STATE OF CALIFORNIA GRAY DAVIS, *Governor*

PUBLIC UTILITIES COMMISSION
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298

February 1, 2002 Item 1

3/6/2002

TO: PARTIES OF RECORD IN RULEMAKING 00-10-002, Phase 2

This is the proposed decision of Commissioner Carl Wood, previously designated as the presiding officer in this proceeding. It will be on the Commission's agenda at the next regular meeting 30 days after the above date. The Commission may act then, or it may postpone action until later.

When the Commission acts on the proposed decision, it may adopt all or part of it as written, amend or modify it, or set it aside and prepare its own decision. Only when the Commission acts does the decision become binding on the parties.

Parties to the proceeding may file comments on the proposed decision as provided in Article 19 of the Commission's "Rules of Practice and Procedure." These rules are accessible on the Commission's website at http://www.cpuc.ca.gov. Pursuant to Rule 77.3 opening comments shall not exceed 15 pages. Finally, comments must be served separately on Administrative Law Judge Mattson and the assigned Commissioner, and for that purpose I suggest hand delivery, overnight mail, or other expeditious method of service.

Lastly, parties may move for **final oral argument** (FOA) by following the procedure, and presenting the information identified in the September 21, 2001 Phase 2 Scoping Memo and Ruling (page 8). A party moving for FOA shall file and serve the motion by February 8, 2002. If more than one party plans to move for FOA, parties shall use their best efforts to present a joint motion. Responses, if any, shall be filed and served by February 13, 2002.

/s/ LYNN T. CAREW
Lynn T. Carew, Chief
Administrative Law Judge

LTC: eap

Decision **PROPOSED DECISION OF COMMISSIONER WOOD**
(Mailed February 1, 2002)

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking into the operation of interruptible load programs offered by Pacific Gas & Electric Company, San Diego Gas & Electric Company, and Southern California Edison Company and the effect of these programs on energy prices, other demand responsiveness programs, and the reliability of the electric system.	Rulemaking 00-10-002 (Filed October 5, 2000) Phase 2 Voltage Reduction

(See Appendix A for List of Appearances)

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INTERIM OPINION ON EMERGENCY VOLTAGE REDUCTION MEASURES

1. Summary

Several methods are used to balance electricity supply and demand to avoid outages. For example, supply may be increased by the addition of new power plants, or the use of existing backup generation. Demand may be decreased by the use of energy efficiency programs, conservation, or curtailment of service to interruptible customers. A reduction in system voltage may also decrease demand. As a last resort, rotating outages may be necessary.

We here consider the use of voltage reduction by electric utilities during peak demand periods as one more of several tools to decrease the frequency or duration of rotating outages. As a result of our review, we endorse existing and ongoing voltage reduction efforts within current standards and rules. We encourage additional cost-effective voltage reduction measures, to be implemented during normal distribution substation work. We decline to order voltage reduction during system emergencies, however, given that the need for this tool has substantially moderated, the benefits are relatively small compared to associated risks, and other reasonable options are available. Parties may propose specific emergency voltage reduction measures for further consideration if the need resurfaces.

2. Background

On January 17, 2001, Governor Gray Davis proclaimed a State of Emergency. The proclamation was based on a profoundly dysfunctional electricity market, including electricity shortages resulting in blackouts for millions of Californians, constituting a condition of extreme peril to the safety of

persons and property. Governor Davis directed immediate implementation of several measures to address the crisis.

Over the next few months, the Governor issued numerous Executive Orders directing implementation of additional measures, such as mandatory reduction in outdoor lighting, increased use of existing power plants where reasonable, streamlined construction of new power plants, the 20 / 20 Rebate Program to encourage conservation, and the Demand Bidding Program to facilitate load curtailment.[1] Some forecasts still predicted a high probability of many rotating outages to balance supply and demand during Summer 2001.

On July 3, 2001, Governor Davis asked the Commission to consider another tool to address the potential for multiple outages during Summer 2001. Specifically, the Governor asked that the Commission consider taking action to have electric utilities reduce distribution system voltage in order to reduce peak demand, alleviate the current shortage of electricity, and reduce the need for rolling blackouts.[2]

In response, the Commission invited parties to submit comments. (Assigned Commissioner's Ruling (ACR) dated July 5, 2001.) In particular, comments were sought on a proposal to have Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE) and San Diego Gas & Electric Company (SDG&E) reduce distribution system voltage by 2.5% on

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[1] Regarding outdoor lighting, see Executive Order (EO) D-19-01. Regarding power plants, see EO D-22-01. Regarding the 20 / 20 Rebate Program, see EO D-30-01, EO D-33-01, and Commission Resolution E-3733. Regarding the Demand Bidding Program, see EO D-39-01, and Commission Decision (D.) 01-07-025.

[2] Press Release PR01:319 dated July 3, 2001.

circuits currently at or above 120 volts, and to 117 volts on circuits operating below 120 volts. Comments were filed and served on July 10, 2001.

By ACR dated July 17, 2001, further information was sought, and a workshop was set for July 25, 2001. The pleadings and discussion revealed differing abilities by each utility to implement voltage reduction, and disputes on the merits and feasibility of various voltage reduction measures.

To further our inquiry, a formal hearing was set to gather evidence. Respondent utilities were directed, and other parties were invited, to each propose a specific voltage reduction plan. In addition, utilities were directed, and parties were invited, to provide a full assessment of the benefits and costs of such plans.

Evidentiary hearing was held on October 11, 2001. Opening briefs were filed and served on November 2, 2001, and reply briefs were filed and served on November 9, 2001.

3. Voltage Reduction Experience and Potential

The Governor's request for us to consider reducing distribution system voltage is best understood in the context of past voltage reduction experience, and present potential.

The Commission developed a conservation voltage reduction program in 1976. The objective was to conserve energy by reducing voltage, with as many residential and commercial customers as possible served within the lower half of the allowable band of 114 to 126 volts at the customer meter (for normal 120-volt service). That is, as much service as feasible was provided between 114 and 120 volts at the meter. It is estimated that more than one billion kilowatt-hours were conserved through the end of 1978 on PG&E's system by this program, with

additional savings on other utility systems. (D.91107, 2 CPUC2d 596, 718; also see D.89315, 84 CPUC 221; D.89711, 84 CPUC 733.)

