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STAFF PROPOSAL ON PHASE II RULEMAKING 20-07-013

Issues Outlined in the April 13, 2022 Assigned Commissioner's Phase II Scoping Memo and Ruling Extending Statutory Deadline

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EXECUTIVE SUMMARY

This document presents Safety Policy Division Staff's (Staff) recommendation for modifications to the Risk-Based Decision-Making Framework (RDF) adopted in Decision (D.) 18-12-014 *Phase Two Decision Adopting Safety Model Assessment Proceeding Settlement Agreement with Modifications*,[1] specifically to the multi-attribute value function (MAVF) approach. The California Public Utilities Commission (Commission) requires investor-owned utilities (IOUs) to use the MAVF for risk quantification to guide the selection of cost-effective risk reduction and safety enhancement programs in utility operations. Staff developed this proposal in response to the April 13, 2022, Assigned Commissioner's Phase II Scoping Memo and Ruling (Phase II Scoping Memo).[2]

The Phase II Scoping Memo seeks input on how to improve the understandability, transparency, and usefulness of the RDF, and specifically the MAVF. This proposal reflects Staff observations as well as testimony and comments from intervenors in the 2022 Pacific Gas and Electric's (PG&E) General Rate Case (GRC) and the 2022 PG&E Wildfire Mitigation Plan (WMP), cited herein. Staff contend that the MAVF's dimensionless risk scores and risk spend efficiency (RSE) values, intended to assist with Commission decision-making on utility proposed safety mitigations, are poorly understood and offer little guidance in determining the cost-efficiency of proposed investments for the Commission. The application of the various components of the MAVF, particularly the assignment of weights and ranges, is complicated and opaque to reviewers. The assignment of weights to the attributes in building the MAVF is often incorrectly applied and misunderstood, even if technically compliant with the Settlement.Agreement (S.A.) adopted in D.18-12-014. The resulting cost-effectiveness measure produced by the MAVF, the RSE value, is limited in its usefulness to decision-makers and other stakeholders as it does not indicate whether benefits outweigh costs.

This Staff Proposal provides recommendations for improvements to the RDF to improve clarity and understandability and to assist Commission decision-making on IOU-proposed safety mitigations.

Staff Recommendations

Based on an extensive consultative process conducted with stakeholders, Staff recommend that the RDF should express the value of the combined risk attributes[3] in

[1] (D.) 18-12-014 *Phase Two Decision Adopting Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with Modifications (S.A. Decision)* (D.18-12-014).

[2] *Assigned Commissioner's Phase II Scoping Memo and Ruling Extending Statutory Deadline* (Phase II Scoping Memo). Order Instituting Rulemaking to Further Develop a Risk-Based Decision-Making Framework for Electric and Gas Utilities (R.20-07-013), issued on April 13, 2020, at 3-5.

[3] Risk attributes at a minimum consist of Safety, Reliability, and Financial risks.

dollars, not dimensionless risk scores, thereby replacing the MAVF with a "cost-benefit approach." The recommendations are as follows:[4]

- Replace Risk Scores with a Dollar Valuation of Risk Attributes in the RDF. Staff recommend adopting a dollar valuation of risk attributes, which leads to a cost-benefit approach, to replace the MAVF in the RDF. Dollar valuation of risks provides a more practical and easily understood comparison of which safety impacts pose the greatest risk and which mitigations are most cost-effective. Dollar valuation is common practice in risk assessment across various industries. For example, actuarial tables and insurance policies, among others, attach a dollar amount to property damage, the loss of life, and injuries (with gradations of injury having different monetary values). Staff propose to use this monetary cost-benefit approach here to provide a more straightforward way to determine which mitigations are most cost-effective at lowering risk. While this proposal provides a standard dollar value equivalency for each attribute, Staff also recommend that IOUs be accorded flexibility to deviate from that standard with a different dollar value as long as they can offer a reasonable justification supported by research and data.

  Adopting a cost-benefit approach would simplify the equivalent risk value calculation relative to the MAVF approach, offering more clarity in the RDF (for a comparison, see Tables 1 and 2 in Section 2 of this document). As a result, the task of assigning weights in the RDF, which is prone to misapplication and misunderstanding, would no longer be necessary. Instead, the trade-off between risk attributes would be examined by comparing costs. Transparency would not be reduced since input values in the cost-benefit approach would be expressed in natural units, just as in the MAVF approach. All the other RDF elements detailed in D.18-12-014, such as IOU determination of scaling functions, remain intact.

  The new approach produces a benefit-cost ratio (the inverse of cost-benefit ratio), analogous to the RSE. The resulting benefit-cost ratios would then compare the dollar benefit of a mitigation risk reduction to the cost of the mitigation, resulting in metrics that are intuitively easier to understand and more useful as a standalone measure than an RSE value.[5] The benefit-cost ratios are

[4] Attributes are "an observable aspect of a risky situation that has value or reflects a utility objective, such as safety or reliability. Changes in the levels of attributes are used to determine the consequences of a Risk Event. The attributes in an MAVF should cover the reasons that a utility would undertake risk mitigation activities." (D.18-12-014 at 16.)

[5] While both an RSE and a benefit-cost ratio measure cost-effectiveness, the RSE measure looks at the ratio of a mitigation's risk reduction score as compared to the cost of the mitigation. The mitigations can then be ranked against each other using the RSE values, but the RSE values do not indicate if the mitigation benefits exceed its costs. The benefit-cost ratio, on the other hand, looks at the ratio of a mitigation's economic benefit to the cost of

not intended to be the sole determinant for decisions made by the Commission on proposed investments by the IOUs; rather, the benefit-cost ratios are expected to serve as a more helpful input for decision-making than the current RSE values.

- Dollar Valuation of Safety Consequences. Staff recommend the IOUs use Department of Transportation (DOT) guidance on the Value of Statistical Life (VSL) to provide a dollar value for safety consequences. This factor can also be referred to as the value of mortality reduction. This Staff recommendation is based on Technical Working Group (TWG) input. The DOT updates VSL annually based on changes to income and inflation. The DOT guidance on VSL for 2021 is $11.8 million.[6]

  Staff recommend the use of DOT VSL as guidance. However, the IOUs may choose a VSL value between the high and low ranges provided by the Department of Health and Human Services[7] (HHS). If an IOU chooses this approach, it must justify its choice and provide a sensitivity analysis for the benefit-cost ratio impact of its choice as compared to the standard DOT VSL. The high and low VSL estimates provided by HHS for the base year 2021 are $5.4 and $17.5 million.

  Staff recommend two methods to apply a monetary value to injury prevention. The first method is consistent with all of the IOUs' previous Risk Assessment Mitigation Phase (RAMP) filings and values a serious injury as 0.25 of a fatality. The second method involves using more granular data at the injury severity level if the data is available. The DOT provides a table detailing what fraction of the VSL should apply to an injury based on the injury's severity level.[8]

  However, with respect to wildfire risk, it is important to note that the use of the DOT VSL is primarily applicable to death and injury caused by *direct* exposure to wildfire. The DOT framework was not designed to handle a major class of injury from wildfire smoke. As smoke-related injuries are considered in future proceedings, estimation and valuation of that class of injuries will be considered. In the meantime, Staff expect IOUs to propose research-based estimates of the impacts of wildfire smoke in their risk assessments.

- Dollar Valuation of Electric Reliability Consequences. Staff recommend using the Lawrence Berkeley National Laboratory (LBNL) Interruption Cost Estimate

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a mitigation. If the value in the benefit-cost ratio is greater than 1, then the benefits outweigh the costs; if the value is less than 1, then the costs outweigh the benefits; and if the value is 1, then the benefits equal the costs.

[6] Departmental Guidance on Valuation of a Statistical Life in Economic Analysis (DOT VSL). Available here: https://www.transportation.gov/office-policy/transportation-policy/revised-departmental-guidance-on-valuation-of-a-statistical-life-in-economic-analysis.

[7] https://aspe.hhs.gov/sites/default/files/2021-07/hhs-guidelines-appendix-d-vsl-update.pdf.

[8] DOT VSL at 10.

(ICE) Calculator[9] as the first step toward dollar-valued quantification of electric reliability risk to support the cost-benefit analysis of mitigation proposals. The ICE Calculator produces a dollar estimate of the cost to customers from electric service outages and recognizes that outages have a greater customer dollar impact depending on the type of customer (residential vs industrial, etc.) affected and the longer the outage lasts. However, the ICE Calculator does not accurately calculate the impacts of durations lasting longer than 16 hours. While there are limitations to the application of the ICE Calculator, it does account for the impact differences between customer categories (residential, commercial, industrial) and outage lengths. ICE, therefore, represents an improvement on the current method of using the basic metric of customer minutes interrupted (CMI),[10] which assumes all customer impacts are the same and that each minute of an outage has the same impact regardless of the outage's duration.

Staff recommend that further improvements to the valuation methodology, such as adopting the ICE 2.0 calculator when available, be considered in future phases of this rulemaking. However, Staff note that the California IOUs have not yet committed to participating in the ICE 2.0 project and recommend they should be required to take part to make the ICE 2.0 more applicable.

