INFO-2022-2

Informational Study Report

10/24/2022

Table of Contents

List of Tables

List of Figures

1.0 Summary

This report is an informational evaluation of a 40 MW Solar Photovoltaic (PV) plus Battery Energy Storage System (BESS) Hybrid Generating Facility with a Point of Interconnection (POI) tapping the Villa – Mirage Jct 69 kV line. The expected Commercial Operation Date (COD) of the Generating Facility is April 1, 2024. The following studies were performed in this informational study:

1. Generating Facility as a 40 MW of Network Resource Interconnection Service (NRIS)
2. Generating Facility as a 40 MW of Energy Resource Interconnection Service (ERIS)

This report is an informational evaluation and does not grant any Interconnection Service or Transmission Service. The results are based on the modeling assumptions and study scope specified by the Customer, which may or may not reflect the standard modeling assumptions followed for the LGIP studies.

1.1 INFO-2022-2 NRIS Results

The total cost of the upgrades required to interconnect INFO-2022-2 on the Villa – Mirage JCT 69 kV line for NRIS is $19.400 million (Table 14, Table 16, and Table 18)

1.2 INFO-2022-2 ERIS Results

The total cost of the upgrades required to interconnect INFO-2022-2 on the Villa – Mirage JCT 69 kV line for ERIS is $19.400 million (Table 14, Table 16, and Table 19)

Maximum allowable output of INFO-2022-2 requiring additional System Network Upgrades is 40 MW.

ERIS of INFO-2022-2 is 40 MW when using the existing firm or non-firm capacity of the Transmission System on an “as available” basis.

2.0 Introduction

This report is an informational evaluation of a 40 MW Solar (PV) plus BESS Hybrid Generating Facility connecting on the Villa – Mirage Jct 69 kV line. Since this is an informational study, the study modeled a generic 40 MW Generating Facility that can maintain ±0.95 power factor at the POI.

A summary and description of the request for INFO-2022-2 as an NRIS are shown in Table 1.

Table 1 – Summary of Request for INFO-2022-2 as an NRIS

INFO#	Resource Type	Service (MW)	Service Type	COD	POI	Location
INFO-2022-2	PV + BESS	40	NRIS	04/01/2024	Villa – Mirage Jct 69 kV line	Saguache County, CO

A summary and description of the request for INFO-2022-2 as an ERIS are shown in Table 2.

Table 2 – Summary of Request for INFO-2022-2 as an ERIS

INFO#	Resource Type	Service (MW)	Service Type	COD	POI	Location
INFO-2022-2	PV + BESS	40	ERIS	04/01/2024	Villa – Mirage Jct 69 kV line	Saguache County, CO

