ENVERUS

Renewable Project Siting Guide e-book

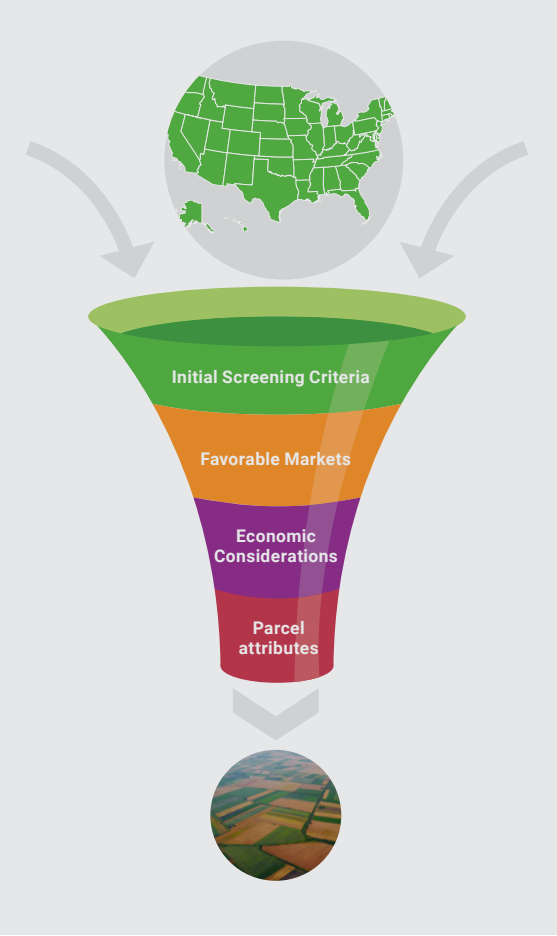
Overview

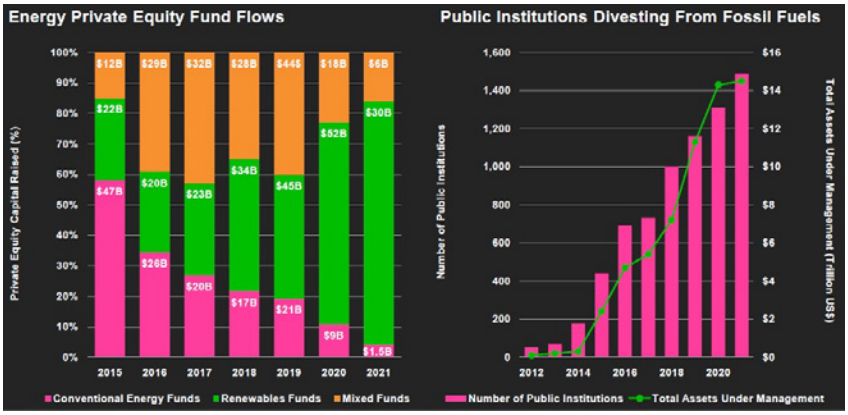
The drive for renewable energy is accelerating. According to the International Energy Agency (IEA), the world's renewable energy capacity jumped an astounding 45% in 2020 as part of an "unprecedented boom" in wind and solar energy. Renewable energy sources are expected to account for 90% of the total global power capacity increase in 2022.[1] We expect state governments and ISOs to set higher renewable energy goals over the next few years to meet net-zero commitments.

With the trend of renewable energy projected to jump to 60% higher than 2020 levels, investors are reallocating more capital to renewable energy projects. Project developers have taken notice of the shift in capital allocation and are working on determining how they can participate in this influx of capital and find land ideal for renewable energy projects.

Siting a renewable energy project is complex, involving multiple economic, environmental and market factors. Traditionally, project siting required developers to pull from multiple sources with varying levels of data integrity. Approval to build a renewable plant is a multi-phase process, with each study potentially costing hundreds of thousands of dollars. But given that upwards of 80% of projects are suspended or withdrawn from the interconnection queue, simplifying the siting process is essential. With solid criteria, tools and data, developers can uncover parcels with potential for renewable project development within minutes, saving time and money.

This guide is designed to help you learn the stages of the renewable siting process and how to establish initial screening criteria. We'll show you how to filter areas by favorable markets, economic considerations and parcel attributes.





The charts and maps in this guide are built with data and analytics from Enverus' Power and Renewables platform within PRISM.

[1] IEA (https://www.npr.org/2021/05/11/995849954/renewable-energy-capacity-jumped-45-worldwide-in-2020-iea-sees-new-normal)

1. Initial Screening Criteria

Setting initial screening criteria is the first step to finding a project site. This criteria will help guide a project developer through the siting process and help them determine what types of projects are appropriate for the site. Depending on how strict the criteria are, up to 90% of project opportunities could be filtered out. Below are some standard screening criteria a developer might set prior to project siting.

Project Size. A developer needs to set the size of the project they are comfortable developing. The developer should look at their own capabilities to understand if they can reasonably take on a project. Does the developer have the staff to plan and develop a 500 MW project? Will the supply chain be able to produce the necessary equipment in a reasonable time? How quickly does the developer want to complete this project? Does the developer have access to funding to support a project of this size? Choosing a project size will help the developer understand the resources required and narrow down their supplier list.

Preferred Regions. Whether it is proximity, comfortability or friendliness of the policy, developers have preferred regions. But a preferred region or state may not have the best economics for renewable project development. Laws and incentives change frequently in the renewable energy industry, and it may be worthwhile to examine the economics of other regions, which could be more favorable and warrant further exploration. For example, PJM has a moratorium on solar as of 2022, prohibiting any development in its area until it evaluates the benefits of solar.

Expected Return on Investment (ROI). To secure funding for a project, developers need a strong grasp of their costs and expected revenue to present to potential investors (or a really good story!). Investors will want to see ROI - how much they can expect back for what they lend out. With renewable innovation and advancements in renewable technologies driving project costs down, being up to date on the latest costs and tax incentives can help make the difference in whether a developer's project is funded. Having a targeted ROI can help give a guideline for the project developer to consider different states or suppliers for their renewable project development.