Additional voltage reduction potential may exist. Summarized briefly, PG&E states that it operates its distribution circuits at the lowest peak load voltage level consistent with PG&E Electric Tariff Rule 2 (Rule 2). As a result, service voltage is typically between 114 and 120 volts for normal 120-volt service, with some service voltage as high as 126 volts.[3] In response to the Governor's voltage reduction initiative, PG&E implemented a plan in July 2001 to review and, as necessary, modify over 2,000 voltage regulating devices to ensure that these devices maintain voltage within Rule 2 limits. The modifications required manual adjustments to voltage regulators at substation banks and feeders. PG&E completed this effort in October 2001. PG&E estimates that this project will reduce system peak demand up to, but no more than, 50 megawatts (MW), with some benefits also occurring during mid-peak and off-peak periods. PG&E states that it will continue to pursue opportunities to reduce demand during both peak and non-peak times as it undertakes normal substation related work. While some potential may exist for additional capacity savings during periods of

[3] PG&E Rule 2 allows a minimum of 114 volts, and a maximum of 120 volts, at the customer meter on most residential and commercial distribution circuits (normal two wire, 120 volt service), and up to 126 volts for some residential and commercial service. Voltage may also be as high as 126 volts at the customer meter on agricultural and industrial distribution circuits. Voltage may be outside specified limits during several conditions (i.e., temporary action of the elements, momentary fluctuations, service interruptions, temporary separation of system parts from the main system, causes beyond PG&E's control). (Rule 2, Section C.) Rule 2 is consistent with national guidelines designed to promote standardization, and provide the basis for safe and reliable service.

minimum load, PG&E estimates no more than an additional 15 MW on a system wide basis. PG&E does not have automatic or remote capability to quickly implement voltage reduction only during system emergencies.

SCE states that it operates its system within SCE Rule 2 limits, or between 114 and 120 volts at the customer meter for typical 120-volt service. Some voltage may routinely be up to 126 volts.[4] SCE reports that it can further reduce voltage on most of its distribution system. If ordered by the Commission, SCE recommends a reduction of 2.5%, limited to no less than 117 volts at distribution substations. SCE says that it can implement this voltage reduction on very short notice, such as at the beginning of a Stage 3 emergency, by remotely changing tap settings on transformer banks.[5] Given 117 volts at the substation, SCE says most customers should experience service voltage at the meter of not less than 110 volts.

SCE estimates that its proposal may reduce peak demand by up to, but no more than, 160 MW. This plan is effective, however, only during high load periods, such as summer on-peak. This occurs because voltage control devices

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[4] SCE Rule 2 is similar to PG&E's Rule 2. One difference is that all residential and commercial distribution circuits are limited to a maximum of 120 volts at the customer meter. Similar to PG&E's Rule 2, voltage may be routinely as high as 126 volts for agricultural and industrial distribution circuits, and voltage may be outside specified limits during the same conditions as stated in PG&E's Rule 2.

[5] The California Independent System Operator (ISO) declares a Stage 1 emergency when forecast or actual operating reserves are less than 7% of available capacity. A Stage 2 emergency is declared when forecast or actual operating reserves fall below 5% of available capacity. A Stage 3 emergency is declared when forecast or actual operating reserves fall below 1.5% of available capacity. The California ISO may call for rotating outages during Stage 3 emergencies.

(e.g., capacitors, boosters, regulators) are not remotely controlled, and will automatically respond, as designed, to offset voltage reduction at times other than high load periods. In contrast, the majority of, if not all, voltage control devices are already operating during high load periods, and a change in tap settings will produce a change in voltage. If the Commission orders emergency voltage reduction, SCE states that utilities must be exempt from liability for damages that might occur from voltage reductions below the Rule 2 specification (i.e., below 114 volts at the customer meter).

SDG&E, like PG&E and SCE, reports that it has implemented a voltage reduction program for many years, with almost 75% of its distribution circuits operating between 114 and 120 volts at the customer meter, as specified in SDG&E Rule 2.[6] According to SDG&E, the remaining 25% of circuits may be outside this range due to the type of customer load served, circuit loading, or circuit configuration constraints.[7] SDG&E, like PG&E, does not have automatic or remote capability to implement voltage reduction. The reduction in demand on SDG&E's system from additional voltage reduction efforts would be very limited.[8]

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[6] SDG&E's Rule 2 is similar to SCE's Rule 2.

[7] For example, voltage may be up to 126 volts on agricultural and industrial distribution circuits for SDG&E, just as it may be for PG&E and SCE.

[8] SDG&E does not present a specific estimate of capacity savings. SDG&E estimates, however, that under the most optimistic projections, the maximum reduction in demand would be approximately 225 MW statewide. (Opening Brief, page 2.) This would be 15 MW for SDG&E, based on subtracting 160 MW for SCE, and 50 MW for PG&E.

4. Proposals

The California Energy Commission (CEC) and The Utility Reform Network (TURN) advocate Commission adoption of emergency voltage reduction plans. In particular, CEC recommends that tariff rules be modified to allow each utility to utilize manual or automatic voltage reduction capability to reduce voltage by up to 2.5% on a selective basis during power emergencies, limited to no less than 117 volts at distribution substations. Power emergencies would generally be when blackouts are imminent, according to CEC. Moreover, CEC recommends that utilities be permitted to provide service as low as 110 volts at the customer meter, as long as there is a plan to restore minimum service to 114 volts at the meter upon conclusion of the emergency. CEC advocates waiver of utility liability if service temporarily drops below 114 volts at the customer meter. Finally, CEC recommends that the Commission study opportunities for voltage reductions by individual customers when the customer owns a substation or distribution transformer.[9]

TURN's recommendation is similar, proposing implementation of a temporary voltage reduction program to avoid or reduce the effect and duration of blackouts. TURN asserts that SCE is the only utility capable of undertaking this program during emergencies, with the ability to implement voltage reductions remotely at low cost limited to on-peak periods. TURN recommends that SCE be ordered to implement voltage reduction of 2.5% during on-peak

[9] CEC's proposal is presented in direct testimony, with clarification and expansion during cross-examination. (Exhibit 102, and Reporter's Transcript (RT) Volume 7, particularly at pages 422-3, 431-2, and 434-5.) CEC did not file either an opening or closing brief summarizing and supporting its proposal.

