



HOUSE COMMITTEE ON SPACE, SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY

“Bridging the Valley of Death: ARPA-E's Role in Developing Breakthrough Technologies”

March 12, 2024 – 10:00 AM

OVERVIEW

On Tuesday, March 12, the House Space, Science and Technology Subcommittee on Energy held a hearing titled, “Bridging the Valley of Death: ARPA-E's Role in Developing Breakthrough Technologies.” During the hearing, Members and witnesses discussed: intellectual property; workforce development; agricultural technology; organization structure and collaboration; technology innovation; and public-private partnerships.

OPENING STATEMENTS

- [Chairman Frank Lucas \(R-OK\)](#)
- [Subcommittee Chairman Brandon Williams \(R-NY\)](#)

WITNESS PANEL

- [The Honorable Lane Genatowski](#) – Former Director, *ARPA-E, U.S. Department of Energy*
- [Mr. Tim Lust](#) – Chief Executive Officer, *National Sorghum Producers*
- [Dr. Tim Held](#) – Chief Technology Officer, *Echogen Power Systems*
- [Dr. Ryan Umstatt](#) – Vice President, *Product & Partnerships, Zap Energy*

QUESTION AND ANSWER SUMMARY

Intellectual Property

Subcommittee Chairman Williams inquired about concerns around Department of Energy (DOE) intellectual property (IP) regulations. Dr. Umstatt emphasized risk is at the core of the IP issue, and acknowledged in most research projects funded by the DOE Office of Science, the government assumes the risk of cost implications stemming from scheduling delays or technical difficulties. He explained if there is a technical performance that does not meet the desired or required performance standards, the government must choose whether to finance solutions to overcome those challenges. However, he highlighted in the DOE's milestone-based fusion development program, companies bear all associated risks themselves – the DOE determines whether a milestone has been accomplished to DOE's performance specifications and schedule expectations before determining payment. He emphasized if a payment is made, it amounts to less than half the cost that company invested in executing its research.

Chairman Williams questioned if there are currently tensions between startups and the DOE around the issue of intellectual property (IP). Dr. Umstatt affirmed. Chairman Williams inquired if it is more difficult to attract outside

investments if a company does not have a clear title to its IP, and asked whether investors ask about IP before deciding whether to invest further. Dr. Umstatted affirmed, and contended Zap Energy's current set of investors and board members examine terms and conditions of a potential DOE award before investing. He highlighted IP is even more important to the company's future investors. He advocated for terms and conditions that are consistent with the need to raise capital for research.

Rep. Jamaal Bowman (D-NY) inquired further about DOE's IP regulations. Dr. Umstatted expressed contempt for companies having to assume all financial risks. He noted there are existing DOE authorities that would support the DOE pinning an agreement with companies that says no patent or invention rights are exchanged or granted by either party. He emphasized there are potential undesirable outcomes the DOE wants to mitigate by having IP provisions. He argued the DOE will be more successful at accomplishing that by incentivizing desired outcomes, rather than burdening companies preemptively with IP provisions. He explained bearing the additional risk of IP is a challenge for companies, as they are already expected to cover the cost overrun risks due to scheduling or performance issues.

Chairman Williams inquired about instances when China has stolen IP. Dr. Umstatted contended it is a challenge, as some fusion companies that are within the Fusion Industry Association (FIA) have seen replicas of their devices produced at conferences.

Workforce Development

Chairman Williams asked for advice on creating a successful fusion workforce. Hon. Genatowski stressed the importance of measuring the impact of preparation and education to the DOE workforce and fellows to ensure those fellows will be successful in the private sector. He advocated for a revolving employment cycle, where the DOE trains fellows who subsequently excel in the industry, and ultimately circle back to Advanced Research Projects Agency–Energy (ARPA-E) and the DOE.

Rep. Bowman asked how to create a workforce development metric, given the early-stage nature of many of research projects and the specialized nature of talent required. Hon. Genatowski did not have a clear idea on how to accomplish this. He noted ARPA-E engages with engineers, lawyers, businessmen, and various other professionals, and suggested educating them on how the federal government can amplify their contributions to society.

Rep. Randy Webster (R-TX) questioned if the DOE conducts job exit interviews to determine what fellows have learned and to establish why they are leaving. Hon. Genatowski affirmed. He explained though the exit interviews are informal, the DOE conducts one with every fellow and program director. He agreed with Rep. Webster that they should record those interviews, though they do not currently. He added ARPA-E does not have a formal human resources (HR) function, but rather, the PhD students recruit other students to research with ARPA-E.

Rep. Webster inquired why fellows leave ARPA-E. Hon. Genatowski explained fellow positions are time-limited, so fellows are encouraged to shift to different jobs inside the DOE, to enter a different part of the government, or to explore the private sector. Rep. Webster asked if ARPA-E fellows sign non-compete clauses upon leaving ARPA-E. Hon. Genatowski noted fellows do not own IP, so non-compete clauses are not applicable.