Equity IRR at $60/MWH of Power Plants in Texas

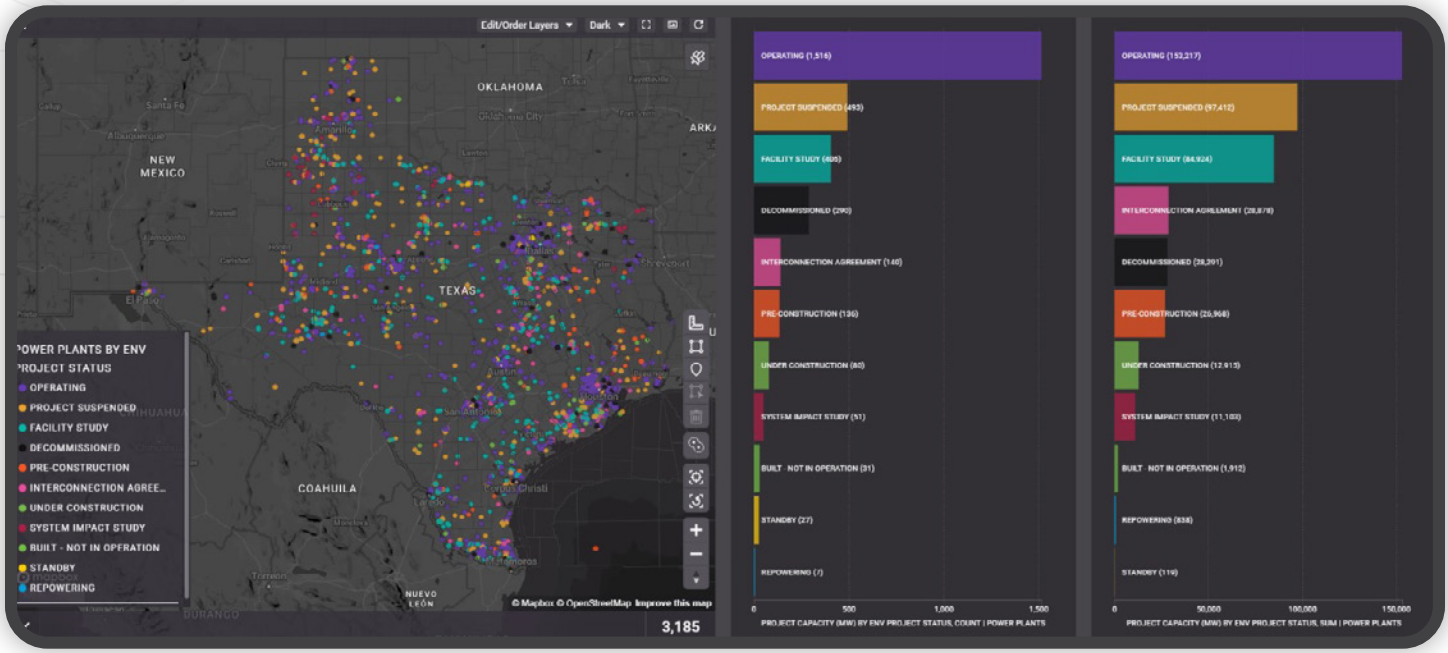
Other Screening Criteria. Project developers may use more screening criteria, with some criteria being specific to just that one developer. It is up to the developer to establish criteria to determine which projects are suitable for undertaking. For example, benchmarking operating and planned project returns may help certain developers with their siting decisions.

2. Favorable Markets

Once a developer has captured their initial screening criteria, the next step is to narrow down the locations to focus on. One way to do this is to focus on the favorable markets for renewables. This focus will uncover prime areas for renewable plant development. There are several ways to think about favorable markets for renewable projects.

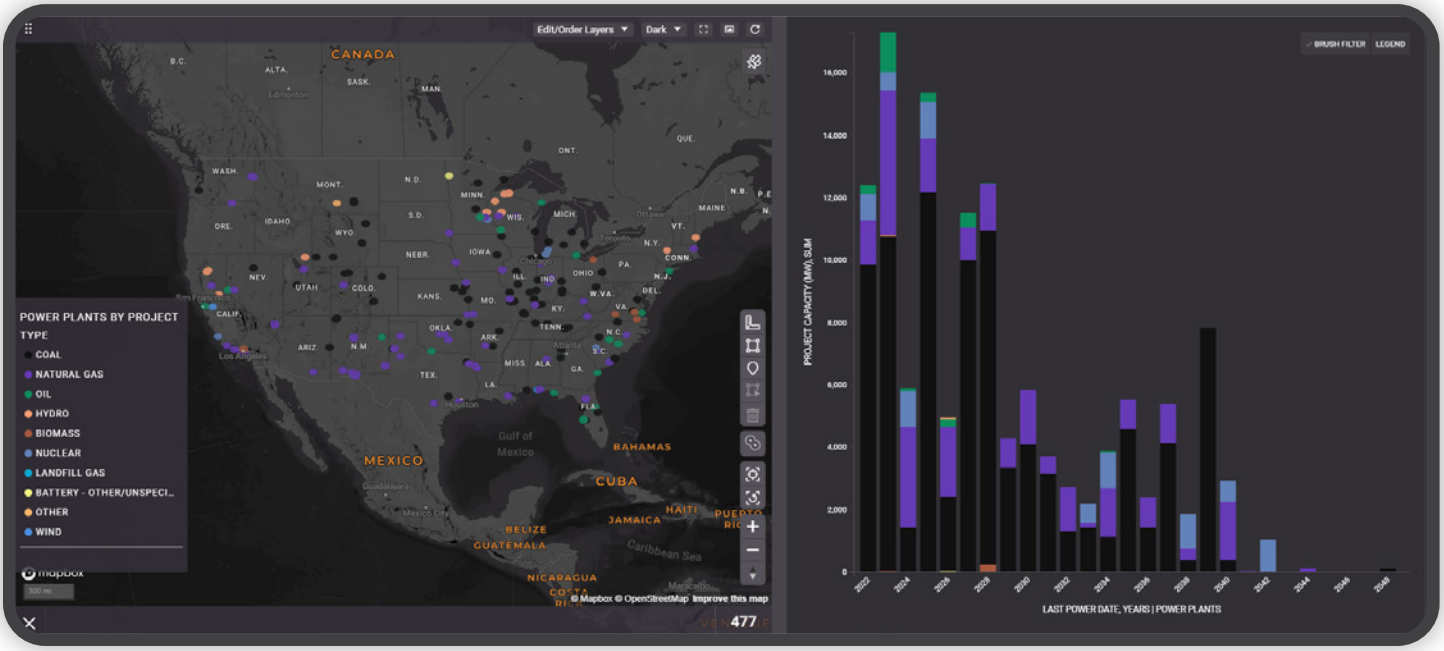
State's Renewable Power Goals. Many states will share their targets for renewable energy for upcoming years. Developers can use this information to understand the expected demand for renewable energy in the coming years and plan accordingly. Additionally, Integrated Resource Plans (IRPs) are a place to track down siting opportunities based on the long-term resource plans of different regions/utilities.

