Date of Issuance: October 2nd, 2014

PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

ENERGY DIVISION **RESOLUTION E-4677**
October 2, 2014

R E S O L U T I O N

Resolution E-4677. The Joint Utilities request approval of 21st Century Energy Systems research and development projects and Cooperative Agreement.

PROPOSED OUTCOME:

- Approve the proposed budget.
- Approve the proposed project business cases and Cooperative Research and Development Agreement, subject to a compliance filing incorporating modifications made herein.

SAFETY CONSIDERATIONS:

- The Commission anticipates that the proposed energy modeling and computing research projects will protect public safety by helping to prevent cyber-attacks and by mitigating any potential adverse impacts of intermittent generation on grid resources.

ESTIMATED COST:

- This Resolution approves the proposed CES-21 projects with a $35 million budget that was authorized in D.14-03-029. This Resolution does not authorize incremental spending beyond what the Commission has previously approved.

By joint Advice Letters 4402-E (Pacific Gas and Electric Company), 3030-E (Southern California Edison Company), and 2592-E (San Diego Gas & Electric Company) filed on April 25, 2014.

SUMMARY

Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E), collectively known as the Joint Utilities, filed the joint AL in compliance with Commission Decisions (D.)12-12-031 and D.14-03-029. These decisions respectively established and then modified the 21st Century Energy Systems (CES-21) program.

This Resolution approves, with modifications, the proposed cybersecurity and grid integration research and development projects contained in the joint AL 4402-E et al (joint AL), filed April 25, 2014. This Resolution directs the Joint Utilities to submit a compliance filing via advice letter containing the project business cases updated to reflect the modifications made herein. This Resolution also approves the proposed budget of $35 million for the projects. Finally, it directs the Joint Utilities to re-submit the Cooperative Research and Development Agreement (CRADA), containing updates made herein, as part of the compliance filing.

BACKGROUND

The CES-21 Program

Energy research and development (R&D) is a crucial area requiring investment for California to achieve its policy goals and ensure continued economic and social vitality in the future. Supporting R&D that ensures safe, reliable, affordable, and environmentally sustainable electricity is therefore a well-established cornerstone of California policy, and various public R&D programs have been successful in advancing these goals. The CES-21 Program leverages high-value resources and expertise to advance the technological frontiers of energy and provide ratepayer benefits.

The CES-21 Program is a public-private collaborative R&D effort between the Joint Utilities and Lawrence Livermore National Laboratory (LLNL). The objective of the program is to address challenges of cybersecurity and grid integration of the 21st century energy system for California. The CES-21 Program will utilize a team of technical experts from the Joint Utilities and LLNL who will leverage and extend ongoing research in grid cybersecurity. The program will also combine data integration with advanced modeling, simulation, and analytical tools to provide the problem solving and planning necessary to address challenges of grid integration.

Timeline and Procedural Background

On July 18, 2011, the Joint Utilities filed Application (A.) 11-07-008, which requested authority to recover the costs for funding the CES-21 Program up to a maximum of $152.19 million in program funding over five years.

In December 2012, the California Public Utilities Commission (Commission) issued D.12-12-031, which authorized the Joint Utilities to enter into a five year research and development agreement with LLNL. This decision authorized the Joint Utilities to spend a total of $152.19 million over five years, with costs allocated to each of the utilities (PG&E – 55%, SCE – 35%, and SDG&E – 10%), and adopted a ratemaking mechanism for each utility to permit recovery of those costs.

On September 26, 2013, Governor Brown signed Senate Bill (SB) 96, which among other things, limited the scope of the CES-21 Program, narrowed its focus to cybersecurity and grid integration R&D projects, and provided a budget cap of $35 million in total over a five year period.[1] SB 96 also directed the Commission to require the Joint Utilities to prepare and submit a joint report to the California legislature by December 1, 2013.[2]

On March 27, 2014, the Commission approved D.14-03-029, which modifies D.12-12-031 to comply with SB 96. In D.14-03-029, the Commission:

- Reduced the CES-21 budget to $35 million (including franchise fees and uncollectibles) over a five-year period[3];
- Limited areas of research to cybersecurity and grid integration[4];
- Modified the cost allocation to PG&E – 50%, SCE – 41%, and SDG&E – 9%[5];
- Reduced the governance structure to three Project Managers, one each from PG&E, SCE, and SDG&E[6];

[1]SB 96 added Section 740.5 to the Public Utilities Code.

[2] Public Utilities Code Section 740.5 (e)(1).

[3] D.14-03-029, Ordering Paragraph (OP) 2.

[4] Id.

[5] Id., OPs 6-8.

- Voided any CES-21 program management expenditures incurred to date and capped future administrative expenses to no more than 10% of the total CES-21 budget[7];
- Required enhanced Legislative and Commission oversight of the CES-21 Program[8]; and
- Revised the CRADA guidelines and project criteria accordingly.[9]

The Joint Utilities filed the joint AL on April 25, 2014 to comply with D.12-12-031, Ordering Paragraphs (OPs) 8, 9, 12, and 14 and D.14-03-029, OPs 13, 14, and 15, which directed them to file for approval of the CES-21 multi-year research and development projects, proposed implementation plan, associated business cases, and CRADA. The joint AL included Attachment 1, CES-21 Proposed Research and Development Project Business Cases, and Attachment 2, CES-21 CRADA.

NOTICE

Notice of the joint AL was made by publication in the Commission's Daily Calendar. The Joint Utilities state that a copy of the Advice Letter was mailed and distributed in accordance with Section IV of General Order 96-B.

PROTESTS

The joint utilities' Advice Letter AL 4402-E, et al., was timely protested by the Office of Ratepayer Advocates (ORA) on May 15, 2014. The Joint Utilities responded to the protest on May 22, 2014.

In its protest filing, ORA provided three overall recommendations: 1) that the Commission order the Joint Utilities to supplement the Machine to Machine Automated Threat Response (MMATR) Project business case and proposal to include a clear implementation plan, budget, and schedule with deliverables and milestones; 2) that the Commission order the Joint Utilities to supplement the

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[6] Id., OP 9.

[7] Id., OP 10.

[8] Id., OPs 14-16, 20-21.

[9] Id., OP 13.

Joint AL to further describe how the MMATR proposal complements and/or leverages all cybersecurity efforts; and 3) that the Commission deny the Flexibility Metrics and Standards Grid Integration Project.

The following is a more detailed summary of the major issues raised in the protest and response. We address all these issues in the following "Discussion" section.

Protesting Party's First Claim: The Joint AL does not provide a sufficiently detailed implementation plan for the MMATR Project, as required by D.14-03-029, OP 14.

