Summary Minutes of the

US Department of Energy (DOE)
Secretary of Energy Advisory Board
Public Meeting
October 12, 2011

Committee Members: William Perry, Chair; Norman Augustine; Frances Beinecke; Nicholas Donofrio; Arthur Rosenfeld; Steven Westly

Date and Time: 9:30AM – 3:00PM, October 12, 2011

Location: Lawrence Livermore National Laboratory (LLNL), Livermore, CA

Purpose: Meeting of the Secretary of Energy Advisory Board

SEAB Staff: Amy Bodette, Designated Federal Officer

DOE Staff: Steven Chu, Secretary of Energy; Tim Frazier, Blue Ribbon Commission Designated Federal Official; Dan Leistikow, Director of Public Affairs; Ian Adams, Office of the Secretary; Alyssa Morrissey, Office of the Secretary

Meeting Summary

SEAB members heard opening remarks from Chairman Perry and Secretary Chu. Secretary Chu gave a presentation on DOE in the innovation chain. Following Secretary Chu's opening session was a "Director's Perspective" from George Miller, LLNL Director. Dr. Miller's presentation was followed by presentations from LLNL on the National Ignition Facility (NIF), cyber security, and computational advances in applied energy. Following the lab presentations, the Board heard updates from the Natural Gas Subcommittee and the Building Efficiency Subcommittee. The last session of the meeting was an update on the Blue Ribbon Commission on America's Nuclear Future from Tim Frazier. After the public comment period, Dr. Perry adjourned the meeting.

The discussion followed the issues presented in the meeting agenda. Secretary Chu gave the bulk of his remarks in his opening, so he did not give a separate presentation just prior to the lunch break. Aside from that change, the timing is as outlined in the meeting agenda.

Opening of Public Meeting

Chairman Perry called the meeting to order and thanked members of the public for attending before turning it over to Secretary Chu for introductory remarks.

DOE in the Innovation Chain

Secretary Chu mentioned that he had recently received a draft report from the Committee on shale gas fracking and expects the final report in about two months. He also mentioned having received the draft Blue Ribbon Commission on America's Nuclear Future report. The Secretary then moved onto the topic of DOE in the innovation chain. He highlighted recent progress on breaking down stovepipes at DOE,

particularly with regard to the SunShot Initiative, batteries, biofuels, and grid integration. He also underscored the use of business models and how they can speed new technology introduction. As a specific example, he discussed carbon capture utilization and storage (CCUS), noting that some oil fields can be brought back to life with carbon dioxide through enhanced oil recovery. Secretary Chu then went into more detail on SunShot: the price of solar is currently $4/W, down from $8/W in 2004. The price will drop another 50% at least before the next decade. The Secretary asserted that the delta between $2/W and $1/W is important – solar would be competitive with all new forms of energy and would go viral. Currently, solar module prices are at $1.10/W compared with predictions of $2.3/W. SunShot is trying to lower structure/installation costs and soft costs as well as looking at reliability and durability. Secretary Chu expanded on the topic of grid integration, comparing it to plumbing – currently, it's like putting water into it and allowing it to flow without any central control; but modest improvements in materials will allow us to put electricity where we want it. He noted that DOE has a convening power to get ISOs/utilities in a room. He also posited that it is possible to pay for grid projects by getting cheaper energy to high-cost energy areas (for example, getting cheap energy from VA to an expensive energy area like NJ). Secretary Chu then moved onto the topic of refrigerator standards. He observed that historically, DOE would talk to industry and industry would say that proposed standards would be catastrophic. In fact, over time the price went down and efficiency went up, reaching a plateau prior to the introduction of each new standard. The lifecycle cost of refrigerators has gone down – a 3x reduction compared to the trajectory without standards. DOE was overestimating the cost of new standards repeatedly after conversations with manufacturers about the data. The Secretary said we are changing the way we do business – looking at learning curves of other countries, for example. Cost trends for other appliances are similar: clothes washers and air conditioners are examples of this. In fact, standards did NOT make the products more expensive. Secretary Chu closed by explaining the Baumol effect, which labels some sectors as progressive and others as non-progressive. The non-progressive category applies to jobs that are people-oriented; productivity can't get much better with fewer people. If wages are tied together, jobs will shift to less productive parts of the economy. If you only focus on the non-progressive or non-tradeable jobs, you will have an economic problem. Secretary Chu's slides include additional details.

