

## Negative Wholesale Power Prices: What Does This Mean?

By Martin Flusberg

A recent article in Business Week magazine (<https://www.bloomberg.com/news/articles/2022-08-30/trapped-renewable-energy-sends-us-power-prices-below-zero>) pointed out that we are seeing a significant growth in occasions when wholesale power prices go negative, often as a result of increases in the amount of wind and solar power being generated. The article noted that wholesale prices went negative about 200 million times across the US in 2021, more than 5 times the number 5 years earlier.

This is neither new news nor unexpected. A November, 2021 report from Berkeley Labs - Plentiful Electricity Turns Wholesale Prices Negative (<https://emp.lbl.gov/publications/pelectricity-turns-wholesale>) – goes into great detail about what is happening and why, including the impact of rising amounts of wind and solar generation. A report from the National Bureau of Economic Research back in 2015 (<http://www.nber.org/papers/w21113>) predicted: “increased penetration of intermittent generation resources (wind and solar) is likely to increase wholesale price volatility”.

Before getting into a more in-depth discussion of what is happening and what it might mean, I thought it would be helpful to explain the concept of wholesale electricity prices, something that did not exist in the U.S. as recently as 26 years ago.

### Origin of Wholesale Power Markets

Until the second half of the 1990's, utilities owned all generating facilities, transmission lines, and distribution lines and had full responsibility for the customers, with state agencies responsible for setting prices based on costs. The industry began to “restructure” (utility-industry-speak for deregulation, which would be an overstatement) in the latter half of the 1990's. As part of this, utilities in about two-thirds of the country were required to divest their generation resources. The Federal Energy Regulatory Commission (FERC) created the Independent System Operators (within states) in 1996 and the Regional Transmission Organizations (crossing state boundaries) in 1999 to promote wholesale competition for electricity supply and non-discriminatory access to transmission service, as well as to encourage broader regional transmission planning, energy trading, and coordination. Below is the FERC map of ISO's and RTO's in the US. The Northwest, Southwest, and Southeast are the regions that do not have any form of restructuring, and where there are no wholesale electricity markets. (In large portions of these areas electricity is provided by federally owned utilities set-up during the depression, specifically the Tennessee Valley Authority (TVA), Bonneville Power

Administration (BPA), Southeastern Power Administration (SEPA), Southwestern Power Administration (SWPA), and Western Area Power Administration (WAPA)).



**FERC map of Independent System Operators and Regional Transmission Organizations**

Wholesale power sales only occur in the areas where generation assets are not owned by utilities. In these areas, the owners of the generation assets sell their electricity to utilities, competitive energy suppliers (in the areas that have them) and some large commercial and industrial customers. As with any such market, pricing is tied to supply and demand. When supply exceeds demand, prices may turn negative – or in other words the generators pay their customers to take the power.

### **Why are Generators Willing to Pay to Deliver Their Power?**

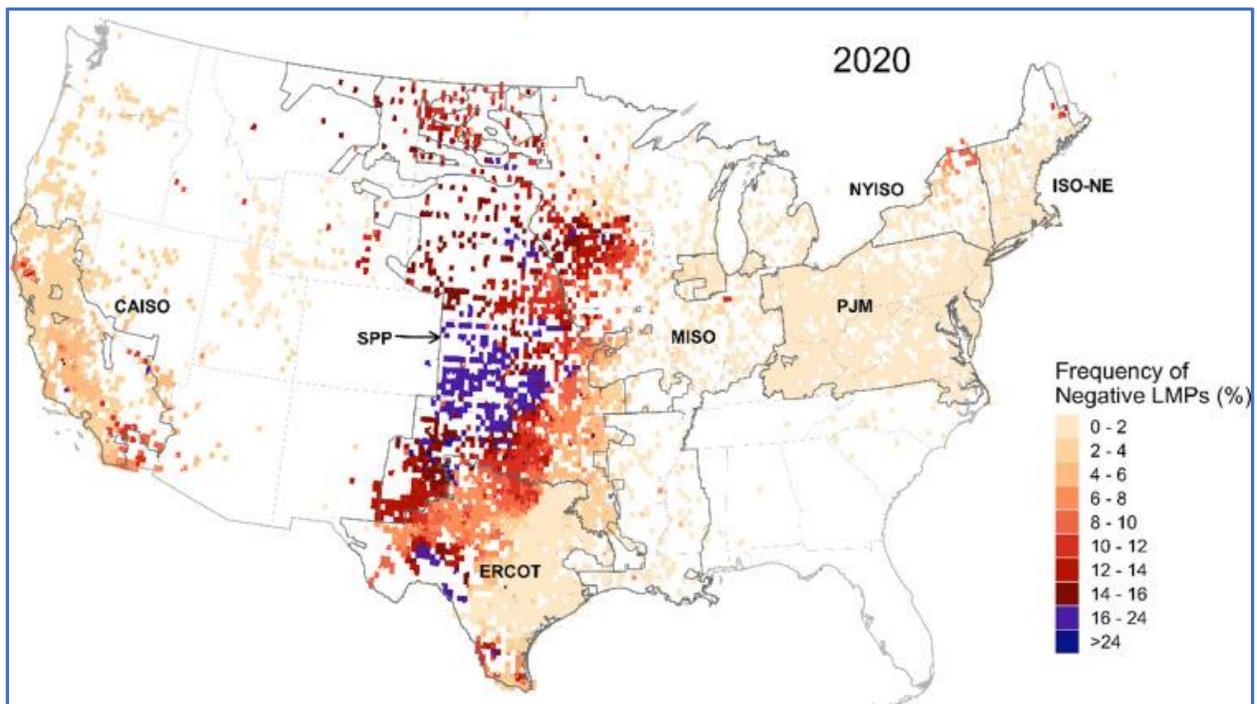
The articles quoted above point out several reasons that generators are willing to sell power at negative prices rather than shut down generation.