As part A of its justification for its recommendation that the Joint Utilities supplement their MMATR project proposal, ORA states in its protest that the project business case fails to comply with the requirements of OP 14 because it "merely presents a list of eleven proposed tasks. …the plan to implement and execute the tasks is not provided." ORA also states that the MMATR proposal does not describe how or whether the tasks impact each other or the overall project, and does not include a schedule or budgets for the tasks. Overall ORA claims that this Joint AL does not provide a sufficiently clear and detailed implementation plan with deliverables and milestones for the project. ORA further claims that this omission would preclude effective annual reporting by preventing the establishment of a baseline against which progress could be evaluated. ORA states that the CES-21 Joint AL 3379 – G/4215 filed on April 19, 2013 (prior to program changes made in SB 96) contained more detailed business cases and ORA is unclear as to why this current joint AL does not. For these reasons, ORA recommends that the Commission order the Joint Utilities to supplement the MMATR Project proposed business case with a detailed schedule that aligns with the annual report requirements in D.14-03-029, Attachments B and C.

In their response to these claims, the Joint Utilities state that the joint AL provided a clear and comprehensive proposed research project business case including project description, approach assessment, and implementation plan and schedule. They state this information is included in AL Attachments 1 and 2, pages 9-12 and 4-6, respectively, and CRADA Attachment A, pages 10-11. The Joint Utilities state that the level of detail in this joint AL is similar to the prior joint AL. They describe the MMATR Project as having three phases: background cybersecurity research, algorithm and tool development, and reporting. Additionally, the Joint Utilities state they will provide status updates within annual reports, and that they will adjust milestones and deliverables of the

research project to reflect ongoing results. They commit to coordinating to ensure the program stays within budget, and to providing briefings to ORA and otherwise supporting ORA's informational needs, but assert that the AL "fully satisfied the requirements in D.14-03-029."

Protesting Party's Second Claim: The joint AL does not sufficiently clarify and demonstrate that the MMATR Project complements and/or leverages other cybersecurity efforts.

As part B of its justification for recommending the supplementation of the MMATR proposal, ORA states that the joint AL does not sufficiently identify other ongoing research or show that the project is different and scoped to provide new contributions. ORA acknowledges the joint AL's descriptions of coordination done to prevent duplication, but states that what it considers to be a "general claim" is not sufficient for determining non-duplication. ORA cites multiple other cybersecurity efforts planned or being undertaken by each of the Joint Utilities, DOE, and others as evidence the Joint Utilities should further demonstrate and characterize their coordination efforts. ORA states the Commission should require the Joint Utilities to further demonstrate, describe, and characterize the nature and extent of their duplication-prevention due diligence, specifically: 1) explain the type of coordination done (whether via email, meetings, phone calls) and with whom; 2) describe how it "convinced them the MMATR Project is not duplicative and indeed unique"; 3) identify past, ongoing, and proposed cybersecurity projects and describe how the MMATR Project complements and furthers those efforts.

In their response, the Joint Utilities state they have exercised "extensive due diligence in coordinating with national R&D leaders in the electric grid cyber security area." They provide details about five coordination activities: 1) visits to the Pacific Northwest National Laboratory and the Idaho National Laboratory; 2) discussions with Sandia National Laboratories, Lawrence Berkeley National Laboratory, and Oak Ridge National Laboratory; 3) evaluation of work done by universities under the Trustworthy Cyber Infrastructure for the Power Grid umbrella; 4) solicitation of feedback and project "deconfliction" from the Electric Power Research Institute (EPRI); and 5) coordination on MMATR business case development with the DOE Office of Electricity Delivery & Energy Reliability to ensure non-duplication and coordination with its Roadmap to Achieve Energy Delivery Systems Cybersecurity. The Joint Utilities deny that the MMATR Project duplicates other work, providing detail regarding four utility efforts: 1) the ViaSat project under contract with DOE, SCE, and Duke Energy complements MMATR because it is specific to extending capabilities of software applications

that could synergistically leverage MMATR Project approaches in the future; 2) the Smart Grid Cybersecurity Project described in the 2013 SCE Annual Report on the Status of Smart Grid Investments focuses on "state of the art mechanisms as they exist today"; 3) PG&E's ADAPT project improves reactions to specific, signature-based threats, whereas MMATR will provide broader, more advanced, automated responses; and 4) none of SDG&E's existing, approved, or outlined cybersecurity efforts are "designed to address the research and development proposed" for the MMATR Project.

Protesting Party's Third Claim: the Flexibility Metrics and Standards Grid Integration Project seeks to define problems to address, but ratepayer funds should be spent on specific problems themselves.

As part of its recommendation that the Commission deny the Flexibility Metrics and Standards Grid Integration Project (Flexibility Metrics Project), ORA cites the proposed goal of Phase 1, as "to define the problem and review methodologies and analytical tools that could be used to solve the problem." ORA states that ratepayer funds should not be spent on projects in search of problems to address, but rather on those that address specific problems. ORA states that the Joint Utilities should have consulted with Long Term Procurement Plan (LTPP) and Resource Adequacy (RA) stakeholders to collaboratively develop the Flexibility Metrics Project to address real obstacles hindering efforts already underway.

In response, the Joint Utilities state that the project business case details the limitations of existing flexibility metrics and standards, and state that a lack of accepted metrics make it "difficult for the Commission to address [flexibility issues] …in LTPP and RA proceedings." They claim that therefore the Flexibility Metrics Project addresses a real problem and need, and will benefit these stakeholders. Further, they state that in April 2014 PG&E reviewed prior and under-development LTPP flexibility models and provided a public report on this review within the proceeding. The Joint Utilities state they intend to undertake "a similar collaborative process" for input and review from stakeholders, and suggest that Flexibility Metrics Project results could be presented to LTPP and RA parties in the same way as PG&E's review.

Protesting Party's Fourth Claim: the Flexibility Metrics Project is not sufficiently shown to be different from, or incremental to, other efforts in this area.

ORA states that the Joint Utilities do not describe other flexibility modeling efforts in enough detail, making it unclear how the Flexibility Metrics Project will be incremental or whether duplication will occur. ORA refers to the five

planning models under review in the LTPP, as well as a California Energy Commission (CEC) proposed research project focusing on modeling and metrics, and state the Joint Utilities did not demonstrate non-duplication or value beyond these efforts.

The Joint Utilities' reply states that the CEC project intends to "improve forecasting and modeling tools for wind and solar generation," whereas the Flexibility Metrics Project will "provide metrics and tools to determine the system's operating flexibility needs. Weather uncertainty and its impact on renewable generation is an input to the evaluation of the system's operating flexibility needs. Both…are important and beneficial to customers." The Joint Utilities further state that project business case Section 1h referenced their coordination to prevent duplication with other work, and the reply includes a copy of a letter from the CEC stating it had found no duplication with its work.

