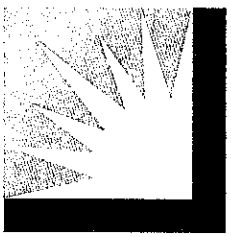
[redacted]

GENERATION INTERCONNECTION SYSTEM IMPACT STUDY

February 3, 2012



SOUTHERN CALIFORNIA
EDISON®
An *EDISON INTERNATIONAL*® Company

Southern California Edison Company

Jorge Chacon
Manager, Generation
Interconnection Planning

EXECUTIVE SUMMARY

Southern California Edison Company ("SCE") received an interconnection request from [redacted] for the interconnection of its 20 MW Project to SCE's Windhub 66 kV Substation, pursuant to the Small Generator Interconnection Procedures ("SGIP") under the Wholesale Distribution Access Tariff ("WDAT"). The [redacted] photovoltaic solar power plant is to be located in Mojave, CA, with the project site located [redacted] of SCE's Windhub Substation. The requested in-service date is November 14, 2014.

In accordance with the SCE's WDAT SGIP, SCE performed an interconnection System Impact Study ("SIS") to determine the adequacy of SCE's electrical system, including both the SCE distribution system and the CAISO controlled grid, to accommodate the Project. The Study was performed for two system conditions: a 2014 heavy summer with a one-in-ten load forecast and a 2014 light spring load forecast (65% of the heavy summer load). These conditions reflect the most critical expected loading condition for the transmission system in SCE's area.

The study included all active generation applications in the study area, regardless of in-service dates, that were submitted prior to the Project application. This includes several higher queued serial projects active in either the CAISO SGIP or the SCE Wholesale Distribution Access Tariff ("SCE WDAT") SGIP. This also includes numerous CAISO Large Generator Interconnection Procedures ("LGIP") and SCE WDAT Clustering Large Generation Interconnection Procedures ("CLGIP") queued generation projects.

The study included the modeling of the East Kern Wind Resource Area ("EKWRA") 66 kV reconfiguration project. This project was proposed by SCE in the CAISO 2010 Transmission Plan as a reliability project to address numerous reliability criteria violations in the existing Antelope-Bailey 66 kV network. This project was presented and recommended for approval by CAISO at the February 16, 2010 CAISO transmission plan stakeholder meeting. The EKWRA project has a proposed in-service date of December 2013.

The study accuracy and results for the assessment of the system adequacy are contingent on the accuracy of the technical data provided by [redacted] Any changes from the data provided could void the study results. The Study report provides detailed Study assumptions and conditions of the system in which the Study was conducted.

CONCLUSIONS

Power Flow

With all queued ahead generation projects and all corresponding facility upgrades modeled, and with the system reconfigurations proposed as part of EKWRA, the power flow study found that the Project did not trigger new base case overloads requiring distribution or transmission level mitigations. However, it is important to note that the project queued directly ahead of [redacted] was identified to trigger the need for a third 220/66 kV transformer bank (mostly distribution upgrade) at Windhub Substation. As such, withdrawals of higher queued projects in the Windhub 66 kV area may shift triggering cost responsibility of this distribution upgrade to the [redacted]

Project. Additionally, the study found that a previously triggered Windhub 500/220 kV transformer bank overload under loss of one 500/220 kV transformer bank is aggravated by the inclusion of the [redacted] Project. However, the study found that a proposed SPS for the triggering higher queued project will be sufficient to mitigate the incremental impacts of the Project without any additional upgrades.

Post-Transient Analysis

The post transient study focused on identifying NERC/WECC/CAISO voltage criteria violations. The study found that the Project did not trigger any new Post Transient voltage criteria violations.

Previous studies for higher queued projects have identified the need to maintain "South of Vincent" power flows at or below approximately 8,500 MW if no upgrades South of Vincent beyond TRTP are assumed. This study concluded that the Project will not impact the existing system's South of Vincent area export capability. However, depending on dispatch, the addition of the Project can increase South of Vincent area export. Due to the fact that the amount of existing and higher queued generation is already sufficient to exceed 8,500 MW South of Vincent flows, operational mitigation measures to manage South of Vincent flow levels is required to accommodate higher queued projects. The dispatch of this Project will also need to be subject to the same operational limitations as all higher queued projects with regard to South of Vincent area export capability.

Transient Stability Analysis

Using the latest revision of the GE PSLF models for higher queued projects, several higher queued projects were found to exhibit characteristics of sympathetic tripping under normally cleared fault conditions. With modified parameters to eliminate the sympathetic tripping of the higher queued projects in simulations, the transient stability study concluded that the addition of the Project would not trigger any transient stability criteria violations on the SCE system.

Short Circuit Duty

A Short Circuit Duty analysis was performed for th[redacted] This analysis used the best short circuit duty case available at this time which includes the latest information available to date regarding all active higher queued generation projects in the area with studies already completed.

These limited results showed that the [redacted] Project may increase SCD by at least 0.1 kA at one location (Windhub 66 kV Substation). This indicates that the SCD impact of the Project is not negligible, and that a more detailed SCD analysis, including the latest available details for all higher LGIP and SGIP queued projects, will be required as part of the Facilities Study.

Deliverability Assessment

The [redacted] Project is pursuing interconnection under the SCE WDAT SGIP Tariff. In terms of deliverability status, all small generation projects (including those under the SCE WDAT SGIP) are considered as "Energy Only" projects by CAISO and therefore no deliverability assessment is performed.

Distribution and Interconnection Facilities

The System Impact Study identified the direct assignment Distribution and Interconnection Facilities required to interconnect the Project. The estimated cost for the interconnection facilities including corporate real estate, licensing, environmental permitting, and telecommunication facilities cost is approximately $6,500,000. It is important to note that the project directly queued ahead of [redacted] triggered the need for a new third 220/66 kV transformer bank at Windhub Substation with an estimated distribution cost of $17,400,000. This cost may shift to [redacted] if higher queued projects requesting interconnection in the Windhub 66 kV area ultimately withdraw.

Transmission Network Upgrades

The System Impact Study found that the addition of the Project did not trigger the need for any new transmission network upgrades.

Facilities Study

A Facilities Study ("FAC") will be required after the SIS, to address facility upgrades required for the Project. If necessary, further review of the Project's SCD impact may be performed as part of the Facilities Study.

Project Schedule

The estimated time to engineer, procure equipment and construct the interconnection facilities and upgrades for the Project is 24 months from the time SCE receives an Authorization to Proceed. This schedule does not include corporate real estate, licensing/permitting or environmental schedules needed to support the project. If permitting is needed for the interconnection facilities the estimated time to complete the Project could take up to 60 months.

The IC has requested an in-service date of [redacted] for the Project. The ability to meet the requested in-service date of the Project may be impacted by EKWRA construction activities. Coordination between EKWRA construction activities and construction of facilities needed to interconnect this project will need to be fully vetted once additional projects specific details are provided, such as actual gen-tie routing.

CONTENTS

[redacted]

SYSTEM IMPACT STUDY

I. INTRODUCTION

Southern California Edison Company ("SCE") received an interconnection request from [redacted] for the interconnection of its 20 MW Project to SCEs Windhub 66 kV Substation, pursuant to the Small Generator Interconnection Procedures ("SGIP") under the Wholesale Distribution Access Tariff ("WDAT"). The [redacted] photovoltaic solar power plant is to be located in Mojave, CA, with the project site located [redacted] of SCE Windhub Substation. The requested in-service date is [redacted]

In accordance with the SCE's WDAT SGIP, SCE performed an interconnection SIS to determine the adequacy of SCE's electrical system, including both the SCE distribution system and the CAISO controlled grid, to accommodate the Project. The Study was performed for two system conditions: a 2014 heavy summer with a one-in-ten load forecast and a 2014 light spring load forecast (65% of the heavy summer load). These conditions reflect the most critical expected loading condition for the transmission system in SCE's area.

The study included all active generation applications in the study area, regardless of in-service dates, that were submitted prior to the Project application. This includes several higher queued serial projects active in either the CAISO SGIP or the SCE Wholesale Distribution Access Tariff ("SCE WDAT") SGIP. This also includes numerous CAISO Large Generator Interconnection Procedures ("LGIP") and SCE WDAT Clustering Large Generation Interconnection Procedures ("CLGIP") queued generation projects.

The study included the modeling of the East Kern Wind Resource Area ("EKWRA") 66 kV reconfiguration project. This project was proposed by SCE in the CAISO 2010 Transmission Plan as a reliability project to address numerous reliability criteria violations in the existing Antelope-Bailey 66 kV network. This project was presented and recommended for approval by CAISO at the February 16, 2010 CAISO transmission plan stakeholder meeting. The EKWRA project has a proposed in-service date of December 2013.

The study accuracy and results for the assessment of the system adequacy are contingent on the accuracy of the technical data provided by [redacted] Any changes from the data provided could void the study results. The Study report provides detailed Study assumptions and conditions of the system in which the Study was conducted.

[redacted]

II. STUDY CONDITIONS AND ASSUMPTIONS

A. Planning Criteria

The study was conducted by applying the CAISO Reliability Criteria. The main criteria applicable to this study are as follows:

Power Flow Analysis

The following contingencies are considered for transmission and sub-transmission lines and 500/220 kV transformer banks ("AA-Banks"):

- Single Contingencies (N-1) – Loss of one line or one AA-Bank and selected overlapping outages of one generation unit and one transmission line
- Double Contingencies (N-2) – Loss of two lines or one line and one AA-Bank identified as common mode failure elements (Outages of two AA-Banks are beyond the Planning Criteria)

Single contingency followed by another single contingency (N-1-1) – Overlapping outages associated with two transmission elements allow for system readjustments which could effectively curtail full output of this project. As such, N-1-1 contingencies resulting in an overload would be addressed with generation curtailment thus eliminating the generation project's corresponding contribution. The following reliability criteria are used:

Transmission Lines	Base Case N-1 N-2	Limiting Component Normal Rating Limiting Component A-Rating Limiting Component B-Rating
AA-Banks (500/220 kV) Transformer Banks	Base Case Long Term & Short Term	Normal Loading Rating As defined by SCE Operating Bulletin

System upgrades for transmission lines are generally recommended for all reliability criteria violations. Special Protection Systems ("SPS") may be allowed for single contingency and credible double contingencies reliability criteria violation in place of system upgrades, provided that the SPS complies with the CAISO Planning Standards' New Generator SPS Guidelines.

