R.20-07-013 and R.18-04-019
Joint Workshop

September 13, 2023

Climate Change

California Public
Utilities Commission

Electrification and Battery Disposal

- Covered Electronic Waste (CEW)
  - Call2Recycle
- Earth911.com
  - 1-800-CLEANUP (1-800-253-2687)
- Community Collection
  - Local county library
- Battery Stewardship (AB 2440)
- Covered Battery-Embedded Products (SB 1215)

Workshop Agenda

Introductions	10:00 – 10:05 am
Opening Remarks: Commissioner John Reynolds' Office	10:05 – 10:10 am
Review Proceeding Issues in Scope, Timelines and Purpose and Expected Outcomes of Workshop	10:10 – 10:15 am
R.18-04-019: Energy Division Presentation	10:15 – 10:30 am
Q & A for Energy Division	10:30 – 10:50 am
Break	10:50 – 11:00 am
R.20-07-013: Safety Policy Division Presentation	11:00 – 11:30 am
Q & A for Safety Policy Division	11:30 – 12:00 pm

Workshop Agenda (Cont.)

Lunch	12:00 – 1:00 pm
R.20-07-013: PG&E Presentation	1:00 – 1:30 pm
Q & A for PG&E	1:30 – 1:50 pm
Break	1:50 – 2:00 pm
Discussion of all proposals	2:00 – 2:50 pm
CPUC Close and Next Steps	2:50 – 3:00 pm

Review of Issues in Scope, Timelines, Purpose and Expected Outcomes of Workshop

ALJ Cathy Fogel

R.18-04-019 Phase 2 Issues Addressed Today

- Are any changes needed to the Climate Adaptation Vulnerability Assessments (CAVAs) to support quantitative assessment of climate risks in Risk Assessment Mitigation Phase (RAMP) filings? If yes, what guidance is needed?
- Should the CAVAs address short-term climate risks (3-5 years or 5-10 years, i.e, concurrent with RAMP timeframes) in addition to current requirements (20-30 years out as focus)?
- Should templates or standardized reporting of CAVA results be required?
- Should the Commission adopt a lexicon of terms related to climate adaptation planning that considers terms used in other proceedings?

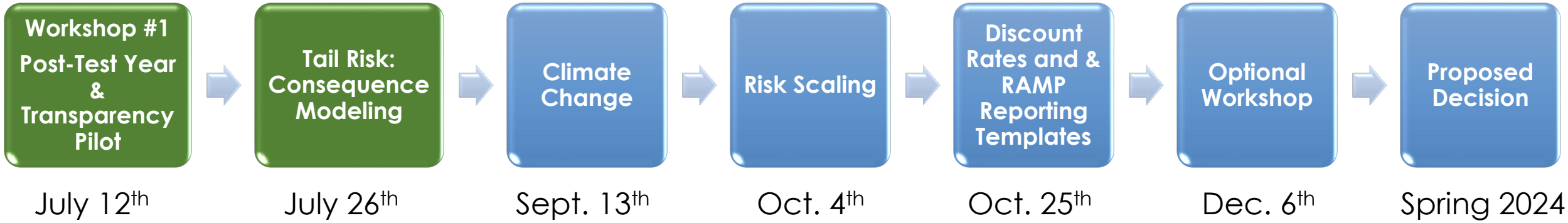
R.18-04-019 Phase 2 Timeline

- Initial party comments on questions related to issues in scope received in July.
- **Climate modeling workshop planned for first October 2.**
- Proposed decision on modeling issues, Q1 2024

R.20-07-013 Phase 3 Issues Addressed Today

- Should analyses or outputs from the IOUs' CAVAs ordered in R.18-04-019 inform quantitative risk modelling of climate hazards using the RDF?
- More generally, how should climate hazards be reflected in RAMP filings?
- **Issues not Addressed Today:**
  - Climate change emissions as a utility risk (not in scope in Phase 3)
  - Deep dive into discount rates as they may pertain to long-term climate change mitigation and adaptation planning (scheduled for Phase 4)

R.20-07-013 Phase 3 Timeline



Purpose & Outcomes for Workshop

- Joint workshop between R.18-04-019 and R.20-07-013.
- Discuss any changes needed to the CAVA framework to support consideration of climate change in the Risk-Based Decision-Making Framework (RDF) and RAMPs
- Discuss any changes needed to the RDF in light of climate change.
  - Currently no guidance for how climate hazards should be integrated into RDF or RAMP filings.
  - Any recommendations for guidance regarding addressing climate hazards within the RDF must consider experience with the CAVA as ordered in D.20-08-046.
- Attendees will provide feedback on the explicit integration of climate change into the RDF and RAMP filings.
- Rulings following the workshop will solicit comments in each rulemaking

