Preventative Maintenance: When You Can't Afford to Have Downtime Go Up

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How much does it cost when electrons stop flowing in your facility? If you were a data centre, you would have lost more than $740,000 USD in 2016 due to outages. That's the figure calculated by the Ponemon Institute, an IT and cybersecurity research center. It's based on a survey of North American facility managers.

What if you're not running a data centre? Different factors weigh in, but power outages are still pricey. One Canadian manufacturer spent more than $100,000 on generator expenses alone while waiting for a replacement transformer after an on-site unit failed.

Whatever way you look at it, professional preventative maintenance pays off when your organization owns medium- and high-voltage electric infrastructure. Here are some of the reasons why.

Domino effect

Preventative maintenance is the process of regularly checking and performing necessary work on equipment to decrease the likelihood of failure and unplanned outages. It's vital with electrical equipment because most electrical devices are primarily mechanical, and when those devices stay in a stationary position without operating, they tend to seize up, meaning that they won't operate when you need them.

Suppose that happens with a circuit breaker, an item called upon during an adverse event. When it trips or opens up, the breaker stops the flow of current in an electric circuit to safely clear a fault or to provide a point of isolation for maintenance workers can perform their work safely. If a circuit breaker doesn't open, there's no protection for downstream equipment or personnel. That means the fault lasts longer, amplifying the damage to equipment or dangerous conditions for maintenance personnel due to energized circuits.

For instance, if a motor fails and the protective device doesn't interrupt the fault, the upstream protection will be called upon to operate. When that happens, a power interruption to a larger area or to the whole plant may occur because now an upstream device has to isolate the fault. Instead of having one line down, many will likely lose power. Once again, there's potential for increased damage to equipment, injury to personnel, a risk of fire, as well as greater productivity losses.

What could possibly go wrong?

Given the stakes, any piece of equipment that resides on your infrastructure between your local hydro company's lines and your main distribution board are all key, critical components to maintain proactively.

Most likely, your first device coming in from the hydro lines is a high-voltage switch. Here again, these are mechanical devices that often seize up due to lack of use. They're also prone to broken insulators and burnt contacts, both of which can impair operation. Remember, any time you need to perform an isolation of your system from the utility's, you have to make sure that switch opens to ensure safe conditions for repair crews.

The next set of devices most facilities have on their infrastructure are lightning arresters, which absorb over-voltages from lightning strikes to help protect electrical equipment. These devices can only withstand so many lightning strikes before they start to degrade. Once they deteriorate, they're at risk for failure, flashovers and, in the case of older equipment, explosions. If an older lightning arrestor explodes, the blast sends shards of porcelain out like shrapnel, potentially causing injuries to personnel and damage to nearby equipment.

While preventative maintenance won't extend the life of a lightning arrester, it will tell you when the device is close to failure so that you can replace it before it becomes a risk to your site and people.

Point of transformation

Transformers are key devices that keep a plant going and, foolishly, they're often neglected. That's a big mistake because transformers are not off the shelf equipment. They must be custom ordered, some specialty transformers from outside North America. Should one fail, you'll wait anywhere from several weeks to a year for a replacement to be manufactured and delivered. Even at the low end of this lead time, would your site be looking at an unexpected $100,000 generator bill?

Among organizations that do conduct preventative maintenance on transformers, many do oil sampling and analysis. That's a great start because oil sampling is diagnostic of equipment health the same way blood samples reveal medical conditions or well-being.

The 5 part 'Standard Analysis' is the minimum regular quality testing that should be performed on transformer fluid at least once per year. This includes dielectric breakdown, neutralization number, interfacial tension*, specific gravity, visual condition, and colour. Power factor and dissolved water content tests can be added to these results, to give a more detailed picture of the fluids physical and chemical properties. (* on mineral oils only)

Dissolved Gas Analysis (DGA) checks for internal faults that include corona, thermal faults, arcing and insulation breakdown. Internal transformer faults break the oil down into several gases. The rate of increase over time and the ratios of these gasses can diagnose potential faults in your transformer, without taking it offline. Most problems and repairs can then be dealt with and worked into planned scheduling, rather than an emergency situation arising due to your transformer suddenly going offline. Dissolved Gas Analysis should be performed on a regular schedule, the size and application of the transformer will determine whether this should be on an annual or more frequent basis.

If the DGA points to possible problems within the insulation of your transformer, furan analysis can be a helpful tool. Testing the furan levels in the oil determines if the paper insulation has been subjected to heat stress. Monitoring the furan level over time can also indicate the condition the insulation is in, to help predict the remaining useful life of the transformer.

Why you need specialized expertise

Considering how much is at risk, preventative maintenance is a smart investment. But, it's not something that most organizations can undertake themselves. Working on medium- and high-voltage infrastructure takes special training that commercial electricians rarely have, and few organizations besides utilities have the need or the budget to keep specially trained staff employed full-time.

Those who work on medium- and high-voltage infrastructure undergo different training than those who work at homes and office buildings. Think of voltage as being similar to water pressure. The more pressure you have, the farther the water will travel. Likewise, the higher an electric system's voltage, the more "pressure" it packs. So, at 600 volts, well trained and qualified personnel can be an inch away from equipment and work safely. At higher voltages, you might need to be three feet or more away from the voltage source to be safe. This creates the need for different tools and techniques than those used by commercial/industrial electricians.

Even if you have employees with the right training, do you have enough of them to conduct proper preventative maintenance in a very short period to minimize downtime?

While a small site might only take a couple of people to perform preventative maintenance quickly, a large facility can wind up with several dozen people on the job. At one large data center served by Spark Power, some 60 workers come onsite simultaneously. Even then, the work can take an entire night, during which the plant or facility goes without power. This team always runs across issues, such as breakers that won't open or close, broken insulators, burnt contacts and more.

On top of specialized personnel, correct maintenance takes specialized equipment. In fact, many manufacturers produce specialized test equipment that's specific to test their trip protection and control devices. It can take as much as eight hours to test one high-end protective relay that requires special test equipment and specially trained engineers or technologist to operate. Organizations that only do such testing once or twice a year probably can't afford all the different equipment they would need to do the job correctly. This is one of the reasons it pays to have dedicated professionals come in for schedule and routine preventative maintenance.

Look at it this way: Outages are already on the rise. According to the 2016 Canadian Blackout Tracker produced by Eaton Power Quality Company, blackouts jumped 21 percent over 2015, and they've increased every year since Eaton first starting tracking them in 2008.

So, chances are, your organization will suffer downtime due to outages in the future. Doing preventative maintenance on your own electric infrastructure will help ensure that any blackout that hits you won't stem from your own negligence.

Looking for more information on services to keep your power infrastructure safe and stable? Download our Pole to Product Infrastructure services brochure.