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Blackout Procedures In California

This paper offers a step-by-step review of the procedures that have been used to order and implement rolling blackouts in California this year. Broadly speaking, the California Independent System Operator (Cal ISO) determines when electrical supplies are falling below demand and alerts the affected utilities, which impose and manage the forced outages among their customers.

Role of the Independent System Operator

Cal ISO manages the reliability of roughly three quarters of the electricity that travels through the transmission lines in the state. These lines are owned and used by the big three investor-owned utilities -- Pacific Gas & Electric Co. (PG&E), Southern California Edison (SCE) and San Diego Gas & Electric Co. (SDG&E) -- and by the Pasadena Department of Water and Power and the city of Vernon. These five are called participating transmission operators, or PTOs.

When demand for electricity exceeds the supply, Cal ISO determines how much of the electrical load must be curtailed or shed. Cal ISO follows procedures for "shedding load" -- in other words, ordering forced blackouts -- that have been established by two voluntary organizations to which it belongs: the Western Systems Coordinating Council (WSCC) and the North American Electric Reliability Council (NERC).

Governing policies of the NERC and WSCC, which can be enforced by fines, require that power continue to be purchased as long as any is available, which effectively prohibits the ISO from setting cutoff deadlines on its negotiations to buy power. Theoretically, such a cutoff would provide more time to assess whether power purchases will be insufficient to meet anticipated demand. But because of up-to-the-minute buying requirements, reports Robin Larson, director of state and regional affairs for Cal ISO, as little as 20 or 30 minutes' notice may precede an order to shed load.

After Cal ISO determines how much load-shedding must occur, it contacts the five PTOs and orders them to eliminate predetermined percentages of the shortfall. Like upended dominoes, other utilities also may be told, in turn, by the PTOs to curtail a share of their power distributions because of contractual arrangements to purchase electricity from, or share distribution systems with, the PTOs.

PTOs' Share of the Load

The following tables illustrate how the burden to shed load is shared among various utilities when PTOs are given the orders to reduce power.

- PG&E must shed 49.6 percent of the transmission system's electric load.

Allocations by PG&E When Ordered to Shed Load:

PG&E -- Sheds 79.2% of the total reduction that PG&E is ordered to make in load.

Sacramento Municipal Utility District -- Sheds 9.4% of PG&E's total reduction.

Modesto Irrigation District -- Sheds 2.0% of PG&E's total reduction.

Silicon Valley Power -- Sheds 2.0% of PG&E's total reduction.

Northern California Power Authority -- Sheds 3.8% of PG&E's total reduction.

City and County of San Francisco -- Sheds 0.8% of PG&E's total reduction.

Turlock Irrigation District -- Sheds 1.4% of PG&E's total reduction.

Western Area Power Administration --- Sheds 1.5% of PG&E's total reduction.

- SCE must shed 42 percent of the transmission system's electrical load.

Allocations by SCE when Ordered to Shed Load:

SCE Sheds 93.9% of the total reduction that SCE is ordered to make in load.

City of Anaheim Sheds 2.6% of SCE's total reduction.

City of Riverside Sheds 2.4% of SCE's total reduction.

City of Colton Sheds 0.4% of SCE's total reduction.

City of Azusa Sheds 0.3% of SCE's total reduction.

City of Banning Sheds 0.2% of SCE's total reduction.

Southern California Water Agency Sheds 0.2% of SCE's total reduction.

- San Diego Gas and Electric must shed 7.4 percent of the transmission system's load.
- Pasadena Water and Power must shed 0.6 percent of the transmission load.
- The city of Vernon must shed 0.4 percent of the transmission load.

The Stages of Power Emergencies

There are three stages of a Cal ISO electricity emergency:

Stage 1 – Operating Reserves are Below 7 Percent

- Customers voluntarily curtail usage.
- All available power is purchased.

Stage 2 – Operating Reserves are Below 5 Percent

- Interruptible customers are curtailed through voluntary load-curtailement programs.
- Emergency assistance is requested from other utilities.

Stage 3 – Operating Reserves are Below 1.5 Percent

- Involuntary load curtailments – blackouts – are initiated.