Staff also note that LBNL is studying the impacts of more prolonged outages in its Power Outage Economic Tool (POET) project with Commonwealth Edison Company in Illinois, as presented to the Commission's Grid Resiliency and Microgrids Team on May 10, 2022.[11] This project could be the basis for a future study to include California utilities.

If IOUs or other stakeholders can demonstrate that an alternative model to ICE developed in-house or by a third party provides equivalent or superior results to the ICE Calculator, they are encouraged to present their results and rationale in response to this proposal.

- Dollar Valuation of Gas Reliability Consequences. Until a standard for gas reliability valuation is developed, Staff recommend that IOUs apply the implied value from their current MAVF risk score calculation contained in their most recent respective RAMP filing. Staff do not assert that this value is ideal but that it can serve until better methods are determined.
- Environmental and Social Justice Impacts. As an initial step to incorporate environmental and social justice (ESJ) consideration in the RDF, Staff

[9] https://icecalculator.com/home
[10] CMI = number of minutes of interrupted customer electric service, defined in IEEE Standard P1366.
[11] Resiliency and Microgrids Events and Materials (ca.gov)

recommend that PG&E conduct a pilot effort to incorporate CalEnviroScreen[12] into their risk assessment and mitigation analysis. This recommendation would require PG&E to include CalEnviroScreen spatial data, including consideration of Disadvantaged and Vulnerable Communities (DVC), as defined in the Commission's climate adaptation decision, Decision (D.) 20-08-046, as they evaluate risks, potential consequences, and propose mitigations as part of the process of developing their 2024 RAMP application. Staff recommend that PG&E identify data gaps and areas for further exploration as part of its pilot. The pilot would require PG&E to:

- Consider equity in the evaluation of consequences and risk mitigation;
- Consider clean energy investments and mitigations that could improve local air quality and public health;
- Evaluate how proposed mitigations may increase climate resiliency in ESJ communities;
- Attempt to ascertain if impacts from wildfire smoke disproportionately impact ESJ communities;
- Estimate the extent to which mitigation investments disproportionately benefit populations outside ESJ communities; and
- Enhance outreach to ESJ communities as part of their risk assessment and mitigation planning.

Staff also recommend that the Southern California Gas Company (SoCalGas) and San Diego Gas & Electric Company (SDG&E) (collectively Sempra Companies) conduct their own pilot work for inclusion in their 2025 RAMP.

Staff do not expect these recommendations will be implemented retroactively into already filed RAMP applications or General Rate Cases. Instead, Staff propose that Phase II recommendations be required in the next expected GRC cycle, beginning with the PG&E's 2024 RAMP.

[12] CalEnviroScreen refers to the Office of Environmental Health Hazards Assessment California Communities Environmental Health Screening Tool. More information available here: https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40

1. INTRODUCTION

The April 13, 2022 Phase II Scoping Memo[13] posed several issues in Phase II that were developed, in part, through a collaborative effort among Staff and parties participating in the TWG sessions for R.20-07-013.

The adoption of the current RDF in D.18-12-014 was a significant step towards a more uniform and quantitative approach in the Safety Model Assessment Proceeding (S-MAP) due in large part to the implementation of the MAVF.[14] The MAVF approach combines distinct risk attributes into a single number to quantify the consequences of risk events. The Settling Parties in that rulemaking expected the adoption of the S.A. to result in "additional increased transparency and participation in how the safety risks are prioritized by the California Public Utilities Commission and the utilities, and provide accountability on how these safety risks are managed, mitigated, and minimized; and from a staff perspective, due to the adoption of a common format, the S.A. minimizes the resources and time devoted to understanding the intricacies of the utility risk model."[15]

However, throughout the RAMP, GRC, and WMP filings applying the current RDF, Staff have observed that the structural components of the MAVF approach are generally not well-understood by practitioners and other stakeholders. In particular, the assignment of weights and ranges, the meaning behind the weights, and the metrics produced by the MAVF approach, such as the risk score, the risk reduction score, and the RSE value, negatively affect transparency and limit its value to decision-makers. This constrains the Commission's ability to prioritize safety while thoroughly evaluating proposed rate increases.

The lack of clarity and usability of the RDF is illustrated in testimony and response testimony on PG&E's pending GRC application.[16] For example, in the AARP Opening Panel Testimony,[17] the Wired Group consultants, testifying on behalf of AARP, offer several reasons why the RSE value resulting from the MAVF approach is of little value to decision-makers. They assert that the current MAVF approach is a mitigation prioritization tool and not a test which can be used to determine which mitigations are cost-effective, and which are not. According to the Wired Group, "the quantification of consequences in dollars is critical to the 'absolute' (as opposed to relative) measurement of risk reduction referred to in the S-MAP Settlement Agreement."[18] In fact, the Wired Group goes as far as

[13] Phase II Scoping Memo at 3-5.
[14] D.18-12-014 at 28-30.
[15] D.18-12-014 at 29-30.
[16] Application (A.) 21-06-021 *Application of Pacific Gas and Electric Company for Authority, Among Other Things, to Increase Rates and Charges for Electric and Gas Service Effective on January 1st, 2023*
[17] *Opening Panel Testimony of Paul J. Alvarez, William Steele, and Dennis Stephens on Behalf of AARP* (AARP Opening Comments in PG&E GRC). Application of Pacific Gas and Electric Company for Authority, Among Other Things, to Increase Rates and Charges for Electric and Gas Service Effective on January 1, 2023, filed June 10, 2022, at 27.
[18] AARP GRC Openings Comments at 29.

to say that the Commission should avoid "relying, in any way, on the Risk Assessment and Mitigation Phase ("RAMP") Pacific Gas & Electric (PG&E) uses to justify many if not most spending proposals in its Application."[19]

The Utility Reform Network (TURN) supports expressing risk using dollar values converted from RSE values. In its Opening Comments on the 2022 PG&E WMP[20] and the Prepared Testimony of Jonathan Lesser in the 2023 PG&E GRC,[21] TURN details the methodology of the current RDF and the meaning of the RSE to all stakeholders, including regulators. Regarding the resulting RSE values, TURN notes that "without expressing risk reduction units in dollars, one cannot reach a conclusion about whether the benefits of a mitigation exceed the costs, which is the typical purpose of a benefit-cost ratio."[22] However, the ensuing debate reflected in TURN's testimony and PG&E's rebuttal,[23] which disputes TURN's methodology for conversation of RSE to benefit-cost ratio as well as their alternative MAVF, demonstrates a need for increased clarity in the methods used in the RAMP. The MAVF framework provides any number of ways to modify weights and scales to suit a utility's desired consequence valuation to justify proposed expenditures.

Staff seek to have the results of the RDF better inform the GRC process by expressing the costs and benefits of proposed mitigations to aid in a reasonableness review of proposed expenditures.

1.1 Workshops and Technical Working Group Sessions

In late 2021, Staff contracted with a consulting group, Level 4 Ventures, Inc. (Level 4), to provide a baseline assessment of the current RDF and guidance on the Phase II subset of selected issues. Level 4 prepared an IOU Baseline Assessment Report (Baseline Report), which evaluates the California electric and natural gas IOU RSE modeling and assumptions to assess whether IOUs maximize the effectiveness of safety investments while minimizing ratepayer impacts.[24]

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[19] AARP Opening Comments at 27.

[20] Opening Comments of The Utility Reform Network On the 2022 Wildfire Mitigation Plans (TURN Opening Comments on PG&E WMP), issued April 11, 2022.

[21] *Prepared Testimony of Jonathan Lesser, Addressing Quantitative Risk Analysis Issues in Pacific Gas and Electric Company's 2023 General Rate Case* (P&GE GRC Testimony of Lesser). Application of Pacfic Gas and Electric Company for Authority, Among Other Things, to Increase Rates and Charges for Electric and Gas Service Effective on January 1, 2023, submitted June 13, 2022.

[22] PG&E GRC Testimony of Lesser at 37.

[23] Pacific Gas and Electric Company, *Chapter 1: Rebuttal Testimony of Sumeet Singh and Yumi Oum, Enterprise and Operational Risk Management Program.* https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A2106021/5195/492368652.pdf

[24] Level 4, *Risk Spend Efficiency Assessment Deliverable 2.1: IOU Baseline Assessment*; https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-policy-division/reports/deliverable-21iou-baseline-assessmentrevised021722.pdf.

Level 4 summarized its Baseline Report in a workshop (Workshop #1) on March 3, 2022. Workshop #1 occurred before the Phase II Scoping Memo issuance to help stakeholders understand the strengths and weaknesses in the RDF and identify opportunities for improvement in Phase II of the Rulemaking 20-07-013.

