Memorandum

To: ISO Board of Governors

From: Keith Casey, Vice President, Market & Infrastructure Development

Date: March 20, 2019

Re: **Decision on ISO 2018-19 transmission plan**

This memorandum requires Board action.

EXECUTIVE SUMMARY

Each year the California Independent System Operator Corporation undertakes a comprehensive assessment of the transmission needs of the system over a 10-year planning horizon and produces an annual transmission plan. The ISO 2018-2019 transmission plan provides a comprehensive evaluation of the ISO's transmission grid to identify upgrades needed to successfully meet California's policy goals, in addition to examining conventional grid reliability requirements and transmission projects that can bring economic benefits to consumers. The tariff requires Board approval of the transmission plan. Accordingly, Management recommends the Board approve the ISO transmission plan for the 2018-2019 planning cycle, included as Attachment A.

The number and capital costs of recommended transmission projects in the 2018-2019 transmission plan represent a modest increase from the low amounts approved in recent previous transmission plans. While the previous lows were due to the considerable progress made in earlier planning cycles in identifying and approving a wide array of transmission projects, emerging issues and evolving economic opportunities as well as localized load growth have led to more transmission projects being identified in this cycle. Given the significant amount of policy-driven transmission projects approved in past planning cycles to support meeting California's 33% renewable portfolio standard in 2020 and the fact that these already approved projects appear to be adequate for meeting a 50% renewable portfolio standard, no policy-driven transmission are being recommend for approval in this year's transmission plan. While California Senate Bill 100, the 100 Percent Clean Energy Act of 2018 which was signed into law on September 10, 2018, raised the renewables portfolio standard to be achieved by 2030 to 60% from the 50% goal previously established through California Senate Bill 350, the implementation details for achieving the goal are not sufficiently developed to inform whether any additional transmission infrastructure is needed.

In addition to the approval of the overall findings and conclusions documented in the transmission plan, and summarized in this memorandum, Management requests that the Board approve eleven reliability-driven transmission projects identified as needed to ensure compliance with NERC and ISO planning standards and two economic-driven transmission projects. All thirteen of these projects are estimated to cost approximately $644.4 million, two of which are eligible for competitive solicitation.

Other key findings and conclusions from the 2018-2019 transmission plan include:

- No policy-driven transmission projects were identified as needed for meeting the 50% RPS state policy objective.
- Seven projects that were placed on hold in the 2017-2018 transmission planning cycle were reviewed, with the following results:
    - Six transmission projects with cost estimates totaling $440 to $550 million were found to be no longer required and are recommended to be canceled.
    - One project will continue to be on hold pending reassessment in future cycles.
- A number of other projects had modifications made to their scopes, generally reducing the scope of the projects to reflect changing circumstances.

The ISO produced this transmission plan after engaging in an extensive stakeholder process. We communicated preliminary results through stakeholder presentations on September 20 and 21, and on November 16, 2018. The ISO released a draft plan on February 4, 2019 and presented it at a stakeholder session on February 14, 2019. Based on comments received from stakeholders, we conducted additional review and made further revisions, culminating in the revised draft ISO 2018-2019 transmission plan. Management proposes the following motion:

> ***Moved, that the ISO Board of Governors approves the ISO 2018-2019 transmission plan attached to the memorandum dated March 20, 2019.***

BACKGROUND

A core responsibility of the ISO is to plan and approve additions and upgrades to transmission infrastructure so that as conditions and requirements evolve over time, we can continue to provide a well-functioning wholesale power market through reliable, safe and efficient electric transmission service. Since it began operation in 1998, the ISO has fulfilled this responsibility through its annual transmission planning process.

