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with revenues for capacity that a power plant can generate and/or the capacity of power that can be reduced during demand response periods. This reimbursement for operational capacity outside of the energy markets has refueled and developed additional capacity solution efforts including renewables and **demand response programs**.

Participation in demand response programs has been proven to work in PJM as it has helped in bidding capacity prices down. Consumers have an incentive to participate in these programs because they are able to monetize their ability to reduce demand during critical peaks thus increasing the reliability of the overall electric system and helping to avoid system emergencies. An increasing number of consumers can alter their normal consumption patterns by lowering their demand in response to hourly market prices.

What the Critics are Saying

On the other hand, many are critical of the capacity markets and do not believe they are as efficient and reliable as some may claim. They argue that no other economic market other than electricity utilizes a capacity market. These other markets continue along efficiently, so why should electric markets be any different? For example, when you buy ice-cream from an ice-cream store, you do not pay an extra cost just to ensure enough ice-cream machines are available to cover the busiest times. If ice-cream sales begin to increase, the store will eventually invest in additional machines, or open another store. Critics argue that the energy markets alone provide enough incentive for new capacity because if energy usage starts to increase, new capacity will be built. Having a separate capacity market is therefore unnecessary and **inefficient**. Capacity costs are ultimately recovered from consumers through **higher electric bills** with the majority of these additional revenues going to existing generators.

Another criticism of capacity markets is that when capacity prices are low, it is **not necessarily beneficial to the generators** who are receiving these revenues. The revenues may not be high enough to cover the costs of maintaining generating units and thus do not provide enough incentive to build new generators or to continue maintaining existing ones. In addition, the short-term price signal of capacity markets does not provide long-term pricing support necessary for long-term investment generation decisions. This obviously poses questions regarding reliability and concerns that there will not be enough generation to meet new demands in the future which is the very issue the markets were designed to solve.

This issue was further brought to light in May 2013 when the PJM capacity auction cleared at a much lower level than many analysts had predicted and more than 50% below the previous year's clearing price. A major source for this price drop was an increase in import capacity from regions outside of PJM. Imports increased close to 90% above the previous year's imports causing a large increase in offered supply while demand forecasts remained relatively flat. About half of the new imports came from MISO with generators hoping to receive more value in PJM with its historically higher capacity prices. This also brings into question concerns about reliability since only about 60% of those imports had firm transmission service into PJM. Can these imports really be relied on to meet peak demand? Some argue that these generators are taking advantage of PJM's current lack of limits on imports and are thus abusing the system rather than helping to provide reliable generation.

Critics also **question the reliability** of renewable resources, Demand Response and Energy Efficiency Programs which are often utilized as capacity resources. Some are uncertain that these types of resources can really be very reliable in peak demand situations for a long period of time. Another argument made by critics is that it can be a very expensive and time-consuming process to install a new capacity market in a region, and thus can end up **tying up a lot of valuable resources** (both human and capital) along the way.

In summary, capacity markets can be found throughout many parts of the country. Concern over adequate capacity reserve margins is again fueling the capacity market debate. Planning reserve margins across the various electric markets are expected to remain sufficient through 2017; however, NERC forecasts by 2022 many areas will dip below their capacity targets. The retirement of an estimated 19 GW of coal-fired generation is expected by 2018. Proponents argue capacity markets offer a way to efficiently send price signals to generators in order to maintain system reliability and encourage alternative capacity solutions. Peaking generators in particular, who are used and reimbursed in peak market conditions, would not receive enough revenues from the energy-only market. The capacity market provides a solution to recover costs and provide for a reasonable return on investment.

Critics on the other hand argue lower revenues when capacity prices are low hurt generators. No other markets function in a similar manner to capacity markets therefore they are unnecessary, inefficient, and ultimately lead to higher electric bills since the costs are passed on to the consumers. Recent imports from MISO to PJM support this notion and highlight the market abuse that can occur without adequate oversight. Furthermore, critics question the reliability of alternative capacity program solutions such as renewable resources, demand response, and energy efficiency measures. Introducing a comprehensive capacity market can also be an expensive and time-consuming process.