Stage 2 and 3 emergencies on circuits where this is feasible, with SCE shareholders held harmless for consequences of this program. TURN states that PG&E and SDG&E should not be ordered to undertake temporary voltage reduction programs at this time.

The California Farm Bureau Federation (Farm Bureau) opposes voltage reduction. If the Commission wishes to pursue voltage reduction, however, Farm Bureau recommends, as an alternative, that consideration be given to incremental implementation of voltage reduction to minimize unintended consequences. That is, under Farm Bureau's alternate proposal, voltage would be reduced in increments of 0.5%. Farm Bureau states that the first 0.5% reduction would not need to wait for a Stage 2 event. Data would be collected and analyzed with each incremental reduction, including assessment of the number of customer complaints, until the full 2.5% is reached, or noticeable problems occur. Farm Bureau recommends that the Commission establish a fund or bond to cover the cost of legitimate losses suffered by customers during an emergency voltage reduction event.

5. Discussion

5.1. Ongoing Voltage Reduction Measures

We endorse PG&E's program to (a) operate distribution circuits at the lowest peak load voltage levels consistent with Rule 2, (b) modify voltage regulating devices to ensure that these devices maintain voltage within Rule 2, and (c) continue to pursue such opportunities during the normal course of substation related work. PG&E reports that the cost of this program is recovered within PG&E's current revenue requirement and rates. No party opposes PG&E's program. We find that PG&E's efforts are consistent with good utility practice, Commission expectations, and Commission orders.

No evidence shows any utility operating consistently or purposefully outside Rule 2 limits. Rather, the testimony shows that each utility strives to operate within the limits of Rule 2, and makes necessary corrections when brought to its attention. Nonetheless, we encourage each utility to continue all reasonable efforts to operate distribution systems at the lowest peak load voltage levels consistent with Commission orders and Rule 2. Further, each utility should explore all reasonable opportunities for additional voltage reduction within Rule 2 limits in the normal course of operations. This includes implementing all cost-effective measures to reduce voltage during normal substation related work, not only to reduce peak demand, but also to save energy. These efforts may be especially relevant for SCE and SDG&E recognizing, however, that the type of customer load served, circuit loading, or circuit configuration may limit those opportunities. While capacity reductions from this effort will be modest, making adjustments within Rule 2 ensures that all reasonable savings are achieved without jeopardizing service, safety and reliability.

5.2. Emergency Measures

We decline to adopt the specific proposals of either CEC or TURN to use manual or automatic voltage reduction capabilities during system emergencies. All other parties oppose these proposals, including PG&E, SCE, SDG&E, Farm Bureau, the Office of Ratepayer Advocates (ORA), the California Manufacturers and Technology Association (CMTA), plus the University of California and the

California State University (UC / CSU).[10] Opposing parties persuade us that the need for emergency voltage reduction has subsided, the potential benefits do not justify the risks, and that other reasonable alternatives are preferable.

5.2.1. Need Has Subsided

As PG&E points out, the Governor's request to study voltage reduction was initiated under far worse conditions than exist today. At that time, California was in the midst of a crisis, we were on the precipice of Summer 2001, and a significant number of rotating outages were predicted. Conditions are now materially different. For example, PG&E interconnected 10 generating plants totaling 1,301 MW during 2001. In addition, for the period of October 1, 2001 through December 31, 2001, PG&E has applications from 41 projects totaling 7,503 MW.

Demand has also declined. PG&E experienced a significant reduction in Summer 2001 peak load not only from relatively cool weather, but also from conservation and the economic slowdown. Some conservation is permanent (e.g., as a result of the replacement of some equipment with energy efficient appliances), and economic recovery will take time. PG&E does not expect loads in 2002 to exceed peak loads in 2000, even if Summer 2002 temperatures return to normal.

[10] The Association of California Water Agencies (ACWA) did not actively participate, but did file a pleading before the evidentiary hearing in which ACWA urged caution, stated that current conditions do not merit this potentially harmful change, and recommended careful consideration in the future if conditions warrant reconsideration of a voltage reduction proposal.

CEC cautions that California's energy supply situation will be in a precarious condition for some time to come if we do not make every effort to conserve and prepare. Any number of events, according to CEC, could again threaten blackouts, including loss of either a power plant or transmission line. No party, however, alleges that we remain in the dire situation we faced last July. Nonetheless, we consider emergency voltage reduction measures as further insurance against rotating outages.

5.2.2. Benefits Are Limited

The benefits of an emergency voltage reduction program are limited to the remote voltage reduction capability of SCE during its on-peak period. That is, absent remote adjustment capabilities, individual site visits to substations and feeders are required to adjust voltage by manually altering voltage regulator controls. The manual nature of this effort makes it extremely difficult to implement temporary changes only during limited hours of daily peak demand or emergencies. No evidence shows that this would be either cost-effective or practical. Only CEC recommends that rules be modified to permit each utility to utilize manual capabilities. We decline to adopt this recommendation.

Remarkably, the majority of rotating outages experienced by California in 2001 have been in periods other than summer on-peak. Nonetheless, voltage reduction may reduce peak demand. Benefits, however, are limited to no more than 160 MWs during SCE's summer on-peak.

5.2.3. Risks are Not Quantified but Potentially Great

While the potential benefits are somewhat predictable, SCE and others correctly point out that the risks are not. For example, it is very difficult to predict the actual effect of voltage reduction on an appliance, since utilization

voltage (i.e., voltage at the appliance) is a function of service voltage (voltage provided by the utility at the customer meter), the internal wiring of a building, the load on individual circuits within a building, and the condition of all appliances on the internal circuits. What is known, however, is that the risk of equipment failure and system disruption increases as voltage decreases.

In particular, voltage reduction (from voltage otherwise planned during system peak) increases the level of current (over that originally forecast) for constant power loads, which in turn increases the risk of equipment overload and failure. Erratic operation of equipment, or equipment failure, can result in injury, property damage, and business disruption. Under existing conditions, PG&E states that approximately 80% of its system is already expected to operate at its current-carrying capacity during system peak. This makes the potential for problems from increased current a significant concern for the utility, as well as its customers.

