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Emergency management in the Swedish electricity market: the need to challenge the responsibility gap

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Abstract

A secure energy supply is a basic need of society. Along with electricity market deregulation, a responsibility gap has arisen, where private energy companies lack economic incentives to invest in an electricity distribution grid that is secured to the level desired by society. This article discusses the emergency management strategies of municipal authorities for securing the electricity supply, according to a networked, or “governance”, control and direction structure, and how this influences the relationship between electricity companies and Swedish municipalities. The Swedish electricity system has traditionally developed in a monopoly context. Since electricity market deregulation, the responsibility for electricity supply security has become unclear; field studies of Swedish municipalities indicate that all actors still seem to be seeking to find their proper roles in the deregulated market. Municipalities still expect to exercise influence over private energy company decisions regarding prioritization of emergency power deliveries. Energy companies vacillate between emphasizing their need to regard economic factors and their sense of responsibility for providing a secure electricity supply to vital municipal functions (even though municipalities may lack contracts specifying this).

Key words: electricity distribution grid, emergency management, regulation, public–private partnerships, governance, security

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Introduction

The electricity market and the need for a secure energy supply have been heavily debated in Swedish media in recent years. This debate mainly stems from Sweden’s experience in 2005 and 2006 with two powerful storms, “Gudrun” and “Per.” These storms damaged the power grid and led to outages in most of southern and central Sweden. In connection with Gudrun, 30 000 km of electricity lines were damaged, leading to outages in most of southern and central Sweden. After the storm, 500 000 households lacked power; half of these got their power back within 24 hours, but 68 000 lacked power for a week or more (SEA 2005a, b; SEMA, 2005). In January 2007, Per left 275 000 households without electricity, and after 24 hours approximately 50 000 still lacked power. Historically, such severe outages are rare. On average, an electricity user is struck by one outage a year, 80 percent of which are unplanned. These outages last an average of 100 minutes a year; approximately 70 percent of these outages last between 1 and 6 hours (SEA, 2007).

Even though extensive and long-lasting outages, such as those caused by Gudrun and Per, are fairly uncommon, their consequences when they do happen are still far-reaching. Climate change is also contributing to expectations that weather-induced outages will increase in frequency and severity. In addition, the consequences of outages are today more severe than in the past. In one state-initiated investigation of the consequences of outages for Swedish

society, the investigation committee gave some examples of how outages influence various actors and sectors, as follows:

Length of outage	Function, actor, or activity	Consequences
1 second (or less)	Industrial processes	Processes stop, with resultant long restart times
1 second	Data systems	Systems stop and data is lost
1 minute	Intensive care	No lighting for surgery or power for respirators and dialysis units
2 hours	Water supply	Users at high elevations will be without water
8 hours	Water supply	Risk of contamination by polluted water
	Heating	Particular problems in healthcare institutions and for the elderly in their homes
10 hours	Telecommunication services with battery reserves	Interruption of telecommunication services
12–24 hours	People and livestock	Lack of water and suitable food
	Provisions	Refrigerated and frozen provisions will be destroyed
Several days	Everyday life	Workplaces and service institutions must close

Table 1. Consequences of power outages (SOU, 1995, p. 20)

Although a secure energy supply is a basic need of society, who is responsible for providing it and how it will be paid for has yet to be completely clarified. Andersson and Malm (2005) discuss the responsibility gap that occurs in deregulated markets, where private companies have financial incentives to avoid costs incurred in relation to infrequent crises or accidents. Private limited companies are responsible to their stockholders to be prepared for various contingencies; however, market forces are not strong enough to impel companies to offer what society regards as acceptable emergency management. In relation to the Finnish electricity market, Kinnunen (2006) states that “too much efficiency leads to too little investment” (p. 853), which could equally apply to the Swedish situation. The reduced role of

governments as energy suppliers, in combination with the need of private companies to minimize expenses and maximize revenues, has led to a gap between government emergency management and private-sector actors. The latter are uninterested in developing a *secure* electricity supply for all the needs of society, and in fact lack the ability to do so (Andersson and Malm, 2005, p. 13).

These storms Gudrun and Per drew attention to weak emergency management in Sweden, the weakness of the Swedish electricity grid, and the loss of reserve capacity. The Swedish electricity grid mainly comprises overhead lines and is thus vulnerable to outages, the consequences of which cause huge economic and social problems throughout society. Because of the experience of these storms, increased expectations have been expressed regarding the ability of both private energy companies and the government to organize responses and take the lead in emergencies; cooperation among all energy companies – private and public – and local and regional authorities to deal with outages is vital in this. Society needs an emergency management system that can handle outages at both the technical and organizational levels.

