**BEFORE THE PUBLIC UTILITIES COMMISSION**
**OF THE STATE OF CALIFORNIA**

| | | |
|---|---|---|
| In the Matter of the Application of The Nevada Hydro Company for a Certificate of Public Convenience and Necessity for the Talega-Escondido/Valley-Serrano 500 kV Interconnect. | ) ) ) ) ) | Application 10-07-001 (Filed July 6, 2010) |

**Direct Testimony of Frederick Depenbrock**

**on behalf of**

**The Nevada Hydro Company**

November 30, 2010

**Direct Testimony of Frederick Depenbrock**

**on behalf of The Nevada Hydro Company**

## Subject Matter Index

**Direct Testimony of Frederick Depenbrock**

**on behalf of The Nevada Hydro Company**

## Introduction

Q. Please state your name, occupation and business address.

A. My name is Frederick Depenbrock. I am an electrical engineering consultant. My business address is 7240 SW 80th Terrace, Gainesville, FL 32608.

Q. Please describe your professional experience and qualifications.

A. My resume is attached as Exhibit 1 to this testimony.

Q. Please describe the TE/VS and LEAPS projects.

A. The Talega-Escondido/Valley-Serrano 500 kV Interconnect Project (TE/VS) is a proposed 500 kV transmission line and associated substations that will connect between Southern California Edison Company's 500 kV Valley-Serrano line and San Diego Gas & Electric's 230 kV Talega-Escondido line, and thereby connect Southern California Edison (SCE) and San Diego Gas & Electric (SDG&E) at 500 kV for the first time, as well as connecting the Lake Elsinore Advanced Pumped Storage (LEAPS) Project to California's existing high-voltage transmission network. Descriptions, a map and diagrams illustrating the locations and project facilities of the TE/VS transmission line and the LEAPS generation are presented in the Executive Summary for the Project's Proponent's Environmental Assessment (CPUC 07-10-005 and FERC Project No. 11858 / ER06-278-005) dated January 2008. The planned in-service date for TE/VS is February 2013.

The Lake Elsinore Advanced Pumped Storage (LEAPS) Project is a proposed 500 MW pumped storage hydroelectric facility to be constructed near Lake Elsinore, California. LEAPS will be a highly-efficient, rapidly dispatchable generation resource;

up to 600 MW of power may be consumed in pumping water into the project's reservoir, it will be capable of producing 500 MW of electricity on a dispatchable basis. The project is planned to have a cycle energy efficiency of 83.3%. That is, on an energy basis for each 1000 MWH of energy consumed to pump water into the upper reservoir 833 MWH of energy can be delivered to the system in its generation mode. The planned in-service date is April 2015.

Q. What role do you have in the development and design of the TE/VS and LEAPS projects?

A. I have been involved in the design and development of the TE/VS and LEAPS projects since 2006 on behalf of Siemens Power Technologies International (PTI), first as an employee of Siemens PTI and subsequently as a consultant. Siemens PTI has a contractual relationship with TNHC under which Siemens PTI provides various engineering and development services to TNHC in exchange for future considerations when the project enters construction. In my role, I have been directly involved in providing TNHC with information and guidance on the transmission aspects of this project, particularly TE/VS. This has included acting as a representative of TNHC for transmission issues in interactions with the CAISO, including the California Southern Region Transmission Planning Group (CSRTP), and the California Public Utilities Commission (Commission). I have conducted the phase angle range requirement analysis for the phase shifting transformers to be installed at the proposed Case Springs Substation, to be located in the Camp Pendleton area. Also, I am conducting the WECC Phase I Path Rating Study to demonstrate that TE/VS can provide a flow under normal system conditions into the SDG&E system of 1,000 MW.

Q. Have you previously provided testimony before this Commission?

A. Yes. I provided testimony on behalf of The Nevada Hydro Company in both the Phase I and Phase II hearings for the Sunrise Project.

Q. What was the purpose of your testimony in those proceedings?

A. The purpose of my testimony was to provide corrective information to the testimony of others who had misrepresented the physical aspects and performance of TE/VS, including incorrect estimates of the ability of TE/VS to deliver power into SDG&E.

Q. What is the purpose of your testimony in this proceeding?

A. The Nevada Hydro Company (TNHC) has asked me to provide testimony on the reliability benefits of TE/VS and the system reliability environment into which it would fit. In that regard, I will present information and related excerpted diagrams of power flows from my study of the increase in the SDG&E's system import capability with the addition of TE/VS as well as information and diagrams related to reliability problems facing SDG&E.

Q. TNHC is also the sponsor of the proposed Lake Elsinore Advanced Pumped Storage (LEAPS) generating plant, which would interconnect with the TE/VS Interconnect. In your professional opinion, could the TE/VS Interconnect be a functional part of the CAISO electrical grid even if the LEAPS generating plant were not built?

A. Yes. TE/VS can function independently of LEAPS. As will be presented later in my testimony, TE/VS can provide a significant reliability benefit to SDG&E because of its connection to other, more northerly parts of the California 500 kV transmission system. This strategically important interconnection will be both more closely tied to that northerly 500 kV system and fully independent, in both interconnection point and path, of the other 500 kV paths to SDG&E.

An example of the way TE/VS and LEAPS can provide important benefits together is the ability of LEAPS to store energy produced by renewable generation facilities at one time period, such as nighttime low load periods, via the northern portion of TE/VS, and to deliver that energy to the SDG&E system at high load, high cost periods via the southern portion of the TE/VS Project. There are almost no renewable energy facilities on a utility scale in the San Diego basin area, the exception so far being the Kumeyaay facility. Since TNHC has proceeded well along the path of obtaining a license from the FERC to build LEAPS, the likelihood of this synergy occurring is quite high.

**Reliability Issues Addressed By TE/VS**

Q. What are the reliability issues facing SDG&E that you believe TE/VS addresses?

A. There are two. The first is that if there were any delay in the completion of the Sunrise Project causing it to come into service after May 2013, SDG&E will not have adequate generation plus import capability to meet its load plus losses during the summer heavy load period under a standard contingency test known as the G-1/N-1 test. The second is, assuming the completion of Sunrise, the likely inadequacy of the SDG&E system under contingency conditions to generate or import adequate energy to meet its peak load plus losses requirement within the San Diego basin in the period of summer 2015 and following if TE/VS is not in service.

Q. Please provide details of why the SDG&E system will not be able to meet its service requirement within the San Diego Basin in 2013 if the Sunrise Project is delayed.

A. The CAISO transmission planning criteria includes what is known as the G-1/N-1 test. In this test a system, such as SDG&E, must be able to fully supply its load with the loss of any generator (G-1) in combination with the loss of any single transmission facility (N-1). The definition of the criterion is located on Page "1 Page 3" in the document entitled, "California ISO, Planning Standards, February 7, 2002" in Section II, 3, entitled "Combined Line and Generator Outage Standard". After the loss of the generator the utility is allowed to adjust its other generators to its best advantage in anticipation of the N-1 possible event.

For the SDG&E system the most serious G-1 event is the loss of the Otay Mesa combined cycle plant, since the loss of the steam portion of the plant will require the shutdown of the gas turbines as well. The N-1 event is the loss of the Imperial Valley to Miguel 500 kV line with the attendant operation of the special protection scheme known as CFE-1 to protect the La Rosita-Rumorosa and La Rosita-Herradera 230 kV lines from overloads (as discussed below). Under this N-1 condition the only remaining import path available to SDG&E is the WECC Path 44, the 230 kV lines to SDG&E from San Onofre Nuclear Generating Station. Path 44 was established to have a rating of 2,500 MW for relatively short-term contingency situations with any line of the Southwest Power Link out of service and 2,200 MW for normal conditions. The description of this Path as included in the WECC Path Rating Catalog is shown as Exhibit 2. The report of the study establishing the rating is the "Comprehensive Progress Report of the 'South of SONGS Re-rating'" prepared by SDG&E and dated March 23, 2001.

With regard to the reliability impacts of a delay in completion and full capability of the Sunrise Project until the heavy load period of 2013, the effect is that SDG&E has the same import capability limit as it does today, 2,500 MW of capability for loss of a Southwest Powerlink line. This is the total flow capability of WECC Path 44.

In 2013 SDG&E has predicted that its summer heavy load would be 5,012 MW, as found in the WECC 2013 summer heavy load flow case, and losses within the San Diego Basin as measured from the load flow case would be 93 MW, for a total supply requirement of 5,105 MW. There is no assurance of when this predicted requirement will occur in the summer period. For the loss of its largest generator, the Otay Mesa combined cycle unit with maximum output of 606 MW, SDG&E has a residual of 2,517 MW of generation within the San Diego basin if all remaining units were operating at their maximum capability, including all Qualifying Facilities.

Because of the reduced number of paths into the San Diego basin the SDG&E system in-basin losses will increase by 102 MW, which functionally reduces the import capability to2,398 MW. Thus, the in-basin capacity requirement is 2,707 MW, which is more than the in-basin capacity available of 2,517. This is a shortfall of 190 MW. Since this situation must be managed without any load shedding, the result is a violation of the planning criteria requirements by 190 MW. While one could argue that the recent economic situation will result in a lower demand in the summer of 2013, it is not likely to be reduced by that much, and in fact could be at least this much or higher.

Q. What is the arrangement of transmission lines that make up the 500 kV connection between the Imperial Valley Substation and the San Diego basin after the Sunrise Project is operational?

A. Exhibits 3 and 4, as found in the CAISO 2010 Final California ISO Transmission Plan on pages 224 and 225, show the import path cut planes for the San Diego basin without and with the Sunrise project. There will be two 500 kV transmission lines between the Imperial Valley Substation, near El Centro, CA, and the San Diego basin, the area in which San Diego Gas & Electric has essentially the entirety of its electric system load. The first is the 500 kV line from Imperial Valley to the Miguel Substation, located in the southern area of the San Diego basin. This line, part of the original Southwest Powerlink Project, has been in service for several years. The second is the proposed but not completed Sunrise Project, a 500 kV line from Imperial Valley to a new substation, called Central Substation, which will have 500/230 kV transformers. From Central two new 230 kV lines are planned to connect with the existing Sycamore substation within the San Diego basin. These lines are shown in Exhibit 5, which is a visual synopsis of the Plan of Service SDG&E included starting on p. 30 of its Phase I Opening Brief for the Sunrise Project CPCN proceeding. An important consideration in the use of the two 500 kV lines from Imperial Valley to the San Diego basin is that the two lines will be in the same corridor for approximately the first 36 miles west of Imperial Valley Substation. After that the lines diverge toward their respective termini.

Q. Why is the fact of the two 500 kV lines occupying the same corridor an important consideration?

A. The Western Electricity Coordinating Council (WECC) has adopted the North American Electricity Reliability Council (NERC) planning criteria for transmission system planning. These are known as Standards TPL-001 to 004. Standard TPL-003 applies to system performance following loss of two or more Bulk Electric System elements. Table 1 from that standard is attached to this testimony as Exhibit 6, page 1. WECC has adopted the NERC standards for use in transmission planning within WECC and has extended them to require testing of significant effects for common corridor failures. The WECC standards are shown in Exhibit 6, pages 2-7. This addition, found inTPL-(001 thru 004) – WECC – 1 – CR – System Performance Criteria, Section B. -Requirements, WRS1.1, states, "The NERC Category C.5 initiating event of a non-three phase fault with normal clearing shall also apply to the common mode contingency of two Adjacent Transmission Circuits on separate towers unless the event frequency is determined to be less than one in thirty years."

With a common corridor length of 36 miles, there are any number of possible causes for a common corridor failure. These range from nature-related events such as lightning, earthquakes or tornadoes to airplane collisions with the lines to malicious behavior such as hunters shooting at insulators, to terrorist attacks seeking to cause blackouts at a Naval base. WECC has an established procedure for evaluating the probable frequency of there being an occurrence of a corridor failure. This procedure is called the Reliability Performance Upgrade Procedure. There are seven steps to the application of the procedure. The requests for any changes in reliability testing requirements are processed and recommendations made by the WECC Reliability Performance Evaluation Work Group (RPEWG). SDG&E conducted this procedure and reported on its results as part of its testimony in the Sunrise Phase II proceeding before this Commission. This information is found in Chapter 6 of SDG&E's Direct Testimony in that proceeding. SDG&E requested that the RPEWG "upgrade" the category of the double line outage from a Category C to a Category D contingency. In its request SDG&E asked for the upgrade approval for the originally planned transmission corridor, which would have had four miles of common corridor for the two 500 kV lines, and the

36 miles of common corridor of the alternative path, which was what was finally agreed to be built. Mr. Henry Zaininger of the Division of Ratepayer Advocates supplied rebuttal testimony in the Sunrise Phase II proceeding that supported both upgrade requests. However, the RPEWG decided that the alternative corridor should not be allowed the upgrade. It is to remain a Category C contingency. This decision is shown in Exhibit 7.

It is my professional judgment, in parallel with that of the RPEWG, that such an event is likely to occur more frequently than once every thirty years. And thus I believe it is necessary to test system performance with such events considered. This becomes more important with the increase in the consequences of such a failure, as will be shown later in my testimony.

Q. Previously you had mentioned a "special protection scheme". Please explain what that is, in general, and how it applies in the planning of the 500 kV transmission lines west of Imperial Valley.

A. WECC has formally adopted a number of operating procedures to provide protection to system reliability and system equipment under stressed conditions. The special protection schemes (SPS) of direct interest in this situation is Operating Procedure CFE-1 and CFE-2, for operations within the Comision Federal de Electricidad (CFE) in the Baja area of Mexico. It has both a summer and fall/winter/spring variant. In the summer variant, if the power flow over either or both the La Rosita to Rumorosa or La Rosita to La Herradura 230 kV lines exceeds their rating, the Tijuana-Otay Mesa 230 kV line will automatically be tripped. In the winter variant, if the power flow over either or both the La Rosita to Rumorosa or La Rosita to La Herradura 230 kV lines exceeds their rating, the Imperial Valley-La Rosita 230 kV line will automatically be tripped. These SPS's was set up to protect the CFE system from high, damaging through-flow of power from Imperial Valley through CFE to Otay Mesa during events such as the loss of the 500 kV Southwest Powerlink line (Imperial Valley-Miguel) west of Imperial Valley.

After the Sunrise Project is in operation a new Special Protection Scheme will be added to provide protection for the N-2 loss of both the 500 kV lines west of Imperial Valley, among other possible contingencies. This new SPS operation is defined in the "Final Report for Sunrise Path Rating Phase 2 Study" prepared by SDG&E to accommodate the requirements of the Project Review Group overseeing the path rating process for Sunrise. On page 5 of that report, caveat 1 includes the definition of this new SPS. Its applicability to the N-2 contingency is accepted by SDG&E in caveat 3, found on page 6. While this is not a settled solution for final implementation, as noted by SDG&E in the report, this new SPS has adequate definition such that it provides interested parties opportunity to test reasonable SPS variants and the effect of the SPS's operation on import capability. It should also be noted that SPS's CFE-1 and CFE-2 will remain in effect.

Q. What are the inadequacies of SDG&E to meet its reliability requirements in 2014 through 2015 and following.

A. As with all system planning, the ability to deal with the future always requires the ability to manage unexpected events as they might arise in the future. In this case the unexpected event from the time of the development of the Sunrise Project is the requirement by the State of California that generators using "Once Through Cooling" either significantly reduce the impact on the ocean environment of using such cooling methods or stop using such processes. In this proceeding, the relevant issue is the requirement that the generating units at Encina be shut down or brought into compliance by no later than the end of 2017. The owner of Encina Station, NRG Energy, has six months from the effective date of October 1, 2010, of the policy on Once Through Cooling set by the State Water Resources Control Board to provide an implementation plan for compliance for Encina. These five units have net capabilities (gross generation less station service power) totaling 946 MW according to the data used in the WECC load flow case.

With the likely forced retirement of the existing generators at Encina as the only realistic option, NRG has the choice of: a.) retiring the units at any time from now to the end of 2017, not replacing them, and doing something else with the land, b.) Retiring the generators before they are forced to do so and replacing them with new generators that do not require once-through cooling, such as gas turbines, or c.) continuing to operate the Encina units until the end of 2017 and then removing and replacing them with suitably compliant units later or using the site for other purposes.

With regard to NRG's choice b.), NRG has initiated the development of the Carlsbad Project, a 530 MW combined cycle facility to be built on the Encina site, but not causing disruption of operation of the existing units during construction of Carlsbad. It is likely to require until early 2015 for the Carlsbad facility to come into service if NRG is successful in completing the development, not a sure bet. In order to operate Carlsbad at its full output, NRG would have to retire Units 1-3 at Encina in order to have adequate transmission capability for Carlsbad and Encina Units 4 and 5. This would make the total net capacity of the Encina site with Carlsbad 1,158 MW. Then at the end of 2017 NRG would have to retire Encina Units 4 and 5, leaving a net capacity of 530 MW at the Encina site.

Without the generation of the five Encina units, there is a reliability gap that SDG&E must successfully traverse in whatever year that occurs.

Q. What is this reliability gap?

A. With regard to the N-2 test, the criterion is set forth by NERC and WECC, as noted previously. In it, the loss of two transmission lines in a corridor must be evaluated. Such an event should not occur more frequently than once every 30 years, and while allowing "planned or controlled" loss of demand, must maintain system stability with all thermal and voltage limits maintained and without cascading outages. Also, the G-1/N-1 test requirement remains in effect.

