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REVISED INTERIM REPORT

EXISTING AND PLANNED TRANSMISSION CAPABILITY INFORMATION TO SUPPORT THE RETI 2.0 PROCESS

Renewable Energy Transmission Initiative 2.0

Transmission Technical Input Group

June 17, 2016

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1. INTRODUCTION

The Renewable Energy Transmission Initiative 2.0 (RETI 2.0) is a statewide, non-regulatory planning effort convened by the California Natural Resources Agency, with participation from the California Energy Commission, California Public Utilities Commission (CPUC), California Independent System Operator, and the U.S. Bureau of Land Management California Office. The RETI 2.0 initiative was created to explore the renewable generation potential available to California utilities to help meet state-wide greenhouse gas (GHG) reduction and renewable energy goals, and to identify the potential transmission implications of accessing and integrating these resources.

The state's goals, codified in the Clean Energy and Pollution Reduction Act of 2015 (SB 350, De Leon) and in Governor Brown's Executive Order B-30-15, include serving at least 50% of statewide retail electricity load from renewable energy by 2030, and more broadly reducing total statewide greenhouse gas emissions by 40%. While no definitive estimate of the total renewable energy necessary to meet these goals has been produced, the RETI 2.0 Plenary Group reviewed previous studies to generate a potential range of incremental renewable energy that could be required by 2030[1], above and beyond the amount required to meet the 33% RPS in 2020. This review found that by 2030, between 25 and 108 terawatt-hours of additional renewable energy (beyond the 33% levels) could be necessary to meet both RPS and GHG goals. If all of this power were produced at an average capacity factor of 30%, then between 9.4 and 41 gigawatts of new renewable energy capacity would be required by 2030 (or 7 to 31 GW at a 40% average capacity factor). While some of the grid connected capacity may be located outside of California, all of it will be required to interconnect through the California grid.

As part of this effort, RETI 2.0 established several working groups, including the Plenary Group, Environmental and Land Use Technical Group, and the Transmission Technical Input Group (TTIG). The role of the TTIG is to document the capacity of the existing transmission system to support additional renewable development, and to identify the potential need for new transmission investments to access and integrate additional renewables and to support a majority-renewables grid.

1.1. TTIG GOALS AND ORGANIZATION

The Transmission Technical Input Group (TTIG) is assisting the RETI 2.0 effort by assembling relevant in-state and west-wide transmission capability and upgrade cost information to inform resource development combinations on the reasonably-needed transmission system implications and to assist in the developing potential corridor scenarios.

The TTIG membership includes all North American Electric Reliability Corporation (NERC)-registered Transmission Planners and Planning Coordinators that operate in California. Table 1-1 identifies the organizations participating in TTIG activities.

[1] RETI 2.0 Plenary Group Report, Brian Turner, 2 May 2016.

Table 1-1: TTIG Participants

Transmission Technical Input Group Member Organizations	
Sacramento Municipal Utility District	California Independent System Operator
Imperial Irrigation District	Los Angeles Department of Water and Power
Silicon Valley Power	Turlock Irrigation District
Modesto Irrigation District	Western Area Power Administration - SNR
San Francisco Public Utilities Commission	Transmission Agency of Northern California
City of Santa Clara	Pacific Gas & Electric
Southern California Edison	San Diego Gas & Electric

Identified deliverables for the TTIG include the following:

- Characterize existing transmission system capacity and planned improvements/changes and their implications for accessing additional renewable resources;
- Provide initial transmission input on likely in-state developments necessary to access potential renewable generation and refine the data as combinations of renewable resources are developed through other RETI 2.0 groups' activities;
- Provide planning level transmission cost estimates and any available information on environmental and other permitting issues for in-state requirements, using existing data to the greatest extent possible;
- Compile transmission planning information on potential WECC-wide system reinforcements that may provide or improve access to renewable generation or to integration resources;
- Work interactively with RETI Plenary Group to evaluate transmission implications for accessing potential renewable energy generation areas.

This report addresses the first deliverable, namely characterizing the existing, planned, and proposed transmission that may be available to support the interconnection of sufficient renewable energy to meet the goals of 50% RPS and 40% economy-wide GHG reduction by 2030. The information provided in this report is intended to set a foundation and a baseline for the second stage of RETI 2.0, in which the TTIG will assess the transmission implications of specific renewable resource development scenarios in the Transmission Assessment Focus Areas.

1.2. METHODOLOGY

Data on transmission capability, utilization and availability was requested of all TTIG participants and, more broadly, of all participants in RETI 2.0. In response, the TTIG members and other respondents provided a variety of information, mostly from the results of their individual planning processes. These processes vary widely and the provided information was therefore not entirely uniform. The transmission information included in this report was provided by grid planners and operators, transmission developers and other RETI stakeholders. This report attempts to summarize this information in a consistent manner.

TTIG did not independently develop any information or perform any system modeling to develop projections of potential existing or new transmission capacity. While TTIG believes the information provided and presented here is reliable and accurate, TTIG does not warrantee any of the information included in the report.

The potential transmission capacity values included in this report are estimates of the transmission that will likely be available once all projects under construction as of January 1, 2016 are completed. Measurements of transmission capability are affected by a variety of physical and operational factors and may change as demand and resources are changed on the system. While the TTIG has made a good-faith effort to provide accurate and current information on transmission capability for purposes of resource planning, it makes no warranty that the transmission is or will be available to specific projects seeking to interconnect to the California grid.

1.3. OVERARCHING ISSUES AFFECTING THE TRANSMISSION GRID

There are numerous issues that impact the availability of transmission capacity on the grid; grid planners typically address these issues in their respective planning processes. In addition, there are several issues unique to this effort that we highlight below. These include:

- Full Capacity Deliverability and Energy-Only resources
- Out-of-state resources and in-state transmission capacity
- California ISO expansion

1.3.1. DELIVERABLE AND ENERGY-ONLY RESOURCES

As noted in Section 1.1, this report intends to characterize existing transmission system capacity and planned improvements/changes and the implications for accessing additional renewable resources for accessing additional renewable resources. To “characterize” this information in a meaningful way, an understanding of the terms Full Capacity Deliverability Status (FCDS) and Energy-only (EO) transmission capacity are necessary. For its current transmission grid, the California ISO developed estimates of the available FCDS and EO transmission capacity. Together these provide an estimate of the capability for new resource interconnections on the existing infrastructure that would not trigger network upgrades. For purposes of RETI 2.0, we define FCDS and EO as:

- Full capacity deliverability status – A California ISO FCDS transmission interconnection provides a reasonable assurance that a generator’s dependable capacity can be delivered to load under contingency conditions simultaneously with all other dependable generation in the same general area at peak load conditions. Transmission upgrades may be required to allow a generator to be available at system peak load during contingency conditions, so that it can be counted in the CPUC’s Resource Adequacy (RA) program. While deliverability reduces the likelihood of curtailment, there is no assurance -- other resources or imports may be more economic and get dispatched in the market instead.
- Energy-only - A California ISO EO interconnection allows a generator to deliver energy when transmission is available, with no assurance that delivery of that resource will be dispatched. EO interconnection does not provide deliverability, and the generator cannot be counted in the CPUC’s RA program. The EO resources may be curtailed if there is insufficient transmission capacity to allow these facilities to deliver their energy to the grid, and in times of over-generation.

Considering California’s resource adequacy program which requires “deliverability”, virtually all resources interconnecting to the California ISO transmission grid have sought and been granted an FCDS interconnection. The result has been that the California ISO transmission grid has been expanded and reinforced, often at substantial expense, to allow for FCDS service. As FCDS transmission capacity on the existing grid becomes less available, the ability to develop and site new transmission becomes more expensive and time consuming.

An alternative to the FCDS interconnection is “Energy-only” resource interconnection. EO interconnection is much faster and less expensive, as there is no need to ensure resource deliverability. This would allow substantially more capacity to interconnect to the grid, increasing the transmission utilization while decreasing the cost of interconnection since few additional network facilities would be required.

Many experts suggest that, going forward, a substantial quantity of resources will seek to interconnect with EO delivery status; however, there are a number of advantages, and several potential drawbacks, to EO interconnections. A summary of the most notable of these potential advantages and drawbacks for resources using EO interconnections are shown in Table 1-2.

Table 1-2: Potential Advantages and Drawbacks for Resources Using EO Interconnections

Energy Only Interconnections	
Potential Advantages	Potential Drawbacks
• Interconnect substantially more capacity without new network upgrades • Lower cost interconnection • Faster interconnection • Allow for the interconnection of more renewables	• No RA value for EO resources; no RA revenue stream • Limited ability to provide ancillary services (A/S) • Operating and revenue uncertainty • Exposure to congestion related costs • Increased exposure to congestion-related costs may create uncertainty about ability to finance projects • Operational complexity when linked to jointly owned transmission paths

The California ISO has developed estimates of the capacity that could be added to its system as both FCDS and EO resources. Currently, only the California ISO estimates transmission capacity for EO resources. While there may be additional EO-equivalent capacity on systems represented by other TTIG members, this has not been quantified at the time this report was written.

1.3.2. OUT OF STATE TRANSMISSION CAPACITY AND ENERGY DELIVERY

While this report is primarily focused on the transmission capability on the existing grid and from projects currently under development, including several transmission projects under development throughout the Western United States that offer the possibility of delivering large quantities of renewable energy to California. Most of these transmission projects are proposed to connect to the California ISO at existing grid intertie points (e.g., California-Oregon border, Eldorado, Hassayampa, northern Baja, Mexico) or, alternatively on existing import paths of other California balancing authorities (e.g., the Nevada-Oregon border, Mead, Intermountain Power Project).

The interaction of these out-of-state projects, the existing grid interties and import paths, and the in-state transmission grid is complex, especially when considering energy deliverability and RPS accounting rules. Consideration of proposed project development along with the capability of existing infrastructure is needed to develop a clear representation of opportunity to import renewables into California. More information about these issues is included in Sections 2 and 3, and will be developed more thoroughly in the latter stages of the RETI 2.0 project.

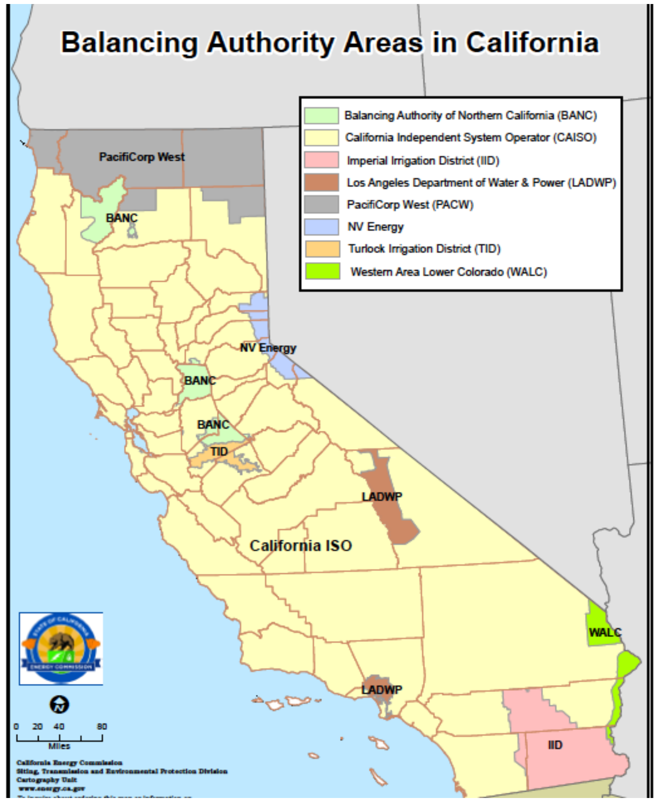
1.3.3. CALIFORNIA ISO GRID EXPANSION

The transmission capacity reported for the California ISO portion of the California grid is based on the current physical and electrical grid boundaries between the California ISO controlled grid and adjacent balancing authorities. While a broader regional footprint for the California ISO is being explored at this time, it is uncertain whether and/or when this expansion may occur and further, how this would affect transmission availability and renewable access. This report only considers the current grid and California renewable requirements.

2. CALIFORNIA TRANSMISSION SYSTEM – CURRENT AND FUTURE CAPACITY

The California electric grid includes a multitude of discrete electric utilities and other energy service providers. For operations purposes these entities have been aggregated into several Balancing Authorities (BA), shown in Figure 2-1.

Figure 2-1: Balancing Authority Areas in California



While the North American Electric Reliability Corporation (NERC) Reliability Standards for the Bulk Electric Systems of North America are uniformly applied throughout the balancing authority areas (BAAs), the processes used by these entities to operate and plan their facilities varies, reflecting each system's unique situation and needs. This is to say that while there are certain attributes of planning that are common within all of the BAAs, there are a variety of approaches used in developing transmission estimates and expected requirements.

Section 2 of this report portrays information that has been specifically provided by the TTIG participants for inclusion in their section of the report. As such, each of the TTIG participants are solely responsible for the content in their section and the views represented therein do not reflect the views of other individual TTIG participants nor do they reflect the consensus view of the TTIG.

2.1. CALIFORNIA INDEPENDENT SYSTEM OPERATOR

The California ISO operates the state's wholesale transmission grid, providing open and non-discriminatory access supported by a competitive energy market and comprehensive planning efforts. Partnering with about 150 entities, the California ISO is dedicated to developing and operating a modern grid that includes over 65,000 MW of power plant capacity, 26,000 circuit-miles of transmission lines serving over 30 million customers.

2.1.1. TRANSMISSION ESTIMATING METHODOLOGY

To develop estimates of transmission capacity to support FCDS and EO resources, the California ISO used information from studies in several of its annual transmission planning processes (TPP) and the annual Generator Interconnection and Deliverability Allocation Procedures (GIDAP) process. Additionally, the California ISO conducted a special transmission study in its 2015-2016 TPP to assess the potential transmission capacity necessary for achieving 50% renewables.

The 33% RPS policy-driven studies performed as part of the California ISO TPP historically have focused on ensuring FCDS for renewable resources based on the California ISO generator deliverability assessment methodology[2]. These policy-driven studies along with GIDAP allocation studies performed over the course of three planning cycles have provided information helpful in understanding the transmission upgrades that would be needed to make all resources fully deliverable.

In preparing for the anticipated wave of new renewable development to achieve the 50% RPS, the California ISO conducted special studies within the 2015-2016 TPP to assess potential transmission additions to meet the RPS. As part of this effort, a preliminary study of the capability of the California ISO grid was performed to evaluate the impact of additional renewable generation resources interconnection on an EO basis. The results of that study are included in the California ISOestimates of transmission capacity discussed below.

