Study Committee C1

Power System Development and Economics

Paper 10812_2022

Active Network Management solutions and their financial implications on distribution grid development

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Motivation

- Distribution grids host a significant part of renewable production, resulting in increased needs to strengthen local grids and their ability to perform new and complex tasks.

- Complements to traditional grid expansions are developing, with new technologies and markets emerging to provide increased flexibility to support the grid. Active Network Management (ANM) solutions provide new methods to plan and operate the power system.

ANM is the exploitation of flexible network assets for the purpose of providing secure means of increasing grid utilization.

- The economic regulation is designed with traditional capital-intensive grid expansion methods in mind, which can make it difficult for less capital-intensive alternatives to compete. As alternative less capital-intensive solutions become more available, DSOs and authorities may need assistance with comparing what type of solution is most efficient and how different regulation affects different investments.

- Comparative assessment of investment strategies may be done using a Cost-Benefit-Analysis (CBA) method, where foreseen quantifiable costs and benefits throughout the lifecycle of different solutions can be evaluated.

Approach

- The paper outlines traditional grid expansion methods and presents an example of a tariff scheme, the information was provided by E.ON Hungary and is thus based on their network development process and the Hungarian tariff scheme. Next, the paper outlines different ANM solutions and describe how they may either supplement or complement traditional grid expansion methods.

- The paper then suggest how the above mentioned alternatives may be compared to identify the most efficient solution to the problem at hand and a CBA is suggested for this purpose.

Setup of the CBA

- In the ANM4L project, the traditional CBA method has been implemented as an easy-to-use module of a tool developed for decision support. The purpose of the CBA module is to provide the user with a first indication of which investments to investigate further. The implementation is done based on an open-source solution using standardised interfaces to enable a broad applicability.

- The CBA is structured as a traditional CBA but modelled to allow for simple input data and estimates revenues etc. based on input data such as investment costs and WACC.

- The user defines relevant test scenarios, they can either be a pure reinforcement case, a pure ANM solution case or a combination of both. The user then provides the following input data for each scenario: total investment cost, estimated cost for flexibility and amount of needed flexibility per year, estimated yearly cost of energy loss, connection fee (if any), first year of planning, number of years spent on planning and construction respectively, discount rate and regulated rate of return.

- Some assumptions are necessary to make the tool easy to use, for example the model currently assumes an OPEX of 5 percent for reinforcement and 10 percent for ANM, a revenue cap based on Swedish regulation, etc. However, all assumptions are possible to change.

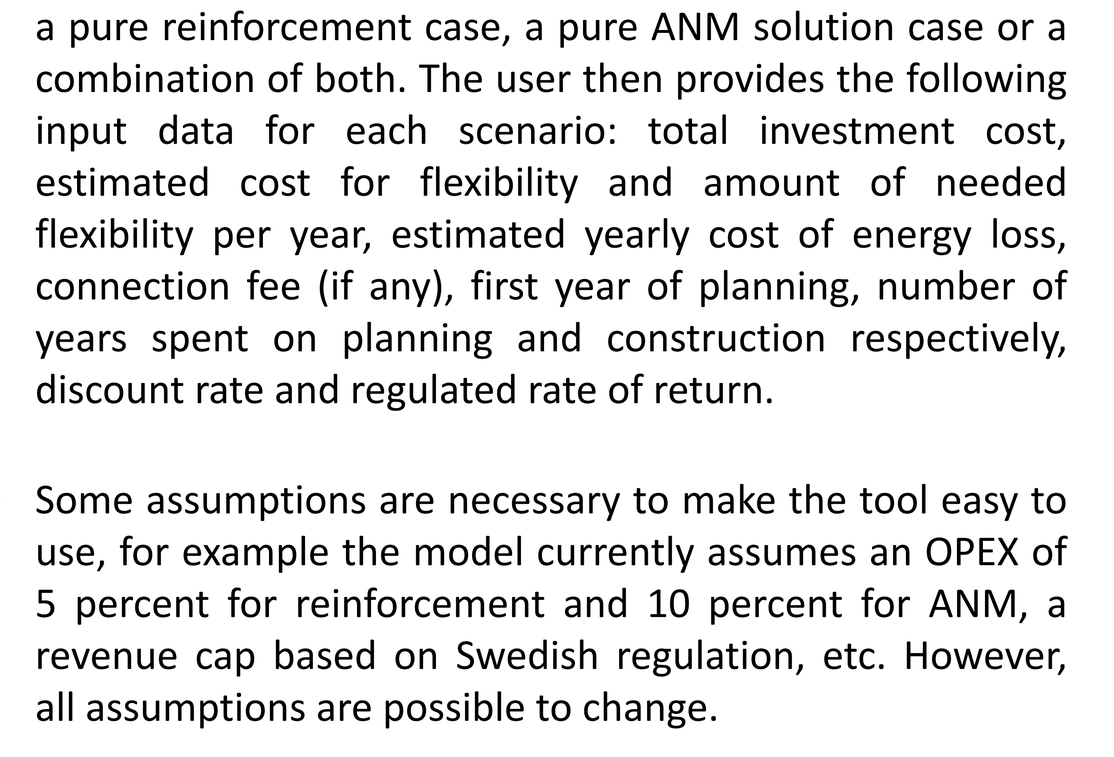

Figure 1: The main steps of the CBA process

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Set up of the CBA cont.