Moreover, reduced voltage has the effect of increasing the exposure of sensitive customer equipment to voltage sags and nuisance-tripping. This can be particularly problematic for sensitive and expensive laboratory and hospital equipment, as well as tools and computers.[11] SDG&E reports increased customer

[11] For example, UC / CSU state that research laboratories experience tremendous problems with even minor voltage drops, and medical centers are extremely concerned that voltage drops could cause life support and radiology equipment to fail. By already limiting most service to 120 volts, California utilities operate under a conservation standard that is more stringent than the national standard. This "takes away two thirds of the voltage drop normally available on MV [medium voltages] systems." (Exhibit 115, Attachment B, Section 4.1 at page 3.) CMTA points out that any further fluctuation in delivery voltage due to routine power quality events from a position of already decreased voltage will affect tools and computer equipment that were not affected in previously similar events, resulting in lost product and production time.

complaints when service falls below 114 volts at the customer meter. In particular, SDG&E testifies that electronic devices (including computers, motor control equipment, and manufacturing process controllers) are sensitive to voltage, and may fail under substandard voltage conditions.

Existing low voltage situations may also be made worse. That is, utilities undertake reasonable efforts to maintain service voltage within Rule 2 limits, and no evidence is offered to the contrary. Distribution systems may not be perfect, however, and some customers may receive voltage below the Rule 2 level at some times. Low voltage problems are generally not identified or remedied until a customer reports a problem, since utilities have no independent means of detecting voltages at every customer meter. A low voltage condition for a particular customer may not be serious until voltage is reduced further by an emergency voltage reduction event. In this case, the emergency voltage reduction may result in erratic operation, equipment failure, injury, property damage, and business disruption.

Reduced voltage and increased current also limits the flexibility of system operators. As a result, their ability to perform outage restoration, and transfer load between feeders when outages occur, is compromised.

SCE states that it would initiate voltage reduction at distribution substations, and voltage reductions would affect entire service areas. SCE does not have the capability to remotely reduce voltage for only selected circuits or customers. (Exhibit 105, page 2.) As a result, voltage reduction would affect essential as well as non-essential customers.[12] At least hypothetically, a voltage

[12] Essential customers are normally exempt from rotating outages because their exposure to rotating outages jeopardizes not only themselves, but also the broader

Footnote continued on next page

reduction plan might be devised that excludes essential customers. Such plan, however, may involve additional costs (e.g., to enable isolating voltage reduction to limited circuits or customers). Absent better and more complete information presented by a party advocating voltage reduction, we must carefully and cautiously weigh the benefits and risks.

Thus, as opposing parties state, emergency voltage reduction can cause injury, damage and disruption. This includes increasing the risk and incidence of injury, equipment damage, and equipment maintenance costs; shortening equipment life; causing equipment outages; disrupting or halting business operations; and reducing system operator flexibility. Voltage reduction also places essential customers at risk, thereby potentially jeopardizing public health, safety and welfare. UC / CSU states that no party knows whether, or the degree to which, one or more of these impacts will occur, and that the Commission should not proceed without more information about the effects. We agree.

5.2.3.1. Rule 2 and ANSI C84.1

We also consider the specific resulting minimum voltages, and the duration of voltage reduction events, in assessing whether or not to adopt the recommendations of CEC and TURN. Rule 2 of each utility, and the American

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public health, safety or welfare. For example, essential customers include police stations, fire stations, prisons, agencies essential to the national defense, and hospitals. (See D.01-06-085.)

National Standards Institute (ANSI) Standard C84.1[13], are relevant in making that assessment.

Rule 2 addresses both service voltage (at the meter) and utilization voltage (at the appliance). In turn, Rule 2 requires that all customer-owned utilization equipment be designed and rated in accordance with voltages specified in ANSI C84.1, if the equipment is to give fully satisfactory performance. (Rule 2, Section C.2.a.)

[13] ANSI C84.1-1995 (R-2001) is titled the "American National Standard for Electric Power Systems and Equipment-Voltage Ratings (60 Hertz)." It establishes voltage ratings for 60-hertz electric power supply and utilization systems, along with operating tolerances for nominal voltages. It is the preeminent standard for national voltage ratings in the United States, and is used by electric utilities, product manufacturers, regulatory commissions, and others. (Exhibit 105, Attachment A-2, letter from Dan Ward, Chairman of Accredited Standards Committee C84.)

The minimum and maximum ANSI C84.1 voltages, based on 120-volt systems, are specified in two ranges:

Line No	Range	Service Voltage	Utilization Voltage
1	A	114-126	110-125
2	B	110-127	106-127

Source: ANSI C84.1-1995 (R-2001), Table 1 and Annex B

Minimum Range A service and utilization voltages are 114 and 110, respectively. Minimum Range B service and utilization voltages are 110 and 106, respectively.

Range A represents voltages for which electrical systems are designed and operated. Range A is the expected normal condition, and the "occurrence of service voltages outside of these limits [Range A] should be infrequent." (ANSI C84.1-1995 (R-2001), Section 2.4.1.)

Range B voltages "shall be limited in extent, frequency, and duration." (Id., Section 2.4.3.) When Range B occurs, "corrective measures shall be undertaken within a reasonable time to improve voltages to meet Range A requirements." (Id.)

CEC's proposal to reduce voltage to no less than 117 volts at the distribution substation means that most customers should experience service voltage (at the meter) of no less than 110 volts. The resulting utilization voltage for most customers would be no less than 106 volts, assuming a drop of 4 volts within the customer's wiring. (Id., Annex B, Note C; also Rule 2, Section 2.b).