With feedback from Staff and parties concerning the issues identified in the Phase II Scoping Memo, Level 4 produced a set of specific recommendations in its Recommendations Report (Level 4 Recommendations[25]) for implementation by the Commission, with input from interested parties. Level 4 presented those recommendations to the TWG, with opportunities for feedback and discussion, on April 20, 2022. The recommendations served as general guidance for developing standards for which Staff and parties would then determine implementation details in a series of ongoing Phase II and Phase III TWG sessions. The Joint IOUs (PG&E and SCE) proposed a schedule and timeline for prioritizing the recommendations in Phase II and Phase III in an informal written comment submission. Staff accepted the Joint IOU proposal and discussed the implementation details of Level 4 Recommendations in the subsequent TWG sessions.

On May 20, 2022, Staff hosted TWG #2 to discuss the recommendation labeled "MAVF 2" in the Level 4 Recommendations Report: "With input from the parties involved, the CPUC should adopt a standard set of parameters/formulas to monetize risk consequences, using standard values from other government agencies or industry sources where possible." Staff issued question prompts before TWG #2 and PG&E provided a post-workshop report summarizing comments from the stakeholders in attendance.

On June 2, 2022, Staff hosted TWG #3 to discuss the recommendation labeled "MAVF 3" in the Level 4 Recommendations Report: "With input from the parties involved, the CPUC should adopt standard metrics for electric and gas reliability, possibly adjusted for regional characteristics, and all IOUs should then use those metrics when estimating MAVF scores." The discussion in TWG #3 centered on metrics for determining reliability, with consideration of customer and outage types, but also included a discussion of risk attitude.

On June 16, 2022, Staff hosted the final TWG session (TWG #4) to discuss the recommendation referred to as "Risk Modeling 3" in the Level 4 Recommendations Report: "With input from the parties involved, the CPUC should adopt a standard readability factor to be used for RSE calculations." Staff also facilitated a discussion of ways to incorporate environmental and social justice (ESJ) impacts into the RDF filing. Staff asked for informal written feedback regarding ESJ impacts resulting from the meeting.

Finally, on June 29, 2022, Staff hosted a second workshop meeting (Workshop #2) to present the Staff Recommendations and take oral and informal written comments with potential revisions to Staff's initial recommendations.

[25] Level 4 Recommendations at 4-6.

1.2 Scoping Memo Issues Addressed

The following sections of this document present Staff recommendations, incorporating feedback from the TWG, on the following Phase II Scoping Memo issues:

- Issue (2): Should the Commission consider revising or refining the RDF methodology for valuing services, mitigations and/or impacts (such as those related to reliability or safety)? If so, should the Commission consider: (a) defining and requiring the use of a consistent VSL); (b) whether the dollar value of attributes should be explicitly addressed; and (c) the valuation of the costs and impacts of public safety power shutoff (PSPS) events as both risks and risk mitigations? Discussion and consideration of PSPS-related issues in this proceeding should avoid duplicating work on PSPS issues being addressed in other proceedings or as undertaken by the Office of Energy Infrastructure Safety (Energy Safety) in the context of its review of utility Ws.
- Issue (7): Should the Commission consider impacts on ESJ communities, including the extent to which action in this proceeding impacts achievement of any of the nine goals of the Commission's ESJ Action Plan?

The recommendations in this Staff Proposal also pertain to the following interrelated Phase II Scoping Memo issues:

- Issue (1): Should the Commission consider revising the RDF adopted in D.18-12-014? What principles or factors should guide consideration of revisions, refinements, or clarifications?
- Issue (3): Should the Commission consider refining or revising the methodology adopted in D.18-12-014 regarding weighting of risk categories and/or the replacement of weights and ranges with direct trade-off values of services and impacts?
- Issue (4): Should the Commission consider refining or revising the requirements for the MAVF contained in the RDF? If so, should this include identifying best practices, minimum requirements (including, potentially, the development of a single risk-attitude function or scaling function), guiding principles, and/or aspirational characteristics for RAMP filings?

The recommendations in this Staff Proposal, should they be adopted, would not take effect until the IOUs' next GRC cycle, beginning with PG&E RAMP in 2024. Further, Staff expects to continue working with parties to R.20-07-013 to advance the implementation details of each of the recommendations in this Staff Proposal, and other prioritized recommendations put forth by parties and Level 4 in 2022 and 2023, as they relate to Phase III for this rulemaking.

2. DOLLAR VALUATION OF RISK ATTRIBUTES IN THE RISK-BASED DECISION-MAKING FRAMEWORK

The Phase II Scoping Memo identifies the following issue: "Should the Commission consider revising or refining the RDF methodology for valuing services, mitigations, and/or impacts (such as those related to reliability and safety)? If so, should the Commission consider: (a) defining and requiring the use of a consistent VSL; (b) whether the dollar value of attributes should be explicitly addressed; and (c) the valuation of the costs and impacts of PSPS events as both risks and risk mitigations? Discussion and consideration of PSPS related issues in this proceeding should avoid duplicating work on PSPS issues being addressed in other proceedings or as undertaken by Energy Safety in the context of its review of utility WMPs."[26]

D.18-12-014 provides guidance for the IOUs to create a RDF with a MAVF, which combines unlike risk attributes into a single metric to quantify risk. While there are some advantages to the MAVF approach in the RAMP and the GRC, disadvantages have become apparent after adoption. The process of establishing weights, ranges, and scales for conversion of natural risk values into a single risk score makes the results, such as the risk score, mitigation risk reduction score, and the RSE value, challenging for stakeholders to interpret. Even the assignment of weights to the attributes in building the MAVF may be incorrectly applied and poorly understood by stakeholders. This lack of understandability affects transparency for many stakeholders and decision-makers. Furthermore, the resulting cost-effectiveness measure in the MAVF, the RSE value, is limited in its usefulness because it does not indicate whether benefits outweigh costs as a standalone metric like one might see in a typical benefit-cost ratio.

Staff recommend adopting a dollar-valued "cost-benefit" approach to the RDF whereby parties apply a dollar valuation for each primary attribute, including Financial, Safety, and Reliability (Electric and/or Gas),[27] which allows expression of risk and mitigation risk reduction in dollars. The RSE then becomes a ratio of benefits to cost that is easier to understand and apply in decision-making.

2.1 Discussion

The direct monetization of attributes in a cost-benefit approach has several advantages over the MAVF approach in offering more understandability, clarity, and simplicity in the RDF.

[26] Phase II Scoping Memo at 3-4.

[27] The Financial attribute is already expressed in dollars.

2.1.1 Understandability and Transparency of Calculations

An advantage of expressing risk in dollar values is that the resulting risk value is intuitively easier to grasp for most stakeholders than the risk scores and the mitigation risk reduction scores in the MAVF. To illustrate this point, consider the following examples in Table 1 and Table 2, which demonstrate the MAVF approach and the equivalent cost-benefit approach, respectively. Table 1 lists three attributes in the MAVF – Safety, Reliability, and Financial – along with the natural units, the expected value in natural units (which can represent either a risk or mitigation), the lower and upper bounds of the range of the attribute, the percent of the range represented by the value, the scaled score, the weights, and the weighted score. The scaling function is linear for all attributes in order to simplify the example.[28]

The natural unit values for this example are 20 fatalities, 500 customer minutes interrupted, and $1 billion of financial loss. The total risk score is the sum of the weighted scores over all attributes. Given the stated range and weight parameters for each attribute, the MAVF calculation results in a risk score of 28.75 in this example. The score of 28.75 lacks any intuitive meaning on its own.

Table 1. Use of MAVF Approach to Calculate a Risk Score

Attributes	Natural Units	Value	Lower Bound	Upper Bound	Percent of Range	Scaling Function	Scaled Score	Weight	Weighted Score*
Safety	Fatalities	20	0	100	20%	Linear	20	50%	10
Reliability	CMI	500 M	0	2 billion	25%	Linear	25	25%	6.25
Financial	Dollars ($)	$1 billion	$0	$2 billion	20%	Linear	20	25%	12.5
								Total Weighted Risk Score	**28.75**

* Weighted Score = Scaled Score x Weight

Compare the methodology in the MAVF approach found in Table 1 to its equivalent cost-benefit approach found in Table 2. The cost-benefit approach in Table 2 uses explicit trade-off values presented by the dollar value of attributes from government and other industry sources. It no longer considers the assignment of attribute weights and ranges.

Table 2 demonstrates the equivalent calculations in the cost-benefit approach by using the attributes and some values found in the Table 1 example and an assumed linear scaling function. The dollar value of attributes allows for a calculation of a risk value expressed in

[28] A linear scaling function representing a risk neutral attitude increases risk proportional to the natural units.

dollars which is a far simpler calculation by comparison (Monetized Risk Value = Value x Dollar Value of Attributes) and offers greater transparency, understandability, and simplicity to the reviewer. The resulting monetized risk value of $2.45 billion is much more accessible than the dimensionless risk score found in the MAVF approach.

Staff expect no loss of transparency with this method. Staff have the same expectation for transparency for any risk decision analysis approach – all inputs must be clear, explicit, and expressed in natural units. The only meaningful difference will be the numerical representation of the combined risk attributes.

