Unpacking CA ISO study erases claimed benefits of regional control over power grid.

The independent system operator of California's electricity market ("CA ISO") uses alternative facts to claim "up to $1.5 billion" benefit by allowing them to take over running the western regional power grid. Corrected numbers—some revealed deep in a CA ISO technical study—erase most claimed benefits.

The CA ISO was required by the legislature to perform one or more studies to demonstrate benefits to California, before making a decision whether to give up control the state has enjoyed over CA ISO for the past two decades. The study used three scenarios for 2030 to evaluate potential benefits:[1]

> **2030 Current Practice ("Scenario 1"):** CA ISO continues to operate without further regional expansion.
>
> **2030 Expanded Regional ISO 2 ("Scenario 2"):** A regionalized ISO operates most of the Western US grid, with similar mix of in-state & out-of-state power supply resources as Scenario 1; with claimed benefit to California of $1 billion annually in 2030.
>
> **2030 Expanded Regional ISO 3 ("Scenario 3"):** The same regionalized ISO control over the Western grid as in "Scenario 2", but much renewable energy development moves out of California, to Wyoming and New Mexico. CA ISO claims $1.5 billion annual benefits in 2030 for this "full regionalization" scenario.

In all three scenarios, the study makes clear that California reaches its 50% renewable target by 2030; showing that *regional control of the ISO is not necessary to reach California's renewable energy goals*. Instead, the study is mainly claiming certain financial benefits. While the amounts sound impressive, they are only 2% to 3% utility bill savings compared to $50 billion or more in total projected electricity costs in 2030.

Taking the top line claims at face value, the study is posing the question whether a residential customer saving $2 or $3 on a $100 electric bill, is worth losing control over California's grid operator, and sharing authority with states that have a strong vested interest in burning coal—a change that proponents have given the anodyne name "regionalization".

However, the CA ISO three main scenarios inflate the benefits while minimizing the cost and risks of regionalization. The publicly claimed savings omit key state energy efficiency requirements, likely future energy storage, decreases in the price of solar energy, and the full cost to California for out-of-state wind power, which—if properly accounted—reduce the benefits of regionalization to the point

[1] All references to CA ISO SB 350 Study, unless otherwise specified. The three scenario descriptions can be found in Volume I. Purpose, Approach, and Findings of the SB 350 Regional Market Study, Brattle, p. I-vii; the study also examined two scenarios for 2020.

where they may not be worth the political, environmental, and market risks. Deep in the study, the ISO quantified some of these *reduced benefits* as "sensitivity cases", meaning they tested how the results are changed in response to making alternative assumptions. But these less favorable results which are more closely aligned to current state policy and energy market facts, are not reflected in the baseline scenarios or in the CA ISO's public claims about the benefits from regionalization, which are built upon faulty assumptions.

Faulty Assumption #1: ISO Scenarios overstate the cost of California solar resources. The ISO uses a baseline assumption that the cost of in-state solar energy will *not decrease* by 2030, which inflates the "benefits" for developing out of state wind power.[2] An ISO alternative "sensitivity case" analysis showed that if the cost of solar decreases to $1/watt by 2025, it *reduces the benefits of regionalization by $150 to $170 million*. Solar power has already dropped in price to $1/watt in 2017, so the $1/watt price by 2025 should have been included in the baseline Scenarios.[3, 4]

Faulty Assumption #2: ISO Scenarios do not count all energy efficiency required by California law. The baseline Scenarios assume that SB350's requirement to double additional energy efficiency is *not implemented at all*. California's new efficiency law is treated as merely a possible contingency. An ISO "sensitivity case" analysis shows that *including SB 350's mandated energy efficiency reduces regionalization benefits by $100 million annually*, because it reduces California's need to buy more electricity.

Faulty Assumption #3: ISO Scenarios understate flexible grid integration resources in California. The ISO baseline Scenarios assume that surplus California renewable energy is exported to other states at below-cost market prices—and claims this net loss as a "benefit". An ISO "sensitivity case" shows that 3000 megawatts of additional energy storage allows Californians to benefit directly from surplus renewable energy. If *California customers* are allowed to use the surplus renewable energy, instead of selling it below cost to other states,[5] the benefits of regionalization are *reduced by over $180 million per year*. The growth of customer-owned storage supported by time of use rates and subsidies from the Self-Generation Incentive Program (SGIP), utilities procuring up to 500 megawatts of additional distributed storage as specified by law, and over 8,000 MW of pending,

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[2] The study assumes solar decreases very modestly in cost, about 10% over 15 years, but this is using fixed dollars with inflation removed. The decrease in fixed dollars is so small, that it is overwhelmed by normal inflation of 2% per year, such that 2030 nominal cost is actually higher once inflation is factored back in. Aside from short term fluctuations, solar PV has consistently decreased in nominal dollar price since the 1950s, so the SB 350 study baseline price trajectory is not supported by historical trends or most future projections.

