Another Energy Problem:

Growing Demand for "Reactive Power" Challenges U.S. Transmission Systems

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ABSTRACT

A significant challenge to the transmission providers reported by the National Electric Reliability Council (NERC) will be to maintain adequate levels of reactive support for the transmission system in the era of open market competition in the U.S. Unlike real power (MW), the reactive component of power (Mvar) cannot be easily transmitted over longer distances and must generally be supplied at the local level.

Without adequate reactive power support, portions of the electric power system can be susceptible to potential voltage collapse or instability according to NERC. Sources of reactive power include generators, synchronous condensers, transmission lines, capacitors, and very specialized reactive support devices generally known as static var compensators (SVCs).

Demand for reactive power is shaped by the size and type of demand, power transactions across the transmission system, and the loading of transmission facilities. This demand for reactive power is growing nationwide.

DECLINE IN REACTIVE IMPROVEMENTS

Many electric utilities made concerted efforts to improve reactive support as demand grew by adding shunt capacitors on their distribution and subtransmission systems, NERC reports. However, such distribution reactive improvement programs have declined in recent years within the industry.

Reactive support programs must be continuous as demand on the distribution system continues to escalate. A chief component of that growth in the need for reactive improvement has been air conditioning which particularly requires increasing levels of reactive support. Most air conditioner demand is motor load, requiring significant reactive power support. Because of its interaction with the transmission system, reactive support is one area that distribution companies must not ignore if reliability is to be maintained on the bulk transmission system.

The physics of transferring power across a transmission line causes it to consume reactive power, with increased transfers resulting in escalating voltage decline across the line. When heavy power transfers occur across a transmission system interface and transmission lines are heavily loaded, voltage in the area of the interface can become depressed if sufficient reactive supplies are not available to the system, NERC has stated.

OPEN ACCESS IMPACTS

When transfers of power follow a consistent directional pattern, it is relatively easy to plan and justify costs for the required reactive support for the transfers. For example, significant reactive support was added on the bulk system to enable higher transfers from ECAR to MAAC and the VACAR subregion of SERC in the early 1990s.

However, under open access transmission, transactions are conducted in large numbers across long distances, and often flow in directions that were not anticipated when the transmission system was originally planned and built. The direction and amount of such transfers has become much more volatile, changing daily, and sometimes hourly.

Consequently, planning reactive support enhancements for improving transfer capability has become more difficult as the pace and level of transactions have become more short-term and real-time.

There is currently no incentive to increase the levels of reactive support on the bulk power system, NERC states. In fact, there are disincentives, because generators are paid to produce real power, not reactive power under current contracting. There is a tradeoff between producing real and reactive power because reactive power generation decreases as the real output increases. **A recent spate of nuclear unit upgrades effectively lowered the units' reactive power output capabilities as the real output of these nuclear units was increased.**

In the long term, transmission providers must reevaluate their bulk power systems in light of open access, including planning for necessary reactive support. Business is increasing on the transmission system, but very little is being done to increase the load serving and transfer capability of the bulk transmission system. This will be essential for supporting development of regional transmission organizations (RTO). Most of the transmission projects planned over the next ten years are intended to reinforce parts of the system to alleviate local problems.

FUTURE PLANNING OPPORTUNITIES

This raises several issues for future planning:

- Can distributed generation become a new market source for reactive power capability?

- Can distributed generation become a source of reliable transmission loading relief avoidance?

- Is there a third party, competitive market for reactive power? Is there a merchant reactive power plant market to avoid voltage reduction which should be encouraged?

- Who manages this critical bulk power system issue in a post-restructured world? Generators? Transmission? Distributors? Marketers?

- Will this issue become impaired further with distribution company mergers and consolidations?

- Will most new transmission gravitate to reinforce the system for local problems management, because of a lack of RTOs and strong regional siting? Are independent system operators doing enough to manage this challenge?

- Is this another incentive for the power quality market to respond?

The ability to transfer electric energy across interfaces or seams hampers reactive power support. NERC believes it is a national imperative that reactive power improvements keep pace with the demands being placed on the transmission systems to maintain reliability. We are already seeing this as an element of key market disruptions.

Reactive power support must ultimately be placed and coordinated among generation, transmission and distribution. With existing regulatory structures, this could be falling in the cracks with open access transmission. Widely varying flow patterns and associated reactive demands have become commonplace and need accommodation.

The reactive power support system will need to become more versatile for open access transmission objectives to be achieved, and needs further attention in the RTO formation process for RTO's to be successful and thrive.

Mr. Zimmer's advisory appeared in his newsletter *E-Notes*, and drew this response:
