

Memorandum

To: ISO Board of Governors
From: Keith Casey, Vice President, Market & Infrastructure Development
Date: March 12, 2014
Re: **Decision on the ISO 2013-2014 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 transmission plan provides a comprehensive evaluation of the ISO 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 is recommending the Board approve the attached ISO transmission plan for the 2013-2014 planning cycle.

As in past years, this year's plan addresses transmission needed to support the state's 33% renewables portfolio standard (RPS). This year's plan, though, focuses most closely on reliability needs in southern California – the LA Basin and San Diego areas – related to the early retirement of the San Onofre Nuclear Generating Station (SONGS) and a significant anticipated reduction in local gas-fired generation in response to state requirements regarding use of coastal water for once-through cooling.

The transmission solutions developed in this year's plan encompass a broad range of conventional and non-conventional solutions, with significant emphasis on enabling solutions that minimize overall emissions, especially in addressing the reliability needs for southern California.

The following thirty-one transmission solutions, totaling \$2.17 billion, are recommended for approval:

- A total of twenty-eight reliability driven transmission projects that were identified as needed to ensure compliance with NERC and ISO planning standards. These solutions represent an investment of approximately \$1.7 billion in infrastructure additions to the ISO-controlled grid, broken down as follows:
 - Six projects have costs greater than \$50 million and a combined cost of approximately \$1.29 billion are recommended for approval at this time.
 - Twenty-two of these projects cost less than \$50 million each, totaling \$409 million. Of these, seventeen have been approved by Management, Assessments of the remaining five projects were not concluded in time for Management approval and therefore are being presented now for Board approval.
- Two policy- driven transmission projects, totaling approximately \$135 million, were identified as needed for meeting state policy needs associated with 33% RPS.
- One economically driven transmission project, totaling approximately \$338 million, was identified as being in ISO ratepayer interests. It also contributes to state policy objectives by increasing the deliverability of renewable energy deliveries from the Imperial Valley zone to California consumers and will enhance system reliability.

Two areas require further study, and may result in amendments to the 2013-2014 plan and requests for future Board approvals:

- The potential need for transmission reinforcement of the San Francisco Peninsula due to outage concerns related to extreme contingencies; and
- Potential economic benefits of an Eldorado-Harry Allen 500 kV transmission line addition that will need further evaluation to assess the impact of NV Energy's planned participation in the ISO's energy imbalance market.

In addition, the SONGS early retirement has shifted power flow patterns in the San Diego and LA Basin areas such that the amount of deliverability for generation in the Imperial Valley is significantly reduced. We have discussed the issue with stakeholders, including the California Public Utilities Commission and the California Energy Commission and have agreed to study solutions in the 2014-2015 planning cycle.

The ISO produced the 2013-2014 transmission plan after engaging in an extensive stakeholder process, consistent with tariff requirements. We communicated preliminary study results to stakeholders on September 25- 26, and on November 20- 21. The ISO

published a draft version of the transmission plan on February 3 and presented it at a stakeholder session on February 12, seeking stakeholder comments that were submitted on February 26. We conducted an additional review of the plan in light of stakeholder comments and made further revisions, culminating in the revised draft ISO 2013-2014 transmission plan posted on March 12 and attached to this memorandum.

Management proposes the following motion:

Moved, that the ISO Board of Governors approves the ISO 2013-2014 transmission plan attached to this memorandum dated March 12, 2014.

DISCUSSION AND ANALYSIS

A core responsibility of the ISO is to plan and approve additions and upgrades to transmission infrastructure so that, as conditions and requirements evolve, it 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. During the 2013-2014 planning cycle the ISO implemented certain tariff amendments approved by the Federal Energy Regulatory Commission as part of the Order No. 1000 compliance process.

Overall findings

Our comprehensive evaluation of the grid needs for reliability, policy and economic transmission solutions, as discussed above, resulted in the following key findings:

- The ISO identified 28 transmission projects with an estimated cost of \$1.7 billion, needed to maintain the reliability of the ISO transmission system;
- One service area, the San Francisco peninsula, has been identified by PG&E as being particularly vulnerable to lengthy outages in the event of extreme (NERC Category D) contingencies, and further studies have been initiated to determine the need and urgency for reinforcement. Depending upon the results, this issue may be brought forward for consideration at a future Board meeting;
- The ISO identified the need for two relatively small policy-driven transmission upgrades;

- The ISO identified a significant reduction in the deliverability of projected renewable generation in the Imperial Valley zone due to reductions in capability resulting from the early SONGS retirement. This issue will require further study in the 2014-2015 planning cycle;
- One economically driven 500 kV transmission project, the Delaney-Colorado River transmission project, is being brought forward for Board approval; and
- One other economic-driven project, a 500 kV transmission line from Eldorado to Harry Allen, which has the potential to provide significant benefits, will require further study in light of NV Energy's announced intention of joining the energy imbalance market and may also be brought to the Board for approval later this year.

