Comments on Illinois Power Agency Policy Study

On January 22, 2024, the Illinois Power Agency (IPA) released a 2024 Policy Study – Draft for Public Comment, pursuant to P.A. 103-0580. SOO Green HVDC Link (SOO Green), in collaboration with its advisor PA Consulting Group, Inc. (PA), has prepared this joint memorandum to provide the following: comments on areas where the IPA's 2024 Policy Study accurately characterizes and quantifies expected benefits that will result from SOO Green's operation, recommendations to improve the Policy Study's modeling assumptions and approaches to yield more accurate projections of expected benefits, and suggestions to better clarify the expected value proposition and cost of SOO Green. Where relevant, the respective party providing each comment area (SOO Green or PA) is noted.

Our comments on the Draft Policy Study are summarized as follows:

- **IPA's Draft Policy Study importantly shows that SOO Green is a cost-effective proposal**, resulting in the lowest net cost to Illinois ratepayers on a $/MWh basis among the three studied policy proposals. While we recognize and emphasize that meeting long-term CEJA targets on time while ensuring will require an "all of the above" approach to developing clean energy resources, we also emphasize SOO Green's unique value proposition in doing so.
- **IPA's Draft Policy Study appropriately recognizes the substantial emission reduction enabled by SOO Green.** Directionally consistent with PA's production cost modeling, the Draft Policy Study projects that over the first 20 years of operation (2030-2049), SOO Green's clean energy deliveries would avoid over 145 million short tons of CO_2, nearly 39,000 short tons of SO_2, nearly 64,000 short tons of NO_X, and over 2,000 short tons of $PM_{2.5}$ emissions from fossil-fired power generation.
- **IPA's Study appropriately recognizes SOO Green's unique contributions to future system reliability.** These reliability benefits, including high capacity accreditation (over 90%) and significant reductions to expected future load shed, are enabled by a diverse mix of wind, solar, and energy storage supply resources, as well as the undergrounding of SOO Green and protection from extreme weather events.
- IPA's Draft Policy Study, informed by production cost modeling performed by Levitan & Associates ("Levitan"), **underestimates the wholesale electricity cost savings that SOO Green would enable for Illinois ratepayers by over $7 billion (nominal) from 2030-2049.**
  - **The IPA study did not include PJM-specific wholesale capacity savings**. The most concerning omission was Levitan's lack of consideration of the wholesale capacity cost savings that SOO Green would enable. As identified by Levitan and GE, SOO Green's capacity accreditation – i.e., the proportion of its nameplate capacity that is likely to be available to provide energy deliveries during times of system need – is strong, but SOO Green's impacts on capacity costs (which would be much lower with SOO Green's capacity in the market) are not modeled. We strongly recommend that the IPA and/or their advisors estimate wholesale capacity cost impacts using a model specific to the PJM capacity market rather than Aurora's capacity expansion functionality, which is difficult to utilize in a "but for" test of capacity market impacts. PA's modeling of the wholesale capacity cost impacts of SOO Green projects SOO Green would enable capacity cost savings of approximately $4.02 billion in nominal dollars ($2.77 billion in 2022$) accruing to Illinois ratepayers in 2030-2049.
  - **Wholesale energy savings will be higher than the IPA study estimates.** Levitan's production cost modeling also incorporates several concerning or unclear assumptions that result in substantially underestimated wholesale energy cost impacts relative to PA's estimate (derived from production cost modeling) of $6.60 billion nominal from 2030-2049 ($4.29 billion in 2022$). These concerning assumptions include long-term natural gas price assumptions based on illiquid NYMEX futures rather than a fundamental forecast (which results in long-term gas prices that are too low), an outdated (and

inappropriately low) PJM electricity demand forecast that does not account for more recent estimates of electrification impacts and large energy user additions (e.g., data centers), and potentially overly aggressive interzonal transmission capacity limits that result in the inappropriate diffusion of wholesale energy price impacts to other parts of PJM (rather than the ComEd zone in Illinois).

- **IPA's Draft Policy Study also provides differing levels of detail on the modeling assumptions and results for the three policy proposals,** and should provide detailed workbooks showing annual assumptions and projections for the SOO Green and offshore wind proposals as it now does for the energy storage proposal. This transparency is critical in providing more refined comments on how the modeling of SOO Green's impacts may be improved.
- **The value of CO_2, SO_2, NO_X, and $PM_{2.5}$ emission reductions will be nearly $13 billion higher (in 2022$) than the IPA study estimates.**
  - **Even in its "high" valuation, Levitan's production cost modeling study underestimates the public health benefits of localized pollutant (e.g., CO_2, SO_2, NO_X, and $PM_{2.5}$) emissions reductions by $1.90 billion (2022$).** While Levitan's production cost modeling directionally captures the appropriate magnitude of emission reduction tonnage, their method for determining the economic value of those emission reductions is not industry standard. PA's production cost modeling more appropriately utilized the Environmental Protection Agency's (EPA) CO-Benefits Risk Assessment (COBRA) tool to estimate the economic value of health benefits from avoided localized pollutant (e.g., SO_2, NO_X, $PM_{2.5}$) emissions, resulting in estimated benefits of $7.18 billion nominal ($4.57 billion in 2022$) from 2030-2049. Note that Levitan's emission reduction benefit estimates are not provided in nominal dollars.
  - **Similarly, Levitan's "high" valuation of CO_2 reductions underestimates the avoided social cost of CO_2 value by $10.93 billion (2022$).** Levitan's approach to valuing avoided CO_2 emissions relies on outdated and overly conservative assumptions that substantially underestimate the value. Levitan's "low" estimate of avoided CO_2 emissions value relies on 2016 Interagency Working Group estimates that have now been replaced by updated EPA estimates finalized in November 2023, and their "high" estimate relies on a static estimate from the finalized EPA guidance using the highest discount rate (2.5%) rather than the industry-standard 2.0%. Levitan should recalculate avoided CO_2 emissions value using only the November 2023 finalized EPA guidance, the 2.0% discount rate, and the time series of social cost of carbon dioxide estimates rather than a static point estimate.
    - **The IPA's Study misses several categories of benefits that SOO Green will bring to environmental justice (EJ) communities**, including SOO Green's commitment to a $100 million community benefits fund.
  - **The IPA's Study does not adequately identify the EJ communities located along SOO Green's planned route in Illinois or in the workforce corridor.** There are three disadvantaged community (DAC) census tracts within the project corridor in Savanna and DeKalb, as well DAC census tracts with a total population of approximately 450,000 within SOO Green's workforce corridor.
  - **The IPA's Study does not contemplate the localized pollutant emission reduction impacts that will benefit over 125,000 Illinois residents that live in EJ communities.** While IPA's study qualitatively acknowledges indirect economic benefits that SOO Green's development may bring to EJ communities in Illinois, it neglects the benefits to EJ communities resulting from emission reductions at fossil-fired power plants located in or near those communities. PA's production cost modeling projects SOO Green's clean energy deliveries would result in particularly substantial emission reduction impacts in Will and Sangamon counties, where over 125,000 Illinois residents live in census tracts identified as disadvantaged communities.
- **SOO Green's interconnection costs may be lower than the study estimates.** IPA's Study likely overestimates SOO Green's interconnection costs, reporting Entrust Solutions Group's (Entrust)

network upgrades estimate of $801.8 million without also providing explanation that Entrust's estimate does not consider that a portion of SOO Green's network upgrades may be funded by other generation projects or alleviated through PJM's Regional Transmission Expansion Plan (RTEP) process. In fact, as noted by the IPA, the most recently available study from PJM related to SOO Green shows network upgrade cost allocation of only $163 million.

- **There is an abundance of clean energy projects in MISO that SOO Green can contract with.** While the IPA's study is technically correct that SOO Green has not yet executed firm agreements with proposed Iowa supply resources, the study should also highlight the abundance of wind, solar, and energy storage development project capacity in Iowa that is active in MISO's interconnection queue. PA's analysis of the MISO queue identified over 12 GW of active wind, solar, and energy storage development projects in Iowa, a substantial portion of which will be well positioned to enter service by 2030 based on average interconnection process and construction timeframes.
- **IPA's study makes an incomplete comparison between SOO Green and Grain Belt Express** that should either be removed or accompanied with a complete analysis of the comparative advantages of the SOO Green underground line for more equal comparison of the projects.

The following sections explain these comments and findings in more detail.

Accurate Aspects of the IPA Study

IPA's Study Shows SOO Green is a Cost-Effective Policy Proposal (PA)

SOO Green recognizes that to meet CEJA mandates on time while ensuring reliability for Illinois electricity customers, an "all of the above" approach to developing and procuring new clean energy resources will be required to provide necessary resource diversity. This recognition thus implies a need to carefully consider the unique benefits that a wide variety of policy proposals and resource types would provide.

However, we also emphasize that despite certain concerning approaches and assumptions utilized to estimate market impacts and net benefits (see further detail below), the IPA's study shows that of the three policy proposals, SOO Green would be the lowest net cost to ratepayers on a $/MWh basis. The IPA's estimate of SOO Green's net cost over the 2030-2049 period is ~$25/MWh (2022$), below that estimated for the energy storage (~$33/MWh) and offshore wind (~$63/MWh)[1] proposals.[2] This means that Illinois ratepayers would realize lower incremental costs for SOO Green's clean energy deliveries on a $/MWh basis.

We further note that if the IPA and their advisors perform the modifications to their benefits analyses recommended in these comments, SOO Green's projected ratepayer cost impacts would be even smaller, and projected "non-bill" benefits even larger. Specifically, our comments below focus on how Levitan's employed assumptions and approaches 1) significantly underestimate the wholesale market savings that SOO Green would enable, and 2) significantly underestimate the economic and public health value of fossil-fired power plant emissions that SOO Green's clean energy deliveries would help avoid.

