# A Comparison of On-demand vs. Service Plan for Electrical System Maintenance Programs

By Denis Koch


## Executive summary

Most organizations have gaps in their electrical infrastructure maintenance practices. As a result, Total Cost of Ownership (TCO) of equipment may rise as instances of downtime increase. Maintenance is performed to prevent faults from occurring. Network operators and plant managers are concerned with safety, security, operations, and equipment lifetime. This white paper provides guidance for improving equipment reliability and for extending electrical equipment operational life span.


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# Introduction

Electrical physical infrastructure represents the life blood that drives operations in most businesses. Favorable environmental conditions need to be maintained and service work needs to be performed on the electrical distribution network. Safety and availability are major objectives of those plant managers who are tasked with ensuring uninterrupted, continuous operation.

The economic crisis has forced organizations to reduce capital expenditure (CapEx) and, as a result, budgets for in-house maintenance teams have been reduced. That same economic crisis has also pressured organizations to find ways to reduce operational expenditure (OpEx) without decreasing productivity. Uninterrupted operation must somehow coexist with safety, security, reliability and extended equipment lifetime.

This difficult balancing act has resulted in risky maintenance planning. Practices such as one-shot maintenance, no response time commitments from vendors in case of emergencies, and lack of a predictive maintenance contingency plan set the electrical system operation at risk.

Research reveals that more than two-thirds (67%) of breakdowns can be avoided through service plans[1]. Cost of downtime can reach up to € 6.5 million per hour in the finance industry (i.e., stock exchange) and up to € 1 million per hour in the petrochemical industry. This paper reviews the various maintenance approaches available and recommends a series of best practices.

**Figure 1**

*Cost of downtime across multiple key industries*

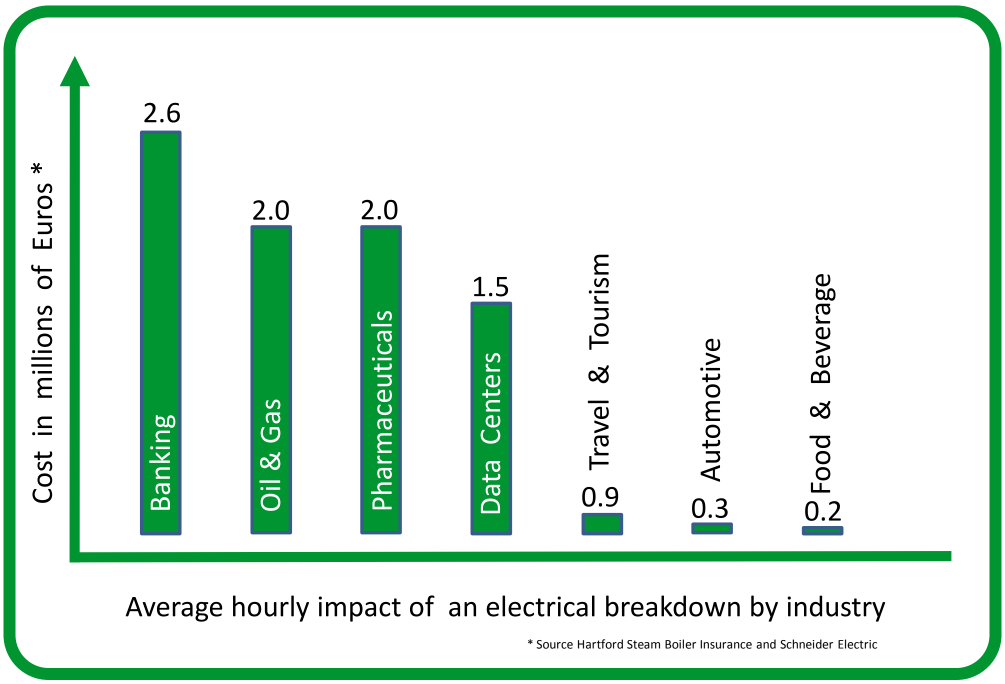



**Figure 1** illustrates how much monetary loss results from an hour of breakdown across selected industries. Electrical network integrity is a critical cost avoidance element, and failures need to be corrected as quickly as possible.

Visits by qualified maintenance personnel serve as a validation that the physical infrastructure equipment is on track to support the electrical system's uptime goals.

