

INFRASTRUCTURE, SECURITY AND SOCIETY – ENERGY PERSPECTIVE

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ABSTRACT

“Security of electricity supply” is widely discussed at both EU and Finnish national level. But at the present, there is no common approach on how to analyze security or vulnerability of electricity distribution. Alongside indicators and probabilistic models there should be deeper understanding of contemporary fears and societal questions. In this paper, I will present my study about the sociology of power system failures, done for the University of Helsinki. Social risk perceptions of both utility personnel and electricity end-users in Finland are examined. These perceptions are then compared and framework for further studies is discussed.

ELECTRICITY DISTRIBUTION AS SECURITY PROBLEM

Alongside competitiveness and the environment, “security of supply” has become a cornerstone of energy politics in Europe. The European Union sees the “new energy landscape” as being threatened by insecurities, ranging from import dependency to changes to Europe’s climate, risks from natural catastrophe, terrorist threat and interruption of energy supply [1]. The EU has also started a European Programme for Critical Infrastructure Protection [2]. Also in Finland infrastructure failures and malfunctions have been deemed a national security issue that threatens the functions vital to society [3].

Sociologists have said that since the late 20th century technologies have been out of control [4] and there is powerful sense of risk on the part of the public [5]. But a recent collaboration study between Scandinavian energy, water and civil protection engineers concludes that there is no common framework or even a common approach on how to analyze security of electricity supply and vulnerability issues related to extraordinary incidents [6]. Knowledge on the different vulnerabilities of electric power networks and their implications for everyday settings is still very limited.

In this paper I will present my sociology master’s thesis for the University of Helsinki [7], where I studied electric power system failures as *social risks*. Both Finnish lay electricity users (9 persons) and experts at Finnish power utilities (7 persons) were interviewed for the thesis. These interviews were subjected to qualitative analysis, seeking patterns and distinctions made in the speech. Also, 115 lay persons answered a survey part of the thesis. Basic statistical summaries were made of this data.

The purpose of the study was threefold: first, to see how the energy experts weight the effects of future threats; second, to study lay risk perceptions of electric power failures; and third, combining the previous, to compare and contrast how energy experts and energy users experience and confront failures. These three points are then used for discussion on studying power system failures further.

EXPERTS CONFRONT THE PROBLEM

A power system failure has been defined as “an incident where a power system component’s ability to perform its function is interrupted or reduced” [8]. In 2003, for instance, a disconnector short circuit followed by a double busbar short circuit caused loss of all electricity distribution lines between Southern Sweden and Denmark. As a result, the electric voltage collapsed and the distribution of over three million end-users was interrupted for two hours. Other recent large-scale power system failures include Central Europe 2006, Sweden 2005, North America 2003, France 1999 and Canada 1998. [9]

There are already many studies on the technicalities of power system failures. In contrast my study sought to find out what makes the failures at our present society a *social risk* : i.e. a future uncertainty, which should be reduced by present decisions [10]. As a start, all the experts of my study shared the idea that electricity distribution has become a very vital system for a modern society. According to one expert, “electricity is critical for a modern society to exist. It is like education system or health care, electricity is that deep structurally. “Another concluded that for a city dweller, electricity networks seem so permanent that they are almost like the natural environment. Thus the utilities saw it important to secure the supply of electricity, whether it was done through grid maintenance, building backup networks or constantly training the personnel.

But even though the electricity distribution in Finland is very reliable, the experts wanted to emphasize that there are threats that are either impossible or very difficult to prevent. The threats include nature’s actions - most of the power failures in Finland are caused by wind and storms or snow and ice load on the cables [11]. “We cannot change the weather “, one utility person said, “We can follow weather predictions, but strong storms are a surprise just as to anyone.”

A second concern was more system-oriented : accidents of large technological systems are not always due to simple

cause and effect, but sometimes due to chains of disruptions, which can mean masses of damaged lines at the same time, cascading effects or emergency systems that are supposed to prevent failures being out for maintenance when they are needed [12]. As an interviewee put it: “A large-scale accident may be improbable, but it is still not impossible.”

This discussion resembles what has been called the *vital systems security* or critical infrastructure protection model of security politics [13]. Vital systems security aims to protect the systems that are critical to economic and political order and focuses on threats that cannot be predicted or prevented, but only reduced. Examples of such threats are natural disasters, disease epidemics, environmental crises and terrorist attacks. This discussion has a long history in the United States and culminated during the energy crises of the 1970s. Lately it has also become a central practice of other Western governments and the EU. It seems that the experts of Finnish utilities share these concerns.

But the experts of my study did not just conclude that electric distribution has become a security problem. They were also concerned for lay people who are unprepared for power failures: “Using electricity is not a part of normal people’s practical reasoning. Using it happens unconsciously”, one expert said. As a solution, electricity use should be more rational and respectful: “It should be part of your everyday life that you are prepared for the power systems to fail.” One utility person even listed risk groups that are especially vulnerable to failures, starting from the elderly and ending to people with health problems.

The linking of electricity use with ways of living is by no means limited to power system failures. Liberalisation of electricity markets has seen the construction of a new consumer “identity“ for electricity users [14]. Also the recent promotion of “energy efficiency“ has turned people from passive users to active participants of energy provision [15]. Following this spirit, the experts of my study demanded that the electricity-using individuals should learn how to take responsibility and understand future occurrences – thus playing their part in minimising security risks.

