Clean Grid Alliance Comments on Scenario's and Sensitivity's to be Included in IURC's HB 1278 Energy Study

Clean Grid Alliance appreciates the opportunity to provide comments on this important endeavor. These comments are structured on the topics outlined at the end of Mr. Dale Thomas's slide deck. Clean Grid Alliance's comments provide guidance on the transition timeline of plant retirements, and the expansion of utility-scale wind, solar and battery resources. In addition, this study has a very light focus on transmission, so Clean Grid Alliance recommends that the extent of that analysis be described in the final report so Indiana's leaders can decide whether the topic also requires some consideration.

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SUMMARY OF RECOMMENDATIONS

Transition for Coal Retirements: Use the plant specific retirement date provided by the utility. In the absence of a specific retirement date use recent EIA data which has plants retiring at 46 years of age. Staff could even reduce plant retirements to 40 years of age to account for the trend-line of plants having shorter economic life-spans.

Transitions for Utility-Scale Renewables

Wind/Solar: If a utility has not determined how it is replacing a retiring plant, Staff should economically select a replacement resource. Staff also has to forecast generation expansion in Indiana by Independent Power Producers. That forecast will be impacted by existing and yet to be proposed renewable energy goals, carbon reduction policies and corporate sustainability goals, as described more fully in section 4(A).

Battery Storage: Battery storage forecasts will become clearer after MISO finalizes some storage interconnection policies and products. This information is needed to provide clarity around the revenue stream available for a battery-only proposal and whether it can be viable. CGA suggests that use of solar plus battery storage will continue to grow over the planning period. CGA suggests economically selecting solar with battery storage using a price that is approximately $5/MWh above that of solar PPAs, but the price should drop over time. These forecasted prices should be benchmarked against recent, proximate, actual bids or PPAs.

New Resource Investment Cost Curves

Wind: For utility-scale wind Staff should use NREL ATB (2019) Techno Resource Group 5 (TRG5) for Land Based Wind.

Solar: For utility-scale solar in Indiana, Staff should use 'Utility PV-Chicago' for northern Indiana and 'Utility PV- Kansas City' for southern Indiana. Assume 50% of utility-scale solar resources will use tracking racks, or Staff should investigate the solar projects in the MISO and PJM generation interconnection queues to determine the ratio of fixed-tilt to tracking racks. As a check on the NREL capacity numbers, CGA recommends benchmarking the wind and solar LCOEs in the NREL ATB against recent, proximate, actual PPAs or bid prices.

Transmission: CGA recommends that the report include a statement explaining that the report does not include wholesale power market alternatives and the extent to which transmission was evaluated in the study. The report should also explain the resulting gaps in knowledge it creates so state leaders can decide whether a transmission analysis is warranted.

Key Sensitivity Levers

CO2: MISO utilities have adopted a carbon reduction goals or are analyzing carbon reductions of 50% or more of the current emission levels by 2030.

1. CLEAN GRID ALLIANCE (CGA)

CGA has been active in the Midwest for nearly twenty years. In the Fall of 2018 we changed our name from *Wind on the Wires* to *Clean Grid Alliance* to reflect the work of a majority of our members who had expanded their focus from wind to also include solar and battery storage. CGA is a not-for-profit that has been active in the MISO transmission planning process since MISO's inception. CGA has been the sector representative at MISO's Planning Advisory Committee for the Environmental-Other Sector for well over a decade.

CGA is a collaboration between renewable energy advocacy organizations and renewable energy developers and manufacturers. The CGA footprint covers nine (9) states in the Midwest, including Minnesota, Wisconsin, and Iowa. CGA's more than forty (40) members include wind, solar, and energy storage developers and manufacturers; nonprofit environmental, public interest, and clean energy advocacy organizations; farmer organizations; and other businesses that support renewable energy.

2. HB 1278

Pursuant to HB 1278 the IURC is to conduct a comprehensive study of the statewide impacts caused by new and emerging technologies, and the transition in the electric generating fleet. The Commission is to focus on the impacts the aforementioned items have on Indiana's generation capacity, system reliability, system resilience and cost of service. The IURC is to consider likely timelines for the transition of resources.