2.1.2. TRANSMISSION CAPACITY ESTIMATES

The California ISO has developed estimates of transmission capacity estimates of transmission capacity for Transmission Assessment Focus Areas (TAFAs). Noted above, these estimates are based on historical analyses, and if an area has not been recently analyzed to assess its transmission availability, no estimates are available. Additionally, there are areas within California that have renewable energy potential that are not located in the TAFAs. The California ISO has not conducted an assessment to determine the transmission potential from these areas. This should not be interpreted to mean that transmission capacity is not available; rather it should be considered as unknown.

The vast majority of the transmission with available capacity serves the Tehachapi and Riverside / Palm Springs areas. While it does not appear the California ISO's existing transmission system is capable of providing full deliverability for all of the renewable generating capacity that would be needed to reach a 50% RPS, the California ISO estimates that up to 22,000 MW of new generation could nevertheless be physically interconnected to the current system. The amount of new generation that could be interconnected with FCDS or EO status, based on the existing California ISO transmission system, is identified in Table 2-1 by transmission area.

Table 2-1: Transmission Capability Estimates within the California ISO[3]

Renewable Zones	FCDS Transmission	EO Transmission
Greater Carrizo	0	590
Central Valley North & Los Banos	130	1,889
Greater Imperial	523	1,849
Kramer & Inyokern	0	412
Lassen & Round Mountain	unknown	1,250
Mountain Pass & El Dorado	535	2,735
Tehachapi	2,628	3,794
Solano	Unknown	879
Sacramento River	Unknown	2,099
Riverside East & Palm Springs	2,450[4]	4,754

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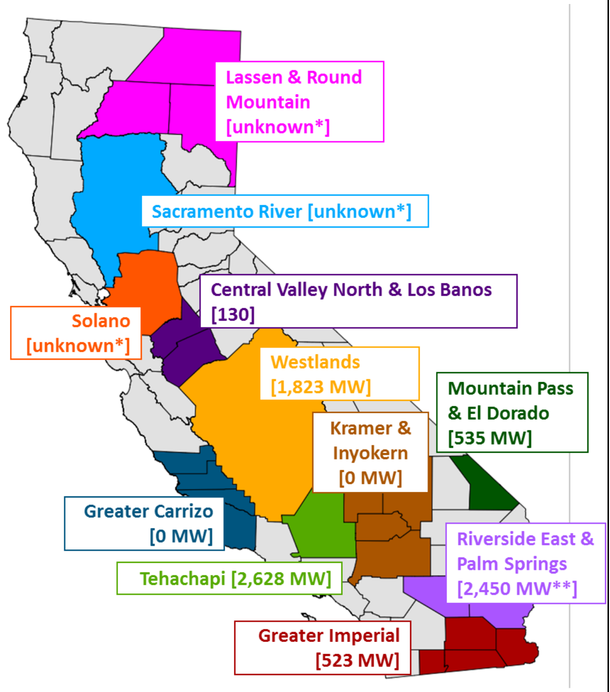
[2] http://www.caiso.com/Documents/On-PeakDeliverabilityAssessmentMethodology.pdf
[3] The capability estimates are based on prior transmission planning and generation interconnection studies. Estimated available transmission has been reduced by the amount of generation that has achieved commercial operation by January, 2016 based on the data available to the California ISO.
[4] Transmission capability provided for the Riverside East and Palm Springs zones is based on the capacity provided

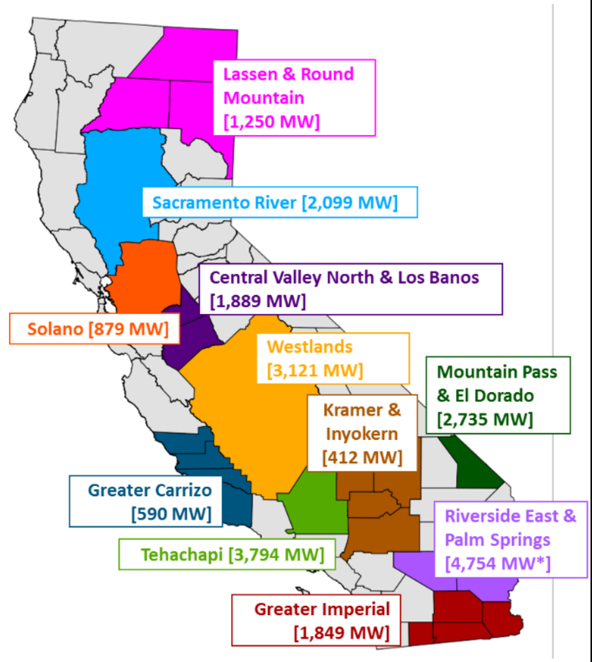
This generation capacity is graphically depicted in Figure 2-2 and Figure 2-3.

Figure 2-2: California ISO Fully Deliverable Capability by Transmission Area



* Insufficient information available through prior transmission planning studies due to very little generation in the interconnection queue
** WOD upgrade factored in

Figure 2-3: California ISO energy only Capability by Transmission Area



** WOD upgrade factored in

2.1.3. DELIVERABILITY FROM THE IMPERIAL AREA

When the California ISO's system is capable of delivering additional energy from the Imperial area, the California ISO either assigns this deliverability to generation that will be connecting directly to the California ISO controlled facilities in the area, or increases the Maximum Import Capability (MIC) from the Imperial Irrigation District. How the California ISO assigns the additional deliverability depends on the location of new generating projects that have entered resource adequacy power purchase agreements with entities that serve load on the California ISO system. [2014-2015 Transmission Plan and 2015-2016 Transmission Plan.]

In its 2011 Renewable Portfolio Standard proceeding, the CPUC established a forecast assumption of 1,400 MW of total Maximum Import Capability from IID in order to facilitate procurement. This 1,400 MW reflects the existing MIC of 462 MW plus a forecast of additional future MIC of 938 MW. However, only 240 MW of additional generation on the IID system was ultimately procured through that process. Based on the generation that entered resource adequacy power purchase agreements, the California

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by the West of Devers Upgrade Project as proposed by SCE.

ISO announced its intention to increase the MIC from 462 MW to 702 MW, once the transmission upgrades necessary to facilitate that adjustment are complete.

Since then, the forecast requirements for deliverability from the Imperial area overall and for increased MIC from IID have been established through the renewable generation planning portfolios provided by the CPUC each year as input into the California ISO's annual transmission planning process. This direction sets the total amount of incremental generation planned for from the Imperial area overall, as well as the specific locations of the forecast generation within IID or connecting directly to the California ISO controlled grid.

2.1.4. NEW CALIFORNIA ISO TRANSMISSION

The transmission capability estimates included in this report include transmission projects that have been recently completed or are currently under development. These projects are listed in Table 2-2. Please note that "Online" dates are subject to change.

Table 2-2: Transmission Upgrades Underway

Transmission Upgrade	California ISO Status	Online Date
Carrizo-Midway	LGIA	energized
Sunrise Powerlink	Approved	energized
Suncrest dynamic reactive support	Approved	2017
Eldorado-Ivanpah	LGIA	energized
Valley-Colorado River	Approved	energized
West of Devers	LGIA	2021
Tehachapi (segments 1, 2 & 3a of 11 completed)	Approved	2016
South Contra Costa	LGIA	2016
Borden-Gregg	LGIA	2018
Path 42 reconductoring	Approved	2016
Sycamore Canyon-Penasquitos	Approved	2017
Lugo-Eldorado line reroute	Approved	2017
Lugo-Eldorado and Lugo-Mohave series caps	Approved	2019
Warnerville-Bellota recond.	Approved	2017
Wilson-Le Grand recond	Approved	2020

More detailed description and status updates of these and a few other transmission projects in Pacific Gas and Electric (PG&E), Southern California Edison (SCE) and San Diego Gas and Electric (SDG&E) areas are presented in Table 2-3, Table 2-4, and Table 2-5.

Table 2-3: Summary of On-going and Completed Projects in the PG&E Power Flow Study Area

Project	Planning Entity	Brief Description	Renewable zones impacted	Status
Table Mountain – Rio Oso 230 kV Line Reconductor	PG&E	The scope of this project was to reconductor the Table Mountain -Rio Oso 230 kV DCTL with larger capacity conductors.	PG&E North, North Valley	Project is operational
Palermo - Rio Oso 115 kV Reconductoring		The scope of this project was to reconductor the 115 kV lines between Palermo and Rio Oso substations with larger capacity conductors.	PG&E North, Sierra	Project is operational
South of Palermo 115 kV Reinforcement	PG&E	The scope of this project is to reconductor the southern portions of the Palermo – Rio Oso Nos. 1 and 2 115 kV Lines as well as the entire Palermo – Pease and Pease – Rio Oso 115 kV Lines.	PG&E North, Sierra	Project is in engineering and design
New Rio Oso – Atlantic 230 kV Line	PG&E	The scope of this project is to install a new 18 mi. Rio Oso – Atlantic No.2 230 kV Line and convert the Atlantic 230 kV Substation to standard 4 element bus.	PG&E North, Sierra	Project is in engineering and design
Rio Oso 230/115 kV Transformer Replacements	PG&E	The scope of this project is to replace the Rio Oso 230/115 kV transformers (Nos. 1 and 2) with higher capacity rated units.	PG&E North, Sierra	Project is in engineering and design
Midway-Solar SS 230 kV Reconductoring	PG&E	The scope of this project was to reconductor the Midway-Caliente SS-Solar SS 230 kV lines with higher capacity conductors.	Carrizo, Los Padres	Project is operational
Gates #2 500/230 kV Transformer Addition	PG&E	The scope of this project is to install a second 500/230 kV transformer at Gates substation.	San Joaquin Valley, Westland	Project is in engineering and design
Central Valley Power Connect (Gates-Gregg 230 kV Line)	PG&E	The scope of this project is to build of a new 230 kV line between Gates and Gregg substations.	San Joaquin Valley, Westland	Project is in engineering and design

Wilson-Legrand 115 kV Reconductoring	PG&E	The scope of this project is to reconductor the Wilson-Le grand 115 kV line with a large capacity conductor	Fresno	Project is in early planning phase
Bellota – Warnerville 230 kV Line Reconductoring	PG&E	The scope of this project is to reconductor the Bellota – Warnerville 230 kV Line with a larger capacity conductor	Fresno	Project is in early planning phase

Table 2-4: Summary of On-going and Completed Transmission Projects in the SCE Power Flow Study Area

Projects	Planning Entity	Brief Description	Renewable Zones Impacted	Status
Tehachapi Renewable Transmission Project (TRTP)	SCE	New and upgraded transmission infrastructure from the Tehachapi Wind Resource Area in southern Kern County to the existing Mira Loma Substation in Ontario.	Tehachapi, Los Angeles County (partial), & San Bernardino Lucerne	In construction with a 11/03/2016 operating date
West of Devers (WoD)	SCE	The project consists of the removal and replacement of approximately 48 miles of existing 220 kV transmission lines with new double-bundle 1590 ACSR 220 kV transmission lines, between the existing Devers Substation (near Palm Springs), Vista Substation (in Grand Terrace), and San Bernardino Substation.	Riverside East, Palm Springs, Riverside County (partial), and San Bernardino-Lucerne	In licensing with an operating date of 08/01/2021
Mesa	SCE	Expand Mesa Substation to a 500 kV substation. Construct new 500 kV switchbacks and rebuild the 230/66/16 kV switch racks. Loop-in Mira Loma-Vincent 500 kV to Mesa. Loop in Goodrich-Laguna Bell and Rio Hondo-Laguna Bell 230 kV lines into Mesa Substation.	Los Angeles County (partial)	In licensing with an operating date of 12/31/2020
Calcite Substation	SCE	New 220 kV Substation to support generation interconnections in the Lucerne Valley.	San Bernardino-Lucerne	In licensing with an operating date of 08/01/2020
Path 42 Upgrade	SCE	Install relays, meters and logic controllers as necessary associated with IID's new proposed SPS. Upgrade the following transmission lines post Devers-Coachella Valley Loop-in Project: Devers-Mirage #1 230kV T/L, Devers-Mirage #2 230kV T/L, SCE-owned portion of Mirage-Ramon #1 230kV T/L and SCE-owned portion of Mirage - Coachella Valley 230 kV T/L.	Palm Springs	In construction with an operating date of 12/31/16

Victor Loop-In	SCE	Loop the existing Kramer-Lugo #1 & #2 230 kV lines into Victor Substation.	Kramer, Victorville, & San Bernardino-Lucerne	Project in Engineering/Design with an operating date of 12/31/2016
Eldorado-Lugo Series Capacitor Upgrade	SCE	This project involves the upgrade of the existing 500 kV Series Capacitors at Eldorado and Lugo on the Eldorado-Lugo 500 kV T/L to 3,300A continuous rating, as well as a new Series Capacitor rated 3,300A in the vicinity of Pisgah Substation.	Mountain Pass, San Bernardino-Baker, Pisgah, San Bernardino-Lucerne	Project in Engineering/Design with an operating date of 12/31/2019
Lugo-Mohave Series Capacitor Upgrade	SCE	This project involves the upgrade of the existing 500 kV Line Series Capacitors at Mohave on the Lugo-Mohave 500 kV T/L's to 3,300A Continuous Rating, as well as a new Series Capacitor rated 3,300A in the vicinity of Pisgah Substation.	Mountain Pass, Pisgah, & San Bernardino-Lucerne	Project in Engineering/Design with an operating date of 12/31/2019
Lugo -Victorville 500 kV SPS	SCE	This SPS is required to reliably interconnect and integrate the Transition Cluster (TC) generation projects. This SPS will trip the TC projects for the N-1 loss of the Eldorado-Lugo and N-2 loss of the Eldorado-Lugo & Lugo-Mohave 500 kV Transmission Lines.	Mountain Pass, San Bernardino-Baker, Pisgah, San Bernardino-Lucerne,	Project in Engineering/Design with an operating date of 09/30/2016
Whirlwind 3rd AA Bank and SPS	SCE	Install the third AA 500/230 kV transformer bank at Whirlwind Substation. This will also require the need to modify the existing Special Protection System to trip generation under an N-1 of one transformer bank.	Tehachapi	Project in Engineering/Design with an operating date of 12/31/2016
Eldorado-Mohave & Eldorado-Moenkopi 500 kV Line Position Swap	SCE	This project involves swapping the line positions of the Eldorado-Mohave and Eldorado-Moenkopi 500 kV lines to reduce the risk of thermal overloads caused by the loss of the Eldorado-Lugo and Eldorado-Mohave 500 kV transmission lines.	Non-CREZ (Nevada)	Project in Engineering/Design with an operating date of 5/1/2017

