COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

ELECTRONIC APPLICATION OF KENTUCKY POWER COMPANY FOR (1) A GENERAL ADJUSTMENT OF ITS RATES FOR ELECTRIC SERVICE; (2) APPROVAL OF TARIFFS AND RIDERS; (3) APPROVAL OF ACCOUNTING PRACTICES TO ESTABLISH REGULATORY ASSETS AND LIABILITIES; (4) A SECURITIZATION FINANCING ORDER; AND (5) ALL OTHER REQUIRED APPROVALS AND RELIEF	))))))))	**CASE NO. 2023-00159**

TESTIMONY OF ANDY MCDONALD

ON BEHALF OF JOINT INTERVENORS MOUNTAIN ASSOCIATION, APPALACHIAN CITIZENS' LAW CENTER, KENTUCKIANS FOR THE COMMONWEALTH, AND KENTUCKY SOLAR ENERGY SOCIETY

October 2, 2023

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I. INTRODUCTIONS & QUALIFICATIONS

Q. Please state for the record your name and business address.

A. My name is Andrew McDonald. My business address is 316 Wapping St., Suite 204, Frankfort, KY 40601.

Q. By whom are you employed and in what position?

A. I am employed by Apogee – Climate & Energy Transitions, a program of Earth Tools Inc.

Q. On whose behalf are you testifying in this proceeding?

A. I am testifying on behalf of Mountain Association ("MA"), Appalachian Citizens' Law Center ("ACLC"), Kentuckians for the Commonwealth ("KFTC"), and Kentucky Solar Energy Society ("KYSES") (collectively, "Joint Intervenors").

Q. Are you a member of any of the organizations you are testifying on behalf of here?

A. Yes, I am a member of KYSES, and I currently serve on KYSES's Board of Directors. I am also a member of KFTC.

Q. Please describe your professional background.

A. I have been working to address climate change and sustainability for thirty years. My experience spans solar energy system design and installation; green building and energy efficiency; state and local energy policy; and community outreach and education. I have written technical and public-education documents on energy issues, including co-authoring the Kentucky Solar Energy Guide in 2004 with Joshua Bills. For twenty years I have been actively involved in efforts to establish, expand, and defend net metering in Kentucky. I have participated in multiple utility rate cases and Integrated Resource

Planning processes as a concerned citizen, intervenor, and expert witness.

I was the Director of the Kentucky Solar Partnership for Appalachia-Science in the Public Interest from 2004 to 2012. In 2013, I joined Earth Tools, where I established our Sustainable Systems Program, and in 2020, founded Apogee-Climate & Energy Transitions.

I am a Certified Energy Manager and I hold an M.Sc. in Sustainable Systems from Slippery Rock University of Pennsylvania and a B.A. in Philosophy from the University of Buffalo. I am attaching my resume as Exhibit AM-1.

Q. Have you previously filed expert testimony in other proceedings before this Commission or before other regulatory commissions?

A. Yes. I have provided expert testimony before the Kentucky Public Service Commission in Case Nos. 2022-0402 and 2020-00174. In Case No. 2013-00287, I submitted testimony that the Commission construed as a public comment.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is as follows:

1. To make recommendations concerning Kentucky Power Company's (Kentucky Power" or "Company") Solar Gardens proposal. These recommendations are as follows:

   a. Include evaluation of the use of Power Purchase Agreements ("PPAs") as an alternative to Company ownership of the Solar Garden facilities.

   b. Include battery storage in at least one of the Solar Garden locations to provide enhanced resiliency, grid services, and additional experience with solar plus storage systems.

c. Consider the locational benefits for the distribution grid, including community resilience, when selecting locations for the Solar Garden facilities.

d. Expand the 25 MW limit for the program if the projects are found to be economical.

2. To discuss the ways distributed energy resources ("DERs"), especially customer-sited solar energy and battery storage systems, are a valuable resource that Kentucky Power should leverage as an asset for reducing costs, improving reliability and resilience, and mitigating the impacts of the proposed rate increases on the Company's customers.

II. SOLAR GARDENS PROGRAM

Q. Can you briefly summarize the Company's Distributed Solar Proposal ("Solar Gardens Program")?

A. Kentucky Power proposes to build one or more distributed solar photovoltaic ("PV") systems on their distribution grid to serve their general customer load. [1] The individual facilities, which they call Solar Gardens, would be no more than 10 MW in capacity and the aggregate capacity of all solar sites would not exceed 25 MW. These facilities would reduce the Company's load with PJM and reduce the Company's costs for energy,

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[1] Direct Testimony of Alex E. Vaughan, *Electronic Application of Kentucky Power Company For (1) A General Adjustment of Its Rates for Electric Service; (2) Approval of Tariffs and Riders; (3) Approval of Accounting Practices to Establish Regulatory Assets and Liabilities; (4) A Securitization Financing Order; and (5) All Other Required Approvals and Relief*, Case No. 2023-00159, at 27 (June 29, 2023) ("Vaughan Direct").

ancillary services, and transmission and generation capacity.[2] By being located on the distribution system and not supplying power into PJM's transmission system, the projects would bypass the PJM interconnection queue, which has been plagued by delays and a backlog of generation projects awaiting approval. By keeping projects under 10 MW and not selling power onto the wholesale market, the Company may also avoid the need for permitting by the Kentucky Electric Generation and Transmission Siting Board, another step that should reduce project cost, development time, and execution risk.[3]

An additional feature of the Solar Gardens Program is a Low-Income Benefit option in which the Company proposes to provide 50 percent of the energy benefits from the Solar Garden facilities to low-income customers who participate in the Federal Low Income Home Energy Assistance Program. The Company estimates this would amount to approximately $66 per customer annually, for a group of about 11,500 customers.

Q. What is your overall assessment of the proposed Solar Gardens Program?

A. Kentucky Power's Solar Gardens proposal represents an important step towards integrating more DERs into the Company's system, and on the whole I believe it offers significant benefits for the Company's customers. The Program provides a specific example of some of the benefits that DERs can provide. In the following section I offer several recommendations for improving the proposal and increasing the value it offers for customers.

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[2] *Id.* at 29–32.

[3] Kentucky State Board on Electric Generation and Transmission Siting, *Kentucky's Electric Generation and Transmission Siting Process For Merchant Facilities; A Guide to Public Participation*, at 2, https://psc.ky.gov/agencies/psc/siting_board/guide.pdf (last visited Oct. 1, 2023).

As mentioned above and as stated by the Company, these "solar facilities will reduce the Company's wholesale load that it purchases from PJM each hour that the solar facilities are producing solar power and injecting it into the Company's distribution system. Because of this, the Company will realize energy, ancillary service, and capacity benefits related to both its generation and transmission obligations in PJM."[4] I encourage the Companies to continue along this path and take advantage of the many benefits that distributed resources offer, including customer-owned and -sited resources. The benefits offered by the proposed Company-owned Solar Garden are also available from customer-owned resources, but the latter are available at no cost to the Company because the customer provides for the capital, financing, operations, and maintenance costs.

Q. What recommendations do you have for improving the Solar Gardens Proposal?

A. **1. Include evaluation of Power Purchase Agreements as an alternative to Company ownership of the Solar Garden facilities.** A solar PPA may offer a substantially lower cost for the Company and ratepayers. In the example project provided by the Companies in response to a Commission staff data request, the total Cost of Service used in the model[5] was very high relative to current solar PPA prices. The Levelized Cost of Energy ("LCOE") over 25 years for the Company-owned project was $0.109/kWh,[6] while solar PPAs in the PJM region were around $0.065/kWh as of Q2-2023, according to the Level Ten Energy PPA Price Index.[7] The Level Ten report

[4] Vaughan Direct at 31:3–7.
[5] Response of Kentucky Power Company to Commission Staff's Supplemental Request for Information, Case No. 2023-00159, Question 1 (Aug. 28, 2023) ("KPCo Response Staff Q2.1"), Attach. 20.
[6] Exhibit AM-2.
[7] Level Ten Energy, *Q2 2023 PPA Price Index Executive Summary, North America*, at 10 (2023), https://go.leveltenenergy.com/l/816793/2023-07-

indicates solar PPA prices may be trending downward again, after peaking in Q1-2023.[8] While the Solar Garden proposal indicated a significant net benefit even with the higher cost of service, much greater savings may be possible for customers if a solar PPA option is considered.

2. Include battery storage in at least one of the Solar Garden locations to provide enhanced resiliency, grid services, and additional experience with solar plus storage systems.

3. When selecting locations for the Solar Garden facilities, consider the locational benefits for the distribution grid. Identify locations with needs that could be addressed by solar (or solar plus storage). For example, identify communities that suffer frequent power outages to provide a community micro-grid; or choose a location that provides critical community services, such as a hospital, water treatment plant, or emergency shelter.