Interconnection Queue. To further understand the demand, a developer needs to evaluate the interconnection queue. The interconnection queue is a list of transmission and generation projects that are currently proposed and seeking to join the grid. The queue reveals information such as the company involved, the electric capacity the project is expected to bring to the grid, the expected timeline for the project to come online, and the status of each project. It also includes information on suspended projects. The interconnection queue provides with valuable insight into areas that are overcrowded with companies competing to build renewable plants and uncovers underserved areas that may be prime for renewable plant development.



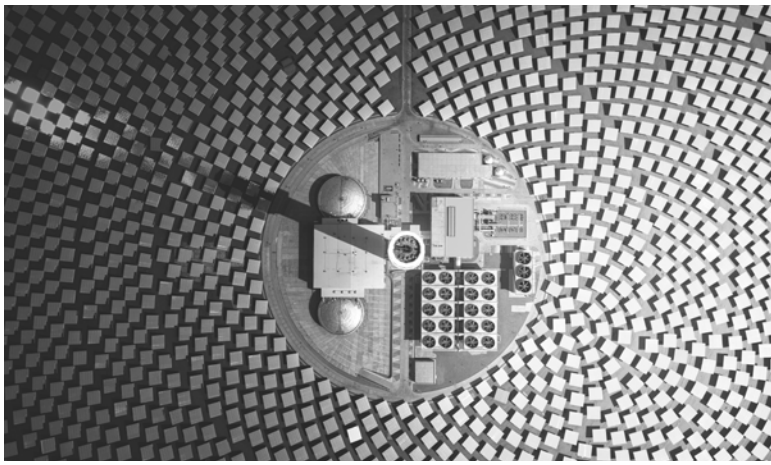
Texas Interconnection Queue by Project Status

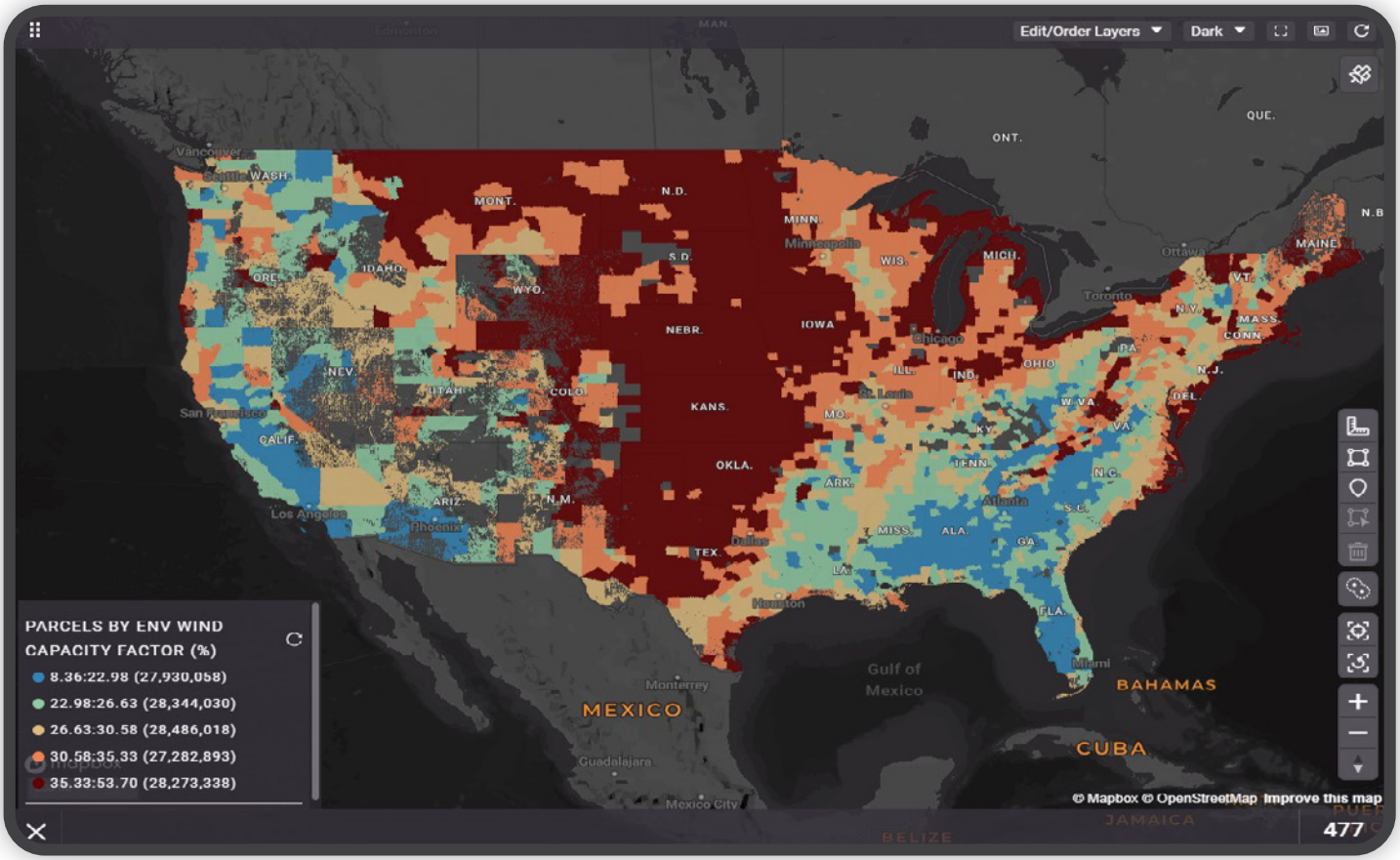
Decommissioned Power Plants. Developers need to look at a power plant's decommission dates. The supply of power in the area will be reduced after a plant is decommissioned and another power generator will need to pick up the loss of power production (assuming there is also no loss of power demand in the area). Decommissioned plants will also affect the price of power, known as locational marginal price (LMP), at nearby nodes.



