Business, Energy and Industrial Strategy Committee (Commons)
"Batteries for electric vehicle manufacturing" Call for Evidence

Written response from the UKRI Faraday Battery Challenge
14 February 2023

About Faraday Battery Challenge

This is a Faraday Battery Challenge (FBC) submission. FBC is run by UK Research and Innovation on behalf of the UK government. With an investment of £541 million between 2017 and 2025. The FBC is a mission-led, coordinated and managed investment programme in applied research, innovation and national scale-up infrastructure that has increased the probability that the UK will successfully prosper from the transition to electrification. As part of a wider ecosystem, the FBC has positioned the UK as a credible scientific, technological and industrial nation in the field of batteries. It develops battery technologies for vehicles that are cost-effective, longer range, faster charging, long-lasting, safe and recyclable. The investment helps grow our own companies and innovative ecosystem and signal to investors that the UK is attractive opportunity for battery sector innovation and production.

Executive summary:
The UK and the EU have set out clear end dates for the sale of non zero emission vehicles which is driving the demand for electric vehicles which require large traction batteries. Current UK battery production capacity is less than 2GWh, and the country needs to act quickly to ensure sufficient capacity is available for 2030.

The Faraday Battery Challenge (FBC) has been building the foundations of the research and innovation base that provides the strong foundation for exploitation. The FBC has built a globally competitive scientific capability at scale harnessing our best talent toward solving the challenges for battery technology. To date it has supported over 97 business led projects with 149 unique organisations, realising over £1.2 billion in accompanying and direct follow-on matched investment [1]. In addition, we have built a truly world-class UK Battery Industrialisation Centre, 3 years ahead of its nearest European competition. This enables UK battery companies and others to develop and refine their manufacturing processes at industrial rate and scale in an open access facility without which technology would remain in the lab or be industrialised elsewhere.

The pace and scale of international interventions mean that the UK requires additional intervention to anchor existing UK vehicle industries and signal to investors that the UK is attractive opportunity for battery sector innovation and production.

[1] UKRI-051021-FaradayBatteryChallengeFundedProjectsBookletSept2021.pdf

1. **Is there enough UK vehicle manufacturing demand in the UK to support gigafactories?**
   a) By 2040, it is forecasted that there will be demand for around 200GWh of battery production [2]. Current UK production capacity is less than 2GWh.
   b) The growing demand for battery technologies will continue due to their widespread use in applications such as electric vehicles, consumer products, and grid-scale storage. In the UK, legally binding targets to reduce greenhouse gas emissions to net zero by 2050 have been established through the Climate Change Act and the need to reach net zero emissions has driven the global demand for batteries. The transportation sector is the largest contributor to emissions, accounting for 27% of total emissions in 2019, with 91% coming from road transport vehicles[3]. The UK and EU have placed a legislative requirement that all new cars and vans sold in the EU as of 2035 should not produce any CO2 emissions. Battery electric vehicles (BEVs) are seen to be the dominate solution to reduce emissions in the transportation sector with many vehicle OEMs announcing ambitious electrification plans.
   c) The Faraday Institution (FI) and Advanced Propulsion Centre (APC) project that by 2030, a minimum of 96 GWh of batteries will be required to meet the demand for BEVs, commercial vehicles, heavy goods vehicles, buses, micro-mobility and grid storage in the UK. This equates to the need for five gigafactories with a capacity of 20 GWh per annum each [4]. This is not only driven by UK legislation but by similar regulation in the European Union which represents a significant export market for UK vehicle production. The automotive sector is a significant contributor to the UK economy, with 742,600 jobs created through its supply chain and £37 billion contributed to the economy, making it crucial to maintain competitiveness with international players [5]. The production of battery electric and hybrid vehicles has been increasing in the UK, accounting for 30.2% of total car production in 2022, demonstrating a clear demand battery production at for gigafactory scale.
2. **Will the UK have sufficient battery production supplies by 2025 and 2030 respectively to meet the government phase-out plans for petrol and diesel vehicles?**
   d) Currently, it is unlikely that the UK will have sufficient battery production supplies by 2030 to meet the growth in demand for batteries from UK automotive. Envision AESC, which supplies Nissan, is currently the only confirmed organisation committed to creating a new gigafactory in the UK. Plans are underway to construct a new facility located adjacent with their current plant in the North-East and this will bring online an additional 12 GWh/year in 2024. This will bring total UK battery production capacity to 14 GWh/year. With no other capacity officially announced, the UK will not have sufficient capacity for 2025 and will need to act quickly to ensure capacity is there for 2030.
   e) To meet the demand, the UK needs several additional gigafactories. McKinsey suggests investment of £5bn to £18bn in battery manufacturing by 2040 is needed to meet new targets, with the Green Finance Institute providing further granularity suggesting $40-50 million in investment per GWh (though this varies by location, company, products and plant stage) [6].