Q. How do these criteria apply to the performance of the SDG&E system under the N-2 corridor failure test?

A. SDG&E attempted to develop the Sunrise Project without a "common corridor" configuration, but it was not successful. Approximately 36 miles of the Sunrise Project 500 kV line is to be built in the same corridor as the existing Imperial Valley-Miguel 500 kV line. Thus, SDG&E must contend with the probability of having a corridor failure that will have a significant effect on its system.

Q. What would be the reliability impact if NRG decided to retire the Encina units in or before 2015 and decided not to replace them?

A. As SDG&E has forecast its load requirement for the 2015 summer heavy load period and included that estimate in the WECC 2015 summer heavy load flow case, the load it must serve is 5,367 MW. This load is within the San Diego basin. It also must supply 108

MW of losses within the San Diego basin as was found in the load flow case. For its entire system, which extends east to North Gila, its losses will be 145 MW under normal conditions as envisioned in the 2015 load flow case for SDG&E, for a total supply requirement of 5,512 MW.

As noted in the CAISO report entitled, "2012-2014 Local Capacity Technical Analysis", there has been a shift in analytical process that moves away from "Reliability Must Run" to "Local Capacity Need". The analysis process is still largely the same in that an area import capability is established and then the local capacity need is set based on the supply requirement. The term "local capacity requirement, or LCR, is often used to speak of local capacity need, and that terminology will be used here.

In applying the G-1/N-1 planning criteria requirement, CAISO in its report at page 98 noted that the most restrictive contingency for G-1 remains the loss of the Otay Mesa combined cycle plant. However, the most restrictive N-1 test is for the loss of the Imperial Valley-North Gila 500 kV line, rather than the Imperial Valley-Miguel line. My analysis followed CAISO's lead, and my tests of the more severe test between the two 500 kV line outages (IV-Miguel vs IV-No. Gila) confirm that decision.

Exhibit 8 shows the system conditions for the SDG&E area with the G-1 and N-1 conditions. Exhibit 9 shows the conditions in the CFE area. As can be seen in Exhibit 10, there is adequate LCR with or without Encina for 2015 conditions. Subsequent years are likely to shown an LCR deficiency for the G-1/N-1 test because of load growth if Encina is not available.

In applying the N-2 planning requirement, the loss of both Imperial Valley-Miguel and Imperial Valley-Central, CAISO implied in its report, also on page 98, that the import limit would be set by the capability of Path 44 alone. However, I found that there was the opportunity to increase this import capability by managing the generation in CFE before the contingency to maximize the import into SDG&E. I have assumed that this opportunity would be used as much as possible by CAISO in developing my own LCR values, but there is no requirement that CFE adjust its generation to suit SDG&E's needs or CAISO requests. So the default value for import capability into SDG&E would be 2,500 MW rather than the 3,140 MW I was able to produce in my testing. My results on LCR are summarized on Exhibit 10 for both the system performance without TE/VS and with TE/VS.

In applying the corridor failure test for the loss of both the Imperial Valley-Miguel 500 kV line and Sunrise line, the maximum possible import capability of the remaining paths of Tijuana to Otay Mesa and Path 44 would be a total of 3,195 MW with the contingencies. The Diagrams labeled Exhibits 11 and 12 show the flows after the loss of the Imperial Valley-Miguel and Imperial Valley-Central 500 kV lines (the corridor failure),and with the action of the Special Protection Scheme developed by SDG&E as noted above and shown in Exhibit 13 by the dashed line between the two 230 kV bus sections at Imperial Valley. The key flows are those of Path 44 (seen in Exhibit 11) and the Otay Mesa-Tijuana 230 kV line (seen in Exhibit 12). Path 44 is at its flow limit. These diagrams, colored by bus and line voltage level, show the flows in Megawatts and Megavars for all lines and transformers and the bus voltages in kV and Per Unit on the bus voltage base.

With the generation inside the San Diego basin determined from this case with optimized imports under contingency, it is possible to restore the system to normal with that generation and check the flows. These are shown in Exhibit 14. As noted in that exhibit, the In-basin tie flow is 3,140 MW used in the LCR calculation. As is evident from the examination in Exhibit 10 of the capacity Net Position for the N-2 contingency with and without Encina, the operating status of Encina is critical to the SDG&E reliability condition.

I did check that by taking the N-2 contingency with SPS from this case that the results are the same as found in Exhibits 11-13.

If one were to assume as I did that CFE would change its generation to provide optimal import results for SDG&E under the N-2 test and the full capability of Encina were operating (not just not retired, but operating at full output), then SDG&E would have 725 MW of spare LCR capacity. However, if Encina were not operating at all for whatever reason, then SDG&E would have an LCR shortfall of 221 MW.

If one were to follow CAISO's lead in its Local Capacity Technical Assessment for 2012-14 it would leave only Path 44, with its short term rating of 2,500 MW and long term rating of 2,200 MW. So, with the increased losses found from using only Path 44, about 100 MW, some load shedding, ranging from 16 MW if Encina were fully available to 962 MW, would be required. This latter amounts to about 20% of SDG&E load. Also, the very high percentage of the total SDG&E in-basin load that must be supplied from elsewhere via 230 kV lines suggests a high probability that the San Diego area may have a blackout, not just a brownout or load shedding event if all or most of Encina were not operable. While the large size and proximity of San Onofre provides a strong stabilizing effect, there are limits to which it is reasonable to risk a nuclear plant shutdown on an emergency basis.

Conditions in 2016 and 2017, with likely higher load than 2015, would put additional stress on the system.

It is important to note that a corridor failure is not something that allows the system operator to adjust in a staged fashion, such as the G-1/N-1 test. Without any forewarning both lines in the corridor may trip out at the same time. On page 8 of the CAISO report, "2011 Local Capacity Technical Analysis" there is a section entitled, Application of N-1, N-1-1 and N-2 Criteria. The last sentence states, 'The N-2 represents NERC Category C5 ("any two circuits of a multiple circuit tower line") as well as WECC-S2 (for 500 kV only) ("any two circuits in the same right-of-way") with no manual system adjustment between the two contingencies.' Thus, there is a load level at which the CAISO system operators must arm a pre-existing load shedding process within San Diego that will be triggered in the event of the corridor failure.

Q. What would be the impacts on the SDG&E area system earlier than 2015 if NRG were to retire the Encina units before 2015?

A. Until the Sunrise Project is in service the retirement of the Encina units would have a major impact on the reliability of the SDG&E system. SDG&E would fail the G-1/N-1 reliability test. With Sunrise in service the retirement of Encina generation, totaling 946 MW, would be essentially a trade-off with Sunrise, rated at 1,000 MW. SDG&E would be within its transfer capability for the G-1/N-1 events in 2015 by 100 MW. For earlier years with Sunrise in service, 2013 and 2014, the LCR position would be slightly better because of lower load.

Q. What would be the impacts of the retirement of Encina's present generators and replacement with other generators after 2015?

A. In 2007 NRG filed an application with the California Energy Commission for the development of the Carlsbad Energy Center. This was envisioned to be a combined cycle plant of 530 MW net generation to be built on the Encina site and replacing Encina Units 1, 2 and 3. This would have allowed the possible continued operation of Encina units 4 and 5, but the Once-Through Cooling compliance requirement means these units will have to be shut down by the end of 2017, regardless of construction activities by NRG at Encina. Thus, the maximum possible power injection at Encina would drop from 946 MW (total plant) to 628 MW (units 4 and 5) and then 530 MW (the new combined cycle plant). It should also be noted that NRG is not bound by the needs of SDG&E for generation and may have other ideas on how to use the Encina site that has nothing to do with power generation. It may decide to do whatever it chooses at its own timing.

The SDG&E reliability performance in 2015 would be as I described earlier, but with a shortfall that would depend on the nature of the reconstruction NRG decides to implement. If NRG were to decide to replace units 1 through 3 with a new combined cycle plant, It would require at least three and a half years and probably four years to demolish the existing units, conduct environmental remediation of the site, and install new generators. This continues the reliability risk in various degrees depending on NRG's choices from 2013 until 2018. However, installing replacement generation would appear to be a poor choice, given the need for renewable energy in SDG&E's total energy mix. It should be noted that NRG has opted to participate in the Ivanpah solar generation project.

**Reliability Benefits Of TE/VS**

Q. How does the inclusion of the TE/VS Interconnect affect system performance?

A. The TE/VS Interconnect provides a third 500 kV path into the SDG&E system's load center in the San Diego basin. Page 1 of Exhibit 15 shows this configuration and that of adjoining equipment. Page 2 of Exhibit 15 provides the ratings of the equipment used in TE/VS. This new path provides the only direct 500 kV connection for SDG&E that ties to the northern part of the CAISO system and, quite importantly, provides a highly independent source not under the same common corridor contingency risks as the other two 500 kV connections to the San Diego basin. This independence is important to the short-term and long-term reliability of electricity supply for San Diego. By TNHC's inclusion of the phase shifting transformers at Case Springs the system operator (California Independent System Operator, CAISO) will have the ability to control how power may flow over TE/VS, and thus the ability to manage a large portion of the import flows to SDG&E. This is a significant improvement in system operational control capability. Without the phase shifters the system operators would have only the ability to shift generation locations to shift transmission power flows, since the system transmission impedances are otherwise fixed at construction if it is not phase shifting equipment.

The three phase shifting transformers are each rated at 500 MVA for normal conditions and 620 MVA for emergency conditions. Thus, for normal conditions the total flow capability across them could be 1,500 MVA. This would be the flow limit for TE/VS for normal conditions since the 500 kV line is rated at 2,598 MVA. Under contingency situations not involving one of the three transformer strings or the 500 kV line the total flow capability of TE/VS is 1,820 MVA. With one of the 500/230 kV transformer and 230 kV phase shifter strings being the contingency, the total capability is

1,240 MVA. Each of the phase shifters has 32 angular position settings ranging from +32 degrees to -32 degrees in 2 degree steps, which allows considerable control for the CAISO operators to manage the flows they desire.

An additional benefit is that with both Sunrise and TE/VS in service the option is then available to build a 500 kV line between Central and Case Springs. This line would provide the first 500 kV tie between the northern part of the CAISO system and the Southwest Power Link within California. This additional 500 kV link has reliability benefits to both SDG&E and Southern California Edison.

Q. Under system normal conditions can the TE/VS Interconnect deliver 1,000 MW of power to the San Diego basin?

A. Yes. The diagram labeled Exhibit 16 shows the system in the SDG&E system area under normal conditions in summer 2015 with TE/VS added and flowing 1,000 MW to SDG&E. All generators at Encina are out of service. The various flows on critical SDG&E import paths are shown in the upper left. All facilities are well within their ratings. Exhibit 17 shows the system flows for 2015 summer heavy load conditions with Encina still fully operational as found in the WECC 2015 base case.

Q. Does the TE/VS Interconnect provide relief for the system overloads caused by the prospective 500 kV corridor failure west of Imperial Valley?

A. Yes. I conducted extensive load flow studies for all years from 2013 to 2015 in preparing this testimony, determining the improvement of system performance, flexibility, and import capability in SDG&E by having TE/VS in service. The diagram labeled Exhibit 18 shows the system in the SDG&E area in the summer of 2015 with TE/VS in service and flowing 1171 MW into SDG&E prior to the corridor failure with Encina out of service and then the corridor failure and SDG&E imports maximized. All transmission elements are within their ratings. The phase shifting transformers remain at the same angle settings as before the contingency and still have some remaining capability. If the CAISO system operators deem it useful or necessary, changes to the phase angle settings can be made, but such changes are not required for reliability purposes. Exhibit 19 shows the same system conditions with Encina's generation in service, but no changes in other SDG&E generation. Again, there are no overloads. Exhibit 20 shows the system conditions prior to the N-2 contingency found in Exhibit 18, that is, with all transmission elements in service and Encina out of service. Note the summary of flows and imports for SDG&E shown in the upper left of the Exhibit. My tests showed that TE/VS is able to provide at least 1,000 MW of import capability to SDG&E whether Encina is operating or retired, and 1,171 in the event Encina is retired.

Q. While you have shown only 2015 information for the performance of the TE/VS Interconnect, would the system perform differently in other years?

A. Not materially. Because the transmission system behavior is set primarily by the system impedances as built, the system will perform essentially the same as seen in the 2015 example until some major new transmission construction changes that impedance pattern. Thus, with Sunrise and TE/VS in service I found essentially the same performance from the system conditions in 2013 through 2015. The addition of the Central to Case Springs 500 kV line would be the type of change that would have significant effect on transmission system performance. In a positive way, I would add.

Q. A major factor in the future power systems in California is the requirement to meet the 33% Renewable Portfolio Standard. How does this requirement influence the importance of the TE/VS Interconnect?

A. In reviewing the various studies conducted to plan for compliance with the RPS, it is obvious that most of the renewable energy will be generated in areas away from the load centers along the Pacific coast. The increased delivery requirements for renewable energy in addition to the already developed easterly-located fossil fuel generation and the shutdown of many "once through cooling" generators along the Pacific coast, or their replacement with lower capacity alternatives, will put increasing stress on the transmission system because of the increasing east to west flows. Thus, a more robust transmission system is an important requirement for both reliable operation and compliance with the RPS. TE/VS is an important element of such a needed robust transmission system, both for what it provides immediately upon its completion, and for what opportunities for additional linkages it provides for north and south flows.

An example of how TE/VS provides opportunities for additional linkages is the possibility of adding the 500 kV link between SDG&E's Central Substation and Case Springs. By so doing SDG&E benefits from having the 500 kV supply to Central as well as the supply through the Case Springs 230 kV maintained during times when the Sunrise Project 500 kV line is out of service. Also, that connection would provide additional 500 kV linkage from the Palo Verde area to Southern California Edison's system and major renewable resources in the Imperial Valley area even if the 500 kV line from Palo Verde to Devers were out of service. This and several other similar possibilities are items for serious consideration by the California Transmission Planning Group.

Q. Are there any other observations you would like to share?

A. I noticed that three of the five 230 kV lines that make up Path 44 are on the same corridor for a distance of about 17 miles. While the chance of a corridor failure here may be slight, the impact could be significant. The presence of the upgrades to the Talega-Escondido 230 kV corridor required for TE/VS to double circuit and double bundle each circuit's conductor now make it possible to bundle the two existing San Onofre-Talega 230 kV lines to ameliorate that three circuit corridor failure.

Q. Does this conclude your testimony?

A. Yes, it does.

# Exhibit 1

**FREDERICK E. DEPENBROCK**
7240 SW 80th Terrace, Gainesville, FL 32608
(352) 256-4475

An established consultant bringing management-level skills in electric utility planning and operations, engineering analysis, economic and regulatory studies, and human dynamics. Wide-ranging experience with domestic and international utility, governmental, religious, and industrial bodies gives a broadly integrated viewpoint.

## PROFESSIONAL EXPERIENCE

| | |
|---|---|
| **April 2007 – Present:** | President, Sun Energy Engineering, LLC<br>Independent Consultant |
| **Dec. 2005 – April 2007:** | Senior Business Development Specialist, Senior Staff Consultant,<br>Siemens Power Technologies International (PTI) |
| **May 2001 – Dec. 2005:** | Independent Consultant |
| **April 2000 – May 2001:** | Organizer and Manager of Power Technologies Inc.'s<br>Denver Office (staff of seven) |
| **May, 1999 – April 2000:** | Independent Consultant |
| **1987 – April, 1999:** | Stone & Webster Management Consultants, Inc.<br>Vice president and manager of Denver Office (staff of 15)<br>Assistant Vice president<br>Executive Consultant |
| **1980 - 1987:** | Pastor, First Presbyterian Church of Hanover, East Hanover, New Jersey |
| **1977 - 1980:** | Assistant Pastor, Noroton Presbyterian Church, Darien, Connecticut |
| **1967 - 1974:** | Stone & Webster Management Consultants, Inc.<br>Manager, Operating Systems Department (staff of 22)<br>Consultant |
| **1961 - 1967:** | Philadelphia Electric Company, Philadelphia, Pennsylvania<br>System Planning Engineer<br>Engineer of Plant Tests |

## PROFESSIONAL ASSIGNMENTS

### Generation and Transmission Planning

Prepared a set of electric power system models for load flow and dynamic modeling for the National Electric Power System of Afghanistan. This required on-site investigation of the system elements in the Kabul area and, as needed, estimation of system characteristics from the reports of others and professional experience. These models were prepared in Siemens Power Technology International's PSS®E. Trained six members of the NEPS engineering staff in the use of PSS®E and system planning process, with an emphasis on preparing model representation from basic equipment characheristics.

As transmission planning consultant to the Lake Elsinore Advanced Pumped Storage Project in California, prepared systems analyses to support the Project's ability to deliver power to and from the San Diego Gas & Electric system. Conducting a Western Electricity Coordinating Council Phase I path rating study for the Talega-Escondido to Valley-Serrano 500 kV Line Project that will interconnect Southern California Edison with San Diego Gas & Electric at 500 kV for the first time. Provided expert testimony to the California Public Utility Commission on two occasions in support of the Project.

Represented Siemens PTI to the WECC Modeling and Validation Work Group.

Principle investigator for a study of the upgrade of WECC's TOT 3 path for increased transfers from Wyoming to the Denver area to accommodate proposed wind generation.

As consultant to Siemens Power Technologies, Int'l. (PTI), served as a business development executive for software sales and consulting services. This has also involved speaking, demonstrations and study assistance in Africa, Southeast Asia, and North America.

