NATIONAL ENERGY TECHNOLOGY LABORATORY

SUMMARY OF BATTERY WORKFORCE INITIATIVE INDUSTRY ROUNDTABLES (OCTOBER 2022)

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Disclaimer

CONTENTS

LIST OF EXHIBITS

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PURPOSE OF THE BATTERY WORKFORCE INITIATIVE INDUSTRY ROUNDTABLES

The U.S. Department of Energy (DOE) hosted two virtual events on Friday, October 21, 2022, and Thursday, October 27, 2022, to bring together battery industry employers to (1) identify priority workforce skills needed to support the rapid growth of this industry and (2) understand current training development and planning underway in the industry. The goal of these roundtable meetings was to begin to catalogue common needs and concerns regarding workforce skills and availability across the industry to inform a collaborative approach to workforce development.

The virtual roundtables provided a special opportunity for companies to share valuable insight and industry knowledge to help establish standardized, sector-based workforce solutions that will result in an influx of qualified workers to support the rapid expansion and long-term success of the domestic battery industry.

The meeting agenda for both days was as follows:

- Welcome/Opening Remarks
- Vision for the Battery Workforce Initiative
- Industry Participant Self-Introductions
- Discussion on Current Status and Industry Views on Training (two rounds)
- Closing Remarks

During the discussion on current status and industry views on training, industry participants were presented with the following questions for consideration, but were welcome to discuss other topics.

Round 1 Questions for Industry Participants
How can an industry-guided skills project help your company meet its factory-level workforce development and training goals?
Where do you expect to recruit workers?
Describe the top production and skilled trades occupations your company expects to hire.
What occupation(s) do you anticipate requires the most significant training/retraining?

Round 2 Questions for Industry Participants
What type of job training are you considering for your factory-floor workers?
What type of job training partnerships is your company considering?
How much do skills needs overlap from company to company in cell manufacturing or Tier 1 suppliers making the same product?

This report offers a summary of key findings and observations derived from discussion during the roundtables.

BATTERY WORKFORCE INITIATIVE BACKGROUND

The United States is seeing enormous growth in the advanced battery industry. Collectively, industry has invested approximately $100 billion toward electrification, with approximately $40 billion of that for advanced batteries. Innovative technology for electric batteries is rapidly increasing, and the number of domestic battery manufacturing plants is increasing as well. DOE heard from industry that a systematic effort was needed to develop a capable workforce for this emerging economic sector. After consultation with business and labor, it was clear that the challenge to build a highly skilled clean energy workforce was larger than any one enterprise or organization. Government could play a role by mobilizing its resources to identify training needs that are common across multiple employers and communicate occupational skill requirements throughout the nation's workforce ecosystem.

While specific training will always be the responsibility of individual employers, there is an opportunity for strategic collaboration to benefit the entire industry. To identify skill requirements for key occupations, the Battery Workforce Initiative brings together advanced battery manufacturers, companies introducing new battery technology, the advocates of work-based learning and quality apprenticeship, and community-based organizations and unions trusted by thousands of workers interested in high-skill, quality jobs. It also draws upon the resources and expertise the DOE and the U.S. Department of Labor (DOL).

DOE is establishing a team of experts and stakeholders from the advanced battery industry to rapidly develop training and materials for key occupations (as defined by industry) in a manner that complements ongoing workforce development efforts. DOE is coordinating this initiative with DOL, American Federation of Labor and Congress of Industrial Organization's Working for America Institute (WAI), Li-Bridge alliance members, and other organizations. DOE is using its National Energy Technology Laboratory (NETL) to implement the initiative.

The purpose of this industry-driven, government-facilitated initiative is to speed up the development of high-quality training, starting with existing examples to develop consensus on core training needs, and then develop training for use by companies and local training providers.