[1] Hartford Steam Boiler Claims Data (2010). URL : https://www.hsb.com/HSBGroup/uploadedFiles/HSB_COM/Information_Resources/420%20%20%20HSB%20Recommended%20Practice%20for%20Electrical%20Preventive%20Maintenance.pdf

## Why electrical infrastructure components fail

Each day, businesses increase workload demands on their electrical physical infrastructure. Unfortunately, the electrical system in place may not have been originally designed to support such increased loads. All electrical equipment needs to be maintained regularly in order to ensure that the infrastructure operates under favorable conditions. This reduces the possibility of breakdowns and enhances safety. The principal reason for electrical system failure is lack of maintenance[2]. Performance and life expectancy of electrical systems is impacted by environmental conditions, overload conditions, and excessive duty cycles. Even when equipment has not been in operation for a long time, a strong possibility exists that it will require proper maintenance before it can function again.

The question is not if the failure will occur, but when? Studies have shown that electrical equipment failure rates are 3 times higher for components which are NOT part of any scheduled maintenance program (as compared to equipment which is part of a service plan).[3]

**Figure 2**

*Common causes of electrical breakdowns*

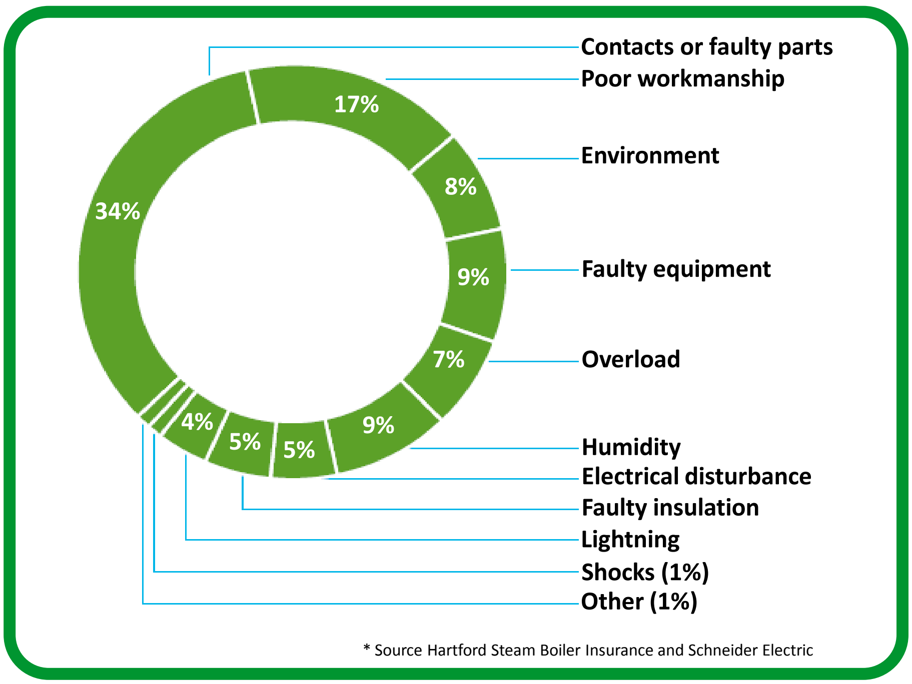



**Figure 2** illustrates common causes of electrical breakdowns in business facilities. Up to 77% of these breakdown categories can be directly attributed to maintenance-related issues.

When electrical systems are in disrepair, not only does unanticipated downtime occur, but both employees and facility visitors can be exposed to potential safety hazards. Fortunately a structured, planned maintenance program can address the majority of these factors thereby helping organizations to both avoid future costs and to safeguard human life**.**

[2] Westray, P. (2013). Electrical Preventative Maintenance (EPM), URL: http://www.districtenergy.org/assets/pdfs/2013CampConference/MicroGrids/WESTRAYPAULElectrical-Preventative-Maintenance-EPM.pdf

