DOCKETED

Docket Number:	15-RETI-02
Project Title:	Renewable Energy Transmission Initiative 2.0
TN #:	211753
Document Title:	Presentation - Transmission Technical Input Group Update by Neil Millar 6/9/16
Description:	N/A
Filer:	Misa Milliron
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	6/8/2016 1:38:49 PM
Docketed Date:	6/8/2016

Renewable Energy Transmission Initiative v2.0

Transmission Technical Input Group Update

Neil Millar
CAISO

TTIG Meeting
9 June, 2016

Presentation Overview

I. TTIG Background & Goals - Neil Millar
II. Interim TTIG Report on Current and Planned Transmission – Neil Millar
III. Transmission Assessment Focus Areas (TAFAs) – Brian Turner
IV. Transmission Availability Update by Planning Area - (Panel Discussion)
    - CAISO
    - IID
    - LADWP
    - TANC
    - WAPA
V. Transmission Evaluation Methodology and Data Sources for Each TAFA
VI. Stakeholder Comments and Next Steps

I. TTIG Background

Goals and Objectives:

The Transmission Technical Input Group will assemble relevant in-state and west-wide transmission capability and upgrade cost information to inform resource development conservations on the reasonably-needed transmission system implications and to assist in the developing potential corridor scenarios.

TTIG participants include all California Transmission Planning Entities

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 PUC	Transmission Agency of Northern California
City of Santa Clara	Pacific Gas & Electric
Southern California Edison	San Diego Gas & Electric

TTIG Deliverables/Methodology:

Through coordinating collection of data from group members, input from stakeholders and CEC workshops supporting a robust stakeholder process, this group will:

- 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 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.

TTIG Deliverables

- 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 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.

II. Interim Report on Current and Planned Transmission

Report on Existing Transmission

- TTIG has compiled and released an interim report:

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

- Report characterizes existing and planned transmission information for all Transmission Planning Areas within CA , as provided by each Planning Area

Report available on RETI website: (include link)

Issues Identified in Report

Significant issues impacting potential transmission development:

- Full Capacity Deliverability and Energy-Only resources
- Out-of-state resources
- Availability of existing out-of-state and in-state transmission facilities

Energy Only Delivery Resources

- Historically most generators have connected to the transmission grid as Full Capacity Delivery Service ("FCDS") participants.

- The need for additional resources to be deliverable (e.g. providing resource adequacy program capacity) has not been determined at this time, and it is possible that energy-only transmission service will suffice.

Energy Only Delivery Resources

Only CAISO is providing estimates of energy-only interconnection potential

Energy Only Interconnections	
Advantages	Risks
• 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 and uncertainty on EO resource generation may impact ability to finance projects • Operational complexity when linked to jointly owned transmission paths

Out-of-State Resources and In-state Capacity

- Several transmission projects in West offer the potential to deliver renewable energy to California
- Once energy reaches CA borders, it will compete with in-state resources for transmission to deliver energy to loads

III. Transmission Assessment Focus Areas

Transmission Assessment Focus Area: Approach

Explore planning goals and resource values

Identify high-value resources that may need transmission

1. How much renewables *might* we need?
   Bookend scale of renewable need by 2030
   Sources include IEPR, Pathways
2. Which resources *might* be important by 2030?
   Review resource costs and values in 2030 context to identify resources and zones of potential value for 2030
   Sources include industry and stakeholder comments, academic and government studies
3. How much renewables *might* come from different areas?
   Bookend range of renewable resources from specific areas that may be developed by 2030
   Sources include comments, studies
4. *Might* this level of renewables require new transmission?
   Match resource ranges to existing transmission capacity and identify where resource range exceeds transmission capacity
   Sources include TPP and WECC studies, stakeholder comment

Proposed Focus Area List

1. **In-state resources**
   - California Desert
     - Tehachapi
     - Victorville/Barstow
     - Riverside East
     - Imperial Valley
   - San Joaquin Valley
     - Modesto to Bakersfield
   - Northern California
     - Solano and East Bay
     - Sacramento River Valley
     - Lassen & Modoc

2. **Import/Export Paths**
   - Eldorado/Mead/Marketplace
   - Palo Verde/Delaney
   - California-Oregon Intertie
   - Central and Northern Sierra

3. **Out-of-State Projects**
   - WY and NM wind
   - NV and AZ solar
   - NV geothermal
   - NW wind and geothermal
   - OOS “Delivery” projects
   - OOS “Network” projects

California Desert

Vast raw resource potential; substantial commercial interest

- Thousands of MW of solar potential, several thousand MW of wind potential, some of the best geothermal resource in the world