The initiative will:

- Convene battery industry organizations to cooperate in the development of training by sharing non-proprietary requirements for high-demand occupations.
- Engage training experts from manufacturers, labor, education, government, and other organizations to participate in facilitated workshops that quickly distill common skills and abilities needed in each industry segment and accelerate decision making.
- Translate those needs into educational and on-the-job training requirements, forming the basis for training materials and guides.

1 KEY FINDINGS AND OBSERVATIONS

In October 2022, the Battery Workforce Initiative sponsored two virtual roundtable meetings for advanced battery industry leaders to share their knowledge, insights, and experience. While the Battery Workforce Initiative will eventually engage other stakeholders, this initial effort was focused only on employers to determine the level of interest in engagement.

This section of the report identifies and discusses notable themes from these sessions. Key occupational areas began to emerge. Questions were answered by participants, which prompted more questions and robust discussions. Driven by the needs of industry, the initiative continues to collect and process information. The following table lists the employers and private sector industry organizations that participated.

Exhibit 1-1. Industry Participants at Roundtable 1 (October 21, 2022) and Roundtable 2 (October 27, 2022)

Company/Organization	October 21 Session	October 27 Session
Our Next Energy (ONE)	✓	✓
LG Energy Solution Michigan Inc.	✓	✓
Samsung SDI	✓	
Amphenol	✓	✓
Panasonic Energy North America	✓	✓
Sparkz Energy	✓	
KORE Power	✓	
Form Energy	✓	✓
Galyen Energy LLC		✓
Stellantis		✓
Ford		✓
General Motors		✓
Proterra Energy		✓

The Expansion of U.S. Battery Manufacturing

Each roundtable started with participants reporting on recent progress in their organization's commitments to expand advanced battery production in the United States.

Recruitment and Retention

The expansion examples above led to another issue for roundtable participants: how to recruit new workers and motivate them to stay on the job.

Roundtable participants said that strategic marketing campaigns are needed to capture the interests of new workers, especially workers who have not seriously considered a career in manufacturing. Traditional methods of advertising and employee attraction are not necessarily effective. Employers need to reach out to students through social media and online tools that build on the familiarity of these individuals to go mobile digital technology and online sources.

The infrastructure of the country's educational system is available to reach people and several company representatives talked about interacting with school systems, including both middle schools and high schools. Recruiting for first- and second-line factory floor-level employees is critical, participants agreed, because new advanced battery facilities will need a large quantity of workers who are comfortable with computers and automated systems to process the large amount of data that is generated by the battery production process.

Several participants described their engagement with community-based organizations that have access to new workers, including people of color and those in underserved communities. Partnerships with such organizations are key to help organizations understand what drives and motivates workers and improves their understanding of modern manufacturing. Some clean tech "rebranding" may be necessary, along with "more appealing" job titles. It may help to show that working in advanced battery manufacturing is "cool" and related directly to greater sustainability for the U.S. economy (e.g., a contribution to lessening the impact of climate change). The sustainability narrative may be especially fruitful in challenging environments, such as rural areas where jobs can be relatively scarce and towns in which service sector jobs (e.g., the hotel and hospitality industry in Nevada) are dominant. This approach may also help where automobile plants historically have absorbed many workers who are receptive to manufacturing employment (e.g., South Carolina and central Indiana). Advanced battery plants face of a lot of competition for workers from other manufacturers.

Once workers are on the job, organizations face the challenge of keeping them. The issue of retention was a frequent topic of concern. Junior workers are more likely to stay if their jobs have a larger meaning and they see opportunities for advancement. Companies are paying attention to what one participant termed "growth mapping," ensuring that new workers understand from the outset what sort of jobs they will be able to move toward as their time at the company continues. When it comes to expectations of junior workers, organizations also need to be sensitive to the fact that people have lives outside work; this insight spotlights the role of benefits like childcare programs.

A Different Sort of Production Worker

The Battery Workforce Initiative intends to help improve the competitive position of companies and joint ventures that employ workers in the United States by identifying the common occupational skill requirements of factory floor, production workers, and technicians. At one company represented at a roundtable, half of the total number of employees at a new factory will be production workers.

