CAISO Regionalization Environmental Topics

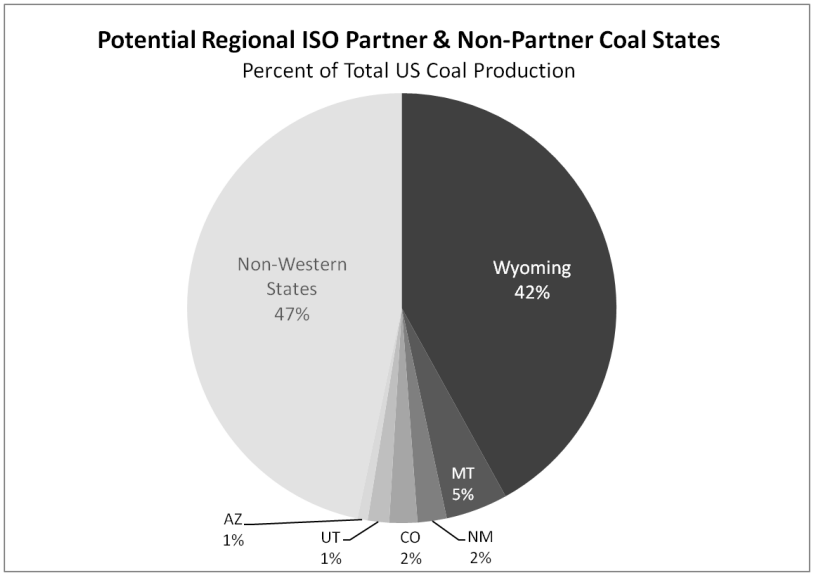
Draft, January 9, 2018, v.2

ISO modeling showed that environmental benefits from regionalization are doubtful:

- The 50% renewable energy target for 2030 is reached *with or without regionalization*
- Regional partner states produce half of nation's coal, and generate 500 times the coal electricity as California
- California only uses 6% coal electric power, almost all imported from other western states; with nearly complete phase out by 2026
- Regional grid projected to have almost no effect on western coal generation by 2030
- By 2020, regionalization of CA ISO results in *higher greenhouse gas emissions*
- Greenhouse gas emissions are projected to be slightly lower with regionalization, but this relies on questionable assumptions
- The regionalization scenarios produce a net loss of 8,000 to 23,000 green jobs in California, with disadvantaged communities losing 4,000 to 8,000 of these green jobs

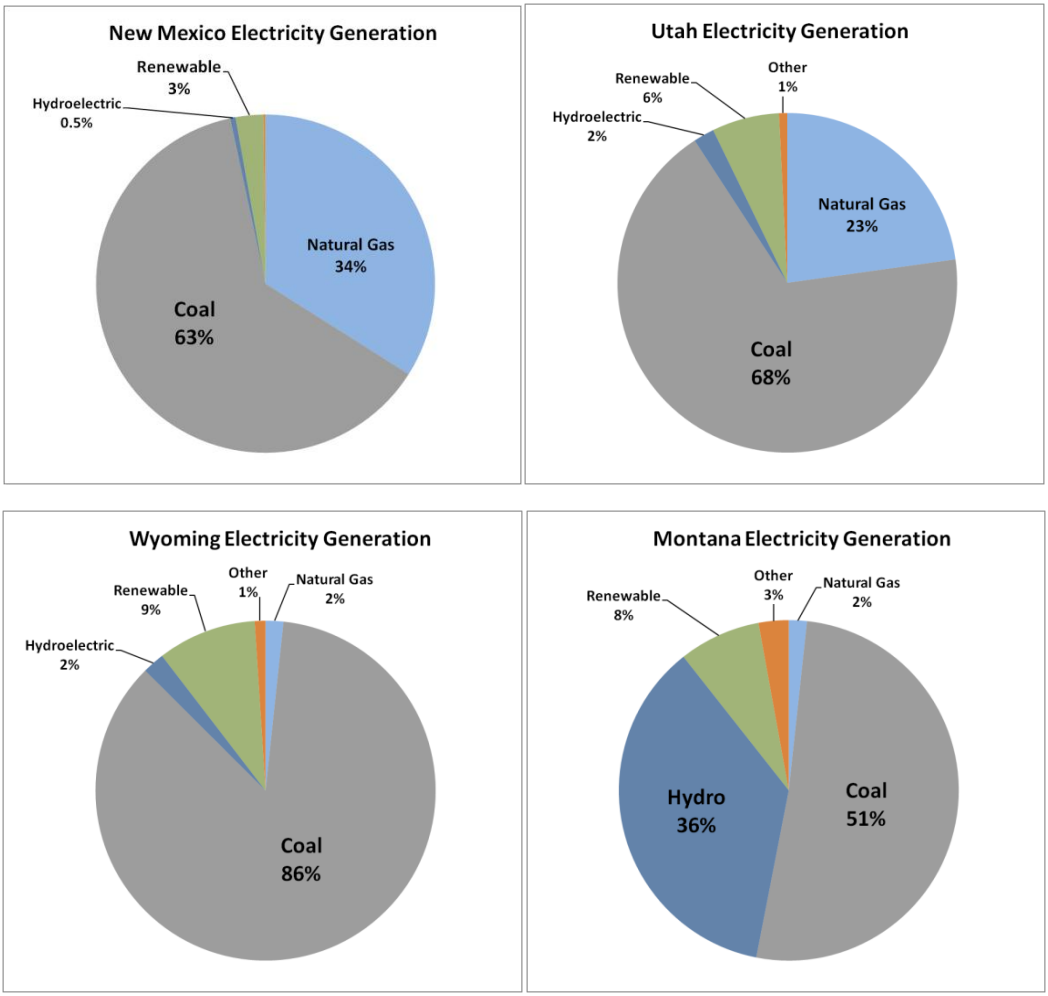
I. Two Pathways: California and the Western Coal States