Board approval of the transmission plan is required. Specifically, section 24.4.10 of the tariff states:

> *The revised draft comprehensive Transmission Plan, along with the stakeholder comments, will be presented to the CAISO Governing Board for consideration and approval. Upon approval of the plan, all needed transmission addition and upgrade projects and elements, net of all transmission and non-transmission alternatives considered in developing the comprehensive Transmission Plan, will be deemed approved by the CAISO Governing Board. Transmission upgrade and addition projects with capital costs of $50 million or less can be approved by CAISO management and may proceed to permitting and construction prior to Governing Board approval of the plan. Following Governing Board approval, the CAISO will post the final comprehensive Transmission Plan to the CAISO website.*

Advancing preferred resources

Increased opportunity for non-transmission alternatives, particularly preferred resources and storage, continues to be a key focus of the transmission planning analysis. In this regard, the ISO's transmission planning efforts focus on not only reliability and on meeting the state's policy objectives through advancing policy-driven transmission, but also on helping transform the electric grid in an environmentally responsible way. The focus on a cleaner, lower-emission future governs not only policy-driven transmission, but also our path for meeting other electric system needs. Of course, opportunities are based on the identified needs.

Further, preferred resource assumptions are also incorporated into the load forecasts adopted through state energy agency activities that the ISO supports, and provide an additional opportunity for preferred resources to address transmission needs.

The ISO's reliance on preferred resources to address specific reliability needs has been summarized in section 8.3 of the transmission plan, in addition to being discussed throughout the plan on an area-by-area study basis. While no new opportunities for storage were recommended for approval in this transmission plan, a significant number were studied for possible benefits. The ISO is also continuing to

work with the local utilities to fine-tune preferred resource requirements, including battery storage, which in conjunction with conventional transmission upgrades will meet reliability needs in several areas – Moorpark and Oakland in particular.

Collaborative planning efforts

The ISO, utilities, the California Energy Commission, the California Public Utilities Commission and other stakeholders worked closely together to ensure alignment of key planning assumptions within the three core planning processes, in particular a single "managed" load forecast, and to assess how to meet the environmental goals established by state policy.

The three core planning processes are the:

- Long-term forecast of energy demand produced by the CEC as part of its biennial Integrated Energy Policy Report (IEPR),
- Biennial integrated resource plan proceedings (IRP) and long term procurement plan proceedings (LTPP) conducted by the CPUC, and
- Annual transmission planning process (TPP) performed by the ISO.

The results of the CPUC's annual process feeding into this 2018-2019 transmission planning process were communicated via a decision in the CPUC's Integrated Resource Plan Process.[1] These assumptions were further vetted by stakeholders through the stakeholder process in developing the 2018-2019 study plan.

KEY FINDINGS

Our comprehensive evaluation of the areas listed above is discussed in the following sections.

Reliability-driven transmission projects

Eleven reliability-driven transmission projects were identified as needed in this planning cycle to ensure compliance with NERC and ISO planning standards, representing an investment of approximately $607.4 million in infrastructure additions to the ISO-controlled grid. All eleven projects are located in the PG&E service territory. These are comprised of nine smaller projects totaling $167.4 million and two dynamic voltage support projects totaling $440 million. The two reliability-driven dynamic reactive support

[1] CPUC Decision, http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M209/K709/209709519.Pth DF.

devices are required for voltage support on the 500 kV network in anticipation of the planned retirement of the Diablo Canyon Power Plant.

In arriving at these projects, the ISO and transmission owners performed power system studies to measure system performance against the NERC reliability standards and ISO planning standards, as well as to identify reliability concerns that included, among other things, facility overloads and voltage excursions. The ISO then evaluated mitigation measures and identified cost-effective solutions.

Following three years of comprehensive review of previously approved projects, the ISO had placed seven projects in the PG&E area on hold in the 2017-2018 transmission planning cycle. Six transmission projects with cost estimates totaling $440 to $550 million were now found to be no longer required and are recommended to be canceled. One project will continue to be on hold pending reassessment in future cycles.

Transmission elements supporting renewable energy goals

The CPUC and CEC provided policy direction to the ISO regarding renewable generation portfolios for 2018-2019 policy-driven transmission planning purposes via the CPUC decision referenced above.

