**The Role of CCS in Meeting Clean Energy Standards**

 Christopher Nichols, National Energy Technology Laboratory, 304 285-4172, Christopher.nichols@netl.doe.gov

Peter Balash, National Energy Technology Laboratory, 412 386-5753, Peter.balash@netl.doe.gov

Nadejda Victor, IBM, 412 347-2304, Nadejda.Victor@IB.NETL.DOE.GOV

## Overview

In his recent State of the Union address, President Obama proposed a Clean Energy Standard (CES) to require that 80 percent of the nation’s electricity come from clean energy technologies by 2035. Advocates of a CES maintain that requiring the deployment of increasing amounts of clean electricity can lead to a variety of benefits, such as the reduction of greenhouse gases and other emissions, as well as an increase in domestic manufacturing of associated technologies. In contrast, opponents have claimed that a federal electricity mandate, depending on its design, could pick winners and losers among competing technologies and serve as a tax that may cause a wealth transfer from those regions of the country lacking compliant resources.

This paper examines the role that research and development into carbon capture and storage can play within the context of a CES. We used MARKAL to run a number of scenarios comparing various parameters such as CO2 emissions, prices and total system costs in a CES environment. We compared these parameters in cases where Carbon Capture and Storage (CCS) R&D has successfully brought down the cost and improved the performance of CCS technologies.

## Methods

## The Market Allocation (MARKAL) model will be used to generate future scenario projections incorporating the a Clean Energy Standard and advanced R&D cases for CCS. MARKAL is a data-driven energy-economic model, used by over 75 institutions in 37 countries. The user specifies the energy system structure, including resource supplies, energy conversion technologies, end-use energy service demands, and the technologies needed to satisfy these demands. The user must also provide data to characterize individual technologies and resources, including their fixed and variable costs, availability, performance attributes, and pollutant emissions. MARKAL then provides a least-cost combination of technologies to satisfy the given demand. Using published cost and performance data from systems studies, improvements in the cost and performance of CCS technology will be charaterized within the MARKAL framework. Then, a number of scenarios will be performed to examine the impacts of the new technology under variations in carbon control regimes, and resource price and availability. Parameters such as price of energy products to consumers (electricity and liquid fuels), CO2 emission levels and price, and overall energy system costs will be used to assess the value of CCS in the context of a CES.

## Results

Initial results indicate that under a CES, CCS with both gas and coal plays an important role in the electricity sector, as seen in the figure below:

However, a CES does little to reduce emissions from other sectors, especially the transportation sector as seen below:


## Conclusions

Initial results from the model runs indicate that improved CCS technologies would allow for more latitude in achieving CO2 reduction targets and allow the system to meet the constraints of a CES at lower cost. Also, a CES does virtually nothing to reduce emissions from other sectors, most especially the transportation sector. Other options must be considered to reduce emissions and improve energy security for these sectors.

## References

Bingaman , Jeff and Murkowski , Lisa, 2011, “**Clean Energy Standard (CES) White Paper”**

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