



U.S. DEPARTMENT OF
ENERGY

Hubs+ Task Force Report

- Bioenergy Research Centers
- Energy Frontier Research Centers
- Energy Innovation Hubs
- ARPA-E

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Hubs+ Task Force Members

- **SEAB Members**

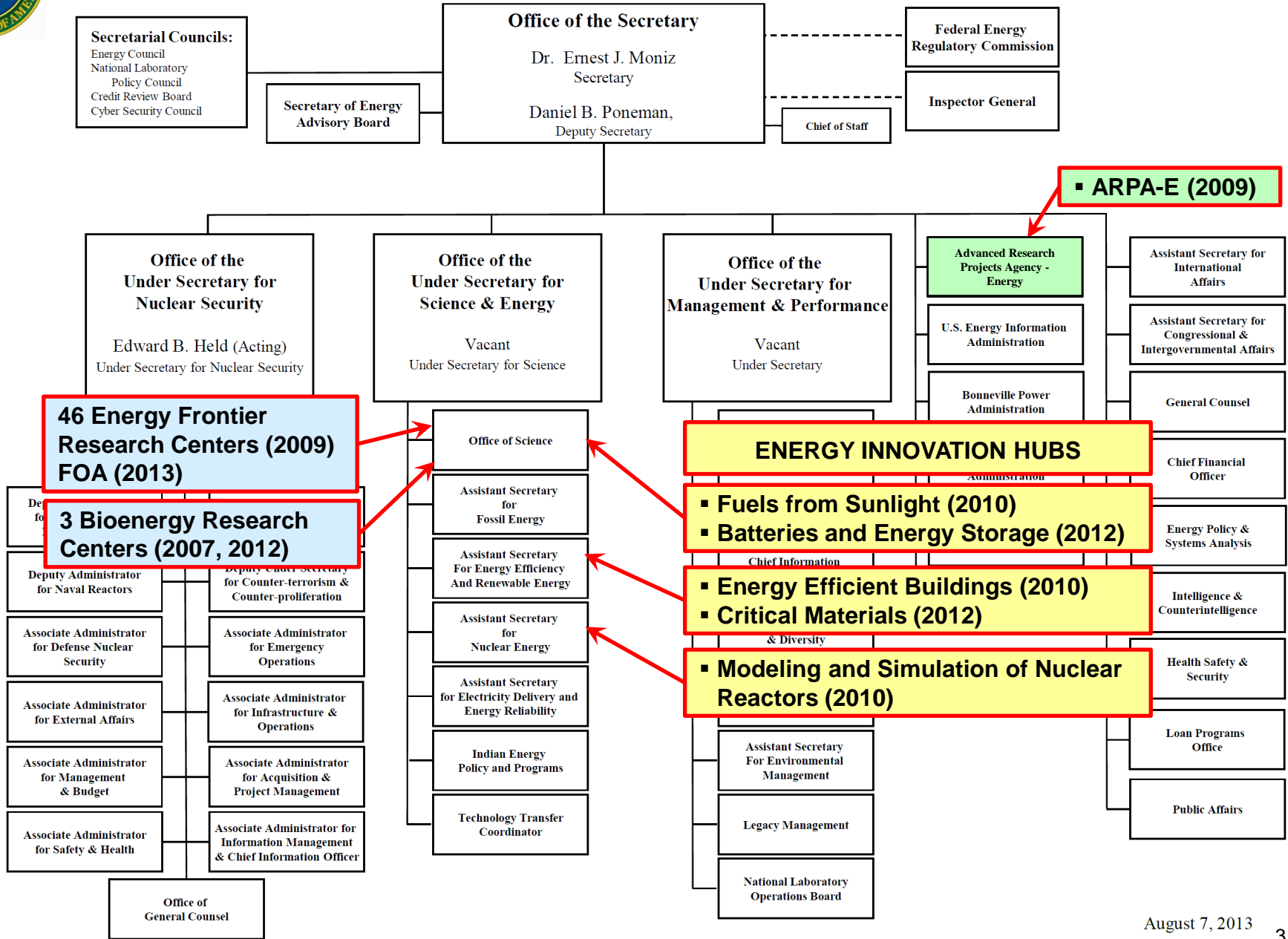
- Cherry Murray, Harvard University (*chair*)
- Rafael Bras, Georgia Institute of Technology
- Deborah Jin, NIST, JILA and University of Colorado, Boulder
- Carmichael Roberts, North Bridge Venture Partners
- Martha Schlicher, Monsanto
- Ram Shenoy, ConocoPhillips
- John Deutch, MIT (*ex officio*)
- Persis Drell, Stanford and SLAC (*ex officio*)
- Shirley Jackson, Rensselaer Polytechnic Institute (*ex officio*)

- **External Advisors**

- Robert Karlicek, Rensselaer Polytechnic Institute
- Mark Little, GE Global Research
- Chad Mirkin, Northwestern University
- Maxine Savitz, National Academy of Engineering
- Chris Somerville, University of California, Berkeley
- John Wall, Cummins



DEPARTMENT OF ENERGY



Questions for Task Force

- Is this suite of new funding and management mechanisms proving effective?
- Are they complementary?
- Are there gaps in the DOE approach to energy, science, and technology innovation?
- Is DOE effectively drawing on the resources of the labs, academia and industry including entrepreneurial start ups?
- What have been the successes of these funding mechanisms?
- What are the challenges they face?