Each of these key findings is discussed below in greater detail.

Reliability driven transmission projects

This plan proposes twenty-eight reliability driven transmission projects, representing an investment of approximately \$1.7 billion in infrastructure additions to the ISO controlled grid. These reliability projects are necessary to ensure compliance with NERC and WECC requirements. Twenty-two of these projects cost less than \$50 million each and have a combined cost of \$409 million. Management approved seventeen of those projects earlier in the planning cycle. The remaining six projects with costs greater than \$50 million each have a combined cost of \$1.29 billion. The six reliability transmission projects with costs greater than \$50 million consist of the following:

- ***Mesa Loop-in*** – Looping the Vincent-Mira Loma 500 kV transmission line into the existing Mesa Substation, and upgrading the substation to include a 500 kV bus;
- ***Install Dynamic Reactive Support at San Luis Rey 230 kV Substation*** – Adding synchronous condensers at the San Luis Rey Substation to provide voltage support to the transmission system in the San Onofre area;
- ***Imperial Valley Flow Controller*** – Installing a phase shifter or back-to-back HVDC flow control device at the Imperial Valley substation to manage flows between the CFE and ISO systems;
- ***Artesian 230 kV substation and loop-in*** – Upgrading the existing Artesian substation to 230 kV and looping in the Sycamore-Palomar 230 kV line (TL23051) to provide a new source into the 69 kV system;

- **Midway-Kern PP #2 230 kV line** – Reconductoring and unbundling the existing Midway-Kern PP 230 kV line into two circuits and looping one of the new circuits into the Bakersfield substation; and
- **Wheeler Ridge Junction Station** – Building a new 230/115 kV substation at Wheeler Ridge Junction and converting the existing Wheeler Ridge-Lamont 115 kV to 230kV operation.

The five projects that cost less than \$50 million each, studies for which were not concluded in time for Management approval or depended to some extent on the solutions that cost more than \$50 million, are:

- New Spring substation near Morgan Hill;
- Bernardo-Rancho Carmel-Poway 69 kV lines upgrade replacing Sycamore-Bernardo 69 kV project;
- Miramar-MesaRim 69 kV system reconfiguration;
- 2nd Escondido-San Marcos 69 kV Line; and
- Voltage Support at Miguel 500/230 kV Substation.

A summary of the number of reliability-driven transmission projects and associated total costs in each of the transmission owners’ service territories is listed below in Table 1. The ISO has operational control over the PG&E and SDG&E lower voltage transmission facilities (i.e., 138 kV and below) and therefore there were more reliability projects identified for those service territories in comparison to the SCE higher-voltage bulk system.

Table 1 – Summary of Needed Reliability-Driven Transmission Projects in the ISO 2013-2014 Transmission Plan

Service Territory	Number of Projects	Cost (in millions)
Pacific Gas & Electric (PG&E)	14	\$486.4
Southern California Edison Co. (SCE)	2	\$626.0
San Diego Gas & Electric Co. (SDG&E)	11	\$584.0
Valley Electric Association (VEA)	1	0.1
Total	28	\$1,696.5

The majority of identified reliability concerns are related to facility overloads or low voltage. Therefore, many of the specific projects that comprise the totals in Table 1 include line reconductoring and facility upgrades for relieving overloading concerns, as well as installing voltage support devices for mitigating voltage concerns. Additionally, some projects involve building new load-serving substations to relieve identified loading concerns on existing transmission facilities. Several initially identified reliability concerns were mitigated with non-transmission solutions. These include generation redispatch and, for extremely low probability contingencies, possible load curtailment.

The first three of the solutions that cost over \$50 million each were developed through the comprehensive review of the needs of the LA Basin and San Diego areas. This review is discussed in more detail below.

Southern California Reliability Assessment (LA Basin and San Diego)

As noted earlier, a major reliability focus of the 2013-2014 transmission planning efforts was the reliability needs in the LA Basin and San Diego area in light of the SONGS retirement, coupled with the impacts of potential retirement of gas-fired generation in these areas.

To that end, the ISO, in consultation with the CPUC, the CEC, the State Water Resources Control Board (SWRCB), SCE, SDG&E and South Coast Air Quality Management District (SCAQMD), developed a Preliminary Reliability Plan, issued in August 2013.

