



SPP DISIS Cluster Analysis July 2024

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Analysis: Fuel Type Costs 2018–2023



Overview

- **Solar Costs:** Solar costs increased steadily from \$89.49 in 2018 to \$232.64 in 2022, reflecting a growing investment or cost in solar energy over time. However, there was a slight decline to \$158.91 in 2023.
- **Wind Costs:** Wind costs showed significant fluctuations. They increased from \$346.64 in 2018 to a peak of \$487.91 in 2019, then decreased to \$169.20 in 2020. Costs rose again to \$352.54 in 2022 before dropping to \$209.44 in 2023. This suggests variability in wind energy costs, potentially influenced by market conditions or technological changes.
- **Storage Costs:** Storage costs rose from \$106.10 in 2018 to \$182.41 in 2022, indicating an increasing emphasis on energy storage solutions. However, there was a decrease to \$143.33 in 2023, which might reflect advances in technology or reduced demand.
- **Thermal Costs:** Thermal costs were only reported from 2019 onwards, starting at \$210.44 and reaching \$162.46 in 2022. They fell further to \$71.73 in 2023, suggesting a possible shift away from thermal energy or improved efficiency in thermal systems.
- **Hybrid Costs:** Hybrid costs were only available from 2019, with a significant rise to \$561.64 that year. They decreased to \$278.01 in 2021, then slightly increased to \$261.63 in 2023. This suggests that hybrid systems experienced initial high costs with some stabilization in recent years.
- Overall, the data indicates that while the costs for Solar and Storage have generally increased, Wind costs have fluctuated significantly. Thermal costs have decreased over time, and Hybrid costs have seen some volatility but are showing signs of stabilization.

Cluster Window	Fuel Type	Avg. Interconnection Costs \$/Kw
DISIS 2018	Solar	\$89.49
	Wind	\$346.64
	Storage	\$106.10
	Thermal	\$ -
	Hybrid	\$ -
DISIS 2019	Solar	\$199.03
	Wind	\$487.91
	Storage	\$150.92
	Thermal	210.44
	Hybrid	561.64
DISIS 2020	Solar	\$118.58
	Wind	\$169.20
	Storage	\$110.02
	Thermal	97.59
	Hybrid	\$ -
DISIS 2021	Solar	\$212.15
	Wind	\$294.99
	Storage	\$17.53
	Thermal	\$ -
	Hybrid	278.01
DISIS 2022	Solar	\$232.64
	Wind	\$352.54
	Storage	\$182.41
	Thermal	162.46
	Hybrid	189.68
DISIS 2023	Solar	\$158.91
	Wind	\$209.44
	Storage	\$143.33
	Thermal	71.73
	Hybrid	261.63

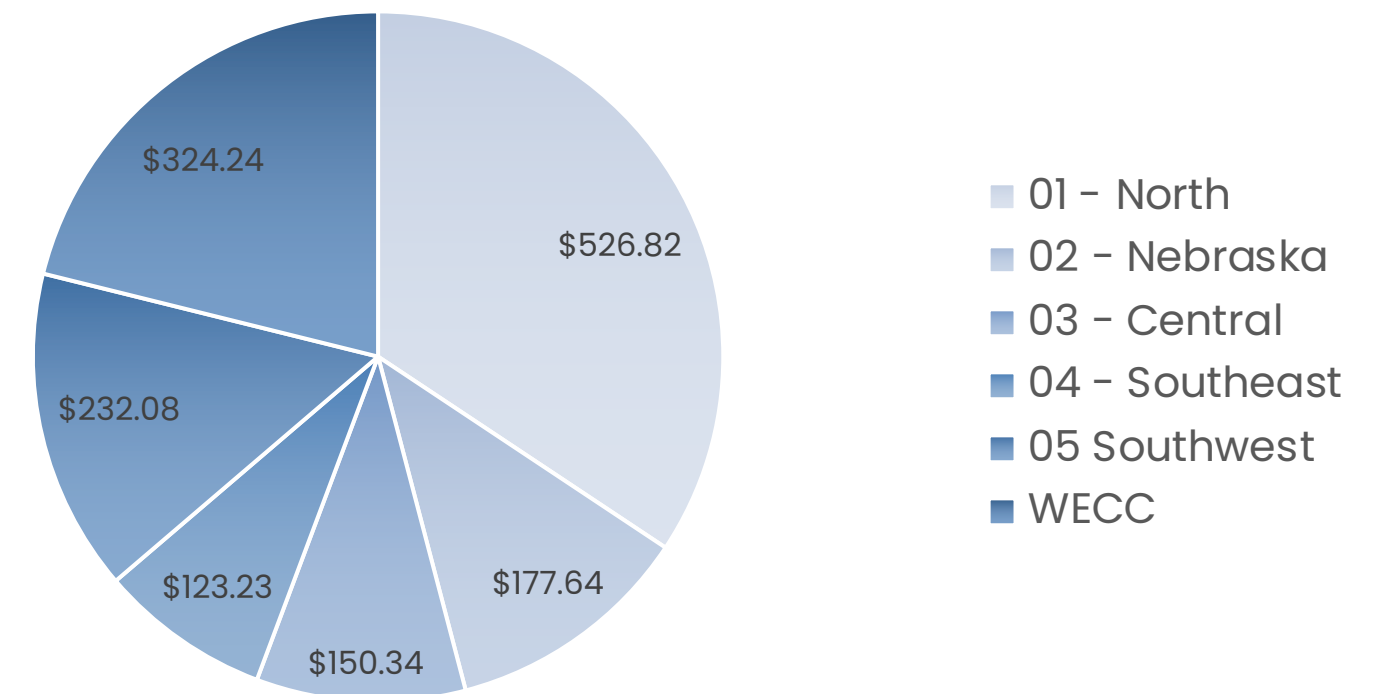
Analysis: SPP Cluster Study Group vs Costs