IPA's Study Recognizes the Substantial Volumetric Emission Reduction Impacts Enabled by SOO Green (PA)

The IPA's study, informed by Levitan & Associates' ("Levitan") production cost modeling, projected that SOO Green's stable clean energy delivery profile would cause substantial reductions in volumetric emissions of carbon dioxide (CO_2), SO_2, NO_X, and $PM_{2.5}$ that would otherwise be released by fossil-fired generators. Specifically, Levitan projected that over the first 20 years of operation (2030-2049), SOO Green's clean energy deliveries would avoid over 145 million short tons of CO_2, nearly 39,000 short tons of SO_2, nearly 64,000 short

[1] The offshore wind proposal net cost does not incorporate the proposed rate increase of 0.25% posited under SB1699 to fund the offshore wind pilot program, as this reduction in net cost would still ultimately be funded by Illinois ratepayers.
[2] Illinois Power Agency, Draft 2024 Policy Study, Errata Announcement: Correction to Modeling Results, February 8, 2024, page 3.

tons of NO_X, and over 2,000 short tons of $PM_{2.5}$.[3] Directionally, these estimates of pollutant emission reduction volumes are consistent with those projected in PA's production cost modeling and speak to the immense environmental benefits that SOO Green would create. For context, the US EPA estimates that the average light-duty passenger vehicle in the US emits approximately 5.1 short tons of CO_2 annually. SOO Green's projected annualized CO_2 emission reduction impacts would be the equivalent of removing the CO_2 emissions associated with over 1.4 million light-duty passenger vehicles. This greatly complements Illinois' goal to reduce carbon emissions to zero by 2050.

IPA's Study Recognizes SOO Green's Unique Contributions to Future System Reliability (PA)

Avoided Load Shed and Accredited Capacity

The IPA's study, informed by GE's resource adequacy study and Levitan's production cost modeling, also appropriately recognizes SOO Green's contributions to future electric system reliability. GE's study projects the effective load carrying capability (ELCC) of SOO Green, or how much additional load SOO Green can serve without changing overall system reliability. This is an industry-standard approach to projecting the firm capacity contribution (relative to nameplate) of a particular resource or resource class. GE's study projects SOO Green's ELCC to be approximately 96% in 2030 and 92% in 2040.[4] This is relatively consistent with Levitan's estimated unforced capacity (UCAP) of 90.1% for SOO Green.[5] Due to this high capacity accreditation and ability to provide relatively stable energy deliveries, GE's study found that SOO Green's operation would reduce Loss of Load Hours (LOLH) and Expected Unserved Energy (EUE) to close to 0 in 2030 and 2040.[6,7]

As we know from the Texas blackouts during Winter Storm Uri in 2021, and load shed in portions of the Southeast during Winter Storm Elliott in 2022, weather related loss of load events stemming from the effects of climate change are becoming more and more prevalent. These incidents can have devastating human and economic consequences, and recovery can extend well beyond the timing of the events themselves. SOO Green, as an underground system sourcing energy from a diverse array of wind, solar, and energy storage resources, puts up a strong line of defense against these types of catastrophes occurring in Illinois, and the LOLH and EUE impacts and capacity accreditation ratings underscore this point. For example, sourcing wind energy from Iowa means those projects will have significantly different wind output shapes than wind generators located in Illinois, bringing added reliability to Illinois. Additionally, there are benefits to pairing wind with solar. Solar dispatches more heavily during daytime hours and hotter seasons when wind output tends to be lower. SOO Green will also firm intermittent resource output with dispatchable energy storage. SOO Green's envisioned portfolio of supply resources would resemble a baseload delivery profile, with the capability to dispatch stored generation during peak system hours.

We agree that SOO Green should have relatively high capacity accreditation given its diversified supply resource profile as well as operational reliability benefits associated with the undergrounding of the line (see further detail below). This high capacity accreditation should significantly reduce the risk of firm load shed.

Benefits of Underground Infrastructure

The IPA's study also makes brief mention of the important reliability benefits associated with underground transmission infrastructure. Specifically, the IPA accurately notes that "given that the SOO Green line is an underground transmission line, it should be relatively protected from wildfires, tree branches, or extreme weather conditions."[8]

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[3] Levitan & Associates, Aurora Production Cost Modeling (Appendix E), January 19, 2024, page 38.
[4] General Electric International, Inc. Evaluation of Illinois' Policy Proposals on Resource Adequacy, January 19, 2024, page 20.
[5] Levitan & Associates, Aurora Production Cost Modeling (Appendix E), January 19, 2024, page 45.
[6] GE's study assumes a reference case without SOO Green where a Loss of Load Expectation (LOLE) of 0.1 days per year, a standard reliability criterion, is met.
[7] General Electric International, Inc. Evaluation of Illinois' Policy Proposals on Resource Adequacy, January 19, 2024, page 24.
[8] Illinois Power Agency, 2024 Policy Study – Draft for Public Comment, January 22, 2024, page 151.

We agree that underground transmission infrastructure is substantially less susceptible to outages caused by extreme weather conditions, and that this is a significant reliability benefit of SOO Green. Furthermore, damage to overhead transmission infrastructure resulting from extreme weather conditions that are relatively frequent in Illinois (e.g., tornadoes, thunderstorms, icing, other high wind events) is a common occurrence. In the 2023 State of Reliability Technical Assessment, which reviews bulk electric system reliability performance for year 2022, NERC states that "[h]ard-to-predict high-wind and lightning systems, such as severe thunderstorms and tornadoes, continue to be the most regular notable challenge for the [bulk electric] system."[9] Specifically, eight of the twelve NERC-identified Large Transmission Weather-Related Events in 2022, which resulted in transmission element losses, were the result of tornadoes, damaging winds, and winter storms that occurred in the Eastern Interconnection.

In a future where climate change is likely to make extreme weather event frequency and magnitude even harder to predict, and where warming temperatures may themselves increase the frequency and magnitude of such events, the reliability benefit of SOO Green's proposed undergrounding should be more fully acknowledged.

Aspects of the IPA Study That Should Be Revised or Reconsidered

IPA's Study Ignores the Substantial Wholesale Capacity Cost Savings that Illinois Ratepayers Would Realize with SOO Green (PA)

Perhaps the single most concerning omission in the IPA's study is the lack of consideration of the wholesale capacity cost savings that SOO Green would enable. Specifically, Levitan's study[10] explicitly states that "Aurora's capacity expansion functionality was utilized to determine capacity prices for PJM", but that:

> "Indirect (market price) impacts of adding incremental capacity into MISO and PJM were not estimated. Perturbing the capacity expansion model makes creating a "but for" test for energy and environmental effects difficult. Resource additions may be deferred and retirements accelerated in response to a new addition, which may lead to limited or no net change in prices"

Simply ignoring potential wholesale capacity price impacts (and associated cost savings to Illinois ratepayers) because modeling those impacts is difficult does not mean that the expected impacts are low in magnitude. This approach is particularly concerning given Levitan's and GE's recognition of the substantial capacity value (accreditation) that SOO Green would have in the PJM ComEd zone. Levitan estimates that SOO Green's capacity accreditation (unforced capacity or "UCAP") would be 90.1%,[11] while GE estimates SOO Green's capacity accreditation (effective load carrying capability or "ELCC") would range from 92-96%.[12] Market modeling aside, over 1,833 MW[13] of new reliability-rated capacity entry into PJM's ComEd Zone, representing 9% or more of PJM's projected 2030 peak demand in the ComEd Zone[14] would undoubtably lead to a substantial reduction in wholesale capacity prices.

For the reasons described by Levitan, PA does not employ Aurora's capacity expansion modeling functionality to project capacity prices in PJM. Rather, PA has developed a Reliability Pricing Model (RPM) simulation model that enables projection of zonal PJM capacity prices without the complication of the model automatically deciding to defer retirements or build new resource additions in response to changes in clearing capacity (e.g.,

[9] NERC, 2023 State of Reliability Technical Assessment, June 2023, page 5.
[10] Levitan & Associates, Aurora Production Cost Modeling (Appendix E), January 19, 2024, pages 33-34.
[11] *Ibid*., page 45.
[12] General Electric International, Evaluation of Illinois' Policy Proposals on Resource Adequacy, January 19, 2024, pages 19-20.
[13] Utilizes Levitan's 90.1% UCAP estimate as the low end of the capacity accreditation range, alongside SOO Green's line loss-adjusted maximum delivery capability into PJM of 2,035 MW.
[14] PJM's 2024 Load Forecast Report projects summer peak demand of 20,378 MW in the ComEd zone.

the entry of SOO Green). PA's RPM simulation model simulates PJM capacity prices based on factors that impact the intersection of the capacity supply curve (e.g. resource participation, missing money, and minimum offer floors) and Variable Resource Requirement (VRR) curve, also known as the "capacity demand curve", such as the target reserve margin, reference technology, and Net Cost of New Entry (CONE).

PA's approach to projecting PJM capacity prices and capacity cost impacts from resource mix changes is industry standard. PA's RPM simulation model, along with similar capacity market simulation models for ISO-NE and NYISO, have been used to support estimates of wholesale capacity cost impacts in other state-led clean energy resource solicitations (e.g., offshore wind solicitations bids in Maryland and New Jersey, the Champlain Hudson Power Express or "CHPE" Tier 4 REC bid in New York) as well as dozens of energy infrastructure transactions and financing processes for resources in PJM.

Using PA's RPM simulation model, PA projects that SOO Green's entry in 2030 would result in a reduction in ComEd zone wholesale capacity prices of approximately $45/MW-day (nominal), on average, from 2030-2039. PA projects that SOO Green's entry in the ComEd zone would result in a zonal capacity surplus, allowing ComEd to clear at the system-wide PJM RTO price. However, if SOO Green were not to enter service, the substantial CEJA-mandated thermal retirements in the ComEd zone would result in a capacity shortfall in the ComEd zone, resulting in capacity pricing clearing at the ComEd zonal Net CONE, which is substantially higher than Net CONE elsewhere in PJM due to lower projected energy margins in ComEd resulting from the high penetration of low variable cost nuclear and renewable energy resources. The approximately $45/MW-day wholesale capacity price impact of SOO Green's entry is projected to result in wholesale capacity cost savings accruing to Illinois ratepayers of approximately $4.02 billion in nominal dollars ($2.77 billion in 2022$) from 2030-2049.

With this in mind, *we respectfully request that the IPA's study consider SOO Green's wholesale capacity cost impacts using modeling functionality other than Aurora's capacity expansion model. Using an RPM simulation model could more accurately consider a "but for" scenario with and without SOO Green.*

IPA's Study Underestimates the Wholesale Energy Cost Savings that Illinois Ratepayers Would Realize with SOO Green (PA)

The IPA's estimate of $3.25 billion[15] in reduced wholesale energy costs that SOO Green would enable over the first 25 years of operation substantially mischaracterizes and underestimates the magnitude of wholesale market cost savings that ratepayers across Illinois would realize.