Anticipating an Emergency

Between 85 and 95 percent of the time, Cal ISO is able to forecast when load shedding could be required. These times usually involve forecasting the weather and comparing the load available to the increased demand. The general lead-time can be from one to seven days, although the hour-by-hour nature of power purchasing makes it impossible to forecast specific times with certainty. At other times, however, the requirement to shed load is unanticipated and immediate, such as when a large generation unit unexpectedly goes off-line or there is an interruption of the transmission system. In these cases, which can result in from 5 percent to 15 percent of required blackouts, there is virtually no notice.

Approximately 12,500 megawatts (MW) of generating capacity is currently off-line in California for scheduled and unscheduled maintenance, and some smaller facilities are not operating because they have not received payments for electricity. By June 15, this figure is expected to drop to 3,500 MW off-line.

The Role of Utilities in Implementing Blackouts

While Cal ISO determines when and how much load must be shed, it is the utilities that implement the blackouts and determine who gets blacked out and for how long. Most of the state's electric customers get their power from PG&E, SCE or SDG&E. These utilities are regulated by the Public Utilities Commission.

On April 3, 2001, the PUC adopted an order that will change the way these three utilities handle rotating blackouts in the future. In decision 01-04-006, the PUC ordered the following:

Reconfiguring Circuits

By June 1, 2001, PG&E, SCE and SDG&E each must file a report that lists circuits capable of being reconfigured to increase the amount of load available for rotating outages and the least costly method for achieving that load reduction.

Including Direct Users in Rotating Outages

Local utilities (the three investor-owned utilities) must begin including transmission-level customers – the large industrial users that get their electricity directly from the transmission lines – in rotating outages.

Like other energy-users, these customers can be eligible for exemptions from blackouts based on an essential need for electricity. (See Page 6 for a list of essential-need customers determined by the PUC.)

Some transmission-level customers generate their own power. Those that are supplying power to the grid in excess of their load at the time of the outage will be excluded from rotating blackouts.

Exempting Hospitals

Local utilities shall include all hospitals on the list of essential-need customers, and exempt them from rotating outages.

Handling Essential-need Customers

Essential-need customers may participate in interruptible-load-shedding programs (in which customers receive discounted rates for agreeing to have their service interrupted during emergencies) for up to 50 percent of their load. But eligibility for these programs will require a demonstration of either back-up generation or a reasonable ability to meet essential needs when power is interrupted.

Comparing Costs of Automatic and Manual Circuit Switches

Local utilities must report by June 1, 2001, on the costs of dispatching personnel to remote locations to implement rotating outages versus the cost of installing automated equipment to shut down circuits.

Health and Safety Considerations in Blackouts

Rolling blackout procedures include some protections designed to guard public health and safety.

Outbound Calling

Local utilities are required to operate an outbound-calling program to notify specific customers of imminent rotating outages, giving priority to customers on life-support systems or under critical care. Local utilities also are required to undertake their best efforts to contact customers with a electrical load of over 300 kilowatts, customers who have shown that they are subject to major economic damage, and customers who have shown that blackouts pose a clear and imminent danger to their personal health or safety.

The utilities must file a report by June 1 that describes their outbound-calling programs, including any changes they have made to improve the programs' operations. They must identify the time required to notify all required customers for an outage of 1 percent, 5 percent, 10 percent, 15 percent and 20 percent of peak load.

Industrial Customers

Local utilities also must report by June 1 on any recent efforts undertaken to address risks to public health and safety

from electrical outages to industrial customers.

BART and Muni

BART and the underground portion of San Francisco's Muni bus system are exempted from rotating outages.

Further Study of Outage Notification

The PUC also amended the list of essential customers who are generally exempted from rotating blackouts. It agreed to study further changes in requirements for notifying customers of blackouts in Phase 2 of its strategy on managing outages.

Notifications procedures under study include outbound calling to customers with special needs, inbound calling by customers for information, notice to cities, and inclusion of blackout information on customer bills. For instance, SCE and SDG&E might be required to begin providing "block numbers" to customers for use in announcing the areas of rotating outages similar to the numbers that PG&E has been putting on bills to its customers.

The PUC's Adopted Priority System for Rotating Outages

Essential-need customers are normally except from rotating outages. However, protection from blackouts cannot be guaranteed because daily circuit switching may temporarily change a customer's outage block and priority classification.

