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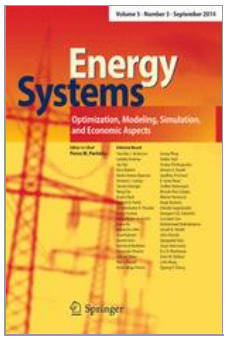
Mathematical optimization for challenging network planning problems in unbundled liberalized gas markets

Abstract

The recently imposed new gas market liberalization rules in Germany lead to a change of business of gas network operators. While previously network operator and gas vendor were united, they were forced to split up into independent companies. The network has to be open to any other gas trader at the same conditions, and free network capacities have to be identified and publicly offered in a non-discriminatory way. We discuss how these changing paradigms lead to new and challenging mathematical optimization problems. This includes the validation of nominations, that asks for the decision if the network's capacity is sufficient to transport a specific amount of flow, the verification of booked capacities and the detection of available freely allocable capacities, and the topological extension of the network with new pipelines or compressors in order to increase its capacity. In order to solve each of these problems and to provide meaningful results for the practice, a mixture of different mathematical aspects have to be addressed, such as combinatorics, stochasticity, uncertainty, and nonlinearity. Currently, no numerical solver is available that can deal with such blended problems out-of-the-box. The main goal of our research is to develop such a solver, that moreover is able to solve instances of realistic size. In this article, we describe the main ingredients of our prototypical software implementations.



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