Building off Desert Renewable Energy Conservation Plan

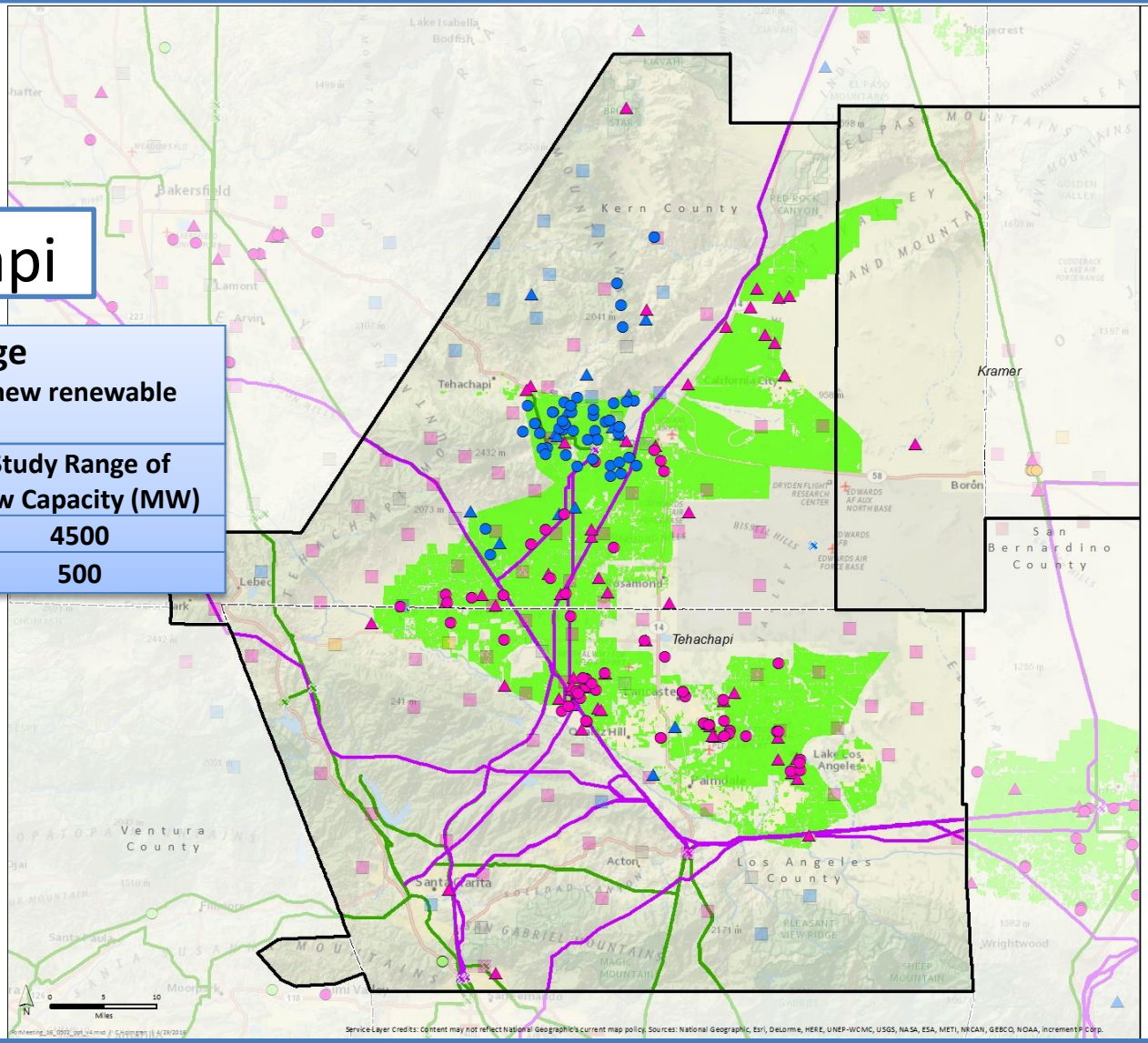
- Exhaustive environmental assessment and land use planning effort
- September 2014 Draft DRECP identified Development Focus Areas on both private and public lands
- October 2013 Draft DRECP Appendix K Transmission Technical Group report identified "tinker toy" conceptual transmission infrastructure needs

Propose focusing on four clusters within and around 2014 DFAs

- Tehachapi/Lancaster
- Victorville/Barstow
- East Riverside
- Imperial Valley

Tehachapi

Study Range Hypothetical additions of new renewable resources	
Resource	**Study Range of New Capacity (MW)**
Solar	**4500**
Wind	**500**



STATE OF CALIFORNIA resources AGENCY

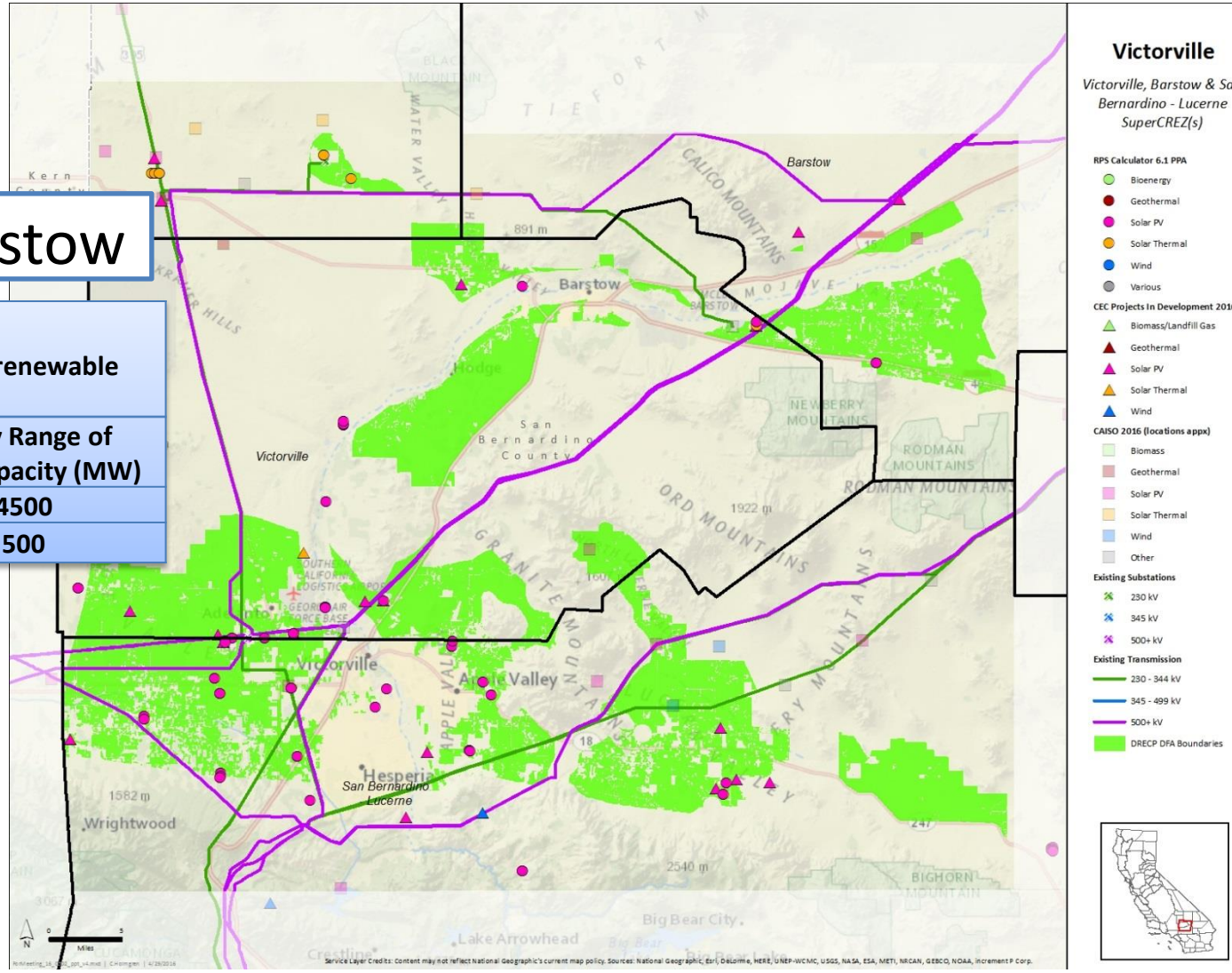
California Public Utilities Commission

California Energy Commission

California ISO

Victorville/Barstow

Study Range Hypothetical additions of new renewable resources	
Resource	**Study Range of New Capacity (MW)**
Solar	**4500**
Wind	**500**