Kramer High Voltage Mitigation - Tertiary and Bus Shunt Reactors	SCE	This project includes a Phase 1 and Phase 2 to mitigate high voltage concerns at Kramer Substation. Phase 1: Installs two (2) 34 MVAR reactors to the 12 kV tertiary winding of the existing 230/115 kV No.1 and No.2 transformer banks. Phase 2: Installs one (1) 230kV 45 MVAR bus shunt reactor at the 230 kV bus at Kramer Substation	Kramer	Project in Engineering/Design with operating dates of: Phase 1: 6/01/16 Phase 2: 6/01/17

Table 2-5: Summary of On-going and Completed Transmission Projects in the San Diego Power Flow Study Area

Projects	Planning Entity	Brief Description	Renewable Zones Impacted	Status
South Orange County Reliability Enhancement Project	SDG&E	Expand Capistrano 138/12 sub to 230/138/12 kV sub with two 230/138 transformers. Build 230 kV line between Talega, Capistrano and San Onofre.	San Diego Local Area	CPCN application under review at CPUC. Estimated ISD: 12/2020.
Sycamore Canyon - Penasquitos 230 kV line	SDG&E	Build underground 230 kV line between Sycamore Canyon and Penasquitos substations.	Greater Imperial	CPCN application under review at CPUC. Estimated ISD: 11/2017.
IV phase shifting transformer	SDG&E	Add two 400 MVA 230 kV phase shifting transformers in parallel at Imperial Valley substation on the 230 kV Imperial Valley – La Rosita transmission line.	n/a	Under construction. Estimated ISD: 6/2017.
New reactive support at San Luis Rey and SONGS	SDG&E	Two 225/-120 synchronous condensers units connected to San Luis Rey 230 kV bus and one 225/-120 MVAr unit connected to San Onofre 230 kV bus.	n/a	Under construction. Estimated ISDs: before the end of 6/2017.
Series capacitor bypass on Southwest Powerlink and the Sunrise Powerlink 525 kV lines	SDG&E	Bypass the existing series capacitors on 500 kV Suncrest – Ocotillo, 500 kV Miguel – ECO, and 500 kV Imperial Valley – North Gila lines.	Greater Imperial	This is a short-term operational solution implemented by the California ISO. SDG&E supports a long-term, permanent solution to address the issues that this short-term solution mitigates, and therefore the series capacitors should not be assumed as bypassed as a part of the baseline assumptions for RETI 2.0 studies.
Interconnect fourth 500/230 kV transformer at	IID	4th 500/230 transformer in the Imperial Valley Substation.	n/a	SDG&E conducting interconnection study.

Imperial Valley sub.				
New Static Var Compensator (SVC) interconnected at Suncrest Substation	NEET West	+300/-100 MVAr SVC interconnected to Suncrest 230 kV bus through a one mile underground circuit.	n/a	SDG&E and NEET West negotiating interconnection agreement.
New transmission between Laramie River Station and Harry Allen substations	TBD	Explore costs and benefits of developing new transmission and/or using existing transmission to support development of high quality wind resources in Wyoming.	Wyoming	Ongoing internal studies. Suggested "conceptual solution" pending at the FERC Order 1000 Western Planning Regions (WPRs).
New transmission between eastern New Mexico and Phoenix area	TBD	Explore costs and benefits of developing new transmission and/or using existing transmission to support development of high quality wind resources in eastern New Mexico.	New Mexico	Ongoing internal studies. Suggested "conceptual solution" pending at the FERC Order 1000 WPRs.
Bay Boulevard substation	SDG&E	Construct a new 230/69 kV substation to replace the existing South Bay 138/69 kV substation. Loop existing 230 kV Otay Mesa-Silvergate-Miguel line into the new Bay Boulevard 230 kV bus.	n/a	Under construction. Estimated ISD: 10/2016.
230 kV Miguel – Bay Boulevard #2 transmission line	SDG&E	Add a new 10 mile 230 kV line between Miguel 230 kV bus and Bay Blvd 230 kV bus on existing overhead structure.	San Diego Local Area and Greater Imperial	Cost recovery approved by California ISO. Need date: 6/2019.
230 kV transmission line between Mission and Penasquitos subs	SDG&E	Build a 230 kV Mission-Penasquitos transmission line	Greater Imperial	Cost recovery approved by California ISO.

2.2. IMPERIAL IRRIGATION DISTRICT

Imperial Irrigation District (IID) was formed pursuant to the California Water Code that provides irrigation and electric service in Southern California. IID provides electric service to more than 145,000 customers in Imperial County and parts of Riverside County with a peak load of approximately 1000 MW. IID is a registered Balancing Authority ("BA") and owns and operates generation, transmission and distribution facilities.

The Imperial Valley has long been at the forefront of renewable energy production. For nearly 20 years, more than 500 MW of geothermal capacity and associated energy has been produced and delivered to California Load Serving Entities ("LSE"). There is a significant amount of additional geothermal resources in the Imperial Valley.   These renewable resources produce zero emissions, utilize proven technologies and are produced in-state.

As a public agency providing power and irrigation services to the Imperial Valley, IID has a strong interest in promoting the development of renewable energy in the region. Imperial County is one of the most impoverished regions in the nation. It has an unemployment rate of over 23.5% and nearly one in four residents live at or below federal poverty level. The development of the renewable energy industry in Imperial County will provide economic development and jobs to a region of California that is in desperate need.

Figure 2-4: Imperial Irrigation District

Transmission lines:

1,421.1 miles

Service Territory:

Imperial County: 4,225 mi^2

Riverside County: 1,954 mi^2

San Diego County: 293 mi^2

Total: 6,471 mi^2

Interties with California ISO, SDGE, SCE, APS, and WAPA

2.2.1. IID TRANSMISSION CAPACITY

IID has over 3000 MW of total transmission capacity that can be used to export renewable energy to the other California LSEs. The capacity is presently under utilized as described in Table 2-6 which shows that there is 2,300MW of available transmission capacity. For example, Imperial County is located near the Chocolate Mountain area, which has a large potential for developing new renewables and is in close proximity to IID's 1000 MW of available transmission capacity on Path 42.

Table 2-6: List the Total and Available Transmission Capacity for Export to CAISO

Existing Transmission Paths for Export to CAISO	Total Transmission Capacity	Brief Description	Available Transmission Capacity	Renewable Zones
Transmission Path	MW		MW	
Path 42	1,500	IID approved a project to re-conductor the double 230kV lines between IID and SCE. The project increases import and exports between CAISO and IID from 600MW to 1500MW.	1,100	Imperial and Riverside CREZ
Imperial Valley Substation	370	IID and SDGE interconnect via a single 230kV line ("S line")	180	Imperial CREZ
FERN	1,170	This one mile interconnection from the existing Fern to Imperial Substation has a rating of 1171MW. The gen tie has an existing 140MW interconnected solar facility. The interconnection point represents a unique opportunity for generators to interconnect at a very low cost since Fern will have CAISO network interconnection points with an IID transmission rate of approximately 0.016 to .022 cents per kW-month.	1,020	Imperial CREZ
Total	3,040		2,300	

In support of further renewable development, IID is proposing several other transmission projects to increase exports from the Imperial Valley to CAISO and other BA's. (Refer toTable 2-7) IID's proposed Strategic Transmission Expansion Plan ("STEP") will provide additional transmission for Southern California load centers to access renewable energy from the West Chocolate Mountains REEA. IID's STEP initiative is designed not only to facilitate the export of Imperial Valley renewables to the Southern

California load centers but also to deliver this energy to other regions of the Southwest. IID submitted its STEP proposal into the California ISO 2013-14 Transmission Planning Process request window. Although its proposed configuration could be refined, the STEP proposal's key element is a new 1100 MW 500 kV AC transmission line from IID's existing Midway substation to SCE's existing Devers substation. The 500 kV circuit will span about 75 miles from the Imperial Valley to SCE's substation near Palm Springs.

The STEP also allows for further expansion of AC line capability by an additional 1100 MWs as well as further expansion of the capacity on the collector system in the Imperial Valley. Furthermore, this project could be completed with relatively limited environmental impacts. Approximately 50 percent of the proposed DC line will be within existing IID rights-of-way or on land owned by IID. Approximately 70 percent of the proposed Imperial Valley collector system has already been permitted by IID. This will greatly ease the burden of siting and permitting.

Table 2-7: Proposed Transmission Capability to Export to CAISO and WAPA

Proposed New IID Transmission for Increasing Export to CAISO and/or Other BA's	Total Transmission Capacity	Brief Description	Renewable Zones
Transmission Path	MW		
Strategic Transmission Expansion Plan ("STEP")	1,100	This 500kV transmission line is 75 miles long adjacent to the existing Path 42. This will strengthen the link between IID and SCE. IID has acquired about 55% of the Right-of-Way. The line is proposed to interconnect IID Midway to SCE Devers substations.	Imperial and Riverside CREZ
Desert Southwest Project (From IID to CAISO/WAPA)	1,100	Proposed 118 miles, 1100MW transfer capability on a single 500kV circuit transmission line. The proposed DSW spans from the Keim substation near Blythe to SCE /Devers substation. IID holds BLM Right-Of-Way Grants.	Imperial and Riverside CREZ
CFE (From IID to CFE)	600	Several alternatives are under evaluation. The objective is to directly connect IID and CFE through a 300 to 600 MW interconnection.	Imperial CREZ
Total	2,800		

2.2.2. IID PROPOSED GENERATION INTERCONNECTION LOCATIONS

To accommodate the high resource potential for geothermal, solar, wind and biomass in the IID BA, Table 2-8 lists the desirable generation interconnection location.

Table 2-8: List of Potential Generation Interconnection

Location	MW	Imperial CREZ Location
Bannistor 230kV Substation	600	North
Midway 92kV Substation	150	North
Midway 230kV substation	600	North
Midway 500kV	800	North
Coachella Valley 92kV	150	North
Avenue 58 Sub	150	North
Anza 92kV Substation	150	North
Calipatria Substation	150	North
Pilot Knob 230kV Substation	250	East
Niland 92kV Substation	400	East
Fern 230kV Substation	800	South
Total	4,200	

2.2.3. POTENTIAL IID TRANSMISSION UPGRADES TO ACCOMMODATE NEW GENRATION

IID has a few transmission and substation upgrades on standby and ready for moving forward to accommodate new generation. A list of these potential upgrades are listed in Table 2-9 below.

Table 2-9: List of Transmission and Substation Upgrades

Location	Brief Description	Capacity Addition (MW)
Midway - Bannistor 230kV #2 line	This project consists of placing another 230kV bundle conduction on the exiting and newly constructed Midway - Bannistor #1, 230kV line.	800
Midway 500kV Substation	Expand the exiting Midway 92kV and 230kV to accommodate STEP and DSW 500kV lines.	1100
N. Gila - Pilot Knob and expansion of Pilot Knob substation	Expand the exiting Pilot Knob substation and a new 230kV line from N. Gila to Pilot Knob. This will provide access to the southwestern market.	800
Fern to CFE 230kV line	New transmission line from IID to CFE.	600

2.2.4. IID PROPOSAL ON MAXIMIZING THE EFFICIENT USE OF EXISTING TRANSMISSION IN THE IMPERIAL CREZ

IID recommends an examination of the current CAISO policy for utilization of existing transmission to allow exports from IID into CAISO. For instance, even with IID and SCE upgrades of Path 42 from 600 MW to 1500 MW did not result in increase of FCDS (See Table 3) from the Greater Imperial Area into CAISO.

Maximizing use of existing transmission in valuing exports from the IID system is crucial to ensure maximum usage of existing transmission capacity and must be #1 priority. IID believes that the current ISO Maximum Import Capability ("MIC") is inconsistent with the physics of the grid, underutilizes existing transmission capacity, provides incentive to locate projects that have the highest adverse impact on the grid, and increases costs to both IID and CAISO/IOU's ratepayers. The current ISO MIC calculation from IID into CAISO can be improved to better utilize existing and unused transmission capacity. The current MIC calculation results in unintended consequences of underutilizing certain available trasnmission capacity in the northern IID area and overutilizing unavailable transmission capacity in the Southern IID area.

To better understand this point, we offer the following example and explanation:

As California's power system evolves in response to 33% -- now 50% -- renewable energy goals and beyond, it is important to incent new generation projects to make the best possible use of existing transmission facilities. The vehicle by which to satisfy this objective is to incorporate an explicit consideration of how to utilize existing transmission capacity in a flexible and efficient manner into renewable project valuation. This can be accomplished by taking into account: (1) the optimal utilization of existing transmission infrastructure; (2) an assignment of a proportional share of transmission costs to projects utilizing new transmission infrastructure regardless of the rationale for the new build; and (3) the allocation of project deliverability in a manner that incents proposed new generation projects to interconnect to facilities that will minimize their overall contribution to existing transmission constraints.

2.2.4.1. BACKGROUND AND FACTS

1. The IID's BAA accounts for 98 percent of the entire area in the Imperial CREZ.
2. Only 2 percent of the Imperial CREZ lies within the CAISO BAA.
3. Over 1,200 MW of wind and solar are under PPA with the IOUs that directly connect to the CAISO facilities in the Imperial CREZ.
4. However, only one solar project of 150 MW (one PPA) with SDGE has been constructed in the IID BAA and is currently delivering solar energy to SDGE customers.
5. IID has ample available transmission capacity to allow significant additional amounts of renewable generation to reach the CAISO BAA. The cost of this available capacity is the lowest in California at $3/MWh.
6. As a result of the MIC currently assigned to IID, renewable energy projects in the Imperial CREZ are incentived to obtain transmission service from CAISO, bypassing the IID system, despite the inefficiency of doing so.
7. There are two existing interties between CAISO's system and IID's system that provide the

needed bridges between these two energy producing and energy consuming areas. These bridges also provide an efficient and effective pathway that can enable California to achieve a significant percentage of its renewable energy goals at a cost that is significantly lower than the cost associated with projects that would interconnect directly into the CAISO.

8. IID submitted to CAISO in March 2015 an analysis demonstrating the generation locational impact in the three CEC designated Imperial CREZ regions (North, South and East). In addition, CAISO has acknowledged these locational impacts.

2.2.4.2. INADEQUATE DELIVERABILITY FROM IID INTO THE CAISO

In 2011, several stakeholders, including IID, CAISO and California Public Utilities Commission (CPUC) identified potential issues with the way in which the MIC between the IID Balancing Authority Area (BAA) and the CAISO BAA was calculated. Recognizing the disadvantage that renewable energy projects interconnecting to IID's BAA faced, on July 7, 2011, the CPUC issued an Assigned Commissioner Ruling (ACR) by Commissioner Ferron that proposed to modify the CAISO's MIC process by developing a forward looking MIC calculation methodology, as opposed to relying solely on historical scheduled imports into the CAISO from IID. In that ACR, the MIC from the IID BAA to the CAISO was determined to be 1,400 MW, which is consistent with resource development projections in IID. The ACR specifically stated that it would be unreasonable for CPUC-jurisdictional load serving entities ("LSEs") to assume less than the 1,400 MW of MIC for procurement calculation purposes.