LLNL Director's Perspective

George Miller, Director of LLNL, gave a presentation on the lab from his perspective. He said the long-term health of LLNL investments requires investment in missions, workforce, scientific capabilities, and safe operations. He gave his perspective on the future, noting that the US is engaged in a global war on many fronts: national security, environment, economic competition. Science and technology have a role to play in these challenges. DOE labs have historically taken on challenges considered to be beyond state-of-the-art – they seemed impossible but labs surpassed expectations. There is no leeway to waste effort on bureaucratic inefficiency. Dr. Miller then outlined challenges and opportunities in meeting programmatic mission needs: weapons, energy, environment, and global security. He said there is a need to sustain infrastructure and lab capabilities – this is a challenge with current fiscal constraints and it is important to recruit and retain best and brightest in the workforce. Dr. Miller spoke of leveraging capabilities in people and tools to meet wider range of national security needs: nuclear security breakthroughs have led to energy and other civilian accomplishments, and high-performance computing can minimize the need for tests and vastly accelerate technology timeline. He described the Livermore Valley Open Campus as an enabler of applied energy strategy and an application of high-performance computing. He also mentioned that LLNL has gotten systems/standards internationally certified with the goal of reducing transactional oversight by Federal government. Dr. Miller concluded with several reasons for optimism: the incredible talent of people and passion for mission, the singular importance of

lab's capabilities to solve important challenges, continued national dialogue on a path forward on nuclear deterrence, and the national security community's recognition of the lab's capabilities. Dr. Miller's slides offer more detail on this topic.

LLNL Progress towards Ignition and Weapons Physics on NIF

Bruce Goodwin, Principal Associate Director for Weapons and Complex Integration, spoke about the National Ignition Facility (NIF). He said NIF can recreate nuclear weapons conditions safely and that the lab was trying to eliminate the need for nuclear weapons testing.

Omar Hurricane, a Program Element Leader in LLNL's Weapons and Complex Integration Directorate, continued the discussion. He explained that NIF experiments include radiation transport, EOs at high pressure, and material strength at high pressure. Dr. Hurricane emphasized the importance of validating simulations/modeling with actual experiments. These experiments have sometimes validated the models, sometimes not. These experiments used to involve explosions – no longer needed with NIF. The experiments also allow talented scientists to "do something." Dr. Hurricane's slides have more information.

Board members asked if getting high-quality cleared scientists is difficult. Dr. Miller responded that as of now, the experience has been positive – there are high-quality people coming in. Some disciplines are difficult to recruit because of demand for their talents in the private sector. The good thing is that people are often patriotic and want to work on the nation's most important problems and some are drawn to the lab's unique facilities. However, he mentioned that it is difficult to compete with the private sector with regard to salaries. Another question from the Board was whether foreign entities were deterred by these experiments. LLNL staff responded that doing good science is a nuclear deterrent – foreign entities see the US using advanced technologies in unclassified circumstances and can read between the lines with regard to capabilities shared in peer-reviewed scientific journals.

Ed Moses, Director of NIF and Photon Science, explained that NIF has an array of capabilities and is capable of the articulated long-term goals. Increasing laser energy and power is available for ignition experiments and NIF diagnostic capabilities are growing. NIF fired 287 system shots for FY11. NIF is preparing for fusion gain experiments. Implosions have made steady progress toward ignition, reaching goals for pressure and implosion quality. Compelling scientific questions are being addressed by NIF. The cyber realm has emerged as one of today's most critical national security domains. The accompanying slides have a number of images and graphs on this topic.

LLNL Strategy for Improvements in Cyber Security

Jim Brase, Deputy Program Director of Intelligence at LLNL, gave a presentation on rethinking cyber R&D for compromised environments. Labs are working to strengthen our national capabilities through government partnerships, ensure the protection of DOE's critical information, build the scientific foundations of cyber and network science, and help to establish new private sector partnerships for sustainable security. LLNL's cyber R&D builds on DOE's long-term investments in computing and information science. Mr. Brase asserted that today's approach to cyber security is not sustainable. The information network environment is rapidly evolving. There is no such thing as a network perimeter due to constant change. With convergence of voice, data, and video, it is difficult to maintain boundaries. Deterrence and protection are problematic in cyber world: lack of identity, adversaries becoming more difficult to deter, and prevention is limited as there is no path to defect-free systems. Mr. Brase said the

goal should be changed from protecting networks to protecting critical missions. The critical timescale has a finite lifetime. R&D roadmaps need to be rewritten. Dimensionality of situational awareness has increased from signatures to network behaviors. There is a need to predict network behaviors. High-performance computing is enabling new approaches to real-time malware analysis. It is possible to develop "family trees" for malware and compare new code to existing family tree of malware. Labs are developing computational models that can predict network behaviors with fidelity and scale. Operations are informing the science, but transition from science back to operations is critical. DOE labs are working together to develop government partnerships to transition R&D in. Network Security Innovation Center is a new industry- and university-focused partnership that aims to go from R&D to incubation to trusted information sharing. Building and retaining workforce is one of our most critical issues and the US doesn't produce enough graduates in computer science and math. More detail on these topics is available in Mr. Brase's slides.

