To: LG Energy Solution Vertech and key stakeholders - Residential DER adopters, Non-DER customers, Low-income / remote communities, Utility companies, Regulators and Policymakers

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Subject: **Fair Energy Pricing Framework to Value Residential Distributed Energy Resources (DERs)**

Executive Summary

The *State of Ohio, ex rel. The Harper and Jansto Family Trust vs. The City of Bowling Green* case depicts the larger debate between utility companies and consumers regarding the costs and benefits of installing rooftop solar PV and batteries and a resolution of the case can inform the net metering regulations at the state level. We propose developing a **Fair Energy Pricing Framework** to compensate for DERs (rooftop solar PV and energy storage technology) to encourage both the development of clean and efficient energy while ensuring cost recovery to the utility company for the grid infrastructure provided. This framework can be utilised by utility companies, policymakers, and electricity regulators to design and implement balanced pricing and compensation structure based on the state-specific data.

Context

The current electricity pricing framework needs to be updated so that it accurately reflects the value that residential rooftop solar and battery systems provide to the Bowling Green (BG) municipal grid[1]. In July 2020, the City of Bowling Green instituted a **"Rider-E" charge** which added a $4 fee per month for every kWh PV installed. The Rider E is based on a cost of service analysis to recover the municipal utilities' cost to provide electricity and to ensure that non-DER consumers are not subsidizing DER consumers. It functions as a penalty on solar households and provides no transparency about whether revenues support assets like the Prairie State coal plant. Additionally, as the rest of the state and country demonstrate significant growth in rooftop solar systems, BG's current net metering structure unreasonably limits the economic feasibility of rooftop solar.

Rooftop solar provides well-documented health and environmental benefits. Excess solar generation reduces reliance on gas-fired peaker plants, lowering greenhouse-gas emissions and air pollutants linked to respiratory illness and millions of premature deaths globally each year. Federal policy actively supports residential solar adoption because it eases strain on the electric grid during periods of high demand and contributes to cleaner, healthier communities. Modern solar inverters also enable homes to provide valuable grid services, further strengthening system reliability.

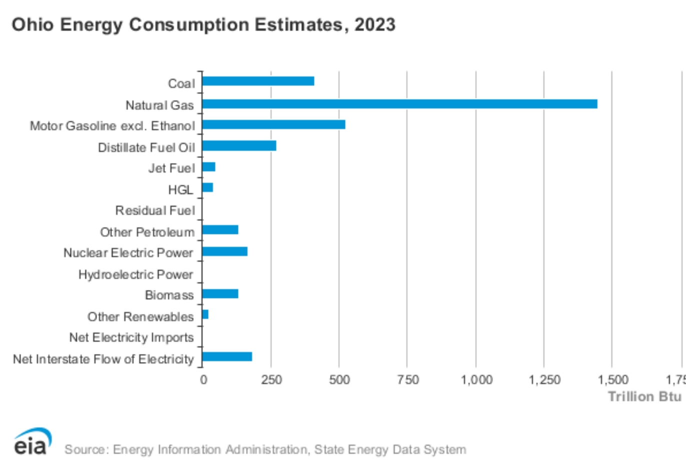


Figure 1: 2023 Ohio energy mix shows high usage of dirty energy like coal and natural gas.

A successful solution to the case must recognize that the electric grid requires continuous investment, maintenance, and replacement which incur costs that must be shared fairly among all customers. Currently, there is additional strain on the grid from utility infrastructure cost and long-term replacement needs due to aging equipment and rising demand, underscoring the importance of a stable funding base for grid resilience. **Therefore, while communities should have an active voice in deciding where their energy comes from, we must pair that agency with fair, predictable grid-cost contributions and strong incentives for DERs and storage so the clean energy transition strengthens, not destabilizes, the broader community.**

Recommendation 1: Development of a Robust Compensation Framework

The proposed framework considers the true value of rooftop solar PV and energy storage technology in terms of its services related to energy independence, grid stability, and emission reductions. We recommend that policymakers and regulators develop and implement a **Fair Energy Pricing Framework** to support installation of DER and energy storage by individual residents and communities in BG. This framework will bear in mind fixed-cost recovery methods, supporting a diversified energy mix, balanced pricing for DER and non-DER consumers, as well as encouraging clean energy.