This draft plan describes the coordinated actions that the ISO and the agencies are pursuing in the near-term (4 years) and the long-term (7 years). The Preliminary Reliability Plan also identified challenging goals that will need to be fully vetted in the public decision-making processes of the appropriate agency, with a focus on ensuring reliability, finding the most environmentally clean grid solutions, and urgently pursuing the variety of decisions that must ultimately be made and approved by key state agencies.

As a result of these and other collaborative efforts, in the 2013-2014 transmission plan the ISO has accounted for the need for continued coordination and alignment with other state agency processes – most notably the CPUC long term procurement proceeding and CEC forecasting processes - as well as the need to move decisively on “least regrets” transmission solutions that can play a significant role in addressing the local area challenges in the LA Basin and San Diego.

Additionally, the ISO has provided analysis of a number of preferred resource scenarios, as well as a broad range of potential transmission solutions, using reduction in conventional generation needs as a measure of the potential benefits of

these options. The analysis of preferred resource alternatives and storage alternatives will inform utility procurement decisions.

The potential transmission solutions addressing southern California reliability needs have been organized into three categories: 1) those optimizing existing transmission lines to address local area needs, 2) major new transmission that provides additional high voltage transmission ties between the SCE and SDG&E systems, and 3) major new transmission that would increase the import capability to the area and could potentially be coupled with other possible state policy objectives – such as promoting renewable energy development in certain areas of the state.

The ISO recommends approval of the first category of transmission solutions at this time, as this should largely address the residual local reliability need (i.e., net of the resource assumptions and procurement authorized by the CPUC) while leaving room for additional preferred resource development. These solutions will also provide a margin for any reduction in local needs stemming from future potential changes in load forecasts. The category 2 and 3 projects will be subject to further consideration in the 2014-2015 planning cycle.

Advancing preferred resources

In the 2013-2014 planning cycle, the ISO developed a methodology for examining the operational characteristics that non-conventional resources such as demand response or storage would need to display in order to be available as supply-side resources in addressing local transmission system needs.

Much of this effort focused on coordinating local area reliability requirements with SCE and SDG&E and testing some specific non-conventional resource scenarios developed by these utilities potentially to meet local needs in the LA Basin and San Diego needs.

This initiative reflects the ISO's commitment to develop an enduring element of the transmission planning process to enable the state's preferred resources to offset the need for conventional generation and transmission solutions. In this year's plan, the effort resulted in deferring a number of local transmission reinforcements in the San Diego area through reliance on preferred resources.

Policy-driven transmission elements supporting renewable energy goals

The ISO's analysis of the transmission system's needs to support the state's 33% RPS standard by 2020 was based on three renewable generation scenarios developed by the CPUC and CEC in a stakeholder process and provided to the ISO to determine the need for policy-driven projects. The reduced number of scenarios from previous transmission

planning cycles, with less variability between several of the scenarios than in the past, reflects the fact that utilities are moving to complete their contracting for renewable resources to meet the 2020 goals, and there is more certainty about the areas in which these resources will locate.

The ISO assessment in the 2013-2014 planning cycle did not identify any new major policy-driven transmission projects, given the transmission projects already approved or progressing through the CPUC approval process. Two smaller policy-driven transmission upgrades have been identified in this transmission plan, which the ISO recommends for approval:

- a 300 Mvar SVC at Suncrest; and
- a Lugo-Mohave series capacitor and related terminal upgrades.

However, in assessing the deliverability of future renewable generation from the Imperial Valley area, the ISO identified a significant reduction in the deliverability due to changes in flow patterns resulting from the retirement of the San Onofre Nuclear Generating Station. Despite the impacts being heavily offset by other reinforcements proposed in this transmission plan, only 1000 MW of the 1715 MW of Imperial Valley renewable generation portfolio amounts can be made deliverable. The change also impacts the ability to achieve deliverability of import capability from the Imperial Irrigation District at the intended level of 1400 MW. The ISO communicated this issue to the California Public Utilities Commission and the California Energy Commission. Given this significant change in circumstance and the significant costs and feasibility challenges of the various transmission options that may be required to address the issue, the ISO will conduct further study in the 2014-2015 transmission planning cycle to develop the most effective solution to this issue, consistent with a request from the state agencies reflected in the renewable portfolios they transmitted to the ISO on February 7, 2014.