First, $3.25 billion is actually Levitan's estimate of wholesale energy cost savings enabled by SOO Green over the first *20 years* of operation (not 25 years), as indicated in Table 2 of Appendix E: Levitan's Aurora Production Cost Modeling which shows $3.25 billion for SOO Green's "Energy Market Impact" over years 2030-2049. This implies that the wholesale energy cost savings associated with SOO Green would be higher over a 25-year period rather than a 20-year period. *We respectfully request that this error in the Draft IPA Study be corrected in the final study.*

Second, the IPA's characterization of SOO Green's energy market benefits versus ratepayer cost allocation is somewhat misleading. Specifically, IPA states that "while the HVDC bill serves to bring power from PJM into MISO to serve PJM customers, costs for supporting this project would be assigned to both ComEd (PJM) and Ameren Illinois (MISO) ratepayers."[16] While we interpret this statement to instead read "bring power from MISO into PJM", it is misleading to assert that only PJM ratepayers in Illinois (i.e., those located in the ComEd zone) would realize benefits associated with SOO Green's operation.

Due to transmission interties among markets and market zones across the Eastern Interconnection, while PA projects the majority of wholesale energy cost savings would be realized in the ComEd zone, PA also projects

[15] Illinois Power Agency, 2024 Policy Study – Draft for Public Comment, January 22, 2024, page 178.
[16] *Ibid.*, page 31.

some wholesale energy cost savings in MISO Zone 4 due to periodic energy exports from the PJM ComEd zone into MISO Zone 4. PA also projects that a significant portion of the localized pollutant (SO_2, NO_X, $PM_{2.5}$) emission reduction impacts would take place at power plants located in MISO Zone 4 (e.g., the coal-fired Prairie State Energy Campus in Washington County). Furthermore, we worry that the IPA's statement implies that the $3.25 billion in wholesale energy cost savings projected by Levitan focuses *only* on energy price impacts in the ComEd Zone, without considering price impacts in MISO Zone 4, as the geographic scope of Levitan's energy market impacts reporting for SOO Green is not clear. *We respectfully request that Levitan clarify whether their energy market impacts projection considers impacts in both the PJM ComEd Zone and MISO Zone 4 (and to the extent it does not, update their quantification to include impacts in both zones), and for the IPA to amend this statement.*

Third, Levitan's Production Cost Modeling Study features several concerning or unclear assumptions that result in projections of diluted wholesale electricity cost impacts relative to what would be expected in practice. Due to the complexities of zonal production cost models and interdependent assumptions, it is not possible to directly tie every concerning assumption to an estimated individual wholesale energy price and cost impact. However, PA's fundamental market modeling conducted with more reasonable and defendable assumptions projects that SOO Green would enable wholesale energy cost savings for Illinois ratepayers located in the PJM ComEd zone and MISO Zone 4 of approximately $6.60 billion nominal from 2030-2049 ($4.29 billion in 2022$), indicating that *the combined effect of concerning modeling assumptions results in underestimating wholesale energy market impacts by approximately $3.35 billion nominal (or over 50%)*. Our concerns with Levitan's modeling assumptions are discussed in further detail below.

Natural Gas Price Assumptions

Levitan's Production Cost Modeling study uses natural gas price assumptions based on NYMEX Henry Hub futures through 2035, regional basis (i.e., difference in price between a regional hub and Henry Hub) projections from S&P Market Intelligence, and escalation of natural gas prices after 2035 using "forecasted annual growth rates of the average price from EIA's 2023 Annual Energy Outlook ("AEO"), Reference and High Oil and Gas Supply cases."[17]

Natural gas prices are a critical assumption in wholesale energy market modeling because offers from natural gas-fired generators set the price of wholesale energy in the majority of hours. Even in wholesale energy markets with substantial generating fuel diversity, natural-gas fired generators are most often at the point in the generation supply curve that intersects with demand for energy in a given period, particularly during on-peak hours when electricity demand is elevated. PA's wholesale energy market modeling (which also uses the Aurora production cost model) of SOO Green's wholesale market impacts projects that natural gas-fired generation will set the price of wholesale energy in PJM 65% of the time in 2030 and 76% of the time in 2040 (without SOO Green).

Using NYMEX natural gas forwards through 2035 and a simple escalation thereafter has resulted in a price projection that is, in PA's opinion, too low and not reflective of real-world fundamentals and dynamics. While NYMEX natural gas forwards can provide a good indication of the direction of natural gas markets in the short-term, they are not representative of long-term fundamental trends. As a matter of practice, NYMEX liquidity essentially ceases after the upcoming heating season. For example, current NYMEX contract volume is strongest in the prompt month (March 2024) and then trends down until the first month of the upcoming heating season (October 2024). Beyond the upcoming winter of 2024-25, liquidity essentially ceases, with only a few hundred contracts being transacted on a daily basis.

This decreasing liquidity essentially renders long-term NYMEX forwards relatively static and not reactive to current dynamics, fundamentals, and devoid of any long-term view with respect to changes in supply-demand. Interestingly, Levitan's Production Cost Modeling study explicitly notes the "lack of liquidity in futures markets

[17] Levitan & Associates, Aurora Production Cost Modeling (Appendix E), January 19, 2024, pages 5-6.

past the prompt year"[18] in defending their decision to hold ComEd zone delivered basis price (to Henry Hub) projections constant. It is unclear why Levitan decided to use illiquid long-term NYMEX Henry Hub forwards when noting concerns around forwards liquidity for other products.

PA approaches natural gas price and fundamental modeling in a different manner. PA's price forecast for Henry Hub and regional basis incorporates NYMEX forwards over two years, a fundamental forecast developed in house beginning four years out, and an interpolation period between the forwards and fundamentals periods in between. PA's fundamental forecast is developed using RBAC's GPCM natural gas modeling software, which allows PA to incorporate their own expert-driven view on supply-demand fundamentals. These fundamental factors include an outlook on liquefied natural gas (LNG) export capacity buildout, which is a substantially growing source of demand that is expected to put upward pressure on long-term natural gas pricing. Fundamental factors that PA considers also include decarbonization in the residential, commercial, industrial, and power generation sectors, and PA's view on the evolving natural gas infrastructure landscape that result in natural gas transmission constraints and regional price separation.

Utilizing fundamental modeling to project natural gas prices is industry standard, similar to the use of fundamental production cost modeling (e.g., Aurora) to project wholesale electric energy prices. For example, the MISO Futures Report Series 1A, which Levitan relied upon to inform to their electricity demand[19] and firm resource additions[20] across MISO in their Production Cost Modeling study, utilizes the GPCM base case price forecast in their future scenario modeling.[21] Duke Energy Indiana, whose service territory is in MISO Zone 6 adjacent to MISO Zone 4 (Ameren Illinois) and is the largest electric utility in Indiana, also uses a fundamental natural gas price forecast for the long-term assumptions in their Integrated Resource Plan. Specifically, Duke's long-term fundamental fuels forecast is provided by IHS Markit[22] and is "based on granular, integrated supply/demand modeling using fuel production costs and end user consumption."[23] Indiana Michigan Power Company, whose territory is in the AEP zone of PJM adjacent to the ComEd zone, utilizes EIA's AEO Reference Case (which is developed using a fundamental modeling approach) for the fuel price forecasts used in their Integrated Resource Plan.[24]

As a result of relying upon Henry Hub futures through year 2035, Levitan's long-term projection of natural gas prices in PJM (including the ComEd zone) is inappropriately low. Figure 1 below shows Levitan's projection of ComEd zone natural gas pricing[25] relative to PA's projection used in its production cost modeling, alongside the EIA's 2023 AEO Reference Case projection.[26] From 2032 onwards, Levitan's projection is substantially lower than the 2023 AEO Reference Case, with the difference averaging approximately $0.90/MMBtu through 2049.

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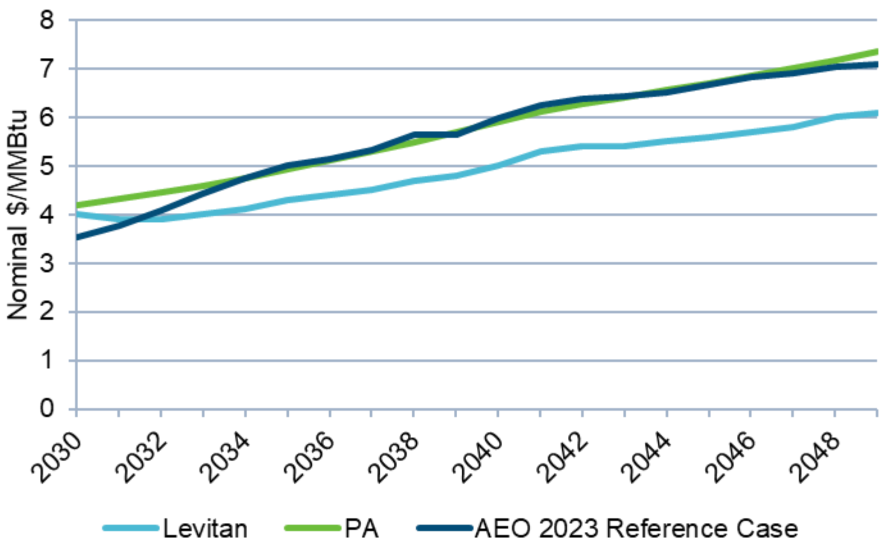
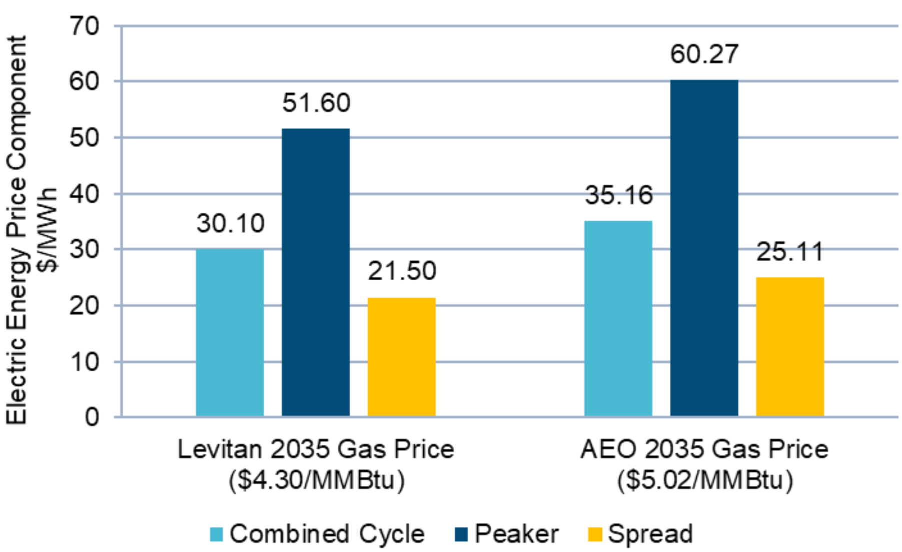
[18] *Ibid.*, page 5.
[19] Levitan & Associates, Aurora Production Cost Modeling (Appendix E), January 19, 2024, page 3.
[20] *Ibid.,* page 8.
[21] MISO Futures Report, Series 1A, page 110. https://cdn.misoenergy.org/Series1A_Futures_Report630735.pdf
[22] IHS Markit is now a subsidiary of S&P Global.
[23] 2021 Duke Energy Integrated Resource Plan, Volume I, December 15, 2021, page 32. https://www.in.gov/iurc/files/REVISED-PUBLIC-DUKE-ENERGY-INDIANA-2021-IRP-VOLUME-I.pdf
[24] Indiana Michigan Power, Integrated Resource Planning Report, January 31, 2022, page 20. https://www.in.gov/iurc/files/2021-I-and-M-IRP-Report-Revised.pdf
[25] Because Levitan's natural gas price projections were only provided in a visual figure and not a numerical table, PA estimated the values to the nearest $0.10/MMBtu.
[26] The AEO 2023 Reference Case projection utilizes the AEO 2023 Reference Case projection of Henry Hub prices combined with PA's projection of delivered natural gas pricing basis between Henry Hub and the ComEd zone. PA's projection of annual average ComEd zone natural gas pricing basis to Henry Hub is minimal (averaging approximately $0.03/MMBtu from 2030-2049.

