



Energy+Environmental Economics

+ Update on the 2015 Special Study

June 29, 2015

Source:

<http://www.cpuc.ca.gov/PUC/energy/Renewables/hot/RPS+Calculator+Home.htm>

50% RPS Energy Only Special Study

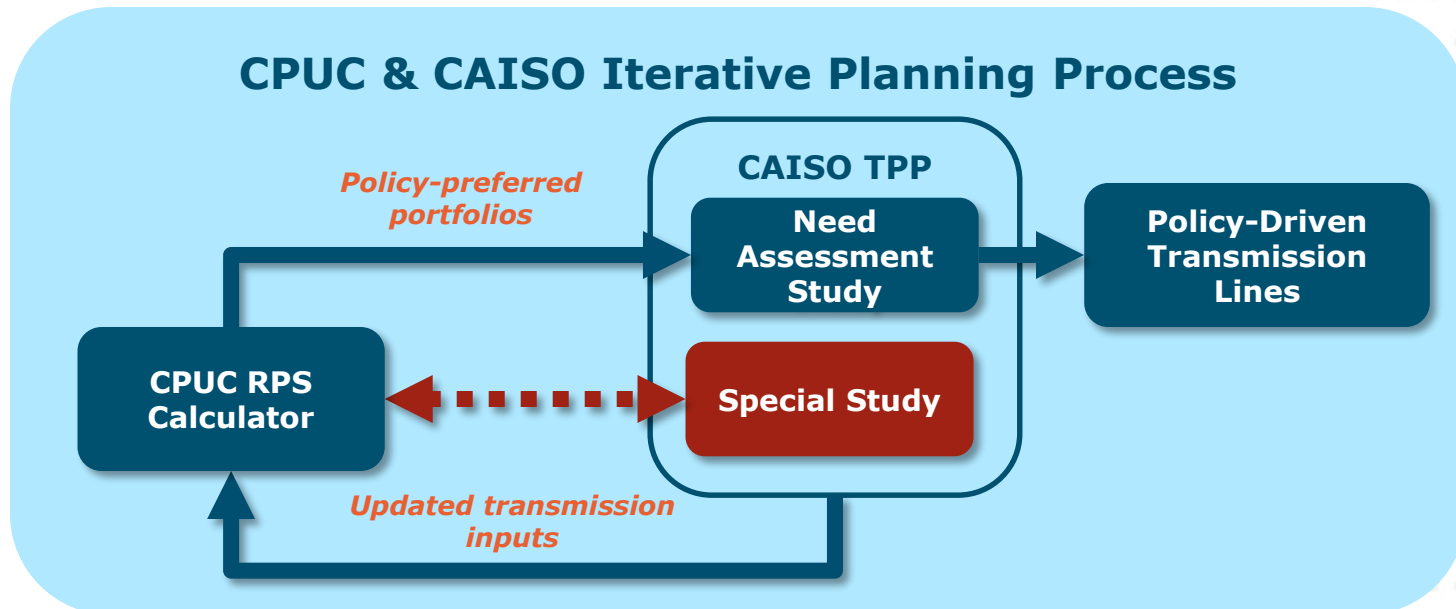
Public Teleconference (6/29/2015)

Arne Olson, Partner
Nick Schlag, Managing Consultant
Gabe Kwok, Senior Consultant



Overview

- + CAISO's Transmission Planning Process (TPP) has historically focused on current policy-preferred portfolio (a 33% RPS portfolio)
- + The idea for the 2015 Special Study was borne of the mutual desires of the CPUC and CAISO to begin investigating impacts of higher RPS targets upon transmission planning
- + 2015 Special Study provides opportunity to conduct analysis to inform future TPP cycles without a direct impact on the current transmission plan





Transmission Planning at Higher Renewable Penetrations

- + To reach 50% RPS goal, an additional 15,000 MW of renewables will be needed in CAISO**
- + 2015 Special Study provides an opportunity to explore challenges and issues that may be encountered at such higher penetrations prior to a formal planning process**
- + Through workshops, stakeholder comments and RPS Calculator development, the question of what role energy-only resources could play in achieving higher renewable goals has emerged**
- + Both questions have directed the scope of the 2015 Special Study to focus on a topic that has not been explored in the transmission planning process: the impacts of adding large quantities of energy-only resources to the system**

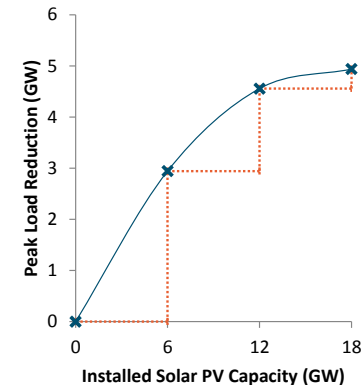
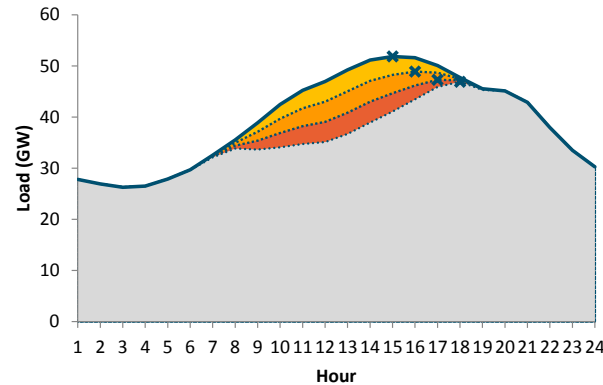