A major question about moving to western regional control of the ISO is whether it could help California with our clean energy and climate goals. A major problem is that many of the potential partner states are heavily committed to coal. The following chart in darker shades of gray shows that 53% of U.S. coal production is located in six of the states that are likely to be partners in a Western regional grid.[1]



[1] Data from U.S. Energy Information Administration (EIA), https://www.eia.gov/state/rankings/?sid=WY#/series/48

In addition to mining coal, these four mountain states also have a very high percentage of coal in the electricity they generate, ranging from 51% to 86%. This raises a real question about their suitability as partners for helping California achieve its renewable energy goals.

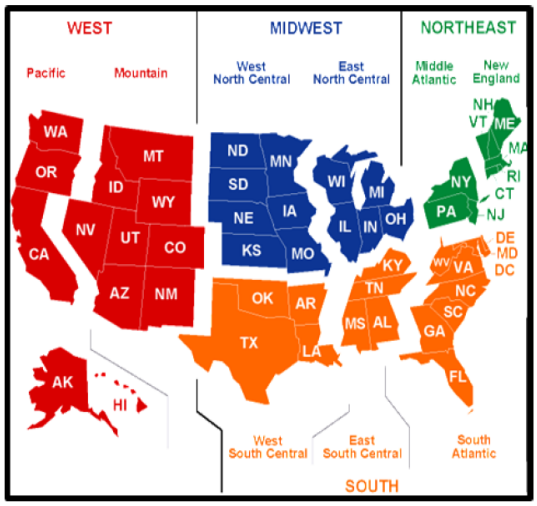


There is a stark contrast between the extreme amount of coal power in the western mountain states and the western coast states. The mountain states collectively generated 160,000 gigawatt-hours of coal power in 2015; while this is less than the previous year, it is more than 20 times the combined coal power from the coast states, and 500 times the coal power of California.[2]

[2] U.S. Energy Information data table and graph, and graphs on California coal, from Tracking Progress, California's Declining Reliance on Coal, California Energy Commission , Jan 8, 2018. http://www.energy.ca.gov/renewables/tracking_progress/

Figure 1: In-State Coal Generation for Calendar Year 2015 – 2016 (GWh)

