BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of Union Electric Company d/b/a	)	
Ameren Missouri's 2020 Utility Resource Filing	)	Case No. EO-2021-0021
Pursuant to 20 CSR 4240 – Chapter 22	)	

CLEAN GRID ALLIANCE'S COMMENTS IDENTIFYING DEFICIENCIES IN THE 2020 INTEGRATED RESOURCE PLAN OF AMEREN MISSOURI

Dated: March 31, 2021

Clean Grid Alliance, by its counsel, respectfully submits the attached comments, pursuant to 20 CSR 4240-22.080, identifying deficiencies in Union Electric Company d/b/a Ameren Missouri's 2020 Integrated Resource Plan ("Ameren Missouri IRP").

INTRODUCTION

It is encouraging to see Ameren Missouri proposing to add 3,100 megawatts ("MW") of wind and solar resources by 2030 and 5,400 MW of wind and solar resources by 2050. CGA is also encouraged by Ameren Missouri's focus on transforming its generation portfolio to cleaner generation sources and prioritizing the flexibility of its portfolio to meet not only the peak hour needs but the energy needs of its customers "around the clock." **Clean Grid Alliance supports this focus and its plan, however, deficiencies exist regarding selection of the Preferred Plan, the incorporation and analysis of hybrid resources, and the levelized cost of energy for large-scale wind and solar resources used in the IRP analysis.**

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DEFICIENCIES IN METHODOLOGY AND ANALYSIS

DEFICIENCY #1: Plan Y is Undervalued in the Scoring of Alternative Resource Plans and Key Facts About the Plan Were Overlooked in the Critical Analysis of the Top Tier Plans

Plan Y provides as much value as the Preferred Plan V and should either be an equivalent to Preferred Plan V or be the contingency plan, instead of Plan P. Plan Y was undervalued because its Composite Score is too low (*see* Ameren Missouri IRP, Chapter 10, Table 10.5 and App. A., for value of Plan Y) and Ameren Missouri's critical analysis failed to consider key benefits Grain Belt Express can provide. The Composite Score is low, because the IRP failed to consider certain factors that would have increased the score for the Customer Satisfaction, and the Economic Development planning objectives.

PROCESS FOR SELECTION OF PREFERRED PLAN

In selecting its Preferred Resource Plan, Ameren Missouri evaluated the Alternative Resource Plans against five planning objectives that were developed for its 2011 IRP (Ameren Missouri IRP, ch9:9-10 and ch10:2-4 and 8-11). The table below identifies the planning objectives and their primary measures. The Cost planning objective was given the greatest weight and the remaining four objectives were equally weighted, as noted below.

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Table 10.1 Planning Objectives and Measures[3]

Planning Objective Categories	Measures	Weighting
Cost	Present Value of Revenue Requirements	30%
Customer Satisfaction	Customer Preferences, Levelized Rates	20%
Portfolio Transition	Resource Diversity, CO_2 Emissions, Probable Environmental Costs	20%
Financial/Regulatory	Free Cash Flow, Financial Ratios, Stranded Cost Risk, Transaction Risk, Cost Recovery Risk	20%
Economic Development	Direct Job Growth (FTE-years)	10%

The IRP's strategic evaluation can generally be described in the following steps. First, Ameren Missouri attributed points to each Alternative Resource Plan based on its ability to meet the measures. The Alternative Resource Plans were then ranked (Ameren Missouri IRP, ch10:11, Table 10.5 and Appendix 10). After ranking the Alternative Resource Plans, Ameren Missouri performed a critical analysis of the top seven plans; evaluating each plan's merits and risks or other constraints, relative to each other.

CUSTOMER SATISFACTION

There were errors in the critical analysis of, and computation of the score for, Customer Satisfaction. If key benefits of Plan Y had not been overlooked, it would have received a Customer Satisfaction score of 5 instead of a 4.