3. TRANSITION TIMING FOR COAL RETIREMENTS

While Indiana utilities have first-hand knowledge on the state of affairs of their coal plants, the IURC should evaluate a range of retirement rates beyond the data provided by its utilities. The U.S Energy Information Administration (EIA) recently posted an article on coal plant retirements in 2018.[1] Those plants retired at an average age of 46 years and had an average nameplate capacity of 350MW. EIA noted that the 2018 plant retirements were much lower in age and much larger in capacity than the plants that retired in 2015, which saw the most retirements in the past 8 years (15 GW). In 2015, the retired plants had an average size of 129MW and average age of 56 years. This change in plant size and age is consistent with the movement toward carbon reduction goals that many MISO utilities are committing to, the fact that mostly smaller plants retired prior to 2018 so the average size of the remaining operating coal plants has increased, and the continued pressure

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[1] US EIA, *More U.S. coal-fired plants are decommissioning as retirements continue*, (July 26, 2019); *available at:* https://www.eia.gov/todayinenergy/detail.php?id=40212

applied to coal plants from a reduction in the average wholesale market prices for energy and lower capacity prices.

While a number of factors influence the decision to retire a plant, in the absence of plant specific capital and operating costs the IURC should assume plants will retire at some average age. The IURC could use the EIA data for average retired plants in 2018, or even go as low as plants retiring at 40 years of age to account for the trend-line of plants having shorter economic life-spans.

