Risk-based Distribution System Asset Management

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Outline

- SINTEF – the short story
- Motivation: Why ”risk-based”?
- Presentation of the Risk-DSAM project
  - Scope
  - Results
  - Plans ahead
Technology for a better society
Our research areas

Approx. 2000 employees per January 1st 2007

- SINTEF Petroleum Research
- SINTEF Energy Research
- SINTEF Fisheries and Aquaculture
- MARINTEK
- SINTEF ICT
- SINTEF Materials and Chemistry
- SINTEF Health Research
- SINTEF Technology and Society
- SINTEF Holding
Our partners

- The Norwegian University of Science and Technology, NTNU
  NTNU is a centre for technological education and research in Norway, with a solid foundation in the natural sciences.

- The University of Oslo, UiO
  The University of Oslo is Norway’s largest and oldest institution of higher education.

NTNU and the SINTEF Group Collaboration in R & D

- NTNU personnel working on SINTEF projects
- SINTEF employees teach at NTNU
- Joint use of laboratories and instruments
International contracts were responsible for 15% of our turnover in 2005
Distribution System Asset Management

- Characteristics
  - Critical infrastructure
  - Ageing (both grid and employees)
  - An industry undergoing transformation

- Task: Managing ageing networks, while meeting conflicting demands from:
  - Customers (price, quality, flexibility)
  - Governments and the society (efficiency, environment, vulnerability)
  - Owners (return)
  - And contribute to a well-functioning free market
Why ‘Risk based’?

- Stochastic impact / outcome of many different aspects in distribution systems

- Evaluating both the probability and consequence of an unwanted event
Why ‘Risk based’? II

- Putting company efforts where it is needed the most
- A dynamic approach providing differentiated solutions
- A measure for seeking cost-efficient risk reduction

- As an opposite to rule based decision making
Background (i)

"Everybody is talking about the weather, but no-one seems to do anything about it..”

Origin unknown

The risk is out there…
Background (ii)

Existing methods and tools are not necessarily adequate in a rapidly changing and uncertain environment
Background (iii)

- The uncertainties are higher than ever.

Y-axis alternatives:
- Income cap
- Safety level
- etc

?
Uncertainty in regulatory framework: What has changed?

Regret is not an option. You have to do it right the first time.
Risk DSAM: Motivation

- To not take risk aspects into consideration is to take decisions wearing blindfolds.

- AND: Decisions are being made. Every day!
The risk is out there…

- Risk is present whether we like it or not. We have to let it influence on the decisions we make.

- Not taking action is also a decision. Are we aware of the risk?

- Is the company operating within risk-margins we are comfortable with?

- The society is more dependent on stable electricity supply than ever before. Are we aware that we face the risk?
Does existing methods and tools provide the solution?

- Existing methods and tools are not necessarily adequate for today’s distribution company

- The RISK DSAM project has been launched to address this challenge

*Risk based Distribution System Asset Management*
The Risk DSAM project

Objective: To improve the knowledge of relevant methods and approaches for holistic risk management within distribution companies.

The project will address several issues related to risk assessment in distribution system companies - including:

- Measures of quantification of risk exposure on strategic level
- Identifying maintenance and reinvestment strategies’ impact on the risk exposure
- Quantification of utility value both on project, and project portfolio level
Project partners:

- **R&D partners:**
  - Research Council of Norway
  - Électricité de France R&D
  - The Norwegian University of Science and Technology
  - SNF – Institute of Research in Economics and Administration (Norway)
  - Lappeenranta University of Technology (Finland)
  - University of Porto/INESC (Portugal)

- **Utility partners:**
Project activities 2006-2010

- PhD study
- Current risk exposure in the distribution sector
- Risk exposure on strategic level
- Utility value on project level
- Maintenance and reinvestments strategies impact on the risk exposure
- Decision support methods and processes
# Risk Management in general

ISO/IEC

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Applied to the Distribution system:

- **Risk study planning**
  - Problem formulation is a key success factor.
  - Motivation for the study
  - System boundaries
  - Stakeholders
  - Objectives and restrictions
  - Time horizon - modelling ambition
  - Terminology

- **Risk Scenario Identification**
  - Threats and sources of risk which affect the system are elaborated. This includes items, events or activities having a potential for a harmful consequence.

- **Risk Modelling, Analysis, Decision making, Communication**
  - Risk treatment
    - Risk avoidance
    - Risk optimization
    - Risk transfer
    - Risk retention
  - Risk evaluation
    - Risk criteria
  - Risk acceptance
  - Risk communication

- **Risk acceptance**
  - Yes
  - No

- **Top-Up or Bottom-Down?**

- **Risk study planning**
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  - Time horizon

- **Risk scenario identification**
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Current Risk Exposure

- Different decision levels and external stakeholders
Current Risk Exposure II

Some of the key questions being asked by distribution system asset managers are:

- When is the right time to do the maintenance?
- Should we reinvest instead of doing maintenance? Is extension of lifetime possible?
- When is the right time to reinvest?
- What are the economical and technical aspects?
- Are the installations safe? How safe?
- Is the company facing an acceptable risk concerning economic performance, safety and other risk criteria?