The following principles were used in determining whether congestion management, SPS, or facility upgrades are required to mitigate base case, single contingency, and/or double contingency overloads:

- Congestion management, as a means to mitigate base case overloads, can be used if it is determined to be manageable and the CAISO Operations concurs with the implementation. Congestion management to mitigate criteria violations may include curtailment of the proposed generation project in real time as needed.

[redacted]

- Facility upgrades will be required if it is determined that the use of congestion management for base case overloads is unmanageable.

- SPS will be recommended for criteria violations under outage conditions if it effectively mitigates system problems, does not jeopardize system integrity, does not exceed the current CAISO single and double contingency tripping limitations, does not adversely impact existing or proposed SPS in the area, and conforms to existing CAISO SPS Guidelines.

- Facility upgrades will be required if the use of an SPS is determined to be ineffective, system integrity is jeopardized, the amount of generation tripping exceeds the current CAISO single and double contingency tripping limitations, adverse impacts are identified to existing or proposed SPS in the area, or the SPS does not conform with the existing SPS Guidelines.

The following study method was implemented to assess the extent of possible congestion:

a) Under Base Case with all transmission facilities in service, the system was evaluated with all existing interconnected generation and all generation requests in the area that have a queue position ahead of this request (pre-project). Included in the study are CAISO-approved transmission projects queued ahead of the generation interconnection request.

b) Under Base Case with all transmission facilities in service, the system was reevaluated with the inclusion of the Project (post-project).

If the emergency loading limits of facilities are exceeded in (a), the overload is identified as an existing overload that was triggered by a project in queue ahead of the Project. If the emergency loading limits of facilities are exceeded in (b) and were not exceeded in (a), the overload is identified as triggered by the addition of the Project. The Project and other market participants in the area may be subjected to congestion management, potential upgrade cost and/or participation of any proposed SPS if the project addition aggravates or triggers the overload. Additionally, the Project may have to participate in mitigation of overloads triggered by subsequent projects in queue, subject to FERC protocols and policies.

Results of these studies should identify:

a) If the system is adequate to accommodate the proposed Project and all projects ahead in queue without the need for congestion management, SPS, or facility upgrades

b) If base case violations exist in the area without the Project after the addition of all projects in queue ahead of the Project

c) If base case violations are triggered in the area with the addition of the Project after the addition of all projects in queue ahead of the Project

[redacted]

The range of base case congestion for the Project will be determined by reducing market generation in the area including the Project. For single outage conditions, the same methodology will be used to identify how much generation tripping is required in order to determine if use of an SPS is appropriate. Use of SPS will be deemed inappropriate if the total amount of generation reduction is found to exceed 1,150 MW under loss of one transmission element and 1,400 MW under loss of two transmission elements. These limits are established by the CAISO utilizing the current Spinning Reserve Criteria.

B. Generation and Load Assumptions

To simulate the SCE transmission system for analysis, the study used databases that were developed to conduct SCE's Annual CAISO Controlled Facilities Expansion Program. The bulk power study considered two load conditions: 2014 heavy summer and a 2014 light spring case which assumed 65% of heavy summer load forecast. The heavy summer and light spring load study assumptions are provided below in Table 4 respectively.

The study evaluated conditions with dispatch of generation inside and outside of the SCE service territory and electrical system in a manner that maximized loadings in the north of Vincent area. This included adjusting the imports on the Midway – Vincent (Path 26) and modeling all pertinent queued ahead generation projects in the vicinity of the Northern Area.

The study included all higher queued LGIP serial projects and all active Transition Cluster ("TC") projects. In addition, the study included all higher queued serial SGIP projects that were qualified to remain serial following the recently implemented CAISO GIP tariff modifications. Generation assumptions for projects that were modeled in this study are provided below in Table 1 through 3 respectively.

[redacted]

Table 1
HIGHER QUEUED SERIAL INTERCONNECTION REQUESTS

CAISO Queue Position	Type	Size (MW)
CAISO Queue #20	New Wind Project	300
SCE WDAT 190	Combustion Turbine	50
CAISO Queue #73	New Wind Project	250
CAISO Queue #79	New Wind Project	51
CAISO Queue #84	New Wind Project	340
CAISO Queue #86 A	New Wind Project	33
CAISO Queue #86 B	New Wind Project	34
CAISO Queue #91	New Wind Project	51
CAISO Queue #92	Combined Cycle	570
CAISO Queue #93	New Wind Project	220
CAISO Queue #94	New Wind Project	180
CAISO Queue #95	New Wind Project	550
CAISO Queue #96	New Wind Project	600
CAISO Queue #97	New Wind Project	160
CAISO Queue #100	New Wind Project	120
CAISO Queue #119	New Wind Project	500
CAISO Queue #132	New Wind Project	297
CAISO Queue #153	New Wind Project	100
	Total	**4,406**

[redacted]

Table 2
TRANSITION CLUSTER INTERCONNECTION REQUESTS

CAISO Queue Position	Type	Size (MW)
CAISO Queue #154	New Solar Project	250
CAISO Queue #175	New Wind Project	650
CAISO Queue #188	New Wind Project	200
CAISO Queue #297	New Solar Project	66
CAISO Queue #342	New Solar Project	50
CAISO Queue #348	New Solar Project	40
CAISO Queue #349	New Solar Project	100
CAISO Queue #407	New Solar Project	325
CAISO Queue #408	New Solar Project	325
CAISO Queue #409	New Wind Project	150
CAISO Queue #412	New Solar Project	250
SCE WDAT 270	New Solar Project	33
	Total	**2,439**

Table 3
HIGHER QUEUED SGIP INTERCONNECTION REQUESTS

CAISO Queue Position	Type	Size (MW)
CAISO Queue #486	Solar	20
CAISO Queue #522A	Solar	20
CAISO Queue #522B	Solar	20
SCE WDAT 361	Solar	5
SCE WDAT 368	Solar	5
SCE WDAT 390	Solar	20
SCE WDAT 391	Solar	20
SCE WDAT 392	Solar	20
SCE WDAT 394	Solar	20
CAISO Queue #531A	Solar	20
CAISO Queue #537A	Wind	19.5
SCE WDAT 402	Solar	10
	Total	**199.5**

[redacted]

Table 4
Antelope-Bailey 66 kV Assumptions

Bus Name	Summer		Spring	
	P Load	Q Load	P Load	Q Load
Northern 66 kV Portion				
Breeze	26.1	0.0	26.1	0.0
[redacted]				
Southern 66 kV Portion				
Acton	17.4	0.0	10.1	0.0
[redacted]				

[redacted]

C. Project

The Project is geographically located [redacted] of SCE's Windhub Substation. Specifically the project is proposed to be located in Mojave, California. The [redacted] meters and metering equipment at the Small Generating Facility site. [redacted] proposes to interconnect the Project to SCE's Windhub 66 kV Substation. [redacted] requested an operating date of November 14, 2014.

The dynamic data used to represent the photovoltaic generator in the GE PSLF Dynamic Software is consistent with the use of the [redacted] These inverters are typically integrated with an array of PV modules, step-up transformers and other balance-of-system components necessary to convert solar irradiance to grid-quality AC power for delivery at transmission or distribution voltage.

A geographic map illustrating the proposed project location is provided below in Figure 1 and a single line diagram illustrating the interconnection as modeled in this study is provided in Figure 2.