Agricultural Technology

Full Committee Chairman Lucas asked why the Rhizosphere Observations Optimizing Terrestrial Sequestration (ROOTS) program is important to grain sorghum and the larger agricultural community. Mr. Lust highlighted most research and investment in the last 50 years has been "above ground" because "working below ground has been too hard." He urged the ROOTS program will help solve worldwide drought and water issues, which will in turn advance energy security from an agricultural feedstock standpoint.

Chairman Lucas noted grain sorghum is important to fuel feedstock, as well as human and animal feedstock, and emphasized it is not always best practice to "look at the top of the plant" to gather data on soil and moisture conditions. Mr. Lust agreed, and added examining water and nitrogen use-efficiency is increasingly important, as it is vital to "do more with less."

Rep. Jim Baird (R-IN) questioned the partnership between ARPA-E and the National Sorghum Producers (NSP). Mr. Lust noted a lot of collaboration between robotic professionals, engineers, and production agriculture workers, with the goal of applying lab-scale research to a field scale.

Rep. Eric Sorensen (D-IL) inquired about emerging technologies, like unmanned aerial vehicles (UAVs), that can help farmers realize the potential of precision agriculture. Mr. Lust highlighted smart farm and sensor technologies are both useful. He urged many agricultural technologies are difficult to scale.

Organization Structure and Collaboration

Chairman Lucas asked if during Hon. Genatowski's time as ARPA-E Director, he noted any changes to structure or processes that could have improved the program. Hon. Genatowski recounted difficulty in "convincing a room full of scientists" to look more intensively at the business side of operations. He suggested it would be helpful for ARPA-E to have "relationship managers" for different sectors of the investment community.

Rep. Claudia Tenney (R-NY) pursued a line of questioning about the Advanced Research Projects Agency-Climate (ARPA-C) and the National Environmental Policy Act (NEPA) process. Hon. Genatowski expressed he is not familiar with ARPA-C, and did not experience issues with NEPA when he worked for ARPA-E.

Technology Innovation

Rep. Sorensen asked how ARPA-E, the DOE, and Congress can bolster fusion energy research and development. Dr. Umstattd remarked new and innovative concepts in fusion energy are going to be crucial to a healthy and vibrant commercial fusion sector. He contended while the Office of Fusion Energy Science (FES) is working on those concepts, ARPA-E should continue to generate new ideas at an accelerated pace. He asserted the milestone-based fusion development program is the "cornerstone of accelerating the pace at which fusion can commercialize and hit the grid."

Rep. Webster questioned how the FES program encourages investors and grows the field. Dr. Umstattd asserted historically, FES and the National Nuclear Security Administration (NNSA) have pursued two different traditional approaches to fusion energy: using strong magnetic fields to confine and heat the plasma of the fusion fuel, or using large lasers. He explained ARPA-E discovered there was technical space in between those approaches where the density of plasma is different, and this posed new scientific evidence was also a cost minimum. Therefore, he contended there was a commercial aspect to launching the fusion program, which was looking for lower cost pathways for developing, which might yield lower cost fusion commercial power plants. He concluded FES built upon the foundation of the plasma science from traditional approaches but found a niche that had been under-explored.

Rep. Chuck Fleischmann (R-TN) inquired about the importance of ARPA-E and early-stage energy research. Hon. Genatowski explained ARPA-E is often the first stop after basic research, and creates both intellectual and economic opportunity, which further attracts the scientific and business communities. She concluded ARPA-E demonstrates technology is doable, feasible, and can be grown to scale.

Rep. Fleischmann questioned how ARPA-E is uniquely suited to tackle technological challenges like recycling spent nuclear fuel. Hon. Genatowski noted ARPA-E already has a set of experts that work in the nuclear area. She added ARPA-E can work with different companies that have different technologies within the same program. Dr. Umstattd emphasized "ARPA-E is a great melting pot of expertise," and therefore encourages different groups that would not otherwise intersect to come up with new solutions for problems that they are facing.

Rep. Zoe Lofgren (D-CA) asked how Zap Energy is taking a different approach than other companies. Dr. Umstattd explained Zap Energy's approach does not need any external magnets or large lasers to help heat, confine, and compress fusion fuel; rather, it maintains Z-pinch plasma long enough to get more fusion energy out than the energy cost of putting it in.

Rep. Lofgren inquired about liquid metals. Dr. Umstattd highlighted there are several companies examining how liquid metals can manage the energy flow that comes out of a fusion plasma, which is millions of times more energy-dense than burning oil or natural gas; he noted this poses a challenge to capturing that energy without

damaging parts of the power plant. He explained one way to do that, which Zap Energy uses, is instead of surrounding it with solid materials that might be damaged by some of the fusion products coming out, the company can build in self-regenerating liquid metal walls.

