

NERC COMPLIANCE MONITORING AND ENFORCEMENT - THE EFFORT AND THE IMPACT.

Minturn S. Osborne, MPS MA
President
Power Agent Systems
Montgomeryville, PA

As we all know, the Federal Energy Regulatory Commission (FERC) has named the North American Electric Reliability Corporation (NERC) as the United States' designated Electric Reliability Organization (ERO) in order to define and defend mandatory electric reliability standards using findings and fines to ensure compliance regarding Critical Infrastructure Protection (CIP).

The amount of detail surrounding this effort is staggering and only a small portion of the effort is outlined below as it relates to Protection and Control of the Bulk Electrical System. While the effort an admirable and necessary, it is the impact that it could have on our industry and economy for decades to come that further warrants our attention.

First: The Effort.

A review of the NERC 2009 Compliance Monitoring and Enforcement Program requirements spreadsheet¹ shows that there are 1,125 requirements based on FERC approved standards. 100 of those requirements and sub requirements are for Protection and Control of protection systems, under frequency and under voltage load shedding equipment, and special protection systems. While they are only 10% of the overall CMEP requirements, their breadth and depth are illustrative of the broad scope of the initiative.

As stated above, standards relative to Protection and Control are a subset of the overall initiative. Please note that we are not talking about transmission and generation systems themselves, but the monitoring the systems which protect those systems.

“Definition of Protection System (excerpted from the NERC Standards Glossary of Terms):
Protective relays, associated communication systems, voltage and current sensing devices, station batteries and DC control circuitry.
Applicability: Owners of generation, transmission, and transmission Protection Systems.
Requirements: The owner shall have a documented maintenance program, with procedures, and with test intervals supported by some basis. The owner must keep records showing that the maintenance and testing has been done according to that documented program²”

Smart grid initiatives, more sophisticated electronics, greater demand, and higher cost and risk of network failure has created pressure for increased network reliability. This means that the current process for monitoring the possible points of failure is being reviewed and upgraded based on accuracy, current available technology, resource capabilities, ease of supervision and ease of reporting. Examples of these sub-portions being protected include but are not limited to transformers, transmission equipment, system interface facilities (e.g. where solar panels tie into the grid) and generators. Getting even more granular, NERC identifies all specific relays being monitored, distinguishes between time based maintenance and condition based maintenance, and finally each potential point of failure has a recommended “maximum verification intervals,” which when translated to English means how often something gets looked at. On top of all of this, there are going to be guidelines for record retention and accessibility.

At this point, the questions you may be asking yourself are, “Why is this necessary?” “Why is it taking so long?” “How does this affect me”? The answers are as follows:

Why is this necessary? It is necessary because advances in technology have allowed for substantially more sophisticated monitoring devices. It is necessary because the US loses \$70 Billion a year to brown outs and black outs. It is necessary because our lives and our livelihoods demand access to electricity 24x7x365.

¹ www.nerc.com/files/2009_CMEP_Reliability_Standards.xls

² “NERC Protection System Maintenance” prepared by the System Protection and Controls Task Force of the NERC Planning Committee

Why is it taking so long? It isn't. The fear of the unknown makes it seem long. The fact is that there are a lot of constituencies that need to have a say. Furthermore, if your protection systems are going to be scrutinized by industry peers and government officials, you want to be absolutely sure that someone has made a painstaking effort to determine the value of each requirement so as not to waste your time or expose you to a service outage based on subpar monitoring requirements.

How does this affect you? It affects different entities in different ways. The list³ of entities and their abbreviations for the entire effort is listed here:

BA - Balancing Authority	RC - Reliability Coordinator
DP - Distribution Provider	RE - Regional Entity
GO - Generation Owner	RP - Resource Planner
GOP - Generation Operator	RSG - Reserve Sharing Group
IA - Interchange Authority	TO - Transmission Owner
LSE - Load-Serving Entity	TOP - Transmission Operator
PA - Planning Authority	TP - Transmission Planner
PSE - Purchasing-Selling Entities	TSP - Transmission Service Provider

Table 1

As you can see from Table 1, there are 16 entities identified. Review of the CMEP Spreadsheet (www.nerc.com/files/2009_CMEP_Reliability_Standards.xls) will indicate which requirements each is expected to meet.

Protection Systems being monitored are for the following areas of the BES:

- transmission equipment
- transformers
- generator step-up transformers
- generator auxiliary load transformers
- system interface facilities for installations such as wind farms which are aggregated through a single connection point to the system, greater than 75 MVA (gross aggregate nameplate rating).
- underfrequency load shedding (UFLS) equipment,
- undervoltage load shedding (UVLS) equipment,
- individual generators of greater than 20 MVA (gross nameplate rating) connected through step-up transformers

This breadth of monitoring and data gathering is going to tell us a lot about these systems and their ability to protect our generation and distribution equipment. Once there are operating in a standardized fashion, what else can they tell us and what is that worth? Before we start gauging the impact this initiative will have there are a few questions we need to address...