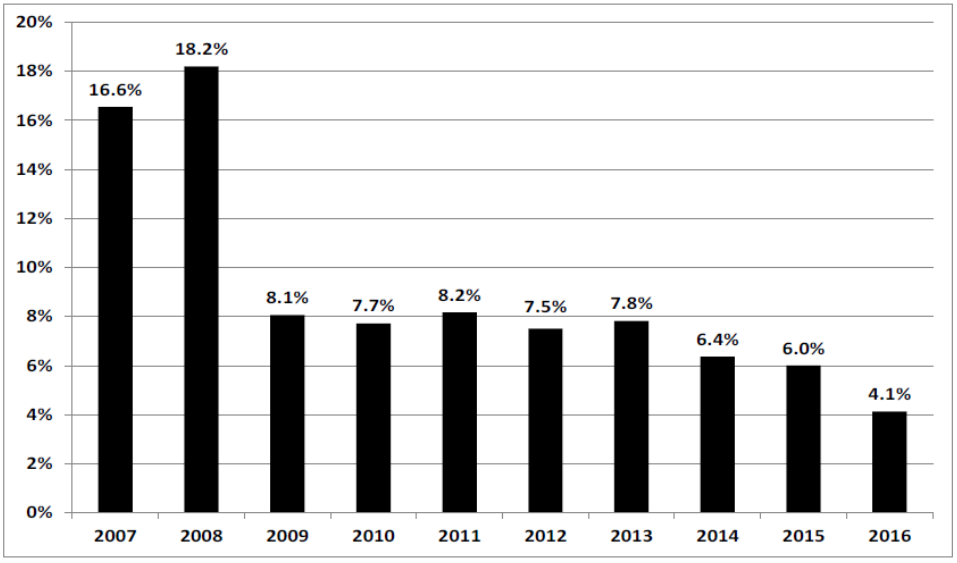
Census Division and State (GWh)	2015	2016
New England	3,882	2,562
Middle Atlantic	68,776	57,538
East North Central	313,779	274,771
West North Central	197,842	183,347
South Atlantic	242,400	238,128
East South Central	151,017	137,683
West South Central	183,326	176,209
Mountain	181,645	160,973
Pacific Contiguous	7,727	6,819
California	*298*	*319*
Oregon	*2,377*	*1,898*
Washington	*5,052*	*4,602*
Pacific Noncontiguous	*2,005*	*2,060*
U.S. Total	1,352,398	1,240,089



Source: U.S. Energy Information, https://www.eia.gov/electricity/monthly/archive/february2017.pdf
and U.S Census Regions and Divisions Map, https://www.eia.gov/consumption/commercial/maps.php

The high coal content of these western states is contrary to California's policy, which since 2006 bans retail sellers of electricity from signing long-term contracts with power plants that have higher emissions than a natural gas power plant. As existing coal contracts retire, the percentage of coal has decreased dramatically. As of 2016, California only got 4% of its electricity from coal, with nearly all of it imported from other western states.

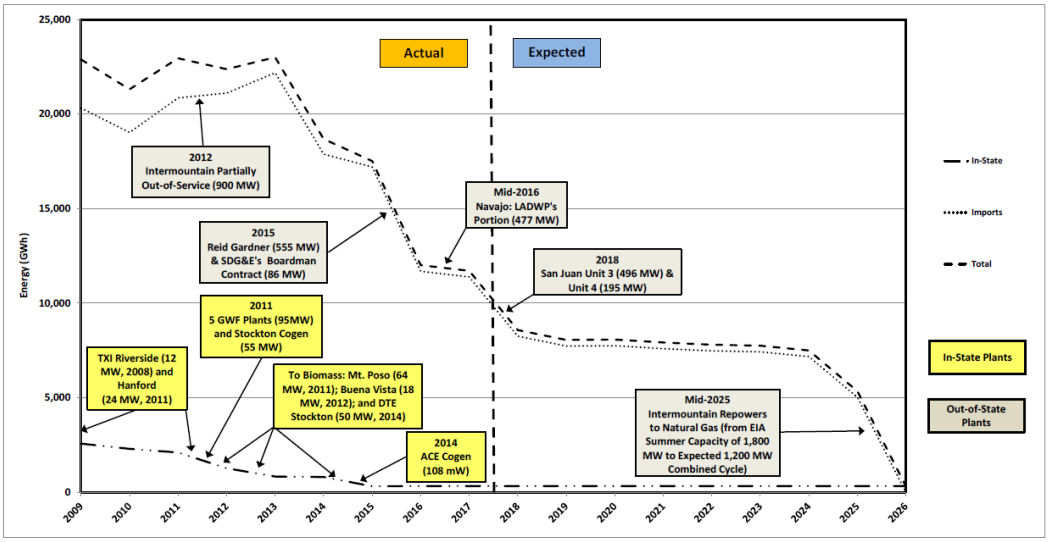
Figure 2: Annual Coal-Fired Generation as a Portion of Total Generation for California



Source: California Energy Commission, Energy Almanac, *Total System Power*, http://www.energy.ca.gov/almanac/electricity_data/total_system_power.html.

By 2026, the state is projected to be free of direct contracts between coal plants and retail electricity supply.

