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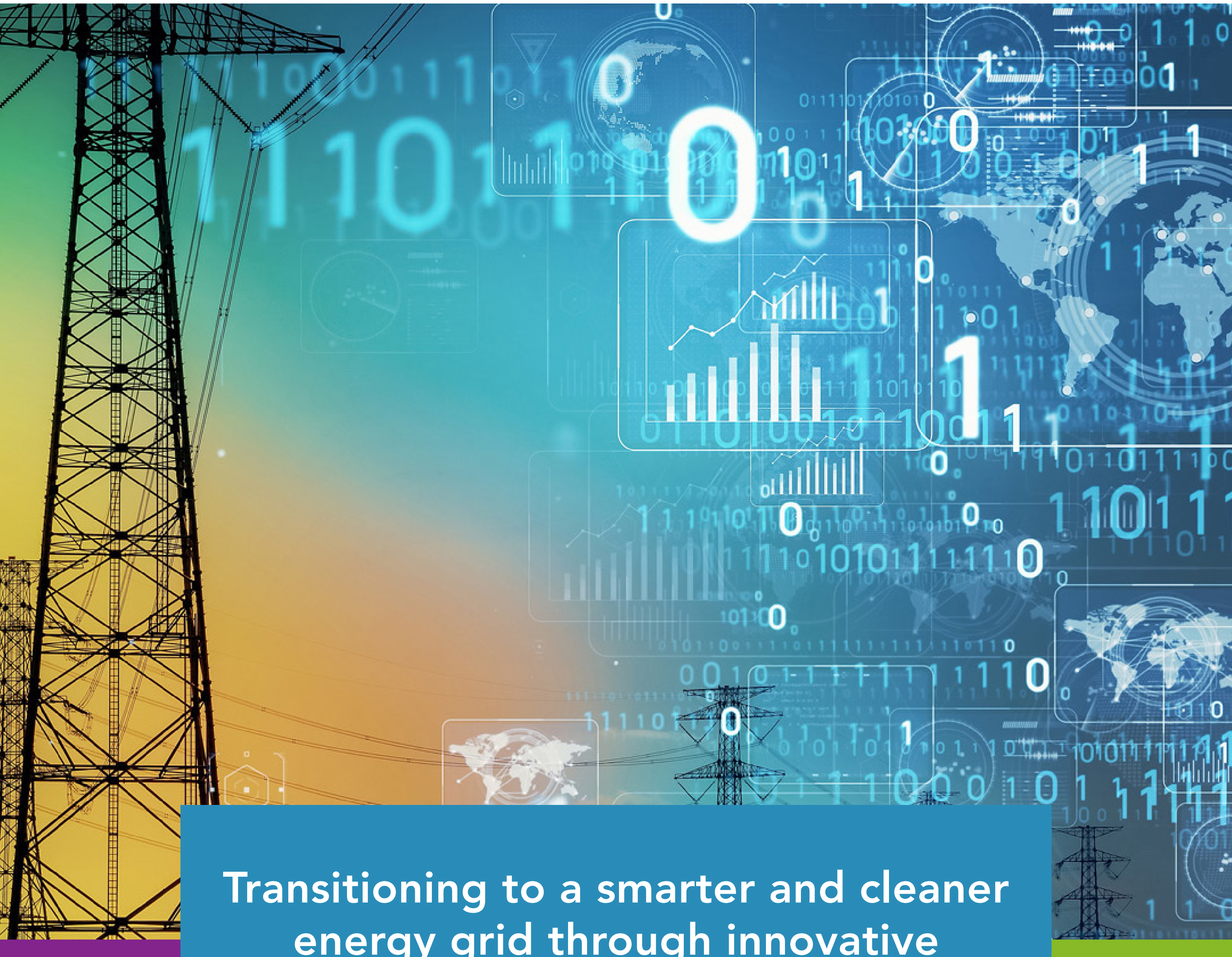

Transitioning to a smarter and cleaner energy grid through innovative AI applications

