The Grid

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Some questions exist as to what we mean by the various players that participate in "The Grid". In particular, what role do PJM and Delmarva Power play and what responsibility do each have in guaranteeing that your home is powered with electricity?

An electric current is created when a stream of electrons moves through a media that conducts electricity, such as a wire. Flow down the wire, from the positive side to the negative side, is measured by terms such as voltage, resistance, and current. If we use a child's slide as a metaphor for the electric current, the voltage – the electric potential between the positive and negative side – would be represented by the height of the slide. The current is how fast the electrons move through the wire; or how fast the child moves down the slide. The resistance measures the opposition to the flow of the electric current; or the friction between the slide and the child's pants.

Begun in 1927, various electric companies in Pennsylvania and New Jersey joined to form a power pool to dispatch electric generating plants in an efficient manner, thereby reducing the cost of electricity. When two Maryland utilities joined in 1956, the pool was named the *Pennsylvania-New Jersey-Maryland Interconnection*, or simply PJM. Delmarva Power (then, Delmarva Power & Light) joined in 1981. Today, the PJM grid covers the states of Delaware, Maryland, New Jersey, Ohio, Pennsylvania, and West Virginia as well as most of Virginia and parts of Illinois, Indiana, Kentucky, and Michigan.

PJM does not create energy; they simply manage the arrival and departure of electrons across this region. Like a train station operator, PJM schedules the arrival and departure of electrons, making sure that energy is moved around the grid in an efficient manner. In addition, PJM coordinates payments for these electrons produced by the various energy generators across the region.

While PJM coordinates the flow of electrons, they do not create the electrons. Generators create the electrons that flow down the wires, just like businesses and industry fill the train cars that are pulled down the track. The role of PJM is to instantaneously balance (*i.e.*, make equal) the supply and demand of electricity across its network. If the demand is not met somewhere in the grid, a blackout (a total loss of energy) or a brownout (a curtailed supply of energy) will occur. Thus, PJM coordinates the movement of the train cars while generators provide the contents of the train cars.

Electric utilities, such as Delmarva Power, are companies (often publicly-owned) that move energy around the subregion of the PJM network. They determine the demand for energy and when energy is supplied to them by PJM, they are responsible for moving that energy where it is needed. In our train analogy, the utility is responsible for maintaining the rail line network, determining where the contents of the train cars (*i.e.*, the electrons) are needed, and moving the train cars to their intended destinations.

The third player in the grid are the electricity generators. Generators may be owned by utilities (such as Baltimore Gas and Electric) or they may simply be merchant generators who connect to

the grid and sell their electrons in the capacity (demand) markets. In short, generators produce electrons, not PJM. With deregulation, Delmarva Power sold all of its generation capacity and is no longer an electricity generator – it is solely an electric utility.

Returning to our railroad analogy, electricity generators fill the train cars with electrons, electric utilities determine the demand for electrons from its subscribers and maintain the local network to supply its subscribers, and PJM efficiently and cost-effectively coordinate the movement of the electrons from the electricity generators to the electric utilities. Thus, PJM is often thought of as "the grid" although the three players together coordinate how electricity gets from the supplier to the user.

It should be noted that the grid is NOT a battery where electrons are stored and dispatched as needed. Supply and demand occur almost instantaneously such that the generation of electricity is a just-in-time process or, put another way, a use-it-or-lose it proposition. Grid-scale batteries to compensate for the inability to match supply and demand instantaneously would have to be so immense that any attempt would be fruitless and doomed to failure.

Some sources of energy generation are more reliable than others. Sources like natural gas can be ramped up or down, or even started and stopped, at a moments notice. Other sources, like wind and solar, are unreliable and depend on the presence of moving air and bright sunlight to generate sufficient amounts of energy. Moreover, wind and solar are highly unpredictable – blowing wind or cloud cover can change rapidly. When these electrons produced by unreliable wind and solar sources disappear, PJM must tell other electricity generators (usually, reliable natural gas sources that are able to be quickly brought online) to quickly meet the demand for electrons. This process is called "dispatching."

The increase in unreliable electrons from solar and wind energy, has strained, and will soon exceed, the ability of fast-ramping electrons from sources such as natural gas to balance supply and demand. Because of politically driven regulatory policies and subsidies that favor wind and solar, new natural gas generation is not being built to "tend" (balance) the ever-increasing generation of unreliable electrons. This is why PJM has imposed a moratorium on new solar connections.

To encourage the construction of new natural gas generators, the price paid for the added capacity must increase to justify the capital expense. This increase in cost would be unnecessary if heavily subsidized solar and wind did not exist. Thus, if an increasing demand for energy is met with an increase in solar and wind energy and is not associated with a concomitant increase in reliable natural gas generation, blackouts and brownouts will proliferate.