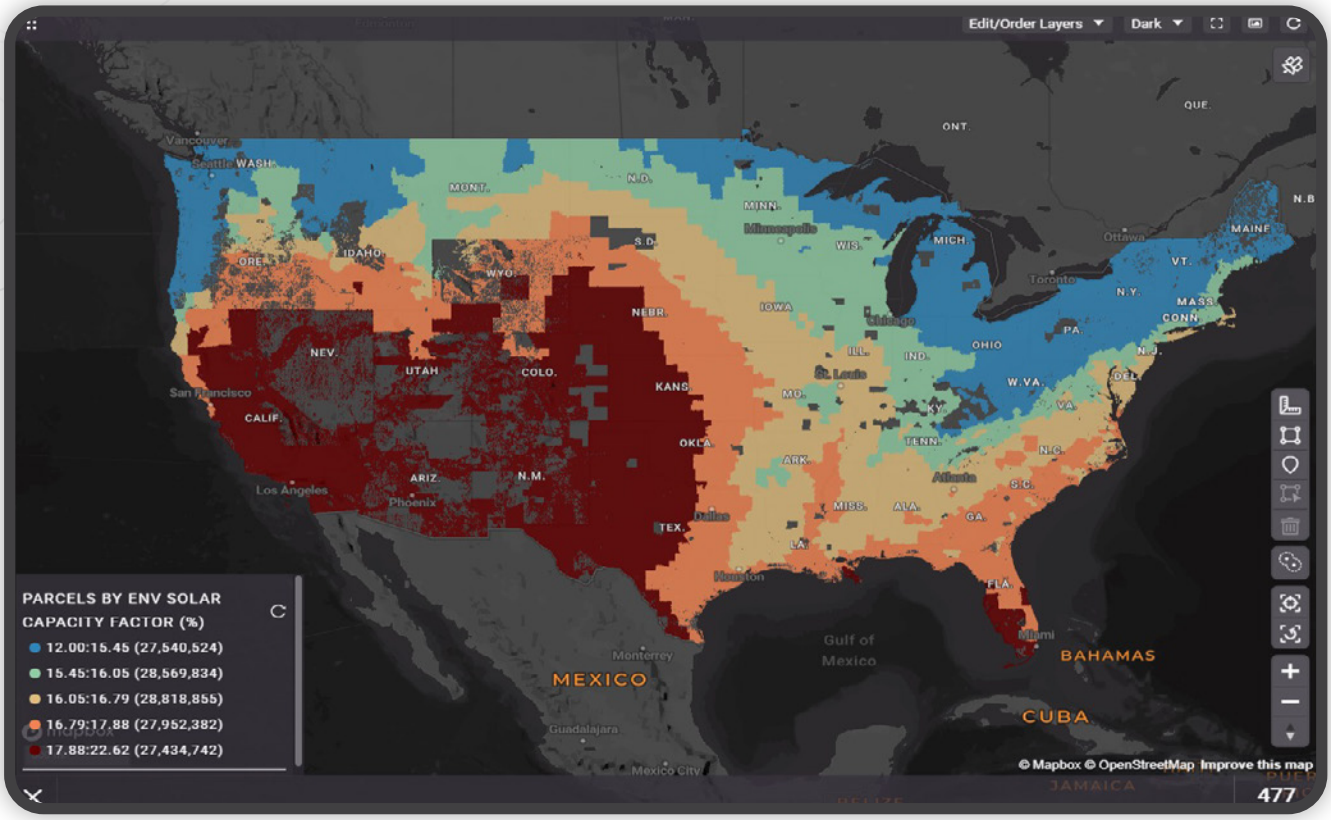
The Planned Decommissioning of Power Plants Until 2050

Solar or Wind Capacity Factor. If a developer is planning to build a solar or wind plant, they will need to understand if the area gets enough sun or wind to generate electricity! Solar or wind capacity factor will help determine how much sun or wind has historically been recorded in the area. With higher solar or wind availability, more electricity can be generated. Ideally, developers want their renewable plants in areas that will see significant sun or wind availability, but those might also be competitive areas, resulting in lower chances of project approval or lower electricity prices. Areas that may not have the highest solar or wind capacity factor, but have less competition, higher chances of project approval and higher price of electricity are still worthy of consideration.



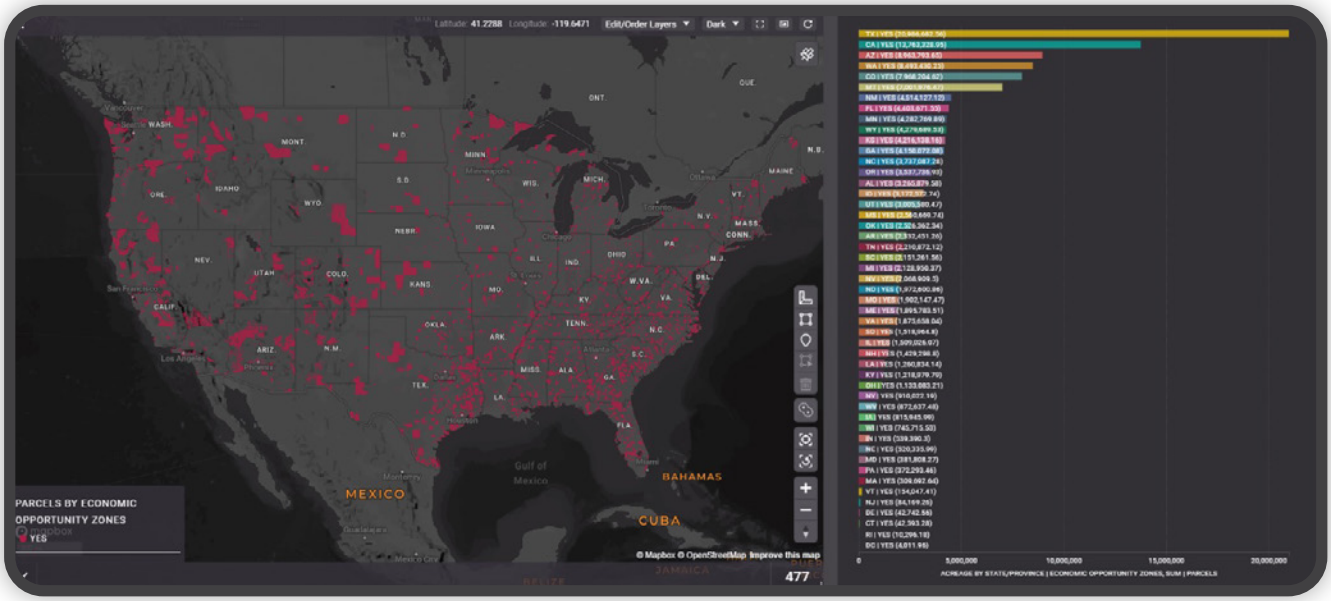


Map of the Wind Capacity Factor (%) of the United States



Map of the Solar Capacity Factor (%) of the United States

Tax Incentives. Currently, federal and state tax incentives contribute significantly to a renewable project's ROI. Some states may have more favorable tax incentives for renewable developers than others, but states with more favorable tax incentives will have more competition and a lower chance of project approval.



