CINeLDI
Centre for intelligent electricity distribution
- to empower the future Smart Grid

Distribution grid planning considering the electricity demand and flexibility potential of electric transport

Aurora Fosli Flataker
Department of Electric Energy, NTNU, Norway

Challenge and objectives

When planning reinforcements or new distribution grid in areas where EV charging is present or expected, one needs a representation (load profile/load model) of the charging demand as input to the planning problem. In addition, the planning task requires data and assumptions of other loads in the system, the planning horizon, costs, and more. As there exist many ways to model the EV charging demand, with different levels of data requirements and detail level, the aim of this work is to evaluate «how fancy» models of the EV charging is needed for the application in distribution grid planning.

Approach

Global sensitivity analysis and uncertainty analysis on an investment model developed in CINELDI
(Rana et al. "Economic assessment of integrating fast-charging stations and energy communities in grid planning" (2023))
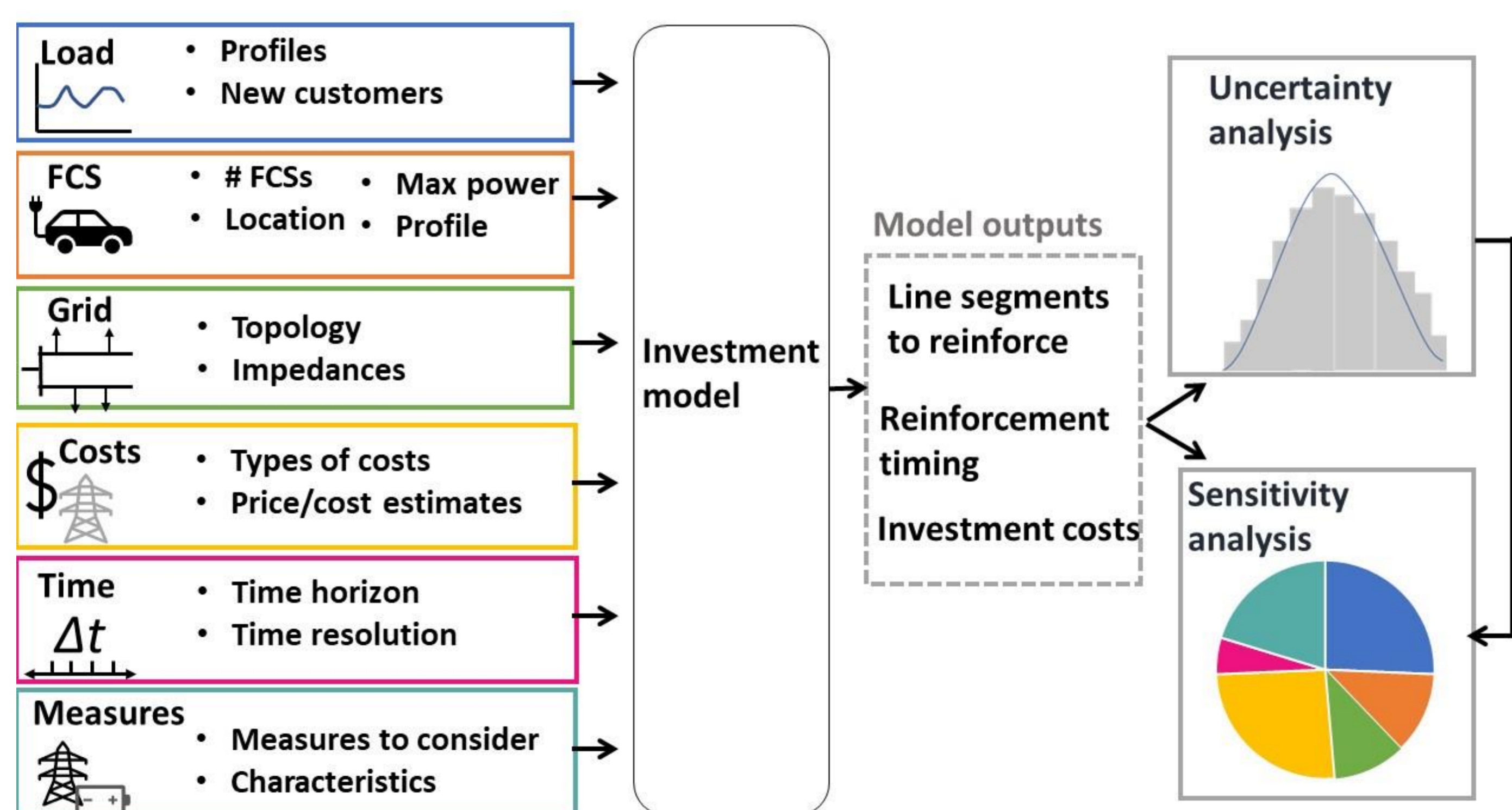

