



# Storm Per

Lessons for a more secure energy supply after  
the second severe storm in the 21st century







# Introduction

The severe winter storms Gudrun and Per put southern Sweden's power supplies to difficult tests. Within an interval of two years the storm winds swept in on a similar path and left overthrown trees and destroyed power lines in its tracks. Storm Per was not as violent as Gudrun but it affected a larger geographical area. The power cuts were not as long as after Gudrun, but they were just as troublesome to handle for many consumers.

In most cases the crisis management was more effective after Per compared with Gudrun, mainly in the early phase of the crisis. It is obvious that the work with Per was easier for those that had been previously involved with Gudrun. The question is – how much of this knowledge gained has been preserved by the organizations involved compared to the knowledge gained by the individuals themselves. Established contact networks, closely united crisis organizations and practical experience all contribute significantly to the speed and effectiveness of disaster recovery.

This report shows how the lessons learned from storm Gudrun benefited the handling of storm Per. Many places in the south of Sweden have, in a short period of time, experienced two severe storms but, as a result, people have gained valuable experience for the future where we may experience even worse weather more often.

There is a great risk that the lessons learned from the crisis work carried out after the storms will in time be lost as people leave and are replaced. The documented experience from the crisis work during the storms Gudrun and Per can be of great use for the organizations who have the task of handling the effects of the storms now and into the future.



Storm Per occurred, like storm Gudrun, during very favourable conditions, when considering that both storms occurred in the beginning of January. It was mild for the time of year, accessibility on the roads was good, there were no influenza epidemics and fortunately few work places were affected as the storm occurred on a weekend.

The Swedish preparedness to handle an energy crisis during less favourable conditions – for example, severe cold – was therefore not tested. According to some of those interviewed “Storm Per was a good exercise to see if we can handle an extensive power cut”. By learning and spreading knowledge about how to handle the recovery from storms like Gudrun and Per we reach a bit further in the strengthening of the preparedness for a more severe disturbance in our energy supply.

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The report is based on, for example, interviews with representatives for public and private operations in 25 selected municipalities spread over the 14 storm-tossed counties as well as a questionnaire that was sent to 2000 households in the storm area.



ELAVBROTT

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VI ÖPPNAR SÅ  
FORT DEN  
ÅTERKOMMER.

Power cut – We will open as soon as it is back.





# Contents

A new storm attacks southern Sweden .....	9
Who loses and who wins from a power cut?.....	17
Experiences and lessons from the storms .....	21
Methods to disseminate gained experiences.....	43
Everyone is responsible for securing the energy supply .....	47
Conclusions .....	53
The Swedish Energy Agency's role .....	57
Further information .....	63
Glossary and factual explanation .....	67





# A new storm attacks southern Sweden

The storm called “Per” attacked larger parts of Götaland and eastern Svealand on the 14th of January 2007. The storm occurred just about two years after the storm called “Gudrun” which caused extensive devastation in the forests and disrupted a large part of the power transmission and distribution network in the affected areas.



The geographical areas mentioned in the document.



Many of the municipalities, network operators and power consumers who were affected by Gudrun were also affected by Per. Storm Per was, with certain local exceptions, not as devastating as Gudrun. On the other hand it affected a larger geographical area. As a result of the storm it is estimated that a total of 440 000 customers have been without electricity for a short or long span of time. The longest power cut duration was approximately 10 days.



The counties and lakes mentioned in the document.



The consequences of the power cut were the usual: lighting failed, no possibility to cook, no heating for many households, petrol stations didn't work, industries had to shut down, telecommunications were interrupted in large areas, trains were cancelled, etc.

Many people in the storm area thought that mobile telephony was more extensively affected than during the Gudrun storm and this made the work of localizing and the repairing power supplies more difficult.

Generally speaking, Per caused less damage than Gudrun even though municipalities such as Mariestad and Töreboda (which are situated in the area between Lake Vänern and Lake Vättern) were hit harder than during Gudrun.

According to the present Electricity Act customers who are without power for 12 hours are entitled to compensation. For many of the network operators the prescribed compensation payment was a larger cost than the work of restoring the distribution network.

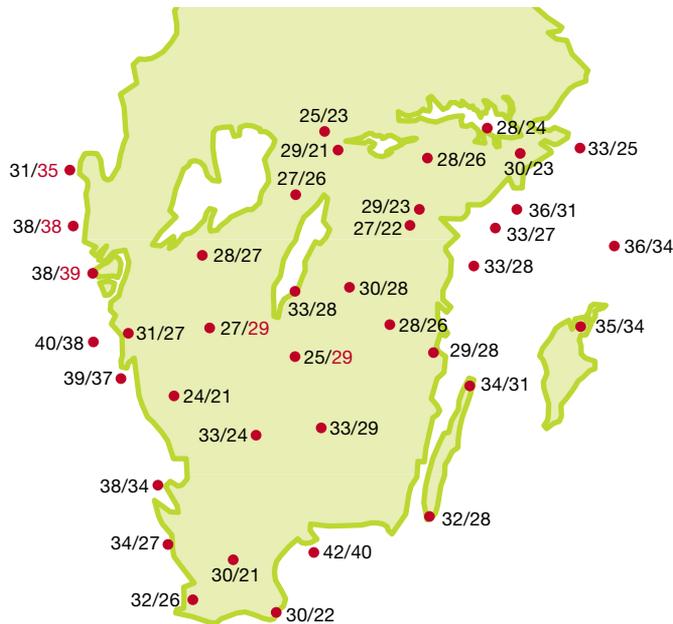
#### **A comparison between Gudrun and Per gives the following picture**

<b>Aspect</b>	<b>Per</b>	<b>Gudrun</b>
Maximum wind-force over mainland (m/s)	29	33
Quantity of destroyed forest (millions of cubic metres)	16	70
Number of customers with power cuts	440 000	730 000
Longest power cut (days)	Approx 10	Approx 45
Maximum time to restore regional grid (days)	1	7
Reallocated capital as a result of power cuts (billions SEK)	1,8–3,4	4–5
Compensation for power cuts paid by network operators (millions SEK)	750	610
Restoration costs for network operators (millions SEK)	650	2 400
Total compensation from insurance companies to affected customers (millions SEK)	550	4 000



The storms Gudrun and Per largely followed the same path. Both of them were formed just west of the British Isles and passed over the southern Norwegian mainland before sweeping in over southern Sweden. The paths for Gudrun and Per then differed somewhere over the Gulf of Bothnia. The somewhat different path for Per meant that the storm winds came from west to west-northwest while Gudrun's winds came mostly from south-west to west.

Per was just as strong as Gudrun in the north of Götaland but did not reach the same levels in middle and south of Götaland.



Wind-forces during Gudrun and Per in metres/second. The figures on the left state the highest wind-forces during Gudrun and the figures on the right state the highest wind-forces during Per. Red figures indicate that the wind-force during storm Per was at least as strong as during Gudrun. SOURCE: SMHI (The Swedish Meteorological and Hydrological Institute).



### **A windy continuation**

When the storm Per had moved towards Estonia on the 15th of January an extensive storm had formed on the 18th of January south-west of the British Isles and which during the night of the 19th of January passed with its centre over Skåne. This storm caused great problems on the continent while Sweden this time avoided the storm winds. The next storm centre passed eastwards over Svealand on the 20–21st of January and there was a brief cover of snow in the larger part of Götaland.

### **Extensive damage to the forest**

According to the Swedish Forest Agency approximately 16 million cubic metres of forest were lost including the extra felling that was needed in order to prevent the threat of infestation from fir bark beetles. The municipalities of Ljungby, Vetlanda and Tingsryd were most affected by the forest damage.