Overview

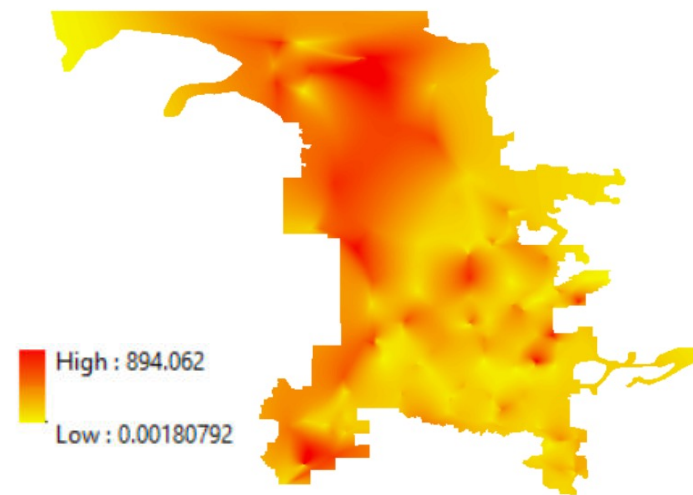
- The average costs per kW for different groups also show considerable variation. The **North group has the highest average cost at \$526.82 per kW**. The WECC group follows with an average cost of \$324.24 per kW. The Southwest group has a moderate average cost of \$232.08 per kW. Nebraska and Central groups have lower average costs, at \$177.64 per kW and \$150.34 per kW, respectively.
- The **Southeast group** has the lowest average cost at **\$123.23 per kW**. These figures illustrate the regional cost disparities in energy projects, with the North group being the most expensive and the Southeast group being the most cost-effective.
- Southeast transmission owners includes Oklahoma Gas and Electric (OKGE), Western Farmers Electric Cooperative (WFEC), American Electric Power Company (AEPW), Grand River Dam Authority (GRDA) and Southwestern Power Administration (SWPA).
- This analysis provides the overall DISIS studies vs their cluster group however analysis their individual DISIS studies are essential for further evaluation.

Cluster Study Group vs Average costs

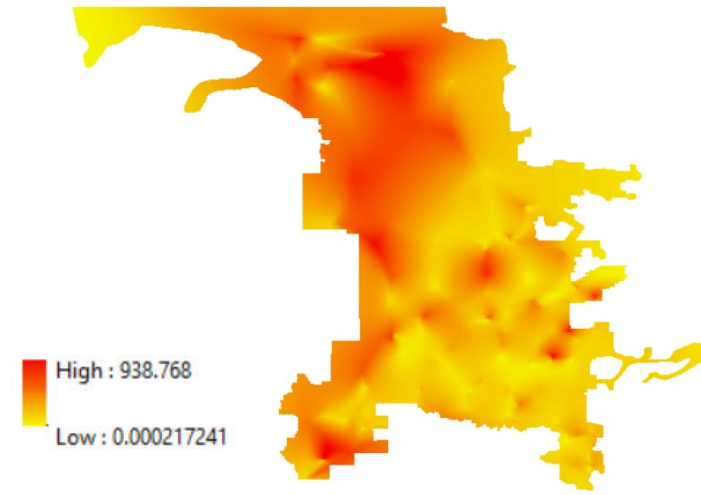


Cluster Study Group	Average Costs
01 - North	\$ 526.82
02 - Nebraska	\$ 177.64
03 - Central	\$ 150.34
04 - Southeast	\$ 123.23
05 Southwest	\$ 232.08
WECC	\$ 324.24

