Safety Policy Division Staff Proposal on Discounting Components in the Cost-Benefit Ratio Used in RAMP and GRC Proceedings

By Steven Haine, P.E.,
Senior Utilities Engineer

This Safety Policy Division Staff document addresses four questions not considered in Phase 2 of the S-MAP OIR for the Commission's consideration. The Staff document will also provide answers to these questions:

1. How to discount the terms in the cost-benefit ratio used in the RAMP and GRC proceedings?
2. Whether the same discount rate must be used to discount both the numerator and the denominator of the cost-benefit ratio.
3. What interest rates should be used to discount the different terms in the cost-benefit ratio?
4. Should the Commission authorize IOUs to vary their use of discount rates by mitigation?

Background

The Commission's current RAMP process prescribes a cost-benefit analysis approach to rank the cost-effectiveness of risk mitigation options. The prescribed method requires the RAMP applicant utility to calculate each risk mitigation option's cost-benefit ratio (CBR). Using the relative rankings of CBRs and other decision-making inputs, the utility decides which risk mitigation options to include in its RAMP application.

The CBR, as used in RAMP proceedings, is defined as the monetized value of risk reduction benefits divided by the corresponding risk mitigation costs:

$$\text{CBR} = \frac{\text{Monetized value of risk mitigation benefits}}{\text{Risk mitigation costs}} \qquad (1)$$

The CBR in Equation (1) implicitly assumes using time-discounted values evaluated at some reference point in time, using an appropriate discount rate. Since time-discounted values are strongly dependent on the rates at which the values are discounted, the relative rankings of the CBRs and the resulting risk mitigation selections are likewise highly dependent on the discount rates. Therefore, determining the appropriate discount rates is essential in RAMP and GRC proceedings.

In the CBR calculations, the outcomes are the accumulation of monetized risk reduction benefits in the numerator and the expenditure of associated risk mitigation costs in the denominator.

A typical reference point for discounting in RAMP and general rate case proceedings is the beginning of the rate case period under consideration. In the Commission's rate case proceedings for the four largest energy utilities, the beginning of the rate case period is also the beginning of the test year for the rate case. Other possible time reference points for calculating discounted values in the RAMP are the beginning of each post-test year (also known as an attrition year).

Short Primer on Time-Discounting

Time-discounting (or discounting) is a method of expressing indifference between time-dependent outcomes at two different times by considering the applicable opportunity cost for delaying the realization of the outcomes. A discount rate represents the opportunity cost to equate two different time-dependent outcomes. The opportunity cost for a monetary amount is the interest rate at which the monetary amount can be invested to earn a return on the investment.

Time-discounting over a one-year period applies a multiplicative discount factor to a value being discounted using an appropriate interest rate (frequently referred to as the "discount rate") applicable over the discounting period. For the remainder of this document, the terms interest rate and discount rate will be used interchangeably. The discount factor to discount a value from the end of a year to the beginning of that year is expressed as:

$$\text{Discount factor} = 1/(1+i), \text{ where } i \text{ is the interest rate} \quad (2)$$

The discount factor allows an entity to express indifference between two options: Receiving a dollar now or receiving a dollar plus an interest i a year from now.

For discounting over two years, suppose the applicable interest rate in Year 1 is i and the applicable interest rate in Year 2 is j. To discount a value from the end of Year 2 to the beginning of Year 1, the combined discount factor over these two years is:

$$\text{Discount factor} = 1/(1+i) \times 1/(1+j) \quad (3)$$

When i and j are the same, the discount factor can be expressed as:

$$\text{Discount factor} = 1/(1+i)^2 \quad (4)$$

Generally, if the assumed interest rate remains constant over n years, the discount factor over n years is:

$$\text{Discount factor} = 1/(1+i)^n \quad (5)$$

Throughout the rest of this document, the term time-discounted value, more commonly referred to as present value, will be abbreviated as PV. The term, present, is always relative to the specific time reference used in the discounting and does not necessarily refer to the current time. The term, net, as used in net present value, emphasizes that the discounted values are the incremental values between the beginning and end of the discounting period.

Discounting Applied to RAMP and GRC

Using the concepts developed so far, Equation (1) can be restated as:

$$\text{CBR} = \frac{\text{NPV of monetized value of risk mitigation benefits}}{\text{NPV of risk mitigation costs}} \quad (6)$$

For the numerator term in Equation (6), the S-MAP OIR (R.20-07-013), Phase 2 decision, D.22-12-027, adopted a monetization methodology to convert the incremental safety and reliability risk reduction benefits into monetized values separately for the safety attribute and the reliability attribute.

