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Attachment 1

Order Instituting Rulemaking to Consider Strategies and Guidance for Climate Change Adaptation (R.18-04- 019): Working Group Session Report on Item “Data Sources, Models, and Tools”

REPORT 2 OF 5

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MARCH 2019

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Executive Summary

I. Introduction

The purpose of this report is to describe and summarize, “(1) the issues assigned to the working group; (2) discussions, relevant framing questions or considerations to move discussions forward from the outset for each issue; and (3) an outline showing proposed resolution(s) of assigned issues.”¹ The report is organized around the consensus and non-consensus items that emerged during the Working Group discussions regarding climate data sources, models, and tools, as part of the Order Instituting Rulemaking to Consider Strategies and Guidance for Climate Change Adaptation (OIR) at the California Public Utilities Commission (CPUC). This report is the second in a series of five total reports that will be issued pertaining to the five topics in the Scoping Memo.

The Working Group met once in Torrance, California and once at the CPUC headquarters in San Francisco on this topic. The first meeting took place on January 8, 2019 and the second meeting took place on February 4, 2019. Both meetings were open to the public, and parties and non-parties to the proceeding participated.

Level-Setting Meetings

Since the OIR was issued, CPUC staff have held a number of workshops to provide important clarification and information to parties about the proceeding and climate science. At the PHC, CPUC staff held two workshops to present the Cal-Adapt tool and hear from an expert panel on the development and use of existing climate adaptation tools and resources. On November 29 from 1pm to 2pm, before the initial Working Group meeting on Topic 1, CPUC staff gave a brief overview of the Working Group process in the proceeding. Finally, shortly after the second Working Group meeting on Topic 1, which took place on December 18, 2018, three of the utilities--PG&E, SCE and SDG&E--made a joint presentation to the Working Group on electric distribution planning at utilities.

a. Framing Questions on Climate Data Sources, Models, and Tools

Working Group Purpose and Questions

The Scoping Memo states that the purpose of the Data Sources, Models, and Tools topic was to “provide guidance to utilities on which data sources and models should be utilized as the basis for inputs into their planning processes.”² The Scoping Memo suggested that the Working Group could consider the following questions:

- What is in these tools and studies?
- What data/studies do the utilities and the Commission need for planning and operations?
- Are the existing tools useful to meet needs? What would make them more useful?
- Should the Commission adopt certain existing studies as being acceptable data sources for decision making?
- Should the Commission adopt certain tools/databases/sources under continual development, such as Cal-Adapt?

¹ Scoping Memo, at p.11

² Scoping Memo, at p. 4.

- Should the Commission require use of certain climate scenarios/timeframes (e.g., some parties have suggested the use of Representative Concentration Pathway (RCP) 8.5 for planning through 2050 or 2060)?
- Should the Commission adopt guidance on the use of specific Global Climate Models?
- Should the Commission adopt any general guidance on use of downscaled projections, or other specific types of modeling?

Working Group Meetings and Staff Proposal on Climate Data Sources, Models, and Tools

Per the Scoping Memo, the Working Group met twice in public fora to discuss Topic 2: Data Sources, Models, and Tools. In advance of the first working group session, CPUC staff requested that the IOUs prepare a presentation describing the climate and weather data currently used in utility system planning and operations. CPUC staff also requested Guido Franco of the California Energy Commission to present on best available datasets for a select group of climate variables that directly impact utility systems.

CPUC staff facilitated Topic 2 Session 1, held from 1:30pm to 3:30pm on January 8, 2019 at the South Bay Cities Council of Government's South Bay Environmental Services Center in Torrance, California. CPUC staff indicated that the goals of the meeting were to:

- Provide an overview of the climate data landscape and data criteria.
- Discuss best available data sets for key variables.
- Provide an overview of IOU work performed or being conducted with consideration of these key variables
- Solicit input from stakeholders on additional considerations and challenges or benefits for adopting specific guidance on select data, models, and tools.³

CPUC staff provided an introduction, followed by a presentation by Guido Franco of the California Energy Commission on available climate data for select climate variables. The IOUs delivered their presentation on use of climate and weather data in real time operations, electric and gas distribution system planning, and hydro resource planning. The presentation included areas of need for adaptation planning for IOUs. The Public Advocates Office commented that the utilities were only presenting on a non-representative sample of their activities—leaving out areas like how weather and climate may be considered for maintenance schedules and procurement.

