EAGLE EYE TECH NOTE

Title	**Calculating ROI on an Infrastructure Project**
Document No.	**TN-052920-1**

Revision History

Date	Revision	Change Description	Author(s)
5/29/20	0	Original document	GP

When you look up the definition of ROI (Return on Investment) on the Web, the definition is quite clear:

"Return on investment (ROI) is a ratio between net profit (over a period) and cost of investment (resulting from an investment of some resources at a point in time). ... In economic terms, it is one way of relating profits to capital invested."

Still, one of the problems with this definition is its simplicity. After all, how do you measure investments in infrastructure projects that typically do not return a profit? While they may improve the resiliency of a service and minimize the potential for failure, the results cannot be reflected as profit.

Let us look at a potential resiliency challenge that many companies in the service sector will face as they return from the pandemic. Because of the restrictions on the use of human resources, the technical press outlets are fully focused on promoting the importance of transitioning from manual service inspections to remote monitoring. This is essential to minimize the risk to personnel under pandemic conditions, and no, we can't assume this one is simply just another 100-year event.

One of the key elements of any resiliency planning is the use of batteries as the final source of power in the event of a power outage. Yet, for many reasons, the majority of them are still subject to calendar- based manual inspections. With that in mind, let us examine the challenge in establishing an ROI for a project to move from manual battery inspections to automated data collection with a battery monitor.

When we look at where cost reductions will come from, the first step is to reduce labor costs. In this case, these will be limited to the travel time and time spent on site. Travel costs will factor into the equation because two persons could be required for safety or other reasons, resulting in two truck rolls to ensure safe distancing. This is not going to be a simple Excel calculation either. Each location will be different, depending on the number and type of installed batteries, the quantity, and distance between locations..

These are also recurring costs, and they will typically increase year over year. As many of these batteries have a design life of twenty years, the amortized cost of the monitor over that period should indicate an acceptable ROI under current calculation methods. The problem is if the staff that currently carries out these tasks is simply reassigned and still requires a truck, the actual reduction in cost will only be the travel costs; almost certainly not enough profit to get off the starting line.

Probably one of the questions that will be asked is why do we need a battery maintenance program. The primary reason is, that unlike almost every other operational asset, a battery is not used under normal operating conditions. Therefore, without a planned maintenance program, the ability to identify changes in the operating parameters that could impact the ability of the battery to perform as required will not be known until the power fails.

To understand the benefits of moving to remote monitoring, it is necessary to understand the limitations of calendar-based maintenance. The most comprehensive calendar-based maintenance schedules for Lead Acid and Nickel Cadmium batteries are published by the IEEE as Recommended Practices. These consist of a Monthly, Quarterly and Annual series of scheduled inspections to collect the required data. Even when you see claims that the maintenance is carried out in accordance with IEEE recommendations, the monthly visits are seldom carried out. While many companies use the Recommended Practices as the basis for a maintenance program, to limit costs they must reduce the number of visits or the level of data that is collected during a visit. Meanwhile, the value of a battery's measurable parameters can vary due to operational and environmental conditions., Unless a reasonable level of data is collected over time, it is a challenge to assess whether a change in value recorded is due to a deterioration in the battery's condition or simply a change in the ambient temperature or other operational factor at the time of measurement.

If we are to establish the value of remote data collection, it will be necessary to identify the impact of a battery failure under all possible operational conditions and demonstrate the ability of a battery monitor to identify a potential failure both prior to and during the discharge event.

In many standby battery applications, the impact of battery failure is limited to a specific service area, but this is not always the case. Often the battery is part of an integrated network in which all elements are battery backed. The impact of an individual battery failure in a specific network element can be indeterminate depending on the network configuration and operational status at the time. As the complexity of these networks grows, so too does the interdependence of elements and the potential for extended service losses due to a single battery failure.

With many of these integrated networks, the required backup time can be four to eight hours or longer, and in these applications the battery monitor has two functions. The first is to identify any changes in the operating characteristics of the individual units over time and have those units replaced to reduce the risk of potential battery failure. If the battery is placed under load, the monitor would then provide real-time data about the rate of discharge and the response of the individual units. If any of the units in a battery suffer from a discharge induced failure that could limit the reserve time, it will allow operations to make the necessary changes to limit the impact of an earlier than planned loss of battery power.

If we are going to achieve these objectives, the battery monitor is going to have meet a rigorous set of requirements. It will have to measure all the necessary battery parameters in order to carry out the level of analysis required to determine the battery's operational readiness. It should be of no surprise that having a monitor collect the necessary volume of data and provide a a quality analysis will not be the lowest cost solution.

This brings us to another reason for not using ROI in its most basic form. If the reduction in manual inspection costs are barely sufficient enough to justify the potential use of battery monitoring, one way to improve the overall ROI needed to get project acceptance will be to select the lowest cost battery monitor. This is perhaps not the best decision one could make.

There is another method by which the value of an investment such as this can be measured, and that is to carry out a Cost Benefit Analysis. This will require that you identify the level of financial losses that could result from a battery failure. The analysis should not just focus on the possible service losses but identify the potential for infrastructure damage that could occur if operations cannot isolate a network element. If the accrued benefits of eliminating these potential losses are fully identified and calculated, the cost of installing the best available monitoring will become insignificant.