Essential-need customers include:

- Government and other agencies providing essential fire, police, and prison services.
- Government agencies essential to the national defense.
- Hospitals.
- Communication utilities, as they relate to public health, welfare and security, including telephones.
- Navigation communication, traffic control, and landing and departure facilities for commercial air and sea operations.
- Electric-utility facilities and supporting fuel and fuel-transportation services critical to continuity of electric-power system operation.
- Radio and television broadcasting stations used for broadcasting emergency messages, instructions, and other public information related to electricity- curtailment emergencies.
- Water and sewage-treatment utilities during emergencies that require their services, such as fire fighting.
- Rail transit systems as necessary to protect public safety.
- Customers served directly at transmission lines to the extent that (a) they supply power to the grid in excess of their load at the time of the rotating outage, or (b) their inclusion in rotating outages would jeopardize the system's integrity.
- In addition, any customer, or customers, who meet the following criteria may enroll in an "Optional Binding Mandatory Curtailment Program" to avoid blackouts by voluntarily curtailing their use of electricity:
- The customer must file an acceptable binding energy- and load-curtailment plan with the utility agreeing to curtail electric use on a circuit by an amount that otherwise would be achieved by a rotating outage. The customer's plan must show how reduction can be achieved in 5 percent increments to the 15 percent level, and show how compliance can be monitored and enforced. The customer must maintain the required reduction during the outage period.
- Several customers on a circuit may file a joint binding plan to guarantee the required curtailment will be achieved from the circuit. Utilities must facilitate communication among customers on a circuit if any customer expresses interest in enrolling in this program.

Outage Notification

These customers have priority in receiving notice of forced power outages:

A. Customers on Life Support or Under Critical Care

Life-support and critical-care customers must be notified of rotating outages that will affect them by recorded or other messages. The call is not required until a rotating outage is imminent. Utilities must undertake their best efforts to inform these customers.

B. Large Customers, Customers Prone to Economic Damage, and Customers with Health or Safety Dangers

As circumstances permit, individual warnings of rotating outages will be given to large customers having demands of 300 kilowatts or more. Warnings will also be given to other customers who can show the utility they would suffer major economic damage, or that there would be a clear and imminent danger to personal health or safety from an unannounced outage. Individual timely warnings cannot be guaranteed, however, because of time, manpower, and communication limits. Also, daily circuit switching may temporarily change a customer's outage block number.

C. All Other Customers

Warnings and other relevant information may be provided by mass media, with no individual notification generally given.

Blackout Procedures Used by Individual Utilities

Here are ways that individual utilities are handling blackout notifications and other load-shedding procedures.

Pacific Gas and Electric Company

"Generally, PG&E receives notification of the possibility of or actual implementation of rotating outages from the Cal ISO during the peak day reliability conference call or real time communication between the Cal ISO and the utility transmission operation center (TOC). The TOC then summarizes the Cal ISO's orders in an e-mail to company employees responsible for the implementation of the company's Electric Emergency Plan. This includes representatives from the company's Account Services Department as well as a number of other departments responsible for communicating externally, such as News Services, Call Center Operations, Internet Services and Public Affairs.

"If rotating outages are imminent, these designated employees use the following existing methods to notify various customer classes or groups:

Existing Methods Customer Class or Group

1. E-mail Account Services Department sends messages to 2,500 nonresidential customers who have asked for an update whenever system conditions change.
2. Manual phone call Account Services Department contacts 4,000 customers (blocks 1-14 only) with demand greater than 300 kilowatts.

Local PG&E Operations Emergency Centers contact 48 county Offices of Emergency Services (OES) in PG&E's service area. These offices, in turn, contact local fire, police and other public safety agencies.

News Department contacts radio and television stations across the service area.

3. Fax News Department faxes press releases to all mass media, including radio, television, and newspapers, as soon as the Cal ISO order is received and PG&E has determined which blocks will be affected.
4. Voice Response Unit (VRU) Automated calls made by Call Center's Outbound Call Operations to 14,000 self-identified residential customers (blocks 1-14 only) on life support and 3,000 self-identified nonresidential customers with demand less than 300 kilowatts subject to major economic damage.
5. Internet (pge.com) Available to all customers with Internet access. Internet Services updates this site when

rotating outages are possible or implemented."