Table 2. Use of Cost-Benefit Approach to Calculate a Monetized Risk Value

Attributes	Natural Units	Value	Dollar Value of Attributes*	Monetized Risk Value**
Safety	Fatalities	20	$10 M/fatality	$200 M
Reliability	CMI	500 M	$2.50/CMI	$1.25 B
Financial	Dollars ($)	$1 B	$1	$1 B
			Total Monetized Risk Value	**$2.45 B**

* The Dollar Value of Attributes is also referred to as the Trade-off Value.

** Monetized Risk Value = Value x Dollar Value of Attributes.

2.1.2 No Assignment of Weights and Ranges in the Cost-Benefit Approach

The simplified cost-benefit approach has the advantage of *not* requiring an assignment of weights and ranges to attributes in the RDF. Weighting in the context of the MAVF can be misinterpreted or misunderstood. In the current RDF, the correct application of the MAVF approach requires IOUs to assign weights based on their attribute measurement ranges. Proper assignment of weights involves an examination of the interaction of both weights and ranges. On their own, the weights are not intended to convey a general notion of importance. And yet, even well-meaning stakeholders often forget or do not understand, that the determination of weights depends on attribute ranges in the MAVF framework.

The required 40 percent minimum weight on the Safety attribute in Ordering Paragraph 2 of D.18-12-014[29] may reflect this misunderstanding. The 40 percent minimum constraint on the Safety weight can produce an inflated value of Safety or require unrealistic manipulation of the Safety range to align the Safety implied value with a generally accepted estimate.

[29] D.18-12-014 at 3.

By moving to a dollar value for each attribute in the RDF, IOUs would no longer need to assign weights and ranges, and stakeholders would not find they need to reverse calculate an implied value of attributes as a check on reasonableness. As Level 4 states in its Baseline Report, this simplified scheme avoids "the conceptual challenge of representing the relative importance of attributes by two (or more) numbers – weight and range."[30] And without needing consideration of weights and ranges in a cost-benefit approach, the problem presented by the required 40 percent minimum weighting on Safety disappears. Furthermore, without the weight and range parameters for each attribute, the trade-offs among attributes are even more apparent as they are each represented in dollar values.

2.1.3 RSE versus Benefit-cost ratio

The MAVF approach and the cost-benefit approach each produce an indication of cost-effectiveness represented by RSEs in the MAVF approach and benefit-cost ratios in the proposed approach. The RSE compares the mitigation risk reduction score against the cost of the mitigation to produce a risk-spend ratio that allows a ranking of mitigations. For example, Mitigation A with an RSE value of 5 is less cost-effective than Mitigation B with an RSE value of 6. However, the mitigation RSE values are only useful in the comparative ranking of mitigations. RSEs do not indicate economic effectiveness.

The benefit-cost ratio produced in the cost-benefit approach not only allows stakeholders to rank the cost-effectiveness of mitigations but also indicates whether the dollar benefit of mitigation outweighs its cost. The benefit-cost ratios offer a more useful and meaningful metric than the RSE for decision-makers. However, just as with the use of RSEs under the S.A., the IOUs would not be bound to select their mitigation strategy based solely on the basis of benefit-cost ratios. As stated in the S.A., "mitigation selection can be influenced by other factors including funding, labor resources, technology, planning and construction lead time, compliance requirements, and operational and execution considerations."[31]

2.1.4 Selection of Alternative Dollar Values for Attributes

A cost-benefit approach can be based on standard dollar values but would not restrict the IOUs in determining a reasonable alternative dollar value for an attribute. For example, an IOU may have a better measure of reliability based on extensive research tailored to its unique service territory. In that case, an IOU could deviate from a specified standard and use a different dollar value provided a sound rationale for determining that value is clear and supported by data.

[30] Baseline Report at 43.
[31] D.18-12-014, Attachment A, p. A-14, No. 26.
https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M250/K281/250281848.pdf

2.1.5 Replacement of the MAVF in the Settlement Agreement.

Although the cost-benefit approach would replace the MAVF in the S.A., many of the same elements of the MAVF would remain intact. This includes flexibility in the S.A. for IOUs to make their own determinations with respect to certain aspects of the risk model. For example, a particular requirement in Step 1A of Appendix A in D.18-12-014[32] addresses scaling functions. IOUs are given the freedom to choose a linear or a non-linear scaling function. A redline edit of Appendix A from D.18-12-014 can be found in the Appendix of this Staff Proposal.

2.2 Staff Recommendations

Staff recommend that IOUs implement the dollar valuation of attributes in a cost-benefit approach, thereby replacing the current MAVF scheme. The shift to a cost-benefit approach that places a monetary value on attributes is already being advocated as a useful decision-making tool by TURN and AARP. TURN determined the implied VSL in PG&E's and the Sempra Companies' MAVF [33] as a check on reasonableness and suggested that the monetary value of a loss in electric reliability be compared to published value of lost load estimates as another check on reasonableness.[34] [35] TURN has also derived a benefit-cost ratio from the MAVF RSE data in its Opening Comments on the 2022 Wildfire Mitigation Plans.[36] The IOUs' have expressed concern that this derivation was a manipulation of the RSEs using the scaling and weighting methods prescribed in the S.A. in a way that the IOUs had not intended. For example, the Sempra Companies, in their response to TURN and Safety Policy Division's critique of the implied value of life in their 2021 RAMP filing[37] stated that "the selected weights and ranges used in their MAVF were selected independent of a resulting [VSL] and that the Companies did not evaluate a VSL in selecting their MAVF attributes and weights. That is not its purpose. Rather, the MAVF aggregates all potential consequences of a risk event and assigns weights to their relative importance."[38] Under the cost-benefit approach, parties would not have to convert unitless risk scores estimated without consideration of an absolute value, then weighted, scaled, and run through a

[32] D.18-12-014 at A-5.
[33] TURN, *Protest of The Utility Reform Network*, (TURN Protest of Sempra RAMP) Application of San Diego Gas & Electric Company to Submit its 2021 Risk Assessment and Mitigation Phase Report (A.21-05-011) and Application of Southern Gas Company to Submit its 2021 Risk Assessment and Mitigation Phase Report (A.21-05-014), at Appendix A-6.
[34] TURN Opening Comments on PG&E WMP at 8.
[35] Dr. Lesser Testimony on P&GE GRC at 19.
[36] TURN Opening Comments on PG&E WMP at Appendix A.
[37] A.21-05-011, *Application of San Diego Gas and Electric Company to Submit its 2021 Risk Assessment and Mitigation Phase Report*
[38] San Diego Gas and Electric Company and Southern California Gas Company Comments on *Safety Policy Division's Evaluation of SDG&E and SoCal Gas's Risk Assessment Mitigation Phase Report*, at p.17. https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M427/K993/427993220.PDF

function into a dollar value suitable for decision support purposes. Estimation of consequences would simply start with a dollar value.

Staff expect that the monetization of attributes in the RDF will create greater understandability and usefulness in the review and decision-making processes of RAMPs and GRCs. First, the trade-off value in dollars for each attribute replaces the current weight and range in the MAVF approach, simplifying the RDF calculation. Second, the move away from explicit weighting would prevent regulators, practitioners, and other stakeholders from being constrained by the 40 percent minimum weighting of the Safety attribute. This 40 percent minimum weighting represents a misunderstanding of weights as a reflection of "general importance" rather than relative importance based on attribute ranges. Third, the representation of risk and risk reduction in dollars and the benefit-cost ratio expressed by the dollar reduction in risk versus dollars expended is intuitively more understandable (and potentially more useful) than representation of risk found in the current MAVF scheme. Risk scores, mitigation risk reduction scores, and RSE values intuitively lack meaning for those who do not understand the MAVF construct.

Despite shifting to a different valuation approach, Staff do not expect a loss of transparency. Staff have the same expectations for transparency for any risk decision analysis approach – all inputs must be clear, explicit, and expressed in natural units. The only meaningful difference should be the numerical representation of the combined risk attributes.

With a shift to a cost-benefit approach, Staff propose to allow flexibility in determining the appropriate dollar valuation of the attributes. IOUs can deviate from a standard dollar value for an attribute with an alternate value as long as the IOUs can offer a suitable justification. A formal process for authorizing an exception will likely be discussed in a future phase of this proceeding.

3. DOLLAR VALUATION OF SAFETY CONSEQUENCES

This section discusses the Staff recommendation for monetization of safety consequences for use in a cost-benefit approach. This recommendation addresses Phase II Scoping Memo Issue #2: should the Commission consider revising or refining the RDF methodology for valuing services, mitigations and/or impacts (such as those related to reliability or safety)? If so, should the Commission consider: (a) defining and requiring the use of a consistent VSL.[39]

A key issue with using the current MAVF is that doing so has repeatedly produced an unreasonable implied value of safety consequences in RAMP filings.[40] Staff and stakeholders have previously analyzed MAVF calculations provided in the IOUs' RAMP filings and found that the implied VSL is $100 million, which is nearly 10 times higher than the methodology suggested by the DOT,[41] and anywhere from six to 18 times higher than the top and bottom of the VSL range suggested by HHS.[42] An implied VSL of this level makes certain mitigations appear more beneficial than they would otherwise because the mitigations are purported to reduce an inflated value of the safety consequence.