Large-scale outages in the early years of this century, for example, in Canada, the USA, Italy, England, and Denmark, have highlighted the importance of the electricity supply, as the economic and social consequences of such outages are huge (Newly et al., 2003; Andersson and Malm, 2005). Another important factor contributing to his interest was the energy crisis in California that followed deregulation of the electricity market there (Andersson and Malm, 2005, p. 25). Several nations have discussed public–private partnerships as a solution to their electricity problems following the privatization of public infrastructure. According to Andersson and Malm (2005), the USA has granted exceptions to competition regulations to

facilitate public–private partnerships, which in turn should increase the supply security of consumers. These partnerships incorporate increased possibilities for exchanging information (about threats to the system) between actors, in the interests of defining suitable security levels for the electricity supply (p. 29). I will discuss how the Swedish state has responded to such threats and the efforts of the Swedish government to secure the electricity supply for its citizens. I will examine how far Swedish public actors have taken public–private cooperation in the deregulated electricity market, and the resultant problems and opportunities for public authorities acting to secure the energy supply. This will be discussed in relation to the experience of Swedish municipalities in connection with the storms Gudrun and Per.

The energy market in Sweden has traditionally been characterized by government control and direction. However, lately and especially since the deregulation of the Swedish energy market in 1996, we have seen a shift to more of a “governance” control and direction structure in the electricity market. I will discuss the consequences of this shift for the strategies and policies of municipal authorities regarding electricity supply security, and how these affect the relationship between electricity companies and municipalities.

The article is organized as follows. First, I consider the difference between policy making in *government* versus *governance* structures. Then I discuss the organization and deregulation of the Swedish electricity market, after which I present the results of case studies of one county in Sweden. The article concludes by discussing actors’ relationships and accountability in the electricity market.

Electricity supply in government and governance structures

The need for governments and public administrations to exert control in actor networks and in relation to public–private partnerships is often highlighted. As more and more policy areas are deregulated, new control structures are necessary, and in the deregulated Swedish electricity market, we can discern a shift from a *government* to a *governance* steering structure.

The traditional *government* approach highlights the chain of command of public organizations and top–down hierarchal decision-making by political actors. “Government” implies that control and direction takes place within governments and their formal institutions, and that the state’s monopoly on the use of legitimate coercion is the focus (Boyer, 1990; Stoker, 1998). State institutions can make decisions, and they also have the capacity to enforce these decisions (Boyer, 1990; Stoker, 1998). The government approach has long been the norm, and has determined the framework for policymaking.

The *governance* approach has been developed to explain the more open and network-oriented decision-making processes that have been observed, involving intricate interplay among public, private, and non-profit organizations. In governance contexts, networks are self-organizing and cannot be fully accountable to governmental bodies. Cooperation and coordination make governance horizontal, even if the state may assume a hierarchal role in exercising power (Rhodes, 1997; Börzel, 1998; Peters and Pierre, 2004;). Government structures are open to the broader governance of partnerships and network-oriented decision-making the role of governments then changes, and they become simply one player among many (Pierre and Peters, 2000).

Notably, responsibility becomes more indeterminate and concealed in a governance rather than a government structure. In a government context, accountability is mainly regarded as a chain of command from the electorate to the politicians, and from them to public administration. In contrast, a governance structure makes accountability intertwined and multiple (Stoker, 2004). In networks and governance structures, contracts are thus vital in determining who is responsible for what (Palm and Wihlborg, forthcoming). Considine (2002) argues that in governance contexts, contracts are used as an alternative to legal mandates and hierarchical chains of command. Contracts thus represent a way of handling the lack of adjustments in legal frameworks to meet the development of partnership and networked governance (Pierre and Peters, 2000, p. 17).

Network operations are regarded as a natural monopoly and is still supervised by public authorities in Sweden. According to Jessop (2002) this is a common way of meta-governance where the state establishes a mix of markets, hierarchies, network, and partly keep a monopoly situation. In this way, the authorities can still serve as a final court of appeal for fundamental issues. On the electricity market this mean that authorities still can influence the grid and especially the level of investments.

I will now turn to the responsibility for a secured energy supply in a deregulated Swedish electricity market, discussing the experience of Swedish municipalities with the storms Gudrun and Per. From a governance perspective, I will discuss the practical consequences of the responsibility gap for the electricity market, and the need for shared responsibility on the part of public- and private-sector actors. First, however, I will briefly describe the organization of the Swedish electricity market and the role of municipalities after deregulation.