Figure: Illustration of the concept of sensitivity- and uncertainty analysis in the context of investment planning and grid integration of fast-charging stations

Expected results

- Sensitivity indices, visualizations and ranking of the input factors' individual and joint contribution to the output uncertainty.

- Guidelines for ranking of priorities for data gathering- and modelling efforts in grid planning. I.e., which inputs are most important to model as accurate as possible? Are the input factors related to EV charging important compared to the other input factors in the planning problem?
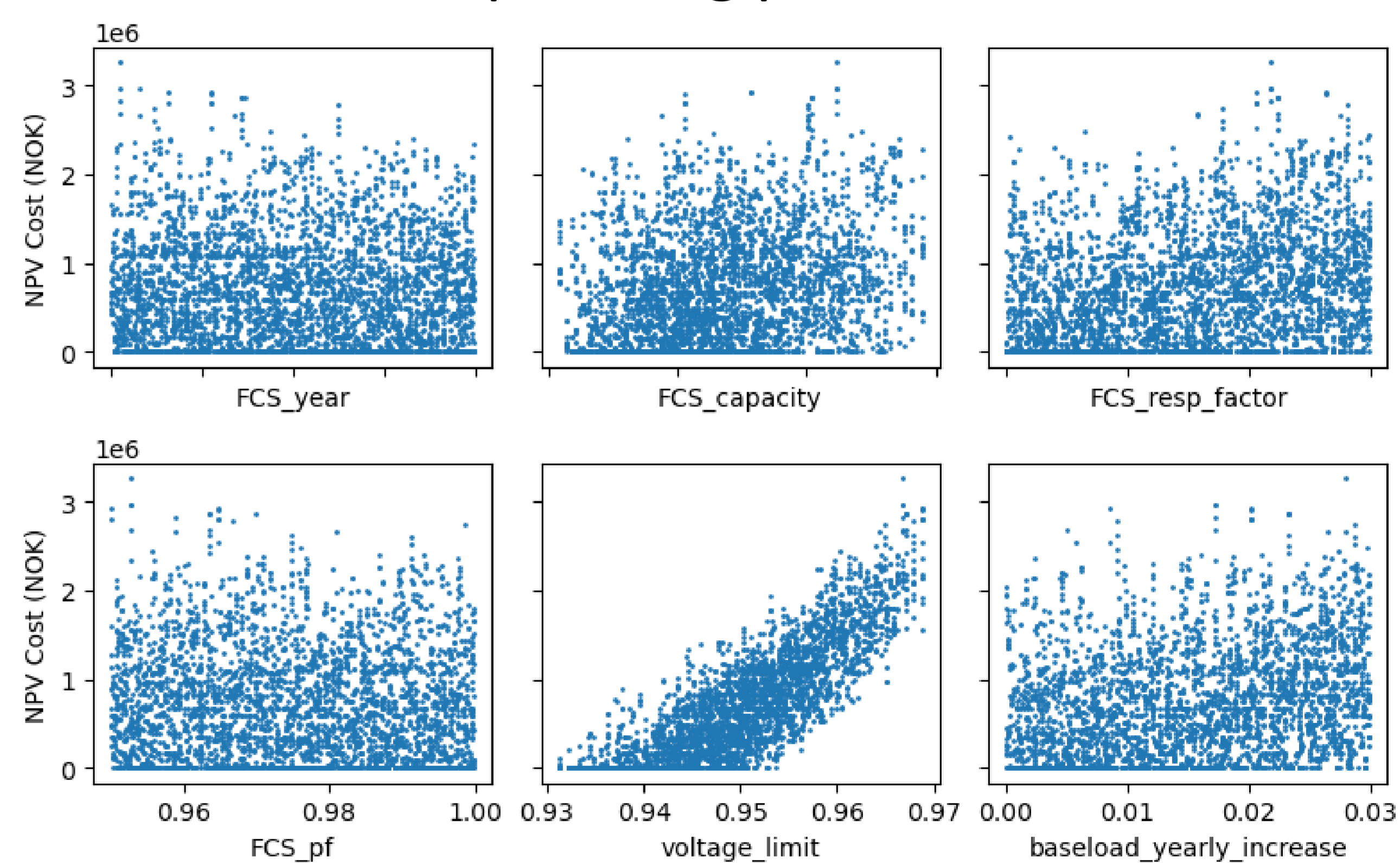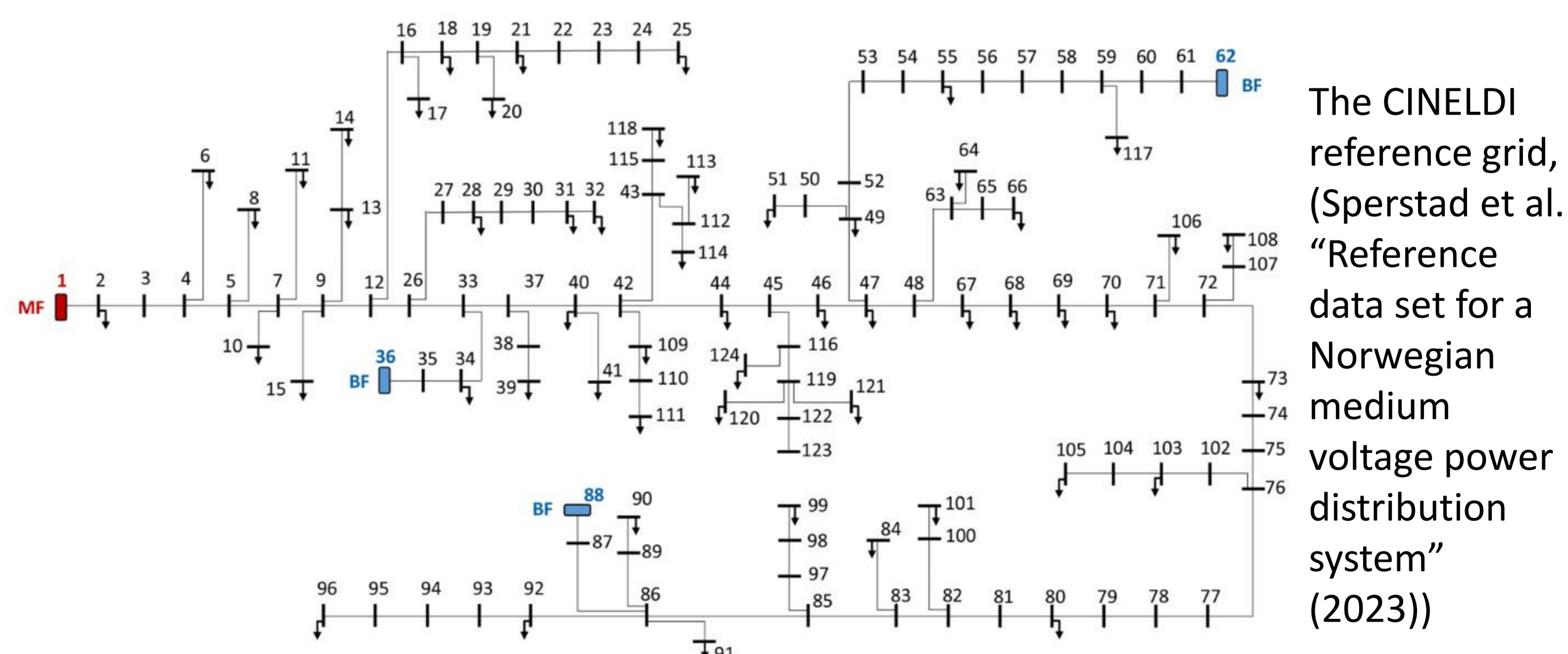

Figure: Scatterplots showing the investment cost (y-axes) when six different input factors (x-axes) are varied within specified ranges of uncertainty.

The CINELDI reference grid, (Sperstad et al. "Reference data set for a Norwegian medium voltage power distribution system" (2023))