Figure 1
Project Geographic Map

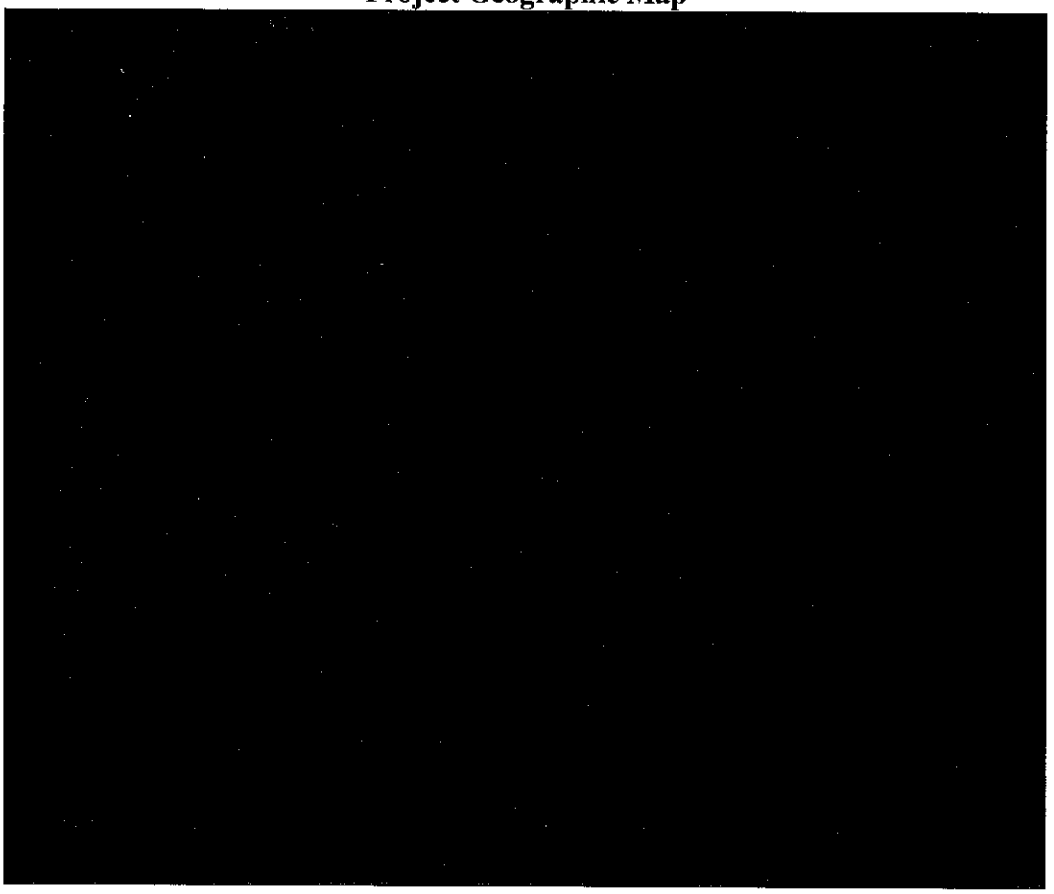
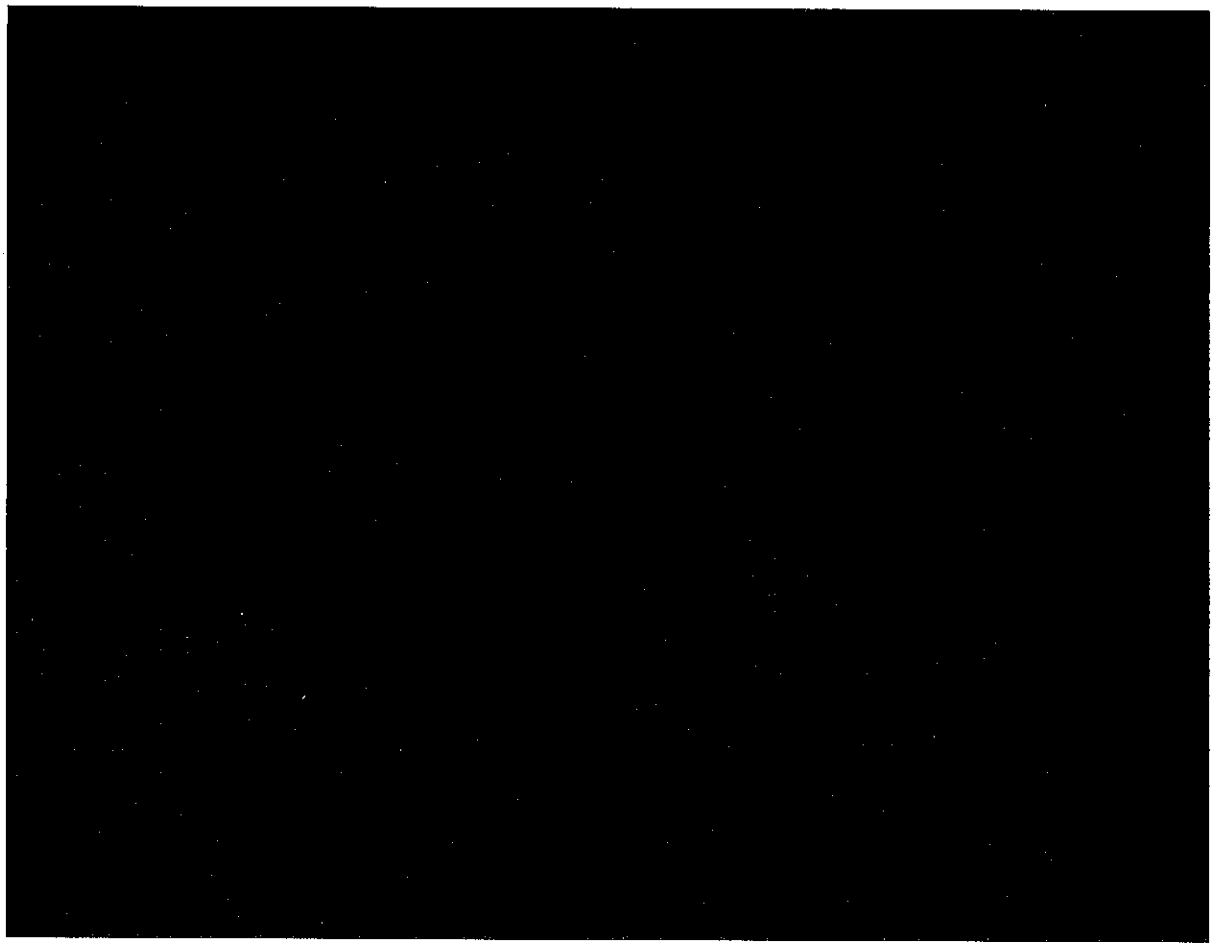


Figure 2

[redacted]

Single Line Diagram as Modeled in this Study



D. Transmission Upgrades to be Included in the Base Cases

A number of transmission upgrades are needed to support queued ahead serial generation projects in the Northern area listed above in Tables 1 through 3. These upgrades are listed below.

1. The Antelope Transmission Project (ATP)

The Antelope Transmission Project ("ATP") consists of new transmission between Antelope and Pardee, between Antelope and Vincent, and between Antelope and Tehachapi. The project also includes the addition of two new substations in the Tehachapi Wind Resource Area ("TWRA"). This project is broken down into the following three segments:

Segment 1:

- Expand Antelope Substation and rating increase to 500 kV

[redacted]

- New 25.6-mile Antelope - Pardee single-circuit 500 kV transmission line

Segment 2:

- New 21.0-mile Antelope-Vincent single-circuit 500 kV transmission line

Segment 3:

- New 25.6-mile Antelope - Windhub single-circuit 500 kV transmission line
- New 9.6-mile Highwind - Windhub single-circuit 220 kV transmission line
- Two New Tehachapi area substations (Windhub and Highwind)

With the addition of the Antelope Transmission Project, the maximum amount of increased system capability has been identified to be 700 MW, as limited by transmission south of Antelope.

2. The Tehachapi Transmission Project (TRTP)

The Tehachapi Renewable Transmission Project ("TRTP") is the final plan of service developed to interconnect approximately 4500 MW of new planned generation resources, which also includes the 700 MW provided by the ATP, in the TWRA. These facilities, needed to interconnect and transmit the electrical power from the new planned generation resources, have been identified through a collaborative planning process held as part of the CAISO South Regional Transmission Plan; and commence upon completion of ATP. Summarized below are the major components of these facilities.

Segment 4:

- New 16-mile Antelope-Whirlwind 500 kV transmission line
- New 500 kV transmission lines to loop existing Midway-Vincent No.3 500 kV line in and out of proposed Whirlwind (part of Segment 9) Substation
- Whirlwind 500/220 kV switchyard equipment required to support loop-in

Segment 5:

- New 18-mile Antelope-Vincent No.2 single-circuit 500 kV transmission line in existing ROW

Segment 6:

- Replacement of Rio Hondo-Vincent No.2 transmission line 500 kV

  Rebuild approximately 32 miles of existing 220 kV transmission line to 500 kV standards from existing Vincent Substation to the southern boundary of the Angeles National Forest ("ANF").

Segment 7:

- New Mira Loma - Vincent 500 kV transmission line (Vincent-Mesa Area)

  Rebuild approximately 16 miles of existing 220 kV transmission line to 500 kV standards from the southern boundary of the ANF to existing Mesa Substation.

[redacted]

This segment would replace the existing Antelope – Mesa 220 kV transmission line.

Segment 8:

- New Mira Loma - Vincent 500 kV transmission line (Mesa Area-Mira Loma)

  Rebuild of approximately 33 miles of existing 220 kV transmission line to 500 kV standards from a point approximately 2 miles east of the existing Mesa Substation (the "San Gabriel Junction") to the existing Mira Loma Substation. This segment would also include the rebuild of approximately 7 miles of the existing Chino – Mira Loma No. 1 line from single-circuit to double-circuit 220 kV structures.

Segment 9:

- New 500/220 kV Whirlwind Substation, located near the intersection of 170th Street and Rosamond Boulevard in Kern County
- Upgrade of the existing Antelope, Vincent, Mesa, Gould, and Mira Loma Substations to accommodate new transmission line construction and system compensation elements

Segment 10:

- New 17 mile Whirlwind - Windhub 500 kV transmission line

Segment 11:

- New Mesa - Vincent (via Gould) 500/220 kV transmission line

  Rebuild approximately 19 miles of existing 220 kV transmission line to 500 kV standards between the existing Vincent and Gould Substations. This segment would also include the addition of a new 220 kV circuit on the vacant side of the existing double-circuit structures of the Eagle Rock – Mesa 220 kV transmission line between the existing Gould Substation and the existing Mesa Substation.

3. *"East Kern Wind Resource Area 66 kV Reconfiguration Project" (OD 2013)*

The East Kern Wind Resource Area ("EKWRA") 66 kV project will separate the existing Antelope-Bailey 66 kV system into two systems. The northern system will be served in a radial fashion from Windhub Substation. The southern system will remain parallel to the 220 kV system at Antelope and Bailey and will retain the label of the Antelope-Bailey 66 kV system. All north-to-south lines that once connected the northern system to the southern system will be opened. Summarized below are the major components of these facilities.

Antelope-Bailey 66 kV System

The Antelope-Bailey 66 kV system will be reconfigured to serve a total of 27 load centers and retain three normally open tie lines to the Windhub 66 kV system. The distribution load centers are: Acton, Anaverde, Bailey, Del Sur, Frazier Park, Gorman, Great Lakes, Lancaster, Little Rock, Neenach, Oasis, Palmdale, Piute, Quartz Hill, Redman, Ritter Ranch, Rosamond, Shuttle, and Wilsona Substations. The eight

[redacted]

customer substations are: Helijet, Lanpri, Oso[1], Purify, Rite Aid, Rock Air, Tortoise, and Westpac Substations.

The Antelope-Bailey system will have three tie lines to the Windhub system:

- Antelope-Cal Cement-Rosamond 66 kV (normally open at Cal Cement)
- Corum-Goldtown-Rosamond 66 kV (normally open at Corum)
- Gorman-Kern River 66 kV (normally open at Gorman)

Windhub 66 kV System

The Windhub System will have a total of 11 load centers, 389 MW of nameplate local generation and three tie lines. Windhub system will have eight distribution load centers: Corum, Cummings, Goldtown, Havilah, Loraine, Monolith, Northwind and Walker Basin and three large customer substations: Breeze, Cal Cement and Correction.

A total of 389 MW of nameplate local generation in the Antelope-Bailey system will be transferred to the Windhub substation. This includes 310 MW of coincident wind generation from Windpark, Windland, and Windfarm and 34 MW of coincident hydro generation from Borel and Kern River.

The Windhub system will have three tie lines:

- Antelope-Cal Cement-Rosamond 66 kV (normally open at Cal Cement)
- Corum-Goldtown-Rosamond 66 kV (normally open at Corum)
- Gorman-Kern River 66 kV (normally open at Gorman)

Substations

There will be line rearrangements in the following substations: Antelope, Cal Cement, Corum, Goldtown, Gorman, Kern River, Lancaster, Monolith, Rosamond, Windfarm, Windland, and Windpark.

- Antelope Substation: Two existing 66 kV lines will be operated as tie lines.
- Goldtown Substation: An existing line will be configured to Windhub-Goldtown-Midwind-Monolith-Morwind and the termination of Goldtown-Lancaster will be de-energized.
- Cal Cement Substation: Four existing 66 kV lines will be configured to Cal Cement-Windpark 66 kV, Windhub-Cal Cement-Monolith, Windhub-Cal Cement, Antelope-Cal Cement-Rosamond 66 kV.
- Gorman and Kern River Substations: The line terminating at Gorman to Kern River No. 1 will be operated as a tie line.
- Lancaster Substation: The existing Goldtown-Lancaster 66 kV line will be configured to Lancaster-Rosamond.
- Monolith Substation: Two existing substation lines will be reconfigured to Windhub-Goldtown-Midwind-Monolith-Morwind and Windhub-Cal Cement-Monolith.