Figure 1: Natural Gas Price Projection Comparison



Assumed lower natural gas prices result in a lower spread in electric energy dispatch costs between more efficient and less efficient generation resources. Figure 2 below shows the difference in the fuel portion of gas-fired generator dispatch costs for a hypothetical combined cycle generator (7 MMBtu/MWh heat rate) and peaker (12 MMBtu/MWh heat rate) using Levitan's year 2035 projected ComEd delivered natural gas price and AEO Reference Case-derived year 2035 ComEd delivered natural gas price. The illustrative spread in dispatch costs between hypothetical combined cycles and peakers is approximately 17% higher between the AEO-derived natural gas price assumption and Levitan's artificially low natural gas price assumption.

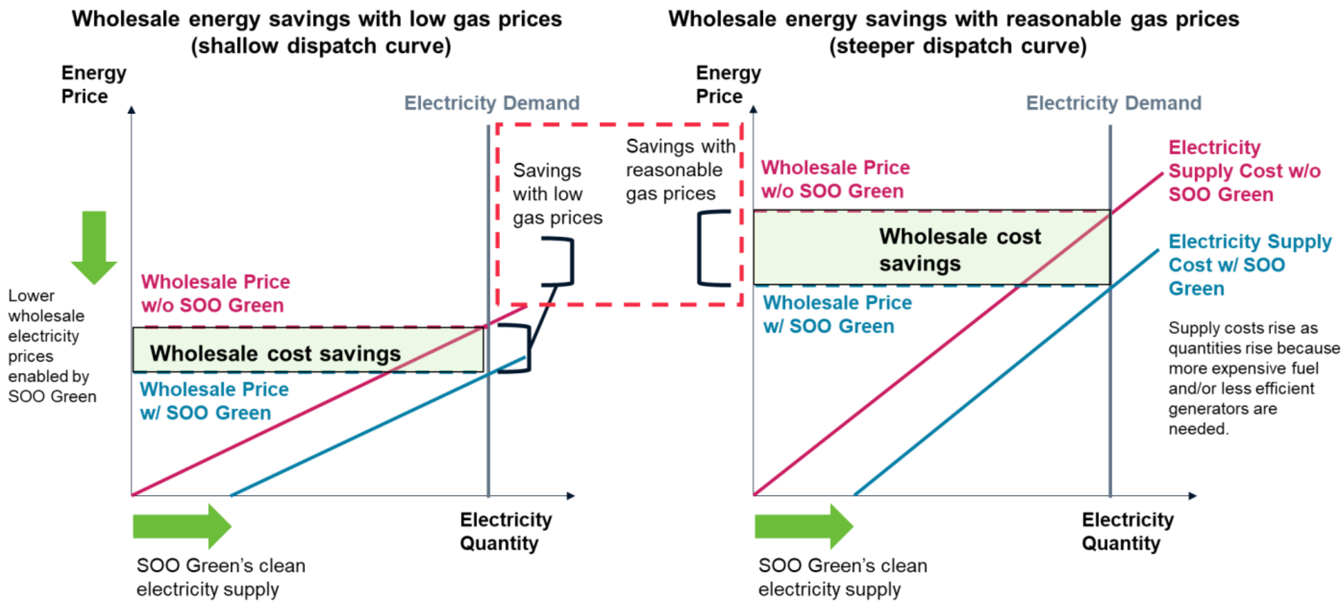
Figure 2: Fuel Portion of Electric Energy Dispatch Cost Comparison



This spread in the dispatch cost between more efficient and less efficient generators is critically important in estimating the wholesale energy cost savings enabled by SOO Green. SOO Green's supplying resource mix will be composed of wind and solar generation (or battery-stored wind and solar) with no dispatch costs. When SOO Green is delivering clean energy into the ComEd zone of PJM, its zero dispatch cost output will push out the dispatch stack of less-efficient generating resources, resulting in more efficient resources setting energy prices more often, and less efficient resources setting energy prices less often. This difference in the frequency that more- or less-efficient generators set energy prices, combined with the spread in dispatch costs between more- and less-efficient generators based on realized fuel prices, determines the wholesale energy cost savings enabled by the project.

Figure 3 below illustrates how low natural gas price assumptions can result in artificially "shallow" generator dispatch merit order curves (i.e., lower spread between more- and less-efficient generators) relative to more reasonable natural gas price assumptions, which result in steeper dispatch curves. With low natural gas price assumptions and shallow dispatch curves, the projected difference in wholesale energy prices (and associated wholesale energy cost savings) caused by SOO Green's clean energy deliveries ends up substantially lower than would be expected with more reasonable natural gas price assumptions.

Figure 3: Illustrative Representation of Wholesale Energy Cost Savings Using Different Gas Prices



Furthermore, Levitan's approach to developing natural gas price assumptions is puzzling given it conflicts with the methodology Levitan used to project coal prices. Levitan's study indicates that coal price assumptions were developed by using 2023 AEO coal price projections *directly*, with adjustments only made to near-term pricing using EIA's Short-Term Energy Outlook. This contrasts significantly with Levitan's approach to developing natural gas price assumptions, which rely on over 10 years of Henry Hub futures and then scale those prices based on long-term *growth rates* derived from the 2023 AEO. It remains unclear why Levitan's long-term coal prices are taken from the 2023 AEO directly, while long-term natural gas prices are not.

With these considerations in mind, *we recommend that Levitan re-run their Production Cost Modeling study using long-term natural gas price projections that are based on fundamental modeling rather than NYMEX futures. A reasonable, publicly available source for updated natural gas price projections to be used in Production Cost Modeling would be the EIA's 2023 Annual Energy Outlook Reference Case.*

Electricity Demand Assumptions

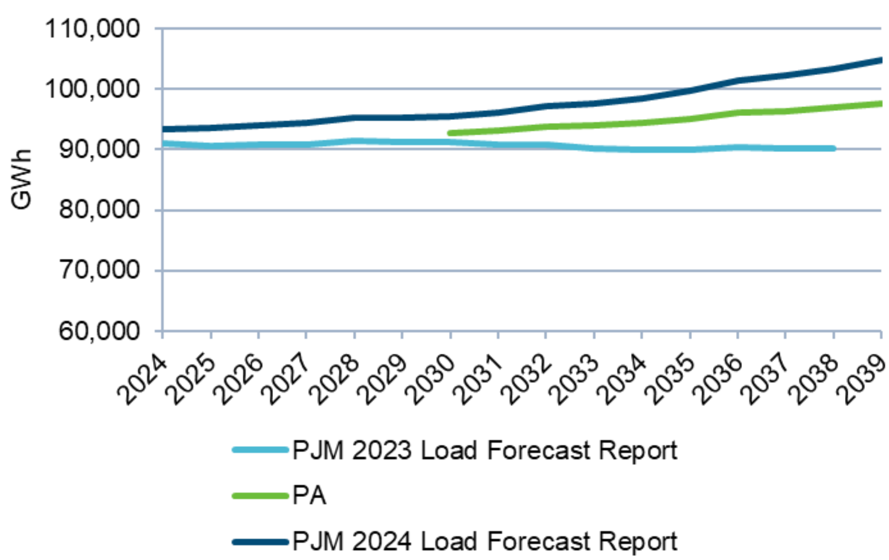
Levitan's Production Cost Modeling Study utilized electricity demand assumptions derived from PJM's 2023 Load Forecast Report. While this was not an unreasonable approach on its face given the timing of IPA's study, it unfortunately results in the use of a demand forecast that is now substantially lower than current forecasts, contributing further to an underestimation of SOO Green's wholesale energy cost impacts.

First, from Levitan's description of their PJM electricity demand assumptions, it is unclear how Levitan arrives at the extrapolated ComEd zone electricity demand forecast shown in Figure 3: Annual Energy Forecast, PJM of their study.[27] Per PJM's 2023 Load Forecast Report, annual energy demand (accounting for the impacts of distributed solar generation, distributed battery storage, and plug-in electric vehicles) in the ComEd zone is projected to remain roughly flat, rising slightly from 2023 (90,558 TWh) to 2028 (91,373 TWh) before declining to 90,253 TWh by 2038. The 5-year, 10-year, and 15-year CAGRs for this demand outlook are 0.0%, -0.1%, and 0.0%, respectively (i.e., flat). However, Figure 3 in Levitan's Production Cost Modeling study shows ComEd zone demand declining at a CAGR of approximately -0.5% from 2038 through 2050[28] It is unclear how Levitan arrived at such a rapid long-term demand decline assumption, which does not align with trends demonstrated in PJM's 2023 Load Forecast Report.