Since the issuance of its 2012 Transmission Planning Report (2011-2012 TPP), the CAISO has included a MIC value table showing the MIC from IID to CAISO for a ten-year planning horizon. Since then, this MIC value table has been used by LSE procurement staff in RFO bid evaluations for projects situated in the IID BAA, and in order to assign resource adequacy values to IID projects. Project lenders also use the MIC value table in their project evaluations. As such, the contents of this MIC value table are of paramount importance to projects situated in the IID, to LSE procurement staff, and to project lenders for successful completion of renewable projects in IID service territory.

In its 2013-2014 transmission plan, however, the CAISO indicated zero incremental deliverability for generators or projects connecting to the IID BAA, while projects that are within the Imperial CREZ or a few yards away, which can interconnect directly to the CAISO system, were deemed deliverable, and some of these were awarded PPAs[5].

Other renewable energy projects that otherwise would have been located in and interconnected to the IID BAA were forced to construct gen-ties and connect to the CAISO BAA in order to obtain deliverability and be considered in the Independently Owned Utilities' (IOUs') solicitations. The renewable energy projects built gen-ties in order to connect directly to the CAISO BAA, in some instances only a few hundred yards away from comparable project sites in the IID BAA, were awarded with Power Purchase Agreements (PPAs) totaling 1200 MW, whereas otherwise competitive projects that would interconnect to the IID BAA were awarded no PPAs at all.

To demonstrate the seriousness of this problem, consider two projects X and Y, both 100 MW and both projects bidding $60/MWh and $50/MWh respectively for renewable energy as a fully deliverable product. Both projects are located in the Imperial CREZ. Project X plans to connect to CAISO Imperial Valley substation as shown in Figure 2-5 and Figure 2-6.

[5] http://www.8minutenergy.com/news/press/srpcorp

Project Y plans to connect to IID's Coachella Valley Substation as shown in Figure 6: Project Y. Because of where the projects interconnect and the resultant energy flows toward the load center in San Diego, the congestion on the transmission corridor downstream leading to San Diego where the energy is consumed is worsened considerably by Project X (CAISO BAA interconnection), but only minimally by Project Y (IID BAA interconnection). By interconnecting to the CAISO's Imperial Valley Substation, Project X contributes 35% of its energy output toward worsening congestion on the transmission corridor to San Diego. However, because Project Y is interconnected further north to IID's Coachella Valley Substation, it contributes only 2% of its energy output to worsening congestion on the transmission corridor to San Diego.

Figure 2-5: Project X

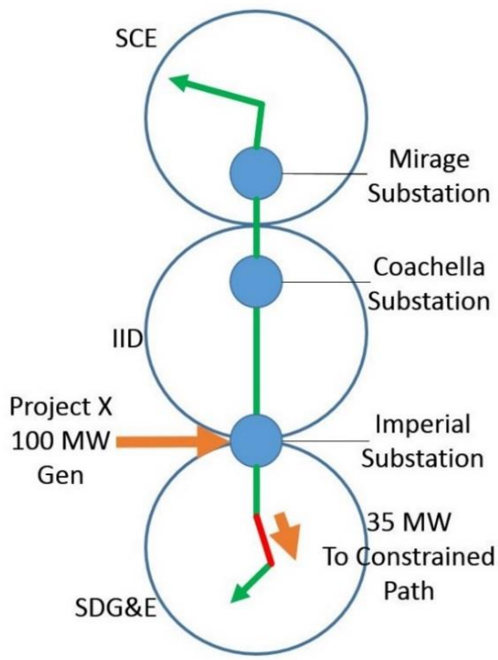
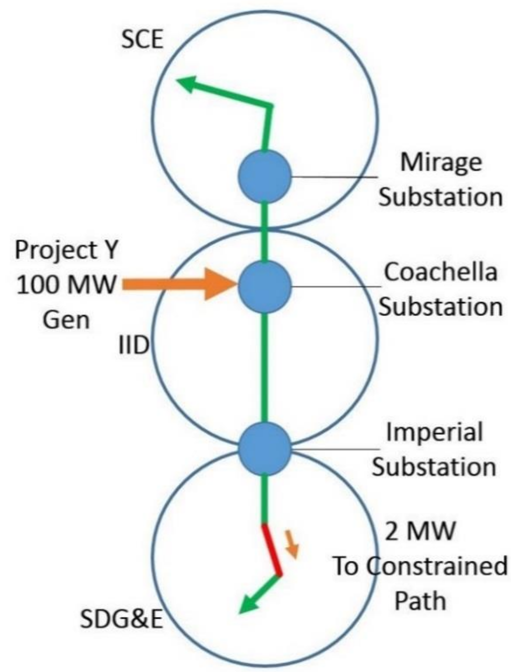


Figure 2-6: Project Y



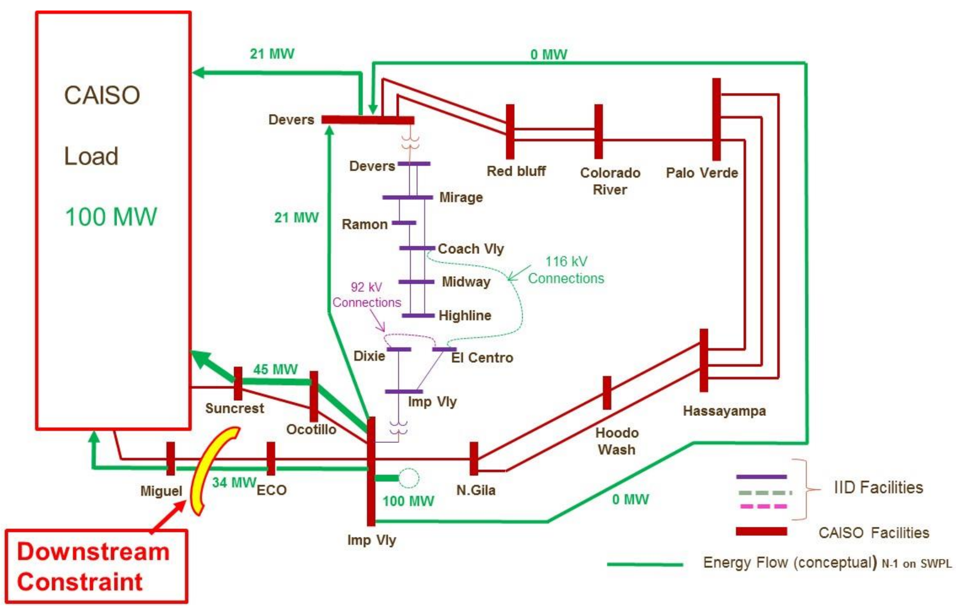
Everything else being equal, and assuming the IOU intends to purchase 100 MW, the current CAISO MIC "kills" Project Y from even competing with project X based on the wrong assumptions of no available MIC from IID. Even if Project Y is cheaper than Project X, the IOU's procurement will dis-qualify Project Y based on no MIC availability. In this instance, rojects connecting to IID BAA always lose to projects a few miles away but connected to CAISO BAA. The irony is and in order for Project X to be fully deliverable, Project X uses 20 MW of IID transmission capacity that CAISO indicated is not available. Furthermore, Project X has the most adverse impact on the transmission grid and exasperates already heavily loaded lines.

This outcome will result in increasing congestion and subsequent higher energy and transmission costs to ratepayers and generators. There is a better solution. In order to maximize the use of the existing transmission system capacity and minimize the need for new transmission lines, the appropriate choice should have been to select Project Y for a full 100 MW (based on price, physically available transmission and effectiveness). This alternative outcome would ensure that projects that have the least overall impact on the existing transmission system (and the lowest overall transmission-related cost, along with other important attributes) should have an edge over projects that worsen congestion.

This example is not a hypothetical example, it's real and it's one of many examples that IID has directly experienced since 2012. This illustrates that the current method used by the CAISO to calculate and allocate the IID MIC and the total amount of deliverability from the Imperial CREZ is impacting the viability of projects connecting to IID BAA, inconsistent with the physics of the grid and actually increases congestion. For instance, most of the new generation awarded PPAs in the Imperial CREZ is clustered in one area near the CAISO BAA's Imperial Valley Substation. This location appears to be the worst possible location from a deliverability perspective, because it adversely affects congestion on the transmission corridor to San Diego. By comparison, projects that are located in the Coachella Valley area of the Imperial CREZ have much less impact on the congested transmission corridor than those interconnected to the CAISO's BAA near Imperial Valley Substation.

Recently, Southern California Edison ("SCE") procured over 406 MW[6] of solar connecting to the CAISO Imperial Valley Substation ("IVS"), in a location with one of the worst impacts on the constrained path. A power system analysis conducted by IID Planners found that the location of generation within the Imperial CREZ[7] would have a disproportional impact on the grid, and, therefore, on the MIC from IID into the CAISO, as illustrated in Figure 2-7 below.

Figure 2-7: Impact of 100 MW Generator Interconnected at Imperial Valley Substation on Downstream Constraint



Interconnecting a 100 MW generator on the CAISO grid at the Imperial Valley Substation results in roughly 34 MW flowing through the downstream constraint into the San Diego load center. Much like trying to build a new on-ramp onto a congested freeway exacerbates traffic congestion, interconnecting a new generator upstream of a well-known transmission constraint exacerbates congestion on the

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6 http://www.8minutenergy.com/news/press/srpcorp

Two 20-year power purchase agreements to sell 406 megawatts-ac of clean, renewable solar energy from Mount Signal Solar Farm II (154 MW-ac; 200 MW-dc) and Mount Signal Solar Farm V (252 MW-ac, 328 MW-dc) utility-scale solar projects in Imperial County, California, to Southern California Edison (SCE).

7 Imperial CREZ consist of all of Imperial County and all of IID BAA.

transmission corridor. Locating a generator further north and away from the constraint, nearer to Devers substation in the northern part of IID's BAA, considerably reduces the impact of new generation on the grid and, consequently, the need for additional transmission.

Table 2-10 below summarizes the disproportional impact of new generators on the constrained path.

Table 2-10: Disproportional Impact of New Generators on the Constrained Path

Projects Approved and Online	IOU	Min MW	Technology	Vintage	Location	BAA	Impact on the Eco-Miguel 500kV Constrained Path (%)	Impact on the Eco-Miguel 500kV Constrained Path (MW)
Kumeyaay Wind	SDG&E	51	Wind	New	San Diego County	CAISO	25%	12.75
Ocotillo Express Wind Project	SDG&E	265	Wind	New	Ocotillo, CA	CAISO/IVS	35%	92.75
Campo Verde/Mt. Signal Solar	SDG&E	49	Solar PV	New	Fillaree Ranch, Imperial Valley	CAISO/IVS	35%	17.15
Imperial Solar Energy Center -South	SDG&E	130	Solar PV	New	El Centro, CA	CAISO/IVS	35%	45.5
Centinela Solar (expansion)	SDG&E	30	Solar PV	New	Calexico, CA	CAISO/IVS	35%	10.5
Imperial Solar Energy Center -West	SDG&E	130	Solar PV	New	El Centro, CA	CAISO/IVS	35%	45.5
Arlington Valley Solar Energy II	SDG&E	127	Solar PV	New	Arlington, AZ	CAISO	40%	50.8
Mt. Signal Solar II	SCE	154	Solar	New	Calexico, Imperial County, CA	CAISO/IVS	35%	53.732
Mt. Signal Solar IV	SCE	252	Solar	New	Calexico, Imperial County, CA	CAISO/IVS	35%	88.312
Subtotal (1)		1188					35.1%	416.994

ORNI 18	SCE	50	Geothermal	New	North Brawley, CA	IID	2%	1
SG2 Imperial Valley	SDG&E	150	Solar PV	New	Calipatria, CA	IID	15%	22.5
Seville Tallbear LLC	SDG&E	20	Solar PV	New	Calipatria, CA	IID	18%	3.6
Calipatria	SDG&E	20	Solar PV	New	Calipatria, CA	IID	15%	3
Midway Solar Farm I	PG&E	50	Solar PV	New	Calipatria, CA	IID	15%	7.5
Subtotal (2)		290					13.0%	37.6
Total		1478						454.6

On average, the CAISO-interconnected projects impact the constraint by 35% as opposed to 13% for IID-interconnected projects. That means for every 100 MW interconnected to the CAISO-grid, the active transmission constraint is worsened by 35 MW.

A second consequence of interconnecting generators to the CAISO grid is the impact on IID's BAA. Because electricity flows through the path of least resistance, interconnecting generation on one entity's electrical grid is not limited to flowing on that entity's grid. Electricity will flow on neighboring grids. To the extent that flow adversely impacts a neighbor's grid, neighbors notify the generators of the need to mitigate the impact.

In the case of generators interconnecting to the CAISO grid, IID is impacted in the form of reduced MIC. Figure 2-7 above illustrates the impact of a 100 MW generator interconnected to Imperial Valley Substation on IID's grid in that roughly 21 MW flow through IID's BAA. Table 2-11 below summarizes the impact of CAISO-interconnected generators on MIC from IID's BAA.