[3] Utility-scale solar falls below $1 per watt (w/ charts), June 12, 2017 Christian Roselund, https://pv-magazine-usa.com/2017/06/12/utility-scale-solar-falls-below-1-per-watt/

[4] Power Purchase Agreement contract prices have decreased to less than $35/MWh, which compares favorably to other renewable energy sources.

[5] Ivan Penn, "*California invested heavily in solar power. Now there's so much that sometimes other states are paid to take it*," LATimes, June 23, 2017, p. 1. http://www.latimes.com/projects/la-fi-electricity-solar/

permitted, and licensed new California pump hydro storage proposals at FERC, imply energy storage by 2030 well beyond the ISO baseline Scenarios.

Faulty Assumption #4: **ISO Scenarios minimize the potential for better coordination under the current system.** The CA ISO assumes limited coordination in bi-lateral markets in the "Current Practice" Scenario, although some improved coordination occurs today in the Energy Imbalance Market ("EIM"). The ISO study includes a "sensitivity" case which shows that better bi-lateral market coordination *reduces benefits of regionalization by over $280 million per year*. While it may be challenging to reach a high degree of coordination in the current market structure, the size of the potential reward—which far exceeds current value of the EIM—shows that it is worthwhile to try.[6]

Faulty Assumption #5: **The ISO inaccurately concludes that "full regionalization" (Scenario 3) will provide up to $1.5 billion of economic benefits to California**. The ISO study estimates that buying more out-of-state renewable power in *Scenario 3 will eliminate about 23,000 green jobs in California and reduce state GDP by $500 million compared to keeping these renewable resources in-state* in the Regional 2 scenario. Thus, the additional $500 million of "benefit to California" in Scenario 3 is illusory. The ISO study concluded that the assumed jobs created in California by Scenario 3 are not green, and are generally located *outside of disadvantaged communities*, exacerbating the job disparity in these communities.

Faulty Assumption #6: **The ISO low-balls the likely price of out-of-state wind contracts which makes it appear less expensive than California solar power.** The ISO study assumes that the price of out-of-state wind is incredibly low—$21to $26 per megawatt-hour (/MWh), and California wind contracts are high at $61/MWh. However, publicly available 2016 contracts for New Mexico wind (without delivery costs to California) demonstrate prices from about $50/MWh today, rising to $75/MWh by 2030. Correcting the ISO low estimates for out-of-state wind to California *slashes the claimed benefit of using WY/NM wind resources by up to $200 million per year*.

Faulty Assumption #7: The ISO low-balls the cost of new transmission lines to advantage out-of-state wind resources over California-based renewable resources. The ISO study estimates the cost of new transmission to move 6,000 megawatts of wind resources from Wyoming and New Mexico to California at $533 million per year, and states "resources that require transmission upgrades are assumed to pay the annual revenue requirement associated (with) those upgrades." [7]

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[6] Western EIM Benefits Report, First Quarter 2017, California ISO, May 1, 2017, Table 1: First quarter 2017 benefits in millions USD. This table shows California ISO benefits of $9.5 million for the quarter, which would be $38 million per year if all quarters were equal, which is obviously much smaller than the CA ISO study finding for improved

[7] 3,000 MW in each state, 6,000 MW total. See E3 Report IV, p. 46, and Table 18, p. 47. Transmission lines are "lumpy," one-time investments, not amenable to incremental capacity additions over time. They are built to handle maximum expected use over a long-term planning horizon; thus new out-of-state resources should pay for the new lines, as the ISO study initially states. Also, see Table 29 for assumed imported wind capacity, and Table 34 for transmission cost share.

