Response to DOE 2011 Framing Document

1) What do you think of the following mission statement for DOE energy research?
General agreement. It would be good to somehow impart a certain urgency of transition from existing to future technologies.

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?
DOE should clearly and precisely define what they mean by clean energy technologies; there is not universal agreement about that definition, and therefore, not a clear goal for those trying to help.
U.S. leadership in clean energy science, technology, and product development can be supported by government initiated and sponsored programs to create a market by stimulating the private sector, by sponsoring universities to educate a workforce on clean energy, and by providing business incentives to invest and innovate in the area.
The balance between international competitiveness and cooperation is not an easy problem. A possible example is the International Space Station, but not sure if this is good example.

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?[2]
Technologies should align with DOE's mission. However, thresholds such as "enter[ing] commercial application at a minimum of 1 Quad annually by 2030" (pg. 17) does not apply to fundamental research (e.g. BES programs). Research should be driven by ideas, not by a bottom line targets. Allocation for fundamental research should be determined by its potential impact and alignment with DOE's mission. Rate of progress to implementation is another useful criterion (which also involves the level of support around the world), but the US is a special case; we need to use our special resources (materials, skills, academic and intellectual power) to lead a limited number of technologies, by choice.
b) How do we balance the diversity of technology options the Department could provide for the private sector against timeliness, scale, and cost-effectiveness?
DOE needs to be an anchor and backstop, and stimulus. Industries (which will invest more than our government in some technologies) will do nothing if the DoE does not show interest in a given area.

c) How can DOE be more effective at each stage of the innovation chain?
d) What are useful metrics to guide DOE technology activities?
Degine national needs; develop foundation for competitive pursuit of technology in those areas. Sustain a well defined focus over as many years as possible so that others can plan, fund, and execute directed efforts to produce technology.

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?

University-lead centers have been demonstrated to be successful in coordinating activities between the private sector, academia, government laboratories, and citizens. For example, NSF Engineering Research Centers have for many years served as an integration platform for academia and industry. Another example is SEMATECH, an industrial consortia that has accelerated the commercialization of semiconductor technology innovations into manufacturing solutions. DOD University Affiliated Research Centers were established to ensure that essential engineering and technology capabilities of particular importance to the DoD are maintained, but centers such as ARL-Penn State work closely with private sector, government laboratories, and academia. These examples suggest useful directions.

b) What are the design principles for an effective 'technology user facility'?[3]

User facilities should provide a unique capability and have a broad user base. A user facility for a particular technology may have too narrow of a focus, and its user base may be limited. Perhaps a user facility on clean energy technologies, with several technologies in its portfolio would serve the community well.

c) How can the Department best gather technology market information? How can information on private sector innovation be captured without compromising competitive advantage?

Allow a third-party with no vested interest, such as a university or government entity, to mediate the exchange of information.

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?

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?

The role DOE has in addressing these barriers is critical and essential since these barriers encompass more than just technology. DOE should also be able to influence policy across federal, state and local entities (as described in pg. 14).

7) Have we correctly identified and structured these six strategies?

In Transport, just progressively electrifying the fleet does not necessary result in vehicle efficiency. We should look at the entire fuel supply chain, and determine the most efficient and economic approach to deliver fuel (not necessary electricity only) that will provide the highest

vehicle efficiency. We should consider other means to deliver fuel, such as e.g. chemical storage, along with how the fuel is being used, in order to properly determine vehicle efficiency.

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 6.1.2.1, we should also consider other forms of energy storage that are beyond batteries. When there is a need for high energy density, (e.g. HLV, long distance vehicles), batteries inherently do not scale well. Chemical storage using reversible electrochemical cells (fuel cells) naturally scale well with energy density since all volume/weight increase is due to the fuel, versus fuel plus energy conversion component in batteries.

Chemical storage using reversible electrochemical cells (fuel cells) can also provide efficient energy storage in buildings. And high temperature reversible electrochemical cells can also provide high quality heat for building HVAC and water heating (section 6.2.1.1.3).

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