Protesting Party's Fifth Claim: the joint AL does not explain how the Flexibility Metrics Project and any results will be used by the Commission and stakeholders.

ORA states that because of its timing the Flexibility Metrics Project cannot add value to the current LTPP proceeding. Further, they state that the joint AL did not acknowledge any of the five modeling efforts currently part of that proceeding, nor did it propose a plan for incorporating project results into the LTPP. They also state that it is unclear how the LTPP will impact the project.

The Joint Utilities respond that Section 8 of the project's business case explains how results will facilitate regulatory and stakeholder processes and state that the LTPP and RA proceedings "are the most likely venues where the benefits of this project can be realized." While acknowledging that this would be difficult during the current LTPP due to timing of the project, they state that the Commission has plenty of opportunities within the biannual LTPP and annual RA proceedings for this to occur. The Joint Utilities restate their intent to share results via collaboration with these proceedings' stakeholders.

Protesting Party's Sixth Claim: the joint AL does not identify the assumptions to be used by the Flexibility Metrics Project, risking noncompatibility with other efforts

ORA claims that the Joint Utilities fail to identify and explain the assumptions their project will use, and states that because LTPP stakeholders have agreed upon assumptions and scenarios to use for their models, the Flexibility Metrics

Project may not be useful if it disregards those assumptions. ORA states it is "uncertain whether the Commission would be willing to accept any results" if baseline scenarios are not comparable to those employed in the LTPP.

The Joint Utilities respond that the Flexibility Metrics Project is not intended to quantify single-use results but rather to "develop new operating flexibility metrics and analytical tools that have multiple uses." They state that these metrics will be useful for "multiple evaluations of system adequacy and need quantifications," and can be used with other assumptions by other parties.

Protesting Party's Seventh Claim: The Joint Utilities do not provide a compelling justification for the need to use LLNL's supercomputing capabilities, nor explain potential consequences for relying on these capabilities

ORA states that the joint AL does not compellingly justify the use of LLNL's supercomputers, claiming that other stakeholders do not use supercomputers and that the assumptions and results of a model are more important than the speed at which it runs. They also state that if the Flexibility Metrics Project requires supercomputing support to produce results, the Joint Utilities and ratepayer funds will be unreasonably, unsustainably dependent upon LLNL and its supercomputers.

In their response, the Joint Utilities state that the extent to which the project will use supercomputers "will be informed by a review of available tools," that they have the opportunity to use and choose from various supercomputers, and that regardless of which are used, they do not expect "that having ongoing super-computing capabilities will be necessary to make future use of the output of this project."

DISCUSSION

The Commission has reviewed the joint AL and attached business cases and CRADA, along with the protest and reply. Commission staff also convened a consensus meeting between the Joint Utilities and ORA to discuss some of the issues raised. Based on this review and analysis, and consistent with Commission decisions and applicable statutes, the following discussion evaluates the protests, business cases, and CRADA.

Discussion and Resolution of Protested Issues

The implementation plan for the MMATR cybersecurity project

The overall ORA protest regarding the proposed implementation plan is that it is not detailed enough and lacks sufficient milestones and deliverables, and that this would hamper Commission oversight of the project's progress. The Commission conducted a review of the joint AL, business case, and CRADA with regard to MMATR implementation details. The joint AL describes the CES-21 program management approach and structure (page 4). On page 6, in the context of discussing project benefits, the joint AL states the Project Managers will "actively review each research project's progress against the milestones and deliverables," with the conditions that as research, "plans, milestones, and deliverables…are adaptive and may evolve." The joint AL further states that significant revisions and course corrections will be documented and included in annual reports.

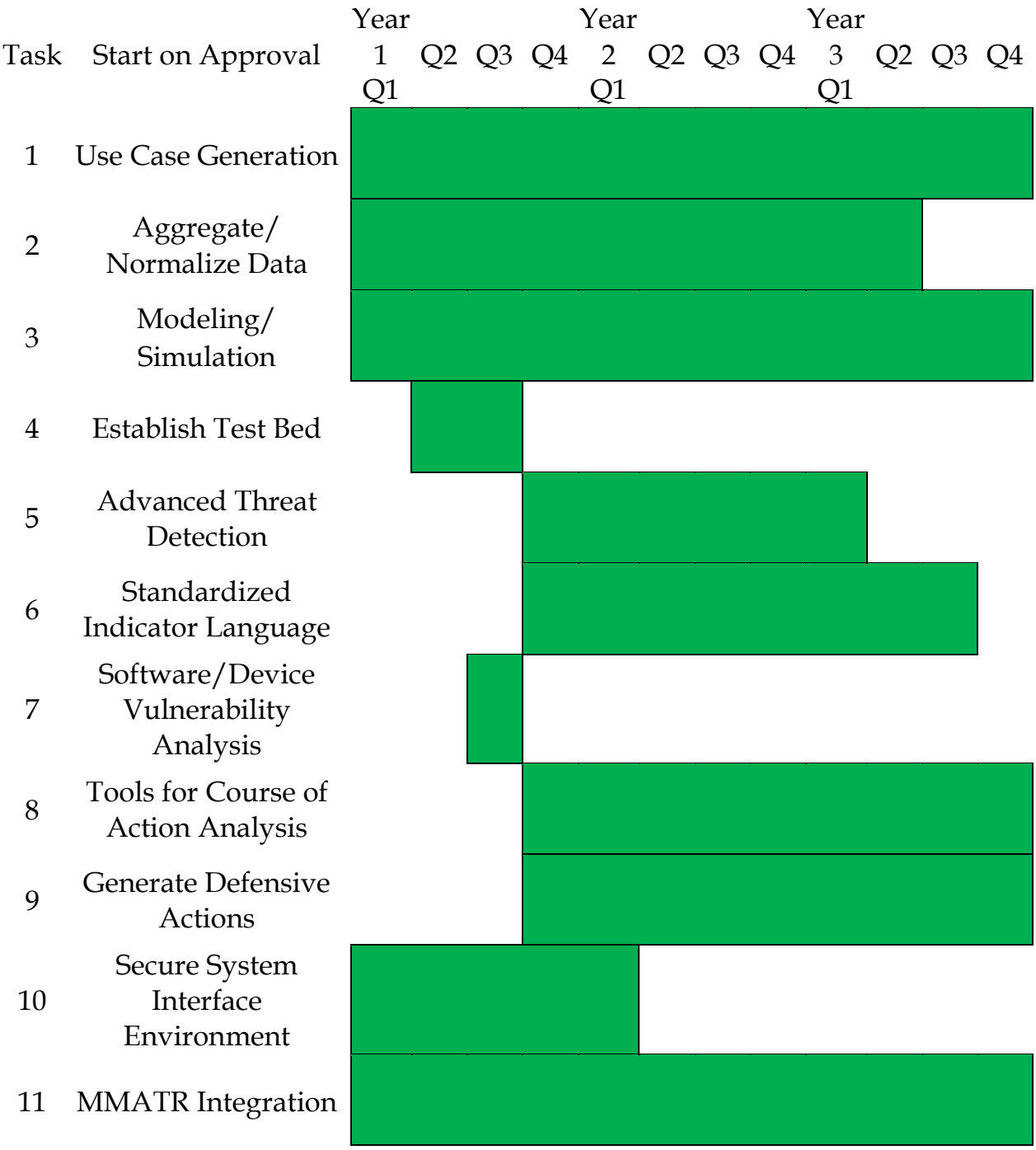
In Attachment 1 of the joint AL, CES-21 Proposed Research and Development Project Business Cases, the Joint Utilities' MMATR business case proposal description consists of a background section, discussion and list of objectives, and expected results in bullet point format (pages 6-8). The research approach section consists of a table giving an assessment of the approach (page 8). The implementation plan and schedule section consists of 11 tasks listed in paragraph form, and a list of resource requirements (pages 9-12). A budget breakdown section gives estimated funding to LLNL/subcontractors and to utilities over three years (page 12). Finally, the Commission notes that a work plan in the form of an estimated visual timeline is included in the CRADA Attachment A, page 10. A list of deliverables, each described as a document describing spiral (which the Commission understands as terminology for the phase of the project) results, is included also.