Table 2 provides a summary of the policy-driven transmission elements identified in the 2013-2014 transmission plan as well as other transmission projects needed to meet the 33% RPS standard in the following categories:

- major transmission projects that have been previously approved by the ISO and are fully permitted by the CPUC for construction – all but one of which (Tehachapi) are completed;
- additional transmission projects that the ISO interconnection studies have shown are needed for access to new renewable resources but are still progressing through the approval process; and
- major transmission projects that have been previously approved by the ISO but are not yet permitted.

Table 2: Elements of 2013-2014 ISO Transmission Plan Supporting Renewable Energy Goals

Transmission Facility	Online
Transmission Facilities Approved, Permitted and Under Construction	
Sunrise Powerlink (completed)	2012
Tehachapi Transmission Project	2015
Colorado River - Valley 500 kV line (completed)	2013
Eldorado – Ivanpah 230 kV line (completed)	2013
Carrizo Midway Reconductoring (completed)	2013
Additional Network Transmission Identified as Needed in ISO Interconnection Agreements but not Permitted	
Borden Gregg Reconductoring	2015
South of Contra Costa Reconductoring	2015
West of Devers Reconductoring	2019
Coolwater - Lugo 230 kV line	2018
Policy-Driven Transmission Elements Approved but not Permitted	
Mirage-Devers 230 kV reconductoring (Path 42)	2014
Imperial Valley Area Collector Station	2015
Sycamore – Penasquitos 230kV Line	2017
Lugo – Eldorado 500 kV Line Re-route	2015
Lugo – Eldorado series cap and terminal equipment upgrade	2016
Warnerville-Bellota 230 kV line reconductoring	2017
Wilson-Le Grand 115 kV line reconductoring	2020
Additional Policy-Driven Transmission Elements Recommend for Approval	
Suncrest 300 Mvar SVC	2017
Lugo-Mohave series capacitors	2016

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 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 five high-priority studies that were evaluated in the 2013-2014 planning cycle. Of these five

studies, the ISO's preliminary economic study results showed financial benefits exceeding costs for two projects – the Delaney-Colorado River 500 kV transmission line and the Harry Allen-Eldorado 500 kV transmission line. Both of these projects were studied in the 2012-2013 transmission planning cycle and further studies were carried over into the 2013-2014 cycle.

Based on the continued analysis, the ISO recommends that the Board approve the Delaney-Colorado River 500 kV transmission line at this time. The benefits of this project are derived both from anticipated production cost savings and through savings in capacity costs provided by increased access to out of state generation.

The ISO's analysis of the Harry Allen-Eldorado line continues to show potential benefits. However, given NV Energy's recent announcement of its intent to join the ISO's energy imbalance market, it would not be prudent to move forward on a recommendation until this market change can be properly reflected in an economic analysis. The ISO intends to conduct this analysis as part of this 2013-2014 transmission planning cycle and may bring forward a recommendation to the Board later this year.

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 to or additions on 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.

Seven transmission solutions identified in the 2013-2014 transmission plan are eligible for competitive solicitation in this transmission plan:

- Imperial Valley flow controller (if HVDC is selected as the preferred technology);
- Estrella 230/70 kV substation;
- Wheeler Ridge Junction 230/115 kV substation;
- Spring 230/115 kV substation near Morgan Hill;
- Suncrest 300 Mvar dynamic reactive support;
- Delaney-Colorado River project; and
- Miguel 500 kV voltage support.

Stakeholder feedback

Stakeholders provided feedback on the draft ISO 2013-2014 transmission plan that was released on February 3 and presented at a stakeholder meeting on February 12. The

more significant stakeholder concerns and our response to those concerns are summarized below.

- **Support for individual projects** – Stakeholder support for the following projects was mixed, ranging from strong support to concern with certain projects proceeding and for certain projects not being recommended for approval:
 - Delaney-Colorado River 500 kV transmission line;
 - San Francisco peninsula reinforcement;
 - Numerous alternative proposals (group II and group III projects) to address southern California – LA Basin and San Diego area - needs; and
 - Proposals for other forms of mitigation, such as the retrofitting of existing generation to be capable of switching from generator mode to synchronous condenser mode.

ISO response: The ISO has reviewed all of the comments carefully, especially in areas where there were suggestions that the ISO was inconsistent in its considerations and application of the various planning criteria. We have concluded that the recommendations made in this memorandum and transmission plan are appropriate.

- **Study of LA Basin and San Diego area needs** – Stakeholders expressed a wide range of views from promoting a “wait and see” approach (by relying on load shedding arrangements, deferral of once-through cooling mitigation plans, possible additional resource procurement through CPUC processes or other tactics) to promoting that the ISO move more aggressively and approve much broader transmission mitigations in this cycle that would meet the entire currently forecast need.