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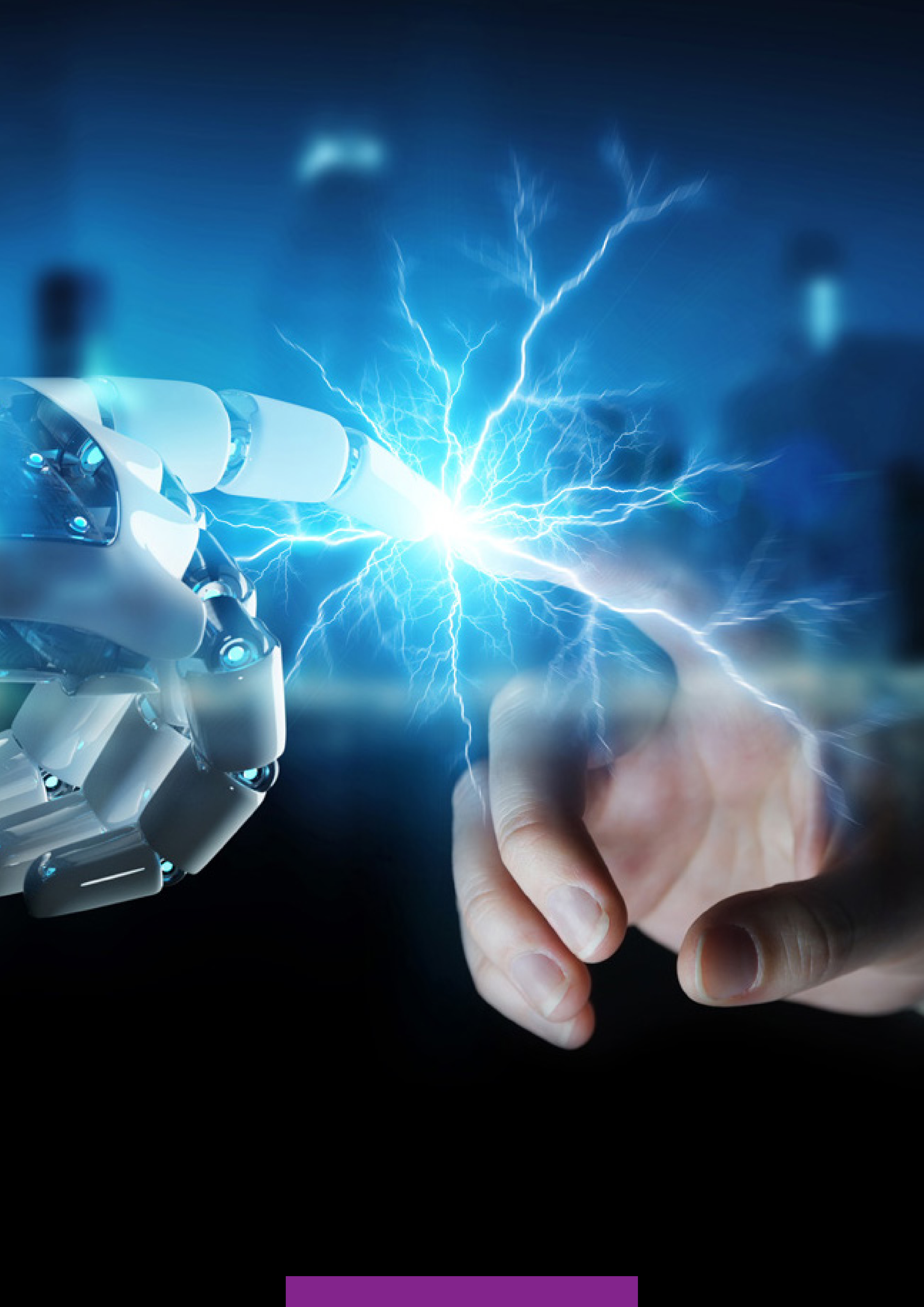

INTRODUCTION

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INTRODUCTION

A stable and reliable power supply is a vital component for the optimal functioning of the economy and our daily lives. It is so indispensable that even minutes of downtime can cause thousands of dollars in lost revenue for certain businesses. It is also critical for effective responses to Covid-19 and other diseases, as all diagnostic tests and treatments require a robust electrical grid. Outages of only a few minutes can be life-threatening. With increasing awareness of such stress, maintaining a stable power supply has become a top priority for many countries.[1]

As of 2015, the estimated total cost of all power interruptions in the US alone stood at USD 44 billion per year, according to Berkeley Lab. That is 25 percent higher than the USD 26 billion per year in 2002. Most of the costs come from commercial customers due to the economic impact of power interruptions.[2]

Stoppage of service due to internal causes, such as equipment failures, account for a substantial share of power interruptions. Based on outage incidents recorded across the world between 1965 and 2012, equipment failure and malfunctions were responsible for 57.96 percent of all disruptions, ahead of natural disasters (30.71%) and other external threats, including human errors and cyber threats.

In the era of smart grid, the system has become more complicated in terms of communication, computation and control. Resilience depends on unpredictable factors, and is therefore vulnerable to targeted attacks. The utilities sector has recognized that it is impossible to prevent all events at all times, explaining the sustained power cuts or degradation of supply for short periods, until they restore normal operating level quickly and efficiently.

