

Tight and compact MILP formulation for a high-resolution of start-up costs in the medium-term unit commitment

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Abstract-

Nowadays, most modern power systems are evolving towards a considerable capacity expansion in their energy storage and interconnection facilities. However, these great developments are not being accomplished fast enough to accommodate the high penetration of variable renewable energy sources. This situation raises demand variability, requiring more flexibility from thermal generators, especially due to their more frequent start-up and shut-down processes. Consequently, the unit commitment requires more accurate and detailed modeling while maintaining computational efficiency. This paper analyzes some of the best models to manage long-duration start-up costs according to the real fuel-consumption curves of a gas-fired generation portfolio. Moreover, we propose a tight and compact MILP piecewise formulation that enhances the resolution of start-up representations and achieves outstanding results compared to the literature benchmarks. The successful performance of this methodology is proven in several large-size case studies focusing on the medium term. Furthermore, conventional day-ahead problems are also run to demonstrate the overall competitiveness of the formulation.

Index Terms- Start-up costs; Unit commitment; Medium-term models; Piecewise linearization; Mixed-integer linear programming

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Citation:

Montero, L.; Morales-España, G.; Bello, A.; Reneses, J. "Tight and compact MILP formulation for a high-resolution of start-up costs in the medium-term unit commitment", Sustainable Energy, Grids and Networks, vol.44, pp.101935-1-101935-12, December, 2025.