Rep. Lofgren asked how liquid metals could address radiation concerns. Dr. Umstatttd asserted Zap Energy's liquid metal blanket acts as a resilient self-healing first wall, but inside it is catching all of the fusion products creating heat, so it becomes a heat transfer fluid that then drives the electricity cycle – this helps breed some of the fuel that that needs to be consumed. He clarified Zap Energy has some solid components that are going to be subject to the energies released by fusion. He advocated for a materials research program, which would be crucial to the eventual “penciling out a profitability of a power plant based on fusion.”

Rep. Lofgren asked when Zap Energy might produce fusion. Dr. Umstatttd contended fusion companies are moving as fast as they can to first de-risk their science. He projected Zap Energy would have pilot programs and commercial power plants ready in the early 2030s.

Rep. Gabe Amo (D-RI) inquired about future of ARPA-E and its contribution to emerging clean energy technologies. Dr. Held cited the [SCALEUP program](#) as having enormous potential value, and encouraged further funding towards that effort.

Rep. Rich McCormick (R-GA) asked how Congress can “cut the red tape” and allow companies to have “unfettered access to advancing our narrative in fusion development using artificial intelligence (AI).” Dr. Umstatttd described the “synergistic opportunity” between AI and fusion energy, in which AI can advance the speed at which fusion proceeds, and when fusion commercializes, it can provide the energy needed to grow AI. He emphasized this innovation requires fusion to develop smaller, faster, and cheaper, which AI can assist with.

Rep. McCormick asked how to protect critical technologies like AI from being “siphoned off” to other competitors. Hon. Genatowski recommended “directing efforts and attention to vetting the people that come to learn at [U.S.] universities, and to keep on it.”

Public-Private Partnerships

Rep. Deborah Ross (D-NC) asked how ARPA-E can help transition innovative clean energy solutions to the private sector. Dr. Held argued it would be most effective to “connect those dots between the end-use customer and the technology developer” to ensure understanding of how technology can benefit the customer, and likewise, how the customer's requirements can guide technology development. He advocated for “further strides” in energy storage.

Rep. Ross questioned how ARPA-E has changed the U.S. private sector's energy and innovation landscapes, and investors' “appetite for risk.” Dr. Umstatttd remarked ARPA-E has been a valuable catalyst for bringing attention back to clean technology as a potential investment. He added ARPA-E has shown there is significant diligence that goes into project selection, and significant effort that goes into helpful and effective active project management. He emphasized ARPA-E helps companies identify key milestones that can help reduce risk and raise their companies' valuations.

Rep. Ross questioned how ARPA-E and Congress can support high-impact energy projects that have the potential to improve grid reliability and save customers money. Dr. Held explained while the typical ARPA-E awards are enough to get companies firmly implanted into the “valley of death,” it takes another “zero to the dollar” to scale up those projects and “climb back out” of the valley. He encouraged continued development in that area.

Rep. Amo asked which ARPA-E resources are most beneficial to Dr. Held and his company, Echogen. Dr. Held explained ARPA-E allowed Echogen to transform its technology from a concept to a functioning demonstration system at a “laboratory scale.” He added interactions with the ARPA-E technical program managers and their “tech to market people” were helpful technically, and helped to foster communications with end-use customers. He clarified ARPA-E's Duration Addition to Electricity Storage (DAYS) funding is not sufficient to build a demonstration commercial scale project, but it allowed Echogen to foster relationships, build a team, and put together what was ultimately a winning proposal for the [Energy Storage Grand Challenge program](#). He added

Echogen gained credibility from working with ARPA-E, and concluded ARPA-E is necessary – but not sufficient – “to fully get to the other side of the valley of death.” He explained Echogen’s project attracted significant private funding due to that credibility, and urged large-scale commercialization requires public-private partnerships.

Rep. Baird noted the valley of death refers to the journey from laboratory testing to commercial, scaled up production. He inquired about the challenges faced in soliciting private investors, and asked how the DOE can be assist in those efforts. Dr. Held contended the most difficult task was attracting enough private investment to execute large-scale projects. He highlighted there is often a “gap” between where companies land at the end of the typical ARPA-E project, and a commercially viable scale. He recounted difficulties in obtaining private financing without guaranteed financial returns. He suggested the DOE’s programs – like SCALEUP and Office of Clean Energy Demonstrations (OCED) programs – reduce the private sector’s financing risks.

Rep. Summer Lee (D-PA) asked if ARPA-E has a strategy to strengthen and diversify networks of potential commercial partners to ensure benefits for small businesses and local communities. Hon. Genatowski remarked ARPA-E focuses on small businesses and colleges to foster the distribution of the benefits and the activities of the federal government.

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Please click [here](#) for the archived hearing.