Project manager of an electric system blackout and correction study for an oil production facility in Indonesia. This involved significant machine testing, machine parameter derivation, and stability analysis.

Transmission planning consultant to major independent power producer over a two-year period for power project acquisitions and development, including extensive development work in WECC area.

Responsible for commercialization and future development of EPRI's EGEAS (Electric Generation Expansion Analysis System) integrated resource planning model and the Resource Planning Workstation (1994 to 1997). This included development of competitive market modeling, unit profitability analysis, and long-term open market optimization. Concluded strategic marketing alliance with Henwood Energy Services, Inc. for co-marketing of EGEAS and Henwood's chronological modeling product, PROSYM.

Project Manager for transmission planning study for development of major expansion of transmission system of Provincial Electricity Authority, Thailand. This study covered all transmission and substation development through 2011 for all parts of the country outside of metro Bangkok, involving over 300 substations.

Project Manager for economic due diligence study for European Bank for Reconstruction and Development in optimal replacement generation in Ukraine for Chernobyl Nuclear Station as part of USAID/G7 assessment of Chernobyl shutdown. Provided testimony to Austrian and Hungarian Parliaments as part of European Bank for Reconstruction and Development financing process.

Responsible for power market Due Diligence Assessment for the Bo Nok Project, a proposed 734 MW coal-fired power plant project in Thailand.

Project Manager for study of "Energy and Economic Modeling Issues Related to an Evaluation of the Regulatory Structure of the Retail Electric Industry in the State of Colorado," for the Electric Advisory Panel to the Colorado General Assembly

Provided advice to Philippines Department of Energy on energy sector modeling through USAID Greenhouse Gas Mitigation Project.

Conducted transmission portion of feasibility study for Kudu Gas Power Project, Namibia. Study involved load flow and stability analysis for 750 MW and 1,500 MW project developments.

Participated in joint planning of transmission for Peach Bottom, Salem, Hope Creek and Limerick power plants (total generation of over 6,000 MW). Developed initial plans to close 500 kV transmission loop around Philadelphia.

Conducted system modeling and economic analysis in due diligence for financing of the Ilijan Project, Philippines.

Extensive experience in load flow, transient stability, and short circuit studies. Carried out generation and transmission expansion studies for several individual companies and large-scale joint generation projects. Conducted transmission capability assessment for many independent power projects.

Conducted integrated resource planning studies for Cities of Gainesville, Tallahassee and Fayetteville. Evaluated fuel cost alternatives, interchange costs, and effects of power pool operation on operating costs and reliability for various clients.

Wrote and helped negotiate a long-term power pooling agreement between Canadian Utilities, Inc. and Calgary Power Co.

Evaluated effects of third-party wheeling, including capacity commitment, loss increase, and voltage drops for Northwestern Public Service and Otter Tail Power Co.

Evaluated types of new generating capacity most applicable, based on load shape, economic dispatch, forced outage experience, and maintenance requirements for Savannah Electric Co., Maine Public Service Co., Sierra Pacific Power Co., and others.

Developed transmission expansion plans for Egyptian Electricity Authority to incorporate proposed new 1200 MW power plant under auspices of U.S. AID 1988.

Reviewed system planning department methods and capabilities as independent audit for corporate management of Florida Power & Light Company 1988.

Participated in feasibility study for conversion of aluminum plant to utility generating site, including transmission, for the Office of the Governor of the U.S. Virgin Islands.

## Clean Air Act Compliance Planning

Provided economic analysis, sensitivity analysis, risk assessment and general project review services for Illinois Power Company, Indianapolis Power & Light Company and Allegheny Power System. Prepared testimony and testified before Indiana Utility Regulatory Commission as expert witness on Clean Air Act Compliance Planning and Integrated Resource Planning Process in Indianapolis Power & Light's pre-approval case for scrubbing Petersburg 1 & 2.

## System Operations

Analyzed Philadelphia Electric Company's system restoration procedure, conducted cold load pickup tests for sample customers, completely rewrote blackstart procedure, and trained system operators.

After Philadelphia blackout in 1967, F.P.C. praised the speed of system restoration in its report of the event.

Conducted all aspects of engineering tests for steam-electric generating station, including heat rate, pulverizer loading and fineness, temperature and pressure controls. Maintained all instrumentation and controls, including turbine governors, boiler intake, and exhaust air and water purification systems. Worked on maintenance planning and repair plans for scheduled outage.

Conducted staffing and organization review of generation and system control staff for Guyana electricity Corporation under auspices of Inter-American Development Bank 1988.

Assisted in developing rehabilitation plan for generating equipment of Corporacion Dominicana Electricidad, Dominican Republic under auspices of the World Bank 1989.

Prepared pre-feasibility analysis of Energy Management System and System Control and Data Acquisition system requirements for national electric utility of Panama under auspices of U.S. State Department Trade Development Program 1990.

Managed power plant "best practices" analysis for Attaka Power Station of Egyptian Electricity Authority for improvement in availability and performance under auspices of United Nation Development Program 1992.

**Data Processing**

In early 1970's, set up and ran the data processing center for Stone & Webster Management Consultants, Inc. Staff consisted of ten systems analyst/programmers, six operators, and three data entry clerks. Converted department from IBM 1620 to NCR Century 200 (two machines) to D.E.C. PDP-10. Developed and operated full range of corporate accounting applications (A/R, A/P, general ledger, payroll, billing, etc.). Managed development of consulting-services-oriented applications. Trained company personnel in interactive computer use.

Managed development, sales, and installation of proprietary computer software. Prepared system as host processor on Tymshare nationwide computer network.

Developed system definition and database definition for Management Information System for Egyptian Electricity Authority under auspices of United Nations Development Program.

Prepared Project Document and Project Formulation Framework for Electricity/Energy Databank Project for national utility of Syria under auspices of United Nations Development Program 1992.

**Load Forecasting**

Developed detailed econometric and end-use forecasts of energy sales by customer class for several U.S. utilities. Set up and carried out customer survey programs for sample of industrial and commercial customers. Performed load coincidence studies between rate classes. Analyzed weather effects on energy sales and peak load.

Prepared demographic and end-use energy and peak load projections for long range expansion plans through 2011 for Egyptian Electricity Authority under auspices of U.S. AID 1988.

## EDUCATION

Drexel University, MS, Electrical Engineering, 1967, Master's thesis subject "Application of Lyapunov Stability Principles to the Computer Solution of the Electric Transient Stability Problem"

Lafayette College, BS, Electrical Engineering, 1961

Princeton Theological Seminary, M. Div., Theological Studies, 1977

## AFFILIATIONS

Institute of Electrical and Electronic Engineers
Eta Kappa Nu, Honorary Electrical Engineering Fraternity

## TESTIMONY PREPARATION AND PRESENTATION

Prepared and presented testimony on aspects of Integrated Resource Planning or transmission planning before the public utility commissions (or equivalent) of the following states:

- Pennsylvania
- Indiana
- Alaska
- Oklahoma
- California

## SELECTED ARTICLES/SPEECHES

"Acid Rain Legislation: Developing Utility Compliance tactics", Electric Power Research Institute Conference on Innovations in Pricing and Planning, May 1990

"System Planning in the 1990s", Stone & Webster Engineering Corporation Summer Seminar, 1990

"Why Inter-Area Electric Transmission?, American Power Conference, April 1991

"Supergrid - Negotiating Our Way To Success," Transmission and Wheeling Conference, November 1991

"Transmission Pricing: Challenges and Opportunities", Stone & Webster Engineering Corporation Summer Seminar, 1993

Organizer and Principal Speaker, "Transmission Pricing Workshop", Denver, March 1994

"How Pumped Storage Can Boost Network Security", *Electrical World*, March 1994

"Non-traditional Transmission Services (Including Retail Wheeling)", Rocky Mountain Electrical League, Spring Meeting, April 1994

Workshop Organizer, "Transmission Pricing Workshop", Beaver Creek, Colorado, June 19, 1995

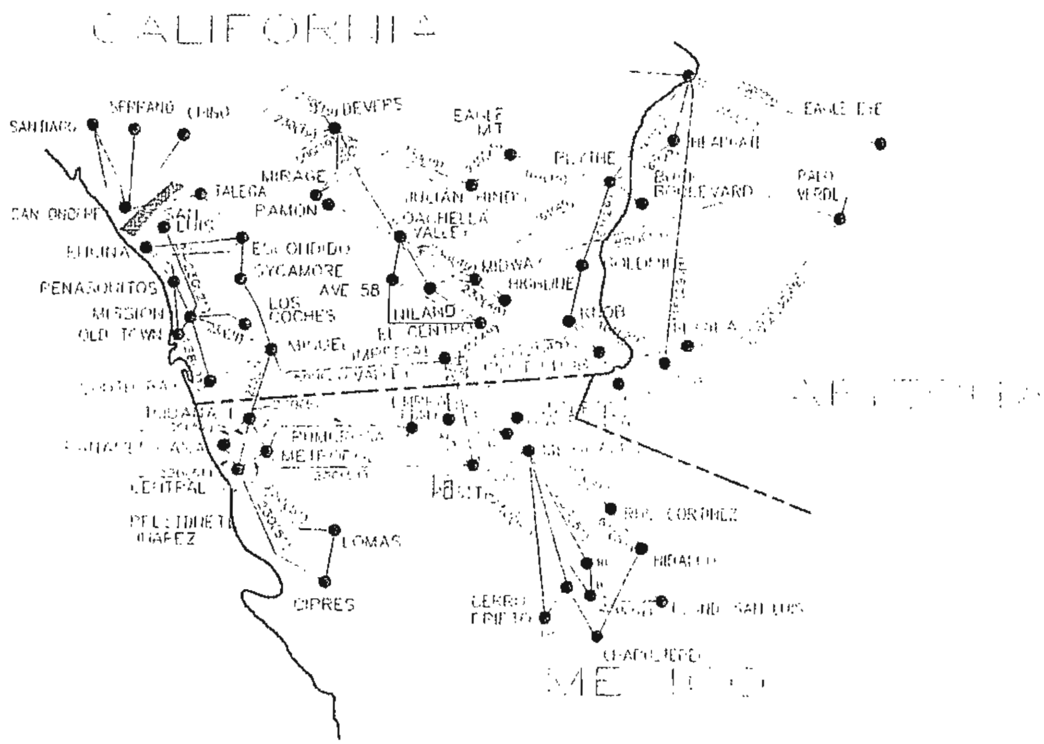
"Electricity and Water Desalination: Separate Sites Offer Value", F. Depenbrock, I. Moch, Jr., Y. Mussalli, EPRI 1995 International Clean Water Conference, La Jolla, California

"Long-range Generation Planning: Knowing The Landscape Before Starting The Journey," Fred Depenbrock and Bill Burke, *Energy Market Magazine*, June/July 1997

"Estimating Profitability and Managing Risks for Generation Ownership in a Transitional Market Environment," EPRI, First Asia-Pacific Conference on Operation and Planning Issues in the Emerging Electric Utility Environment, Kuala Lumpur, August 1997

# Exhibit 2

# 44. South of San Onofre



Revised February 2005

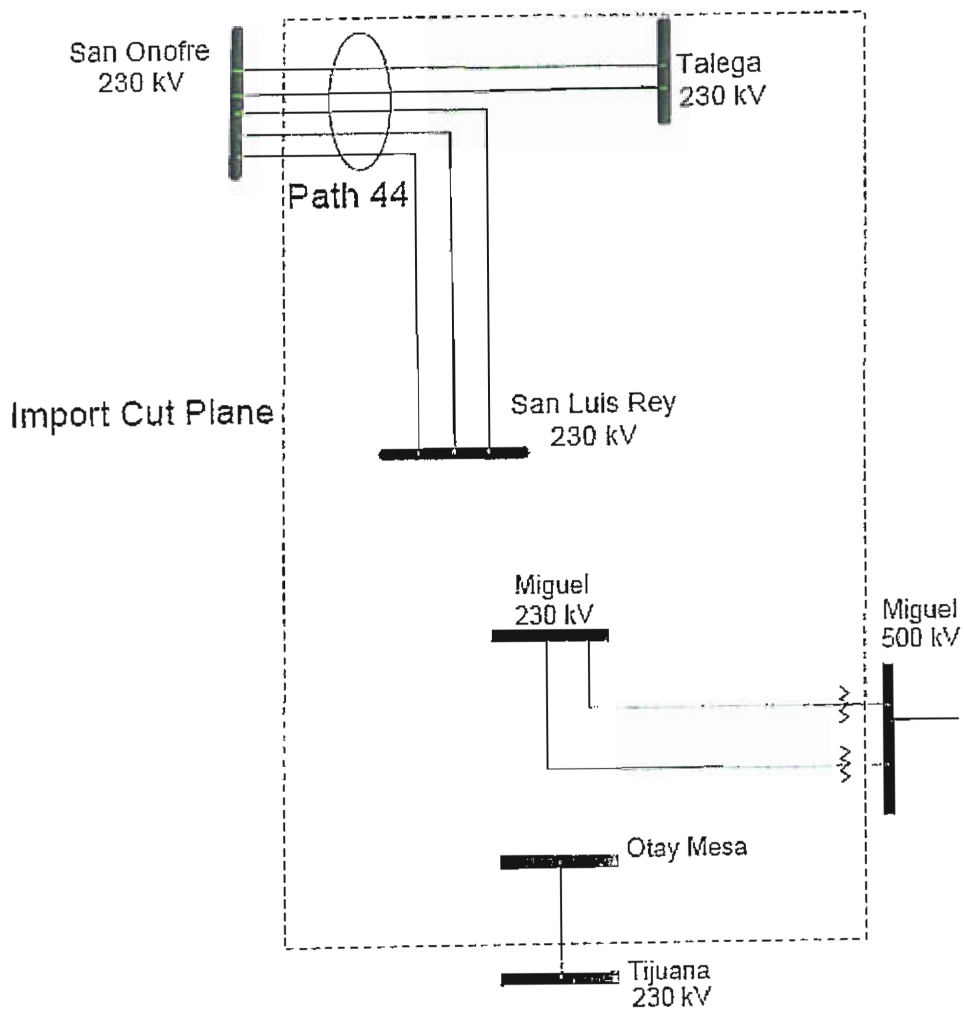
# 44. South of San Onofre

Accepted Rating ☒
Existing Rating ☐
Other ☐

| | |
|---|---|
| **Location:** | South of San Onofre Nuclear Generating Station (SONGS)<br>San Onofre Interconnection, San Diego County, California |
| **Definition:** | <u>South of SONGS Lines</u> — <u>Metered End</u><br>SONGS-San Luis Rey — SONGS<br>SONGS-San Luis Rey — SONGS<br>SONGS- San Luis Rey — SONGS<br>SONGS-Talega #1 — SONGS<br>SONGS-Talega #2 — SONGS |
| **Transfer Limit:** | North to South: 2200/2500 MW (see System Conditions below)<br><br>South to North: No longer required based on determination made in 1999 through WECC review.<br>(See letter from PCC Chairman to PCC, OC, and TSS dated June 26, 2001) |
| **Critical Disturbance that limits the transfer capability:** | The 2200 MW north to south rating is based on flowability on the path under normal conditions.<br><br>During critical contingency operating conditions with a 2500 MW north to south flow, outage of SCE's Del Amo-Ellis 230 kV line loads the Barre-Ellis 230 kV line to 99.8% of its N-1 contingency "A" rating of 2850 amps. |
| **When:** | Accepted dual ratings were approved by PCC on February 11, 2000. |
| **System Conditions:** | For north to south flow, the 2200 MW rating is applicable under normal conditions. The 2500 MW rating is applicable only for times when any segment of the Southwest PowerLink is out of service for any reason. |
| **Study Criteria:** | WECC, SDGE, and the California ISO. |
| **Remedial Actions Required:** | The need for arming RAS for local load shedding will be determined by the California ISO and SDGE during seasonal operating studies, however, no load shedding requirement has been identified at this time. |
| **Formal Operating Procedure:** | None |
| **Allocation:** | San Diego Gas & Electric owns lines as defined above. The California ISO exercises operational control of the lines and associated facilities. |
| **Interaction w/Other Transfer Paths:** | None |
| **Contact Person:** | Linda P. Brown<br>San Diego Gas & Electric<br>8316 Century Park Court, CP52A<br>San Diego, CA 92123-1582<br>(858) 654-6477<br>(858) 654-1692 - fax<br>lpbrown@semprautilities.com |