The analysis assumes ~4,000 MW imported wind power contracted in 2030 under Scenario 3 will only pay a pro-rated share of $273 million per year.[8] If the new wind resources are assumed to bear the entire revenue requirement of $533 million for the new transmission lines that are being built only to send new wind power to California, (regardless of whether the wind power fully utilizes the capacity of the new transmission), *the benefit of Scenario 3 is reduced by $260 million per year*.

Faulty Assumption #8: The ISO over-estimates energy storage costs, which limits storage in their Scenarios. The ISO study claims that unlimited storage can be "selected" by their model—implying a level playing field. But storage is only "selected" if it is the least cost resources. Unfortunately, the model assumptions push the scales from both sides, by *underestimating* the cost of out of state renewable energy, and *overestimating* the cost of energy storage. The ISO study assumed a lithium battery storage cost of $450 per kilowatt-hour (/kWh) in 2015.[9] However, McKinsey & Co.'s comprehensive study of energy storage pricing demonstrates that energy storage cost is now $230/kWh, half the cost CA ISO assumes.[10] Multiple pricing forecasts demonstrate that battery pack prices will be much lower than what ISO assumes.[11]

Faulty Assumption #9: The ISO assumes that the Trump Administration's FERC will not compel California to act contrary to state law. ISO's analysis says that nothing will change legally if California regionalizes ISO's control of the power grid. This assumes that the Trump FERC will exercise self-restraint and not tell California what to do, as it legally could do in directing a Western Regional ISO. Connecticut, Maryland, New York and Wisconsin, among other states, have had major disagreements with the FERC directing those states to act in ways contrary to their state laws and policies. All these states have joined regional ISOs, called RTOs (regional transmission organizations). Sharing control with other states that have very different energy resources and interests, exposes California to significant political risks over its energy supply and environmental policies. Reduced control and oversight may also increase California's potential exposure to market power and financial loss. So, any claimed financial "benefits" must be weighed against the potential increased cost and risks, which the ISO study does not adequately evaluate.

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[8] Equivalent to estimated actual import level.

[9] Table 20, E3 Report IV p. 50, combined capacity and power conversion cost, assuming 4-hour capacity. Note that by convention storage prices are measured according to the *storage capacity* for a single charge cycle, and *not* by kilowatt-hours of energy delivered over the lifetime of the storage.

[10] http://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/battery-storage-the-next-disruptive-technology-in-the-power-sector, at p. 1.

[11] Study finds that storage prices are falling faster than PV and wind technologies, July 31, 2017 Emiliano Bellini, "*Energy storage projects may bring the cost per kWh of a lithium-ion battery down from $10,000/kWh in the early 1990's to $100/kWh in 2019, according to a new study written by a research team from University of California and TU Munich in Germany, and published in Nature Energy."* https://www.pv-magazine.com/2017/07/31/study-finds-that-storage-prices-are-falling-faster-than-pv-and-wind-technologies/

Also see https://www.bloomberg.com/news/articles/2017-02-21/big-batteries-coming-of-age-prompt-bankers-to-place-their-bets.

Supplemental Tables & Graphs

1. CA ISO Regionalization Study Sensitivity Cases

In response to stakeholder input, the CA ISO regionalization study included analysis of alternative assumptions called "sensitivity cases.[12,13] Sensitivity case A assumes improved coordination between California and utilities in other western states, without regionalizing CA ISO. Sensitivity case B, "High energy efficiency", reflects state policy created by SB 350, the same law that required the CA ISO regionalization study. Sensitivity case C provides additional flexible resources such as energy storage, reducing the need to curtail solar energy. Sensitivity case G, assumes utility-scale solar decreases in price to $1 per watt by 2025. These four sensitivity cases--most of which reflect current state policies and market realities-- reduce financial savings from regionalizing the CA ISO.

Table 2. Overview of sensitivities analyzed.

Sensitivity	Description
A. High coordination under bilateral markets	ISO simultaneous export limit is increased from 2,000 MW to 8,000 MW for Current Practice 1, while the procurement and operations are kept business-as-usual and ISO-wide ("Current Practice 1B")
B. High energy efficiency	The additional achievable energy efficiency (AAEE) is doubled by 2030.
C. High flexible loads	3,000 MW of 4-hour batteries are added in all scenarios.
D. Low portfolio diversity	Pumped hydro and geothermal are taken out of the portfolios and total California wind is restricted to 2,000 MW in all scenarios.
E. High rooftop PV	The total installed capacity of rooftop PV in the ISO balancing area is increased from 16 GW to 21 GW by 2030.
F. High out-of-state resource availability	Southwest solar RECs and Northwest wind RECs renewable potential is increased so that they account for up to half of the 50% RPS goal (ISO only, not non-ISO California entities), which equals to a renewable potential of 4,526 MW of Northwest wind RECs and 4,279 MW of Southwest solar RECs.
G. Low cost solar	Solar costs are reduced to $1/W-DC by 2025.
H. 55% RPS	The California RPS goal is increased to 55%.