The forest damage after storm Per was approximately 20–25 percent of the damage that occurred after storm Gudrun.

### **Approximately 440 000 customers were affected by power cuts**

The Swedish Energy Agency estimates that the total number of affected electricity customers during Per was approximately 440 000, compared with a total of 730 000 who had power cuts during Gudrun.

For some customers power cuts lasted up to two weeks.



## A NEW STORM ATTACKS SOUTHERN SWEDEN

Network operators	Number of affected customers		Number of affected as % of total number of customers		Longest power cut time [days]	
	Gudrun	Per	Gudrun	Per	Gudrun	Per
Alvesta Elnät AB	1 600	208	35	10	20	2
Brittedals Elnät ek. för.	3 200	1 290	100	40	15	3
E.ON Elnät Sverige AB	260 000	170 000	30	19	35	8
Emmaboda Elnät AB	1 930	1 960	49	50	13	2
Eskilstuna Energi och Miljö AB	2 300	1 112	5,2	2,5	0,5	1
Falbygdens Energi Nät AB	6 600	3 050	39	18	14	7
Fortum Distribution AB	85 000	80 000	10	9	10	2
Gotlands Energi AB	17 000	18 000	45	47	2	2
Jönköpings Energi Nät AB	3 600	6 600	7	13	2,5	2,5
Kalmar Energi Elnät AB	0	0	0	0	-	-
Katrineholm Energi AB	4 000	2 000	21	11	7	1
KREAB Öst AB	7 200	4 200	100	58	20	4
Ljungby Energinät AB	8 400	120	100	1,5	0,12	0,04
Mariestad-Töreboda Energi AB	700	1 500	5	11	2	3
Mälarenergi Elnät AB	4 200	6 000	4	6	1	2
Nybro Elnät AB	2 012	470	24	6	7	2
Olofströms Kraft Nät AB	9 000	9 000	67	67	33	5
Ronneby Miljö och Teknik AB	5 000	2 500	42	21	1	0,5
Rödeby Elverk	2 150	400	52	9	8	1
SEVAB Nät AB	4 600	800	28	5	2	1
Sjogestads Eldistributionsförening	140	330	5	12	0,40	0,08
Telge Nät AB	10 000	4 800	21	10	6	2
Tranås Energi AB	1 320	1 240	12	11	7	4,5
Vattenfall AB	180 000	85 000	21	10	20	7
Vetlanda Energi och Teknik AB	450	260	5	3	5	2,5
Östra Kinds Elkraft ek. för.	2 100	1 000	73	25	6	2
<b>TOTAL affected customers</b>	<b>622 502</b>	<b>401 840</b>				

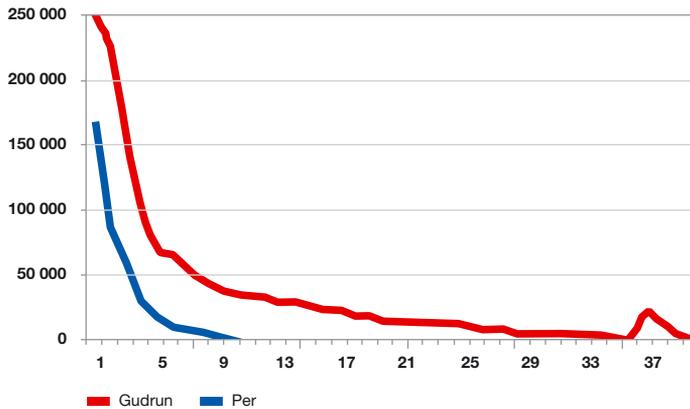
The number of affected electricity customers and power cuts during Gudrun and Per respectively for the 26 network operators who were included in the study. Approximately 90 percent of all affected customers were customers of the network operators in the table.

SOURCE: EACH RESPECTIVE OPERATOR.



The restoration work after storm Per mainly followed the same pattern as during Gudrun but in most cases it was significantly quicker. Most electricity customers got their power back within 1–2 days.

**Number of customers without electricity per day**



Number of customers without electricity after storm Gudrun and Per respectively in E.ON's network. SOURCE: E.ON ELNÄT AB.

The shorter power cuts during storm Per relieved the consequences for the network operators' customers.

The power cuts due to failures in the regional networks were much fewer. This can be explained partly by the tree securing programme that is being carried out by the regional network operators and partly by the fact that storm Per was not as powerful. The longest power cut in the regional network took one day to restore, while there were power cuts in the regional network after Gudrun that took seven days to restore.





## Who loses and who wins from a power cut?

A larger power cut means costs for some people and profit for others. The result becomes unplanned transactions of capital between different interested parties.

Based on the available documentation the total reallocation of capital due to power disruptions during and after storm Per is somewhere between SEK 1 800 and 3 400 million.

### **Network operators lost the most**

Storm Per cost the network operators approximately SEK 1 400 million, of which approximately SEK 750 million constituted power cut compensation for affected customers. The costs for electricity consumers are estimated to SEK 180–1 800 million depending on the assumptions made. There is a lack of sufficient documentation in order to arrive at a more exact calculation.

That the network operators' compensations for Per were much greater than for Gudrun depends on the fact that a statutory compensation for loss of power supply was introduced after Gudrun. The present compensation level is higher than the voluntary compensation that most of the network operators applied after Gudrun.

Industry compensated production interruptions by introducing extra shifts and overtime as soon as power supply was restored. The costs for industry have thereby been limited to a price increase for production, reduced by possible insurance compensation and compensation from power network operators. The end customers/consumers were, in all examined cases, not affected by the production disruptions. Storm Per caused, in some cases, damage to buildings and equipment but it meant less economical consequences and was mitigated in certain cases by insurance compensations.

County Administrative Boards and municipalities increased their personnel costs and had among other things additional costs for advertising.



Only two County Administrative Boards have accounted for their costs for the handling of storm Per. Based on this information, all of the affected County Administrative Boards' costs for Per can be roughly estimated at just under SEK 8 million.

Exact information concerning the storm costs for Per is not available from the municipalities. Based on the sums that are shown, the costs for the municipalities can be estimated at a maximum of SEK 180 million.

It is estimated that the insurance companies have had direct expenditures of approximately SEK 11 million for damage that the power cuts caused. This figure does not include the costs for damage to forests and buildings which amount to a significantly higher figure.

The loss of revenues due to the reduced use of electricity which affected electricity suppliers, network operators and the state in the form of lost revenues from taxation can be regarded as negligible.

The train operators were affected by extra costs by replacing rail traffic with buses. In addition to direct costs for bus traffic the train operators also suffered lost ticket revenues when travellers chose other alternatives.

Food retailers were affected by ruined chilled and frozen products. One of Sweden's leading food retailers, ICA, states that the cost in their case amounts to SEK 500 000.

### **Compensation for loss of supply and extra work created "winners"**

Some electricity customers have benefited economically from the power cut. These are mainly customers who have received compensation from network operators for power cuts to weekend cottages with emptied water plumbing for the winter or where the compensation has exceeded the extra costs that the customers have had as a result of the power cut.



Among the “winners” there are also:

- contractors called in by the network operators.
- hotels and restaurants in the storm area.
- manufacturers, wholesalers and retail shops for batteries, power generator sets, paraffin oil heaters, candles, etc.
- electrical equipment suppliers.
- bus and air traffic companies who gained more customers when trains were at a standstill.

### **Long-term after-effects**

Extensive and prolonged power cuts in the rural parts of the country can mean that companies move closer to population centres with more secure power supplies. The consequences of this are difficult to assess.