On January 23, 2019, in advance of Topic 2 Session 2, CPUC staff requested that the IOUs respond to a data request indicating how they are utilizing weather and climate data to account for a wide range of climate change impacts in their planning processes.

Also, on January 23, 2019, CPUC staff released a staff proposal outlining a two-part approach for identifying climate data sources and models to be used as the basis for planning inputs (see [Appendix A](#) for the full staff proposal).

³ "Data Sources, Models, and Tools". CPUC Staff Presentation (Jan 8, 2019), at p. 3.

Figure 1. Key Elements of Staff Proposal for Identifying Climate Data Sources and Models

1. Established general data criteria to provide guidance for standardized use of existing climate data
2. Establish and run an ongoing Technical Advisory Group to revise and update climate data criteria

The goals of Topic 2 Session 2, as stated in the CPUC Staff's Presentation, were to:

- Develop an initial list of all relevant data sets that can be used immediately by IOUs for adaptation planning, with the recognition that these are recommendations that will be reviewed on an annual basis by the proposed Technical Advisory Group (TAG).
- Gain acceptance on the criteria used to determine which climate data are recommended for use by the IOUs in adaptation planning.
- Gain acceptance of the formation of a TAG by the CPUC and IOUs, along with initial guidance on the formation and roles of the TAG.⁴

Session 2 was facilitated by Dr. Juliette Finzi Hart of the US Geological Survey (USGS) and took place from 10am to 4pm on February 4, 2019 at CPUC headquarters in San Francisco. The facilitator provided an overview of the Fourth California Climate Assessment, as well as the utility-specific research contained therein. Dr. Robert Kay of ICF presented two such studies, undertaken in partnership with San Diego Gas & Electric (SDG&E) and the Southern California Gas Company (SoCalGas) and with funding through EPIC and PIER Natural Gas, examining the exposure and sensitivity of gas and electricity assets in the SDG&E service territory to climate hazards. Subsequently, stakeholders reviewed IOU responses to the CPUC data request, followed by a review of available high-quality, California-specific climate data sources. The afternoon focused on discussion of criteria for identifying usable science and the details of forming a potential TAG.

The attendees for each of these meetings are listed in [Appendix D](#) below.

II. Consensus Issues

This section lists concepts upon which the Working Group appeared to agree.

- A. **Necessity of considering forward-looking weather and climate data.** During both sessions there was agreement amongst stakeholders that given the accelerating nature of climate change the IOUs should consider forward-looking climate and weather data in their planning processes.
- B. **Incorporation of climate change considerations should be flexible enough to account for the evolving nature of science.** During both sessions there was agreement that CPUC guidance to the utilities regarding the use of climate data should account for the evolving nature of climate science and allow for the use of the most up-to-date climate projections.

⁴ "Topic 2: Climate Data Sources, Models, and Tools". CPUC Staff Presentation (Feb 4, 2019), at p. 3.

III. Near-Consensus Issues

This section lists items upon which there was emerging agreement but with some participants disagreeing or expressing reservations about the details of a proposal.

- A. **A. Management of climate data updates for IOU planning.** Session 2 included a robust discussion of both what a “Climate Data Technical Advisory Group (TAG)” would do and of whom it should be composed, but there was some agreement that such an effort at managing climate data updates should exist. However, the exact nature of this effort and what form it would take was not resolved.
- B. **Cal-Adapt is a high-quality repository of climate information for California.** Much of the discussion in both sessions centered on Cal-Adapt, the California Energy Commission (CEC) funded tool that allows users to interact with the localized constructed analog (LOCA) downscaled data from the Fourth California Climate Assessment. Generally, it was agreed that Cal-Adapt is a useful platform backed by rigorous, peer-reviewed science.

In Session 2, a representative of Lawrence Berkeley National Labs (LBNL) made the point that LOCA downscaling is just one downscaling technique, and that other techniques might be more appropriate, or equally appropriate, for a specific use of downscaled data. It was also noted that Cal-Adapt does not consider multi-variable coincident/confluence event modeling.

- A. **Potential list of criteria for determining general use of existing climate data.** During Session 2, stakeholders discussed the data criteria put forth in the staff proposal.

