Comments on DOE Notice of Request for Information (RFI) on Ensuring the Continued Security of the United States Critical Electric Infrastructure

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Battery Council International (BCI) appreciates the opportunity to offer comments on the DOE Request for Information on Ensuring the Continued Security of the United States Critical Electric Infrastructure.

BCI is a not-for-profit trade association formed in 1924 to promote the interests of the lead battery industry. BCI has member companies worldwide engaged in every facet of the industry: battery manufacturers and recyclers, marketers and retailers, suppliers of raw materials and equipment, and expert consultants.

Lead batteries provide 70% of the worldwide rechargeable battery storage capacity sold each year, and form the backbone of global battery markets. The U.S. lead battery industry directly employs approximately 24,700 U.S. workers and spends $1.7 billion annually on payroll. In addition to the workers the lead battery industry directly employs, it supports 30,900 supplier jobs and 36,600 jobs from worker spending in different industries. Together, these impacts total 92,200 jobs, providing more than $6 billion in labor income and more than $26.3 billion in economic output in 2018. In addition, BCI member companies spent $100.4 million on research and development.

BCI supports DOE's objective of ensuring a secure critical electric infrastructure for America. The country's electric power industry depends on a wide spectrum of technologies – including lead batteries – for functions ranging from backup power supply during system disruptions to facilitating the integration of power from variable resources such as wind and solar to the electric grid. The lead battery industry is an important partner in a suite of energy storage technologies that are becoming increasingly essential to ensuring a reliable and resilient electric power system.

The RFI issued on April 21, 2021 seeks comments on (1) the development of a long-term strategy for DOE to develop and execute a comprehensive program for ensuring electric system security and (2) whether the Secretary of Energy seek to issue any prohibition orders on the acquisition of equipment that would be imported and installed on the electric power system.

BCI offers comments to these subject areas from two perspectives. The first perspective is that of a provider of energy storage products and services to the country's electric power industry. The second is that of a user of electricity to run manufacturing operations. While each perspective has unique characteristics, they nonetheless are related and require a holistic approach from government policymakers. The domestic battery industry must be able to function in a policy environment that fosters innovation and opportunities for success so that it can serve the needs of the nation's electric power industry. At the same time, battery manufacturers must be confident that the power they purchase from the electric power industry is provided in a safe, economic, reliable and secure manner. BCI is confident that DOE and other federal agencies share these priorities.

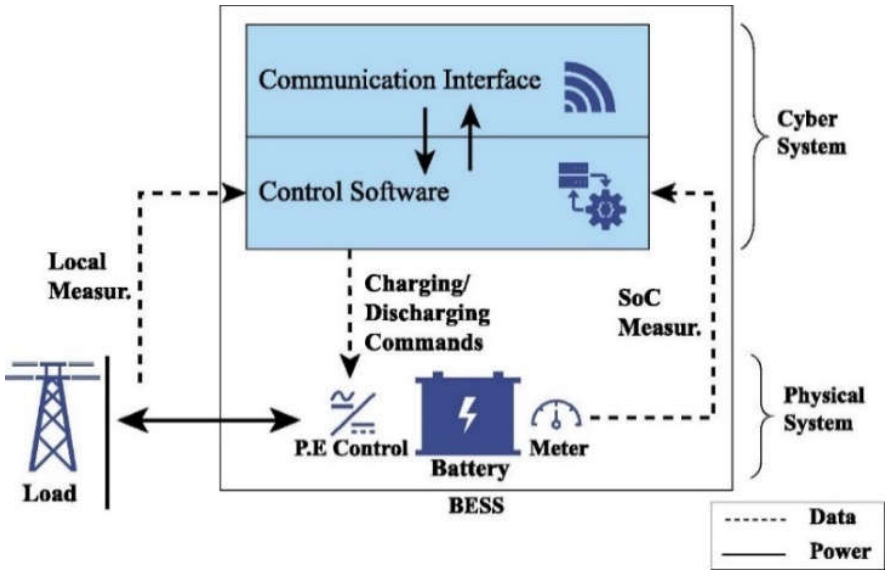
Introduction

As the nation's electric power industry confronts the challenges of maintaining a reliable and resilient system, the North American lead battery industry recognizes the changing profile of the country's energy landscape. The working relationship between the lead battery industry and DOE needs to be strengthened to address these challenges. The electric power industry is evolving from its traditional structure as a one-way provider of electricity to a more interactive structure in which consumers not only have more electric supply options from utilities and non-utilities, but in some instances are becoming electric power suppliers themselves. For example, a greater supply of power is coming from variable resources such as wind and solar units that are more affected by weather conditions than traditional baseload capacity from the use of fossil fuels and nuclear power. Some of these variable power units are owned by utilities, some are owned by non-utility third parties, and others are owned by consumers themselves with the ability to sell surplus power they do not use to their local utilities.