Manufacturers, wholesalers and retailers who sell mobile generator sets and different types of heaters increased their sales after the storms. Such sales are expected to be higher than “normal” in the future, until the customers’ increased demand is met.

Insurance companies can be long-term “winners” since repeated storm damage can be expected to increase the interest for insurances.

### **Marginal environmental damage**

The direct environmental damage that occurred due to power cuts was marginal and mostly consisted of:

- noise, exhaust and fuel spillage in the use of power generator sets.
- increased use of diesel fuel when buses replaced cancelled trains.
- increased car driving due to badly-functioning telecommunications.





## Experiences and lessons from the storms

By following up storm Per and comparing the course of events and actions with Gudrun, the society has a unique possibility of evaluating the decided and implemented measures.

Many people who were involved in storm Gudrun have improved their preparedness and their routines to cope with a long power cut.

After Gudrun many reports were written about after-effects and restoration work largely and possibly due to the government's request to be able to receive financial contributions from EU's solidarity fund.

However, few participants have documented their experiences from what happened during storm Per. One explanation can be that storm Per, for most people, did not give any new experiences since the course of events of the storm, the consequences and the outer conditions were quite similar to the Gudrun storm.

The lack of documentation means that a large part of the knowledge that would be of use in future crises is in the heads of individuals rather than in organizations. There is a risk that the knowledge is lost when people quit or when the knowledge simply gets forgotten.

This section describes some of the experiences that different parties have gained and what can be of use in the future.



## **General advice to authorities and other concerned parties**

- **Training.** It is important to train the crisis organization in solving problems that can arise. It is a good thing that one does not only act spontaneously in an incident – during training it is allowed to make mistakes.
- **Build contact networks.** It is important to have well-established networks with people who know and cooperate with each other. During lengthy power cuts it is vitally important to have contacts with the network operators and telephone operators. It is also important that the preparedness coordinators in a certain region have contact with each other.
- **Clarify responsibility.** It is important that the allocation of responsibility is clarified for all people involved. Who is responsible for which activity? What are the financial prerequisites? What agreements regulate the operations? What responsibility do the network operators and heating suppliers have? What responsibility do the consumers of electricity and district heating have?
- **Plan for the use of power generator sets.** Make an inventory of available generator sets. Plan for their locations and how the maintenance and fuel replenishment shall be managed when they are in operation.
- **Obtain a good situation picture.** A quick and correct situation picture offers greater possibilities for faster and more accurate decisions. Rural postmen can be a very good source of information about the situation for the rural population.
- **Inform.** It is important that the handling of information starts in good time. If it is delayed in the beginning it is very difficult to regain. Reaching the public correctly with information means,



for example, having good contacts with the local radio stations. Predetermined information sites should also be chosen, putting up notices and utilizing the rural post services.

- **Have patience with certain measures.** The beginning of a crisis demands great efforts but certain actions should be taken first when the situation picture has cleared. For example, wait for the network operators' forecasts for the restoration work before mobile generator sets are distributed.

### **Check list for energy consumers**

- **Make an assessment** of how long you can cope without electricity and heating supplies, depending on the time of year. If you have good endurance it could be advantageous to wait for the network operator's restoration forecast before you take extra action.
- **How dependent on electricity is the heating system** in your house? Even if electricity is not the main source of energy, electricity is often required to distribute the warmth. Can you use battery systems or generator sets? Is the installation of fireplace heating or paraffin stoves a suitable alternative?
- **If you think that you need a generator set**, find out the capacity that is required. Make the necessary preparations (procurement, preparatory electrical installations, etc.). Consider fuel supplies and maintenance.
- **Does your insurance cover extra costs** for damage and extra work during power cuts? Does the compensation from the network operator for loss of supply cover the remaining part? What are the possibilities of claiming damages from the network operator?



- **If you have your own well**, the water supply to the house is usually dependent on electricity. Find out if you can use the pump with a generator set or draw water for a few days' needs if a storm approaches.
- **Listen to the information on the radio** during a power cut. Remember the car radio!
- **Go through contracts** with the power suppliers (network operators, district heating companies, etc.). Do the contracts give you sufficient security? Is it clear what is expected of you? What responsibility do the energy suppliers have?

### **Early mobilization means quicker help**

There are many examples that the experiences from Gudrun were of great use in the handling of the disaster recovery efforts of Per. Many municipalities, network operators, public authorities, voluntary organizations and insurance companies stated that they had started their work 1–2 days quicker after Per. The rapid mobilization depended on contacts and routines that were established after Gudrun and the fact that the personnel who handled the problems after Per were largely the same as those who worked with Gudrun.

### **More electric lines are buried**

Even before Gudrun many network operators had invested in insulated overhead lines that are much better, from an operational security point of view, than un-insulated lines. After the storm Gudrun it was established that both un-insulated and insulated overhead lines had been damaged. The poles did not withstand the pressure from the trees that fell from the storm winds. Many companies were therefore forced to revise their strategy and now realize that underground cables are the primary alternative. The driving force here is also the amendments to the Electricity Act which means statutory compensation for loss of supply and a



requirement that power cuts after 1 January 2011 may not exceed 24 hours.

The network operators' investments in the network have been doubled or tripled after Gudrun.

### **District heating suppliers need sufficient reserve fuel**

Swedish district heating plants normally have oil boilers in reserve if the largest production unit would be disabled. In addition, the district heating companies normally have sufficient reserve power to run their oil boilers. The generator sets' capacity is however not sufficient for the heating plants to be able to handle solid fuel such as chips, refuse or peat and run their solid fuel boilers.

Some district heating plants have very small oil stocks that only allow a few days of operation at maximum heat production. They estimate that they can quickly purchase more oil if there would be a breakdown in their own production or if there is a period of extreme cold. In the event of large prolonged power cuts that affect everyone in a region the delivery time for oil will probably be longer than normal, due to the great demand and the limited transport capacity.

### **There is a need for better knowledge about distributed generation in island networks**

Island networks that were established in order to supply entire or parts of villages and population centres with electricity from mobile generator sets only occurred during Per to a limited extent (in total approximately 200 cases), while during Gudrun only in the county of Kronoberg there were nearly 200 cases.

Many network operators would like a discussion and more knowledge about the operation of island networks with regard to priorities, logistics and technical solutions with the aim of the quicker establishment of operational islands when required.



### **The network operators' emergency cooperation organization worked**

The network operators thought that their emergency cooperation organization worked well. The organization was established at the end of the 1990's and means that individual network operators assist each other with resources during extensive power cuts. This concept for preparedness and crisis management has been further developed since storm Gudrun. The IT system SUSIE has been utilized by all of the interviewed network operators during storm Per to exchange information about number of affected customers, estimated restoration time, help needed, etc.

### **Quick information more important than quick help**

In connection with storm Gudrun there was dissatisfaction with the information that the network operators gave concerning the repair situation after the storm. Everyone who is dependent on electricity wants to know when their supplies will be resumed since it is important for their own measures.

The network operators realized after Gudrun the necessity of being able to give correct and current information about the power cuts to their customers and other parties. In an initial phase it can even be more important with information than repairing the network. The fact that the network operators had made great improvements with their information work was apparent with the storm Per.

### **Petrol stations are still vulnerable**

The power cuts after Per affected a number of petrol stations in the countryside as pumps and payment functions stopped working – in certain cases up to 5 days.

In addition it is necessary that data and telecom communications are fully functional in order that the stations are able to supply fuel to the customers. In some cases the oil companies have





made successful attempts with wireless communication on the mobile 3G network.