Figure 2. List of Proposed Data Selection Criteria in Staff Proposal

- The climate data will adhere to selection of Global Climate Models (GCM), climate scenarios, and downscaling techniques provided by the Climate Action Team Research Working Group for the most recent California Climate Change Assessment.
- Climate data should provide the geographical resolution and temporal resolution required for the research or planning at hand.
- Methodology should have demonstrated acceptance by the community-of-practice (Modified from: peer-reviewed methods used to produce data should be given priority over non-peer-reviewed methodologies).
- The data sets replicate, in a statistical sense, historical conditions.
- Multiple climate variables (e.g. temperature, precipitation, wind, humidity, solar radiation) should be provided.

Many stakeholders expressed a desire to ensure the criteria are flexible enough to allow appropriate data to be used for the wide range of purposes to which they could be applied. An LBNL representative (Andy Jones) noted that the proposed criteria might be interpreted as precluding scenario- or event-specific modeling, a sentiment echoed by the Small Business Utility Advocates (SBUA, Paul Chernick). LBNL offered that a better way to conceptualize data guidance might be as “best practices” versus “minimum requirements.” A CEC representative noted that being included in a California Climate Assessment should be a sufficient qualifier for use, but not a minimum requirement so as not to exclude other useful data. Natural Resources

Defense Council (NRDC) commented that the discussion should focus on developing criteria that would be used to determine what data to use and how said data should be applied, rather than whether specific currently available data sets should be used. The Public Advocates Office agreed and noted that it would be more helpful to learn about Cal-Adapt's technical advisory committee and how to engage with it.

Climate Resolve expressed concern for appropriate data management, i.e. "vintaging" of data sets used for various analyses as well as the need for a process to endorse the "most current" climate data for preferred use. There was also discussion from both stakeholders and IOUs about the importance of having transparency on the methodologies behind the modeling, how "settled" the science is on the various modeling approaches and ensuring that metadata accompany the models so that they can be accurately assessed or compared to other approaches.

The approach of using all available data for analysis was also broached. SDG&E discussed briefly how they used a combination of sea level rise and coastal flooding information to conduct their vulnerability analyses. Facilitator Juliette Finzi Hart mentioned the work of the AB 2800 Climate-Safe Infrastructure Working Group that recommended using all available data and employing an adaptation pathways approach that permits an examination of a range of scenarios and supports basing planning decisions on observational decision-points throughout time.

The California Environmental Justice Alliance (CEJA) expressed concern that the criteria allow for the prioritization of disadvantaged communities by being flexible enough to include climate or socioeconomic data that measures disadvantaged communities' vulnerability.

Facilitator Juliette Finzi Hart synthesized the conversation on climate science use and availability to suggest the following modifications to the data selection criteria proposed by CPUC Staff:

- Criterion 1 should be modified to apply principles beyond Global Climate Models (GCM) so as not to exclude other useful climate data (e.g. hydrological data). The facilitator asked the group whether utilities should be able to consider GCMs beyond those identified in the Fourth California Climate Assessment and if this would be a first decision/discussion point for the potential TAG.
- Criterion 2 could be removed since it was clear that only data that are at the appropriate temporal or spatial scale would be used by utilities in their respective planning processes.
- Criterion 3 should be broadened to apply to more than GCMs and to include all types of climate data. CPUC Staff suggested a clause regarding the necessity of metadata could be added. Public Advocates Office advocated for the inclusion of a clause on transparency in and limitations of methodology could be added.
- Criterion 4 should be edited or removed because it was unclear if this criterion was necessary, as it was noted that most modeling data is validated through hindcasting.
- Criterion 5 should be removed since it could be too restrictive.

These suggestions were met with some agreement in the room, and no vocal dissent, indicating general stakeholder interest in modifying the criteria accordingly.

B. The Proposed Technical Advisory Group. The staff proposal included functions of a potential TAG.

Figure 3. Proposed Functions of a Technical Advisory Group for Climate Data Considerations from Staff Proposal

- Review existing climate data and assess new, emerging climate data;
- Developing long-term criteria for climate data considered suitable for IOU planning and operations
- Deliver a report to the CPUC on an annual basis that includes:
 - Recommendations to the IOUs on which data are acceptable for use in IOU adaptation planning.
 - Recommendations to the CPUC if /when the TAG identifies any changes that it suggests be made to the data criteria

Stakeholders generally agreed that a body of researchers, non-market-participant stakeholders, and IOU representatives should perform the proposed functions; however, most of the Technical Advisory Group discussion focused on the particulars of TAG membership and potential integration with existing bodies. Absent more thorough discussion of the TAG’s mission, this item is being listed as “near-consensus.”