R.18-04-019: Staff Presentation on CAVA- RAMP Linkages

Presenter: Kristin Rounds, Energy Division

10:15 am – 10:45 am

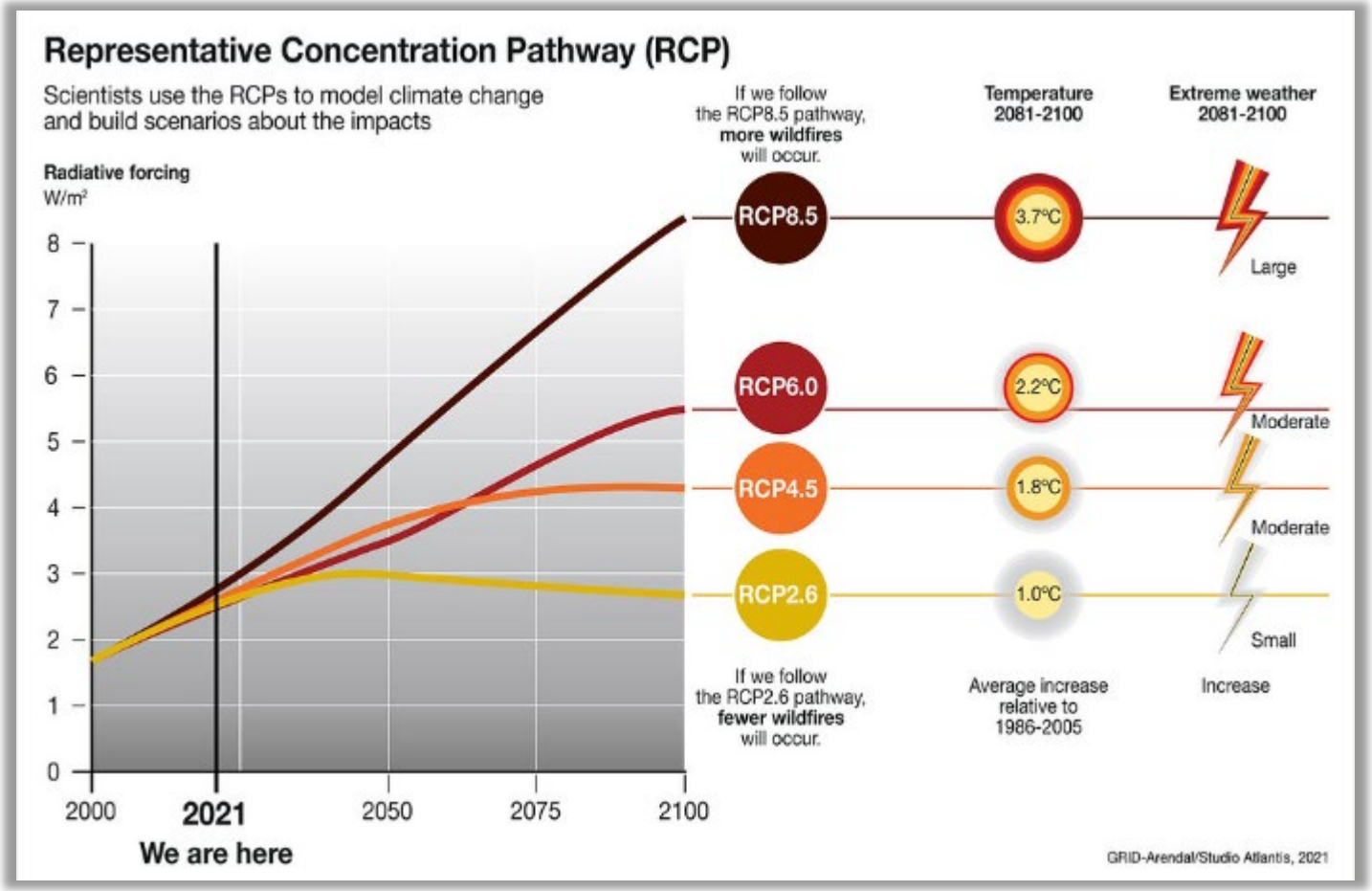
R.18-04-019: Order Instituting Rulemaking to Consider Strategies and Guidance for Climate Change Adaptation

"The purpose of this Rulemaking...is to provide a forum for addressing **how energy utilities should plan and prepare for** increased operational risks due to **changing climate conditions**...Energy utilities need this guidance to plan to continue to fulfill their mission to provide safe, reliable, and affordable service..."

Climate Adaptation and Vulnerability Assessments (CAVAs)

D.19-10-054 - Data Sources

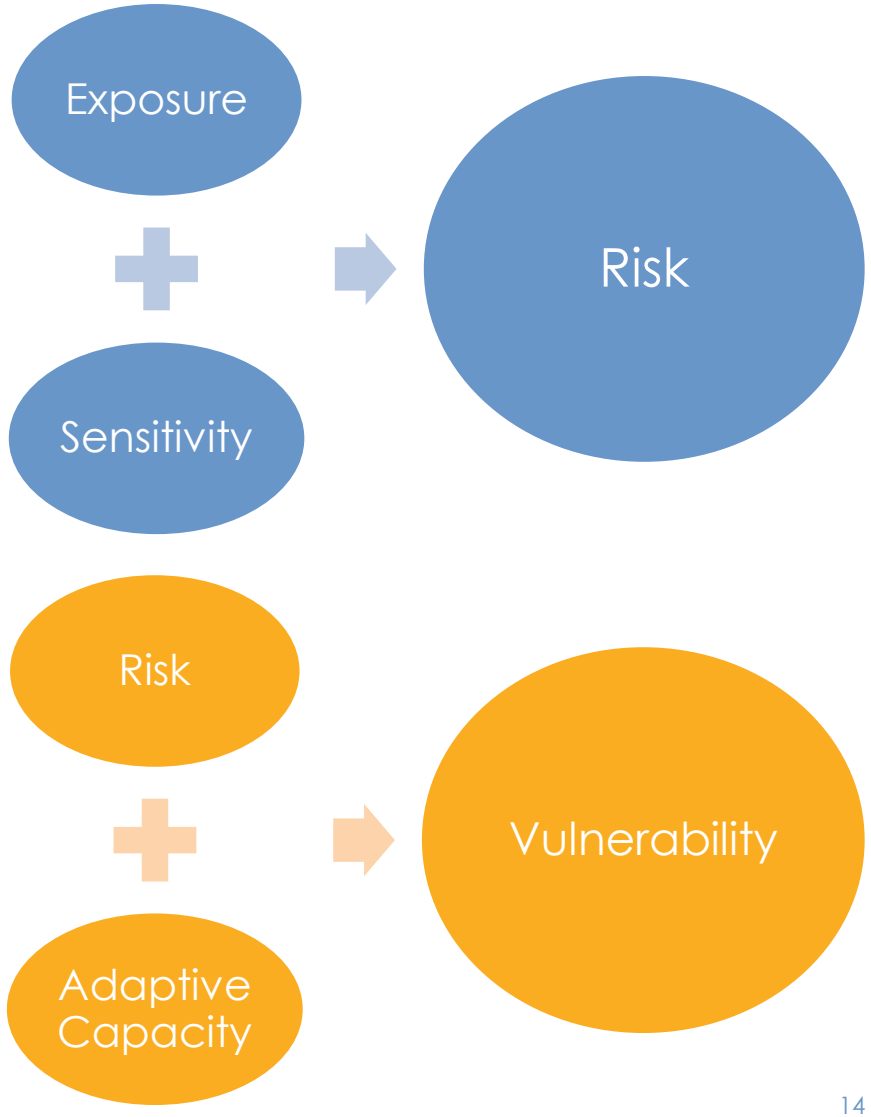
1. Identifies the California Fourth Climate Assessment and any subsequent assessments as the primary source of climate forecasts, pathways, and scientific studies.
2. Establishes the criteria for any further data or models that energy utilities may develop to understand climate impacts.
3. Directs the use of Representative Concentration Pathway (RCP) 8.5 for planning and investment purposes.



Climate Adaptation and Vulnerability Assessments (CAVAs)

D.20-08-046 - Risks, Methods, and Timeframes

1. Requires analysis of Temperature, Sea-Level Rise, Precipitation, Wildfire, and cascading events for utility-owned infrastructure & contracts.
2. Directs utilities to use California's Department of Water Resource's two-step vulnerability assessment methodology that 1) combines exposure and sensitivity to determine risk, and 2) combines risk and adaptive capacity to determine vulnerability.
3. Sets intermediate and long-term timeframes for analysis. The intermediate focuses on the next 10-20 years while the long-term addresses the next 30–50 years. The decision considers the "key time frame" as the next 20–30 years.



Understanding the CAVA Climate Data

Global Climate Models (GCMs)

GCMs are developed under the Coupled Model Intercomparison Project (CMIP) as part of the World Climate Research Program. GCMs simulate the physical, chemical, and biological responses of the climate system according to a scenario of future emissions or concentrations of greenhouse gases (GHG).