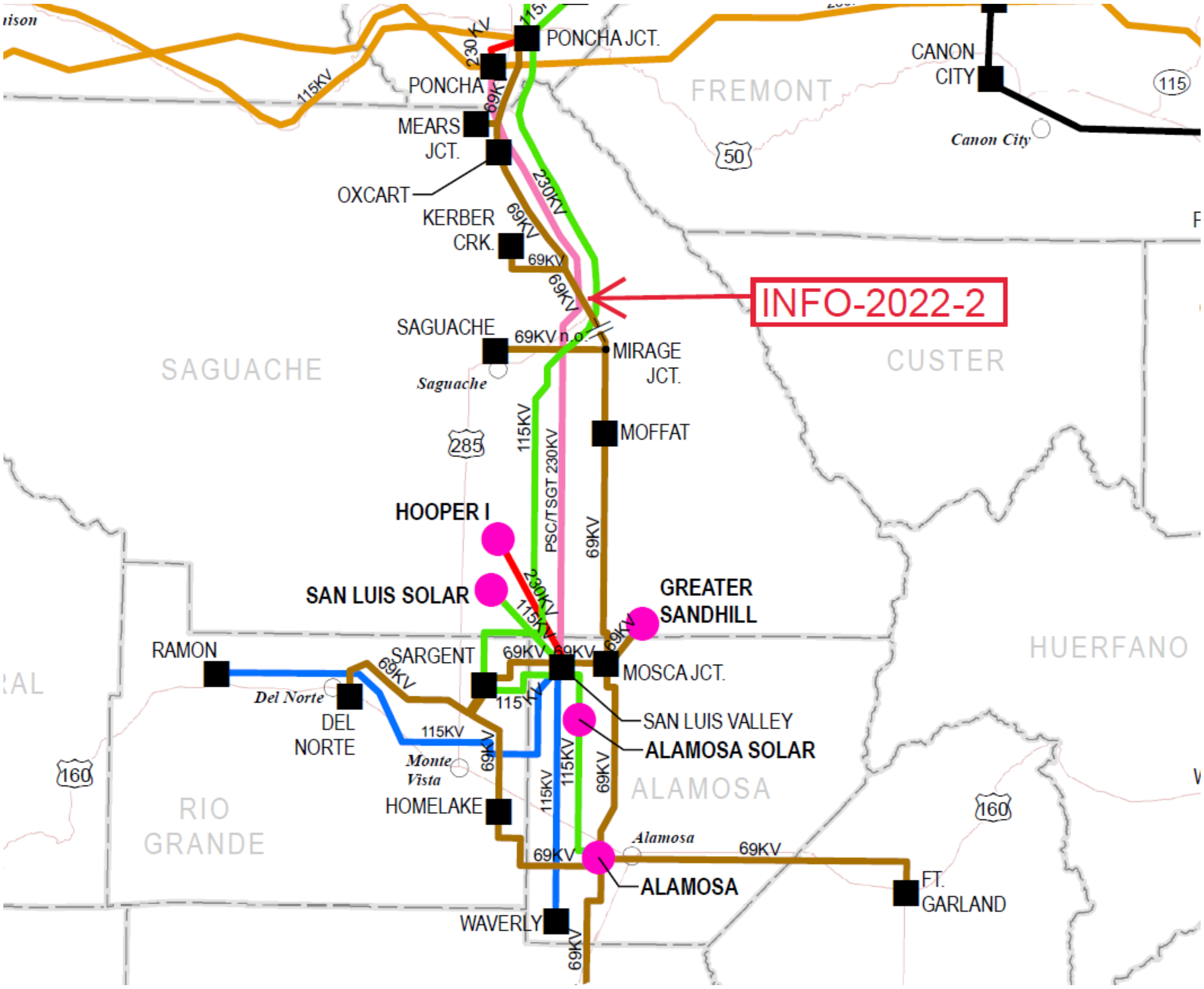

Figure 1: Approximate Location of INFO-2022-2 POI

3.0 Study Scope

The study was performed using the modeling assumptions specified by the Interconnection Customer (IC).

The scope of the study includes steady-state (thermal and voltage) analysis, and cost estimates. The non-binding cost estimates provide total cost responsibility for Transmission Provider Interconnection Facilities (TPIF), Station Network Upgrades, and System Network Upgrades.

Per the Study Request, INFO-2022-2 was analyzed as both an ERIS and NRIS.

3.1 Study Pockets

The POI of INFO-2022-2 is located within the San Luis Valley study pocket.

3.2 Study Areas

The study area for the San Luis Valley study pocket includes the WECC base case zone 710. The Affected Systems included in the analysis are Tri-State Generation and Transmission Inc. (TSGT), Black Hills Energy (BHE), Colorado Spring Utilities (CSU), CORE, and Western Area Power Administration (WAPA) transmission systems in the study area.

3.3 Study Criteria

The following steady-state analysis criteria is used to identify violations on the PSCo system and the Affected Systems:

<u>P0 - System Intact conditions</u>:
Thermal Loading: ≤ 100% of the normal facility rating
Voltage range: 0.95 to 1.05 per unit

<u>P1 & P2-1 – Single Contingencies:</u>
Thermal Loading: ≤ 100% normal facility rating
Voltage range: 0.90 to 1.10 per unit
Voltage deviation: ≤ 8% of pre-contingency voltage

<u>P2 (except P2-1), P4, P5 & P7 – Multiple Contingencies:</u>
Thermal Loading: ≤ 100% emergency facility rating
Voltage range: 0.90 to 1.10 per unit
Voltage deviation: ≤ 8% of pre-contingency voltage

3.4 Study Methodology

The steady-state power flow assessment is performed using the PowerGEM TARA software. The generation redispatch for ERIS is identified using TARA's Security Constrained Redispatch (SCRD) tool.

Thermal violations are identified if a facility (i) resulted in a thermal loading >100% in the Study Case after the study pocket GIR cluster addition and (ii) contributed to an incremental loading increase of 1% or more to the benchmark case loading.

Voltage violations are identified if a bus (i) resulted in a bus voltage >1.1 p.u. (or <0.9 p.u.) in the Study Case after the study pocket GIR cluster addition and (ii) contributed to an adverse impact of +0.005 p.u. (or -0.005 p.u.) compared to the Benchmark Case voltage.

DFAX criteria for identifying contribution to thermal overloads is ≥1%. DFAX criteria for identifying contribution to the voltage violations is 0.005 p.u.