[1] Oso load will be rolled to Alamo Substation.

[redacted]

- Windhub Substation 66 kV switch rack will be configured to a breaker-and-a-half configuration. Initially there will be two 280 MVA transformer banks, three capacitor banks and five 66 kV lines.
- Rosamond Substation: Two 66 kV lines will be reconfigured; Corum-Rosamond will be reconfigured to Corum-Goldtown-Rosamond with the Corum and Goldtown leg normally open and operated as a tie line. A new line will be terminated at Rosamond, Lancaster-Rosamond.
- Corum Substation: Existing Corum-Rosamond 66 kV line will configured as Corum-Goldtown-Rosamond.

Subtransmission lines

The following existing 66 kV subtransmission lines will be rearranged:

- Goldtown-Lancaster
- Corum-Rosamond
- Cal Cement-Monolith-Rosamond-Windfarm
- Cal Cement-Goldtown-Monolith-Windland
- Cal Cement-Monolith-Windpark
- Antelope-Cal Cement

The EKWRA project will result in the following newly reconfigured lines:

- Windhub-Cal Cement
- Windhub-Cal Cement-Monolith
- Windhub-Goldtown-Midwind-Monolith-Morwind
- Windhub-Canwind-Enwind-Varwind
- Windhub-Dutchwind-Flowind
- Cal Cement-Windpark
- Corum-Goldtown-Rosamond
- Arbwind-Monolith
- Lancaster-Rosamond
- Antelope-Cal Cement-Rosamond

4. *"Transition Cluster Phase II Upgrades"*

Upgrades for the Transition Cluster Phase II projects in the Northern bulk system include:

- Installation of second and third AA bank transformers at Whirlwind Substation
- Sectionalization of Windhub 220 kV bus for SCD mitigation
- Installation of Whirlwind AA bank transformer N-1 SPS
- Installation of Windhub AA bank transformer N-1 SPS
- Use of congestion management (8500 MW South of Vincent area export limit)
- Installation of "TRTP Internal" 500 kV transmission line N-2 SPS
- Rebuild of Neenach Substation

[redacted]

E. Existing Special Protection Systems

The existing system has several existing Special Protection Systems ("SPS") for single and double element outage conditions. The relevant SPS that may be impacted by the Project include the Big Creek SPS, Pastoria Energy Facility ("PEF") SPS, and Path 26 SPS.

F. Power Flow Study

The Project System Impact Study considered two power flow study scenarios. Each case was derived from CAISO Expansion Study base cases.

a). SCE System with a 2014 Heavy Summer load forecast and all serial generation projects in queue ahead of Project and associated upgrades if known, Case 1.

The study considered heavy load conditions with generation patterns and Path 26 imports dispatched in a manner that would stress the SCE system in the area of interconnection of Project. This was done in order to identify the extent of potential congestion. Generation included: Regulatory must-take, all existing generation in the Northern areas, and all other proposed generation projects in queue ahead of Project.

b). SCE System with a 2014 Heavy Summer load forecast and all serial generation projects in queue ahead of Project and associated upgrades, if known, and the inclusion of Project, Case 2.

Case 1 was modified to include Project modeled at the requested point of interconnection with a net generation of 20 MW.

c). SCE System with a 2014 Light Spring load forecast and all generation projects in queue ahead of Project and associated upgrades if known, Case 3.

The study considered light load conditions with generation patterns and Path 26 imports dispatched in a manner that would stress the SCE system in the area of interconnection of Project. This was done in order to identify the extent of potential congestion. Generation included: Regulatory must-take, all existing generation in the Northern areas, and all other proposed generation projects in queue ahead of Project.

d). SCE System with a 2014 Light Spring load forecast and all generation projects in queue ahead of Project and associated upgrades, if known, and the inclusion of Project, Case 4.

Case 3 was modified to include Project modeled at the requested point of interconnection with a net generation of 20 MW.

Additional Power Flow Study assumptions are summarized in Table 5 below.

[redacted]

Table 5
Power Flow Study Assumptions (MW)

Area Assumptions	2014 Heavy Summer		2014 Light Spring	
	Case 1 Pre-Project	Case 2 Post-Project	Case 3 Pre-Project	Case 4 Post-Project
Generation	21,771	21,712	18,326	18,339
Import	-4,603	-4,593	1,144	1,156
Load	25,670	25,670	16,729	16,729
Losses	633	634	453	454

G. Short Circuit Duty Study

To determine the impact on short-circuit duty, within SCE's electrical system, after inclusion of the Project, the study calculated the maximum symmetrical three-phase-to-ground short-circuit duties. Generation and transformer data represented in the generator and transformer data sheets provided by the customer were utilized. Bus locations where short-circuit duty is increased with the proposed Project by at least 0.1 kA and the duty is in excess of 60% of the minimum breaker nameplate rating are flagged for further review. Upon completion of the detailed circuit breaker review, circuit breakers exposed to fault currents in excess of 100 percent of their interrupting capacities will need to be replaced or upgraded, whichever is appropriate. It should be noted that other WECC entities may request specific information within the WECC process to evaluate potential impact within their respective systems of this project addition.

A limited Short Circuit Duty analysis was performed for this Project. This analysis used the best short circuit duty case available at this time which includes the latest information available to date regarding all active higher queued LGIP and SGIP projects.

H. Transient Stability Study

For transient stability evaluation, three-phase faults with normal clearing are studied for single contingencies; single-line-to-ground faults with delayed clearing are studied for double contingencies according to NERC/WECC planning criteria. The evaluation was conducted for the critical single and double contingencies affecting the area of interest. All outage cases were evaluated with the assumption that existing Special Protection Systems (SPS) or Remedial Action Schemes ("RAS") would operate as designed where required. The study results were evaluated utilizing the applicable Planning Criteria as summarized in Table 6 below.

[redacted]

Table 6
WECC DISTURBANCE-PERFORMANCE TABLE
OF ALLOWABLE EFFECTS ON OTHER SYSTEMS
(In addition to NERC requirements)

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 (See Note 2)
A	Not Applicable	Nothing in Addition to NERC		
B	≥ 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 **59.6 Hz** for 6 cycles or more at a load bus	Not to exceed **5%** at any bus
C	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 **59.0 Hz** for 6 cycles or more at a load bus	Not to exceed **10%** at any bus
D	< 0.033	Nothing in Addition to NERC		

Note 2: As an example in applying the WECC Disturbance-Performance Table, Category B disturbance in one system shall not cause a transient voltage dip in another system that is greater than 20% for more than 20 cycles at load buses, or exceed 25% at load buses or 30% at non-load buses at any time other than during the fault.

I. Post – Transient Voltage Study

The power flow study voltage results were used as a screen to identify those contingencies that may require additional post-transient voltage studies. Single and double contingencies identified in the power flow to have a voltage drop in excess of 5% were selected for post-transient voltage analysis. The Post-transient voltage studies compare voltage deviations to the NERC/WECC/CAISO reliability requirements including the SCE guidelines of 7% for single contingency outages and 10% for double contingency outages and identify those outages which result in a criteria violation. Mitigation measures will be recommended for any criteria violation identified.

J. Deliverability Assessment

The [redacted] Project is pursuing interconnection under the SCE WDAT SGIP Tariff. In terms of deliverability status, all small generation projects (including those under the SCE WDAT SGIP) are considered as "Energy Only" projects by CAISO and therefore no deliverability assessment is performed.

[redacted]

III. GENERATOR ELECTRIC GRID FAULT RIDE-THROUGH CAPABILITY CRITERIA AND POWER FACTOR CRITERIA

WECC has adopted a Generator Electrical Grid Fault Ride-Through Capability Criteria. CAISO and SCE currently support a Low Voltage Ride-Through Criteria to ensure continued reliable service. The Criteria is summarized as follows:

1. Generator is to remain in-service during system faults (three phase faults with normal clearing and single-line-to-ground with delayed clearing) unless clearing the fault effectively disconnects the generator from the system.

2. During the transient period, generator is required to remain in-service for the low voltage and frequency excursions specified in WECC Table W-1 (provided below) as applied to load bus constraint. These performance criteria are applied to the generator interconnection point, not the generator terminals.

3. Generators may be tripped after the fault period if this action is intended as part of a SPS.

4. This Standard will not apply to individual units or to a site where the sum of the installed capabilities of all machines is less than 10MVA, unless it can be proven that reliability concerns exist.

5. The performance criteria of this Standard may be satisfied with performance of the generators or by installing equipment to satisfy the performance criteria.

6. The performance criterion of this Standard applies to any generation independent of the interconnected voltage level.

7. No exemption from this Standard will be given because of minor impact to the interconnected system.

8. Existing generators that go through any refurbishments or any replacements are then required to meet this Standard.

[redacted]

IV. STUDY RESULTS

A. Power Flow Study Results

The power flow study focused on identifying system thermal overload problems on transformers and transmission lines in the CAISO-controlled transmission system with the addition of the Project.

A.1. Subtransmission Power Flow Study Results

With all queued ahead generation projects and all corresponding facility upgrades modeled, and with the system reconfigurations proposed as part of EKWRA, the power flow study found that the Project did not trigger new base case overloads requiring Subtransmission level mitigations. However, it is important to note that the project queued directly ahead of [redacted] was identified to trigger the need for a third 220/66 kV transformer bank at Windhub Substation. As such, withdrawals of higher queued projects in the Windhub 66 kV area may shift triggering cost responsibility of this distribution upgrade to the [redacted] Project. To address this possibility two scenarios where included in Table 7. The first provides the base case flow on the Windhub 220/66 kV transformer banks with the inclusion of the third transformer bank at Windhub and the second provides the base case flows without the inclusion to the third transformer bank at Windhub.

A.2. Transmission Power Flow Results

With both the Antelope Transmission Project (ATP) and Tehachapi Renewable Transmission Project (TRTP) in service, and with the addition of the Project, the study identified that the Project aggravated the Windhub 500/200 kV transformer bank overload, triggered by higher queued projects. The study found that the proposed SPS for the higher queued projects will be sufficient to mitigate the incremental impacts of the Project without any additional upgrades.

