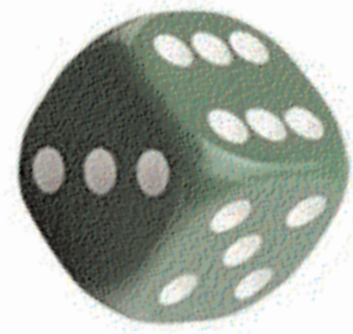
Following on from David Davies on understanding risk in Assets 3, Ype Wijnia talks about the tricky business of implementing risk management in practice at Essent Netwerk

RISKY BUSINESS



In 1999 the Dutch electricity sector was split into distribution and retail companies. Because of strong pressures on pricing imposed by the new regulatory authorities, the distribution companies faced a reduction of up to 50% of their income, as had happened in the United Kingdom. Although most distribution companies had been operating on tight budgets for a few years, this was a serious challenge. As most of the expenses of a distribution company are network-related, Essent Netwerk (EN) considered it vital to review the decision-making process regarding infrastructure capital expenditure (capex) and operating expenditure (opex). To get the right perspective we will start our review a little earlier, at the moment most of the staff started their employment in the electricity sector.

THE GOOD OLD DAYS (BEFORE 1999)

Most of the staff was employed in the 1970s. This was a period of prolonged high growth (7% annually) of electricity use, resulting in a doubling of the load every ten years. The focus in this period was on building new capacity, and not on challenging decisions about new capacity. The reasoning behind this was that if you did not need the capacity this year, you would next year. The motto more or less was "build or black out".

During the 1980s the load increase disappeared, or even changed into a decrease of electricity demand. This was not immediately recognized, resulting in large overcapacities in parts of the network, the so-called gold plated system.

Finally, in the '90s utilities became cost aware. Enabled by the gold plating, management found that an effective way of reducing expenditure was asking two questions: "can we do this project at a lower cost?" and "can we do this project next year?" This decision making approach was still up and running when liberalization hit. The decision making process is shown in the diagram below.

Liberalization forced the utility companies to review their decision making again. This review resulted in a list of shortcomings:

- Unclear what problems are tackled
- Second guessing in Risk analysis and approval
- Almost no process control
- Proposals not reviewed in Total Business Context
- Budget approval on first come first served basis
- Some proposals re-entered the process time after time
- Almost no post evaluation of delivered benefits

HERITAGE DECISION MAKING PROCESS

*INVESTMENT PROPOSALS INCLUDE MAINTENANCE SCHEMES

REVERSED PROCESS

*INVESTMENT PROPOSALS INCLUDE MAINTENANCE SCHEMES

To summarize, the analysis showed poor consistency within the total portfolio, mainly because almost no formal problem analysis was being carried out.

THE FIRST STEPS IN RISK MANAGEMENT

The obvious solution to the lack of problem analysis was to start asking the one question, "What will happen if we don't do this project?" This was formalized by reversing the first two steps in the decision making approach in the beginning of 2001.

This meant the engineers weren't allowed to start developing investment proposals until their problem definition was accepted. In this process the default outcome is doing nothing.

To prevent engineers exaggerating the risks to get approval for their projects, EN added two measures. First, the responsibility for the risk was transferred to the management as soon as the problem entered the process. This reduced the perceived personal risk for the engineer in not being able to solve the problem. The second measure was to remove the budget limit in decision making to allow any proven real problem, no matter how big or small, to be solved.

This reversal showed great advantages. Less time was spent on irrelevant issues, the resolutions to accepted problems were funded quite easily, and amazingly, the expenditures were reduced by about 15% even though the budget limit was relaxed.

COMPLICATIONS

Despite the benefits of the process reversal there were a few concerns, too. A few examples:

- Not certain if all risks were mitigated
- No prioritization between problems
- No clear process control
- No feedback from implementation for reconsidering decisions

This was because the reversed process was in fact a "fix when failed" approach. This is fine for cutting costs, but less effective for controlling operational performances. As the regulator showed increasing eagerness to get involved in performance regulation, enduring a fix when failed approach would result in a head-on collision with the regulator.

Another concern was that the results of bad decisions would emerge only after several years, and of course really big investment programs will take years to complete. So once they didn't comply with the targets, it would take them years to recover, and due to the reduced income they wouldn't have the cash to make the necessary investments. This is more than a serious challenge. How can you reduce costs without losing control of the operational performance and the risks you face?

DID ESSENT GO TOO FAR? DID ALL PROBLEMS REALLY NEED TO GO THROUGH THE SAME PROCESS?

BOTTOM UP RISK MANAGEMENT

To control your risks you have to manage them. To manage risks you need to know them. So you start by evaluating the network performance, identifying places in which the performance is inadequate (bottlenecks), and you develop investment proposals for the bottlenecks. Next you capture the risks associated with not solving the bottleneck, and you make the go/no-go decision.