When the study pocket has a mix of NRIS and ERIS requests, it is studied by first modeling the NRIS GIRs at their full requested amount and modeling the ERIS GIRs offline. Network Upgrades required to mitigate the thermal and/or voltage violations are only allocated to NRIS requests because other GIR's output is modeled at zero.

The NRIS GIRs and their associated Network Upgrades are then modeled in the NRIS Study Case, and ERIS GIRs are dispatched at 100% to study the system impact. Violations are identified and the study evaluates if a generation redispatch combination eliminates the violation. If generation redispatch is unable to eliminate the violation, upgrades will be identified.

The resources included in the Optimal Power Flow (OPF) redispatch are:

- All PSCo and Non-PSCo resources connected to the PSCo Transmission System
- Higher-queued NRIS generation in the PSCo queue
- Generation connected to an Affected System Transmission System if that generation is a designated network resource to serve load connected to PSCo
- All other generation connected to an Affected System Transmission System and Stressed in the Study Case may be dispatched to the Base Case level

Maximum allowable ERIS generation is calculated for each GIR using its distribution factor(s) (DFAX) for overloads identified at full output, such that all identified overloads are eliminated.

4.0 Base Case Modeling Assumptions

The 2026HS2a1 WECC case released on July 31, 2020, was selected as the starting case. The Base Case was created from the Starting Case by including the following modeling changes. The following approved transmission projects in PSCo's 10-year transmission plan, with an in-service date before summer 2026 were modeled: (http://www.oasis.oati.com/woa/docs/PSCO/PSCOdocs/FERC_890_Q1_2020_Transmission_Plan_Presentation.pdf)

- Cloverly 115 kV Substation – ISD 2021
- Graham Creek 115 kV Substation – ISD 2022
- Husky 230/115 kV Substation – ISD 2022
- Mirasol 230 kV Substation – ISD 2022
- Avery Substation – ISD 2021
- Barker Substation – Bank1 ISD: 2021, Bank 2 ISD: 2022
- High Point Substation – ISD 2022
- Titan Substation – ISD 2022
- Dove Valley Substation – ISD 2023
- Stock Show – ISD 2026
- Monument – Flying Horse 115 kV Series Reactor – ISD 2024
- Ault – Husky 230 kV line – ISD 2022
- Husky – Graham Creek – Cloverly 115 kV line – ISD 2022
- Gilman – Avon 115 kV line – ISD 2022
- Climax – Robinson Rack – Gilman 115 kV – ISD 2022
- Greenwood – Arapahoe – Denver Terminal 230 kV – ISD 2022
- Upgrade Villa Grove – Poncha 69 kV Line to 73 MVA – ISD 2021
- Upgrade Poncha – Sargent - San Luis Valley 115 kV line to 120 MVA – ISD 2021
- Upgrade Antonito – Romeo – Old40 Tap – Alamosa Terminal – Alamosa Switchyard 69 kV line to 143 MVA – ISD 2023
- Tundra Switching Station 345 kV – ISD 2022
- Upgrade Allison – SodaLakes 115 kV line to 318 MVA – ISD 2022

The following additional changes were made to the TSGT model in the Base Case per further review and comment from TSGT:

- Fuller – Vollmer 115 kV line modeled at 173 MVA – ISD 2022
- Black Squirrel – Vollmer 115 kV line modeled at 144 MVA – ISD 2022
- Black Squirrel – Black Forest Tap 115 kV line modeled at 144 MVA – ISD 2022
- Beaver Creek – Adena 115 kV line modeled at 114 MVA
- Fuller 230/115 kV, 150 MVA #2 transformer – ISD 2023
- Paddock – Shaw Ranch – Calhan Tap – Santa Fe Springs 115 kV Loop was modeled open

The following additional changes were made to the CSU model in the Base Case per further review and comment from CSU:

- Cottonwood – Tesla 34.5 kV line is modeled open and Kettle Creek – Tesla 34.5 kV line is modeled closed on the CSU system – ISD 2023
- Briargate South 115/230 kV transformer project tapping the Cottonwood – Fuller 230 kV line – ISD 2023

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

In addition, the following higher-queued generation from PSCo's queue were modeled offline in the Base Case along with any System Network Upgrades identified in their corresponding studies.