Energy-Only Resources at Higher Renewable Penetrations

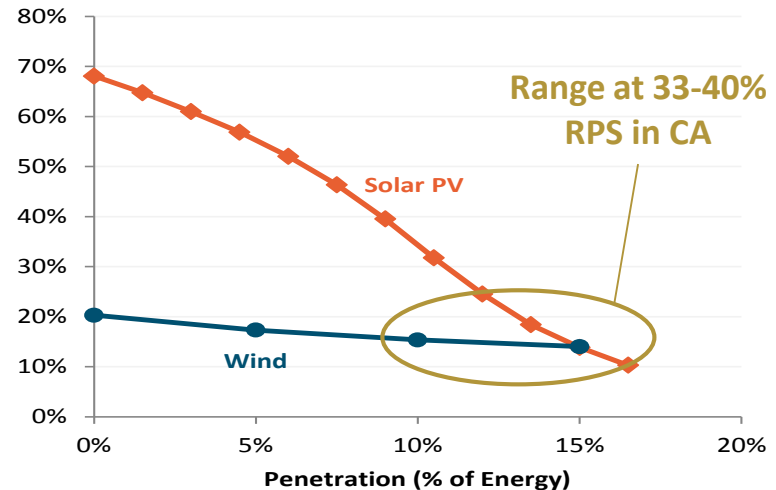
+ **At higher penetrations, a number of factors make energy-only resources increasingly attractive relative to fully-deliverable resources:**

- Marginal ELCC of renewable resources declines
- Avoided cost of generation capacity remains relatively low
- System-level curtailment/overgeneration issues limit need for transmission during high loads
- Marginal transmission investments become increasingly costly

+ **In this paradigm, renewables are added to the system for their energy production**



Marginal ELCC (% of Nameplate)



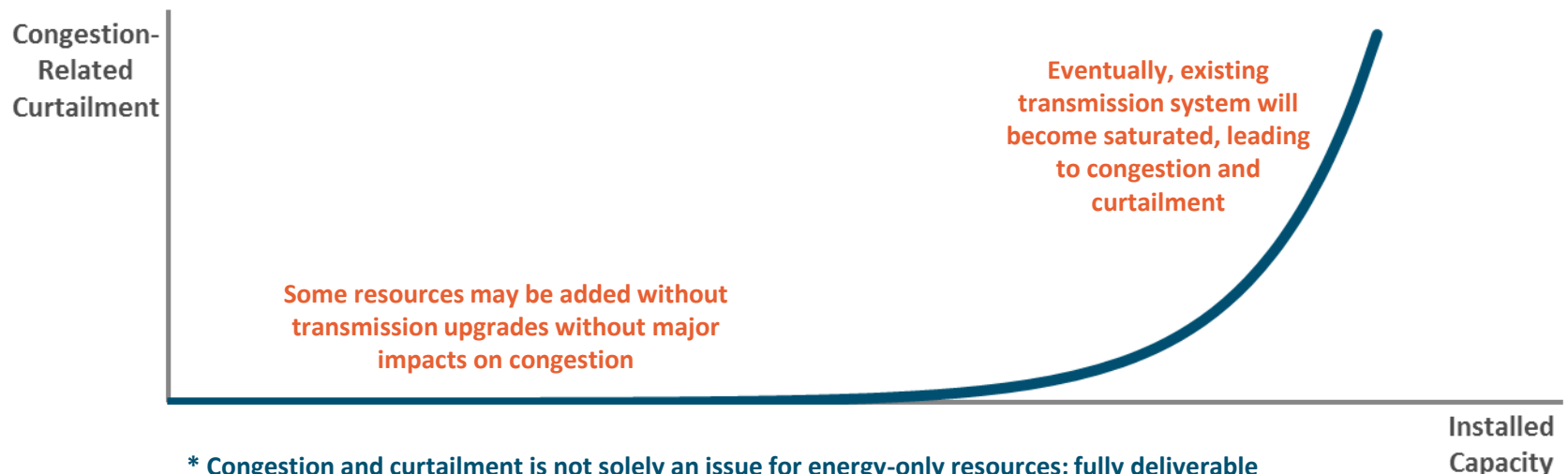
Source: RPS Calculator



Energy-Only Resources & Congestion-Related Curtailment

- + While energy-only resources will become more attractive at higher penetrations, the transmission system is limited in its ability to accommodate them
- + Continuing to add generation without upgrades to the transmission system will eventually lead to increases in congestion and congestion-related curtailment

Impact of Adding Generation without Transmission Upgrades



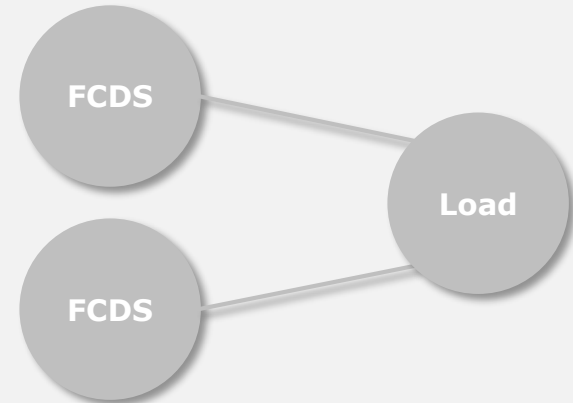
* Congestion and curtailment is not solely an issue for energy-only resources; fully deliverable resources may also contribute to congestion/curtailment



Deliverability Overview

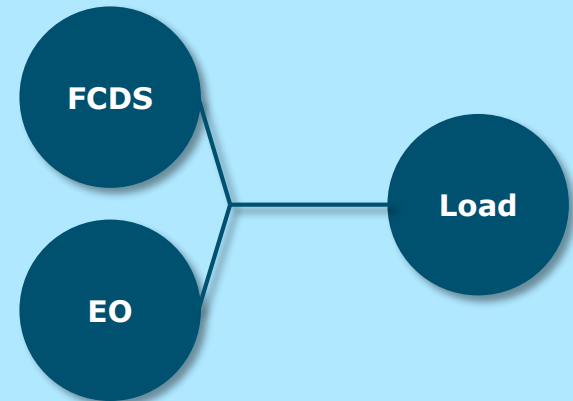
Historical Planning: All Resources Fully Deliverable