Table 2-11: Impact of CAISO-interconnected Generators on MIC from IID's BAA

Projects Approved and Online	IOU	Min MW	Technology	Vintage	Location	BAA	Impact on the Eco-Miguel 500kVConstrained Path (%)	Impact on the Eco-Miguel 500kV Constrained Path (MW)
Kumeyaay Wind	SDG&E	51	Wind	New	San Diego County	CAISO	15%	7.7
Ocotillo Express Wind Project	SDG&E	265	Wind	New	Ocotillo, CA	CAISO/IVS	18%	47.7
Campo Verde/Mt. Signal Solar	SDG&E	49	Solar PV	New	Fillaree Ranch, Imperial Valley	CAISO/IVS	20%	9.8

Imperial Solar Energy Center -South	SDG&E	130	Solar PV	New	8 mi SW of El Centro, CA	CAISO/IVS	20%	26.0
Centinela Solar (expansion)	SDG&E	30	Solar PV	New	Calexico, CA	CAISO/IVS	20%	6.0
Imperial Solar Energy Center -West	SDG&E	130	Solar PV	New	8 mi SW of El Centro, CA	CAISO/IVS	20%	26.0
Arlington Valley Solar Energy II	SDG&E	127	Solar PV	New	Arlington, AZ	CAISO	40%	50.8
Mt. Signal Solar II	SCE	154	Solar	New	Calexico, Imperial County, CA	CAISO/IVS	20%	30.7
Mt. Signal Solar IV	SCE	252	Solar	New	Calexico, Imperial County, CA	CAISO/IVS	20%	50.5
Subtotal (1)		1188					21.5%	255.1
ORNI 18	SCE	50	Geothermal	New	North Brawley, CA	IID	0%	0.0
SG2 Imperial Valley	SDG&E	150	Solar PV	New	Calipatria,CA	IID	0%	0.0
Seville Tallbear LLC	SDG&E	20	Solar PV	New	Calipatria,CA	IID	0%	0.0
Calipatria	SDG&E	20	Solar PV	New	Calipatria,CA	IID	0%	0.0
Midway Solar Farm I	PG&E	50	Solar PV	New	Calipatria,CA	IID	0%	0.0
Subtotal (2)		290						0.0
Total		1478						255.1

As a result of the 1,188 MW interconnected to the CAISO's BAA near Imperial Valley Substation, MIC from IID's BAA is reduced by roughly 255 MW. By incorporating the effect that new projects would have on existing transmission from adjacent BAAs, such as IID, would align the incentives to locate generation in a manner that is conducive to maximizing use of existing transmission infrastructure and, therefore, would maximize the transportation of renewable energy to load centers at the lowest possible cost. This step is critical to provide the appropriate indicator to facilitate the development of generation in locations that do not stress the grid and, thereby, assist the IOUs and other buyers in their procurement process.

Power system analysis results indicate that generation interconnected to IID's Coachella Valley substation has only a 2% impact on the constrained path of the ECO-Miguel 500 kV line[8]. By contrast, a generator connected to the Imperial Valley 230 kV substation has a 35% impact on the same constrained path. The lower the impact that any generator has on a constrained path, the lower will be the cost to ratepayers.

The specific location of projects situated within the Imperial CREZ will have a significant impact on the amount of total CREZ generation that can be reliably delivered to load centers. Thus, the specific location of generation located within the Imperial CREZ will have a wide range of impacts on the total amount of generation that can be built in a world-class renewable energy resource area. Given California's aggressive renewable energy mandate, and the remarkably high quality of the resources in the Imperial CREZ, it is of the greatest importance to maximize the amount of high-quality renewable generation that the State can rely on from this area.

Specifically, the deliverability calculation for generation connected, respectively, to CAISO facilities and to the IID BAA should be modified based on the geographic location of a given generator and the actual behavior of the transmission system based on that geographic location (A geographical map of Imperial CREZ is shown below). This can be accomplished by adopting the Locational Effectiveness Factor ("LEF") methodology. The CAISO recently adopted similar methods for the Los Angeles and San Diego basins[9].

The need to change: Under the example discussed above, the LEF for a generator connected to the Coachella Valley (CV) substation is 98%. These results indicate that injecting 100 MW of generation at the CV substation will result in 2 MW of flow increase on the CAISO's constrained path and 98 MW on its unconstrained paths. By contrast, for a generator interconnecting at the CAISO's Imperial Valley 230 kV substation, the LEF is. 65%, which indicates that a generator connecting to that substation will result in 35 MW of flow on the constrained path and 65 MW flow to unconstrained paths. The key point is that when more generation connects to buses with higher LEFs, there will be a higher degree of deliverability. In the specific case of interconnections of new generation within the IID BAA, this means that such interconnections will result in less congestion than new interconnections directly to the CAISO BAA within the Imperial CREZ. Hence, the CAISO's presumed MIC of 0 MW that is assigned to the IID BAA ignores both the actual impacts, as well as the basic physics, of interconnections within the Imperial CREZ and must be revised upward by a very significant amount. As a first step in this necessary correction, the CAISO should utilize the LEF to inform its stakeholders regarding the impacts of the procurement and the interconnection of new generation in both IID and CAISO BAAs.

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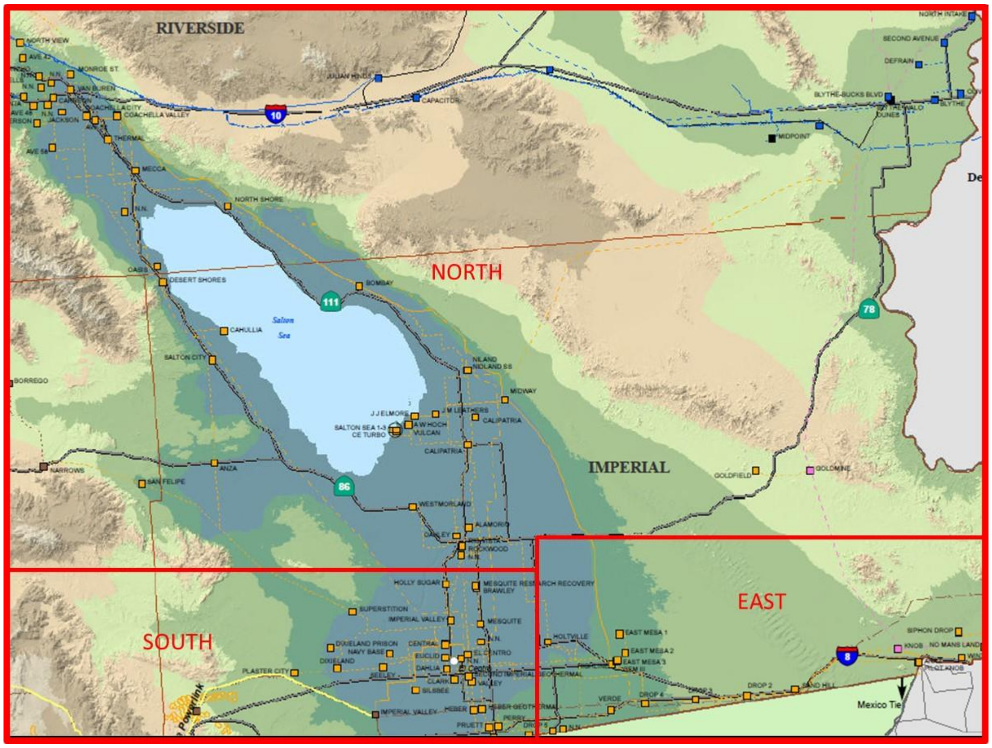
[8] A 100 MW injection at the Coachella Valley substation will results in 2 MW or 2% flow on the constrained path. The rest (98 MW or 98%) will flow on other non-constrained paths.

[9] http://www.CAISO.com/Documents/LocationalEffectivenessFactors-LA-Basin_2013-2014.pdf; http://www.CAISO.com/Documents/LocationalEffectivenessFactors-SanDiego_2013-2014.pdf

The current ISO policy of ignoring the generation locations impact is costing California ratepayers millions of dollars. Since an overwhelming amount of renewable generation from the Imperial CREZ has been procured on behalf of the IOU's and since CAISO have implemented similar method for IOUs procurement in San Diego and Los Angeles areas under the CPUC in D.13-02-015, why not implement the same method for the three regions within Imperial CREZ?

Figure 2-8: Geographic Map of Imperial CREZ



2.3. LOS ANGELES DEPARTMENT OF WATER AND POWER

The Los Angeles Department of Water and Power (LADWP) transmission system consists of high-voltage (above 230kV) alternating current (AC) and direct current (DC) transmission corridors as well as a 115kV-to-230 kV in-basin network totaling more than 3,600 miles. Of those, high-voltage AC and DC transmission lines alone account for 2,900 miles and provide over 5,000MW of import capability. LADWP utilizes these resources to transport power from the Pacific Northwest, Utah, Arizona, Nevada, and from within California to serve its customers and to wheel power for the Cities of Burbank and Glendale. In addition, LADWP's transmission system is interconnected with other utilities in the Western Electricity Coordinating Council (WECC) to coordinate and promote electric reliability throughout the Western United States. Thus, the importance of the security and adequacy of LADWP's transmission system extends beyond its physical boundaries.

2.3.1. TRANSMISSION EXPANSION

In order to meet 50% Renewable Portfolio Standard (RPS) requirement in 2030, LADWP has initiated and planned three major transmission projects which consist of Barren Ridge Renewable Transmission Project, South of Haskell Canyon Transmission Project, and Victorville-LA Basin Transmission Project.

Figure 2-9: LADWP Transmission Projects

- Barren Ridge: Implement Barren Ridge Renewable Transmission Project to transmit renewables from Mohave Desert and Owens Valley areas for meeting RPS from 2016 through 2020
- South of Haskell: Upgrade South of Haskell Canyon Transmission System to further improve transfer capability of Barren Ridge Renewable Transmission Project for meeting RPS from 2024 through 2030
- Victorville-LA Basin: Upgrade Transfer Capability of Victorville to LA Basin transmission system enable to transmit renewables from Eldorado Valley, Arizona, and Southern Nevada areas for meeting RPS from 2024 through 2030

Table 2-12 details the specific activities to be undertaken for each of these projects.

Table 2-12: Summary of LADWP's On-going and Completed Projects

Projects	In-Service
Barren Ridge Renewable Transmission Project	
Construct new Haskell Canyon 230kV Substation	September-2016
Construct new Barren Ridge - Haskell Canyon 230kV Line 2 & 3	September-2016
Reconductor Haskell Canyon - Rinaldi 230kV Line 1	May-2016
Loop Castaic lines into Haskell Canyon Substation	May-2016
Reconductor Barren Ridge - Haskell Canyon 230kV Line 1	June 2017
Construct new Castaic-Haskell Canyon Line 3	June-2017
South of Haskell Canyon Transmission Project	
Rerate Olive-Northridge 230kV Line 1	December-2017
Rerate Haskell Canyon - Olive 230kV Line 1	December-2017
Rerate Haskell Canyon - Sylmar 230kV Line 1	December-2017
Construct new Haskell Canyon - Sylmar 230kV Line 2	December-2022
Victorville to LA Basin Transmission Project	
Upgrade equipment at Victorville, Mead, and Century Substations	June-2020
Install new 500/287kV auto-transformer at Victorville Substation	June-2020
Upgrade 500/230kV auto-transformer Bank H at Toluca Receiving Station	June-2020
Reconductor Valley-Rinaldi 230kV Line 1 & 2	June-2018
Reconductor Valley-Tuloca 230kV Line 1 & 2	June-2020
Replace 230kV Circuit Breakers at Rinaldi	December-2022
Install shunt capacitors at Century, Gramercy, and Hollywood Substations	December-2022

LADWP has increased its renewable energy through successful project development and completed agreement with multiple developers and project entities. Renewable projects that supply power to LADWP are geographically diverse; solar energy comes from Mohave Desert and Owens Valley, wind energy comes from the ridges of the California Tehachapi Mountains, the north-central hills of Oregon, the southern Washington Columbia River Gorge area, the Milford Valley of Utah, and Southwestern Wyoming, and geothermal energy comes from Southwest Nevada. Planning for future renewable energy will continue to emphasize geographic diversity, as well as technology diversity.

The solar energy from Owens Valley and Mohave Desert will reach 650MW in 2016 with additional 600MW by 2030.

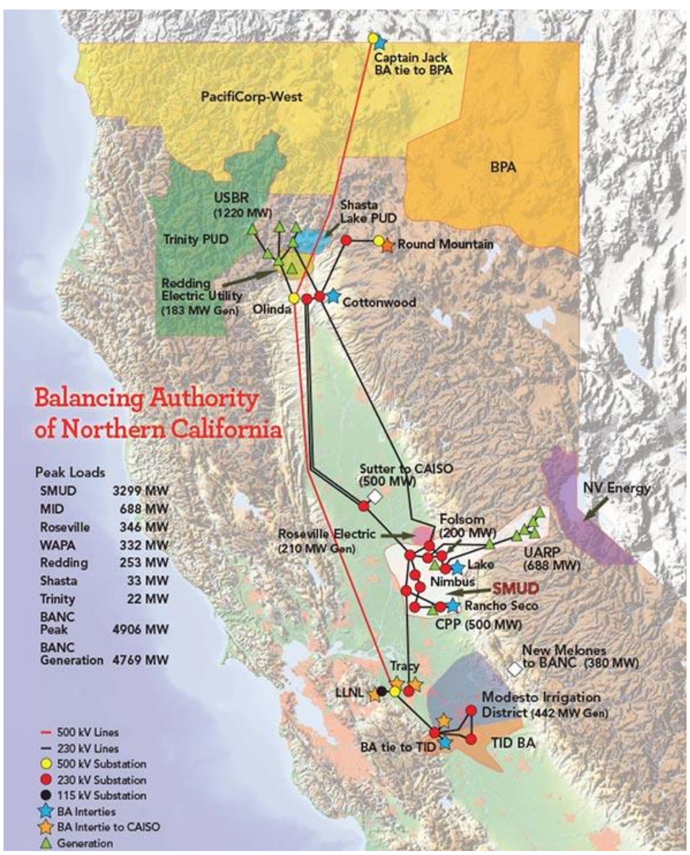
2.3.2. INTERMOUNTAIN POWER PROJECT (IPP) REPLACEMENT

To support LADWP's strategy to completely divest from coal-fired resources by 2025, a combination of energy efficiency, demand response, renewable resources (consisting of wind, solar and geothermal), and energy storage as well as energy from a combined-cycle natural gas generating facility are identified as key resources to replace two 950 MW coal-fired units. In 2015, all 36 participants approved an amendment to replace IPP by 2025 by repowering IPP with at least one combined-cycle natural gas generating unit. The repowered IPP unit will provide flexible capacity that will be used to firm and back up renewable resources, and provide a mechanism to integrate them reliably into LADWP's grid. The 2,400MW capacity of the Intermountain Power Project DC Line (IPPDC) would then import the energy from the combined-cycle natural gas generating facility and renewable resources in the Rocky Mountain Region.

2.4. BALANCING AUTHORITY OF NORTHERN CALIFORNIA

The Balancing Authority of Northern California (BANC) is a Joint Powers Authority (JPA) consisting of the Sacramento Municipal Utility District (SMUD), Modesto Irrigation District (MID), Roseville Electric, Redding Electric Utility, Trinity Public Utility District (TPUD) and the City of Shasta Lake as its founding Members. BANC assumed the Balancing Authority responsibilities on May 1, 2011 from SMUD that include the matching of generation to load and coordinating system operations with neighboring Balancing Authorities.

Figure 2-10: BANC Transmission System



BANC is the third largest Balancing Authority in California and the 16th largest Balancing Authority within the WECC area. The Central Valley Project (CVP) generation, owned by the Bureau of Reclamation and Western Area Power Administration's transmission facilities along with the 500 kV California Oregon Transmission Project (COTP), are included among other resources within the BANC footprint. BANC Members contract for about 40% of the CVP hydroelectric resource. The COTP is jointly owned by several parties including WAPA and BANC Members via the Transmission Agency of Northern California (TANC).