A resilient infrastructure needs to have a diverse range of energy sources and given its unique features, lead batteries must be a key part of that mix. In fact, there is no substitute. The lead battery industry, with its unequaled 99% recycling rate, already provides 70% of the worldwide rechargeable battery capacity sold each year. And, lead batteries are increasingly important to the nation's electric supply infrastructure in assuring that the integration of power from these variable resources does not impair overall reliability and resiliency. Among the vital use cases served by lead batteries:

- Advanced manufacturing facility backup power systems
- Telecommunications power storage systems
- Grid and micro-grid power storage
- Grid frequency regulation
- Renewable energy power storage, smoothing, and time shifting
- Electric vehicle charging stations
- Transportation and logistics equipment
- Medical and public safety equipment
- National security and defense equipment

Batteries, and their accompanying management systems, play a key role in this evolving electric power industry paradigm. An abstract model of a BESS as part of an information technology system is shown below. The battery is linked to a meter that measures its state of charge and in turn is controlled by software that interfaces with the central utility management system. It is the management system that sends dispatch commands through the interface and software to the BESS.



Source: Alexandria Engineering Journal, 2019

BCI notes other issues in the battery supply chain that should be considered by DOE. For example, the sourcing of battery materials can be problematic. In the case of lead batteries, the fact that more than 85% of the materials used by North American lead battery manufacturers come from domestic recycling facilities provides a degree of supply certainty compared to the availability of materials for lithium-ion batteries that must be imported. The lithium, cobalt, graphite and other materials used in the manufacture of lithium-ion batteries must be imported.While efforts are being made by both public and private sectors to develop domestic sources of these materials, the security of imported materials continues to require attention from DOE and other agencies. By contrast, the U.S. has significant lead reserves and robust manufacturing and recycling capacity, enough to meet our growing demands. The nation's recycling investment means that lead batteries are the only chemistry that is today delivering on the promise of a continuation of raw material supply now and looking into the future.

DOE must ensure that the policies it adopts to promote a more secure and resilient electricity infrastructure take into account the critical role that lead batteries play in terms of safety, clean energy, recycling efficiency, having a domestic supply chain, and functionality.

<u>BCI raises two additional considerations in the context of this RFI.</u>

The first consideration is the need for "onshore" battery manufacturing within North America. Where much of the intellectual property developed in the U.S. for other technologies like lithium-ion has been "offshored" for manufacturing in other countries, the lead battery industry for more than 100 years has been – and remains – a vital domestic industry supplying the majority of rechargeable battery energy storage capacity. Within the past several years, the lead battery industry has demonstrated its commitment to the future with by entering into several important research and development programs with DOE and national laboratories to improve the efficient performance of this vital domestic energy storage resource.

Additional government investment and commitment to lead battery research and development is needed, and will provide positive returns on government investment, because lead batteries will forever be an important foundation of critical energy infrastructure. As the U.S. Government pursues the development

of new and renewed manufacturing hubs across the country that are energy dependent, efficient and durable, lead batteries are going to continue to be the bedrock battery technology serving the country's growing demand for rechargeable energy. Research and development investments to increase their energy density and performance can unleash the power of these batteries even further.

Existing government-private research efforts are already paying dividends. Among these is the Lead Battery Science Research Program (LBSRP), which has a cooperative research and development agreement (CRADA) between 16 North American companies in the lead battery industry[1] with Argonne National Laboratory to use the lab's state-of-the-art equipment and expertise in a "deep dive" to explore the behavior of recycled materials used in lead batteries. The goal of this research is to improve the efficient utilization of these materials so that a new, more efficient, generation of lead batteries will be developed and produced in North America. This research already has provided impressive results and has led to expanded research with Pacific Northwest National Laboratory, the University of Toledo and other institutions. This work is important as the lead battery industry, which has had a strong domestic infrastructure for more than 100 years, can continue to serve the changing needs of its customers.