Provide suggestions to DOE to enhance HUBs+ success in achieving energy breakthroughs as quickly as possible

- Guidelines for which topics are best suited for each management construct.
- Guidelines for when it is appropriate to begin, renew and terminate an EFRC, BRC, Hub, or ARPA-E project.
- Suggestions for effective oversight by DOE.

Executive Summary

DOE must

- invest significantly to explore, develop and advance technologies to improve energy efficiency and to broaden access to new energy sources;
- seek and support innovation broadly and make its investments efficient and cost-effective;
- Combine innovation, risk tolerance and disciplined project management to identify and support a portfolio of projects that are
 - risky and exploratory
 - focused on delivering innovative products into real applications.

Executive Summary

- The modalities under review currently implemented by the DOE addresses the full science-technology continuum -- from basic science to speculative innovation to system-level integration -- and balance the magnitude of funding appropriate to the risk of successful delivery.
- Fundamentally, the Task Force supports these constructs.
- A clearer definition of the role of each modality across the Department and more disciplined management would be beneficial to the Department to ensure that each mode of investment has the greatest opportunity to deliver on its intended objective.

Executive Summary

- The new constructs effectively engage national labs, academia and industry.
- They are complementary to the regular DOE programs.
- EFRCs and ARPA-E fund high risk science and innovation; appear to be performing as planned, but ARPA-E needs external review.
- The larger Hubs and BRCs fund science through application and beyond, have uneven span of the science – technology continuum and have had mixed success to date.
- We encourage DOE to consider how the efficiencies and productivity of the funding modalities, particularly at the scale of the Hubs, could be an appropriate way to organize work at the National Laboratories to ensure focus on problems of national interest.

Recommendations – across all constructs

- **Crafting the FOA**

- The best players must be encouraged to compete to manage and perform.
- Both top down grand challenges and bottoms up community input are needed to define the rationale, goals, investment scale, timeframe and metrics of success of each construct.
- Larger constructs such as Hubs should include defined ramp up and ramp down phases with stage-gate milestones to determine the continuation of the project.
- Process for review and sunset should be spelled out in FOA.

Comment:

- Suggest 10-year horizon for success for large constructs, 5 years with serious mid term evaluation for subsequent 5 year possible renewal.

Recommendations – across all constructs

- **Require a strong project management culture and effective on-site leader**
 - The larger and more applications-focused constructs must have a strong scientific/technical on-site leader who understands and supports both the science and technology as well as a strong disciplined project management culture.

Comments

- Suggest the high level project milestones and a change management practice be jointly developed with construct leadership and DOE program managers.
- It is possible to manage science effectively in a project management culture.