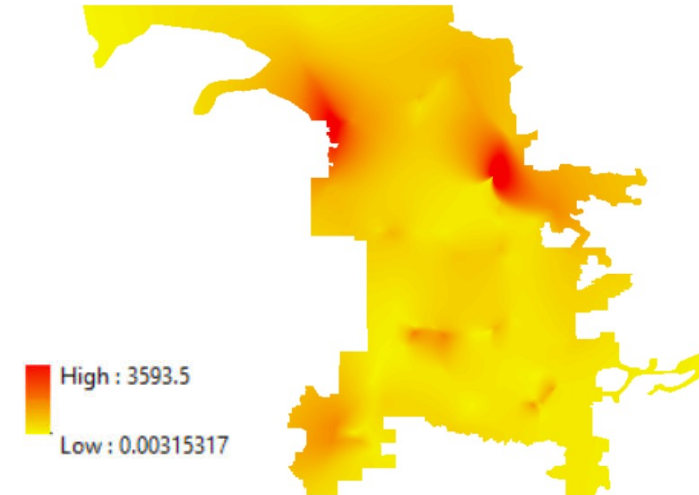
Analysis: Cost (\$/kW) Based on Fuel Types



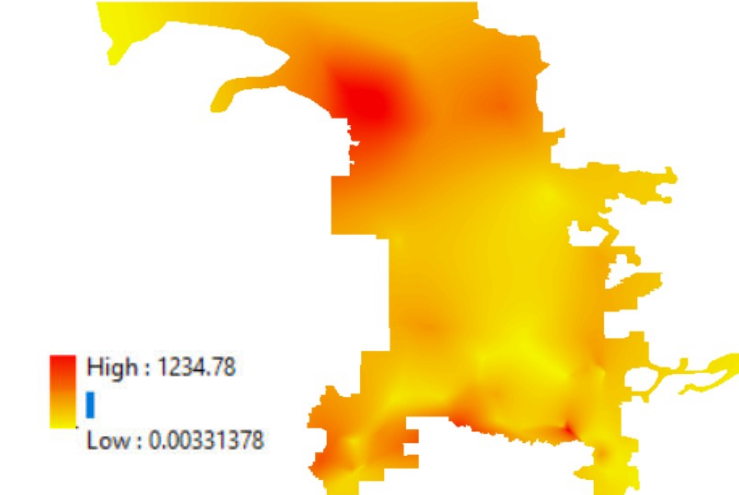
Solar



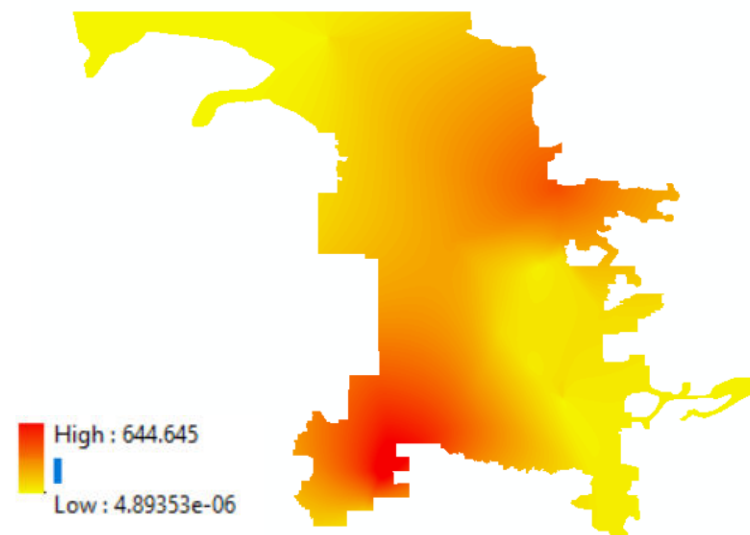
Storage/BESS



Wind



Hybrid



Thermal

Overview

- The highest cost for a wind project is for **GEN-2018-070** at \$3,600 per kW.
- The second highest is for **GEN-2023-067**, which has a cost of \$2,400 per kW.
- The average cost of **wind projects** is significantly at **\$278 per kW**, indicating that the two projects mentioned are outliers or have special conditions contributing to their higher costs.
- **Hybrid projects**, on the other hand, have an average cost of **\$267 per kW**, which is relatively close to the average cost of wind projects, suggesting that hybrid projects might be cost-competitive with wind projects.
- Other costs **Thermal** projects have the lowest average cost at **\$108.11 per kW**, **Storage** projects also have a relatively low average cost at **\$142.47 per kW** and **Solar** projects have a moderate average cost of **\$166.73 per kW**.

Note: The costs on the above plots were observed from DISIS study results SPP has published from DISIS (2018-2023).

