

Summary Minutes of the

US Department of Energy (DOE)
Secretary of Energy Advisory Board
Public Meeting

Committee Members: William Perry, Chair; Ralph Cicerone; John Deutch; Nicholas Donofrio; Michael McQuade; Arthur Rosenfeld; Steven Westly; Dan Yergin

Date and Time: 8:30 AM- 3:30 PM, January 31, 2012

Location: Department of Energy Forrestal Building, 1000 Independence Avenue, SW, Washington, DC 20585

Purpose: Meeting of the Secretary of Energy Advisory Board

SEAB Staff: Alyssa Morrissey, Deputy Designated Federal Officer

DOE Staff: Secretary Steven Chu; Deputy Secretary Daniel Poneman; Renee Stone, Senior Advisor; Richard Kauffman, Senior Advisor; Ramamoorthy Ramesh, SunShot Director; Minh Le, Solar Energy Technologies Program Chief Engineer; Rachel Tronstein, Deputy SunShot Director; Dave Howell, Hybrid and Electric Systems Team Leader; David Danielson, ARPA-E Program Director; Lauren Azar, Senior Advisor.

Meeting Summary

SEAB members heard opening remarks from Secretary Chu. During the first half of the day, the Board heard presentations from DOE staff, including a presentation on renewable energy and energy efficiency financing from Senior Advisor Richard Kauffman, an overview of the SunShot initiative from SunShot Director Ramamoorthy Ramesh, and an overview of the batteries tech team from Dave Howell. The Board heard updates from the Building Efficiency Subcommittee, and a Subcommittee on small modular reactors was established. Just before lunch, the Board heard from the Chairs of the Blue Ribbon Commission, General Brent Scowcroft and Congressman Lee Hamilton. The last session of the meeting was a presentation on transmission from Senior Advisor Lauren Azar.

The discussion followed the issues and timing as presented in the meeting agenda.

Opening of Public Meeting

Chairman Perry called the meeting to order and turned it over to Secretary Chu for introductory remarks.

Grand Challenges Presentation from Secretary Chu

The Secretary touched on several topics, from challenging our nation's scientists to work on energy-related research, to manufacturing, to natural gas for long-haul transportation vehicles.

Engaging Scientists at Laboratories and Universities

The Secretary stated that he was excited about launching a concerted effort to engage universities and national laboratories to present energy challenges to scientists and grad students, informing them of exciting problems in energy waiting to be solved. DOE is well-positioned to engage these audiences. The discussion revolved around several areas that have great potential for game-changing discoveries and advancements for energy applications.

Materials

Materials science is an area with a great amount of potential for scientists to make important advances. Wide band gap semiconductor materials have the capability to transform power electronics. Another area of promise is magnetic materials that have lightweight permanent magnets that use less or no rare earth material. As we go to highly efficient cars, high strength steels are becoming more important.

Manufacturing

The members discussed helping industry build a foundation for future competitiveness in manufacturing. New materials manufacturing methods can change the field, such as titanium and carbon composites. Most innovations in new materials are still being done in the U.S., however, many of the companies do not have staying power.

DOE supercomputers have helped design fuel efficient, low noise jet engines. DOE's supercomputing is so advanced that companies sometimes borrow our scientists to operate the supercomputers.

The Secretary believes we will get the lead in batteries again. There is potential for doubling energy density in batteries through research at Argonne. Batteries plus motors plus lightweight materials is what you need for electric cars.

Natural Gas for Trucks and Diesel vs. Gasoline

The discussion turned to natural gas for long haul trucks. Secretary Chu stated that natural gas could be half the cost of diesel – less if you don't include the cost of liquification and infrastructure. John Deutch noted that Class 8 trucks using liquefied natural gas (LNG) means there needs to be an infrastructure and there will be end-of-life issues. He also indicated that you can't use LNG trucks in the developing world where the diesel trucks currently go. Once you get into compressed natural gas (\$2.30) you have more options. The Secretary expressed that LNG long haul trucking will happen at some point; focusing first on big trucks first where the payoff is very rapid.

The Secretary also addressed the price of diesel versus gasoline, saying that we export diesel to Europe and import gasoline because of how refineries have been set up in the United States. Daniel Yergin noted that Europe's fleet of vehicles is more than half diesel and that diesel is the fuel for growth in countries like China and India. Diesel engines are more efficient. Because of that, if you are concerned about lifecycle rather than first cost of the vehicle, you choose diesel, even for personal cars, but especially trucks. As for use in the U.S., hurdles include fewer diesel stations and consumer choice. The automobile engines have made incredible progress to accommodate different types of fuel.

