



**California Assembly Utilities and Commerce Committee
&
Joint Legislative Committee on Emergency Management
Briefing Paper on September 8, 2011 Southwest Power Outage**

Abstract

This paper discusses the operation of the transmission system with respect to the Southwest Power outage and power restoration, and community emergency management, wireless communication system, and wastewater treatment facility response to the blackout.

I. Introduction

On September 8, 2011 a power outage occurred that affected approximately 1.4 million electricity customers (4 to 5 million people) in California, Arizona, and Mexico. The outage began around 3:30 p.m. Power was restored in some areas within 4 hours and all power was restored within 12 hours.

The cause of the outage has been attributed to work being performed on a 500-kilovolt transmission line located in Yuma, Arizona at or near or the North Gila Substation operated by Arizona Public Service (APS). The North Gila Transmission line serves APS, Imperial Irrigation District (IID), and San Diego Gas & Electric (SDG&E) customers – the latter two of which are both in California. However, it is not clear if the work on the transmission line was a single event or one of a number of other events that caused the outage to spread throughout the affected area.

Specific to California, the outage impacted all customers of SDG&E and some customers of IID and parts of Southern California Edison (SCE) service areas in some parts of Orange and Riverside Counties.

Various critical infrastructure problems occurred during the outage, primarily involving waste water treatment facilities and wireless communication systems. Nearly 3.5 million gallons of sewage was released into the Los Penasquitos Lagoon and the Sweetwater Channel near the San Diego Bay and two wildlife preserves.

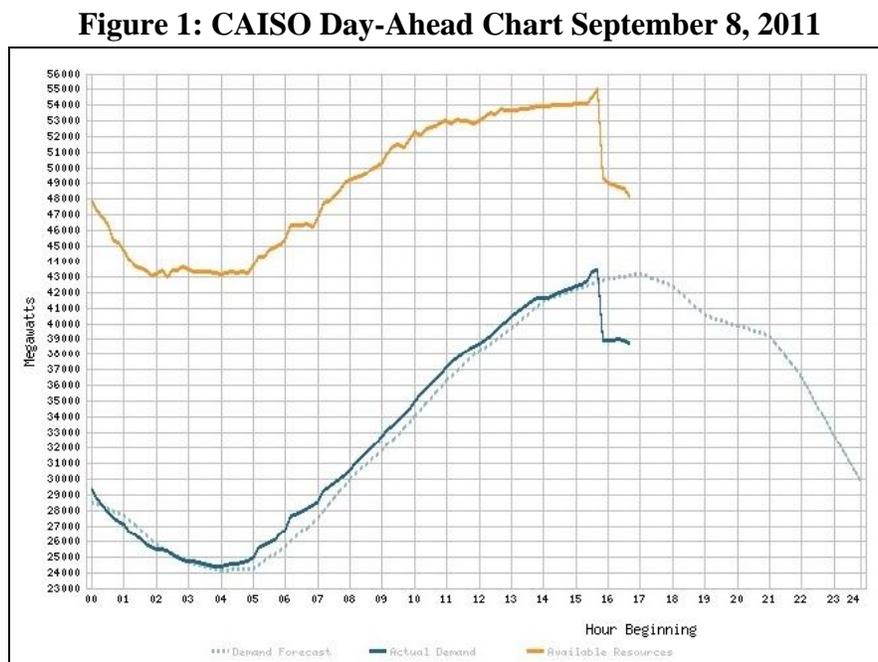
Local businesses lost revenues or revenue opportunities during the outage. For those businesses with products that rely on refrigeration, some inventory losses may also have occurred.¹

During the outage, community emergency response plans were put into effect. San Diego Mayor Jerry Sanders issued precautionary 'boil water' alerts to local citizens within 13 areas of San Diego from possible adverse health affects related to consuming contaminated drinking water. SDG&E performed welfare checks on customers who are on medical accounts and provided frequent updates on the outage and efforts to restore power.

II. Losing power and Restoring Power

Figure 1 illustrates the total power available throughout the California Independent System Operator (CAISO) region on the day of the outage. The upper line shows total available generation and the lower line shows actual real time demand for electricity within CAISO's region. The outage is clearly visible when the lines in the graph drop at roughly 1530 in the afternoon. While the graph shows that there was adequate generation to meet demand, this graph does not provide information on what was going on in the regions neighboring CAISO. It has been reported that Imperial Irrigation District, which is a neighboring region to CAISO, was at a near-record day for electricity demand at the time of the outage.

