



Resilience against storms (Northern) European perspective

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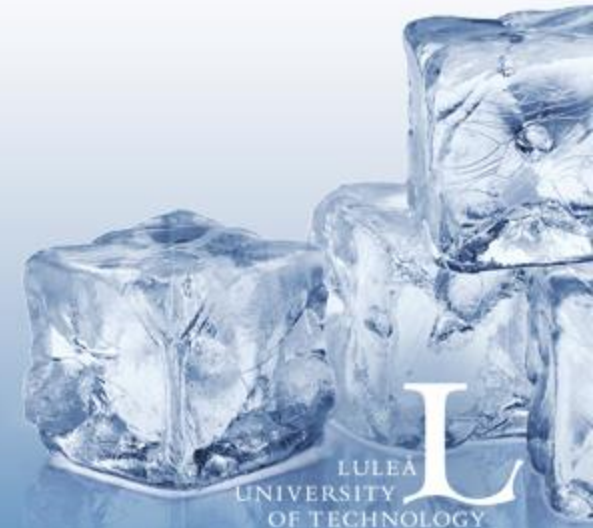
(STRI AB, Gothenburg, Sweden)





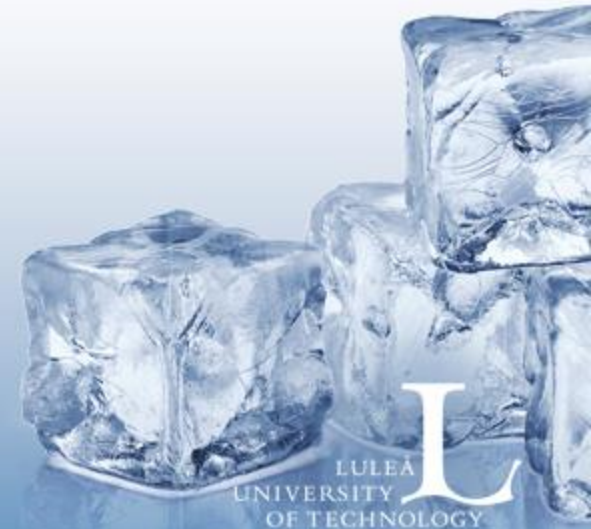
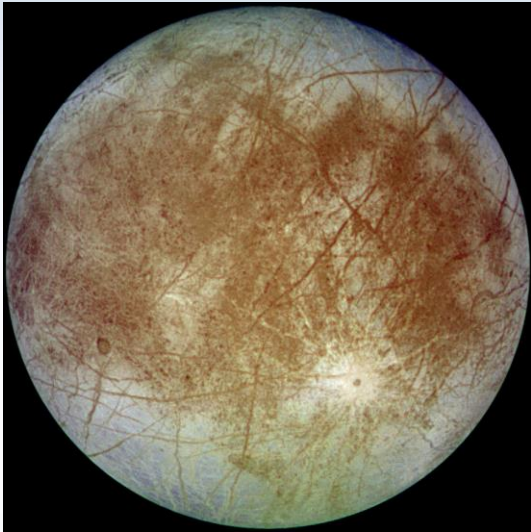
This presentation

- A few words about Europe
- Exceptional events
- Sweden – Gudrun
- Regulation
- Some technical comments