Additionally, NRDC and CEJA mentioned that a future TAG might take on additional ongoing roles related to other questions in this OIR and should include vulnerable and disadvantaged groups.

The Public Advocates Office expressed concern with the short amount of time available for discussion of the criteria, as well as with the pace of the proceeding more broadly. The Public Advocates Offices commented that if a Technical Advisory Group (TAG) will nevertheless be formed, its meetings would likely need to be open to the public and that an open comment period should be held—at a minimum.

IV. Non-consensus Issues

This section lists concepts around which there was substantial disagreement.

- A. Duties and Logistics of a Technical Advisory Group.** Much of Session 2 was spent discussing whether and how to form a new TAG. SCE and PG&E expressed support for a body to review and assess climate data for potential IOU use, but believed these tasks should be assigned to one of the State’s existing climate-focused bodies, potentially the Technical Advisory Council (TAC) of the Integrated Climate Adaptation and Resiliency Program (ICARP) housed within the Governor’s Office of Planning and Research (OPR). Rob Kay of ICF noted that SB 246, which establishes the ICARP TAC, lists the kinds of scientific and technical membership that might be appropriate to manage climate data considerations.

However, Jonathan Parfrey of Climate Resolve, and a member of the ICARP TAC, expressed that, in practice, the ICARP TAC membership has different expertise than would be needed to perform the proposed functions. Specifically, he expressed concern that there is not enough scientific expertise on the ICARP TAC. Climate Resolve expressed that the ICARP committee was mainly staffed by local government officials and not members of the climate science community.

In response, it was raised that a whole-of-government approach to managing climate data is preferable, and that the ICARP TAC is best situated organizationally to achieve this management of data even if the current membership is not best equipped for the TAG's proposed functions. It was also noted that the need for climate adaptation guidance is not specific to the energy sector and therefore an energy-focused TAG- should link with other state agencies.

Cal-Adapt and the California Climate Assessment process were also put forth as initiatives that could convene, and benefit from, a new advisory body. SCE expressed support for aligning the TAG and the Climate Assessment process, and for the importance of coordinating with established energy policy working groups and processes. Examples of these established groups include the Demand Analysis Working Group (DAWG) in the Integrated Energy Policy Report process, the Distribution Forecasting Working Group (DFWG) in the Distributed Resource Planning (DRP) process, and relevant bodies involved in the Integrated Resource Planning (IRP).

NRDC and Public Advocates Office questioned the need to establish a new TAG and submitted that extending the Climate Change Adaptation OIR working group beyond the proceeding could perform the proposed TAG functions. CPUC staff noted that while consideration of climate data should be part of an ongoing process, there are statutory bounds on the length of Commission proceedings – managing ongoing climate data considerations would require a different convening format.

LBNL replied that more representation from the climate science community would be necessary to determine which data sets were credible and appropriate for use in utility operations and planning, which was echoed by Climate Resolve and PG&E. Public Advocates Office agreed that additional expertise is needed. The Public Advocates Office further noted that it was unclear whether the hypothetical TAG would be tasked with determining what levels of “risk” are appropriate or whether the TAG would be responsible for reviewing the state of the science and connecting scientists to energy practitioners. The Public Advocates Office expressed concern that determining acceptable levels of risk could be a fundamentally political question, and one that scientists may not be comfortable determining.

The group also discussed the importance of including representatives with a variety of technical expertise on the TAG, including climate science knowledge, utility planning, engineering, infrastructure and procurement process experience, social science perspectives, ratepayer, and environmental justice perspectives.

- B. Use of proprietary data/analysis for planning.** Stakeholders disagreed regarding whether the IOUs should be able to use proprietary data and analysis for climate adaptation planning

purposes. The Public Advocates Office suggested that, at the time of oversight, all data and analysis used for utility planning should be freely available to the public on the grounds of transparency and fairness. A CEC representative agreed that proprietary data should be disallowed.