This is consistent with ANSI C84.1 Range B. Thus, it "makes sense to consider temporary operation in Range B when rotating blackouts are imminent."[14]

Nonetheless, there are important risk factors that must be weighed before adopting CEC's proposal. First, if emergency voltage reduction is authorized as recommended, the event might last as long as the entire SCE on-peak period, or up to 6 hours each summer weekday.[15] Parties dispute the duration of "temporary," and whether or not ANSI C84.1 intends a Range B event to last up to 6 hours each summer weekday. ANSI C84.1 is not clear, but does state in part that operating outside Range A "should be infrequent," and Range B events "shall be limited in extent, frequency, and duration." We decline to find a program that authorizes Range B up to 504 hours per year[16] to be consistent with events that are "temporary," "infrequent," and "limited in extent, frequency and duration." We agree with ANSI C84.1 Committee Member Conrad that temporary does not mean operating distribution systems in Range B through an entire season.[17]

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[14] "Comments on California Voltage Reduction," Larry Conrad, July 30, 2001, Exhibit 115, Attachment, B, Section 4.1 at page 3. Larry Conrad is a member of the ANSI Committee responsible for ANSI C84.1.

[15] SCE's summer on-peak period is noon to 6:00 p.m. summer weekdays, except holidays. The summer season begins at 12:00 a.m. on the first Sunday in June, and continues until 12:00 a.m. on the first Sunday in October. Summer holidays are Independence Day (July 4) and Labor Day (first Monday in September).

[16] In Summer 2002, for example, there are 84 weekdays (excluding holidays) at 6 on-peak hours per day, for a total of 504 on-peak hours.

[17] "I do not support operating distribution systems through and [sic] entire season for 110 volts…" ("Comments on California Voltage Reduction," Larry Conrad, July 30, 2001, Exhibit 115, Attachment, B, Section 4.1 at page 2.)

Second, even if successful in maintaining utilization voltages no lower than 106 volts for limited periods, operation in Range B for extended times "nearly assures some customers will see voltages below Range B."[18] Thus, voltages below Range B are nearly certain, with concurrent risk of injury, damage and disruption, if we authorize emergency voltage reduction, and it is used for long periods, including up to as often as allowed.

Third, there is an important difference between the National Electrical Code (NEC) and ANSI C.84.1 with regard to voltage drop. The NEC encourages building designers to limit voltage drop to 5% (6 volts on a 120 volt system) compared to 4 volts in ANSI C84.1. This creates a bias for problems because voltages in buildings are allowed to be 2 volts lower than permitted in ANSI C84.1. "This is one more argument for caution when lowering overall system voltages even below Range A."[19]

Fourth, there is no evidence that voltages on branches and ends of circuits that are properly balanced for Range A will necessarily be uniformly reduced during an emergency voltage reduction. Rather, some voltages may be below Range B during an emergency voltage reduction event, even when voltages started inside Range A, because systems are not designed for this level of operation, particularly over long periods. Thus, the emergency voltage reduction proposal places some customers at substantial risk of utilization voltage less than 106 volts. This includes not only non-essential customers, but also essential customers normally excluded from rotating outages.

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[18] Id., Exhibit 115, Attachment B, Section 4.1 at page 4.

[19] Id., Exhibit 115, Attachment B, Section 4.1 at page 4.

Finally, the Chairman of the Accredited Standards Committee C84 states that service voltage of 114 volts is the minimum voltage to ensure acceptable performance of equipment.[20] That is, the Chairman of the responsible committee warns of unacceptable performance when service voltage is below 114 volts. Unacceptable performance creates risk of injury, damage and disruption.

5.2.3.2. Test Results

The CEC witness testified that tests performed under his supervision confirm that all appliances and commercial motors operate safely and efficiently at utilization voltages as low as 110 volts. (Exhibit 102, page 2; RT Vol. 7, page 423.) This is the low end of Range A, and does not itself support use of Range B during the recommended emergency voltage reduction program.

The CEC does not base its recommendation on testing of equipment below 110 volts at the appliance. (RT Vol. 7, page 427.) Rather, CEC's recommendation is based on ANSI C84.1 Range B, wherein utilization voltage may be reduced to 106 volts. The tests performed by the CEC's witness, however, included operating equipment at much lower voltages for the purpose of satisfying those concerned that voltage reduction will be harmful and damaging to equipment. (RT Vol. 7, page 427.) No damage to equipment was observed at voltages down to 100 volts during the tests, according to CEC's witness. (RT Vol. 7, page 424.)

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[20] "Relative to ANSI C84.1, at this point all CVR [conservation voltage reduction] initiatives have recognized that 114V at the service entrance is the limiting factor. ASC [Accredited Standards Committee] C84 believes that this is the proper limit (i.e., the minimum voltage) to ensure acceptable performance of various utilization equipment." (Exhibit 105, Attachment A-2, page 2.)

These test results, however, have not been published, have not received formal peer review,[21] and were not introduced as evidence. We are not persuaded that the test results are representative of all equipment that might be subject to emergency voltage reduction, or actual conditions faced by individual customers.

Test results were available to representatives of PG&E, SCE, and SDG&E, as well as one member of the ANSI Committee responsible for ANSI C84.1.[22] Witnesses for PG&E, SCE and SDG&E all oppose CEC's recommendation, despite having access to the data. The representative of the ANSI Committee responsible for ANSI C84.1 made several cautionary statements, despite having access to the data.[23] Thus, this limited informal peer review does not demonstrate support for the conclusions reached by CEC.

The CEC witness also reported consulting with the manufacturer of all tested equipment to confirm that their equipment will operate as low as 105

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[21] By formal peer review we mean a published comment on the test and its results. The comment may seek to evaluate such things as whether or not the test design was reasonable, the equipment sample was representative, the tested homes were representative, the test is reproducible, and the results are reasonable. Formal peer review might also include publication of other test results seeking to replicate the results of the original test.

[22] The CEC witness reported that the tests were performed in cooperation with PG&E, and that PG&E has a copy of the results. Results were given to representatives of SCE and SDG&E. Results were given to, and discussed with, Larry Conrad, one member of the ANSI Committee responsible for ANSI C84.1. (RT Vol. 7, pages 436-7.)

[23] Regarding the CEC tests, Conrad states: "I have seen some California test data…It would be very wise to ask equipment manufacturers to review the data and test protocol…" (Exhibit 105, Attachment B, page 4.) Also see other statements referenced above at footnotes 16, 17 and 18.

volts. (RT Vol. 7, pages 424-5.) We are not convinced that this adequately supports the CEC's recommendation, since the actual range of utilization voltage may go below 105 volts during an emergency voltage reduction event.