4. Expand the 25 MW limit of the program if the projects are found to be economical. Based on the analysis of the sample Solar Garden project provided by the Company, these projects are expected to provide substantial economic benefits.[9] The Company should leverage these projects to provide as many benefits for its customers and communities as possible.

I recommend that the Commission support Kentucky Power's Solar Garden proposal with the modifications that I have described above.

17/37bhhy/816793/1689639546mVH9ljkc/2023Q2_NA_ExecutiveSummary_PPAPriceIndex.pdf; *Id*. at 2 ("Each quarter, the LevelTen Energy PPA Price Index reports the prices that wind and solar project developers have offered for power purchase agreements (PPAs) on the Level Ten Energy Marketplace, the world's largest collection of PPA pricing offers.").

[8] *Id.* at 10.

[9] KPCo Response to Staff Supplemental Q2.1, Attach. 20.

III. LEVERAGING DISTRIBUTED ENERGY REOURCES TO REDUCE COSTS AND IMPROVE SERVICES FOR CUSTOMERS

Q. Do distributed energy resources represent a valuable asset that Kentucky Power can leverage to improve the affordability, reliability, and resilience of electrical service for their customers?

A. Yes. DERs are a valuable resource that can and should play an increasingly significant role in meeting the Company's customers' needs for more affordable, reliable, and resilient electrical service. The Company's Solar Garden proposal acknowledges this value, and yet the opportunities offered by DERs extend beyond the 25 MW of solar that the Company has proposed. As my testimony will show, leveraging the value of DERs will help to ensure the Company's rates are fair, just, and reasonable, and directly supports the Company's four objectives as identified in its 2022 Integrated Resource Plan:[10]

1. Customer affordability
2. Rate stability
3. Maintaining reliability
4. Local impact & sustainability

Q. Can you discuss more specifically what other benefits distributed energy resources offer to Kentucky Power and its customers?

A. DERs can help to serve crucial Company needs:

[10] Case No. 2023-00092, *Kentucky Power 2022 Integrated Resource Plan, Volume A – Public Version*, at 22 (Ky. PSC Mar. 20, 2023) ("KPCo 2022 IRP-Vol. A").

(a) **Supplying capacity requirements**. Customer-owned solar can serve as a capacity resource just as the proposed Company-owned Solar Garden would. Other examples of DERs that offer capacity value are battery energy storage and demand response resources such as controllable thermostats, water heaters, and electric vehicle chargers.

(b) **Reducing fuel price volatility**. DERs reduce the Company's reliance on fossil fuel generation, thereby reducing customer exposure to fuel price volatility.

(c) **Improving reliability of the distribution grid.** DERs can support the distribution grid and improve its resilience and reliability, at lower costs to ratepayers. For example, by reducing loads on transformers, DERs can extend the life of existing transformers and defer maintenance and replacement costs.[11] Batteries can provide voltage and frequency support, improving the reliability of distribution circuits.[12]

(d) **Increasing Resilience**. DERs can provide critical support to customer and community resilience. The need for greater resilience is especially important for Kentucky Power's customers, due to the region's specific geography, its vulnerability to natural disasters, and the economic hardship facing the region.

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[11] Natalie Mims Frick et al., *Locational Value of Distributed Energy Resources*, Lawrence Berkeley National Laboratory, at 14–15 (Feb. 2021), https://eta-publications.lbl.gov/sites/default/files/lbnl_locational_value_der_2021_02_08.pdf.

[12] *See* Stratagen, *Pennsylvania Energy Storage Assessment: Status, Barriers, and Opportunities*, at 23 (Apr. 2021) ("Pennsylvania Energy Storage Assessment"), https://files.dep.state.pa.us/Energy/Office%20of%20Energy%20and%20Technology/OETDPortalFiles/EnergyAssurance/Strategen_PA_Energy_Storage_Assessment_April_2021.pdf

Kentucky Power has an extensive network of distribution wires through mountainous and forested terrain, and as described in the Company's testimony, falling trees are the greatest source of power outages on their system.[13] Customer-sited solar plus storage systems can enable customers to ride through grid-outages without losing power. These DERs can be deployed to provide individual customer resilience; at community centers that provide resilience for the community; and in microgrids that enable multiple customers to share power when the grid is down.

(e) **Overcoming barriers to deployment of new resources.** DERs are deployed in small increments, but those small units can be deployed relatively quickly, often circumventing barriers that face larger centralized generation projects. PJM's interconnection queue, for example, has become a bottleneck, preventing gigawatts of wind and solar from coming online while projects wait for a backlog of applications to be processed and approved by PJM.[14] The Company's Solar Garden proposal would effectively skirt this problem by building the solar facilities on the Company's own distribution system, to serve local loads, avoiding the use of the PJM transmission system. While many utility-scale projects in PJM have been waiting years for approval,

[13] Direct Testimony of Everett G. Phillips, *Electronic Application of Kentucky Power Company For (1) A General Adjustment of Its Rates for Electric Service; (2) Approval of Tariffs and Riders; (3) Approval of Accounting Practices to Establish Regulatory Assets and Liabilities; (4) A Securitization Financing Order; and (5) All Other Required Approvals and Relief*, Case No. 2023-00159, at 14–18 (June 29, 2023) ("Phillips Direct").
[14] *See* Ethan Howland, *FERC approves PJM's 'first-ready, first-served' interconnection reform plan, steps to clear backlog,* Utility Dive (Dec. 1, 2022), https://www.utilitydive.com/news/ferc-pjm-interconnection-reform-plan-queue/637717/.

smaller distribution-level projects can have a much easier and faster path for development. Although DERs are developed in relatively small units, their combined impact can add up to a major resource for the grid.

Q. What are specific examples of how DERs can support reliability and resilience?

A. Customer resilience can be improved, for example, by Demand-Side Management ("DSM") programs that provide home weatherization and insulation upgrades. The loss of power in the winter is less critical in a well-insulated home, as the indoor temperature will drop more slowly. Likewise in the summer, outages during heatwaves are less dangerous for residents of well-insulated homes that can better withstand high outdoor temperatures.

By giving attention to the locational value of DERs, whether owned by the Company or Customer, Kentucky Power can achieve needed improvements at specific locations on the distribution grid. For example, the utility San Diego Gas & Electric ("SDG&E") has deployed a mix of DERs to form a Virtual Power Plant ("VPP") in Shelter Valley, California, a remote rural community 90 minutes from San Diego. With a combination of battery storage, rooftop solar, smart thermostats, and controllable water heaters, SDG&E uses the VPP to support the grid during times of peak demand.[15]

The utility Green Mountain Power ("GMP") in Vermont is developing Resiliency Zones to provide secure power using battery storage, and in some cases renewable power, when the wider grid is down.[16] In Rutland, Vermont, GMP uses a 2.5 MW solar array

[15] *SDG&E Pioneers Virtual Power Plant to Help Ease Strain on the Power Grid During Extreme Heat*, SDG&E News Release (Aug. 28, 2023), https://www.sdgenews.com/article/sdge-pioneers-virtual-power-plant-help-ease-strain-power-grid-during-extreme-heat.
[16] *See* Green Mountain Power, *GMP Resiliency Zones* (Sept. 29, 2022) ("GMP Resiliency Zones"),

and 4 MW/3.4 MWh battery to serve as a microgrid and emergency shelter at the local high school. The project has reduced the utility's operating costs while providing emergency back-up power to the community.[17] GMP presently plans to add about three new Resiliency Zones each year.[18]

As these examples illustrate, battery storage systems can provide back-up power to homes and critical community facilities, like nursing homes and schools. Adding solar to a battery storage system provides an even greater level of resilience, as the solar power can be used directly and for re-charging the battery, extending the availability of back up power.[19]

The deployment of customer-sited solar plus storage systems could play a critical role in improving the resilience of the communities and customers that Kentucky Power serves, while reducing costs. This exemplifies the opportunity Kentucky Power has to leverage the financial benefits offered by DERs to fundamentally improve the services provided to the Company's customers.

https://greenmountainpower.com/news/gmp-resiliency-zones/#:~:text=Our%20Resiliency%20Zones%20provide%20backup,types%20of%20weather%20and%20storms.

[17] Todd Olinsky-Paul, *Resilient Power Project Case Study: Stafford Hill Solar Farm and Microgrid*, Clean Energy Group, at 6 (Jan. 2019), https://www.cesa.org/wp-content/uploads/Stafford-Hill-Case-Study.pdf.