The organization of the Swedish electricity market

The way Sweden organized its energy market through most of the twentieth century has its roots in the 1860s when its cities often owned the gas plants established in them. When the electricity system was established in the 1880s, Swedish municipalities continued to play a central role, by both producing and distributing electricity. (Kaiser 1986; Palm, 2006) As of 1920, all 110 Swedish cities had electricity plants; half of these plants were owned by the municipalities and half by private actors. This division of functions, in which municipally owned companies distribute electricity and major private-sector power companies produce it, is called “The Swedish Model”, and this structure remained in place until the 1990s and deregulation (Lundgren, 1978; Kaijser, 1994).

The deregulation of the electricity market

The restructuring of the electricity market commenced in January 1992 as the production and sale of electricity were separated from network operations at a national level. Svenska Kraftnät was established and made responsible for running the national grid as the Transmission System Operator (TSO). This entails ensuring that the generating plants of the Swedish electricity system are working together reliably and that electricity production and imports correspond to Swedish consumption and exports (Svenska Kraftnät et al., 2006).

On 1 January 1996, new electricity legislation came into force. The reform this ushered in entailed the production and sale of electricity being separated from its transmission; power trading and network operations may not be conducted by the same legal entity, but rather must be conducted separately by different organizations. Deregulation thus made it possible to produce and trade electricity competitively. However, network operations were and are regarded as a natural monopoly, and the network is regulated and supervised by public

authorities (Government Bill 2004/05:62). Today, the Energy Market Inspectorate within the Swedish Energy Agency is legally the regulator of electricity networks and the electricity market. It must ensure that the network tariffs are reasonable, not going beyond the cost-recovery principle, and that network operations do not subsidize other activities (Svenska Kraftnät et al., 2006). In connection with the storms Gudrun and Per, security of electricity supply has been increasingly debated in Sweden, and the distribution companies have been criticized for mostly having overhead distribution lines and not having invested in buried lines. However, this situation is starting to change, and the proportion of buried lines has increased, at least in local distribution nets.

According to the Power Supply Contingency Planning Act (SFS, 1997:288), Svenska Kraftnät is responsible for Sweden's electricity contingency planning; it is responsible for the electricity supply during times of crisis and war, and must cope with society's demand for electricity (NordReg, 2006).

The storm Gudrun led to new regulations and changes to the Electricity Act (Government Bill, 2005/06:27). The new Act gives consumers better guarantees of a secure electricity supply and strengthens the electricity companies' obligation to secure the electricity supply and make contingency provisions. This is one way to deal with the conflict or "gap" between the companies' desire to maximize profits and their societal responsibilities. For example, the energy companies now must compensate the consumers if an outage exceeds 12 hours, which was not regulated by law before. Starting in 2011, an outage exceeding 24 hours will be even more expensive for the energy companies (SFS, 1997:857, ch. 3, § 9a).

Emergency management as a municipal responsibility

Swedish emergency management is based on responsibility for geographic areas, municipalities, county administrative boards, and the national government being responsible at the local, regional, and national levels, respectively. This means that they are responsible for coordinating actors at their individual levels before, during, and after a crisis; they never encroach on the responsibility, however, that belongs to another level of government. (Palm & Ramsell, 2007/

Swedish municipalities have a general social responsibility to their citizens and must ensure that they do not suffer prolonged outages. Several municipalities have reserve generation capacity to use in case of emergency, most commonly supplied by diesel generating units. Such backup systems cannot supply large loads, so prioritization is often needed – a controversial issue in Sweden. Several studies have identified the need to prioritize electricity provision, supplying it to the most important users even in peacetime crises; this need was further emphasized by Gudrun and Per. Today, however, such prioritization has no legal basis. The Electricity Act is normally interpreted to state that no prioritizing can be done in peacetime, for example, when capacity shortage calls for load shedding. Another situation when prioritizing would be called for is during power restoration after a long outage. In practice, however, municipalities and energy companies prioritize certain customers today when absolutely necessary. Many municipalities have listed which actors and facilities should be given first priority, which second, third, etc. The Swedish Energy Agency also has the task of studying how legal, organizational, and technical barriers will be removed to make it possible to prioritize in peacetime crises.

Besides, according to Swedish law (SFS, 2006:544), municipalities are responsible for maintaining municipal services, even during crises. Some municipalities interpret this law as allowing municipalities to prioritize between their services and their citizens.