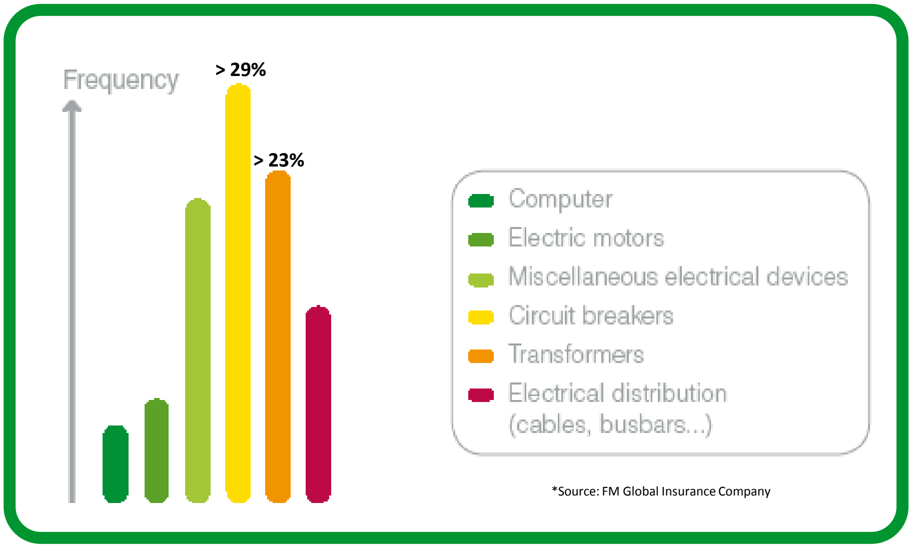
[3] HSB (2010): Recommended Practices for EPM. URL: https://www.hsb.com/HSBGroup/uploadedFiles/HSB_COM/Information_Resources/420%20%20%20HSB%20Recommended%20Practice%20for%20Electrical%20Preventive%20Maintenance.pdf

## Faulty Components

If not detected ahead of time, faulty parts can lead to a catastrophic event. **Figure 3** illustrates the comparative failures of different types of electrical equipment and their relative frequency of occurrence over a period of 10 years.

**Figure 3**

*Common causes of failures / accidents in a facility*



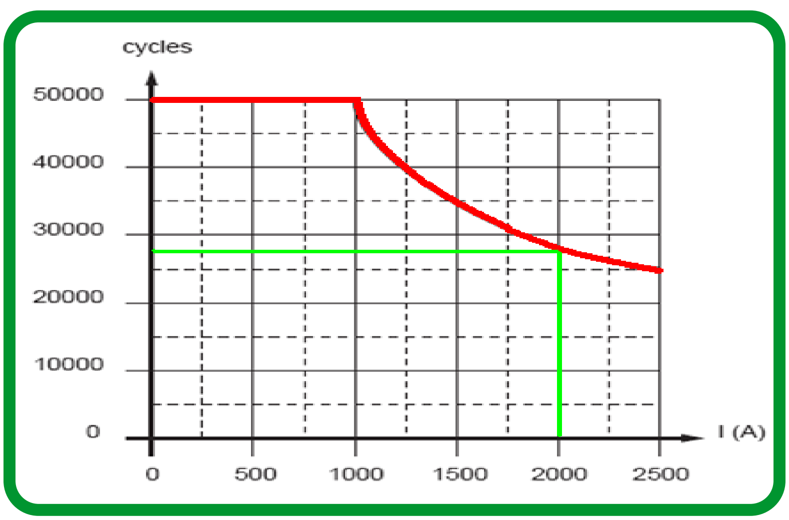

As seen in **Figure 3**, more than 50% of faulty component failures that have been identified as "accidents" by insurers involve either circuit breakers or transformers.

## Heavy usage of equipment

Heavy equipment usage in specific applications can make them vulnerable to frequent breakdowns. The graph below shows an example of an electrical furnace circuit breaker and how its life expectancy is affected by the number of operation cycles. If regular maintenance is performed on such equipment, the life of that particular piece of equipment can be extended. Since this equipment often follows a predictable pattern of decline, breakdowns can be forecasted, and appropriate actions can be taken before the breakdown occurs. Thus, emergency situations are avoided.

**Figure 4**

*Heavy usage of an electric furnace circuit breaker*



## On-demand maintenance vs. service plans

Organizations have a number of choices to make when it comes to development of a maintenance program. One option is traditional, on-demand maintenance. In this particular case, maintenance is only performed when the business owner or related stakeholders request it. In these cases, equipment lifecycle issues are rarely taken into consideration. No long term agreement exists between the business and the service provider. When compared to customers with service plans in place, the "on-demand maintenance" customer is not treated as a priority by the service provider. In this scenario, cost is low, but the risk of losses that can negatively impact the business is high.

Another choice is to engage the service provider directly by signing up for a service plan. In addition to standard maintenance, service plans offer a "predictive maintenance" element that is based upon an audit of equipment to be covered by the plan. Under this scenario, costly technical issues are averted before they actually occur.