The attempts with generator sets have shown that the quality that is required from the generator sets means too great costs so that the owners of the petrol stations are not prepared to make the investment.

### **The households' own preparedness is lacking**

Questionnaires to households in the affected areas show that only a third of the households had taken any measures to cope with a power cut. The experiences after storm Gudrun did not cause more people to take measures to improve their ability to deal with loss of energy supplies.

A half of the households who were affected by power cuts during Per state that the power cut caused problems with heating supplies. Of this number, somewhat over a third coped with their heating supplies by previously installed fireplaces or stoves. Approximately 10 percent already had paraffin stoves and about 8 percent bought or hired/borrowed generator sets during Per.

A third of the households who plan measures in order to better cope with power cuts will, for example:

- make the heating system independent of electricity from the network.
- supplement existing heating systems with alternative solutions.
- provide a generator set.
- exchange heating system.
- provide alternative solutions for cooking (wood stoves, gas-stoves, spirit stoves, etc).



### **Information should be spread through many channels**

Some of the storm-affected households were irritated that network operators and other participants refer to their web sites for current information when people do not have access to electricity or functioning telecommunications. Several people suggested that information should be sent out by the usual post since the Post Office reaches everyone. On the other hand the networks operators' efforts for better information on the web sites have been very much appreciated. Many people in the countryside can benefit from web-based information since they, in many cases, work in other places or have neighbours who do.

The radio is the source of information that reaches people quickly and on a broad front and many people consider it to be reliable. However, not everyone has fresh batteries in reserve at home and do not note that the car radio is battery-operated, or that mobile telephones with radio receivers need to be charged.

It is important that the network operators' efforts for more and better information on the web sites do not replace the verbal contacts in an improved customer service or information on the radio. Diversity in the communication channels is the key word!

### **The media gave a good picture of the situation**

The mass media satisfied the general public's great interest with frequent reports about the storm recovery work.

The analysis of the media's reporting after Per shows that the number of affected customers, in most cases, was overestimated. Only 14 percent of the analysed reports underestimated the number of affected customers. One explanation for the high figures is that customers generally regained their power supply after a short time and the information that the media had gathered became out of date when it reached the general public.



For individual people, the media's reporting is important for their own planning during a long power cut. The information that is primarily needed is local forecasts about the duration of power cuts in the local area. This is also reflected in the media's reporting after Per, which was much more frequent with regard to local information than national information.

### **Extra insulation in refrigerated counters in stores**

The storms have made the food retailers realize how vulnerable they are for longer power cuts. In some cases there are generator sets but they are often not sufficient to compensate for a longer power cut. The food retailers manage the risk of power cuts as a business risk, among others. They generally regard that it is too expensive to install generator sets for all shops or chains of shops.

Several shops solved the problem with fridges and freezers by laying Styrofoam as extra insulation which works for a short period of time.

### **Industry awaits more reliable networks**

Storm Gudrun was a clear reminder of industry's need for reliable energy supplies in order to cope with modern demands for flexible production and just-in-time deliveries. Even telecom and data communication is vital in order that industries can function, since data traffic is a prerequisite for communication between companies and their customers, suppliers and Group companies.

The preparedness measures to which companies took the initiative after Gudrun could hardly be carried out before the storm Per once again showed the vulnerability.

Few industries see an investment in full-scale auxiliary power as realistic. However, securing key components such as IT systems, sprinkler systems and alike, are on the other hand viable and have often been carried out after Gudrun or will be carried out



after Per. Securing the power supplies is considered by industry to be a task for the network operators.

Industrial companies expect that the network operators' efforts to bury electric cables will give a significantly higher reliability for power supplies and the problems with power cuts will reduce in the near future.

### **Banks invest in manual registers**

For Swedbank, a leading bank in Sweden with relatively many offices in the countryside, the Gudrun storm was a valuable test for the bank's crisis and disaster preparedness. The storm meant a certain increase in costs for greater surveillance since some alarm systems were out of order. Some 40 offices were affected by power cuts.

After Gudrun the bank drew up routines that help the centrally responsible staff to easily survey the status at the bank offices. Reserve and contact routines were established in order to make contact with key persons. Since the mobile network can be cut, the routines have been supplemented with manual registers.

No new measures were taken after Per.

### **Care centres need more secure telecommunication**

After Gudrun the power cuts and interruptions in the telecommunications traffic became a big problem for nursing and care work. After Per some care centres were without electricity for one or a few days and the fixed telephone network did not function for a few days at a few places. In all, about a half of the care centres in the county of Kronoberg were affected by interruptions in the power supply and telecommunications.

After the storm Per, the county council of Kronoberg decided to purchase satellite telephones in order to secure the communication to the care centres.



### **More telecommunication stations will have auxiliary power**

The large Swedish telecom operator Telia estimates that two thirds of the telecommunication cuts during both Gudrun and Per depended on power cuts and a third depended on physical damage to telecommunication lines and stations. The company located several generator sets at some stations and supplied a number of everyday commodity shops with computers so that the customers could pay their bills. Mobile telephones were loaned out by some 50 Telia and electronic retailers in the storm area.

Telia states that despite the tenfold information effort during Per there was criticism for the lack of information during the interruptions. Telia intends to further expand the communication with county administrative boards and the municipalities as well as voluntary organizations such as The Federation of Swedish Farmers.

After Gudrun the robustness of radio links and the operation of generator sets was improved. Telia intends to locate 110 generator sets with remote starting ability in the counties of Kronoberg and Halland. During 2008, 250 generator sets will be located in the county of Västra Götaland.

Many municipalities have reacted strongly that telephony has functioned far from satisfactorily in connection with the storms of late. Among other examples it was difficult in several places to reach the emergency number 112 which was why some municipalities quickly set up emergency telephones in selected areas.

In order to secure the telephony abilities, certain municipalities will invest, or have already invested in a number of satellite telephones. The intention is that these will be used in certain places but also be utilized by the local government personnel within home help service and home health services.





### **Housing firms need auxiliary power**

With a few exceptions, the housing firms have not taken any measures to secure heating with auxiliary power.

A housing firm in Älvkarleby, which is also responsible for the peak production of heating in the district heating system, will procure a permanently installed generator set to be able to run oil boilers and district heating pumps during power cuts.

There are reasons for the housing firms to examine their auxiliary electricity supplies and where they can temporarily borrow or hire reserve equipment. In Falköping it has been noted that mobile generator sets should be located and connected where they probably will be used. The auxiliary power in the centre of Falköping was never needed but a connection to a service house was made in a smaller part of the municipality that was affected by power cuts.

### **More people should document their experiences**

In order to make the most of the experience that is created in the work of remedying the consequences of a storm it is necessary that a lot of participants become better at documenting what happened, what consequences there were and what worked well or can be better in the remedial work. Here there is a lot to desire from the municipalities, county administrative boards, authorities and other participants who have left the work after Per undocumented.

Two municipalities have however stated that they started their work at a slower rate in connection with Per as compared to Gudrun. The main reason for this was that new managers had no experience of the work with Gudrun. When knowledge and experiences have not been documented, been passed on or been practiced, the organization loses valuable competence in connection with personnel changes.



## **The municipalities need to be better with information**

Due to the experiences from Gudrun, storm Per was not a bigger challenge for most of the municipalities.

Most of the municipalities in areas that were hit hard by the Gudrun storm had prepared plans for warm shelters and personnel when Per occurred. After Per many more municipalities have started the planning for setting up warm shelters. A prolonged power cut in the winter can mean that municipalities have a very short time to select and initiate the number of warm shelters that are needed. By preparing buildings in good time there is good preparation for possible heating cuts.