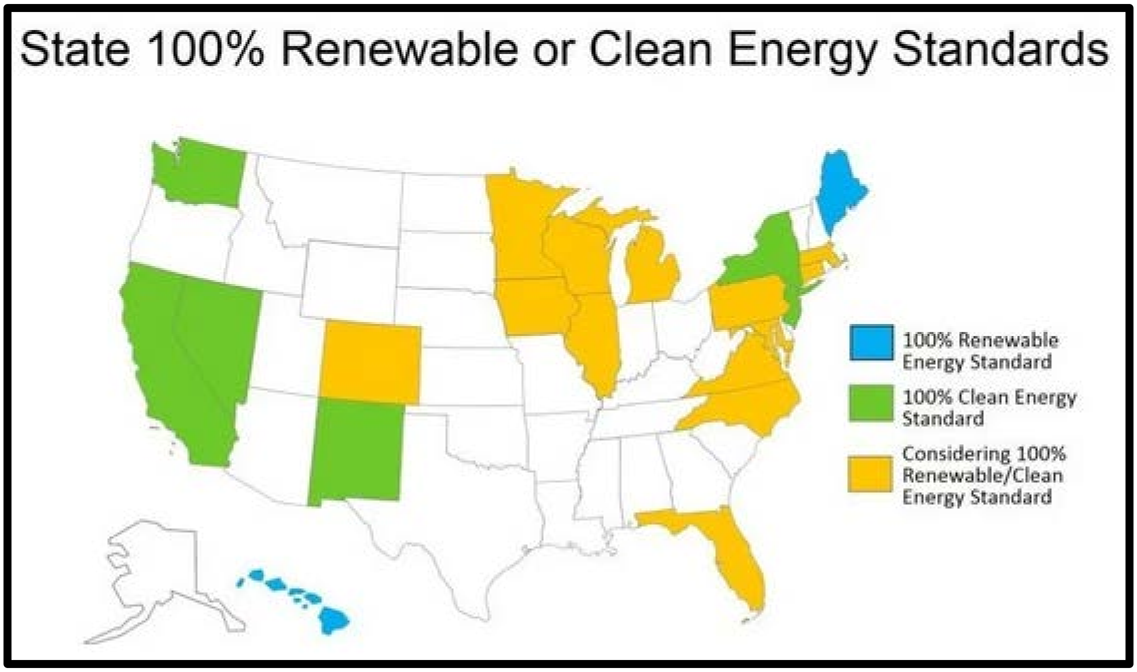
4. NEW RESOURCE PORTFOLIO MIX

A. Utility Scale Renewable Resources

There are a number of factors affecting the expansion of utility-scale wind and solar resources in Indiana. One of the initial points Staff should focus on is the projection of both utility and Independent Power Producer generation expansion. Independent Power Producers currently own and operate a significant amount of generation within Indiana and are looking to add quite a bit more when you look at the large number of projects they have within the MISO and PJM generation interconnection queues. Their resources sell power to Indiana utilities and to utilities outside of Indiana, and all of their projects within Indiana inject electricity into Indiana's electric grid. Independent Power Producers may also build projects outside of the state that serve Indiana utilities in the next fifteen years. In addition, a large portion of utility-scale wind and solar growth is driven by corporate investment – not utilities. The Fortune 1000 corporations have sustainability targets invest in utility-scale renewable resources as a way to offset their electric use in either PJM, MISO or Indiana. Combined, the renewable energy target of the Fortune 1000 is 85 GW by 2030. Some of those resources will be built in Indiana. The study needs to account for that generation because it will impact the wholesale market prices in Indiana. CGA is investigating data that might inform Staff on the transition rate of this category of generation expansion and will update this section after finishing its review of that data.

Carbon reduction targets is another driver of utility-scale renewable resource growth in Indiana. A large number of states and utilities have established some form of carbon reduction target. These policies will drive renewable resources development anywhere in PJM or MISO –

and consequently in Indiana. There is also potential for future carbon reduction policies at the federal level.[2] Carbon reduction policies will impact Indiana differently -- having more or less of a direct impact – depending on whether the policy is implemented by the federal government, Indiana or a neighboring state of Indiana. In forecasting the potential impact of carbon reduction Staff can look to utility IRPs for guidance. Neighboring states in the Midwest are considering carbon reduction targets or clean energy targets[3] (see map below). If Michigan and Illinois adopt



higher clean energy standards they would drive wind/solar/hybrid project development in Indiana to meet their needs. MISO utilities have adopted a carbon reduction goals or are analyzing carbon reductions of 50% or more of the current emission levels by 2030. The IURC should consider a similar range in this analysis.

A factor that is easier to incorporate in this study are capital costs or cost of energy by resource. Wind and solar continue to be the lowest cost generating resources in the country. Selection of new generation expansion based on economics would have the utilities adding renewable resources as the primary source of energy, and then supplementing that with battery

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[2] Carbon policies could also be evaluated as a sensitivity. Testing more than one carbon reduction target to gauge the impact of a spectrum of carbon reduction targets.
[3] Union of Concerned Scientists, *States March Toward 100% Clean Energy – Who's Next?*, (Aug. 28, 2019); *available at*: https://www.ecowatch.com/tokyo-typhoon-faxai-2640274309.html?rebelltitem=1.

storage or conventional generation if those types of resources prove to be a more cost effective method for attaining capacity reserve margins, or providing ancillary services than renewable resources.

Improvements in technology and materials are driving the cost of wind and solar resources lower. Suggested capital costs are provided in section 4(c)(*infra*). Utility-scale wind resources are increasingly improving their output through the use of better materials, higher turbines, or the use of low speed wind turbines. These changes allow turbines to operate more hours and at increased capacity factors. These turbine advancements also open new areas of Indiana for wind development.

Utility-scale solar prices have fallen dramatically since 2006. From 2006 to 2012 PPA prices have dropped $20-$30/MWh per year on average, with a smaller price decline of approximately $10/MWh per year from 2013 through 2016. This declining price has been driven by lower installed project prices and improving capacity factors. Solar trackers (instead of fixed-tilt racking system) dominated the utility-scale solar installation market in 2017; nearly 80% of newly installed utility-scale solar capacity used solar trackers. And solar trackers are also pushing into the less-sunny regions (Global Horizontal Irradiance (GHI) <4.75kWh/m2/day) of the U.S – such as the Midwest (whose 20%-80% GHI is 3.8-4.0 in the Midwest[4].

As plants retire, generator owners will likely want to repurpose the site for another source of generation. MISO recently amended its Generator Replacement Criteria[5] so that utility-scale solar plants could replace a retired coal or natural gas plant.