Arup noted that while the second-order data they create is private and cannot be made public or distributed. PG&E noted that this kind of analysis is based on publicly available GCMs and their methodology is available and peer-reviewed. CPUC Staff expressed interest in exploring the issue further. PG&E posited that the utilities should not be precluded from using useful and innovative tools only available at a cost, especially as the actions utilities take based on that data will still be funded and approved via the general rate case and require justification.

Public Advocates Office noted that as a result of public information laws, proprietary information may become public as a matter of course. Arup agreed that in practice it can be difficult to preserve the confidentiality of proprietary information in circumstances with a great deal of oversight. Facilitator Juliette Finzi Hart noted that this was discussed in the AB 2800 Climate-Safe Infrastructure Working Group, where it was recommended that only data and methods that are publicly-reviewable and/or available were appropriate for state-funded or managed infrastructure projects.

V. Other Issues of Note

This section lists other concepts of note that surfaced during discussion.

- A. **Specific Guidance Regarding Global Climate Models and Representative Concentration Pathways.** PG&E and SCE raised the issue that the IOUs are seeking guidance on climate planning assumptions due to the range of projections provided by available climate models. They noted that policy choices will need to be made about which representative concentration pathway (RCP) and which subset of GCMs should be used for planning, recognizing these choices may vary by use case. Because the models in Cal-Adapt are all scientifically valid but present a range of expected outcomes, policy-makers need to decide what level of risk public service providers should plan for, recognizing that there is a tradeoff between planning for higher levels of risk and affordability. Hiro Kuchida of SCE noted that while the focus of this WG was on good data, stakeholders really need a firm understanding of the key risks and issues the CPUC wants to focus on. Without this, stakeholders are potentially focusing on dimensions of science and data that may not be necessary to explore. SDG&E concurred that risk is an important piece in understanding what is good data to use in planning.

Rob Kay of ICF, which represented SDG&E at the workshop, noted that utilizing an adaptation pathways approach allows utilities to consider and plan for higher levels of risk while allowing for a planning approach that provides a mechanism for stepwise implementation of different strategies, potentially offsetting large initial costs. This was identified as an important discussion point for Topic 5.

- B. Integrating Climate Data into State Energy Proceedings.** During the discussion, it was noted that forward-looking climate data should likely be applied to processes led by the CPUC and CEC in addition to IOU planning processes. SCE made the point that the CEC Integrated Energy Policy Report (IEPR) demand forecast already incorporates the effects of climate change in some ways, and that the IOUs should be careful that their use of climate data for planning does not “double count” climate change impacts. NRDC commented that understanding how proceedings like the IRP and DRP do or do not account for climate change and influence utility planning is an important part of this process.

- C. Political Implications of Disregarding Lower Emission RCPs.** In Session 1, Climate Resolve noted that discussion of the climate data excluded RCP 2.6, the lowest GHG emission scenario considered by climate modelers. If the CPUC were to provide guidance ignoring this RCP, Climate Resolve indicated that it could be interpreted as an implicit admission that California and/or the globe is admitting defeat with regard to GHG mitigation policies. This could potentially provide counterarguments for the State’s GHG reduction goals and strategies. This issue was raised again at the second meeting by the Public Advocates Office. A CEC representative replied that, regardless, real world data reflects that the global emissions and emissions in California are on a “business-as-usual” emissions trajectory, indicating that an RCP 8.5 scenario is most likely and thus should be planned for.

- D. Consideration of Literature from Social Science Disciplines.** In both sessions, CEJA and Public Advocates Office noted the importance of considering research and data related to climate impacts from the social sciences. A CEC representative noted that Fourth California Climate Assessment includes some discussion and incorporation of the social impacts of climate change. CEJA raised the importance of including data sources such as CalEnviroScreen that measure climate impacts on disadvantaged communities and allow for the prioritization of such communities.

- E. Consideration of Traditional and Local Knowledge and Information.** In both sessions, some stakeholders also noted the importance of discussing if/how to incorporate information from either/both local and traditional knowledge resources. There was not much discussion on the details of how to achieve this and it was indicated that this would likely be discussed in Topic 4.

Appendices

Appendix A. Staff Proposal on Climate Data Sources, Models, and Tools

Climate Change Adaptation for Energy Utilities – Climate Data Sources, Models, and Tools

Staff Proposal | January 2019

Introduction

The main purpose of this Rulemaking is to provide guidance to utilities on how to incorporate climate change adaptation into their planning and operations. However, with accelerating climate change, historical observations and measurements are no longer adequate predictors of future climate and weather. The IOUs' operations and planning processes – for distribution planning, energy procurement, and infrastructure projects, as well as holistically – must therefore evolve to incorporate projections of future climate conditions.