- Individual GIRs (GI-2014-5, GI-2014-6, GI-2014-7, GI-2014-9, GI-2014-13, GI-2014-14, GI-2016-4, and GI-2016-15)
- Transitional Cluster (GI-2018-24, and GI-2019-6)
- DISIS-2020-001 Cluster
- 2RSC-2020-05 Cluster
- DISIS-2020-002 Cluster
- DISIS-2021-003 Cluster
- DISIS-2021-004 Cluster
- DISIS-2022-005 Cluster

While the higher-queued NRIS requests in the study pocket were dispatched at 100% while performing each study pocket's analysis, the higher-queued ERIS requests were modeled offline.

5.0 San Luis Valley Study Pocket Analysis

The San Luis Valley (SLV) study pocket analysis was performed for both heavy summer (HS) and a light load (LL) scenario.

5.1 Benchmark Cases Modeling

The heavy summer scenario Benchmark Case was created from the Base Case by adopting the generation dispatch in Table 3.

Table 3 – Generation Dispatch Used to Create the SLV Heavy Summer Benchmark Case (MW is Gross Capacity)

Bus Number	Bus Name	ID	Status	Pgen (MW)	Pmax (MW)
70485	ALMSACT1	G1	1	16.37	19.40
70486	ALMSACT2	G2	1	16.03	19.00
70933	COGENTRIX_PV	S3	1	21.34	30.00
70931	GSANDHIL_PV	S1	1	14.45	16.10
70932	HOOPER_PV	S2	1	25.55	30.00
70395	SUNPOWER	S1	1	33.8	52
88881	GI-2021-4	G1	1	42.00	42.00
990001	GI-21-23 G	GN	1	95.00	95.80
Total				264.54	304.30

The light load scenario Benchmark Case was created from the heavy summer Benchmark Case by scaling the San Luis Valley area loads down, to 40% of the heavy summer values, and turning off Alamosa CT1 and Alamosa CT2 and adopting the generation dispatch in Table 4.

Table 4 – Generation Dispatch Used to Create the SLV Light Load Benchmark Case (MW is Gross Capacity)

Bus Number	Bus Name	ID	Status	Pgen (MW)	Pmax (MW)
70485	ALMSACT1	G1	0	0	19.40
70486	ALMSACT2	G2	0	0	19.00
70933	COGENTRIX_PV	S3	1	21.34	30.00
70931	GSANDHIL_PV	S1	1	14.45	16.10
70932	HOOPER_PV	S2	1	25.55	30.00
70395	SUNPOWER	S1	1	33.8	52
88881	GI-2021-4	G1	1	42.00	42.00
990001	GI-21-23 G	GN	1	95.00	95.80
Total				232.14	304.30

5.2 INFO-2022-2 – NRIS

5.2.1 Study Cases Modeling

The San Luis Valley heavy summer and light load scenarios' NRIS Study Cases were developed from the respective Benchmark Cases by modeling INFO-2022-2 as a tap on the Villa to Mirage Jct 69 kV line. The 40 MW NRIS output of INFO-2022-2 is balanced against all PSCo generation connected to the PSCo Transmission System outside the study pocket on a pro-rata basis.

5.2.2 Steady-State Analysis

The contingency analysis was performed on NRIS Study Cases from both heavy summer and light load scenarios.

The results of the system intact analysis on the NRIS Study Cases are shown in Table 5.

The results of the single contingency analysis on the NRIS Study Cases are shown in Table 6.

The results of the multiple contingency analysis on the NRIS Study Cases are shown in Table 7

Xcel PSCo identified that the single contingency overloads tabulated in Table 5 and Table 6 are mitigated by the System Network Upgrades tabulated in Table 8.

Table 7 shows the multiple contingency analysis on the Study Cases. Per TPL-001-4, multiple contingency overloads are mitigated using system adjustments, including generation redispatch (includes GIRs under study) and/or system operator actions. None of the listed multiple contingency overloads are attributed to INFO-2022-2.

Both single and multiple contingency analysis showed no voltage violations attributed to INFO-2022-2.

Table 5 – San Luis Valley Study Pocket NRIS Results – System Intact Analysis

Overloaded Facility	Type	Owner	Facility Normal Rating (MVA)	Contingency Definition	Heavy Summer Scenario Branch Loading			Light Load Scenario Branch Loading		
					Benchmark Case (%)	NRIS Study Case (%)	Delta (%)	Benchmark Case (%)	NRIS Study Case (%)	Delta (%)
PONCHA (70326) TO PONCHA (70327) 115/69 kV CKT #T2	Xfmr	PSCo	13.3	Base Case	9.4	313.3	304.0	8.4	317.3	308.9
INFO_22_2 (200) TO VILLA (70508) 69 kV CKT #1	Line	PSCo	25.8	Base Case	0.7	153.1	152.4	0.7	153.2	152.5

