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Dr. Paul J. Hommert
President and Laboratories Director

April 15, 2011

Steve

Mr. Steve Koonin
Under Secretary for Science
U.S. Department of Energy
1000 Independence Avenue SW
7B-058/FORS, S-4
Washington, D.C. 20585

Subject: QTR Framing Document

Dear Steve:

Thank you for the opportunity to comment on the QTR framing document. We feel that this is an extremely important undertaking by the Department of Energy and stand ready to support you during the next steps of gathering community input through topical panels. The attached document summarizes our feedback. I applaud the personal energy and leadership you've brought to this effort.

The attached document summarizes our feedback which I hope you and your team will find useful.

I'd like to emphasize one area where I believe Sandia can be particularly helpful. We have a strong and positive history of successful industry partnerships which I believe will be a key foundational enabler of the eventual DOE strategy. This is noted in your document. Although not specifically requested in the QTR draft, we are eager to help provide our experience and learning in this area should you be interested.

Sincerely,

Paul

Attachment

Sandia Feedback to the DOE QTR framing document

General Comments:

1. *The central role of industry in addressing our energy challenges is very well articulated in the framing document, as is the role of DOE in supporting precompetitive research. A wide range of technologies will be required and we support the approach of DOE in not picking technology winners at an early stage of research.*

2. *Additional goals may be useful to accelerate progress. Some suggestions are: 1) reduce petroleum use AND increase the production of domestic carbon-neutral alternative fuels; 2) reduce GHG emissions from the electricity and transportation sector; 3) increase the security and resiliency of the electric grid as well as the oil and gas infrastructures; 4) create new US based energy jobs.*

3. *Another challenge that one might consider highlighting is the aging infrastructure (electricity, oil, gas) and the reliability, safety and security challenges this poses to the nation. A related dimension is the increasing energy security challenges represented by cyber. This is a natural interface between DOE and DHS.*

4. *A key aspect to the successful implementation of new technologies is the understanding and ultimate acceptance of the technologies by consumers and the public at large. Recommend consideration of the technology portfolio simultaneously with consideration of policy, economics and general human behavior.*

5. *Rigorous and quantifiable systems studies to guide technology development strategy and policy decisions may be of great value to the QTR activity or as an outcome to be worked in the following year. This would also provide a systematic, transparent methodology for understanding how an improvement on one hand might cause a problem elsewhere. For example, electrifying the light duty vehicle fleet could increase GHG emissions if the electricity comes from conventional coal fired power plants. The need for systems approach is highlighted by the (direct rebound), (indirect rebound) discussion in section 2.2.*

6. *The QTR is narrowly focused on technologies. A future QER will need to address:*
   - *a) State and local policies and objectives*
   - *b) International codes and standards*
   - *c) Energy assurance both civilian and DoD*
   - *d) Resiliency of energy supply and delivery (including cyber threats..)*

e) Global energy infrastructure
f) Environmental impacts

7. *Should consider further clarification of the $3B energy supploy R&D in 2010. This number seems small when compared with the $4.3B Federal investment in energy RD&D.*
8. *Consider indicating the fraction of the overall trade deficit related to crude imports. – Section 3.1*
9. *Amplify in Section 3.1 the extreme volatility to supply that comes from the likely long-term instabilities associated with Middle East supply (price shocks, e.g., Libya not resulting from sustained demand growth.)*
10. *The central column of the strategies matrix (figure 2) could potentially be characterized as delivery, making the three macro elements "Supply", "Delivery" and "Demand". Delivery includes not only the electrical grid but also potential new infrastructures needed in the transportation sector (charging stations, biofuel distribution, hydrogen reformers..)*

11. *Given the dominance of coal in today's electricity production and the size of our domestic reserves, more discussion about the future of coal is warranted including what will be required to transition to cleaner coal fired plants. These plants will be a significant part of the stationary power infrastructure for some time.*

Question 1 What do you think of the following mission statement for DOE energy research?

Suggest the following edit: *To facilitate the invention, refinement, and early deployment of meaningful technologies that promote energy security and enable options for scaling by the private sector toward national energy goals. [We recognize that energy security is a subset of national energy goals but feel it deserves special emphasis.]*

Question 2. How can DOE activities best support U.S. leadership in clean energy innovation? In clean energy manufacturing? In clean energy deployment? How do we balance international competitiveness against international cooperation?

Innovation: Support public private partnerships that provide early risk reduction for the private sector. Develop and publish outcome driven (e.g.

with performance goals) clean energy roadmaps to make it clear what the Department's enduring objectives are.

Clean energy deployment: Coordinate development roadmaps with State's policies and goals. Establish national standards such as clean air standards, energy star ...