Several roundtable participants pointed out that companies need skilled machine operators who understand computer interfaces and are comfortable interacting with complex computer systems. They must be attentive "machine tenders" with a holistic understanding of how the entire automated system functions. Entry-level production workers and "material handlers" require a basic level of aptitude toward automated systems, with the ability to diagnose glitches and fix them without necessarily calling a technician or engineer to intervene. The

knowledge and skills to perform "minor maintenance" and troubleshoot problems needs to be pushed further down on the factory floor hierarchy, meaning that operators need to be more autonomous and able to work independently. Organizations are experimenting with varied tests to identity this different sort of production worker and are willing to share their findings.

On the other hand, the extent that the operational skills of advanced battery production overlap with skills and aptitudes that may have been learned during automotive assembly for internal combustion engines (ICE) or medical devices remains to be determined. There are parallels and similarities between work in modern, high-tech, robotic-heavy ICE factories and battery production lines, remarked several participants. The characterization of clean energy work needs to be demystified so that a clear pathway from one sort of factory production job to another may be articulated.

Segmentation of skills is also a consideration. A career ladder or skill map for an advanced battery production worker may involve a series of different levels of knowledge and skills to be achieved to move up and, presumably, obtain higher earnings and greater prestige on the job. An entry-level worker would need to come in with certain skills and automation-friendly aptitudes and the ability to perform rudimentary assignments before a move up to "more advanced" work. This sort of career ladder could also better allow for the transition from production worker/operator to technician.

Required Training and Education

Regardless of the skills and aptitudes held by entry-level workers, the advanced battery production environment requires continuous learning to adapt to evolving technology and production processes. Roundtable participants agreed that computer literacy is a must, but finding personnel to handle the flood of data produced by the manufacturing process has been difficult. Operators must be able to manipulate the Graphical User Interface (GUI) systems that allow a user to provide detailed instructions and maintain quality. Information in databases must be correlated. Processing data through the supply chain also is crucial because companies must be able to track the "lineage" of an advanced battery from the raw materials to finished components that are assembled into battery packs. Updating the information technology infrastructure is often a necessity.

Participants were asked what sort of training (e.g., on-the-job, classroom instruction, etc.) a battery manufacturing factory requires—is it more learning new skills or learning a new knowledge set? The consensus was that both are necessary and cannot be separated. This is an emerging industry where workers are being trained in real time. The process of integrating knowledge acquisition and skill competencies is complex. One large company, determined not to rely on college degrees as an indicator of the "best talent," is analyzing the skills necessary for all their jobs across the country; they have removed degree requirements from their job descriptions. Their "skills-first" focus facilitates their interaction with community-based partners who can serve as a source of interested workers. Participants endorsed the practice of on-the-job training as important.

Companies are also reaching out to the K-12 infrastructure. Students need to learn the metric system, for example, to be able to calibrate equipment produced in countries such as Korea and Japan; this knowledge should be integrated into middle school and high school curricula. Earning stackable credentials could ease the path of these individuals into the industry. For production workers, high school graduation will be required; a vocational school education and the "new age skills" of constant exposure to data will be an advantage. Greater career education in the K-12 schools would start to fill the pipeline sooner for workers to move into advanced battery manufacturing, though there is a shortage of curricula at this point and enrollment tends to be low in communities where programs are available.

Maintenance and Demand for Technicians

Operators and "material handlers" at the shop floor production level need a basic knowledge of battery physics, the capacity to monitor machines, and sufficient understanding of the machinery to perform diagnostics. Continuous maintenance and the skills of "Production Maintenance" and "Industrial Maintenance Technician," for example, are critical for sustaining product quality and safe working conditions. One international company has 700 individuals in that space. "Maintenance is a huge issue. The battery manufacturing process is highly automated. If robots cannot function safely, the line can't be operated," affirmed one participant. Technicians at multiple levels are needed. Several participants mentioned the occupational area of mechatronics (which covers four key areas of mechanical; electrical; tools; and heating, ventilation, and air conditioning [HVAC] skills) to maintain the facility.

