



# Modeling the Potential for Southwest Imports

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Tim Belden  
tbelden@energygps.com

1

## Agenda

- Project Overview
- Important Trends
- Summary of Findings
- Key Uncertainties
- Review of the Modeling Techniques



2

## Project Overview

- Objectives:
  - Estimate monthly export potential from California to PNW by month for 2019.
  - Provide overview of California capacity planning process.
  - Develop model that can be used and improved upon in the future by NWPCC.
- Data: All publicly available data from CA Public Utility Commission, CA Energy Commission, EIA, BPA, FERC.
- Project limited to approximately 60 person-hours.



3

## Important Trends

- Renewable build out driven by RPS.
- Excess energy from renewables placing downward pressure on prices.
- Low electricity prices place financial pressure on existing natural gas generation. No new merchant generation.
- Virtually all new/refurbished generation will be financed with long term PPA.
- Boom to bust merchant generation model gives way to regulatory planning model.
- Once through cooling units will refurbish if CPUC desires.
- Utilities are becoming vertically integrated again via contract.



4

## Summary of Initial Findings

- CA should have surplus power to export to the PNW in all months except evening peak in July to September.
- Shortages will be driven by high coincident evening peak in CA and PNW. This happens in Q3.
- Little solar available during evening peak hours.
- Assumptions regarding availability of wind and solar important driver – especially during summer.
- Contracting and market friction associated with CA exports likely bigger concern than availability of supply.

## Summary of Initial Findings August Evening Ramp Values

- Natural gas generation comprises 60% of available generation.
- Nuclear, hydro, and DSW imports comprise 18% of available generation.
- Wind and solar account for 12% of available generation (20<sup>th</sup> percentile for wind and 50<sup>th</sup> percentile for solar).
- Biomass and storage comprise 10% of available generation.
- Diverse resource mix with 9 types of supply and no source exceeding 10% other than natural gas.

## Important Uncertainties

- Quantity of intermittent resources available in CA during critical PNW times. Model built so that user can select percentile or exceedance.
- Once through cooling repower, retirement, and replacement.
- Availability of imports from Desert Southwest to California.
- Will California permit significant exports? They did in 12/2013.



7

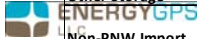
## 2019 CA Load Resource Balance PNW Single Max Hour Scenario

	Intalld Capacity		Aug HE18 Capacity		Jan HE8 Capacity	
	MW	%	aMW	%	aMW	%
Demand Response	2,916	3%	0	0%	0	0%
Hydro	10,613	11%	6,012	8%	2,534	4%
Nuclear	2,323	2%	2,129	3%	2,203	4%
Natural gas	51,096	52%	43,909	60%	42,472	70%
Biomass, Geo, etc	4,201	4%	3,529	5%	3,529	6%
Wind	8,202	8%	2,154	3%	430	1%
Solar	15,997	16%	6,794	9%	213	0%
Pump Storage	2,943	3%	2,943	4%	2,943	5%
Other Storage	719	1%	719	1%	719	1%
Desert SW Imports	0	0%	5,496	7%	5,496	9%
<b>Total</b>	<b>99,010</b>	<b>100%</b>	<b>73,684</b>	<b>100%</b>	<b>60,538</b>	<b>100%</b>
Load			(67,262)		(42,377)	
Reserves			(5,038)		(4,187)	
<b>Total</b>			<b>(72,300)</b>		<b>(46,564)</b>	
Surplus			<b>1,384</b>		<b>13,973</b>	



8

Variable	Data Source	Methodology
Demand Response	WECC Reliability Document	Binary flag in model, available to meet CA Local Demand depending on inputs
Hydro	EIA Historical Production, CAISO RT Production	Used EIA data to generate worst in last 10 production by month. Scaled off of CAISO RT Data to determine peaking capability.
Nuclear	EIA Form 923	Historical average production to determine average capacity factor.
Natural Gas	CEC Plant Database, CAISO 1515, CPUC LTPP	1515 Data used to estimate average outage % by month, CEC data for total state capacity and CPUC LTPP to determine capacity additions.
Biomass, Geo	CPUC RPS, CEC Plant Database, CPUC Planning Document	Additional Gen added to current (CEC Plant DB) to meet RPS requirements, flat average outage rate by CPUC availability percentage.
Wind	CPUC RPS, CAISO RT Production, CPUC Planning Document, CEC Plant DB	Current Capacity from CEC plant DB, added new capacity based on analysis of CPUC RPS contract document and total need, scaled using CPUC capacity factor and CAISO RT prod to generate 12x24.
Solar	CPUC RPS, CAISO RT Production, CPUC Planning Document, CEC Plant DB	Current Capacity from CEC plant DB, added new capacity based on analysis of CPUC RPS contract document and total need, scaled using CPUC capacity factor and CAISO RT prod to generate 12x24.
Pumped Storage	FERC Document	FERC planning document
Other Storage	ALJ Decision	ALJ Decision set out procurement targets by year.
Non-PNW Import	CPUC Planning Document	CPUC planning document, removed PNW import capacity from total.



## Once Through Cooling Math

	<b>MW</b>
Total	20,400
SONGS	-2,200
Already Retired	-656
<b>Remaining Today</b>	<b>17,544</b>
Announced Retire	-1,985
<b>Remaining Post Retirements</b>	<b>15,559</b>
Newer OTC Generation	-2,317
Diablo Canyon	-2,300
<b>Units to Refurbish or Retire</b>	<b>10,942</b>



## New Gas Generation by 2019

### New Thermal Generation

Under Construction	3,015	90% success rate
SCE RFO	1,500	75% success rate by 2019
SDG&E RFO	600	75% success rate by 2019
Other	900	
<b>Total</b>	<b>5,115</b>	



11

## New Wind and Solar by 2019

Significant additional capacity needed to fulfill RPS mandate of 31% of retail load by 2019 from current 20%. Most new generation will be in-state solar.

**Additional GWh/Year Needed** 35,373

	MW	CF	% Of New	Change from Current
<b>Additional Solar</b>	13,786	24%	89%	623%
<b>Additional Wind</b>	1,714	33%	11%	26%
<b>Additional Biomass/geo/other</b>	48	84%	0%	0%
<b>Total New Resources</b>	15,548	26%	100%	



12

## Capacity Factors

- Thermal and Nuclear – Total capacity reduced by expected planned and unplanned outages for each month.
- Solar and Wind – User can stipulate an exceedance level which is calculated using historical data.
- Hydro – Based on conservative assumptions from historic, observed data.
- Imports – Assumes no PNW imports. Remaining DSW imports based on CEC planning document.



13

## How We Identified Hour for Export User Selected Parameter

- PNW Load Approach: used BPA historical data to determine max hour by month.
- CA Load Approach: used CAISO and FERC 714 (for POUs) data to find historical max hour.
- Flat: sourced from CEC Data
- Peak: CEC flat average for 2019 scaled using FERC 714 and CAISO data.



14

## Additional Research

- California hydro peaking capacity during low water years. Very conservative assumptions in model right now.
- Refine estimates for Desert Southwest import estimates.
- Select exceedance levels for renewable generation during critical periods.
- Continue to refine thermal new build and retirements.



15

## Questions

Tim Belden

[tbelden@energygps.com](mailto:tbelden@energygps.com)

503-764-9120



16