Based on review of these elements, the Commission agrees with ORA's protest and finds that the proposed MMATR implementation plan was not sufficiently detailed. The project business case does not include a timeline or implementation plan by which the tasks will be managed; the terms "milestone" and "deliverable" do not appear in the business case. The 11 tasks listed in pages 9-12 are sufficient in terms of describing the work to be done but do not consistently identify task interdependencies, timelines, or relative importance to the success of the project. Furthermore, it is unclear why the estimated timeline was included in the CRADA but not in the business case; the Commission also notes that the estimated timeline lists only ten tasks rather than 11 ("Secure System Interface

Environment" is not included). This makes it hard for the Commission to conclude that the estimated timeline in the CRADA serves as a sufficient work plan for the tasks in the business case. The Joint Utilities' reply helpfully characterizes the project as having three phases but does not say how these phases will be delineated and tracked or which tasks they include.

As previously stated, the Commission convened a consensus meeting with the Joint Utilities and ORA to discuss protested issues. As a result, the Joint Utilities specified additional milestones, deliverables, and detail in the form of the "MMATR estimated timeline of tasks and work plan" and additional project management elements provided below.

MMATR estimated timeline of tasks and work plan



Additional project management elements:

- **Task Oversight:** The critical path represents the main interdependent tasks whose failure or non-completion would endanger the entire project. The MMATR Project critical path consists of, and connects, tasks 1, 2, 4, 6, 8, and 9.
- **Continual Management:** Task 11 consists of continual cycles of review and evaluation using the Agile Development Cycle. This may lead to redirection of efforts.
- **Reporting:** The Project Managers will provide reports to the Commission. Informal reporting will take place at the end of every six month period. Formal reports will be submitted annually as well as within 60 days after completion of R&D as required by D.12-12-031. All reports will identify the critical tasks including their percent completeness and estimates for completion date.
- **Programmatic Review Meetings:** Project Managers will meet with Energy Division and ORA staff every six months after the start of the project for programmatic review and status updates. Current technical direction and program management metrics will be reviewed. Technical direction updates will be provided verbally, and confidential documentation reviewed in a reading room, due to the nature of the work. In their comments on this draft Resolution, the Joint Utilities clarified that this reading room can be "transportable" to efficiently provide confidential information to Commission staff at the Commission's offices in San Francisco.

This Resolution requires the foregoing "MMATR estimated timeline of tasks and work plan" and additional project management elements be fully adopted and used by the Project Managers of the MMATR Project; this Resolution also requires the Joint Utilities to add these changes to the project business case and submit the updated business case via compliance filing. Additionally, the Project Managers must update the estimated timeline within the CRADA Attachment A to match the one above and include the updated CRADA in the compliance filing.

To inform future Commission oversight of future project progress, the Joint Utilities also provided more detail about the Agile Development Cycle project management method to be used in the MMATR Project. The cycle schedule is fixed and development is gauged against pre-defined metrics for each task.

Progress will be evaluated continually, and work will continue only if it is deemed by the Project Managers to be within pre-set risk tolerance and completion criteria. If progress does not meet these criteria, that work becomes a candidate for "off-ramping," or discontinuation. Project Managers will conduct a final cost/benefit and risk assessment for any tasks being considered for off-ramping. A plan for disposition will be adapted and the task can be off-ramped or continued.

The Commission finds these additional details and requirements reasonable and beneficial to tracking, evaluating, and managing the project to a successful conclusion. This Resolution requires Project Managers to inform the Director of the Energy Division or the Director's designee via letter if and when any critical path task is considered or selected for discontinuation. The Commission further finds that, with these formal additions to the implementation plan, the plan is now sufficiently detailed and the concerns raised by ORA have been addressed. As with all research projects, a certain level of flexibility and uncertainty is inherent and the Commission understands that specific deliverables and timelines may change.

MMATR as incremental cybersecurity effort

ORA's primary protest in this area is that the joint AL does not sufficiently demonstrate the MMATR Project is non-duplicative of other cybersecurity efforts. D.12-12-031 requires the business cases to "review the project to ensure it does not duplicate other research"; Public Utilities (PU) Code Section 740.1(d) requires the Commission to hold as a guideline in approving research the avoidance of unnecessary duplication.

Based on review of the materials, additional information provided by the Joint Utilities at the session convened by Commission staff, and consistent with previous decisions, the Commission rejects ORA's second claim and finds that the Joint Utilities have sufficiently demonstrated the MMATR Project is unique and incremental in the cybersecurity space. The business case and protest reply demonstrate a reasonable process was taken to coordinate with utilities, the Electric Power Research Institute (EPRI), and the United States Department of Energy (DOE), as well as other groups, as is required by D.12-12-031 and D.14-03-029. The reply provides additional detail about visits, discussions, evaluations, feedback received, and coordination done with multiple state and national research groups and agencies. The joint AL, reply, and information provided at the consensus meeting demonstrate that the proposed work is unique in the current field of cybersecurity defense work, and the Commission is

satisfied that the project meets requirements for avoiding unnecessary duplication. The project managers are responsible for managing its progress, continuing to coordinate with other research groups and cybersecurity stakeholders, and keeping the Commission fully informed as the project develops to ensure duplication with other efforts does not arise.

Overall, the Commission finds that the concerns related to this project have been addressed. As modified, the proposed project meets the applicable requirements of D.12-12-031 and D.14-03-029, SB 96, and PU Code Sections 740.1 and 740.5. This Resolution approves the MMATR Project presented in the joint AL and its Attachment 1, as modified, subject to the compliance filing ordered by this Resolution.