Analysis: SPP DISIS Cluster vs Costs

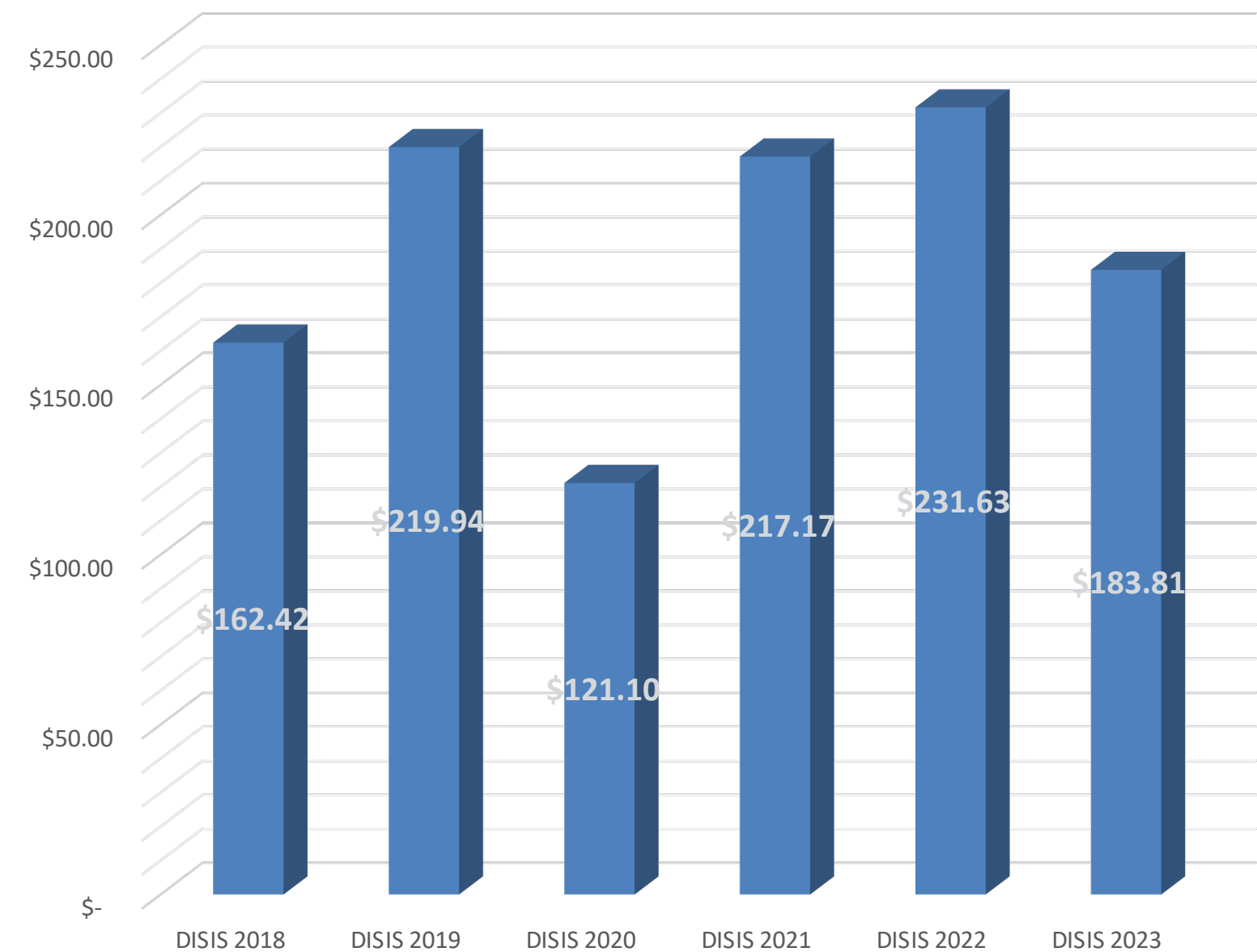


Overview

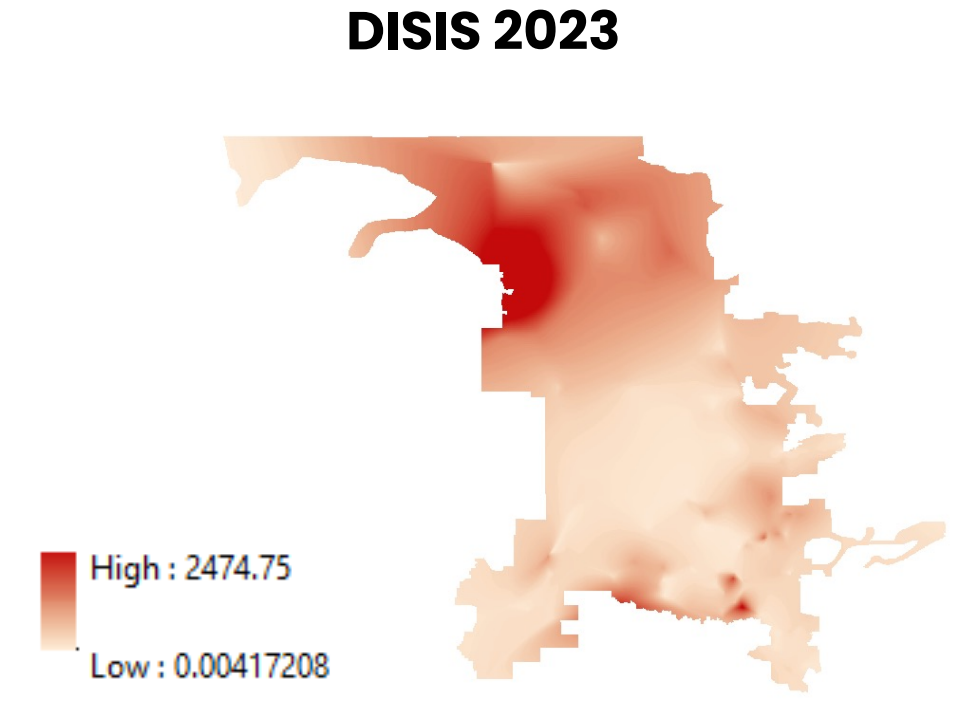
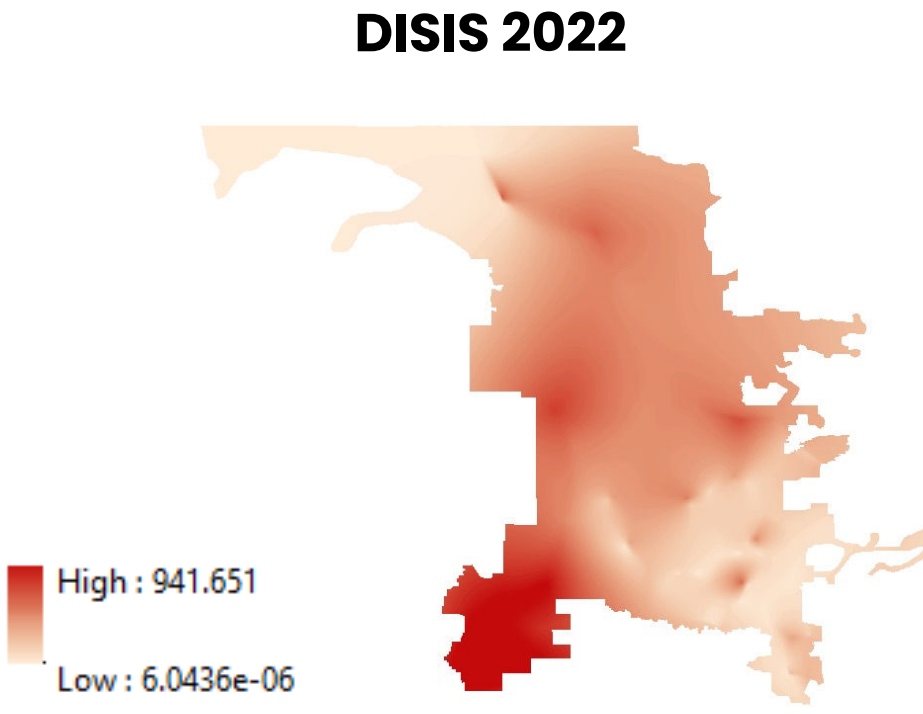
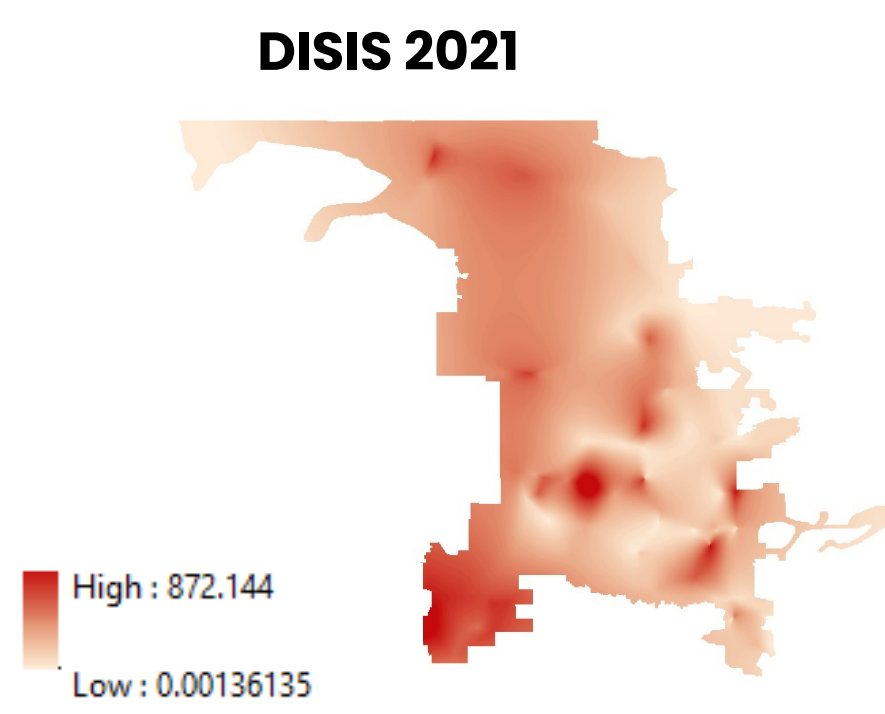
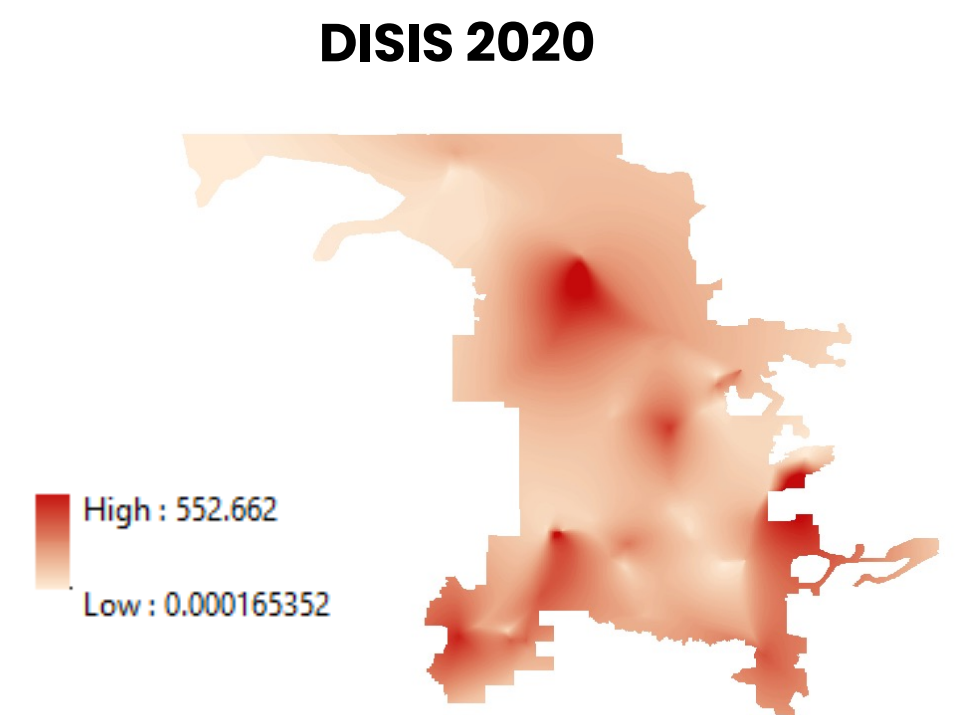