The CEC witness concludes that all equipment will operate without damage or failure at 106 volts, or even somewhat lower. The only equipment harmed by voltage reduction, according to the CEC witness, will be (1) equipment that is improperly installed and without proper safeguards, or (2) equipment that was ready to fail anyway. (RT Vol. 7, page 446.)

We are not persuaded it is reasonable to define away the problem by concluding that only causes other than voltage reduction can be responsible for damage to equipment. Equipment damage and failure is accelerated with voltage reduction. Equipment installed improperly and without safeguards that does not fail under normal voltage conditions (Range A), but which fails as a result of emergency voltage reduction, will expose the customer to potential injury, property damage or business disruption. Equipment that was going to fail anyway, but whose demise is accelerated and results from an emergency voltage reduction, will expose the customer to potential injury, property damage or business disruption.

We agree with ORA that we do not live in a world wherein all equipment at all times meets current code (even if it met required code at the time it was installed), is properly installed, and has fully functional safeguards and safety devices. We decline to expose ratepayers to unknown but potentially large risks by concluding that all equipment is properly installed to meet current code requirements, and with proper safeguards or safety devices that are fully operational at all times. Moreover, even where a motor has an automatic sensor to shield the motor from harm during a low voltage event, the protection may be

to disconnect the motor from the circuit, or otherwise terminate motor operation. The motor might be saved, but there may be large consequences (e.g., lost product, production time, lab results).

There may be many causes and reasons for injury, damage and disruption due to equipment failure other than from voltage reduction. We will not simply assume away any relationship to voltage reduction, however, given the clear, unambiguous and persuasive testimony from the majority of witnesses on this subject.

5.2.3.3. Stable Voltage

At least in theory, one approach to mitigating the risk of emergency voltage reduction is to require customers to protect themselves at their own expense. Customers may do this by installing their own special or auxiliary equipment (e.g., capacitors) to increase utilization voltage from 106 to 110 volts during an emergency voltage reduction event.[24] No party, however, offers any estimates of the scope or cost of such self-protection.

The relative reliability of California's electricity system has for decades allowed all, or nearly all, customers to rely on stable voltage within ANSI C.84.1 Range A. Expecting or requiring customer self-protection from an emergency voltage reduction program shifts an unknown amount of costs to an

[24] For example, "where the operation of the applicant's equipment requires unusually stable voltage regulation or other stringent voltage control beyond that supplied by PG&E in the normal operation of its system, the applicant, at his own expense, is responsible for installing, owning, operating, and maintaining any special or auxiliary equipment on the load side of the service delivery point as deemed necessary by the applicant." (PG&E Rule 2.C.1.e.)

unknown number of customers. We decline to adopt this shift of burden absent information on the effect.

5.2.3.4. Liability

An essential element of CEC and TURN recommendations is waiver of utility liability for injury or damage resulting from emergency voltage reduction. Waiver of utility liability transfers the risk of voltage reduction from the utility to its customers. Specifically, it transfers resulting harm to the customers who experience injury, damage or disruption. We decline to adopt this approach for several reasons.

First, the shift of burden is inequitable. That is, affected customers are forced to bear an unreasonably disproportionate responsibility for system-wide load reductions. Second, the magnitude of the liability is unknown. We are not persuaded to adopt this recommendation without specific information about the resulting exposure. Third, if those customers are essential customers, it harms not only the customer, but also the broader public health, safety and welfare.

As an alternative to waiver of utility liability, Farm Bureau proposes that the Commission establish a fund or bond to cover losses. We have no estimate of the size of the fund or bond that would be necessary, and decline to adopt this approach without reasonable boundaries.

TURN asserts that a utility is generally held harmless from damages due to blackouts caused by events beyond its control, and, assuming the utility acts responsibly, should similarly not be liable for damages that result from a program consciously undertaken to avoid blackouts. According to TURN, this recommendation is premised on the assumption that there is a net societal benefit to "keeping the lights on." Other than opinion testimony either

in favor of, or opposition to, voltage reduction, no evidence is presented that seeks to quantify the net benefit or tradeoff between voltage reduction and rotating outages. We are not persuaded that the net benefit of "keeping the lights on" by voltage reduction is greater than the net benefit of rotating outages (as discussed more in the section below).[25]

TURN supports compensation to ratepayers for any damages they suffer by voltage reduction through use of Federal Energy Regulatory Commission (FERC) Account 925 (Injuries and Damages). In response, SCE points out that there may be an accounting mechanism to record the cost of damages, but the current rate structure and revenue requirement are not based on either implementation of a voltage reduction program (and the increased damages that might result), or the exposure having been shifted to ratepayers.

Simply recording costs in FERC Account 925 does not result in cost recovery. We are not inclined to adjust rates to permit this recovery, or permit recovery of an insurance premium for this coverage, given that we have no information on the amount of any adjustment. We similarly decline to authorize a memorandum account for future recovery without any information on the exposure.

Several parties point out that the concern regarding waiver of liability, and the limited information available, is evidence in-and-of itself that a voltage reduction program is not ready for implementation. We agree.

[25] We use the term net benefit to mean gross benefit minus gross cost, including risk.

5.2.3.5. Risk of Voltage Reduction Compared to Rotating Outage

While we decline to transfer the risk of voltage reduction from the utility to its customers, we recognize that absent an emergency voltage reduction program customers are exposed to an incremental increase in the potential of rotating outages. Rotating outages involve risks to customers, as well as the broader public health, safety and welfare. In balancing the risks of emergency voltage reduction compared to the risks of exposure to an incremental increase in rotating outages, we are persuaded by the majority of parties that rotating outages are preferable.

That is, not only the utilities, but also ORA, CMTA, Farm Bureau and UC / CSU argue against voltage reduction. As these parties contend, emergency voltage reduction involves unknown effects over potentially long durations without an existing or proposed warning system. Rotating outages, however, are announced before they occur, are of limited duration (e.g., 60 to 90 minutes), and customers have several options available to mitigate their exposure or damage from rotating outages.[26] Moreover, emergency voltage reduction, as proposed, exposes essential as well as non-essential customers to unacceptable risk, while, in contrast, essential customers are normally exempt from rotating outages. Every party in opposition to voltage reduction has

[26] For example, customers may participate in the Optional Binding Mandatory Curtailment (OBMC) program. The OBMC program exempts customers from rotating outages when one or more customers on a circuit agrees to curtail electric use on the entire circuit for the entire rotating outage period by amounts of 5%, 10% and 15%, as needed. (See D.01-04-006.)

weighed these alternatives, and elects rotating outages over voltage reduction. We think this is reasonable.