Figure 3: Actual and Expected Reductions of Energy by Coal-Fired Plants Used to Serve California 2009-2026 (GWh)



Sources: 1) Electricity Supply Forms (S-1 and S-2) submitted by LSEs for the California Energy Commission's *Integrated Energy Policy Reports (IEPR),* http://www.energy.ca.gov/almanac/electricity_data/ (under Utility Plans 2017 and Utility Capacity and Supply Plans for 2011 – 2015); and 2) M-S-R Resolution No. 2015-02, http://msrpower.org/Portals/0/Public%20Documents/M-S-R%20Public%20Power%20Agency%20Commission%20Agendas/MSRPPACommissionMeeting-July222015.pdf.

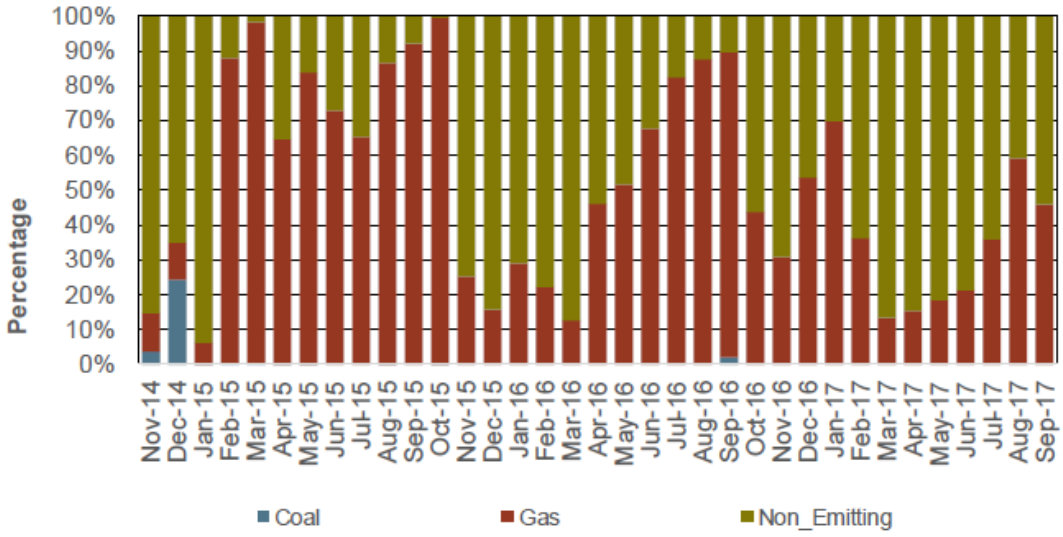
II. Imported Fossil Fuel Generation Disguised as CA ISO Generic Power

Contracted coal power is on the way out; however, there is still a backdoor way for coal and natural gas to sneak into the state, disguised through regional markets in a generic form without being able to directly track where the power is from. Energy Commission reports on the sources of California's electricity refer to this as "unspecified sources of energy", which accounts for about 15% of the state's electricity. Because in-state power can be tracked, all "unspecified energy" is imported from the western grid into California, and is a significant source of greenhouse emissions in the electricity sector. One example, is the Energy Imbalance Market.

The Energy Imbalance Market (EIM) is promoted as a way to integrate more renewable energy into California's grid, by selling surplus renewable energy to other western states. However, The EIM is a two way street, providing both exports and imports for California. Since the inception of the EIM an average of 50% of electricity imported into California through this market has

been natural gas power. Initial glitches in setting up the market resulted in nearly a quarter of EIM electricity imports pouring in from out of state coal plants in November 2014.[3]

Figure 70: Percentage of EIM Transfer into ISO by Fuel Type



While the percentage of fossil fuel imported through the EIM has decreased over the first few years, even in 2017 the average share of natural gas power was more than 1/3rd of EIM transfers into California. It is also unclear if this decrease in gas is a trend, of just a temporary effect of large surplus of hydropower in that year.

III. GHG Reduction--study claims of greenhouse gas benefit are minimal to non-existent

a) California CO2 emissions shown to be *higher in 2020* by partnering with PacifiCorp.

b) Claimed reductions of additional 4 to 5 MMT CO2 in 2030; study says this is "8 to 10% of total CO2" on an assumed 2030 baseline of 55 MMT CO2. However, California's actual policy baseline is 1990 when electric generation caused 110 MMT CO2, so claimed reduction is only an additional 4% to 5%--half what the study tries to take credit for by changing to a much lower baseline.