Furthermore, although PJM's 2024 Load Forecast Report had not yet been released at the time Levitan performed their study, it is now available and there are critical changes in the 2024 Load Forecast that should be considered. The 2024 Load Forecast Report includes much more rapid ComEd zone demand growth projections than the 2023 Load Forecast Report. Whereas the 2023 Load Forecast projected roughly flat energy demand in the ComEd zone, the 2024 Load Forecast more appropriately accounts for factors like accelerated growth in electric vehicle charging demand, which are more in line with expected trends given Illinois state policy goals for reducing emissions from transportation. Figure 4 below shows a comparison of ComEd zonal energy demand forecasts from:

- PJM's 2023 Load Forecast Report (which Levitan states they use as the basis for their demand assumptions);
- PA's forecast of SOO Green's energy market impacts (also performed prior to the release of PJM's 2024 Load Forecast Report, but with long-term demand projections much closer to those in PJM's most recent forecast); and
- PJM's 2024 Load Forecast Report.

Figure 4: ComEd Zone Energy Demand Forecast by Source



Differences in zonal electricity demand forecasts can have a significant impact on projected wholesale energy cost savings impacts. Assuming flat or declining zonal electricity demand growth, along with a significant influx

[27] Levitan & Associates, Aurora Production Cost Modeling (Appendix E), January 19, 2024, pages 4-5.
[28] Based on values estimated visually by PA to the nearest 1,000 GWh, as detailed numerical tables were not provided.

of new renewable energy capacity to meet CEJA targets and ~13 TWh of SOO Green's clean energy deliveries would likely result in significant outflows of clean energy from the ComEd zone to other zones in PJM and MISO. While these clean energy exports would still back down emissions from polluting generation elsewhere, the energy price impacts in the ComEd zone specifically (which are realized by Illinois ratepayers), would be more muted. Conversely, assuming stronger electricity demand growth driven primarily by transportation electrification would result in a greater zonal need for energy and fewer exports to other zones, leading to more substantial ComEd zonal energy price reductions with the introduction of SOO Green.

With these considerations in mind, *we recommend that Levitan re-run their Production Cost Modeling study using more up-to-date demand forecast assumptions from the 2024 PJM Load Forecast Report.*

Zonal Transfer Limit Assumptions

It is very difficult to opine on the accuracy of the zonal transfer limit assumptions that Levitan employed in their production cost modeling because the description of their assumptions is highly opaque. However, given Levitan projected similar emissions impacts from SOO Green as PA's production cost modeling, but substantially different wholesale energy price impacts for Illinois ratepayers, PA anticipates that Levitan's assumed zonal transfer limits into and out of the PJM ComEd Zone and MISO Zone 4 are much higher than what is possible in practice. This results in an inappropriate diffusion of the wholesale market benefits (i.e., energy price reductions) to non-Illinois portions of PJM and MISO.

Specifically, Levitan does not state their zonal import and export capacity assumptions for the PJM ComEd Zone and MISO Zone 4 in their report. Rather, Levitan describes their process for developing inter-zonal transmission transfer limits as:

- Using emergency transfer limits sourced from MISO Loss of Load Expectation ("LOLE") Working Group Materials on Seasonal Capacity Import Limits and Capacity Export Limits, as well as PJM Base Residual Auction ("BRA") Planning Parameters;
- Adjusting emergency transfer limits in PJM to reflect PJM day ahead interface flows and limits operating data;
- Relying on default settings provided by Energy Exemplar (the developer of the Aurora production cost modeling tool) in "cases where data are not available or sources conflict"; and
- "[T]he professional judgment of the modeling team".[29]

Unfortunately, this description provides no concrete indication of the magnitudes of inter-zonal transmission transfer limits that Levitan assumed for the PJM ComEd Zone and MISO Zone 4. However, there are elements of the stated approaches that are concerning.

First, PA's professional opinion is that it is inappropriate to rely upon resource adequacy planning parameters (e.g., capacity emergency transfer limit or "CETL") to develop assumptions for average inter-zonal transfer limits, since the assumptions developed for resource adequacy planning reflect limits during emergency conditions that are not necessarily reflective of average system operating conditions.

Second, while PA also utilizes Aurora to conduct production cost modeling, PA performs their own power flow modeling to adjust the default transfer capability settings provided by Energy Exemplar, rather than relying on these settings directly. While PA is unable to share the exact default settings provided by Energy Exemplar due to confidentiality requirements, they have observed instances where default transfer capability settings were non-sensical (e.g., assuming no ability for the PJM ComEd Zone to import power from any neighboring MISO or PJM Zone), and it is unclear whether Levitan adjusted settings to account for such obvious issues.

[29] Levitan & Associates, Aurora Production Cost Modeling (Appendix E), January 19, 2024, page 3.

Additionally, while PA agrees that inter-zonal transfer limits should be informed by actual interface flows, resulting magnitudes can vary substantially depending on how the historical flow data is analyzed. Table 1 below shows statistics on historical exports from PJM to MISO zones that neighbor the PJM ComEd zone over years 2020-2023. The results show the wide range of export flows that take place in practice, with the 50th through 90th percentile flows being substantially lower than the peak flows observed for each zone. If Levitan were to have used a flow limit based on values closer to peak observed exports, it would substantially overestimate the ability for generation to be exported out of the PJM ComEd Zone and into neighboring zones, resulting in inappropriate diffusion of wholesale market impacts outside of the ComEd Zone.

Table 1: 2020-2023 PJM Export Flows to Select MISO Zones[30]

MISO Zone Receiving PJM Exports	Peak Export (MWh)	90th Percentile Export (MWh)[31]	70th Percentile Export (MWh)	50th Percentile Export (MWh)
Alliant East	2,837	1,100	800	625
Alliant West	1,445	780	545	365
Ameren Illinois	5,606	1,996	1,343	954
Indianapolis Power & Light	2,232	774	566	404
MidAmerican Energy Company	2,082	1,319	1,100	939
Northern Indiana Public Service Company	3,373	1,833	1,600	1,432
Wisconsin Electric	2,380	1,493	1,094	855

Due to the lack of clarity on Levitan's inter-zonal transfer limit assumptions and evidence that their approach to developing these assumptions may be problematic, *we recommend that:*

- *In the forthcoming final study, Levitan transparently state their MW inter-zonal transfer capability assumptions for all modeled power market zones in PJM and MISO; and*
- *Confirm that Levitan has consulted with PJM, MISO, and ideally, ComEd, to validate these inter-zonal transfer capability assumptions.*

IPA's Study Underestimates the Public Health Benefits Created by SOO Green's Impact on Localized Pollutant Emissions (PA)

To determine the economic value associated with reduction of emissions from harmful localized pollutants (SO_2, NO_X, $PM_{2.5}$), Levitan's production cost modeling study established $/short ton ranges based on a sample

[30] Source: ABB's Energy Velocity Suite. The select MISO zones reflect those that are in states that are adjacent to the PJM ComEd Zone (i.e., Illinois, Indiana, Iowa, and Wisconsin).
[31] The 90th, 70th, and 50th percentile values reflect the maximum of these percentiles observed for years 2020 through 2023. For example, if the 90th percentile value in year 2020 was higher than the 90th percentile value in individual years 2021, 2022, and 2023, then the displayed value reflects the 90th percentile from year2020.

of academic literature.[32] This approach of relying on single studies rather than an industry-standard modeling tool used across a variety of regulatory processes, or meta-analyses that compile estimates across a variety of academic literature, is problematic. Furthermore, the studies in question are quite dated with publication years ranging from 2016-2019.

A more appropriate approach to determining the full value of avoided localized pollutant emission reductions is using the Environmental Protection Agency's CO-Benefits Risk Assessment (COBRA) tool. Since 2001, the COBRA has provided governments, agencies, planners, and analysts with a credible and accessible way to screen and map estimated changes in air pollution (and the economic value of health impacts associated with such changes) related to clean energy policy, programs, and development. COBRA has become an industry standard assessment tool through its federal agency foundation and reputable data sources for both its emissions and health impact valuations. This includes utilizing the National Emissions Inventory, incorporating scientific research insights from notable research entities (e.g., American Cancer Society, Harvard School of Public Health), and regularly considering literature review findings through the EPA's Integrated Science Assessments, which are developed by the Center for Public Health and Environmental Assessment.

COBRA's industry relevance and effectiveness is demonstrated by its use cases. COBRA has been used by state and federal agencies to assess various climate and energy policy and regulatory developments. It has been included as an analytic tool in significant processes and works such as rule development by New Jersey's Department of Environmental Protection for implementing New Jersey's Environmental Justice Law (2022),[33] Connecticut's Department of Energy and Environmental Protection assessment of adopting California's medium and heavy-duty vehicle emission standards (2022)[34], NYSERDA's New York State Offshore Wind Master Plan (2018),[35] the Massachusetts Department of Public Health's (and collaborators) assessment of regional Climate Action Plan strategies in Western Massachusetts (2017),[36] and the Department of Energy's benefit-cost evaluation of investment in geothermal technologies by (2011).[37]

PA's production cost modeling used COBRA to estimate the public health impacts associated with reductions of emissions of SO_2, NO_X, and $PM_{2.5}$, as well as ammonia (NH3) and volatile organic compounds (VOC). PA estimates the value of these avoided emissions resulting from SOO Green's operation to total $7.18 billion nominal ($4.57 billion in 2022$), relative to Levitan's "low" estimate of $0.47 billion and "high" estimate of $2.67 billion (both in 2022$).