[12] CA ISO SB 350 Study, Volume II, p.4
[13] ibid., Volume IV, Renewable Energy Portfolio Analysis, E3, p.5.

2. Result of Sensitivity Cases

Lower *renewable procurement cost* accounts for most ratepayer savings the CA ISO study found for regionalization. The top line "Base Case" in the table below shows projected savings for the two regional ISO scenarios (Regional 2 and Regional 3), compared to "Current Practice" where CA ISO continues to be controlled by California. Savings in the base cases are $680 and $799 million per year in 2030.[14]

The sensitivity cases A, B, C, and G, which include improved coordination in California's current market structure, meeting the state's efficiency goals, increased energy storage, and low cost solar at $1 per watt, all *reduce the savings* from a western regional grid operator compared to the Base Case. For example, solar at $1 per watt in sensitivity G reduces the savings by about $150 million $170 million (i.e., from $680 to $799 million, down to $510 to $647 million respectively). However, current projections show solar prices going lower than $1 per watt in the future, which will reduce the "benefit" of CA ISO regionalization even further.

Table 7. Summary of 2030 Sensitivity Results

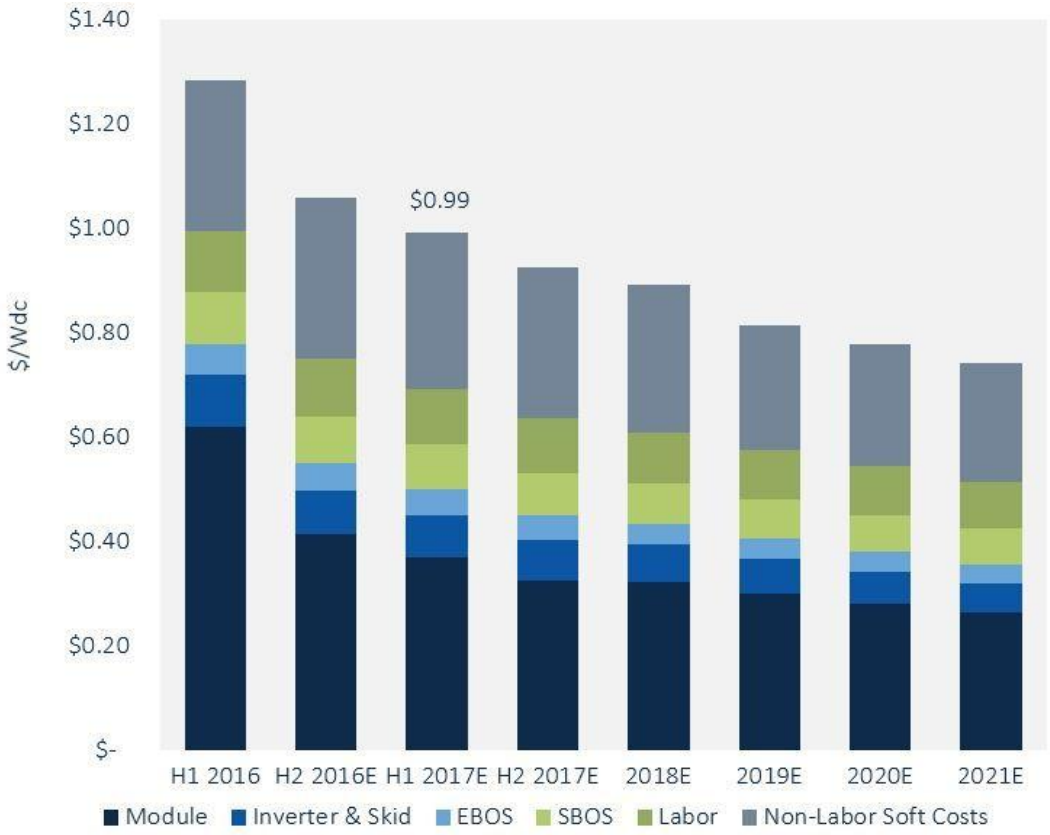
Renewable procurement cost savings from regional market ($MM/year)		Regional 2 vs. Current Practice 1	Regional 3 vs. Current Practice 1
Base Case		$680	$799
A.	High coordination under bilateral markets	$391	$511
B.	High energy efficiency	$576	$692
C.	High flexible loads	$495	$616
D.	Low portfolio diversity	$895	$1,004
E.	High rooftop PV	$838	$944
F.	High out-of-state resource availability	$578	$661
G.	Low cost solar	$510	$647
H.	55% RPS	$1,164	$1,341