Figure 1: CAISO Day-Ahead Chart September 8, 2011



¹ SDG&E has a web page for customers to submit a claim for damages due to the September 8, 2011, power outage, pending the results of the investigations currently on-going. SDG&E is not assuming responsibility for any losses incurred as a result of the power outage. Once the investigations have been completed the SDG&E Claims Department will contact claimants. <http://www.sdge.com/customer/claims.shtml>

When the Arizona transmission line went out of service, power flows increased over other transmission lines connected to the same transmission system.

Transmission systems throughout the United States are managed by "Balancing Authorities."² For example, the California Independent System Operator and the Western Area Power Administration are Balancing Authorities. Some, but not all, utilities, such as the Imperial Irrigation District also serve as a Balancing Authority. Balancing authorities analyze generation and transmission schedules submitted a day in advance to manage or avoid real-time bottle necks in the flow of electricity within a prescribed regional boundary comprised of generation, transmission, and electricity loads.

California has six Balancing Authorities. However, there are other Balancing Authorities within the Western Region some of which were also affected by the Southwest Outage. Table 1 shows a list of the Western region Balancing Authorities. No fewer than five of the 35 Western Balancing Authorities were involved in or affected by this outage. While the topic of this hearing is the Southwest Outage, it is not clear whether or not other interdependencies exist in these other regions that could expose Californians to widespread outages again in San Diego or elsewhere in California.

Table 1: Western Region Balancing Authorities

<p>WECC-AZNMSNV (Arizona, New Mexico, Southern Nevada) Number of Balancing Authorities: 11</p> <p>Arizona Public Service Company, AZPS DECA, LLC - Arlington Valley, DEAA El Paso Electric Company, EPE Gila River Maricopa Arizona, GRMA Harquahala L.L.C. HGMA, Imperial Irrigation District, IID Nevada Power Company, NEVP Public Service Company of New Mexico, PNM Salt River Project, SRP Tucson Electric Power Company, TEPC Western Area Power Administration - Lower Colorado WALC</p>
<p>WECC-CAMX (California Mexico) Number of Balancing Authorities: 5</p> <p>California Independent System Operator CISO Comision Federal de Electricidad CFE Los Angeles Department of Water and Power LDWP Sacramento Municipal Utility District SMUD Turlock Irrigation District TID</p>

² In the San Diego Region the transmission system is managed by the CAISO and the IID. In this region of California, other Balancing Authorities were also involved in managing the transmission system. This includes Comision Federal de Electricidad (CFE) in Mexico, Arizona Public Service in Arizona, and Western Area Power Administration in Colorado covering parts of Arizona.

WECC-NWPP (Northwest Pacific) Number of Balancing Authorities: 17

Alberta Electric System Operator AESO
Avista Corp. AVA
Bonneville Power Administration BPAT
British Columbia Transmission Corporation BCHA
Idaho Power Company IPCO
NorthWestern Energy NWMT
PacifiCorp-East PACE
PacifiCorp-West PACW
Portland General Electric Company PGE
PUD No. 1 of Chelan County CHPD
PUD No. 1 of Douglas County DOPD
PUD No. 2 of Grant County GCPD
Puget Sound Energy PSEI
Seattle Department of Lighting SCL
Sierra Pacific Power Company SPPC
Tacoma Power TPWR
Western Area Power Administration - Upper Great Plains West WAUW

WECC-RMPA Number of Balancing Authorities: 2

Public Service Company of Colorado PSCO
Western Area Power Administration - Colorado-Missouri WACM

Information systems within each balancing authority reported the change in power flows. Power flows increased to levels that were not scheduled and ultimately, reached levels that were at, or in excess of, safety standards. SCE's San Onofre Nuclear Generation Station (SONGS) was safely taken offline. When SONGS went offline it had the effect of keeping the outage from spreading further throughout California. In addition, a power plant operated by the Comision Federal de Electricidad (CFE) in Mexico was also taken offline.

To restore power, balancing authorizes available generators, and utilities established new paths for electricity to flow via other transmission lines. It is not clear if the amount of time needed to restore power could have been lessened by better transmission equipment or communication systems within the various balancing authorities.

Reliability Oversight and Investigating this Event

The Western Electricity Coordinating Council (WECC) provides coordination among the western regional Balancing Authorities in order to maintain a reliable electric power system in Western North America. Table 1 provides insights into the outage issue to the extent that California electricity reliability is affected by unanticipated events that may occur in a Balancing Authority that is not only not in California but may not have communicated with California Balancing Authorities with respect to maintenance or unexpected outage events that may be occurring that could or would impact California. Three of the Balancing Authorities involved in this outage were from the WECC-CAMX group and two were from the WECC-AZNMSNV group of Balancing Authorities. According to the California Public Utilities Commission (CPUC) the various balancing authorities involved with this outage do not regularly communicate with each other.