If you decide not to go on with the project, you add the risk to the risk register. The sum of the risks in the risk register would be your predicted risk position, wouldn't it? This approach seems very logical and straightforward, but is has a major flaw – it produces the wrong answer.

The first fundamental problem is the match between the identified bottlenecks and the actual performance. Most incidents are not related to bottlenecks, but have a more or less random appearance. For example, 50% of the interruptions for EN are due to excavation work, and occur suddenly, in parts of the network that appear to be working perfectly. Simply summing the unapproved investment proposals doesn't account for those random events.

To circumnavigate this flaw, one could add this random risk to the risk register, but it doesn't completely solve the problem. This is because the next issue lies in the identification process of the bottlenecks, which works basically bottom up. How do you make sure that all bottlenecks are identified, and that everyone bringing up a bottleneck has used the same criteria? In the case of a clear underperformance you can be pretty sure to capture the weak spot, but what about hidden failures?

The second fundamental problem is in the decision making itself. No matter what approach you follow, a go/no-go decision in itself is a risky thing. People do make mistakes, and a mistake on a go/no-go decision for a major project has serious consequences. Besides, how can you make sure all but no more than the critical decisions reach the top level?

It is clear that an investment scheme for a 3 million euros high voltage cable needs top management approval. But consider the effect of entering the wrong settings in a protection device after the cable has been put in operation. This error of the service engineer can result in an interruption in a very large area on a single failure, which is precisely what the new cable was intended to prevent. In other words, the low-level error makes the high-level decision worthless.

RISK BASED ASSET MANAGEMENT

Again, this solution starts with knowing about your risks in order to manage them. The deviation from the traditional approach is that this time we do not relate the risk to points in the network, but we analyze the risk in a more holistic and business-orientated way. We start at the top, thinking about what events would put us out of business. From these major catastrophes one can derive the values the business should care about, because if you don't, something will go wrong, and somebody who cares will give you a hard time. For EN, those business values are Shareholder value, Safety, Reliability and Compliance with the law. Top management identified – for all these key business

RISK BASED ASSET MANAGEMENT PROCESS

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values – the risk tolerability.

The next step in the risk capture process is to identify all ways by which those business values could be threatened, the so-called risks. Those risks are decomposed, and evaluated against the risk tolerability matrices. The result is that all the risks are classified as Intolerable, High, Medium, Low and Negligible. It is only after you have classified the risks that you start searching for points in the network where the risk can occur, the bottlenecks. This process, as shown in the next figure, was implemented in 2003.

The difference with the traditional approach is that you now can proactively search for those bottlenecks with the highest associated risk, instead of hoping they will show up in the bottom-up process. We develop a strategy for each risk, and we group similar bottlenecks in programs. The risks are recorded in a risk register, so we can track these. Decision-making has changed too. Because we group bottlenecks in programs, we don't have to make a go/no-go decision on each individual bottleneck. All we do is sort them according to their yield, and solve those that are within budget limits.

Top management sets the total budget by evaluating the expected performance against the performance targets, and the budget is divided over the programs by using the same marginal yield for all programs. The expected performance is the sum over the risk register minus the associated risk of the solved bottlenecks.

TOP MANAGEMENT IN THE LEAD – THIS WAS QUITE A SHOCK TO MOST PEOPLE IN DISTRIBUTION

DIMENSIONS FOUND IN RISK IDENTIFICATION WORKSHOP

DIMENSION	LOWER LIMIT (EXAMPLE)	UPPER LIMIT (EXAMPLE)
CONSEQUENCE SCALE	NEGLIGIBLE (VOLTAGE SAG)	CATASTROPHIC (EUROPEAN BLACKOUT)
CONSEQUENCE DURATION	10 MS (VOLTAGE SAG)	WEEKS (STORM FRANCE DECEMBER 1999)
PROBABILITY (1/YR)	<10–6 (METEORITE DESTROYING EUROPE)	>10000 (MEDIUM VOLTAGE INTERRUPTIONS)
MITIGATION SIZE	100 € (WHAT TYPE OF JOINT FOR SPECIFIC CUSTOMER)	>1 G€ (NEW HIGH CAPACITY POWER PLANT)
COMPLEXITY	SINGLE CRITERION THRESHOLD (LOAD LEVEL EXCEEDED)	MULTI CRITERIA WEIGHTED SUM (MAINTENANCE CONCEPT)
SCOPE	TECHNICAL (SETTINGS FOR PROTECTION DEVICE)	ETHICAL (CAN WE CONTINUE OPERATING OVERHEAD LINES IF THEY MIGHT INCREASE THE LIKELIHOOD OF LEUKEMIA)
TIME HORIZON	TOMORROW (NEW CUSTOMER APPLICATION)	25 YEARS (NETWORK DESIGN FOR DISTRIBUTED GENERATION)
ACTORS	SINGLE ACTOR SINGLE OBJECTIVE	MULTI ACTOR MULTI OBJECTIVE
PERCEPTION	PERCEPTION IN LINE WITH OBJECTIVE RISK ANALYSIS	PERCEPTION NOT ACCORDING TO OBJECTIVE RISK DUE TO PSYCHOMETRIC ASPECTS AS VOLUNTARY, CONTROLLABLE ETC
UNCERTAINTY	ALMOST CERTAIN	UNCERTAINTY ABOUT CONSEQUENCES AND LIKELIHOOD
AMBIGUITY	SHARED OBJECTIVES	CONFLICTING OBJECTIVES