[14] SB 350 Study, E3, Volume IV, Renewable Energy Portfolio Analysis, p. 9

3. Cost of Utility-Scale Solar Energy Reaches $1/Watt

The cost of utility-scale solar photovoltaic plants reached $1 per watt in 2017, three years ahead of the program target established by the U.S. government Sunshot program for 2020, and eight years ahead of the "Low cost solar" sensitivity case that the CA ISO study considers for 2025.

FIGURE: U.S. Utility PV Fixed-Tilt Turnkey EPC System Pricing, H1 2016-2021E ($/Wdc) [15]



Source: U.S. PV System Pricing H2 2016, GTM Research

[15] *Utility-Scale Solar; SunShot $1 per Watt Solar Cost Goal: Mission Accomplished, Years Ahead of Schedule*, by Eric Wesoff, January 25, 2017. https://www.greentechmedia.com/articles/read/sunshot-1-per-watt-solar-cost-goal-mission-accomplished-years-ahead-of-s

4. CA ISO Study Renewable Energy Cost Assumptions

The CA ISO study assumed installed cost of utility scale solar photovoltaic projects was $2.17 per watt (= $2174 per *kilowatt*) in 2015, and $1.82 per watt in 2030, a decrease of only 16% over 15 years.[16] By contrast, the GTM forecast shows almost 50% cost reduction over 5 years, by 2021. Furthermore, the 2030 cost is given in 2015 dollars, which presumably are worth more than 2030 dollars. Assuming the Federal Reserve target of 2% annual inflation, this requires adding 34% to calculate the price in 2030 nominal dollars, which equals $2.45 per watt. In other words, the CA Study assumes that the nominal price of solar photovoltaic projects will increase over a 15 year period, a projection that is contrary to mathematically consistent trends since the 1950s, as well as worldwide public policy, the solar industry's expectations, and most analysts.

Table 16. Renewable resource cost & performance assumptions in RESOLVE.

Resource	Geography		Capacity Factor (%)	Capital Cost (2015 $/kW)		LCOE (2015 $/MWh)	
				2015	2030	2015	2030
California Geothermal	Imperial		90%	$ 5,142	$ 5,142	$ 76	$ 96
	Northern California		80%	$ 3,510	$ 3,510	$ 59	$ 81
California Solar PV	Central Valley & Los Banos		30%	$ 2,174	$ 1,826	$ 58	$ 76
	Greater Carrizo		33%	$ 2,174	$ 1,826	$ 53	$ 69
	Greater Imperial		31%	$ 2,174	$ 1,826	$ 56	$ 73
	Kramer & Inyokern		34%	$ 2,174	$ 1,826	$ 50	$ 66
	Mountain Pass & El Dorado		34%	$ 2,174	$ 1,826	$ 50	$ 65
	Northern California		29%	$ 2,174	$ 1,826	$ 59	$ 78
	Riverside East & Palm Springs		32%	$ 2,174	$ 1,826	$ 53	$ 70
	Solano		29%	$ 2,174	$ 1,826	$ 59	$ 78
	Southern California Desert		34%	$ 2,174	$ 1,826	$ 51	$ 67
	Tehachapi		33%	$ 2,174	$ 1,826	$ 52	$ 68
	Westlands		31%	$ 2,174	$ 1,826	$ 55	$ 72
OOS Solar PV	Arizona		34%	$ 2,001	$ 1,711	$ 45	$ 56
California Wind	Central Valley & Los Banos		30%	$ 2,069	$ 2,008	$ 51	$ 76
	Greater Carrizo		31%	$ 1,914	$ 1,857	$ 49	$ 74
	Greater Imperial		35%	$ 2,083	$ 2,022	$ 43	$ 68
	Riverside East & Palm Springs		33%	$ 2,047	$ 1,987	$ 57	$ 82
	Solano		27%	$ 1,992	$ 1,933	$ 58	$ 82
	Tehachapi		35%	$ 2,087	$ 2,025	$ 47	$ 72
OOS Wind	New Mexico	1	46%	$ 1,738	$ 1,687	$ 21	$ 46
		2	42%	$ 1,738	$ 1,687	$ 26	$ 51
		3	39%	$ 1,738	$ 1,687	$ 30	$ 55
	Oregon		32%	$ 1,943	$ 1,885	$ 49	$ 74
	Wyoming	1	46%	$ 1,738	$ 1,687	$ 21	$ 46
		2	42%	$ 1,738	$ 1,687	$ 26	$ 51
		3	39%	$ 1,738	$ 1,687	$ 30	$ 55