The Flexibility Metrics Project and the defined problem

ORA's protest in this area states that the Flexibility Metrics Project is not demonstrably addressing a clear gap or problem, whereas the Joint Utilities' reply states that it does. In its review and analysis of this issue, the Commission finds that the project addresses a recognized problem but that some of ORA's concerns are valid in the context of the demonstrated necessity of proposed tasks in Phase 1.

PG&E (the leader of the Flexibility Metrics Project) published a report in April 2014 titled *Collaborative Review of Planning Models* (Collaborative Review). Although the Collaborative Review is not mentioned in the joint AL, nor are its recommendations contextualized in the Flexibility Metrics Project business case, the Commission finds that it serves as appropriate background material for this issue. The Collaborative Review incorporates input from stakeholders in the Commission's current Long Term Procurement Plan (LTPP) proceeding.[10] It evaluates five models and identifies the point where analysis provided by each model ends, beyond which additional studies can be understood as incremental. The five reviewed models are CAISO's deterministic approach, E3's Renewable Energy Flexibility (REFLEX) model, SCE's stochastic approach, Astrape Consulting's Strategic Energy and Risk Valuation Model (SERVM), and LLNL and CEC's weather model.

[10] PG&E solicited input from 2014 LTPP stakeholders to produce this review, and sent the review to the service list of the 2014 LTPP (R. 13-12-010), but it was not a formal product of the proceeding and is not on the record.

The Collaborative Review identifies eight important modeling features useful in evaluating the performance of the grid and defining possible solutions to deficiencies. These features include the ability to run multiple scenarios, consideration of production costs and transmission constraints, and consideration of modeling operating constraints.[11] The five reviewed models consider these features to varying extent but the Collaborative Review concludes that much work remains, and suggests three areas that future work should focus on: 1) developing system-wide flexibility metrics and standards, 2) improving how the grid outside of California is modeled, and 3) reducing model run time to enable a greater number of sensitivity runs.[12] As described in the business case, the Flexibility Metrics Project seeks to study this interrelated set of issues. While there may not be universal consensus about the best approach towards resolving them, the Commission finds that these issues are recognized and that they were identified with LTPP stakeholder input.

However, the Flexibility Metrics Project proposed Phase 1 tasks (gather and analyze data, review methodologies and tools, and determine how to incorporate current findings) may be similar to work already completed by PG&E in the Collaborative Review. Because the project business case does not mention this Review or specify how Phase 1 work will build upon its recommendations the Commission cannot conclude whether the potential for overlap exists. Therefore this Resolution requires that to the extent that the Collaborative Review already identifies applicable gaps, research needs, or limitations of current models, the Flexibility Metrics Project Manager must ensure that Phase 1 work builds off these findings and must not spend time or project funds on redoing work. The Commission finds this reasonable and consistent with the Project Manager's existing responsibility to avoid unnecessary duplication of efforts. This requirement should not be burdensome because the Collaborative Review and the proposed project involve some of the same PG&E staff members. Future reports containing updates on Phase 1 should clearly identify which aspects of the Collaborative Review have informed the project.

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[11] Pages 7-8, Collaborative Review of Planning Models, April 18, 2014. Available online at http://www.cpuc.ca.gov/NR/rdonlyres/ECE43E97-26E4-45B7-AAF9-1F17B7B77BCE/0/CombinedLongTermProcure2014OIR_Report_CollaborativeReview.pdf

[12] Page 8, Collaborative Review.

The Flexibility Metrics Project as incremental work

ORA protests that the proposed modeling project is not demonstrated to be incremental to existing efforts, particularly in light of the multiple other flexibility models currently under review in the 2014 LTPP. Based on its review of the joint AL, reply, PG&E's Collaborative Review, and information provided during the aforementioned consensus meeting, the Commission rejects this protest and finds that the Flexibility Metrics Project is reasonably justified as adding diversity of analysis to current flexibility modeling efforts.

Planning for future electric generation needs faces a new challenge in California: assessing and managing complex issues related to operational flexibility. In the LTPP, the Commission is in the process of examining whether a single modeling approach – deterministic, stochastic, or other – can determine whether there is a need for flexible resources.[13] Because the modeling studies being introduced into the LTPP are testing new approaches, the additional study proposed in this project adds to the diversity of analyses that the Commission may be able to consider.

The joint AL, reply, Collaborative Review, and information provided at the consensus meeting show that existing models related to grid flexibility in the LTPP are investigating similar fundamental questions as the proposed project, but with significant differences in terms of focus and goals.

For example, the Flexibility Metrics Project's objective is to:

> "[D]efine new operating flexibility metrics and standards based on a probability measure of the occurrence, the magnitude, and the duration of ramping shortages at different time intervals. These metrics will be applied using production simulation and reliability models of the California system to determine their robustness under a wide range of realistic scenarios of weather conditions, and loads and renewable generation scenarios."[14]

The work to be undertaken in the 2014 LTPP involves the same issues and the same types of models. For example, the LTPP will study both deterministic and stochastic model results and address the questions of: "Is there a need for

[13] Page 5, May 6, 2014 Scoping Ruling, R.13-12-010.

[14] Pages 6-7, Flexibility Metrics and Standards Proposed Research Project Business Case.

additional flexible resources to meet operational flexibility requirements during the forecast period, now through 2024? What is the preferred tool for determining whether there is a need for flexible resources?"[15]

One significant difference, however, is that the current LTPP proceeding does not have the explicit goal of establishing a reliability standard for operational flexibility. It is focused on the immediate question of whether new flexible resources should be procured now to ensure system reliability. The Flexibility Metrics Project, on the other hand, has an explicit objective of developing and possibly proposing, within a future Commission proceeding, an alternative measure of reliability in the system. As the business case states, a new, more robust modeling approach could allow long-term system planners to use a measure other than a Loss of Load event or a Planning Reserve Margin to express the sufficiency of resources to meet reliability needs.[16] This is a potential benefit from the project that is additional to present long-term planning studies.

The proposed project will supplement the range of modeling studies presently being developed within the current LTPP, especially in the development of metrics and standards to measure electric system reliability, and it can be expected to add to the diversity of analyses that may ultimately be considered by the Commission in future proceedings. Thus, the Commission finds that the proposed Flexibility Metrics Project is reasonably demonstrated to be supplemental to other current modeling efforts.

Ensuring the Flexibility Metrics Project results will be useful

ORA's protest in this area focuses on concerns relating to how project results can be compatible with, affected by, and incorporated into Commission proceedings. The joint AL and reply make clear that the project's stated objective is to develop a flexibility standard to be incorporated into Commission LTPP and/or Resource Adequacy (RA) proceedings. They also clearly state that any realization of benefits from the project also likely depends upon its results being incorporated into Commission proceedings. These considerations make the issue of integration with Commission proceedings an important one.

