

# Swedish survey on cost of power outages

Daniel Torstensson

Department for quality regulation  
Energy Markets Inspectorate



***Study performed in 2005 by  
Fredrik Carlsson  
& Peter Martinsson  
Dep of Economics  
University of Gothenburg***



# Outline

- Aim and methodology
- Results
  - Household sector
  - Industry, agriculture and public sector



# Aim and methodology

- To estimate different customer perceived valuation of power reliability

## **Household**

- Measuring the hypothetical WTP to avoid power outage through contingent valuation
- Planned and unplanned; 1 hour up to 24 hour, uncertain length of the outage

## **Industry/ Public sector/ Agriculture**

- Measuring the hypothetical power outage cost
- Planned and unplanned; 1 hour up to 24 hour, uncertain length of the outage



# Hypothetical data

- To estimate the cost of power outages for households customers were asked about their WTP
- Possible risks with the method:
  - Answers can be exaggerated or diminished
  - The customer may not have enough information to give an appropriate answer



# Household- Scenario unplanned outage

- Imagine that an outage occurs on an evening in January and that it starts at 6 pm. For each question we ask you to answer how much your household would be willing to pay in order to avoid this outage by connection to the service. We ask you to consider your answers as carefully as possible and to remember that it is possible to answer zero kronor as well. We ask you to answer your WTP for an outage on 1, 4, 8 and 24 hour.



# Household- Scenario planned outage

- How much would your household be willing to pay in order to avoid a power outage that starts at 6 pm on an evening in January? You know in advance that the outage will occur. We ask you to answer your WTP for an outage on 1, 4, 8 and 24 hour.



# Household survey





# Results

3000 inquiries were enclosed  
56 % answered

	<b>Average</b>	<b>Median</b>	<b>Share of zeros</b>
<b>Non planned</b>			
1 hour	9	0	0,86
4 hours	37	0	0,68
8 hours	108	15	0,46
24 hours	223	90	0,36
2 to 6 hours	69	0	0,59
<b>Planned</b>			
1 hour	6	0	0,90
4 hours	28	0	0,74
8 hours	84	0	0,51
24 hours	189	50	0,39

# Normalization and comparison with earlier Swedish studies

<b>Duration (unplanned/ planned)</b>	<b>1994</b>	<b>2003 2,1 kW</b>	<b>Difference</b>	<b>2003 4,5 kW</b>	<b>Difference</b>
1 hour	2,7	4,5	67 %	2,1	- 22 %
4 hour	10,3	17,8	73 %	8,4	- 18 %
8 hour	28,9	51,9	80 %	24,5	- 15 %
1 hour	1,2	3,0	150 %	1,4	17 %
4 hour	4,2	13,6	224 %	6,4	52 %
8 hour	17,2	40,0	133 %	18,9	10 %

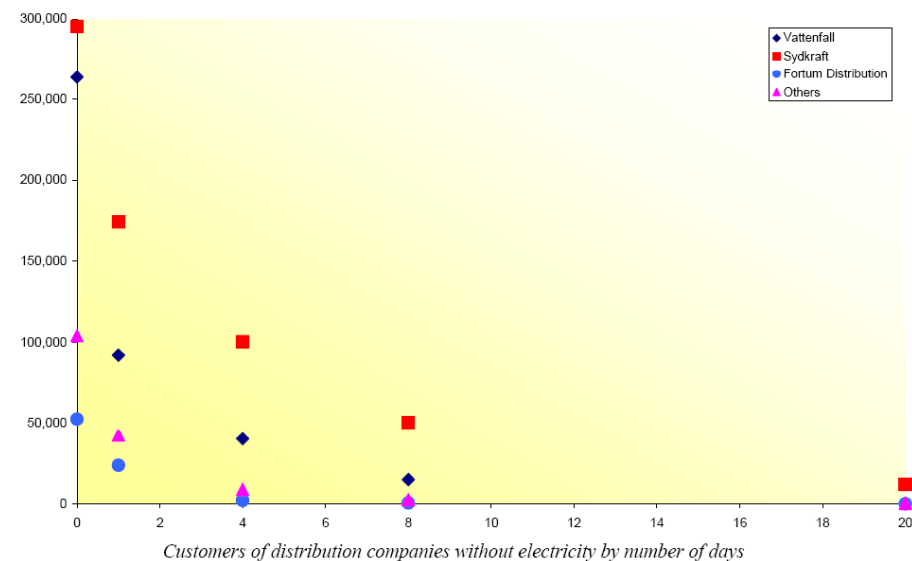


# The *Gudrun* storm (2005)



## About 660 000 customers affected!

- 350 000 restored within 24h
- 160 000 restored between 1 and 3 days
- 80 000 restored between 4 to 7 days
- 56 000 restored between 8 to 20 days
- 12 000 interrupted for more than 20 days
- Last customer restored after 34 days...



