Integrated power and natural gas model for energy adequacy in short-term operation

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Abstract— The significant growth in gas-fired units worldwide has increased the grade of interdependency between power and natural gas networks. Since these units are usually required to ramp up during the peak and backup intermittent renewable generation and contingencies, the power system tends to demand more flexibility and reliability from the gas system. This paper contributes with a novel mixed-integer linear programing (MILP) formulation that couples power and gas networks taking into account the gas traveling velocity and compressibility. As a result, the model accounts for the gas adequacy needed to assure the power system reliability in the short term. The robustness of the MILP formulation allows guaranteeing global optimality within predefined tolerances. Case studies integrate the IEEE 24-bus system and Belgian high-calorific gas network for validating the formulation.

Index Terms— Integrated energy systems, natural gas networks, reliability, short-term operation, unit commitment.

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