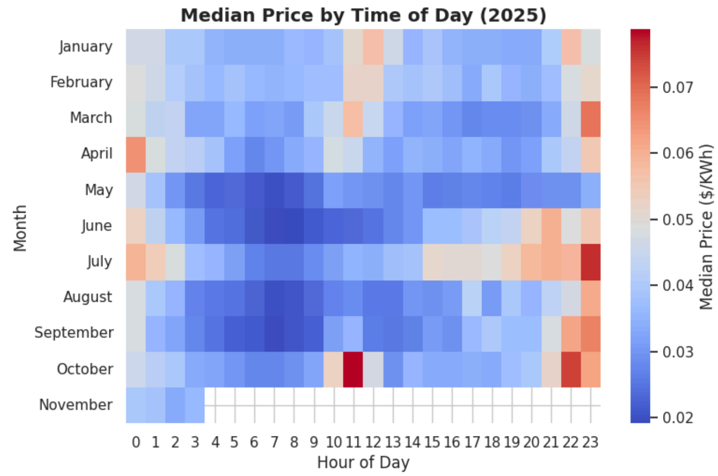


Figure 2: Price of energy at different times of the day by month shows Ohio energy prices are most expensive in mid June and July at the end of the day.

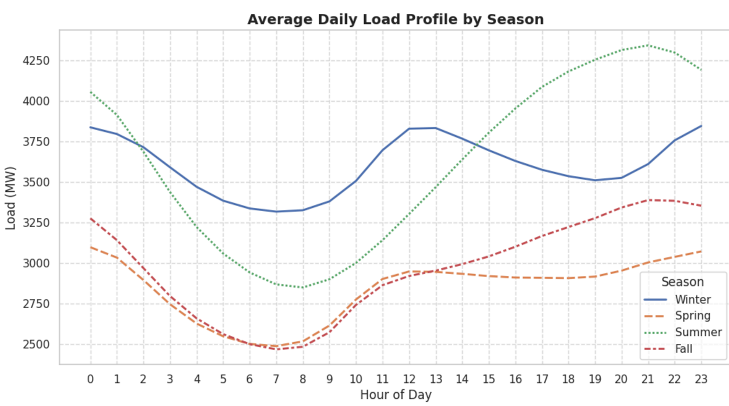


Figure 3: Ohio's grid is stressed overwhelmingly by summer afternoon/evening peak loads.

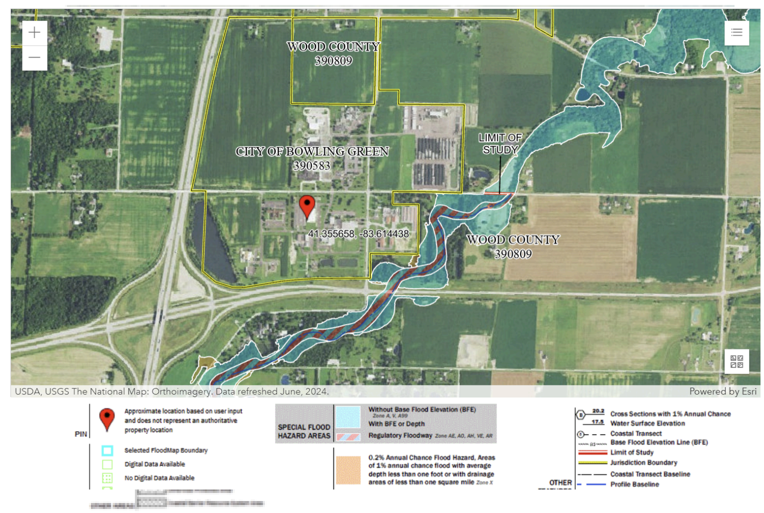


Figure 4: FEMA Flood map shows the City of Bowling Green and larger parts of Ohio have a high risk of flooding.