- Power flow studies conducted for all resources to ensure deliverability during peak periods
- Costs of delivery network upgrades are recovered through transmission access charge (TAC)
- Resources receive RA credit based on NQC



2015 Special Study: Combination of Energy Only & Fully Deliverable Resources

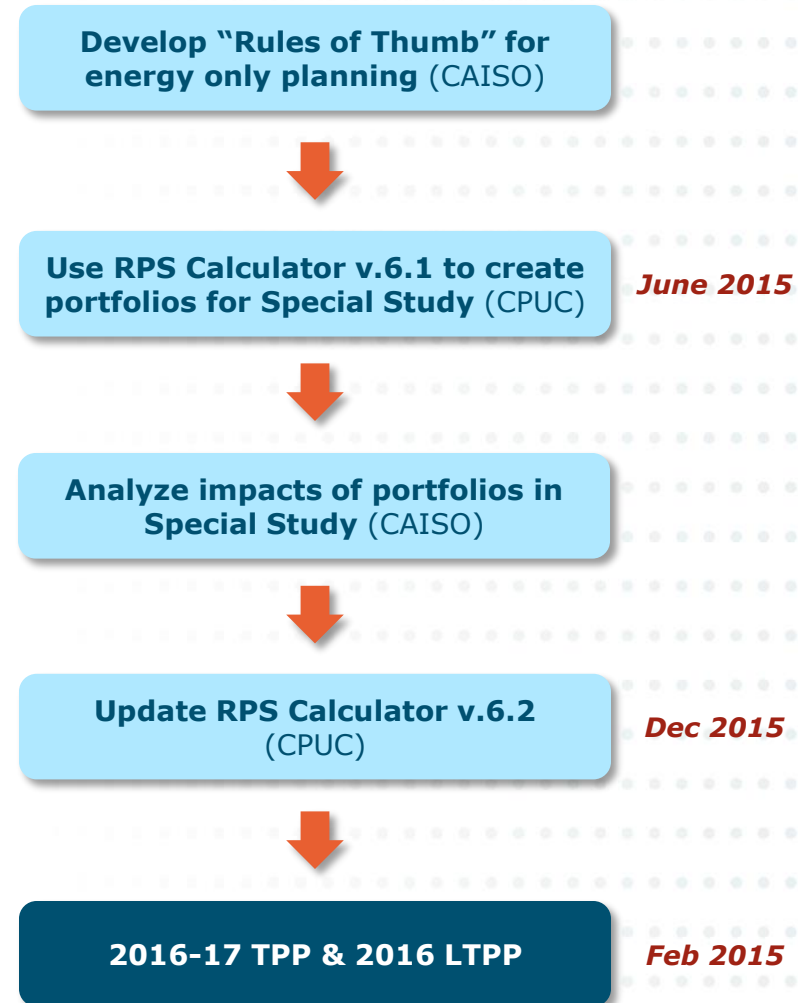
- No new transmission investments on behalf of energy only resources
- No capacity credit in RA for purchaser of energy-only resource
- Opportunities for ratepayer savings if avoided transmission investment outweighs foregone RA value and congestion costs





Plan for 2015 Special Study

- + **Purpose:** provide useful information on transmission impacts of 50% RPS portfolios for use in subsequent planning cycles
- + **Scope:** analyze multiple portfolios achieving 50% RPS utilizing energy-only resources to meet the RNS
- + **Results of 2015 Special Study will not:**
 - Support any policy-driven transmission lines
 - Supplant resource portfolios used in CAISO TPP and CPUC LTTP

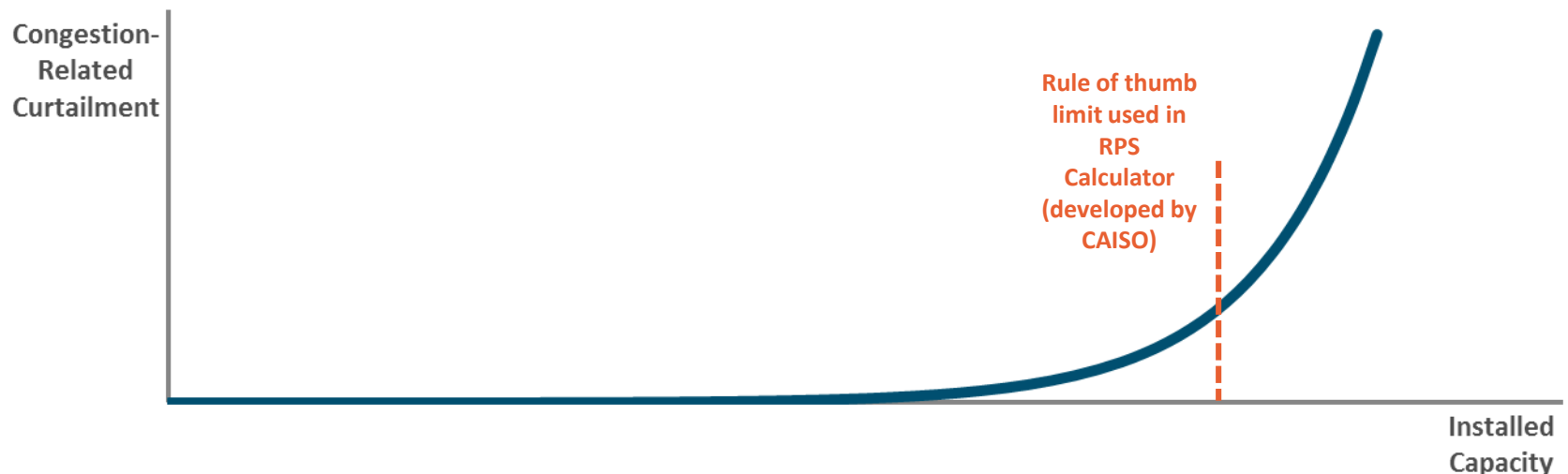




Limits to Energy Only-Resources

- + Prior versions (v.1 – v.6.0) of the RPS Calculator have assumed that all new renewable resources are made fully deliverable
- + Separate functionality to allow energy-only resources to compete to fill the RNS has been implemented in preparation for RPS Calculator v.6.1
- + CAISO has developed “rules of thumb” to limit energy only resources in various locations intended to capture the point at which congestion would become a significant issue