# Influence of the Swedish storm Gudrun on WTP

## Results:

- After the Gudrun storm there were more respondents that utilized the value of zero

## Reflection:

- It may be due to protest habit, since the question may impose that you have to pay extra for continuity in supply



# Business, agricultural and public sector



# Main question

- What is the estimated cost of non planned power outage?
- We ask you to assess the cost for an external caused power outage that is not planned and that starts at a Thursday in January at 10 am. We ask you to specify the cost for different duration (1 minute, 1 hour, 4 hour and 24 hour). Do also specify how long time it will take before your production can start after a power outage (time from the end of the power outage).



# Frequency of answers and representativity

- Industry: E-mail inquiry: 33 %
  - Retail: E-mail inquiry: 32 %
  - Public sector: E-mail inquiry: 49 %
  - Agriculture: Mail inquiry: 32 %
- 
- Industry: Over representation of larger companies and under representation of companies from Stockholm and south of Sweden
  - Retail: Over representation of smaller companies
  - Public sector: Normal representation
  - Agriculture : Over representation of agriculture with large acreage and under representation of agriculture with cattle and poultry.



# What do constitute the costs for power outages in different sectors?

	<b>Industry</b>	<b>Retail</b>	<b>Public sector</b>	<b>Agriculture</b>
Loss of sale	34 %	37 %	4 %	7 %
Ruin products/goods	27 %	15 %	20 %	28 %
Change over of activities	44 %	42 %	43 %	48 %
Restart of activity	44 %	32 %	29 %	12 %
Claim for damages and lost good will	14 %	9 %	3 %	
Damage of works	18 %	7 %	9 %	



# What is the experience of power outages in different sectors for the last 12 months?

	<b>Industry</b>	<b>Retail</b>	<b>Public sector</b>	<b>Agriculture</b>
No outage	72 %	85 %	88 %	31 %
Outage	28 %	15 %	12 %	69 %
Less than 1 minute	15 %	6 %	3 %	14 %
Between 1 minute and 4 hours	24 %	14 %	11 %	58 %
Between 4 hours and 24 hours	4 %	2 %	2 %	23 %
Longer than 24 hours	1 %	1 %	1 %	9 %

# Which kind of means have been utilized to be safeguarded from adverse consequences of power outage?

	<b>Industry</b>	<b>Retail</b>	<b>Public sector</b>	<b>Agriculture</b>
No means	45 %	49 %	50 %	62 %
UPS systems for uninterrupted AC	22 %	23 %	15 %	1 %
UPS systems for uninterrupted DC	4 %	4 %	3 %	0 %
Reserve power station	8 %	9 %	13 %	29 %
Over-voltage protection	10 %	11 %	8 %	7 %
Thunderstorm protection	12 %	16 %	11 %	11 %
EMC filter	3 %	2 %	0 %	1 %
Insurance for production losses	9 %	5 %	0 %	5 %
Other	3 %	3 %	3 %	4 %
Do not know	3 %	4 %	13 %	1 %



# Sectors with high normalized costs

- Credit institutions, insurance and real estate companies
- Whole sale trade and retail trade
- Engineering industry
- Pulp industry



# Other factors that influence on cost of power outages

## **Industry**

- + turnover, maximal effect, have taken action to protect from consequences
- No experience of outages

## **Retail**

- + turnover, have taken action
- No experience of outages

## **Public sector**

- + Numbers of employed, taken action
- No experience of outages

## **Agriculture**

- + turnover, have taken action
- No experience of outages



# Comparisons with earlier studies

Swedish study from 1994:

- costs have increased compared with 1994, more for retail, only exception is agriculture
- the increase is more pronounced for planned outages

Norwegian study from 2003:

- much higher costs in Norway