The Customer Satisfaction planning objective attempts to measure an Alternative Resource Plan's levelized annual rates, energy efficiency, reliability, availability of DER and DR programs, inclusion of new clean energy resources, and significant reductions in CO2 emissions. (Ameren Missouri IRP, at ch9:10). The IRP's critical analysis of Plan Y failed to account for the increased reliability that Grain Belt Express provides Ameren Missouri, MISO and SPP. Grain Belt Express is a bi-directional transmission line. It can access low-cost renewable resources in the

windy parts of Kansas (delivering power from west to east) and during periods of system emergency Grain Belt Express can transmit power from east to west. Given the outages SPP experienced in mid-February due to cold weather, the bi-directional aspect of Grain Belt Express is an important reliability benefit. Lanny Nickell, SPPs Chief Operating Officer, stated that "We [SPP] were relying on unprecedented amounts of imports from our neighbors, they helped us a lot. But there were times they faced congestion on their systems causing them to interrupt exports."[1] Grain Belt Express's technology allows power to be precisely controlled. This is especially important when conditions require grid operators to rely on imported supply from other states or RTOs to meet power needs. The geographic diversity that Grain Belt Express provides was not discussed in the IRP and will be an ever important feature with increasing weather instability across our country.

The Customer Satisfaction score should have been a 5 because Plan Y had one of the lowest PVRR results and provided benefits related to three other measures. Three of the five Customer Satisfaction points should have come from the low PVRR score (*see* Ameren Missouri IRP, ch10:9). As many as 3 more points should have been awarded to Customer Satisfaction, one point for each of the following measures:

- early retirement of coal generation;
- addition of significant renewables; and
- inclusion of customer programs for renewable energy.

Plan Y helps with the retirement of generation because it has a Renewables Expansion Plan (adding 5,400 MW of nameplate wind and solar capacity by 2050) and includes wind resources via Grain Belt Express. The Renewables Expansion plan has a significant peak period

[1] SPP Special Board of Directors Meeting, held March 2, 2021.

capacity of 1,715 MW, and even more with the addition of power that Grain Belt Express can deliver. Grain Belt Express is designed to deliver 500 MW of energy into the Ameren Missouri footprint. All of this peak capacity can contribute to early retirement of coal plants. In addition, these renewable resources could easily be used to meet, or foster, new renewable energy programs such as green tariff programs that can meet Missouri's large commercial and industrial customers' sustainability goals.

A factor not fully discussed in the IRP is Plan Y's carbon emission benefit. The significant amount of renewable resources in Plan Y takes on increased value with President Biden's move to update the social cost of carbon price[2] to $51 per metric ton[3]. Grain Belt Express will access wind resources with very high capacity factors relative to wind resources in or near Ameren Missouri's footprint. Grain Belt's wind resource has 1.7 times the greenhouse gas emission reduction potential for the same amount of installed MWs of solar or wind installed in or near Ameren Missouri's footprint.

FINANCIAL/REGULATORY

The critical analysis states that Plan Y has risks associated with regulatory approvals that offset the advantage it provides of retiring multiple coal-fired energy centers. (Ameren Missouri IRP, ch10:22). Grain Belt Express has obtained regulatory approvals in Kansas, Missouri and Indiana and the IRP overlooks the opportunity, subject to approval by the Missouri and Kansas

[2] This value captures the net value damage of CO2 emissions -- climate change impacts, changes in net agricultural productivity, human health effects, property damage from increased flood risk, natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services.
[3] The social cost of carbon increases to $85 per metric ton in 2050.

Commissions, for Invenergy Transmission to move forward with the Western portion of the project while pursuing the remaining approvals in Illinois.[4]

ECONOMIC DEVELOPMENT

The Economic Development score for Plan Y should have been a 5, instead of a 4, because Plan Y has the potential to create over 40,000 full-time equivalent jobs. Plan Y is comparable to Plan P, however, there are two key differences (see table below). Plan P has a Renewable Expansion Plan. Plan Y has the Renewable Expansion Plan plus Grain Belt Express. Grain Belt Express would provide jobs related to 4,000 MW of wind construction and operation and the

PLAN	JOBS (FTE)	DSM	WIND (MW)	SOLAR (MW)	RETIREMENTS	TRANSM.
P	35,470	RAP	2,700	2,700	Sioux & Rush	No
Y	34,236	RAP	4,000	2,700	Sioux & Rush	Yes
Difference	(1,234)		1,300			Yes
Corrected Y	**40,443**					

construction and maintenance of a 780-mile transmission line. The additional wind projects that Grain Belt Express will access and the transmission line would naturally generate more work and jobs than Plan P, yet for some reason Plan Y has approximately 1,200 fewer jobs than Plan P.