Cal-Adapt Analytics Engine

A sub-set of GCMs from CMIP that are selected based on their ability to most effectively represent the regional climate of California. The GCMs are either statistically or dynamically downscaled to produce various spatial (3km – 9km – 45km) and (monthly, daily, hourly) temporal scales for analysis.

Utility Climate Adaptation and Vulnerability Assessments

Why Utilize Global Climate Models for Evaluating Weather-Related Grid Impacts?

- Climate change has fundamentally impacted our ability to accurately forecast weather.
- The traditional planning assumption that the future climate will look statistically similar to the past climate is no longer accurate due to climate change. This concept is referred to as “non-stationarity”.
- As the climate changes, the magnitudes, durations, and frequencies of extreme weather events may occur outside the historical range of observations, resulting in a change in the average magnitude of extreme weather events and/or a change in the variability of the events.
- GCMs enable us to better capture the non-stationarity of the future climate.

Challenges of Utilizing Climate Projections in the RAMP

- **GCMs are Inherently Uncertain-** They are based on a multitude of scientific assumptions about how Earth's climate systems interact with each other, and then layered with numerous socio-economic assumptions to account for human-induced greenhouse gas emissions that accelerate global warming. An additional set of assumptions is made to downscale GCMs to regional resolutions.

- **Risk-Scores Incorporating CAVA Could Reflect False Precision-** To create the probability distribution needed for estimating the likelihood of a risk event, modelers must assume that climate simulations are random samples- they are not. Relying on fundamentally faulty assumptions to conduct risk analysis leads to reduced statistical confidence in results.

- **Utilizing climate projections for short-term analysis may result in marginal impacts-** Climate impacts derived from GCMs in the short-term (<=5 years) may ultimately result in marginal changes to risk scores.

Alternative Approaches for Climate-Informed Risk Planning

- The existing RAMP framework presents challenges for meaningful application of the CAVA data, as discussed.
- The California Department of Water Resources (DWR) developed a risk-planning framework utilizing climate projections as a sensitivity rather than the driver of the analysis to cope with uncertainty.
- The DWR method delays estimation of probabilities until assessment of adaptation alternatives. This makes the consequences of any assumption quickly realized in terms of effects on decisions.
- The DWR method suggests that risk-based planning be *informed* by the best available science on climate change while not being dependent on precise prediction of future values.

Source: DWR. 2019b. *Decision Scaling Evaluation of Climate Change Driven Hydrologic Risk to the State Water Project Final Report*: Available here

- Energy Division supports a Risk-Based Decision-Making Framework that adequately accounts for climate change.
- Energy Division cautions against a stringent predict-and-act paradigm for climate hazards that could result in false "certainty" of risk.
- Climate science is constantly progressing so its prudent to maintain flexibility in data application.
- Rigorous analysis of climate risks to utility infrastructure and associated cost efficiencies of proposed adaptations at a more granular level than that currently done in the CAVAs is still needed.

  → This is the case even if the RAMP is ultimately found to be the incorrect venue for such analysis.

Q&A on ED Presentation

10:30 am – 10:50 am

Discussion Questions

- Questions or comments on ED presentation?
- Are any changes needed to the CAVA to support quantitative assessment of climate risks in RAMP filings? If yes, what's needed?
- Should the CAVAs address short-term climate risks (3-5 years or 5-10 years, i.e, concurrent with RAMP timeframes) in addition to current requirements (20-30 years out as focus)?
- Should templates or standardized reporting of CAVA results be required, if so, addressing what information?
- Should the Commission adopt a lexicon of terms related to climate adaptation planning that considers terms used in other proceedings?

Discussion Questions

- What is the relationship between near-term, RAMP-driven investments and long-term adaptation benefits?
- What existing methodologies exist for quantifying the "climate adaptation value" of a RAMP-driven investment?
- Can near-term RAMP-driven investments help California prepare for climate change in the long-term? If so, how?

Break

10:50 am – 11:00 am

R.20-07-013: Staff Proposal on Climate Change and the Risk-based Decision-making Framework

Presenter: Eddie Schmitt, Safety Policy Division

11:00 am – 11:30 am

Contents

- Procedural Background
- Definitions and Differences
- Addressing Climate Change in Risk Assessment
- Further RAMP-CAVA Integration
- Refining the RDF
- Takeaways

Procedural Background

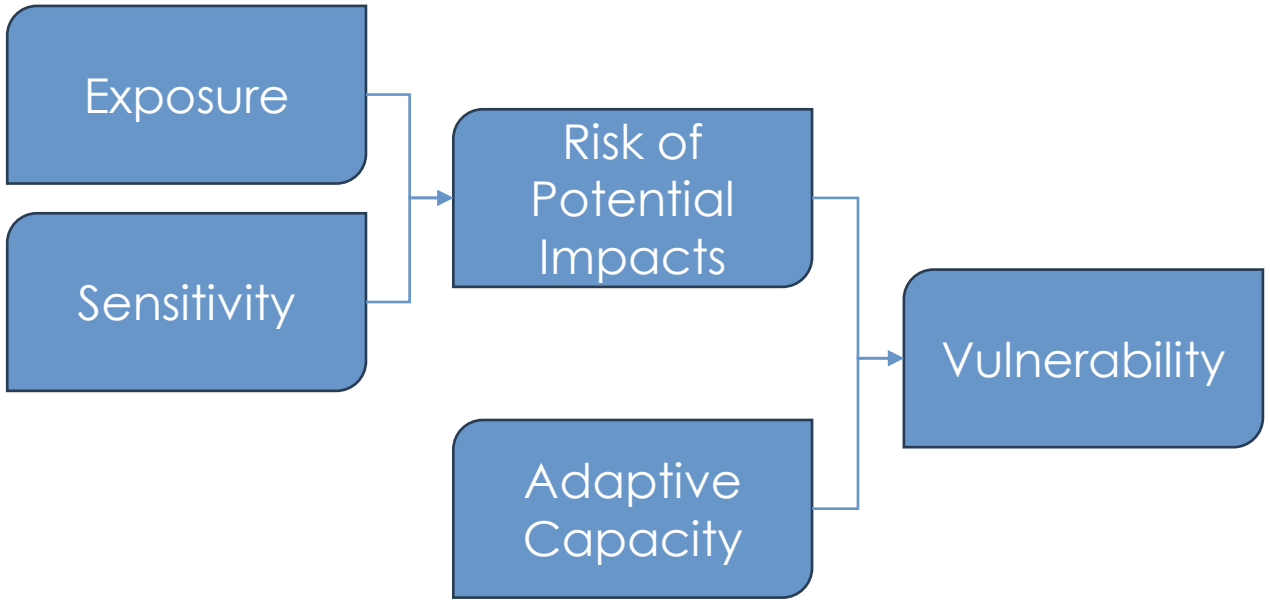
- RDF OIR. 20-07-013 suggested coordination with Climate Change Adaptation proceeding (R.18-04-019)