Europe

- No major earthquakes
- No extreme hurricanes
- No extreme weather



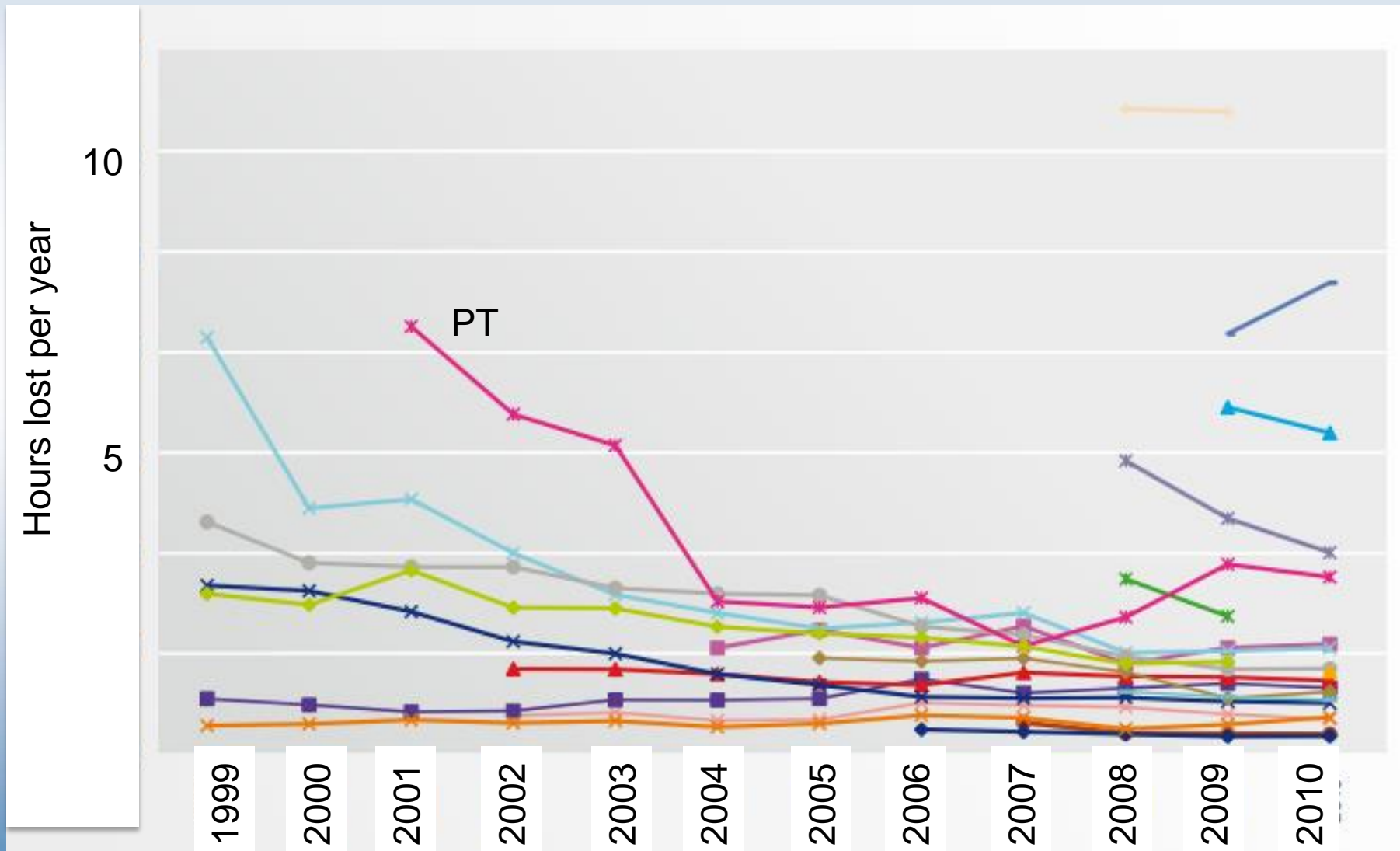
Exceptional events in reliability statistics

- Most countries: exceptional events should not be included in the statistics and not be used for tariff regulation.
- No common definition of exceptional events