ISO response: The ISO has been seeking a balanced, reasoned approach, recognizing the uncertainties that need to be addressed, the need to address reasonable lead times for reinforcements, and the need to progress on all fronts – preferred and conventional resources and system reinforcement.

- **Analysis of preferred resources** – A number of stakeholders have commented favorably on the steps the ISO has taken to develop more information that can assist in the identification and procurement of preferred resources (such as demand response) that meet local needs, rather than exclusively on system needs. Others have called for more analysis and more specific results.

ISO response: We are pleased with the encouragement received from stakeholders, and intend to further the analysis of potential preferred resource mixes in the 2014-2015 transmission plan. As the value different preferred resources provide varies depending on the specific local circumstance as well as the characteristics of other preferred resources in the local area, the initial stage of analysis is a positive first step, but further work is necessary in future cycles.

- ***Level of detail and range of alternatives studied in developing recommendations*** – Some stakeholders expressed the view generally, as well as in specific examples, that broader ranges of alternatives should be examined, and that the ISO should provide more detail in the transmission plan regarding each recommendation.

ISO response: The ISO has considered feedback on a case by case basis, and we consider the analysis sufficient to support the recommendations made in this plan.

The ISO consultation process for the 2014-2015 study plan and study assumptions has commenced and we have encouraged participation in that forum.

- ***Consistent treatment of load shedding for extreme contingency events*** – Some stakeholders disagreed with our rationale for finding that transmission projects are needed to avoid load shedding in the event of multiple contingencies where load shedding is permitted by NERC planning criteria. Other stakeholders have suggested that additional projects should be approved in other areas of the transmission system to eliminate load shedding in the event of multiple contingencies in those areas as well.

ISO response: The ISO acknowledges that judgment is called for as part of the criteria and is to be applied in determining when load shedding should not be accepted as a consequence for extreme contingency events. Consistency is also important in applying that judgment. Based on previous feedback, the ISO has considered consistent parameters in evaluating proposed projects, and has enhanced its planning standards to provide additional guidance and direction regarding consistency. Those revisions were approved by the Board on July 13, 2011. Management has also indicated that it will conduct a stakeholder process in 2014 to further codify in the ISO's transmission planning standards its practices regarding load shedding for multiple contingency events.

- ***Deliverability requirements being considered in assessing policy related transmission reinforcement requirements*** – Some stakeholders questioned the rationale for applying our deliverability methodology in considering the need for policy-driven upgrades, noting that the 33% RPS objective applies to energy and not capacity. Stakeholders have also questioned the validity of the deliverability methodology.

ISO response: The ISO notes that the CPUC/CEC portfolios put a heavy weighting on generation that is viable, and in particular, the “commercial interest” portfolio has been selected as the base case. Virtually all projects in the discounted core are seeking full capacity delivery status (e.g. deliverability). Based on the ISO’s experience working with generation interconnection customers, full capacity delivery status has been demonstrated as a necessity in advancing generation projects. The ISO has therefore included the deliverability analysis in assessing the need for policy-driven upgrades since the framework for approving policy-driven upgrades was introduced. Regarding the methodology, in 2013 the ISO published in-depth material and conducted a stakeholder education session providing more detailed explanations and relevant examples of the methodology through a significant commitment of resources.

Conclusions

The 2013-2014 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 31 transmission projects, estimated to cost a total of approximately \$2.17 billion, as needed to maintain the reliability of the ISO transmission system, meet the state’s renewable energy mandate, and deliver material economic benefits.

The transmission plan also identified four subjects which require further study, the latter two of which may result in Management seeking additional Board approval of certain amendments to the 2013-2014 transmission plan at a future meeting:

- continuing the coordinated and iterative process of addressing southern California (LA Basin and San Diego area) needs with an emphasis on preferred resources, as well as resolving remaining technical decisions regarding recommended solutions that contribute to the overall need;
- identifying potential transmission solutions to the significant reduction in the deliverability of projected renewable generation in the Imperial Valley zone due to reductions in capability resulting from the early SONGS retirement;

- addressing the potential need for transmission reinforcement of the San Francisco Peninsula due to outage concerns related to extreme contingencies; and
- reviewing the economic benefits of an Eldorado-Harry Allen 500 kV transmission line addition, once existing study work can be updated to reflect NV Energy's intention to participate in the ISO's energy imbalance market.

MANAGEMENT RECOMMENDATION

Based on the findings that the transmission projects and the elements listed above are the most cost-effective, feasible solutions for meeting the identified reliability- and policy-driven transmission needs in the ISO system, Management recommends that the Board approve the attached 2013-2014 transmission plan.