With this in mind, *to align with industry best practice, we recommend that Levitan recalculate the estimated localized pollutant emission reduction benefits associated with SOO Green using EPA's COBRA tool.*

[32] Specifically, Levitan cited the following papers:

- Jaramillo, P. and Muller, N., "Air pollution emissions and damages from energy production in the U.S.: 2002-2011, Energy Policy 90 (2016) pp.202-211.
- Goodkind, A.L. et al, "Fine-scale damage estimates of particulate matter air pollution reveal opportunities for location-specific mitigation of emissions," PNAS, April 30, 2019, vol. 116, no. 18, 8775-8780, www.pnas.org/cgi/doi/10.1073/pnas.1816102116.
- Holland, S.P.; Mansur, E.T.; Muller, N.; Yates, A.J.; Decompositions and Policy Consequences of an Extraordinary Decline in Air Pollution from Electricity Generation, NBER Working Paper 25339, December 2018.

[33] Shawn M. LaTourette, Commissioner, Department of Environmental Protection. Environmental Justice Rules Proposed New Rules: N.J.A.C. 7:1C. June 2022.

[34] Connecticut Department of Energy and Environmental Protection. "An Assessment of Connecticut's Need to Adopt California's Medium and Heavy-Duty Vehicle Emissions Standards." March 2022.

[35] New York State Energy Research & Development. "New York State Offshore Wind Master Plan, Charting a Course to 2,400 Megawatts of Offshore Wind Energy." January 2018.

[36] Massachusetts Department of Public Health, Bureau of Environmental Health, and Bureau of Community Health and Prevention. "Assessing the Health Impacts and Benefits of Regional Climate Action Plan Strategies in Western Massachusetts." March 2017.

[37] US Department of Energy. "Retrospective Benefit–Cost Evaluation of U.S. DOE Geothermal Technologies R&D Program Investments: Impacts of a Cluster of Energy Technologies." December 2011.

IPA's Study Uses Outdated and Overly Conservative Estimates of the Value of CO_2 Emission Reductions (PA)

The Levitan Production Cost Modeling study uses a range of Social Cost of Carbon (SC-CO_2) values to calculate benefits associated with SOO Green's CO_2 emission reduction impact. The study used two values: $15.50/ton developed in 2016 by the Interagency Working Group (IWG), and $152/ton developed by the EPA in 2023 using a 2.5% discount rate.[38] The Levitan study states that they used the 2023 value as the "as the upper end of the range of social cost of carbon values for the calculation of displaced CO_2 emissions benefits."[39]

The 2016 IWG SC-CO_2 value that Levitan uses as the low end of the CO_2 emission reduction benefit range is outdated, and the EPA's updated 2023 SC-CO_2 estimates should be considered a more accurate representation of estimated benefits. In November 2023, the EPA published its Report on Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances.[40] This report contains cost estimates that "reflect recent advances in scientific literature on climate change and its economic impacts and incorporate recommendations made by the National Academies of Science, Engineering and Medicine (National Academies 2017)".[41] Furthermore, the report acknowledges that these estimates likely do not include the full impact of climate change in their value: "There are still many categories of climate impacts and associated damages that are only partially – or not at all – reflected in these estimates".[42] Therefore, the 2023 estimates are likely conservative, and should not be considered the upper range of cost benefits.

The EPA study was subject to external peer review and the report published in November 2023 is final. The updated EPA social cost of greenhouse gas estimates (including SC-$CO_{2)}$ are now standard in federal regulatory processes. For example, the EPA's New Source Performance Standards governing methane and other harmful pollutant emissions for oil and natural gas operations, which were finalized in December 2023,[43] explicitly utilized EPA's updated social cost of methane (SC-CH_4) estimates in its Regulatory Impact Analysis. Furthermore, the methane rule's net benefits calculation relies on climate benefits calculated using the 2.0% (rather than 2.5%) discount rate.

Consequently, the 2023 SC-CO_2 estimate is a more accurate and updated value than the 2016 SC-CO_2 estimate, and the Levitan study should only consider the 2023 SC-CO_2 in calculating monetized benefits of CO_2 reduction. Furthermore, per federal standard, the Levitan study should rely on the 2023 SC-CO_2 estimates using a 2.0% (rather than 2.5%) discount rate and account for the growing SC-CO_2 value over time, rather than using a static estimate reflective of value in 2020.

Specifically, to align with updated federal standards, we recommend that Levitan recalculate the estimated CO_2 emission reduction benefits associated with SOO Green using the following SC-CO_2 schedule (interpolating between decade years) published by the EPA:

[38] Both values are reported as in 2022$
[39] Levitan & Associates, Aurora Production Cost Modeling (Appendix E), January 19, 2024, page 40.
[40] Report on Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances, EPA, November 2023. https://www.epa.gov/system/files/documents/2023-12/epa_scghg_2023_report_final.pdf
[41] Id., p. 1
[42] Id., p. 3
[43] https://www.epa.gov/system/files/documents/2023-12/eo12866_oil-and-gas-nsps-eg-climate-review-2060-av16-final-rule-20231130.pdf

Table 2: EPA Estimates of the Social Cost of Carbon (2.0% Discount Rate)[44]

Year	2020 $ per metric ton CO_2
2020	$190
2030	$230
2040	$270
2050	$310
2060	$350
2070	$380
2080	$410

For context, PA's wholesale market modeling of the impact of SOO Green projects a CO_2 emission reduction value of $33.0 billion in 2022$, relative to Levitan's "high" CO_2 value estimate of $22.1 billion. Of the (2022$) $33.0 billion in CO_2 reduction value projected by PA, $5.3 billion results from reduction of CO_2 emissions from generators located in Illinois (ComEd zone of PJM or MISO Zone 4).

IPA's Study Misses Several Categories of Benefits That SOO Green Will Bring to EJ Communities

Project and Workforce Corridor in Illinois (SOO Green)

With regard to EJ benefits that SOO Green would bring to Illinois, the Draft IPA Policy Study states the following:

- "The draft legislation for the proposed SOO Green HVDC transmission line will not have a direct impact on environmental justice communities in Illinois."
- "There are no environmental justice communities along the route or located in Plano."
- "There are indirect ways a project can impact environmental justice communities beyond a direct impact on the built environment. By creating employment opportunities for residents of nearby environmental justice communities, a project could stimulate the local economy and provide opportunities for community investments to help address the historical negative impacts of pollution."[45]

However, the EJ communities in the Draft IPA Study are defined solely based on the Environmental Justice Communities map46 prepared by IL Solar for All (ILSFA),[47] a state program that brings the benefits of solar energy to income-eligible households, nonprofit organizations, and public facilities. This EJ community map is based on a specific definition of communities impacted by legacy pollution from energy generation. In addition to the ILSFA tool, SOO Green used the Federal Climate and Environmental Justice Screening Tool

[44] Report on Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances, EPA, November 2023, page 4. https://www.epa.gov/system/files/documents/2023-12/epa_scghg_2023_report_final.pdf
[45] Illinois Power Agency, 2024 Policy Study – Draft for Public Comment, January 22, 2024, page 170.
[46] https://elevate.maps.arcgis.com/apps/webappviewer/index.html?id=d87a45c18a5c4e0fa96c1f03b6187267
[47] https://ipa.illinois.gov/content/dam/soi/en/web/ipa/documents/10-17-22-ipa-il-solar-for-all-factsheet.pdf

(CEJST)[48] to identify disadvantaged communities (DACs) where EJ can be addressed by the project. The federal CEJST tool has identified three DAC census tracts within the project corridor in Savanna and DeKalb.

Additionally, beyond the project corridor, SOO Green worked with the Illinois Department of Commerce and Economic Development (DCEO) to identify the workforce corridor for the project in Illinois. These include EJ communities in the following sixteen Illinois counties: Boone, Carroll, DeKalb, Grundy, Jo Daviess, Joliet, Kane, Kendall, LaSalle, Lee, McHenry, Ogle, Stephenson, Wheaton, Whiteside, and Winnebago. Based on the ILSFA classification, EJ communities within SOO Green's workforce corridor include census tracts in Glendale Heights, Joliet, Rockford, Stirling, and West Chicago. Based on the federal CEJST tool, SOO Green has identified 121 additional DAC census tracts (population 450,000) outside the project corridor, but within the workforce corridor. To assist in workforce development and training, SOO Green has engaged and established partnership commitments with economic development agencies and community colleges in EJ communities within the Illinois workforce corridor.

We request that the IPA's discussion of the EJ impacts associated with SOO Green include discussion of the federally identified DACs along the project corridor and EJ communities in the project's workforce corridor identified in collaboration with the Illinois DCEO.

Localized Emission Reductions in Illinois (PA)

In their discussion of the EJ impacts of SOO Green, the IPA makes general note that the project can create indirect benefits for EJ communities. Specifically, the IPA states that:

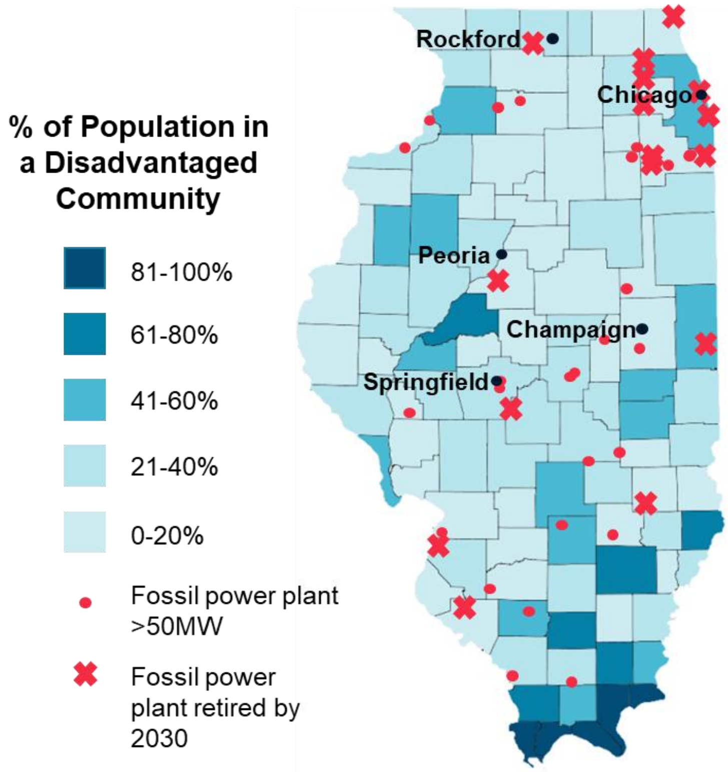
> "[T]here are indirect ways a project can impact environmental justice communities beyond a direct impact on the built environment. By creating employment opportunities for residents of nearby environmental justice communities, a project could stimulate the local economy and provide opportunities for community investments to help address the historical negative impacts of pollution."[49]

While this example of indirect economic benefits is on point, the IPA neglects to address another key source of benefit creation that SOO Green would enable in Illinois EJ communities: the reduction in harmful air pollutants from fossil-fired generating units located in or near these communities. PA's production cost modeling projects that by supplying approximately 13 TWh annually of clean electricity in the ComEd zone, SOO Green would reduce the frequency of dispatch of emitting power plants both in the ComEd zone and in MISO Zone 4 (due to interties between the zones).