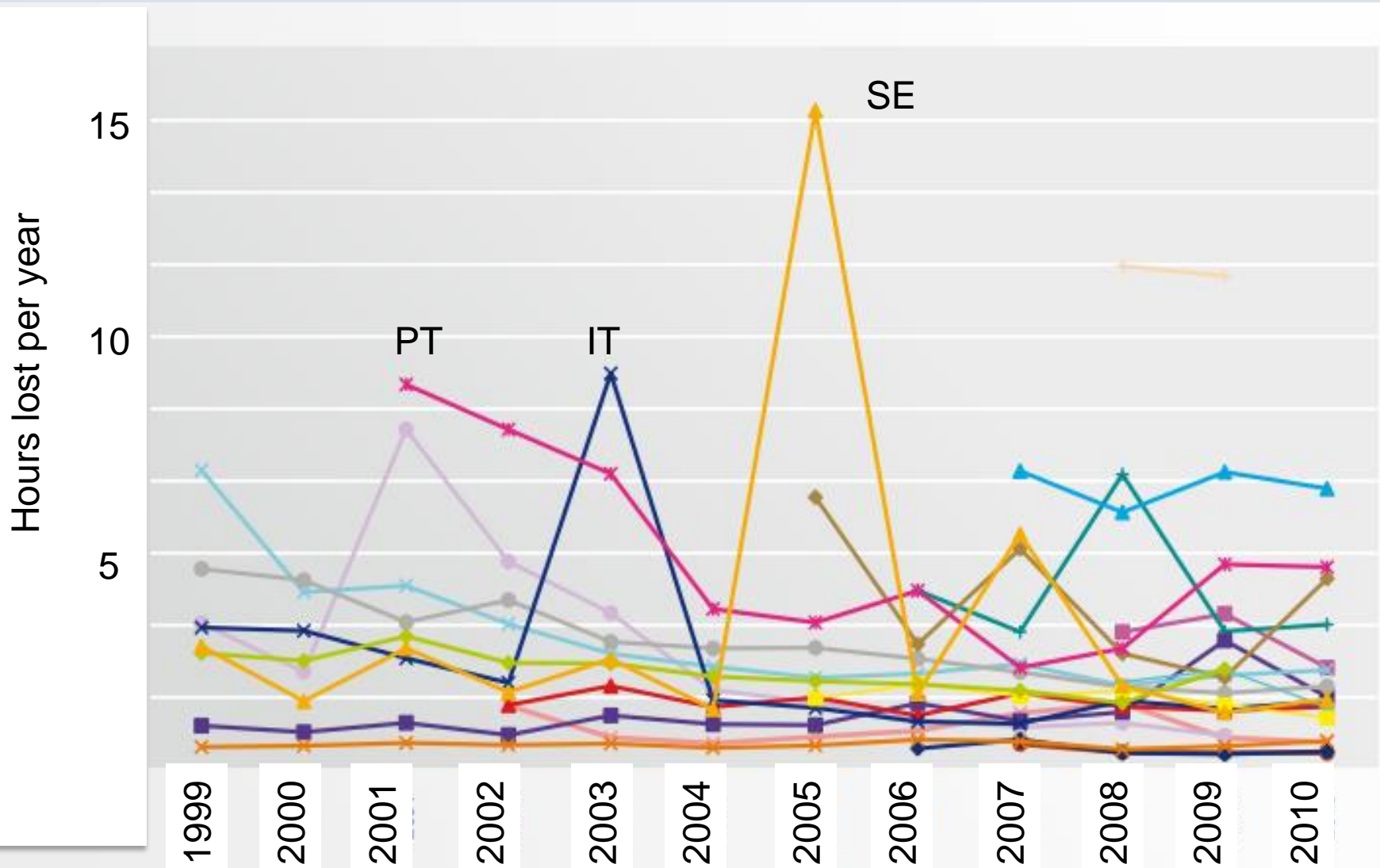


European statistics

SAIDI – excluding exceptional events



SAIDI – all events



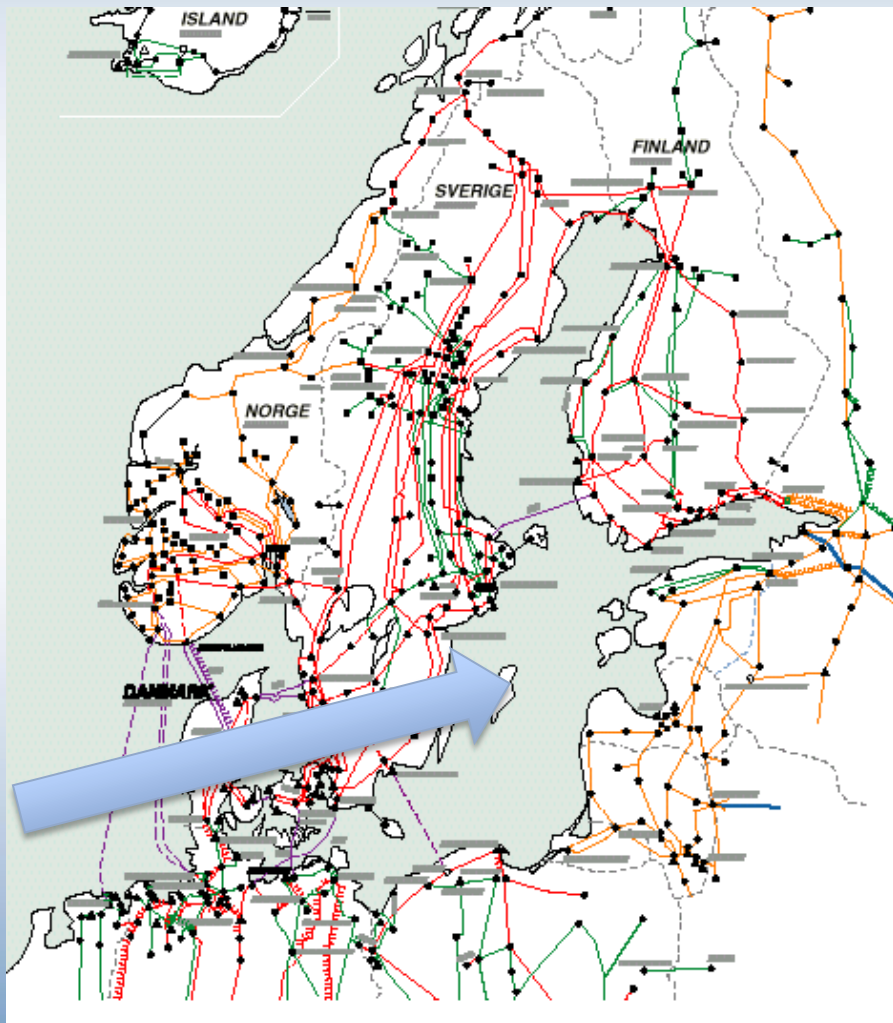
Why excluding exceptional events?

- Less year-to-year variations in statistics
- Easier to see trends
- Less uncertainly in investments
- The grid is not designed for exceptional events
- Customer have better understanding for interruptions due to exceptional events