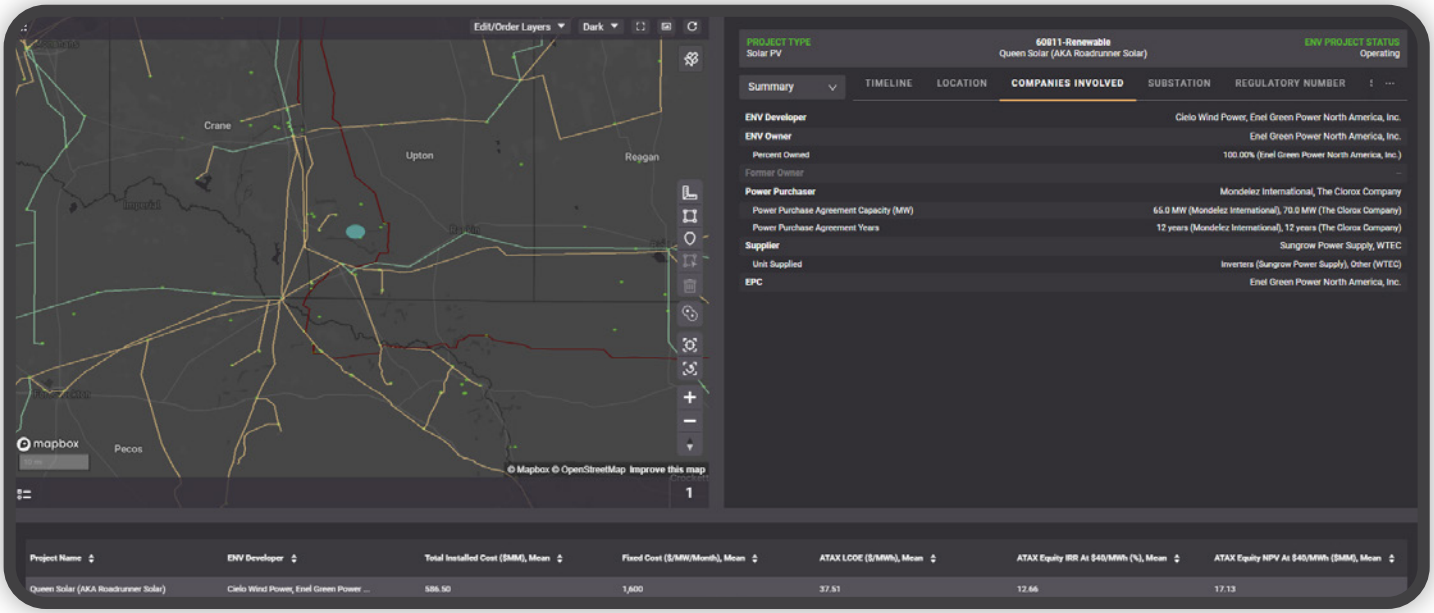
Parcels by Economic Opportunity Zones

Other Screening Criteria. Developers will have other locational conditions that they may find favorable such as economic opportunity zones or designated energy communities. These will all have to be taken into consideration based on the goals and objectives of each project the developer is looking to build.

3. Economic Considerations

At this point, the developer has filtered down to a smaller list of areas that warrant further due diligence. The next step is to evaluate the economics of projects in the narrowed-down area. This step is critical to understanding if a project will achieve or exceed the developer's targeted ROI. Below are some relevant economic data and analytics developers can evaluate in existing renewable power plants to help benchmark the financials behind the developer's renewable project.

Renewable Plant Costs. A developer can start understanding the economics of renewable plants by looking at similarly built plants. Developers can find recently built, similarly sized plants that use the same renewable technology in the target area to get an estimate of what their project costs will look like. Some of the economic numbers to evaluate are levelized cost of energy (LCOE)[2], total installed costs, variable operating and maintenance costs, and capex per megawatt[3]. There are public resources providing some of these economic data points. If the public data is for a general area or state, developers will need to make reasonable assumptions to estimate the economics for the plant of interest, factoring in plant size, the technology used, the date built, material costs and labor costs. For the sake of this guide's readability, we use PRISM Foundations Power and Renewables | NAV & Economics Analytics to present the cost data and analytics.



Example of an operational solar plant's installed cost, fixed cost, LCOE, IRR at $40/MWh, and NPV at $40/MWh

Reviewing the economics of similarly built plants will also help the developer benchmark their supply chain and development costs to understand if their project's costs are in line with the industry.

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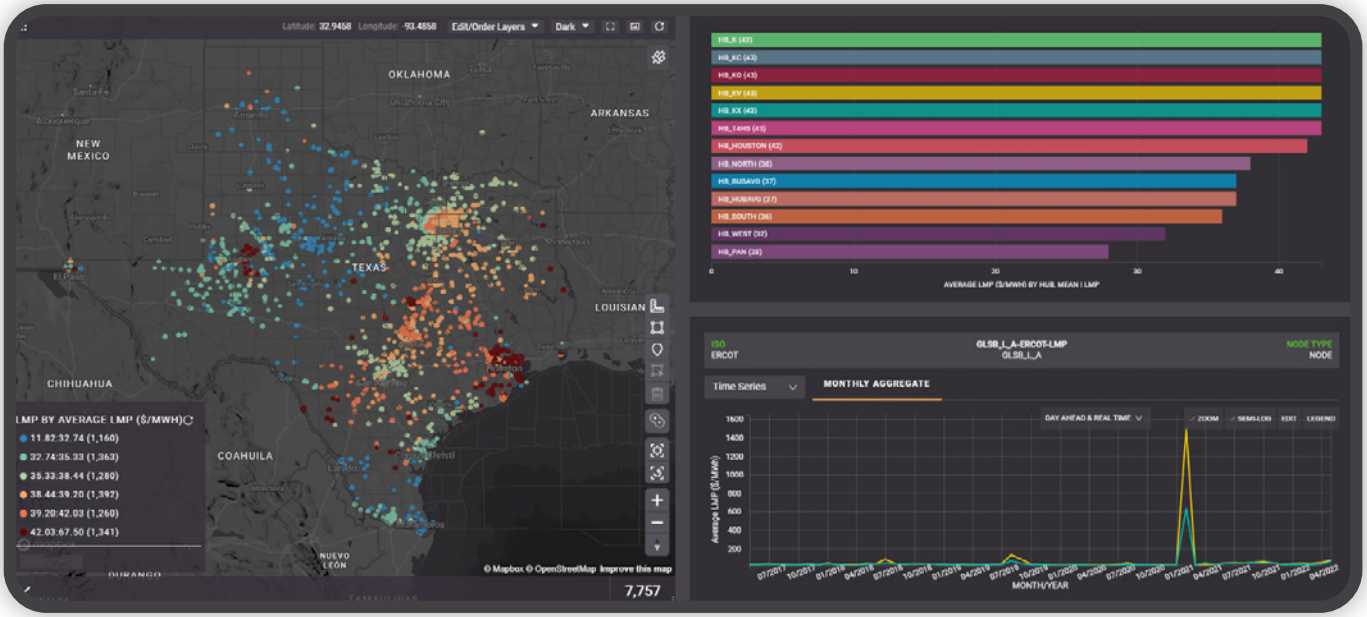
2. LCOE is the average net present cost of electricity generation for a generating plant over its lifetime and can also be considered the breakeven electricity price.