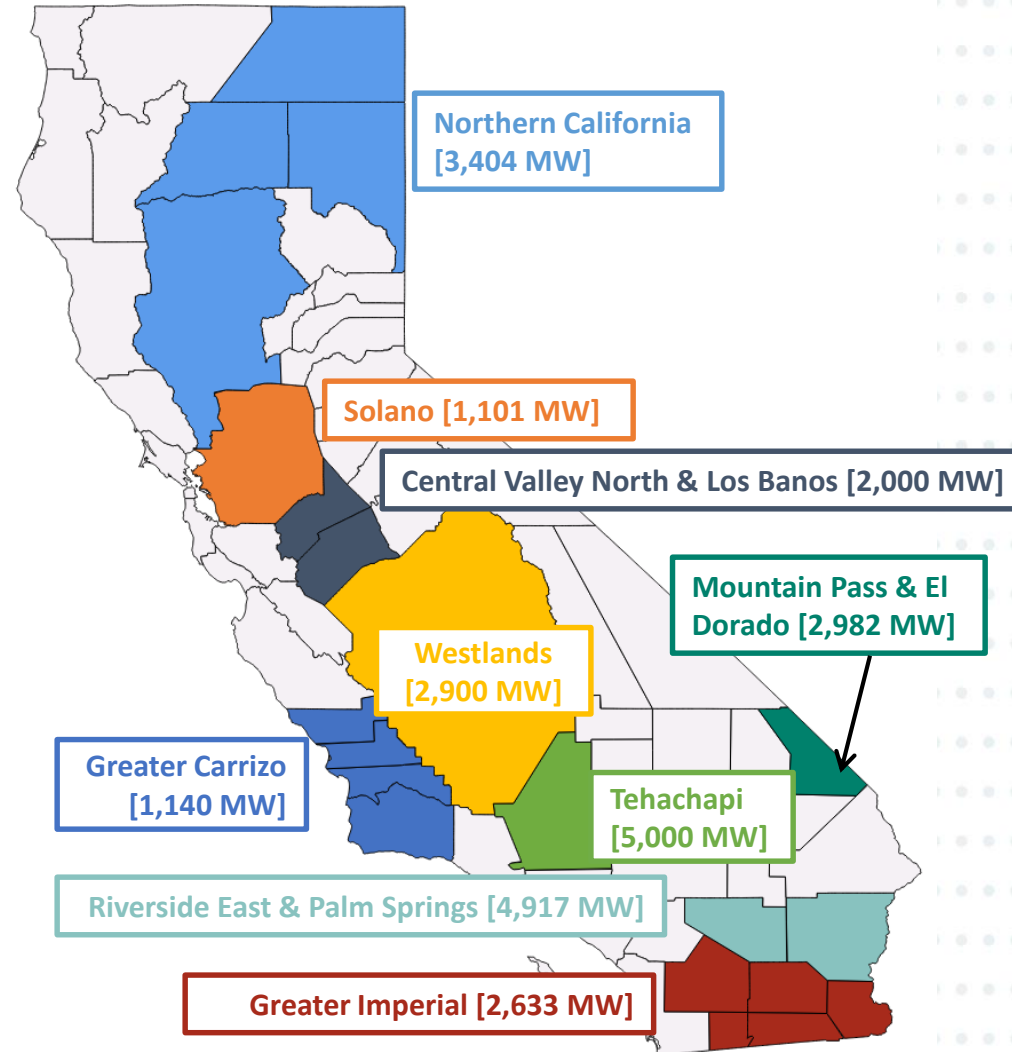
Impact of Adding Generation without Transmission Upgrades





CAISO Energy-Only Rules of Thumb

- + CAISO's rules of thumb indicate availability of **>26,000 MW** of capacity for energy-only resources on the existing system
- + 2015 Special Study will focus on evaluating the appropriateness of rules of thumb for use in subsequent TPP cycles; possible outcomes:
 1. Rules of thumb adequate for use
 2. Rules of thumb require minor adjustment
 3. Rules of thumb require major revisions





PORTFOLIOS



2015 Special Study Focus

+ RPS Calculator has been used to generate three 50% RPS portfolios:

1. California Fully Deliverable:

- RNS may be filled only by resources located in California
- All new resources must be fully deliverable, leading to the need for new transmission investment

Generated for stakeholder reference

2. California Energy Only:

- RNS may be filled only by resources located in California
- All resources are assumed to be connected to the existing transmission system

Generated as inputs for Special Study

3. WECC Energy Only:

- RNS may be filled by resources throughout the Western Interconnection
- All resources are assumed to be connected to the existing transmission system

+ CAISO's 2015 Special Study will analyze Portfolios 2 & 3



Updated Data and Functionality for RPS Calculator v.6.1

+ Based on stakeholder feedback from the February 2015 workshop, E3 and Black & Veatch made major updates for v.6.1, including:

