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Good morning Chairman Williams, Ranking Member Bowman and distinguished members of the subcommittee and committee. As the Vice President of Product and Partnerships at Zap Energy, I'm here today to share the story of the ARPA-E intersections that have been vital to the founding of our fusion energy company and its continued success. As some context for my remarks, I had the opportunity to serve at ARPA-E from 2014 to 2018—first, as a tech-to-market advisor and then as their Deputy Director for Commercialization. I left ARPA-E to go work in the private sector and eventually joined Zap Energy in 2021.

The birth of Zap Energy the company coincides with a high potential, high impact ARPA-E program that explored off-roadmap concepts for lower-cost pathways to fusion energy. Once developed, fusion energy will be a critical asset in our energy mix as a provider of clean, on-demand, safe and sustainable energy. Overcoming fusion's technology challenges has major implications in economic prosperity, energy independence, national security, and natural resources, so it is well-suited to ARPA-E's mission supporting transformative energy innovations in the greater national interest.

While government grants for science are usually exploratory in nature and emphasize discovery, a milestone-based cooperative research agreement typical of ARPA-E is extremely application focused. The ARPA-E project awarded to the University of Washington and Lawrence Livermore National Lab team that helped spark the creation of Zap Energy was a dramatic departure from

the earlier DOE[1] support that established the scientific foundation for our fusion approach. ARPA-E required the research team to think from the desired end state backwards: What was a viable technology development pathway? What were the quantifiable milestones along that pathway? What do power plant owners and operators care about and what will be the key elements for commercial success? Beyond using milestones to manage the project, ARPA-E encouraged adding value through the pursuit of publications, patents, follow-on funding and the creation of new companies. The project team was successful on each of these fronts.

Experts in business and fusion science don't often end up in the same room, but ARPA-E helped create conditions that catalyzed the 2017 founding of Zap Energy by entrepreneur Benj Conway alongside professors Uri Shumlak and Brian Nelson. Soon after its founding, Zap Energy was awarded a $6.7M follow-on project by ARPA-E. Zap continued to set and then meet specific development milestones all while growing the company through ever-increasing rounds of private capital now equaling over $200M from a broad set of investors including Bill Gates's Breakthrough Energy Ventures, Shell, and Chevron, the first U.S.-based oil & gas major to make an investment in fusion. Our goal is ambitious and straightforward: develop and deploy fusion as rapidly as possible.

As Zap grew, ARPA-E innovated its support for fusion development. New program directors and new staff rotated in and launched new programs to address gaps and accelerate the pace of progress. Instruments for measuring fusion are often extremely complex, requiring many years of highly specific experience and significant hardware costs that can put them out of reach for a startup. So, ARPA-E supported diagnostic capability teams that brought their advanced measurements to our fusion devices at Zap Energy. Working alongside scientists and engineers from Los Alamos and Lawrence Livermore National Labs, the University of California at Berkeley, and the University of Nevada in Reno, we published of over a dozen peer-reviewed articles[2] and increased our fusion performance by a factor of 50 in under four years.

Zap isn't alone in benefiting from ARPA-E's efforts. When ARPA-E launched its first fusion development program in 2015, there were just a dozen fusion start-ups. Today, there are over 40 around the world. From my own personal survey of publicly disclosed funding, there was around

[1] Brief history: https://arpa-e.energy.gov/news-and-media/blog-posts/arpa-e-investor-update-vol-2.
[2] Key publications: https://www.zapenergy.com/research

half a billion private dollars invested in fusion in 2015. Three years later, that private investment had doubled and today the total is estimated at nearly $6B.[3] Based on these trajectories, we are at a critical juncture in the effort to commercialize fusion energy.

Today, Zap Energy is one of eight companies selected in the Department of Energy's $46M milestone-based fusion pilot plant program, the cornerstone of the U.S.'s Bold Decadal Vision for commercial fusion energy. During this 5-year program, these eight companies need to collectively raise over $4B to develop and prove out aspects of their fusion pilot plant designs. We are excited by the U.S. ambition to lead the global fusion commercialization effort but are concerned about the scarcity of Federal resources applied to this flagship program. Other nations are not complacent. Just in the last year, the UK,[4] Germany,[5] and China[6] have each announced new funding commitments in excess of $250M in their respective countries. For comparison, a helpful model for the U.S. milestone-based fusion program has been NASA's Commercial Orbital Transportation Services program[7] which leveraged $684M in Federal funds allocated to two companies to incubate the now rapidly-expanding commercial space launch industry. While this milestone-based fusion energy development program is currently authorized[8] up to $415M, and the companies are preparing to raise and deploy $4B, only $46M in Federal funds has been announced thus far. The FY24 appropriation for this program has now been set at $40M.

The global race to deliver fusion energy to the grid is underway. With your strong support, fusion can become a success story for the United States and for ARPA-E in the way that early DARPA seeds flourished into today's internet. Thank you for the opportunity to provide these remarks, and I'd be happy to answer any questions.

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[3] https://www.fusionindustryassociation.org/fusion-industry-reports/
[4] https://www.gov.uk/government/news/government-announces-up-to-650-million-for-uk-alternatives-to-euratom-rt
[5] https://www.researchprofessionalnews.com/rr-news-europe-germany-2023-9-germany-launches-370-million-fusion-research-programme/
[6] https://english.cas.cn/newsroom/mutimedia_news/202309/t20230918_376979.shtml
[7] https://www.nasa.gov/wp-content/uploads/2016/08/sp-2014-617.pdf
[8] 42 USC 18645: Fusion energy, section (i) Milestone-based development program