With regard to reliability of the electricity deliveries, reliability oversight of transmission systems has been delegated by the Federal Energy Regulatory Commission (FERC) to the North American Reliability Corporation (NERC). NERC has delegated regional reliability authority to

the Western Electricity Coordinating Council (WECC) for the Western United States. WECC has established reliability standards for entities within its region. One of the reliability rules is referred to as "N minus 1" which would require that a Balancing Authority be able to maintain reliability in the event that one part of the system fails (such as a transmission line or a generation facility).

Among other rules, WECC rules allow formation of 'reserve sharing groups' (RSG) which: "decrease the required level of contingency reserve carried by each member of an RSG by effectively coordinating the use of a pool of generation resources, thereby lowering the cost for all members. The allocation of contingency reserves to RSG members is based on the contracts within each RSG. Under most circumstances, when a Balancing Authority implements a reserve sharing event, it calls on reserves from other RSG members to replace a sudden loss of generation."

It is currently not known if the reserve sharing arrangements played a role in the inability of the various entities to continue to provide power.

Overlapping investigations are underway into the cause of the outage. These include:

- a) CAISO. The CAISO has established a task force to investigate the cause of the event. Members of the CAISO task force are: WECC, APS, SDG&E, IID, CAISO, CFE, SCE, and the Western Area Power Association (WAPA).
- b) FERC and NERC. In addition, FERC and NERC are conducting an investigation. In addition to the parties named in the CAISO task force, the FERC inquiry will include the CPUC and the Arizona Corporations Commission.³

While it is clear that these investigations will examine the cause of the outage, it is not clear whether the investigations will examine the steps taken to restore power to determine whether there are lessons learned that could have shortened the duration of the outage. It is also not clear if the examinations will look beyond this incident to determine whether there are other groupings of Balancing Authorities that might present potential for disruptions due to transmission and generation configurations that flow among and between various Balancing Authorities. This would be important to examine this both California itself and other regions. It is also not clear whether these reports will be made public or available to the Legislature for examination and ongoing analysis.

It may be relevant to reflect on the elimination of the California Electricity Oversight Board (EOB) along with all of its duties. The EOB was established as part of California's effort to restructure the electricity market in 1996. The goal of the EOB was to ensure that wholesale energy markets and the electric transmission system function reliably and provide electricity at fair costs to California's consumers and businesses. Governor Schwarzenegger eliminated the EOB on the basis that CAISO has developed extensive procedures for market oversight, and the CPUC has intervened with Federal Energy Regulatory Commission on market oversight issues. The EOB ceased operations on April 1, 2008. It is not clear that transmission reliability oversight was specifically transferred to either the CPUC or the Energy Commission.

³ The Arizona Corporations Commission is the State's oversight agency for Arizona utilities.

Additional investigation may be warranted to determine whether California has adequate oversight of electricity reliability that might make California vulnerable to widespread outages that result from manmade or natural events within Balancing Authorities that are not located in California.

III. Reliability of Wireless Communication Systems

The Joint Legislative Committee on Emergency Management held an informational hearing on the topic of emergency communications one month before the Pacific Southwest Outage occurred. At this hearing, wireless carriers, including AT&T, were clear in their assertion that the cellular network is not designed for everybody who has a cell phone in a specific region to use it at the same time.

According to AT&T, hundreds of cell phone towers in San Diego County shut down when the outage hit the region. AT&T was able to bring the towers back on line by bringing in generators, fuel, and technicians to restore service. Within six hours, about 99 percent of the towers were back in operation. AT&T landline service was unaffected.

Other carriers (Cricket, Verizon, Sprint, Nextel) saw almost no failures. Cricket reportedly was in the process of deploying generators when power was restored.

Usage spikes (voice and text) occurred around the time of the outage and then slowly dropped.

While it is not possible to provide a system that has no outage vulnerabilities, it is clear that the wireless industry can and should be taking steps to be prepared for, and respond in a timely manner to, outages caused by natural or manmade causes. For example, wireless service providers have developed mobile cell and satellite equipment, which can be deployed into and around an affected region in the event that a communication system failure occurs.