Table 6 – San Luis Valley Study Pocket NRIS Results – Single Contingency Analysis

Overloaded Facility	Type	Owner	Facility Normal Rating (MVA)	Contingency Definition	Heavy Summer Scenario Branch Loading			Light Load Scenario Branch Loading		
					Benchmark Case (%)	NRIS Study Case (%)	Delta (%)	Benchmark Case (%)	NRIS Study Case (%)	Delta (%)
PONCHA (70326) TO PONCHA (70327) 115/69 kV CKT #T2	Xfmr	PSCo	13.3	ROMEO (70367) TO REATAP (70552) 69 kV CKT #1	9.4	315.2	305.8	8.5	321.1	312.6
INFO_22_2 (200) TO VILLA (70508) 69 kV CKT #1	Line	PSCo	25.8	GI-21-23 (990001) TO GI-2021-23 (990002) 34.5/0.69 kV CKT #1	0.7	153.2	152.6	0.7	150.8	150.2

Table 7 – San Luis Valley Study Pocket NRIS Results – Multiple Contingency Analysis

Overloaded Facility	Type	Owner	Facility Emergency Rating (MVA)	Contingency Name[1]	Heavy Summer Scenario Branch Loading			Light Load Scenario Branch Loading		
					Benchmark Case (%)	NRIS Study Case (%)	Delta (%)	Benchmark Case (%)	NRIS Study Case (%)	Delta (%)
INFO_22_2 (200) TO VILLA (70508) 69 kV CKT #1	Line	PSCo	25.8	BF_298	0.0	149.0	149.0	0.0	149.8	149.8
FTN_VLY (70193) TO DESRTCOV (70449) 115 kV CKT #1	Line	BHE	222.0	BF_217	101.0	102.0	1.0	101.6	102.7	1.1
FTN_VLY (70193) TO MIDWAYBR (73412) 115 kV CKT #1	Line	BHE	171.0	BF_217	130.3	131.6	1.3	131.1	132.5	1.4
PONCHA (70326) TO PONCHA (70327) 115/69 kV CKT #T2	Xfmr	PSCo	13.3	BF_298	0.0	320.8	320.8	0.0	315.2	315.2
DESRTCOV (70449) TO W.STATON (70456) 115 kV CKT #1	Line	BHE	222.0	BF_217	113.1	114.1	1.0	113.7	114.8	1.1
EAST PORTAL (73000) TO WEST POR (73001) 69 kV CKT #1	Line	WAPA	30.0	P7_020a	135.7	137.8	2.1	135.8	139.4	3.5
EAST PORTAL (73000) TO MARYLKSB (73436) 69 kV CKT #1	Line	WAPA	30.0	P7_020a	130.8	132.8	2.1	130.9	134.4	3.5
WEST PORTAL (73001) TO MCKENZIE (73132) 69 kV CKT #1	Line	WAPA	36.0	P7_020a	114.2	116.0	1.8	114.3	117.2	2.9
MONUMENT (73414) TO FLYHORSE (78664) 115 kV CKT #1	Line	CSU	157.0	P7_065	99.5	100.9	1.4	100.5	101.9	1.4
MARYLKSB (78066) TO MARYLKSB (73436) 69/115 kV CKT #1	Xfmr	WAPA	30.0	P7_020a	132.2	134.3	2.1	132.3	135.8	3.5

[1] Contingency Definitions corresponding to Contingency Names are given in Appendix A.

Table 8 – San Luis Valley Study Pocket NRIS – System Network Upgrades

Network Upgrade	Facility Type
UPGRADE PONCHA (70326) TO PONCHA (70327) 115/69 kV CKT #T2	Xfmr
UPGRADE INFO_22_2 (200) TO VILLA (70508) 69 kV CKT #1	Line

5.2.3 Affected Systems

WAPA, BHE, and CSU are identified as impacted Affected Systems as result of NRIS study overloads on their facilities as listed in Table 7.

5.2.4 Summary

NRIS identified for INFO-2022-2 is 40 MW.

The NRIS study identified the overloads caused by the INFO-2022-2 as a NRIS GIR and identified suitable System Network Upgrades for the identified overloads.

5.3 INFO-2022-2 – ERIS

5.3.1 Study Cases Modeling

The San Luis Valley heavy summer and light load scenarios' ERIS Study Cases were developed from the respective Benchmark Cases by modeling INFO-2022-2 as a tap on the Villa to Mirage Jct 69 kV line. The 40 MW ERIS output of INFO-2022-2 is balanced against all PSCo generation connected to the PSCo Transmission System outside the study pocket on a pro-rata basis.