STATE OF CALIFORNIA resources AGENCY

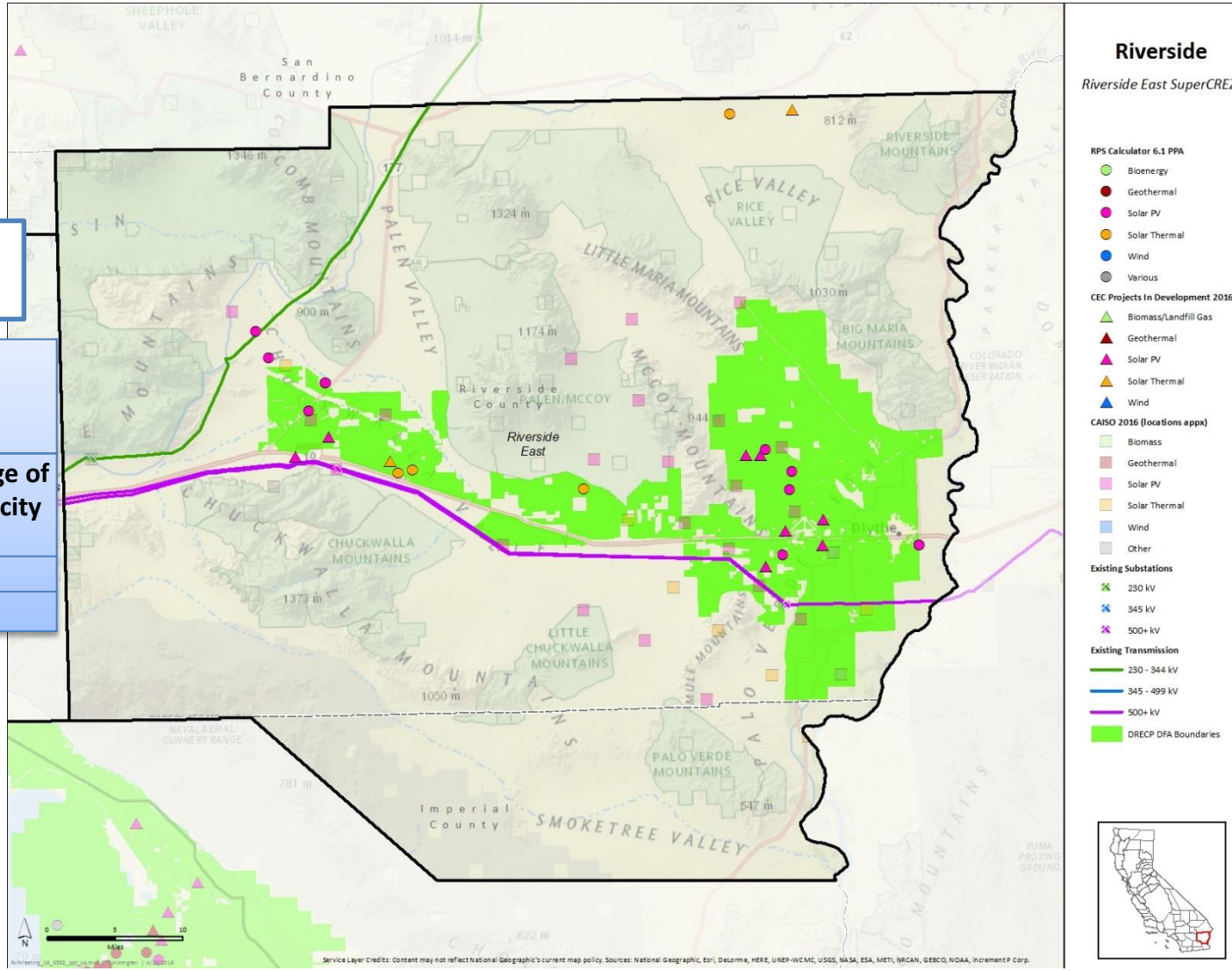
California Public Utilities Commission

California Energy Commission

California ISO

Riverside East

Study Range Hypothetical additions of new renewable resources	
Resource	**Study Range of New Capacity (MW)**
Solar	**4,000**
Wind	**1000**