At the August hearing, representatives from AT&T asserted that, “given the shared nature of the wireless network, operators must design the networks to handle anticipated traffic loads.” While one could not have predicted or “anticipated” the Pacific Southwest Outage, the San Diego region in particular has experienced its share of emergencies throughout the past ten years. It is a reasonable expectation then, that redundancy of wireless capabilities would be a high priority in this area.

The Federal Communications Commission (FCC) currently has an open proceeding investigating reliability and continuity of communication networks. This proceeding began in April 2011 conduct a comprehensive examination of the reliability, resiliency and continuity of communications networks to provide service during major emergency (natural or man-made) and to consider whether standards are needed to ensure adequate service levels to meet public safety and/or critical infrastructure needs. This investigation is comprehensive, looking at all aspects of communication networks, including wireless, broadband, and voice over internet systems. It is examining the extent to which service providers provide and plan for continuity of service (including placement of personnel and equipment in the event of an unanticipated need to restore service); whether or not backup power or alternatives to backup power are adequate to address timely service restoration; and system redundancy to improve reliability. The FCC is also

examining the extent to which public safety, commercial entities, and utilities rely upon these communication systems. Capacity and overload issues as well as maintenance procedures and failure types are also being examined. The FCC will also take comments on what actions, if any, the FCC should take to foster improved performance and reliability. There is no information available on when the FCC will make its final recommendations.

According to the National Institute of Health , wireless-only households continue to grow:⁴

"Preliminary results from the July–December 2009 National Health Interview Survey (NHIS) indicate that the number of American homes with only wireless telephones continues to grow. One of every four American homes (24.5%) had only wireless telephones (also known as cellular telephones, cell phones, or mobile phones) during the last half of 2009—an increase of 1.8 percentage points since the first half of 2009. In addition, one of every seven American homes (14.9%) had a landline yet received all or almost all calls on wireless telephones."

Ronald Lane, Director of San Diego County’s Office of Emergency Services asserted at the August hearing of the Joint Committee, that 17% of homes in the San Diego region have no land line.

Some land line providers do provide a free low dial tone service for citizens to have access to a phone that will be able to call 9-1-1 in the event of an emergency. It is not clear how much this service is available or publicized by the land line providers in California.

A key “take-away” from the August hearing of the Joint Legislative Committee on Emergency Management was that additional public education was needed on both the parts of government agencies (i.e. emergency managers) and the wireless companies to inform the public of two things:

- a) Maintaining a land line is an important aspect of emergency preparedness that will allow for residents and families to remain in contact with loved ones and emergency personnel during prolonged disasters (in which power may be out for days at a time, which would reduce the ability to use cellular phones that have expired their battery life).
- b) During a disaster, people should make one or two calls to loved ones to verify their safety, and then refrain from using their cellular device to avoid contributing to a collapse of the system.

In the wake of the Pacific Southwest Outage, it is clearer than ever that a public education campaign on this topic is vital to the state’s ability to function during an emergency.

IV. Backup Power for Pumps Providing Drinking Water and Wastewater Facilities

According to a September 22, 2011 report provided to the Public Utilities Department of the City of San Diego, the San Diego water and wastewater system was able to deliver uninterrupted

⁴ Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, July–December 2009, Stephen J. Blumberg, Ph.D., and Julian V. Luke, Division of Health Interview Statistics, National Center for Health Statistics

potable water service to over 90% of its customers and treated over 97% of the sewage discharged to the system⁵.

Water System

Thirteen areas in the City of San Diego lost water service as a result of not having emergency generators for the pumping stations. As a result, the City issued a precautionary order to boil water or use bottled water in those areas. At no time was the water system compromised (confirmed by water quality testing).

Sewage System

When all electrical power was lost, two of San Diego City's pump stations (Pump Station 1 and Pump Station 64) associated with the regional wastewater treatment plants spilled approximately 2.6 million gallons of sewage into Los Penasquitos Creek and approximately 870,231 gallons of sewage into Sweetwater Bay. Beaches and parks 5 miles north and south of the mouth of Los Penasquitos Lagoon were closed and daily water sampling began on September 9, 2011. Beaches were reopened on September 14, 2011. Warning signs are posted while testing continues to warn individuals who may have contact with the water or the fish in the area. A bio-assessment is currently underway and two follow up assessments are planned for 3- and 6-month following to address the extent of any ongoing adverse impacts.

Voluntary standards from the Office of Water Program Operations at the Environmental Protection Agency recommend separate and independent sources of electrical power from either two separate utility substations or one substation and a generator. Both of the pump stations that failed had independent sources of power from two separate utility substations. The City contacted SDG&E regarding deployment of mobile generators to the pump stations. Power was restored before they were delivered. It is unclear whether SDG&E had a generator large enough to power either of the pump stations.

