

Electricity Markets

In North America, utilities do not necessarily generate all the electricity they supply to their residential and commercial retail customers. They can buy or sell extra watt-hours as needed on the **wholesale market**. Independent power producers (IPPs) are part of this market, and are impacted by its **rules** and the roles of their fellow **participants**.

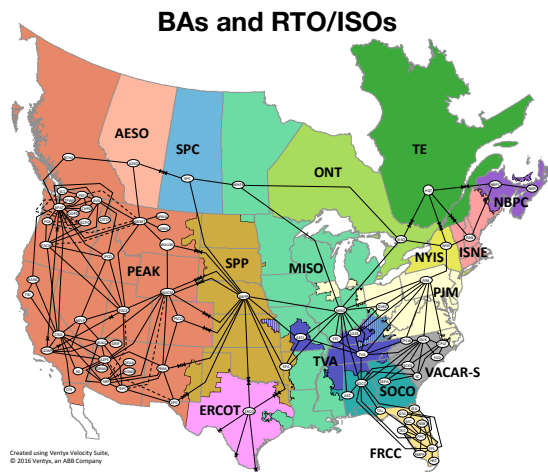
There are three ways to buy (or sell) electricity on the **wholesale market**^[1]:

- **Real-time**: for immediate use, based on the current price of electricity, which is related to supply and demand
- **At auction**: for future use, usually estimated a day ahead or more.
- **Contracted**: between a supplier and an off-taker for a period of several years or more, often through a Power Purchase Agreement (**PPA**)

The Rules

There is one basic rule in electricity management: **generation and load must always be balanced**. Both oversupply and undersupply can cause problems, including fires, blackouts, and damaged machinery. To prevent this, the grid is managed to make sure generation (supply) is constantly adjusted to match load (demand).

The **Federal Energy Regulatory Commission (FERC)** is the regulatory agency that sets and enforces the rules for the energy markets^[2]. It upholds the Federal Power Act, which ensures fair access to the grid for all generators to sell their electricity^[3]. Beginning in 1996, FERC established the *RSO/ISOs* to break up the regional monopolies of utilities that owned the entire generation, transmission, and distribution assets^[4]. FERC currently ensures that *BAs* and *RTO/ISOs* meet the reliability standards set by the North American Electric Reliability Corporation (NERC).



NERC Balancing Authorities, as of Oct. 1, 2015: https://www.nerc.com/comm/OC/RS%20Landing%20Page%20DL/Related%20Files/BA_Bubble_Map_20160427.pdf

Balancing Authorities (BAs)^[5] and **Regional Transmission Organizations/Independent System Operators (RTO/ISOs)** are responsible for operation of the wholesale market. They plan ahead for and actively maintain the grid's load-generation balance within a given area. They are also responsible for maintaining the grid's power quality to NERC standards. RTO/ISOs are significantly larger than BAs, and may cover several states.

The Participants

There are four main types of participants in the wholesale market:

1. **Independent Power Producers (IPPs)** generate electricity for sale, but do not usually own the transmission or distribution infrastructure.
2. **Investor-Owned Utilities (IOUs)** are for-profit, privately owned companies that own generation equipment but also often transmission and/or distribution networks. IOUs are regulated by State Public Utilities Commissions (PUCs).
3. **Publicly Owned Utilities (POUs)** are nonprofit, publicly owned organizations that can be operated by municipal districts, city departments, irrigation districts, or rural cooperatives^[6].
4. **Federal Power Marketing Administrations (PMAs)**^[7] sell the hydropower generated at US Army Corps of Engineers dams. Each of the PMAs also serves as Balancing Authority for its region.



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Percent of Infrastructure Ownership by Market Participant Type

Participants	IPPs	IOUs	POUs	PMA's
Generation	40%	38%	15%	7%
Transmission	—	80%	12%	8%
Distribution	—	50%	50%	—

What Markets Are Best for Wind and Solar?