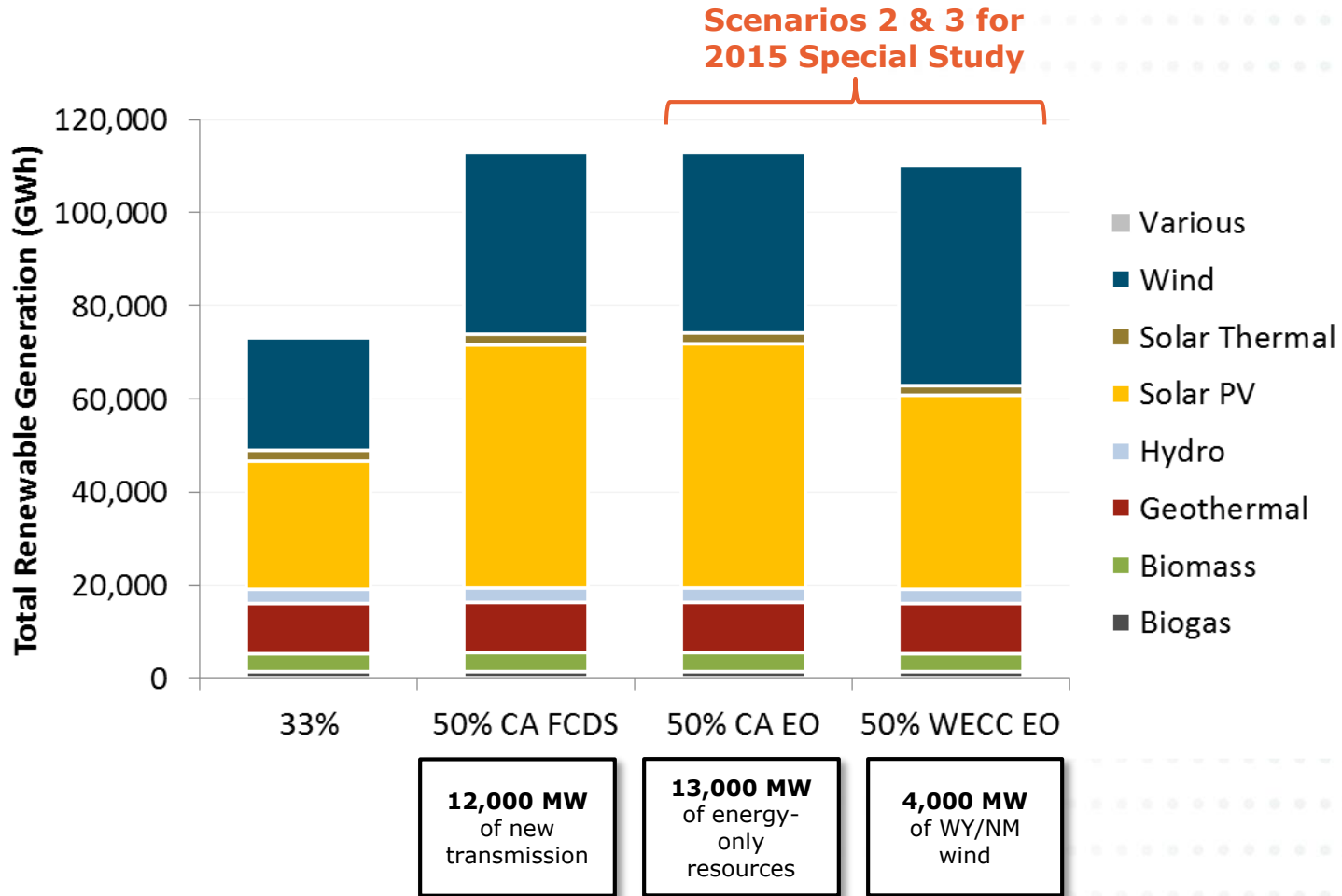
- **EO deliverability functionality added based on CAISO rules of thumb**
- Energy storage functionality added
- Resource cost and potential update
 - Solar PV capital costs reduced ~25%; geothermal capital costs increased ~20%
 - New distribution generation potential
- Conceptual transmission cost and availability update
 - Includes AC and DC options for OOS resources
- Existing and commercial project list update
 - Reflects up-to-date PPAs approved and terminated
- Energy valuation
 - Added new profiles for New Mexico, Rocky Mountain and Desert Southwest wind

+ RPS Calculator v.6.1 will be released at the end of July 2015



Scenario Comparison: Resources

+ Incremental resources selected above 33% include a mix of wind and solar PV:





Summary Figures - Overview

- + For each scenario, future resources are summarized by type, location, and deliverability

New Fully Deliverable Resources

New Fully Deliverable Resources (MW)

(shows all future resources, including contracts signed by utilities & generic projects selected by RPS Calculator)

New Energy Only Resources

New Energy Only Resources (MW)

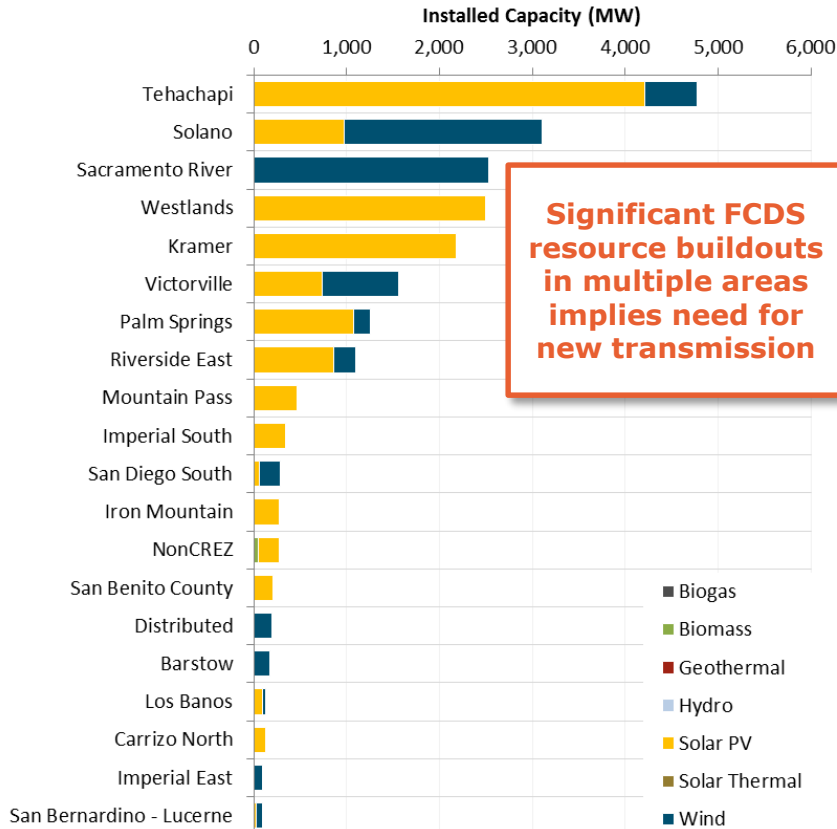
(shows all future resources, including contracts signed by utilities & generic projects selected by RPS Calculator)



