Thank you. It is a pleasure to talk to all of you today to introduce you to the ERD3 project and to our progress.
To give you an overview of what I’ll talk about in the next 15 minutes, I am going to talk about the expert elicitation work that my colleagues and I are doing in support of our project, Energy Research, Development, Demonstration and Deployment, paid for by the Doris Duke Charitable foundation.

To begin with, I’ll give you an update of how many elicitations we’ve completed by industry. Followed by a general outline of the elicitation model we are following. Our scope, objectives, policy assumptions. Finally, I’ll discuss how this work can inform project, program, and budget decision makers, as well as problems that we’ve run into as we’ve been implementing our elicitations.
We are focusing on 7 technology areas, covering supply side and demand side energy technologies.

As you can see, we have completed our fossil energy, bioenergy, grid-scale energy storage, nuclear energy, and light-duty vehicle technology elicitations.

We are still receiving answers for our building envelope and photovoltaics elicitations.
Expert elicitation outline

Part I: Purpose and Overview
Provide survey outline

Part II: Background Data
Provide current state of the art
1. Current federal and private RD&D budgets
2. Current technology efficiency and cost

Part III: Explanation of Bias and Overconfidence
Raise awareness of need to think broadly in probabilistic ranges

Part IV: Expertise Level
Ascertain expert's technology knowledge

Part V: Baseline Technology Performance and Cost
Expert's expected technology performance and costs (2010, 2030)

Part VI: Design Federal RD&D Budget
Recommend budget and technology portfolio

Part VII: Revised Technology Performance and Cost
Expert's expected technology and costs if RD&D budget and technology portfolio are implemented
Our elicitations focus on collecting U.S. expert opinion about the state of RD&D in the U.S. and how it will develop through 2030. We ask American experts only, in order to get their advice on federal spending. The results of the elicitations will be used to form recommendations for the U.S. government and agencies.

I’ll add here that although we are focusing on the U.S. as a whole, we ask experts to consider specific regions in cases that technology applications might be regions specific.
OBJECTIVES

Obtain expert opinion about the current and future state of technologies

- Probability distribution functions (PDFs) of technology cost and performance
  - Business as usual
  - With RD&D investment
- Comparison of multiple technologies and innovation stages

Obtain expert recommendations

- Budget and allocation
- Deployment policies and incentives

Excerpt from a poker chip game asking experts to allocate budget among technologies by innovation stage

Added to our scope, we are seeking expert opinion about the current and future state of technologies.

Towards this end, as I described before, we are collecting probability distribution functions of technology cost and performance with business as usual government funding and with revamped RD&D investment. We also ask experts to compare multiple technologies and innovation stages when making their recommendations for a revamped RD&D budget.

As a result, we obtain budget and allocation. We also ask them qualitative questions about deployment policies and incentives.
Policy context

- Baseline from Annual Energy Outlook 2010
  - Technology performance standards (examples)
    - Appliances
    - Buildings
    - Vehicles
  - Environmental regulations (examples)
    - Clean Air Act
    - Corporate Average Fuel Economy

- Alternate policies gathered from experts
  - Varying buildings performance standard
  - Deployment (examples)
    - Incentives
    - Standards

The elicitations are based on the assumption that there is no change from policy assumptions made in the Annual Energy Outlook 2010.

Specific changes to energy policy are aggressive building code scenarios for building envelope experts, and deployment incentives and standards that we elicit from experts in our elicitations. While we asked the building experts to consider an advanced building performance standard, the experts’ recommended deployment incentives and standards are not accounted for in their cost and performance estimates.
We expect that our elicitation results can inform program or project level decision makers and corporate level decision makers.

We collected technology and policy recommendations from the experts. The technology recommendations can be directly used by program or project level decision makers, and the policy recommendations can be used directly by the corporate level decision makers.

The technology recommendations, after being refined through discussions with high-level reviewers, results in budget size and allocation recommendations that can be used by corporate level decision makers about technology portfolio RD&D.
While we have tried our best to understand how technology performance and cost will change due to government spending, there are some things that we could not easily ask experts to quantify. First, it’s not clear how much of the technology change is due to government spending alone or due to private spending and activity. It’s also not clear how much additional private spending and activity occurs (and so affects technology change) due to revised government spending.

Second, as we are assembling recommendations for spending, we may be double-counting recommended spending for interdisciplinary research. For example, we asked bioenergy experts whether there is complementary research to be done with fossil energy technologies and we asked fossil energy experts about complementary research with bioenergy technologies. It’s not clear that adding the recommendations from both sets of experts results in a budget for both technologies.
Research obstacles

Communicating with experts

- Double-checking experts answers
  - Internet based elicitation helps experts self-check answers

- Experts might be biased or anchoring

Experts appear unbiased, and to heeded our warning about bias. They are willing to fund technologies regardless of their self-proclaimed expertise level per technology.

But their estimates of future costs coincide with, or are optimistically lower than projected costs. In this example, we see experts biogasoline costs around or lower than the 2030 conventional gasoline cost projected by the Energy Information Administration.

Lastly, there are some problems we ran into with expert elicitation. The first problem was easier to solve than the second. We found that we had to call experts and check their answers for consistency, but when we started posting elicitations online they were able to do reality checks in real time on their own.

The second problem is proving more difficult because we don’t know that we can prove what we think might be happening. The experts might be biased towards their technology area (that is, bioenergy experts are optimistic about the future of bioenergy) and they might be anchoring their estimates to a published future estimate. As you can see here on the left, the experts appear unbiased, as they are willing to fund technologies within their technology area regardless of their self-proclaimed expertise level. But on the right, we see that their estimates of future costs coincide with, or are optimistically lower than projected costs. In this example, we see experts biogasoline costs are around or lower than the 2030 conventional gasoline cost projected by the AEO 2010.
Thank you

- To our advisory board, Matt Bunn, Venky Narayanamurti, Kelly Gallagher, and John Holdren for comments on our method;
- To the Doris Duke Charitable Foundation for our research grant;
- To all of you for your attention, time, and feedback.

This is the end of my presentation. Thank you for your attention.