The U.S. Bureau of Labor Statistics' Occupational Handbook explains that the cluster of skill sets for "Electro-mechanical and Mechatronics Technologists and Technicians" involves the installation, repair, upgrade, and testing of both electronic and computer-controlled mechanical systems. These technicians or technologists "combine knowledge of mechanical technology with knowledge of electrical and electronic circuitry. They operate, test, and maintain unmanned, automated, robotic, or electromechanical equipment." In November 2022, the Glassdoor online job search website listed more than 6,000 jobs for "Manufacturing Maintenance Technicians" in the United States.

The Quality and Safety Connection

"The quality levels that are required [in advanced battery production] are far more excessive than what has been conventionally supplied to the automotive industry," said one roundtable participant. "There are so many different skill sets required in these high-quality, high-speed manufacturing lines," a colleague added, a setting that requires a different mindset and attention to systems that are expected to last the entire lifetime of an electric vehicle. Based on experience working in high-technology battery production in China, a participant said: "There can't be any secondary quality; everything must be top shelf."

Quality roles are difficult to perform and personnel come to an advanced battery factory with different levels of understanding the best practices of high-quality production. A participant with a background in manufacturing semi-conductors and disk drives said that quality is his biggest concern and manufacturers need to achieve a level of quality akin to medical devices. When downstream companies in the supply chain sign a contract with a manufacturer, they are often held liable for a level of quality that affects the safe functioning of the final product (e.g., a battery pack in an electric vehicle). Limiting contamination in the lithium-ion battery production process is a prerequisite for maintaining quality and ensuring a satisfactory level of safety for shop-level production workers and the entire assembly environment.

Participants stressed that a high level of attention to safety needs to inform all manufacturing and operating systems. Safety in an advanced battery plant is different from regular manufacturing, with dangerous high-voltage applications toward the end of the production process. “From a general safety standpoint, you have to have very intense quality monitoring, quality checks, and process controls in everything that leads up to making the [battery] cell. But it can’t stop at the cell, because they behave differently when they are in an array than when you have one cell on its own,” explained a participant whose company makes many high-voltage connectivity products and the sensors that control battery packs. Currently, this organization is working on detecting “thermal runaway,” a problem that arises when one advanced battery cell in a pack malfunctions and enters an uncontrollable state and self-heats, which may result in smoke, fire, and violent cell-venting. “There is not a single design that can be said is intrinsically safe and has no risk,” this industry expert concluded.

Fundamental safety training and an orientation toward safety issues are part of base-level training that shop-floor workers obtain when they start employment. As they move into different parts of the manufacturing process, that base level is supplemented by on-the-job training in specific departments, followed by 30-, 60-, and 90-day evaluations, guided by supervisors, according to the process of one company. Modules to provide training are offered both onsite and offsite. Another participant agreed that they are looking at that sort of model and looking at “micro-opportunities for growth potential.”

Government regulations to help maintain safety in these cutting-edge manufacturing workplaces were discussed. Industry representatives are working with the U.S. Department of Transportation (DOT) to identify gaps in standards and regulations, but building codes for electric vehicle charging systems are lagging. Government regulators are playing catch-up, participants said, but there is a steep learning curve for those trying to develop a regulatory framework. Some expertise and knowledge may come from manufacturers in China, who have already resolved many of the issues companies are currently confronting in the United States on quality and safety, according to a participant.

Closing Remarks

Government officials, subject matter experts, and initiative administrators expressed their appreciation to the industry representatives for their participation in the roundtables. Their openness to describing their advanced battery production experience, and their willingness to share their knowledge and resources, was a tangible expression of the strategic collaboration that the initiative seeks to inspire among varied manufacturers and supply chain organizations. Officials from DOL's Employment and Training Administration (ETA) offered their support as an initiative partner and encouraged employers to engage with state and local workforce boards as training programs develop.

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