STATE OF CALIFORNIA resources AGENCY

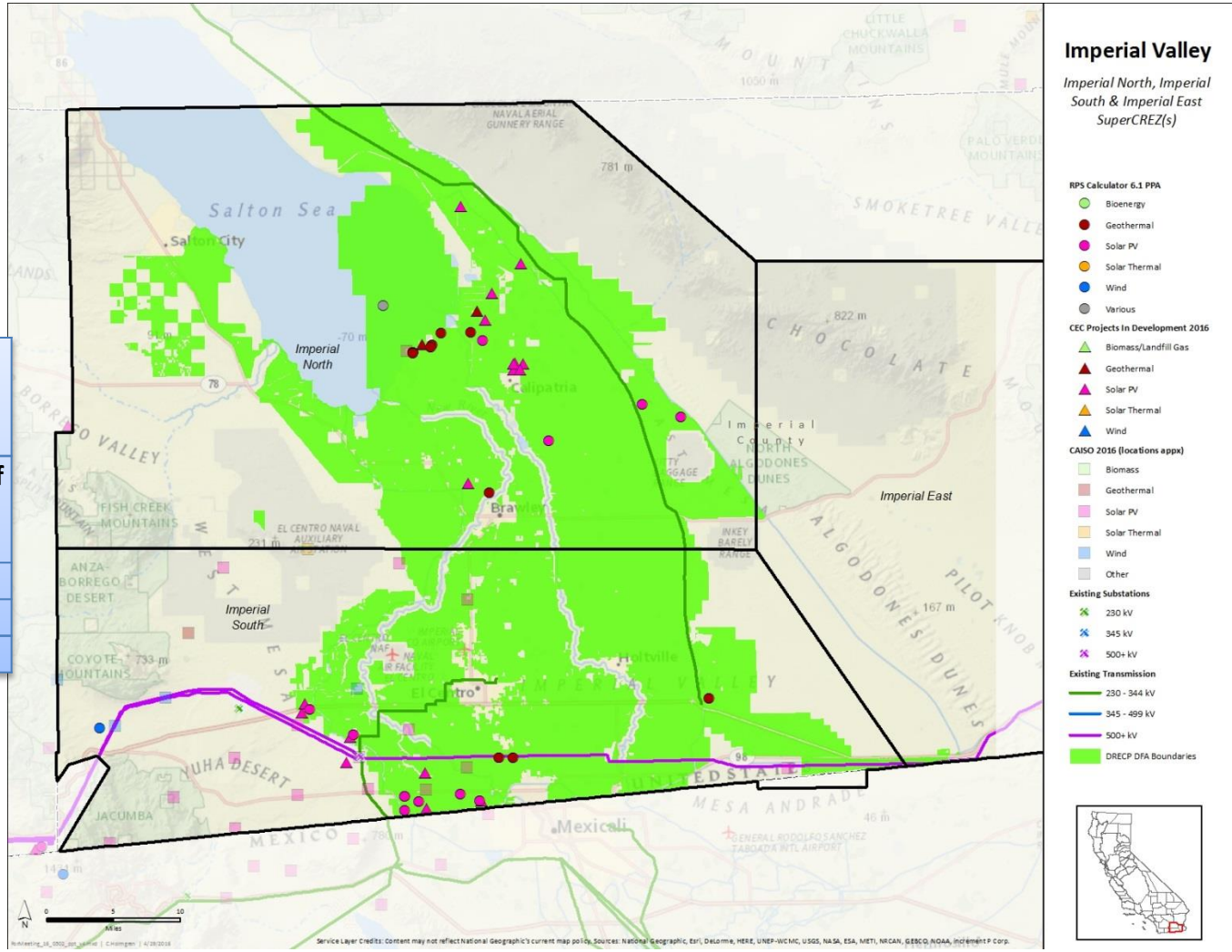
California Public Utilities Commission

California Energy Commission

California ISO

Imperial Valley

Study Range Hypothetical additions of new renewable resources	
Resource	Study Range of New Capacity (MW)
Solar	3500
Wind	500
Geothermal	1000



STATE OF CALIFORNIA resources AGENCY

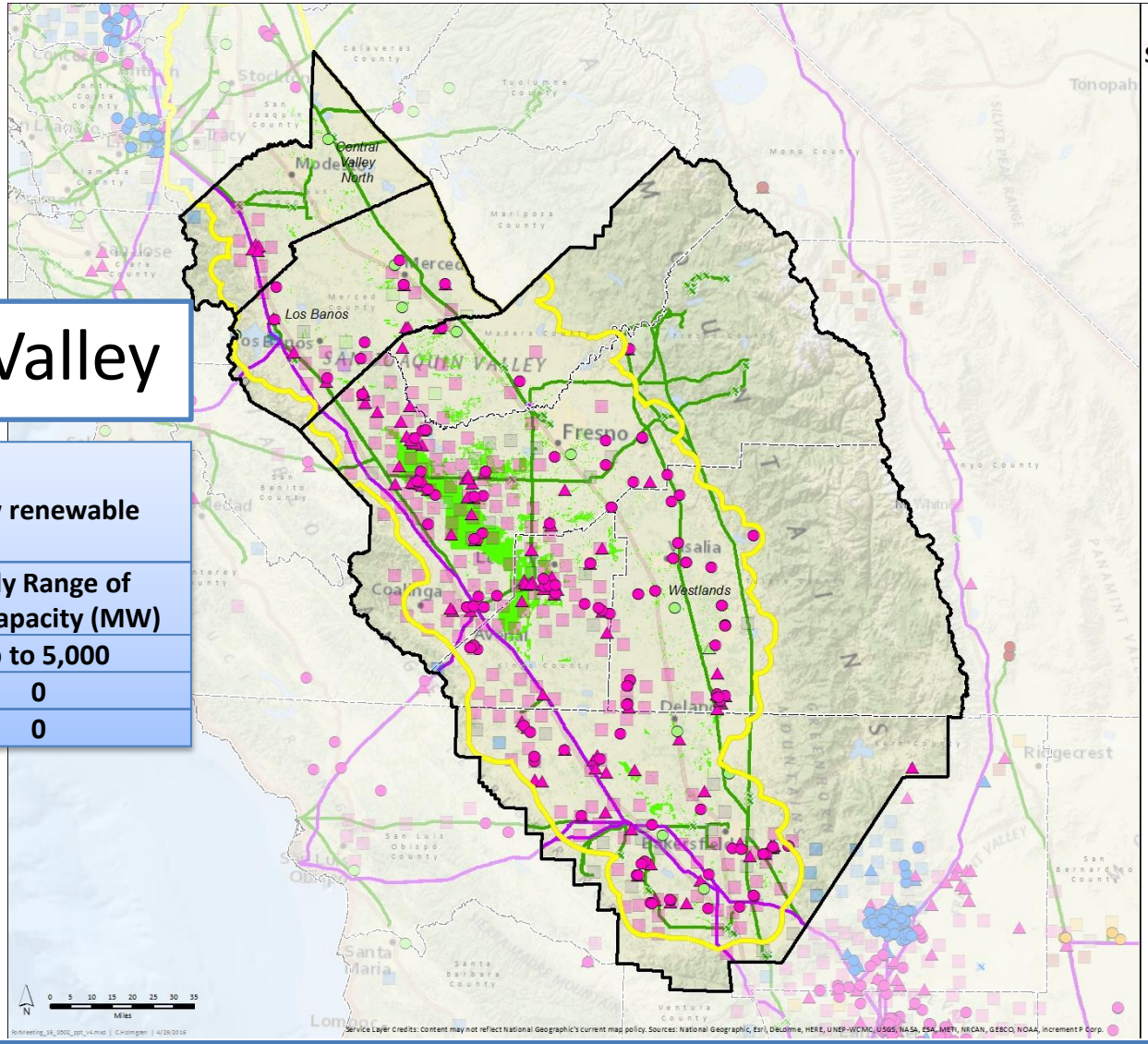
California Public Utilities Commission

California Energy Commission

California ISO

San Joaquin Valley

Study Range Hypothetical additions of new renewable resources	
Resource	**Study Range of New Capacity (MW)**
Solar	**Up to 5,000**
Wind	**0**
Geothermal	**0**