LAY PERCEPTIONS

In contrast to the experts, some lay people of the study were actually relaxed about electric power interruptions. A power failure could mean spending more time with other people or an enforced break from work. According to the survey part, most people think they can manage days without lights, warm water and computers (see table 1). As one interviewee put it, “I’m not troubled by power failures. Of course can calculate economic losses of them, but personally I don’t understand what they are.”

Table 1. How long the respondents (N=115) could spend without certain appliances.

Appliance	Days without using
Fridge	1
Toilet	2
Warm water	3
Lights	6
Computer	10

Many also made the link of power failures and being in “nature“. Over 80 percent of the survey respondents think that one should accept that nature causes power failures. “It is actually positive to have big storms with blackouts every now and then”, one interviewee said. Short blackouts during storms meant burning candles and enjoying the atmosphere. In short, easy power failures especially caused by nature were seen as manageable. I call these *minimal harm interruptions*.

But people ceased to be relaxed, if the failure started to cause trouble or economic losses. The melting of a freezer or prolonged cold weather could make an interruption very difficult. One interviewee in particular had had very much trouble from constant power failures. Contrasting the idea of the positive atmosphere of power failures, she said that in her house, “one cannot get to the atmosphere of a failure but still has to restart all the appliances.” I call these *serious harm interruptions*.

The same person thought that electric utilities should make their grids more reliable and “follow development, just as all sectors of society”. After having difficult power failures, people generally attempted to explain the interruptions, with over half the respondents linking liberalized energy markets and rising energy price to power system failures. As one person put it, “some failures are clearly connected to utilities not doing their work properly”.

There is a clear distinction at work: some power failures are being seen as cause for concern, others are not. It is common finding of social risk studies [16] that depending on person’s attitudes one risk rather than the other is selected as important. According to my study, people take power failures more seriously if they have already experienced failures and especially if they feel that utilities have little control of failures. Otherwise, people appear to accept failures in a quite fatalistic manner.

It may also be that people are managing without electric distribution because they can use personal and social skills instead of electricity. As shown by table 2, most respondents had already acquired sort-of “immunity” towards easy power failures. Perhaps in the context of everyday life, it would be very difficult or even impossible to be much more rational and responsible about electricity use.

Table 2. How the respondents (N=115) had already prepared for power failures.

Preparedness	%
Candles and matches	100
Flashlight and batteries	98
Battery-operated radio	80
Utility phone number	66
Fireplace	56

LAY-EXPERT COMPARISONS AND CONTRASTS

Before comparing lay and expert perceptions, one should recall a constraint which is also an issue with my study : Power failures are inherently different things for different groups. For utilities, power failures are an internal risk or a possible future harm, which can be reduced with present calculations and investments. For lay people, power failures are an external risk that is caused by forces that are beyond people's own control : there is usually nothing normal people can do to bring the electricity back. Discussion of risks happens thus at different levels. [10]

Restrictions in mind, my study still gives some suggestions for lay-expert comparisons. For the lay people of my study, there was a difference between minimal harm interruptions and serious harm interruptions. In both cases it is difficult to make lay people more responsible about the risks of failures. Minimal harm interruptions cause fatalism and people feel they are already quite prepared for these kinds of accidents. Serious harm interruptions cause criticism and it is seen as the utilities' responsibility to deal with failures.

But the lay persons were not disinterested in power failures. The public in Finland has been known to apply "conspiracy theories" to power system failures and this was evident in my study as well. This resonates well with the present cultural spirit of low expectations [5], although some studies see that the public has felt mistrustful of utilities already long since [17]. Never the less, normal people can afford to be fatalistic about power failures, but the utilities have to both be and appear to be proactive.

According to one study [17], public risk perceptions do not even relate to objectively existing physical risk ; rather, they are judgements of the behaviour and trustworthiness of the expert institutions. This places further pressure on utilities in solving the problems caused by interruptions.

STUDYING FURTHER FAILURES

Nowadays it is easy to amplify the sense of risk on the part of the public [5]. Risk communication between experts and the public is thus a dangerous affair. Because mistrust prevails and the participants observe on different basis, communication between the stakeholders may well widen the gap between the experts and the lay persons instead of

narrowing it.

There should be further research on *how* to communicate about the risks of power system failures, and also *when* not to communicate about them at all. The main challenge for research is to specify the boundaries between minor and catastrophic events for different stakeholders [18]. As stakeholders have different acceptance criteria for risks, this brings us to very wide questions : What is probable and what is improbable in each particular context? When do different stakeholders become risk averse and reject all quantitative calculation ? How much security of electricity supply do different stakeholders need? And when vital systems security is discussed, what is threat of terrorism, natural catastrophe and disease epidemics put to perspective in different countries ? A social study of security should look at the processes through which the answers to such questions are found [19].

To understand power system failures, we need indicators, yardsticks, instruments and probabilistic models on the vulnerabilities of electric power networks. But while this kind of knowledge is necessary, it is not sufficient. Alongside, there should be deeper understanding and diagnosis of the fears in our contemporary society and solutions on how, as members of society, the utilities and electricity end-users ought to react.

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