- The model then estimates costs and revenues for the total life span of the investments, discounts the future cash flow and produce the net present value (NPV) for each scenario. The model also provides the user with the total costs although these should be used with caution depending on what the user included in the input data.

Findings from model results

- The CBA was tested in a recent analysis , not included in the paper, comparing two investment alternatives in Sweden. The current regulation promotes CAPEX intensive investments as these generates a large payback from tariffs during a long time, see Figure 2.

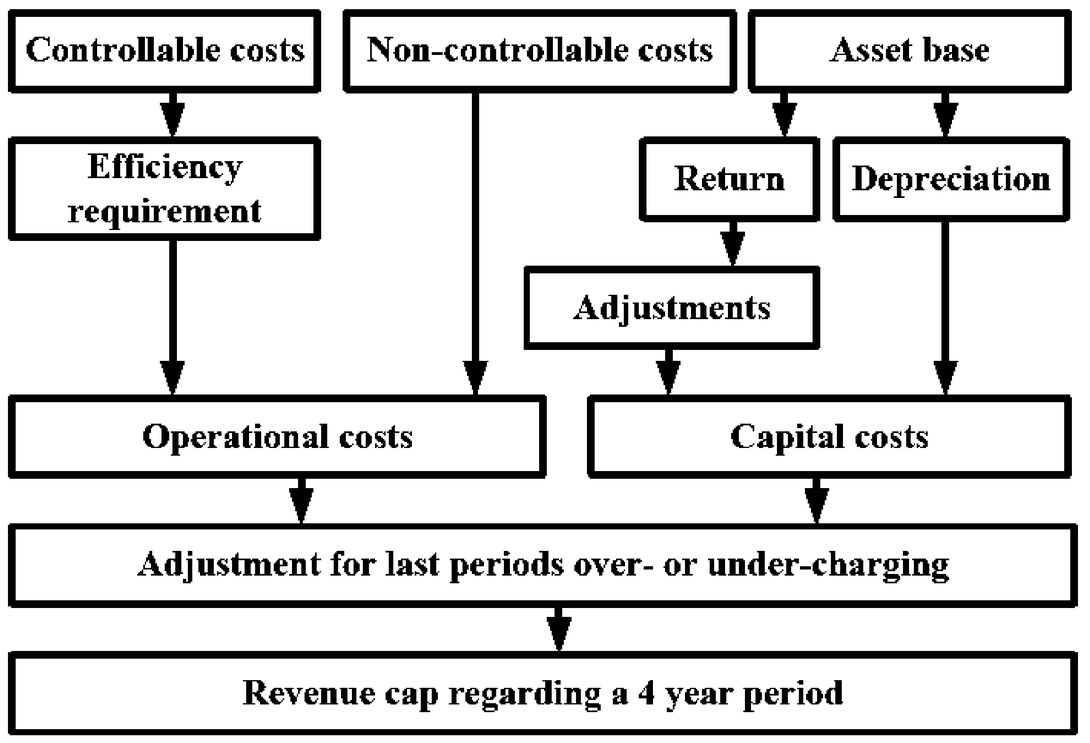

Figure 2: Overview of the Swedish revenue cap

Conclusions

- Tools and methods that can handle complex assessments of various investment strategies are needed as technology develops.

- The regulatory framework influences the financial situation of the DSO and therefore how DSOs develop their grids, where the incentives of the current revenue-cap may lean towards more or less capital intense development solutions.

- The CBA analysis can be performed under different regulatory schemes to investigate how different regulation affects the DSO incentives to invest in different alternatives to solve a certain issue in the grid.

The ANM4L project

This work has been done within the framework of the European research project ANM4L (Active Network Management For All) project, with partners from Sweden, Germany and Hungary. The goal of the ANM4L project is to develop solutions securely increase the grid utilization. The developments in the ANM4L project are based on three pillars: 1st ANM control solutions, 2nd Business solutions, 3rd ICT solutions. These pillars are collectively resulting in a toolbox developed to support the operation and planning of distribution grids, which functionality and replicability will be tested and demonstrated within the ANM4L project

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