Anticipating higher renewable generation requirements going forward, the CPUC communicated a portfolio based on its “42 MMT scenario” that results in approximately a 57 percent RPS as a sensitivity portfolio for policy-driven planning efforts. The CPUC declined to provide a “base” portfolio for actual project approval purposes as it was considered unnecessary given past transmission planning studies and steadily declining estimates of the amount of grid-connected renewables necessary to achieve the 50 percent by 2030 goal.

The ISO has accordingly performed policy-driven study assessments of the 42 MMT scenario as a sensitivity with the results being provided to the CPUC for future resource planning purposes, and the ISO is not recommending any new transmission solutions at this time for policy purposes.

Elements of 2018-2019 ISO Transmission Plan Supporting Renewable Energy Goals

Transmission Facility	In-Service Date
Transmission Facilities Approved, Permitted and Under Construction	
West of Devers Reconductoring	2021
Sycamore – Penasquitos 230 kV Line	Completed
Additional Major Network Transmission Identified as Needed in ISO Interconnection Agreements but not Permitted	
None at this time	
Policy-Driven Transmission Elements Approved but not Permitted	
Lugo – Eldorado series cap and terminal equipment upgrade	2020
Warnerville-Bellota 230 kV line reconductoring	2023
Wilson-Le Grand 115 kV line reconductoring	2020
Suncrest 300 Mvar SVC	2019
Lugo-Mohave series capacitors	2020
Additional Policy-Driven Transmission Elements Recommend for Approval	
None identified in 2018-2019 Transmission Plan	

Economically-driven transmission projects

The objective of the ISO's economic studies is to identify transmission congestion and analyze if the congestion can be cost-effectively mitigated by network upgrades. Generally speaking, transmission congestion increases consumer costs because it prevents lower-priced electricity from serving load. Resolving congestion bottlenecks is cost-effective when projected ratepayer savings are greater than the cost of the project. In such cases, the transmission upgrade can be justified as an economic project. Further, the ISO's tariff and Transmission Economic Assessment Methodology enables review of other economic benefits, including the reduction of local capacity costs, as a consideration in assessing the benefits of potential transmission upgrades.

Due to the convergence of circumstances set out below, the ISO undertook far more economic planning analyses than typical, or envisioned in the ISO tariff. Beyond screening congestion results to select key focus areas for economic studies:

- The ISO received a number of economic study requests;
- A number of proposed reliability projects cited material economic benefits that could warrant moving forward;
- Several interregional transmission projects were submitted;
- In conjunction with the expanded 10-year local capacity technical study the ISO undertook in this planning cycle – examining not only the need and the characteristics of the need but alternatives to reduce local gas-fired generation capacity requirement - the ISO selected a subset of local capacity areas for detailed economic analysis where options appeared potentially viable.

As well, a number of the above proposals and submissions overlapped, necessitating a comprehensive study approach. While the ISO tariff allows the ISO to limit the number of economic evaluations to five or less, the ISO studied proposals in 12 study areas, considering 25 alternatives overall, and with the largest area study addressing eight separate stakeholder-submitted proposals.

The ISO's study results were heavily impacted by certain conditions existing in this planning cycle, and the consequential assumptions that were applied:

- The longer term requirements for gas-fired generation for system and flexible capacity requirements continues to be examined in the CPUC integrated resource planning process as well as in other ISO study processes. As no actionable direction has yet been set through the CPUC's IRP process regarding the future of the existing gas-fired generation fleet as the state transitions to reduced reliance on GHG-emitting resources, the uncertainty

necessitated taking a conservative approach in this planning cycle in assigning a value to upgrades potentially reducing local gas-fired generation capacity requirements for generation that may nonetheless be required for system purposes;

- A number of project sponsors based their submissions on assumptions that went beyond the policy direction received from the CPUC given the current status of its integrated resource planning process, that were far less conservative in valuing local capacity requirement reductions, or that applied planning standards that were more demanding than the ISO's approved planning standards.