The complex answers to these questions hold the essence of risk based distribution system asset management.
Current Risk Exposure III

- **Risk exposure** is the aggregation of exposure to different risk criteria.

- An initial survey among the participating companies in the project points out the following risk related challenges as being the most relevant:
  - Challenges regarding operational/legal framework
  - Organisational challenges
  - Technical challenges
  - Environmental challenges
  - Reputation challenges
  - Societal challenges

- The different risk criteria address different sides to the DSO’s total risk exposure, and are by their nature somewhat different and may call for different methods for handling.
Challenges regarding operational/legal framework

- Unpredictable regulatory framework – regulatory risk
- Contractual obligations towards local authorities / customers
- Changes in quality of supply regulation
- Changes in safety / environmental regulation
- Changes in owner demands with increasing profit expectations
Organisational challenges

- Outsourcing of services: Having control and making sure that rules and regulations are complied with, and that safety is sufficiently handled.
- Possible threats regarding an inactive service market.
- Cases with in-house contractors: The interface between owner and contractor may become a challenge with regard to responsibilities during operation.
- Mergers of companies with diverging history and culture - taking care of risk handling in a transition period.
- Degrading / vanishing competence and local knowledge due to reductions in working staff and retirements.
- Lack of competence regarding the use of new methodology within several areas of asset management, such as risk assessment and condition monitoring of different components.
- Cooperation with other infrastructure services e.g. in term of sharing infrastructure paths.
- Possible threats regarding disappearance of manufacturers of the aged components (lack of spare parts).
Technical challenges

- Generally ageing infrastructure which is getting nearer it’s estimated useful lifetime
- Reinvestment decisions on whether to still maintaining existing components or the replace with new. A key issues here is end-of-life estimation
- Wrong handling of components
- Uncertainty in load development in the network
- Reduction in load in rural areas
- Introduction of distributed generation such as wind and small hydro power
- Introduction of new end-user technologies of questionable quality that gives power quality challenges
Environmental challenges

- Land use problems
- Potential local pollution, e.g. oil spill from distribution transformers or other oil filled components, and possible run-off from imbued wooden poles
- Other types of pollution, e.g. SF6-gas leakages from switchgear
Reputation challenges

- Disputes regarding land use
- The aesthetics of power grid components
- Decreasing reliability in parts of the grid
- Decreasing voltage quality in parts of the grid
- Safety of professionals and the general public
- Bad relationship with media
Societal challenges

- Increasing vulnerability due to adverse weather, severe faults, increased utilisation of the network, etc.
- Increasing reliability and voltage quality demands
Schematic risk picture for distribution companies

Distribution system
Distribution company

Unwanted events

Consequence classification

Threats / Challenges

Safety
Reputation impact
Contractual obligations
Quality of supply impact
Environmental impact
Economy

Safety

Economy

Environmental impact

Quality of supply impact

Reputation impact

Contractual obligations
Further work

Distribution system risk management concept
Recommended work flow
Support system relationships
Objectives - Parameters - Indicators
Tools
Competence building
Further work I

- Risk exposure on company/strategic level
  - Develop methods, which can be used to describe the risk exposure for a distribution company.

- Maintenance and reinvestment strategies’ impact on the risk exposure
  - Develop methods, which can be used to describe how alternative maintenance and reinvestment strategies affect the technical condition of the network and then the related risk exposure on company level.

- Utility value on project level
  - Develop methods, which can be used to describe the utility value of maintenance and reinvestment projects.

- Decision support methods and processes
  - Investigate and describe how information about risk exposure on strategic level, planning, operative and physical level can improve the decision processes in a distribution company.
Summarised

- Distribution system asset management cover many rather different issues – economic, technical and other more qualitative criteria such as safety of personnel.

- There is a need to establish a holistic asset management scheme covering these issues.

- To address these challenges the RISK DSAM project has been launched to build competence and provide solutions.
New solutions? Hopefully better than this…

"The picture shows a double screwdriver invented by senior economist M. Oney. The essence of the invention lies in the efficiency potential for tightening twice as many screws at the same time…"
Concluding remarks

- To **not** take risk aspects into consideration is to take decisions wearing blindfolds.
- Risk is present whether we like it or not. We have to let it influence on the decisions we make.
- Existing methods and tools are not necessarily adequate in a rapidly changing and uncertain environment
- **Do you want to join us in our efforts? Visit our website, and get in touch.**

http://www.energy.sintef.no/Prosjekt/RISKDSAM/
Look ahead!