 KV VOLTAGE LESS THAN 0.950 PU	MEAD_345	002_PV-CR							0.941279	0.935431
WALC = 300 KV VOLTAGE LESS THAN 0.950 PU	MEAD_345	142_CR-RB_500_1_2							0.940924	0.935038
WALC = 300 KV VOLTAGE LESS THAN 0.950 PU	MEAD_345	143_RB-DV_500_1_2							0.939728	0.93352
WALC = 300 KV VOLTAGE LESS THAN 0.950 PU	MEAD_345	145_PV-WW_PV-CR_500							0.93914	0.932671
WALC = 300 KV VOLTAGE LESS THAN 0.950 PU	MEAD_345	146_PV-CR_PV-HA_500							0.941255	0.935413
WALC = 300 KV VOLTAGE LESS THAN 0.950 PU	MEAD_345	147_PV-CR_PV-RD_500							0.943266	0.937486
WALC = 300 KV VOLTAGE LESS THAN 0.950 PU	MEAD_345	152_HA-NG_2_NG-HW_500							0.930075	0.919284
WALC = 300 KV VOLTAGE LESS THAN 0.950 PU	MEAD_345	153_HA-NG_2_HA-HW_500							0.930018	0.930224
WALC = 300 KV VOLTAGE LESS THAN 0.950 PU	PEACOCK_345	152_HA-NG_2_NG-HW_500								0.945578