[18] *GMP Resiliency Zones.*

[19] Cybersecurity and Infrastructure Security Agency, *Resilient Power Best Practices for Critical Facilities and Sites with Guidelines*, *Analysis, Background Material, and References*, at 95 (Nov. 2022), https://www.cisa.gov/sites/default/files/2023-01/CISA%20Resilient%20Power%20Best%20Practices%20for%20Critical%20Facilities%20and%20Sites.pdf.

Q. What is the potential growth of distributed solar generation in Kentucky Power Company's territory?

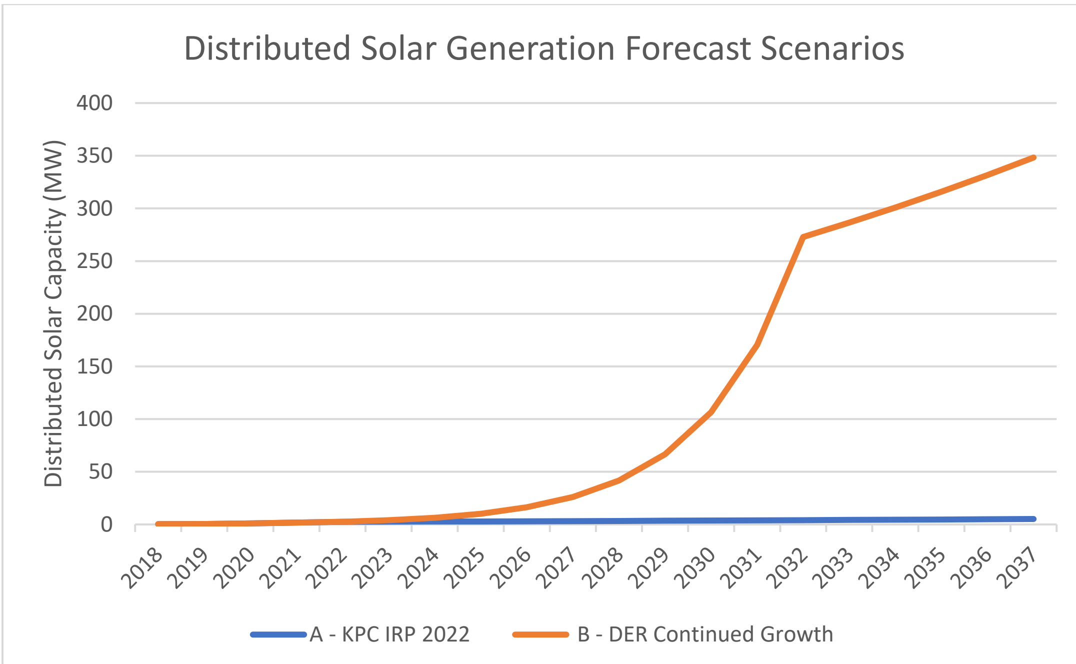
A. Distributed solar generation currently represents a very small portion of Kentucky Power's power supply. As of December 2022, Kentucky Power had 184 net metering customers totaling 2.5 MW (megawatts) of installed capacity.[20] This represents only 0.18% of the Company's annual peak demand (1359 MW, which occurred in December 2022).[21] The Company's 2022 IRP presented a forecast of future net metering customer growth that projected net metering capacity would reach 3.7 MW by 2030, following an annual growth rate of 5%.

A review of Kentucky Power's historic net metering customer data dating back to 2018, however, shows that actual growth rates averaged 90% per year from 2018 to 2022, and 60% per year from 2020 to 2022. Kentucky Power offers no explanation in their IRP as to why they expect customer adoption of solar to dramatically slow over the next 15 years. If net metering's recent growth trend were to continue for the rest of the decade, we would see net metering capacity increasing dramatically to 107 MW by 2030, representing 7.8% of Kentucky Power's maximum peak demand.[22] Figure 1 illustrates these two scenarios of future distributed solar growth on Kentucky Power's system. "Scenario A" is based on Kentucky Power's 2022 IRP and "Scenario B – DER Continued

[20] U.S. Energy Information Administration, *Electricity: Annual Electric Power Industry Report, Form EIA-861 detailed date files* (data last rel. Aug. 3, 2023), https://www.eia.gov/electricity/data/eia861/ (found under the 2022 early release files for net metering); *See* Response of Kentucky Power Company to Joint Intervenors' First Request for Information, Case No. 2023-00159, Question 27 (Aug. 28, 2023) Joint Intervenors requested an up-to-date set of equivalent data from the Company in this case, but the Company refused to provide it.
[21] KPCo 2022 IRP-Vol. A. at 23.
[22] Exhibit AM-3.

Growth," projects the historic annual growth rate of 60% continuing until 2033, when the rate reduces to 5% per year.

Figure 1 – Distributed Solar Generation Forecast Scenarios



Q. Why does the Company assume such limited growth of distributed solar?

A. Kentucky Power's 2022 IRP offers no explanation for its assumption that distributed solar capacity growth would slow to a mere 5% per year. While seemingly arbitrary, this growth rate would have the effect of keeping total net metering capacity below 1% of the Company's annual peak demand. Kentucky statute allows (but does *not* require) utilities to stop offering new net metering service once total net metering capacity reaches 1% of their annual peak load,[23] so it may be that in this forecast the Company was assuming they would impose this limit.

[23] KRS 278.466(1).

Q. Is Kentucky Power Company required by law to stop offering net metering after net metering installed capacity reaches 1% of their previous year's peak load?

A. No. Kentucky's net metering statute, as amended in 2019, allows utilities to stop offering net metering after reaching 1% of their annual peak load, but does *not* require them to stop. KRS 278.466(1) states:

> Each retail electric supplier shall make net metering available to any eligible customer-generator that the supplier currently serves or solicits for service. If the cumulative generating capacity of net metering systems reaches one percent (1%) of a supplier's single hour peak load during a calendar year, the supplier shall have no further obligation to offer net metering to any new customer-generator at any subsequent time.[24]

While utilities are not obligated to offer net metering to new customers beyond 1%, they are not prohibited from doing so. If allowing distributed solar to grow beyond 1% is found to be in their customers' and the Company's best interest, the utility has the opportunity to do so. Indeed, allowing and supporting distributed solar to continue to grow is precisely what Kentucky Power should do, to bring hundreds of MW of low-cost solar power onto their system, at minimal cost to the utility.

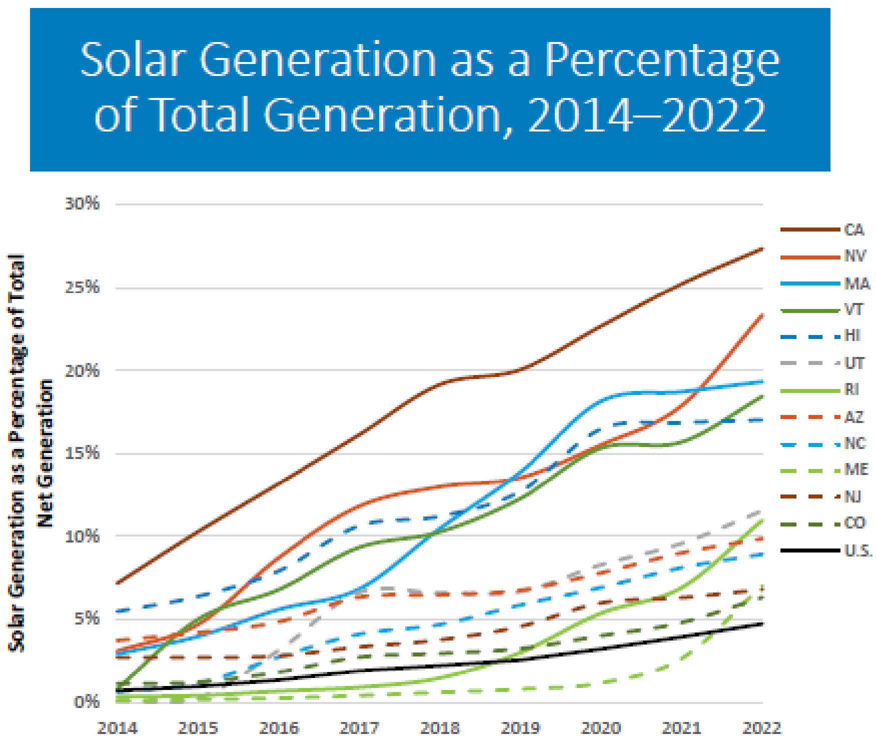
Q. Is a 1% limit on net metering needed to protect the utility grid?

