Memorandum

To: ISO Board of Governors
From: Keith Casey, Vice President, Market & Infrastructure Development
Date: March 8, 2017
Re: **Decision on the ISO 2016-2017 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 2016-2017 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 2016-2017 planning cycle, included as Attachment A.

Continuing the recent trend of prior transmission plans, the number and capital costs of recommended transmission projects in this 2016-2017 transmission plan are considerably reduced from previous years due to the considerable progress made in previous planning cycles in identifying and approving a wide array of transmission projects. Similarly, the focus in previous cycles on ensuring that the transmission system supports the state's 33% renewables portfolio standard has also led to an established path to achieving that goal without a need for additional transmission reinforcements. While California Senate Bill 350, the Clean Energy and Pollution Reduction Act of 2015, was signed into law on October 7, 2015, and established, among other goals, a 50% renewables portfolio standard by 2030, the implementation details for achieving this goal will take time to develop and thus was not formally assessed in this planning cycle.

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 two reliability-driven transmission projects identified as needed to ensure

compliance with NERC and ISO planning standards. These projects have an estimated cost of approximately $24 million and are not eligible for competitive solicitation.[1]

Other key findings and conclusions from the 2016-2017 transmission plan include:

- No policy-driven transmission projects were identified as needed for meeting the 33% RPS state policy objective.
- No economically-driven transmission projects were identified as needed.
- A review of previously-approved transmission projects, given materially-changed circumstances underpinning the original need for the projects, resulted in the cancellation of 13 primarily local sub-transmission projects in the PG&E service area. Further, Management recommends that 15 projects in the PG&E service area and one project in the SDG&E service area be placed on hold pending further review in the 2017-2018 planning cycle due to materially-changing circumstances.

The ISO produced this transmission plan after engaging in an extensive stakeholder process. We communicated preliminary results through stakeholder presentations on September 21 and 22, and on November 16, 2016. The ISO released a draft plan on January 31, 2017 and presented it at a stakeholder session on February 17, 2017. Based on comments received from stakeholders, we conducted additional review and made further revisions, culminating in the revised draft ISO 2016-2017 transmission plan. Management proposes the following motion:

> ***Moved, that the ISO Board of Governors approves the ISO 2016-2017 transmission plan attached to the memorandum dated March 8, 2017.***

[1] Due to timing and the unique characteristics of the projects, neither of these projects has been approved by Management in advance of the Board meeting despite their being below the $50 million threshold established in the tariff.

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 meeting the state's policy objectives through advancing policy-driven transmission, but also to help 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.

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 a separate section of the transmission plan (section 7.3), in addition to being discussed throughout the plan on an area-by-area study basis. As well, preferred resources play an emerging role in the draft plan being developed to

accommodate the potential future retirement of the Dynegy Oakland generating station.

Collaborative planning efforts

The ISO, utilities, the California Energy Commission, the California Public Utilities Commission and other stakeholders worked closely 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 processes are the:

- Long-term forecast of energy demand produced by the CEC as part of its biennial Integrated Energy Policy Report (IEPR),
- Biennial Long-Term Procurement Plan proceeding (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 2016-2017 transmission planning process were communicated via an assigned commissioner's ruling in the 2014 LTPP.[2] These assumptions were further vetted by stakeholders through the stakeholder process in developing the 2016-2017 study plan.

KEY FINDINGS

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

Reliability-driven transmission projects

Two 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 $24 million in infrastructure additions to the ISO-controlled grid. Both are located in the SCE service area.

One of these two projects, upgrading the existing Lugo-Victorville transmission line, was found to be needed in the 2015-2016 transmission plan to alleviate potential thermal

[2] Rulemaking 13-12-010 "Assigned Commissioner's Ruling Adopting Assumptions and Scenarios for use in the California Independent System Operator's 2016-17 Transmission Planning Process and Future Commission Proceedings," filed on May 17, 2016.

overloads. However, as it involved a transmission line jointly owned with a non-ISO participating transmission owner (LADWP), Management deferred requesting Board approval until coordination had occurred. Through collaboration with LADWP over the past year, they indicated their intent to fund the upgrades on the LADWP portion of the circuit and capture the proportional share of increased transfer capacity. Given this development, Management seeks approval for only the SCE-related upgrades to the transmission line at an estimated cost of $18 million[3].

The second project, the Big Creek Rating Increase Project, has an estimated cost of $6 million. The project entails upgrading a limited number of transmission towers and terminal equipment at two SCE substations. These upgrades together with the reconductoring that SCE is moving forward with as a capital maintenance project allow the line ratings to be increased, addressing a reliability need. (Both these upgrades and the reconductoring are necessary to achieve the increased ratings.) The SCE capital maintenance project, which does not require ISO approval, entails reconductoring four 220 kV circuits with an Aluminum Conductor Composite Core (ACCC) conductor to address previously identified GO 95 clearance issues, and is moving forward in any event.