Staff recommend using the published DOT VSL adjusted for the base year of their RAMP filing as the standard dollar value. Alternatively, an IOU may choose a VSL value between the high and low ranges provided by the HHS, but must justify its choice and provide a sensitivity analysis for the benefit-cost ratio impact of its choice as compared to the standard DOT VSL.

3.1 Discussion

Under the current MAVF approach, IOUs are not expected to provide a dollar valuation of Safety. However, stakeholders can use the given weights and ranges to reverse calculate the implied value of Safety to check the reasonableness of the risk model. Using the following formula, for example, the SCE implied value of Safety in the 2022 RAMP filing[43] shows an implied VSL of $100 million per fatality:

$$\textit{Implied Value} = (\textit{Safety Weight}/\textit{Safety Range}) \div (\textit{Financial Weight}/\textit{Financial Range})$$

$$= (50\,\%/100) \div (25\%/\$5\ \textit{billion}) = \$100\ \textit{million}$$

[39] Phase II Scoping Memo at 3-4.
[40] See for example, (A.20-06-012) at p. 17, SPD Staff Evaluation of SDG&E and SoCal Gas RAMP (A-21-05-011) at 8.
[41] DOT, *Valuation of a Statistical Life Guidance* (DOT VSL) at 7-8. Available here: https://www.transportation.gov/resources/value-of-a-statistical-life-guidance.
[42] HHS, *Updating Value per Statistical Life Estimates* (HHS VSL) at D-11. Available here: https://aspe.hhs.gov/sites/default/files/2021-07/hhs-guidelines-appendix-d-vsl-update.pdf.
[43] Application of Southern California Edison Company Regarding 2022 Risk Assessment Mitigation Phase (RAMP), A.22-05-013

The implied value of $100 million is approximately ten times higher than any of the VSL published in guidance documents across government and industry sources, such as the DOT,[44] HHS,[45] the American Society of Mechanical Engineers (ASME), the Institute of Electrical and Electronics Engineers (IEEE), the Environmental Protection Agency (EPA),[46] California Air Resources Board (CARB),[47] and the Robinson, Hammitt, and O'Keefe survey.[48] PG&E and the Sempra Companies also had implied VSL of $100 million in their latest RAMP filings. An implied VSL of this magnitude favors mitigation investments that reduce an inflated value of the Safety attribute. Under the MAVF approach, to achieve a VSL that is more in line with government- and industry-suggested standards, IOUs would need to manipulate the weights and ranges and comply with the required minimum Safety weighting of 40 percent in a way that could result in an inaccurate impression of an IOU'srisk priorities.

By adopting the recommendation to directly express the Safety attribute in dollars in a cost-benefit approach, stakeholders no longer have to conduct such reasonableness checks on VSL. IOUs would no longer need to assign weights and ranges that result in overinflated implied VSL. Instead, stakeholders can expect that the IOUs used an already agreed upon standard (or a justified alternative value) to estimate the Safety consequences in dollars. Stakeholders can then focus on the results of the cost-benefit approach and less on the value being used.

It is important to keep in mind that the dollar value of a fatality in a cost-benefit approach is not the same as placing a dollar value on individual lives. The VSL is an estimate of how much people are willing to pay for small reductions in their risks of dying from adverse health conditions. The EPA provides the following example:[49]

> Suppose each person in a sample of 100,000 people were asked how much he or she would be willing to pay for a reduction in their individual risk of dying of 1 in 100,000, or 0.001%, over the next year. Since this reduction in risk would mean that we would expect one fewer death among the sample of 100,000 people over the next year on average, this is sometimes described as 'one statistical life saved.' Now suppose that the average response to this hypothetical question was $100. Then the total dollar amount

[44] DOT VSL. Available here: https://www.transportation.gov/resources/value-of-a-statistical-life-guidance.
[45] HHS VSL. Available here: https://aspe.hhs.gov/sites/default/files/2021-07/hhs-guidelines-appendix-d-vsl-update.pdf.
[46] U.S. Environmental Protection Agency, *Mortality Risk Valuation* (EPA Mortality Risk Valuation). Available here: https://www.epa.gov/environmental-economics/mortality-risk-valuation.
[47] CARB, *Review of Mortality Risk Reduction Valuation Estimates for 2016 Socioeconomic Assessment*. Available here: https://ww2.arb.ca.gov/sites/default/files/2021-10/SCAQMD%20Mortality%20Risk%20Reduction%20Valuation.pdf.
[48] Lisa A. Robinson, James K. Hammitt, and Lucy O'Keeffe, *Valuing Mortality Risk Reductions in Global Cost-benefit Analysis*. Available here: https://cdn2.sph.harvard.edu/wp-content/uploads/sites/94/2017/01/Robinson-Hammitt-OKeeffe-VSL.2018.03.23.pdf.
[49] EPA Mortality Risk Valuation at section "What does it mean to place a value on life?"

that the group would be willing to pay to save one statistical life in a year would be $100 per person × 100,000 people, or $10 million.

Multiple sources for VSL estimates, such as the DOT, EPA, and HHS are transparent in their estimation methodology. In DOT's case, the agency also provides a formula to compute the VSL based on inflation and changes in income.[50] The DOT publishes an annual update for the prior year based on such changes. The DOT also offers estimates for the value of injury prevention based on the severity of the injury as a fraction of the VSL (see Table 3).

Table 3: Relative Disutility Factors by Injury Severity Level[51]

MAIS Level	Severity	Fraction of VSL
MAIS 1	Minor	0.003
MAIS 2	Moderate	0.047
MAIS 3	Serious	0.105
MAIS 4	Severe	0.266
MAIS 5	Critical	0.593
MAIS 6	Unsurvivable	1.000

Source: DOT, *Valuation of a Statistical Life Guidance,* at 10.

HHS also publishes VSL estimate ranges with a low, middle, and high value and forecasts the VSL estimate range for future years in constant dollars.[52]

3.2 Staff Recommendations

Staff recommend that the IOUs use the published DOT VSL[53] adjusted for the base year of their RAMP filing, as the standard value in expressing the Safety attribute in dollars. For example, in 2021, the published DOT VSL[53] is $11.8 million. Or, as an alternative, the IOUs may choose a different value that sits between the high and low ranges provided by the HHS adjusted for the base year of their RAMP filing. The IOU must justify its choice of this alternative VSL and provide a sensitivity analysis for the benefit-cost ratio impact of its

[50] DOT VSL at 7-8.
[51] The description for each category on the Abbreviated Injury Scale (AIS) can be found here: Federal Aviation Administration, *Treatment of the Values of Life and Injury in Economic Analysis, at 2-2. Available here: https://www.faa.gov/regulations_policies/policy_guidance/benefit_cost/media/econ-value-section-2-tx-values.pdf.* DOT uses a Maximum Abbreviated Injury Scale (MAIS), which is similar to the AIS.
[52] HHS VSL, Table D.2, at D-11.
[53] Departmental Guidance on Valuation of a Statistical Life in Economic Analysis (DOT VSL). Available here: https://www.transportation.gov/office-policy/transportation-policy/revised-departmental-guidance-on-valuation-of-a-statistical-life-in-economic-analysis.

choice compared to the standard DOT VSL. The high and low estimates given by HHS for 2021 are $5.4 and $17.5 million.[54]

Staff recommend applying a three to seven percent per year discount rate to VSL, which is consistent with DOT and other government agency guidance. Staff acknowledge that the development of discount rates is an ongoing priority that needs further discussion in subsequent phases of the RDF proceeding.

Lastly, Staff recommend two methods to value monetization of injury prevention. The first method is consistent with all major IOUs previous RAMP filings and involves weighing a serious injury as 0.25 of a fatality.

The second method involves using more granularity at the injury severity level if the data is available. The DOT has guidance on how to apply VSL to injuries based on the severity level.[55] Staff recommend using the fractions outlined in Table 3 to monetize the value of injury prevention.

Staff selected DOT as a VSL standard because the agency updates VSL annually based on changes in inflation and income. HHS is used in conjunction because they provide high and low estimates for VSL, allowing for a range of VSL to be used by IOUs.

However, with respect to wildfire risk, it is important to note that the use of the DOT VSL is primarily applicable to death and injury caused by *direct* exposure to wildfire. The impact of wildfire smoke is a major class of injury for which the DOT framework was not designed and to which the DOT framework is not easily applied. Staff recommend utilities propose data-driven estimates for establishing costs of smoke-related injuries/health consequences. Estimating the probabilities and health consequences of wildfire smoke is critically important.