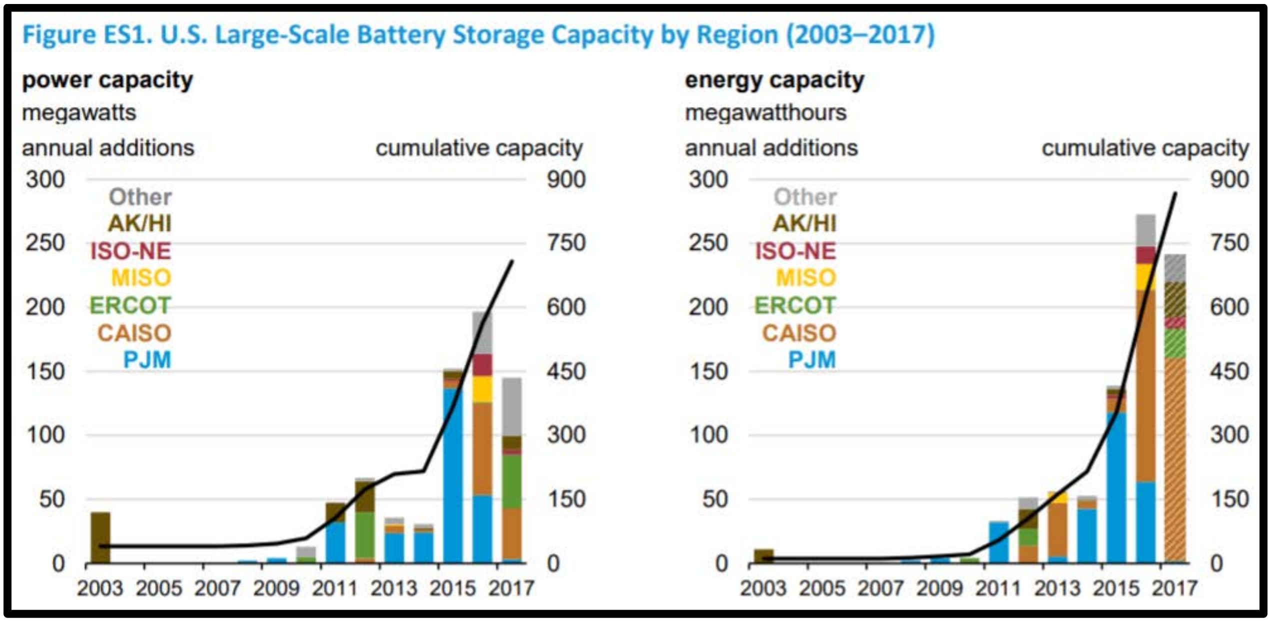
B. Battery Storage

Battery storage is an active an ongoing discussion at this time in a number of states and RTOs. While battery storage is a necessary component of an evaluation of all available technologies, projecting energy storage deployment in the near-to-long-terms is difficult given the

[4] Lawrence Berkeley National Laboratories (LBNL), *Utility-Scale Solar: Empirical Trends in Project Technology, Cost, Performance and PPA Pricing in the United States – 2018 Edition*, table 2 at 11 (Sept. 2018); *available at*: https://emp.lbl.gov/sites/default/files/lbnl_utility_scale_solar_2018_edition_report.pdf

[5] MISO, *Generator Replacement Study Practices*, (Aug. 13, 2019), presentation to the MISO Planning Subcommittee; *available at*: https://cdn.misoenergy.org/20190813%20PSC%20Item%2005a%20Study%20Practices%20for%20Generator%20Replacement371630.pdf

range of operations it can perform and range of products it requires revenue from. Below is a graph depicting the locations of large scale battery installations deployed through 2017:



Source: EIA 2018[6]

Confounding the ability to project energy storage deployment are the rapidly plunging costs, along with new regulatory structures (specifically FERC Order 841). As shown below, the cost of lithium-ion battery prices have been declining, roughly 20% annually, for the past decade.

