WHITEPAPER

ASSET CRITICALITY

The role asset criticality assumes in risk management for electric utilities

Date: June 16, 2016
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Reference to part of this report which may lead to misinterpretation is not permissible.

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<th>Date</th>
<th>Reason for Issue</th>
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</thead>
<tbody>
<tr>
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Table of Contents

1 EXECUTIVE SUMMARY – IDENTIFYING CRITICALITY ........................................... 2
2 INTRODUCTION – WHAT IS CRITICALITY? .......................................................... 3
3 REPORT BODY – CRITICALITY FACTORS FOR BETTER ASSET MANAGEMENT ............ 4
4 CONCLUSION – CRITICALITY INDEXING IMPROVES PERFORMANCE .......................... 7
1 EXECUTIVE SUMMARY – IDENTIFYING CRITICALITY

How can you identify the asset that represents the greatest risk to the utility?

Especially through the maze of today’s differing regulatory requirements, financial responsibility and system reliability, how is this criticality assessment best achieved?

How can organizations identify their most critical assets that are in the poorest condition in their complex and interconnected systems?

This whitepaper is intended to start utilities down the road to identifying and utilizing criticality, and to include a criticality rating in the asset management program. The process can be as simple as identifying the device that is loaded the heaviest and may fail due to one criterion, or as advanced as identifying all aspects of a component that expose the utility to high risk situations.

To develop criticality, a company needs to assess the priority of risk in its decision making process, which would include identifying critical components and the consequences of their failure. The following components need consideration to establish a comprehensive criticality assessment:

1. Financial impact
2. Environmental impact
3. Regulatory impact
4. Loss or reduction of service
5. Stranded generation
6. Service needs (public concern)
7. Black start path
8. Load transfer capability
9. Safety

A fully developed criticality program along with asset health will provide the basis for risk management. Defining criticality down to individual assets allows system operators to identify which device is exposing the corporation to the highest risk in the event of failure or mis-operation.
2 INTRODUCTION – WHAT IS CRITICALITY?

More often than not, criticality at the electric utility has different meanings based on the requirements of each department. If there is a defined corporate criticality evaluation, the following internal requirements should be addressed:

- Do all departments understand the rating?
- Do all departments know in which database the information is stored?
- Do the proper personnel have access to it?

To have an established and successful criticality rating, all departments responsible for operations, maintenance, planning and reliability need to have access to not only the criticality rating, but also to the factors that are involved in calculating the value.

Today’s scheduling environment trends are to perform as much work in a given area or substation as possible, in order to save on travel time. In other words, “as long as we are here let’s do everything now,” versus coming back later to complete lower priority work. This does little or nothing to address risk. Scheduling based on risk reduction will provide better return on investment as risk always has a financial component associated to it. The nine bullet points for defining criticality mentioned in the executive summary all have financial implications. If we use environmental factors, as an example, here are some of the aspects to consider:

1. Is the device close to water or wetlands?
2. How many gallons of oil are in the device?
3. What type of containment is at the facility?
4. Does the device or the bushings contain PCB?
5. How many pounds of SF6 are on the system and are the proper procedures in place to handle a large release of SF6 gas by-products?

All of these components contain financial implications and should be calculated in any relevant criticality algorithm.
3 REPORT BODY – CRITICALITY FACTORS FOR BETTER ASSET MANAGEMENT

The assumption of this whitepaper is that the utility currently has access to a software program which has the capabilities to automatically perform a criticality, health and risk assessment. This not only includes the accounting of the major inputs but weighting each input based on the utilities requirements. This should be an automated process to immediately change the final value as inputs are changed.

We will address each of the nine factors relating to a criticality assessment.

1. **Financial**: This input could be assigned at the substation or individual asset level. If it is at the substation level, the loss of revenue per day or per hour based on station load would be calculated. If at the device level, the same calculation would apply. This would include the loss of individual feeder breaker or transformer, as examples. A company could also use a simple value of low, medium or high as a lost revenue indicator.

2. **Environmental impact**: There are many variables to environmental impact. Some common assumptions may be things like “there are oil containment facilities at the substation, so why do I need to be concerned about this?” Many catastrophic failures result in the expulsion of oil and solid oil soaked components outside the confines of the station yard. Even if there is containment, the company is still liable for solid waste disposal of the station soil, stone and clean up materials. Many utilities track PCB’s in most pieces of major equipment but fail to identify PCB in bushings. PCB contaminated bushings can lead to major clean up expenses if they fail violently. The following is a starter list of Environmental factors to consider, such as:
   a. Proximity to water or wetlands
   b. Oil containment (pits, oil water separator, berm etc.). These would be rated based on each design’s capability to contain the oil within the station yard.
   c. Equipment oil capacity
   d. Equipment PCB content
   e. Equipment bushing PCB content

3. **Regulatory impact**: Regulatory impact identifies both federal and state regulatory requirements and how outages would impact them.
   a. Identify NERC requirements at the component or position level. Also identify which NERC policy is applied.
   b. CADI, SADI, and others. Identify frequency or duration of outages for individual device. The customer count for each circuit exit or station transformer would be considered.
4. **Loss or reduction of service**: The ability to transfer customer load or critical circuits to other substations or circuits would be considered. The ability to transfer keeps the interruption time to a minimum as a result of an outage. This could be represented as an input displaying the percentage of load that could be transferred. Another input would be identifying circuits that have customers with minimum voltage trip protection and would be affected by lower than normal voltage supplies.