[3] Market Performance Report September 2017, California ISO, Nov. 29, 2017. http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=BA9489A9-1B4A-4D56-8AB2-DBE56269893D

c) Study relies on states building renewables beyond RPS requirements, which firstly is an add-on speculative assumption, and secondly is not necessarily related to regionalization. The evidence is that this has happened in other regions of the country; but there is no similar buildout of extra renewables on the western grid. If this does not happen, then:

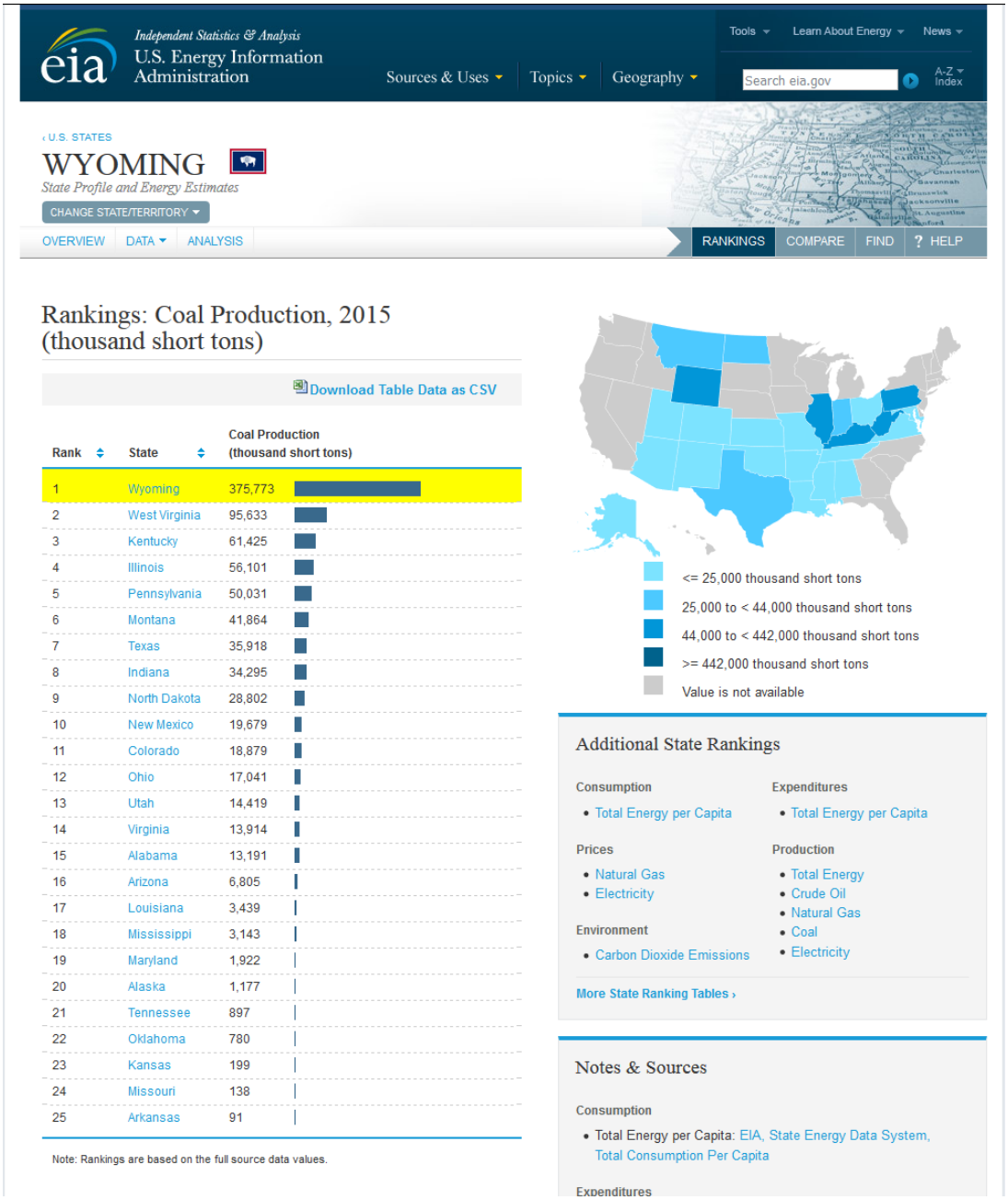
"Simulating the Regional 3 scenario without any assumed facilitation of renewables development beyond-RPS showed that a regional market would only slightly decrease CO2 emissions WECC wide and those associated with CA loads" SB 350 Presentation, Brattle, Slide 44.

d) Imports of electricity from out of state in general, and the ISO market in particular, are major sources of greenhouse gas emissions for California's electricity supply, accounting for nearly all coal power and much of the natural gas power delivered to the state. Thus a regional market is inherently incompatible with the goal of a carbon-free electricity supply for California, as SB 100 intends.