A. No. The 1% threshold was established when Kentucky's net metering law was established in 2003. In the original version of the statute, utilities were given the right to request permission from the PSC to cease offering net metering service after reaching 1% of their annual peak demand. At that time, net metering was still fairly new and the solar PV industry as a whole was in its infancy. The 1% threshold was included as a safety measure while utilities and the electricity industry learned how to incorporate distributed

[24] *Id.*

resources into the grid. Twenty years later, the solar PV industry is established as the fastest growing new energy resource in the world. Extensive real-world experience has demonstrated that grid penetrations of solar much higher than 1% can be handled safely and effectively. Figure 2 shows solar generation as a percentage of total generation in the twelve leading states plus the United States as a whole. Solar generation ranges from 6%–28% among these states and the United States as a whole is at 5%.[25] While this data includes utility-scale and distributed solar, it demonstrates that our utility grids can manage large percentages of variable solar generation.

Figure 2 – Solar Generation as a Percentage of Total Generation, 2014 – 2022



[25] David Feldman et al., *Spring 2023 Solar Industry Update*, National Renewable Energy Laboratory, at 34, 37 (Apr. 27, 2023), https://www.nrel.gov/docs/fy23osti/86215.pdf.

Q. Is a 1% limit on net metering needed to prevent cost-shifting and cross-subsidization of customer-generators?

A. No. One rationale that has been used to justify limits on net metering, such as a 1% system-wide cap on installations, is the alleged need to prevent cross-subsidization between non-customer-generators and net metering customers. Despite the many weaknesses to these claims, this has been a common argument that utilities have made for imposing various limits on net metering.[26] However, the question of cross-subsidization for the Companies has been resolved through the ratemaking process that established the Companies' NMS-II rates.[27]

Following changes to Kentucky's net metering statute in 2019, utilities now have a mechanism for recovering their costs to serve net metering customers through the ratemaking process.[28] The Company now has a net metering structure which provides for the recovery of their costs and ensures no cross-subsidization by non-participating ratepayers. Therefore, allowing net metering to continue to higher capacities beyond 1%

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[26] See Direct Testimony of Andrew McDonald, *Electronic Application of Kentucky Power Company or (1) A General Adjustment of Its Rates for Electric Service; (2) Approval of Tariffs and Riders; (3) Approval of Accounting Practices to Establish Regulatory Assets and Liabilities; (4) Approval of a Certificate of Public Convenience and Necessity; and (5) All Other Required Approvals And Relief*, Case No. 2020-00174, at 5–9 (Oct. 7, 2020), https://psc.ky.gov/pscecf/2020-00174/fitzkrc%40aol.com/10072020080922/Direct_Testimony_of_Andrew_McDonald.pdf; Karl Rabago Public Comments, *Consideration of the Implementation of the Net Metering Act*, Case No. 2019-00256 (Nov. 13, 2019), https://psc.ky.gov/pscscf/2019%20cases/2019-00256//20191113_Karl%20Rabago%20Public%20Comment.pdf.

[27] Order, *Electronic Application of Kentucky Power Company for (1) A General Adjustment of Its Rates for Electric Service; (2) Approval of Tariffs and Riders; (3) Approval of Accounting Practices to Establish Regulatory Assets and Liabilities; (4) Approval of a Certificate of Public Convenience and Necessity; and (5) All Other Required Approvals and Relief*, at 25, Case No. 2020-00174 (May 14, 2021), https://psc.ky.gov/pscscf/2020%20Cases/2020-00174//20210514_PSC_ORDER.pdf.

[28] *See* KRS 278.466(5) (**"**Using the ratemaking process provided by this chapter, each retail electric supplier shall be entitled to implement rates to recover from its eligible customer-generators all costs necessary to serve its eligible customer-generators, including but not limited to fixed and demand-based costs, without regard for the rate structure for customers who are not eligible customer-generators.").

should have no cost-shifting implications. In the future as PV installations increase, if the Company believes that is leading to changing cost impacts, they can apply to the Commission to adjust their net metering rates, using the ratemaking process that produced the Company's current NMS-II rates, consistent with the legacy protections for NMS-II customers with respect to rate structure.

Q. Is distributed solar generation a low-cost resource for the Company?

A. Yes. Like energy efficiency measures that customers install at their own expense, net metered solar energy systems are installed by customers using their own financial resources. Customer-generators are responsible for all capital, operating, and maintenance expenses for these systems throughout their operational life, and bear the risk for these investments, not the utility, nor other ratepayers. This contrasts with supply-side resources that the Company might develop, for which the Company (and ultimately its customers) would be financially responsible, either through ownership (incurring the costs of capital and long-term operations and maintenance) or through long-term power purchase agreements with third-party developers. As the Company's Solar Garden proposal demonstrates, solar resources on the distribution system provide multiple direct financial benefits to the utility, through reduced costs for energy, ancillary services, and transmission and generation capacity from PJM.[29] However, when the customer owns these generation assets, the utility gains the benefit without the costs of ownership, making customer-owned DERs even more valuable than Company-owned resources.

Q. Are there policies the Commission and Kentucky Power could use to support and drive the growth of distributed solar resources?

[29] Vaughan Direct at 31.

A. Yes, if Kentucky Power chooses to approach distributed solar as a valuable resource that should be leveraged for the many benefits it offers, there are several policies they could implement to support its ongoing growth, in addition to (and as improvements upon) the Company's Solar Garden proposal.

Q. What policies would you recommend to support and drive the growth of distributed solar resources?

A. I would recommend that Kentucky Power implement the following policies:

1. Eliminate the 1% limit on net metering as an official Company policy. This would signal to the solar industry and investors that Kentucky Power is supportive of distributed solar's long-term growth in the region and that the utility will not impose arbitrary, unnecessary market barriers.

2. Raise the cap on net metering customer system size from 45 kW up to at least 500 kW.[30]

3. Allow and encourage third-party ownership of distributed solar systems (e.g., solar leases and power purchase agreements) to expand access for residential, commercial, and industrial customers.

4. Allow and encourage Virtual Net Metering to expand access to solar, especially for residents of multi-family housing.

5. Focus on equity and access for low- and moderate-income ("LMI") customers with policies to reduce up-front costs and finance expenses, including on-

[30] KRS 278.465–466 (requiring retail electric suppliers to offer net metering to customers with eligible generators, including solar photovoltaics, up to 45 KW. The statute does not prohibit utilities from offering net metering to customers with generators larger than 45 KW, however.).

bill financing.

6. Collaborate with community partners on education, consumer protection, and workforce development programs.

Q. With respect to your second policy in the list above, why should Kentucky Power make net metering available for PV systems up to 500 kW capacity?

A. Increasing the availability of net metering to systems up to 500 kW would significantly expand the market for distributed solar in Kentucky Power's territory, especially for commercial customers such as public schools, hospitals, grocery stores, and many other businesses. The current 45 kW cap limits net metering to residential and small commercial customers, despite the fact that many commercial customers have loads that could require hundreds of kW of solar. This creates an arbitrary and unnecessary market barrier for a large group of Kentucky Power's non-residential customers. This creates an arbitrary and unnecessary market barrier for a large group of Kentucky Power's non-residential customers.

If larger PV systems up to 500 kW were allowed to participate in net metering, the growth of distributed solar up to 100+ MW by 2030 would be more readily achieved. This would expand the solar market to include many more commercial and institutional roofs, in addition to ground mount structures in locations such as parking lots.

Expanding access to distributed solar will also more effectively leverage federal incentives from the Inflation Reduction Act ("IRA"), which offers bonus tax credits to commercial taxpayers and now makes the solar tax credit available to tax-exempt, non-profit organizations via a "direct pay" mechanism.[31] The economic development value of distributed solar expansion on this scale, coupled with the associated influx of federal resources to the region, would be substantial. Kentucky Power is in a unique position to help its customers tap into these resources, which could help mitigate the effects of the rate increase requested by Kentucky Power in this case and help ensure that the resulting rates are fair, just, and reasonable.

If the Company is open to raising the cap on individual net metering system size, I only recommend doing so if the Company also lifts the 1% cap on total net metering capacity. If the individual cap is raised to 500 kW but the 1% cap remains in effect, the result could limit the availability of net metering to residential and small business customers, if many large commercial and industrial customers choose to invest in net metering and use up much of the available capacity below the 1% cap.

Q. How would third-party ownership support the growth of distributed solar generation and help mitigate the effects of the proposed rate increase?

A. One of the primary barriers to solar adoption is the high up-front cost for installing PV systems. Solar leases and PPAs address this barrier by eliminating the up-front cost to the customer and, instead, enable the customer to gradually pay for the installation over time. "Under a solar lease arrangement, a homeowner enters into a service contract to pay scheduled, pre-determined payments to a solar leasing company, which installs and owns the solar system on the homeowner's property."[32]

[31] The Inflation Reduction Act, (Direct Pay) ("IRA"),H.R. Con. Res. 5376, 117th Cong. (2022) (enacted), https://www.whitehouse.gov/cleanenergy/directpay/ (last accessed Oct. 2, 2023).
[32] Nate Hausman, *A Homeowner's Guide to Solar Financing: Leases, Loans, and PPAs,* at 4, Clean Energy States Alliance, (updated Nov. 2018), https://www.cesa.org/wp-content/uploads/Homeowners-Guide-to-Solar-Financing.pdf.

