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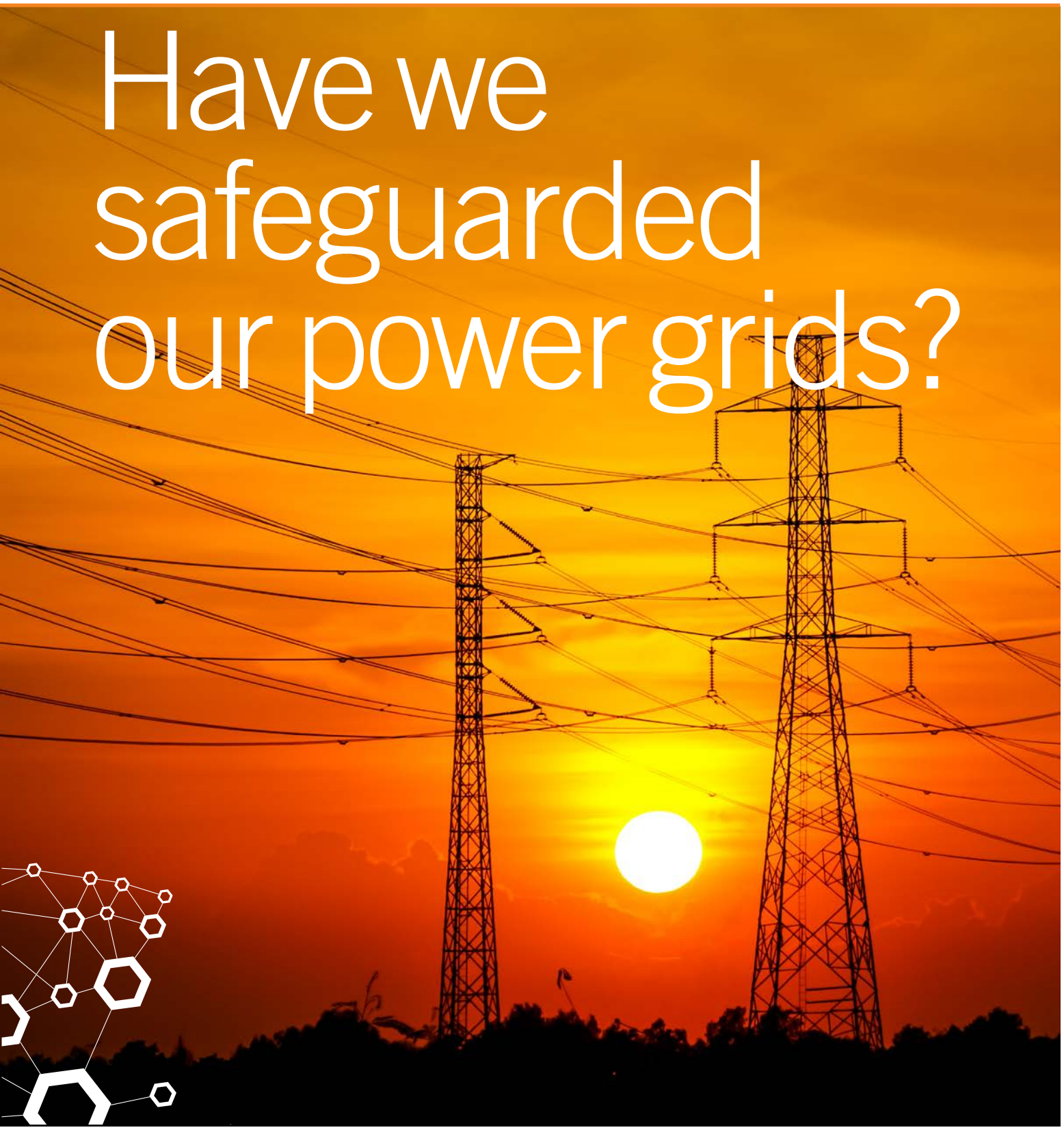
PÖYRY INSIGHT ARTICLE - SWEDEN

# Have we safeguarded our power grids?



# The importance of risk assessments for the power grid


Today's society is dependent upon a reliable electric power supply. Developed Nations are so dependent on electricity networks that any significant interruption to electricity supply can have severe economic and social consequences. Hence, power grids are arguably essential for our society and classified as a critical asset that needs to be protected. The power grid and conduct risk assessments are therefore crucial for grid owners in order to avoid such incidents.