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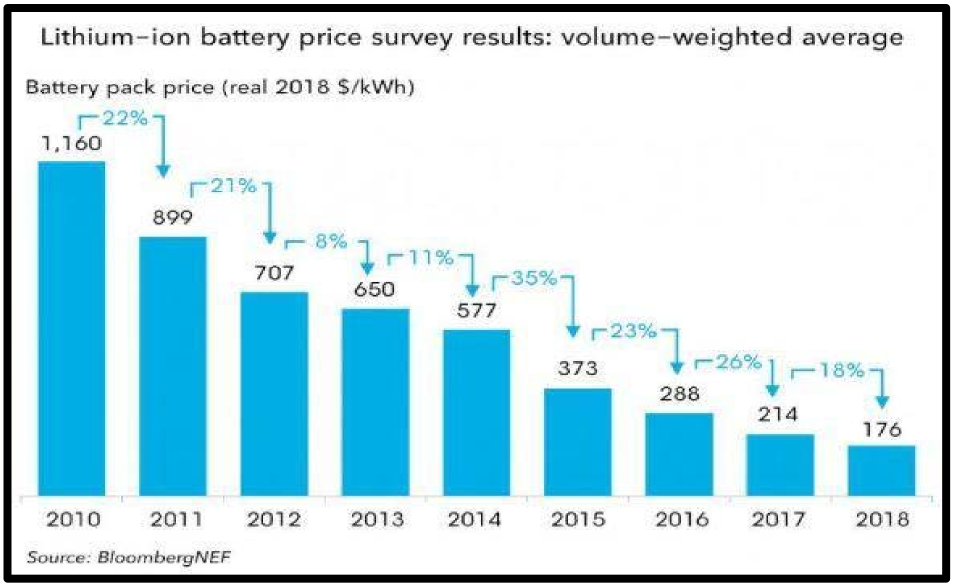
[6] Energy Information Administration, *US Battery Storage Market Trends*, (May 2018); *available at:* https://www.eia.gov/analysis/studies/electricity/batterystorage/pdf/battery_storage.pdf.



Source: BNEF 2019[7]

Bloomberg New Energy Finance (BNEF) does make projections for energy storage deployment, on a national level. Based on BNEF's projections, it appears the United States may add approximately 50 GW of energy storage capacity by 2030.

Within the past two years, solar with battery storage has become a more frequent bid response from Independent Power Producers. The graph below[8] shows the PPA price of solar installed in the U.S from 2015 to early 2018. The orange shaded circles indicate solar with battery storage projects. Three solar plus battery storage PPAs were entered into in May 2018 for projects in Nevada (each using 4-hour batteries sized at 25% of PV nameplate capacity). Those PPA prices indicate that the incremental price adder for storage (above that of solar-only) has fallen to approximately $5/MWh. This would be down from a $15/MWh adder from just a year earlier in May 2017.[9]

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[7] BloombergNEF, *Behind the Scenes Take on Lithium-Ion Battery Prices*, (March 5, 2019); *available at:* https://about.bnef.com/blog/behind-scenes-take-lithium-ion-battery-prices/.
[8] LBNL, *Utility-Scale Solar: Empirical Trends in Project Technology, Cost, Performance and PPA Pricing in the United States – 2018 Edition*, fig. 19 at 33 (Sept. 2018); *available at*: https://emp.lbl.gov/sites/default/files/lbnl_utility_scale_solar_2018_edition_report.pdf
[9] LBNL, *Utility-Scale Solar: Empirical Trends in Project Technology, Cost, Performance and PPA Pricing in the United States – 2018 Edition*, at iv (Sept. 2018); *available at*: https://emp.lbl.gov/sites/default/files/lbnl_utility_scale_solar_2018_edition_report.pdf

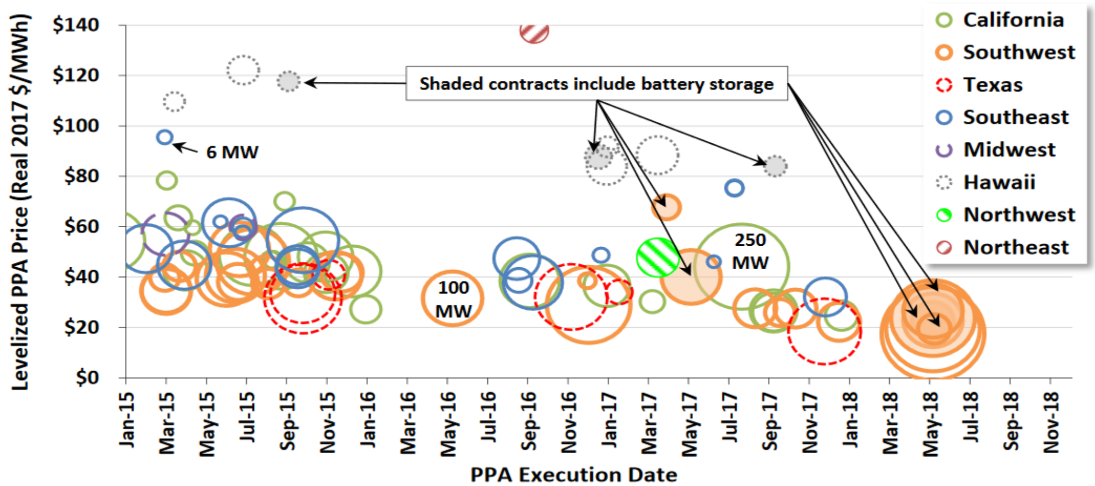


Figure 19. Levelized PPA Prices by Region, Contract Size, and PPA Execution Date: 2015-2018 (YTD) Contracts Only

These prices are informative and should be benchmarked against recent, proximate, actual bids or PPAs. A LBNL report should be issued shortly with updated information for 2018-2019.