With a solar PPA, the customer contracts with a developer that installs, owns, and operates the solar system on the customer's property. The customer purchases all the energy produced by the solar array at a specified rate per kWh, potentially lower than the local utilities' kWh rate. Solar leases and PPAs can be structured so that the customer achieves immediate and ongoing savings on their utility bills, with no up-front cost.[33]

Enabling third-party ownership would increase access to distributed solar for commercial, industrial, and institutional customers, such as public schools, universities, churches, government facilities, and other non-profit organizations. In states where solar PPAs are allowed, "[r]etail solar PPAs are often the model of choice for local government solar projects."[34] This would provide the added community benefit of enabling essential community institutions, such as public schools, to reduce their utility costs and stabilize their energy bills for the long-term.

As of 2018, forty percent of residential solar systems in the United States were installed using third-party ownership.[35] However, these financing mechanisms are not generally available in Kentucky due to ambiguities in state regulations and statute. A PSC Staff Opinion (2012-010) was issued in 2012 that addressed issues related to solar leases and power purchase agreements. The Staff Opinion was prepared in response to a request from then-Secretary of the Kentucky Energy and Environment Cabinet, Leonard Peters. The Opinion reviewed several scenarios related to leases and power purchase agreements, identifying circumstances in which leases or PPA's may be permissible under Kentucky

[33] See generally *Id.* at 5.
[34] IREC, *Solar Power Purchase Agreements: A Toolkit for Local Governments*, at 3-1 (Mar. 2015), https://irecusa.org/wp-content/uploads/2021/07/Solar-Power-PPA-Toolkit_FINAL_041015.pdf.
[35] *Id.*

statute. However, the conclusion of the letter states, "This letter represents Commission Staff's interpretation of the law as applied to the facts presented. This Opinion is advisory in nature and not binding upon the Commission should the issues presented herein be formally presented for Commission."[36]

The Staff Opinion 2012-010 suggests that further guidance from the Commission is needed to resolve uncertainties and clearly establish under what circumstances third-party ownership is permissible in Kentucky. Without such guidance, in the form of a declaratory order or in the context of this case, it would be imprudent for a third-party to expend resources developing such a business model. If this could be done, a major barrier to the distributed solar market would be removed. This would not only expand the solar market but would make solar much more accessible to low- and moderate-income customers. At a time when Kentucky Power is proposing dramatic rate increases, on top of rates that are already a major burden on their customers, providing rates that are fair, just, and reasonable must include enabling customers to take actions to control their own utility costs. Allowing third-party ownership of solar energy systems is a key measure the Company could implement to empower customers to control and lower their energy costs.

Q. What is virtual net metering?

A. Virtual net metering is a utility rate structure that allows the credits from a single solar array to be allocated to multiple customers' accounts. For example, in a multi-family apartment building, virtual net metering would allow the solar energy from a rooftop

[36] Kentucky Public Service Commission, Staff Opinion 2012-010, Letter to Hon. Leonard K. Peters, at 9 (May 18, 2012).

array to be credited to individual tenant's accounts, in proportion to their contractual share of the solar array. Each participating tenant would receive credits on their utility bill just as they would in a traditional net metering arrangement. There are variations to how virtual net metering programs can be structured. For example, a program may require participants to live in the building where the solar array is located. Alternately, the utility may allow a solar array to be shared among any mix of its customers regardless of their location, so long as the array is on the utilities' distribution system and all participants are their customers. Virtual net metering can be a powerful means for expanding access to solar to renters and the many people who live in multi-family housing.

Q. How would these policies work together to mitigate the impacts of the proposed rate increase on Kentucky Power's low- and moderate-income populations, while increasing equity and access to solar?

A. Low-income customers face numerous barriers when it comes to accessing the benefits of solar energy. This includes the high up-front cost of installation, lack of access to capital and low-cost financing, low credit ratings, the fact that many low-income customers are renters, and many live in multi-family housing. In a report for the Public Service Commission of Wisconsin, the consulting firm Cadmus identified key policies for expanding the rooftop solar market and increasing access for low-income customers.[37] Those policies included:

Third-party ownership – removes the up-front cost barrier and provides

[37] Jeremy Eckstein et al., *Focus on Energy 2021 Rooftop Solar Potential Study Report*, Cadmus, at 8 (Oct. 4, 2021), https://apps.psc.wi.gov/ERF/ERFview/viewdoc.aspx?docid=421984.

immediate utility bill savings.

Virtual net metering – makes net metering available to tenants in multi-family housing and can be combined with third-party ownership.

Provide incentives for low-income customers to cover up-front costs, as well as home-readiness improvements. Cadmus recommends the use of financial incentives, such as rebates, to assist low-income customers with the up-front cost of solar.[38] Additionally, many low-income homes require energy efficiency investments and structural improvements (e.g., roof repair or replacement) prior to installing solar. Cadmus recommends that solar programs aimed at serving low-income customers should offer incentives for home-readiness improvements, in addition to incentives for solar installation costs.[39]

Q. What role could on-bill financing play in expanding access to and deployment of solar energy systems, while reducing the burden of the proposed rate increases?

A. On-bill financing (i.e., "Pay As You Save" or "Inclusive Utility Investments") programs offer another avenue for making solar more accessible for customers. Through on-bill financing, the up-front cost of the installation is covered by the utility and paid back over time via a charge on the utility bill. Payments can be structured to provide immediate and ongoing utility bill savings for the customer. The charge for the solar investment remains with the meter until it is paid off, rather than with the customer, which makes the program available to renters. If a customer moves away and closes their account, the next resident becomes responsible for paying the solar charge on the bill (and receives the

[38] *Id.* at 52.
[39] *Id.* at 48.

benefit of the solar savings, too).

On-bill financing has been used for energy efficiency improvements by electric utilities in multiple states, including Kentucky, and could readily be expanded to include solar PV. On-bill financing should be of particular interest to Kentucky Power because it provides an opportunity to earn a return on investments from power supplies located on their customers' properties:

> Tariffed on-bill programs treat improvements to the energy performance of homes and buildings as an investment in system reliability and as a development of lower cost distributed energy resources, such as energy efficiency. The utility employs its established authority to make investments and seek cost recovery through tariffs using existing mechanisms for issuing bills and collecting revenue. The investment in energy savings is tied not to an individual customer but to the location until the value of the utility's investment is recovered. A tariffed investment does not add to the debt profile of the location owner the way a bank loan would. A notable benefit of this model is that it can be utilized by renters and LMI customers, especially those with limited credit or low credit scores, because the utility's investment is based on the cost effectiveness of the upgrades and not the socio-economic status of the billpayer at that location. . . . Customers, vendors, and capital providers using the PAYS system have produced an unprecedented rate of resource efficiency investment while also improving options for low cost, local, clean energy resources. PAYS is the most widely used form of tariffed on-bill programs for energy efficiency.[40]

The Company should consider offering an on-bill financing program to increase access to distributed solar and energy efficiency and to offset the impacts of the proposed rate increase on its customers.

[40] Southeast Energy Efficiency Alliance, *Utility Guide to Tariffed On-Bill Programs*, at 3 (Wesley Holmes et al., eds., Feb. 2020), https://www.seealliance.org/wp-content/uploads/SEEA_TOBGuide_FINAL_UPDATED_2020_04_13.pdf.

Q. How can the Companies collaborate with community partners to support the solar market?

A. Based on the experience of the Joint Intervenors, who work in the communities served by Kentucky Power, there is strong interest in distributed solar generation in the region. KPC should leverage this community support and collaborate with partners in the non-profit, private, and public sectors to drive sustained growth in the solar market. Specific areas that the Company and community partners can work on would include public education, consumer protection, permitting and codes, and workforce development.

Q. What benefits could be gained through a robust Distributed Energy Resource strategy supporting customer-sited solar and battery storage systems?

A. Combined solar and storage systems offer enhanced values to the utility and customers. For the customer, a solar plus storage system provides greater resilience and increases the availability of the battery-solar system. During a grid outage, a solar-only system will cease producing power for safety reasons to prevent power from back-feeding the grid, thereby leaving the customer without power (a frustrating reality for many net metering customers). In battery-only systems, the customer will have back-up power but be limited by the storage capacity of the battery. If the outage drags on long enough, eventually a battery can become discharged.

