Geospatial multi-factor influencing models optimize project siting for revenue and risk reduction.

Advanced Geospatial Analysis and Data for Clean Energy Siting

Disaster Risk Assessment:

Assessing risk is a critical part in the evaluation of potential solar sites. Common risks for solar projects include hail, extreme winds, flooding, snow and ice, and frost heave. GIS can be used to evaluate the potential risk in the prospecting phase of project development and highlight areas that will have lower risk. Figure 1 focuses on the risk of extreme hail.

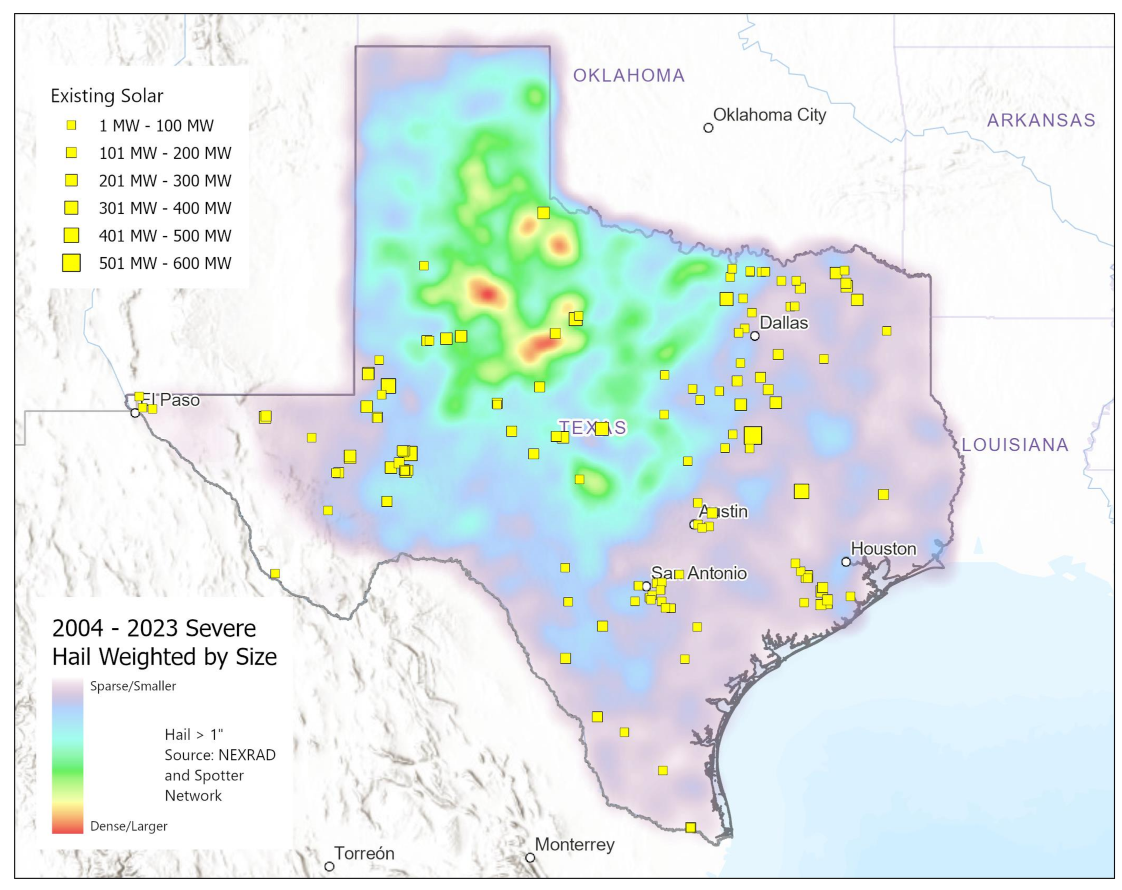

Figure 1: Heat maps showing hail size trends in Texas, with conservative adjustments for areas with smaller hail sizes.

Methodology-Twenty years of hail data from NOAA and NEXRAD were analyzed using an algorithm to filter outliers and assess hail potential across the US. Seasonal, diurnal, and periodic fluctuations (e.g., ENSO) were considered to understand historical and changing hail patterns.

Siting for Revenue Maximization:

Economic factors are crucial for optimal siting decisions. Combining multiple data layers through a multi-factor influencing model (MFIM) is more robust than relying on a single source. While locational marginal prices (LMPs) indicate current potential revenue, they are not always predictive of the future. Our MFIM combines and weighs various layers to support early siting efforts.