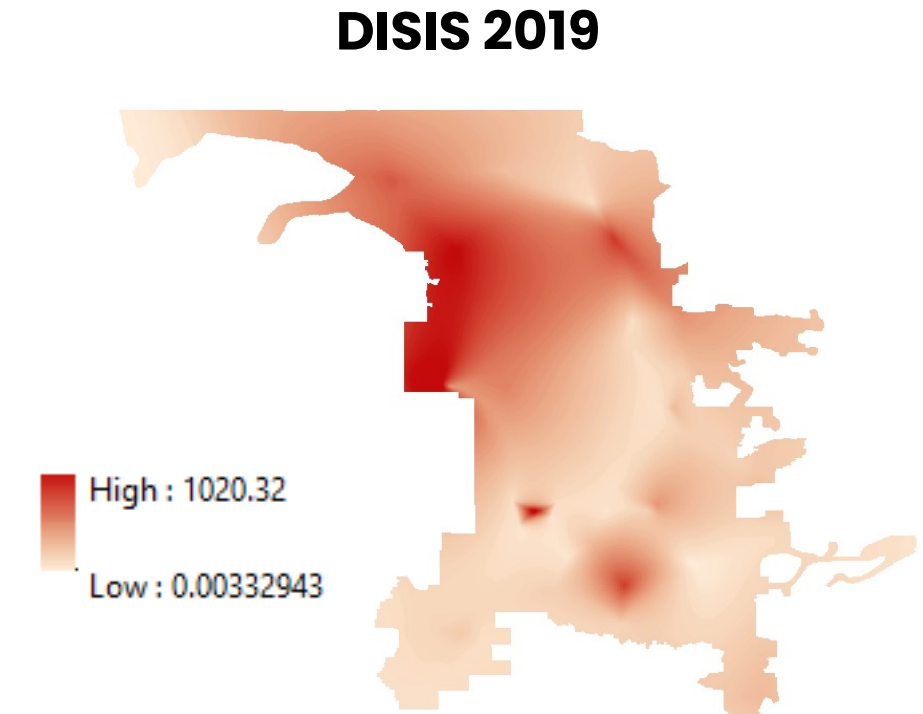
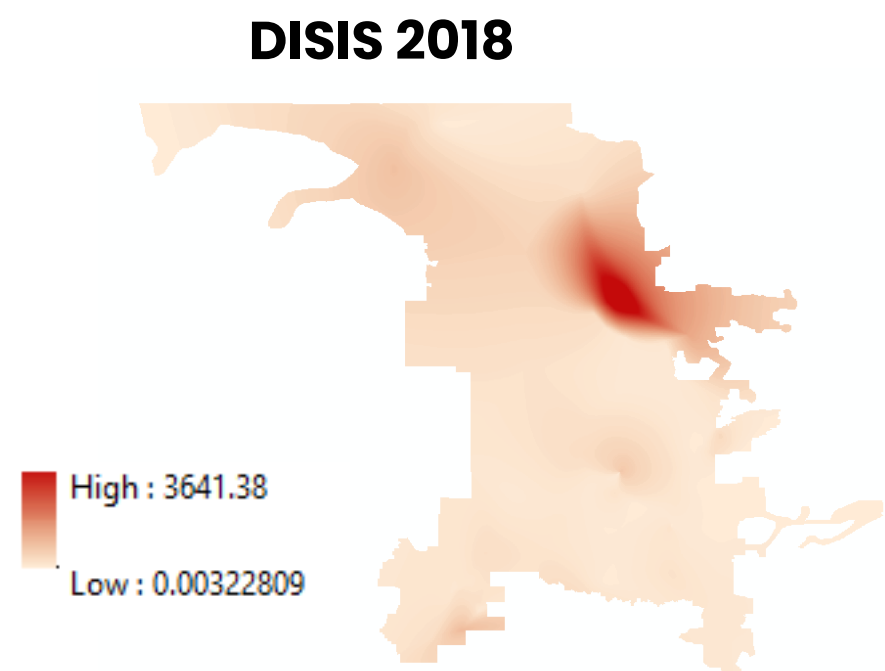
- The costs over the years show noticeable fluctuations. In 2018, the cost was \$162.42, and it rose significantly to \$219.94 in 2019. After a dip to \$121.10 in 2020, costs increased again, reaching \$217.17 in 2021 and peaking at \$231.63 in 2022.
- However, there was a slight decrease in 2023, with the cost falling to \$183.81. Overall, while the costs exhibited a general upward trend from 2020 to 2022, they declined slightly in the most recent year. This reduction in 2023 suggests a minor shift after a period of generally rising costs. Overall, the data indicates a trend of increasing costs with some fluctuations, culminating in a modest decrease in the most recent year.