STATE OF CALIFORNIA resources AGENCY

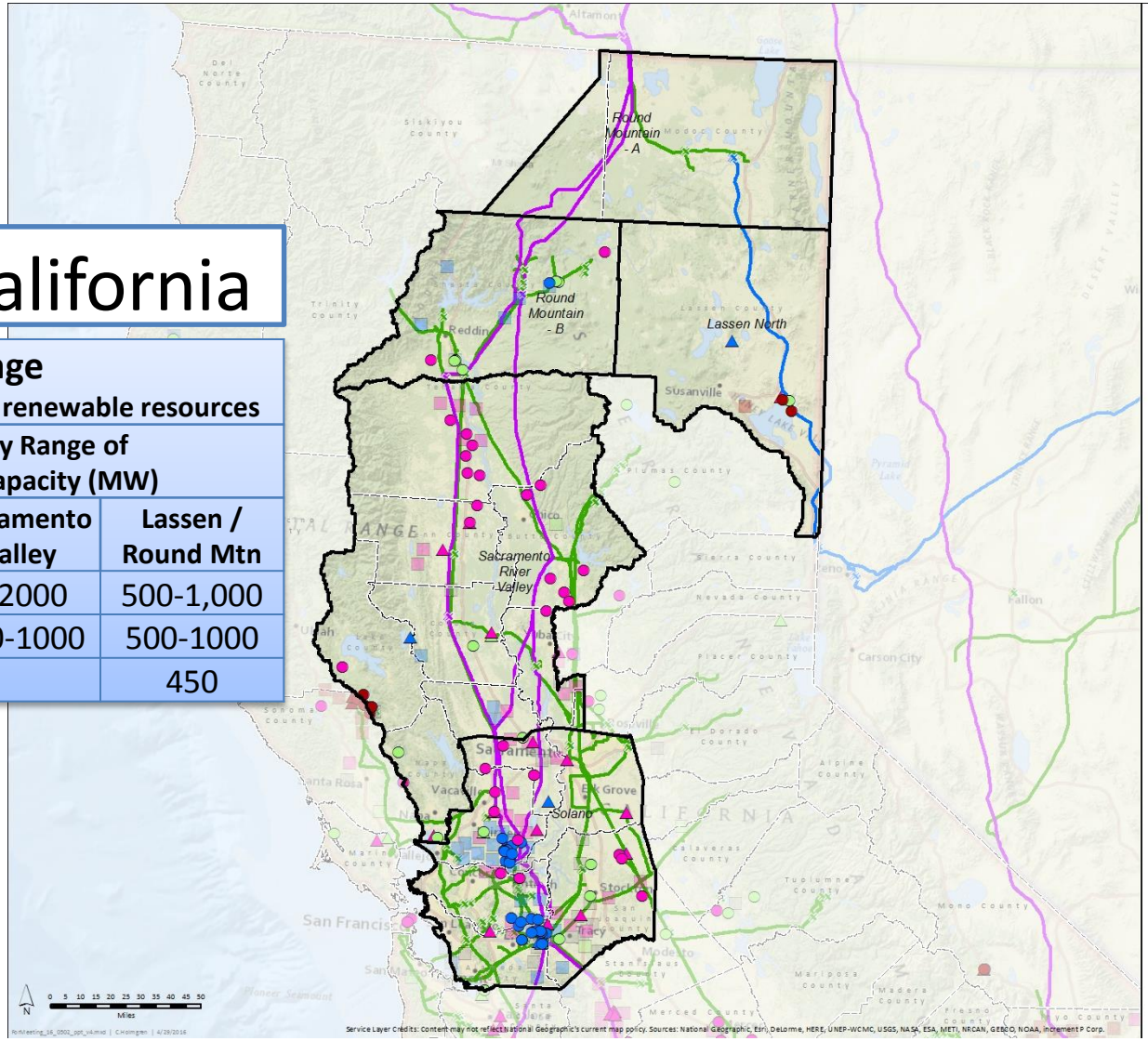
California Public Utilities Commission

California Energy Commission

California ISO

Northern California

Study Range Hypothetical additions of new renewable resources			
Resource	**Study Range of New Capacity (MW)**		
	Solano	**Sacramento Valley**	**Lassen / Round Mtn**
Solar	1-2,000	1-2000	500-1,000
Wind	500-1000	500-1000	500-1000
Geo			450