The Scoping Memo states that the purpose of Working Group Topic 2 is to “provide guidance to utilities on which data sources and models should be utilized as the basis for inputs into their planning processes.”⁵ As the nature of a changing climate necessitates shifting from planning inputs based on historical observations to inputs based on projections of future climatic conditions, this proposal proposes criteria and sources for climate projections. Climate change adaptation planning will ultimately involve additional datasets beyond physical climate data, such as socioeconomic and land use data, which are out of scope for this document.

Climate science evolves as scientists gain a better understanding of the various components that interact to create the weather and climate conditions. As a result, this guidance on climate data-based inputs for IOU planning and operations also proposes a process through which new science can be reviewed and incorporated into IOU climate change adaptation plans.

Proposed Approach to Climate Data Selection

Staff propose a two-part approach to identifying data sources and models to be used as the basis for planning inputs:

- 1. Establish general data criteria to provide guidance for standardized use of existing climate data**

⁵ Scoping Memo, p.4

The first part is to develop criteria for the CPUC and IOUs to identify which existing climate data sets, models, tools, studies, and analyses (heretofore referred to as “climate data”) are most appropriate for the IOUs to use going forward for proceedings addressing infrastructure or operations planning in which projections of physical climate change impacts should be considered. Establishing criteria, rather than picking specific data sources, incorporates flexibility into the choice of data sources while allowing some standardization of assumptions that will be inherent in projections. Staff proposed an initial set of criteria, described below, which can be discussed and enhanced by the R.18-04-019 Working Group.

2. Establish and run an ongoing Technical Advisory Group to revise and update climate data criteria

Staff recognize the ever-evolving state of climate science and data, as well as the need for flexibility to innovate in new analysis techniques and methodologies. Staff recommend that the CPUC lead the formation of a Technical Advisory Group (TAG), consisting of CPUC staff, climate science experts, social scientists, and IOU representatives, that convenes annually to:

- review existing climate data and assess new, emerging climate data;
- review the criteria for climate data considered suitable for IOU planning and operations
- and deliver a report to the CPUC on an annual basis that includes:
 - recommendations to the IOUs on which data are acceptable for use in IOU adaptation planning.
 - recommendations to the CPUC if and when the TAG identifies any changes that it suggests be made to the data criteria

State policies and guidance documents for climate change adaptation are also quickly evolving. At its annual review, the TAG will review current state policies and guidance documents to ensure that the recommendations on adaptation planning provided to the IOUs are in concordance with the Joint Agency Steering Committee, Demand Analysis Working Group, Climate Action Team Research Working Group (RCAT) recommendations, the Cal-Adapt advisory committee, and other state climate change adaptation-focused efforts.

Proposed Data Criteria

Italicized text indicates an Outstanding Question or Consideration. To be considered during the WG discussion.

1. Available and Most Relevant Climate Variables for Utilities

The list below identifies the variables that are most critical for adaptation planning by the IOUs because of their potential impact on utility infrastructure and/or operations. The TAG may identify additional variables. The TAG will review and recommend, as necessary, the best existing data sets and formats for each of these climate variables on an annual basis.

Staff have included datasets that meet the below criteria for some of the below variables. These datasets are not final endorsements by the CPUC but are meant to drive discussion as to what datasets would meet the criteria proposed below.

- a. Temperature

- i. LOCA downscaled datasets⁶
- b. Precipitation
 - i. LOCA downscaled datasets
- c. Relative Humidity
 - i. LOCA downscaled datasets
- d. Wind
- e. Solar Radiation
- f. Streamflow
 - i. Datasets from Variable Infiltration Capacity model (driven by LOCA)⁷
- g. Sea Level Rise
 - i. Datasets included in Ocean Protection Council guidance
 - ii. CosMos projections⁸
- h. Coastal Erosion / Storms / Flooding
 - i. CosMos projections

2. Criteria for Preferred Datasets

In order to determine which climate data are acceptable for use by IOUs for adaptation planning, staff propose the following data criteria, including important outstanding questions for discussion in italics.