COMPLEXITY LEVELS IN DECISION MAKING

	RISK ANALYSIS	DEVELOPMENT INVESTMENT PROPOSAL (*)	BUDGETING AND APPROVAL	INVESTMENT DELIVERY	EVALUATION	
Complexity						Volume
BASIC	SINGLE CRITERION: AGE, LOAD, FUNCTION	1 TECHNICAL SOLUTION	SIMPLE (COST, BUDGET AND FEASIBILITY	SPECS, TIME, MONEY	SPECS, TIME, MONEY	HIGH
INTERMEDIATE	COMPOSED CRITERIA: CONDITION, FUNCTIONALITY	MULTIPLE SOLUTIONS, SAME TYPE	MULTI CRITERIA, NON QUANTIFIED (WEIGHTED SUM)	MONEY, INFORMATION, TIME, ORGANISATION AND COST	LESSONS LEARNED	MEDIUM
Current process						
ADVANCED	RISK LEVEL	MULTIPLE SOLUTION TYPES, INCLUDING DOING NOTHING (REFERENCE)	MULTI CRITERIA, QUANTIFIED (WEIGHTED SUM)	SLA CONTAINING END GOAL, MUTUAL DRIVERS AND CSF	RISK MITIGATION	LOW
SYSTEMATIC	RISK POSITION	SETS OF SOLUTIONS	PORTFOLIO PERFORMANCE	STRATEGIC PARTNERSHIP	BUSINESS PERFORMANCE	RARE

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BENEFITS – AND CONCERNS

The impact of this holistic approach is tremendous. Perhaps the most significant issue is that top management is put in the place it should have, which is in the lead. This was quite a shock to most people working in the distribution industry, who were used to acting as virtually independent operating professionals.

The change of perspective forced them to **review their organization**. As they now work in a completely process-orientated way, they decided to link roles to stages in the process and cluster roles into job descriptions. Those jobs are very different from the ones that existed previously, although many basic engineering skills remained the same.

Another part of the business they needed to review was the **decision-making support system**. In the traditional process all decisions have a major human involvement. In the new process this would be impossible, simply because the number of decisions involved is about ten times higher.

Although this should work theoretically, EN ran into serious trouble when implementing the process. They found the number of risks exploded beyond a manageable level. Besides the risks differed widely in size, time horizon, scope and complexity. The table below shows the extremities found.

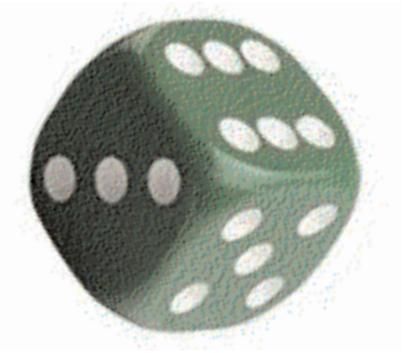
IT IS VERY EASY TO LOSE YOUR ENGINEERING STAFF IN A HOLISTIC APPROACH

The combination of number and spread of the risks forced the staff back into old habits, as they couldn't cope with the enormous complexity but still did want to solve problems. Did Essent go too far? Did all problems really need to go through the same process?