LLNL Computational Advances in Applied Energy

Julio Friedmann, Deputy Program Director of E&E Security, gave a presentation on high-performance computing (HPC) and accelerating clean energy technology deployment. DOE leads the world in HPC application and use. HPC is moving to applied programs, including nuclear and fossil. A DOE/SC program on climate model, diagnosis, and intercomparison at LLNL has played a key role in international climate community. The goal is to quantity the fidelity of model simulations and uncertainty in projections. Dr. Friedmann discussed the application of HPC and simulation, touching on platform and architectural development, basic science and algorithms, applied energy simulations, and the path to exascale computing. He provided examples that LLNL and other labs are involved in: Efficient buildings, as a Buildings Hub partner; efficient vehicles, as part of the Navistar consortium; renewable prediction, through NARAC, where they were already making predictions and partnered with other labs and industry to make improvements; and CCS, where they cut steps out of scaling up demonstration. HPC has proven successful in molecular dynamics and design to make materials for clean energy. CA Energy Systems for the 21st Century (CES-21) is a new $150M, 5-year partnership with investor-owned utilities (IOUs) to speed smart grid solutions, which aims to partner with companies that can demonstrate technologies. HPC is ideally suited for scale-up of grid models and pilot projects. Data centric and high throughput computing can reduce cost, risk, and waste. Industrial partners are eager to participate in Livermore Valley Open Leadership Campus. DOE leadership led to a national summit and near-term actions. Other countries, such as China, are linking HPC to national competitiveness. Dr. Friedmann's slides include graphs and more information on this topic.

Buildings Subcommittee Update

Steve Westly gave an update on the Buildings Subcommittee, reporting that it has had two calls/meetings since the last full committee meeting. The Subcommittee is in the midst of setting up a West Coast meeting looking at smaller firms, state/city government officials, for opinions and advice. Subcommittee terms are now finalized and a plan for writing its report is established.

Natural Gas Subcommittee Update

Renee Stone, Designated Federal Officer for the Shale Gas Subcommittee, gave an update on the Subcommittee. She reported that the full committee adopted subcommittee recommendations. Thus far, the Subcommittee has gotten positive comments on detail/substance of report. The Subcommittee

plans to turn in its final report November 18. A public meeting is scheduled for October 31 in DC. Ms. Stone also noted that the website public comment process has been popular.

Blue Ribbon Commission on America's Nuclear Future (BRC) Update

Tim Frazier, Designated Federal Officer, gave an update on the BRC. The BRC was established in March, with a draft report submitted July 29 and the final report due and expected to be submitted on January 29. The report includes an evaluation of existing technology and R&D, as well as options for safe/permanent storage and legal/commercial arrangement. Mr. Frazier provided a description of different subcommittees and calendar of activities that can be found in his slides. He then outlined the BRC's 7 key recommendations. (1) A new approach to siting & development that is adaptive, staged, consent-based, transparent, and standards/science based. (2) A new, single-purpose organization focused on the transportation, storage, and disposal of nuclear waste in the US. (3) Assured access to funding, including near-term changes to handling of annual nuclear waste fee payments, longer term access to balance of Nuclear Waste Fund, and a process wherein a fee is paid into a third party trust. (4) Development of a permanent deep geological disposal site for spent fuel and high-level nuclear waste expeditiously and safely. (5) Development of one or more consolidated interim storage facilities as part of managing the back end of the nuclear fuel cycle in which stranded fuel and shutdown plants should be first in line (nine sites are non-operating reactors). More sites would share the responsibility and this would change the existing order from the current "oldest fuel first." This would also include the possibility of spent nuclear fuel takeback internationally. (6) Creation of stable long-term support for R&D, including related workforce needs/skills and advanced reactor and fuel cycle technologies. (7) International leadership on non-proliferation concerns, safety/security, and consolidated international storage sites. Mr. Frazier continued with a description of the Commission's proposed near-term actions for DOE: Complete a rulemaking to establish the aforementioned irrevocable trust, lay the groundwork for implementing consolidated storage, offer technical assistance, address transportation of spent nuclear fuel (which is a major concern for some although it has been done successfully for years), keep the repository program moving forward, and look for legislative changes to enable participation in spent nuclear fuel takeback. He concluded with the next steps for the BRC, which are to conduct outreach to solicit feedback on draft Commission report and deliver the final report in January. Mr. Frazier's slides have further detail on the above topics. Following Mr. Frazier's presentation, Secretary Chu made a comment that the public/private entity could remain somewhat autonomous and would be able to act in a way that a Federal government entity cannot.

Public Comment

One individual spoke during the public comment session.

Mary Lea Kelly from Trivalley Cares, which has 5600 members, explained the organization's vision for the future of LLNL. She said Trivalley Cares envisions LLNL as a world-class center for civilian science – a green lab, with the ratio reversed from its current percentage of 89% of resources devoted to weapons activities. Ms. Kelly asserts that it is unnecessary to have both LLNL and Los Alamos for nuclear weapons-related activities and says the goal should be curatorship of weapons stockpile. With regard to NIF, she notes that it has cost $5-7B so far and says ignition was promised every year since 2002. Her proposal is to make NIF a "true user facility." She says NIF is not needed for existing stockpile stewardship. Regarding the Open Campus, she says that it needs more analysis and that it should be a step toward real civilian science and not "greenwashing."

Chair Wrap-Up

Bill Perry adjourned the meeting and noted that the next meeting will be in DC on January 31, followed by a meeting in Los Alamos on a TBD date in April.

Respectfully Submitted:

Amy Bodette
Designated Federal Officer

I hereby certify these minutes of the 10/12/2011 SEAB meeting are true and correct to the best of my knowledge.

William J. Perry
Chair