As the Mussey Grade Road Alliance (MGRA) has pointed out in their comments on both SDG&E's RAMP application[56] and in comments on WMPs, the impacts of wildfire smoke on Californians cumulatively may result in more negative health outcomes than the fires themselves.[57] The California Department of Public Health[58] states that exposure to particulate matter (PM) is currently the principal known public health threat from wildfire smoke. Fine particles from smoke and coarse particles from ash are respiratory irritants that can cause coughing, wheezing, and difficulty breathing. Certain groups may be particularly sensitive to wildfire smoke due to life stage (children and older adults), pre-existing medical

[54] HHS VSL at D-11.
[55] DOT VSL at 10.
[56] Mussey Grade Road Alliance Comments on San Diego Gas and Electric Company's 2021 Risk Assessment Mitigation Phase Application A.21-05-011. https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M429/K683/429683013.PDF; at p. 9.
[57] OEIS Docket 2022-WMPs; Mussey Grade Road Alliance comments on 2022 Wildfire Mitigation Plans of PG&E, SCE, and SDG&E; pp. 47-52.
[58] Wildfire Smoke: Considerations for Public Health Officials, CDPH, 2019. Available here: https://calhospital.org/wp-content/uploads/2021/04/wildfire_smoke_considerations_for_californias_public_health_officials_august_2019.pdf

conditions (e.g., lung and heart conditions), and socioeconomic factors (access to safe housing and health care, linguistic isolation, lack of transportation, and other socioeconomic factors). Recent reviews conclude that a strong association exists between exposure to wildfire smoke and all-cause mortality and respiratory morbidity.[59] In addition, several recent studies identify elevated risks of specific health outcomes, including emergency department visits for ischemic heart disease, dysrhythmia, heart failure, pulmonary embolism, and stroke.[60] At least one study in California[61] found that PM from wildfire smoke has a more significant health impact than other sources of PM pollution in the Southern California Region.

Staff note that Energy Safety's Wildfire Risk Modeling Working Group intends to explore the quantification of smoke impacts in forthcoming working group meetings. There is an opportunity to incorporate methodologies developed in that forum into the RAMP process that can benefit both non-ESJ communities where wildfire mitigations will occur and as well as ESJ communities affected by wildfire smoke.

[59] Reid, C.E., Brauer, M., Johnson, F.H. et. al. *Critical review of health impacts of wildfire smoke exposure*. *Environ. Health Perspectives* 124(9), pp. 1334-1343 (2016). Available at: https://doi.org/10.1289/ehp.1409277

[60] Wettstein, Z. S., Hoshiko, S., Fahimi, J. et al. *Cardiovascular and cerebrovascular emergency department visits associated with wildfire smoke exposure in California in 2015.* Journal of the American Heart Association 7.8 (2018): e007492. Available at: https://doi.org/10.1161/JAHA.117.007492; Cascio, W. E. *Wildland fire smoke and human health*. Science of the total environment. 624 (2018): 586-595. Available at: https://doi.org/10.1016/j.scitotenv.2017.12.086

[61] Aguilera, R., Corringham, T., Gershunov, A. et al. *Wildfire smoke impacts respiratory health more than fine particles from other sources: observational evidence from Southern California*. Nat Commun 12, 1493 (2021). Available here: https://doi.org/10.1038/s41467-021-21708-0

4. DOLLAR VALUATION OF ELECTRIC RELIABILITY CONSEQUENCES

The Phase II Scoping Memo identifies the following issue: Should the Commission consider revising or refining the RDF methodology for valuing services, mitigations, and/or impacts (such as those related to reliability or safety)? If so, should the Commission consider: (a) defining and requiring the use of a consistent VSL; (b) whether the dollar value of attributes should be explicitly addressed.[62]

Reliability risk, along with Safety and Financial risk, is one of the three primary risk attributes in the RDF. These attributes align with the Commission's goals of achieving safe, reliable, and affordable utility services. However, quantifying reliability in the RDF as adopted in D.18-12-014 does not address some of the fundamental considerations of the impact of lost electric service such as customer type and outage duration.

Staff recommends adopting the LBNL ICE Calculator as the first step toward better quantifying electric reliability risk. This following sections discusses this recommendation, starting with a review of current challenges.

4.1 Discussion

In the most recent RAMP applications, PG&E and SCE have adopted the natural unit of CMI to express reliability impacts. SDG&E used the related metrics of the System Average Interruption Duration Index (SAIDI) and the System Average Interruption Frequency Index (SAIFI)[63] to estimate reliability impacts. One problem with those measurements is that the impact of lost minutes is not linear. There is a significant difference in impact for commercial, industrial, and residential customers, as commented on in the TWG sessions.[64] Extended outages of electricity have a different effect than short outages.[65] For example, a refrigerator that loses power for a few minutes will preserve food, but a more prolonged outage spoils the food. A large factory that loses electric service beyond its backup device capacity may have to cease operation and lose valuable production. Further, if advance warning of the interruption is given, such as for a PSPS, some customers are better able to take steps to minimize the impact compared to an unannounced loss of service.

Another problem is that the S.A. requires the conversion of natural units into dimensionless risk score numbers by the MAVF.[66] It is difficult for parties and Commission staff to appreciate the meaning of these dimensionless numbers. Some reviewers have

[62] Phase II Scoping Memo at 3-4.
[63] IEEE defines SAIDI as the System Average Interruption Duration Index, in minutes of interruption experienced by a customer. SAIFI is the System Average Interruption Frequency Index, in number of interruptions. The CPUC has adopted these and other IEEE-defined metrics for reliability reporting.
[64] R.20.07-013 Phase II, Technical Working Group #2, Post-Workshop Report (TWG#2 Report) at 12.
[65] TWG #2 Report at 11.
[66] MAVF is the Multi-Attribute Value Function for quantifying risk as defined in the Settlement Agreement.

found it convenient to calculate an implied dollar value of the risk attributes based on the weighting and range of the financial attribute, which is possible because the purpose of the MAVF is to establish an equivalency between the attributes so they can be added to produce a total risk score.

To illustrate derivation of the implied value of a reliability risk event from a recent example, in the 2022 SCE RAMP the natural units of electric reliability are CMI. The range chosen is 0-2 billion minutes with an MAVF weight of 25 percent. SCE uses linear scaling. Then the implied dollar value can be established from the financial attribute range ($0-$5 billion) and weight (25%) with the formula:

Implied Value = Financial Range/Financial Weight x Reliability Weight/Reliability Range

= $ 5 billion/25% x 25%/2 billion minutes = $2.50 per customer minute.

However, once that dollar value has been found, the question remains whether the range and weighting chosen by the utility have produced a reasonable value for reliability. The 2022 SCE RAMP implied value of one customer minute interrupted is $2.50, while in the 2020 PG&E RAMP, the value is $1.00. Staff do not have a way to determine if those figures are reasonable.

The TWG sessions discussed the possible use of the ICE Calculator developed by the Lawrence Berkeley National Laboratory. The ICE Calculator[67] produces a dollar estimate of the cost to customers from electric service outages.

ICE was created to support cost-benefit analysis of reliability improvements. ICE accounts for the different impacts on three customer categories (residential, commercial, industrial) and models the effects of varying outage durations. Thus ICE handles some of the primary concerns identified in TWG sessions.

ICE economic models were developed from national customer surveys, but the user can select California as the State of interest. The other input variables are SAIDI, SAIFI, and the number of customers for each customer category.

4.2 Staff Recommendations

Staff recommend the adoption of the LBNL ICE Calculator to solve the quantification and dollar valuation challenges related to reliability risks. However, if IOUs can demonstrate that an alternative model, developed in-house or by a third party, provides equivalent or superior results to the ICE Calculator, they are encouraged to present their results and rationale in their RAMP filing.

[67] LBNL, *Interruption Cost Estimate (ICE) Calculator* (ICE Calculator).

TWG members have pointed out some limitations with the current ICE calculator; many of these are the subject of developments towards an ICE 2.0 model by the LBNL, expected in 2024.

Some of the areas where ICE may be improved in the 2.0 version are:

- Variations in costs between the three California IOUs (pending their participation in the study);
- Updated cost data;
- Impacts of announced vs. unannounced interruptions; and
- Interruptions of greater than 16 hours, up to 24 hours of duration.

Although there are limitations with the ICE Calculator, it is presently the best available standard means for producing a reasonable quantification of reliability risk in dollars. The ICE Calculator is a good first step toward dollar-valued quantification of electric reliability risk to support the cost-benefit analysis of mitigation proposals. Staff recommend that further improvements to the RDF, such as adoption of the ICE 2.0 Calculator when available, should be considered in future proceeding phases. Staff also note that LBNL is studying impacts of outages longer than 24 hours in the POET program, which is focused on midwestern utility customers, but could be expanded to include California in a future study.

If the Commission adopts the ICE model for electric reliability, Staff recommend that the Commission should require the large IOUs to participate in the customer survey process needed to incorporate California data in the ICE 2.0 model.

5. DOLLAR VALUATION OF GAS RELIABILITY CONSEQUENCES

The Phase II Scoping Memo identifies the following issue: Should the Commission consider revising or refining the RDF methodology for valuing services, mitigations and/or impacts (such as those related to reliability or safety)? If so, should the Commission consider: (a) defining and requiring the use of a consistent VSL; (b) whether the dollar value of attributes should be explicitly addressed.