* OOS = out-of-state, LCOE = levelized cost of energy . Solar capital cost is expressed with respect to AC capacity with assumed inverter loading ratio of 1.3; i.e. the cost per kW-AC is 1.3 times higher than the cost per kW-DC.

The study also assumes, in a note, that AC price is 1.3 times higher than the DC price due to "inverter loading", meaning more solar panels are installed than the rated capacity of the inverter. While this is not strictly a linear function as assumed here, even by this more stringent definition utility scale solar is already about half the cost projected for 2030 in the CA ISO study.

[16] SB 350 Evaluation and Plan, Volume IV Renewable Energy Portfolio Analysis, SB 350 Study Assumptions, E3, July 8, 2016, p. 43.

5. Lower Energy Storage Prices

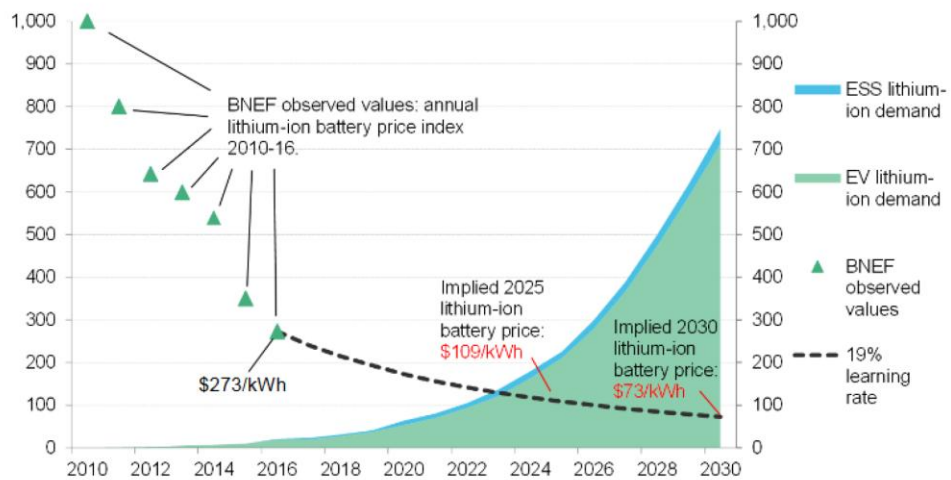
The CA ISO study assumed energy storage price of $375 per kilowatt-hour of capacity in 2015, and $183 in 2030. (SB 350 Assumptions, Technical Appendix, E3, p. 50)

Table 20. Energy storage cost assumptions by technology.

Type	Cost Metric	2015	2030
Lithium Ion Battery	Storage Cost ($/kWh)	$375	$183
	Power Conversion System Cost ($/kW)	$300	$204
	Fixed O&M Battery/Reservoir ($/kWh-yr)	$7.5	$3.7
	Fixed O&M PCS ($/kW-yr)	$6.0	$4.1
Flow Battery	Storage Cost ($/kWh)	$700	$315
	Power Conversion System Cost ($/kW)	$300	$204
	Fixed O&M Battery/Reservoir ($/kWh-yr)	$14.0	$6.3
	Fixed O&M PCS ($/kW-yr)	$6.0	$4.1
Pumped Hydro	Storage Cost ($/kWh)	$117	$117
	Power Conversion System Cost ($/kW)	$1,400	$1,400
	Fixed O&M Battery/Reservoir ($/kWh-yr)	-	-
	Fixed O&M PCS ($/kW-yr)	$15	$15

However, the Energy Commission's progress report on energy storage shows a graph with historical and projected cost of lithium batteries far below the CA ISO study assumptions, at $273 per kilowatt-hour in 2016, projected to reach $73 per kilowatt-hour by 2030.[17] This will further erode the value of a regional ISO.