Considering that a quarter of those who replied to the questionnaire survey did not know that their municipality had organized warm shelters, the municipalities should examine their procedures in order to inform their residents about the location and availability of warm shelters.

The municipalities in the study have mentioned the following energy-related recommendations to refer to with regard to preparedness for difficult trials such as prolonged power cuts.

- **Plan for the use of power generator sets.** It is worth, in advance, to make an inventory of all the available power generator sets and as required, prepare contracts for the hire of additional ones. Supplying districts with auxiliary power so that the needs for heating, water, provisions and fuel are met is an enormous challenge. Not least, extensive planning is required for fuel supplies, service and spare parts. After storm Gudrun, E.ON among others, offered the municipalities in their network area the possibility of stock-keeping generator sets and gas-stoves to lend to residents in a crisis. Some municipalities mean that it is wise to discuss in advance whether the municipalities in question shall in fact provide generator sets to the residents or not. Several of the storm-affected municipalities pose the question regarding



where the municipalities' responsibility ends and where the private person's responsibility starts. Private people have a great responsibility for their own preparedness. The municipalities can, in their information, make that responsibility clear and thereby remind people that they themselves can prevent the consequences of an interruption in the energy supplies.

- **Who have alternative heating systems?** How many of the homes and residents have alternative heating systems in the form of, for example, tiled stoves and stoves that can still provide heating during power cuts or interruptions in the district heating supplies? Are these heating systems inspected or are they not allowed to be lit?
- **Find out where there are vulnerable residents.** Find out in advance the proportion of residents who lack alternative heating supplies and thereby can have acute problems with their heating. How many people are affected? How quickly do the houses get cold? Where in the municipality are these houses located and how quickly can measures be needed?
- **Plan for warm shelters.** Select premises that can offer residents warm food, water, shower and washing possibilities, telephones, information and possibilities for overnight accommodation. These warm shelters should have pre-installed connection points for quick connections to mobile generator sets or the use of "permanently" located generator sets. If possible, parts of the electrical installation within the house should be sectioned off in certain warm shelters in order to only supply those parts of the premises that need to be used as a warm shelter.
- **Make a survey of weak points in the power distribution network.** In cooperation with the network operators, find out the power lines and installations that are often affected by power cuts.



- **Form a regional cooperation committee.** It is worth forming some sort of regional/local cooperation committee that shall not preferably consist of too many members.
- **Examine plans.** Examine the contingency planning for prolonged power cuts (warm shelters, heat supplies, etc.) What is the level of the preparedness and how many residents are included?
- **Cooperate with voluntary organizations.** For the municipality, voluntary organizations such as the Swedish Civil Defence League can be an excellent resource in crisis situations.
- **Plan for endurance.** It is important to utilize resources so that they last a long time. As an example, the location of mobile generator sets must be coordinated with the organization that is available for the administration and operation of the generator sets.
- **Consider especially the old and the weak.** The municipality has a special responsibility to take care of residents, who due to age or illnesses are especially sensitive to the cold. Special attention should be made for the sick who are cared for in their homes where they are dependent on electrical devices and those people who have emergency medical alarms.

### **The county administrative boards gained benefits from the experiences from Gudrun**

For most county administrative boards, storm Per did not mean any greater consequences. No crisis organization needed to be activated. All of the county administrative boards that were involved in the Gudrun storm have, however, stated that the experiences from Gudrun were of great benefit in connection with storm Per.

The work during the storm Gudrun laid the basis for a line of measures for increasing the preparedness in the county administrative boards. Even if storm Per was managed in an easier way, there were still a few items that can be improved, as follows:



- The forms of cooperation with external parties can be further developed.
- It is important to plan for endurance.
- Training is required for support resources in the crisis organization such as offices, switchboard operators, information etc.
- A survey of the fuel supply situation is needed.

County administrative boards with experience from the storms have contributed with the following recommendations for preparedness for difficult situations such as prolonged power cuts.

- **Assume that power cuts may be prolonged.** Have reserve plans for this.
- **Use all resources directly.** If the situation is not so serious, it is possible to reduce the efforts later.
- **Get started quickly.** Consider how the start of the crisis organization shall take place and have localities ready.
- **Inform.** Cooperate with other participants. Ensure that other people who are not directly involved also receive information.
- **Prepare measures.** Analyse different scenarios and be prepared for help needed in different situations.
- **Keep a close contact with the network operators.** Identify points of contact and contact channels in good time.
- **Prepare for good staff work.** Work simply. Develop the heart of the crisis organization and train the staff. Let the staff manager focus on what is important. Get organized with staff for endurance.
- **Train and exercise.** Train personnel to establish routines together with network operators, telecom operators and municipalities.
- **Build contact networks.** Ensure arrangements/networks are already in place with network operators, municipalities, police, rescue services, etc.





- **Pass on experiences.** When representatives from different sectors meet and give their impressions, contact networks can be created and important knowledge can be spread.

### **The Rakel system will be reinforced**

Rakel, which is a new, common radio communication system for public organizations that work with general order, security and health, was in operation in certain southern counties and undergoing installation in other parts of the country when Per occurred. The system was primarily affected by operational disturbances in the county of Kalmar. Disturbances also occurred in Skåne and Blekinge.

The following analysis showed, for example, that the storm hit the power supplies to a number of base stations in the system. This should not have had any consequences for the system since auxiliary power with batteries shall be initiated, but due to incorrect settings in the system, there were still operational disturbances. In some cases the power cuts were longer than the capacity of the batteries and no mobile generator sets were available during the storm.

The supplier of the Rakel system has corrected the incorrect parameters and drawn up proposals for increased operational reliability. The supplier has also procured portable generator sets that will be used in prolonged power cuts.

### **Voluntary help will be more effective with fully functioning mobile telephony**

Voluntary resources play an important role in the crisis management system and contributed with valuable efforts after the storms.

For organizations such as the Swedish Civil Defence League, the Federation of Swedish Farmers, voluntary civil duty electrical repairers, The Swedish Voluntary Motor Transport Corps, the



Swedish Central Federation of Women's Motor Transport Corps, the Swedish Voluntary Radio Organization and the Swedish Voluntary Flying Corps, fully functioning mobile telephony is of vital importance for calling in personnel and carrying out efforts. After Per, the people who handled the voluntary resources considered that the problem with deficient availability in the mobile telephony was worse than after Gudrun.

After the adjustments that were implemented, based on the experiences from Gudrun, the contracts with the voluntary organizations and the management of them are considered to have functioned well. The obscurities concerning the employer's responsibility which still exist will be corrected in the affected contracts.

In order to preserve personal and organizational networks with the voluntary organizations it is important that they are offered the possibility of taking part in the exercises that other participants carry out.

### **Fireplaces should be inspected in time**

Chimney-sweeps had a lot of extra and unplanned work in connection with storm Gudrun. In a few cases they were pressed with work when many people wanted to use fireplaces that maybe had not be used for many years. A fireplace that has not been inspected for safety will automatically be given prohibition for lighting after three years. The prohibition also applies to chimneys.

After the storm Gudrun there was an increase in the renovation of older fireplaces and several new installations of mainly fireplace heating stoves.

Owners of fireplace heating stoves should, when possible, be informed that the stoves must not be lit more than the instruction for use states. Metal chimneys are especially sensitive and the isolating material can be ruined if the fire is extensive, thus resulting in a fire risk.