CAISO Regionalization Environmental Issues

Supplemental Material on Data Sources

ISO Regionalization = Partnering with Six Top Coal Mining States[4]



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Rankings: Coal Production, 2015
(thousand short tons)

Download Table Data as CSV

Rank	State	Coal Production (thousand short tons)
1	Wyoming	375,773
2	West Virginia	95,633
3	Kentucky	61,425
4	Illinois	56,101
5	Pennsylvania	50,031
6	Montana	41,864
7	Texas	35,918
8	Indiana	34,295
9	North Dakota	28,802
10	New Mexico	19,679
11	Colorado	18,879
12	Ohio	17,041
13	Utah	14,419
14	Virginia	13,914
15	Alabama	13,191
16	Arizona	6,805
17	Louisiana	3,439
18	Mississippi	3,143
19	Maryland	1,922
20	Alaska	1,177
21	Tennessee	897
22	Oklahoma	780
23	Kansas	199
24	Missouri	138
25	Arkansas	91

Note: Rankings are based on the full source data values.

Additional State Rankings

Consumption
- Total Energy per Capita

Expenditures
- Total Energy per Capita

Prices
- Natural Gas
- Electricity

Production
- Total Energy
- Crude Oil
- Natural Gas
- Coal
- Electricity

Environment
- Carbon Dioxide Emissions

More State Ranking Tables ›

Notes & Sources

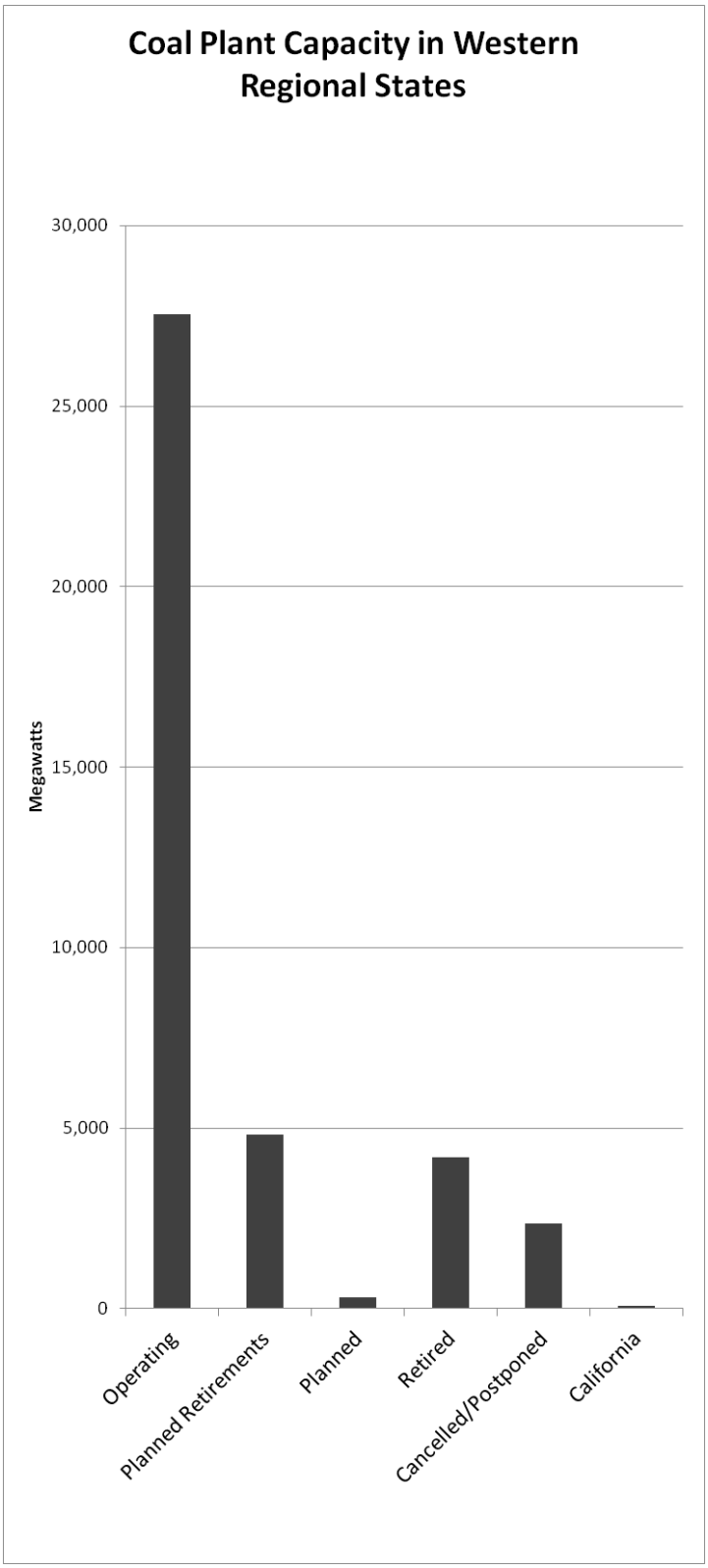
Consumption
- Total Energy per Capita: EIA, State Energy Data System, Total Consumption Per Capita