BANC is the Balancing Authority but not the Planning Authority for its member. BANC members perform their own planning functions. Below is a discussion of the BANC member's transmission planning and capability.

2.4.1. SACRAMENTO MUNICIPAL UTILITY DISTRICT

Colusa Sutter 500 kV Transmission Line Proposal

Sacramento Municipal Utility District (SMUD) and the Western Area Power Administration – Sierra Nevada Region (Western) propose to construct a 500 kV transmission project interconnecting the California Oregon Intertie Project (COTP) near the existing Maxwell 500 kV series capacitor station to a new 500/230 kV substation near the existing O'Banion 230 kV station. The project name is Colusa Sutter Transmission Line or CoSu.

SMUD and Western are not seeking a formal Western Electricity Coordinating Council (WECC) Path Rating using the WECC Path Rating Process. However, due to the proximity of the project proposal to the existing WECC Path 66, all technical studies were performed with the California Oregon Intertie (COI) at its rating of 4800 MW to ensure there are no adverse impacts to the existing COI rating.

A primary objective for this new transmission project is to provide SMUD full transmission access to its current rights on the COTP, which it currently cannot fully utilize. To address this need, SMUD requested additional capacity on Western's transmission system between the COTP and the SMUD system. Western did not have sufficient available transmission capacity to meet the request and the SMUD and Western agreed to initiate discussions to evaluate a jointly developed project that could accomplish the objective.

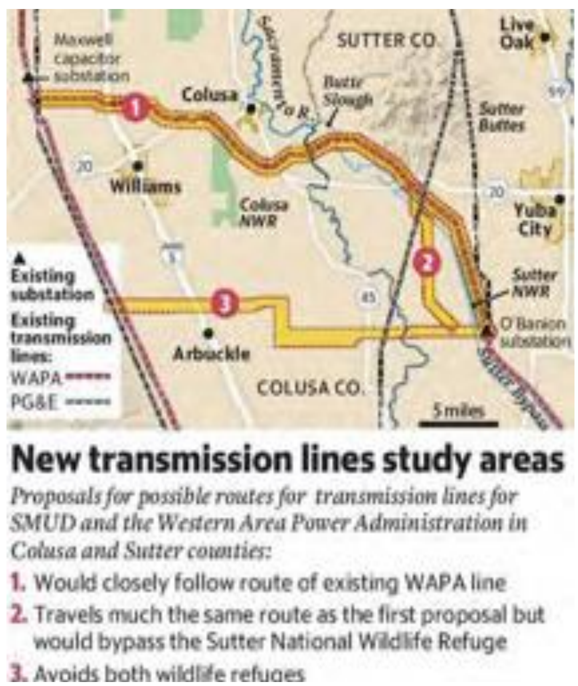
SMUD and Western have formed a project coordination review group within WECC that is currently studying the impacts, if any, to neighboring transmission systems and existing WECC rated paths.

It is important to note that the SMUD Board of Directors has only approved an agreement that allows initiation of an environmental review and to begin regional transmission review activities. Hence, no final decision has been made regarding the project.

Benefits

- Increased Access to Pacific Northwest Clean Power
- Direct COTP Interconnection
- Supports GHG Reduction from SMUD Thermal Generators
- Preserves Reliability at high load Levels
- Increases import limits

Figure 2-11: Colusa - Sutter



2.4.2. TRANSMISSION AGENCY OF NORTHERN CALIFORNIA

The Transmission Agency of Northern California (TANC) is the largest owner of and project manager for the California-Oregon Transmission Project (COTP) which includes approximately 350 miles of 500-kV line extending from the California-Oregon Border to the Tracy area and two 500/230-kV substations (one in the Cottonwood area and the other in the Tracy area). The COTP is operated in parallel with the two Pacific AC Intertie 500-kV lines and these three lines comprise the California-Oregon Interties (COI). The rated transfer capability of the COI facilities is 4,800 MW in the north-to-south direction and 1/3 of this capacity is allocated to the COTP. The COTP is used to transmit power between the Pacific Northwest and California.

In the recent past TANC worked with other parties to identify potential transmission facilities that would allow for significant amounts of renewable generation located in Northern California, Northern Nevada, and the Pacific Northwest to be delivered to load centers in California while maintaining the existing capability of the COI facilities. This effort included optimizing the use of existing transmission lines and corridors and TANC strongly believes that such should be done as part of the RETI 2.0 process. TANC is also of the opinion that the RETI 2.0 process should include maintaining the existing transfer levels of the COI facilities (including the COTP) such that they can continue to be used to import resources (largely hydro and renewables) from the Pacific Northwest.

While TANC does have a generation interconnection process in place there are no generation projects in the TANC interconnection queue at the present time. However, TANC is of the opinion that “energy only” renewable generation located in the Sacramento Valley area could be interconnected with the COTP.

2.4.3. WESTERN AREA POWER ADMINISTRATION – SIERRA NEVADA DISTRICT

The following table provides a summary of on-going and completed projects in the Western Area Power Administration – Sierra Nevada District (Western SNR) power flow study area.

Table 2-13: Summary of Western SNR's On-going and Completed Projects

Project	Planning Entity	Brief Description	Renewable zones impacted	Status
SLTP	Western	San Luis Transmission Project links Tracy 230 kV to San Luis 230 kV. The project will enable federal hydro-power facilities at San Luis, O'Neil and Dos Amigos to be integrated with the rest of the CVP facilities. SLTP will also enable future renewable generation at these sites to be interconnected with Western systems. The expected in service date is 1/2022. Another possible alternative is for a partnership project to build the SLTP at 500 kV from Tracy Substation to a new 500 kV yard to be connected south of Los Banos to the Los Banos/Gates 500 kV line.		System Impact Study completed. Environmental and facility studies are underway. Environmental Impact Statement will be issued in Spring of 2016.
San Luis Solar Project South	Western	A 16.5 MW solar generation is to be connected to O'Neil 70 kV substation through a gen-tie. The expected in service date is 12/2016.		System Impact Study completed.
San Luis Solar Project North	Western	A 10 MW solar generation is to be connected to O'Neil 70 kV substation through a gen-tie. The expected in service date is 12/2016.		System Impact Study completed.
Lassen Wind Project	Western	100 MW wind generation, located in Lassen County, approximately 10 miles northwest of Eagle Lake, proposed to connect to Western's Round Mountain- Cottonwood 230 kV line, through a gen-tie. The expected in service date is 6/2022.	CREZ2 Lassen North?	Project in LGI queue. Feasibility Study to be started soon.
Elverta Line Swap	Western	Swapping the Roseville–Elverta 230 kV line with the O'Banion–Elverta #2 230 kV line at Elverta substation. With all lines in-service, the project will mitigate overload on Elverta–Hurley 230 kV, due to Elverta 230 kV Breaker 1182 internal fault or failure. Mitigates most overloads under clearance conditions, on both the Western and SMUD systems.		Scheduled to be completed by Fall of 2016.

Cottonwood-Olinda Line Reconductor	The scope of this project is to reconductor the Cottonwood-Olinda 230 kV line with larger capacity conductors.	Scheduled to be completed by Fall of 2016.

2.5. TURLOCK IRRIGATION DISTRICT

The Turlock Irrigation District (TID) transmission system is interconnected with:

- the Pacific Gas & Electric Company and the California Independent System Operator (California ISO) at the Westley Tap near the Westley Switchyard
- the City and County of San Francisco (CCSF) and the California ISO at the Oakdale Tap of CCSF's Moccasin-Newark #3 and #4 115 kV lines
- the Western Area Power Administration, the Sacramento Municipal Utility District, and the California-Oregon Transmission Project at Tracy Substation.

Transmission service using TID's share of the California-Oregon Transmission Project is also available through the Transmission Agency of Northern California.

TID does not currently have any Available Transfer Capability (ATC) Paths and therefore does not calculate ATC.

3. INTERREGIONAL COORDINATION

There are substantial renewable resources located outside of California that may be developed in the 2030 timeframe and may seek to deliver energy to California to support its RPS and GHG reduction goals. At the same time, electricity load centers outside California may be important markets for California's own abundance of renewable energy, at least at certain times of the year. While there are limits to the RPS compliance that can be claimed from renewable resources that interconnect to systems outside of the California grid, the diverse portfolio of renewable resources and load centers around the West may offer significant value in helping to achieve California's broader de-carbonization goals.

In fact, over the last decade a great deal of interest by third party developers has been focused on developing transmission to deliver renewable resources in locations such as Wyoming or New Mexico to California. At the same time, other western states' and utilities have been engaged in planning to address their own resource and policy objectives, including the retirement of aging fossil power plants, state RPS requirements, and most recently the implications of the federal Clean Power Plan. Finally, there is a growing recognition of the value that interregional coordination and energy trade can provide in lowering each sub-regions overall costs through better matching of resources with loads. To address these needs and opportunities, multiple venues have developed to facilitate interregional planning.

Interregional coordination through FERC Order No. 1000 provides the California ISO and other transmission providers in California a unique opportunity to work with other transmission planning regions to coordinate a high level assessment of transmission opportunities that increase the transfer capability between regions across the West.

3.1. WESTERN ELECTRICITY COORDINATING COUNCIL

The Western Interconnection has a long history of conducting regional planning studies for generation and transmission projects, which have allowed the region to provide a diverse mix of resources to consumers, allowed for sharing of resources to meet non-coincident energy requirements, and optimize the value of transmission.

Historically, much of these studies have been done by the Western Electricity Coordinating Council (WECC), a North American Electric Reliability Corporation (NERC)-designated region. The WECC region includes fourteen states, two Canadian provinces, and a portion of Baja, Mexico.

Specifically, the WECC's Transmission Expansion Planning PolicyCommittee (TEPPC) develops an annual regional transmission framework (the "Common Case") using member input and stakeholder review. TEPPC then uses this framework to complete a series of 10-year studies with the goal of identifying any potential issues with the interconnection that may cause reliability issues. In addition to this, the TEPPC Common Case is also used by the sub-regional planning entities to assist them in planning for their own grid operations.

3.2. WESTERN INTERSTATE ENERGY BOARD

In addition to Western regional planning studies conducted by WECC and TEPPC, the Western Interstate Energy Board (WIEB) and Western Governors Association have conducted several initiatives to identify renewable generation resources that could be used to meet regional renewable demand, and identify the transmission that would allow energy providers to meet these needs. The Western Renewable

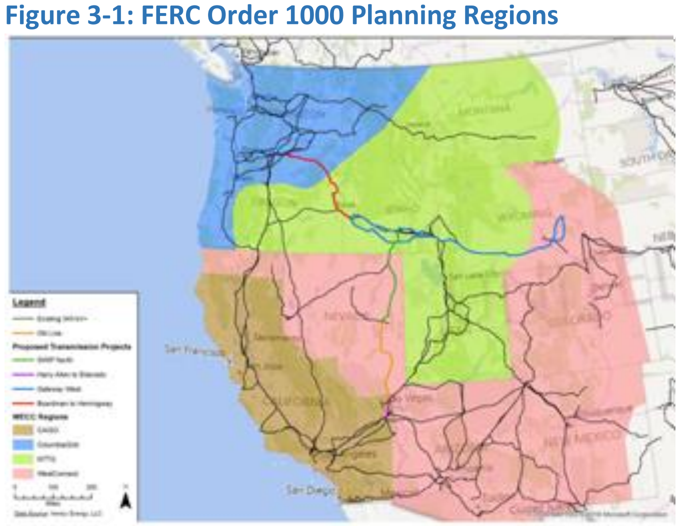
Energy Zone (WREZ) initiative,[10] which concluded in 2012, produced a valuable database of information on Western U.S. renewables. WIEB has also funded a variety of other associated research projects, such as assessing the requirements to integrate renewables into the energy sector and identifying constrained transmission paths.

3.3. FERC ORDER 1000 INTERREGIONAL COORDINATION

In July 2011, the Federal Energy Regulatory Commission (FERC) issued Order No. 1000 on "Transmission Planning and Cost Allocation by Transmission Owning and Operating Public Utilities." The order required public utility transmission providers to implement certain regional planning reforms which, among other things, required the formation of transmission planning regions[11] across the Western Interconnection. In Order No. 890, the Commission found that, when transmission providers engage in regional transmission planning, they may identify solutions to regional needs that are more efficient than those that would have been identified if needs and potential solutions were evaluated only independently by each individual transmission provider. In consideration of this finding, Order No. 1000 required the transmission planning regions to develop a coordinated process for considering interregional projects. These "regional" and "interregional" reforms were designed to work together to ensure an opportunity for more transmission projects to be considered in the regional planning processes on an open and non-discriminatory basis both within the individual planning region and across multiple planning regions.

As a result of Order No. 1000 four planning regions ("western planning regions"), as shown in Figure 3-1 were formed. Through collaborative efforts, the western planning regions reached agreement on joint tariff language that was ultimately proposed for inclusion in each transmission utility provider's tariff. FERC, in its consideration of the joint compliance filing by the western planning regions, commented that the joint filing was considered a significant achievement and reflected a commitment by the western planning regions to work towards a successful and robust interregional planning process under Order 1000. A final FERC order on the western planning regions' joint filing was received in June, 2015. Since that time the western planning regions are actively engaging in interregional coordination activities.

Figure 3-1: FERC Order 1000 Planning Regions



As noted earlier, the western planning regions were formed in compliance with Order No. 1000. A general geographic representation of the areas within the western interconnection that are represented by these planning regions is shown in Figure 3-1. While the western planning regions share a common interregional tariff, their regional processes do vary.

A brief description of each planning region is provided in the following sections 3.3.1 through 3.3.4.

[10] http://www.westgov.org/rtep/219-western-renewable-energy-zones

[11] The western planning regions are California ISO, ColumbiaGrid, Northern Tier Transmission Group (NTTG), and WestConnect.

3.3.1. WESTCONNECT

The WestConnect Regional Transmission Planning Process (planning process) was developed for compliance with Order No. 1000, Transmission Planning and Cost Allocation by Transmission Owning and Operating Public Utilities. The biennial planning process consists of seven primary steps as outlined in Figure 3-2.