STATE OF CALIFORNIA resources AGENCY

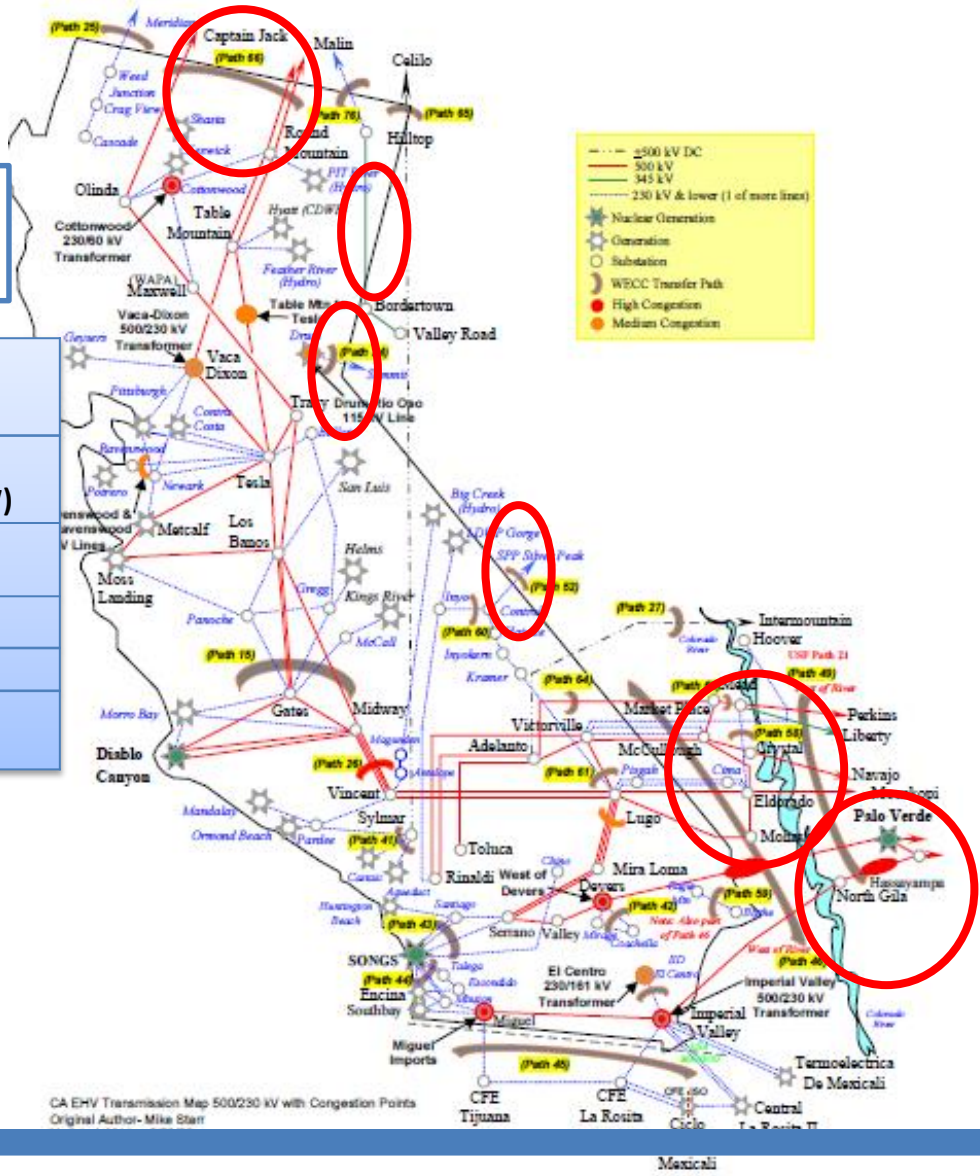
California Public Utilities Commission

California Energy Commission

California ISO

Import / Export Paths

Study Ranges Hypothetical additions of new renewable resources	
Delivery point or path	**Study Range of New Capacity (MW)**
Eldorado/Mead/Marketplace	3000
Palo Verde/Delaney	3000
California-Oregon Intertie / Path 66	2000
Central/Northern Sierra (Path 76; Path 24; Path 52)	500



STATE OF CALIFORNIA resources AGENCY

California Public Utilities Commission

California Energy Commission

California ISO

Transmission Assessment Focus Areas

Study Ranges Hypothetical additions of new renewable resources	
Delivery point or path	**Study Range of New Capacity (MW)**
Imperial Valley	Up to 5000
Riverside East	Up to 5000
Victorville/Barstow	Up to 5000
Tehachapi	Up to 5000
San Joaquin Valley	Up to 5000
Solano	1500-3000
Sacramento River Valley	1500-3000
Lassen / Round Mountain	1500-3000
Path 46 / Palo Verde / Delaney	Up to 3000
Path 46 / Eldorado / Marketplace	Up to 3000
Path 66 / California-Oregon Intertie	Up to 3000
Central/Northern Sierra (Path 76; Path 24; Path 52)	Up to 500

Transmission Assessment Focus Areas

- Several renewable rich resource areas will be focused on:

California	Out of State
Tehachapi	El Dorado / Mead / Marketplace
Victorville / Barstow	Palo Verde or Delaney
Riverside East	California Oregon Interface
Imperial	Central Sierra
San Joaquin	
Northern California	

IV. Transmission Availability Update by Planning Area (Panel Discussion)

California ISO

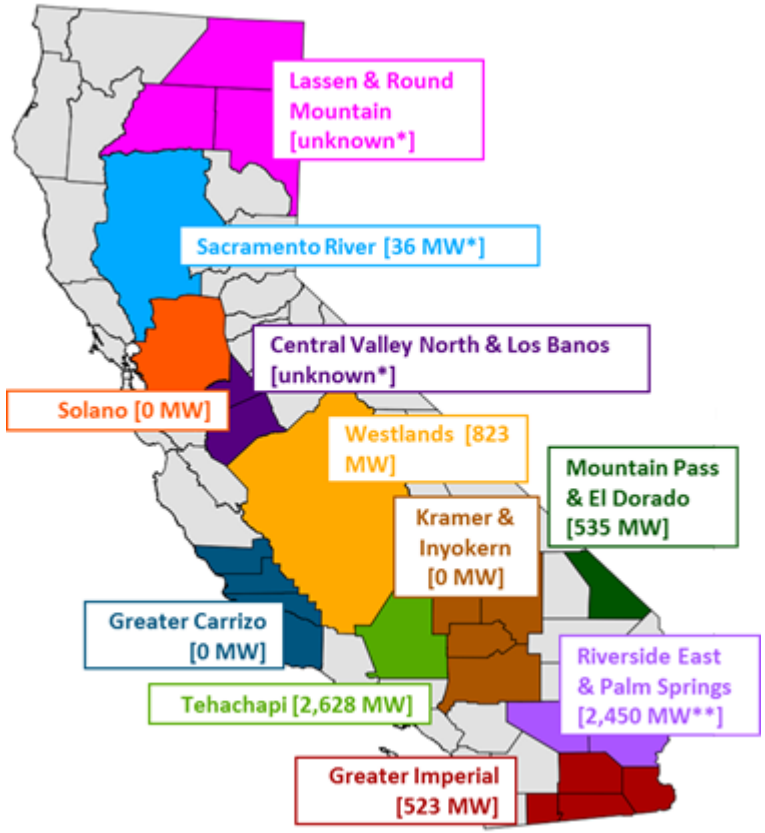
- Developed Estimates of amount of additional generation that could (i) achieve Full Capacity Deliverability Status, or (ii) be connected as Energy-only resource
- Capability estimates include all resources as of June 1, 2014

Estimates of capacity by area are very preliminary and are for planning purposes only. This is not an offer of capacity, not does it warrantee that capacity will be available for an specific generating resources.