Combining solar plus storage creates a more resilient system—the solar array can recharge the batteries even when the grid is down, providing the customer with a limited but indefinite supply of electricity until the grid is repaired, which can be used to serve critical loads. (That is to say, the solar array and battery will have maximum limits as to how much energy they can supply in a day, but if consumption is kept within those limits, the battery can continue to be recharged by sunlight each day, indefinitely). Furthermore, the presence of the battery allows solar generation to be used on-site when the grid is down, making the solar array more valuable to the customer. Using solar energy directly also preserves stored energy in the battery.

Solar plus storage systems can play a vital role in improving community resilience:

> In communities across the United States, public buildings, such as hospitals, police departments, fire stations, and other facilities, provide critical services that require continued operations during natural disasters or malicious attacks that disable the electric grid. In many areas, schools or other large public buildings serve as emergency shelters for prolonged recovery periods. While onsite diesel generators have historically powered a majority these sites, other DER options can support a microgrid system to provide the dual benefits of both backup power during an emergency and efficient, onsite energy that reduces utility bills year-round.[41]

This resilience potential is an important feature of DERs and battery storage that can provide direct benefits to Kentucky Power's customers in their communities. The ability to provide power at local critical facilities when the larger grid is down can be a life-saving function of these distributed energy systems, such as during natural disasters.

Q. Why is Kentucky a favorable location for Behind the Meter Storage?

A study by the National Renewable Energy Laboratory ("NREL") examined where the best potential markets for behind-the-meter ("BTM") storage might be, based on utility demand charges. According to the study, "high demand charges are often cited as a critical factor in battery project economics,"[42] because the batteries can be used to

[41] U.S. Dep't. of Energy, *How Distributed Energy Resources Can Improve Resilience in Public Buildings: Three Case Studies and a Step by-Step Guide*, at 2 (Sept 2019), https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/How%20DERs%20Can%20Improve%20Resilience%20in%20Public%20Buildings_Three%20Case%20Studies%20and%20a%20Step-By-Step%20Guide_APRIL%20EDIT%20v3.pdf (citations omitted).

[42] Joyce McLaren et al., *Identifying Potential Markets for Behind-the-Meter Battery Energy Storage: A Survey of U.S. Demand Charges*, NREL, at 1 (Aug. 2017), https://www.nrel.gov/docs/fy17osti/68963.pdf.

shave peak loads, reducing customer demand charges. NREL identified demand charges in excess of $15 per kilowatt (kW) as creating especially favorable economics for BTM storage. Their study analyzed demand charges from utilities throughout the United States and noted Kentucky as one of the most favorable locations. Kentucky had the sixth-greatest number of commercial customers (41,000) eligible for rates with demand charges greater than $20/kW.[43] Kentucky Power's Tariff IGS (Industrial General Service) fits within this category, with demand charges ranging from $17.52/kW to $27.32/kW, depending on the type of service.[44] Kentucky Power had 71 customers using Tariff IGS as of March 2023.[45]

While Kentucky Power's Industrial General Service customers would find the greatest peak demand savings from on-site batteries, other commercial customers could find batteries attractive for their resilience value, in addition to their financial value. This includes facilities such as hospitals, nursing homes, public schools, fire departments, police stations, jails, water and wastewater treatment plants, grocery stores, and other food service facilities, where secure power systems that can endure grid outages could provide vital services for their local communities. Unlike conventional diesel or propane generators, which sit idle most of the time, a battery or solar-plus-battery back-up system can be used on a daily basis to reduce demand and energy charges, while also being available to provide back-up power during grid outages.

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[43] *Id.* at 6, Table 3.

[44] Application of Kentucky Power, Section II: Filing Requirements and Exhibits A through R, Vol. 1, Exhibit E, at 61 of 194 (June 29, 2023). The demand charges indicated are as-proposed by the Company.

[45] Response of Kentucky Power Company to Commission Staff's First Request for Information, Case No. 2023-00159, Question 15 (May 31, 2023), Attach. 3.

It is notable that Kentucky Power offers numerous Time-of-Day ("TOD") rates that incentivize customers to shift their loads into off-peak periods. Our review of Company data indicates very little customer participation in these optional TOD rates.[46] Programs that incentivize batteries and other load-shifting technologies offer the Company an opportunity to encourage more customers to use these TOD rates and reduce the Company's peak load expenses.

Table 1 – Customer Participation in TOD Tariffs[47]

Tariff	**Number of Customers as of March 2023**
RS TOD	6
SGS TOD	500 (meeting participation cap)
MGS TOD	142
LGS TOD	7

Q. Do DERs offer any advantages in terms of rate of deployment and execution risk?

A. A significant feature of DERs, including solar and batteries, but also many other technologies, is their ability to be installed in small, modular units, but in large quantities and at a relatively rapid pace compared to large, centralized, utility-scale facilities. Utility-scale solar and batteries will be very important elements of our electricity grid as it develops in the coming years, but as the backlog on the PJM Interconnection queue demonstrates, there are execution risks for these large projects. Permitting, interconnection, and transmission all present potential barriers to large projects. Investing in and supporting DERs provides the utilities with valuable diversity and a hedge against

[46] *Id.*
[47] *Id.*

execution risk for their utility-scale projects.

Q. Can you point to any solar plus storage incentive programs being offered by a utility in the Southeast?

A. Yes. Duke Energy Progress in North Carolina is implementing a solar plus storage pilot program called PowerPair. Duke was ordered by the North Carolina Utilities Commission ("NCUC") to develop a pilot program that would "evaluate the operational impacts to the electric system of behind the meter residential solar plus energy storage."[48] The program aims to support the installation of up to 30,000 kW of solar and 40,500 kWh of battery storage, in the homes of 3,000 residential customers. Duke will provide participating customers with up-front payments to offset the installation costs of the solar and battery equipment. In addition, some customers will receive annual performance payments for allowing the utility to discharge their batteries as needed for peak demand shaving. The PowerPair program was approved by the North Carolina Utilities Commission NCUC in August 2023.[49]

Q. Have customer-sited battery storage programs been found to be cost-effective?

A. Yes. An assessment for the Massachusetts *ConnectedSolutions* program concluded that "(a)mong the supply-side and demand-side measures reviewed in this report, customer-

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[48] Application of Duke Energy Progress LLC for Approval of PowerPair Solar and Battery Installation Pilot Program, *In the Matter of Application of Duke Energy Progress, LLC for Approval of its PowerPairSM Solar and Battery Installation Pilot Program Pursuant to the North Carolina Utilities Commission's March 23, 2023, Order in Docket Nos. E-2, Sub 1287 and E-7, Sub 1261, Docket No. E-2, Sub 1287*, at 1 (NCUC June 21, 2023), https://starw1.ncuc.gov/NCUC/ViewFile.aspx?Id=6a0003ce-3176-4f43-b7c0-3de316a2b542.

[49] Public Staff's Corrected Initial Comments, *In the Matter of Application of Duke Energy Progress, LLC for Approval of its PowerPairSM Solar and Battery Installation Pilot Program Pursuant to the North Carolina Utilities Commission's March 23, 2023, Order in Docket Nos. E-2, Sub 1287 and E-7, Sub 1261, Docket Nos. E-2, Sub 1287, E-2, SUB 927, E-7, SUB 1032, E-7, SUB 1261* (NCUC Aug. 25, 2023), https://starw1.ncuc.gov/NCUC/ViewFile.aspx?Id=8b069fad-cbef-4475-a69d-acbd6ceab344pcglclefindmkaj/.

sited battery storage is by far the lowest priced new winter peaking resource now available to utilities."[50] In an accompanying report, the Applied Economics Clinic ("AEC") reported that the Commercial & Industrial program's planned benefits exceeded costs by a ratio of 4:1.[51] The residential battery program's planned benefits exceeded costs by a 2:1 ratio.[52] As was noted above, GMP in Vermont reports ratepayer savings around $3 million per year from their battery programs.

IV. KENTUCKY POWER COMPANY'S RFP

Q. Do you have any comments concerning the RFP issued by Kentucky Power on September 22, 2023?

A. Yes. I am concerned that a provision in the Solar and Wind RFP will significantly limit the number of applications the Companies will receive for distributed solar and wind resources and thereby undermine the Companies' ability to assess the true availability and cost of distributed solar and wind resources. On p.6 of the RFP it states:

> 3.10.2. Projects must be interconnected to KPCO's distribution electrical system and must have a completed Distribution Impact Study from the KPCO Distribution Planning Group prior to the Proposal Due Date. In addition, the application for the Distribution Impact Study shall have a utility date and time-stamp no later than September 22, 2023.[53]

[50] Joshua R. Castigliego et al., *Energy Storage for Winter Reliability: How Batteries Became the Low-Cost Solution for Power Assurance in Massachusetts*, at 4 Applied Economics Clinic for Clean Energy Group, (Dec. 2021), https://static1.squarespace.com/static/5936d98f6a4963bcd1ed94d3/t/61a922c432b9410b85d074a8/1638474442164/Energy-Storage-for-Winter-Reliability_AEC_2Dec2021.pdf.
[51] Bryndis Woods et al., *ConnectedSolutions: A Program Assessment for Massachusetts, Applied Economics Clinic*, at 18 (Sept. 2021), https://www.cleanegroup.org/wp-content/uploads/ConnectedSolutions-An-Assessment-for-Massachusetts.pdf.
[52] *Id.* at 20.
[53] American Electric Power Service Corporation as agent for Kentucky Power Company, Request for Proposals Power Purchase Agreements (PPAs) from Qualified Bidders for Solar Energy Resources, and / or Wind Energy Resources, at 6 (Sept. 22, 2023) (emphasis omitted), https://www.kentuckypower.com/lib/docs/business/b2b/rfp/ky/KPCO_2023_Wind_Solar_PPA_RFP.pdf.