Table 7
Overloads with [redacted] Project

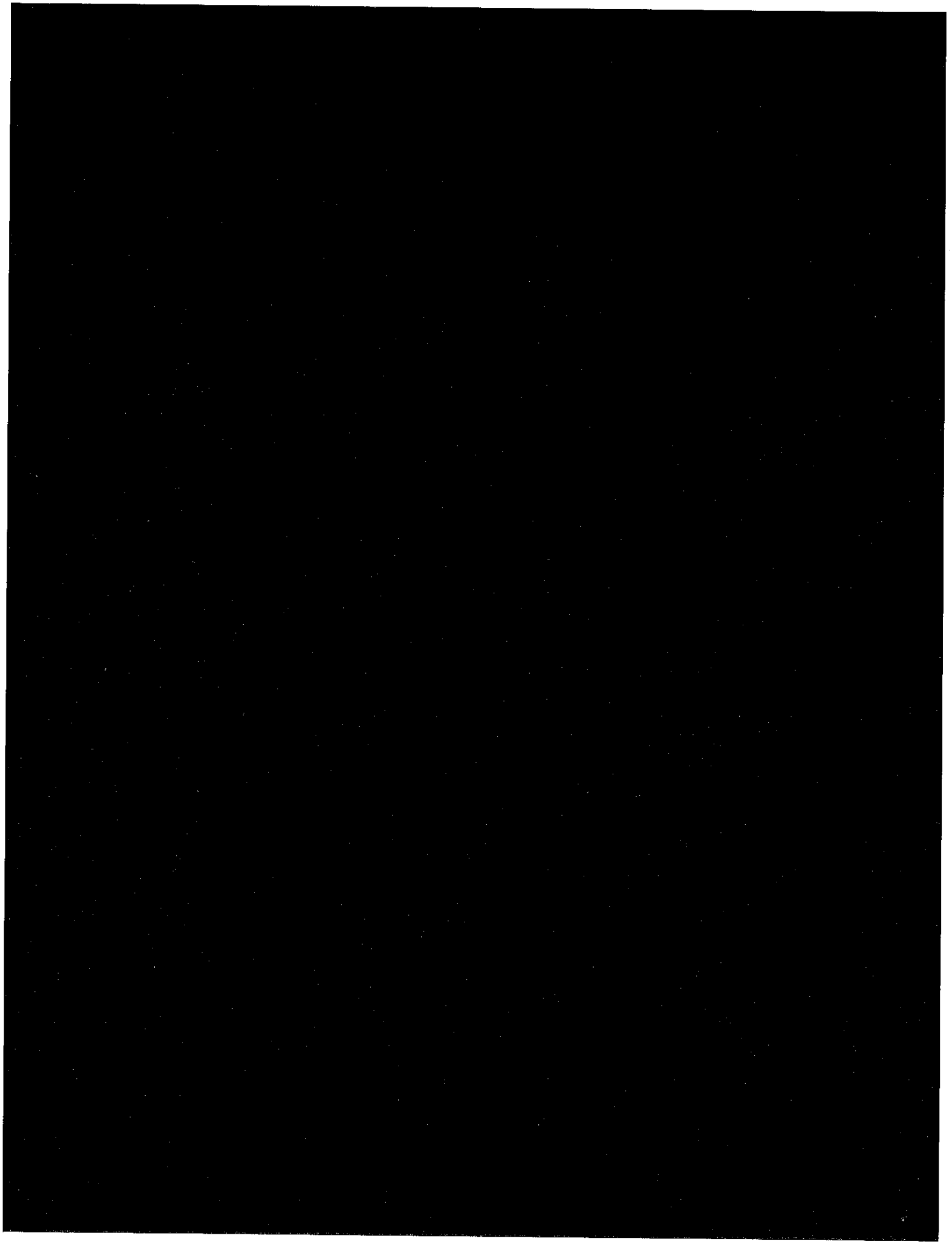
Overloaded Facility	Rating	Heavy Summer		Heavy Spring	
		Pre	Post	Pre	Post
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

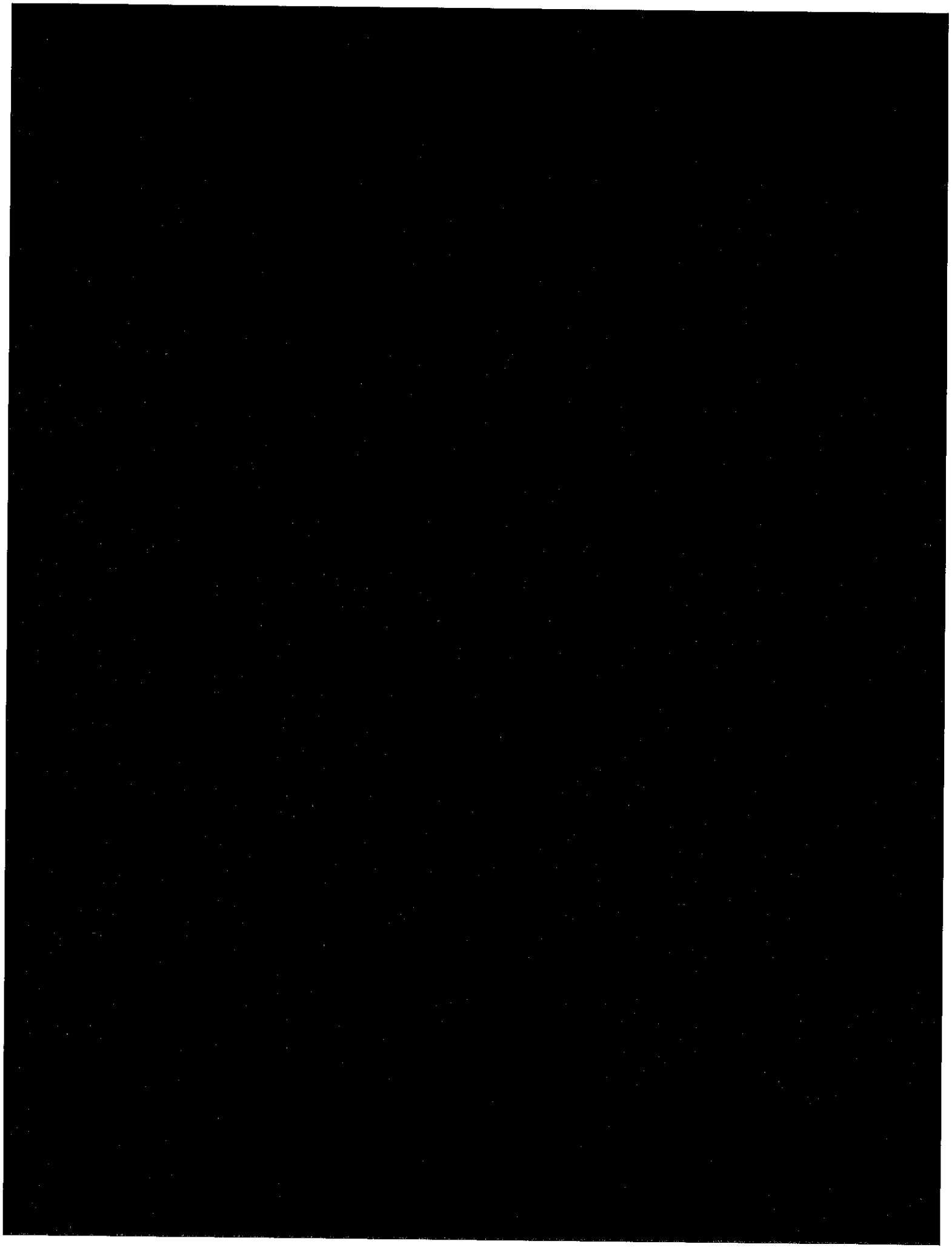
Note: N = normal and E = emergency. **Bold** stands for loading in excess of line capability.

