Does Location Matter When Selecting an Off-site Renewable Project?

A statistics-driven look into why project location impacts the ability to hedge against rising electricity costs

Introduction

Natural gas driven power markets are experiencing what many believe to be historically rock-bottom electricity prices, a dynamic which is coinciding with both ever-cheaper wind and solar economics as well as a growing demand for renewables among a wide range of customers. In this context, large energy users across the country are procuring growing quantities of off-site renewable generation not only to fulfill their carbon reduction goals and to support branding efforts, but also to hedge against inevitably rising electricity costs. Indeed, long tenor renewable contracts can provide a cushion against natural gas volatility and structural price increases at a cost and duration that is unavailable through traditional electricity supply options.

Off-site renewables are the least-cost form of renewable energy and are delivered through the electrical transmission system (a.k.a. "the grid"). Given the state-by-state differences in electricity market structures, off-site renewables are delivered to customers either through the customer's regulated utility, such as under a Green Tariff, or through the wholesale markets, often referred to as a "Virtual Power Purchase Agreement" (Virtual PPA). Unique combinations of different state market structures and renewable resources in each state result in a range of energy costs and procurement mechanisms. For energy users in competitive wholesale markets (ex. PJM, ERCOT, SPP, MISO, etc.) who are currently considering procurement from an off-site renewable project, this technical brief will explore the impact of a project's location relative to the location of a campus's load in hedging against rising electricity costs.

A Brief Background on Competitive Wholesale Markets

Whereas customers in regulated markets are limited to buying bulk electricity from their incumbent utility, customers in competitive markets generally have "retail choice": These customers may buy electricity from the distribution utility, a retail electric supplier, or directly from the wholesale market. Additionally, customers in competitive markets can choose to buy their energy directly from a power plant, such as an off-site renewable project. This ability for end customers to contract directly with wholesale generators has led to the rise of Virtual PPAs delivering bulk, low-cost renewable power to end customers through the wholesale markets.

Although it may not be intuitive, this "retail choice" extends beyond state lines. A university in Virginia, for example, could buy electricity from a wind project in Texas. This potential exists because the wind project is located in a wholesale market, ERCOT. There have been a handful of historic off-site renewable transactions done with large geographic distance between the project and customer location, spurred by attractive Virtual PPA pricing. In the example above, an ERCOT wind project that is favorably priced relative to Virginia power pricing would seem to make the decision a "no brainer". This is supported by a prevailing view that the cost of electricity in Virginia and Texas are correlated and move in lock-step as natural gas prices rise and fall.

Unfortunately, however, these historic off-site renewable transactions have underperformed for two key reasons: energy forecasts at these remote generation locations failed to predict significant reductions in wholesale energy values and the cost of electricity at the location of the seller's power generation and the buyer's load do not in fact move in lock-step, as revealed by statistical analysis.

The Importance of Energy Price Correlation Between Buyer and Seller Locations

In order to understand the importance of location in assessing the value and risk profile of an off-site renewable contract, it is critical to examine the correlation in pricing between the location of the buyer's load vs. the seller's power generation. The degree to which two variables' movements are associated is described by the "Correlation Coefficient". A correlation coefficient of 1.0 would indicate that two variables move in lock-step, a coefficient of 0.0 would indicate that the two variables are completely uncorrelated, and a correlation coefficient of -1.0 would indicate variables that are perfectly inversely correlated (i.e. as one moves up by X, the other moves down by X).

An examination of the correlation of electricity prices in Virginia versus West Texas over the past 6 years reveals an average correlation coefficient of roughly 0.1, clearly indicating that these two markets are poorly correlated and do not move in lock step.

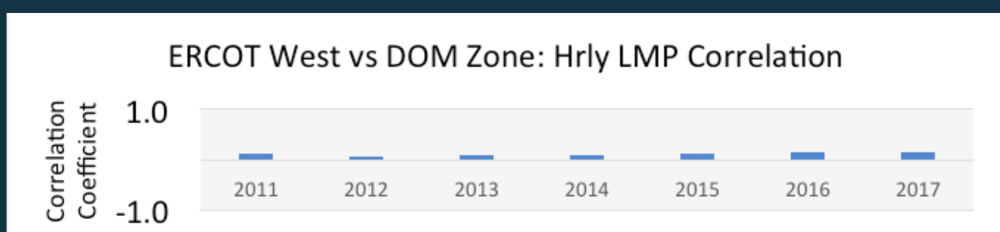

Fig 1. Historic correlation between ERCOT West zone and Dominion (Virginia) zone hourly energy prices.

Based on this lack of correlation, one could ask "Why would you buy output from a wind project in Texas if your facilities are not located in Texas?". The answer lies in the approximate pricing in the table below, which shows that off-site wind PPA pricing in West Texas is significantly less than solar PPA pricing in Virginia. In this example, the average cost to serve a Virginia-based DOM Zone buyer's load is $33/MWh and the buyer is contemplating a Virtual PPA with an ERCOT wind farm at $18/MWh or a DOM Zone solar farm at $37/MWh. Based on historical Locational Marginal Prices ("LMPs"), it appears that the off-site wind transaction results in a $2/MWh positive value (i.e. $20 wind LMP minus $18 wind PPA) whereas the off-site solar transaction would result in a -$3/MWh value (i.e. $34/MWh solar LMP minus $37/MWh solar PPA).