Requiring bidders to have submitted applications for a Distribution Impact Study by the same date the RFP was issued will greatly restrict the potential pool of proposals. Considering that the RFP seeks projects to come online in January 2027 or January 2028, there should be ample time for distribution-level projects to be developed, even if their application for the Distribution Impact Study had not been received by the date the RFP was issued. This requirement risks biasing the RFP process against distribution-connected projects. In future RFPs I would recommend the Company provide respondents more time to submit this application, to enable a larger number of projects to respond to the RFP.

V. RECOMMENDATIONS

Q. Do you recommend that the Commission approve the proposed Distributed Solar Garden programs proposed by Kentucky Power?

A. With the modifications I explain in the following question, I do recommend the Commission approve the Distributed Solar Garden program as proposed by Kentucky Power.

Q. What recommendations do you have for the Commission regarding the Kentucky Power's DER programs?

A. I recommend the following:

1. Include evaluation of Power Purchase Agreements as an alternative to Company ownership of the Solar Garden facilities.

2. Include battery storage in at least one of the Solar Garden locations to provide enhanced resiliency, grid services, and additional experience with solar plus storage systems.

3. When selecting locations for the Solar Garden facilities, consider the locational benefits for the distribution grid. Identify locations with needs that could be addressed by solar (or solar plus storage).

4. Allow the Solar Garden program to expand beyond 25 MW if the projects are found to be economical.

5. Develop policies and programs to support customer-owned and -sited DERs. Leverage customer investments in DERs to provide greater benefits and reduced costs for all customers. In particular:

a. Allow and encourage net metering to continue beyond the 1% threshold as an official Company policy.

b. Raise the cap on individual net metering systems from 45 kW to 500 kW.

c. Allow third-party ownership of customer-sited solar energy systems.

d. Allow virtual net metering.

e. Develop programs to encourage customer adoption of battery storage systems for reducing peak demand and customer resilience.

Q. Does this conclude your testimony?

A. Yes.

VERIFICATION

The undersigned, Andrew McDonald, being first duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing testimony and that the information contained therein is true and correct to the best of his information, knowledge, and belief, after reasonable inquiry.

[signature]

Subscribed and sworn to before me by 29 this Sep. day of 2023, 2023.

Alyson Martin

[signature]
Notary Public KYNP78274

ALYSON MARTIN NOTARY PUBLIC STATE AT LARGE KENTUCKY

My commission expires: Aug. 24 2027

Exhibit AM-1

ANDREW SCOTT MCDONALD, CEM, M.SC.

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Frankfort, KY 40601 andyboeke@yahoo.com

EDUCATION & CERTIFICATIONS

- **Certified Energy Manager, Association of Energy Engineers, 2020, #26142.**
- **Slippery Rock University of Pennsylvania, 2003, *M.S. in Sustainable Systems.***
- **State University of New York at Buffalo, 1992**. ***B.A. Philosophy.***

WORK EXPERIENCE

- September 2013 – present. ***Director, Apogee-Climate & Energy Transitions, Earth Tools, Inc.***
  Providing design, consulting, project development, and installation services for solar energy, energy conservation, green building, and other sustainability-related projects. Performing research, advocacy, and education on sustainable energy issues, especially concerning Kentucky electric utilities.
- January 2013 – September 2013. ***Independent consultant***.
  Provided consulting services for green building and solar energy projects.
- January 2004 – January 2013. ***Director, Kentucky Solar Partnership, Appalachia – Science in the Public Interest*.**
  Implemented programs to advance the use of solar, other renewable energy resources, and energy efficiency in Kentucky. Responsibilities included public education, organizing contractor training, policy research and advocacy, technical consulting, and development of demonstration projects.
- January 2003 – January 2004. ***Independent Contractor***.
  Provided research, design, and construction services for green building projects.
- August 2001 - December 2002: ***Graduate Assistant, Robert A. Macoskey Center for Sustainable Systems Education and Research at Slippery Rock University of PA*.**
  Responsible for monitoring resource use at Center and developing strategies for increased resource conservation; special focus on energy systems.
- January 2001 - May 2001: ***Graduate Assistant, Pennsylvania Center for Environmental Education, Slippery Rock University.***
  Performed data analysis and edited a published report concerning environmental education.
- January 2000 - July 2000: ***Conservation Assistant, Frontera Audubon Society, Harlingen, Texas.***
  Provided research, networking and logistical support for a federal lawsuit.
- April 2000 - June 2000: ***Crew Leader, U.S. Census Bureau, Harlingen, Texas.***
- October 1995 - May 1999: ***Staff and Resident, Proyecto Fe y Esperanza/Casa Juliana, Alamo, Texas.***
  Proyecto Fe y Esperanza (PFE) operated a demonstration center for sustainable living and environmentally appropriate technology. Located in a low-income, Mexican-American immigrant farm-worker community, PFE worked in various ways to improve the quality of life in this community.
  - January 1998 - May 1999: ***Project Director***
    Coordinated the reorganization of PFE during transitional period. Managed merger of PFE with a program offering experiential education tours of the US/Mexico border.
  - May 1997 - May 1999: ***Appropriate Technology Program Coordinator***
    Maintained and developed PFE's Appropriate Technology (AT) Demonstration Center; consulted with regional groups and individuals regarding AT and sustainable living; contracted to build various AT systems (i.e. solar water heaters, solar cookers, cisterns, compost toilets); collaborated with local organizations, e.g. Habitat for Humanity, on community development projects; designed and co-authored technical manuals and other educational materials.

- October 1997 - December 1997: ***Member, Solar Cooker Team, Cuzco and Arequipa, Peru.***
  Introduced solar cookers in three communities, trained local people in their construction and use, and did follow-up work in two communities we had worked with in 1994 (see below).
- July 1996 - October 1996: ***Educator for Composting Program, City of Alamo, Texas.***
- January 1995 - September 1995: ***Volunteer, United Farm Workers Organic Farm Cooperative, Alamo, Texas.***
  Assisted in all aspects of farm operations, management, and organizational development.
- January 1994 - June 1994: ***Member, Solar Cooker Team, Arequipa, Peru.***
  At invitation of Medical Mission Sisters, we worked to design an economical, efficient solar cooker using locally available materials. We trained local people in construction and use of solar cookers; helped design Spanish-language pamphlet explaining use and construction of cooker.
- September 1992 - October 1993: ***Waste Watch Coordinator, Appalachia - Science in the Public Interest, Livingston, Kentucky.***
  Performed research, authored publications, and organized workshops.

Other Relevant Work Experiences

- Performed complete renovation of farm house using green building strategies to achieve an energy efficient, net-zero-electricity passive solar home for my family (2010 – present).
- Installed 2.1 KW solar photovoltaic system at my home, achieving net-zero electricity usage for our home and farm (2011, expanded in 2017). Expanded solar photovoltaic system to 7.3 KW in 2020.
- Assisted my wife in operation of a certified organic vegetable farm (2005 – 2022).
- Designed and installed battery-based PV system, solar water heater, and water pumping system from rainwater cistern for off-grid straw-bale house, Frankfort, Kentucky, 2013.
- Designed and developed 30 grid-tied or off-grid solar PV systems, including first solar lease in Kentucky, 2014 – present.
- Provided consulting services for Stonebridge Hospitality, Inc., owner of four hotels in Frankfort, Kentucky, regarding energy efficiency and sustainability improvements to their hotels (2010 – 2011).
- Designed 12 KW solar photovoltaic system for Earth Tools, Inc. and provided technical support in drafting a successful USDA REAP Grant application. Installation completed September 2011. Have prepared four successful USDA REAP Grant applications in total.
- Designed and managed installation of 17 solar water heating systems, serving 68 apartments, for the Housing Authority of Owensboro, Kentucky, 2010.
- Consulted with the Frankfort YMCA on renovation of solar thermal pool heating system, 2007 – 2010.
- Managed installation of solar water heaters on homes of seven families in Eastern Kentucky, 2008 – 2009.
- Developed and managed statewide rebate program for solar water heaters, 2006 – 2007.
- Provided educational presentations to the public about solar electric and solar water heating systems.
- Co-chaired the Frankfort Mayor’s Task Force on Energy Efficiency and Climate Change, 2007.
- Participated in Al Gore’s Climate Reality Project training (2008) and have made numerous public presentations about climate change and the energy transition.
- Consulted on green design features for the CHIPS Group Home in Pulaski, Pennsylvania, for RCI Company Architects, 2002 - 2003.
- Have implemented and managed multiple Federal and state grant projects, including from US Departments of Energy, Agriculture, EPA, and Kentucky Office of Energy Policy.