Before addressing what discount rates to use in the CBR, it will be helpful first to have a common understanding of the mechanics of CBA as used in the RAMP/GRC proceedings:

When a utility performs risk mitigation, the risk reduction activity benefits not only the utility but also the utility's ratepayers, members of the public who are not the utility's ratepayers, society at large within the utility's service territory, and the utility's workforce and contractors.[1] Since each of these groups is a potential beneficiary of the utility's risk mitigation activity, the benefits portion of the CBR must capture risk reduction benefits from the perspective of all these different groups. Each of these groups may have different rates of opportunity cost at which the group becomes indifferent between risk outcomes at different times.

Next, we examine what constitutes the benefits portion of the CBR, i.e., the numerator of the CBR in Eq. (1).

The adopted S-MAP Settlement Agreement requires a minimum of safety, reliability, and financial attributes. Therefore, risk mitigation benefits can be stated as:

Risk mitigation benefits = safety improvement + reliability improvement
+ financial impact reduction [2] (7)

Where

Safety Improvement = reduction of fatalities + reductions in serious injuries (8)

Expressing Equation (8) in terms of monetized values,

Monetized value of Safety Improvement = reduction of fatalities x VSL
+ reduction in serious injuries x a fraction of VSL, (9)

Where VSL stands for the Value of a Statistical Life.

Likewise, for electric reliability,[3]

Monetized value of Reliability Improvement = Monetized value of reduction in electric outage customer-minutes (10)

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[1] Risk reduction benefitting the environment and reducing climate change impacts would be reflected in the risk reduction benefits accruing to these groups.

[2] A risk and its mitigation activity do not necessarily have both a non-zero safety and a non-zero reliability impact at the same time.

[3] A similar term also applies to gas reliability, but to simplify the discussion, the gas reliability term is omitted.

Since the utility finances its operations and investments in safety and reliability improvements through a mix of debt and equity issuances, the appropriate opportunity cost for discounting the financial impact component and the mitigation cost component should be the utility's adopted weighted average cost of capital (WACC). The WACC properly accounts for the utility's opportunity cost of its expenditures on risk mitigation activities to maintain or improve its safety and reliability performance, given the utility's financial structure as reflected in its WACC.

Does Cost Benefit Ratio Analysis Require a Single Discount Rate in the CBR?
To answer this question, recall the definition of time-discounting: Time-discounting is a method of expressing indifference between time-dependent outcomes at two different times by considering the applicable opportunity cost for delaying the realization of the outcomes. The discount rate represents the opportunity cost, and since an opportunity cost is always tied to a specific subject, the discount rate must also be connected to a specific subject expressing indifference between two outcomes. Therefore, the discount rate is always from the perspective of a particular subject expressing indifference between outcomes. Imposing a uniform opportunity cost or discount rate on all subjects reflected in the CBR makes no sense since each group's opportunity cost/discount rate may differ drastically.

Who are the subjects in the CBR depends on which term is being discounted and who is entitled to express indifference between different time values for that term. For risk mitigation costs in the denominator, the party allowed to express indifference is the party paying for the mitigation costs, i.e., the utility. However, for the numerator in the CBR, it is the primary beneficiary of each attribute that is the most appropriate subject entitled to express indifference between outcomes. For the safety and reliability attributes in the numerator of the CBR, the primary beneficiary of the utility's risk mitigations is society at large since the utility is not performing risk mitigation only to benefit itself or its employees in areas with no public access. Instead, for the safety and reliability attributes, the primary beneficiary of the utility's risk mitigation activities is society at large. Society at large, and not the utility, is the proper subject entitled to express indifference between different safety and reliability outcomes at different times. For the financial attribute, since this attribute is meant to model financial impact on the utility, it is the utility that is the subject.

The following table shows the different terms in the numerator and the denominator of the CBR:

Table 1: Terms in the CBR and the Beneficiaries of Mitigation

Risk Attributes and Sub-attributes	Injured Parties or Beneficiaries of Risk Mitigations	Monetized Unit Value
Safety - Reductions in fatalities	Utility, Utility ratepayers, members of the public who are not ratepayers of the utility, society at large, utility's	Value of Statistical Life (VSL)

	workers and contractors	
Safety - Reductions in serious injuries	Utility, Utility ratepayers, members of the public who are not ratepayers of the utility, society at large, utility's workers and contractors	Fraction of VSL, typically each serious injury equals ¼ of a VSL
Reliability - Reductions in electricity outages (customer-minutes)	Utility ratepayers, members of the public who are not ratepayers of the utility, society at large, utility's workers and contractors	Interruption cost calculated by LBNL's ICE calculator
Financial - Reductions in financial impact	Utility	No monetization step needed on actual dollar value
Mitigation Costs	Utility	No monetization step needed on actual dollar value