DERs, particularly the combination of solar PV with battery systems contribute to grid stability amidst extreme weather events and other threats. These benefits need to be accounted for when determining the value of solar energy. Solar paired with energy storage can play a critical role in stabilizing the grid in the hot months when the load spikes due to AC usage. The grid must be prepared to support energy demand at peak times, this means the higher the spike in energy demand during the summer (figure 3), the more energy costs everyone needs to pay for grid infrastructure that won't be used most of the year. By incentivizing solar and battery usage in Ohio, it relieves strain on the grid and reduces prices for everyone. During emergencies, like flooding, there are often energy outages and energy spikes. This can be mitigated with houses adopting solar and batteries. According to NOAA Billion-Dollar Disaster Events, Ohio has seen an increase in Billion Dollar Events as climate change worsens which calls for a more robust grid.

Recommendation 2: Addressing Rider E charge for the Ohio case study

We recommend an alternative framework to the cost of service study in Bowling Green to ensure fair compensation for the DER consumers. The section provides a comparison of two scenarios which estimate how long it will take for the homeowners to make up the costs they spent on DER for a 25 year time period. As seen in the Ohio case study[4], the household installed rooftop solar PV with a battery storage facility of 13.95 kW in 2019 and 2020 with a total cost of installation of $37,000. The residential solar consumers are charged a market rate of approximately 0.13 cents per kWh for electricity delivered to their homes and offered a compensation rate of 0.075 cents per kWh for solar generation that is exported from their home at times when self-generation exceeds on-site demand.

Scenario one: Current payback period for this household with Rider E

Under Rider E (2020), the municipal utility mandated an escalating fee scale starting at $1 per kWh in 2021 with an eventual increase to $4 per kWh in 2024. There is no cap on future increases. This leads to a monthly charge of $56 for the residential consumer in the case of rooftop solar PV ($4 per kW monthly charge for ~14 kW).

Scenario two: Our proposed solution with waiver of Rider E and incentives for DERs

This scenario includes the removal of Rider E charges for residential rooftop solar PV consumers with battery storage. Create a stronger incentive for rooftop solar and battery installment by offering a time-varying export rate. “Peak” would be defined as the top 5% of system-demand hours, during which customers receive a higher credit at 15¢/kWh for excess energy they export. All other hours would be priced at a regular off-peak rate of 7.5¢/kWh. At the end of the summer, once peak demand subsides, Bowling Green would return the accumulated peak-export credits to customers. This will incentivize batteries and PV together as most of the high demand in the summer is in the evening and night when there is not enough sun. Reducing the need for expensive grid infrastructure will bring the energy prices down for everyone and lower the risk of blackouts which can be very costly. Additionally, a state funded Ohio program will subsidize 30% as the base case and an additional 10% if the project is sited in a low income community as defined in the IRA[5]. To avoid overstating household revenue or battery throughput, we assume an 80% depth-of-discharge for residential storage during peak events, consistent with conservative battery-cycling practices and typical utility planning assumptions.

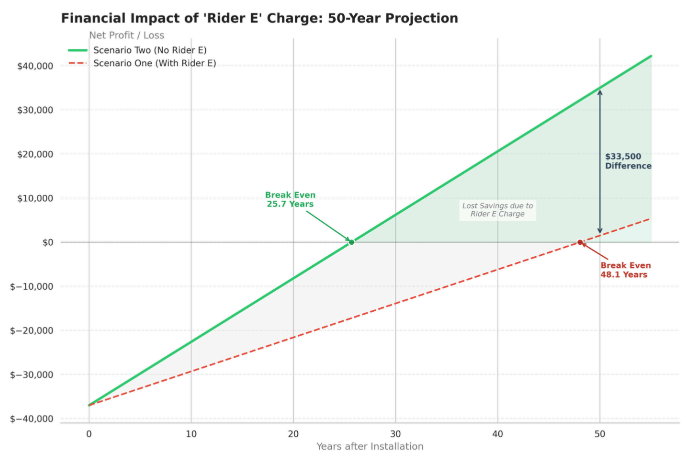


Figure 6 (right): Financial impact of Rider E charge on the feasibility of adopting residential rooftop solar

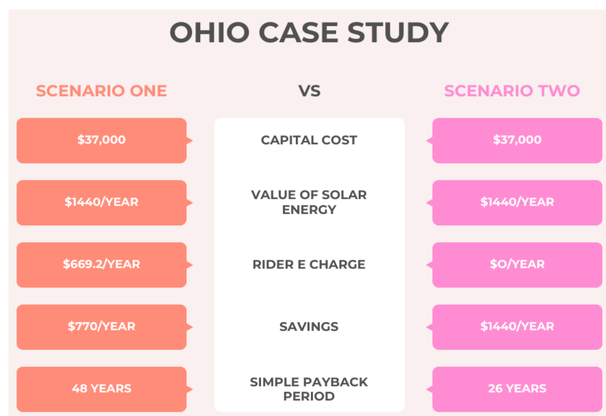


Figure 5: The waiver of Rider E charge in scenario two cuts the payback period almost in half