Using National Renewable Energy Laboratory's JEDI models for wind and transmission lines, CGA computed the additional direct jobs that should be added to Plan P because of an additional 1,300 MW of wind generation being built and a 780 mile transmission line being built. That work adds approximately 5,000 full-time equivalent ("FTE") construction and maintenance

[4] Invenergy Press Release, "Grain Belt Express to Increase Local Access to Low-Cost, Homegrown Clean Energy, Adding Up to $7B in Energy Savings for Kansas and Missouri Consumers" (August 25, 2020).

jobs, beyond what is forecasted for Plan P, over the planning period of this IRP. This results in Plan Y's corrected jobs number being a little over 40,000 FTE jobs.

Suggested Remedy

Plan Y should either be an equivalent to Preferred Plan V or be the contingency plan, instead of Plan P.

DEFICIENCY #2: Use of Hybrid Resources in Preferred Plan

Hybrid resources (solar + battery, wind + battery, and wind + solar) are valuable supply resources that can replace retiring plants. All three of these resources need to be better evaluated in future IRPs so they can be properly considered as new supply-side resources.

The solar + battery resource is the only hybrid resource in the IRP. Of all the new supply-side resources evaluated by the IRP, solar + battery is the lowest cost resource that can meet any number of needs a utility may have – capacity, energy, ancillary services, system flexibility with fast ramping service. Solar+battery is a clean energy resource that can help reduce Ameren Missouri's overall CO2 emissions at marginal premium to stand-alone wind or solar resources; that price premium should decrease as battery technology continues to improve.

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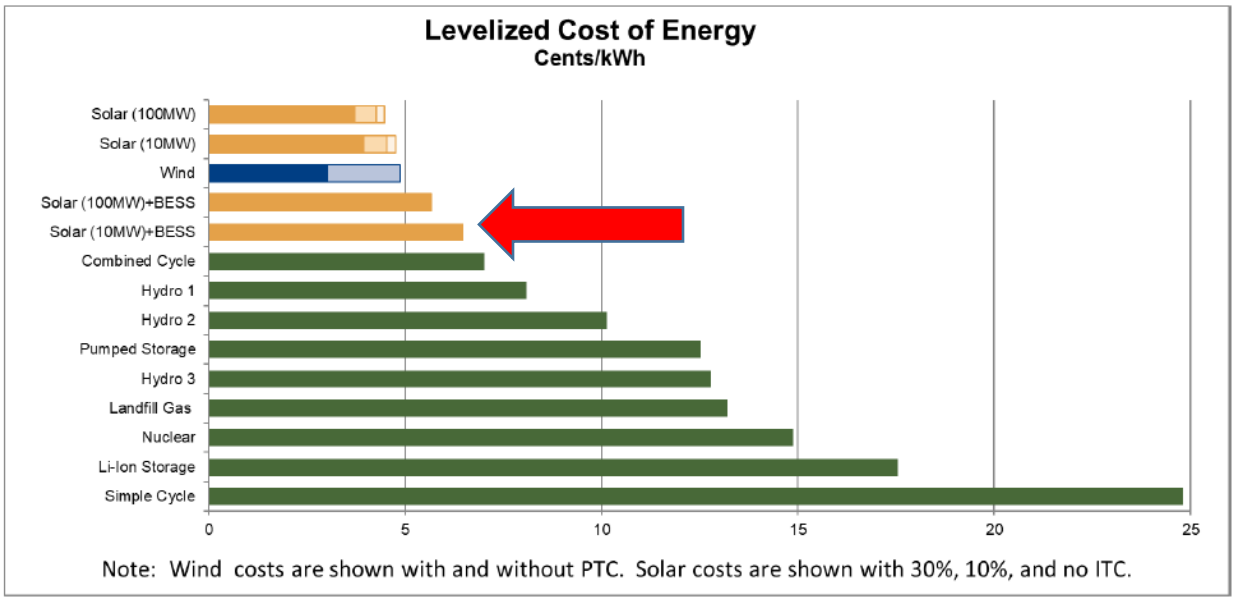
Figure 6.4 Levelized Cost of Energy