TURN argues that denial of an emergency voltage reduction program on the SCE system would be unfair to SCE ratepayers. TURN says such denial would require SCE ratepayers to suffer rotating outages even though these ratepayers have paid for a system that would allow voltage reduction, thereby permitting more customers to remain on line.

To the contrary, no evidence shows that SCE's capability to remotely change tap settings on transformer banks was implemented for the purpose of emergency voltage reduction. It is not unfair to SCE ratepayers that this capability not be used for an otherwise unintended purpose. Whether or not this capacity should be used for the additional purpose of emergency voltage reduction depends upon the benefits and costs. For all the reasons stated above, we find that potential benefits do not outweigh the costs, including risk.

TURN asserts that the concern about possible lost product, production time and other effects from voltage reduction must be weighed against the certain consequences from rotating outages. We agree, and conclude that the risk of injury, damage and disruption from voltage reduction exceeds those same risks from rotating outage.

5.2.4. Other Reasonable Alternatives Are Preferable

Investments in several alternatives promise more secure benefits with greater potential capacity savings and fewer risks. These include investments in new generation, energy efficient equipment, conservation programs, and expanded interruptible rate tariffs. CMTA asserts that additional participation in demand responsive programs and similar measures can provide far greater savings than an emergency voltage reduction plan. UC/CSU contend

that energy efficiency and demand reduction programs allow customers to manage their loads in accordance with their understanding of usage and needs, and are vastly preferable to a top-down energy management approach that includes substantial unknowns. We agree.

TURN claims that demand reduction alternatives are more costly than voltage reduction. TURN states, for example, that interruptible programs cost $84 / kW-year or more as an incentive for a few customers to interrupt load, while voltage reduction is much less costly. TURN says it understands why large customers want other ratepayers to spend ratepayer money on the large customers to interrupt load, but that this is not good public policy. Finally, TURN argues that demand reduction programs are highly uncertain, as illustrated by the performance of SCE's interruptible customers over the past 18 months.

To the contrary, the cost of voltage reduction may be low to ratepayers as a whole, but can be very high to those who suffer injury, damage or disruption. The cost may be very high to public health, safety and welfare if the affected customer is an essential customer. Moreover, we think the reliability of SCE's interruptible program is increased after the recent opportunity for those SCE customers who were not well suited for the program to opt-out. On balance, we think it is better to have demand reduction programs at known costs along with controlled interruptions as needed rather than the unknown costs, risks and effects of voltage reduction.

5.2.5. Decline Other Variations of Emergency Voltage Reduction

TURN recommends that we order SCE to implement emergency voltage reduction not only during on-peak Stage 3, but also on-peak Stage 2. For

all the reasons stated above, we decline to adopt CEC's recommendation to authorize an emergency voltage reduction program during power emergencies, when blackouts are imminent. Because we do not adopt the more limited CEC proposal, we similarly decline to adopt the more expansive TURN proposal.

CEC recommends that the Commission study opportunities for customers who own their own substations or distribution transformers to implement voltage reductions in response to system emergencies or energy conservation. No other party supports this recommendation. CEC has no estimate of costs or potential savings. We have no reason to believe the potential savings would justify costs incurred by both the Commission and customers, and the risks incurred by customers. We do not authorize utilities—entities we directly regulate—to implement emergency voltage reduction. We decline to study opportunities for customers—whom we do not directly regulate—to engage in the same, or similar, action, absent a compelling showing that an untapped opportunity reasonably exists.

Farm Bureau's alternate recommendation is to implement voltage reduction in 0.5% increments. No other party supports this recommendation. If benefits are linear, each 0.5% increment would mean up to a maximum of 32 MW in potential savings on SCE's system. Farm Bureau's recommendation, however, involves implementing voltage reduction until customers complain, and / or noticeable problems occur. Customer complaints and noticeable problems would most likely include complaints and problems based on injury, damage and disruption. We are not inclined to implement a program until injury, damage and disruption occur.

Further, Farm Bureau's recommendation is more like an experiment than an emergency voltage reduction plan. We are not persuaded that we

should engage in such an experiment. Overall, we think the need has subsided, potential benefits do not justify the risks, and other reasonable alternatives are preferable, thereby making the Farm Bureau's alternate recommendation no more desirable than the core recommendation.

Finally, utilities and others recommend comprehensive and thorough laboratory and field testing, as well as formal input from ANSI, the Institute of Electrical and Electronic Engineers, manufacturers, consumer testing groups, and consumers before proceeding with a voltage reduction program. We do not think this is necessary. The need for emergency voltage reduction has subsided and the benefits are marginal. The cost and burden on parties to further assess the risks and benefits are unlikely to be necessary or reasonable, given the availability of other alternatives.

5.2.6. Conclusion

The current energy situation does not at this time justify adoption of one or more of the recommended emergency voltage reduction programs. Rather, numerous other programs now in place as a result of Executive Orders by Governor Davis, as well as initiatives by this Commission and utilities, have significantly moderated the need to authorize an emergency voltage reduction program. If authorized, such program would be effective only in SCE's service area beginning in Summer 2002. On balance, the potential benefits are modest, while the costs and risks, although not quantified, are potentially great. Other reasonable alternatives are available. The majority of parties oppose an emergency voltage reduction program. Both the Chairman of ASC C84 and a member of the ANSI C84.1 Committee caution against service voltages below 114 volts. As a result, we decline to adopt an emergency voltage reduction program.

Nonetheless, should the need resurface, parties may propose specific emergency voltage reduction measures for further Commission consideration.

6. Comments on Proposed Decision

The Presiding Officer and Assigned Commissioner's proposed decision was filed with the Commission and served on all parties in accordance with Section 311(d) of the Public Utilities Code and Rule 77.1 of the Rules of Practice and Procedure. Comments were filed and served on _____, 2002, and reply comments were filed and served on _____, 2002.