3. Capex per megawatt is the cost to build a plant in relation to megawatt output; it can also be considered as the breakeven electricity price.

Price of Power. Developers ultimately want to know how much they can make from the power generated from their renewable plants! Two parameters developers want to evaluate are locational marginal pricing and solar or wind weighted prices. Depending on the arbitrage opportunities given the solar and wind weighted prices vs all hours pricing, a developer may also consider developing batteries co-located with their renewable plants.

- **Locational Marginal Pricing (LMP).** Understanding LMP is critical in determining what a renewable plant can sell its power for once it is connected to the grid. An area with consistently lower LMP may be less desirable to develop a renewable plant, particularly in situations where the power purchase agreement (PPA) doesn't cover the useful life of the plant. In addition, new plants coming online in an area could drive LMP lower, impacting the project's ROI negatively. On the flip side, if plants are being decommissioned in the area, LMP may become higher, positively impacting the project's ROI. In addition, LMP data can give guidance to developers in setting prices for PPAs.

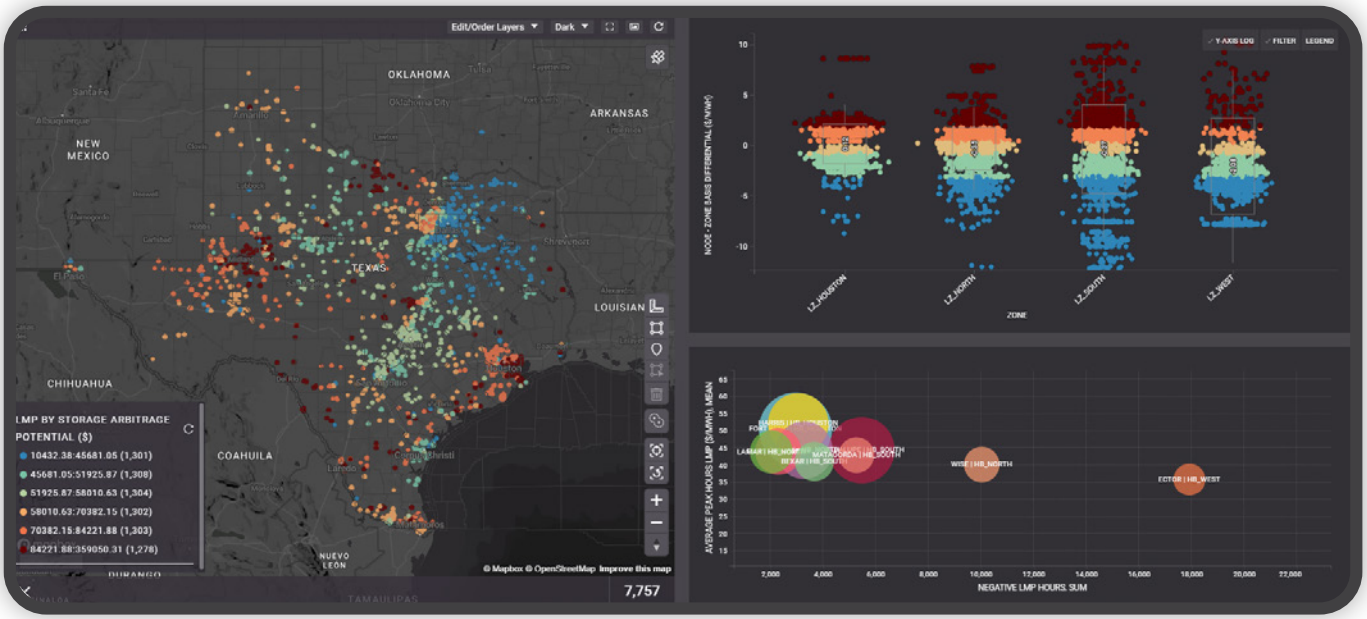


LMP by Average LMP in the Texas Area From April 2017 to April 2022.

- **Solar and Wind Weighted Prices.** Solar and wind weighted prices are the LMP during times when solar and wind generate electricity for the grid. Understanding the solar and wind weighted prices will give the developer a better estimate of the price they can sell electricity to the grid when it is being generated by the developer's solar and wind plants. This price can be significantly different than the average all hours pricing.

LMP by Average Wind Weighted LMP From April 2017 to April 2022.

- **Battery Considerations.** If LMP is significantly higher during parts of the day when solar and wind power are not being generated, a developer may consider using batteries. Batteries can store electricity when LMP is lower and bring the electricity to the grid when LMP is higher.