## RISK ASSESSMENT PROCESS

Risk assessment processes are vital to enable power grid owners to be able to ensure a dependable and secure transportation of electrical energy for their customers. The choice of method and approach to carrying out the process is decisive for the result of a risk assessment. Depending on the system in question and the aim of the risk assessment, methods for how to conduct the process should be carefully considered and evaluated before choosing an appropriate approach.

## COMPLEXITY REQUIRES CLARITY

Because of the complexity of systems like power grids, the assessment's delimitations also need to be clearly defined before starting the process. The delimitation should for example define system boundaries and the assessment's level of detail. These kinds of clarifications will make it possible to obtain a realistic description of the investigated system and the risks and threats it may be exposed to. Furthermore, risk assessments need to be considered with regard to the concept of security and safety. This article aims to present the importance of risk assessment processes of power grids regarding the concept of security and how to protect the physical and technological infrastructure from being compromised.

Historically, risk assessments have focussed on risks that have generated threats towards the physical infrastructure. The increased complexity of the power system and the integration of IT technology has shifted the focus of risk assessments to include more threats against the technical infrastructure. Different methods are therefore needed in order to be able to investigate, analyse and evaluate these risks.

## HOW TO ANALYSE DIFFERENT KINDS OF RISKS

According to recent studies[1] of the most critical risks regarding the Swedish power grid, nature related and antagonistic risks can be distinguished as the two categories which generate the greatest risk. To analyse and evaluate these risks two different types of methodologies are required.

## NATURE RELATED RISKS

Regarding nature related risks, the most advantageous method to investigate their probability and consequence is by using a semi quantitative approach. Both expert opinions and quantitative data need to be considered to generate the most reliable result and in order to determine a suitable evaluation method the following parameters should be considered:

**RISK PARAMETERS**

- The stochastic nature of the risk
- The reliability of the entire power system
- The identification of its most vulnerable components

Based on these parameters a simulation model is recommended in order to analyse the impact that strong winds and lightning have on the power system's reliability. Furthermore, simulation based models can be promoted as suitable methods since they often include Monte Carlo simulations, which make it possible to capture the stochastic characteristics of the weather. However, for geomagnetic storms and floods, a different approach would be more appropriate. These events occur with a different frequency and also lack reliable quantitative measurements, which makes an analytical method more appropriate in order to investigate their impact on the power grid.

## ANTAGONISTIC RISKS

In recent years the focus has been directed towards antagonism and due to the power grid's technological development these kind of risks are expected to increase. Regarding the Swedish power grid, espionage, terrorism, vandalism and sabotage are identified as the antagonistic threats with the greatest capacity to pose a risk. Also, the spread of confidential data and the risk of intrusion into sensitive IT systems is among the great risks associated with antagonistic threats. When it comes to threats directed towards the physical infrastructure, it has been found that theft of copper and sabotage are the most common incidents.

## CONCLUSIONS

The identified risks presented in this article should be further investigated through a well-constructed risk assessment processes to provide relevant solutions for managing these risks. Due to the lack of prior experience and statistical evidence for high impact and low frequency events, it is advocated that qualitative methods including relevant experts' knowledge and experiences are important in order to analyse these sorts of risks. Creative processes are presented to be an effective strategy to identify unexpected risks and to further investigate and evaluate them. Hence, workshops should be used when investigating antagonistic risks.

**CASE EXAMPLES**

**Cyprus (2011)**
A large explosion at a military facility damaged a nearby Power plant. This resulted in a setback of 830MW and nearly 60% of the islands total generating capacity. With no interconnections to the mainland Cyprus faced an emergency electricity situation, resulting in planned energy outtakes for 2-4 hours per day until the power could be totally restored after one month. The highest cost estimation for this event exceeded in 30,000M€ for industry, service providers and civil population.

**Germany (2006)**
A power line was intentionally switched off to let a large ship pass underneath. The system was at the time fed by a large amount of wind energy, and a last-minute change in the timing of the switch-off led to frequency instabilities. One power line got over loaded, and triggered a series of events that in the end affected 20 countries as far away as Morocco. Full resynchronization was achieved within 38 minutes, resulting in only minor damages of an estimated 100M€. The political impact, on the other hand, and the debate between having a centralized or decentralized grid is still on-going.

**PÖYRY'S RECOMMENDATIONS**

A well designed risk assessment process is essential in order to secure a reliable electric energy supply. This has to be done with respect to the availability of data, statistics and expertise. Furthermore the risk assessments methods have to be chosen with regard to the studied system and the risks it is exposed to in order to be customized for a specific company.

[1] *Hotkatalog för Elbranchen,* Svenska Kraftnät. *Counting the cost: the economic and social costs of electricity shortfalls in the UK*, Royal Academy of Engineernig.

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