## **Methods to disseminate gained experiences**

The fact that so few have documented their experiences from the work with Per increases the need to spread the knowledge that has been gained from the people who worked with the crisis efforts during the storms. There is otherwise a risk that the knowledge will be lost in connection with the turnover of personnel or due to the fact that experiences are forgotten.

A good way of transferring knowledge is by organizing multi-discipline meetings and exercises. In these cases, existing procedures and forms of cooperation can be discussed and possibly be restructured at the same time as networks are created and maintained. One example of this type of cooperation is the regional meeting that Swedenergy (an industry organisation representing energy companies) and Svenska Kraftnät (the Swedish power transmission system operator, etc) organized after both the storms Gudrun and Per in the county of Kronoberg. These sorts of meetings should be arranged regularly and not just after larger disturbances that have happened. One proposal is that regional meetings of this type are arranged by the county administrative boards together with the network operators' emergency cooperation boards.

### **Proposals for methods**

Spreading experience to other people is not entirely easy. Many people consider that verbal information is the most effective as written information has the tendency to be left on the bookshelf. Verbal information also gives the receivers the possibility of posing questions. The list below shows the tips for the spreading of experience that have appeared during discussions with people with responsibility at municipalities and county administrative boards.



- **Verbal information.** Evaluation meetings, lectures, conferences and seminars give opportunities for discussion and for posing questions. Seminars can be combined with written documentation.
- **Reports.** It is important to write reports and have routines for their distribution. Many people prefer brief and concise reports instead of “heavier” and more extensive ones. Sometimes reports arrive a long time after an event – it is desirable that the information is disseminated quickly.
- **Websites.** Experiences from the crisis work should be published on the municipalities’ websites.
- **Network meetings.** In regional multi-discipline meetings it is possible to exchange experiences. There are often regional cooperation networks between different participants and between “preparedness-people” who meet with certain continuity. Many people consider that this type of information should be spread further to the municipalities.
- **Training and exercises.** Training should be conducted in the home organization. It is also valuable to take part in other parties’ exercises in order to gain new angles of approach, to create networks and promote cooperation.
- **Observation.** It is instructive to take part and observe the work during a crisis. Participants from municipalities and county administrative boards who are not affected can gain great benefits from being present in larger crises with the aim of being able to share and exchange experiences.
- **Staff manager conferences.** Staff managers should meet in order to illustrate and share experiences from crisis management.







# Everyone is responsible for securing the energy supply

Power cuts can never be eliminated. In order that the security in the power supplies in general can be improved it therefore demands that the individual consumer takes responsibility to reduce the consequences of a power cut. Authorities, municipalities and network operators should therefore find forms for increasing the consciousness of the consumers.

All people, organizations and companies are responsible for protecting themselves and their property and not cause accidents or damage to other people, animal life, property and the environment. The consequences of this are that all energy consumers have a responsibility to analyse, prevent and handle accidents, damage or inconveniences that can arise due to disturbances in the energy supplies.

## **Greater demands on the network operators**

The changes in the Electricity Act which came into force after Gudrun place demands, for example, on the network owners' supply reliability and improved information to the authorities about power cuts.

From 1 January 2006, electricity customers have the legal right to compensation for power cuts if the electricity supply is completely interrupted for a continuous period of at least 12 hours. (If a power cut depends on faults in the national grid, no compensation needs to be paid.) The size of the compensation depends on the duration of the power cut and amounts to at least 12.5 percent of the customer's estimated annual network cost or at the lowest, 2 percent of the price base amount (for 2007 this meant at the lowest SEK 900). The compensation for power cuts that last more than 12 days is maximized to 300 percent of the customer's annual network cost.



For many network operators the compensation for loss of supply was a heavy cost item after Per. The network operators' costs for the storm amounted to approximately SEK 1 400 million, of which the costs for compensation for loss of supply constituted approximately SEK 750 million. The compensation cost for Per was therefore considerably higher than for Gudrun, despite the fact that the power cuts were considerably shorter.

The prescribed sum for compensation for loss of supply may be modified according to what is reasonable if the restoration work has been delayed in order not to expose employees to considerable risks. Some of the operators have utilized this regulation for adjusting the prescribed sum for power cut compensation.

From 1 January 2011, the basic regulation is that a power cut may not exceed 24 hours. Thereby, the network operators' responsibility for the reliability of the network will be clear.

### **The amended Electricity Act pushes the network operators' investments**

The Swedish power transmission system has a long technical length of life and the current network has an age that varies between 0 to 60 years. The network operators started in year 2001 in earnest the work on improving the networks in the countryside. In 2004 the branch calculated that the costs for this work would amount to SEK 13 billion. In order to live up to the legal functional demand by the latest 2011, the calculated investment after Gudrun and Per has been upvalued to SEK 25 billion.

After Gudrun, the network operators intensified the work of safeguarding the regional networks from falling trees. On 1 January 2007, 80 percent of the regional networks were safeguarded from trees.

Experiences from storm Per show that the measures taken have had a positive effect on the service reliability.



The network operators concentrate to a larger extent on burying power lines instead of having lines hanging on poles in the forest areas. Thereby, a large part of the risk for power cuts is reduced as a result of storms and snow storms.

The operators are also installing remotely controlled disconnectors in strategic places in the overhead line network in order to be able to limit possible damage and shorten the power cut periods. Thus, they plan to maintain larger parts of the overhead line network. One of the large network operators states that they have today a distribution of 70 percent overhead lines and 30 percent underground cables and that they estimate to have in three years time a distribution of 40 percent overhead lines and 60 percent underground cables. Other network operators quote a much more long-term work.

The intensified demands on compensation for loss of supply are weighty reasons for the network operators to increase their investments in more secure networks. The fact that in case of power cuts the network operators may nowadays produce electricity in mobile or fixed auxiliary power plants will most likely mean that the operators procure more generator sets.

When storm Per occurred, the amended Electricity Act had been in force for approximately one year, which is not ample time to be able to draw far-reaching conclusions on effects of the law.

### **Electricity consumers' own responsibility becomes clearer**

There is only one in ten households who consider that they themselves have the main responsibility for the interruptions, damage and inconveniences that a cut in the power or heating supply can cause. Most households consider that the responsibility lies with the electricity or heating suppliers. Others state in their answers that the municipalities or the state has the responsibility.



The consequence of this is that most private persons have not taken any measures to strengthen their ability to handle interruptions in the electricity or heating supplies.

In the questionnaire survey there are some people who state that they as entrepreneurs are dependent on electricity and telecommunications in order to run their operations. This indicates that many people still have not realized their own responsibility or that they have settled and started companies without really realizing the risks that the choice of localization mean.

The demands of the amended Electricity Act that power cuts in “normal” cases, from the year 2011, may not exceed 24 hours make the electricity consumer’s own responsibility clearer. A person who has higher demands on the availability must analyse the situation and alone find a solution, for example, by procuring his/her own generator set.

The Energy Markets Inspectorate will draw up instructions that the network operators shall inform the electricity customers concerning the supply reliability in the network and concerning the right to compensation for loss of supply and damage. The main reason for this is that the electricity consumers shall be better equipped to decide if they need to have their own preparedness for interruptions in their power supplies. The instructions to the network operators are expected to be complete at the earliest during 2009.







# Conclusions

## **Things can get worse**

Sweden has been hit by severe storms previously, even though they have seldom affected such large areas as during the storms Gudrun and Per. In many cases great strains occur, when combinations of events happen, which on their own could have had moderate or no effect. The consequences of Gudrun and Per would have been considerably more serious if the storms had been followed by a period of severe cold or if more populated areas had been hit by prolonged power cuts. Cold is therefore a factor that must be observed in contingency planning and exercises.