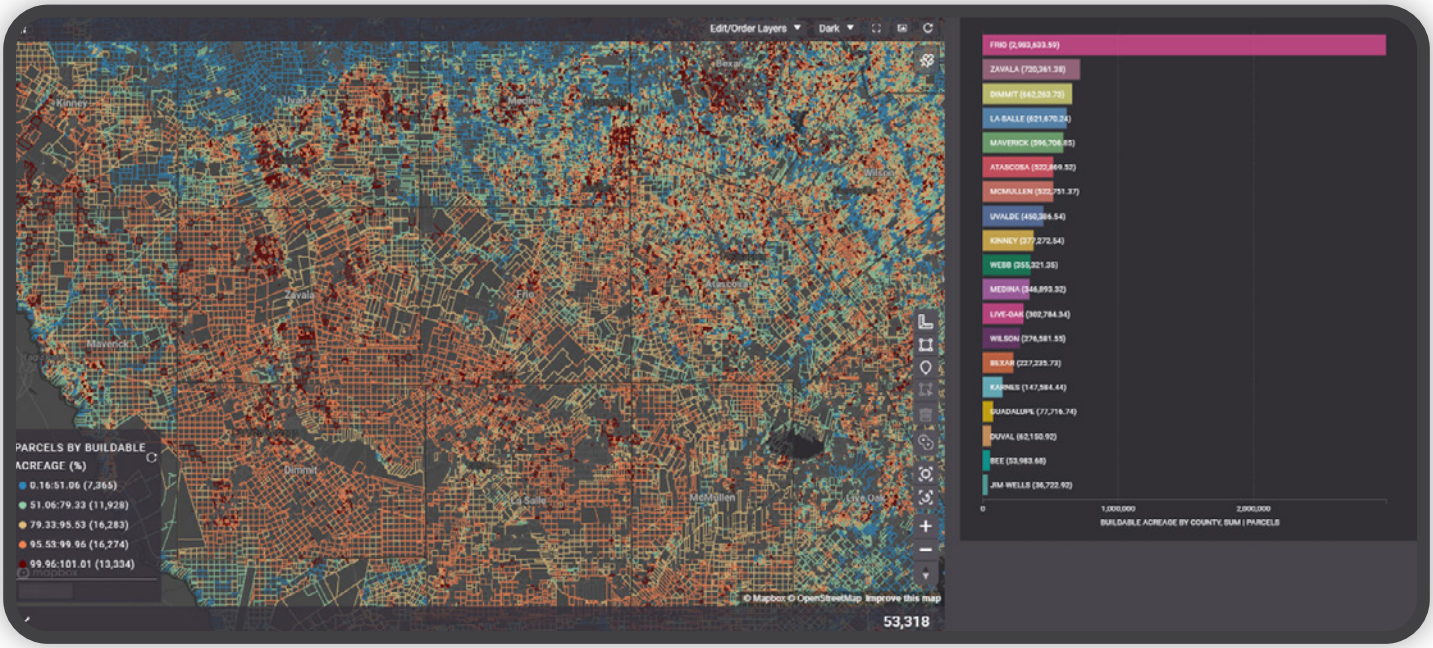


LMP by Storage Arbitrage Potential

4. Down to the Parcel

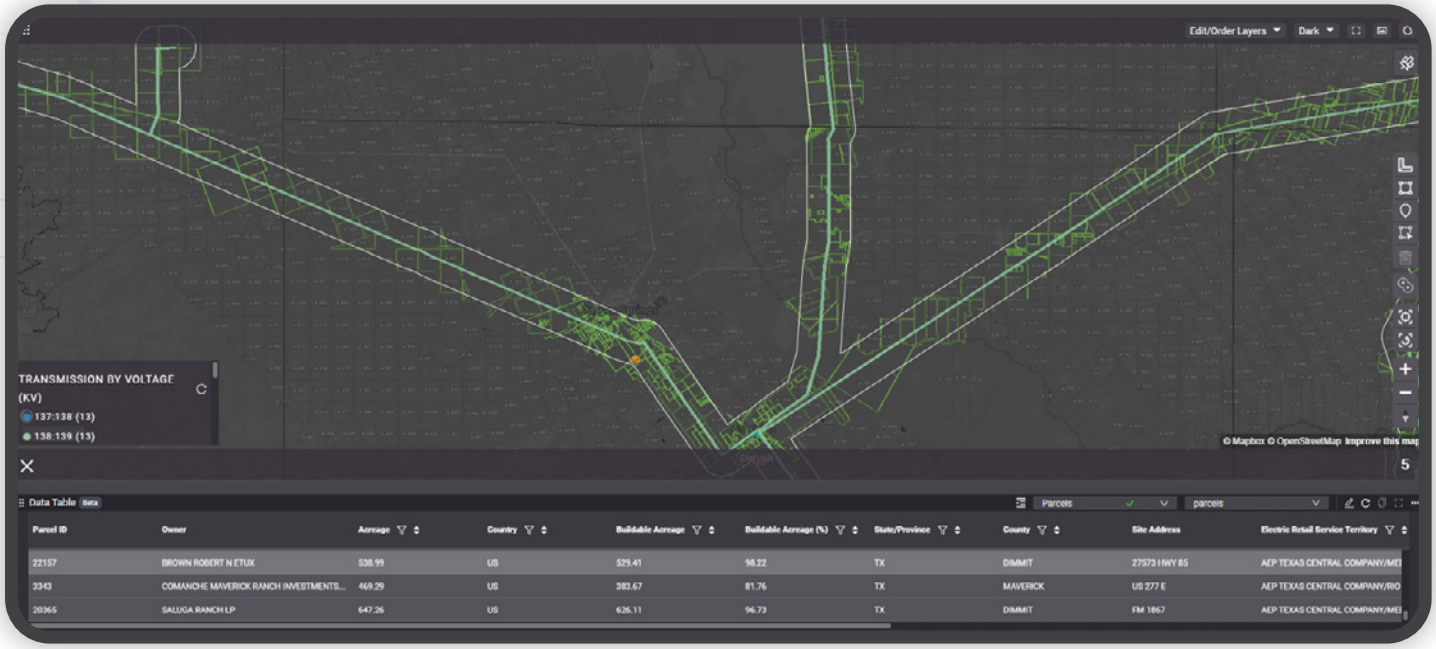
With favorable markets and economic considerations narrowing down areas of interest, a developer can evaluate characteristics of the land to find the most suitable parcel for renewable plant development.

Exclusion Layers. There are areas that are not suitable for renewable plant development. Developers should exclude parcels that include waterways, protected areas, existing infrastructure, pipelines (both above and below ground), or are in proximity to towns and floodplains from their search for suitable land development. In addition, solar and wind have ideal levels of slope to maximize the power produced. Adding all the exclusion layers will give you a map of the ideal places for solar or wind plant development.