Southern California Edison

"As soon as the Stage 3 emergency is declared, we will contact the news media, especially radio and television stations, which are encouraged to broadcast the news immediately. We may have as few as 10 minutes after a Stage 3 emergency is declared before we begin rotating outages. Obviously, that is not enough time to allow individual notifications for the affected customers. Customers can contact SCE at (800) 655-4555 to find out whether their neighborhood is part of a current

controlled outage. We will use the media as much as possible to communicate with customers if a Stage 3 declaration is made....

"[C]ircuits have been arranged into groups. Each group includes a number of circuits that comprise approximately 100 megawatts of electricity usage per group, with each circuit generally serving between 800 and 2,000 customers. The amount of power Cal-ISO designates for curtailment will determine the number of groups that are interrupted at any one time (e.g., if Cal-ISO calls for 500 megawatts, we would interrupt service to about five groups). The groups will be interrupted, as operating conditions permit, and each outage is expected to last about one hour.... Once a group has been used in a rotating outage, it is moved to the bottom of the list....

"Unfortunately SCE cannot determine exactly which customers will be affected in advance of need. We will not know how much 'load' relief Cal-ISO requires from SCE in any given Stage 3 emergency until it is declared. Therefore, we cannot predict how many, or which, groups will need to be interrupted. Furthermore, providing details in advance about affected areas poses certain safety risks....

"We track the order of the groups of circuits that have been interrupted and rotate among them to ensure that the same group will not always be first and that the impact to any one group is minimized....It's possible for neighbors to be on different circuits. Circuits do not necessarily align with streets, neighborhoods, or community boundaries. One street could easily be served by two different circuits....

"SCE cannot guarantee uninterrupted service to any customer. However, we do keep track of all customers who have applied for, and been certified as, 'critical care' customers (those who cannot be without electric service for more than two hours) pursuant to SCE's Medical Baseline program."

San Diego Gas & Electric Company

SDG&E reported on May 3 that it had requested PUC permission to create a Rolling Blackout Reduction Program using backup generators to help eliminate or minimize the potential for rolling blackouts this summer in San Diego County. To make the program work, SDG&E would need commitments from customers that they would turn on backup generators at SDG&E's request during a Stage 3 emergency and simultaneously reduce their electrical consumption for the grid.

The program could generate up to 50 additional megawatts of capacity in the region, or enough to serve about 50,000 homes, estimates the utility, which hopes to implement the program by June 1, 2001.

Funding for the \$15 million proposal to pay for customer incentives and fuel costs is being sought from a pot of \$25 million that the PUC has earmarked for customer demand-reduction incentive programs.

When rolling blackouts are threatened, SDG&E reports, it "is doing its best to communicate in advance with customers on life support, medical facilities, and public agencies... Customers with special health needs are contacted to remind them that there is a chance of electric outages during periods of high demand and other factors and encourage them to have backup systems in place."

Sacramento Municipal Utility District

SMUD receives notification from PG&E that it must curtail its load by 9.4 percent of the total load-shedding requirement that has been imposed by Cal ISO on PG&E.

SMUD goes first to its conservation programs -- customers who have signed up for the summer peak corps will have their air conditioners cycled off. There also is a voluntary corps of customers such as grocery stores and state office

buildings that will reduce their energy use upon request. SMUD makes these requests by phone or pager. Water systems also are asked by SMUD to voluntarily reduce their pumping, and typically will do so if it doesn't interfere with their water pressure.

Some big industrial users receive lower contract rates for agreeing to temperature-dependent shutdowns on hot days. This process has been used on blackout days, even though temperature may not be a factor in the decision to curtail power.

SMUD may get as little as 15 minutes' notice from PG&E. If the voluntary efforts come up short – if, say, electrical consumption has been reduced 53 megawatts and 47 more still must be cut, blackouts are imposed in a roughly clockwise direction by matching circuits with the amount of energy reduction needed. SMUD uses talk radio, the news-wire services and its Website to convey this information immediately. But it avoids naming specific locations, partly because its electrical distribution system doesn't follow natural geographic boundaries.

Prepared by Kip Wiley and Rebecca LaVally,

California Senate Office of Research