## **Personal responsibility should be communicated better**

The deregulations of the energy markets have meant that the responsibility for planning and crisis preparedness during recent years have, to an increased extent, been moved from the state and the public sector to the market (producers, distributors and consumers). The public responsibility for the crisis management is today mainly at the municipality level. This places greater demands on information concerning the limits for the state's, the municipalities', companies' and the individual inhabitants' responsibilities. It is especially important to make private persons conscious of their own responsibility. Many people, especially younger generations, live in the belief that everything works and that the responsibility rests with someone else. Therefore, personal responsibility must be exposed more clearly to the general public. It is the impression today that there is no understanding for the fact that the network operators' utmost responsibility is purely financial. Money that is paid out after a power cut does not warm the house, it only warms the wallet!



### **Experiences should be documented**

Everyone forgets. It is therefore important after every critical event to accurately document all lessons learned, supplement risk and vulnerability analyses as well as revising the contingency planning.

### **Practice makes perfect**

The differences in effort times for restoration, support and help operations between storm Gudrun and storm Per show that practice is important so that efforts can be started quickly. Before Gudrun there were (with few exceptions) no plans or completed exercises for such an incident. With Per, many people had many experiences of Gudrun fresh in their minds and everything went much quicker – particularly, in the municipalities where they had not made staff changes in the time between the storms. It is reasonable to assume that Sweden will be affected by new storms – but not as often as needed to maintain peoples abilities without special training. In the lack of real events it is therefore important to practice often and consider unpredicted combinations of events in order to keep the effort ability at a high level. Even parties outside the home organization should be invited to participate.

### **Preparedness for power cuts in more populated areas must be better**

Neither Gudrun nor Per caused any larger population centres prolonged power cuts. The course of events and efforts after Gudrun and Per indicate that the preparedness for longer and more extensive cuts in the energy supplies to more populated areas are insufficient and that such interruptions are not included in the contingency planning.



### **Weather warnings should reach the general public more clearly**

Prior to storms that can seriously affect the power supplies in a region the quick and clear weather warnings via the media are of utmost importance for people in the area to take measures in order to reduce the consequences.

### **The costs should be surveyed better**

The accounting of the costs for the efforts from one's own organization in extreme events should be improved. In this way, better prerequisites are created in order to introduce cost-utility analyses in the contingency planning at both local and national levels.

### **Increased compensation demands improved availability**

The fact that the restoration of the electricity network was quicker after Per than after Gudrun has a number of explanations. It is likely that the tightened demands of the Electricity Act concerning financial compensation to affected customers have been of significance. The operators' regeneration of the power distribution network shows that the demands for compensation will yet have greater significance for the quality of the network services in the future.

### **Telecommunications must be more reliable**

The course of events after Gudrun and Per clearly show how rescue and recovery work is made more difficult when telecommunications do not work. High reliability in the power supplies to fixed and mobile telecommunications is of the utmost importance but the telecom systems must also fulfil high demands on their own technical reliability in the event of storms and other demanding natural incidents. The rapidly expanding IP telephony is especially sensitive to interruptions in the power supplies.





# The Swedish Energy Agency's role

The Swedish Energy Agency has a general responsibility for reliable energy supplies in Sweden. This mainly consists of assisting other parties with the prerequisites that are required in order to prevent and mitigate interruptions in the energy supplies.

In the event of power cuts, the Swedish Energy Agency has no operational tasks that directly aim to remedy acute faults in the infrastructure or to mitigate the consequences that faults have caused.

## Preventive tasks

The Swedish Energy Agency's preventive work means, for example:

- by means of horizon scanning and analyses, survey and spread information concerning threats, risks and possible measures to all energy consumers and participants at regional and local levels who are responsible for preparedness matters within power supplies.
- in the role of staff authority for the government, proposing amendments to regulations as required.
- producing relevant factual material and adapting it to the target groups concerned and making it available when required.
- preparing information and support efforts to those who manage the consequences of extensive interruptions in the energy supplies.

## During a crisis

During an ongoing energy crisis the Swedish Energy Agency shall:

- contribute to the national situation picture that is presented to decision makers and the media with the aim of facilitating decisions on suitable measures and relieving anxiety in affected districts.



- indicate the consumers' responsibility and assist with “help to self-help” by offering information that shows how consumers, property owners, health care personnel and others can improve their own situation. The Swedish Energy Agency also produces information that is directed towards the municipalities’ preparedness coordinators in order to support the municipalities in the role of the responsibility for the geographical area. Since it is important to have contact with local editorial offices, local informers are used such as the Swedish Civil Defence League, the local energy and climate advisors as well as preparedness coordinators. All contacts for these cases are organized in advance.

### **After a crisis**

After an energy crisis the Swedish Energy Agency can take the initiative for an evaluation of the crises based on a broad society perspective, draw conclusions, propose improvement measures and spread knowledge about things that worked well and things that can be improved. Summarized experiences from incidents and actual interruptions in the power supplies are available on the Swedish Energy Agency’s website.

### **The Swedish Energy Agency’s responsibility in heating interruptions**

The Swedish Energy Agency’s area of responsibility also includes matters concerning secure heating supplies.

Interruptions in the heating supplies are normally local and primarily affect property owners or people responsible for a certain geographical area (municipalities and county administrative boards). The Swedish Energy Agency has no part to play in connection with interruptions of this kind.

Extensive heating crises mainly occur in connection with power cuts. If such a power cut is extensive the heating crises may



possibly affect larger population centres. If then cold weather prevails at the same time, there is a risk for regional crises with houses that run the risk of total freezing and in the need of mass evacuation. Even in these cases the Swedish Energy Agency does not have any operational responsibility.

Extensive power cuts and heating interruptions often occur at the same time. The Swedish Energy Agency's work in these matters is therefore often integrated. The leaflets listed under the heading "Further information" can also be used during extensive heating interruptions.

### **Measures for more secure energy supplies**

The Swedish Energy Agency continually investigates the measures that can be taken in order to increase Sweden's preparedness within energy supplies. The agency also submits proposals for changes in legislation and distributes information concerning the handling of interruption in energy supplies. Some of the preparedness projects run by the Swedish Energy Agency are here shortly described.

- **Good, local examples.** UPOS is a development project for private/public cooperation with the aim of identifying, planning and taking concrete preparedness measures in order to prevent and manage serious strains in the energy supplies. The aim is to create good examples and promote the cooperation between the different participants. Local development projects have been carried out so far in approximately 20 municipalities and regions.
- **Better situation picture for energy crises.** SALENE is an IT system under development for current surveillance of the energy supply situation. The focus of the system is the situation in Sweden. The system collects information from different sources, summarizes the information and, as required, sends messages (warnings) to users at the Swedish Energy Agency and the Energy Markets Inspectorate.



- **Households' energy preparedness** – a cooperation project with the Swedish Civil Defence League with the aim of increasing the possibilities for households to prevent and remedy difficulties as a result of interruptions in the energy supplies.
- **Priorities for customers during power shortages** – proposals and tests for a new national planning system for temporary disconnections in the distribution network.
- **Increased use of power generator sets** – tests of generator sets available on the Swedish market and recommendations to importers/buyers and customers.
- **Annual analyses** of threats, risks and vulnerability within the energy sector.
- **Information to different target groups.** The Swedish Energy Agency produces information that helps various parties to increase their preparedness for and to better cope with the consequences of interruptions in electricity and heating supplies. See leaflets under “Further information”.