Biofuels

Biofuel feedstocks are a challenge in the U.S. because sugar isn't cheap here so we need to use complex sugars the must be broken down. In biofuels, getting the first touch highly automated is important. Production costs have been reduced substantially in Brazil with automation and industrialization of first touch of crops.

Bringing New Technologies from Lab to Manufacturing

Hub-like entities are one way DOE gets industry to convene with labs to get out prototypes – helping manufacturers do things they wouldn't do on their own because of the investment involved: Biocenters, the precursors to DOE's current hubs, were started under Secretary Bodman's tenure. The general feeling is they are successful to extremely successful with regard to forming companies and starting projects, including pilot plants. Many of them have been successful in this way without Federal funds.

Renewable Energy and Energy Efficiency Finance – Richard Kauffman

Renewable energy is important because of financing connecting with innovation. Richard's talk was about expanding how we think about financing and energy efficiency/renewable energy.

Regarding the cost of financing in the U.S. – when you think about renewable energy, running costs are next to zero. It doesn't matter whether we talk about technology or hardware or financing costs – costs are costs. We have high financing costs in the U.S. with regard to renewable energy. We can think about how we can innovate and reduce technology costs but there is tremendous low hanging fruit with regard to reducing financing costs.

One of the benefits of lowering the cost of financing is through the elasticity of demand we can increase the size of the domestic market. He asked people to broaden their frame when thinking about financing to think about how to lower the costs and how to think about lowered financing costs in terms of demand generation in the U.S.

U.S. policymakers as well as people in the private sector have been struggling with how to finance innovation. Programs like the DOE Loan Program and proposals like the Clean Energy Development Administration (CEDA) all go to the question of the valley of death. Venture capital money gets companies to form but greater capital and time is higher in this sector than in others to get a company to scale. The gap in the private sector to finance this valley of death is an argument for government involvement.

Look at how proven technology in the renewable energy space is financed. For a solar or wind park that uses proven technology, you need to use private sources of capital. There are 3 elements: tax equity, debt, and regular equity. Because all of the sources of capital are private, all of them are very expensive. Many renewable energy generation projects are developed using a technique using project financing. Cash flows in the project itself support the debt of the project. When you consider a generation project, there is depreciation of equipment – stable project with long term projects has fair amount of debt. At the project level, there is little taxable income. They need to find someone else to take advantage of tax benefits (tax equity partner) and the biggest participants historically in this have been AIG, Wachovia, and Lehman Brothers as a way for financial institutions to reduce their taxable income. That market is very limited and expensive. Looking at debt, most of the debt that comes to these projects go to banks and it has been European banks that have provided debt to projects. They have now retreated from market.

On the equity side, equity being raised is at private equity rates of return (12-15%). All of the sources of capital are private and expensive. For most other sectors of the economy with mature technology where risks are very modest, we use public markets. When a company wants to raise 20-year debt, it goes to the bond market. But even though you have project with 20 year life, developers still need to go to banks to get money – that is a market failure. In other sectors of the economy they can get publicly

traded equities, master limited partnerships, or in the case of real estate, REITS. In the case of renewable energy, because of current law, you can't publicly trade and be financed in the same way.

Cost of capital when you go through in the aggregate may be 25% lower if we could finance the sector the same way we do other sectors. This would lower the cost of financing through the elasticity of demand and create benefits of scale – a challenge with renewable energy is that it needs more scale and costs can then come down.

The conversation until this point focused on challenges faced with mature technologies. When talking about things that are innovative, it's difficult to tell how much of the problem is due to their being innovative and how much is due to the anachronistic financing infrastructure. If we are able to create underlying financing infrastructure for mature technologies in this area, there would be a migration from bank debt to publicly traded investment-grade debt. When investors got comfortable, they wanted a higher yield and that's what created the high yield market and the emerging markets debt market. There would be demand for higher-yielding projects that would use first of a kind generation technologies. But it won't happen unless you first establish market for proven generation technology.

Leaving government aside, if a company has an opportunity to raise money from private sources, private equity firm, it can raise debt from private sources or can go to public bond and stock markets. There has been no public stock or bond market. You can't currently buy stake in a project – only the developer. If there were public markets for proven technology we would find that once the financing infrastructure was in place, there would be a demand for higher yields that would provide an opportunity for financing first of a kind generation projects. That is what the loan program has done. We might also find the challenge of financing the first commercial plant is solved as well because we provided an opportunity for an off-take.