In summary, two upgrades were found to be needed as economic-driven projects in the 2018-2019 planning cycle:

- Giffen Line Reconductoring Project, estimated to cost less than $5 million, to reduce congestion in a generation constrained area.
- Pease LCR Reduction Project, the looping in of the Pease-Marysville 60 kV line into the East Marysville 115 kV substation, estimated to cost $32 million and eliminating the need for local capacity requirements in the Pease sub-area.

Revised transmission project scopes

A number of previously approved transmission projects received modified project scopes due to changing circumstances, two of which are of note.

First, the ISO is pursuing revisions to the scope of the previously approved S-Line Transmission Upgrade to consist of an appropriately sized single circuit 230 kV circuit, which provides the same local capacity requirement reduction value to the ISO as the original double-circuit line. As well, the ISO is updating the estimated cost to ISO ratepayers of the S-Line upgrade from $32 million to $40 million in light of revised costs estimates provided by IID. This increase in estimated cost would be offset by the savings of no longer needing a new line termination at the Imperial Valley Substation, which was required under the original double circuit configuration.

Second, the batteries approved as a transmission asset in the ISO's 2017-2018 transmission plan as part of the Oakland Clean Energy Initiative have been re-visited in coordination with PG&E and the conditions no longer necessitate transmission asset treatment of the approved batteries. Accordingly, PG&E is continuing with its

procurement activities but no longer constrained to having the batteries directly connected to ISO-controlled transmission grid.

Interregional Transmission Coordination Process

The ISO's 2018-2019 (annual 15-month process) transmission planning cycle marked the first year of the second biennial cycle since these coordination processes were put in place addressing the requirements of FERC Order No. 1000. This cycle reflects the complete transition from old process to new, taking into account the status of the policy drivers and the progress achieved in implementing the new interregional processes.

Six interregional transmission projects were submitted into the biennial process. Of those, three were screened and submitted into the ISO's economic study process for further analysis. None of the three projects studied in this cycle were found to be more economic and cost-effective than regional proposals for meeting identified needs.

Competitive solicitation for new transmission elements

The ISO's transmission planning process includes a competitive solicitation process for reliability-driven, policy-driven and economically-driven transmission facilities over 200 kV. Upgrades or additions to an existing participating transmission owner facility and the construction or ownership of facilities within an existing participating transmission owner's substation are excluded from competition.

Two of the transmission projects in this transmission plan were found to include facilities eligible for competitive solicitation, namely the two reliability-driven dynamic reactive support devices:

- Gates 500 kV Dynamic Reactive Support Project
- Round Mountain 500 kV Dynamic Reactive Support Project

The ISO will accordingly commence a competitive solicitation process in April for the Gates 500 kV Dynamic Reactive Support Project, conditioned on the 2018-2019 Transmission Plan being approved. Further review of the engineering detail for the termination of the Round Mountain 500 kV Reactive Project is required due to siting issues at the Round Mountain substation. Management will provide the additional detail regarding the termination of the reactive support as an addendum to this transmission plan once they are determined. The competitive procurement process for the project will commence after that has taken place.

Special studies conducted in the planning process

In parallel to the mandated analysis framework set out in the tariff described above, the ISO also undertook a number of special studies to help prepare for future planning cycles by reaching further into the issues emerging through the transformation of the California electricity grid. These studies are provided on an informational basis only, and are not the basis for identifying needs or mitigations for Board decision in this planning cycle. The special studies undertaken in this planning cycle and the issues driving those studies are summarized below:

