August 31, 2020

Daniel Simmons, Assistant Secretary
Office of Energy Efficiency and Renewable Energy

Bruce Walker, Assistant Secretary
Office of Electricity

U.S. Department of Energy
1000 Independence Avenue SW
Washington, DC 20585

Re: Response to Request For Information On Energy Storage Grand Challenge Draft Roadmap

Dear Assistant Secretary Simmons & Assistant Secretary Walker—

The U.S. Energy Storage Association (ESA) respectfully offers these comments in response to the Energy Storage Grand Challenge draft roadmap and related request for information issued by the Department of Energy (DOE). ESA is broadly supportive of DOE’s Grand Challenge effort and commends the work that has informed this product to date. In comments below, ESA describes high-level, priority considerations for the Grand Challenge roadmap effort.

ESA is the national trade association dedicated to energy storage, working toward a more resilient, efficient, sustainable, and affordable electricity grid – as is uniquely enabled by energy storage. With more than 190 member companies, ESA represents a diverse group of power sector stakeholders, including independent power producers, electric utilities, energy service companies, financiers, insurers, law firms, installers, manufacturers, component suppliers and integrators involved in deploying energy storage systems, both in the U.S. and around the globe. Our members work with all types of energy storage technologies, including lithium-ion, advanced lead-acid, flow batteries, zinc-air, liquid air, compressed air, and pumped hydroelectric storage among others.

ESA recently released a new “100x30” vision for energy storage in the U.S. for 2030, by which time we project 100 GW of new storage to be installed on the U.S. grid, including batteries, pumped hydro, and other technologies. We base this projection on the increasing value of energy storage in similar use cases as identified in the Draft Roadmap: accommodating the expansion of variable renewable generation (i.e., facilitating an evolving grid), promoting grid reliability and resilience (i.e., recognizing interdependent network infrastructure, maintaining critical services during disruptions, serving remote communities), and enhancing the value of
electrification at the interface of end-users and the grid (i.e., electrified transportation, facility flexibility). There are two aspects of the ESA 100x30 Vision that we believe are relevant to the Grand Challenge. First, the attainment of the 100 GW goal by 2030 requires supportive federal, state and local policies that directly incentivize and encourage the deployment of energy storage systems. Second, the expansion of energy storage RD&D and commercialization activity will attract investment in domestic energy storage manufacturing capacity and related production facilities. ESA estimates that the deployment of 100 GW of energy storage by 2030 would create at least 200,000 jobs, without accounting for a surge in U.S. technology innovation or expansion of domestic manufacturing. Expanding the domestic manufacturing base would provide even more employment for U.S. workers.

Ultimately, the federal government should consider reorganization of DOE’s energy offices to elevate energy storage technology investments on par with investments in energy conversion technologies (i.e., generation & end-use technologies) and energy transportation technologies (i.e., wire, pipeline, & subsurface extraction technologies). With nearly all energy still stored in the form of molecular fuels, diversification of storage technologies, including new chemical carriers, is a critical and necessary objective for 21st century energy innovation investment. The Energy Storage Grand Challenge provides a unique opportunity to lay the foundation of that reorientation of DOE’s energy offices.

OVERALL RECOMMENDATIONS

RECOMMENDATION: DOE will best succeed if it emphasizes technology demonstration and scale up to drive storage innovation. The goal of the Grand Challenge on “Innovate Here, Make Here, Deploy Everywhere” will be most likely to be realized with a significant emphasis on growing the U.S. domestic market for energy storage. Customer demand—by grid operators, businesses, and households—is critical for guiding innovation investments, proving technologies, and ensuring a viable market pathway is available for new technologies. DOE will succeed if it (1) strongly supports technology demonstrations in real-world operational environments to drive customer learning and critical feedback on storage technology development and (2) if it focuses on clearing barriers to and promoting early deployment for storage technologies. Doing so will also better enable other entities (i.e., Congress, federal agencies, state regulators & legislators, wholesale market operators) to build on DOE’s work to build a domestic market and meet the “Innovate Here, Make Here, Deploy Everywhere” goal of the Grand Challenge.

