Episode 2 - Structure and Operations of Electricity Markets

Welcome to the second installment in SmartWatt Weekly's Electricity Market Series. This week we'll look at some examples of the structure and operation of Electricity Markets. After reading this segment you should be able to answer the following questions:

1. What is the power pool? How does it operate?
2. Why are power pools necessary in today's electricity markets?
3. How are supply and demand imbalances equalized?
4. What instruments are utilized to mitigate the associated risks of power pools?

Let's kick off this week's installment looking at power pools: a system of trading wholesale electricity. This system determines which generating sets or plants are called upon to meet the demand for power at any time. Essentially a market, the power pool also determines and sets the price of power for a period of demand. Power pools are crucial simply because storage technology and capacity of today cannot be relied upon to meet volatile patterns of power demand, and thus simultaneous production is necessitous.

Competitive electricity pools are a very unusual form of commodity trading but they have well-established roots in the operation of large power systems. Unlike a traditional market relying on repeated interactions between suppliers and consumers to reach the market equilibrium, a pool provides a mechanism for determining this equilibrium in a systematic way. There are indeed various ways in which a power pool operates, let's look at some of these variations:

Generating companies submit bids to supply a certain amount of electrical energy at a certain price for the period under consideration. These bids are ranked in order of increasing price, with the cheapest offer taking precedent. From this ranking, a curve showing the bid price as a function of the cumulative bid quantity can be built. This curve is deemed to be the supply curve of the market.

The demand curve of the market can be established by asking consumers to submit offers specifying quantity and price and ranking these offers in decreasing order of price. Since the demand for electricity is highly inelastic, this step is sometimes omitted and the demand is set at a value determined using a forecast of the load.

The intersection of these "constructed" supply and demand curves represents the market equilibrium. All the bids submitted at a price lower than or equal to the market clearing price are accepted and generators are instructed to produce the amount of energy corresponding to their accepted bids.

Regularly, all submitted offers that are greater than or equal to the market clearing price are accepted and the consumers are informed of the amount of energy that they can draw from the system.

The market clearing price represents the price of one additional megawatt-hour of energy and is therefore called the system marginal price or SMP. Generators are paid this SMP for every megawatt-hour that they produce, whereas consumers pay the SMP for every megawatt-hour that they consume, irrespective of the bids and offers that they submitted. However, the SMP is one of several elements that determine the final price paid to generators, other variables include the Loss of Load Probability which gauges the probability that electricity generated will not meet demand. Furthermore, the Value of Lost Load is the maximum price attributed to the supply of electricity demand. Finally, Capacity Payment is the payment for any available capacity, regardless of whether the generators produced or not. Capacity payment rise during periods of shortages and falls when system capacity exceeds demand.

Electricity being left in the hands of a power pool might make consumers feel a little nervous, however, there are instruments utilized to minimize the risk. One such instrument is spot markets:

Spot markets provide a mechanism for handling the imbalances that occur between a party has contracted to buy or sell and the amount that it needs or can produce. If electrical energy is to be treated as a commodity, a spot market must, therefore, be organized.

The reality is that imbalances between generation and load must be corrected so quickly that a conventional spot market mechanism is not feasible. Instead, the system operator is given the responsibility to maintain the system in balance using what is commonly referred to as a "managed spot market".

This mechanism is a market because the energy that is used to achieve this balance is freely offered by the participants at a price of their own choosing. It is a spot market because it determines the price at which imbalances are settled. However, it is a managed market because the bids and offers are selected by a third party rather than through bilateral deals.

There is no consensus on the name to be given to this function. In addition to the term "spot market", names such as "reserve market", "balancing mechanism", and "real-time market" and others are used.