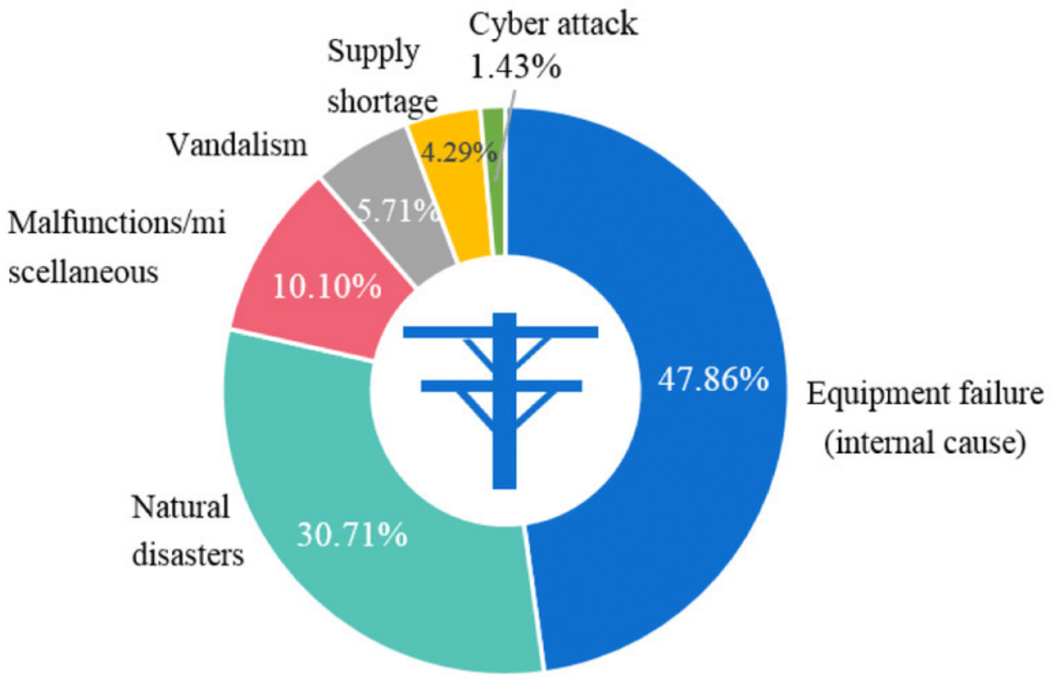

Figure 1
Power outage causes for 140 worldwide outage data from 1965 to 2012. Bie, Z., Lin, Y., Li, G., Li, F. (2017). Battling the extreme: A study on the power system resilience. Proceedings of the IEEE, 105(7), 1253-1266. Retrieved from: https://www.researchgate.net/publication/316025063_Battling_the_Extreme_A_Study_on_the_Power_System_Resilience

Resilience is defined by the United Nations Office for Disaster Reduction (UNISDR) as 'the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.'[3]

This clearly shows that frequent inspection of assets and quick resolution of issues as and when they occur will have a positive impact on the trustworthiness indicators. However, several trends in the industry have made improvement in the continuity of supply and reduction in the span of disconnection a challenging task.

Declining reliability of age-old infrastructures such as transmission lines and transformers that have been in operation for over 40 years, loss of significant share of qualified employees to retirement or attrition, and increasing frequency of extreme weather events causing substantial damage to the electrical infrastructure are some of the factors constraining the ability of utilities to offer dependable supply to their end users.

On the other hand, the power sector is witnessing the benefits of transitioning to digitized and digitalized entities over the last two decades. A large number of sensors and control systems have been deployed by these utilities and a massive quantity of data now resides with such organizations ready to be exploited.

Artificial intelligence (AI) is that technology that has the potential to make sense of the enormous size of information and predict accurately to aid the power sector in managing the fault detection and prevention challenge successfully. Although AI technologies have developed extensively over the last decade, it has not been widely adopted by utilities in fault detection and prevention applications.

CONCLUSION

Faults in the electrical grid due to the constant aging equipment or natural causes, including storms and vegetation, are the main reasons for power outages, at least in the developed countries of the world. But, even in those, the above factors do not account for the majority of disruptions. There are still many other cases that need to be addressed in order to the power supply more reliable for consumers.

Over the past decade or two, stakeholders have invested in digital transformation to improve efficiency and gain competitive advantage in their fields. In the process, companies have significantly pushed the boundaries of artificial intelligence, and the technology now has immense potential in the energy sector.

In situations where it is difficult to recruit and retain field workers, computer vision technology will play an important role in helping facilities inspect and identify damaged equipment on hundreds of thousands of miles of transmission and distribution lines using drones and cameras. Other applications include inspecting solar panels and sites seriously affected by natural disasters to assess the impact in near real time and allocate operators to the exact locations.

Machine learning has enabled organizations to identify assets that are most likely to be on the verge of failure by considering a variety of factors in real time, such as evaluate age, overhead/ underground, asset utilization and duration, weather, user concentration degree, GIS coordinates, and historical failure rates. This made the prediction of the risk assessment many times more efficient than the manual approach. Given the benefits of artificial intelligence in fault detection and preventive maintenance in the energy sector, several companies, a large portion of which are startups, have off-the-shelf and customizable products on offer.

It is time for utilities to take the best approach to their competencies and implement AI or risk losing customers to competitors.

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