The IRP evaluated early retirement dates for Labadie, Rush and Sioux energy centers, but did not evaluate a hybrid resource as their replacement. Year after year the transmission system's resilience is challenged by changing weather patterns and increased storm severity. The operational benefits and system flexibility that hybrid resources provide the transmission system need to be evaluated relative to the services soon to be retired plants are providing. Hybrid plants are the multi-dimensional 6th man of the generating fleet and Ameren Missouri should evaluate their reliability capabilities in future IRPs. The higher capacity values and operational benefits of hybrid resources are an important consideration for a more predictable and controllable power delivery to Missouri ratepayers.

Suggested Remedies

[1] Solar + battery is the least cost capacity providing resource in the current list of new supply-side resources and should be evaluated as a replacement for retiring resources – under both planned and early retirement dates identified in the IRP.

[2] Ameren Missouri should evaluate whether hybrid resources would alter the early retirement dates of Labadie, Sioux or Rush energy centers.

[3] Ameren Missouri needs to evaluate cost and operating characteristics of all three hybrid resources listed above, and consider them as new supply-side resource in future IRPs.

[4] As renewable resources are incorporated into the MISO footprint each utility will need to increase its generating fleet's flexibility. Ameren Missouri needs to develop metrics for adding flexible resources to meet its energy needs 24x365. Future Ameren Missouri IRPs will also need to consider renewable and hybrid output curves relative to Ameren Missouri's customer electric demand curve(s) when selecting generation to either add to the fleet or purchase through power purchase agreements.

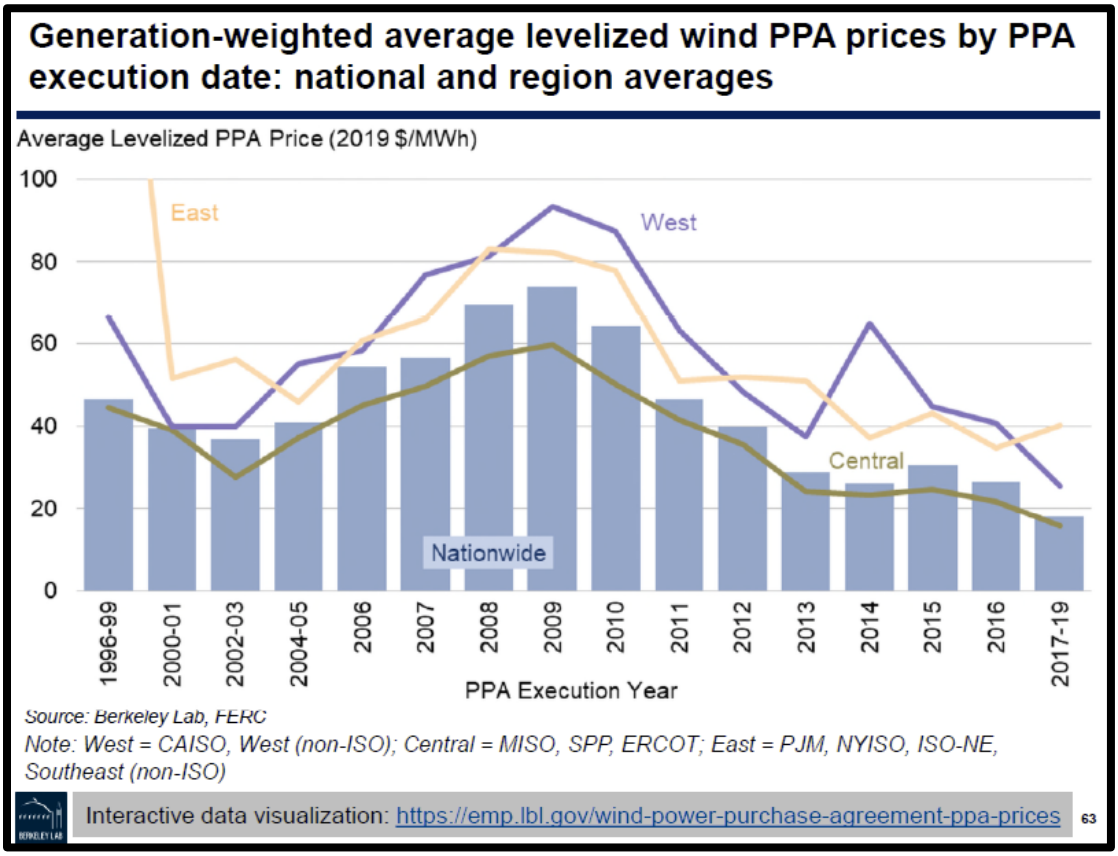
DEFICIENCY #3: Reduce the Levelized Cost of Energy for Wind and Solar Resources