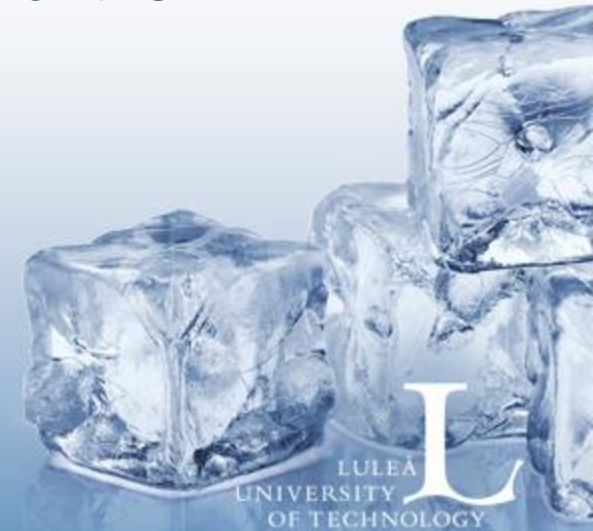
- But: no incentive for resilience



The storm Gudrun

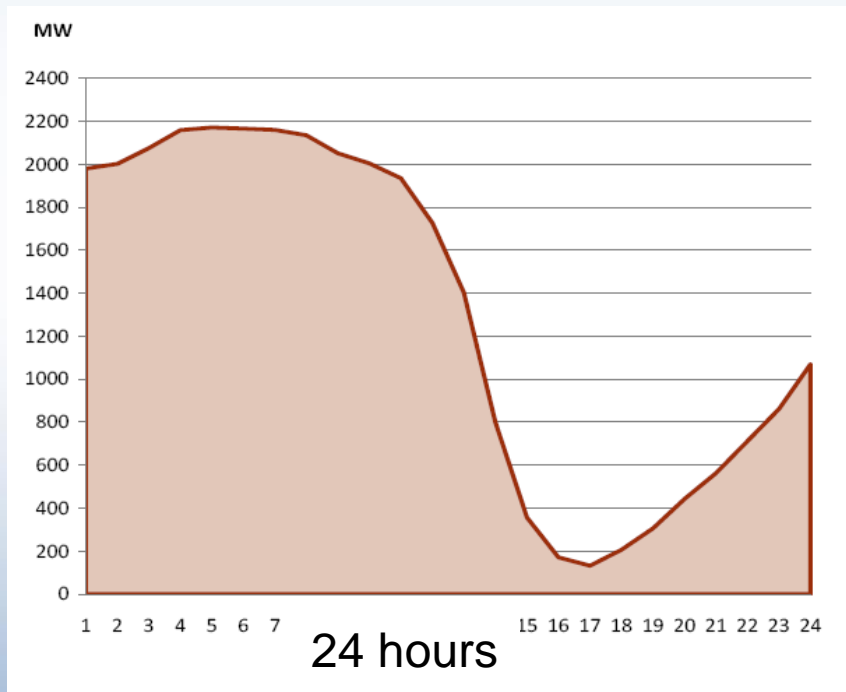


- 8 – 9 January 2005
- 341 000 without power
- After 4 days: 100 000
- After 2 weeks: 25 000
- After 3 weeks: 10 000
- Up to 3 months

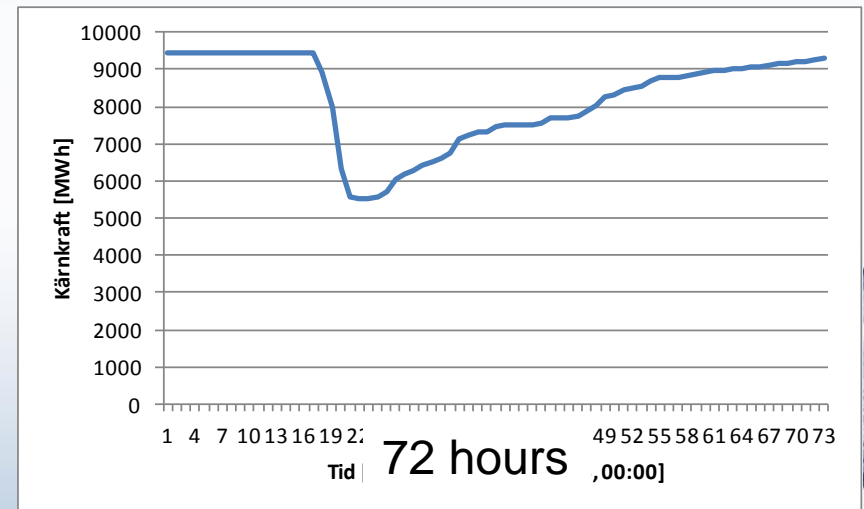


Power production during Gudrun

Wind power in Denmark

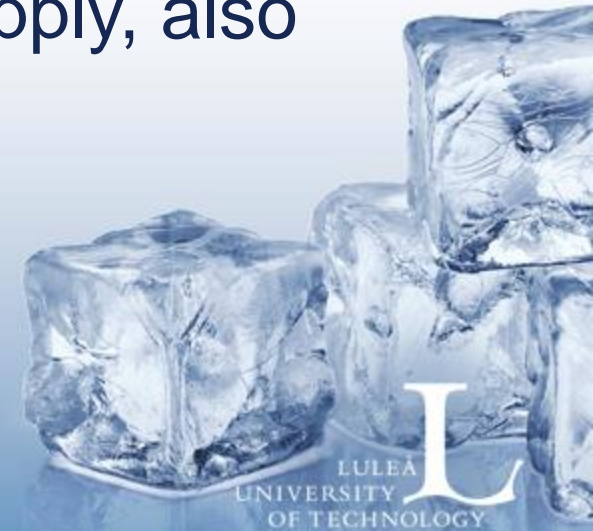


Nuclear power in Sweden



Immediate consequences of Gudrun

- Political decision: this will not happen again
 - It happened again two years later
- Underground distribution everywhere
- Legislation to define the responsibility of network operators to maintain a reliable supply, also during extreme circumstances