- ***Reliance on Gas-fired Generation in Local Capacity Areas.*** The ISO conducted additional analysis of local capacity requirements in local capacity areas, to help inform resource planning issues. First, the 10-Year Local Capacity Study conducted as part of this cycle was expanded to include detailed information regarding the characteristics of the local capacity area needs that are the basis for assessing non-transmission and preferred resource solutions. Second, transmission or other hybrid alternatives were developed for half of the area and sub-area needs, selected on a prioritized basis. These first two steps were considered to be of use in future resource procurement processes. Third, a subset of those areas and sub-areas were submitted into the ISO's economic study process to assess the viability of moving forward with some level of local capacity requirement reduction on the economic basis used to assess transmission development.
- ***Northwest Hydro.*** The ISO undertook a major informational special study in the 2018-2019 transmission planning cycle in response to a February 15, 2018 letter from Robert B. Weisenmiller, Chair of the CEC, and Michael Picker, President of the CPUC, requesting that the ISO undertake specific transmission sensitivity studies on the potential to increase the transfer of low-carbon supplies to and from the Northwest. This resulted in an extensive coordination effort among state agencies and a host of potentially affected owners and operators, as well as other stakeholders. The study results did not support pursuing capital expenditures to achieve a path rating increase at this time. The ISO will continue to monitor and participate in the WECC path rating process review. If the WECC path rating process is updated to recognize the concept of using the conditionally credible contingency of the adjacent 500 kV lines in the same right-of-way on separate towers, the ISO will work with the owners of the COI facilities to initiate a WECC path rating process to increase the rating of COI to 5,100 MW. The ISO will also continue

to monitor the progress of LADWP on the identified further study work of PDCI and BPA on the dynamic transfer capability and implementing sub-hourly scheduling on PDCI. The ISO acknowledges and appreciates the broad support and effort on behalf of many that went into that study.

The ISO also provided updates to previous study results conducted in past transmission planning cycles:

- ***Longer-term system and flexible capacity requirements.*** The results from previous years were updated with the most recent study assumptions and using the CPUC's 42 MMT resource scenario. The results continued to affirm the high reliance on the existing gas-fired generation fleet to address renewable integration challenges, unless other resources are developed to address those issues.
- ***Large-scale storage benefits.*** These studies were also updated to reflect the latest planning assumptions. They reaffirmed previous years' results that large scale storage can provide material benefits, but energy market benefits alone are not sufficient to offset the costs of the projects.

As well, the frequency response analysis and model improvement process conducted through previous years' special study efforts have now been migrated to a routine component of the transmission planning study cycle, and is now referred to as an "Other Study" to be performed annually.

STAKEHOLDER FEEDBACK

Stakeholders have provided feedback on the draft ISO 2018-2019 transmission plan that was released on February 4, 2019, and presented at a stakeholder meeting on February 14, 2019. The ISO has reviewed all of the stakeholder comments carefully, and has concluded that the recommendations made in the transmission plan are appropriate. The more significant stakeholder concerns, and our response to those concerns, are summarized below.

- ***General support for the transmission plan –*** Stakeholders generally provided complimentary feedback on the transmission plan itself and the scope of ISO analysis, and in particular, the analysis conducted as a special study extending the scope of the 10-year Local Capacity Technical Study.

  ISO response: The ISO appreciated the positive feedback, has reviewed all of the stakeholder comments carefully, and has concluded that the recommendations made in the transmission plan are appropriate.

- ***General support with some concerns for projects being canceled or held for further review –*** Stakeholders generally support the cancellation of the projects identified for cancellation. Concerns have been expressed that the comprehensive review should be repeated each year forward, rather than reverting to a case-by-case review.

  ISO response: Now that the comprehensive review of previously approved projects has been completed, the ISO intends to revert to its practice of reviewing individual projects on a case-by-case basis as needed.

- ***Dissatisfaction with CPUC-coordinated study assumptions –*** A number of stakeholder comments expressed dissatisfaction with the transmission plan study assumptions, especially those that negatively impacted the potential benefit assessment of proposed transmission projects:

  - Lack of a CPUC "base case" for policy-driven transmission planning and approval purposes, and in particular, a case above 50% RPS only being considered for sensitivity purposes.
  - Concern with CPUC portfolios including "energy only" resources instead of requiring all additional renewable generation to achieve full capacity deliverability status.
  - Assumptions that the gas-fired generation fleet, except for once-through cooling compliance plans, will largely remain in service through the planning horizon, and the resulting conservative value placed on local capacity requirement reductions for gas-fired generation.