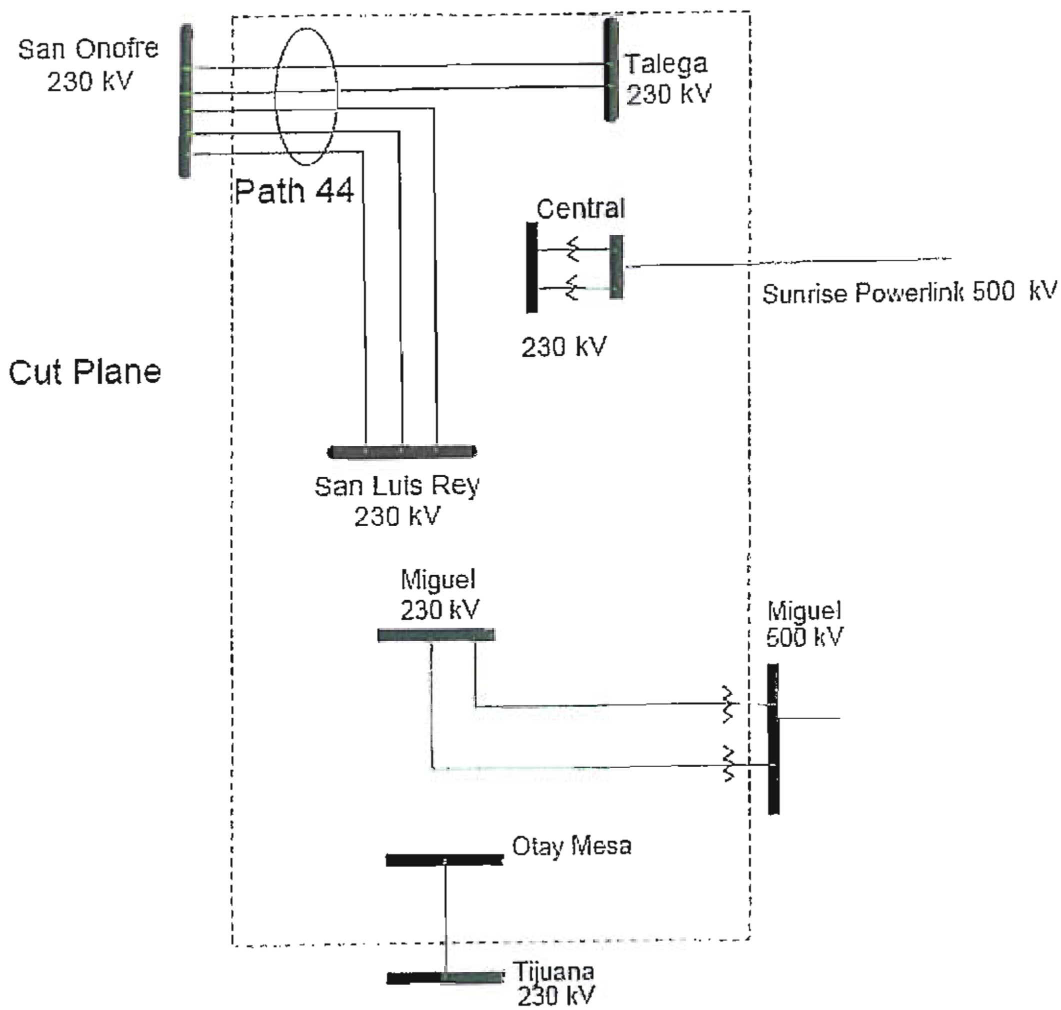
# Exhibit 3

**San Diego Gas & Electric Company**
San Diego Basin Import Cut Plane
Pre-Sunrise Project



# Exhibit 4

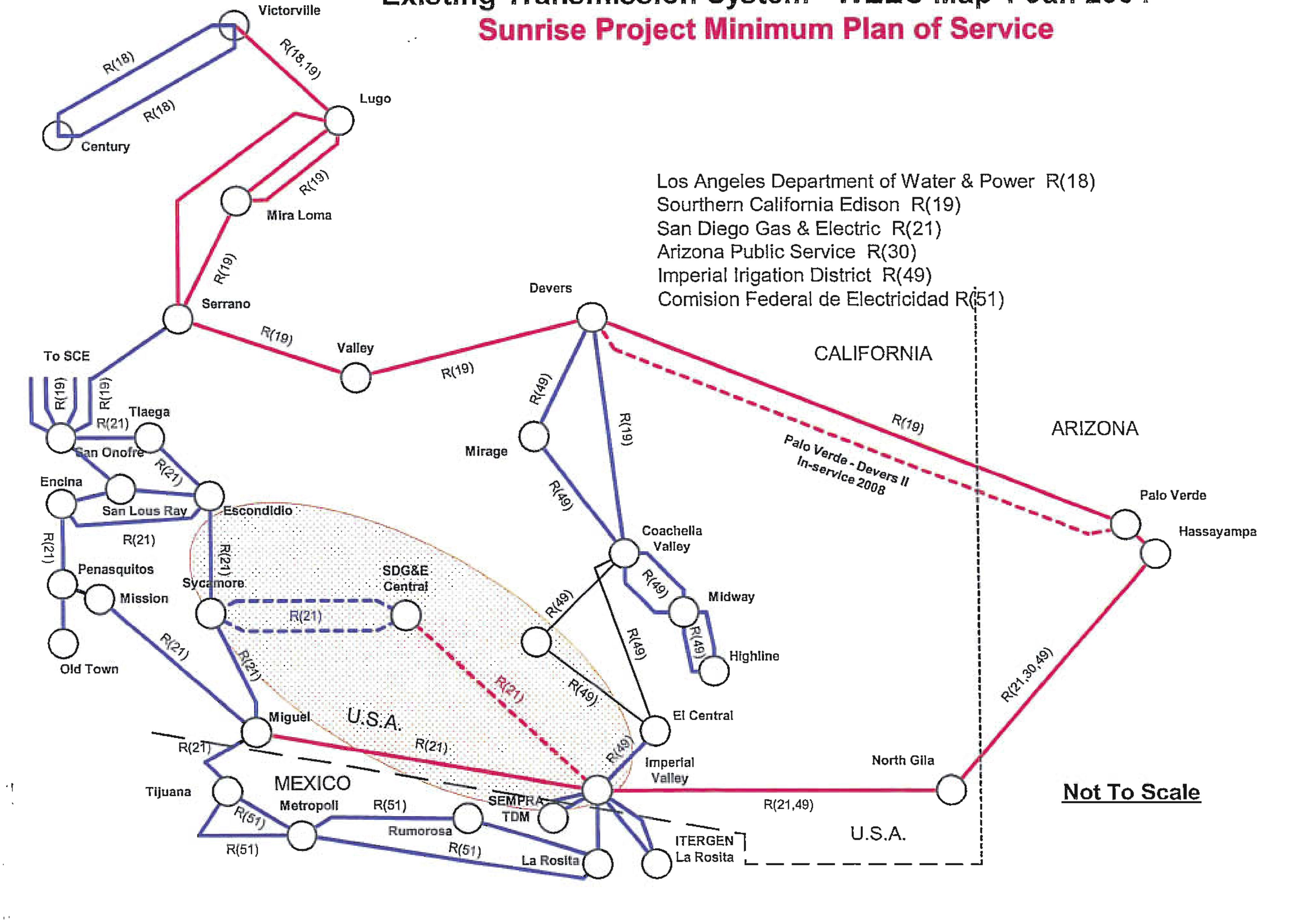
**San Diego Gas & Electric Company**
San Diego Basin Import Cut Plane
With Sunrise Project



# Exhibit 5

# Existing Transmission System - WEEC Map 1 Jan 2004

## Sunrise Project Minimum Plan of Service



# Exhibit 6

## Table I. Transmission System Standards – Normal and Emergency Conditions

| Category | Contingencies | System Limits or Impacts | | |
|---|---|---|---|---|
| | Initiating Event(s) and Contingency Element(s) | System Stable and both Thermal and Voltage Limits within Applicable Rating [a] | Loss of Demand or Curtailed Firm Transfers | Cascading Outages |
| A<br>No Contingencies | All Facilities in Service | Yes | No | No |
| B<br>Event resulting in the loss of a single element. | Single Line Ground (SLG) or 3-Phase (3Ø) Fault, with Normal Clearing:<br>1. Generator<br>2. Transmission Circuit<br>3. Transformer<br>Loss of an Element without a Fault | <br>Yes<br>Yes<br>Yes<br>Yes | <br>No [b]<br>No [b]<br>No [b]<br>No [b] | <br>No<br>No<br>No<br>No |
| | Single Pole Block, Normal Clearing [e]:<br>4. Single Pole (dc) Line | Yes | No [b] | No |
| C<br>Event(s) resulting in the loss of two or more (multiple) elements. | SLG Fault, with Normal Clearing [e]:<br>1. Bus Section<br>2. Breaker (failure or internal Fault) | Yes<br>Yes | Planned/ Controlled [c]<br>Planned/ Controlled [c] | No<br>No |
| | SLG or 3Ø Fault, with Normal Clearing [e], Manual System Adjustments, followed by another SLG or 3Ø Fault, with Normal Clearing [e]:<br>3. Category B (B1, B2, B3, or B4) contingency, manual system adjustments, followed by another Category B (B1, B2, B3, or B4) contingency | Yes | Planned/ Controlled [c] | No |
| | Bipolar Block, with Normal Clearing [e]:<br>4. Bipolar (dc) Line Fault (non 3Ø), with Normal Clearing [e]:<br>5. Any two circuits of a multiple circuit towerline [f] | Yes<br>Yes | Planned/ Controlled [c]<br>Planned/ Controlled [c] | No<br>No |
| | SLG Fault, with Delayed Clearing [e] (stuck breaker or protection system failure):<br>6. Generator<br>7. Transformer<br>8. Transmission Circuit<br>9. Bus Section | Yes<br>Yes<br>Yes<br>Yes | Planned/ Controlled [c]<br>Planned/ Controlled [c]<br>Planned/ Controlled [c]<br>Planned/ Controlled [c] | No<br>No<br>No<br>No |

## Definitions

### Common Corridor:

Contiguous right-of-way or two parallel right-of-ways with structure centerline separation less than the longest span length of the two transmission circuits at the point of separation or 500 feet, whichever is greater, between the transmission circuits. This separation requirement does not apply to the last five spans of the transmission circuits entering into a substation.

### Adjacent Transmission Circuits:

Transmission circuits within a Common Corridor with no other transmission circuits between them. Transmission Lines that cross but are otherwise on separate corridors are not Adjacent Transmission Circuits.

## A. Introduction

1. **Title: System Performance Criteria Under Normal Conditions, Following Loss of a Single BES Element, and Following Extreme BES Events**

2. **Numbers:** TPL-001-WECC-1-CR

   TPL-002-WECC-1-CR

   TPL-003-WECC-1-CR

   TPL-004-WECC-1-CR

3. **Purpose:** System simulations and associated assessments are needed periodically to ensure that reliable systems are developed that meet specified performance requirements with sufficient lead time, and continue to be modified or upgraded as necessary to meet present and future system needs.

4. **Applicability**

   **4.1.** Planning Authority

   **4.2.** Transmission Planner

5. **Effective Date:** April 18, 2008

## B. Requirements

**WRS1.** In addition to NERC Table I, Planning Authorities or Transmission Planners shall comply with the WECC Disturbance-Performance Table (Table W-1) of Allowable Effects on Other Systems contained in this section when planning the Western Interconnection. Table W-1 does not apply internal to a Transmission Operator Area.

**WRS1.1.** The NERC Category C.5 initiating event of a non-three phase fault with normal clearing shall also apply to the common mode contingency of two Adjacent Transmission Circuits on separate towers unless the event frequency is determined to be less than one in thirty years.

**WRS1.2.** The common mode simultaneous outage of two generator units connected to the same switchyard, not addressed by the initiating events in NERC Category C, shall not result in cascading.

**WRS1.3.** The loss of multiple bus sections as a result of a failure or delayed clearing of a bus tie or bus sectionalizing breaker shall meet the performance specified for Category D of Table W-1.

**WRS1.4.** For contingencies involving existing or planned facilities, the Table W-1 performance category can be adjusted based on actual or expected performance (e.g. event outage frequency and consideration of impact) after receiving Board approval to change the Performance Level Adjustment Record.

**WRS2.** Individual systems or a group of systems may apply requirements that differ from specific requirements in Table W-1 for internal impacts. If the individual requirements are less stringent, other systems are permitted to have the same impact on that part of the individual system for the same category of disturbance. If these requirements are more stringent, these requirements may not be imposed on other systems. This does not relieve the system or group of systems from WECC requirements for impacts on other systems.

WRS3. Reactive power resources, with a balance between static and dynamic characteristics, shall be planned and distributed throughout the interconnected transmission systems to ensure system performance as defined below.

**WRS3.1.** For transfer paths, voltage stability is required with the pre-contingency path flow modeled at a minimum of 105% of the path rating for system normal conditions (Category A) and for single contingencies (Category B). For multiple contingencies (Category C), post-transient voltage stability is required with the pre-contingency transfer path flow modeled at a minimum of 102.5% of the path rating.

**WRS3.2.** For load areas, voltage stability is required for the area modeled at a minimum of 105% of the reference load level for system normal conditions (Category A) and for single contingencies (Category B). For multiple contingencies (Category C), post-transient voltage stability is required with the area modeled at a minimum of 102.5% of the reference load level. For this criterion, the reference load level is the maximum established planned load limit for the area under study.

**WRS3.3.** Specific requirements that exceed the minimums specified in WRS3.1 and WRS3.2 may be established, to be adhered to by others, provided that technical justification has been approved by the Planning Coordination Committee (PCC) of the WECC.

**WRS3.4.** WRS3 applies to internal WECC Member Systems as well as between Member Systems.

WRS4. The Planning Authorities and Transmission Planners shall meet the same performance category for unsuccessful reclosing as that required for the initiating disturbance without reclosing.

WRS5. For any event that has actually resulted in cascading, action must be taken so that future occurrences of the event will not result in cascading, or it must demonstrate that the Mean Time Between Failure (MTBF) is greater than 300 years (frequency less than 0.0033 outages/year) and approved by PCC.

**WR5.1.** Any contingency adjusted to Category D must not result in a cascading outage unless the MTBF is greater than 300 years (frequency less than 0.0033 outages/year) or the initiating disturbances and corresponding impacts are confined to either a radial system or a local network.

## C. Measures

WMS1. Planning Authority or Transmission Planner has documentation that it complies with the WECC Disturbance-Performance Table (Table W-1) of Allowable Effects on Other Systems as required by WRS1.

WMS2. The Planning Authority or Transmission Planner has documentation that it has planned for reactive power resource as required by WRS3.

WMS3. The Planning Authority or Transmission Planner has documentation that it meets the same performance category for unsuccessful reclosing as required by WRS4.

WMS4. The Planning Authority or Transmission Planner with less stringent individual requirements than these WECC requirements has documentation that other Planning

Authorities or Transmission Planners performance are permitted to have the same impact on that part of the individual system for the same category of disturbance.

**WMS5.** The Planning Authority or Transmission Planner has documentation that it has Planning Coordination Committee (PCC) approval to adjust in Table W-1 the Performance Level Adjustment Record involving existing or planned facilities.

**WMS6.** For any event that has actually resulted in cascading, the Planning Authority or Transmission Planner shall have documentation that it has taken action so that future occurrences of the event will not result in cascading, or it must have documentation that it has PCC approval that the Mean Time Between Failure (MTBF) is greater than 300 years (frequency less than 0.0033 outages/year).

## D. Compliance

### 1. Compliance Monitoring Process

#### 1.1. Compliance Monitoring Responsibility

Western Electricity Coordinating Council (WECC)

#### 1.2. Compliance Monitoring Period and Reset

Annual

#### 1.3. Data Retention

Four Years

#### 1.4. Additional Compliance Information

None

**Version History** – Shows Approval History and Summary of Changes in the Action Field

| Version | Date | Action | Change Tracking |
|---|---|---|---|
| 1 | April 6, 2008 | Replaces the Part I - NERC/WECC Planning Standards | |

## 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 (See Note 3) |
|---|---|---|---|---|
| A | Not Applicable | Nothing in addition to NERC | | |
| B | ≥ 0.33 | Not to exceed 25% at load buses or 30% at non-load buses.<br><br>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.<br><br>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 | | |

*Notes:*

1. *The WECC Disturbance-Performance Table applies equally to either a system with all elements in service, or a system with one element removed and the system adjusted.*

2. *As an example in applying the WECC Disturbance-Performance Table, a 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.*

*Table W-1*

3. *If it can be demonstrated that post transient voltage deviations that are less than the values in the table will result in voltage instability, the system in which the disturbance originated and the affected system(s) shall cooperate in mutually resolving the problem.*

4. *Refer to Figure W-1 for voltage performance parameters.*

5. *Load buses include generating unit auxiliary loads.*

6. *To reach the frequency categories shown in the WECC Disturbance-Performance Table for Category C disturbances, some planned and controlled islanding may occur. Underfrequency load shedding is expected to arrest this frequency decline and assure continued operation within the resulting islands.*

7. *For simulation test cases, the interconnected transmission system steady state loading conditions prior to a disturbance shall be appropriate to the case. Disturbances shall be simulated at locations on the system that result in maximum stress on other systems. Relay action, fault clearing time, and reclosing practice shall be represented in simulations according to the planning and operation of the actual or planned systems. When simulating post transient conditions, actions are limited to automatic devices and no manual action is to be assumed.*