Generally, RTOs are best adapted to intermittent renewable projects^[8]. Larger than BAs in terms of customers and generation sources, RTOs can more easily balance the variable nature of wind and solar generation. In addition, many RTOs like MISO (Midcontinent Independent System Operator) and PJM (Pennsylvania-New Jersey-Maryland Interconnection) have clearly defined rules for wind generators connecting to the grid in their control areas which simplify and streamline interconnection.

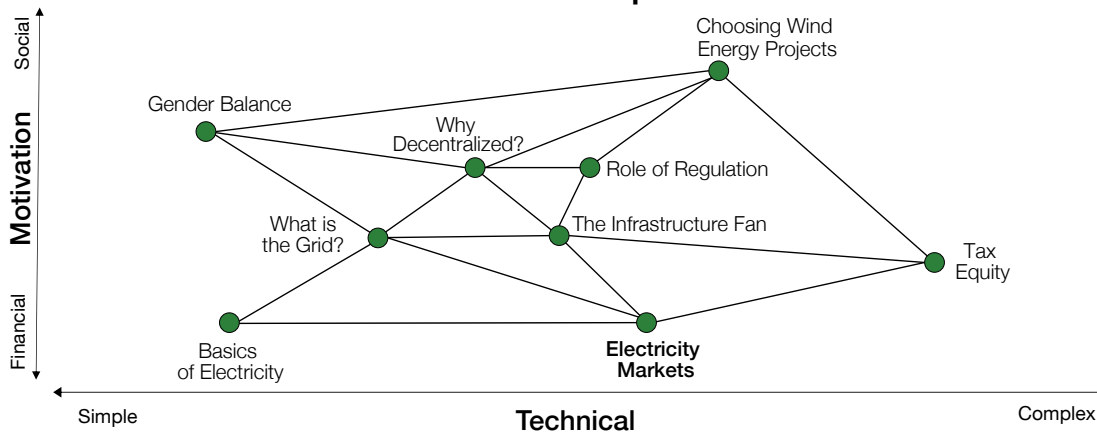
Energy Storage

The grid has a very limited capacity to store electricity. Recent developments like grid-scale storage and demand-management technologies are starting to make a difference but have not yet triggered a change in grid-management rules.

References and Further Reading

- [1] Environmental Energy Leader, "Wholesale Energy Markets Explained" (2015): <https://www.environmentalleader.com/2015/02/wholesale-electricity-markets-explained/>.
- [2] Federal Electricity Regulatory Commission (FERC), "What FERC does" (2020): <https://www.ferc.gov/about/what-ferc/what-ferc-does>.
- [3] Institute for Energy Research, "History of Electricity": <https://www.instituteforenergyresearch.org/history-electricity/>.
- [4] Penn State Department of Energy and Mineral Engineering, "Regional Transmission Organizations" (2020): <https://www.e-education.psu.edu/eme801/node/535>.
- [5] North American Electric Reliability Corporation (NERC), "Balancing area coordination: Effectively integrating renewable energy into the grid" (2015): <https://www.nrel.gov/docs/fy15osti/63037.pdf>.
- [6] American Public Power Association (APPA), "About APPA" (2020): <https://www.publicpower.org/about>.
- [7] USA Gov, the Official Guide to Government Information and Services. "A to Z index of departments and agencies", <https://www.usa.gov/federal-agencies/power-administrations>.
- [8] Bakke, G. "The Grid: The fraying wires between Americans and our energy future." *Bloomsbury, USA*. (2016): <https://www.bloomsbury.com/us/grid-9781632865687/>.

Where this White Paper Fits In



About Treehouse Investments: Treehouse Investments is a minority-owned firm dedicated to addressing climate change. We are a family business, founded by a family from Puerto Rico. We target direct investments in both publicly traded and private entities. Our focus areas fall under the broad description of decentralized infrastructure: companies and projects that contribute to building sustainable and resilient energy, water, and waste systems.