The levelized cost of energy ("LCOE") used in the IRP for wind and solar resources is well above what we see in the market for power purchase agreements. (Ameren Missouri IRP, ch6:5 and 6:9). The LCOE for wind and solar resource options needs to be adjusted to be in the reasonable range of prices in and near the Missouri market.

Wind power purchase agreement ("PPA") prices from 2017 to 2019 were in the $10 to $20 per MWh range.[5] Adding the production tax credit of $23 per MWh you have an unsubsidized price of $33 to $43 per MWh, which is much lower than the $48.70 price used in the IRP. (Id.). Lending rates are low right now, so it would be reasonable to lower the discount

[5] Lawrence Berkley National Laboratory, "Wind Energy Technology Data Update: 2020 Edition", at 64-66 (August 2020) available at: https://emp.lbl.gov/sites/default/files/2020_wind_energy_technology_data_update.pdf.

rate from 6% to the 3% to 4% range. That would yield a LCOE of $39 per MWh to $42 per MWh[6], which is within the range of actual PPA prices for the 2017 to 2019 period.[7]



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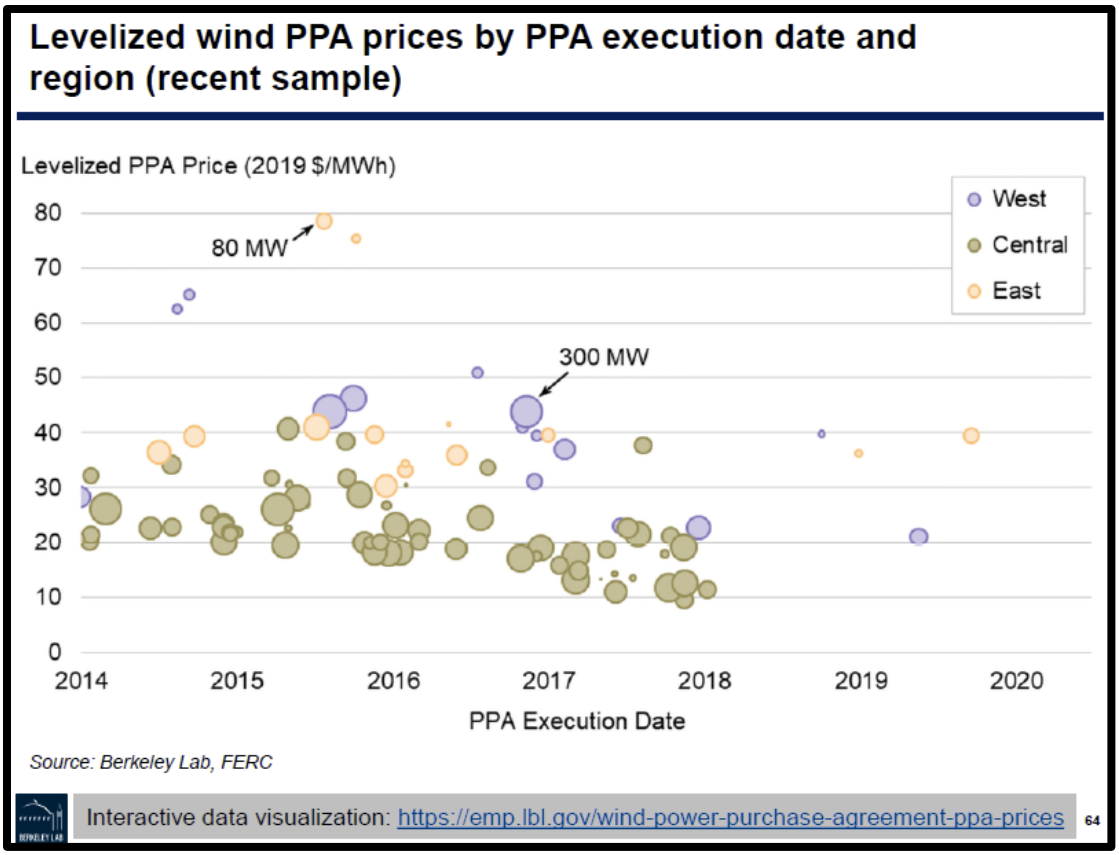
[6] CGA calculated the LCOE of the current Resource Options and the Resource Options with CGA's proposed revised discount rates using National Renewable Energy Laboratory's ("NREL") Levelized Cost of Energy Calculator, available at: https://www.nrel.gov/analysis/tech-lcoe.html.

