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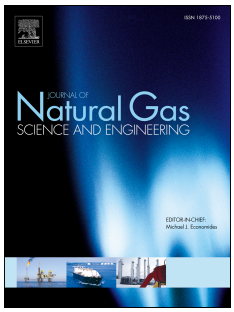

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Carbon Dioxide Source Selection and Supply Planning for Fracking Operations in Shale Gas and Oil Wells

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Abstract

As a promising alternative approach for shale gas and oil withdrawal, fracking using CO_2 instead of water has been proved to be not only technically feasible but also environmentally friendly. This paper aims at evaluating CO_2 fracking from an economic perspective by considering the collection, supply, transportation, and storage of CO_2. More specifically, a CO_2 source selection and supply planning problem is defined and discussed from three aspects: CO_2 collection and storage at sources, CO_2 transportation, and CO_2 storage and usage at well pads. Cost models for the three aspects are built, based on which, a mixed-integer nonlinear programming model is developed to determine the optimal set of sources, the corresponding supply and transportation plan, and the investment in associated facilities and equipment. A two-stage algorithm is proposed, which decomposes the original model into a large set of simple sub-problems and a mixed-integer linear problem. A case study for three emerging well pads in North Dakota is presented to illustrate the implementation of the mathematical model and algorithm, and a sensitivity analysis is conducted to analyze the influences of four key parameters over the cost of using CO_2.

Keywords: CO_2 fracking; source selection; supply planning; mathematical model; two-stage algorithm; sensitivity analysis.