5. **Stranded Generation**: Many utilities are being faced with distributed generation. This is putting new reliability requirements on distribution substations. These can be everything from land fill generation, small gas turbine facilities or small wind farms. The value could be MW stranded due to a loss of critical breakers or circuits at either distribution or transmission class substations.

6. **Service needs**: This value would account for requirements of special service contracts and critical or priority customers. If your utility has service level contracts with large customers the ability to identify all equipment servicing the account would be valuable. This would include the equipment at the substation servicing them and the equipment at remote ends of the line or lines serving that customer. Critical or priority customers would include hospitals, airports, police and fire departments as well as other high profile customers in the service area.

7. **Safety**: This could include values of low impact, medium impact or high impact as examples. Safety is the number one priority for the utility when it comes to human resources. Sometimes this is lost when it pertains to the design or location of substations or equipment. Examples may be as simple as identifying equipment near where school yards, parks, busy intersections or sidewalks are located. The critical question is: “if there is a failure of a device could its location account for a high level of concern for possible human impact?”

Once the inputs and values have been established it is necessary to weight each of the components based on the utilities’ criticality requirements. Possible weightings for the 9 factors could be a breakdown such as the below list, or may be further tailored to the exacting specifications and demands of the individual utility.

List of potential weightings for criticality factors:

a. Financial 20%

b. Environmental 10%

c. Regulatory 15%

d. Loss of service 10%

e. Stranded generation 15%

f. Service needs 10%

g. Safety 20%
Once the weighting has been established, it is then time to assign the value to each entry. It can be as simple as having a value from 1 to 3. As an example:

Environmental impact: The probability of an environmental event impacting the budget based on the inputs could be 1=low impact, 2=medium impact or 3=high impact. If 3 was the rating it could mean that you have oil filled equipment very close to a river, lake or wetlands. It could also indicate that there are PCB filled or contaminated equipment at the location.

The example below identifies criticality data at the position, equipment level or location level as seen in a database. All or some of the entries could be used in your criticality calculation.

Location Criticality data
Customer Count INTEGER
Dual Trnsfmrs RADIOBUTTON_Y/N
Transfer Capability RADIOBUTTON_Y/N
Proximity to Water STRING_10
Radial Feed RADIOBUTTON_Y/N
Max Fault Current INTEGER kA
Public Concern LOOKUP_DD
Financial Loss Index LOOKUP_DD

Position or Equipment Criticality data.
Operating Class LOOKUP_DD
Bulk Electric System RADIOBUTTON_Y/N
NERC RADIOBUTTON_Y/N
NERC Reg LOOKUP_DD
Equipment Function LOOKUP_DD
Load Type LOOKUP_DD
Back up Capabilities LOOKUP_DD
SCADA RADIOBUTTON_Y/N
Critical Customers RADIOBUTTON_Y/N
Priority Customers RADIOBUTTON_Y/N
Circuit Criticality LOOKUP_DD
Stranded Generation DECIMAL_2 MW

Once the data has been loaded in to the software, an algorithm is created to evaluate each component and it’s value. The result would be a value ranging from 1.00 to 3.00. The value is then used as a multiplier in the Criticality, Health and Risk (CHR) evaluation. Criticality x Health = Risk. The result would identify critical components in poor health which would elevate the risk score, and alert the utility to opportunities for mitigation or risk monitoring.
4 CONCLUSION – CRITICALITY INDEXING IMPROVES PERFORMANCE

Though many utilities have implemented condition based maintenance, they still suffer the consequences of critical components either having a functional or catastrophic failure. In many cases, the device may have been due for maintenance but had not been scheduled. With the criticality index applied and a criticality, health and risk algorithm created, the system will automatically place the most at-risk device in poor health at the top of the schedule. The individuals identifying capital replacement projects or scheduling maintenance now have the information they need to set the maintenance or replacement priorities based on the latest information available.

By having criticality, asset registration, operational data, maintenance procedures, and inspection results data all in the same database, field and office personnel can access one true relevant data set and see all CHR values. This means better communication and better results in maintaining system reliability, minimizing risk, and optimizing utility operations.
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