A second consideration relates to battery recycling. The domestic supply of the large majority of necessary raw materials from North American recycling is a core supply chain strength of the lead battery industry, providing significant protections from global supply interruptions. BCI is concerned about the potential ramification for the battery industry should domestic recycling capacities for lead batteries erode, or the domestic recycling infrastructure for other chemistries not emerge. BCI agrees with the concerns of EPA and others over the export of used batteries to illegal or underperforming reclamation facilities that lack environmental and safety standards comparable to facilities in U.S.—where BCI member facilities operate under the strictest government and voluntary standards in the globe. In addition to environmental impacts, the unsafe, informal, or illegal recycling of batteries results in lower overhead expenses and enables under-regulated facilities to unfairly compete with North American recyclers, further undermining the security of North American recyclers and the domestic supply chain. BCI strongly supports efforts to bring all recycling enterprises throughout the world into alignment with the high standards of recyclers in North America.

BCI offers for DOE's consideration comments to specific topics raised in the RFI.

A. Development of a Long-Term Strategy

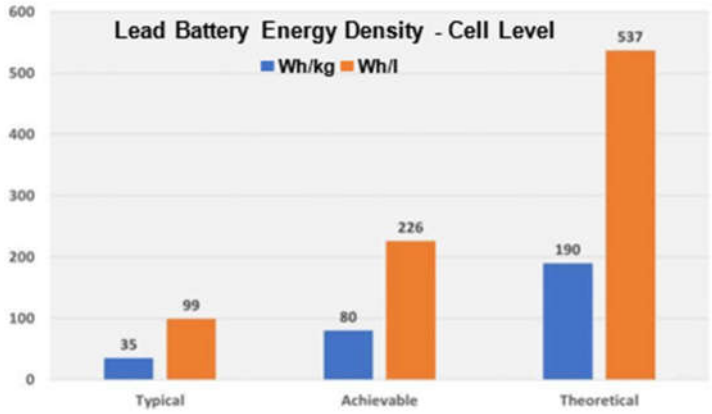
3. What actions can the Department take to facilitate responsible and effective procurement practices by the private sector? What are the potential costs and benefits of those actions?

BCI notes that through the years, DOE—in a non-partisan manner—has consistently sought support from Congress for a wide range of programs in support of the battery industry. DOE should continue to support the development and deployment of innovative energy technologies—and in particular technologies which provide advantages in terms of safety, sustainability, and recyclability—for a more affordable, secure and reliable future for American consumers. This policy not only should be continued but expanded to incorporate national security and cybersecurity objectives. BCI supports more targeted energy security initiatives through the augmentation of energy systems of mission critical facilities, including the Defense

[1] LBSRP member include Clarios, Crown Battery, Doe Run Company, Stryten Manufacturing, East Penn Manufacturing, EnerSys, RSR Technologies, Trojan Battery Company, Advanced Battery Concepts, Borregaard Lignotech USA, Inc., Cabot, Gridtential, Microporous, Superior Graphite, Teck Metals

Critical Infrastructure (DCI); the interdependency between DCI and surrounding municipalities; local government; emergency services; water and wastewater facilities; and health care facilities, among others.

Achieving those long-term results requires a sustained investment in research and development so that lead batteries can help North America accelerate the growth of a domestic manufacturing infrastructure. Committed government investment in these efforts through the national labs and support for private efforts, similar to government investment in performance R&D for other battery technologies, will unlock these advances in a timeframe that would be unachievable for industry alone. The performance of current lead battery designs reflects various technical challenges, for which solutions lie on the horizon that could open up the possibility of achieving the full theoretical energy density of lead batteries (see figure below).



America's lead battery industry is a proud partner with DOE and the national laboratory system in the use of state-of- the-art equipment and expertise to help develop the next generation of lead batteries that will be even more powerful, efficient and environmentally beneficial. In addition to the CRADA between the LBSRP and Argonne, projects include:

- BCI member companies are also participating in, and funding, at least seven other DOE lead battery technology research programs at ANL, Ames Laboratory, Pacific Northwest National Laboratory, and the National Renewable Energy Laboratory.
- Lead battery recycling companies are supporting DOE research into battery recycling technologies at Oak Ridge National Laboratory and the Re-Cell Center at Argonne.
- Multiple projects are underway with DoD (through the Defense Logistics Agency) to develop new advanced lead batteries and systems for forward deployed units in applications where lead batteries are preferred for their reliability and resilience in demanding battlefield situations.

The industry has identified several areas for research and development which hold the promise to deliver dramatic improvements to lead battery performance.

For example, improved energy density could be unlocked by resolving the current low and uneven active material utilization, and a high dependence on inactive lead, as a result of the form factors of the batteries required by existing applications. Remediation of these deficiencies through the development novel designs such a bi-polar batteries and other innovations on the drawing board, offers the opportunity to

significantly improve lead battery energy density. Numerous research areas hold the promise of significantly improving lead battery cycle life, including:

- Electrical resistance of lead sulfate progressively increases electrode resistance as the battery discharges,
- Dissolution of lead sulfate controls the recharge capability of the battery and varies with acid concentration, current density, temperature, additives, etc.,
- Lead sulfate coalesces to form larger less soluble crystals, further impairing charging, and
- Precipitation of lead sulfate stresses the active mass due to volumetric change and results in pore blocking of the 3-dimensional electrode.