- Phase I Public Advocates Office recommended that the results of the IOUs' CAVA submissions be incorporated in the IOUs' RAMP applications

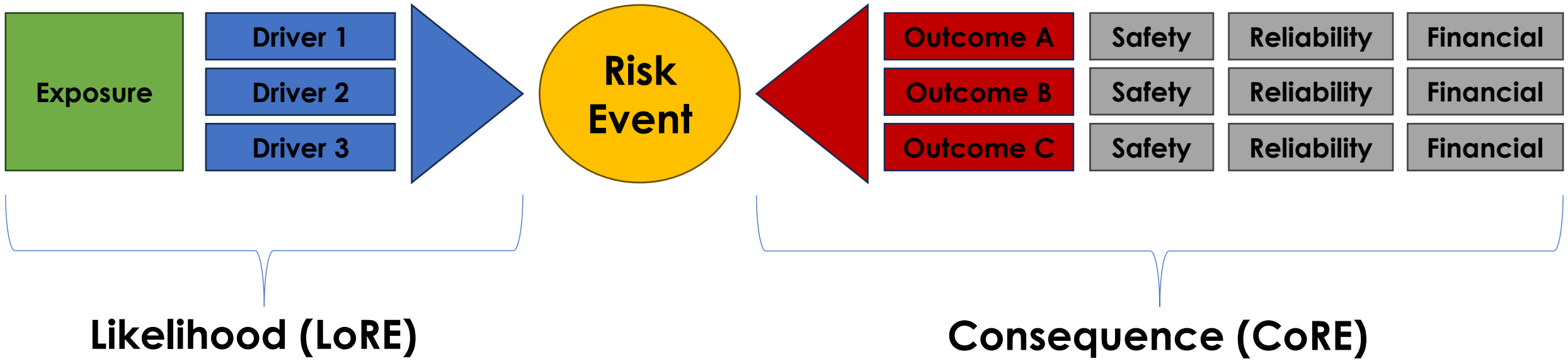
- Phase 2 Environmental and Social Justice Pilots (D.22-12-027)
  - "evaluate how the selection of proposed mitigations in the RDF may impact climate resiliency in disadvantaged and vulnerable communities." (Item 4)

Climate Adaptation and Vulnerability Assessment (CAVA)

- Two-step Vulnerability Assessment
  - Assets, Operations and Services (AOS)
- Requires analysis of:
  - temperature
  - sea-level rise
  - precipitation and flooding
  - wildfire
  - cascading events
- Timeframes:
  - Intermediate (10-20 years)
  - Key Timeframe (20-30 years)
  - Long-term (30-50 years)
- Adaptation Options



Risk Bowtie



LoRE × CoRE = Monetized Risk Score

Differences in RDF and Climate Proceedings

- Risk Event vs. Hazard
- Mitigation vs. Adaptation Options
- Enterprise Risks vs. Assets, Operations and Services
- Annualized Frequency vs. Probabilities
- 4-year cycle vs. 20-30 year outlook

Addressing Climate Change in Risk Assessment

- IOUs have primarily addressed climate change qualitatively in their RAMP applications
  - SCE listed potential adaptation options from the CAVA in its 2022 RAMP filing
  - Refined CAVA adaptation options for the 2025 GRC.
- Quantitative Examples
  - PG&E's 2020 RAMP filing included "consequence multiplier" and "escalation of frequency"
  - SCE's 2025 GRC stated they will begin downscaling Global Climate Models (GCM) for estimating changes to future Public Safety Power Shutoffs (PSPS)

Staff Approach 1: Further RAMP-CAVA Integration

1. Adjust language within the RDF
2. Create a procedure for incorporating CAVA data inputs and/or CAVA results within the RAMP
3. Create a reporting template for CAVA results

SA 1: Adjust language within the RDF

- Step 1B: Row 8:
  - The ERR must consider any risks associated with hazards identified in the Climate Adaptation Vulnerability Assessment as defined by D.20-08-046 or any future decision that refines the requirements of the Climate Adaptation Vulnerability Assessment. See the Procedure for Incorporating CAVA results in the RAMP for details.
- Step 2A: Row 11:
  - When considering what data inputs into the CAVA and/or CAVA results are appropriate inputs for calculating the impact of climate change on the Frequency of a Risk Event, Drivers should reflect both current and forecasted conditions and may include both external actions as well as characteristics inherent to the asset.

SA 1: Adjust language within the RDF (cont.)

- Step 3: Row 16:
  - When calculating the effects of Mitigations, utilities must also consider the mitigation of risk achieved by "adaptations options" included in their CAVAs that were funded through a GRC that will continue to have an effect during the four-year RAMP cycle. See the Procedure for Incorporating CAVA results in the RAMP for details.

Draft Procedure for Incorporating Inputs into the CAVA and/or CAVA Results in the RAMP

1. Collect hazards identified in the CAVA into a list.
2. Identify any risks associated with the CAVA hazards and compile into a list.
3. Compare the list of risks related to CAVA hazards with the ERR used to prepare the RAMP as outlined in Step 1B: Row 8 of the RDF.
4. Add any unique risks related to CAVA hazards to the ERR.
5. Complete Step2A: Rows 9-11, Step 2B: Row 12 and Step 3: Rows 13-15 as outlined in the RDF.
6. Consider what data inputs into the CAVA and/or CAVA results are appropriate data to use when completing Step 2A: Row 10 to calculate potential Consequences of a Risk Event that properly reflects the impact of climate change, including how such data can affect the Outcome of a Risk Event.
7. Consider what data inputs into the CAVA and/or CAVA results are appropriate data to use when completing Step 2A: Row 11 to calculate the Frequency of a Risk Event that properly reflects the impact of climate change, including how such data can affect the Exposure and/or Drivers of a Risk Event.
8. Collect "adaptation options" identified in the CAVA (relative to the 10-year timeframe) that tie back to a specific risk(s) in the ERR into a list.
9. Compile a list of CAVA "adaptation options" that were funded through a previous GRC that also serve to reduce near-term risk (10-year timeframe).
10. Calculate the risk reduction effects of the CAVA "adaptation options" in Step 9 of this procedure that will continue to have an effect during the current four-year RAMP cycle.
11. Include these "adaptation options" within Step 3: Row 16 denoting them as a mitigation as outlined in the RDF and note in the narrative description of these mitigations that their funding has already been incorporated into the GRC.
12. Complete Step 3: Rows 17-25 as outlined in the RDF.