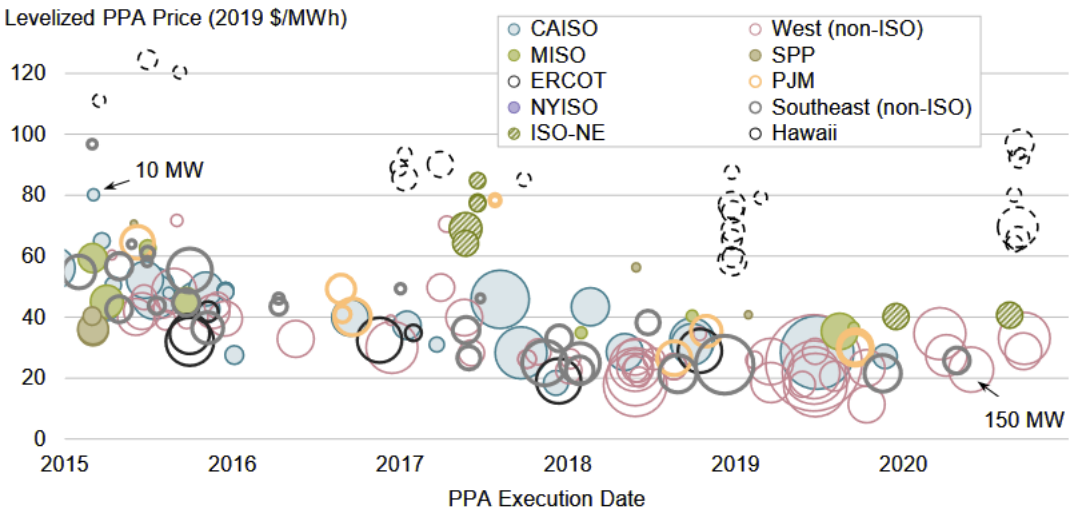
[7] This assumes Ameren Missouri continues to use a declining forward capital cost curve for utility-scale wind projects. (Ameren Missouri IRP, ch6:6 and 6:9).



Similarly for solar, CGA does not take issue with the inputs for 100 MW solar projects but for the discount rate. Solar PPA prices from 2018 through 2020 were in the $20 to $40 per MWh range[8] – which is at least $5 per MWh lower than the LCOE for utility-scale projects used in the IRP. It is reasonable to assume that solar would be able to access a similar discount rate as wind. Applying a 3% to 4% discount rate to solar projects would lower the LCOE for all solar resources used in the IRP analysis. Focusing on large-scale solar, its LCOE with a discount rate in the 3% to 4% range would be $34 to $38 per MWh, which is within the range of actual PPA prices for the 2017 to 2019 period and is comparable to the $31 to $42 per MWh range forecasted by Lazard[9].

[8] Lawrence Berkley National Laboratory, "Utility-Scale Solar Data Update: 2020 Edition", at 30-31 and 36 (November 2020), *available at*: https://emp.lbl.gov/sites/default/files/2020_utility-scale_solar_data_update.pdf.
[9] Lazard, "Lazard's Levelized Cost of Energy Analysis – Version 14.0" at 16 (October 2020) available at: https://www.lazard.com/media/451419/lazards-levelized-cost-of-energy-version-140.pdf.

