This study investigates the applicability of range analysis, which provides a series of values for each coefficient or constant through which the current solution can remain optimal, to the LP-based bottom-up energy systems model.

A simple hypothetical energy system model is considered (Fig. 1).

By comparing the standard approach with the range analysis approach (Fig. 2), the results show that range analysis can provide additional, useful information such as an accurate marginal abatement cost curve (Fig. 3), and cost targets for the introduction of new technologies (Fig. 4).

Figure 1: Overview of the simple hypothetical energy system model (6 variables, 4 constraints)

Figure 2: The optimization results with different CO₂ costs. (a) Trade-offs between cost (value of obj. func.) and CO₂, (b) the corresponding optimal solutions (tech. mix) by the standard approach, and (c) by range analysis

Figure 3: Comparison of CO₂ marginal abatement cost curves

Figure 4: Ranges of objective function coefficients (unit cost of technology) for six different technologies