Figure 3-2: WestConnect Regional Planning Process

The WestConnect Regional Transmission Planning Cycle (planning cycle) is biennial and commences in even numbered years, resulting in the development of a Regional Transmission Plan every other year. During the biennial planning cycle, WestConnect establishes the region's reliability, economic, and public policy transmission needs. It also solicits alternatives (transmission or non-transmission alternatives (NTAs)) from members and stakeholders to meet the regional needs. WestConnect evaluates the alternatives submitted in order to determine which alternatives meet the region's needs more efficiently or cost effectively, and identifies those alternatives in the WestConnect Regional Transmission Plan. Identified alternatives that are submitted for the purposes of cost allocation may go through the cost allocation process if they pass the cost/benefit thresholds established for the relevant category of project (reliability, economic, public policy) and if they are further determined to be eligible for regional cost allocation. Additional details of the WestConnect Regional Transmission Planning Process can be reviewed in the WestConnect Regional Business Practices Manual (BPM).

3.3.2. NORTHERN TIER TRANSMISSION GROUP

The Northern Tier Transmission Group (NTTG) was formed in 2007 to promote effective planning and use of the multi-state electric transmission system within the Northern Tier footprint. Northern Tier provides a forum where all interested stakeholders, including transmission providers, customers and state regulators, can participate in planning, coordinating and implementing a robust transmission system. NTTG fulfills requirements of the FERC Order 1000 for each public utility transmission provider to participate in a regional transmission planning process that produces a regional transmission plan and has a regional cost-allocation method. NTTG evaluates transmission projects that move power across the regional bulk electric transmission system, serving load in its footprint and delivering electricity to external markets. The transmission providers belonging to Northern Tier serve more than 4 million retail customers with more than 29,000 miles of high voltage transmission lines. These members provide service across much of Utah, Wyoming, Montana, Idaho and Oregon, and parts of Washington and California.

Figure 3-3: NTTG Regional Planning Process

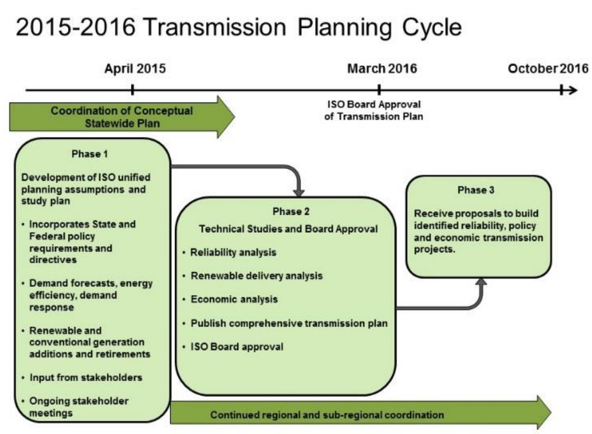
3.3.3. COLUMBIA GRID

ColumbiaGrid was formed with seven founding members in2006 to improve the operational efficiency, reliability, and planned expansion of the Northwest transmission grid. Eleven parties have signed ColumbiaGrid's Planning and Expansion Functional Agreement (PEFA) to support and facilitate multi-system transmission planning through an open and transparent process. ColumbiaGrid's primary grid planning activity is to develop a biennial transmission expansion plan that looks out over a ten-year planning horizon and identifies the transmission additions necessary to ensure that the parties to the ColumbiaGrid Planning and Expansion Functional Agreement can meet their commitments to serve load and transmission service commitments. A significant feature of the transmission expansion plan is its single-utility planning approach. The plan has been developed as if the region's transmission grid were owned and operated by a single entity. This approach results in a more comprehensive, efficient, and coordinated plan than would otherwise be developed if each transmission owner completed a separate independent analysis. In the years between biennial plans, ColumbiaGrid may produce an update to the biennial plan, if warranted, based on the results of ColumbiaGrid's annual system assessment, study team results or planning participant studies.

3.3.4. CALIFORNIA ISO

A core California ISO responsibility is to identify and plan the development of solutions to meet the future needs of the California ISO controlled grid. Fulfilling this responsibility includes conducting an annual transmission planning process that culminates in the California ISO Board of Governors (Board) approved, comprehensive transmission plan. The plan identifies needed transmission solutions and authorizes cost recovery through California ISO transmission rates, subject to applicable regulatory approvals, as well as identifying other solutions (e.g., non-wires alternatives) that will be pursued in other venues to avoid building additional transmission facilities if possible. The plan is prepared in the larger context of supporting important energy and environmental policies and assisting in the transition to a cleaner, lower emission future while maintaining reliability through a resilient electric system. A report documenting the the California ISO's comprehensive transmission plan is prepared for each planning cycle; the report for the 2015-2016 planning cycle being the most recent.

Figure 3-4: The California ISOPlanning Cycle



The plan primarily identifies needed transmission facilities based upon three main categories of transmission solutions: reliability, public policy and economic needs. The plan may also include transmission solutions needed to maintain the feasibility of long-term congestion revenue rights, provide a funding mechanism for location-constrained generation projects or provide for merchant transmission projects. The California ISO also considers and places a great deal of emphasis on the development of non-transmission alternatives; both conventional generation and in particular, preferred resources such as energy efficiency, demand response, renewable generating resources and energy storage programs. Though the California ISO cannot specifically approve non-transmission alternatives as projects or elements in the comprehensive plan, these can be identified as the preferred mitigation in the same manner that operational solutions are often selected in lieu of transmission upgrades. Further, load modifying preferred resource assumptions are also incorporated into the load forecasts adopted through state energy agency activities that the California ISO supports, and provide an additional opportunity for preferred resources to address transmission needs.

3.4. PROPOSED INTER-REGIONAL TRANSMISSION PROJECTS

There are numerous transmission projects under development throughout the Western U.S. that could potentially facilitate the delivery of renewable energy to California. Several transmission developers have been participating in the RETI 2.0 initiative, and below is information provided by these project developers on their proposed lines. All of the lines have at least one termination point outside of California and are intended, at least in part, to facilitate the delivery of renewable energy resources to California.

Some of these planned transmission projects have made significant progress in obtaining the necessary environmental permits and state regulatory approvals. All of the projects will support the continued reliability of the Western grid. In addition, a number of these planned transmission projects are affiliated with renewable resource development projects, several of which have secured key environmental permits or have laid the groundwork for such permits. The proposed lines are depicted on Figure 3-5 below.

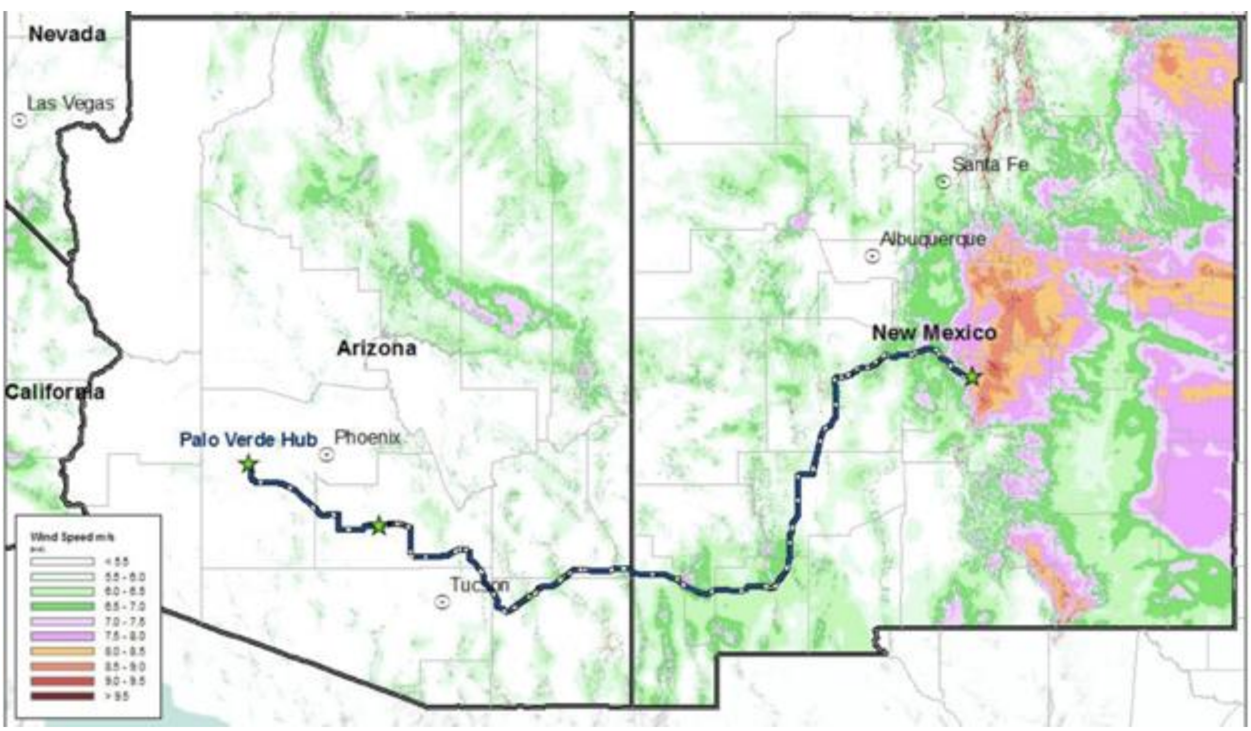
Figure 3-5: Western Region Proposed Transmission Projects

Many of the proposed projects would deliver energy to the California ISO grid at deliver points in Arizona and Nevada. Some of these proposed developments would likely require transmission network additions in Arizona/Northern New Mexico in order to reach the California grid delivery points. Further, once the additional energy is delivered to California from out of state transmission, it must compete for the same transmission capacity that in-state resources are seeking. This interaction between in-state resources and delivery of out-of-state resources will be explored more fully in later stages of RETI 2.0.

The information included below was provided to RETI by the project developers, including technical information on project size and locations, as well as project status and potential development timing. The TTIG has not independently assessed this information and does not expressly or indirectly endorse any of the projects.

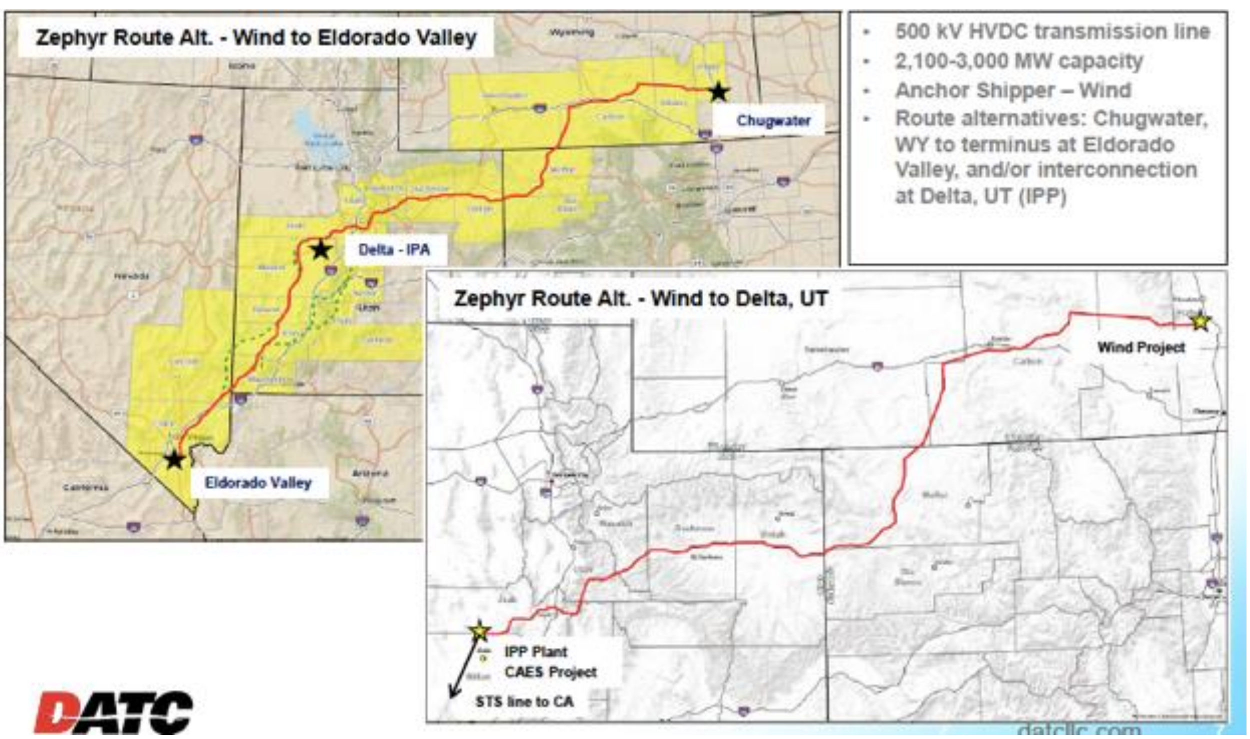
3.4.1. SOUTHWEST POWER GROUP - SUNZIA

Developer	Southwestern Power Group
Description	515 miles, 2 single-circuits, 500kV project, from new SunZia East to existing Pinal Central substations (2 x AC or AC + DC) Obtain transmission service over the existing system from Pinal Central to Palo Verde (or Westwing)
Location	New Mexico and Arizona
Capacity Rating	3,000 MW
Status	Permitting began in 2008. Record of Decision issued by BLM in January 2015. AZ state permit received in Feb 2016.
On-line date	COD in 2020/2021, subject to commercial arrangements
Additional Information	The line would access wind resources in New Mexico
Web site	www.sunzia.net



3.4.2. DUKE AMERICAN TRANSMISSION CO. – ZEPHYR POWER TRANSMISSION PROJECT

Developer	Duke American Transmission Company
Description	500 kV HVDC transmission line
Location	Route alternatives: Chugwater, WY to terminus at Eldorado Valley, and/or interconnection at Delta, UT (IPP)
Capacity Rating	2,100-3,000 MW capacity
Capital Cost	$2 to 3.5 billion in capital
Status	Refining federal, state and local right-of-way permit applications
On-line date	Target date – mid-2020s
Additional Information	○ 2011 Development Agreement with Pathfinder Renewable Wind Energy (Pathfinder). Pathfinder is the anchor shipper on Zephyr project. Pathfinder offtake agreements are a primary condition precedent to proceeding with Zephyr. Parties cooperate on development and marketing (CA utilities) activities ○ In addition to the Wind Project, Pathfinder is developing a Compressed Air Energy Storage (CAES) project to store wind energy. CAES site is on the current proposed route for Zephyr, and adjacent to the Inter-mountain Power Authority (IPA) coal plant near Delta, Utah.
Web site	○ http://www.datcllc.com/projects/zephyr/



