Finding tight and compact models for energy system modeling

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Résumé

To achieve climate goals by 2050, accurate energy system optimization (MIP) models are needed to help decision-makers make investment plans. To increase the accuracy of these MIP models, a high resolution in the temporal and spatial dimensions is needed, as well as many details on the operational capabilities of energy generators. However, this results in large-scale models, of which the optimal solution cannot be obtained within any meaningful computing time, not even by supercomputers using the best possible solvers. Thus, researchers often seek the right trade-off between computational tractability and accuracy. Still, they forget that improving the existing model formulations in terms of tightness and compactness could already improve computation speed. The tightness of a formulation increases if the LP-relaxation is closer to the convex hull of the MIP model. The compactness of a formulation depends on its (relative) number of constraints, variables, and nonzero elements in the constraint matrix. In my talk, I want to share different ways to obtain and prove tight and compact MIP models to improve the computational tractability of large scale optimization problems, and open the discussion on how we might be able to do this more automatically, and on a broader scale.

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