Draft Reporting Template of CAVA Results for Inclusion in the RAMP

HAZARDS	RISK EVENT OR ENTERPRISE RISK	TIME HORIZON (years)	ADAPTATION OPTION	MITIGATION
Flooding	Transmission Substation Outage	70 (2030-2100)	Floodwalls around substations or Flood Monitoring Devices	Real-time mitigation (?) and Floodwalls
Wildfire	Distribution Outage	2025-2028	Undergrounding	Undergrounding

Staff Approach 2: Refining the RDF to Incorporate Climate Data, Models and Projections

1. Adjust language within the RDF

2. Create a procedure for incorporating climate data and models within the RAMP.

Unique Aspects of Staff Approach 2

- Climate Data, Models and Projections
  - Inclusive of inputs into the CAVA and/or CAVA results
- Climate-related Investments
  - Projects that serve to offset the impact of climate hazards over a certain length of time.
  - Projects identified in a previous GRC or other cost recovery venue that will continue to have an effect during the four-year RAMP cycle
  - This includes the "adaptation options" from the CAVA as discussed in Approach 1.

Takeaways to Staff Approach 1 RAMP-CAVA Integration

- **(-) CAVA results** focus on assets primarily impacts Reliability risks.
  - Would impact some safety risks but may need to reanalyze CAVA results for other attributes
- (-) CAVA results can be translated into an Outcome, but not relevant for Frequency
- (+) **CAVA inputs** might be relevant to assessing all three attributes
- (+) Using CAVA inputs and/or CAVA results harmonizes RAMP applications with climate-requirements across proceedings

Takeaways to Staff Approach 2 Refining the RDF

- (+) More flexibility in how climate change can be quantitatively integrated into risk assessments
- (+) Allows for incorporation of most recent science
- (-) But requires Commission and parties to stay abreast of advancements in climate science; ensuring transparency could be challenging
- (-) Currently, there is no advance access to IOU's climate change modeling assumptions

Appendix

SA 2: Adjust language within the RDF

- Step 1B: Row 8:
  - The ERR must consider any risks that can be identified through the use of climate data, models and projections. See the Procedure for Incorporating climate data and models in the RAMP for details.

- Step 2A: Row 11:
  - When considering what climate data, models and projections are appropriate data for calculating the impact of climate change on the Frequency of a Risk Event, Drivers should reflect both current and forecasted conditions and may include both external actions as well as characteristics inherent to the asset.

SA 2: Adjust language within the RDF (cont.)

- Step 3: Row 16:
  - When calculating the effects of Mitigations, utilities must also consider the mitigation of risk achieved by climate-related investments identified in a previous GRC or other cost recovery venue that will continue to have an effect during the four-year RAMP cycle. See the Procedure for Incorporating Climate Data Models and Projections in the RAMP for details.

Draft Procedure for Incorporating Climate Data, Models and Projections in the RAMP

1. Identify any risks associated with the results of climate change-related data, models and projections relevant to the IOU's service territory and compile into a list.
2. Compare the list of risks related to climate change-related data, models and projections with the ERR used to prepare the RAMP as outlined in Step 1B: Row 8 of the RDF.
3. Add any unique risks related to climate change-related data, models and projections to the ERR.
4. Complete Step2A: Rows 9-11, Step 2B: Row 12 and Step 3: Rows 13-25 as outlined in the RDF.
5. Consider what climate change-related data, models and projections are appropriate inputs for inclusion in completing Step 2A: Row 10 to calculate potential Consequences of a Risk Event that properly reflects the impact of climate change, including how the climate change-related data, models and projections can affect the Outcomes of a Risk Event.
6. Consider what climate change-related data, models and projections are appropriate inputs for inclusion in completing Step 2A: Row 11 to calculate the Frequency of a Risk Event that properly reflects the impact of climate change, including how the climate change-related data, models and projections can affect the Exposure or Drivers of a Risk Event.
7. Collect climate-related investments identified in a previous GRC or other cost recovery venue that tie back to a specific risk(s) in the ERR into a list.
8. Compile a list of climate-related investments that have cost forecasts that were approved in the IOU's previous GRC or other cost recovery venues and serve to reduce near-term risk (10-year timeframe).
9. Calculate the risk reduction effects of the climate-related investments in Step 8 of this procedure that will continue to have an effect during the current four-year RAMP cycle.
10. Include these climate-related investments within Step 3: Row 16 denoting them as a mitigation as outlined in the RDF and note in the narrative description of these mitigations that the associated costs will be excluded from consideration in this RAMP filing because their funding has already been approved by a previous GRC or other cost recovery venue.
11. Complete Step 3: Rows 17-25 as outlined in the RDF.

Q & A on SPD Presentation

11:30 am – 12:00 pm

Discussion Questions

- Questions or comments on presentation? Do parties have comments on the proposed language changes to the RDF for Approach 1? Approach 2? Do parties support Approach 1 or Approach 2, if so why/why not?
- Should all RAMP risks be climate-informed? If not, what are appropriate criteria to determine if a given risk should be climate-informed?
- Beyond the SPD proposal, are there other steps the utilities or the Commission should take to ensure appropriate modeling of climate change risks and communication of associated uncertainties in IOU RAMP and GRC filings?
- As climate science / modeling improves in coming years, how should the Commission support information sharing and utilities' use of the best techniques / data to inform planning, modeling and related mitigation proposals?

Discussion Questions

- Which mid- to long-term climate-related investments (e.g., "adaptation-investment," "adaptation option," "resiliency-investment") also serve to mitigate near-term risk, if any?
- How should the near-term risk reduction benefit of a climate-related investment be quantified for inclusion in IOU RAMP filings?

Lunch

12:00 – 1:00 pm

Climate Change Presentation

Presenters: Pacific Gas and Electric

1:00 pm – 1:30 pm

PG&E Proposed RAMP-CAVA Integration

Nathan Bengtsson, Vincent Loh

R.20-07-013 Phase 3, Workshop #3

Sept 13th, 2023

Background, Purpose, Desired Outcomes

Background

- IOUs have approached integrating CAVA and RAMP modeling in multiple methodologies due to the differing nature of both.

Purpose

- PG&E provides its proposal for moving forward with improving the integration of CAVA and RAMP modeling.

Desired Outcomes

- Collaboration and informed input on SMAP and Climate Change Supplement in the RDF OIR Phase III Decision.

Overall Objective: Determine a path forward for improving Climate Vulnerability Assessment (CAVA) Results in the Risk-Based Decision-Making Framework (RDF)

Questions to Consider

- Does PG&E's proposal for a CAVA/RDF Integrating Framework Proposal improve upon the current state?
- How should the RDF be modified to address PG&E and SPD's Proposals?
- Does PG&E's path forward maintain both the onus and flexibility necessary for IOUs to continue to comply with RAMP and make necessary climate-informed decisions?
- Are there alternative approaches needing further consideration?