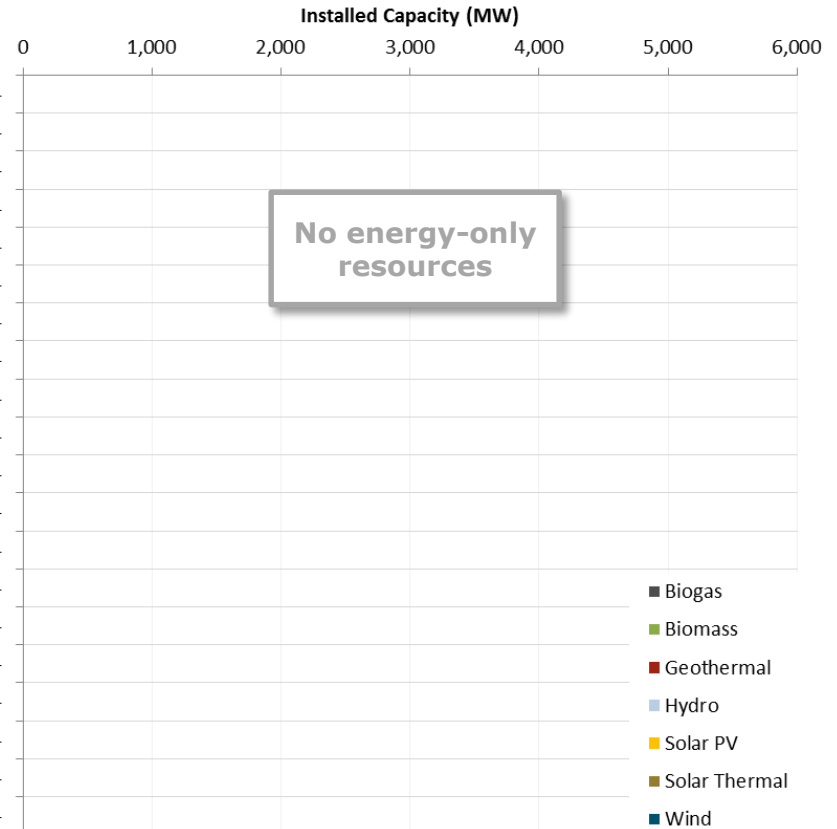
Scenario 1: California Fully Deliverable