Levelized utility-scale PV PPA prices by PPA execution date and region (recent sub-sample of the data shown on prior slide)



Source: Berkeley Lab, FERC

Interactive data visualizations: https://emp.lbl.gov/pv-ppa-prices and https://emp.lbl.gov/capex-lcoe-and-ppa-prices-region

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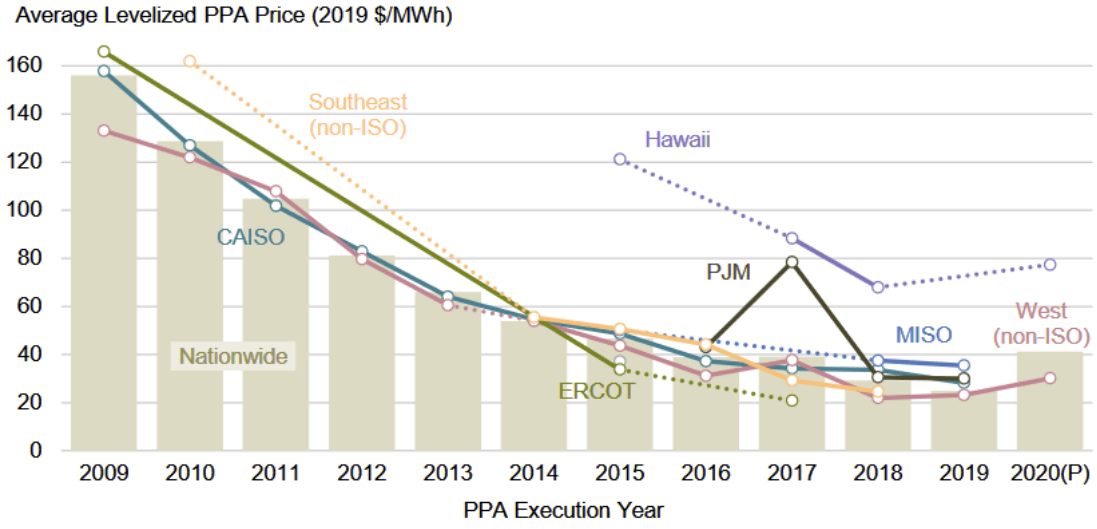
Generation-weighted average levelized PPA prices by PPA execution date: national and regional averages



Source: Berkeley Lab, FERC

Note: Region-years with <2 projects are excluded from the graph. The dashed portions of lines span intermediate years that have no data (e.g., 2016 in Hawaii, or 2011-2013 in the Southeast). 2020 data are preliminary (P).

Interactive data visualizations: https://emp.lbl.gov/pv-ppa-prices and https://emp.lbl.gov/capex-lcoe-and-ppa-prices-region