Proposed Criteria:

- The climate data will adhere to selection of Global Climate Models (GCM), climate scenarios, and downscaling techniques provided by the Climate Action Team Research Working Group for the most recent California Climate Change Assessment.⁹
 - Impact studies should adhere to the guidance regarding the selection of GCMs, climate scenarios (e.g. Representative Concentration Pathways) and downscaling techniques provided by the CEC for the most recent State Climate Assessment.¹⁰
- As much as possible, climate data should provide the geographical resolution and temporal resolution required for the research or planning at hand.
 - Analyses should, where possible, avoid using simulations from single GCMs, but rather use analytical approaches that allow exploration of extremes and the range of potential outcomes in order to gage uncertainty and to better understand extreme event likelihood
 - Climate data should include projections of the shifting of averages as well as information on extremes and tail projections.

⁶ LOCA datasets are developed by Scripps Institute of Oceanography and can be accessed via Cal-Adapt: <https://cal-adapt.org/data/>

⁷ VIC model datasets for streamflow and other variables are available via Cal-Adapt: <https://cal-adapt.org/data/>

⁸ United States Geological Survey, More information available at: https://www.usgs.gov/centers/pcmssc/science/coastal-storm-modeling-system-cosmos?qt-science_center_objects=0#qt-science_center_objects

⁹ Guidance as of January 2019 (Fourth Assessment) can be accessed at following: http://www.climateassessment.ca.gov/techreports/docs/20180827-Projections_CCCA4-CEC-2018-006.pdf

¹⁰ Guidance as of January 2019 (Fourth Assessment) can be accessed at following: http://www.climateassessment.ca.gov/techreports/docs/20180827-Projections_CCCA4-CEC-2018-006.pdf

- Peer-reviewed methods used to produce data should be given priority over non-peer-reviewed methodologies
 - *What if data come from reports by reputable consultants, but are not peer-reviewed? What are the criteria for determining acceptability?*
 - *What if data come from IOU in-house scientists (potentially not peer-reviewed)? What are the criteria for determining acceptability?*
- The data sets replicate, in a statistical sense, historical conditions.
 - *“It is worth noting that the reproduction of historic climate statistics is arguably a necessary but not sufficient criterion for the credibility of future projections. As the observational record of the period of time under which we are experiencing climate change grows, we will have increased ability to validate models on their ability to capture historic responses to greenhouse gases, not just their ability to represent static historic climate statistics.”¹¹*
- Multiple climate variables (e.g. temperature, precipitation, wind, humidity, solar radiation) should be provided.
 - *What if there are multiple, “competing” data sets that lead to different answers? Can we develop a process by which an IOU uses all available data and utilize analysis to weigh/stack results?*
 - *E.g., Two models show coastal flood vulnerability to a certain line; one exceeds further inland. Can an IOU use both datasets, with different planning / regulatory requirements for each?*

Conclusion

Staff propose the above approach to provide an initial framework around a broad and deep body of research. From this proposal, Staff aim to prompt discussion and welcome stakeholder feedback on the following objectives for Topic 2:

1. Formation of a Technical Advisory Group, along with initial guidance on the formation and roles of the TAG
2. Consensus on criteria used to determine which climate data are recommended for use by the IOUs in adaptation planning
3. An initial list of relevant data sets that meet the above criteria that the TAG can review and consider.

¹¹Jones, Andrew, Lawrence Berkeley National Lab

Appendix B. Topic 2 Session 1 Agenda

California Public Utilities Commission

Proceeding #: R1804019: Climate Adaptation

Working Group Agenda

Topic 2: Data Sources, Models, and Tools

January 8, 2019 1:30pm – 3:30pm

South Bay Cities Council of Government's South Bay Environmental Services Center:

<http://www.southbaycities.org/programs/environmental-services-center>

20285 S. Western Ave., Suite 100

Torrance, CA 90501

For Remote Participation:

JOIN WEBEX MEETING

<https://centurylinkconferencing.webex.com/centurylinkconferencing/j.php?MTID=m1de2d91093b59a0660092a433a0f62a3>

Meeting number: 714 603 406

Meeting password: R1804019

JOIN BY PHONE

Local access number (required): 1-877-820-7831 (US) Access number: 1-720-279-0026 (US) Attendee access code: 937081

Meeting Objectives:

- Solicit input and develop an inventory of climate/weather datasets, models, and tools that exist currently and could be applied to utility climate adaptation planning.