For example, a generator may have physical constraints that inhibit its ability to ramp down production at a specific time. Alternatively, a generator may anticipate demand - and therefore prices - to increase in the near-term and therefore not want to shut down in order to avoid time consuming start-up procedures. Some generators may need to continue production because of power contracts already in place.

With wind and solar, the issue is even more complicated. In addition to the fact that the level of wind generation is tied to the level of wind and therefore highly variable, wind generators are provided a Federal Production Tax Credit, so it may very well make sense to continue to generate when prices turn negative. Solar generation is also tied to weather conditions, but while there have been some production tax credits for solar, solar has been provided more in the way of investment tax credits, with the tax credit being offered for building the solar facility rather than for producing solar power. Federal renewable tax credits for wind and solar have been extended for at least 10 years under the recently passed Inflation Reduction Act

### Where are we Seeing the Greatest Instances of Negative Wholesale Prices?

The Berkeley Labs report presented the following map showing areas with the most instances of Negative Marginal Locational Pricing (NLMP):



Source; Berkeley Labs

The map makes it clear that negative prices appear in specific regional clusters. For example, one of those is the wind-rich Central Plains region, where production tax credits delay curtailment of wind energy even as prices turn negative. In particular, Kansas and western Oklahoma have areas where market participants can be paid to buy electricity in more than 25% of all hours. Negative prices are also relatively frequent across much of the Southwest Power Pool (SPP). Another area with frequent negative prices is western Texas, a region with a

large numbers of wind turbines (not to mention a large number of oil and gas wells) and a growing number of solar plants. In this region, the problem can be traced to insufficient transmission capacity to address the growing amount of renewable energy.

### **Are Negative Wholesale Prices Good for the Energy Consumer?**

Wholesale power prices do ultimately have an impact on retail prices, but a short-term negative price does not have a direct impact. Customers are typically on a fixed price for some period of time and do not experience real-time price fluctuations. But frequent negative wholesale prices could be a disincentive to expand renewable energy generation. So, what can be done to minimize if not eliminate the occurrence of negative pricing?

### **Reducing Negative Wholesale Power Prices**

1. Expand Transmission Lines – This is referenced in the Business Week article and discussed in more depth in the Berkeley Labs Report. That report points out that there is a particular problem in the West Texas Permian Basin where there has been considerable wind power built. Transmission Lines were built out in western Texas in 2013 and that led to amelioration of the pricing problems that had existed then, but continued build out of wind farms has made the problem even worse than it was back then. The Berkeley report also notes that there are similar issues but not on the same scale in Northern New York and Northern New England, as the map points out.
2. Storage – Of potentially even more significance in addressing supply/demand distortions is power storage. If renewable energy can be stored, then energy produced when supply exceeds demand can be stored and then sold when demand is higher. This could have a significant impact on energy prices. It can also significantly reduce the need for fossil fuel generation currently required because both solar and wind power are intermittent. Expanded storage capabilities in homes and businesses will also lead to an expanded ability to leverage power produced at those facilities to feed the grid.
3. Time-Based Pricing – Commercial and Industrial (C&I) customers across the country already are on time-of-use (TOU) rates that encourage shifting usage from peak to off peak periods, something that is further promoted by demand-response programs which provide additional incentives for shifting loads (or automatically curtail them). But TOU pricing is very uncommon for residential customers and very few of them participate in demand-response programs. Expanding TOU pricing to residential customers – which would require extensive residential customer training on what this really entails – can provide a further basis for better matching supply and demand and avoiding the occurrence of negative wholesale prices.

**Bottom Line**

Negative Wholesale Power Pricing is not, of itself, a particularly good or bad development in the electricity market. It does indicate, however that there is a growing base of renewable power which is a very good development. Ensuring that there are sufficient transmission resources in place, greatly expanding energy storage, and continuing to leverage time-based pricing will greatly support the expansion of renewable generation which is critical to achieving the energy transition.