Predictive Maintenance is a broad term and involves varying approaches to problem avoidance and prevention depending upon the criticality of the business. The difference between Preventive and Predictive Maintenance is that Preventive Maintenance tasks are completed when the machines are shut down and Predictive Maintenance activities are carried out as the machines are running in their normal production modes.

A service plan can also include maintenance activities that estimate and simulate equipment condition over time, utilizing probabilities to assess downtime risks. In most instances, service plans include replacement of parts, scanning of breaker panels, component / system adjustments, cleaning, and possible updating of physical infrastructure firmware.

At the basic level, a maintenance service plan can be deployed as a strategy to improve the availability performance of the electrical system. At a more advanced level, the plan can be leveraged as the primary approach to ensure the availability of electrical distribution equipment.

**Table 1** compares some of the options available through both types of maintenance approaches.

**Table 1**

*On-Demand Maintenance vs. Service Plan approach*

| Maintenance Program Type | | |
|---|---|---|
| **Options** | **On-Demand** | **Service Plan** |
| Preventive maintenance | Available | Available |
| Predictive maintenance | Available | Available |
| Corrective maintenance | Available | Available |
| • Service fee | Yes | None |
| • Technical support (24 x 7) | Not Available | Available |
| • Labour and travel charges | Full price | Discounted price |
| • Cost of parts | Full price | Discounted price |
| • Commitment to prioritized response | Low | High |

Service plans hold a clear advantage over on-demand maintenance when it comes to emergency on-site intervention, labour, and spare parts costs. The options highlighted in **Table 1** can be customized according to the unique requirements of the business. Some businesses are more critical in nature than others. With lives at stake, a hospital, for example, cannot afford to have unexpected breakdowns. In such a case scheduled maintenance is critical as electric faults can be predicted before they occur. A supermarket also cannot afford to lose customers and risk of product spoilage if the electrical system was to break down. Although these facilities may have integrated alternate sources of power like generators into their systems, the lack of maintenance on even these backup sources can compromise overall reliability.

Service plans prevent such losses. Emergency on-site intervention along with the priority access to spare parts resolves issues in such environments and minimizes downtime.

## Recommended practices

The first step in conducting proper electrical equipment maintenance is to begin by enforcing manufacturer standard requirements and specific manufacturers' recommendations[4]. Visits by qualified maintenance personnel serve as a validation that the electrical equipment is on track to support the organization's uptime goals. Maintenance professionals with electrical distribution expertise can identify the aging of various internal components and determine how much the component influences the overall reliability of the system.

The maintenance professional should observe the environment (circuit breakers, installation practices, cabling techniques, mechanical connections, load types) and alert the owner to the possible premature wear and tear of components. He should also point out factors that may have a negative impact on system availability (i.e., possible human error in handling equipment, higher than normal temperatures, presence of gas in oil for transformers, and corrosion).

A maintenance visit should also include an evaluation of outside environmental factors that can impact performance. The depth and breadth of the maintenance visit will depend upon the criticality level of the operation and should result in the formulation of an appropriate service plan.

[4] Hartford Steam Boiler (2008) How to prevent costly electrical system problems. URL: http://www.hsb.com/HSBGroup/uploadedFiles/HSB_COM/Information_Resources/Electrical%20Preventive%20Maintenance.pdf

## Conclusion

Investing in a service plan enables an organization to avoid up to 67% of potential electrical breakdowns and therefore avoids the financial losses that accompany such breakdowns. Service Plans reduce overall maintenance expenses and also prolong the life of electrical equipment.

Organizations wishing to justify a conversion from an on-demand approach to a service plan approach should execute the following simple steps:

**Step 1:** Record the number of electrical breakdowns that the target organization has encountered in the last 5-10 years and their impact. Quantify the amount of money spent on correction of the electrical faults through on-demand maintenance.

**Step 2:** Contact the electrical equipment manufacturer and task them with proposing a service plan that can be customized to the nature of the business. The proposed service plan should guarantee emergency on-site intervention and delivery of spare parts so that corrective action can be performed as soon as possible in case of a breakdown.

## About the author

**Denis Koch** is a Senior Marketing Manager in the Schneider Electric Field Services Electrical Distribution Business Unit. He holds a Bachelor Degree in Electrical Engineering and over the last 10 years has assumed numerous engineering and marketing positions within a variety of business units and operational divisions. An expert in strategic and operational marketing, he has recently helped to launch the Solar Business within Schneider Electric and is currently implementing transformation programs across all geographies, related to service plan development and deployment.