California ISO Fully Deliverable Capability by Transmission Area

- Sufficient transmission capacity to meet 33% RPS
- Additional transmission capacity would be required to meet 50% RPS with all FCDS resources

Note: Capability estimates were not developed for Transmission areas with little or no commercial interest

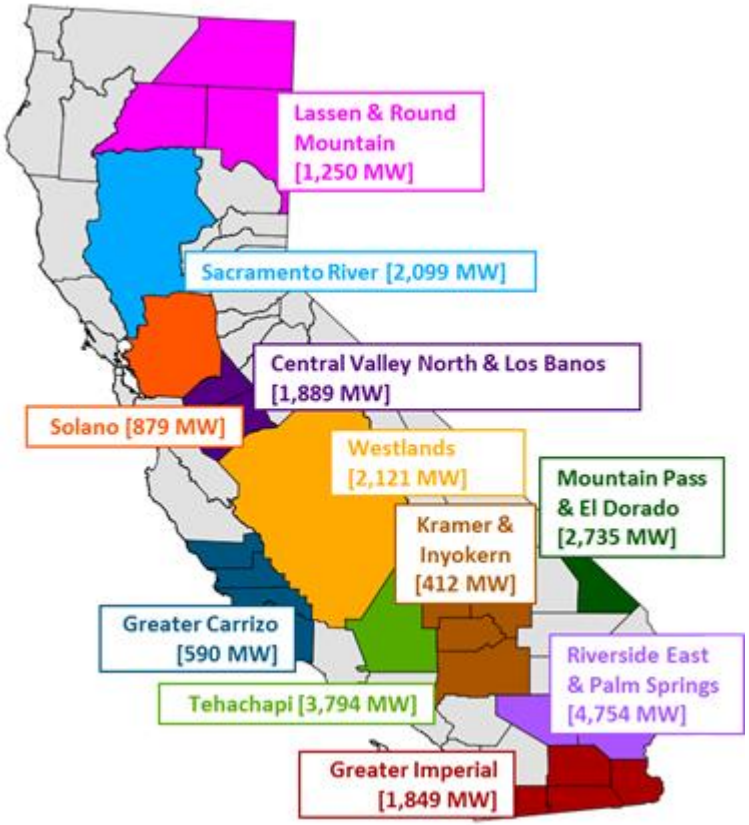


California ISO Energy-only Capability by Transmission Area

- There is sufficient transmission to accommodate resources beyond 33% on an "energy only" basis
- Will allow faster and less expensive resource interconnection
- EO capacity areas generally comport with commercial interests

TANC is of the opinion that it would likely not be possible to interconnect 3,300 MW of EO resources in the Lassen/Rd Mtn and Sacramento River Areas

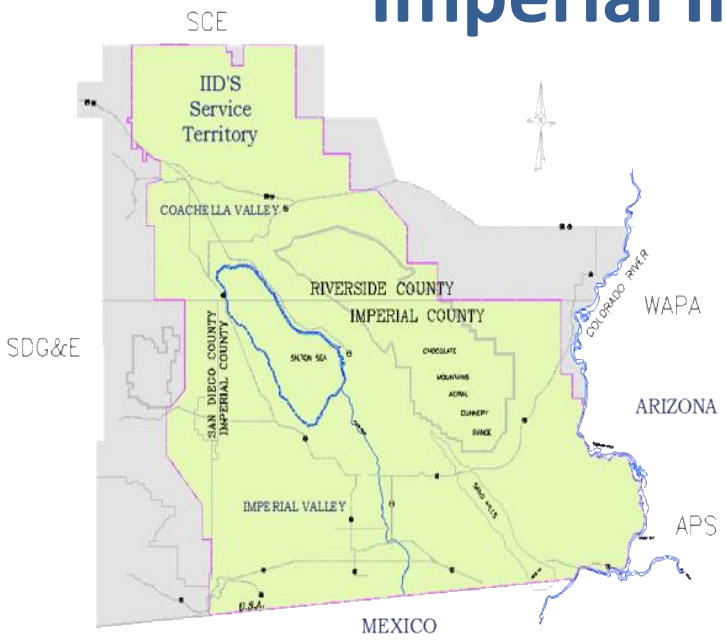
Estimated Energy-only capacity is over 22,000 MW



California ISO Transmission Facilities under Development

Transmission Upgrade	CAISO Status	Online Date
Carrizo-Midway	LGIA	energized
Sunrise Powerlink	Approved	energized
Suncrest dynamic reactive	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-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

Imperial Irrigation District (IID)



Transmission lines: 1,421.1 miles

Service Territory:

- Imperial County: 4,225 SQ Miles
- Riverside County: 1,954 SQ Miles
- San Diego County: 293 SQ Miles

Total: 6,471 SQ Miles; Interties with CAISO, SDG&E, SCE, APS, and WAPA

Existing Transmission Capability to Export

Exiting Transmission Paths for Export to CAISO	Total Transmission Capacity	Brief Description	Available Transmission Capacity	Renewable Zones
Transmission Path	**MW**		**MW**	
Path 42	1,500	This project consisted of re-conductoring 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 exiting Fern to Imperial Substation. The gen tie has a rating of 1171MW with exiting 140MW interconnected solar facility. The interconnection represents a unique opportunity to interconnect at a very low cost since Fern will have CAISO as three 1st network interconnection points with IID transmission rate of approximately 0.016 to .022 cents per kW-mon.	1,020	Imperial CREZ
Total	3,040		2,300	

STATE OF CALIFORNIA resources AGENCY

California Public Utilities Commission

California Energy Commission

California ISO

Imperial Irrigation District (IID)

Proposed Transmission Capability to Export

Exiting IID Transmission for 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 exiting 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)	1100	Proposed 118 miles, 1100 transfer capability on a single 500kV circuit transmission line. The proposed DSW span 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		

Proposed New Renewables location to support the Export

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	4200	

Transmission System Improvement for Renewable Resources

For

Renewable Energy Transmission Initiative
Transmission Technical Input Group

by
Mukhlesur Bhuiyan/Daniel Scorza
Los Angels Department of Water and Power

June 9, 2016

STATE OF CALIFORNIA resources AGENCY

California Public Utilities Commission

California Energy Commission

DEPARTMENT OF WATER AND POWER CITY OF LOS ANGELES FOUNDED 1781

LADWP

Clean Energy and Pollution Reduction Strategy

- LADWP renewable resources are geographically diverse including solar energy from Mohave Desert and Owens Valley, Wind energy from 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 from Southwest Nevada
- By the end of 2016, additional Solar Energy 650MW from Owens Valley/Mohave Desert and 500MW from Nevada
- Potentially increase to 600MW Solar Energy from Owens Valley/Mohave Desert by 2030
- 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 at Intermountain in Utah

LADWP

- Implement Barren Ridge Renewable Transmission Project to transmit renewables from Mohave Desert and Owens Valley areas for meeting RPS from 2016 through 2020
- 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
- Existing Interconnection Requests– 1794MW
- Solar Projects Completion by 2016 – 650MW

Transmission Projects and Renewable Interconnection Requests in Owens Valley and Mohave Desert