+ Scenario represents “business-as-usual” use of the RPS Calculator

New Fully Deliverable Resources



New Energy Only Resources

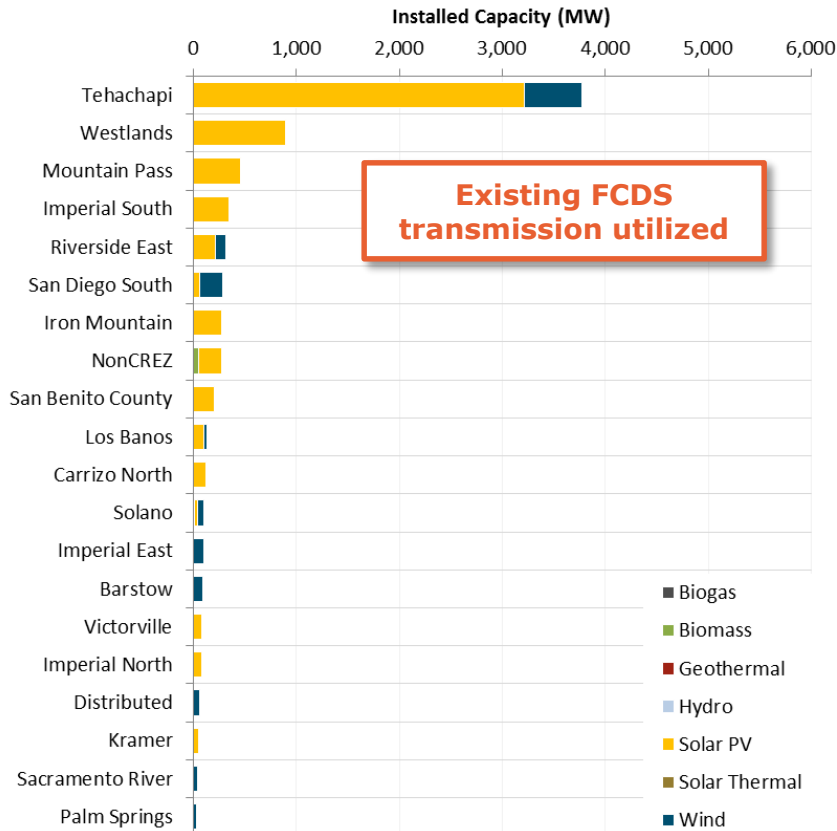




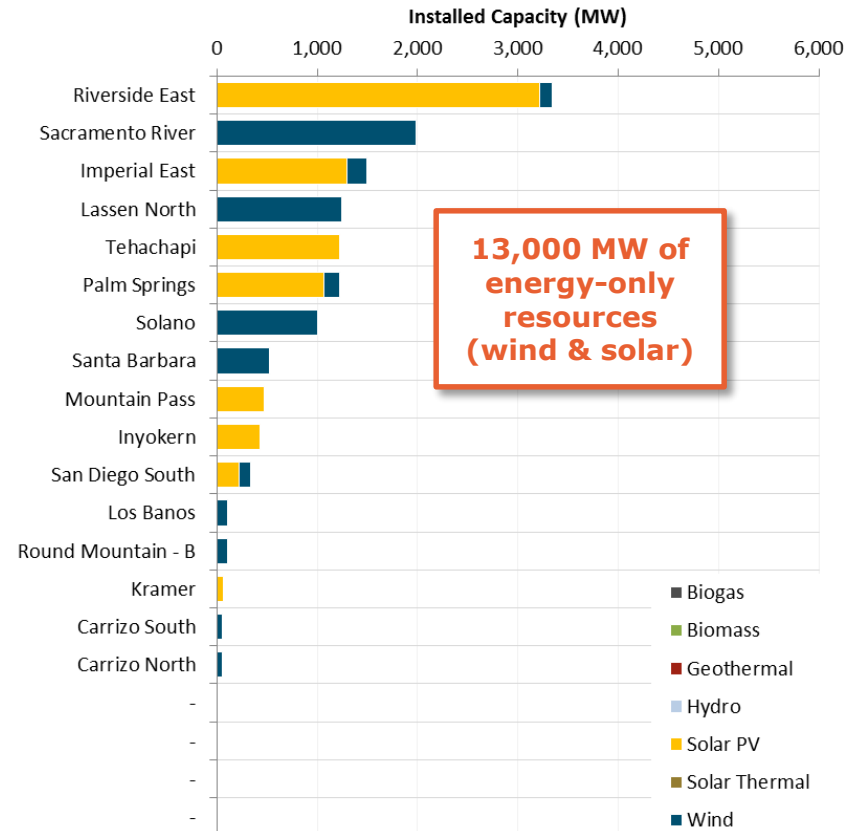
Scenario 2: California Energy Only

+ Deployment of energy-only resources is geographically balanced

New Fully Deliverable Resources



New Energy Only Resources

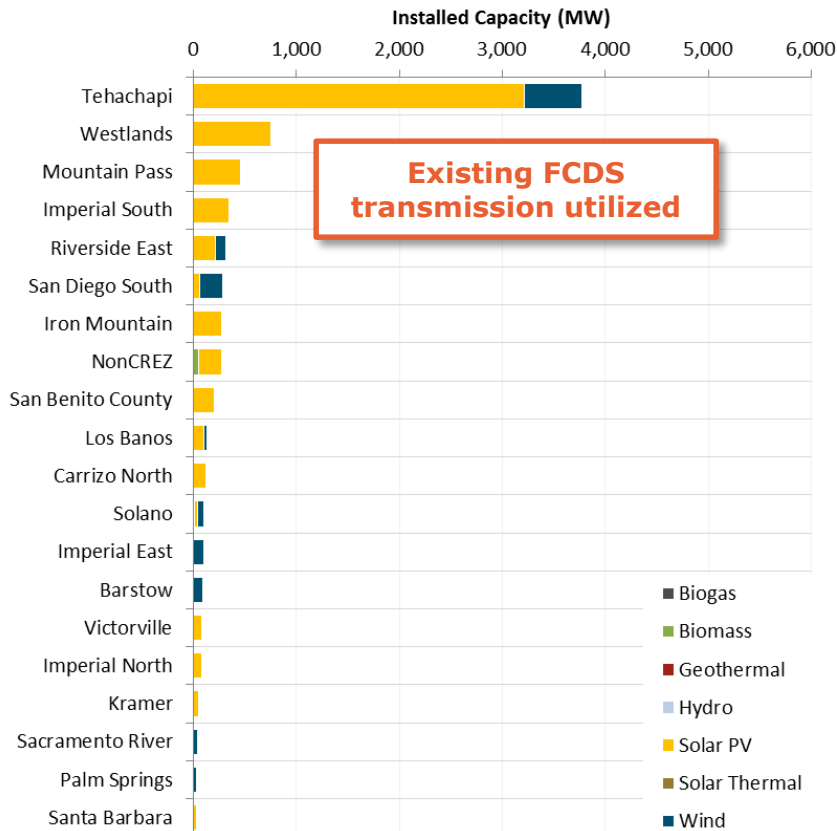




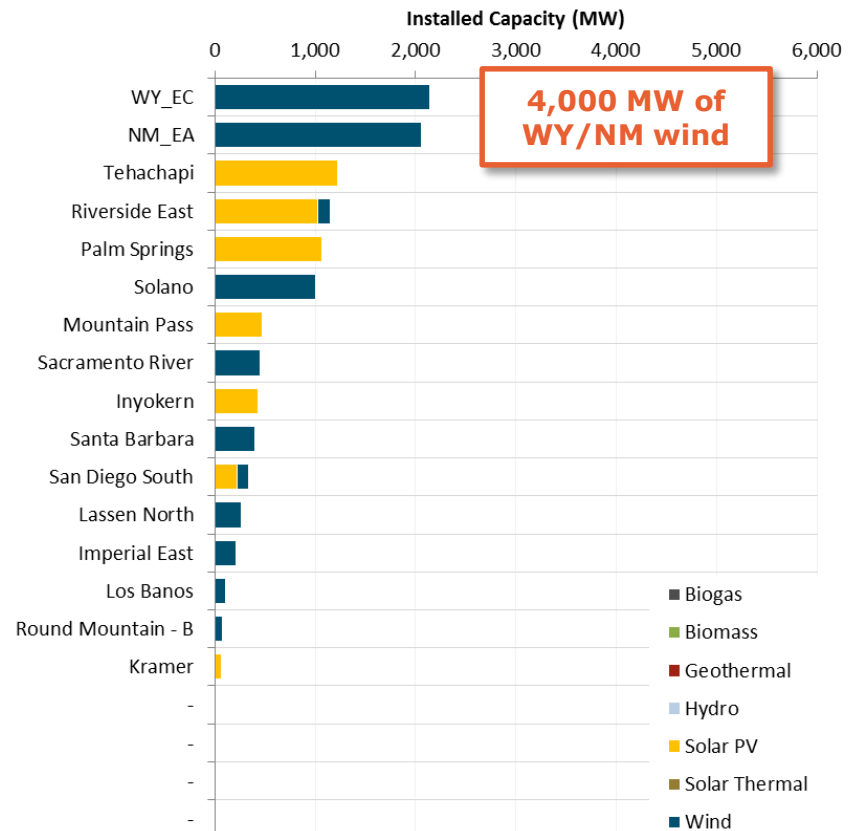
Scenario 3: WECC Energy Only

+ Wyoming & New Mexico wind displace a combination of in-state wind & solar PV