Recommendation 3: Holistic approach for accelerating DER adoption

The acceleration of DER adoption needs to be considered as a critical pillar in the electricity infrastructure and services. DERs can provide an alternative to delay the **distribution infrastructure upgrade costs**. The distribution costs represent the biggest chunk of total utility costs (Appendix 7). Additionally, policymakers should focus on addressing information asymmetry challenges when it comes to electricity rates for DER and non-DER consumers. Consumers should clearly understand the framework and the applicable electricity rates if they choose to adopt DER.

The **Social Vulnerability Index (SVI)** is calculated based on socioeconomic, household composition, disability, minority status and language, housing, and transportation data according to the U.S. Center for Disease Control and Prevention (Appendix 6).

Alternatives

One alternative policy solution would be to **only remove the "Rider E" charge** to incentivize solar; however this would not encourage PV and battery adoption. Batteries are needed to stabilize the grid and add an additional measure of security during peak load times. Incentives for batteries should both be an initial investment to help the project get started and an incentive to help support the grid. The 30% and 15% subsidies for low and middle income households to build energy storage encourages the batteries to be built and incorporating a this proposed solution could additionally be used as a case study for other places in the US considering how to incentivize solar and batteries while also ensuring fair compensation to the utility companies for the infrastructure costs.

A second alternative can be a **phase-wise approach with gradual increase of additional charges** for DER adoption. However, this will provide incentives on a first come first serve basis and is not an equitable approach, considering the upfront costs to DER adoption. Additionally, it can incentivize DER adoption only in the short term and witness a sharp decline once the higher charges become applicable.

Endnotes

1. https://doi.org/10.1016/j.rser.2020.110599
2. Solar Integration: Inverters and Grid Services Basics | Department of Energy
3. https://go.woodmac.com/e/131501/-Q3-utility-webinar-slides-pdf/34x57d/2765434904/h/SY8dCx92hJkWu4fE2vQBz66Gy-V1vAgKihcgUJpNam0
4. https://legacy.www.documentcloud.org/documents/26186211-harperjanstocomplaint2025/
5. https://www.epa.gov/green-power-markets/summary-inflation-reduction-act-provisions-related-renewable-energy

Technical Appendix

Appendix 1: Additional details on the Fair Energy Pricing Framework

The design of the **Fair Energy Pricing Framework** for residential consumers with and without DERs will consider the key metrics such as electricity rates for electricity consumption from the grid, charges for using grid infrastructure (fixed costs), savings in infrastructure investment requirements due to DERs, feed-in rates based on time of day (TOD), for instance, feed-in during peak demand, carbon dioxide emissions reductions, incentives for adoption of DERs and DER value in terms of grid stability and resilience during power outages.

Appendix 2: Calculations for Ohio case study

Scenario 2: Time required to recover the initial $37,000 solar and battery cost (without the 'Rider E' charge

Definitions:

- PV size: P = 13.95 kW

- Capex: C0 = $37,000

- Annual PV generation: G = P * Y

//Y = 954 kWh/kW-year is the typical annual solar yield in Ohio given its location. According to Google Project Sunroof[1]

→ G ≈ 13,300 kWh/year

[1] https://sunroof.withgoogle.com/data-explorer/place/ChIJwY5NtXrpNogRFtmfnDlkzeU/

//12,400kWh is used in this case from the data[2]

- Import rate: r = \$0.13/kWh

- Export (Ohio status quo): e1 = \$0.075/kWh

- Self-consumption with battery: s ≈ 0.65

// Using the specific energy data case study provided, they used 65% of the energy they generated and sold 35% of it back to the grid. They used 11,255kWh and sold 5,095kWh back to the grid.

