SAND2013-9225P

Natural Gas Supply Shock Propagation:

An Agent-Based Approach

The Sandia's Natural Gas LDRD and the Natural Gas Initiative is an effort to understand the long-term implications of the natural gas supply shock, its propagation, and the effects of different policies and regulations. The project aims to develop a multi-model, multi-timescale spatially-based framework to represent the NG network evolution, as it is affected by the decisions of investors, consumers, and regulators.

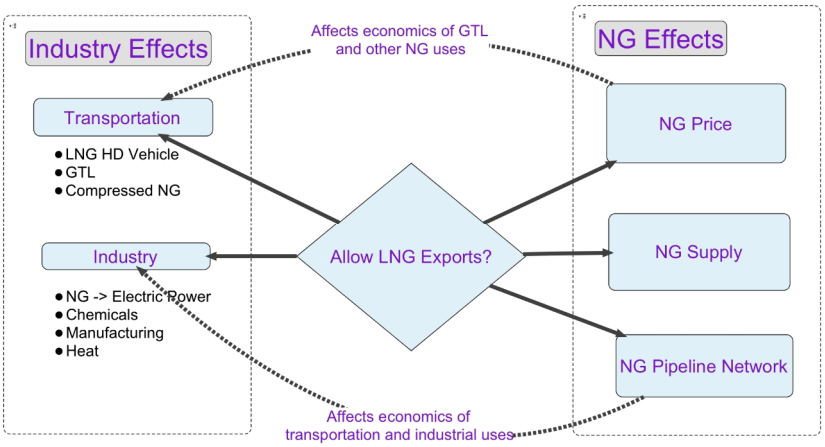

Figure 1. A partial outline of possible effects of allowing LNG exports. This diagram represents the effects on price and supply and the effects on possible competing uses of NG.

The NG network operations are represented by an existing NG network model, developed at Sandia (GAM). The long-term investment and consumption decisions will be represented by an agent-based model integrated with GAM. The NG supply is modeled by a system dynamics framework. The key feature of our approach is the ability to represent the effects of the decisions made by multiple independent entities (LNG exporters, regulators…) and the resulting potentially path-dependent and non-linear NG system evolution. The Figures 1. and 2. represent respectively the interactions and the time scales modeled. The main challenge to the project is to acquire the data on the investment decisions and consumption choices and to quantify the associated uncertainty for a set of scenarios. To date, we have demonstrated the approach on an example the LNG exports scenario and evaluated its possible effects on the current NG network state and operations.

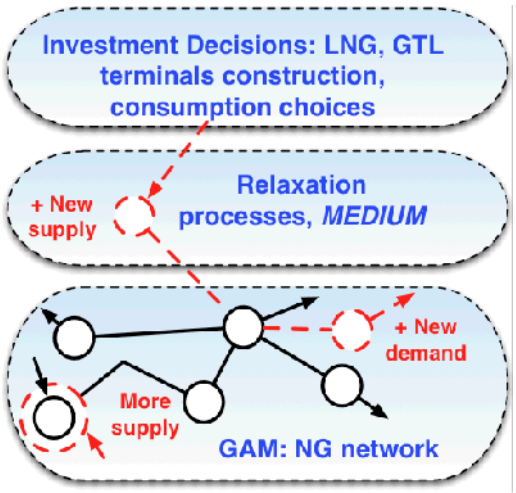

Figure 2. Model components operating on different time scales.

Select Publications:

Barter, GE, D. Reichmuth, J. Westbrook, LA Malczynski, TH West, DK Manley, KD Guzman, DM Edwards, 2012. Parametric analysis of technology and policy tradeoffs for conventional and electric light-duty vehicles. Energy Policy, Elsevier.

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Kobos, PH, MA Cappelle, JL Krumhansl, TA Dewers, A. McNemar, DJ Borns, 2011. Combining power plant water needs and carbon dioxide storage using saline formations: Implications for carbon dioxide and water management policies. International Journal of Greenhouse Gas Control, Elsevier

Mitchell, RA, WE Beyeler, ML Wilson, TF Corbet, Jr., 2010. Modeling Natural Gas Pipeline Networks Using the NISAC Gas Allocation Method. Sandia National Laboratories, unpublished memo.

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