Regarding energy efficiency, there is not a scale issue because it ought to pay for itself. There is a bizarre market failure because of lack of information and other disincentives, but there is a key element here in financing that we can solve – taking the same things that have been developed in other sectors and applying it to this sector.

SunShot Tech Team – Ramamoorthy Ramesh

SunShot's goal is a 75% reduction in the cost of solar modules from 2011 to 2020 – the entire project is underscored by global competitiveness. SunShot covers the full technology readiness level spectrum through the Valley of Death.

SunShot is a crosscutting program that is a team effort and an experiment at DOE. The interoffice team works very closely and has occasional big meetings with big debates and constructive confrontation to generate new ideas for funding opportunities. They also get lots of feedback from stakeholders through workshops and have an internal advisory board.

The team has made incredible progress in questioning the status quo and streamlining processes. The team looked back 10 years for existing money and recovered \$41M that was redirected to other activities. The average time for getting funding was 56 weeks previously. The average is now 28 weeks. The review process has become much shorter – program managers have done a much more intense reviewing job.

The SunShot team is trying to shift the competitive process – for example, taking an R&D subprogram that was stagnant for 20 years and coming up with a revamped program they call the “Michael Jordan Program” named for the 23% efficiency goal.

Soft costs are a big issue for solar – permitting, inspection, interconnection, customer acquisition, etc. SunShot’s Rooftop Challenge aims to streamline these processes.

See the SunShot PowerPoint presentation for more detail on these programs and information on additional initiatives within the program.

Batteries Tech Team – Dave Howell

Electric drive vehicles include conventional hybrids, plug in hybrids, and all-electric vehicles – each has benefits and barriers. The goal of the batteries tech team is to develop battery technology that increases energy density and decreases cost. The tech team also ensures that energy storage R&D is coordinated among different offices within DOE. The over-arching battery goal is a penny a mile. They also have a fast charge goal of 10 miles per minute.

See the Batteries Tech Team PowerPoint presentation for more detail on the tech team’s progress and goals.

Buildings Subcommittee Report – Steve Westly, Michael McQuade, Art Rosenfeld

The Subcommittee has been delving into the capability and role of DOE in building technologies, with the goal of making recommendations in areas where DOE has authority. Some of the recommendations will take into account the recommendations of SEAB’s Technology Transfer Subcommittee report.

Subcommittee members noted that the activity of interagency coordination has increased but that there are areas for potential improvement, such as pushing the adoption of better practices for government buildings and streamlining the funding opportunity process.

The Subcommittee is close to having final outline to share with the full SEAB Committee and a final report within 90 days or so.

Establishment of SMR Subcommittee

A Subcommittee on Small Modular Reactors (SMRs) was proposed and agreed to. The Chair of the Subcommittee will be Nick Donofrio. The SEAB members on the Subcommittee will be: Norm Augustine, Frances Beinecke, and John Deutch. The additional members of the Subcommittee who were not already on the full SEAB Committee were not finalized as of the time of the meeting. Nick Donofrio said the Subcommittee’s goal is to have a report completed by this summer.

Deputy Secretary Poneman underscored the diversity of expertise and wisdom at this pivotal time in the development of the reactor and said there is a lot of interest globally because of energy security, carbon, economic, and non-proliferation aspects – noting this topic is very worthy of a subcommittee.

Blue Ribbon Commission – General Brent Scowcroft, Congressman Lee Hamilton (by phone)

The Chairs noted that the recommendations are the same, with the addition of the transportation issues section, which was added in response to public comment on the draft.

The BRC believes a new single purpose organization is right for purpose and credibility to get the program back on track. The central task of the new organization is to site, license, build, and operate the facility for consolidation and disposal of waste. All eight key elements outlined in the report are necessary to establish truly national waste management system to ensure the U.S. remains at the forefront of nuclear issues (see report for a list).

People around the country are sensitive to the question of timing – we have worked for 50 years for a solution of nuclear waste and still don't have one. These recommendations will take time but some near term options are included to get the U.S. back on track. It is long past time for the government to make good on its commitments and the members of the BRC will continue to work to ensure that the recommendations are advanced.

Congressman Hamilton thanked the members of advisory board for their interest and said the members are in a position to help them out. His view is that they have produced a good, unanimous report with excellent group of commissioners thanks to the Secretary's leadership. We have reached a point where we can begin to resolve a problem that has plagued us for decades. There has been a lot of damage to the country and an inability to solve the problem precludes us playing international role in nuclear energy. Fundamentally, one choice is to follow the approach that we have taken for several decades that is costly and time consuming and has not produced a solution. The other option is to take the path they recommend that does not guarantee success but gives a path forward. Knowledge and contacts of this committee can be very helpful.