RECOMMENDATION: DOE should focus energy storage innovation investments on enabling longer durations at lower cost. As the power sector works to meet net-zero and clean energy targets and the grid evolves to include more variable renewable resources, energy storage will lay an increasingly central role in grid reliability and flexibility. Numerous studies have indicated that longer-duration storage technologies, intra-day and inter-day, will be needed to sustain operational reliability with ambitious clean energy and net-zero targets. A variety of promising
technologies exist, either through mechanical/kinetic storage, thermal storage, electrochemical storage, power-to-gas storage, or even hybrids thereof. Most of these technologies are pre-commercial today and may face both product and process innovation challenges, both of which are critical to solve for the development of next generation of cost-effective energy storage technologies. Doing so will require a focus on grid-connected demonstrations at scale that build the experience and confidence for widespread deployment, a departure from DOE’s historic focus on small-scale pilot projects for energy storage.

RECOMMENDATION: DOE should establish a Federal Advisory Committee specific to energy storage. The ongoing development of the Grand Challenge will require meaningful and sustained stakeholder involvement to help shape the RD&D agenda and commercialization programs. Energy storage is currently the most dynamic and quickly changing segment of the entire energy industry, which poses significant information challenges for policy design and execution. DOE’s proposal for periodic opportunities for stakeholder input may not suffice to provide DOE with actionable information in a timely manner; additionally, the nature of annual or biennial consultation will tend to produce wide-ranging requests for input that most industry members will lack bandwidth to respond to effectively. A standing Federal Advisory Committee dedicated to energy storage issues that meets on a similar schedule as the Electric Advisory Council could facilitate timely input on cross-cutting issues of national importance while keeping meetings focused in a manner that secures broader stakeholder engagement. DOE currently provides management support to more than 22 Federal advisory committees, involving over 900 members, and continues to expand these bodies. Such an advisory committee would not supplant current stakeholder processes, such as the Energy Storage Program Annual Peer Review, but could help address key information needs for the Grand Challenge development.

RECOMMENDATION: Describing the anticipated resourcing of each track over time will better inform stakeholders of DOE’s strategy. In addition to describing the milestones and trajectory of each part of the roadmap, DOE could improve clarity in its strategy by indicating the level of resources dedicated to each track (and, if available, any sub-track), either in absolute terms or as a proportion of overall effort in the Grand Challenge, as well as how resource levels are expected to change through 2030. Doing so will help identify current and anticipated gaps in office capabilities and allow for better sequencing of activities.

RECOMMENDATION: The roadmap should identify specific objectives that DOE can coordinate with other federal agencies. As DOE undertakes work on the Energy Storage Grand Challenge, the systematic approach described provides an opportunity for DOE to serve as convener and anchor partner to other federal agencies whose public mission may be supported with energy storage deployment. For example, DOE can assist the Department of Homeland Security with use of energy storage in both pre-disaster mitigation and post-disaster recovery efforts; the Department of Defense and General Services Administration with identifying critical facilities that merit onsite storage for resilience; the Department of Transportation with
implementation of energy storage to integrate fast-charging infrastructure for heavy duty electric vehicles and vessels; the Departments of Interior and State with analysis on materials needs for a domestic supply chain; and so forth. Identifying these opportunities early will help drive buy-in from other agencies and integrate DOE storage efforts in their complementary planning processes.

TECHNOLOGY DEVELOPMENT TRACK

RECOMMENDATION: The Electrified Mobility use case should include in its scope all robotics, not simply vehicles. While Electrified Mobility is rightfully identified as a critical use case, ESA notes that electric vehicles can be understood to be a subset of robotics technologies, advances in which will depend on portable sources of power with significant performance. At present, the most progress of energy storage for robotics has been in unmanned aerial vehicles and other small autonomous devices. DOE’s R&D strategy focused on this Electrified Mobility will be more robust if it includes other equipment with autonomous mobility.

RECOMMENDATION: The Facility Flexibility use case should designate grid interactivity as a criterion. The use case of Flexibility for buildings and energy-intensive facilities rightfully emphasizes the optimization of processes within the boundaries of a facility. Nonetheless, DOE’s R&D strategy will be improved if it makes clear that grid interactivity—the ability of those optimization processes to interact in real-time with external grid conditions—is also a success criterion for the Flexibility use case.

MANUFACTURING AND SUPPLY CHAIN TRACK

RECOMMENDATION: Manufacturing process R&D merits significant investment and should include the Office of Science in addition to DOE’s applied R&D offices. The draft roadmap rightfully includes a focus on shared technical barriers in manufacturing energy storage technologies, although ESA notes that these should be seen as potential challenges for the Office of Science in addition to the applied R&D offices identified by DOE. The fabrication of novel materials at scale with extremely low impurities can present significant early-stage R&D challenges, not unlike those faced previously in semiconductor material fabrication. DOE’s manufacturing and supply chain strategy will be best served by ensuring that process R&D is both emphasized and captures fundamental materials science challenges.