Renewable electricity delivered by SOO Green will have a direct and lasting impact by providing replacement for power currently generated by fossil fuel plants slated for retirement under CEJA and currently located in EJ communities. Based on the ILSFA EJ map, many of the fossil fuel plants slated for retirement by 2030 are in the vicinity of EJ communities in the following ten Illinois counties: Cook, DuPage, Lake, Will, and Winnebago (in PJM) and Christian, Jasper, St. Clair, Tazewell, and Vermillion (in MISO). Furthermore, several of the fossil-fired power plants that would dispatch less frequently after 2030 due to SOO Green's clean electricity delivery are located in counties that host significant populations living in census tracts identified as disadvantaged communities (DAC). Figure 5 shows a map of fossil-fired power plants grouped into those that are expected to retire in 2030, for which SOO Green would help provide replacement power, and those expected to continue operating beyond 2030, which would see emissions reduced as a result of SOO Green's deliveries. These plants are mapped relative to Illinois counties represented by share of the population living in identified DACs.

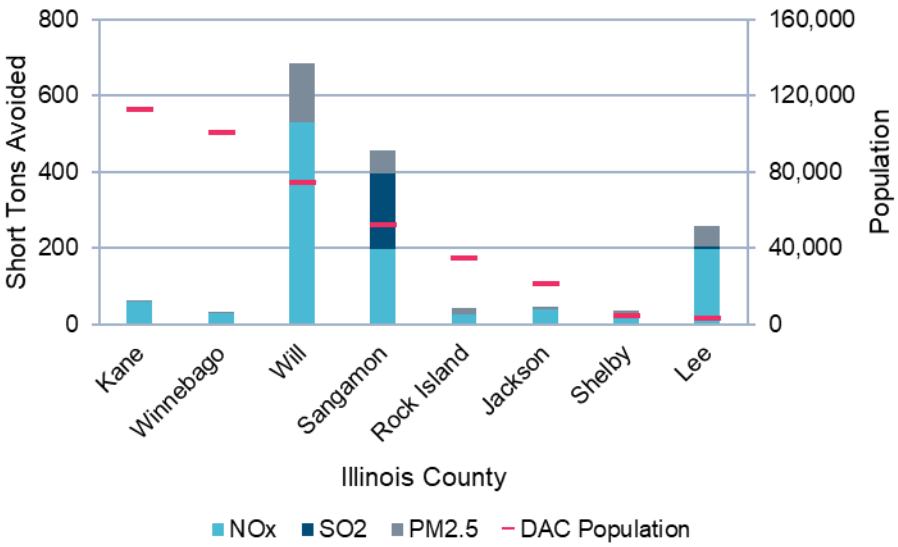
[48] https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5
[49] Illinois Power Agency, 2024 Policy Study – Draft for Public Comment, January 22, 2024, page 170.

Figure 5: Illinois Coal and Natural Gas-Fired Power Plants and Disadvantaged Communities



Additionally, Figure 6 below shows fossil-fired generator emission reductions (in short tons) for units located in Illinois counties that feature one or more census tracts identified as DACs, alongside the population living in DAC census tracts in each county. Harmful pollutant reduction impacts are particularly noteworthy in Will and Sangamon counties, where PA projects SOO Green would enable the reduction of over 700 tons of NOx, emissions, approximately 200 tons of SO_2 emissions, and over 200 tons of $PM_{2.5}$ emissions in the first 10 years of operation (2030-2039), and where over 125,000 Illinois residents live in census tracts identified as DACs. Furthermore, based on the federal CEJST tool, we have identified 673 additional DAC census tracts (population 2.4 million) in Illinois that are outside the workforce corridor, but within PJM's territory where SOO Green will deliver renewable power.

Figure 6: Generator Emission Reductions and DAC Populations in Illinois Counties (2030-2039)[50]



With this in mind, ***we request that the IPA's discussion of the EJ impacts associated with SOO Green include consideration and quantification of the generator emissions reduced by SOO Green for units located in or near disadvantaged communities.***

Project and Workforce Corridor in Iowa (SOO Green)

The Draft IPA Policy Study also casts doubt on EJ benefits that SOO Green would create in Iowa, stating that:

- "Though the Agency has not conducted an analysis to identify the location of environmental justice communities in Iowa, the route of the HVDC transmission line in Iowa would primarily be underground and in rural areas, thus unlikely to affect communities that are disproportionately impacted by pollution."
- "The proposed locations of the renewable resources providing energy to the SOO Green transmission line would be in rural areas with smaller populations, thus reducing the impact on environmental justice communities."[51]

While much of the project corridor in Iowa is rural, the colocation of the project within transportation rights of way requires it to pass through 24 municipalities, some of which are DACs with legacy pollution. Specifically, DAC census tracts have been identified within the project corridor by Iowa state agencies and the federal CEJST tool in these municipalities: Mason City, Charles City, North Buena Vista, and Dubuque.

While potential generation communities in Iowa are rural, the Iowa Economic Development Authority (IEDA) has identified several DACs within communities in Iowa that SOO Green can source generation from, based on DAC criteria developed by the Iowa Finance Authority (IFA). Using the federal CEJST tool, SOO Green has identified 20 additional DAC census tracts (population 58,000) within the renewable power generation area in Iowa, while outside the project corridor and outside the identified project workforce counties.

[50] PA (emission reduction impacts) and US Climate and Economic Justice Screening Tool (DAC populations).
[51] Illinois Power Agency, 2024 Policy Study – Draft for Public Comment, January 22, 2024, page 170.

We request that the IPA's discussion of the EJ impacts associated with SOO Green include discussion of the federally identified DACs along the project corridor and EJ communities in the project's workforce corridor identified in collaboration with the IEDA and IFA.

Community Investment Fund (SOO Green)

Beyond local economic activity, job creation, and emission reduction benefits, SOO Green has made commitments to the Illinois DCEO and the IEDA to create and leverage a $100 million community benefits fund capitalized by project investors and sponsors, focused on generating value in DACs along the project corridor. Key stakeholders identified from EJ communities and DACs will be surveyed to identify potential high-impact investments that the fund can support, to deliver lasting benefits to the community that can include assistance with long-term community energy planning.

We request that the IPA's discussion of the EJ impacts associated with SOO Green include discussion of SOO Green's commitment to a $100 million community benefits fund.

IPA's Study Mischaracterizes SOO Green's Transmission Interconnection Costs (PA)

IPA's study, informed by a study performed by Entrust Solutions Group (Entrust),[52] reports the potential network upgrade costs resulting from SOO Green's interconnection in PJM at $801.8 million.[53] As IPA correctly notes, "these are only estimates and ultimately actual costs can only be determined by the completion of full interconnection studies by the applicable RTO."[54] However, even the presented estimate of $801.8 million and surrounding description is misleading, and it is more likely that SOO Green's ultimate cost allocation for required network upgrades to accommodate its interconnection will be much lower. In fact, PJM's System Impact Study of the SOO Green project, completed in November 2021, indicated that the network upgrade costs attributable to SOO Green were $163 million.

First, Entrust studies the impacts of SOO Green on the transmission system in isolation, when in reality PJM will study SOO Green's interconnection as part of a large cluster of proposed projects that have applied to PJM's interconnection queue. As part of a large cluster of proposed projects that is studied simultaneously, SOO Green will not be the only proposed resource driving necessary network upgrades to accommodate additional generation. Instead, SOO Green's impact will be combined with the other projects', and costs of necessary network upgrades allocated to projects based on their contribution to violations. This means that, unless SOO Green will be the only project interconnecting on the 345 kV system in the vicinity of the Plano substation in the ComEd zone (which is highly unlikely, given the large volume of new clean energy resources that need to be brought online to meet CEJA targets), it is very likely that other projects will also contribute to exacerbating the constraints identified for SOO Green. In turn, these other projects will also be allocated a portion of the costs associated with the network upgrades to alleviate those constraints.

Under PJM's updated interconnection process, SOO Green will be considered in Transition Cycle (TC) 1. TC 1 includes a large volume of projects other than SOO Green seeking to interconnect in the ComEd Zone (approximately 10.5 GW), of which approximately 6.8 GW are solar, energy storage, and wind projects seeking to interconnect at 345 kV (the same voltage as SOO Green). Of this 6.8 GW of proposed non-SOO Green capacity in TC 1, approximately 1.3 GW is either in close proximity to Plano or located in the Chicago area. Given the volume of additional project capacity that will be studied in the same cluster as SOO Green, it is very likely that these other projects will share a significant portion of identified network upgrade costs.

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[52] Entrust Solutions Group, Analysis of Impact of Policies on the Illinois Transmission System, January 19, 2024.
[53] Illinois Power Agency, 2024 Policy Study – Draft for Public Comment, January 22, 2024, page 177.
[54] *Ibid.*

Additionally, PJM also conducts a regular Regional Transmission Expansion Plan (RTEP) to identify and plan transmission system upgrades to continue to ensure system reliability and improve market efficiency. As a result, the RTEP process may identify upgrades necessary to transmission system components that would have otherwise been affected by SOO Green, meaning the upgrades (or some portion of them) would be conducted by PJM transmission owners and costs allocated to PJM ratepayers whether or not SOO Green would enter service. In this case, SOO Green would not bear the full cost of the required network upgrades identified.