The storm Per and experience in the county of Östergötland

The focus here is on the municipalities in Östergötland and their experience of the storms. Gudrun did not strike Östergötland as hard as did the second storm, Per; however, Östergötland's neighboring counties did experience severe problems because of Gudrun. I will briefly outline the lessons learned from the Gudrun experience, to determine whether these in any way influenced the subsequent storm preparedness of Östergötland municipalities. Have they learned anything from Gudrun with regard to coordination, formal agreements, and strategies for handling outages?

The country of Östergötland consists of 13 municipalities. Of these, I will mainly focus on the results of case studies of four municipalities: Linköping, Norrköping, Boxholm, and Kinda, see figure 1. These case studies involved 13 interviews with politicians, municipal officials, and officials in two energy companies owning the majority of the distribution network in the region. In Kinda municipality, I also undertook participatory observation of a collaboration meeting, the results of which I will discuss here.

Figure 1 Map showing the location of the case study municipalities

The municipality of Linköping has 130 000 inhabitants, and the municipal government owns a local energy company that owns most of the distribution network in the municipality. In Linköping, the energy companies were responsible for arranging the emergency reserve and coordinating contingency activities. The municipality of Norrköping also has approximately 130 000 inhabitants, but it sold its electricity distribution company to E.ON in 2001. The municipality of Boxholm has 5 000 inhabitants, and here Vattenfall owns the distribution network. Kinda municipality has 10 000 inhabitants and here E.ON owns most of the distribution network.

Main results of the evaluations of Gudrun

Evaluating the experience of Gudrun indicated that the needs for back-up energy source and prioritization between consumers were solved differently in different municipalities. In general, the municipalities were not very well prepared, and lacked plans for such an

extensive and for long-lasting outage. The particular strategies the municipalities used were very much explained by the particular knowledge possessed by the municipalities, personal initiatives, and personal networks that facilitated the possibility of contacting the right people in other organizations and informally solving problems as they occurred (SEA, 2005a, pp. 7–8).

The need for reserve generation capacity in the municipalities was handled differently in different regions during Gudrun. The energy companies affected also had to mobilize reserve capacity; for example, E.ON summoned assistance both from within Sweden and from Europe. E.ON delivered 650 small and 500 large generating units; the smaller ones were mainly delivered to private households and companies, while the larger ones were sent to municipalities and their rescue services (SEA 2005a, p. 19).

The expenditure for acquiring emergency generation capacity varied between municipalities. Many municipalities accepted all back-up energy sources offered, focusing not on negotiating the price, but on securing power for as many inhabitants as possible. These municipalities reasoned that they could deal with the economic consequences later. The post-storm restoration efforts and administrative burdens have been huge for many municipalities. One lesson learned from the Gudrun experience was that the allowable expense allotted for emergency generation capacity must be clarified for the future (SEA 2005a)

Prioritizing the distribution of the reserve generating capacity was done by the municipalities together with the electricity companies. Such prioritizing differed between municipalities, according to the various criteria guiding the process. In several instances, the public questioned why a certain prioritization decision had been made. The private electricity

companies claimed that it was the municipalities that had determined the prioritization, while the municipalities claimed it was the energy companies; clearly, there had been discussion, and the actors had been divided as to who would be held accountable for the final decisions.

The storm Per in the county of Östergötland

None of the municipalities that did not own an energy company had any formal agreement with the energy company concerning, for example, emergency reserves. The procurement of back-up energy sources was done based on personal contacts and networks. One municipality, Norrköping, had sold its electricity company to E.ON in 2001. At that time, the politicians and emergency manager in Norrköping believed that E.ON could handle the electricity supply because:

As long as it is the same people working in E.ON who worked in NME [the former municipally owned electricity company] it will work. Because we know who to contact and they know who they will contact in the municipality. (Interview chair of the municipal executive board)

E.ON has concessions in several Östergötland municipalities and has had to develop working relationships with actors in each of them. E.ON's operations coordinator stated that cooperation and communication with the different municipalities differed greatly. In general, E.ON has forged better working relationships with larger municipalities, such as Norrköping, than with the smaller ones, such as Boxholm. For example, during the storms there were problems receiving updated contact lists regarding which municipal actors E.ON should inform of the occurrence of outages and of how long E.ON thought they would take to repair. In some municipalities, such information exchange simply did not happen. Both E.ON and the municipal representatives felt this indicated that some municipalities lacked updated emergency management systems.

However, all four municipalities here analyzed had made lists concerning how they should prioritize users if they had to distribute emergency power supplies. The main problem in this regard was whether or not these lists were legal, and various actors differed in their opinions about this.