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.

Continuing with the review commenced in the 2015-2016 planning cycle, the ISO has reviewed a large number of previously-approved transmission projects in the PG&E service territory, and identified 13 projects that are recommended to be cancelled. These recommendations reflect a number of changing circumstances from when the project projects were approved several years ago. The most significant changes mitigating the need for these projects are declining load forecasts and increased penetration of distributed renewable energy resources and their associated production profiles. The ISO also identified 15 other projects that need further study

[3] The Lugo-Victorville 500 kV line is jointly owned by LADWP and SCE. However, five of the Six Cities hold contractual entitlements to transmission service over the LADWP portion of this line, and one City has an entitlement to service through the Victorville Substation. The ISO has operational control over the Cities' entitlements to transmission service on the LADWP and SCE portions of the Lugo-Victorville 500 kV line and at the LADWP Victorville Substation. To the extent that any of the $16 million cost of LADWP's portion of this project is recoverable from the Six Cities, the Six Cities are entitled to reflect such costs in their respective Transmission Revenue Requirements, as the ISO's finding of need for this project pertains to the entirety of any project capacity that will be under the ISO's operational control.

in the 2017-2018 cycle to take into account evolving load forecast information available in the upcoming CEC IEPR update.

Further, one previously approved reliability project in the SDG&E area requires further review in next year's transmission plan. Specifically, the need and viability of the Mission-Penasquitos project in the SDG&E area has been impacted by the siting decision of the CPUC in approving the Sycamore-Penasquitos project.

Transmission elements supporting renewable energy goals

The CPUC and CEC provided policy direction to the ISO regarding renewable generation portfolios for 2016-2017 policy-driven transmission planning purposes via a letter dated June 13, 2016. In that communication, the CPUC and CEC recommended that the ISO re-use the "33% 2025 Mid AAEE" RPS portfolio used in the 2015-16 TPP studies, as the base case renewable resource portfolio in the 2016-17 TPP studies.[4] Because these portfolios were already studied in the 2015-2016 TPP, the ISO needed to reassess in the 2016-2017 TPP only those portions of the system that had material changes that would affect the ability to deliver renewable generation in the portfolio. After reviewing the changes to the planning models from the 2015-2016 TPP to the 2016-2017 TPP, the ISO determined that material changes had been made to the transmission system only in the Imperial Valley area. Therefore, the ISO needed to perform a generation deliverability analysis of only the Imperial Valley area to complete the 2016-2017 TPP policy-driven need assessment, which was completed and showed no need for additional transmission to support generation deliverability from that area.

The reduced number of scenarios from previous transmission planning cycles and the consistency with the previous year's portfolios are indicative of the greater certainty around the portfolios, as utilities have largely completed their contracting for renewable resources to meet the 2020 RPS goals.

4 http://www.caiso.com/Documents/2016-2017RenewablePortfoliosTransmittalLetter.pdf

Elements of 2016-2017 ISO Transmission Plan Supporting Renewable Energy Goals

Transmission Facility	Online
Transmission Facilities Approved, Permitted and Under Construction	
Tehachapi Transmission Project	2016 - completed
Path 42 and Devers-Mirage 230 kV Upgrades	2016 - completed
West of Devers Reconductoring	2021
Sycamore – Penasquitos 230kV Line	2018
Additional Network Transmission Identified as Needed in ISO Interconnection Agreements but not Permitted	
Borden Gregg Reconductoring	2018
Policy-Driven Transmission Elements Approved but not Permitted	
Eldorado-Mohave and Eldorado-Moenkopi 500 kV Line Swap	2018
Lugo – Eldorado series cap and terminal equipment upgrade	2019
Warnerville-Bellota 230 kV line reconductoring	2017
Wilson-Le Grand 115 kV line reconductoring	2020
Suncrest 300 Mvar SVC	2017[5]
Lugo-Mohave series capacitors	2019
Additional Policy-Driven Transmission Elements Recommend for Approval	
None identified in 2016-2017 Transmission Plan	

[5] In service date to be revisited by project sponsor when Environmental Impact Report is completed.

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.

Through its own analysis and the input of stakeholders, the ISO identified the five highest priority studies in the 2016-2017 planning cycle. The analyses compared the cost of the mitigation plans to the expected reduction in production costs, congestion costs, transmission losses, capacity or other electric supply costs resulting from improved access to cost-efficient resources.

Considering the five high priority studies, the ISO determined that there were no economic upgrade recommendations needed in this plan.

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.

None of the transmission projects in this transmission plan includes facilities eligible for competitive solicitation.