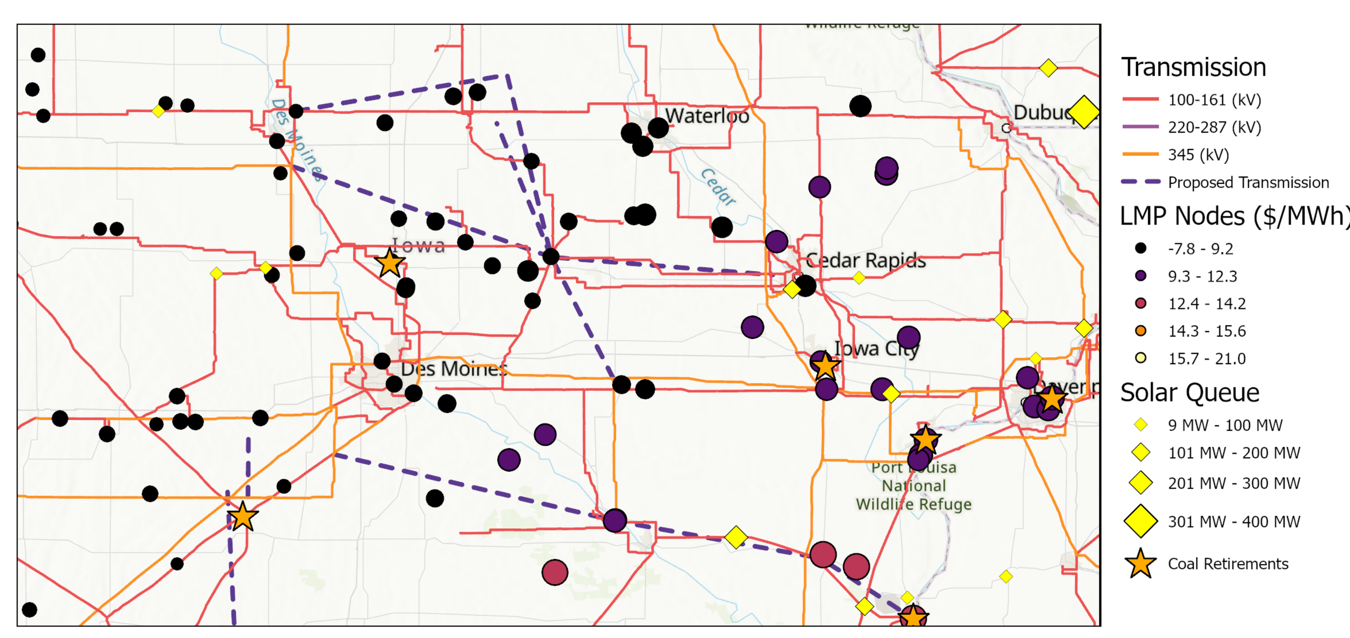

Figure 2: Map showing Transmission lines, LMP nodes, Coal retirements and solar type assets in the interconnection queue.

Methodology - Analyzed LMPs using the economic MFIM for solar siting (annual averages). The volatility index is ranked based on TB4 analysis. Considered existing and future electricity supply, using EPA fossil retirement data and ISO interconnection queue data. The broader MFIM also considers load growth forecasts by utility and population growth rates.

Results and Discussion:

Individual data layers are divided into groups that can include (but are not limited to): risk, economics, electricity supply and demand, site suitability/terrain, land costs, fossil generation retirements, solar resource, regulatory factors, and infrastructure. Groups can additionally have subgroups.

This approach, especially when sensitivity analyses are used, improves siting choices by reducing bias and uncovering overlooked regions, especially when combined with environmental and regulatory factors in a holistic MFIM.

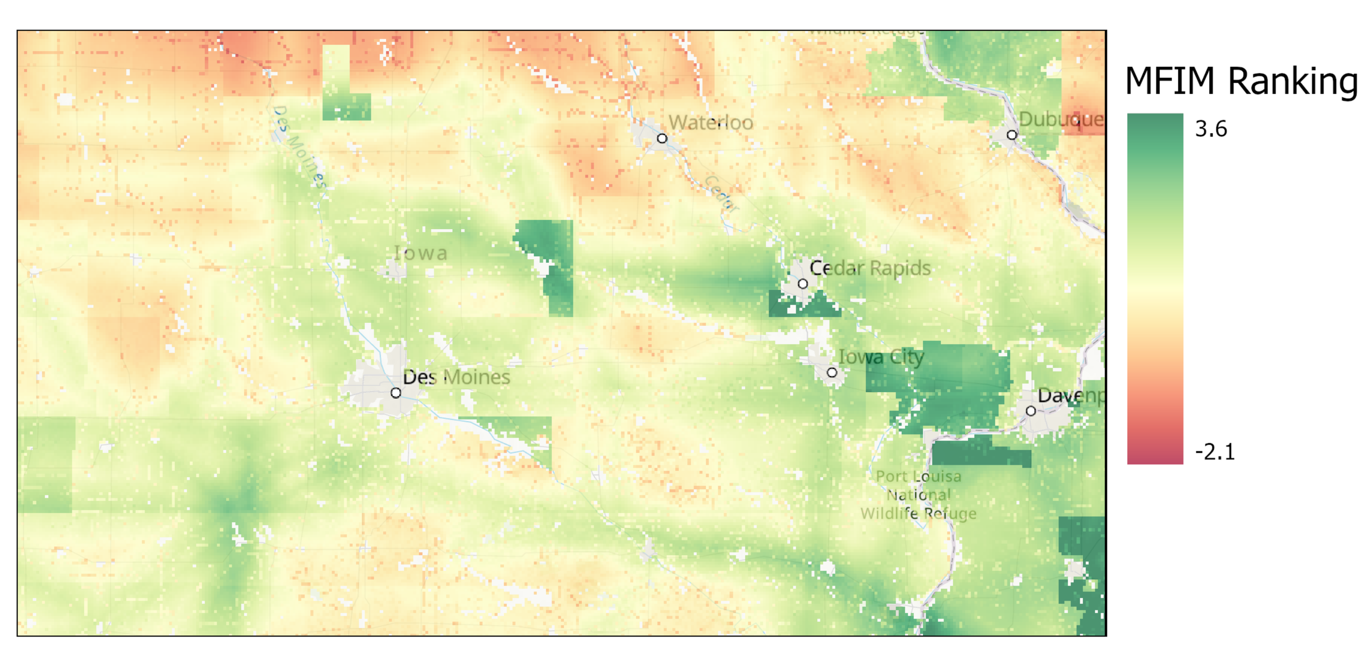

Figure 3: Map showing combined ranking of different layers.

Methodology - Each layer is spatially evaluated and ranked within its subgroup, assigned a weight, and combined using a weighted sum approach. Subgroups are combined using a weighted sum approach, then re-scaled to -1 to 1.Sensitivity analyses adjust layer influence.

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