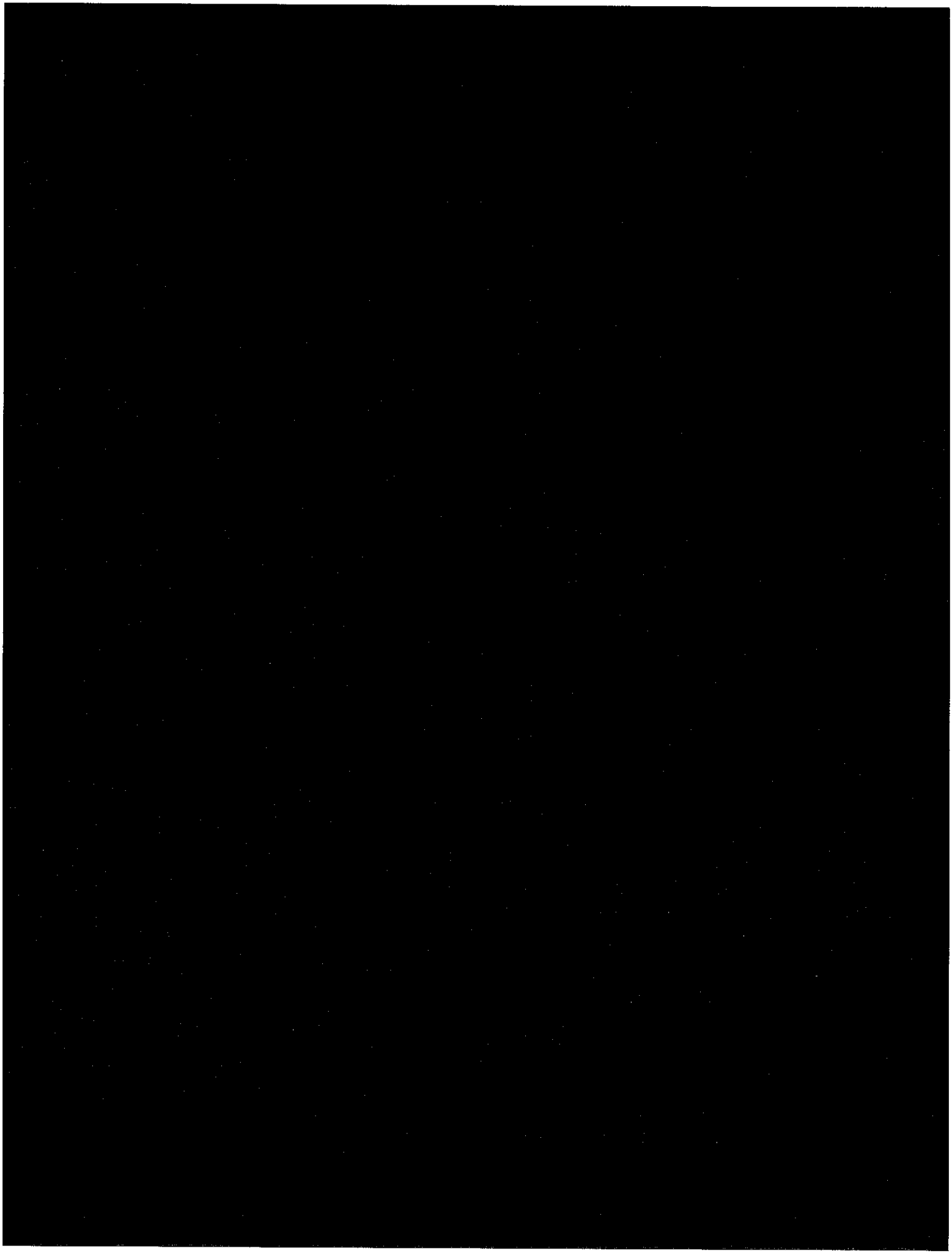
A.3. Power Flow Plots

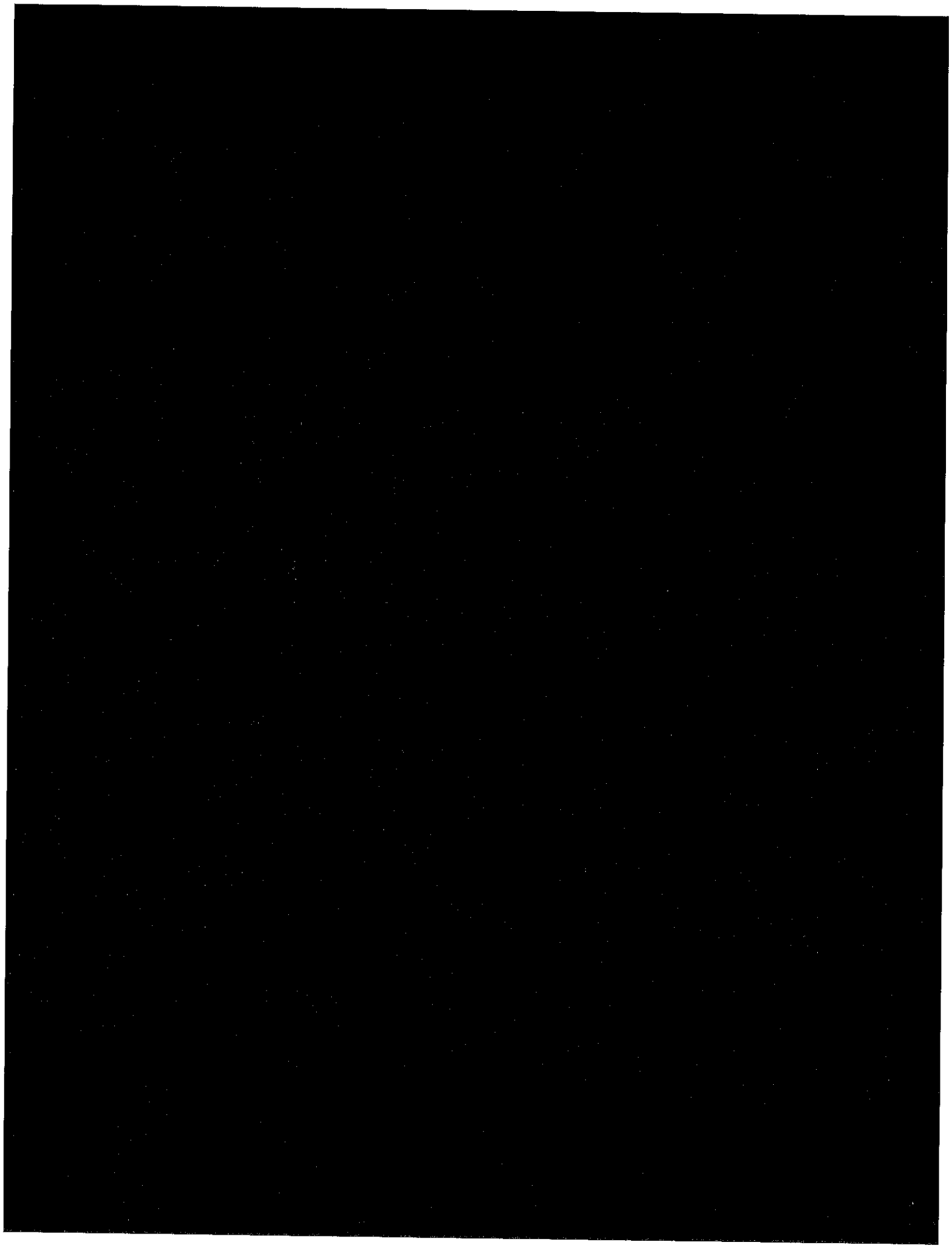
Base case power flow plots for both spring and summer conditions with the addition of the Project are shown in the figures below.

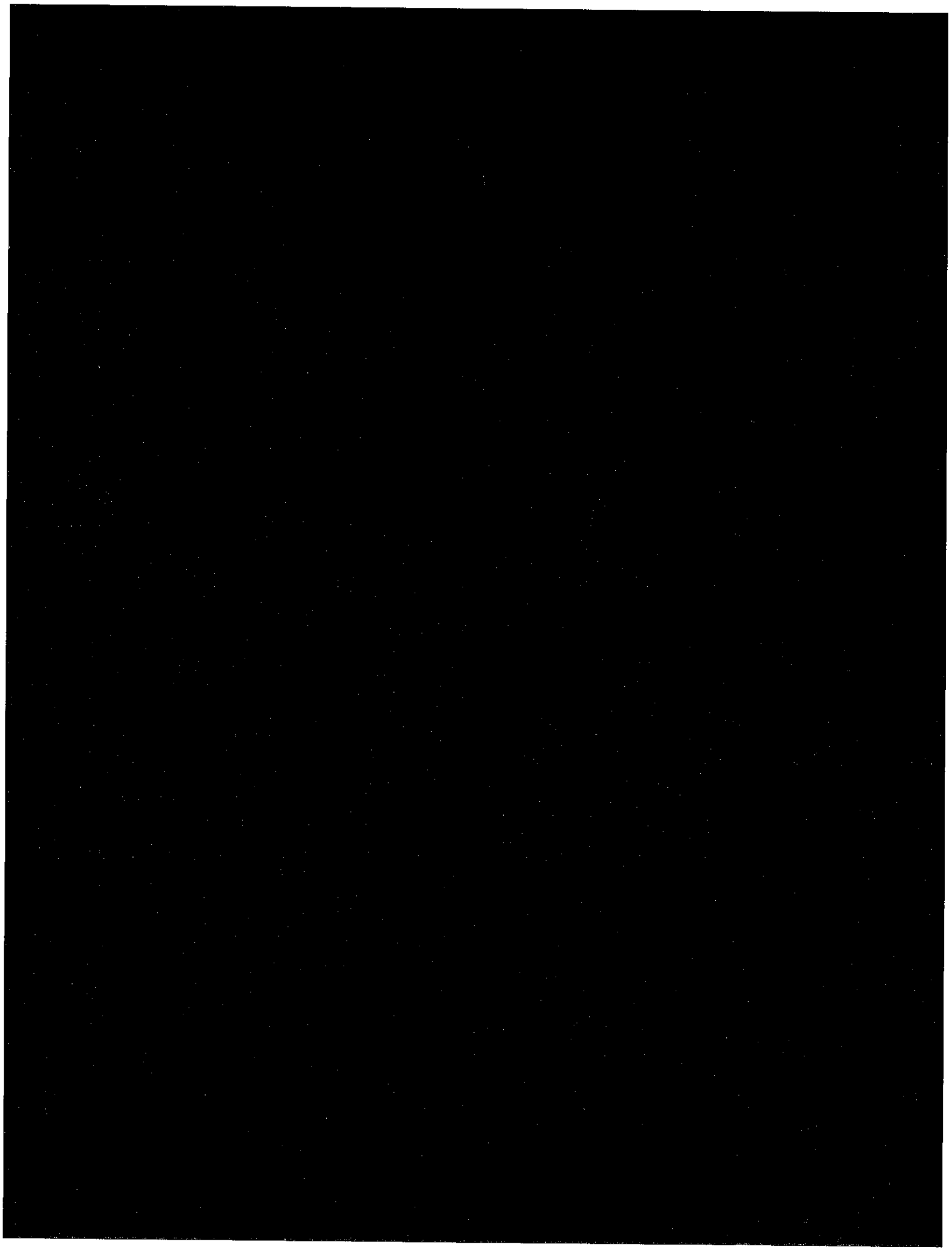
[redacted]