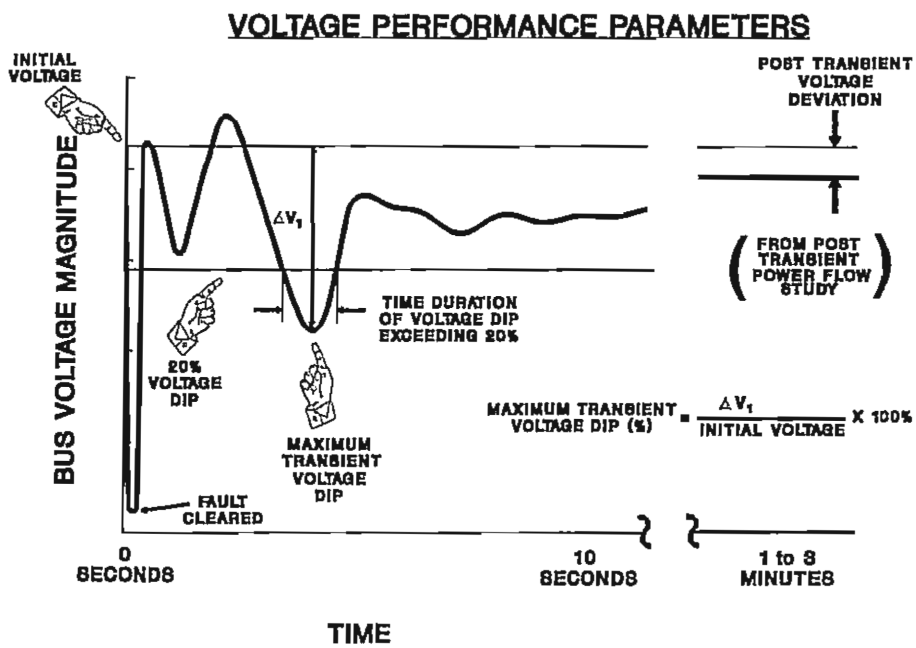



*Figure W-1*

# Exhibit 7

RPEWG's Evaluation of SDG&E's Sunrise Powerlink and Southwest Powerlink Double Line Outage Category Upgrade Request (Proposed Path)

1) After reviewing SDG&E's report, the RPEWG recommends that the proposed path (4 miles – 12 towers) for the Sunrise Powerlink and Southwest Powerlink double line outage analysis should be approved for the category upgrade to Category D with cascading allowed.
2) The RPEWG recommendation is based on the review by the RPEWG of SDG&E MTBF calculation and robust line design that showed
    a. the MTBF for the Sunrise Powerlink and Southwest Powerlink would tend towards 928 years, which is over the 300 year MTBF required for allowing cascading
    b. the robust line design shows all 11 risks factors to be Low Risk
    c. the extent of the cascading would be expected to be limited to the Southern California area
    d. the cascading could be mitigated by the addition of approximately 1300 MVAR of reactive support in Southern California or the load drop of 400 MW in the San Diego area

RPEWG's Evaluation of SDG&E's Sunrise Powerlink and Southwest Powerlink Double Line Outage Category Upgrade Request (Alternate Path)

1) After reviewing SDG&E's report, the RPEWG recommends that the alternate path (36 miles) for the Sunrise Powerlink and Southwest Powerlink double line outage analysis should not be approved for the category upgrade to Category D.
2) The RPEWG recommendation is based on the review by the RPEWG of SDG&E MTBF calculation and robust line design that showed
    a. the MTBF for the Sunrise Powerlink and Southwest Powerlink would tend towards 21 years
    b. the robust line design showed Moderate Risk for 3 risks factors and High Risk for 3 risk factors

# Exhibit 8

SCE Net MW Ties = -4740.7 MW

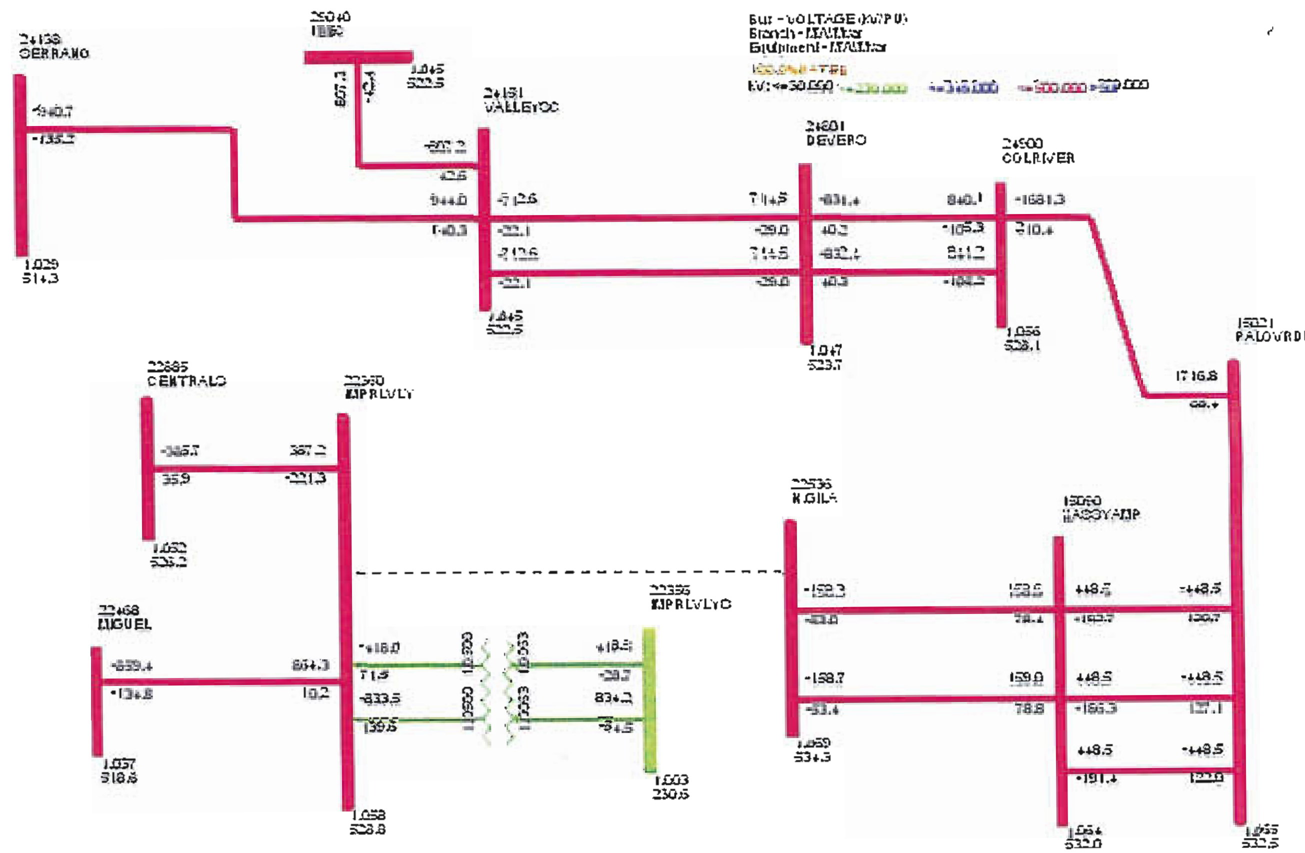
SDGE System Net MW Ties = -2931.7 MW

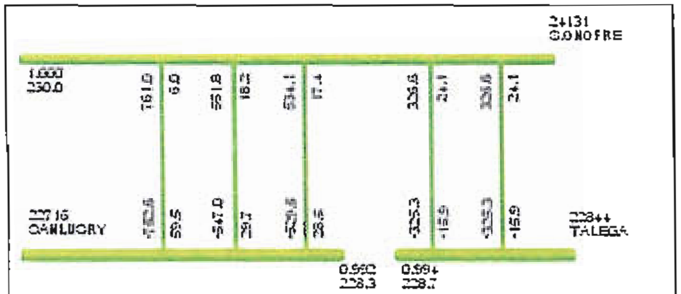
SDGE In-Basin Net MW Ties = -4066.9 MW

Miguel from Imperial Valley 500 kV = -869.4 MW

Central from Imperial Valley 500 kV = -385.7 MW

Otay Mesa - Tijuana = -321.8 MW



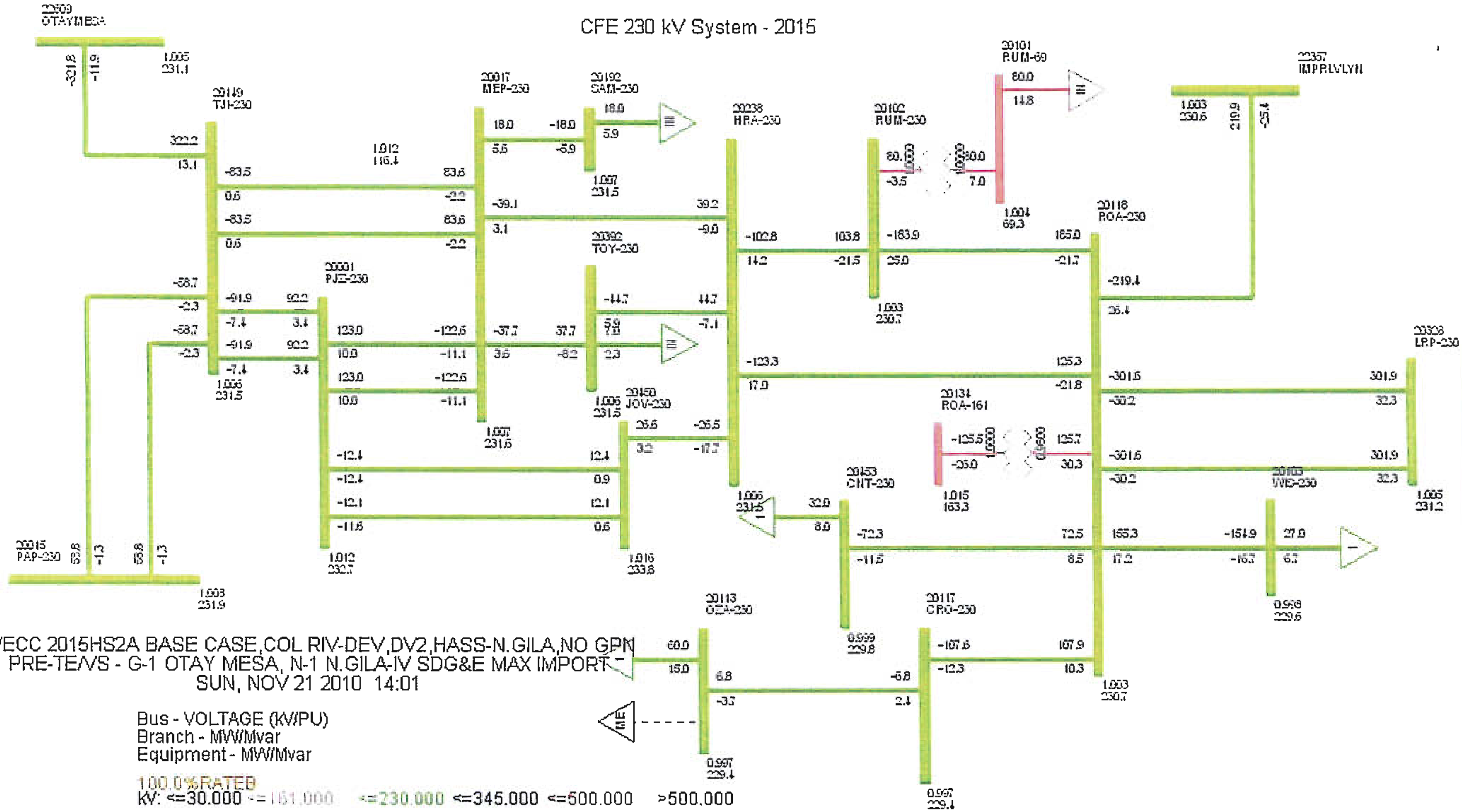

Path 44 (South of SONGS) = -2500.0 MW

Path 44 Rating - 2,200 MW long-term, 2,500 MW short-term

WECC 2015HS2A BASE CASE,COL RIV-DEV,DV2,HASS-N.GILA,NO GPN
PRE-TE/VS - G-1 OTAY MESA, N-1 N.GILA-IV SDG&E MAX IMPORT
TUE, NOV 16 2010 9:33

# Exhibit 9

CFE 230 kV System - 2015




WECC 2015HS2A BASE CASE,COL RIV-DEV,DV2,HASS-N.GILA,NO GPN
PRE-TE/VS - G-1 OTAY MESA, N-1 N.GILA-IV SDG&E MAX IMPORT
SUN, NOV 21 2010 14:01

Bus - VOLTAGE (KV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar

100.0%RATEB
KV: <=30.000 <=161.000 <=230.000 <=345.000 <=500.000 >500.000

# Exhibit 10

San Diego Gas & Electric Company
Local Capacity Requirement
2015

| | | | |
|---|---|---|---|
| SDG&E Load - MW | System & In-basin Heavy Load | 5367 | |
| | In-basin losses - Normal Conditions | 108 | |
| | in-basin requirements | 5475 | |
| SDG&E Import capabilities - MW | | Pre-TE/VS | With TE/VS |
| For N-2 Loss of Imperial Valley-Miguel and IV-Central | | | |
| | In-basin | 3140 | 4135 |
| For Loss of G-1 Otay Mesa and N-1 Imperial Valley-N. Gila | | | |
| | In-basin | 4067 | 5046 |
| SDG&E Local Capacity requirement - MW | | | |
| For N-2 Loss of Imperial Valley-Miguel and IV-Central | | | |
| In-basin | | | |
| | Load +losses | 5475 | 5475 |
| | Import Capability | 3140 | 4135 |
| | LCR - MW | 2335 | 1340 |
| | Capacity available | | |
| | With Encina | 3060 | 3060 |
| | Without Encina | 2114 | 2114 |
| | Capacity Net Position | | |
| | With Encina | 725 | 1720 |
| | Without Encina | -221 | 774 |
| For Loss of G-1 Otay Mesa and N-1 Imperial Valley-N. Gila | | | |
| In-basin | | | |
| | Load +losses | 5475 | 5475 |
| | Import Capability | 4067 | 5046 |
| | LCR - MW | 1408 | 429 |
| | Capacity available | | |
| | With Encina | 2454 | 2454 |
| | Without Encina | 1508 | 1508 |
| | Capacity Net Position | | |
| | With Encina | 1046 | 2025 |
| | Without Encina | 100 | 1079 |

Prepared by: Fred Depenbrock
Siemens PTI
11/20/2010

# Exhibit 11

SCE Net MW Ties = -5091.3 MW

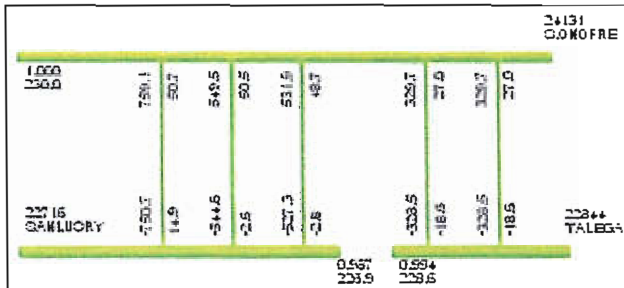
SDGE System Net MW Ties = -2619.1 MW

SDGE In-Basin Net MW Ties = -3194.9 MW

Miguel from Imperial Valley 500 kV = 0.0 MW

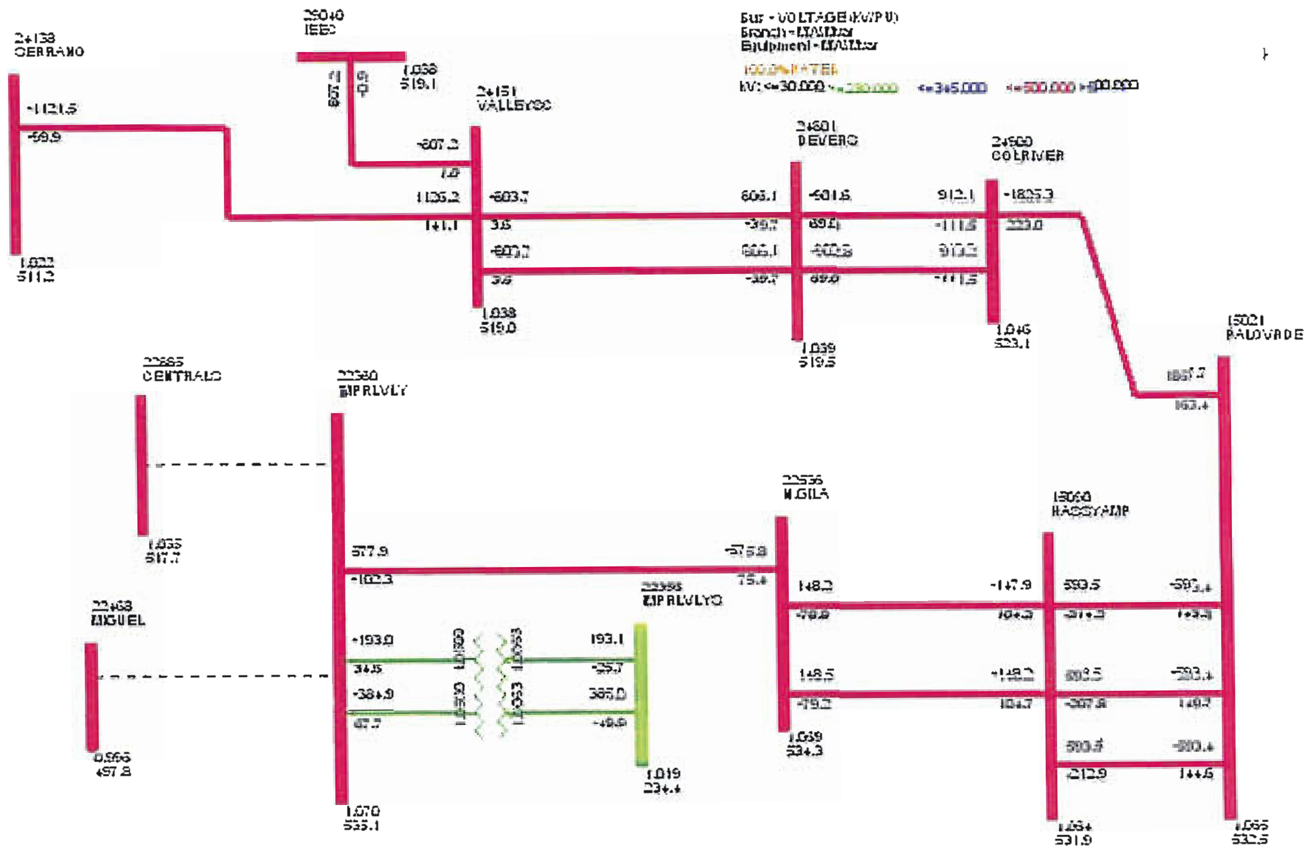
Central from Imperial Valley 500 kV = 0.0 MW