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[15] LTPP Scoping Ruling, May 6, 2014 at 4-5

[16] Page 3, Flexibility Metrics and Standards Proposed Research Project Business Case.

The Commission reviewed the joint AL and business case for this project and finds that ORA's concerns are warranted. Although the project approach is reasonable and the work beneficial, the proposal does not contain a specific plan of action Project Managers will take to ensure results can and will be integrated with Commission proceedings. To say that the flexibility standard can be used in an eventual future LTPP or RA proceeding, and that results will be shared with those stakeholders, is appropriate and commendable but constitutes broad expectations rather than a plan. Project and proceeding uncertainties notwithstanding, these expectations must be made plain by tasks, deliverables, and milestones.

As a result of the consensus meeting convened by Commission staff, additional process details were identified to help ensure project results are made useful. The utilities proposed the three following elements to add to the project process to increase the likelihood that the benefits of the Flexibility Metrics Project are realized. It is noted here that the additional input related to this project comes from PG&E and SDG&E, as SCE is not funding or supporting the Flexibility Metrics Project.[17]

First, the utilities proposed to form a Collaborative Advisory Group that includes Commission staff, the California Independent System Operator, ORA, The Utility Reform Network, and other experts who can provide input and review deliverables as they become available. The utilities propose this advisory group meet every six months to review progress.

Regarding this first proposal, the Commission finds that having an advisory group for stakeholders is a beneficial addition to the Flexibility Metrics Project implementation plan, and this Resolution adopts it as such. The Project Managers should ensure Commission staff for LTPP and RA proceedings have the opportunity to participate; other experts should include those working on other flexibility models in these proceedings. The primary purpose of the advisory group should be to assist in connecting the Project Managers and project progress with ongoing developments in LTPP and RA flexibility modeling efforts, and vice versa. The Commission may request additional

[17] As explained on page 2 of the Flexibility Metrics and Standards Project Business Case, contained in Attachment 1 of the joint AL, "SCE is placing its highest priority on addressing utility cyber security issues. As such, SCE will not be supporting or allocating resources to the Flexibility Metrics and Standards project."

meetings to collaborate and share input as the project and LTPP activities progress.

Second, the utilities proposed they take the following specific actions to help ensure results are integrated with Commission proceedings. They proposed the actions assuming the project will be funded and able to start on November 1, 2014, and the 2016 LTPP timeline will be similar to that of the on-going 2014 LTPP.

The proposed actions include:

1) The project will use the assumptions from the 2014 LTPP (such as the Trajectory Scenario) to evaluate different possible operating flexibility metrics and standards.
2) The Project Manager will present the preliminary results and recommendations in a public workshop in early 2016 using initial input assumptions from the 2014 LTPP.
3) Assuming applicable 2016 LTPP modeling assumptions are available during the project time span, the Project Manager will demonstrate the use of any recommended flexibility metrics and standards with at least one of the scenarios adopted in the Commission's 2016 LTPP assumptions and scenarios decision. This demonstration will be filed within that proceeding.
4) Parties in the 2016 LTPP will have the opportunity to comment on results and recommendations.

The Commission finds that these additional activities are necessary, beneficial, and important to the success of the Flexibility Metrics Project and realization of its benefits, and this Resolution requires them. Furthermore, the Commission recognizes that such activities represent a commitment within the project management process to take *reasonable and intentional actions to ensure resulting metrics and standards are useful and valuable to proceedings*. Therefore this Resolution requires these or similar activities regardless of whether the project starts on November 1, 2014 and irrespective of the specific timeline of future proceedings. Additionally, this Resolution specifies that activities 1 and 3 above must, at the least, use the Trajectory Scenario specifically, because in the event that only one scenario assumption is used, it should be the "most likely" scenario adopted by the Commission.

The Commission's intent is to ensure that the metrics and standards are useful in Commission proceedings, and minor delays should not be seen as a reason to deviate from that commitment. For example, if the project starts later than November 1, 2014, the Project Managers can still present whatever results or status updates they have via a workshop at an appropriate time during the 2016 LTPP. Six month reports must include progress updates toward these actions. If factors arise that could preclude the actions, the Project Managers must inform the Commission and work with Energy Division and ORA staff to identify the best way to help ensure results are useful and valuable to proceedings at that time. Because the Flexibility Metrics Project's ultimate usefulness depends on integration with Commission proceedings, and particularly in light of the enhanced oversight signals provided by D.14-03-029 and SB 96, the Commission finds these process requirements appropriate and necessary.

Third, the utilities propose a final stage of activities entitled Transfer Project Benefits and Results. They commit to publishing a final report with findings and recommendations and making it publicly available to all parties through the LTPP. They also commit to ensuring that other parties in the LTPP proceeding will be able to license and use any new or improved tools (if any) that are developed through the project.

The Commission finds the activities and commitments in this third proposal beneficial and important to the eventual usefulness of the project results, and this Resolution approves these additions to the project management process (although a final report is not a new requirement, it is beneficial to clarify that it will be provided within the 2016 LTPP proceeding). In keeping with this commitment, this Resolution requires the Project Managers to inform the Commission if they become aware of any barriers that could hinder or prevent other parties from licensing or using any tools developed through the project. In addition, this Resolution requires the full database of detailed input assumptions to be made publicly available along with the final report, to the extent possible according to the CRADA. Finally, and consistent with the proposed activities, this Resolution requires the Project Managers to offer an informal training session for Commission staff on the tools and metric(s) developed by the project. This can be held concurrently with a workshop or Collaborative Advisory Group meeting, or at another time. The Commission additionally clarifies that: 1) these requirements and activities can and should be integrated efficiently into the project process at points that serve rather than hinder its progress, at the discretion of the Project Managers; and 2) the 2016 LTPP may be the target venue

for the use of project results, but is not the exclusive venue; above all, our intent is to reasonably integrate results with applicable Commission proceedings and grid integration advancements.

As a result of the additional proposed actions that are approved herein, the Commission finds that the concerns raised by ORA in this area have been fully addressed. The Commission commends the parties for their productive collaboration and commitment to reaching consensus for the benefit of this important research.

Assumptions and compatibility for the Flexibility Metrics Project

The protest in this area regards the assumptions and inputs to be used, and whether uncertainty therein affects the usefulness of eventual results. In their reply to ORA's protest, the utilities state that resulting tools and/or metrics will be usable with other assumptions by other parties. As previously discussed, this Resolution requires that the Project Managers take action to ensure stakeholders can use the results. Also, the aforementioned commitments and modifications made herein represent specific actions that will help ensure compatibility and usefulness.