PG&E Proposal

A Two-Pronged Solution

Path forward within RAMP

- IOUs continue to incorporate CAVA results in the existing RAMP in the manner most appropriate to their circumstances

- No changes are necessary at this time for the SMAP or additional rulemaking that will impact the RAMP

Path forward within RDF OIR – "CAVA/RDF Integration Framework Proposal"

1. *Cumulative Risk Measures:* Utilize a cumulative view of climate risk to improve climate change impact representation.
2. *Scenario-Based Approach to Hazard Quantification:* Use climate scenarios established in CAVA to quantify Climate Hazards.
3. *Confidence Ranges:* Cumulative Risk Measures expressed in percentile Hazard scenarios.
4. *Scenario-based approach to Modeling Cascading Events:* Cascading events are incorporated by defined scenarios and Risk Events.
5. *Uncertainty Analyses:* Transparency Proposal provides the quantification of uncertainty and sensitivity.

RDF, CAVA Frameworks

Essential Components of RDF, CAVA

RDF

Risk$ = LoRE x CoRE

Mathematically, for some Event *X*, and Consequence *C**:

$$E[C] = \underset{\text{LoRE}}{p(X)} \cdot \underset{\text{CoRE}}{E[C|X]}$$; A "deterministic" value**

CAVA

Climate Change is represented by a set *H* of measurable, probabilistic Hazards:

H = { Extreme Temperatures, Sea Level Rise, … }

= *{ T, S, … }; H* is random

A specific Climate scenario *h* is given by specific values *t*, *s*

h = *{T=t, S=s, … }*

* *C* is risk-adjusted/"scaled";

** Assumed $E[C|\overline{X}] = 0$; no consequences if the risk event does not occur

RDF/CAVA Integration – General Approach

Hazards are not Event Risks, but Affect Them

RDF/CAVA

Recognize that Risk in future years is conditional on Climate outcomes

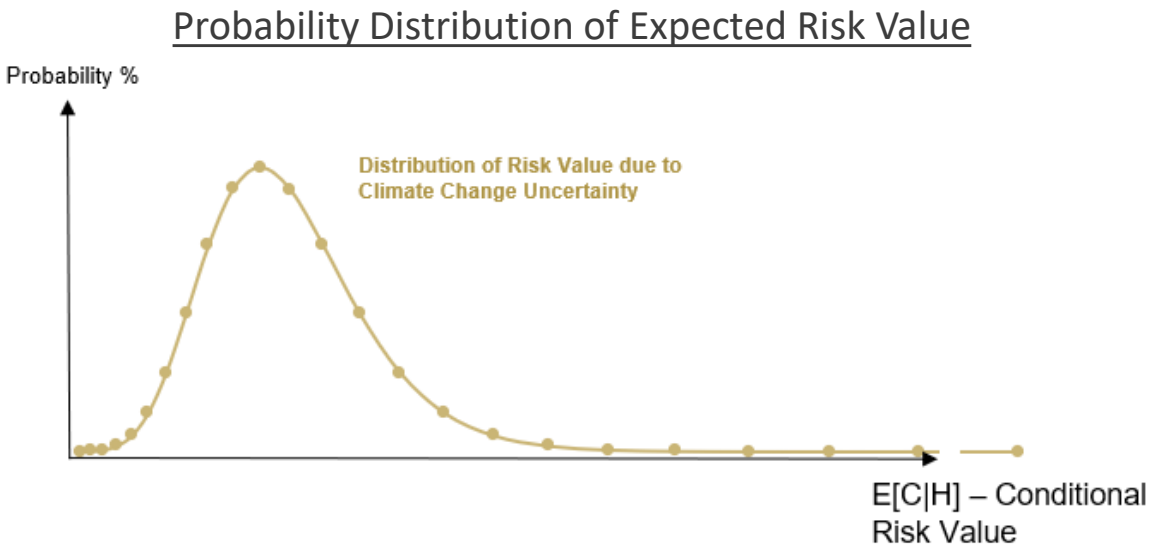
Risk$|***H*** = LoRE|***H*** x CoRE|***H*** ; "|" means "given" (ie, conditional on)

Mathematically

$$E[C|\boldsymbol{H}] = p(X|\boldsymbol{H}) \cdot E[C|X, \boldsymbol{H}] \quad ;$$

LoRE given ***H*** CoRE given ***H***

Because ***H*** is random, the Risk value is *no longer deterministic*



RDF/CAVA Integration Proposal

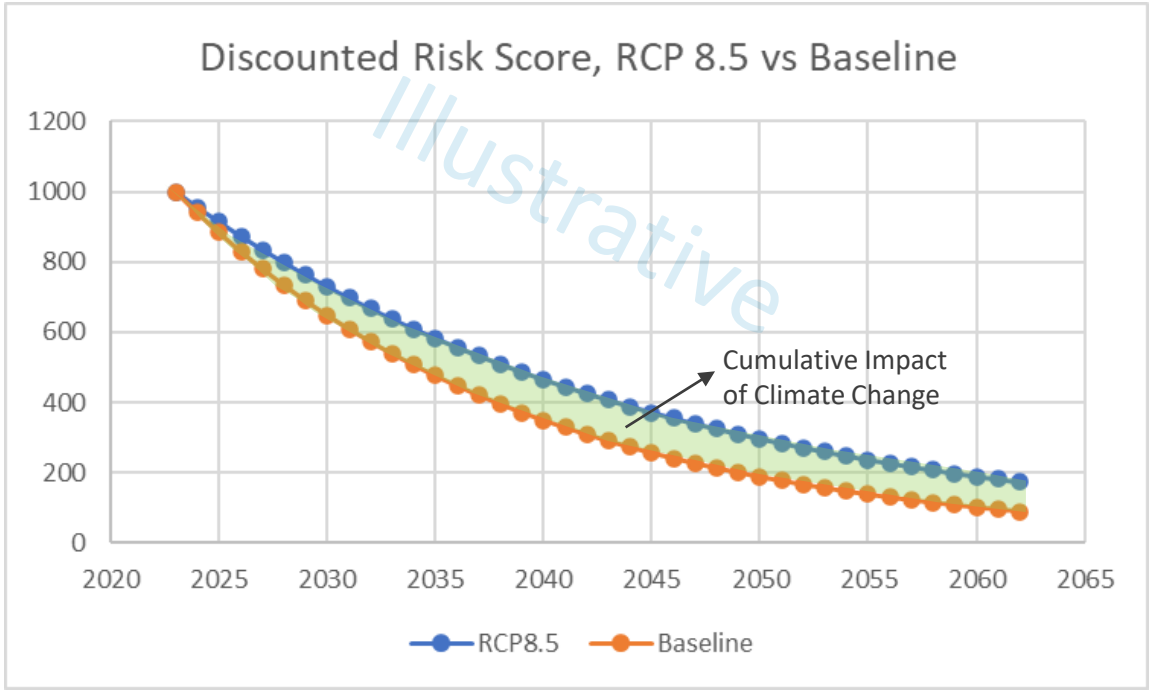
Incorporate Cumulative Risk Measures and Scenarios into the RDF

