III.9 Impact of Hydrogen Production on U.S. Energy Markets

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Brookhaven National Laboratory (BNL), Upton, New York
Power & Energy Analytic Resources (PEAR), Atlanta, Georgia

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Objectives

- Develop a consistent, integrated framework for evaluation of impacts of hydrogen production within U.S. energy markets.
- Evaluate costs and timeliness of various scenarios for developing hydrogen supply infrastructure.
- Evaluate impacts on U.S. energy markets, including price and consumption changes for coal, natural gas, renewables and electricity.
- Identify most economic routes and financial risks of hydrogen production infrastructure.

Technical Barriers

This project addresses the following technical barriers from the Systems Analysis section of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan:

- B. Lack of Consistent Data, Assumptions, and Guidelines
- C. Lack of Macro-Systems Model
- E. Lack of Understanding of Transition of a Hydrocarbon-Based Economy to a Hydrogen-Based Economy

Approach

Energy and Environmental Analysis, Inc. (EEA), together with BNL and PEAR, will conduct an analysis of options and tradeoffs involved in the establishment of a hydrogen production infrastructure using a new version of the MARKAL model. MARKAL is an integrated, intertemporal analytical tool capable of evaluating changes in energy markets over the long term (2005-2050). For this project, MARKAL will be modified to incorporate the latest and most consistent cost and performance data for alternative hydrogen production technologies and will be built out to represent separate regions of the U.S. A key focus of the work

will be to evaluate impacts of an evolving hydrogen economy on U.S. energy markets, including price and consumption changes for coal, natural gas, renewables and electricity.

The project will examine alternative scenarios to identify the characteristics of a hydrogen production infrastructure developed over time to service hydrogen demand, including hydrogen fuel cell vehicles introduced for mass marketing starting around 2020. The analysis will deal with the competition among different production technologies with respect to hydrogen demand levels, technology costs, regional cost variations, transmission costs, carbon sequestration options and costs and the impact of hydrogen production on production feedstock prices. The analysis will describe alternative technological, regulatory and market scenarios and will calculate optimal solutions for energy system configuration and build-out over a time horizon through 2050. The final report will discuss the key issues affecting development of a viable hydrogen infrastructure, including potential stranded assets and hydrogen production infrastructure bottlenecks, and will provide detailed information for use in further targeted analyses including the Macro System Model.