Agenda:

1:30pm – 1:45pm Welcome and Introduction to Today's Discussion – *Reese Rogers, CPUC*

1:45pm-2:30pm Selection of Data Sources for Climate Adaptation Analyses for the Energy System – *Guido Franco, California Energy Commission*

2:30pm-3:00pm IOU's Perspective on Necessary & Available Data – *Joint IOUs*

3:00pm-3:30pm Facilitated discussion & Next steps – *CPUC Staff / All*

3:30pm - Adjourn

Appendix C. Topic 2 Session 2 Agenda

Climate Adaptation Working Group: Topic 2 – Data Sources, Models, and Tools

Agenda

Monday, February 4, 2019

10 am – 4pm

Courtyard Room
California Public Utilities Commission
505 Van Ness Ave.
San Francisco, CA

Facilitator: Juliette Hart (USGS)

10:00 – 10:15	Welcome and introductions - <i>Reese Rogers (CPUC), Juliette Hart (USGS)</i>
10:15 – 11:00	Overview of California Fourth Assessment Studies - <i>Rob Kay (SDG&E), Juliette Hart (USGS)</i>
11:00 – 12:00	Discussion of Climate Science Use & Applicability – <i>Juliette Hart (USGS), All</i>
12:00 – 1:00	Lunch
1:00 – 2:15	Discussion on Criteria for Identifying Usable Science - <i>Juliette Hart (USGS), All</i>
2:15 – 3:30	Discussion on Formation of Technical Advisory Group - <i>Juliette Hart (USGS), All</i>
3:30 – 3:45	Workshop Review & Final Discussion - <i>Juliette Hart (USGS), All</i>
3:45 – 4:00	Wrap Up & Next Step

Appendix D. List of Attendees at the Working Group Meetings on the Climate Data Sources, Models, and Tools

Date of Meeting/Description	Attendees
January 8, 2019 / Initial Meeting on Climate Data Sources, Models, and Tools (Topic 2 Session 1)	<p><i>Meeting Attendees:</i> [In Person] CPUC: Kristin Ralff Douglass, Joanna Gubman; Sempra: Deanna Haines. SoCalGas: Karineh Gregorian; SDG&E: Tim Lyons; PG&E: Heather Rock, Nathan Bengtsson; SCE: Dhaval Dagli, Tyson Laggenbauer, Brian Landry; CEC: Guido Franco, Pam Doughman; Public Advocates Office: Sonya Ziaja, Meghan O'Brien; South Bay Cities Council of Governments: Erin Cornelius, Carolyn Yvellez; ICF Consulting: Robert Kay</p> <p>[Webex Attendees Unavailable]</p>
February 4, 2019 / Full-Day Meeting on Climate Data Sources, Models, and Tools (Topic 2 Session 2)	<p>Attendees: [In Person] CPUC: Commissioner Liane Randolph, Rachel Peterson, Juliette Finzi-Hart (facilitator), ALJ Mary Mackenzie, Kristin Ralff-Douglas, Reese Rogers, Sarah Owens; CEC: Pamela Doughman, Luanne T, Guido Franco, Susan Wilhelm; OSA: Liz Whiteman; Public Advocates Office Sonya Ziaja, Meghan O'Brien, Tom Gariffo; SCE: Michael Barigian, Bryan Landry, Sarah Lee, Hiro Kuchida; PG&E: Heather Rock, Nathan Bengtsson, Steven Koenig, Jane Oliveira; SDG&E: Timothy Lyons, Brian D'Agostino, Jose Lopez; SoCalGas: Karineh Gregorian, Deanna Haines; NRDC: Mohit Chhabra, Patricia Valderrama; Climate Resolve: Jonathan Parfrey; CEJA: Roger Lin, Kelly Armijo, Adam Buchholz;; CBE: Tyler Earl;; SBUA: Paul Chernick; Gwen Johnson; Pacific Institute: Peter Gleick; Green Power Institute: Gregg Morris; California Water Association: Mari Davidson; Gridworks: Matthew Tisdale; ICF: Rob Kay; UCS: Jamesine Rogers Gibson</p> <p>[Webex] Lawrence Berkeley National Labs: Andy Jones; PG&E: Jessie Knapstein</p>

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