For help navigating the capacity market debate, Day 2 market requirements, and other market-related aspects in general please contact Elizabeth Kaiser and Ernesto Perez. ■

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- **Access to power quality information**
- **Defined communication and security standards**
- **Real-time monitoring possible**
- **Better integration with multiple software packages including CIS, OMS, MDM, engineering analysis software, and GIS**
- **Ability to better adapt to future Federal or State imposed reliability, conservation, or security standards**
- **Savings that can be realized through engineering analysis due to the availability of more data to optimize the distribution system**
- **Satisfies current desire for real time billing information**
- **Better adaptation to net metering installations** (distributed generation)

AMI is the logical and important first step for a utility in implementing a modern smart grid. Once a utility has an AMI metering system in place, the utility is in a position to leverage the data provided by the AMI system to improve service to its consumers. The availability of real time data provides system engineers and operations personnel the ability to examine their system with a level of certainty like never before. The main AMI benefits discussed in the remainder of this article are in relation to distribution system planning and troubleshooting.

AMI is the logical and important first step for a utility in implementing a modern smart grid.

Enhanced system planning and optimization using detailed system model: The enhanced information available from AMI meters is very useful in ensuring proper load allocation in the detailed engineering model. A detailed engineering model is one of the most powerful tools in the system engineer's arsenal. However, the engineering model is only as good as it's data input. One of the major cornerstones of the engineering model is the geographic representation and accurate definitions of the distribution lines, devices, transformers, and customers. Another cornerstone is the loading data that is used to allocate the model to future or past peak loading for planning analysis. The data provided by AMI metering can be used to ensure customers are in the right location in the model and tied to the correct phase. The enhanced data also allows for an accurate representation of each consumer's past peak demand and usage data. This data ensures that load is distributed correctly within the model for a more accurate representation of actual loading. Once this information is correctly applied, the system model can be used to identify conductor ampacity, transformer overload, or voltage concerns as well as the impacts of upgrades to the distribution system infrastructure. Voltage readings from the meters can also be used to verify the accuracy of the model results. A detailed engineering model can also be combined with an Outage Management System (OMS) for enhanced functionality. These data sources can also be used to deploy Intelligent Electronic Devices (IEDs) in critical locations on distribution feeders. These IED devices can include reclosers, automated switches, voltage regulator controls, and capacitor controls. These IEDs can be monitored and have the ability to send real time data back for decision making by a central computer or engineer in order to best respond to system fluctuations and outages. This data can be used in conjunction with the AMI metering data to fine tune the distribution system. Therefore, AMI provides critical data that can be used to determine the proper approach to voltage and var management and how to respond to outages.

Past experience has shown that the majority of distribution transformers are oversized. There can be significant cost savings available to the utility if they can size transformers more effectively and increase the number of consumers per transformer.

Use enhanced metering data to perform transformer loading and troubleshooting analysis: Enhanced metering data can also be used to perform transformer loading analysis. The AMI data provides coincident peak loading for consumers served by a single transformer. This provides a more accurate assessment of transformer loading when compared to traditional methods. In the past, utilities have sized transformers for new consumers using rule of thumb methods or simple calculations of what the customer usage and demand will be. Commercial and industrial transformers are typically sized using a combination of the proposed customer panel loading schedules and the planning engineer's experience. Each of these methods must factor in the diversity of loads. However, system peaks usually do occur at certain times during the day including the morning before work and school, the evening around dinner time, and heat of the day when cooling load is the biggest driving factor. Past experience has shown that the majority of distribution transformers are oversized. There can be significant cost savings available to the utility if they can size transformers more effectively and increase the number of consumers per transformer. The data provided by AMI metering systems can help utilities make better decisions on transformer sizing. Another useful feature that is available is using the AMI data to see if transformers are overloaded or failing. This use of the data can help avoid unexpected outages and the resulting downtime for utility customers.

Use metering data to develop time of use rates for billing: AMI metering provides the means to analyze copious amounts of customer usage data over the period of an entire day, week, month, and year. This data can be useful to utilities to develop Time of Use (TOU) rates. TOU rates can be a tool for utilities to offer incentives to progressive consumers that have the capability to shift their usage to off peak periods. These types of rates have several benefits for