Otay Mesa - Tijuana = -894.9 MW



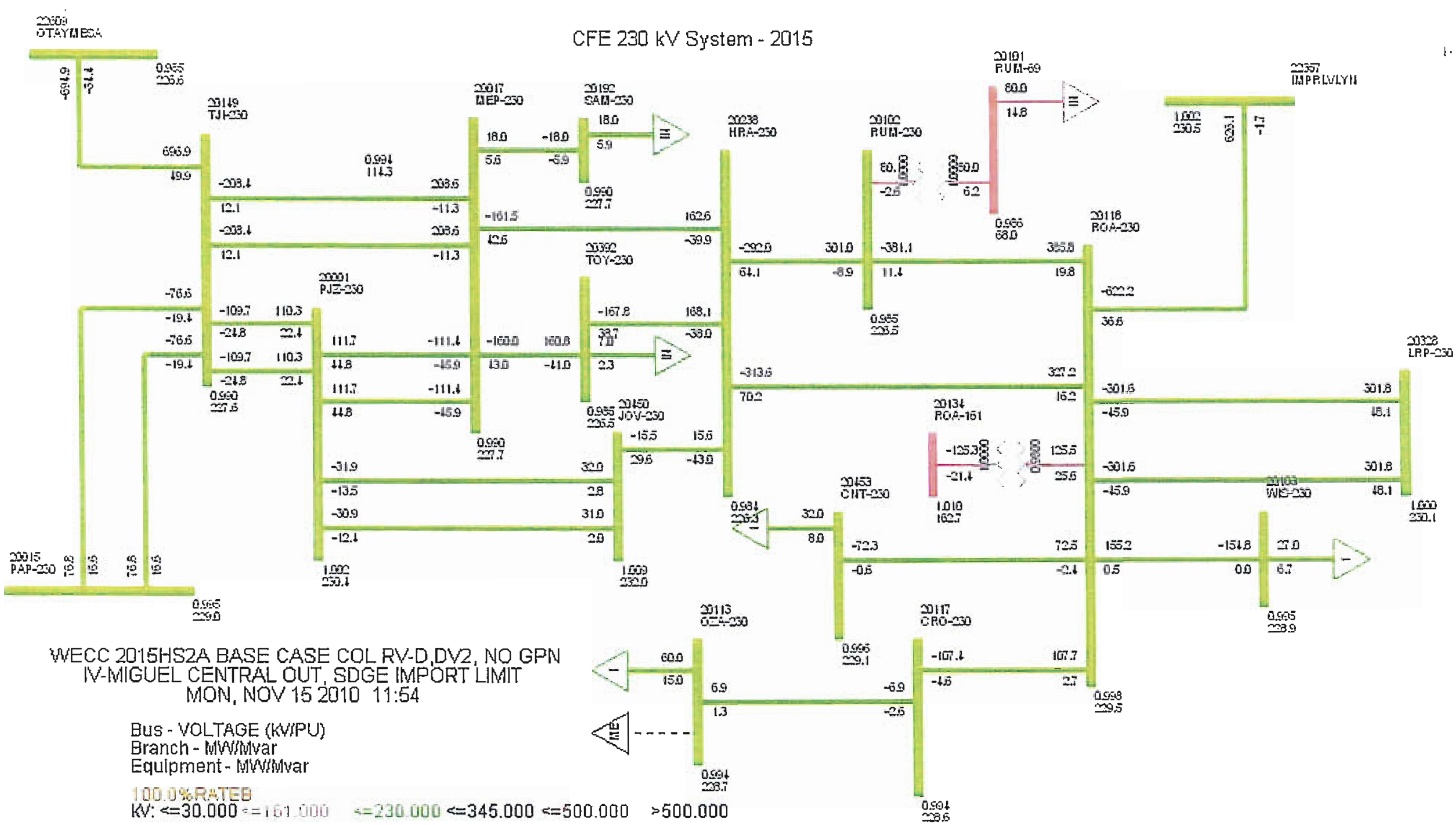

Path 44 (South of SONGS) = -2500.0 MW

Path 44 Rating - 2,200 MW long-term, 2,500 MW short-term



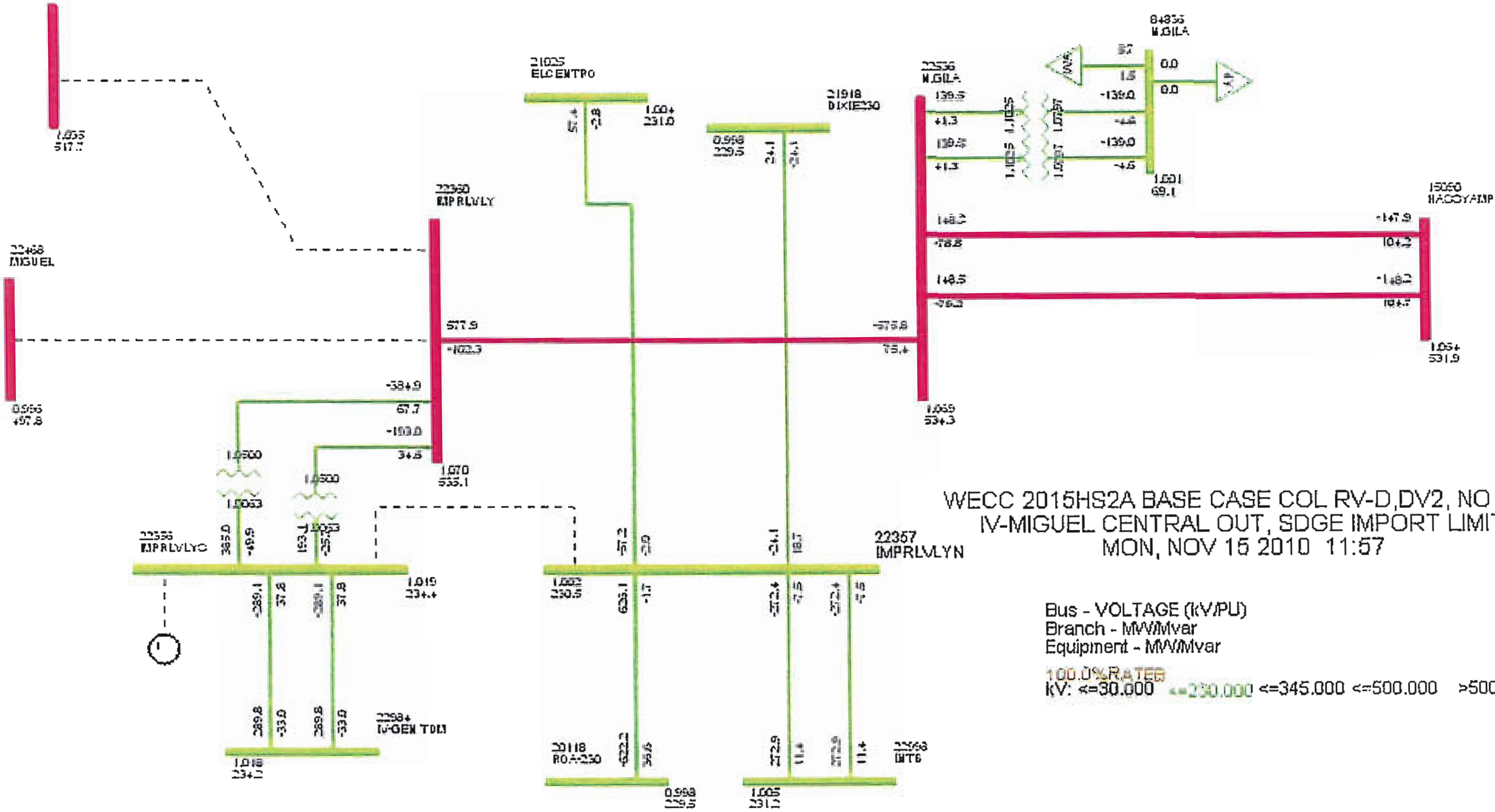

WECC 2015HS2A BASE CASE COL RV-D,DV2, NO GPN
IV-MIGUEL CENTRAL OUT, SDGE IMPORT LIMIT
MON, NOV 15 2010 11:54

# Exhibit 12


CFE 230 kV System - 2015
22609 OTAYMESA
20149 TJI-230
20017 MEP-230
20192 SAM-230
20238 HRA-230
20102 RUM-230
20191 RUM-69
22357 IMPRLVLYN
20118 ROA-230
22328 LRP-230
20091 PJZ-230
20392 TOY-230
20150 JOV-230
20134 ROA-161
20453 CNT-230
20103 WIS-230
20015 PAP-230
20113 OZA-230
20117 CRO-230
WECC 2015HS2A BASE CASE COL RV-D,DV2, NO GPN
IV-MIGUEL CENTRAL OUT, SDGE IMPORT LIMIT
MON, NOV 15 2010 11:54
Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%RATEB
kV: <=30.000 <=161.000 <=230.000 <=345.000 <=500.000 >500.000

# Exhibit 13

# Imperial Valley - North Gila Area




WECC 2015HS2A BASE CASE COL RV-D,DV2, NO GPN
IV-MIGUEL CENTRAL OUT, SDGE IMPORT LIMIT
MON, NOV 15 2010 11:57

Bus - VOLTAGE (kV/PU)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%RATED
kV: <=30.000 <=230.000 <=345.000 <=500.000 >500.000

# Exhibit 14

SCE Net MW Ties = -6869.6 MW

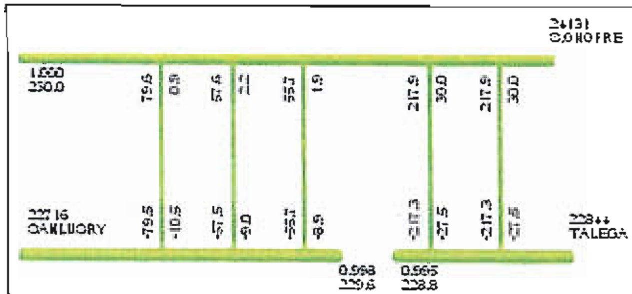
SDGE System Net MW Ties = -2050.0 MW

SDGE In-Basin Net MW Ties = -3139.7 MW

Miguel from Imperial Valley 500 kV = -1424.6 MW

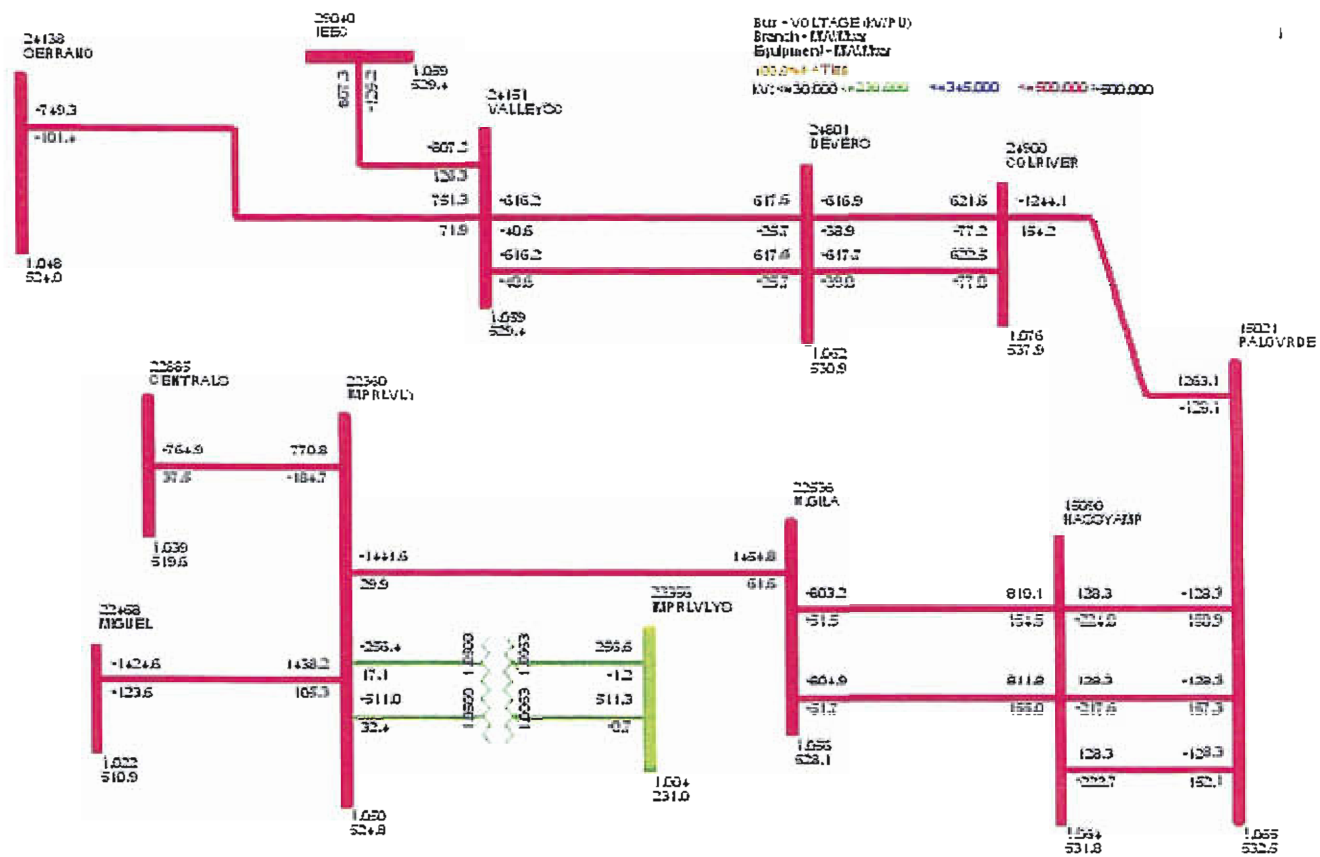
Central from Imperial Valley 500 kV = -764.9 MW

Otay Mesa - Tijuana = -321.6 MW




Path 44 (South of SONGS) = -628.7 MW

Path 44 Rating - 2,200 MW long-term, 2,500 MW short-term

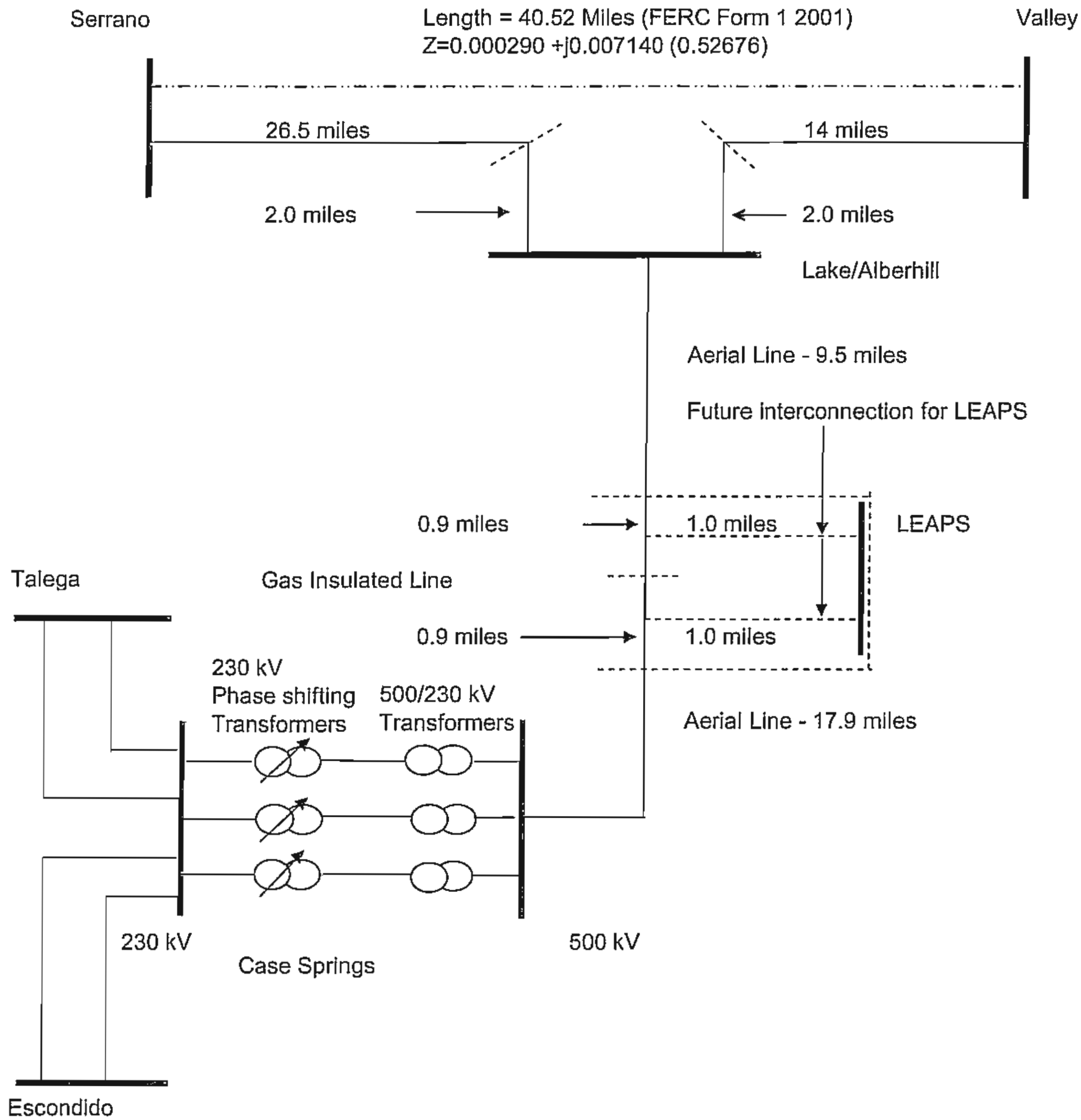



WECC 2015HS2A BASE CASE,COL RIV-DEV,DV2,HASS-N_GILA,NO GPN
PRE-TE/VS - PRE N-2 IV-MIGUEL, CENTRAL SYSTEM NORMAL
TUE, NOV 16 2010 9:50