- Self-use = sG ; Exports = (1 – s)G

- Self-use savings: S_self = sG * r

- Export savings: S_exp = (1 – s)G * e1

- "Rider E" fee: F1 = 4 * P * 12 = \$669.2/year

//\$4 per kW of installed solar capacity every month is the Rider E charge which is a monthly fee and where P is the size of the solar system which is 13.95kW for this specific case.

- Battery value: B1 = 0 (no grid compensation in this Ohio case)

Total annual savings:

Savings1 = G(sr + (1 – s)e1) – F1

Plugging numbers (s = 0.65):

S1 = 13,300(0.65·0.13 + 0.35·0.075) – 669.2

≈ \$1440/year

Payback period:

Simple payback period = Capital investment / Annual Savings

T1 = C0 / S1 =\$37,000 / \$770 ≈ 48 years

If energy generation remains the same every year, removing the added \$4/kw/month:

T2 = C0 / S1 = \$37,000 / 1440\$ ≈ 26 years

T1-T2 ≈ 22 years

It could take up to 22 more years to pay off their investment with the 'Rider E' charge

Calculating Peak Pricing for Ohio Solar

This document summarizes earnings scenarios for a Bowling Green, Ohio household involved in the current solar lawsuit context. The analysis assumes:

[2]https://www.documentcloud.org/documents/26187766-bowlinggreenspreadsheetsrcvd1025/?mode=document

- Three Tesla Powerwall batteries (13.5 kWh each * 3 = 40.5 kWh total)
- 80% depth-of-discharge (DoD) for best practices cycling and ensuring the batteries are healthy, (40.5 kWh * 0.8) = 32.4 kWh
- ~90% efficiency (32.4 kWh * 0.9 = 29 kWh)
- Effective exportable energy per peak dispatch: ~29 kWh
- Peak defined as the highest 5% of system-demand summer hours
- Peak export rate: 15¢/kWh
- Current off-peak credit: 7.5¢/kWh

Peak Window Calculation

Summer (June-August) contains approximately 2,208 hours. The top 5% equals ~110 high-demand peak hours. These hours usually fall on about 25 to 40 high-demand summer days, which is a realistic number of times a household could choose to discharge their batteries for peak pricing.

Energy Per Dispatch

Total exportable energy per full peak discharge:
40.5 kWh × 0.8 DoD × 0.9 efficiency ≈ 29.16 kWh
Rounded: ~29 kWh per peak event

Household Earnings Under 15¢/kWh Peak Pricing

Peak Dispatch Count	Peak kWh Exported	Peak Season Earnings, 15¢
25 events (conservative)	≈729 kWh	≈$109
35 events (moderate)	≈1,021 kWh	≈$153
50 events (high participation)	≈1,458 kWh	≈$219

Additional Earnings for Summer Demand

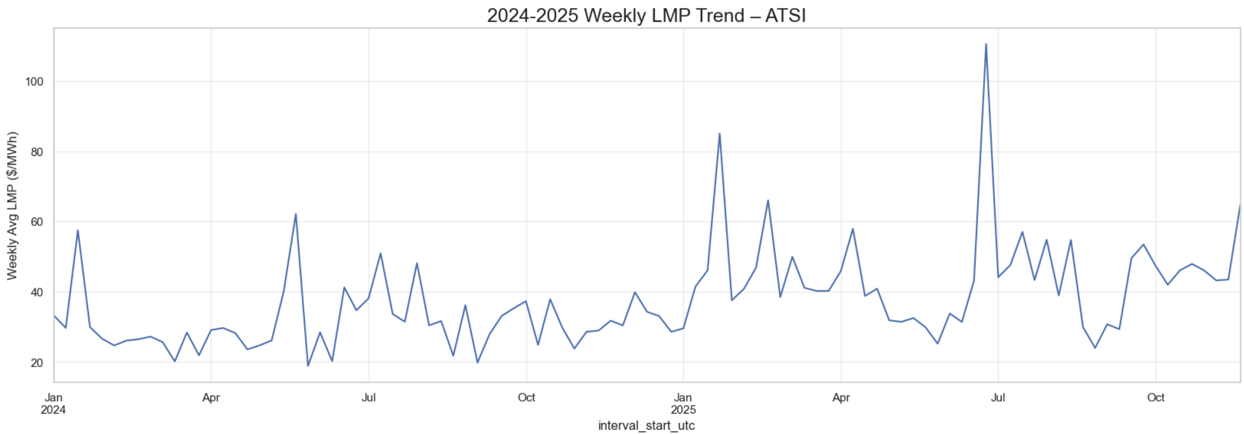
Additional earnings: 15¢ – 7.5¢ = 7.5¢ per kWh
- Low scenario, 25 events → +$55
- Medium scenario, 35 events → +$77
- High scenario, 50 events → +$109

With these additional earnings, the Harper and Jansto Family would earn back their investment in solar much quicker than in (Figure 6).