Expenditures

The ISO study considered eleven states as potential partners for their proposed western regional grid management scheme. Six of these are among the top coal states, collectively responsible for over 50% of the nation's coal supply: Wyoming (Rank #1), Montana (#5), New Mexico (#10), Colorado (#11), Utah (#13), and Arizona (#16).

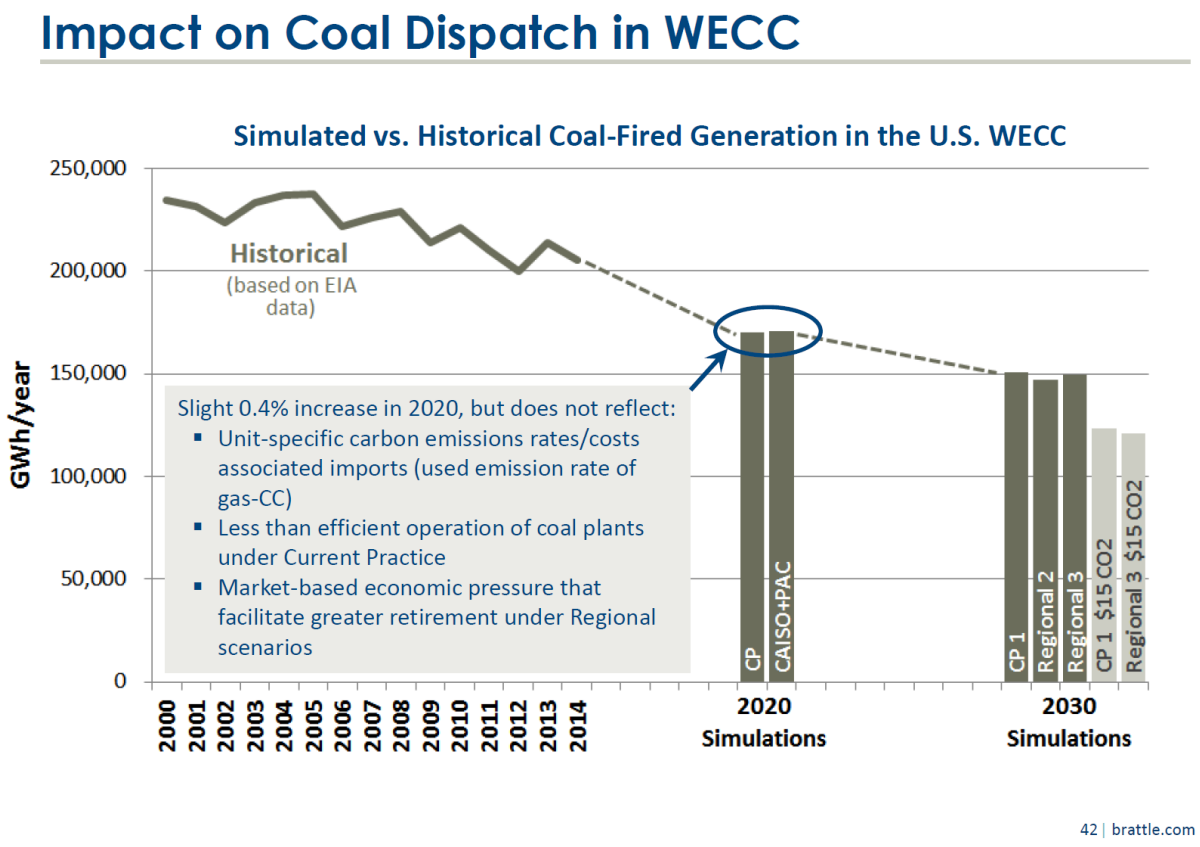
[4] U.S. Energy Information Administration, https://www.eia.gov/state/rankings/?sid=WY#/series/48