5.3.2 Steady-State Analysis

The contingency analysis was performed on the ERIS Study Cases using OPF to redispatch to alleviate any single contingency and system intact overloads according to Section 3.4. Table 9 and Table 10 show the system intact and single contingency overloads which could not be mitigated by redispatch using OPF. This shows the need for ERIS System Network Upgrades for the facilities tabulated in Table 11.

The system intact overloads for the ERIS Study Case (including required ERIS System Network Upgrades tabulated in Table 11) are shown in Table 12.

The single-contingency overloads for the ERIS Study Case (including required ERIS System Network Upgrades tabulated in Table 11) are shown in Table 13. The maximum allowable ERIS generation is calculated using each GIR's distribution factor (DFAX) for each of the overloads, such that all the identified overloads in Table 12 and Table 13 are eliminated.

Table 9 – San Luis Valley Study Pocket ERIS – System Intact Overloads (After OPF Redispatch)

Overloaded Facility	Type	Owner	Facility Normal Rating (MVA)	Contingency Definition	Heavy Summer Scenario Branch Loading (After OPF Redispatch)	Light Load Scenario Branch Loading (After OPF Redispatch)
					ERIS Study Case (%)	ERIS Study Case (%)
PONCHA (70326) TO PONCHA (70327) 115/69 kV CKT #T2	Xfmr	PSCo	13.3	Base Case	313.1	317.2
INFO_22_2 (200) TO VILLA (70508) 69 kV CKT #1	Line	PSCo	25.8	Base Case	153.1	153.2

Table 10 – San Luis Valley Study Pocket ERIS – Single Contingency Overloads (After OPF Redispatch)

Overloaded Facility	Type	Owner	Facility Normal Rating (MVA)	Contingency Definition	Heavy Summer Scenario Branch Loading (After OPF Redispatch)	Light Load Scenario Branch Loading (After OPF Redispatch)
					ERIS Study Case (%)	ERIS Study Case (%)
PONCHA (70326) TO PONCHA (70327) 115/69 kV CKT #T2	Xfmr	PSCo	13.3	ROMEO (70367) TO REATAP (70552) 69 kV CKT #1	148.5	320.9
INFO_22_2 (200) TO VILLA (70508) 69 kV CKT #1	Line	PSCo	25.8	GI-21-23 (990001) TO GI-2021-23 (990002) 34.5/0.69 kV CKT #1	153.2	150.3

Table 11 – San Luis Valley Study Pocket ERIS – System Network Upgrades

Network Upgrade	Facility Type
UPGRADE PONCHA (70326) TO PONCHA (70327) 115/69 kV CKT #T2	Xfmr
UPGRADE INFO_22_2 (200) TO VILLA (70508) 69 kV CKT #1	Line

Table 12 – San Luis Valley Study Pocket ERIS (Including ERIS System Network Upgrades) – System Intact Overloads

Overloaded Facility	Type	Owner	Facility Normal Rating (MVA)		Contingency Definition	Heavy Summer Scenario Branch Loading			Light Load Scenario Branch Loading		
			Benchmark Case	ERIS Study Case (with System Network Upgrades)		Benchmark Case (%)	ERIS Study Case (with System Network Upgrades) (%)	Delta (%)	Benchmark Case (%)	ERIS Study Case (with System Network Upgrades) (%)	Delta (%)
PONCHA (70326) TO PONCHA (70327) 115/69 kV CKT #T2	Xfmr	PSCo	13.3	42.7	Base Case	9.4	97.6	88.3	8.4	98.9	90.5
INFO_22_2 (200) TO VILLA (70508) 69 kV CKT #1	Line	PSCo	25.8	39.5	Base Case	0.7	99.9	99.3	0.7	100.0	99.3

Table 13 – San Luis Valley Study Pocket ERIS (Including ERIS System Network Upgrades) – Single Contingency Overloads

Overloaded Facility	Type	Owner	Facility Normal Rating (MVA)		Contingency Definition	Heavy Summer Scenario Branch Loading			Light Load Scenario Branch Loading		
			Bench mark Case	ERIS Study Case (with System Network Upgrades)		Benchmark Case (%)	ERIS Study Case (with System Network Upgrades) (%)	Delta (%)	Benchmark Case (%)	ERIS Study Case (with System Network Upgrades)	Delta (%)
PONCHA (70326) TO PONCHA (70327) 115/69 kV CKT #T2	Xfmr	PSCo	13.3	42.7	ROMEO (70367) TO REATAP (70552) 69 kV CKT #1	9.4	98.2	88.8	8.5	100.1	91.5
INFO_22_2 (200) TO VILLA (70508) 69 kV CKT #1	Line	PSCo	25.8	39.5	GI-21-23 (990001) TO GI-2021-23 (990002) 34.5/0.69 kV CKT #1	0.7	100.0	99.4	0.7	98.4	97.8

5.3.3 Affected Systems

No Affected Systems are identified as part of the ERIS study.