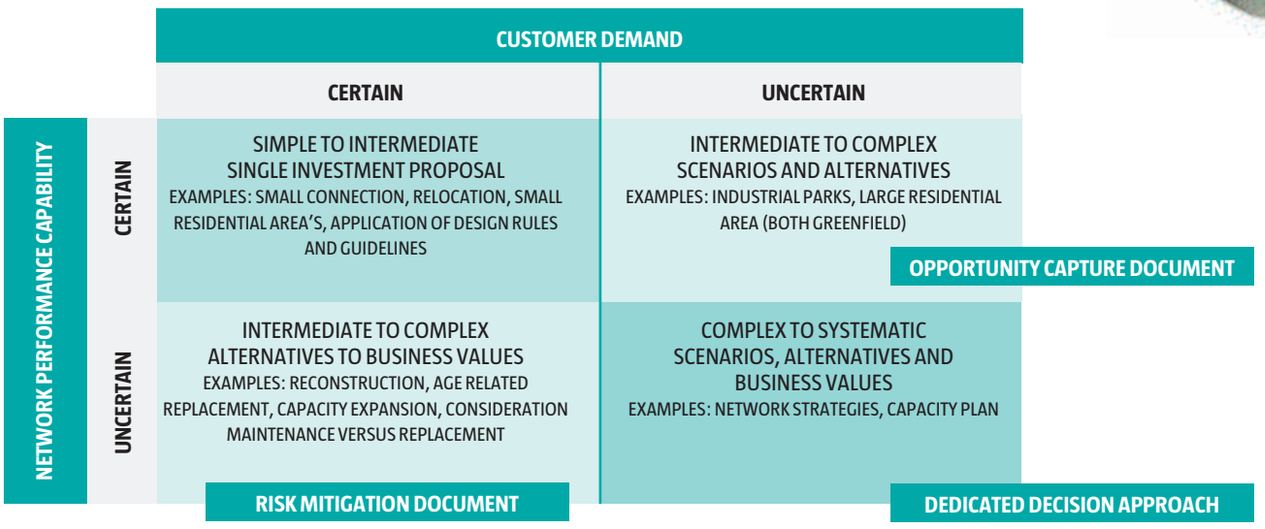
SIMPLIFYING THE PROCESS

Essent proved its willingness to change by – again – reviewing the decision making process. They found that the holistic approach was too sophisticated for most of the problems and too primitive to deal with all relevant aspects of some highly complicated and uncertain problems. The diagram below shows rough distribution of work volumes over complexity levels.

Most work is basic, controllable by simple standards. Some problems need a little bit more sophistication, but not a full quantitative risk analysis. Only a few problems really need an all out analytic approach. The setting of standards also requires a proper analysis. Finally, very few problems need a state of art approach, but this is restricted to the real strategic issues.



UNCERTAINTY AND DECISION APPROACH



CLASSIFICATION OF DECISION MAKING

Although the concept of different levels of complexity in decision making is conceptually appealing, the key question is how to decide what level of complexity a specific decision needs. Essent Netwerk found that the driver for the level of complexity is the amount of uncertainty in the decision.

Some problems, like the choice between maintenance and replacement, are uncertain with respect to the performance capability of the current components. Decisions should be made on the quantified and weighted impact on the business values.

For other issues, like the development scheme of new industrial parks, the uncertainty is in the final demand and growth rate of the park. In this case one needs to model multiple scenarios. Because the infrastructure can be designed from scrap it is not likely that alternative solutions will differ wildly on other business values than economy. The selection criterion is the expected net present value of an investment scheme. For both decision types specialized documents are designed to guide the asset engineers through the decision making process (see diagram below).

In a very few cases both network capabilities and customer demand are uncertain. For these decision problems we design a specific decision approach, to accommodate all special requirements.

CONCLUSIONS

Implementing risk based asset management for distribution networks is a very challenging task. This has to do with the enormous complexity of risks surrounding those networks. Faced with this complexity one is easily tempted into a holistic approach, but beware... It is also very easy to lose your engineering staff in a holistic approach. Essent Netwerk has experienced both sides. If there is a lesson to learn from them, it could be summarized into the following points:

THE CAPABILITY TO MANAGE COMPLEXITY IS A SCARCE RESOURCE THAT SHOULD NOT BE WASTED ON RELATIVELY SIMPLE ISSUES

Risk analysis

- The number of risks is very high, numbering perhaps in the thousands. This requires more attention to structuring the risks than usually anticipated.
- Risks show a much higher variety in complexity, uncertainty and ambiguity than can be handled in a single process

Organization

- Risk based asset management required a lot of new capabilities from your workforce. Even if you invest heavily in capability development the change can go too fast for many employees.
- Running a too complicated process in your organization isn't any good. A primitive but controlled process delivers much more value than a sophisticated but hardly followed process
- The capability to manage complexity is a scarce resource that should not be wasted on relatively simple issues. Use it to make the high volume workflows easier.

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ESSENT NETWERK

Essent Netwerk (EN) is the largest Dutch energy distribution company in the Netherlands. EN manages the assets in about 33% of the geographical area.of the Netherlands. It has 2,500,000 customers for electricity and 1,800,000 customers for gas.

Its electricity asset base consists of 2000 km overhead line, 120000 km underground cable, 170 substations and 60,000 ring main Units. For gas the numbers are 37,000 km pipeline, 200 connections with Gasunie (the national natural gas grid) and 2300 stations. Total annual turnover is about 1250 Million euros, of which about 250 M is direct network-related expenditure (including capital expenditure and operating expenditure).