Cluster Window	Average Cost (\$/kW)
DISIS 2018	\$ 162.42
DISIS 2019	\$ 219.94
DISIS 2020	\$ 121.10
DISIS 2021	\$ 217.17
DISIS 2022	\$ 231.63
DISIS 2023	\$ 183.81

DISIS Cluster vs Average Costs



Analysis: Cost (\$/kW) based on various DISIS study years



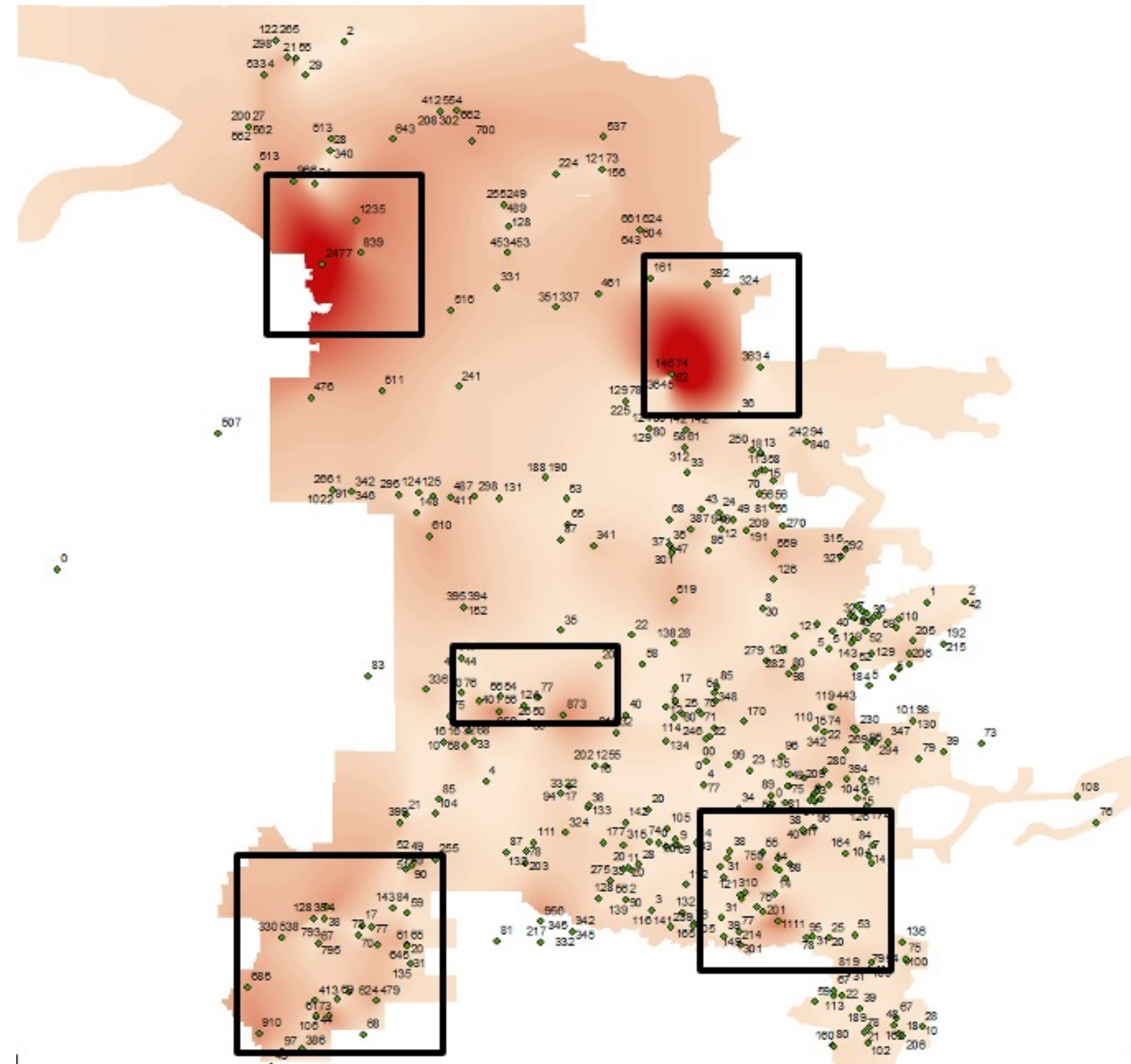
Note: The costs on the above plots were observed from DISIS study results that SPP has published from DISIS (2018-2023).

Analysis: Average Interconnection Cost (\$/kW)



Heatmap of DISIS Projects and their average interconnection costs (\$/kW)

The boxed areas in the SPP cluster map indicate regions with higher average costs.



Note: The costs on the above plots were observed from DISIS study results that SPP has published from DISIS (2018-2023).

About **ZEG**: Your Premier Partner in Engineering Excellence.



With a commitment to innovation and sustainability, we at ZEG are reshaping the energy landscape. Leveraging our extensive engineering and renewable energy expertise, we deliver tailored solutions that drive progress and propel our clients toward a greener future.



Background

ZEG founded in 2022 as a 100% employee-owned engineering advisory. Our team provides power grid interconnection-related services to industry stakeholders across power segment.



Mission

To tailor cost-effective solutions that ensure success for our customers in the deployment of clean energy and the next generation of grid technologies while maintaining the power grid security, reliability, and resiliency.



Vision

We will revolutionize the landscape of traditional engineering advisory firms, setting a new standard of excellence.



Values

We are committed to upholding values of integrity, accountability, expertise, accessibility, and collaboration. These principles guide our work and interactions, ensuring that we deliver the highest quality of service to our clients and partners.

ZEG at a Glance



DATA ENCOMPASSES PERIOD FROM 2022 TO PRESENT

Dependable Delivery

We prioritize timely delivery without compromising quality. Our streamlined processes and dedicated team ensure that we meet your deadlines, helping you achieve your goals promptly and effectively.

Technical Expertise

With over 50 years of combined experience in electric utilities, renewable development, and engineering consulting, our team deeply understands our customers' needs and challenges. promptly and effectively.

Regional Expertise

We excel in regional market design, interconnection procedures, and stakeholder processes, ensuring efficient and effective solutions tailored to local requirements.

Superior Innovation

Our customized tools and platforms, developed through years of experience, enhance the efficiency and quality of our services. These innovations are now used by transmission owners and grid operators in their planning processes.

Flexibility & Agility

Our lean, employee-owned team provides flexible, efficient and accurate services, ensuring faster timelines and higher accuracy while passing on cost savings to our customers.

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