Entrust explicitly notes this uncertainty associated with cost allocation in their study, stating that (italicization added for emphasis):

- “The HVDC project was studied using the latest released PJM AG1 system impact study models. The released AG1 system impact study cases were released in 2019 and do not contain any network upgrades that the AG1 cluster cycle requires to go into service. The AG1 system impact study cases do not contain any PJM Queue projects after cluster cycle AG1 and do not contain RTEP projects after 2019. *Mitigation for constraints observed in the study can possibly be done using network upgrades from other PJM planning studies*.”[55]
- “Some constraints may be mitigated by other projects outside of the interconnection process. The PJM Transmission Expansion Advisory Committee identifies network upgrade projects to resolve baseline reliability criteria violations. *These transmission system enhancements may provide mitigation for constraints seen for SOO Green*.”[56]
- “The SOO Green HVDC project would be considered in the Transition Cycle #1(AE1, AE2, AF1, AF2, & AG1) in the new PJM interconnection process. *Other requests in Transition Cycle #1 may also contribute to the overloads reported, and thus share network upgrade costs with SOO Green*.”[57]

This appears to be the reason that Entrust’s estimate of the network upgrade costs associated with SOO Green are roughly in line with PJM’s initial Feasibility Study of SOO Green (approximately $715 million)[58], but so much higher than the cost allocation estimate prepared in PJM’s initial System Impact Study, which identified network upgrade cost allocation for SOO Green of approximately $163 million. Like the Entrust Study, PJM’s initial Feasibility Study would have considered SOO Green’s impact to the transmission system in isolation, while the System Impact Study would have studied SOO Green as part of a cluster of projects, all of whom would share network upgrade costs to some extent.

Despite Entrust specifically identifying these uncertainties associated with network upgrade cost allocation in their study, IPA’s study is effectively silent on these uncertainties when reporting Entrust’s estimate of $801.8 million in network upgrade costs required to integrate SOO Green. This omission is particularly puzzling given IPA’s explicit discussion of the results of PJM’s initial System Impact Study for SOO Green in another section of their study[59] which showed network upgrade cost allocation estimates that were approximately 80% lower than those reported in the Entrust study.

Therefore, *we recommend that IPA clarify in their study that the network upgrade cost estimate for SOO Green prepared by Entrust is not an estimate of the costs that will be allocated directly to SOO Green, and to include the results of PJM’s initial System Impact Study alongside Entrust’s estimates to demonstrate how the ultimate network upgrade cost allocation to SOO Green may be substantially lower.*

[55] Entrust Solutions Group, Analysis of Impact of Policies on the Illinois Transmission System, January 19, 2024, page 31.
[56] *Ibid.,* page 32.
[57] *Ibid.*
[58] AF1-200 is the queue position of the SOO Green project in the previous PJM interconnection process.
[59] Illinois Power Agency, 2024 Policy Study – Draft for Public Comment, January 22, 2024, page 189.

IPA's Study Makes Misleading Comparisons of Overhead vs Underground Power Line Costs (SOO Green)

The IPA's study also makes a brief but quite specific reference to underground transmission lines being 3-5 times more expensive that overhead lines. As evidence to support this statement, the IPA references a Lane Engineering article which pertains to distribution (not transmission) line projects in its Oregon service territory. We believe that it is misleading to use distribution network examples to support a claim made on a transmission project and that such a comparison is too simplistic and does not take into account the unique site-specific aspects of the SOO Green project:

- The Lane Electric referenced paper only looked at underground Distribution Network projects, which by their nature are more complex (more individual cables, in areas of higher customer concentration, leading to significantly more underground obstructions that have to be dealt with), and because of that generally more expensive than an overhead alternative.
- When it comes to transmission projects, the cost of the Right of Way is usually the determining factor. Overhead projects require multiple cables and a broad, dedicated land area to accommodate cables, towers, and an appropriate safety buffer. Quite often, landowners object strenuously to the siting of such overhead transmission projects, leading to costly and time-consuming legal battles. In the end, millions of dollars are spent over many years and the result is a battle over the use of eminent domain rights to take control of the required land.
- Undergrounding an HVDC system requires fewer wires and a much smaller and simpler right of way requirement. In the case of SOO Green, which will be mostly sited in an existing Railroad Right of Way, the land requirements are de minimis (an area 5 feet across, running inside the Railroad corridor).
- The SOO Green route is very rural and flat for almost its entirety. This makes a simple underground installation inside a pre-existing railroad right of way even simpler. HVDC underground cable installation involves a simple 3-foot-wide trench to a depth of about 5 feet. The cable will be placed inside composite conduit and then direct buried. These simplified construction techniques bring even the capital cost comparisons between overhead and underground transmission much closer to parity.
- In the specific case of transmission running between Iowa and Illinois, when Right of Way costs *and* capital costs are taken into account, overall costs and schedule benefits favor the underground SOO Green solution.

We request that IPA remove the reference to the Lane Electric study of underground distribution lines stating a 3-5X difference in the costs of underground vs overhead. If making statements in the report about cost differences between overhead and underground, IPA should include the total costs including siting and obtaining the required Rights of Way, which are typically much higher for overhead transmission projects.

The Abundance of Wind, Solar, and Storage Development Project Capacity in Iowa Should Be Highlighted (PA and SOO Green)

IPA's study notes that "[p]resently, the renewable sources proposed by SOO Green that connect to the HVDC transmission line and provide energy to Illinois are not yet built. Additionally, the specific locations and attributes of these projects are yet to be identified by the developers."[60] While this is technically true, the statement masks the diverse array of clean energy resource projects currently under active development in Iowa that could partner with SOO Green to supply clean energy deliveries over the line.

MISO's interconnection queue[61] currently has approximately 12 GW of active clean energy projects. This is a strong mix of wind, solar, and battery storage projects that easily exceed SOO Green's proposed supply mix

[60] Illinois Power Agency, 2024 Policy Study – Draft for Public Comment, January 22, 2024, page 168.
[61] https://www.misoenergy.org/planning/resource-utilization/GI_Queue/gi-interactive-queue/, accessed February 6, 2024.

capacity. See Table 3 below, which shows that SOO Green's proposed capacity of any individual resource type does not exceed 50% of the active Iowa project capacity currently in MISO's queue. While over 60% of this capacity is relatively new to the queue (part of the 2022 study cycle), PA's analysis has shown that solar and wind projects from past study cycles[62] have taken approximately 3-3.5 years from entering the queue to executing an Interconnection Agreement (IA). This finding is consistent with analysis performed by the Lawrence Berkeley National Laboratory, which found that from 2018-2022, generation projects that executed IAs in MISO typically took approximately 2.5-3.5 years from submitting an interconnection request to executing an IA.[63] Renewable and storage project construction timelines vary but are typically in the range of 18-24 months (i.e., 1.5 to 2 years).

Even assuming total development timelines towards the high end of the range (approximately 5.5 years), most projects in the 2022 study cycle would enter service by 2027/2028, well before SOO Green's anticipated commercial operation date of 2030. To further underscore the robust market for renewable energy projects in Iowa and the interest that developers there have in supplying Illinois via SOO Green, we also point out that SOO Green has signed Letters of Intent (LOIs) with several well-funded and highly experienced developers of Iowa projects. These projects alone total 3,500 MW of wind and solar generation, all with existing MISO queue positions. SOO Green is in active discussions with others to add additional commitments in line with the target resource mix for the project.

Table 3: MISO Interconnection Queue Development Capacity in Iowa[64]

Iowa Resource Type	Capacity in Queue (MW)	Capacity in SOO Green's Proposed Supply Resource Mix (MW)	Surplus (Shortfall) (MW)	% SOO Green
Wind	6,014	2,650	3,364	44%
Solar	3,731	1,850	1,881	50%
Battery Storage	2,275	650	1,625	29%

With this in mind, *we respectfully request that the IPA highlight the robust volume of wind, solar, and energy storage development projects that are currently active in Iowa that could partner with SOO Green to supply clean energy deliveries over the line, rather than focusing only on the lack of named supply resources.*

IPA's Study Makes Confusing, Inappropriate, and Incomplete Comparisons Between SOO Green and Grain Belt Express (SOO Green)

SOO Green noted the repeated direct comparison between the SOO Green underground transmission line and the Grain Belt Express overhead transmission line. While we understand the need to benchmark SOO Green against industry standards and support doing so using an appropriate group of peer projects, the inclusion of and repeated comparison to this specific project implies that the two lines are in direct competition in a zero-sum environment. In reality, not only are the lines not in competition, but in order to meet CEJA goals

[62] Specifically, cycles 2016, 2017, and 2018.
[63] Rand, J., *et al.* Lawrence Berkeley National Laboratory. Queued Up: Characteristics of Power Plants Seeking Transmission Interconnection As of the End of 2022. April 2023. https://emp.lbl.gov/sites/default/files/queued_up_2022_04-06-2023.pdf
[64] Note that 735 MW of capacity are listed as "hybrid" solar/battery fuel type projects. These projects are assumed to have 735 MW each of solar and battery storage.

in 2030 (fossil generation retirements and RECs for 40% of usage), 2035 (additional fossil generation retirements), 2040 (RECs for 50% of usage), and 2050 (goal of 100% clean energy), the State of Illinois needs many utility scale projects, including both projects in addition to widespread investment in in-state and adjacent state renewable generation.

Grain Belt is mentioned 23 times in the analysis of SOO Green—the only portion of the IPA study with a direct project comparison. This creates the impression that the two projects are mutually exclusive or that Illinois ratepayers would not benefit if both were built. SOO Green does not believe a comparison is necessary because both can be independently cost-beneficial, and the cost-effectiveness of one does not impact the cost-effectiveness of the other. However, if a comparison were offered, the advantages related to cost and project risk mitigation should have been raised, including:

- SOO Green has full control of the right of way and is "shovel ready" from a real estate standpoint;
- SOO Green does not require the use of eminent domain in Illinois;
- The underground line travels in existing rights of way and therefore does not impact the usefulness of farmland;
- SOO Green is not defined as a public utility;
- SOO Green includes a convertor station in Illinois; and
- SOO Green's point of interconnection in the PJM ComEd Zone would be in close proximity to the Chicago metro area, the largest population and load center in Illinois.

While a comparison is not necessary, if the IPA ultimately decides to include a comparison the comparison should fully describe and analyze the comparative advantages of SOO Green.

We respectfully request that the IPA modify the report in one of two ways: 1) all specific references to Grain Belt are removed and we are compared with general industry standards, or 2) The IPA includes a full analysis of Grain Belt that includes full treatment of SOO Green's comparative advantages as well. We further respectfully request that the IPA modify the report to make explicitly clear that the projects are not mutually exclusive and should be each evaluated on their own merits.