C. New Resource Investment Cost Curves

Staff should use NREL's 2019 Annual Technology Baseline (ATB) workbook for its resource expansion analysis. For utility-scale wind Staff should use Techno Resource Group 5 (TRG5). For utility-scale solar Staff should use 'Utility PV-Chicago' for northern Indiana and 'Utility PV- Kansas City' for southern Indiana. Staff should assume 50% of utility-scale solar resources will use tracking racks, or Staff should investigate the solar projects in the MISO and PJM generation interconnection queues to determine the ratio of fixed-tilt to tracking racks. The capacity factors used in 2019 ATB for utility-scale solar calculations are conservative for some states in the Midwest -- such as Indiana, Illinois and Missouri.

As a check on the NREL capacity numbers, CGA recommends benchmarking the wind and solar LCOEs in the NREL ATB against recent, proximate, actual PPAs or bid prices.

i. Renewable Resources Within Scenarios

In developing scenarios Staff should use the 'Mid' NREL prices for Base Case scenarios and the 'Low' NREL prices for high renewable penetration scenarios. If renewable resources are run as a sensitivity Staff could use the 'Mid' and 'Low' NREL prices as separate sensitivities.

CGA encourages Staff to not use 'Constant' NREL price, because wind and solar costs are continuing to drop as technology improvements continue.[10]

D. Transmission

Indiana's electricity is supplied through two wholesale power markets – PJM and MISO. Indiana utilities can purchase power through these markets as an alternative to owning/operating a power plant, or as a replacement of a power plant to be retired. In the workshop it was stated that this study's analysis is limited to Indiana generation expansion and is not considering wholesale power market alternatives that could provide lower cost power. That scope would not account for potential bilateral contracts that could offer lower prices than current Indiana utility-owned generation or current wholesale electric prices within Indiana and may not reflect actual decisions by a utility.

In addition, the scope of this study does not account for transmission expansion, or at best it will provide a de minimis accounting of transmission. Generation expansion without transmission expansion will create congestion and pockets of higher electricity prices. When there is more power being generated than what is being used or is more than the capacity of a transmission line, then congestion will occur. On the generator side of the constraint, energy prices will be low – potentially lower than the cost to operate generators on that side of the constraint. On the load or customer-side of the constraint, the power prices will increase. This amount of increase is determined by the bid price of the generator the RTO will use to meet the customer demand. That generator will typically have a higher cost of operation than the generator on the opposite side of the constraint. If the model is not accounting for congestion then it will not account for plant curtailments – which largely affect wind resources. In addition, the analysis will not account for potential pockets of wholesale market price spikes. While this is not a fatal flaw, it should be noted within the report.

[10] CGA assumes that SUFG is economically selecting resources in each of its scenarios and sensitivities. If SUFG is going to perform an external forecast of utility-scale wind and solar expansion and then hard-code the resulting growth curve into the Aurora model, CGA requests the ability to review your assumptions and inputs for the external model or to have the opportunity to provide input into the development of those assumptions.

A number of studies, reports and whitepapers have explained and documented how transmission expansion can provide economic benefits to PJM and MISO.

At the workshop it was mentioned that a small component of LBNL's work would focus on transmission. CGA recommends that the report have a statement explaining the role of transmission – how it provides reliability and can reduce overall system production costs – and explain the extent to which it will be analyzed in this study and the resulting gaps in knowledge it creates so leadership can make a decisions as to whether transmission analyses are warranted. Further, CGA recommends that Staff develop a proposed outline or draft on this topic to which stakeholders can respond with comments. Another option is to reserve 10-15 minutes at the next workshop to discuss this topic.

5. KEY SENSITIVITY LEVERS

A. Fuel Prices

CGA offers no comments at this time on the use of Fuel Price as a sensitivity, but reserves the right to respond to comments of other stakeholders.

