Comment Submitted for the DOE Quadrennial Technology Review for Energy

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DOE's Energy Quadrennial Technology Review (QTR) requests input on the focus and makeup of Doe funded energy RD&D moving forward in time. The QTR at several points projects in the need for a balanced "agnostic" allocation of resources for energy technology development. Yet DOE's planned budgets for carbon management of fossil energy are being cut. This decision, represented in the President's budget request and subsequent dialogues with Congress, seems based on a number of assumptions regarding the value of fossil energy carbon management technology and the potential market for technology innovations.

The dynamic nature of markets and technical developments in recent years point to the limited capability to predict the ultimate value of RD&D based on anticipated markets, fuel price projections, and socially defined research agendas. Yet DOE proposed budgets limit or remove R&D investments from potentially key contributors to long term energy solutions such as fuel cells. The fundamental problem is that when funding is removed, the technology developed to that point is often permanently lost and in many cases goes overseas or must be recaptured later when the perceived value of the research changes.

Some examples; as late as 2008, the importance of shale gas as a domestic energy resource was not factored into estimates of natural gas cost, or the importance of natural gas as a short term contributor to greenhouse gas reduction; and even DOE's current projections ignore the potential size and importance of plays such as Marcellus to ensure long term availability of cleaner energy through natural gas. As another example, current DOE estimates of the eventual "cost" of carbon capture and the subsequent market for carbon capture technology ignore the potential for breakthrough power generation technologies such as chemical looping to all but eliminate the predatory energy cost of carbon capture. Chemical looping technology should produce the same thermal efficiency as a typical CFB for use in production of steam or electricity. However, a nearly pure carbon dioxide stream is produced without any energy penalty.

First, as to the role of fossil energy research, without a substantial investment of additional RD&D, shale gas plays may be limited by the potential for environmental damage and the value of chemical looping for near term carbon management may not be properly evaluated. In short, predictions of low natural gas fuel prices due to development of the abundant Marcellus may not materialize and coal technologies may prove to be both efficient and environmentally friendly. In the face of such uncertainty, research in both areas should be continued. If research is not continued the technology may be lost forever as has happened many times.

Second, in light of the volatility of current predictions and the potential for game changing "black swans" to influence the value of energy technology investments; a Real Options approach to investments in energy technology RD&D seems more appropriate. Using such an approach DOE would manage investments based on the opportunities that are maintained and the flexibility to produce timely breakthroughs as needed. Using such an approach DOE would plan its RD&D investments around 1) keeping the US's technology options open and 2) making investments that US commercial businesses cannot make. This approach would, we think, better ensure the value of RD&D investments for maintaining US competitiveness and our credibility

to influence world markets. This portends a significantly greater RD&D investment in fossil energy technologies than those in current projected budgets. It also projects a need for the QTR to utilize a formal Real Options approach to evaluating RD&D focus and scope. This approach would be sensitive to current projections and social drivers; but aware of the transient nature of such projections and the need to plan for many possible futures.

Thank you for your kind attention.

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