RECOMMENDATION: Domestic manufacturing efforts aimed at batteries should include other storage technologies and target them based on industrial clusters. ESA strongly supports DOE efforts to establish a domestic energy battery manufacturing ecosystem, including through the proposed Federal Consortium for Advanced Batteries. Nonetheless, outside of batteries there will be manufacturing opportunities in other storage technologies, such as novel phase-change materials for thermal storage, new mechanical storage equipment with high tolerances, or next-generation power-to-gas conversion equipment. ESA recommends that DOE seek opportunities to establish domestic supply chains for other technologies as well. To do this
effectively, DOE could undertake an analysis of industrial clusters in the U.S. to target geographies where such supply chains would be most likely to leverage existing industrial organization—not just in technology development and manufacturing, but also upstream, such as in mining and chemical processing, and downstream, such as in recycling (i.e., “mining from waste”) and safe disposition.

**RECOMMENDATION:** DOE should conduct a value chain analysis to determine where investments can translate to largest employment gains. The focus of the Grand Challenge on promoting a domestic supply chain is predicated in part on creating new jobs in the U.S. energy storage sector. However, the value added in upstream processes (e.g., raw materials, chemical processing) has not been quantified or compared with value added in downstream processes (e.g., manufacturing, construction, installation). To best target public investments, DOE could undertake value chain analysis to determine the most productive parts of the supply chain that can be onshored, resulting in greater employment gains.

**POLICY AND VALUATION TRACK**

**RECOMMENDATION:** DOE should support policymaking by increasing data collection on key energy storage technology characteristics. As outlined by ESA at the July EIA Energy Storage Workshop, policymakers, grid operators, and other key decision makers commonly seek information on the volume of storage deployed and planned and the cost/cost structure of storage projects to inform their work. DOE can support deployment data collection by including MWh in its reporting, not just MW; developing methods for estimating DER storage deployment, based on state energy office and regulatory information; and track utility resource plans and RTO/ISO interconnection queues to generate forward estimates of deployment. DOE can support cost data collection by creating an empirical report, similar to LBL’s Tracking the Sun or Wind Technologies Market Reports, as well as establish methods for breaking out storage costs from hybrid project data.

**RECOMMENDATION:** DOE should support policymaking by increasing analytical evidence and tools on electric system needs and energy storage benefits. As outlined by ESA at the July EIA Energy Storage Workshop, policymakers, grid operators, and other key decision makers commonly seek analysis on several aspects of energy storage to inform their work. These include: the size of the grid need for storage; the emissions impacts of storage; the system and customer benefits from storage deployment; the contribution of storage to resource adequacy; and the value of storage services. DOE can support analytical evidence for the size of grid needs by studying systems that deploy storage in a standalone context, beyond just a renewable hybrid, and studying storage in different energy mixes, beyond just high renewables futures, and at different levels of interconnection. DOE can support analytical evidence for resource adequacy contribution of storage by undertaking reliability analyses, using methods like EUE or ELCC, across grid regions for varying deployments of storage; developing capacity accreditation guidelines for hybrid resources; and developing a metric to reflect system flexibility needs to
complement LOLE convention. DOE can support analytical evidence for valuation by cataloguing valuation methods from various state and RTO/ISO source; developing a menu of methods to value resilience & guide for method selection; and developing an option valuation framework for storage as a non-wires alternative. DOE can support analytical evidence of the emissions effect of storage by conducting empirical studies of storage impact on system dispatch and emissions, both GHGs and local ambient air concerns like NOx and SOx, as well as creating datasets on marginal unit GHG emissions across various regions by location, hour, and season. Finally, DOE can provide guidance to regulators and other stakeholders on utility planning models and software packages that can adequately capture energy storage operations in long-term resource planning and/or T&D planning—including development of computational tools not provided by private sector actors, as appropriate.

**RECOMMENDATION:** DOE should support state officials to undertake gap analysis that informs storage deployment policies. Many states are still working to put in place a regulatory framework that allows remuneration of energy storage for all of the services it provides—and as such, there is a “gap” between storage projects’ economic potential and actually accessible revenues. An example of this analysis is the New York Energy Storage Roadmap, which examined use cases, available revenue streams, and various hard & soft costs to quantify the current financial gap in deploying energy storage. DOE could provide grants to any state utility commission, energy office, or relevant state agency that conducts a gap analysis such as this.