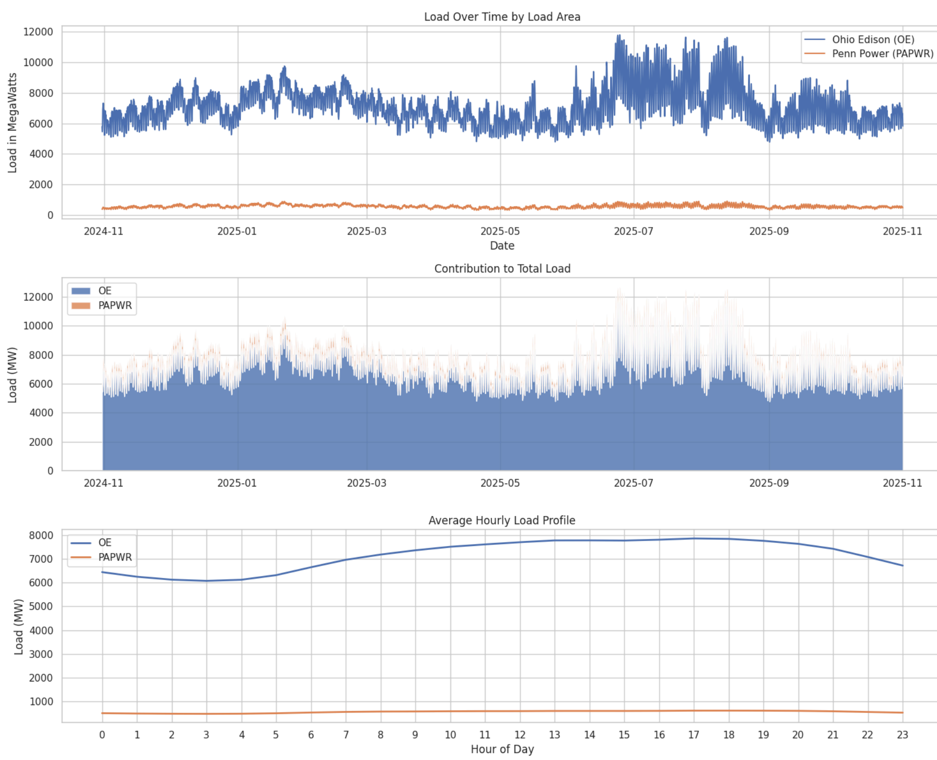
Interpretation for the Ohio Case

Under a strengthened peak-pricing structure, a household in Bowling Green with three Tesla batteries could earn approximately $110–$220 during a typical summer peak season according to this case study. This structure provides an incentive to install grid storage and PV while also ensuring fair compensation to the BG Utility. As a case study for other utility companies, these values are based on previous policy and lays the groundwork for future similar systems.