Figure 2: Observed and Forecast EV Lithium-Ion Battery Prices 2010–2030 ($/kWh)



Source: A. Zamorano with Bloomberg New Energy Finance, per April 18, 2017, IEPR workshop

[17] Tracking Progress, Energy Storage, California Energy Commission, November 2017, p. 6. http://www.energy.ca.gov/renewables/tracking_progress/

6. Energy Storage in California Provides More Flexible Load

Currently existing and planned energy storage projects and programs should increase total California energy storage to between 6,000 and 7,300 megawatts by 2024, with up to 3,800 megawatts being new. [18] The CA ISO study only assumed a fraction of existing pump hydro storage, plus 1350 megawatts of new energy storage programs, and 500 megawatts of new pump hydro storage. Furthermore, the low utilization of the state's pump storage, ranging from 3% to 14%, suggests there is a lot of room for improved coordination with renewable energy and existing storage.

California Energy Storage Facilities & Programs				
Program/Resource	Authority	Jurisdiction	Capacity MW	
Pump Hydro - Existing		IOU, POU	3,558	
New Pump Hydro - Eagle Crest			1,200	
Subtotal Pump Hydro				4,758
Utility Storage	AB 2514 (Skinner, 2010), CPUC	IOU	1,325	
CCA Storage - 1% of Peak	AB 2514 (2010), CPUC	CCA	61	
Utility Storage	AB 2514 (2010), LADWP	POU	150	
Utility Storage	AB 2514 (2010), Other	POU	35	
Utility Storage	AB 2868 (Gatto, 2016)	IOU	500	
Utility Storage	SB 801 (Stern, 2017)	POU	100	
Customer Storage - SGIP	CPUC	IOU	300	
Subtotal New Programs				2,471
Total				7,229

Pump Storage in California				
Plant Name	Location (County	Capacity (MW)	Energy (GWh)	Capacity Factor
W.R. Gianelli	Merced	424	135	4%
Castaic	Los Angeles	1,682	449	3%
Helms	Fresno	1,212	861	8%
Eastwood	Fresno	200	239	14%
Olivenhain-Hodges	San Diego	40	32	9%
Total		3,558	1,715	6%

[18] These tables collate data from Tracking Progress, Energy Storage, California Energy Commission, November 2017. http://www.energy.ca.gov/renewables/tracking_progress/

7. California Law Increasing Energy Efficiency [19]

the public utility's annual targets established pursuant to Sections 454.55 and 454.56, and the public utility's actual energy efficiency savings and demand reductions.

(c) (1) On or before November 1, 2017, the commission, in collaboration with the Public Utilities Commission and local publicly owned electric utilities, in a public process that allows input from other stakeholders, shall establish annual targets for statewide energy efficiency savings and demand reduction that will achieve a cumulative doubling of statewide energy efficiency savings in electricity and natural gas final end uses of retail customers by January 1, 2030. The commission shall base the targets on a doubling of the midcase estimate of additional achievable energy efficiency savings, as contained in the California Energy Demand Updated Forecast, 2015-2025, adopted by the commission, extended to 2030 using an average annual growth rate, and the targets adopted by local publicly owned electric utilities pursuant to Section 9505 of the Public Utilities Code, extended to 2030 using an average annual growth rate, to the extent doing so is cost effective, feasible, and will not adversely impact public health and safety.

(2) The commission may establish targets for the purposes of paragraph (1) that aggregate energy efficiency savings from both electricity and natural gas final end uses. Before establishing aggregate targets, the commission shall, in a public process that allows input from other stakeholders, adopt a methodology for aggregating electricity and natural gas final end-use energy efficiency savings in a consistent manner based on source of energy reduction and other relevant factors.

(3) In establishing the targets pursuant to paragraph (1), the commission shall assess the hourly and seasonal impact on statewide and local electricity demand.

(4) In assessing the feasibility and cost-effectiveness of energy efficiency savings for the purposes of paragraph (1), the commission and the Public Utilities Commission shall consider the results of energy efficiency potential studies that are not restricted by previous levels of utility energy efficiency savings.