However, one of the most important tools for ensuring the usefulness of the proposed work is transparency of the assumptions and inputs; this includes access to the full input assumptions that are tailored to the specific approach or at a higher level of detail. This Resolution therefore requires that the Project Managers provide the database of detailed inputs and assumptions to the Collaborative Advisory Group and make it publicly accessible via LLNL's website or a project website. The Project Managers shall also facilitate review of the database by the Collaborative Advisory Group during the course of the project, such as after the initial completion of the database before modeling starts and when the database undergoes a major update.

Based on review and analysis of the joint AL, protest and reply, and in light of the modifications made herein, the Commission finds that the project will be sufficiently poised to connect with stakeholder assumptions and be compatible with Commission processes.

The Commission finally acknowledges that a certain balance must be struck between full compatibility with other efforts and unique advancements within this project; the Commission expects the actions and commitments approved in this Resolution to serve as effective feedback loops, but does not expect that the

project results will be wholly compatible with or identical to all approaches taken by other groups.

Justification for and consequences of using supercomputing

The final issue raised in protest is that of the justification for using LLNL's supercomputing capabilities, and potential consequences therein. After reviewing the submitted materials and meeting with the Project Managers, the Commission rejects ORA's protest in this area and is satisfied that the project's use of supercomputing is reasonable and that the project can avoid depending on LLNL's capabilities after the end of the project.

As was previously discussed, the project is demonstrably broader, more advanced, and/or more complex than various existing efforts, and the gaps and research needs in this area are known to be complex. Gaps in flexibility planning are also characterized by variable interdependencies, predictions, and probability uncertainties. Thus, the Commission finds it is reasonable that this project, particularly because of its relatively modest budget resources, uses existing advanced supercomputing capabilities and expertise. The use of advanced computing is understood by the Commission to be part of the project's ability to quickly address as many questions as is possible and useful.

In regards to the possibility of future dependency on LLNL, the utilities have made clear within the proposed tasks, approach, and CRADA that they have discretion and review over the extent and nature of supercomputing done by LLNL. This allows the Commission to find and conclude that regardless of the computing used the Project Managers are fully empowered to ensure that stakeholders can use the tools or results, as they have proposed to do and as is required by this Resolution.

Overall, the Commission finds the issues raised in protest have been addressed, and rejects ORA's broader recommendation to deny the Flexibility Metrics Project. As modified, the proposed project meets the applicable requirements of D.12-12-031 and D.14-03-029, SB 96, and PU Code Sections 740.1 and 740.5. This Resolution approves the Flexibility Metrics Project presented in the joint AL and its Attachment 1, as modified, and subject to the compliance advice letter filing ordered by this Resolution.

This Resolution clearly indicates the modifications to be made to the proposed projects and CRADA. Accordingly, the Commission expects the compliance advice letter will likely classify as Tier 1, but finds it necessary to make this

determination after its filing.[18] Therefore, the tier of the compliance advice letter filing ordered by this Resolution shall be designated not by the Joint Utilities but by the Commission based on review of its content, and said advice letter will not be rejected for lack of tier designation.

Review of the CRADA

The Commission has reviewed the CRADA included in Attachment 2 of the joint AL. This CRADA is marked as draft and preliminary subject to approval by the National Nuclear Security Administration. The CRADA consists of the research contract between LLNL, PG&E, SCE, and SDG&E. Its Attachment A consists of a Statement of Work, Scope, Tasks, and other implementation details for the proposed projects. Because this Resolution has made additions and clarifications to various project details, Attachment A must be updated to reflect any applicable changes. For example, as previously discussed, the estimated schedule for the MMATR Project needs to be updated. Therefore this Resolution approves the CRADA, subject to the Joint Utilities' compliance filing containing a final CRADA with Attachment A updated to reflect the changes in this Resolution.

Additionally, and related to matters that must be addressed prior to the finalization of the CRADA, the Commission is required by PU Code Section 740.5 (d) to require that LLNL ensures CES-21 cybersecurity work is new and non-duplicative. As discussed in the prior discussion section, this Resolution finds that the MMATR Project fulfills this criterion. Consistent with D.14-03-029 OP 12, this Resolution requires that the Project Managers ensure that LLNL confirms this finding before finalizing the CRADA.

COMMENTS

Public Utilities Code section 311(g)(1) provides that this Resolution must be served on all parties and subject to at least 30 days public review and comment prior to a vote of the Commission. Section 311(g)(2) provides that this 30-day

[18] Consistent with General Order 96-B (available at http://docs.cpuc.ca.gov/PUBLISHED/GENERAL_ORDER/164747.htm), Energy Industry Rule 5 et seq., the Commission may reclassify the tier of the Advice Letters submitted pursuant to this Resolution based on analysis of the content.

period may be reduced or waived upon the stipulation of all parties in the proceeding.

The 30-day comment period for the draft of this Resolution was neither waived nor reduced. Accordingly, this draft Resolution was mailed to parties for comments, and the Joint Utilities submitted comments on September 15, 2014. Their comments consisted of minor typographical corrections and requests for clarifications noted herein, including a request that the compliance filing be due within five business days, rather than five days, after the approval of this Resolution.

FINDINGS

1. D.12-12-031 and D.14-03-029 respectively established and then modified pursuant to SB 96 the 21st Century Energy Systems (CES-21) Program. The CES-21 Program is a public-private collaborative R&D effort between the Joint Utilities and Lawrence Livermore National Laboratory (LLNL).
2. The CES-21 Program will utilize a team of technical experts from the Joint Utilities and LLNL who will leverage and extend ongoing research in grid cybersecurity. The program will also combine data integration with advanced modeling, simulation, and analytical tools to provide problem solving and planning necessary for the challenges of grid integration.
3. Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E), collectively known as the Joint Utilities, filed Joint AL 4402-E et al. in compliance with D.12-12-031 and D.14-03-029.
4. Pursuant to D. 12-12-031, OPs 8, 9, 12, and 14 and D.14-03-029, OPs 13, 14, and 15, the joint AL seeks approval of the CES-21 multi-year research and development projects, proposed implementation plan, associated business cases, and CRADA.
5. The joint utilities' Advice Letter AL 4402-E, et al., was timely protested by the Office of Ratepayer Advocates (ORA) on May 15, 2014. The Joint Utilities responded to the protest on May 22, 2014.
6. The protest by ORA raised several issues related to implementation details, duplication of efforts, need for specific proposed work, consequences of the selected approach, and other issues.
7. Commission staff convened a consensus meeting with the Joint Utilities and ORA to address issues raised in protest.