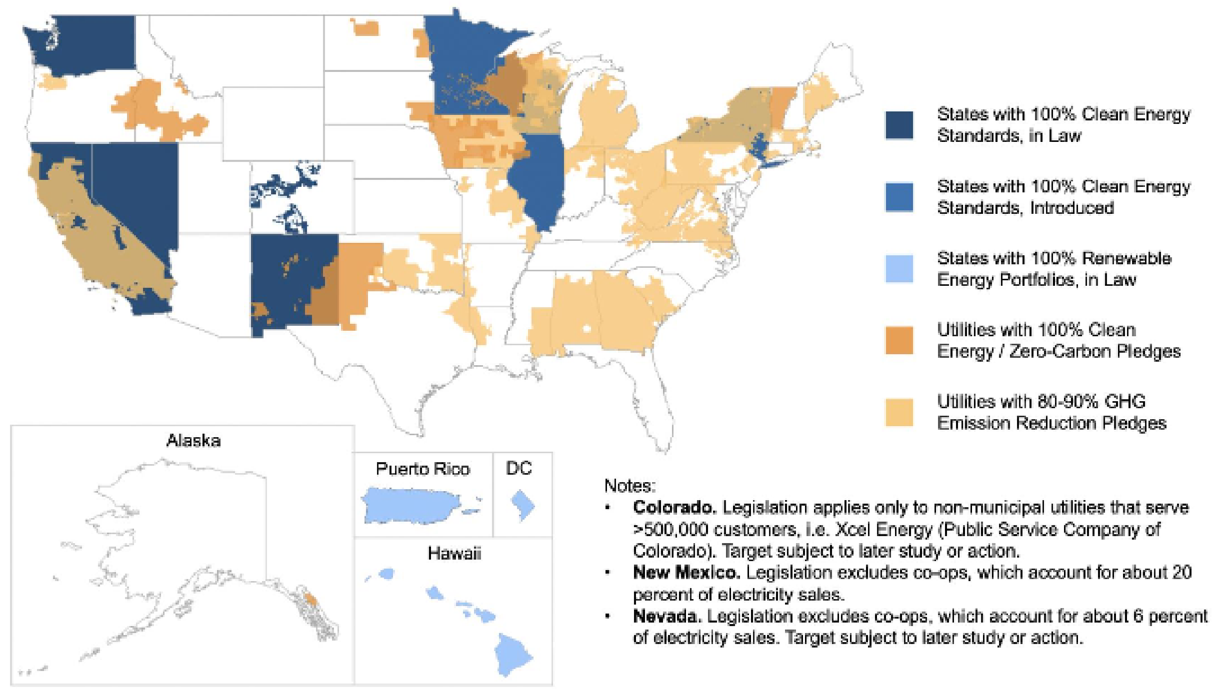
B. Environmental Costs

i. CO2

CGA supports the use of carbon reduction policies in a scenario or two, or used as a sensitivity. The attention it has received through the media, via corporate investment and by elected officials across the country is a good indicator that some action on this is likely to occur. In addition, a number of utilities include a carbon price or carbon impact proxy in their integrated resource models; it would be prudent to account for that in this study.

Clean Air Task Force recently published a paper[11] on states, and utilities that are setting some form of carbon reduction target:

[11] Clean Air Task Force, *Fact Sheet: State and utility climate change targets shift to carbon reductions, technology diversity*, at 9 (May 5, 2019).



Appendix C: Map of State laws enacted and proposed, and power company carbon pledges

MISO sets a price that reduces carbon emissions by 20% from current level by 2031 and the maintaining that level and nearby utilities have set or are analyzing carbon reduction goals near or above 50% of current level by 2030 (see section 4.A. (*supra)* for further discussion of these points).

ii. *ELG*

CGA offers no comments at this time on the use of ELG as a sensitivity, but reserves the right to respond to comments of other stakeholders.

iii. *CCR*

CGA offers no comments at this time on the use of CCR as a sensitivity, but reserves the right to respond to comments of other stakeholders.

C. New Resource Investment Cost Curves

CGAs recommended forward looking price curves were discussed in section 4.C. (*supra*).

CGA looks forward to future workshops and opportunities to review and comment on the development of models, scenarios and sensitivities.

Respectfully submitted,

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