5.3.4 Summary

The ERIS study showed system intact single contingency overloads which could not be alleviated by performing OPF redispatch. These overloads require System Network Upgrades for INFO-2022-2 requested as ERIS as shown in Table 11.

A DFAX analysis, with respect to thermal overloads, was performed to compute the maximum allowable output for INFO-2022-2 as an ERIS. The maximum allowable output of INFO-2022-2 as an ERIS (including the required System Network Upgrades from Table 11) is:

- ERIS of INFO-2022-2: 40 MW

ERIS, when using the existing firm or non-firm capacity of the Transmission System on an "as available" basis is:

- INFO-2022-2 is 40 MW

6.0 Cost Estimates, Time Frame and Assumptions

There are three types of costs identified in the study:

1. Transmission Provider's Interconnection Facilities (TPIF) which are directly assigned to each GIR
2. Station equipment Network Upgrades, which are allocated each GIR connecting to that station on a per-capita basis per Section 4.2.4(a) of the LGIP
3. All System Network Upgrades which are allocated by the proportional impact per Section 4.2.4(b) of the LGIP
    - System Network Upgrades allocated to INFO-2022-2 as an NRIS
    - System Network Upgrades allocated to INFO-2022-2 as an ERIS

6.1 Total Cost of Transmission Provider's Interconnecting Facilities

The total cost of Transmission Provider's Interconnection Facilities for INFO-2022-2 is given in Table 14.

Table 14 – Total Cost of Transmission Provider's Interconnection Facilities

GIR	POI	Total Cost (million)
INFO-2022-2	Villa to Mirage Jct 69 kV line	$2.100

Table 15 specifies the INFO-2022-2 project's Transmission Provider's Interconnection Facilities and the corresponding costs.

Table 15 – INFO-2022-2 Transmission Provider's Interconnection Facilities

Element	Description	Cost Est. (million)
New 69 kV Switching Station	Transmission Provider's Interconnection Facility at a new 69 kV Switching Station on the Mirage Jct. – Villa Grove 69 kV line. The new equipment includes: • (2) 69 kV deadend structures • (1) 69 kV circuit breaker • (3) 115 kV surge arresters • (2) 69 kV disconnect switches • (3) CT/PT combination metering units • Fiber communication equipment • Station controls • Associated electrical equipment, bus, wiring and grounding • Associated foundations and structures • Associated transmission line communications, fiber, relaying and testing.	$2.100
Total Cost Estimate for Interconnection Customer-Funded, PSCo-Owned Interconnection Facilities		**$2.100**
Time Frame	**Site, design, procure and construct**	**36 Months**

6.2 Total Cost of Station Network Upgrades

The total cost of Station Network Upgrades for INFO-2022-2 is given in Table 16.

Table 16 – Total Cost of Station Network Upgrades by GIR

GIR	POI	Total Cost (million)
INFO-2022-2	Villa to Mirage Jct 69 kV line	$11.300

The details of the Station Network Upgrades required at the Villa to Mirage Jct 69 kV new POI Switching Station are shown in Table 17.

Table 17 – Station Network Upgrades – INFO-2022-2 69 kV Switching Station

Element	Description	Cost Est. (million)
New 69 kV Switching Station	Install a new Switching Station on the Mirage Jct. – Villa Grove 69 kV line. The new equipment includes: • (4) 69 kV deadend structures • (2) 69 kV circuit breakers • (6) 69 kV disconnect switches • (6) 115 kV surge arresters • (1) Electrical Equipment Enclosure (EEE) • Station controls and wiring • Associated foundations and structures	$9.500
New 69 kV Switching Station	Install required communication in the EEE at the new 69 kV Switching Station	$0.600
PSCo's Mirage Jct. Switching Station	Remote end upgrades for line 6905 at Mirage Jct. 69 kV Switching Station	$0.500
PSCo's Villa Grove Switching Station	Remote end upgrades for 6905 at Villa Grove 69 kV Switching Station	$0.500
New 69 kV Switching Station	Siting & Land Rights support for substation construction	$0.200
Total Cost Estimate for PSCo-Funded, PSCo-Owned Interconnection Facilities		**$11.300**
Time Frame	**Site, design, procure and construct**	**36 Months**

6.3 Total Cost of System Network Upgrades

6.3.1 INFO-2022-2 – NRIS

Steady-state analysis for INFO-2022-2 as an NRIS discovered System Network Upgrades in the San Luis Valley Pocket. The System Network Upgrade costs associated with INFO-2022-2 studied as an NRIS request are described in Table 18.