Gas reliability is one of the risk attributes addressed in the Scoping Memo. The prospect of evolving the MAVF approach to a dollar valuation for all risk attributes requires a method for gas reliability valuation in dollars. However, Staff has not identified a suitable standard, such as the ICE model for electric reliability, that could be used for gas reliability.

Until a standard for dollar valuation has been developed, Staff recommend the IOUs apply a dollar value for gas reliability based on the implied value from their most recent RAMP filing produced under the current MAVF risk score calculation.[68] However, if the IOU can provide a value based on research, they should provide that research in their RAMP filing in support of their alternative figure.

5.1 Discussion

In the current RDF, the natural units of gas reliability are given a range, weight, and scaling according to the MAVF guidelines to produce a dimensionless risk score value. It is difficult to associate the risk score with a real-world impact unless the reviewer looks for the natural units in the underlying calculation worksheets. If the risk value were expressed in dollars, it would be easier to understand the impact and interpret the reasonableness.

While working with the TWG members, Staff have not found a tool comparable to the ICE model for lost gas service suitable to calculate a risk value or check for reasonableness. Such a standard would account for the impacts of lost gas service on customer categories and durations, like the ICE model for electricity. The loss of fuel for a gas-fired electric generating plant would have much more significant impact than the loss of gas service for residential customers.

It is not surprising that less emphasis has been placed on the value of gas reliability risk in the RAMPs, since electric reliability has been a much greater concern. A recent report[69] by the Gas Technology Institute found that gas service was 64 times more reliable than electric service, based on surveys of 12 utilities serving 10.5 million customers. And gas

[68] D.18-12-014

[69] Gas Technology Institute, *Assessment of Natural Gas and Electric Distribution Service Reliability*, July 19, 2018. Available here: https://www.researchgate.net/publication/355478543_Assessment_of_Natural_Gas_and_Electric_Distribution_Service_Reliability_GTI_TOPICAL_REPORT_Assessment_of_Natural_Gas_and_Electric_Distribution_Service_Reliability

supports a narrower range of end uses than electricity, so outages tend to have a lower impact on customers.

The current MAVF process determines a risk score for gas reliability based on a range of outcomes and a weight relative to the other attributes. An implied dollar value can be found by association of the financial attribute range and weight.

To illustrate the derivation of implied value from a recent example, in PG&E's 2020 RAMP[70] the natural units of gas reliability are given as number of customers affected by a gas outage. The range chosen was 0-750,000 customers with a MAVF weight of five percent. Then, the implied value of gas reliability can be established from the financial attribute range ($0-$5 billion) and weight (25%) in the same manner as presented in Section 4.1.

PG&E implied gas reliability value = $5 billion/25% x 5%/750,000 outages

= $1,333 per customer outage.

In their 2021 RAMP, SoCalGas chose to express the gas reliability attribute with two sub-attributes: number of customer outages and volume of curtailment events exceeding 250 million cubic feet per day, each weighted at 50 percent of the gas reliability attribute. The combined gas reliability attribute has range of one and a weight of 23 percent. The customer outage range is 0-100,000 customer meters and the curtailment range is 666 million cubic feet (MMcf) gas volume. The financial attribute's range is $500 million with a weight of 15 percent. The calculation is:

a) *Customer outage value = $500 million/15% x (50% x 23%)/100,000 customer meters*

= $3,833 per customer outage

b) *Gas curtailment value = $500 million/15% x (50%x23%)/666 MMcf*

= $0, if daily curtailment is less than 250MMcf/day

= $575,575/MMcf, if daily curtailment exceeds 250MMcf/day

Staff note a considerable difference between the PG&E and SoCalGas numbers but cannot determine if either is reasonable or unreasonable. The actual value depends on factors such as the number of industrial versus residential customers in the service territories, so these differences may be appropriate.

[70] Application of Pacific Gas And Electric Company (U39M) to Submit its 2020 Risk Assessment and Mitigation Phase Report (PG&E 2020 RAMP), Table 1, at 3.

5.2 Staff Recommendations

Until a standard for dollar valuation has been adopted, Staff recommend that IOUs apply a dollar value for gas reliability based on the implied value from their current MAVF risk score calculation, (i.e. the value from their most recent RAMP filed under the guidance of the S.A.).[71] Staff do not intend to establish that this value is accurate, but it can serve as a proxy until a better method can be determined. However, if the IOU can provide a value based on research, they should provide that research in their RAMP filing in support of their alternative figure.

[71] D.18-12-014

6. ENVIRONMENTAL AND SOCIAL JUSTICE IMPACTS

Issue seven of the Phase II Scoping Memo asks if the Commission should consider impacts on ESJ communities, including the extent to which action in this proceeding impacts achievement of any of the nine goals of the Commission's ESJ Action Plan?"

6.1 Discussion

The Commission's ESJ Action Plan includes nine goals.[72] These are:

1. Consistently integrate equity and access considerations throughout Commission proceedings and other efforts.
2. Increase investment in clean energy resources to benefit ESJ communities, especially to improve local air quality and public health.
3. Strive to improve access to high-quality water, communications, and transportation services for ESJ communities.
4. Increase climate resiliency in ESJ communities.
5. Enhance outreach and public participation opportunities for ESJ communities to meaningfully participate in the Commission's decision-making process and benefit from Commission programs.
6. Enhance enforcement to ensure safety and consumer protection for ESJ communities.
7. Promote high road career paths and economic opportunities for residents of ESJ communities.
8. Improve training and staff development related to ESJ issues within the Commission's jurisdiction.
9. Monitor the Commission's ESJ efforts to evaluate how they are achieving their objectives.

The most recent update to the ESJ Action Plan places a renewed focus on equity, defined as "increasing access to power, redistributing and providing additional resources, and eliminating barriers to opportunity, to empower low-income communities of color to thrive and reach full potential."[73] The appendix to the Action Plan includes a series of recommendations for each of the nine goals. Goal four, increasing climate resiliency in ESJ communities, consists of four action items. One of them is a RAMP-related recommendation[74] that would "require IOUs to overlay planned infrastructure mitigations on

[72] Environmental and Social Justice Action Plan Version 2.0 Approved April 7, 2022 at 3. Available here: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/news-and-outreach/documents/news-office/key-issues/esj/esj-action-plan-v2jw.pdf.
[73] Environmental and Social Justice Action Plan version 2.0. at p. 8.
[74] Environmental and Social Justice Action Plan version 2.0. at p. 43.

the CalEnviroScreen[75] map to identify what portions of the mitigations would occur within disadvantaged communities when geographic locations of proposed mitigations are known." The plan would also require IOUs to include "the disadvantaged community (DAC) proportion percentage of the mitigation in the RAMP narrative and what risk reduction is estimated for the DAC portion."[76]

This ESJ Action Plan proposal was discussed at the June 16, 2022, TWG #4. The Sempra Companies, PG&E, and SCE submitted informal comments on June 24th. The discussions in the TWG and the informal comments indicated that the ESJ Action Plan recommendation did not include enough information to discern a clear purpose or use to reduce risks. The IOUs argue that too many outstanding questions and unexplored complexities remained to pursue a mandatory Geographic Information System (GIS) overlay of mitigation investments and ESJ communities at this time. For example, SCE asks "whether the intent of highlighting the spend and risk in ESJ communities is purely for information purposes or is it intended to promote or prioritize spending in these communities?"[77] Further, SCE raised questions about the scope of the ESJ analysis and asked how it would impact tranching in the RAMP analysis. SCE also pointed out that a GIS overlay would not be applicable to all RAMP risks (e.g. employee and contractor safety).[78] Therefore, further exploration of this topic in the next phase of this proceeding is necessary.

The Sempra Companies further note that the "objective associated with this goal, pending further Commission clarifications: the reporting of mitigation activities affecting ESJ communities (including metrics in RAMP reports)" would require an "unknown amount of effort, which requires further analysis on current risk mitigations and geographic data."[79]

Staff agree that many questions remain about how and for what purpose the recommended GIS information could be used. In addition to the questions about the nature and purpose of the analysis, it is unclear what an overlay of mitigation investments on CalEnviroScreen may reveal. For example, Staff anticipate that the majority RAMP mitigations directed at reducing wildfire risk, will be located outside of ESJ communities in the Wildland Urban Interface (WUI). However, as noted above, one of the most devastating

[75] Cal enviro screen refers to the California Communities Environmental Health Screening Tool developed by California's Office of Environmental Health Hazard Assessment. Available here: https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30

[76] Environmental and Social Justice Action Plan version 2.0. at p. 43.

[77] Southern California Edison Company's (U 338-E) *Informal Comments on Environmental and Social Justice Impacts on RAMP Applications* at 4.

[78] Southern California Edison Company's (U 338-E) *Informal Comments on Environmental and Social Justice Impacts on RAMP Applications* at 5.

[79] SoCalGas and SDG&E Risk OIR Phase II Informal Comments on Increasing Climate Resiliency in Environmental and Social Justice (ESJ) Communities, at 3.

impacts of wildfire is the health impacts from wildfire smoke, which has a disproportionate impact on ESJ communities.[80]

In informal comments, PG&E indicated that they see future opportunities for overlaying CalEnviroScreen data with risks and mitigations. Further, they stated the effort would require testing to determine impacts and model changes for effective implementation. Thus, PG&E believes that instead of creating a requirement to apply CalEnviroScreen data in this phase, the Commission should direct a limited prototype of this overlay.