  ISO response: The ISO does not believe it would be reasonable or practical to act contrary to the coordinated efforts with the CPUC and CEC. The ISO encourages stakeholders to raise their concerns within the CPUC's Integrated Resource Planning proceedings, where they may be addressed more appropriately.

- ***Dissatisfaction with ISO study methodologies –*** A number of stakeholder comments expressed dissatisfaction with ISO study methodologies and the ISO planning standards, especially those that negatively impacted the potential benefit assessment of proposed transmission projects:

  - ISO planning standards enabling current reliance on special protection systems that can trip load or generation under specific conditions. (In contrast, certain stakeholders continue to advocate for more aggressive load shedding, beyond current ISO and/or NERC standards).

- Requests to attribute value to desirable characteristics, but for which a need was not identified.
- The ISO's consideration of physical intertie limits as opposed to scheduling capacity limits that, among other implications, has created a gap between ISO production cost modeling results and day ahead scheduling limitations being experienced in the market.
- The ISO's consideration of ISO ratepayer benefits – as opposed to WECC-wide production cost savings - in assessing potential economic-driven transmission projects.
- Concern that the results of this transmission planning cycle showing low benefit-to-cost ratios for certain projects due to using conservative valuation assumptions would bias or taint consideration of these projects in future planning cycles should less conservative assumptions become warranted.

ISO response: The ISO considers the ISO planning standards, and the application of special protection systems, to be a reasonable balance of reliability needs and ratepayer cost. Individual concerns can be expressed in the planning cycle, and if they have sufficient merit, the ISO will consider a separate stakeholder initiative to review those areas of concern.

Regarding the scheduling limit issue, the ISO is negotiating with industry participants to find means that may provide additional capacity through the ISO tariff and increase use of the existing transmission capacity, before advancing physical alternatives that would duplicate existing and underutilized capacity.

Regarding the consideration of ISO ratepayer benefits, the ISO's view set out in its Transmission Economic Assessment Methodology is that, as the ISO ratepayers are, ultimately, responsible for the transmission costs, the ISO ratepayer perspective is critical in the consideration of economic-driven transmission opportunities.

Regarding economic findings in this study, the ISO reiterates that each transmission study stands on its own, and conclusions can be revisited in future transmission planning cycles when new information is available.

- ***Requests for additional reporting –*** A small number of stakeholders have requested process expansion such as an annual review of all previously approved projects and cost oversight and reporting of previously approved projects.

ISO response: The ISO reviews previously approved projects on a case-by-case basis where material changes in circumstance have occurred. Cost reporting is best monitored through the quarterly reports provided to the CPUC, with access being made available upon request.

- ***ISO input into CPUC portfolio and resource mapping processes –*** Comments of concern were received regarding the transparency of the ISO's provision of transmission capability information into the CPUC IRP process, and the ISO's role in identifying a potential shortcoming in the CPUC's use of that information in the resource mapping processes that led to subsequent sensitivities being performed.

  ISO response: The ISO will continue to work with the CPUC to provide transparency on its inputs in the IRP process. However, the ISO does see the need to address issues on a timely basis if it is aware of modeling shortcomings.

CONCLUSION

The 2018-2019 ISO transmission plan provides a comprehensive evaluation of the ISO transmission grid to identify upgrades needed to adequately meet California's policy goals, address grid reliability requirements and bring economic benefits to consumers. This year's plan identified thirteen transmission projects, having an estimated cost of approximately $644.4 million, as needed to maintain the reliability of the ISO transmission system and provide for the economic operation of the grid. Further, the plan has identified six previously approved projects that can be canceled, with only one remaining project on hold and that requires further review.

Based on the findings that the transmission solutions listed above are the most cost-effective, feasible solutions for meeting the identified transmission needs in the ISO system, Management recommends that the Board approve the attached ISO 2018-2019 transmission plan.