Different Pathways on Coal



Regional ISO Has Minimal Effect on Western Grid Coal Power

The SB 350 Study found that the amount of coal generation is almost unaffected by regionalization of CAISO. In 2020, embarrassingly, the modeling showed a slight increase (0.4%) in coal generation between Current Practice ("CP")—where CAISO continues to serve California— and a regionalized CAISO combined with PacifiCorp ("CAISO+PAC"). By 2030, the two regional ISO scenarios ("Regional 2", and "Regional 3") have only slighly less use of coal on the western grid compared to continuing with CAISO as a California run grid—Current Practice ("CP1") scenario.[5]



The way to reduce coal was by adding a $15 per ton cost on carbon dioxide, which is an exogenous, add-on feature, that is independent of whether or not CAISO becomes a regional grid operator. Adding this carbon cost reduces coal in the western grid in the Regional 3 scenario, but it reduces coal almost as much in the Current Practice ("CP1 $15 CO2"), where CAISO continues under California governance. Getting western coal states to accept a carbon price that significantly reduces use of coal seems much more unlikely in today's political context than in 2016.

[5] Presentation on SB 350 Study, July 26, 2016, Brattle, Slide 42.

Imported Power Major Source of California's Electricity Greenhouse Gas Emissions [6]

2017 Edition California Greenhouse Gas Inventory for 2000-2015						
— by Category as Defined in the 2008 Scoping Plan						
million tonnes of CO2 equivalent - (based upon IPCC Fourth Assessment Report's 100-yr Global Warming Potentials)						
From:www.arb.ca.gov/cc/inventory/data/data.htm						
Electric Power	**90.34**	**88.06**	**95.09**	**89.65**	**88.24**	**83.67**
In-State Generation	***46.75***	***41.20***	***51.02***	***49.47***	***51.72***	***49.93***
Natural Gas	40.59	35.92	45.77	45.66	46.43	45.16
Other Fuels	5.05	4.03	4.44	2.91	4.40	3.65
Fugitive and Process Emissions	1.10	1.25	0.82	0.90	0.90	1.13
Imported Electricity	***43.59***	***46.86***	***44.07***	***40.17***	***36.51***	***33.74***
Unspecified Imports	13.45	15.52	17.48	11.82	13.44	11.21
Specified Imports	30.14	31.34	26.59	28.35	23.07	22.52

[6] Source: California Air Resources Board

California Out of State Coal and Unspecified Imports [7]

In 2014, coal accounted for only 4% of California's electricity supply, almost all of which was imported from the western regional grid. Unspecified Sources of Power accounted for almost 15% of the state's electricity, also imported from the western grid. This unspecified power includes CA ISO's various markets: spot market, 15 minute market, day ahead, and Energy Imbalance Market (EIM). The content of this unspecified power has to be determined afterwards using models of the western grid, to determine which power sources had surplus power to sell on the generic electricity commodity markets.

2016 Total System Electric Generation in Gigawatt Hours

Fuel Type	California In-State Generation (GWh)	Percent of California In-State Generation	Northwest Imports (GWh)	Southwest Imports (GWh)	California Energy Mix (GWh)	California Power Mix
Coal	**324**	**0.16%**	**373**	**11,310**	**12,006**	**4.13%**
Large Hydro	24,410	12.31%	3,367	1,904	29,681	10.21%
Natural Gas	98,831	49.86%	41	7,120	105,992	36.48%
Nuclear	18,931	9.55%	0	7,739	26,670	9.18%
Oil	37	0.02%	0	0	37	0.01%
Other (Petroleum Coke/Waste Heat)	394	0.20%	0	0	394	0.14%
Renewables	55,300	27.90%	11,710	6,952	73,961	25.45%
Biomass	5,868	2.96%	659	25	6,553	2.26%
Geothermal	11,582	5.84%	96	1,038	12,717	4.38%
Small Hydro	4,567	2.30%	229	1	4,796	1.65%
Solar	19,783	9.98%	0	3,791	23,574	8.11%
Wind	13,500	6.81%	10,725	2,097	26,321	9.06%
Unspecified Sources of Power	**N/A**	**N/A**	**26,888**	**14,937**	**41,825**	**14.39%**
Total	198,227	100.00%	42,378	49,963	290,567	100.00%

http://www.energy.ca.gov/almanac/electricity_data/total_system_power.html

[7] Source: California Energy Commission, http://www.energy.ca.gov/almanac/electricity_data/total_system_power.html