New Fully Deliverable Resources



New Energy Only Resources





Scenario Comparison: New Resources

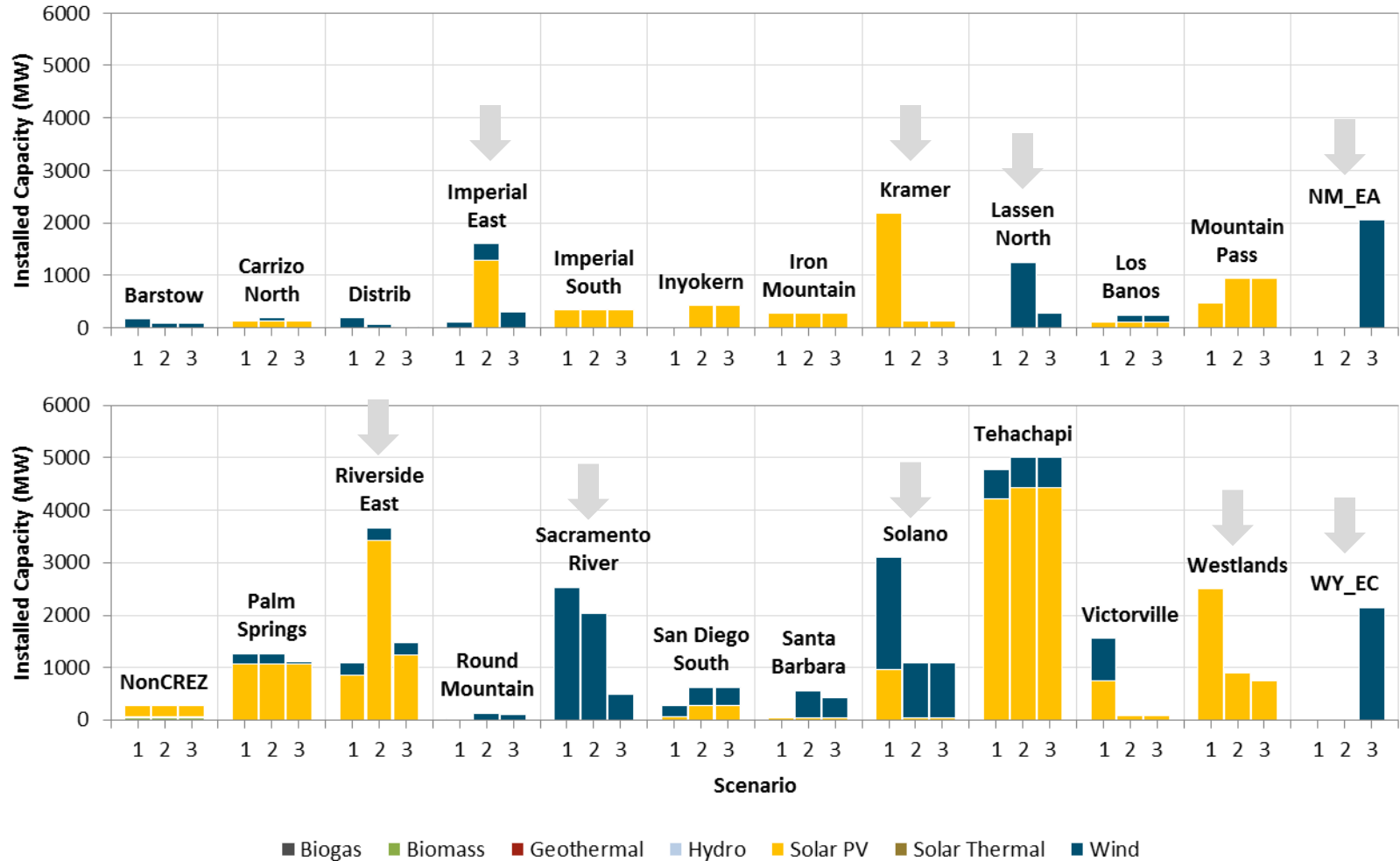


Figure shows all future resources, including contracts signed by utilities & generic projects selected by RPS Calculator



Energy+Environmental Economics

Thank You!

Energy and Environmental Economics, Inc. (E3)

101 Montgomery Street, Suite 1600

San Francisco, CA 94104

Tel 415-391-5100

Web <http://www.ethree.com>

Arne Olson, Partner

Nick Schlag, Managing Consultant

Gabe Kwok, Senior Consultant

arne@ethree.com

nick@ethree.com

gabe.kwok@ethree.com