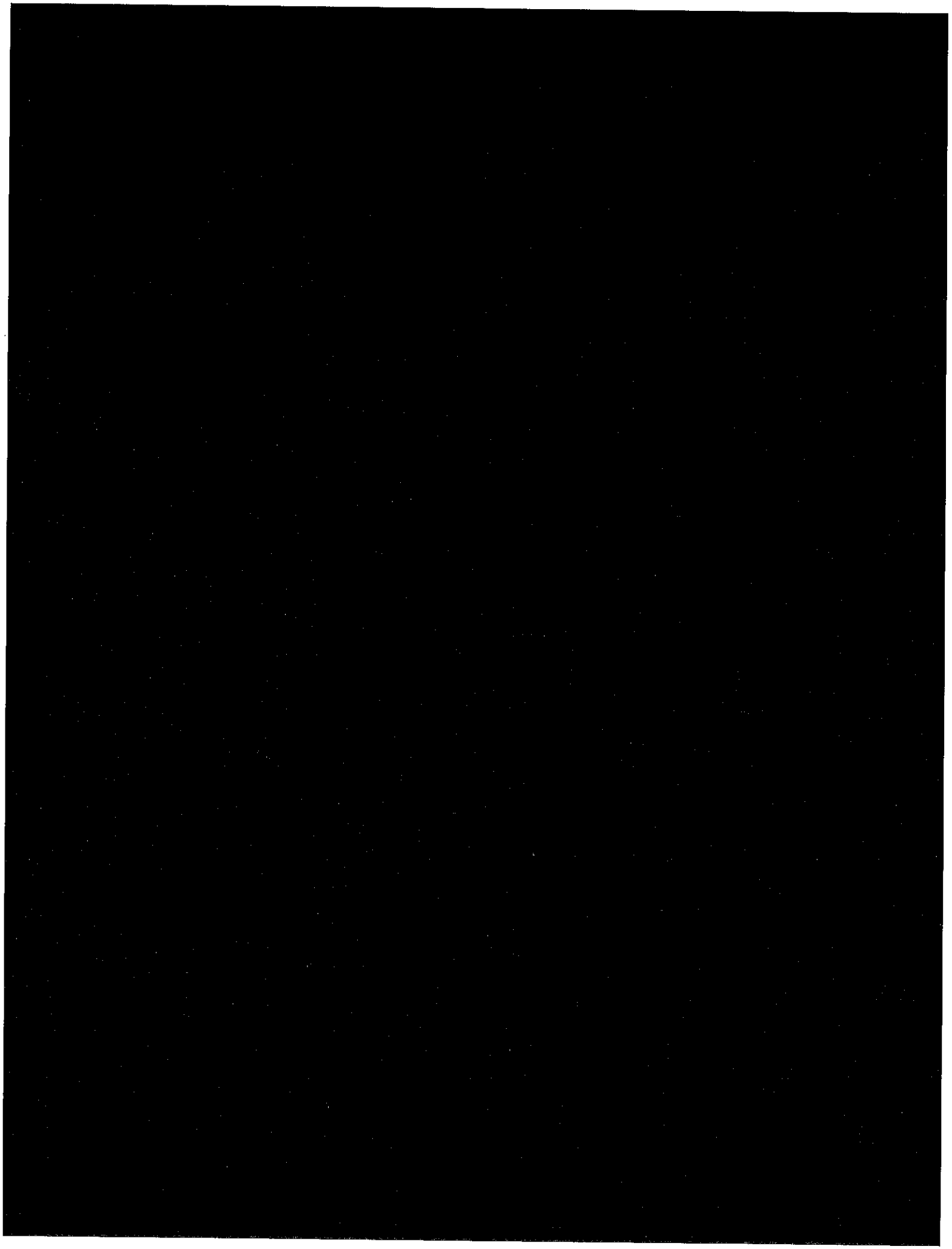


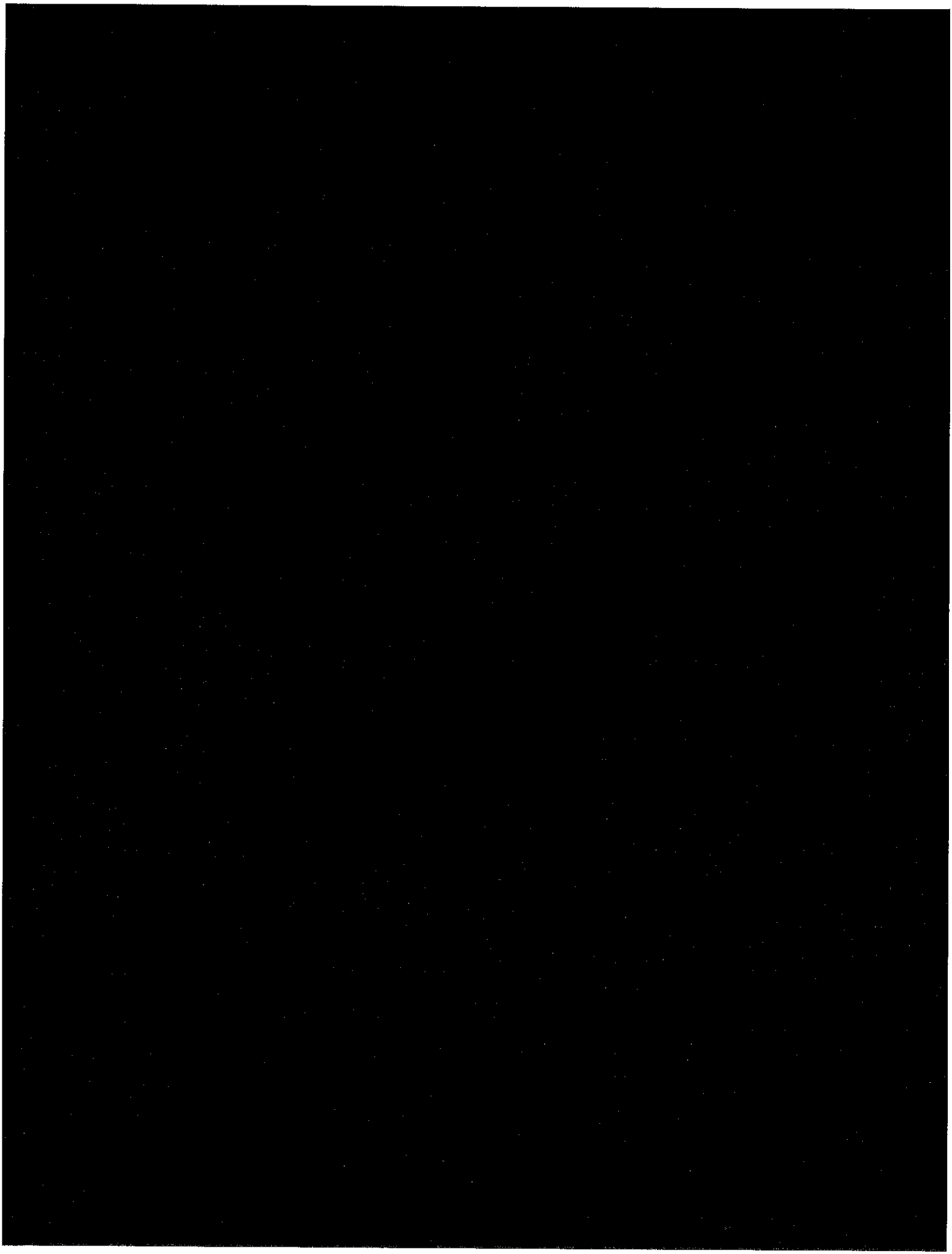


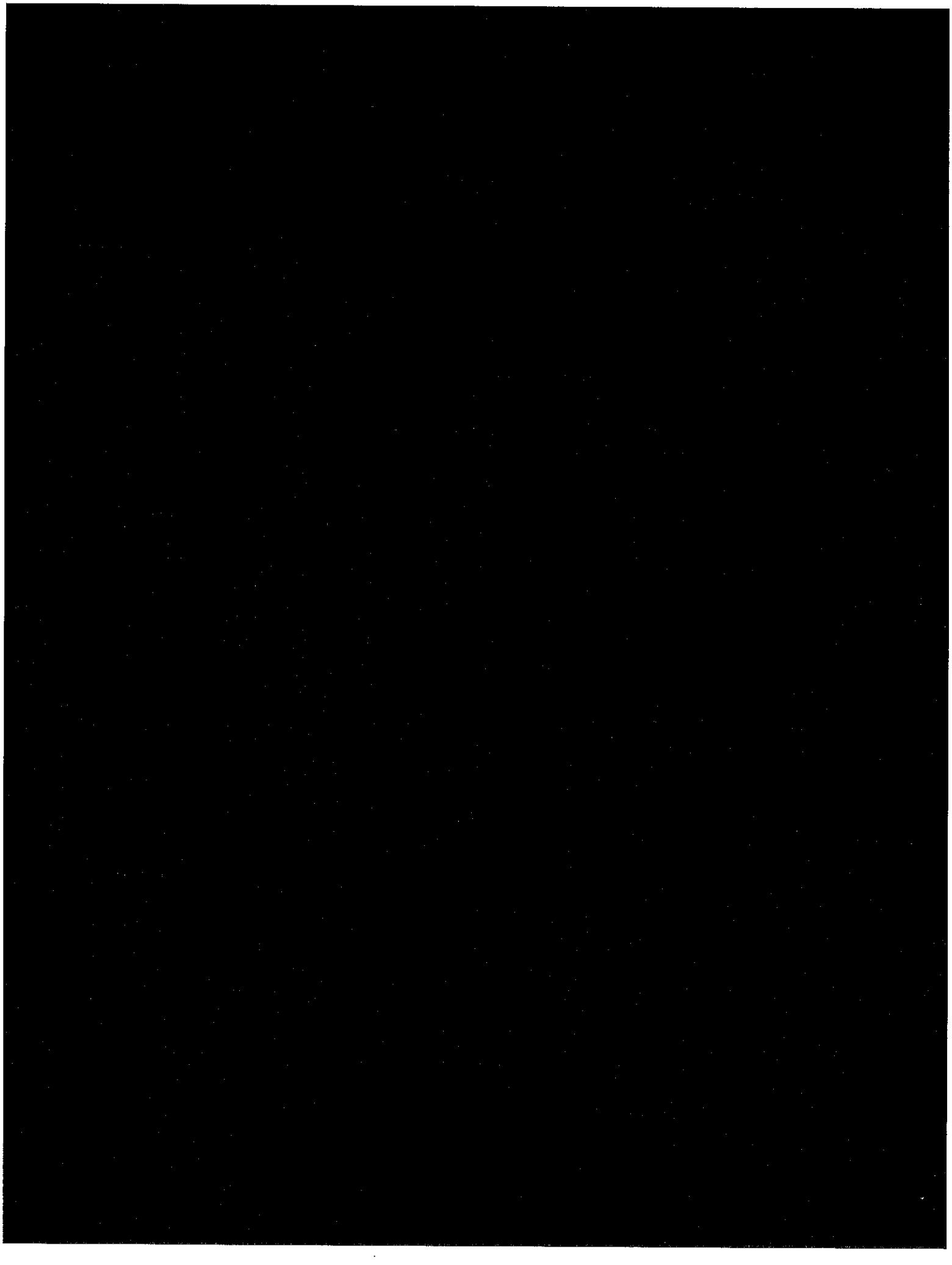












B. Short-Circuit Duty Study

B.1. Inverter Characteristics of the [redacted] Project

A preliminary short-circuit duty analysis was performed for the Project. [redacted] has identified that their Project will be using [redacted] The test reports obtained from the manufacturer indicates that the amount of short-circuit duty contribution is limited to [redacted] The contribution of the Project was modeled based on technical data provided by the inverter manufacturer and assuming that the Project will meet grid-level Low Voltage Ride-Through ("LVRT") requirements.

B.2. Preliminary Short Circuit Duty Study Results

In order to provide as much useful information as possible to [redacted] a limited Short Circuit Duty analysis was performed. This analysis used the best short circuit duty case available at this time which includes the latest information available to date regarding all active higher queued LGIP and SGIP projects. See Tables 8-1 and 8-2 below.