Generators for Backup Power Supply

It not clear whether generator transfer switches at the electrical service equipment for the drinking water or wastewater stations were equipped with. A transfer switch provides a safe method of connecting a generator to electrical service equipment. Without a transfer switch it would require substantial time and labor to connect a generator to the station.

SDG&E has recently acquired 31 emergency portable generators of varying sizes (100kW to 800kW) to help support critical infrastructure during disasters, fires and other emergencies⁶. The San Diego County Office of Emergency Services (OES) has a list of these generators should they be needed during a region-wide emergency (water, sewer, telecom, evacuation center, etc.). SDG&E relies on County OES or a similar responsible agency to make the request for use of the

⁵ Impacts of the September 8, 2011 Countywide Blackout of the Public Utilities Department, September 22, 2011, City of San Diego Public Utilities Department.

⁶ SDG&E emphasizes that its portable generators are not intended to take the place of prudent emergency preparedness and planning. Customers that require 24/7 uninterrupted power such as hospitals, water and wastewater utilities and communications should have permanent back-up emergency generation.

portable generators. For example, during the 2003 wildfires, SDG&E deployed a generator to the Ramona Water District.

V. Citizen Preparedness

As a result of the widespread fires that the San Diego Community has suffered throughout the past decade, it is likely that of all regions in California, the San Diego citizenry should be best prepared for an emergency such as a power outage lasting for up to 12 hours. The California Emergency Management Agency (CalEMA) recommends preparing for a minimum of 72 hours of self-sufficiency in the event of a serious crisis.⁷

From all newspaper accounts, it appears that most citizens were able to manage through the outage without any serious or widespread problems (health emergencies, public safety, crime, food). The local citizens acted responsibly, heeded the warnings of emergency responders, and provided support to each other throughout the event.

Mayor Sanders was in contact with SDG&E, and San Diego's police and fire departments, and activated the region's emergency operation center accordingly. In addition, the Mayor advised the community to minimize use of landlines and cell phones and restrict travel to emergency purposes only.

SDG&E deployed nearly 200 workers to provide welfare checks on medical and life support to customers not reachable by phone. Workers knocked on over 1,800 doors both during and after the outage to ensure their customers' safety. They also utilized other communication channels such as Twitter, email and their website to provide updates. In addition, SDG&E coordinated with government emergency responders during the incident to provide information on the extent of the outage and updates on progress toward restoring power.

SDG&E worked with media at the local, state and national level providing live interviews, outage/restoration information, and safety information. Police, sheriff and fire departments were also updated regularly and local, state and federal elected officials were briefed throughout and after the event.

The San Diego Police Department reported no major incidents, no increase in violence and remained fully operational receiving 911 calls and dispatching services during the outage.

That said several media outlets covered allegations that students at California State University, San Diego (San Diego State University, or SDSU) were asked to leave the dormitories on campus during the outage. According to the *Los Angeles Times*, resident assistants knocked on doors in the blacked-out Chapultepec Hall dormitory in particular to order students to "leave the building and go home or stay with friends." The paper further alleged that resident assistants told students who remained in the dorm that they would have to surrender their campus ID cards so that administrators could keep tabs on those staying. SDSU has denied these allegations through

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<http://www.oes.ca.gov/Operational/OESHome.nsf/978596171691962788256b350061870e/55C950F3BE85D1C688256CD8007CD9CB>

a letter from Sally Roush, Vice President for Business and Financial Affairs, to the respective committees.

VI. Conclusion

Throughout the past two decades, the Legislature has focused California's attention on the imperative of preserving the state's supply of electricity and the necessity of maintaining the grid to support higher usage at various times. While it is generally understood that outages will occur and that accidents will happen, it is crucial that governments, agencies, and private companies work to both minimize these incidents maintain a sense of calm and continuity for the public when emergencies occur. Maintaining reliability of communication infrastructure during natural or manmade events is also an imperative. It is important to note that during the Pacific Southwest Outage, disaster was avoided. The utilities, jurisdictions affected, and residents of Southern California very much deserve to be commended in this regard.

Nonetheless, there are still lessons that can be learned from the southland's recovery from this incident. It is clear that, while praise is merited, room for improvement exists within both the public and private sectors. It is imperative that we, as a state, continue to strive for improvement in this arena with a keen eye towards enhanced public safety and emergency management when outages occur.