In addition to the discussion of the ESJ Action plan recommendation, a different topic arose during the TWG. Joseph Mitchell representing MGRA pointed out that the affordability of rates should also be an ESJ consideration. He cited MGRA's testimony in PG&E's GRC,[81] which used publicly available epidemiological data correlating income to life expectancy to illustrate that rate increases associated with major hardening projects could adversely impact more lives than risks from wildfire, including wildfire smoke effects.

Other studies corroborate MGRA's safety and health concerns about rate increases. Several studies have linked affordability or energy insecurity with adverse health outcomes, particularly in communities associated with Environmental Justice inequities.[82,83,84] Further, work done in other proceedings at the Commission bolster the points raised by MGRA. For example, interviews conducted under the Essential Use Study by PG&E, SCE, and SDG&E found that, "respondents who reported affordability issues in paying their electric bill, approximately half mentioned skipping other bills, 45% reported reducing or forgoing necessities like food and medical care, and 68% mentioned making changes to try to reduce their electricity bill."[85] In an Integrated Energy Policy Report, entitled Energy Equity Indicators: Tracking Progress, Energy Commission Staff cited a 2016 study by Drehobl and Ross, that found, "high energy bills relative to income may drive low-income households to make do with insufficient heating or cooling, which can increase the incidence of asthma, especially in children."[86]

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[80] D'Evelyn, S.M., Jung, J., Alvarado, E. et al. Wildfire, Smoke Exposure, Human Health, and Environmental Justice Need to be Integrated into Forest Restoration and Management. Curr Envir Health Rpt (2022). https://link.springer.com/article/10.1007/s40572-022-00355-7#citeas

[81] Direct Testimony of the Mussey Grade Road Alliance on Pacific Gas and Electricy Company 2023 General Rate Case (A.21-06-21); Testimony filed June 13, 2022;

[82] Diana Hernández, *Understanding 'energy insecurity' and why it matters to health*, Social Science & Medicine, Volume 167, 2016, Pages 1-10, ISSN 0277-9536. Available here: https://doi.org/10.1016/j.socscimed.2016.08.029.https://www.sciencedirect.com/science/article/pii/S0277953616304658

[83] Sonal Jessel, Samantha Sawyer, and Diana Hernández, *Energy, Poverty, and Health in Climate Change: A Comprehensive Review of an Emerging Literature*, Frontiers in Public Health, v. 7, 2019. Available here: https://www.frontiersin.org/article/10.3389/fpubh.2019.00357

[84] Cong, S., Nock, D., Qiu, Y.L. *et al.* Unveiling hidden energy poverty using the energy equity gap. *Nat Commun* **13,** 2456 (2022). Available here: https://doi.org/10.1038/s41467-022-30146-5

[85] California Essential Use Study – Task 2 Qualitative Interview Summary Memo, June 6, 2022, at p. 6

[86] Energy Equity Indicators: Tracking Progress, Project Title: Energy Equity, Docket #: 18-IEPR-08, filed June 25, 2018, by Stephanie Bailey of the California Energy Commission.

The RAMP applications tend to focus on dramatic, salient consequences such as wildfire, pipeline explosions, injuries, accidents, etc. In emphasizing mitigations to reduce the safety impact of these risks, the Commission should not ignore the increasing rates' chronic safety and health impacts. Staff concur with MGRA's July 8th comment, that "methodologies to include public harm from rate impacts should be incorporated into the RAMP/GRC process" and recommend further exploration of these issues in a subsequent phase of this proceeding. However, this is beyond the scope of this proposal.

6.2 Staff Recommendations

Staff acknowledge that the ESJ Action Plan recommendation needs further exploration and elaboration. However, in the meantime, Staff believe it is critical to begin incorporating elements of the Commission's ESJ Action Plan as soon as practicable. To this end, Staff propose that because PG&E is the next IOU to file a RAMP following Commission consideration of the Staff proposal, PG&E should pilot the incorporation of CalEnviroScreen, including consideration of DVCs[87] as defined in D.20-08-046 issued in the Commission's ongoing rulemaking considering strategies and guidance for climate change adaptation, into their risk-based decision-making work.[88] PG&E should include the results of this work in their 2024 RAMP application.

PG&E's pilot should:

1. Consider equity in the evaluation of consequences and risk mitigation using CalEnviroScreen or other data sources to better understand how risks may disproportionately impact some communities more than others.
2. Consider investments in clean energy resources to improve safety and reliability and mitigate risks in ESJ communities.
3. Include consideration of mitigations that improve local air quality and public health, including observations from Assembly Bill (AB) 617 community air protection program[89].

[87] DVCs include the highest-scoring census tracts according to the California Cal Enviro Screen; all California tribal lands; census tracts with median household incomes less than 60 percent of state median income; and census tracts that score in the highest five percent of Pollution Burden within Cal Enviro Screen but do not receive an overall Cal Enviro Screen score due to unreliable public health and socioeconomic data.

[88] *Decision on Energy Utility Climate Change Vulnerability Assessments and Climate Adaptation in Disadvantaged Communities (Phase 1, Topics 4 and 5)* (D.20-08-046) at 108.

[89] Pursuant to Assembly Bill (AB) 617 (C. Garcia, Chapter 136, Statutes of 2017), CARB established the Community Air Protection Program (CAPP or Program). The Program's focus is to reduce exposure in communities most impacted by air pollution. Communities around the State are implementing strategies to measure air pollution and reduce health impacts. More information available here: https://ww2.arb.ca.gov/capp/about

4. Evaluate how proposed mitigations may increase climate resiliency in ESJ communities.
5. Evaluate if estimated impacts from wildfire smoke disproportionately impact ESJ communities.
6. Estimate the extent to which risk mitigation investments disproportionately benefit populations outside of ESJ communities.
7. Enhance outreach and public participation opportunities for ESJ communities to meaningfully participate in risk mitigation and climate adaptation activities consistent with D.20-08-046.

Staff recommend PG&E produce a white paper identifying areas for further exploration, challenges they faced incorporating environmental and social justice into risk-based decision-making, and how to better target mitigations that improve local air quality and climate resilience in disadvantaged and vulnerable communities. This white paper should be submitted concurrently with PG&E's RAMP Application and its Climate Adaptation and Vulnerability Assessment.

Staff also recommend that the Sempra Companies conduct their own pilot study and white paper for submission with their 2025 RAMP unless different requirements are developed in the intervening time.

7. FUTURE WORK TOPICS

This proposal seeks to modify portions of the S.A. adopted in D.18-12-014 while leaving the remainder intact, such that an IOU could produce a compliant risk assessment by following the modified S.A appended to this proposal. Nonetheless, Staff expect to continue exploration of related topics to further refine and improve the RDF.

Following Workshop #2 on June 29, 2022, where Staff presented its initial draft recommendation to adopt a monetization/cost-benefit approach in the RDF, the IOUs expressed a strong interest in developing further guidance on the following issues:

- Risk attitude:[90] Ensuring that IOUs will have the flexibility to define risk consequence costs in a way that correctly captures the attitude of the appropriately defined stakeholders toward the risk events.
- Probabilistic ranges:[91] Ensuring that the IOU's final approach is structured to capture and deal with uncertainty (probabilistic ranges).
- Acceptable risk levels (risk tolerance): [92] Ensuring the final approach handles threshold risk events and concepts such as ALARP (As Low as Reasonably Practical).

In addition to these issues, Staff will continue to facilitate TWG sessions in a later phase of this proceeding to develop further guidance on the cost-benefit approach and improve upon the process. Staff also intend to work on further refinements to the valuation of attributes, such as the electric and gas reliability consequences and continue discussions with stakeholders regarding the incorporation of the ESJ impacts into the RAMP. Staff recommendations on the incorporation of ESJ impacts into the RAMP will likely cover both geographic disparities in mitigations and impacts and health and safety impacts associated with increasing energy costs.

In a future phase of this proceeding, Staff may also explore a formal process for allowing IOUs to propose an alternate value of an attribute that deviates from the standards defined in the Staff recommendations. The Commission would then determine whether the alternative model is adequate and may be used.

[90] Risk attitude describes a stakeholder's tolerance for uncertainty, typically classified as risk averse, risk neutral, or risk tolerant, and represented in the RDF by the scaling functions in the RDF, respectively, as convex scaling, linear scaling, and concave scaling.

[91] Estimates of the final decision-making metrics, such as the RSE in the case of MAVF or a benefit-cost ratio in the case of direct monetization, are based on uncertain data and assumptions. The treatment of uncertainty may be handled by a variety of sensitivity analysis methods that examine the effect of varying key input assumptions on the final decision-making metrics.

[92] An acceptable level of risk is a determination of a risk level that is as low as reasonably practicable without requiring what is deemed as excessive investment to reduce risk further.

End of

Attachment A