The American lead industry has also organized a "Lead Battery Grand Challenge" (LBGC), which is a plan for developing lead battery solutions optimized for new grid energy storage applications that among other things would provide critical support for EV charging. With government support, the LBGC is intended to build upon and beyond basic science research, by undertaking applied science work, and investing in efforts to transferring knowledge to American lead battery manufacturers and suppliers, developing requisite manufacturing and supply chains, and instituting workforce training in an effort to innovate, manufacture, supply, maintain and recycle its optimized grid energy storage lead battery solution.

To guide efforts of the LBGC and other research efforts, the industry has established a research Roadmap integrating the tasks necessary to support the innovation of a grid optimized lead battery solution, establish it in American manufacturing, sell it worldwide and recycle it in a circular economy.

Specifically, the LBGC is designed to explore innovations that have the potential to dramatically improve the performance of lead battery grid energy storage performance. Innovation within the LBGC will be developed along the following four research tracks:

- Develop cell architecture specific to grid energy storage to achieve a 100% improvement in energy density, by focusing on bipolar cell construction,
- Evaluate the use of chemically prepared active materials to achieve a 50% reduction in manufacturing time and work in progress by eliminating curing and formation manufacturing activities,
- Determine design and manufacturing techniques appropriate to increasing cell compression to achieve a 50% improvement in grid storage application cycle life, and
- Investigate materials and designs optimizing electrolyte concentration in active material to achieve a five-fold improvement in dynamic charge acceptance, and a round trip efficiency of greater than 90%.

The LBGC roadmap is designed to integrate with the DOE Energy Storage Grand Challenge objectives to "Innovate Here, Make Here, and Deploy Everywhere".

B. Prohibition Authority

1. To ensure the national security, should the Secretary seek to issue a Prohibition Order or other action that applies to equipment installed on parts of the electric distribution system, i.e., distribution equipment and facilities?

2. In addition to Defense Critical Electric Infrastructure (DCEI), should the Secretary seek to issue a Prohibition Order or other action that covers electric infrastructure serving other critical infrastructure sectors including communications, emergency services, healthcare and public health, information technology, and transportation systems?

3. In addition to critical infrastructure, should the Secretary seek to issue a Prohibition Order or other action that covers electric infrastructure enabling the national critical functions?

BCI offers for DOE's consideration a general response to these three questions.

America's battery supply chain is complex from both domestic and global perspectives. Decisions about investment in any production enterprise are based on long-term factors like locations of production, contracts with suppliers and best practices for supply chains. A domestic producer of energy storage products likely has contracts with international suppliers because that producer must take a holistic approach in providing customers with the best value.

BCI encourages DOE to evaluate policies aimed at incentivizing the domestic ("onshore") battery industry—through the strengthening of existing lead battery manufacturing and recycling infrastructure paired with the deployment of manufacturing and recycling resources for other chemistries. The lead battery industry presents significant opportunities to secure domestic supply chains because North American manufacturing is already meeting 90% of domestic lead battery demand. It is critical that the U.S. invest in a robust and diversified domestic battery industry, which necessarily includes addressing the manufacturing and raw material production capacity deficits which the U.S. currently experiences in comparison to other countries for technologies such as lithium-ion based battery technologies. But, it is critical to support and further the development of the U.S.'s existing lead battery manufacturing and recycling industry which will play a critical role enabling the deployment of energy storage technologies for mobile and stationary applications.

DOE should continue to support the domestic development and deployment of innovative energy technologies—and in particular technologies which provide advantages in terms of safety, sustainability, and recyclability—for a more affordable, secure and reliable future for American consumers. This commitment has traditionally – and should continue to be – supportive of a wide range of technologies and lead batteries are positioned to be a central part of that commitment. Indeed, investment today in the fundamental research underlying energy storage technologies will allow the U.S. to become a leader in next generation batteries—including lead batteries—, rather than falling further behind. More funding for the utilization of national laboratories and universities in the research and development of new and improved battery technologies is strongly recommended.

All of these steps are consistent with the goal of strengthening the national security posture of an essential domestic lead battery industry by strengthening the domestic capacity to meet energy storage needs without undue reliance on technologies or source susceptible to the influence of foreign adversaries.