- Co-authored "Greening the New Science and Technology Center" for the Dean of the College of Health, Environment and Science at Slippery Rock University, April 2002.
- Designed and installed a solar electric system at the Robert A. Macoskey Center for Sustainable Systems Education and Research, April 2002, Slippery Rock, Pennsylvania.
- Led reconstruction of a root cellar, summer 2001, Frankfort, Kentucky.
- Assisted construction of a passive solar, timber frame house, including installation of a solar electric system and composting toilet in Frankfort, Kentucky, 2000.
- Led Composting Toilet Design workshop at Cedar Ring Congress, Frankfort, Kentucky, April 1997.
- Co-hosted weekend solar oven construction workshops, Frankfort, Kentucky, October 1994 and 1995.

PUBLICATIONS

- *Local Solar, Local Savings: How to Cut Electricity Costs in Half for Public Schools and Local Governments in Frankfort, Kentucky*, with Walt Baldwin, February 2021.
- *Frankfort's Energy Future: Exploring the Benefits of Renewable Energy and Energy Efficiency for the Frankfort Plant Board*, with Daniel Holder and Nathan Shuler, August 2016.
- *Recommendations to the City of Frankfort from the Mayor's Task Force on Energy Efficiency and Climate Change*, co-author, December 2007, Frankfort, KY.
- *The Kentucky Solar Energy Guide*, with Joshua Bills. 2005. Appalachia – Science in the Public Interest, Mt. Vernon, KY.
- *High Performance Buildings: Bringing Environmentally Sound Building Practices Into the Mainstream in Kentucky*. 2004. Appalachia – Science in the Public Interest, Mt. Vernon, KY.
- *Developing a Strategic Plan for the Implementation of a Campus Sustainability Initiative at Slippery Rock University of Pennsylvania: A Master's Thesis*. 2003. Slippery Rock University (SRU), Slippery Rock, PA.
- *A Study of Energy Use at the Macoskey Center for Sustainable Systems Education and Research: Social Costs, Ecological Impacts, and Sustainable Energy Solutions*. 2002. [A series of four posters with accompanying Power Point presentation and pamphlet.] SRU, Slippery Rock, PA.
- *Inclusion of Environmental Education in Pennsylvania Teacher Preparation Curricula* (with Dr. Thomas Mastrilli and Dr. Paulette Johnson). 2002. Pennsylvania Center for Environmental Education, Slippery Rock, PA.
- "In Memory of Lorenzo Cleofas Mejia." *Mesquite Review: International Literature, Art and Culture*. August/September 2000, no. 18.
- *The Casa Juliana Solar Water Heater* (with David Omick). 1998. Proyecto Fe y Esperanza, Alamo, Texas.
- *The Casa Juliana Compost Toilet* (with David Omick). 1997. Proyecto Fe y Esperanza, Alamo, Texas.
- *A Solar Cooker* (with Mark Schimmoeller). 1996. Self-published.
- "Solar Cooking in Southern Peru" (with Mark Schimmoeller), *Home Power Magazine*. December 1994/January 1995, no. 44.

Boards and Memberships

- Kentucky Center for Renewable Energy and Environmental Stewardship, Board member, 2009 – 2011.
- Kentucky Conservation Committee, Board Member, 2008 – 2015. President, 2014 – 2015.
- Kentucky Solar Energy Society, Founding Member, Board Member and Chair, 2008 – 2009, Board Member, 2019 - present.
- Envision Franklin County, 2004 – present.

Exhibit AM-2 is being submitted
as a separate Excel attachment.

Exhibit AM-3

Net Metering Capacity and Installation Totals - Kentucky Power Company						
	MW	Annual Growth Rate	Installations	Annual Growth Rate	Avg Installation Size KW	
2018	0.275		24		11.5	
2019	0.297	8%	26	8%	11.4	
2020	0.988	233%	64	146%	15.4	
2021	1.761	78%	124	94%	14.2	
2022	2.482	41%	184	48%	13.5	

Source: EIA Form 861 for years 2018 - 2022.

KPC has reported no non-net metering distributed energy resources to EIA from 2018-2022, based on form 861.

https://www.eia.gov/electricity/data/eia861/

Avg Annual Growth Rates NM Capacity		
Avg Annual 2018-2022	90%	
Avg Annual 2020-2022	**59.6%**	
KPC Summer Peak, July 2005	1358	MW
KPC Summer Peak June 2022	996	MW
KPC Winter Peak Dec 2022	1359	MW

1% of Peak		13.59
Percent of Peak		
65.44	MW	5%
104.44	MW	8%
298	MW	22%

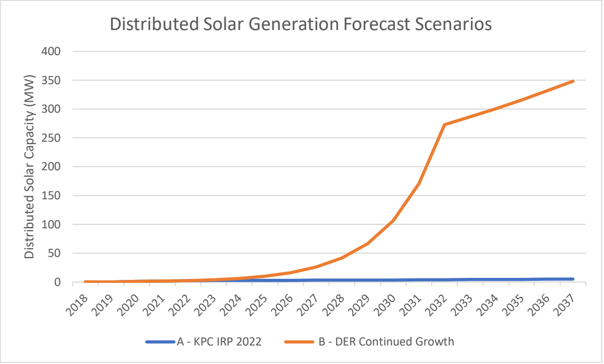
AGR = Annual Growth Rate

Exploring different annual growth rates

	NM Capacity			NM Installations	
	90% AGR	60% AGR	90% then 60%	90% AGR	60% AGR
2022	2.482	2.482	2.48	184	184
2023	4.71	3.961	4.71	350	294
2024	8.96	6.321	8.95	664	469
2025	17.01	10.088	17.00	1,261	748
2026	32.32	16.100	32.29	2,396	1,194
2027	61.39	25.695	61.34	4,551	1,905
2028	116.62	41.006	116.53	8,646	3,040
2029	221.54	65.442	186.44	16,423	4,851
2030	420.83	104.439	298.31	31,198	7,742
2031	799.41	166.675	477.30	59,263	12,356
2032	1,518.56	265.998	763.68	112,576	19,719
2033	2,884.66	424.509	1221.88	213,851	31,470
2034	5,479.71	677.477	1955.01	406,232	50,224
2035	10,409.28	1,081.19		771,679	80,153
2036	19,773.50	1,725.48		1,465,884	127,916
2037	37,561.82	2,753.71		2,784,599	204,143

Net Metering Capacity Future Growth Rate Scenarios

	Scenario A	**Scenario B - DER Continued Growth**			
	A - KPC IRP 2022 MW	**B - DER Continued Growth MW**	**Qty. NM Installations Cumulative**	**KW/Installation**	**NM Percent of KPC Annual Peak Load**
2018	0.275	0.275	24	11	0.02%
2019	0.297	0.297	26	11	0.02%
2020	0.988	0.988	64	15	0.07%
2021	1.761	1.761	124	14	0.13%
2022	2.482	2.482	184	13	0.18%
2023	2.606	3.971	294	13	0.29%
2024	2.736	6.354	471	13	0.47%
2025	2.873	10.166	754	13	0.75%
2026	3.017	16.266	1206	13	1.2%
2027	3.168	26.026	1929	13	1.9%
2028	3.326	41.641	3087	13	3.1%
2029	3.492	66.626	4939	13	4.9%
2030	3.667	106.601	7903	13	7.8%
2031	3.850	170.562	12644	13	12.6%
2032	4.043	272.899	20231	13	20.1%
2033	4.245	286.544	21243	13	21.1%
2034	4.457	300.871	22305	13	22.1%
2035	4.680	315.914	23420	13	23.2%
2036	4.914	331.710	24591	13	24.4%
2037	5.160	348.296	25820	13	25.6%



Historic data through 2022.

Scenario A - KPC IRP assumes 5% annual growth rate through 2040.

Scenario B uses the recent actual growth rate 2020-2022 of 60% through 2032, then reduces growth rate to 5% annually through 2037.