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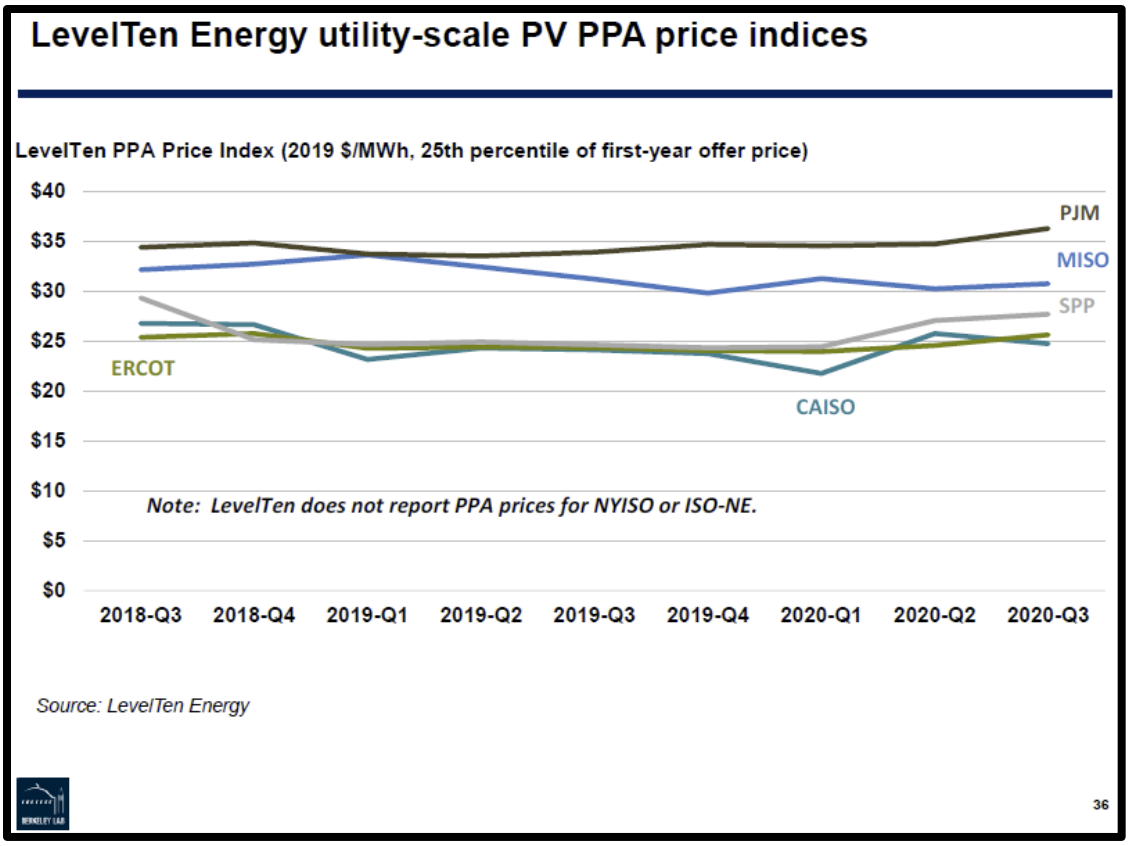

Suggested Remedies

LCOE prices for all wind and solar Resource Options should be adjusted using a discount rate of 3-4% instead of 6.04%.

REVISED LEVELIZED COST OF ENERGY ($/MWh)			
		Revised Discount Rate	
	Ameren IRP	3%	4%
wind - 100MW	$48.70	$39	$42
solar - 1 MW	$97.30	$71	$79
solar - 10 MW	$47.50	$36	$40
solar - 100 MW	$44.90	$34	$38

DEFICIENCY #4: Reduce the Levelized Cost of Energy for Hybrid Solar Resources

The LCOE used in the IRP for hybrid solar resources is well above forecasts and market trends. (Ameren Missouri IRP, ch6:5). MISO's queue has a variety of hybrid projects in the queue – solar+battery, solar+wind, and solar+wind+battery.

	Solar + Battery			Solar + Wind	Solar+Wind+Battery
State	2021	2022	2023	2023	2023
Illinois	358.6	408.6	200	412	100
Indiana		399.5	569		
Louisiana		50	299		
Michigan			499		
Minnesota			150	335	
Montana			20		
TOTAL (MW):			**2,954**	**747**	**100**

CGA anticipates more data will become available in the next couple of years as the projects listed above are developed and placed in-service. Those projects will help correlate cost inputs and PPA prices. We anticipate the capacity factors for these projects will be greater than the 27% Ameren Missouri has used in its modeling, and we anticipate that other revenue streams will need to be considered when calculating a hybrid projects LCOE. Thus, CGA is not recommending any specific cost input changes for hybrid projects other than what was recommended in Deficiency #3 -- a reduction of the discount rate from 6.04% in the IRP (Ameren Missouri IRP, ch6 Appendix A) to the range of 3-4%. That reduction would reduce the levelized cost of energy for both the 13M and 125MW solar+storage resource options.

Suggested Remedies

LCOE prices for both solar+battery Resource Options should be adjusted using a discount rate of 3-4% instead of 6.04%.

REVISED LEVELIZED COST OF ENERGY ($/MWh)			
		Revised Discount Rate	
	Ameren IRP	3%	4%
solar + storage - 13MW	$64.80	$43	$48
solar + storage - 125MW	$56.60	$38	$42

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CONCLUSION

Wherefore, Clean Grid Alliance requests the deficiencies and concerns described herein be adopted by Ameren Missouri.

Dated: March 31, 2021

Respectfully submitted,

Clean Grid Alliance

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