RAMP														
	Long Term Interest Rate	4.25%												
	Discount Factor		88%	84%	81%	77%	74%	71%	68%	65%	63%	60%	58%	55%
	Risk		2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
	WildFire		21,429	20,538	19,683	18,864	18,657	17,881	17,381	16,893	16,415	16,273	15,596	14,947
	Large Uncontrolled Water Release		61	59	57	55	53	51	50	48	47	45	43	41
	Loss of Containment - Gas Transmission		255	244	236	228	219	210	202	195	188	180	175	167
	Distribution Overhead Failure		471	451	432	414	402	385	371	358	345	331	323	309
	…													
Climate Change Supplement														
Climate Hazard(s)	Risk	Cumulative Impact due to Hazard (in Risk Units)	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Increased Temps	WildFire	30,257	643	616	590	566	560	536	521	507	492	488	936	897
Flood Risk	Large Uncontrolled Water Release	24	-	0	1	1	1	1	1	1	1	1	1	1
Flood Risk, subsidence	Loss of Containment - Gas Transmission	68	-	-	2	3	3	3	3	3	2	2	4	4
Increased Temps	Distribution Overhead Failure	241	8	7	7	6	11	10	9	8	8	7	13	12
Increased Temps	New Risk from CAVA scenarios - Circuit Overloading	2,865	-	-	-	37	37	37	37	37	37	37	74	74
Increased Temps	New Risk from CAVA scenarios - Cascading Event X	2,958	-	-	-	-	-	22	22	22	22	22	96	96
	…													
Overall Impact of Climate Change		36,414	(Risk Units)											
Legend														
	Baseline Risk Value (score) currently reported in PG&E RAMP													
	Cumulative Impact (across all years) on Risk Due to Climate Hazard Intensification													
	Annual impact (discounted $) on Risk due to Climate Hazard Intensification													
	Sum of all the Cumulative Impacts													

Cumulative Risk Measures

Sum the Impacts of Climate Change Over the Long-Term Horizon

- Appropriate because Climate Change results in a Risk trajectory over time.
- Overall *Impact of Climate Change* is the incremental change, due to Climate Hazards, in all Risk values over a baseline scenario and investment period (30-50 years).



Scenario-based Analysis in RDF

Utilize CAVA Scenarios to Obtain Ranges for how Risks Intensify

How do we get back to a "deterministic" value for "LoRE x CoRE" that incorporates Climate Change?

- Find mean (probability weighted sum) over all possible climate outcomes

$$E[C] = \sum_{h} p(H = h) \times E[C|H = h]$$

  This is challenging because it requires complex modeling that may be beyond current capabilities and available data.

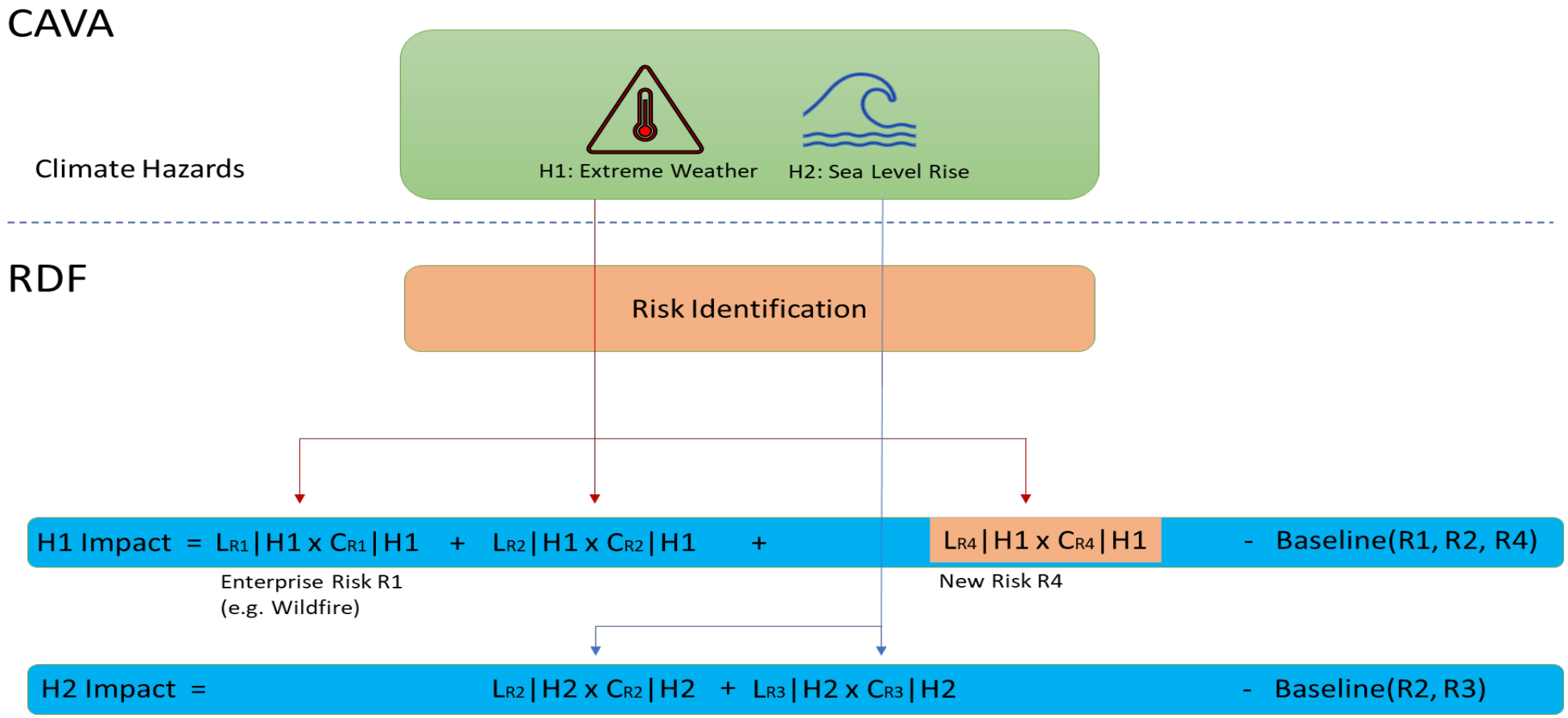
- As a first step, derive Hazard scenarios from Climate scenarios, e.g. Representative Concentration Pathway (RCP) 8.5, ie, $h_{RCP8.5} = \{t_{RCP8.5}, s_{RCP8.5}, \ldots\}$ and use them to determine Risk values
  $E[C|\boldsymbol{H}=h_{RCP8.5}] = p(X|\boldsymbol{H}=h_{RCP8.5}) \cdot E[C|X, \boldsymbol{H}=h_{RCP8.5}]$;

- Multiple scenarios can be utilized to give a *range* of Risk values. Weighted scenarios can give an estimate of the Expected Impact of Climate Change.