# Exhibit 15

**TE/VS Transmission System Upgrades**

Diagram showing Layout



**TE/VS Transmission System Upgrades**

Impedances, Lengths and Ratings



| Line Component | Impedance (Per Unit) (line voltage,100 MVA Base) R | X | B | Length (Miles) | Ratings (MVA) A | B | |
|---|---|---|---|---|---|---|---|
| Valley-Serrano | 0.0002900 | 0.0071400 | 0.52676 | 40.52 | 2598 | 2598 | 3000Amps |
| Serrano-Lake | 0.0002040 | 0.0050220 | 0.37050 | 28.5 | 2598 | 2598 | 3000Amps |
| Valley-Lake | 0.0001145 | 0.0028193 | 0.20800 | 16.0 | 2598 | 2598 | 3000Amps |
| Lake-LEAPS (Aerial) | 0.0000680 | 0.0016740 | 0.12350 | 9.5 | 2598 | 2598 | 3000Amps |
| Lake-LEAPS (GIL) | 0.0000055 | 0.0000470 | 0.07447 | 0.9 | 3464 | 3464 | 4000 Amps |
| LEAPS (GIL) - North | 0.0000061 | 0.0000522 | 0.08274 | 1.0 | 3464 | 3464 | 4000 Amps |
| Lake-LEAPS (Total) | 0.0000795 | 0.0017732 | 0.28070 | 11.4 | 2598 | 2598 | 3000Amps |
| Case Springs-LEAPS (Aerial) | 0.0001281 | 0.0031541 | 0.23270 | 17.9 | 2598 | 2598 | 3000Amps |
| Case Springs-LEAPS (GIL) | 0.0000055 | 0.0000470 | 0.07447 | 0.9 | 3464 | 3464 | 4000 Amps |
| LEAPS (GIL) - South | 0.0000061 | 0.0000522 | 0.08274 | 1.0 | 3464 | 3464 | 4000 Amps |
| Case Springs-LEAPS (Total) | 0.0001396 | 0.0032533 | 0.38990 | 19.8 | 2598 | 2598 | 3000Amps |
| Escondido-Talega | 0.0094500 | 0.0729000 | 0.15100 | 51.0 | 456.1 | 456.1 | 1,145 Amps |
| Escondido-Case Springs(each) | 0.0034280 | 0.0528882 | 0.10955 | 37.0 | 912.2 | 912.2 | 2,290 Amps |
| Telega-Case Springs(each) | 0.0012971 | 0.0200118 | 0.04145 | 14.0 | 912.2 | 912.2 | 2,290 Amps |
| Transformers | | | | | | | |
| 500 MVA 500/230kV Auto | 0.0003550 | 0.0270650 | 33 tap positions | | 500 | 620 | |
| 500 MVA 230 kV phase shifter | 0.0007100 | 0.0266300 | 33 tap positions | | 500 | 620 | |

# Exhibit 16

SCE Net MW Ties = -5391.3 MW

SDGE System Net MW Ties = -2973.7 MW

SDGE In-Basin Net MW Ties = -4029.6 MW

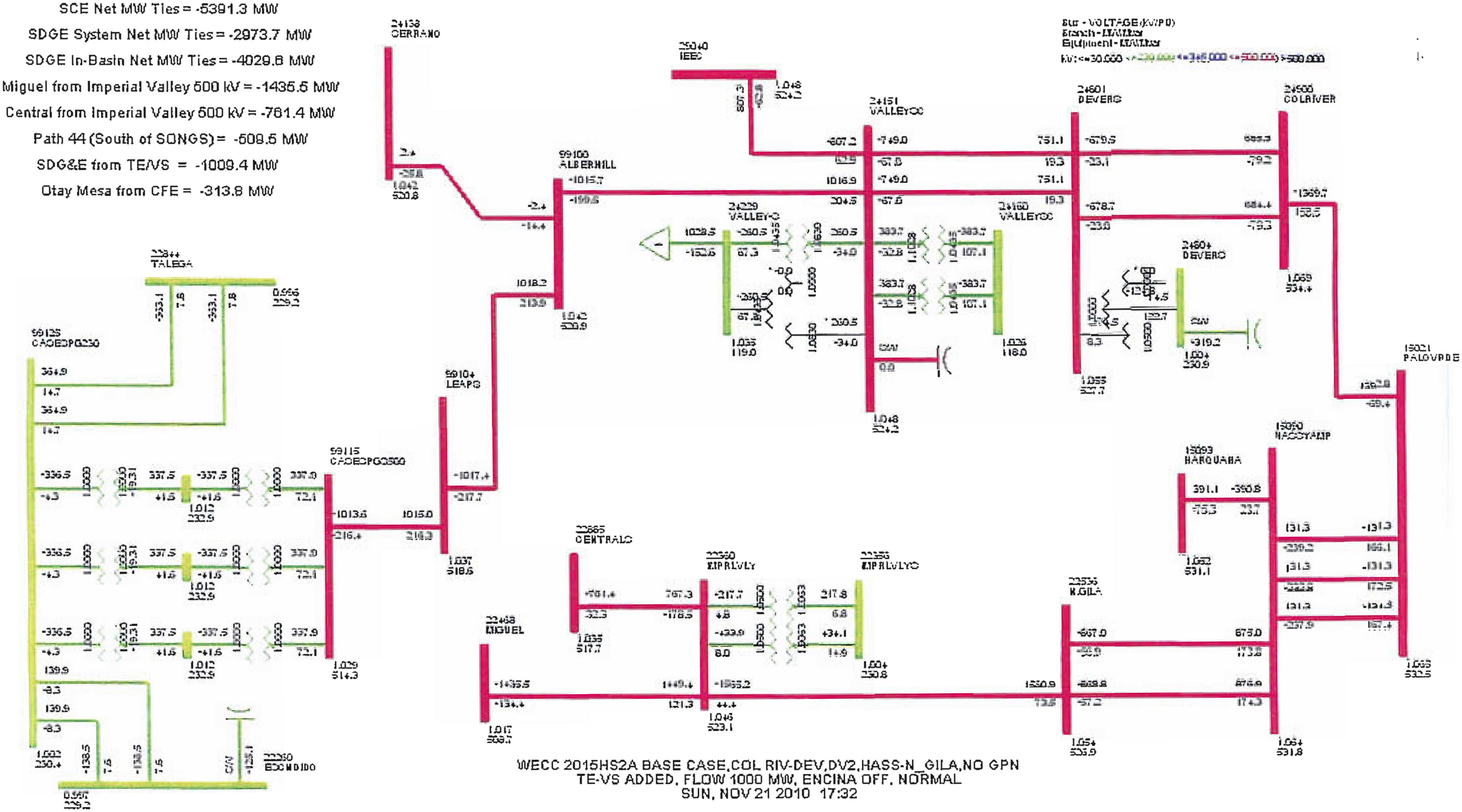
Miguel from Imperial Valley 500 kV = -1435.5 MW

Central from Imperial Valley 500 kV = -761.4 MW

Path 44 (South of SONGS) = -508.5 MW

SDG&E from TE/VS = -1009.4 MW

Otay Mesa from CFE = -313.8 MW




WECC 2015HS2A BASE CASE,COL RIV-DEV,DV2,HASS-N_GILA,NO GPN
TE-VS ADDED. FLOW 1000 MW, ENCINA OFF, NORMAL
SUN, NOV 21 2010 17:32

# Exhibit 17

SCE Net MW Ties = -5489.6 MW

SDGE System Net MW Ties = -2017.2 MW

SDGE In-Basin Net MW Ties = -3084.8 MW

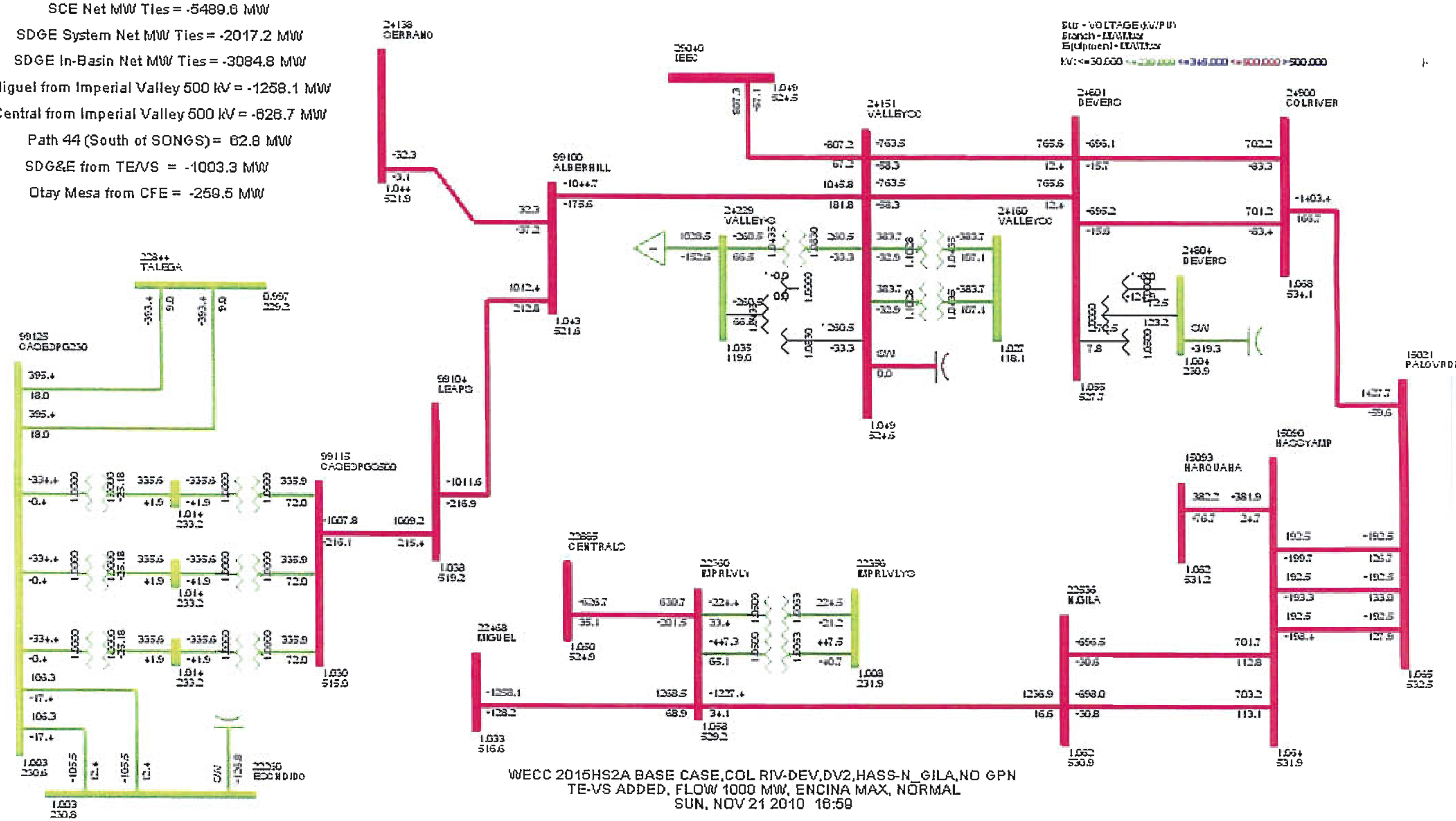
Miguel from Imperial Valley 500 kV = -1258.1 MW

Central from Imperial Valley 500 kV = -828.7 MW

Path 44 (South of SONGS) = 62.8 MW

SDG&E from TE/VS = -1003.3 MW

Otay Mesa from CFE = -259.5 MW




WECC 2015HS2A BASE CASE,COL RIV-DEV,DV2,HASS-N_GILA,NO GPN
TE-VS ADDED, FLOW 1000 MW, ENCINA MAX, NORMAL
SUN, NOV 21 2010 16:59

# Exhibit 18

SCE Net MW Ties = -4031.7 MW

SDGE System Net MW Ties = -3084.5 MW

SDGE In-Basin Net MW Ties = -4225.7 MW

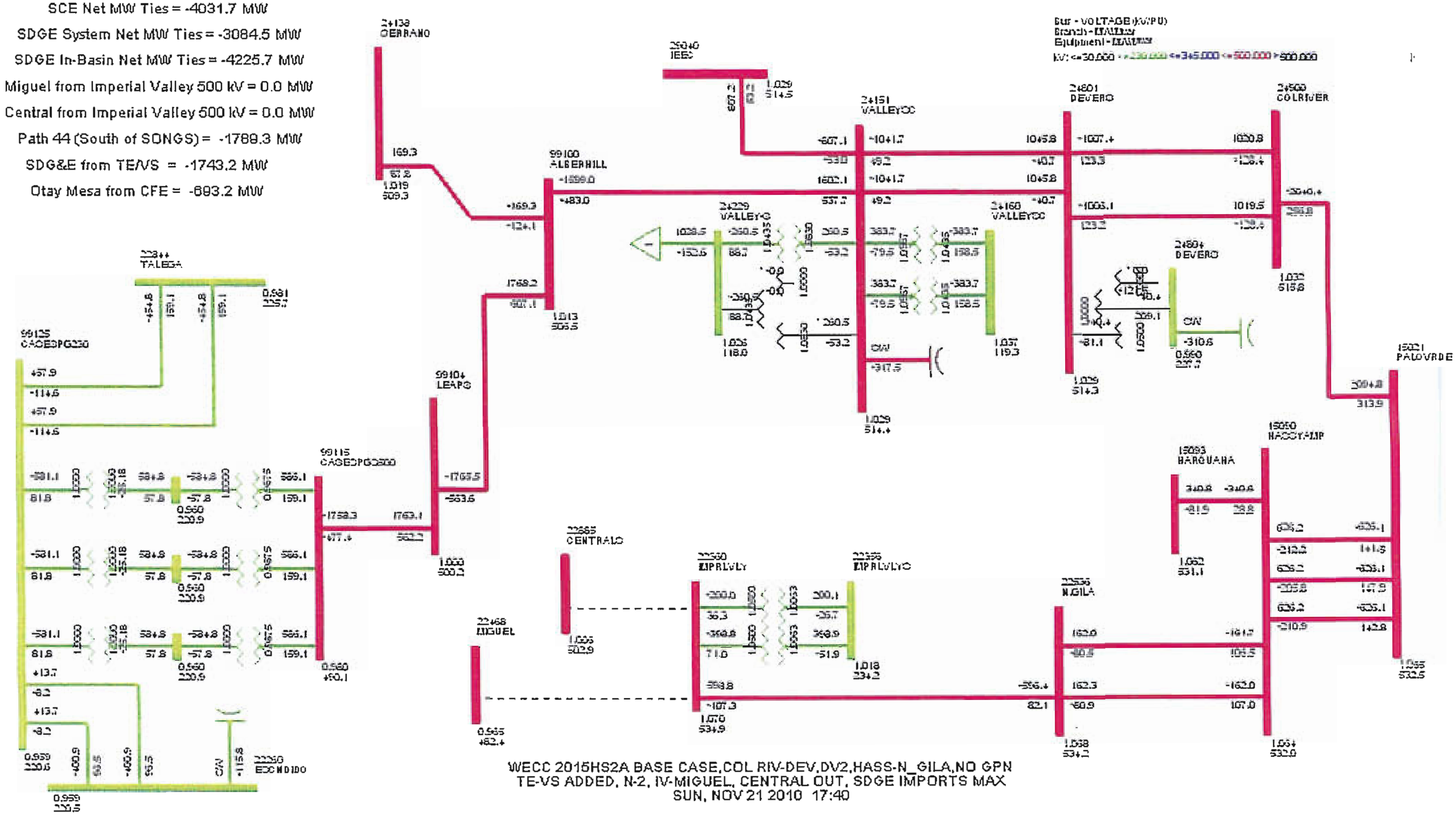
Miguel from Imperial Valley 500 kV = 0.0 MW