**RECOMMENDATION:** DOE should partner with states to develop frameworks for valuing power system resilience investments. While many grid operators and state & local governments are examining energy storage for resilience, the lack of defined methods for valuing resilience prohibits factoring such value into cost-benefit analyses that inform public & private resilience planning and procurement decisions. ESA recommends that DOE’s Office of Cybersecurity, Energy Security, and Emergency Response, in coordination with the Office of Electricity, establish a technical assistance program for states to develop local programs and market mechanisms for investments in local electric service resilience. ESA also recommends that DOE, in coordination with state regulators, utilities, and resilience technology providers, establish a set of technical terms and definitions by which the provision of electrical service resilience can be specified for use in resilience investment programs, markets, and transactions. ESA recommends that DOE create a library of methods and measures by which investments in electrical service resilience can be evaluated, which can inform DOE’s technical assistance to help states develop the resilience cost-benefit methodologies underlying each state’s resilience programs and markets. Finally, ESA recommends that DOE coordinate with FEMA and all other federal agencies involved in the funding and deployment of electrical service resilience investments to establish a consistent evaluation standard for all resilience investment cost-benefit analyses conducted for federal programs.

**RECOMMENDATION:** DOE can best catalogue public policies on energy storage by using categories of access, competition, and valuation. Policy barriers include issues of (1) access,
where storage is limited from physical grid access or from market access; (2) competition, where storage is excluded from broader planning, procurement, and programs; and (3) valuation, where storage is not valued or not compensated for the flexibility it can provide. The public policies that address these issues tend to be similar across jurisdictions. Access policies reform interconnection and permitting processes to be appropriate for storage, update regulations to allow multiple-use storage, update ownership rules, and so on. Competition policies reform utility resource planning to incorporate storage appropriately, allow energy storage to qualify for market services, incorporate storage considerations in clean energy standards, and so on. Valuation policies establish storage targets, create storage incentive programs, develop market services for flexibility, reform rate designs and tariffs, and so on. ESA welcomes the opportunity to provide greater background to DOE on the wide range of policies among states, RTOs/ISOs, and federal agencies that present or address these barriers.

ADDITIONAL RESOURCES:

- ESA Policy Statement on Ownership and Competition
- ESA Policy Statement on C&I Rate Design
- ESA Policy Statement on Storage-as-Transmission
- ESA Policy Statement on Multiple-Use Storage
- Enabling Versatility: Allowing Hybrid Resources to Deliver Their Full Value to Customers
- ESA White Paper: Energy Storage Incentive Programs
- State Policies to Fully Charge Advanced Energy Storage

WORKFORCE DEVELOPMENT TRACK

RECOMMENDATION: Funding a fellowship program for rising technologists can accelerate U.S. storage industry capacity. Energy storage technologies vary and present numerous use cases, resulting in a wide range of technical implementations and business models. To accelerate the development of U.S. talent in the storage workforce, DOE could institute a fellowship program that places early career power sector professionals in storage companies and at National Labs, rotating 6-12 month placements periodically. Fellows would receive a stipend and focus on either a rotation through various storage use cases (e.g., system supply, T&D infrastructure, electrified mobility) and/or a rotation through various parts of the storage value chain (e.g., manufacturing, systems integration, facility operation). Additionally, DOE could support professionals from backgrounds not traditionally represented in the power sector to undertake such fellowships, ensuring a diverse U.S. storage workforce.

RECOMMENDATION: DOE should invest in training of first responders and code professionals in safety and hazard management. As storage technologies are deployed more widely in the built environment, allied professionals in the code enforcement sector and fire departments
will increasingly require information and training for safety. Accurate information and training on safe operations in the presence of energy storage systems will instill confidence in first responders, municipal authorities, regulators, financiers and insurers. In addition, code enforcement knowledge is important to ensure development of uniform and efficient permitting, so that code officials can fully support the safety of installed systems. ESA recommends DOE’s Office of Electricity sustain an allocation of resources to provide training and technical assistance to firefighters and code inspectors on storage.

ADDITIONAL RESOURCES:


CONCLUSION

ESA appreciates the opportunity to comment on the DOE Energy Storage Grand Challenge Draft Roadmap. While these comments are high-level and do not address the full scope of questions posed in the request for information, ongoing stakeholder engagement will best ensure that the detailed considerations of the roadmap are addressed systematically. We look forward to supporting DOE’s work to elevate the priority of energy storage technology innovation investments and ensure their translation into business growth that solidifies the U.S. as a global storage technology leader.

Sincerely,

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