What can you do now? Audit! Any time you build anything new on your network, it is axiomatic that you do an audit to determine what to keep and what to discard. Regardless of what NERC finally requires you to do regarding monitoring your protection systems, you are going to need to know what is out there now and if it complies with the NERC's criteria. Unless your network grows and changes so fast that information gathered in the next 18 months is going to become obsolete in the following 18 months, do an audit of your protection systems. Once you do an audit, make absolutely sure you maintain and update those records.

What if you have limited resources? As far as an audit is concerned incorporate auditing functions into the daily tasks of personnel who work with these systems. Gradual ongoing inventory and schematic updates are better than nothing and a lot cheaper than gang auditing with an outside contractor.

What if you think you will not be able to afford to meet these requirements? I think the short answer is you cannot afford not to. The more in depth response is that NERC is fully aware that the depth, breadth, and frequency of these monitoring efforts. Smaller operators are working through cooperative ventures and trade organizations (American Public Power Association (APPA), National Rural Electrical Cooperative Association (NRECA), etc.) to share their concerns and impact the final outcome of the council.

³ www.nerc.com/files/2009_CMEP_Reliability_Standards.xls

Second: The Impact

I would submit that the determinations coming from the NERC requirements will facilitate how back up power supplies are installed, monitored supported and chronicled, but also impact how back up power supplies are developed, delivered, and expanded as well. The key learnings generated by this effort could reach beyond the utility industry to the telecommunications, data center, and manufacturing industries as well.

When these requirements are accepted by all constituents and implemented beyond the electrical industry there will be significant economic pressure brought to bear as a result. Negative pressure created by fines for non-compliance and positive pressure created by efficiency-driven savings in capital and operating expenditures. As the stakes are raised and the rewards more quantifiable, here are changes we might see:

Imbedded Measurement Devices: It is tough to make batteries sexy, but we can make them smart. Measurement Devices imbedded into batteries can provide a number of immediate and unimpeded measurements. The gathering and processing of information will be substantially streamlined. This will allow manufacturers and customers to have more timely information regarding a bulk of data being sought in the NERC requirements.

Monitoring Software will get better and broader More sophisticated monitoring software packages will process the majority of protocols and generate more pertinent reports, performing runtime analysis via algorithms as well as standardized representation of required information. Right now we have SNMP, SCADA, MODbus, and other communications protocols create an additional challenge when handling data gathered from information from the batteries, the strings and the sites. More versatile software can aggregate the following information on a broader level.

What Gets Measured Gets Done Standardized “compliance scores” for personnel and equipment will allow for universal assurance of back up power availability. Our nomenclature now includes numerous terms, acronyms and initialisms which are shorthand for far more technical concepts. The NERC standards will be organized around reference values used to measure the performance of a site, string, or cell. They can also be used to create a compliance score for how closely a certain company adheres to the required processes.

Disaster Response Support Real time system documentation made available to disaster response teams can include your resources and reserves as well as that of your customers’ generators. Some of your customers are now contributing to the grid during their regular test runs. Emergency response officials will want to know what alternative capacity is out there during emergencies.

Radio Frequency Identification Chips RFID Chips could go beyond inventory management and tied into the monitoring system to provide more compelling information. Currently, monitoring systems show where a battery is, what performance the battery is capable of and how it is performing. With RFID, you can chart the performance of a particular model of battery in a number of different environments which can guide design, purchase and replacement decisions.

Cautionary Considerations

Beyond Back Up Power Supplies Who owns the information and what do they plan to do with it? If energy is at the heart of the economy and we are at the nerve center of energy, then a lot can be learned from the information we share. Furthermore, if this information is going to be gathered and presented in standardized forms, then that information could be extrapolated beyond back up power status to broader issues related to the battery industry, the power industry, the lead industry. Financial analysts, battery manufacturers, other back up power professionals and other government agencies could have substantial interest in what we learn from these readings.

Homogenization Adherence to standards sometimes limits innovation. How static will these recommendations be and how often will they be up for review? Furthermore, standardization increases commoditization so how are we as vendors, integrators and manufacturers going to continue to stand out and differentiate ourselves from our competition if every customer has to have the exact same thing?

Conclusion

The question we have to ask ourselves is, “How can we capitalize on this renewed focus on monitoring to make our systems even better?” If the NERC plan is to prevent the challenges of the last decade, the suggested points of measurement and procedures are acceptable. Medium and small utilities may feel the need to seek dispensation from meeting the full breadth of the requirements, but what is being discussed is essentially the goal which we should all be striving for. However, if the proposed criteria can be broadened with an eye to the future, this search for standards and procedures can allow us to address past disasters and capitalize on new opportunities.