Let's follow an example of a generic risk event to see how it affects the different risk reduction benefit terms in the numerator of the CBR.[4] Suppose this risk event results in fatalities, injuries, and electric outages. As the table above shows, suppose there is actual harm to different groups of injured parties. The utility will monetarily compensate some or all of the victims, depending on its degree of liability. For example, the injured parties or the injured parties' families will receive monetary compensation, which will be reflected in the financial attribute in the CBR. The utility may finance the payments to the injured parties through immediate cash withdrawals from its cash reserves, payouts from insurance claims, or additional money funded through a mixture of new equity issuance and debt. Additionally, premiums on the insurance policies are paid out of the utility's cash reserves. In the long run, the utility will finance the monetary compensations to the victims using a mixture of equity and debt issuance that reflects the utility's WACC.

It is also important to note that although the safety and reliability impacts are monetized according to the revised S-MAP Settlement Agreement, no cash payments are involved in the safety and reliability attributes. Instead, any cash payments to the injured parties and actual monetary costs to the utility because of the risk event are embedded in the financial attribute

[4] In actuality, the safety, reliability, and financial attribute terms in the numerator of the CBR are not recorded values of actual risk events but are stochastic values of the utility's risk models. However, the reasoning still applies since the stochastic risk models are intended to model the behaviors described herein.

term, as shown in the preceding paragraph. Since no cash payments and no cash accruals are involved in the safety and reliability attribute terms, there should be no opportunity cost involved in the safety and reliability attributes. Any time value discounting of the safety and reliability impact terms should be to discount the growth rate of unit values underlying those terms, i.e., the growth in value of VSL and the cost per customer-minute of service outage. The increase in value of the VSL is dictated mainly by the inflation rate and the per-capita real growth rate of wages. There may also be a preference for receiving a societal benefit in the present over an identical benefit in the future. In its 2021 RAMP report, the Sempra utilities cited a 3% discount rate to express this "social rate of time preference." Staff proposes to conceptually accept the validity of a separate discount rate to represent a social rate of time preference to discount benefits that primarily affect society. However, Staff does not recommend a specific rate at this time. This social rate of time preference should be compounded with the inflation rate and the per-capita real growth rate of wages to arrive at an effective compounded discount rate for the safety and reliability terms in the CBR, according to this formula:

$$\text{Discount rate for safety and reliability terms} = (1+i) \times (1+j) \times (1+k) - 1 \qquad (11)$$

Where i is the inflation rate, j is the real growth rate of wages, and k is the social rate of time preference.

A qualitative and intuitive argument can also be made to help explain this last point. Observe that safety and reliability impacts affect the utility, society, and the public. Since society is assumed to continue into perpetuity, from a societal perspective, the value of a fatality averted a year from today should not differ from the value of a fatality averted today by more than the amount attributed to inflation and the per-capita real growth of wages above inflation, plus a societal preference for receiving a societal benefit in the present over some future time. From a societal perspective, the safety and reliability attribute terms have no opportunity cost since the two terms do not involve actual cash accruals or cash flows. To summarize, the proper discount rate for the safety and reliability terms should be the effective compounded rate of the projected average inflation rate, the projected per-capita real growth rate of wages over the general rate case period, and a social rate of time preference. Furthermore, to impose uniformity, Staff proposes that the Commission adopt a common projected average inflation rate and projected real growth rate of wages for the four largest energy utilities to use in the CBR calculations.

Let's summarize what has been concluded so far:

1. The utility's WACC is the appropriate rate to discount the financial impact component in the numerator of the CBR and the risk mitigation cost component in the denominator of the CBR.
2. The monetized values of the safety impact component and the reliability impact component in the numerator of the CBR should not be discounted using the utility's WACC.
3. Conclusions 1 and 2 imply that the applicable discount rates for the numerator and the denominator of the CBR do not have to be the same.

Table 2 summarizes the Staff proposed discount rates for different terms in the CBR.