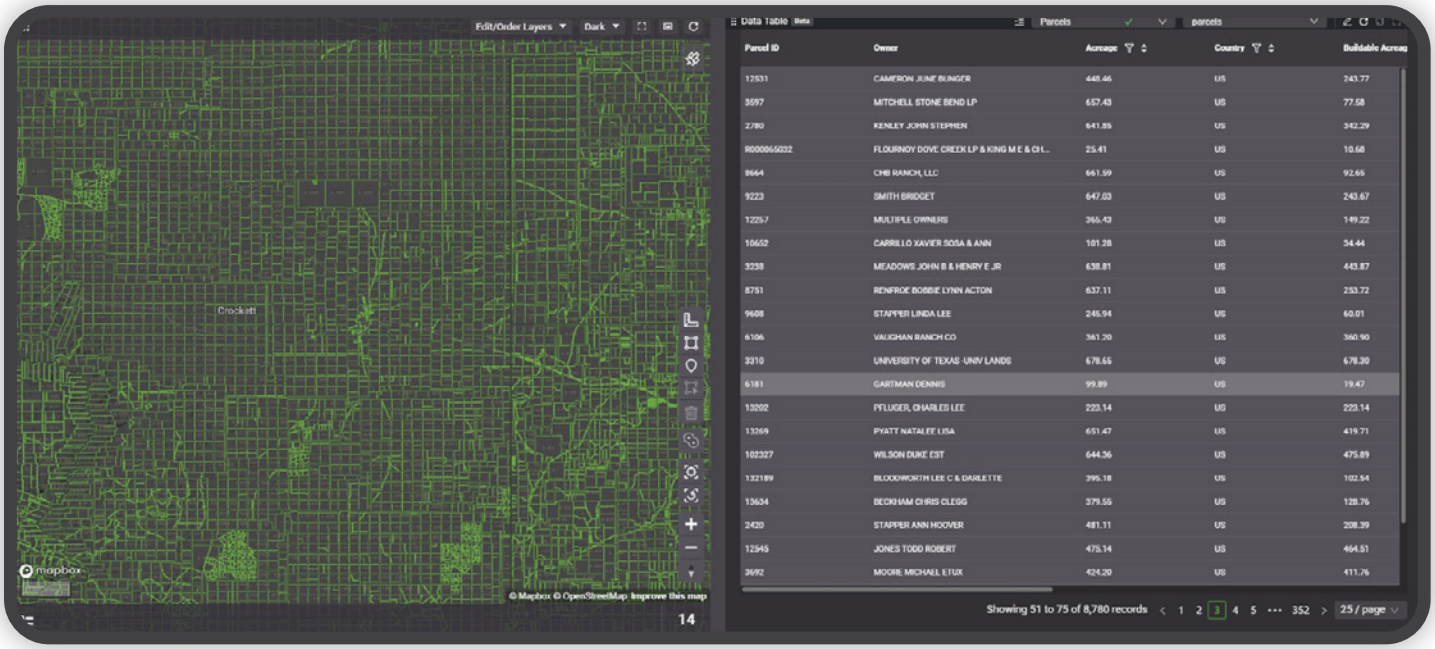
Parcels by Buildable Acreage (%)

Proximity to Infrastructure. If possible, a developer should identify the right size parcel(s) as close to transmission lines as possible. The closer a plant is developed to a transmission line, the lower the interconnection costs will be to bring power to the grid. Developers can exclude parcels that exceed a certain radius from a transmission line.



Parcels within a set distance from transmission lines

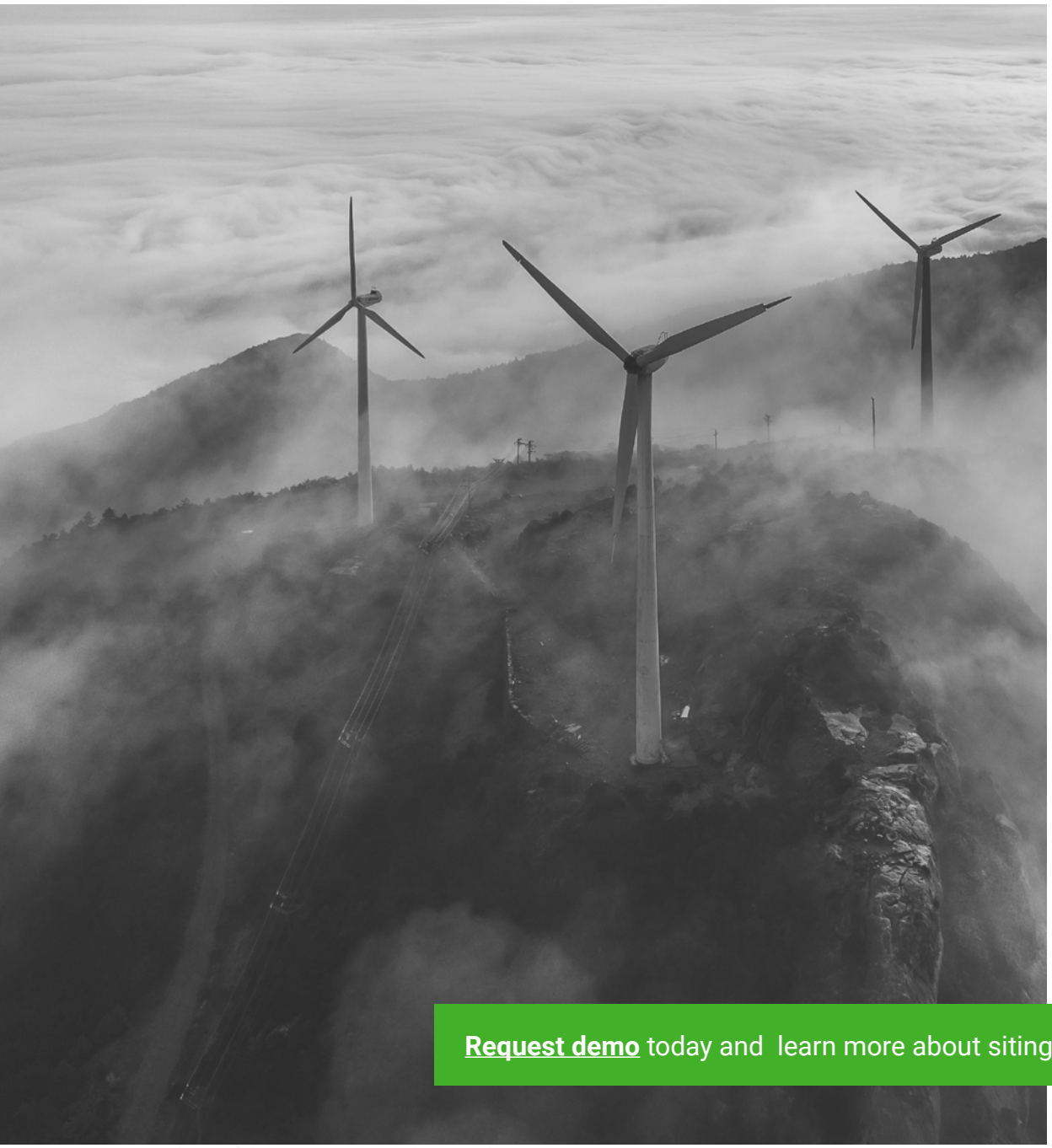
Who Owns the Land? Once all the exclusion layers have been determined, the developer will be left with suitable land for renewable plant development. The next step is to identify the parcel owners of the suitable land and to reach out to the owners about developing on their land. In most cases, the parcel owners can be found in public sources.



Parcel view of parcel owners

Conclusion

With the right data and analytics, developers can narrow down the best parcels of land for renewable solar or wind development within a couple of minutes. At a time when there is a lot of capital chasing renewable projects, it is key to have an edge. Enverus' Power & Renewables platform offers that edge.



Request demo today and learn more about siting renewable projects.