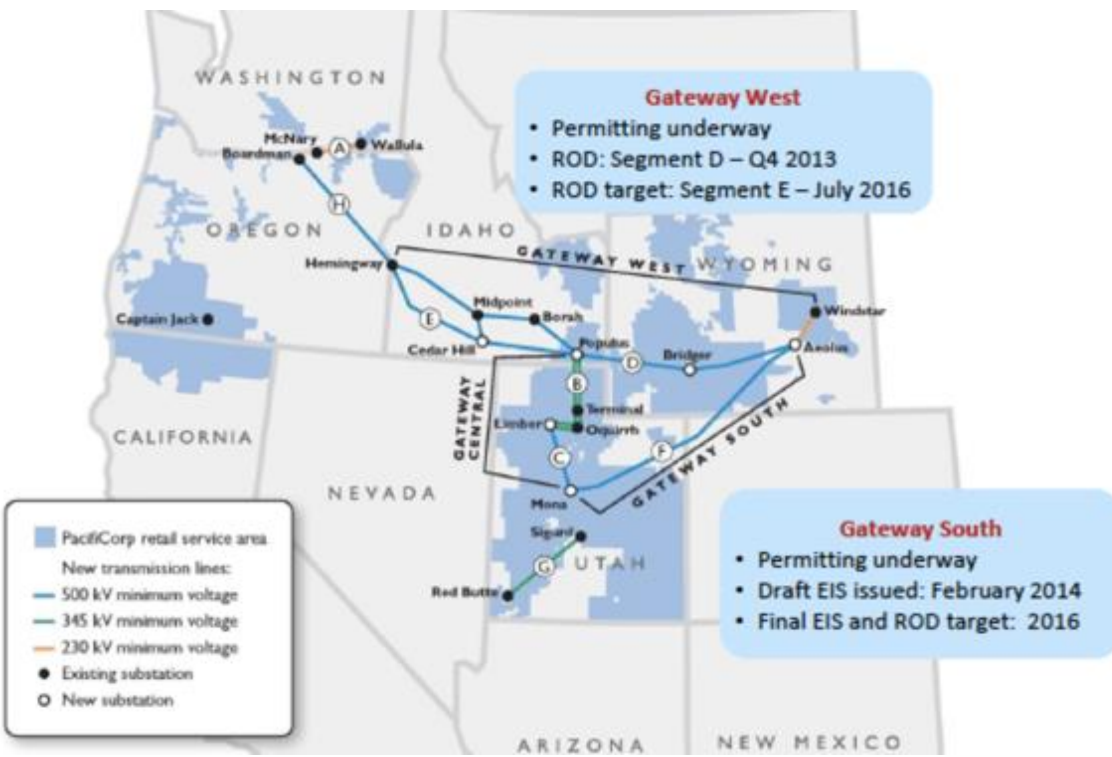
3.4.3. TRANSWEST EXPRESS

Developer	TransWest Express LLC
Description	600 kV HVDC transmission line
Location	Wyoming to the Desert Southwest region (California, Nevada, Arizona)
Capacity Rating	1,500 MW initial/3,000 MW final
Capital Cost	$3 billion
Status	BLM says Record of Decision is "anticipated for June 2016"
On-line date	2017-2019 estimated construction
Additional Information	• Potential use of 500 kV AC included in permitting • Would deliver wind energy from WY
Web site	http://www.transwestexpress.net

3.4.4. PACIFICORP - ENERGY GATEWAY

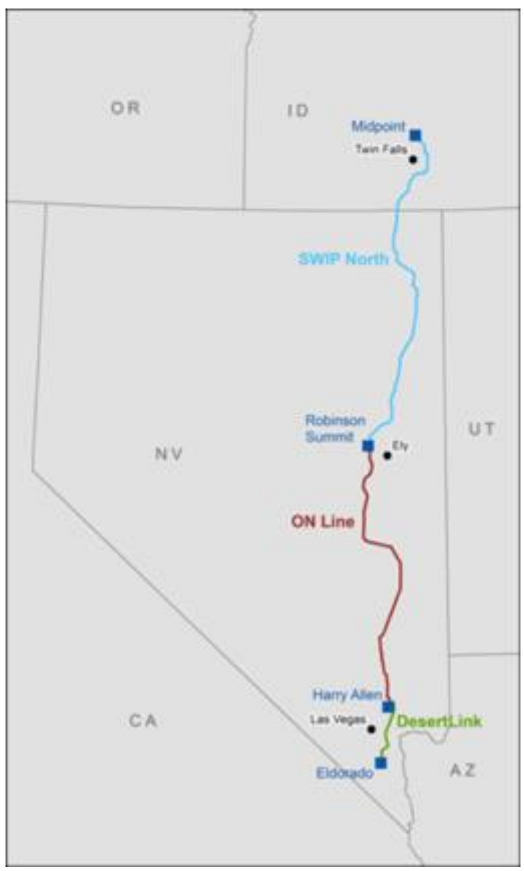
The PacifiCorp Gateway project is composed of multiple transmission segment in parts of the PacifiCorp system. Please refer to the PacifiCorp website for detail on specific segments

Developer	PacifiCorp
Description	2,000 miles of transmission in several segments. Includes 230 kV, 345 kV and 500 kV transmission
Location	Wyoming, Utah, Idaho, Oregon
Capacity Rating	Varies by segment
Capital Cost	Not provided
Status	Portions of line completed and others are under construction and development
On-line date	Various
Additional Information	Project would interconnect to the Southwest Intertie Project (SWIP) North to deliver energy to in Southern Nevada.
Web site	http://www.pacificorp.com/tran/tp/eg.html



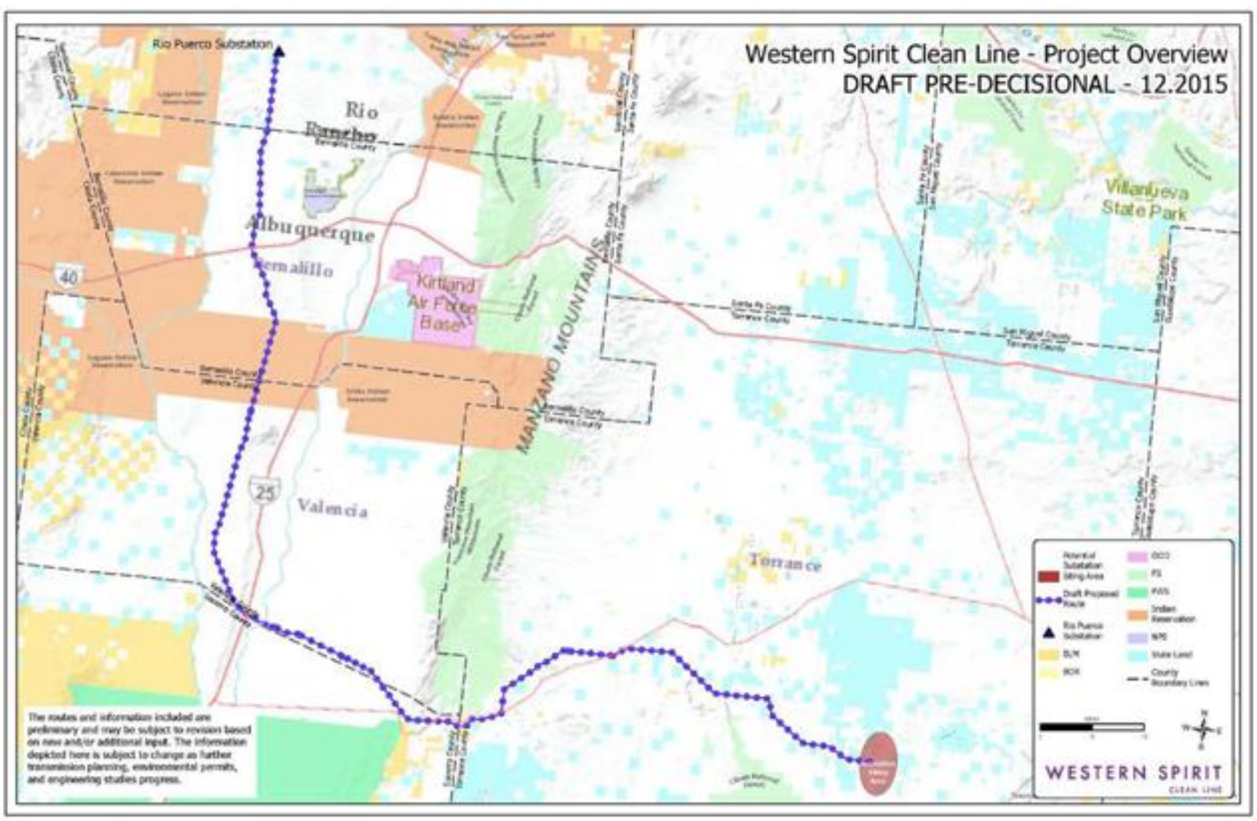
3.4.5. LS POWER – SOUTHWEST INTERTIE PROJECT (SWIP) NORTH

Developer	LS Power
Description	Midpoint to Robinson Summit 500 kV line (SWIP North)
Location	Idaho, Nevada
Capacity Rating	LSP Capacity – 1000 MW (NVE Capacity = 700 MW)
Capital Cost	Not provided
Status	Under development - NEPA complete; BLM issued Notice to Proceed; 24 months construction
On-line date	2020
Additional Information	Project would tie into recently constructed One Nevada Transmission Line (ON-Line) project at Robinson Summit in Nevada.
Web site	http://www.lspower.com/projectmap.htm



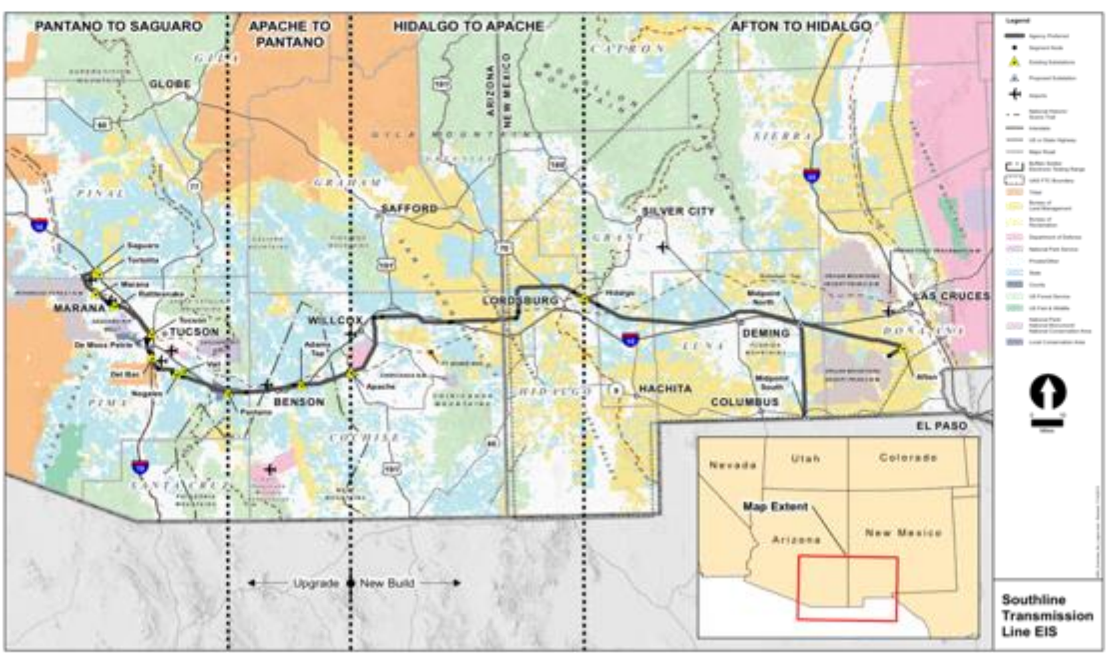
3.4.6. CLEAN LINE – WESTERN SPIRIT

Developer	Clean Line Energy Partners
Description	The Western Spirit Clean Line will collect approximately 1,000 MW of renewable power from east-central New Mexico and deliver the power to markets in the Western United States that have a strong demand for clean, reliable energy. Western Spirit will interconnect with Public Service Company of New Mexico (PNM) at Four Corners; power can be imported to California via APS's existing 500 kV system
Location	New Mexico (route not yet determined)
Capacity Rating	1,000 MW
Capital Cost	Cost estimate not provided
Status	Under development, all authorizations expected by end of 2017
On-line date	late 2018
Web site	http://www.westernspiritcleanline.com/site/home



3.4.7. SOUTHLINE TRANSMISSION PROJECT

Developer	Southline Transmission, L.L.C./ Black Forest Partners, L.P.
Description	240 miles of new 345-kilovolt (kV) double-circuit electric transmission lines in New Mexico and Arizona plus an upgrade of existing transmission lines that involves rebuilding approximately 120 miles of existing single-circuit 115-kV transmission lines, currently owned by the Western Area Power Administration (Western), to double-circuit 230-kV.
Location	New build between existing Afton Substation, south of Las Cruces, New Mexico, and the existing Apache Substation, south of Willcox, Arizona. The Upgrade Section would connect the Apache Substation to the existing Saguaro Substation northwest of Tucson, Arizona
Capacity Rating	Up to 1,000 MW
Capital Cost	Cost estimate not provided
Status	Under development
On-line date	2018
Additional Information	The Project will interconnect with up to 14 existing substation locations and may include development of a new substation in Luna County, New Mexico
Web site	http://southlinetransmissionproject.com/location.html



3.4.8. SAN DIEGO GAS & ELECTRIC COMPANY – AC-TO-DC CONVERSION PROJECT

Developer	San Diego Gas & Electric Company
Description	Convert a portion of the 500 kV Southwest Powerlink (SWPL) to a multi-terminal, multi-polar HVDC system with terminals at North Gila, Imperial Valley, and Miguel Substations. The AC-to-DC conversion project will increase import capability into the San Diego and Greater Imperial Valley transmission-constrained load pockets during critical contingency conditions. The increased import capability will reduce Local Capacity Requirements (LCRs) and the attendant requirement of LSEs serving load in the San Diego area to contract for comparatively scarce, and therefore costly, dependable generating capacity within those LCR areas.
Location	Arizona, California
Capacity Rating	Increase transfer capability between North Gila, Imperial Valley and Miguel substations and increase import capability into the San Diego LCR area by 500-1,000 MW
Capital Cost	$700-900 million
Status	Design work and planning studies are in progress
On-line date	2025
Additional Information	Use existing 500 kV conductors to connect the converter terminals. Center conductor becomes neutral with +/- 500 kV DC on the two outside conductors. Increases transfer capability between North Gila substation and the San Diego area without the need for new conductors or additional transmission line right-of-way. Project provides additional transmission capacity to facilitate delivery of renewables from the Imperial Valley, northern Baja Mexico, Arizona and New Mexico to Southern California load centers.
Web site	Not yet available