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PRIORITIZING INVESTMENT THE VALUE OF PORTFOLIO DECISIONS IN ELECTRICITY INFRASTRUCTURE

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Overview

All over Europe the energy distribution network companies are confronted with tighter budgets, as the regulators place efficiency targets on those monopolists. The distribution companies react both by true efficiency measures (can the same result be achieved for less money) as by effectiveness measures (is the investment really necessary for the company). The latter question is the most difficult to answer, as most investments in the distribution system are measures to control risks that have a relatively small probability and large consequence. Therefore, for each individual investment it is safe to assume that it will not be a problem to postpone the investment one year. However, for the system as a whole the risk will increase substantially. This means it is vital to include a quantitative risk measure with a minimum **yield** (risk reduction per euro) requirement into the investment selection with. This is not very straightforward. Determining the risk for an individual investment is plagued by uncertainties, making the risk assessment more of an art than a science. Therefore, the yield requirement meaningless if it is to be more than a order-of-magnitude type, but the yields of the investment proposals usually are in the some order of magnitude. Besides, setting a yield requirement does neither tell in advance whether the budget will be exceeded, nor if the resulting system performance is still adequate. A possibility to overcome these last two problems is the portfolio decision. The decision is than made over the total of investment proposals, which shows directly if the budget is violated. If risk is included into the portfolio decision it can show the effects on the system performance, but this requires that the proposals can be ranked to their yields. As in most cases the ranking is less sensitive to uncertainty than the absolute figures, this has the additional benefit of increasing the certainty about the best value for money. Finally, if the figures are reliable enough, the portfolio approach facilitates the discussion about the level of the budget. This paper describes the approach used to fulfill the requirements of the risk based portfolio decision and the results a Dutch energy distribution company achieved with it.

Methods

The methods used are on two levels: valuing risk and valuing opportunities. See figure:

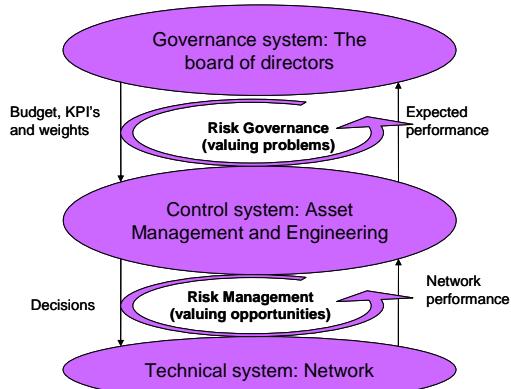


Figure 1: The investment decision making model

The yield of the investment proposals is determined with a multi criteria analysis. Effects on the key performance indicators are normalized, weighted and summed to determine the total risk reduction of a proposed investment. Dividing the risk reduction by the investment costs gives the yield for a project. To select the optimal set of projects multiple methods are applied, ranging from relative simple approaches to full branch and bound algorithms.

Results

A software tool was developed to facilitate the portfolio decision. The portfolio approach and tool were applied within a Dutch energy distribution company. The results of the approach were used in the decision on the investments for the next year. The yield graph (see below) was used to determine the budget in relation to the expected performance. Within this budget the optimal set of projects was determined. Both engineering staff and decision makers were pleased by the approach, despite some earlier hesitations.

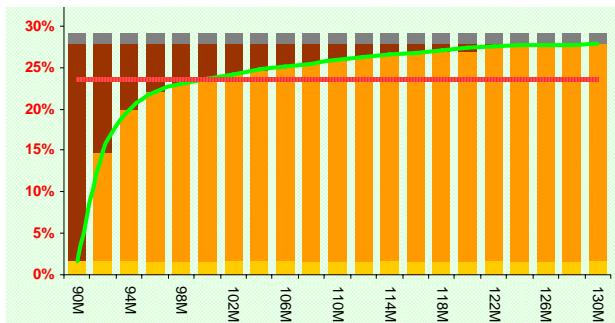


Figure 2 The yield-graph : the green line indicates the theoretically optimal yield based on the linear relaxation, the orange bars indicate the optimized yield corresponding to a feasible integer solution. The grey part of the bars correspond to the part of the yield that is ruled out by fixing projects to be not part of the selected portfolio. Analogously, the light orange part indicates the yield that is guaranteed by fixing projects to be part of the portfolio. The red line indicates the current performance.

Conclusions

The risk based portfolio approach can be applied to determine the optimal set of investments for a energy distribution company. In the case described it was welcomed very much.

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