STATE OF CALIFORNIA resources AGENCY

California Public Utilities Commission

California Energy Commission

California ISO

LADWP

Upgrade Victorville to LA Basin Transmission System

- Upgrade Transfer Capability of Victorville to LA Basin transmission system enable to transmit renewables from Eldorado Valley, Arizona, Southern Nevada, Wyoming, and New Mexico for meeting RPS from 2024 through 2030
- Existing Interconnection Requests - Victorville/ Marketplace (1250MW) , and Intermountain (1724MW)
- Solar Projects Completion by 2016 – 500MW

STATE OF CALIFORNIA resources AGENCY

California Public Utilities Commission

California Energy Commission

California ISO

TANC

- TANC is the largest owner of and project manager for the 500-kV California-Oregon Transmission Project (COTP) which is operated in parallel with the Pacific AC Intertie 500-kV facilities and 230-kV facilities owned by WAPA and PG&E
- TANC believes that it is critical that the ability of the COTP and the balance of the system in northern California to deliver resources from the Pacific Northwest (wind and hydro) and the hydro resources in Northern California to load centers in northern California not be impacted
- TANC does not presently have any active interconnection requests for the COTP
- TANC is an active participant in seasonal operating studies that determine the operating transfer capabilities of the system in Northern California
- TANC develops a ten-year transmission plan focusing on the system in Northern California and is an active participant in the CAISO annual TPP study process as it relates to Northern California

TANC

- The COTP is routed through the center of the Round Mountain, Sacramento River, and Solano TAFAs and includes 500/230-kV substations in two of these TAFAs.
- Previous generation interconnection studies performed by TANC have indicated that the amounts of FC resources that could be interconnected to the COTP without reinforcing the system is very limited.
- TANC has not undertaken any detailed studies to assess the amounts of EO resources that could be connected with the COTP or other portions of the system in Northern California
- Based on the results of previous studies, TANC is of the opinion that some amounts of EO resources could be connected to the COTP and to other facilities in Northern California but believes that amounts of such are much lower than the preliminary amounts identified by the ISO.

WAPA

Project	Planning Entity	Brief Description	Renewable zones impacted	Status
SLTP	Western	San Luis Transmission Project links Tracy 230kv to San Luis 230kv. 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 230kV line with the O'Banion–Elverta #2 230kV line at Elverta substation. With all lines in-service, the project will mitigate overload on Elverta–Hurley 230kV, due to Elverta 230kV 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.

V. Transmission Evaluation Methodology and Data Sources for Each TAFA

TAFA Information (Illustrative, Partial)

TAFA	Impacted Transmission System	Proposed Study Range (Solar/Wind/Geo)
In-State		
Tehachapi	CAISO	4500/500
Victorville	LADWP, CAISO	4500/500
Riverside East	CAISO, IID	2000-4000/ 500-1000
Imperial	IID, CAISO	3500/500/1000
San Joaquin	CAISO	5,000
Northern California	CAISO , SMUD, TANC	500-1000 / 500-1000 /450

TTIG members will evaluate these resource ranges based on

- The existing information summarized in the TTIG report
- Existing studies that provide insights into higher renewable development in respective TAFAs

Methodology to Assess/Design Transmission for California Planning Areas

- Collaboration of affected Transmission Planning Areas for assessing TAFA's
- Transmission information from previous Planning Area studies and analyses
- Potential transmission upgrades limited to *achievable* transmission development (those that can be accommodated without significant modifications to the current grid). The capacity provided may be less than the Proposed Study Range identified by RETI 2.0 management team for each TAFA
- Transmission capacity estimates are not exclusive – development in one area may impact available capacity in another area.

Methodology to Assess/Design Transmission for Import / Export Paths

TTIG information provided by project proponents participating in RETI on transmission capacity, cost, and timing

- Similar to CA methodology, TTIG has limited assessment of MW for resource areas to achievable level (that can be accommodated without redesign of current grid)
- TTIG is not assessing any impacts on non-CA grid such as need for non-line network upgrades required to accommodate the new line or regulatory processes required to approve and develop the transmission
- Stress that most regional transmission will only deliver energy to the CA grid an a CA grid entry point. The energy will still need to compete with CA resources for delivery to loads.

Methodology to Assess Regional Transmission Network

- RETI 2.0 has requested that Western Interstate Energy Board conduct a short “regional consultation”
  - Summarize the existing, planned, and potential capability of the out-of-state transmission network to deliver renewable energy to California, to deliver California excess renewables to western load centers, and to support more renewable energy trade across the west generally.
- RETI 2.0 and WIEB staff will develop a set of questions on expected renewable supply and demand patterns and transmission implications
- Target audience/participants are state officials, utilities, renewables and transmission developers, environmental and other advocates
- Process will take place in July and involve webinar(s), in-person workshop(s), and written comments. WIEB will write report summarizing input for presentation to RETI 2.0 in August

TAFA Information (Illustrative, Partial)

TAFA	Impacted Transmission System	Data Sources	Proposed Study Range (Solar/Wind/Geo)
In-State			
Tehachapi	CAISO	CAISO Special Study, GIDAP	4500/500
Victorville	LADWP, CAISO	LADWP's queue, LADWP transmission info, CAISO GIDAP and special study	4500/500
Riverside East	CAISO, IID	GIDAP, IID study info, CAISO GIDAP and special study	2000-4000/ 500-1000
Imperial	IID, CAISO	IID Study info, CAISO GIDAP and special study	3500/500/1000
San Joaquin	CAISO	San Juaquin study, CAISO GIDAP and special study	5,000
Northern California	CAISO , SMUD, TANC	Special Study, TANC and CAISO ten-year plans; previous CAISO GIDAP studies	500-1000 / 500-1000 /450

VI. Stakeholder Comments and Next Steps

Stakeholder discussion questions

1. What existing studies or data should TTIG consult to assess individual TAFAs:
   - California desert
   - San Joaquin Valley
   - Northern California
   - Import/Export Paths and interconnection points
2. What existing studies or data could TTIG consult to address broader issues:
   - Very high study ranges in one TAFA that could entail significant change in grid topology
   - Scenarios involving the high end of study range from multiple TAFAs
   - Interaction of import/export paths and “local” generation
   - Seams and import/export between CA balancing authorities
   - Scheduling/deliver over jointly-owned transmission paths
   - Energy only vs. full deliverability for imports or across BAs
3. What kind of TTIG output is feasible and appropriate to address:
   - Conceptual transmission upgrades
   - Environmental/land use implications of conceptual transmission
   - Cost of upgrades