

Addressing the battery talent shortage with interdisciplinarity

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Main

Batteries are widely regarded as a key decarbonisation technology, and their deployment continues at a rapid pace amidst governmental decarbonisation mandates, growing economic opportunities and increasing energy security concerns. The main volume drivers for batteries are currently electric vehicles and stationary energy storage. However, future applications will be diverse, and the energy transition will require an orders-of-magnitude increase in production. This expansion will require innovative minds with the right skills to adapt battery development, production, and deployment to meet future needs. Yet, there is a growing shortage of these skilled individuals, with this becoming the limiting factor for scale-up.

Estimates of the number of battery-related jobs vary, but the [2023 Volta Foundation report](#) suggests that there will be 35-162 jobs per GWh. With over 9,000 GWh of global battery production already announced ([Benchmark Mineral Intelligence](#)), this translates to 300,000 to 1.4 million jobs by 2030. For the US battery energy storage sector alone, the [2022 National Renewable Energy Lab report](#) estimated that a minimum of 130,000 additional workers (compared to 2020 estimates) would be needed by 2030. This narrative continues across different renewable energy sectors.

Many disciplines contribute to battery development: material scientists develop next-generation materials, electrical engineers explore novel state-estimation techniques for battery management systems, and policymakers create new regulations for increased sustainability. Notable works in all of these individual fields exist; however, a successful future battery industry will be characterised by its ability to solve the “AND” problem. Can we create sustainable solutions that have high performance, long lifetimes, and low cost, combined? Achieving this goal will need a holistic approach, stretching beyond traditional singular disciplines to integrate knowledge across domains in an interdisciplinary approach.

Practitioners, therefore, need not only to possess deep subject area knowledge but also to understand systemic challenges, exercise critical thinking skills, and collaborate effectively in multidisciplinary teams. Failure to do so can result in a subsystem optimisation trap, where, for example, energy density is optimised without consideration of cost, manufacturing feasibility, or material availability. An interesting dichotomy related to the current battery talent landscape is the concurrent global search for skilled individuals, alongside layoffs in battery fields to recalibrate focus ([Volta Foundation](#)). Whilst there are many causes of this, frequent technology refocuses may stem, in part, from an absence of early-stage holistic considerations.

An example of these multidisciplinary considerations can be seen in the development of next-generation battery systems, such as lithium-metal anodes being explored as an alternative to graphite due to their high specific capacity. However, rechargeable lithium-metal cells have yet to achieve significant commercial scale despite promising lab-scale demonstrations. Successful commercial deployment, therefore, needs to overcome coupled challenges across areas such as cost-effective sourcing of lithium metal at sufficient purity and scale, stable solid-electrolyte interphase formation for improved durability, and volume expansion issues impacting pack design.

The increasingly interdisciplinary nature of the battery field, contrasting with mostly singular disciplinary educational offerings, could be a contributing factor to the battery skills shortage,

particularly in battery engineering positions. In these roles, subjects such as mechanical and electrical engineering traditionally have not incorporated electrochemistry into their curricula, posing challenges in attracting talent from these domains. One opportunity to address this could be through Massive Open Online Courses, which have the potential to provide complementary upskilling. Furthermore, greater adoption of project-based learning with multidisciplinary teams can facilitate greater understanding of the multi-physics battery challenges. A notable example is the Formula Student competition, where multidisciplinary engineering teams design, make, and race electric vehicles. However, more efforts are needed to bridge the engineering and scientific fields.

Addressing this skills shortage will require a coordinated effort from multiple stakeholders. Academia will be a major source of battery talent, while increased collaboration with industry can provide insights into manufacturing and deployment challenges that universities may lack access to. Diversifying talent by recruiting from non-battery backgrounds will also be important because it has the added benefit of fresh perspectives to address battery challenges. For instance, knowledge from the paint industry could enable accelerated development of coating processes in battery manufacturing. Furthermore, outreach activities aimed at inspiring early-stage students need to be integrated into a holistic battery talent strategy. The Royal Institution offers excellent examples of inventive and exciting demonstrations of electrochemistry principles, which can be difficult to visualise.

The talent shortages in other renewable energy fields are also emerging, all sharing the common theme that the “AND” problem needs to be solved. For instance, the deployment of hydrogen fuel cells requires teams with expertise in electrocatalysis, heat transfer, and manufacturing, among others. Therefore, talent development plans should integrate across various renewable energy disciplines, fostering knowledge sharing and encouraging mobility across fields.

A future battery industry not only requires a sufficient volume of talented individuals but also demands interdisciplinary awareness and the ability to work effectively in multidisciplinary teams. Providing upskilling opportunities and routes for transitioning between fields will be important for cross-pollination of ideas. While there is still work to be done, all the key ingredients exist to enable our low-carbon future.

Competing interests

B.W. is a member and chair of the Faraday Institution Training and Diversity Panel and a co-investigator for the Faraday Institution Multi-Scale Battery Modelling project.