BRC Discussion

Chairman Perry said that Livermore is close to achieving fusion – if that happens, there is the possibility of future application of fusion to burn nuclear waste. He wondered if that was considered in the course of study. Gen. Scowcroft responded that in general they are supportive of technology that would help with the problem. Regardless of what technology brings, there will be some waste – this is what the BRC focused on.

John Deutch thought it was a great report that addresses an important problem for the country that has yet to be solved and must be addressed. He made a couple of points: the report has great wisdom but the most important thing is the existence of consolidated storage facility. He does not think it is a wise idea to establish an independent authority for waste disposal unless it has financial authority.

Steve Westly asked about the approach that Germany is taking – ramping up the nuclear program – ability to handle political and “act of God” issues like earthquakes. He also wondered, with the sheer number of miles truckers drive with nuclear waste, what the probability is of an accident. Gen. Scowcroft said there is no way you can eliminate every conceivable problem, which is why this problem has taken so long to resolve. He said it is possible to be prepared for transportation such that if there is an accident, the integrity of the container will survive.

Deputy Secretary Poneman commented on incredible work that the BRC has done and on how it fits into broader strategy. The back end of the fuel cycle is one of the main challenges that need to be overcome for the President's vision of nuclear being involved in our clean energy future. Private capital is now available to build new nuclear in regulated markets. SMRs and a Clean Energy Standard are the other part. Proliferation problems can be as devastating as something like Fukushima. And finally, there is the waste problem. No policy will succeed over decades unless it solves the waste issue. This report will

form critical basis of addressing these issues that will be necessary for nuclear energy to play role in long term.

Michael McQuade offered strong compliments on the process and output of report. Even if we never build another nuclear plant, we still have a problem to solve. If we don't solve this problem, we can't address the future of nuclear. The Commission's recommendation is that we do not create a set of decisions that block options for the future.

Transmission – Lauren Azar

Currently, the timeline for getting permits is long – contrary to timeline for transmission lines being built. During the course of 15 years, permits could be required from states, bridge crossing, NEPA for Federal lands, cultural resources, National Park Service, and /or forest lands. The Rapid Response Team is intended to make these processes run concurrently rather than sequentially and to increase the efficiency of the process. Sometimes environmentalists don't like the Rapid Response Team for Transmission (RRTT) because they are worried that the effectiveness of the reviews will not be maintained, but that is not correct. Often each agency is looking at its own segment of the 200 miles. The goal is to coordinate all Federal agencies from the beginning, identify all required Federal approvals, and coordinate schedules.

There are seven pilot projects – five in the Western Interconnect and two in Eastern – with regular meetings on each of these projects. If someone tries to change a deadline, they get emails – creating accountability for project delays. Problems can be elevated quickly to the level of the Secretary so they don't spin around in lower levels. DOE is convening the other agencies and setting up performance metrics right now that ultimately tie in with the time it takes for generation, hoping to drive the times together.

PMAs are one of the few ways in which DOE can directly impact infrastructure buildout. There are four in the U.S., covering most of the country, and were created to sell energy from Federal hydro-electric dams. SWPA, WAPA, and BPA have other powers as well. Borrowing authority is an additional authority for BPA and WAPA, although WAPA has been having troubles finding projects to finance despite having many applications.

There is also the problem of transmission lines in the country getting older/obsolete. A lot of aging infrastructure needs to be rebuilt, so part of this is rebuilding smarter. The grid of the future doesn't look like it does right now. DOE can't implement anything but can educate and convene.

Regarding the amount of authority DOE has in the area of security: there is a tremendous amount of authority in responding to security issues. If natural disasters or terrorist attacks happen, DOE's powers are great. Prospectively, DOE/DHS/FERC/NERC all have a piece of the responsibility. On the question of whether we can use that power for leverage in these issues – would like to take this into account when designing the new grid, surely. At the same token, don't want to be overzealous.

Public Comment

No individuals signed up for public comment.

Chair Wrap-Up

Chairman Perry adjourned the meeting and noted that the next meeting would take place on April 17 (an adjustment from the original date).

Respectfully Submitted:

Alyssa Morrissey
Deputy Designated Federal Officer

I hereby certify these minutes of the January 31, 2012, SEAB meeting are true and correct to the best of my knowledge.

A handwritten signature in black ink that reads "William J. Perry". The signature is written in a cursive style with a large, prominent "W" and "P".

William J. Perry
Chair