8. This meeting resulted in the identification of additional details and project management elements that substantively addressed many of the issues raised.
9. As modified, the MMATR Project meets appropriate and applicable requirements.
10. PG&E published a Collaborative Review of Planning Models report in April 2014. This review, developed out of coordination with flexibility modeling stakeholders in the Commission's current Long Term Procurement Plan (LTPP) proceeding, evaluates other models and identifies incremental modeling needs.
11. Traditional approaches for planning future electric generation needs for supply have not fully incorporated or assessed complex issues related to flexibility, and there is no standard for operating flexibility established within the LTPP.
12. As modified, the Flexibility Metrics Project meets appropriate and applicable requirements.
13. As with all research projects, a certain level of flexibility and uncertainty is inherent and specific deliverables and timelines may change.
14. Research uncertainties notwithstanding, research goals and expectations must be made plain by tasks, deliverables, and milestones; in light of the enhanced oversight signals provided by D.14-03-029 and SB 96, additional process requirements are appropriate and necessary.
15. As modified, the proposed projects meet the applicable requirements of D.12-12-031 and D.14-03-029, SB 96, and PU Code Sections 740.1 and 740.5.

THEREFORE IT IS ORDERED THAT:

1. The CES-21 budget of $35 million is hereby approved for the proposed research and development projects, as modified. Funds must be expended within five years of the approved projects' start date.
2. The proposed MMMATR cybersecurity project, with a funding allocation of $33 million, is hereby approved, as modified, subject to the Joint Utilities' filing a compliance advice letter within 5 business days of the approval of this Resolution. The compliance advice letter shall contain an updated business case for the MMATR project that reflects the modifications and clarifications made in this Resolution and listed below:

a. The "MMATR estimated timeline of tasks and work plan" and additional MMATR project management elements identified in this Resolution's discussion section must be fully adopted into the business case and used by the Project Managers of the MMATR Project.

b. The Project Managers will inform the Director of the Energy Division or the Director's designee via letter if and when any critical path task is considered or selected for discontinuation.

c. The Project Managers are responsible for managing its progress, continuing to coordinate with other research groups and cybersecurity stakeholders, and keeping the Commission fully informed as the project develops to ensure duplication with other efforts does not arise.

3. The proposed Flexibility Metrics Project, with a funding allocation of $2 million, is hereby approved, as modified, subject to the Joint Utilities' filing a compliance advice letter within 5 business days of the approval of this Resolution. The compliance advice letter shall contain an updated business case for the Flexibility Metrics Project that reflects the following modifications and clarifications made in this Resolution and listed below:

a. To the extent that PG&E's Collaborative Review of Planning Models already identifies applicable gaps, research needs, or limitations of current models that otherwise would have been done in Phase 1, the Project Managers will ensure that Phase 1 work builds off these findings and must not spend unnecessary time or project funds on redoing work. Reports containing updates on Phase 1 will clearly identify which aspects of the Collaborative Review have informed the project.

b. The Project Managers shall form a Collaborative Advisory Group that includes Commission staff, the California Independent System Operator, ORA, The Utility Reform Network, and other experts; "Other experts" should include those working on other flexibility models in Commission proceedings. The advisory group will meet once every six months. The primary purpose of the advisory group will be to assist in connecting the Project Managers and project progress with ongoing developments in LTPP and RA flexibility modeling efforts, and vice versa.

c. The Project Managers shall incorporate these four actions into the project management process:

    1. The project will use 2014 LTPP assumptions, including the Trajectory Scenario, to evaluate different possible operating flexibility metrics and standards.
    2. The Project Managers will present the preliminary results and recommendations in a public workshop in early 2016 using initial input assumptions from the 2014 LTPP.
    3. Using any applicable 2016 LTPP modeling assumptions that are available during the project time span, the Project Managers will demonstrate the use of any developed flexibility metrics and standards with at least one of the scenarios (and if only one, the Trajectory Scenario/expected case) adopted in the Commission's 2016 LTPP. This demonstration will be filed within that proceeding.
    4. Project Managers will ensure that parties in the 2016 LTPP will have the opportunity to comment on results and recommendations.

d. The actions listed in Ordering Paragraph 3c or their proxies shall take place regardless of project or Commission proceeding timelines. Reports will include progress updates toward these actions. Should unforeseen changes prevent them, the Project Managers will inform the Director of the Energy Division or the Director's designee via letter and work with the Commission to identify the best proxy actions; appropriate proxy actions would be ones that reasonably and intentionally help ensure results are useful and valuable to Commission proceedings.

e. The Project Managers shall undertake a final stage of activities entitled Transfer Project Benefits and Results, which shall include: i) publishing a final report with findings and recommendations and making it publicly available to all parties through the LTPP, ii) making the full database of detailed modeling input assumptions available, to the extent allowed by the CRADA, iii) ensuring that other parties in the LTPP proceeding will be able to license and use any new or improved tools (if any) that are developed through the project, and iv) an

informal training session for Commission staff on the tools and models developed by the project. The Project Managers will inform the Commission via a letter to the Director of the Energy Division or the Director's designee if they become aware of any barriers that could hinder or prevent other parties from licensing or using any tools developed through the project.

f. The Project Managers shall provide the full database of detailed modeling input assumptions, to the extent allowed by the CRADA, to the Collaborative Advisory Group once the database is available and subsequent to any major changes.

4. The Joint Utilities are directed to file a compliance advice letter within 5 business days of the approval of this Resolution. The advice letter tier shall not be specified by the Joint Utilities, but rather shall be determined by the Commission based on review of its content. The advice letter shall contain:

    a. The changes to the project business cases identified in Ordering Paragraphs 2 and 3;

    b. The CRADA, with Attachment A updated to include the "MMATR estimated timeline of tasks and work plan" approved by this Resolution, as well as any other changes made herein that are relevant.

    c. A letter from LLNL confirming its view that MMATR research parameters reflect a new contribution to cybersecurity and that there will not be a duplication of research being done by other private and governmental entities.

    d. An updated copy of the CES-21 joint report, pursuant to PU Code Section 740.5(e)(1), to be reviewed by the Commission for submittal to the Legislature.

5. The Joint Utilities must notify the Commission via a letter to the Director of the Energy Division when the CRADA is approved by the National Nuclear Security Administration (NNSA). If the CRADA is not approved by the NNSA within 120 days of the effective date of this Resolution, the Joint Utilities must inform the Director of the Energy Division of the CRADA's status via letter, and continue to provide these letters of notification every 60 days until its approval.

This Resolution is effective today.

I certify that the foregoing Resolution was duly introduced, passed and adopted at a conference of the Public Utilities Commission of the State of California held on October 2, 2014; the following Commissioners voting favorably thereon:

/s/ Paul Clanon
PAUL CLANON
Executive Director

MICHAEL R. PEEVEY
President
MICHEL PETER FLORIO
CATHERINE J.K. SANDOVAL
CARLA J. PETERMAN
MICHAEL PICKER
Commissioners