E.ON, bearing in mind the Electricity Act, felt it was not legal to prioritize. However, all actors interviewed agreed that in practice they do prioritize when needed, allowing, for example, hospitals, water purification plants, homes for the aged, to regain electricity provision first when possible.

In Linköping, the municipality and its energy company believed, according to the emergency management act for municipalities (SFS, 2006:544), that they could prioritize in providing emergency electricity service. The emergency coordinator in Linköping said:

We interpret the law as allowing the granting of priority to socially important electricity users during crises. We, in the municipal administration, choose which users will be prioritized and the energy company just implements our decisions.

In Linköping, both the municipality and the electricity company agreed that it was the municipality that determined the prioritization. In Norrköping, the municipality claimed that they determined the prioritization; E.ON, however, emphasized that *they* made the final decision, although they listened to the municipality's desires. So, in this case there was again disagreement, although this time each party thought that the responsibility was theirs.

Unclear roles and deals: the example of Kinda

Sweden has shifted from an electricity system in which public actors take great responsibility for securing the electricity supply, to one in which private-sector legal arrangements and

agreements determine the level of the supply security. The related problems and confusion for all involved actors were exemplified at a collaboration meeting held in Kinda, involving E.ON, politicians, officials, and local industry, to discuss how to coordinate efforts in the event of future power outages.

During the meeting it became clear that politicians and officials in Kinda assumed that the municipal organization and services should be prioritized during an outage; however, the municipality had no agreement or contract with the energy company stating that they should be prioritized. Traditionally, however, municipal administrations have been prioritized, and municipal actors, and to some extent energy company actors as well, still held this to be appropriate.

Municipal officials and politicians returned to the question of how the municipality should act to influence which power lines E.ON restored first; the representatives of E.ON faltered in responding to this matter. In discussion, they alternated between emphasizing that they are a competitive company in a market that requires contracts, and that they must meet and agree to municipal requirements without demanding a contract. E.ON's regional manager said, for example:

First, we choose [to deal with] the areas that give power back to the most people, because that costs us the least. ... You can't tell us how to act, because our operations are determined by economic conditions.

The information manager from E.ON added:

But of course, we are listening to how you would prefer us to prioritize between different users, such as homes for the aged.

The regional manager agreed, saying:

Yes, absolutely – we want to have ongoing discussion and dialog.

At the meeting, they also discussed concrete proposals for how the municipality could take part in E.ON's prioritization deliberations. For example, E.ON and the municipality agreed to arrange a second meeting at which to decide what areas in the municipality would be prioritized in a crisis and the order in which lines should be buried.

At this collaboration meeting, also private-sector company representatives were attending the meeting discussion about a secure electricity supply. The companies had paid for a secured electricity supply and had their supply lines buried all the way to the building. The municipality had not paid for that, but expected to have a secured supply anyway. However, no one commented on that.

Concluding discussion: the need for societal support

Swedish energy systems have traditionally developed in a monopoly situation and a government context, in which the systems developed according to formal regulation, taxation, and emission limits. The actors are not used to *negotiating* concerning electricity supply security or talking in terms of contracts and formal agreements. The electricity market is in transformation; a more governance-based control structure is being adopted, public–private partnerships are increasingly common, and the need for contracts is highlight. As well, the municipality is still partly seen as a governmental actor, rather than just one of several players acting within a control network. This resulted in a privileged position for the municipalities that however also is under transformation. All actors still seem to be seeking their appropriate roles in the deregulated market. This is why, for example, E.ON can emphasize both that they are a profit-maximizing company and that they feel responsibility for securing electricity supply to vital municipal activities, even though municipalities lacks a contract requiring this.

What then is the lessons learned from this case study? The Swedish state have kept a monopoly situation and created a meta-governance position over the grid. But the municipalities have not such a regulatory role, their role is more fuzzy. The municipalities have an obvious responsibility for the citizens' welfare services, even during blackouts. In those cases where the municipality not owns the local grid, the municipality has no influence over how to prioritize between users when that is possible.

When the electricity market adjusts to a governance structure, municipalities must cooperate with private-sector actors. The municipalities need to play a more proactive role in the electricity market and for example contracting partners, which can provide emergency reserve power, or for securing electricity supply to specific municipal services.

Municipalities also need to engage continuously in these issues and appoint someone responsible for these issues, something small municipalities often lacks. The consequences of this are that the grid companies had difficulties exchanging information with small municipalities, because they do not know with whom they are supposed to communicate. That result in a failure of the Swedish comprehensive goal of an equal electricity supply.

The most important is however to clarify the roles on the electricity market, so that the citizens know who is accountable for what!

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