Clean energy manufacturing: Work with industry to establish R&D roadmaps for manufacturing technologies.

International balance: Work to establish global standards. Support collaborative, international precompetitive research. Develop open test-bed facilities for technology testing and evaluation for the sharing of information and best practices.

Question 3.What principles should the Department follow for allocating resources among technologies of disparate maturity and potential time to impact?

a) **What should be the criteria for including a technology in the DOE portfolio? What should be the criteria for removing a technology from the DOE portfolio? How should programs be structured and managed to accommodate entry and exit of technologies within the DOE portfolio?**
b) **How do we balance the diversity of technology options the Department could provide for the private sector against timeliness, scale, and cost-effectiveness?**
c) **How can DOE be more effective at each stage of the innovation chain?**
d) **What are useful metrics to guide DOE technology activities?**

The DOE must have principles that ensure they are supporting a portfolio that extends from early stage research to late stage technology risk reduction. Investment principles should be outcome focused and measured against the metrics articulated in the energy goals. Given the importance of the private sector in delivering solutions, the Department should form an Industrial Advisory board to provide input on creating investment principles. Investments should be driven by long range DOE plans, on order 10 years, that are semiannually refreshed and globally informed. Investment strategies should support technology roadmaps and be aligned with federal policy. In turn, federal policy will be the driver to incentivize industry participation.

Question 4. What are the optimal roles for the private sector, government laboratories, citizens and academia in accelerating technology innovation?

a) **How can DOE best coordinate activities between and among these types of organizations (including the wide variety of institutions within each class)? How should we gauge the effectiveness of this coordination? How can the basic-applied coupling be optimized? Are there examples in other sectors or other countries that can serve as models?**
b) **What are the design principles for an effective 'technology user facility'?**
c) **How can the Department best gather technology market information? How can information on private sector innovation be captured without compromising competitive advantage?**

States are key players in the deployment of technologies and setting energy policy so need to be included. As the risk of new technologies or concepts is reduced, DOE's role should diminish and private sector roles should increase.

Education and outreach to energy consumers (residential, commercial and manufacturing) is critical for successful adoption of new technologies.

Question 5. What are principles and best practices in performing large-scale demonstration projects?

a) **How close to commercial viability does a demonstration have to be? What are the optimal cost sharing arrangements? How might demonstrations be coordinated with DOE financing activities?**
b) **How can demonstration projects better benefit all stakeholders beyond the immediate participants? How are lessons-learned best captured and promoted, and how is intellectual property best handled?**
c) **How should DOE determine whether demonstrations adequately address technical and operation risks?**
d) **What defines failure or success in the demonstration phase?**

The objectives of Large-scale demonstration projects should be

1. *Test new technology solutions deployed at near scale to gather operational learning needed to identify any needed modifications/improvements prior to full-scale deployment.*
2. *Gather consumer based input relevant to technology options.*
3. *Reduce risk sufficient for the private sector to be able to invest alone in full-scale deployment.*

Question 6. A number of non-technical barriers including federal, state and local regulations, market failures, and non-technical risks impact the rate of

deployment of energy technologies. What, if any, role should the Department have in addressing these barriers?

> *We suggest the following re-phrasing of the question to a more positive approach: "What role should the Department have in addressing/creating enablers for new energy technologies?"*
>
> *To successfully deploy energy solutions, barriers at the state and local level must be addressed. The Department should have a structured state outreach function that tracks local policies and goals and coordinates with Federal priorities. A good example is the need to coordinate and capitalize on the smart metering investments (ARRA) with implementation challenges at the state and local level to understand non-technical issues associated with consumer adoption concerns along with setting consistent goals/standards across the country. The Department should invest in programs related to human behavior since technology without a committed user is not a solution.*

Question 7. Have we correctly identified and structured these six strategies?

The six strategies are good. It is not clear where to address the need for closing the cycle on waste byproducts which are created throughout the energy supply, delivery and end use phases. Spent nuclear fuel, CO_2, and contaminated or heated water are all waste byproducts that need to be addressed systematically. In tandem with the framework it is necessary to address the interdependencies between the stationary and transportation sectors (e.g. electricity produced by carbon rich technologies).

Question 8. We welcome comment on the selection of these technologies and sources, as well as suggestions of alternate technologies and sources, and updated technology, cost, and forecast data, particularly in rapidly-moving fields.

In the Transport section, there is a need to be more explicit about deploying alternative fuels, which have the potential for being produced domestically. In the stationary section, a strategy for transitioning from today's supply infrastructure to a "cleaner" electricity supply should be developed. There is currently mention of each individual contributing technology, but no description of how the transformation from today's enterprise will occur and what DOE's role will be in reducing the risk of such a transformation.