Special studies conducted in the planning process

In parallel to the mandated analysis framework set out in the tariff described above, the ISO has also pursued a very aggressive 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 ISO Board decision in this planning cycle. The special studies undertaken in this planning cycle and the issues driving those studies are summarized below:

- ***Risks of early economic retirement of gas fleet.*** This analysis focuses on two aspects of reliability:
    - Whether localized areas of the grid transmission system where the retirement of a number of similarly situated generators would create reliability issues or other negative impacts on the operation of the transmission system, and,
    - Whether system-wide reliability requirements, e.g. load following, operating reserves and regulating reserve levels, are unduly compromised.
- ***Continuation of frequency response analyses through improved modeling***. Building on the study results and concerns identified in previous cycles, the focus in the 2016-2017 transmission planning process concentrated on identifying and addressing generator modeling issues, rather than on conducting additional frequency response studies. Also, having accurate models is important in order to be compliant with NERC standards MOD-032 and MOD-033.
- ***Gas/electric reliability coordination.*** These studies further examined the dependence of the electric system reliability on the natural gas pipeline and storage network, looking across both northern and southern California.
- ***50 Percent renewable generation and interregional coordination.*** These studies explored implications of various 50% renewable generation portfolios considering continued reliance on incremental renewable generation to provide full capacity delivery status resource adequacy capacity, as well as implications of shifting to energy-only resources. Both in-state and out-of-state resources were considered. The analysis also formed the basis for coordination with the ISO's neighboring western planning regions through our respective FERC Order No. 1000 interregional coordination efforts to review a number of interregional project submissions. The consideration of the interregional transmission project submissions will require further effort in 2017 and coordination with the other planning regions' multi-year cycles.
- ***Large-scale storage benefits.*** These studies update the information-only efforts undertaken in the 2015-2016 planning cycle, using updated 50% RPS portfolios and exploring locational benefits of several known potential large storage sites.

- ***Slow-response resources in local capacity areas.*** These studies focused on identifying the necessary characteristics for slow-response resources to be capable of providing local resource capacity. The ISO's preliminary analysis has been documented in the transmission plan, and further efforts will continue to support the CPUC's resource adequacy proceedings.

STAKEHOLDER FEEDBACK

Stakeholders have provided feedback on the draft ISO 2016-2017 transmission plan that was released on January 31, 2017, and presented at a stakeholder meeting on February 17, 2017. The more significant stakeholder concerns, and our response to those concerns, are summarized below.

- ***General support for individual projects –*** Stakeholders generally support the two projects recommended for approval. Concerns have been expressed that the capital maintenance elements of the Big Creek Rating Increase Project should have been subject to the ISO planning process.

  ISO response: The ISO has reviewed all of the stakeholder comments carefully, and has concluded that the recommendations made in the transmission plan are appropriate. Regarding the SCE capital maintenance project, Management has reviewed the issue and remains convinced that mitigation of line clearance issues with existing transmission circuits remains the responsibility of the participating transmission owner.

- ***General support and also concerns for projects being cancelled or held for further review –*** Stakeholders generally support the cancellation of the projects identified for cancellation. Concerns have been expressed that the review efforts should go further. Concerns have also been expressed that projects should not be too hastily cancelled, as re-starting those projects would be administratively cumbersome, time consuming and costly.

  ISO response: The ISO has reviewed all of the stakeholder comments carefully, and has concluded that the recommendations made in the transmission plan are appropriate. Responding to stakeholder feedback, a number of projects are not being recommended for cancellation, but rather are being recommended to cease ongoing siting and permitting work or to advance that work to a logical point prior to actually seeking permits to assist in the review of the project.

- ***Reliance on renewable generation portfolios provided by state agencies –*** Several stakeholders have reiterated their concerns that the ISO should not

wait for CPUC direction on policy-driven needs to achieve RPS goals beyond 33%, noting existing legislation in place for RPS goals beyond 33%.

ISO response: The ISO continues to rely on the coordination achieved with the state agencies, and in particular, the reliance on the portfolio development process led by the CPUC to provide direction on policy-driven needs to achieve state renewables goals. The ISO acknowledges the challenge before the CPUC and has supported both the CPUC's development of its Integrated Resource Planning framework and the Renewable Energy Transmission Initiative 2.0 to assist in the development of future policy direction. The ISO's special studies are also assisting those efforts, as well as positioning the ISO with improved understanding of the issues to be addressed when policy direction is available.

- ***Special Studies –*** There was strong interest in the special studies conducted in the transmission planning cycle, and numerous comments requesting the additional analysis be continued in future planning cycles.

  ISO response: The ISO's 2016-2017 transmission plan provides updated results for a number of key issues, and identifies where further work is required. That work will be undertaken through several paths – through continuation of the 2016-2017 transmission plan study efforts, through updates launched in the 2017-2018 planning cycle, or on separate tracks to support CPUC regulatory processes.

CONCLUSION

The 2016-2017 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 two transmission projects, having an estimated cost of approximately $24 million, as needed to maintain the reliability of the ISO transmission system. Further, the plan has identified 13 projects that can be cancelled, and 16 projects that require further review before proceeding to construction.

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 2016-2017 transmission plan.