Table 2: Discount Rate for Different Terms in the CBR

Risk Attributes and Sub-attributes	Injured Parties or Beneficiaries of Risk Mitigations	Monetized Unit Value	Discount Rate
Safety - Reductions in fatalities	Utility, Utility ratepayers, members of the public who are not ratepayers of the utility, society at large, utility's workers and contractors	Value of Statistical Life (VSL)	Effective compounded rate of Inflation Rate, real growth rate of wages above inflation, social rate of time preference[5]
Safety - Reductions in serious injuries	Utility, Utility ratepayers, members of the public who are not ratepayers of the utility, society at large, utility's workers and contractors	Fraction of VSL, typically each serious injury equals ¼ of a VSL	Effective compounded rate of Inflation Rate, real growth rate of wages above inflation, social rate of time preference
Reliability - Reductions in electricity outages (customer-minutes)	Utility ratepayers, members of the public who are not ratepayers of the utility, society at large, utility's workers and contractors	Interruption cost calculated by LBNL's ICE calculator	Effective Compounded rate of Inflation Rate, real growth rate of wages above inflation, social rate of time preference
Financial - Reductions in financial impact	Utility	No monetization step needed on actual dollar value	Utility's WACC
Mitigation Costs	Utility	No monetization step needed on actual dollar value	Utility's WACC

Staff proposes answers to the four questions:

Answer 1(a). to Q.1: For each risk mitigation program, each risk mitigation project, or each risk mitigation activity, the CBR shall be calculated by dividing the NDV of the monetized value of risk mitigation benefits by the NDV of the risk mitigation costs, as shown in Equation (6) using appropriate interest rates for the safety term, the reliability term, and the financial term in the

[5] If i is the inflation rate, j is the real growth rate of wages, and k is the social rate of time preference, then the effective compounded discount rate for safety and reliability terms = $(1+i) \times (1+j) \times (1+k) - 1$

numerator, and an appropriate interest rate for the cost term in the denominator. The appropriate interest rates will be discussed in answers to questions (2) and (3). The numerator and the denominator terms shall be discounted separately before dividing the numerator term by the denominator term.

Answer 1(b): **Test Year CBR** - For each risk mitigation, the utility shall provide the CBR of projected incremental cost expenditures and expected incremental risk reduction benefits during the test year, using the beginning of the test year as the reference point for discounting for this CBR.

Answer 1(c): **Individual Post-Test Year CBR** - For each risk mitigation, the utility shall provide the CBR of incremental costs and incremental risk reduction benefits for each post-test year separately, using the beginning of each post-test year as the reference point for discounting for each CBR. For example, for a rate case with three post-test years (PTY1, PTY2, PTY3), the utility shall provide the CBR of discounted annual incremental values for each risk mitigation, evaluated at the beginning of PTY1, PTY2, and PTY3. The CBR evaluated at the beginning of PTY1 shall only include incremental values during PTY1, and the CBR evaluated at the beginning of PTY2 shall only include incremental values during PTY2, etc.

Answer 1(d): **CBR cumulatively for the entire GRC period** - For each risk mitigation, the utility shall provide the CBR of annual incremental costs and incremental risk reduction benefits cumulatively during the entire rate case period, using the beginning of each successive year as an intermediate reference point to arrive at the final discounted value evaluated at the beginning of the test year. For example, for a rate case with three post-test years (PTY1, PTY2, PTY3), the utility shall discount the incremental values in PTY3 using the beginning of PTY3 as the reference point and using the appropriate discount rate applicable to each term during the PTY3 period. The resultant discounted values evaluated at the beginning of PTY3 are discounted again, utilizing the beginning of PTY2 as the next reference point and using the appropriate discount rate applicable to each term during the PTY2 period. This process is repeated, using the beginning of PTY1 as the next reference point and the appropriate discount rate applicable to each term during the PTY1 period. Finally, the process is repeated, using the beginning of the Test Year as the ending reference point and the appropriate discount rate applicable to each term during the Test Year period. The same discounting process is applied to incremental values in each year of the rate case period. The resultant NDVs are then combined separately for the numerator and the denominator and used in the CBR Equation (6) to arrive at the CBR cumulatively for the entire GRC period evaluated at the beginning of the rate case period. The described discounting process can be simplified as in Equation (5) if the appropriate discount rates can be assumed constant over the entire general rate case period.

Answer to Q.2 and Q.3: Staff proposes that the financial impact and mitigation cost components be discounted at the utility's adopted weighted average cost of capital (WACC). Staff also proposes that the safety and reliability components in the risk mitigation reduction benefits of the CBR be discounted at an interest rate different from its adopted WACC. Specifically, Staff proposes that the safety and reliability terms in the CBR be discounted at the effective compounded rate of the projected long-term average inflation rate, the projected real per-capita

growth rate of wages above inflation, and a social rate of time preference. Staff does not recommend a specific rate of time preference for societal benefits at this time and instead recommends the consideration of a specific rate be coordinated with the Climate Adaptation proceeding.

Answer to Q.4: Staff recommends that this issue remain open so that the social rate of time preference can be discussed within specific contexts. Additionally, the prioritization of statewide goals that require future investments in mitigations, which need a variable discount rate to be realized, may require further discussion.