(5) The energy efficiency savings and demand reduction reported for the purposes of achieving the targets established pursuant to paragraph (1) shall be measured taking into consideration the overall reduction in normalized metered electricity and natural gas consumption where these measurement techniques are feasible and cost effective.

(d) The targets established in subdivision (c) may be achieved through energy efficiency savings and demand reduction resulting from a variety of programs that include, but are not limited to, the following:

(1) Appliance and building energy efficiency standards developed and adopted pursuant to Section 25402.

(2) A comprehensive program to achieve greater energy efficiency savings in California's existing residential and nonresidential building stock pursuant to Section 25943.

(3) Programs funded and authorized pursuant to the California Clean Energy Job Creation Act (Division 16.3 (commencing with Section 26200)).

[19] SB 350, Section 6, http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350

8. SB 350 Requirements Related to Regionalizing CAISO [20]

Note: emphasis added to sections relevant to the reasons for and content of the SB 350 study with *underline italic*.

SEC. 13.

Article 5.5 (commencing with Section 359.5) is added to Chapter 2.3 of Part 1 of Division 1 of the Public Utilities Code, to read:

Article 5.5. Transformation of the Independent System Operator

359.5.

(a) It is the intent of the Legislature to provide for the transformation of the Independent System Operator into a regional organization to promote the development of regional electricity transmission markets in the western states and to improve the access of consumers served by the Independent System Operator to those markets, and that *the transformation should only occur where it is in the best interests of California and its ratepayers*.

(b) The transformation of the Independent System Operator into a regional organization shall not alter its obligations to the state or to electricity consumers within the state or its obligations to comply with state laws. The Independent System Operator shall retain its obligations set forth in Section 345.5, shall maintain the standards for open meetings and public access to corporate records as set forth in Section 345.5, and shall facilitate effective tracking and reporting mechanisms in support of state enforcement of Division 25.5 (commencing with Section 38500) of the Health and Safety Code.

(c) The voluntary transformation described in subdivision (a) shall occur through additional transmission owners joining the Independent System Operator with approval from their own state or local regulatory authorities, as applicable.

(d) Modifications to the Independent System Operator governance structure, through changes to its bylaws or other corporate governance documents, would be needed to allow this transformation.

(e) The Independent System Operator shall prepare the governance modifications needed as described in subdivision (d), but *they shall not become effective until all of the following occur*:

(1) The Independent System Operator conducts one or more studies of the impacts of a regional market enabled by the proposed governance modifications, including overall benefits to ratepayers, including the creation or retention of jobs and other benefits to the California economy, environmental impacts in California and elsewhere, impacts in disadvantaged communities, emissions of greenhouse gases and other air pollutants, and reliability and integration of renewable energy resources. The modeling, including all assumptions underlying the modeling, shall be made available for public review.

[20] http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350

(2) The commission, Energy Commission, and State Air Resources Board jointly hold at least one public workshop where the Independent System Operator presents the proposed governance modifications and the results of the studies described in paragraph (1). The related Independent System Operator documents shall be made public before the workshop.

(3) The Independent System Operator submits to the Governor the studies described in paragraph (1) and revised bylaws or other corporate governance documents setting forth the proposed modifications to its governance structure.

(4) The Governor transmits to the Legislature the studies described in paragraph (1) and revised bylaws or other corporate governance documents setting forth the proposed modifications to its governance structure, no later than December 31, 2017.

(5) The Legislature enacts a statute implementing the revised governance changes.

(f) The Independent System Operator shall expeditiously adopt the modifications to its governance structure enacted by the Legislature pursuant to paragraph (5) of subdivision (e) so that the modifications become effective before new transmission owners from outside California complete the process of joining the Independent System Operator.

(g) The revised governance structure shall not alter or abridge the contractual rights of a transmission owner to withdraw from participation in the Independent System Operator.

(h) One year after the seating of the new, revised governing board of the Independent System Operator pursuant to the modifications of its governance structure, and every two years thereafter, the Independent System Operator shall prepare a report to the states within the areas it serves documenting its furtherance of applicable state and federal laws and regulations affecting the electric industry.

(i) This article is repealed on January 1, 2019, if a statute implementing the governance modifications has not become effective on or before January 1, 2019.