Central from Imperial Valley 500 kV = 0.0 MW

Path 44 (South of SONGS) = -1789.3 MW

SDG&E from TE/VS = -1743.2 MW

Otay Mesa from CFE = -683.2 MW




WECC 2015HS2A BASE CASE,COL RIV-DEV,DV2,HASS-N_GILA,NO GPN
TE-VS ADDED, N-2, IV-MIGUEL, CENTRAL OUT, SDGE IMPORTS MAX
SUN, NOV 21 2010 17:40

# Exhibit 19

SCE Net MW Ties = -5078.5 MW

SDGE System Net MW Ties = -2054.2 MW

SDGE In-Basin Net MW Ties = -3145.7 MW

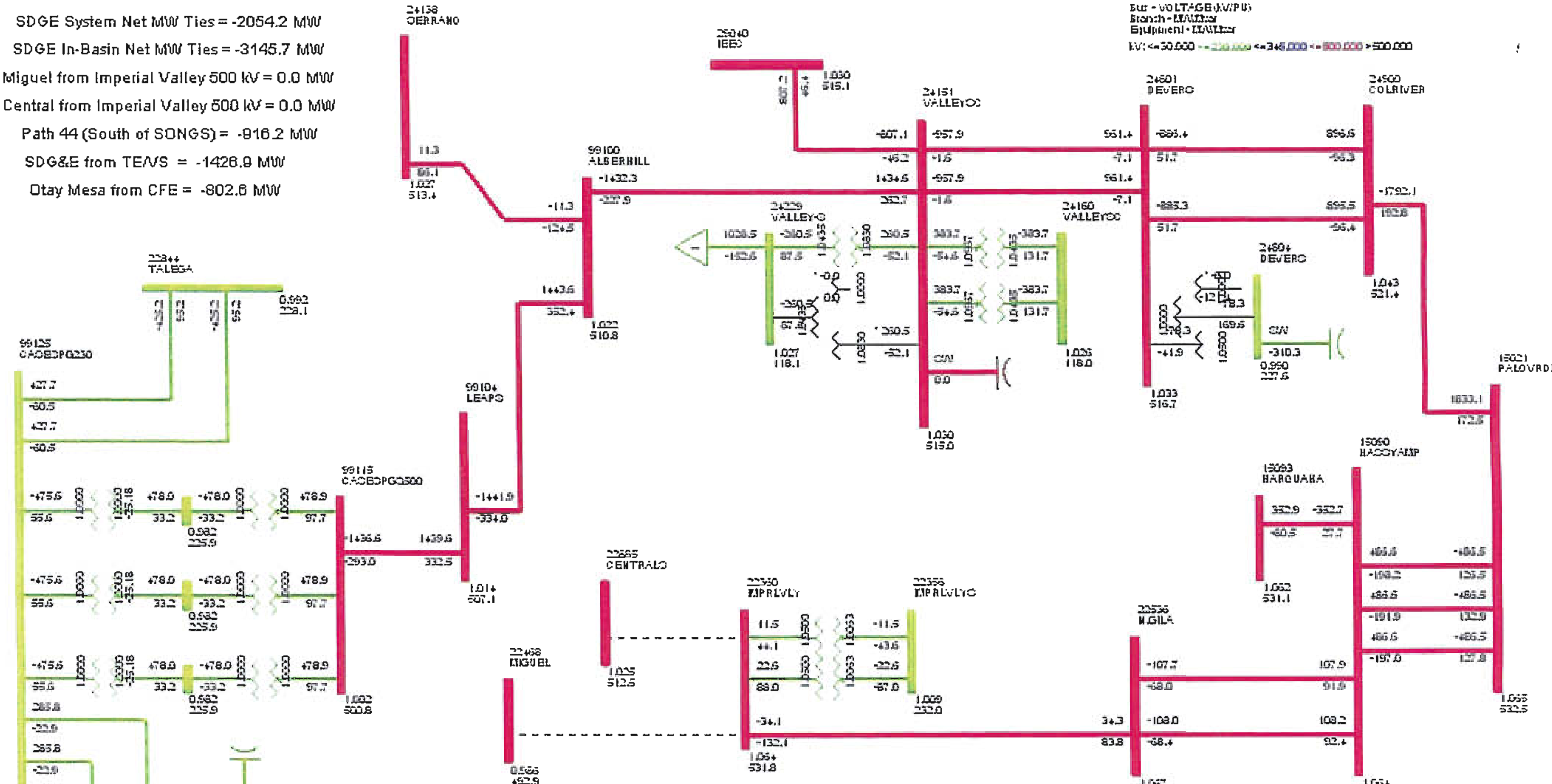
Miguel from Imperial Valley 500 kV = 0.0 MW

Central from Imperial Valley 500 kV = 0.0 MW

Path 44 (South of SONGS) = -916.2 MW

SDG&E from TE/VS = -1426.9 MW

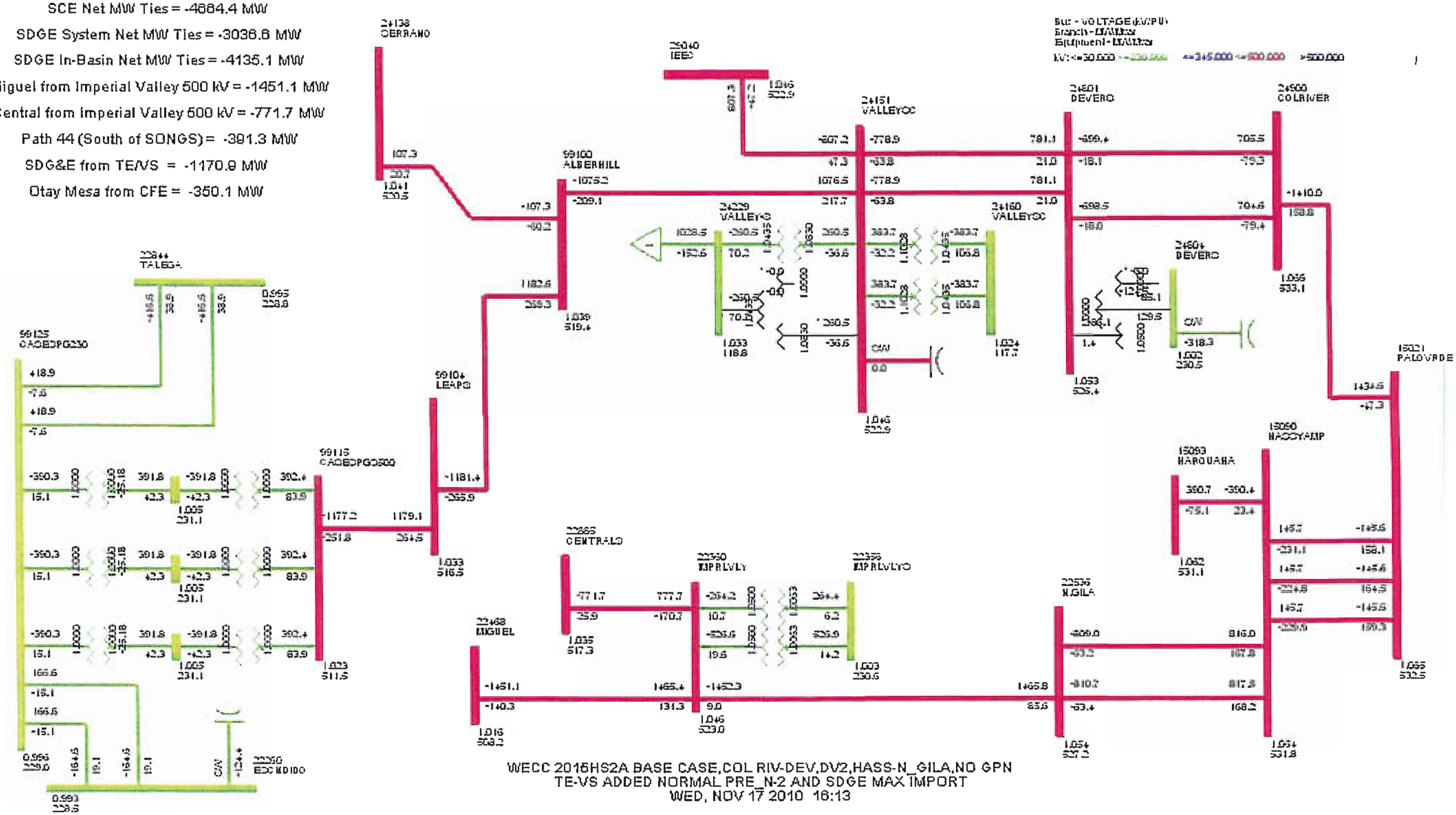
Otay Mesa from CFE = -802.6 MW




WECC 2015HS2A BASE CASE,COL RIV-DEV,DV2,HASS-N_GILA,NO GPN
TE-VS ADDED, FLOW 1000 MW, ENCINA MAX, N-2
SUN, NOV 21 2010 19:17

# Exhibit 20

SCE Net MW Ties = -4684.4 MW
SDGE System Net MW Ties = -3036.8 MW
SDGE In-Basin Net MW Ties = -4135.1 MW
Miguel from Imperial Valley 500 kV = -1451.1 MW
Central from Imperial Valley 500 kV = -771.7 MW
Path 44 (South of SONGS) = -391.3 MW
SDG&E from TE/VS = -1170.9 MW
Otay Mesa from CFE = -350.1 MW




WECC 2015HS2A BASE CASE,COL RIV-DEV,DV2,HASS-N_GILA,NO GPN
TE-VS ADDED NORMAL PRE_N-2 AND SDGE MAX IMPORT
WED, NOV 17 2010 16:13

## CERTIFICATE OF SERVICE

I hereby certify that I have this day served a copy of

**"DIRECT TESTIMONY OF FREDERICK DEPENBROCK ON BEHALF OF THE NEVADA HYDRO COMPANY"**

on all known parties to A.10-07-001 by transmitting an electronic mail message with the document attached to each person named in the official service list who provided an electronic mail address.

Executed this 30th day of November, 2010 at Washington, D.C.

*/s/ Patrick L. Morand*
Patrick L. Morand
Wright & Talisman, P.C.
(202) 393-1200
morand@wrightlaw.com

**Service List**
**A.10-07-001**

**Last Updated November 23, 2010**

## Parties

ARNOLD B. PODGORSKY
WRIGHT & TALISMAN, P.C.
1200 G STREET, N.W., SUITE 600
WASHINGTON, DC 20005
FOR: WRIGHT & TALISMAN, P.C.

PATRICK L. MORAND
WRIGHT & TALISMAN, P.C.
1200 G STREET NW, SUITE 600
WASHINGTON, DC 20005
FOR: THE NEVADA HYDRO COMPANY

ROBERT KANG
SOUTHERN CALIFORNIA EDISON COMPANY
2244 WLANUT GROVE AVE., PO BOX 800
ROSEMEAD, CA 91770
FOR: SOUTHERN CALIFORNIA EDISON COMPANY

PAUL A. SZYMANSKI
ATTORNEY AT LAW
SAN DIEGO GAS & ELECTRIC COMPANY
101 ASH STREET HQ 12
SAN DIEGO, CA 92101
FOR: SAN DIEGO GAS & ELECTRIC COMPANY

CHARITY SCHILLER
BEST BEST & KRIEGER LLP
3750 UNIVERSITY AVENUE
RIVERSIDE, CA 92502-1028
FOR: ELSINORE VALLEY MUNICIPAL WATER DISTRICT

GENE FRICK
4271 BAGGETT DR
RIVERSIDE, CA 92505
FOR: SANTA ANA MOUNTAINS TASK FORCE OF THE SIERRA CLUB/FRIENDS OF THE FOREST (TRABUCO DISTRICT)/THE SANTA ROSA PLATEAU

JACQUELINE AYER
40701 ORTEGA HIGHWAY
LAKE ELSINORE, CA 92530
FOR: FOREST RESIDENTS OPPOSING NEW TRANSMISSION LINES (FRONTLINES)

JOHN PECORA
16336 GRAND AVENUE
LAKE ELSINORE, CA 92530
FOR: JOHN PECORA

GREGORY HEIDEN
CALIF PUBLIC UTILITIES COMMISSION
LEGAL DIVISION
ROOM 5039
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3214
FOR: DIVISION OF RATEPAYER ADVOCATES

JONATHAN EVANS
CENTER FOR BIOLOGICAL DIVERSITY
351 CALIFORNIA ST., SUITE 600
SAN FRANCISCO, CA 94104
FOR: CENTER FOR BIOLOGICAL DIVERSITY

## Information Only

MRW & ASSOCIATES, LLC
EMAIL ONLY
EMAIL ONLY, CA 00000

CAL. INDEPENDENT SYSTEM OPERATOR CORP.
EMAIL ONLY
EMAIL ONLY, CA 00000

JENNIFER M. HALEY
BEST BEST & KRIEGER LLP
EMAIL ONLY
EMAIL ONLY, CA 00000-0000

JUDITH SANDERS
CAL. INDEPENDENT SYSTEM OPERATOR CORP.
EMAIL ONLY
EMAIL ONLY, CA 00000-0000

NATHAN JACOBSEN
EMAIL ONLY
EMAIL ONLY, CA 00000-0000

RUSS KANZ
EMAIL ONLY
EMAIL ONLY, CA 00000-0000

SOPHIE A. AKINS
BEST BEST AND KRIEGER, LLP
EMAIL ONLY
EMAIL ONLY, CA 00000-0000

JOHN BUSE
CENTER FOR BIOLOGICAL DIVERSITY
5656 S. DORCHESTER AVE. NO 3
CHICAGO, IL 60637

MAYA LOPEZ GRASSE
4209 E. VERMONT ST.
LONG BEACH, CA 90814

FRED MOBASHERI
CONSULTANT
ELECTRIC POWER GROUP, LLC
201 SOUTH LAKE AVE., SUITE 400
PASADENA, CA 91101

LUPE GARCIA
ELECTRIC POWER GROUP
201 S. LAKE AVENUE, STE. 400
PASADENA, CA 91101

CASE ADMINISTRATION
SOUTHERN CALIFORNIA EDISON COMPANY
2244 WALNUT GROVE AVENUE, ROOM 370
ROSEMEAD, CA 91770

DAVID KATES
THE NEVADA HYDRO COMPANY
2416 CADES WAY
VISTA, CA 92083
FOR: THE NEVADA HYDRO COMPANY

DON LIDDELL
DOUGLASS & LIDDELL
2928 2ND AVENUE
SAN DIEGO, CA 92103

KEVIN O'BEIRNE
REGULATORY CASE MGR.
SAN DIEGO GAS & ELECTRIC COMPANY
8330 CENTURY PARK COURT, CP32D
SAN DIEGO, CA 92123

CENTRAL FILES
SAN DIEGO GAS AND ELECTRIC COMPANY
8330 CENTURY PARK CT, CP32D, RM CP31-E
SAN DIEGO, CA 92123-1530

JOHN E. BROWN
BEST BEST & KRIEGER LLP
3750 UNIVERSITY AVENUE, SUITE 400
RIVERSIDE, CA 92502
FOR: ELSINORE VALLEY MUNICIPAL WATER DISTRICT

KRISTIN ESTENGER
RANCHO CAPISTRANO PROPERTY OWNERS ASS
34655 ARROYO ROAD
LAKE ELSINORE, CA 92530

LINDA LOU RIDENOUR
33628 BRAND ST.
LAKE ELSINORE, CA 92530
FOR: LAKE ELSINORE HISTORICAL SOCIETY

MARTIN RIDENOUR
33628 BRAND ST.
LAKE ELSINORE, CA 92530
FOR: BUTTERFIELD MULTIUSE TRAILS

RONALD E. YOUNG
DISTRICT GEN. MANAGER
ELSINORE VALLEY MUNICIPAL WATER DISTRICT
3131 CHANEY STREET / PO. BOX 3000
LAKE ELSINORE, CA 92531-3000

PETER LEWANDOWSKI
THE NEVADA HYDRO COMPANY
26051 VIA CONCHA
MISSION VIEJO, CA 92691

CALIFORNIA ENERGY MARKETS
425 DIVISADERO ST. STE 303
SAN FRANCISCO, CA 94117-2242

STEPHEN E. VEVLVIS
ATTORNEY AT LAW
MILLER, STARR & REGALIA
1331 N. CALIFORNIA BLVD., 5TH FL.
WALNUT CREEK, CA 94596
FOR: FRIESIAN FOCUS, LLC, THE FERNANDEZ TRUST, AND JOSEPH AND JOAN FERNANDEZ

## State Service

ANDREW BARNSDALE
CALIF PUBLIC UTILITIES COMMISSION
ENERGY DIVISION
AREA 4-A
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3214

ANGELA K. MINKIN
CALIF PUBLIC UTILITIES COMMISSION
DIVISION OF ADMINISTRATIVE LAW JUDGES
ROOM 5017
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3214

MICHAEL YEO
CALIF PUBLIC UTILITIES COMMISSION
ELECTRICITY PLANNING & POLICY BRANCH
ROOM 4103
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3214

NICHOLAS SHER
CALIF PUBLIC UTILITIES COMMISSION
LEGAL DIVISION
ROOM 4007
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3214