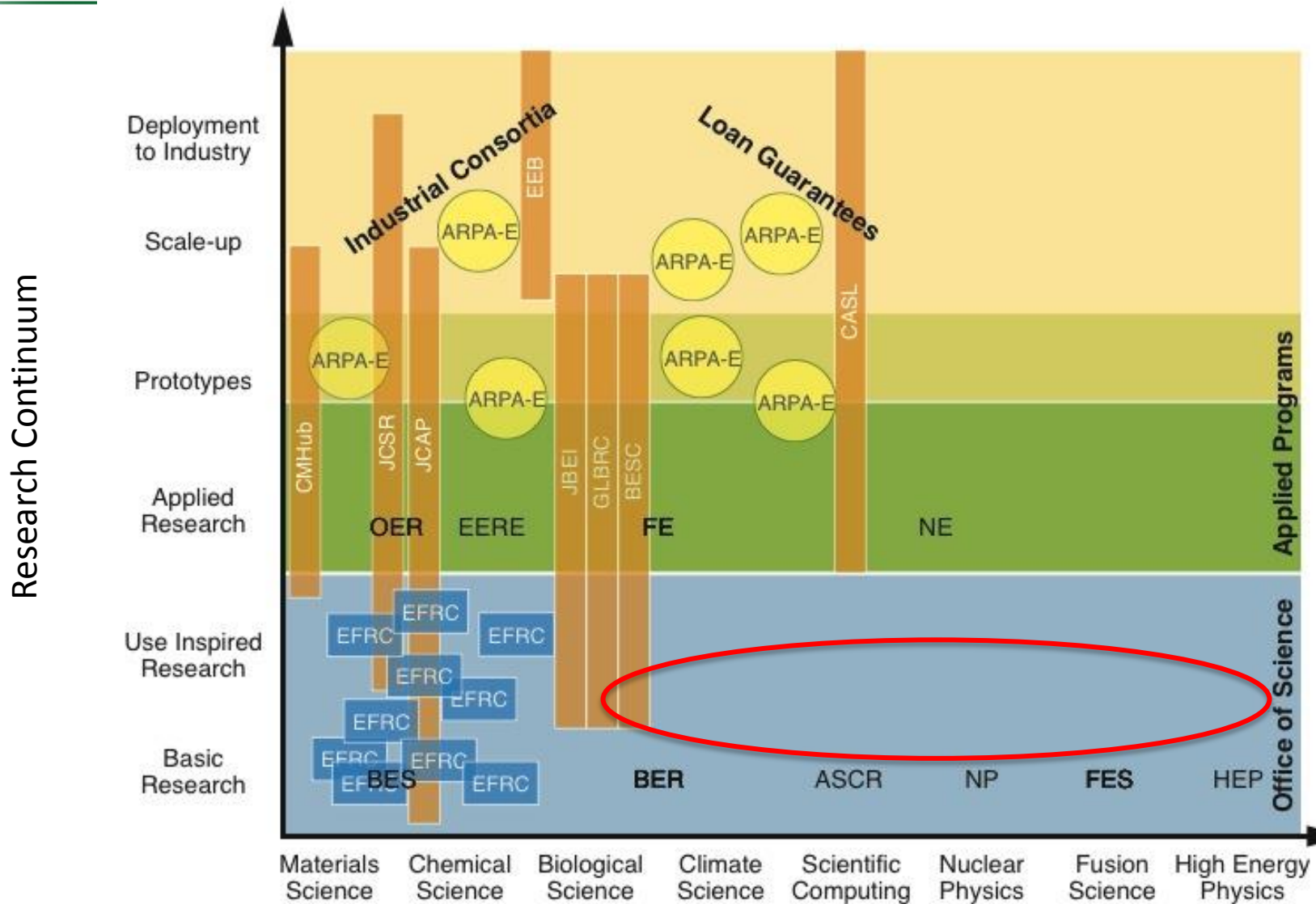
Recommendations – across all constructs

- **Retroactive evaluation of return on investment**
 - DOE needs to establish a system to systematically and retroactively capture data 5-10 years after first funding a construct to measure its transformational impact, especially collectively for the Hubs, BRCs and ARPA-E.
 - Measure of success is not just the science, but transformation of the industry.

Comments:

- Office of Energy Policy and Systems Analysis would be the relevant office to create a consistent system across the DOE.
- A framework was demonstrated in the NRC study “ Energy research at DOE: was it worth it?”

Gap Analysis



BACKUPS

Comments – BRCs

- **Process for renewal/sunset**

- Need to evaluate the state of the field, the appropriate goals and size as well as the need for BRCs before the mid term of the second 5 year funding cycle.
- Assessment should include the voice of the lignocellulosic biofuel industry that has emerged since 2007.

- **Evaluation**

- BRCs should consistently be reviewed by a single committee.
- Team research, the establishment of a coherent multidisciplinary program should be a criterion of success.

Comments – EFRCs

- **Extend beyond BES to other parts of OSC**
 - Use-inspired team research concept is working well.
 - ASCR has similar concept.
- **Proposal review**
 - Staggered calls with fewer proposals in each review cycle will relieve reviewer fatigue and congestion.
- **Regular PI programs are important**
 - EFRCs should not crowd out individual PI programs at universities critical to US science enterprise.

Comments – ARPA-E

- **Evaluation of success**

- National Academy of Science review required by law in 2015.
- ARPA-E director should sponsor this NRC review.
- Review is needed before increase of funding, though high risk budget is small as a percentage of total DOE R&D.

- **Program managers key**

- Sustained high caliber of the program managers is essential to the success of the overall program and should be a criterion in the review.

Comments – Hubs

- **Consensus building on topics**

- Community input is needed to clearly define the scientific and technical challenges and whether a topic is appropriate for the Hub concept of use-inspired science to further technology,
- whether the technical goals are plausibly doable in 5-10 years,
- whether the cost could be market relevant in a reasonable timeframe.
- Possible multiple Hubs on a single broad topic might be appropriate

- **System feasibility and market relevance vs prototypes**

- A deliverable prototype may not be the relevant goal for all Hubs, but system feasibility and market relevance may be more important.

- **Funding level**

- DOE should consider a range between \$15 - \$30M /year appropriate to the task.

Comments – Hubs

- **Mid-term reviews with teeth**

- 5 year plan plus possible 5 year extension is a reasonable plan for an effort so critical to the national energy landscape.
- Mid term reviews need to have teeth, considering a range of options for continued funding including review of the need for a Hub on the topic and possible ramp down of funding or transition to regular DOE programs.
- Continued funding beyond 10 years should require a complete reevaluation of the need for a Hub requiring input from community, industry and Hub Leadership Council.

- **Hubs acting as hubs**

- Hubs should make use of EFRC, ARPA-E and regular programs in all DOE offices relevant to their topic.