Table 18 – System Network Upgrades – San Luis Valley Study Pocket for NRIS

Element	Cost Est. (million)
Minimum 43 MVA summer normal rating for the Poncha 115/69 kV CKT #T2 Transformer	$6.000
Minimum 40 MVA summer normal rating for the INFO-2022-2 – Villa Grove 69 kV line*	$0
Total Cost Estimate for PSCo-Funded, PSCo-Owned Interconnection Facilities	**$6.000**

Note:
* Line rated 148 MVA summer normal after recent rebuild

6.3.2 INFO-2022-2 – ERIS

Steady-state analysis for INFO-2022-2 as an NRIS discovered System Network Upgrades in the San Luis Valley Pocket. The System Network Upgrade costs associated with INFO-2022-2 studied as an NRIS request are described in Table 19.

Table 19 – System Network Upgrades – San Luis Valley Study Pocket for ERIS

Element	Cost Est. (million)
Minimum 43 MVA summer normal rating for the Poncha 115/69 kV CKT #T2 Transformer	$6.000
Minimum 40 MVA summer normal rating for the INFO-2022-2 – Villa Grove 69 kV line*	$0
Total Cost Estimate for PSCo-Funded, PSCo-Owned Interconnection Facilities	**$6.000**

Note:
* Line rated 148 MVA summer normal after recent rebuild

6.4 Summary of Costs assigned to INFO-2022-2 as NRIS

The total cost of the required upgrades for INFO-2022-2 to interconnect at a new INFO-2022-2 69 kV Switching Station on the Villa to Mirage Jct 69 kV line as NRIS is $19.400 million.

- **Cost of Transmission Provider's Interconnection Facilities is $2.100 million (Table 14)**
- **Cost of Station Network Upgrades is $11.300 million (Table 16)**
- **Cost of System Network Upgrades is $6.000 million (Table 18)**

The list of improvements required to accommodate the interconnection of INFO-2022-2 are given in Tables 15 and 17. System improvements are subject to revision as a more detailed and refined design is produced.

6.5 Summary of Costs assigned to INFO-2022-2 as ERIS

The total cost of the required upgrades for INFO-2022-2 to interconnect at a new INFO-2022-2 69 kV Switching Station on the Villa to Mirage Jct 69 kV line as ERIS is $19.400 million.

- **Cost of Transmission Provider's Interconnection Facilities is $2.100 million (Table 14)**

- **Cost of Station Network Upgrades is $11.300 million (Table 16)**
- **Cost of System Network Upgrades is $6.000 million (Table 19)**

The list of improvements required to accommodate the interconnection of INFO-2022-2 are given in Tables 15 and 17. System improvements are subject to revision as a more detailed and refined design is produced.

6.6 Cost Estimate and Time Frame Assumptions

The following assumptions are provided for the cost estimates and estimated time frame to complete the upgrades noted.

1. The cost estimates are in 2022 dollars with escalation and contingencies applied.
2. Allowances for Funds Used During Construction (AFUDC) is not included.
3. These estimated costs include all applicable labor and overheads associated with the siting, engineering, design, and construction of these new PSCo facilities.
4. This estimate does not include the cost for any Interconnection Customer owned equipment and associated design and engineering.
5. A level of accuracy is not specified for the estimates.
6. Labor is estimated for straight time only – no overtime included.
7. Lead times for materials were considered for the estimated time frame based upon current conditions.
8. PSCo (or it’s Contractor) crews will perform all construction, wiring, testing, and commissioning for PSCo owned and maintained facilities.
9. Customer will be required to install two (2) redundant fiber optics circuits into the Transmission provider’s substation as part of its interconnection facilities construction scope.
10. Line outages will be necessary during the construction period. Outage availability could potentially be problematic and extend requested back-feed date.
11. Power Quality Metering (PQM) will be required on the Customer’s generation tie-line terminating into the POI.

12. The Customer will be required to design, procure, install, own, operate and maintain a Load Frequency/Automated Generation Control (LF/AGC) RTU at their Customer Substation. PSCo / Xcel will need indications, readings, and data from the LFAGC RTU.

7.0 Appendices

Appendix A: Multiple Contingency Definitions	Appendix A - Multiple Contingen