Findings of Fact

1. The Commission's existing CVR program, as stated in Rules 2 of PG&E, SCE and SDG&E, already requires that most service voltage (at the customer meter) be between 114 and 120 volts (for normal 120 volt service), with limited exceptions.

2. Each utility strives to operate within the limits of Rule 2, and makes necessary corrections when brought to its attention.

3. PG&E and SDG&E do not have automatic or remote capability to quickly implement voltage reduction during system emergencies.

4. The Governor's request to study voltage reduction was initiated under far worse conditions than exist today, with current conditions now including increased supply and decreased demand.

5. The benefits of an emergency voltage reduction program are limited to the remote voltage reduction capability of SCE during its summer on-peak period, saving no more than an estimated 160 MW.

6. The risks of injury, damage and disruption increase as voltages decrease.

7. Emergency voltage reduction can cause injury, damage, and disruption, including increasing the risk and incidence of injury, equipment damage, and

equipment maintenance costs; shortening equipment life; causing equipment outages; disrupting or halting business operations; and reducing system operator flexibility.

8. Minimum ANSI C84.1 Range A service and utilization voltages are 114 and 110, respectively, and minimum Range B service and utilization voltages are 110 and 106, respectively.

9. ANSI C84.1 Range A identifies voltages for which electrical systems are designed and operated, and is the expected normal condition, while the occurrence of service voltages outside of Range A should be infrequent.

10. ANSI C84.1 requires that Range B voltages be limited in extent, frequency, and duration, and when Range B occurs, corrective measures shall be undertaken within a reasonable time to improve voltages to meet Range A requirements.

11. If emergency voltage reduction is authorized as recommended, the event might last as long as the entire SCE on-peak period, or up to 6 hours each summer weekday (excluding holidays), for a total of 504 hours in 2002.

12. A program that authorizes Range B up to 504 hours is not consistent with events that are “temporary,” “infrequent,” and “limited in extent, frequency and duration.”

13. Operation in Range B for extended times nearly ensures some customers will see voltages below Range B, with concurrent risk of injury, damage and disruption.

14. The NEC encourages building designers to limit voltage drop to 5% (6 volts on a 120 volt system) compared to 4 volts in ANSI C84.1.

15. The 2 volt difference in allowance for voltage drop within buildings between the NEC and ANSI C84.1 creates a bias for problems, and necessitates caution when lowering overall system voltages below Range A.

16. Emergency voltage reduction places some customers at risk of utilization voltage less than 106 volts, including not only non-essential customers, but also essential customers normally excluded from rotating outages.

17. The Chairman of the Accredited Standards Committee C84 states that service voltage of 114 volts is the minimum voltage to ensure acceptable equipment performance.

18. Unacceptable equipment performance creates risk of injury, damage and disruption.

19. CEC test results have not been published, have not received formal peer review, and were not introduced as evidence.

20. All equipment does not at all times meet current code, reflect proper installation, and have safeguards and safety devices that are fully functional.

21. Waiver of utility liability for injury, damage or disruption resulting from emergency voltage reduction transfers the risk of those outcomes from the utility to its customers, and specifically to the customers who experience injury, damage or disruption.

22. The transfer of risk from the utility to its customers is inequitable, the magnitude of the liability is unknown, and, if those customers are essential customers, it harms not only those customers, but also the broader public health, safety and welfare.

23. Emergency voltage reduction involves unknown effects over potentially long durations without an existing or proposed warning system, while rotating

outages are announced before they occur, are of limited duration, and customers have several options available to mitigate their exposure or damage.

24. Investments in alternatives (including investments in new generation, energy efficient equipment, conservation programs, and expanded interruptible rate tariffs) promise more secure benefits with greater potential capacity savings and fewer risks than does emergency voltage reduction.

25. CEC recommends that the Commission study opportunities for customers who own their own substations or distribution transformers to implement voltage reductions in response to system emergencies or energy conservation, but CEC presents no estimate of possible costs or potential savings.

26. Numerous other programs now in place as a result of Executive Orders by Governor Davis, as well as initiatives by this Commission and utilities, have significantly moderated the need to authorize an emergency voltage reduction program.

27. The potential benefits of emergency voltage reduction are modest, the risks are not quantified but potentially great, and reasonable alternatives are available.

Conclusions of Law

1. PG&E, SCE and SDG&E should each continue all reasonable efforts to operate their distribution systems at the lowest peak load voltage levels consistent with Commission orders and Rule 2.

2. PG&E, SCE and SDG&E should each modify their existing voltage regulating devices, as necessary and reasonable, to ensure operation within Rule 2 limits.

3. PG&E, SCE and SDG&E should each explore all reasonable opportunities for additional voltage savings in the normal course of their operations, including

implementation of all cost-effective measures to reduce voltage during normal substation related work.

4. The voltage reduction recommendations of the CEC and TURN should not be adopted, but, should the need resurface, parties may propose specific emergency voltage reduction measures for further consideration.

5. This order should be effective today so that utilities may continue all reasonable efforts to pursue voltage regulation and capacity savings within the limits of Rule 2 and ANSI C84.1; the uncertainty of possibly implementing an emergency voltage reduction program is removed; and parties can explore all other alternatives, as necessary, for avoiding rotating outages with Rule 2 and ANSI C84.1 limits without delay.

INTERIM ORDER

IT IS ORDERED that:

1. Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company shall continue all reasonable efforts to operate their distribution systems at the lowest peak load voltage levels consistent with Commission orders and Rule 2; modify their existing voltage regulating devices, as necessary and reasonable, to ensure operation within Rule 2 limits; and explore all reasonable opportunities for additional voltage savings in the normal course of their operations, including implementation of all cost-effective measures to reduce voltage during normal substation related work.

2. This proceeding remains open for other Phase 2 issues, but is closed regarding emergency voltage reduction plans. Parties may, however, propose further Commission consideration of an emergency voltage reduction plan, as necessary and reasonable, by filing a pleading pursuant to any relevant portion of the Public Utilities Code, including a petition under Public Utilities Code Section 1708.5, if the need to consider such plan resurfaces.

This order is effective today.

Dated _____, at San Francisco, California.

Appendix A

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