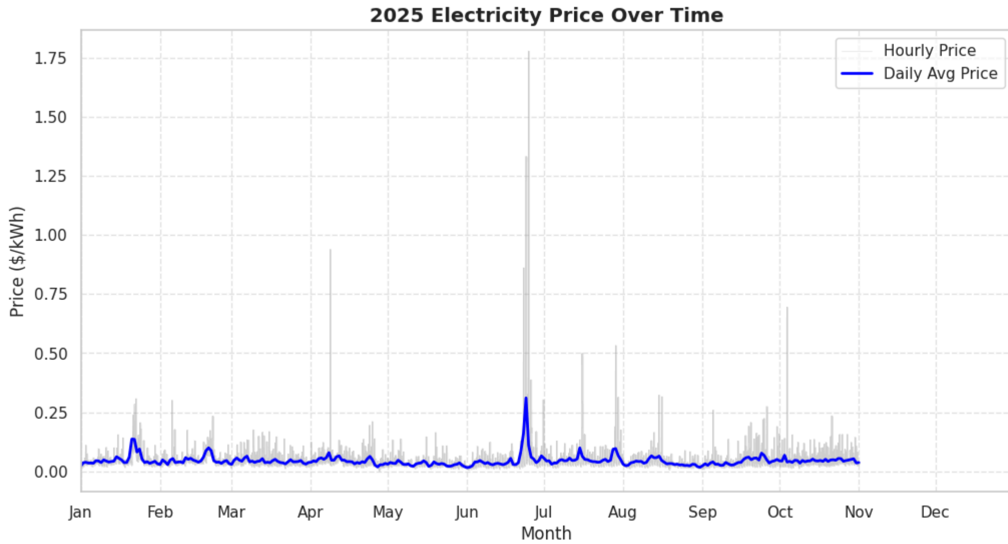
Appendix 3: Data analysis based on LMP trends



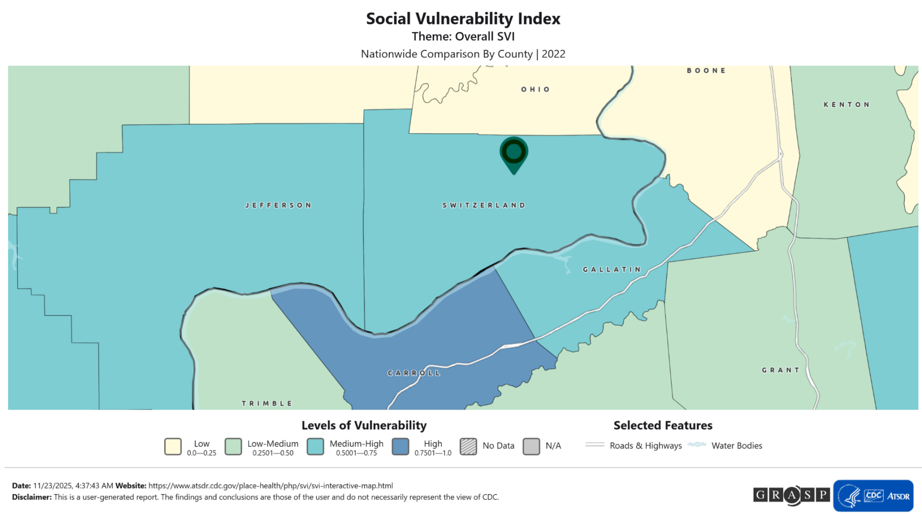
Appendix 4: Demand analysis based on load data



Appendix 5: Trends in electricity prices



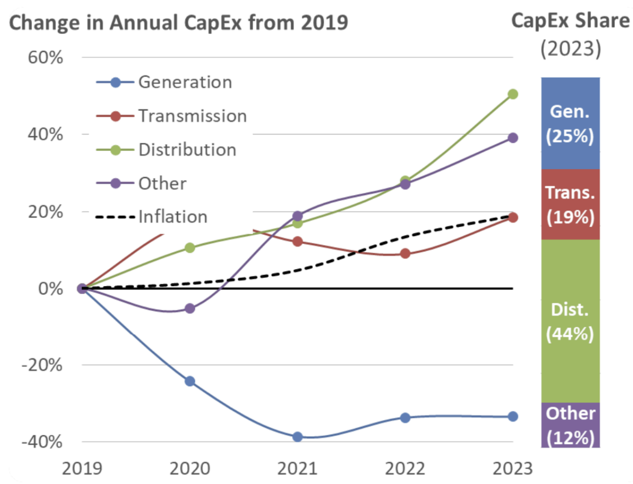
Appendix 6: Social Vulnerability Index (SVI) for BG Municipal area codes



The city of Bowling Green, Ohio is ranked as a Medium-High on the Social Vulnerability Index (SVI) which is calculated based on socioeconomic, household composition, disability, minority status and language, housing, and transportation data according to the U.S. Center for Disease Control and Prevention CDC.

Appendix 7: Breakdown of utility costs

Distribution system costs grew the most among utility costs



Growth in Utility Capital Expenditures from 2019 to 2023

Utilities are spending the most on local grid upgrades which is represented by the green distribution line which continues to increase.