## Further information

All the following documents are only available in Swedish, except “Storm Gudrun – How can we become better at dealing with natural catastrophes?”. If not stated otherwise the publications are issued by the Swedish Energy Agency (<http://www.swedishenergy-agency.se>).

- Evaluation of the storm Per – Consequences and lessons for more secure energy supplies (ER 2007:37)
- Storm Gudrun – How can we become better at dealing with natural catastrophes?” (ET 2007:36)

### **Leaflets “Reliable energy supply for you”:**

- Power cuts – what do I do? (ET 2007:37)
- Heating in houses with electricity and heating cuts (ET 2007:38)
- Heating in flats with electricity and heating cuts (ET 2007:39)
- How quickly will the house be cold in a power cut? (ET 2007:40)
- Power cuts and cold – what to do with your property? (ET 2007:43)
- Warm shelters – guidance and good examples (ET 2007:44)
- Generator sets in power and heating cuts (ET 2007:41)
- Measures for the elderly and the sick in extensive power and heating cuts (ET 2007:45)
- Working together during extensive power cuts (ET 2007:46)
- Fuel supplies for many dispersed generator sets (ET 2007:47)
- Tests of generator sets and general buying advice (ET 2007:42)
- Check list with functional requirements for generator units (ET 2007:48)



### **Others:**

- The media companies' experiences from the storms Gudrun and Per (The National Board of Psychological Defence (<http://www.psyccdef.se/inenglish/>), DNR 109/07)

### **Other documents from the Swedish Energy Agency:**

- Rationing of fuel – A study of rationing preparedness in Sweden and Europe (ET 26:2000)
- Oil and Natural gas – Present and future situations for two of the world markets' most important energy resources (ET 38:2000)
- Fuel blockades in France and Great Britain – A comparison in crisis management (ET 20:2001)
- The year 2000 problem and energy supplies (ET 29:2001)
- The municipalities' heating preparedness – Preparations and solutions for heating supplies in a crisis (ET 38:2001)
- Biofuel and waste fuel – How the transfer to renewable sources of energy affect Sweden's electricity and heating preparedness (ET 40:2001)
- The electricity crisis in California – causes, measures and consequences (ET 6:2002)
- The North European electricity market – Situation report and problem-oriented analysis (ET 13:2002)
- The Russian oil – Present situation and future possibilities (ET 1:2003)
- The energy situation in Scandinavia – Present situation, threatening picture and measures (ET 16:2003)
- The HEL project – Increased cooperation for the security and preparedness of the Swedish energy supplies (ET 4:2004)



- Blackout – The extensive power cuts in 2003 – causes, consequences and measures (ET 32:2004)
- China’s increasing energy demand – Rapid financial growth affects the global energy market (ET 2005:6)
- Emergency storage of oil – The significance and development of the global oil storage (ET 2005:14)
- Europe’s natural gas dependence – Measures for secure natural gas supplies (ET 2006:6)
- Hurricanes in the Gulf of Mexico – and their consequences for the global oil market (ET 2008:02)





# Glossary and factual explanation

Expression	Explanation
County Council	<p>County and regional councils administrate health care. County councils administrate matters that are too costly to handle at municipal level. County and regional councils' key responsibilities are:</p> <ul style="list-style-type: none"> <li>- public health and medical care</li> <li>- public dental care</li> <li>- regional development</li> <li>- public transport (in cooperation with municipalities)</li> <li>- culture</li> <li>- support for industry and commerce</li> <li>- tourism</li> </ul> <p><a href="http://www.skf.se/startpage_en.asp?C=6390">http://www.skf.se/startpage_en.asp?C=6390</a></p>
Country Administrative Board	<p>Sweden is divided into 21 counties, each of which has its own County Administrative Board and County Governor. The function of the County Administrative Boards is to be a representative of the state in their respective counties, and serve as a link between the inhabitants, the municipal authorities, the Central Government, the Swedish Parliament and the central state authorities. <a href="http://www.lst.se/lst/en">http://www.lst.se/lst/en</a></p>
Municipalities	<p>Sweden has 290 municipalities. They are responsible for administrating matters at local level including:</p> <ul style="list-style-type: none"> <li>- pre-schools, secondary schools, upper-secondary schools</li> <li>- elderly care</li> <li>- assistance to the functionally impaired</li> <li>- rescue services</li> <li>- water and waste</li> <li>- public libraries</li> <li>- public transport (in cooperation with county councils)</li> </ul> <p><a href="http://www.skf.se/startpage_en.asp?C=6390">http://www.skf.se/startpage_en.asp?C=6390</a></p>
Islanding	<p>Islanding is the generic term used to describe a scenario where a section of a transmission or distribution network, which contains distributed generation (DG), is separated from the main transmission or distribution grid. Subsequent to this separation, the DG continues (or is restarted) to power the loads trapped within the island.</p> <p><a href="http://www.ensg.gov.uk/assets/dgcg00026.pdf">http://www.ensg.gov.uk/assets/dgcg00026.pdf</a></p>
Horizon Scanning	<p>Horizon Scanning is defined by the Government Office for Science (UK) as: 'the systematic examination of potential threats, opportunities and likely future developments, including (but not restricted to) those at the margins of current thinking and planning.'</p> <p><a href="http://www.hsl.gov.uk">http://www.hsl.gov.uk</a></p>



## Currency exchange rates

SEK 1000 are approximately equal to GBP 85 or USD 170 or EUR 105.

## The southern part of Sweden



The municipalities mentioned in the document are highlighted. The map shows the southern part of Sweden.





PHOTOGRAPHY: STEFAN NILSSON, STEFAN FEHRM, LARS-GÖRAN RYDQVIST, PETER ÅKLUND/SCANPIX, GUNNAR LUNDMARK/SVD/SCANPIX, ANNICA JÖNSSON/SCANPIX, LARS OTTOSSON/SCANPIX, JEPPE GUSTAFSSON/SCANPIX, PER WESTERGÅRD, HURRAI/LAGEREEK, MASKOT BILDBYRÅ, MATTON. COVER PHOTOGRAPHY: HURRAI/LAGEREEK.

## **Knowledge from the handling of the consequences of the storms Gudrun and Per must not be wasted**

Within a two year period southern Sweden has been hit by severe storms that have overthrown huge volumes of forest and caused many power cuts.

The storm named Gudrun in 2005 was a great test for those who had to handle the restoration work. The lessons learned from that storm contributed to the fact that the work after the storm Per was quicker and more effective in the areas that were affected previously.

This report summarizes the most important lessons from the handling of the storms. The main aim is to spread the knowledge to new officials and people in other areas than those concerned in the winter storms of 2005 and 2007.

### **The Swedish Energy Agency encourages a smarter use of energy...**

The Swedish Energy Agency is the national agency for energy-related matters. Our mandate is to establish prerequisites in order to attain the energy-political objectives. Among other aspects, it is a question of an ecological, economically sustainable and secure energy supply where the use of energy has the lowest possible effects on health, the environment and the climate.

### **...and a secure energy supply**

An important part of the Swedish Energy Agency's mandate is to encourage a secure energy supply in Sweden, both in the short term and the long term. The agency has an overall responsibility for the energy supply of, for example, electricity and heating as well as being the supervision agency for the oil and gas supplies. We monitor and analyse incidents and energy cuts in the world around us, indicate needs for measures, disseminate information about risks, threats and possibilities as well as proposing amendments to regulations. We support the preventive work carried out by local and regional organizations such as municipalities and energy companies. Another important task is to give energy consumers advice and guidance regarding the ways of preventing and mitigating the consequences of interruptions and failures. In shortage situations the agency has an overall responsibility to plan and coordinate measures that reduce energy consumption.



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