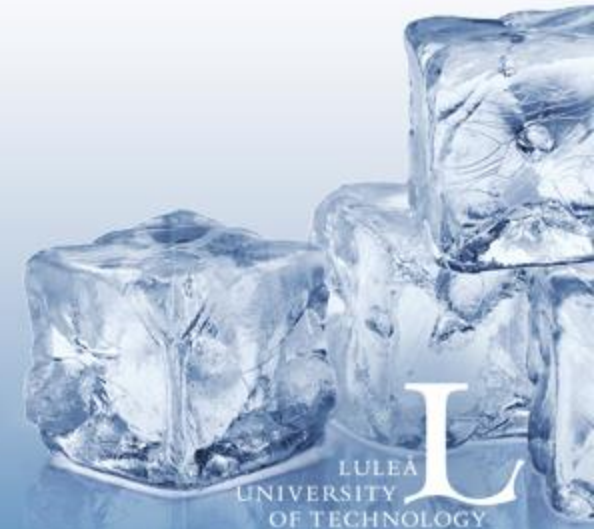
Existing regulation (2014)

- Tariff regulation including SAIDI and SAIFI
 - 5 year average including all events
- Maximum number of interruptions
 - 3 to 13 “depending on ”
- All “regional connections” shall be safe from trees
- Compulsory compensation
 - Interruptions longer than 12 hours
 - But exceptions are possible
- No interruption shall last longer than 24 hours
 - No exceptions
- Publication of the reliability for each utility



Compulsory compensation

Duration	Part of annual bill (network fee)	Minimum amount
12 hours	12.5 %	USD 130 (SEK 900)
24 hours	27.5 %	USD 260 (SEK 1800)
48 hours	62.5 %	USD 385 (SEK 2700)
72 hours	87.5 %	USD 510 (SEK 3600)
96 hours	112.5 %	USD 640 (SEK 4500)



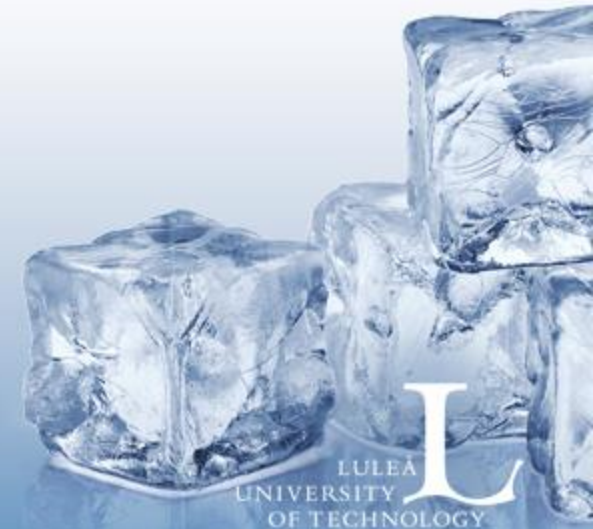
Publication of the results (2012)

Company	Number of customers with interruption longer than 24 hours	Total number of customers
Vattenfall	1746	742 908
Fortum	228	118 918
E.ON	163	80 182
Fortum	110	101 040
LEVA i Lysekil	93	10 069
Eskilstuna Energi	26	47 393
Upplands Energi	25	12 766
Härjeåns	16	26 626

Maximum duration of interruptions



- Winter 2011/2012
- 79 000 customers longer than 24 hours, up to several days
- 42 utilities involved



The regulator does an investigation

- Step 1: data gathering
 - 29 utilities with interruptions longer than 2 days
 - 23 utilities with interruptions longer than 3 days
 - 8 utilities with interruptions longer than 10 days
- Step 2: assessment of responsibility
 - This is unacceptable – utilities to come with a plan to prevent this in the futures
- Step 3: fines when it happens again



More technically

- No long interruptions due to interruptions originating at voltage levels above 24 kV
 - Those lines are safe from trees
- Main problem are overhead distribution lines
- Measures taken by the utilities
 - More crews available when storms are expected
 - Better coordination between utilities
 - Underground cables and tree trimming
 - Remote-controlled disconnectors



Conclusions

- Removing exceptional events from statistics
 - No incentive for resilience
- Tariff regulation based on SAIDI and SAIFI
 - No incentive for resilience
- Maximum duration of interruptions
- Compensation and fines
- Publication of the performance