Table 8-1
3PH SCD impacts of [redacted] Project
(based on best available data for higher queued projects)

Bus Name	Bus KV	PRE CASE X/R	PRE CASE KA	POST CASE X/R	POST CASE KA	DELTA KA
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Table 8-2
SLG SCD impacts of SEPV7 Project
(based on best available data for higher queued projects)

Bus Name	Bus KV	PRE CASE X/R	PRE CASE KA	POST CASE X/R	POST CASE KA	DELTA KA
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

These limited results showed that the Project may increase SCD by at least 0.1 kA at one location (Windhub 66 kV Substation). This indicates that the SCD impact of the Project is not negligible, and that a more detailed SCD analysis, including the latest available details for all higher LGIP and SGIP queued projects, will be required as part of the Facilities Study.

V. DISCUSSION OF MITIGATION MEASURES

The System Impact Study found that the addition of the Project did not trigger the need for any transmission network upgrades for power flow, post-transient, or transient impacts. The transmission system SCD impacts of the Project will need to be reassessed as part of the Facilities Study.

VI. ESTIMATED PROJECT SCOPE, COST, AND SCHEDULE

A. Distribution and Interconnection Facilities

[redacted] has requested interconnection to the Windhub Substation for their Project. The System Impact Study identified the direct assignment Facilities required to interconnect the Project. The estimated cost for the interconnection facilities including corporate real estate, licensing, environmental permitting, and telecommunication facilities cost is approximately $6,500,000. It is important to note that the project directly queued ahead of [redacted] triggered the need for a new third 220/66 kV transformer bank at Windhub Substation with an estimated distribution cost of $17,400,000. This cost may shift to [redacted] if higher queued projects requesting interconnection in the Windhub 66 kV area ultimately withdraw.

B. Transmission Network Upgrades

The System Impact Study found that the addition of the Project did not trigger the need for any new transmission network upgrades.

C. Estimated Cost

Table 9 provides an estimated cost for equipping one 66 kV position at Windhub Substation and installing a new 220/66 kV A-bank transformer at Windhub Substation.

Table 9
Cost Estimates Provided in Millions

Facility Upgrade	Triggered by Queued Ahead Project	Triggered by WDT 435 Project
Network Upgrades: Equip one 220 kV position at Windhub Substation	$3.3	-
Distribution Upgrades: Install one 220/66 kV transformer bank, equip one 66 kV position at Windhub Substation	$14.1[2]	-
Interconnection Upgrades: Equip one 66 kV position at Windhub Substation including SCE's portion of the gen-tie, RTU, metering, telecom, RP, licensing and CEH&S.	-	$6.5[2]
Total	$17.4	$6.5

[2] The ITCC included in this cost estimate was computed using a 35% rate. Because of recent enactment of H.R. 4853, the Tax Relief, Unemployment Insurance Reauthorization and Job Creation Act of 2010, and upon formal acceptance by the CPUC of SCE's advice letter (filed on December 27, 2010), this rate may change for electric CIAC recorded or received after September 8, 2010 through December 31, 2011.

[redacted]

D. Project Schedule

The estimated time to engineer, procure equipment and construct the interconnection facilities and upgrades for the Project is 24 months from the time SCE receives an Authorization to Proceed. This schedule does not include corporate real estate, licensing/permitting or environmental schedules needed to support the project. If permitting is needed for the interconnection facilities the estimated time to complete the Project could take up to 60 months.

The IC has requested an in-service date of November 14, 2014 for the Project. The ability to meet the requested in-service date of the Project may be impacted by EKWRA construction activities. Coordination between EKWRA construction activities and construction of facilities needed to interconnect this project will need to be fully vetted once additional projects specific details are provided, such as actual gen-tie routing.

VII. CONCLUSIONS

Power Flow

With all queued ahead generation projects and all corresponding facility upgrades modeled, and with the system reconfigurations proposed as part of EKWRA, the power flow study found that the Project did not trigger new base case overloads requiring distribution or transmission level mitigation. However, it is important to note that the project queued directly ahead of [redacted] was identified to trigger the need for a third 220/66 kV transformer bank (mostly distribution upgrades) at Windhub Substation. As such, withdrawals of higher queued projects in the Windhub 66 kV area may shift triggering cost responsibility of this distribution upgrade to the [redacted] Project. Additionally, the study found that a previously triggered Windhub 500/220 kV transformer bank overload under loss of one 500/220 kV transformer bank is aggravated by the inclusion of the [redacted] Project. However, the study found that a proposed SPS for the triggering higher queued project will be sufficient to mitigate the incremental impacts of the Project without any additional upgrades

Post-Transient Analysis

The post transient study focused on identifying NERC/WECC/CAISO voltage criteria violations. The study found that the Project did not trigger any new Post Transient voltage criteria violations.

Previous studies for higher queued projects have identified the need to maintain "South of Vincent" power flows at or below approximately 8,500 MW if no upgrades South of Vincent beyond TRTP are assumed. This study concluded that the Project will not impact the existing system's South of Vincent area export capability. However, depending on dispatch, the addition of the Project can increase South of Vincent area export. Due to the fact that the amount of existing and higher queued generation is already sufficient to exceed 8,500 MW South of Vincent flows, operational mitigation measures to manage South of Vincent flow levels is required to accommodate higher queued projects. The dispatch of this Project will also need to be subject to the same operational limitations as all higher queued projects with regard to South of Vincent area export capability.

Transient Stability Analysis

Using the latest revision of the GE PSLF models for higher queued projects, several higher queued projects were found to exhibit characteristics of sympathetic tripping under normally cleared fault conditions. With modified parameters to eliminate the sympathetic tripping of the higher queued projects in simulations, the transient stability study concluded that the addition of the Project would not trigger any transient stability criteria violations on the SCE system.

Short Circuit Duty

In order to provide as much useful information as possible to [redacted] a limited Short Circuit Duty analysis was performed. This analysis used the best short circuit duty case available at this time which includes the latest information available to date regarding all active higher queued LGIP and SGIP projects.

These limited results showed that the [redacted] Project may increase SCD by at least 0.1 kA at one location (Windhub 66 kV Substation). This indicates that the SCD impact of the Project is not negligible, and that a more detailed SCD analysis, including the latest available details for all higher LGIP and SGIP queued projects, will be required as part of the Facilities Study.

Deliverability Assessment

The [redacted] Project is pursuing interconnection under the SCE WDAT SGIP Tariff. In terms of deliverability status, all small generation projects (including those under the SCE WDAT SGIP) are considered as "Energy Only" projects by CAISO and therefore no deliverability assessment is performed.

Distribution and Interconnection Facilities

The System Impact Study identified the direct assignment Facilities required to interconnect the Project. The estimated cost for the interconnection facilities includes corporate real estate, licensing, environmental permitting, and telecommunication facilities costs. The estimated cost for the interconnection facilities is approximately $6,500,000. In addition, it is important to note that the project directly queued ahead of [redacted] triggered the need for a new third 220/66 kV transformer bank at Windhub Substation with an estimated distribution cost of $17,400,000. This cost may shift to [redacted] if higher queued projects requesting interconnection in the Windhub 66 kV area ultimately withdraw.

Transmission Network Upgrades

The System Impact Study found that the addition of the Project did not trigger the need for any new transmission network upgrades.

Facilities Study

A Facilities Study ("FAC") will be required after the SIS, to address facility upgrades required for the Project. If necessary, further review of the Project's SCD impact on the CAISO controlled transmission system may be performed as part of the Facilities Study.

[redacted]

Project Schedule

The estimated time to engineer, procure equipment and construct the interconnection facilities and upgrades for the Project is 24 months from the time SCE receives an Authorization to Proceed. This schedule does not include corporate real estate, licensing/permitting or environmental schedules needed to support the project. If permitting is needed for the interconnection facilities the estimated time to complete the Project could take up to 60 months.

The IC has requested an in-service date of November 14, 2014 for the Project. The ability to meet the requested in-service date of the Project may be impacted by EKWRA construction activities. Coordination between EKWRA construction activities and construction of facilities needed to interconnect this project will need to be fully vetted once additional projects specific details are provided, such as actual gen-tie routing.

[redacted]

VIII. CAVEATS and RESPONSIBILITIES

A. Conceptual Plan of Service

The results provided in this study are based on conceptual engineering and a preliminary plan of service and are not sufficient for permitting of facilities. The Plan of Service is subject to change as part of the ongoing Interconnection Study process.

B. Customer's Technical Data

Additional technical data related to the Interconnection Customer's project may be required as part of the ongoing Interconnection Study process. The study accuracy and results for the Study are contingent upon the accuracy of the technical data provided by the Interconnection Customer. Any changes from the data provided could void the study results.

C. Study Impacts on Neighboring Utilities

Results or consequences of this Study and/or to-be-performed Studies (System Impact and Facilities Study) may require additional studies, facility additions, and/or operating procedures to address impacts to neighboring utilities and/or regional forums. For example, impacts may include but are not limited to WECC Path Ratings, short circuit duties outside of the CAISO Controlled Grid, and sub-synchronous resonance (SSR).

D. Use of SCE Facilities

The Interconnection Customer is responsible for acquiring all property rights necessary for the Interconnection Customer's Interconnection Facilities, including those required to cross SCE facilities and property. This Interconnection Study does not include the method or estimated cost to the Interconnection Customer of SCE mitigation measures that may be required to accommodate any proposed crossing of SCE facilities with Interconnection Customer's Interconnection Facilities. The use of SCE property rights shall only be permitted upon written agreement between SCE and the Interconnection Customer. Any proposed use of SCE property rights may require a separate study and/or evaluation, at the Interconnection Customer's expense, to determine whether such use may be accommodated.

E. SCE Interconnection Handbook

The Interconnection Customer shall be required to adhere to all applicable requirements in the SCE Interconnection Handbook. These include, but are not limited to, all applicable protection, voltage regulation, VAR correction, harmonics, switching and tagging, and metering requirements.

F. Western Electricity Coordinating Council (WECC) Policies

The Interconnection Customer shall be required to adhere to all applicable WECC policies including, but not limited to, the WECC Generating Unit Model Validation Policy.

G. System Protection Coordination

Adequate Protection coordination will be required between SCE-owned protection and Interconnection Customer-owned protection. If adequate protection coordination cannot be achieved, then modifications to the Interconnection Customer-owned facilities (i.e., Generation-tie or Substation modifications) may be required to allow for ample protection coordination.