Scenario-based Analysis in RDF, continued

Utilize CAVA Hazard Scenarios to Identify New Risks

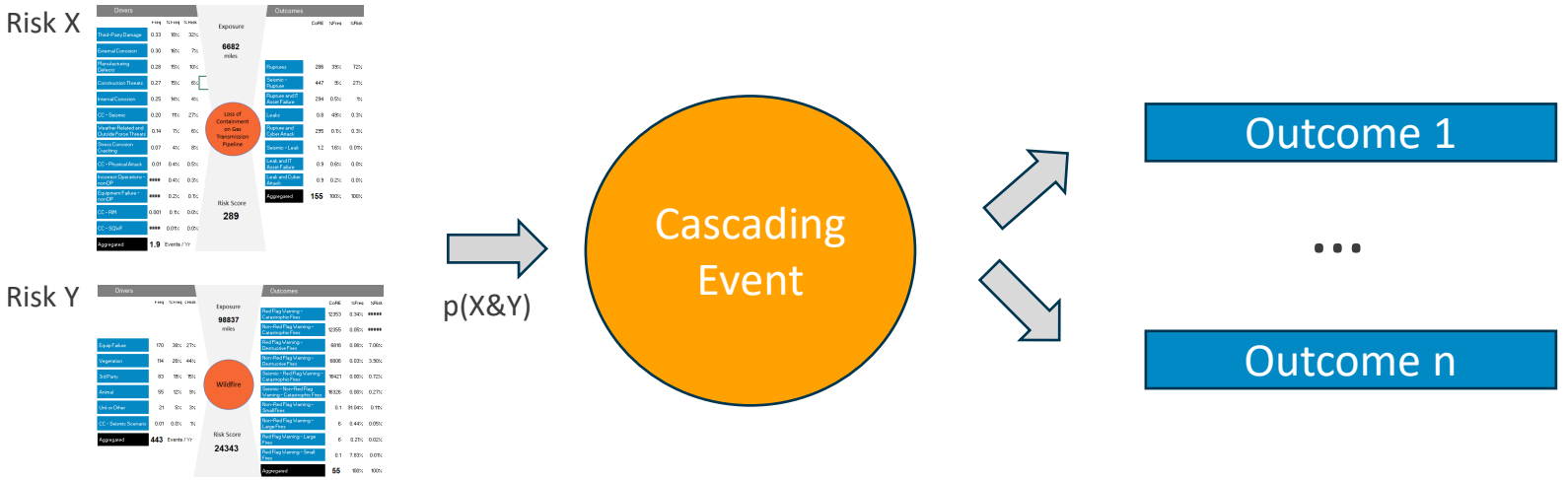
- RDF is event-based; without identifying what the events and Risks are, Climate Impact cannot be quantified. Hence RDF should include an Identification Process for new, climate-related Risks.



Cascading Events

Model Cascading Events as Risks

The RDF considers Risks separately. Cascading Events can occur when multiple Risk Events happen at the same time (or in sequence), compounding the Consequences.



CAVA scenarios can be utilized to identify potential Cascading Events, which will be modeled as Risks in the RDF.

Next Steps and Conclusion

Next Steps

- PG&E proposes to do pilot study of the CAVA/RDF Integration Framework by Q4 2025 and submit in the Risk OIR.
- PG&E will perform a gap assessment of the CAVA/RDF Integration Framework Proposal within 60 days of submitting the Proposal.
- Risk OIR Working Group Members will review and provide questions and feedback for discussion in a Workshop in the Rulemaking.
- Additional actions to be taken will be determined by the Rulemaking Process.

Conclusion

PG&E believes the CAVA/RDF Integration Framework Proposal is a viable and reasonable path forward:

- It provides a conceptually sound framework for integrating CAVA into the RDF.
- Implementation issues and shortcomings will be identified by a pilot study.

Thank You

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Q & A for PG&E

1:30 pm – 1:50 pm

Discussion Questions (Provided by PG&E)

- Does PG&E's proposal for a CAVA/RDF Integrating Framework Proposal improve upon the current state?
- Does PG&E's path forward maintain both the onus and flexibility necessary for IOUs to continue to comply with RAMP and make necessary climate-informed decisions?
- Are there alternative approaches needing further consideration?
- Is PG&E's proposed schedule appropriate (slide 59) or should other steps be considered, ie, encouraging/ requiring other utilities to pilot before/concurrently with PG&E, either using PG&E's methodology or another methodology developed by the IOU?

Related Discussion Questions

- What is missing or lacking in PG&E's proposal? How could the requirements be amended?
- Does PG&E's proposed methodology prevent duplication of costs for climate-related investments previously authorized in venues other than the GRC? If not, what language would parties add to address this issue?
- Is a "one size fits all" pilot necessary or should IOUs be given discretion to try different methods? What are pros/cons?
- Given PG&E's proposal, should the Commission modify the RDF to ensure that climate hazards or risks are quantitatively accounted for within the risk models in the IOU's RAMP filings? If so, how?

Break

1:50 pm – 2:00 pm

Discussion of Presentations and Proposals

2:00 pm – 2:50 pm

“Planning” Discussion Questions

- How can utilities identify whether or not future climate hazard conditions will have a meaningful impact on risk scores and warrant additional research and analysis to inform risk models? Should the Commission direct utilities to undertake a process to investigate this? On what timeline?
- Should CAVA data inputs (GCM climate data or projections) or CAVA results (assets identified as vulnerable or potential adaptation options), or both, be reflected in the RDF and IOU RAMP filings?
- What approaches can utilities undertake with different climate data sets to evaluate a range of potential future weather patterns, including of lower probability, high-impact conditions (that could have implications for risk events described in RAMP filings)?

“Planning” Discussion Questions (cont.)

- Do climate hazards pose any additional risks that may not yet be included in Enterprise Risk Registries? If yes, what risks?
- Should and, if so, how should climate data, models or projections, including inputs into the CAVA or CAVA results, be used to affect the calculation of Likelihood of Risk Event or Consequence of Risk Event in IOU RAMP filings?

CPUC Close and Next Steps

2:50 pm – 3:00 pm

Next Steps

1. Workshop Recording on Youtube (3-4 days)

   https://www.youtube.com/user/CaliforniaPUC

2. SPD & PG&E File Climate Change Proposals (September 19)

3. Ruling with Questions for Party Comment (approx. September 22)

4. Workshop #3 Opening Comments (October 13)

5. Workshop #3 Reply Comments (October 20)

Thank you!

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