Electricity Supply Cost - DOM Zone Facility ($/MWh)	**$33**
ERCOT West Zone Annual Values ($/MWh)	**$20**
ERCOT Wind PPA ($/MWh)	**$18**
DOM Zone Annual Avg Values ($/MWh)	**$34**
DOM Zone Solar PPA ($/MWh)	**$37**

Fig 2: Indicative 2017 values for Virginia electricity supply costs as "DOM Zone" facility, off-site Texas wind energy & PPA values, and off-site Virginia solar energy & PPA values.

This approach to determining project value is flawed for several key reasons. First, it presupposes that historic LMPs are predictive of future LMPs. They are not. Secondly, this view of the highest value project does not consider the correlation between the value of energy at the generators vs. the value of energy at the buyer's load. While some factors may affect pricing in a common direction (ex. changes in natural gas prices, weather, etc.), our statistical review shows that ERCOT West and DOM zones do not move in lock-step. Further, the uncorrelated nature of power pricing in different markets will continue to grow as there is increasing renewable penetration, particularly in rural areas with limited load (i.e. West Texas or Western PJM vs Northern Virginia). Consequently, a buyer seeking to enter into an off-site renewable transaction to hedge against rising electricity costs cannot rely on the performance of the off-site Texas wind project if its facilities are not located near the project in Texas. The lack of correlated pricing increases the risk that the hedge will not function as intended.

Two future scenarios are shown below to demonstrate this reality. **Fig 3** shows the electricity supply cost for the hypothetical Virginia buyer increasing from $33/MWh to $42/MWh. In this future scenario, uncorrelated ERCOT West zone pricing may increase from $20/MWh to $22/MWh providing some hedge benefit, while the highly correlated DOM zone solar pricing increases from $34/MWh to $43/MWh providing the full hedge benefit as it moves in full lock-step with the cost to serve the buyer's load.

Electricity Supply Cost - DOM Zone Facility ($/MWh)	**$42**
ERCOT West Zone Annual Values ($/MWh)	**$22**
ERCOT Wind PPA ($/MWh)	**$18**
DOM Zone Annual Avg Values ($/MWh)	**$43**
DOM Zone Solar PPA ($/MWh)	**$37**

Fig 3: Forecasted 2025 values for Virginia electricity supply costs as "DOM Zone" facility, off-site Texas wind energy & PPA values, and off-site Virginia solar energy & PPA values.

As seen in **Fig 4**, a buyer seeking to hedge against increases in future energy cost could see the worst-case scenario play out by contracting with the off-site Texas wind project. In this scenario the electricity supply costs have risen for the Virginia buyer and the off-site wind transaction is out of the money as the ERCOT market has softened. In this example, the buyer's value from the wind PPA has decreased to -$4/MWh ($14/MWh ERCOT values vs $18/MWh wind PPA), but the cost of meeting their load has increased by $9/MWh (from $33 to $42/MWh). This represents a truly worst-case outcome for an energy manager. Conversely, if the buyer were to contract with a local off-site solar project, the value of the off-site solar PPA provides the full hedge benefit. While the cost of serving load has increased by $9/MWh, the value of the solar PPA has also increased by $9/MWh. In other words, in this scenario, the wind PPA costs the buyer a net $4/MWh and their electricity supply costs have risen by $9/MWh. Alternatively selecting the off-site solar PPA effectively locks in the buyer's cost of power supply with a net cost of $0/MWh ($9/MWh supply cost increase less $9/MWh PPA benefit). The high correlation driven by the solar project's location has created value for the buyer by effectively hedging against future price increases.

Electricity Supply Cost - DOM Zone Facility ($/MWh)	**$42**
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Fig 4: Forecasted 2025 values for Virginia electricity supply costs as "DOM Zone" facility, off-site Texas wind energy & PPA values, and off-site Virginia solar energy & PPA values.

Conclusion

In addition to the goal of reducing carbon emissions, many buyers are contemplating off-site renewable transactions today to save money by hedging against rising energy costs. While we can have confidence that any off-site transactions will reduce the buyer's carbon footprint regardless of the generator's location, location relative to the buyer's load is key in determining whether an off-site renewable project will perform as a hedge against rising energy costs. The uncorrelated nature of power markets will continue to grow as renewable penetration continues, as will the divergence in pricing between major load centers and the remote renewable generation areas within each power market (ex. Eastern PJM load vs Western PJM generation). Customers are thus well served by having a keen eye towards location and correlation, with a strong preference for "in region", when selecting an off-site renewable project.

About this Publication:

The Insights for Action series provides detailed analysis of issues and challenges that are faced by institutions in the Climate Leadership Network as they pursue their ambitious climate goals.

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