[2] UK Electric Vehicle and Battery Production Potential to 2040 (faraday.ac.uk)
[3] Transport and Environment Statistics: 2021 Annual Report (publishing.service.gov.uk)
[4] Accelerating Progress (apcuk.co.uk)
[5] https://tide.theimi.org.uk/sites/default/files/2022-06/IMI%20-%20Annual%20Research%20Report%202022_summary%20report.pdf
[6] Powering-The-Drive-To-Net-Zero-Report.pdf (greenfinanceinstitute.co.uk)

f) To meet the anticipated demand and drive for localisation promoted by "Rules of Origin", Europe has 33 gigafactories under development with five operational. The largest are LG Energy Solution's Polish site, which is targeting 32 GWh of capacity, and Samsung's site in Hungary, which is targeting 20 GWh by the end of this year [7]. With only one confirmed company building a new gigafactory in the UK it is clear the UK is lagging behind EU countries in attracting investment in battery-making [8].

g) The UK is making progress but not fast enough compared to its European competitors. Envision AESC plant in Sunderland has potential expansion capacity to circa 35-40GWh[9]. There is further potential capacity - if following BritishVolt administration - plans are activated for utilising the site in Blyth. The Faraday Institution notes that if the UK does not attract and develop a largescale battery manufacturing industry in the next few years, there is a risk that the production of EVs could move out of the UK and gravitate towards where the batteries are manufactured [10].

h) While the FBC and other important supportive Government interventions such as the ATF, have helped to catalyse significant private investment into the sector - including the chemical supply chain where a substantial element of the economic value lies - the scale of these investments has not been enough to secure UK-supplied mass production batteries for automotive by 2025. It should be noted that it typically takes up to five years to design and build new gigafactories [11].

i) Clear, consistent policy and public interventions in research and innovation are necessary to attract investment against strong international competition but insufficient to secure the UK supply chain. Investment support for scale-up and industrialisation is crucial to ensure businesses select the UK as their manufacturing location over other nations. This is against a background of growing international competition exemplified by the United States Inflation Reduction Action and EU Green Deal Industrialisation Plan.

3. Is UK-based battery production necessary to support the manufacture of electric vehicles in the UK?

j) Yes. In the medium/long term and there are a number of reasons for this. Battery Pack manufacture has to be adjacent to vehicle manufacture for economic, safety and logistics reasons. Electric vehicle battery packs are big, heavy and high voltage. These factors combine to make them very difficult and therefore expensive to move. As an example, a Tesla Model Y battery pack weights 530kg and is 2.2m x 1.5m x 0.3m meaning very few can fit in a shipping container before reaching capacity. As lithium batteries they are considered dangerous goods and at 400+ volts have significant health and safety requirements to manage. These factors mean shipping battery packs in significant volumes is not practical.

k) Cell manufacture and most of the upstream materials processing will at least need to be in a territory that allows compliance with Rules Of Origin regulations (i.e. either the UK or EU by 2027). To make the supply chain as resilient as possible and to minimise the cost of goods in transit, there will be a geographical convergence of vehicle manufacturing and cell manufacturing particularly as OEMs migrate to 100% EV production.

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[7] https://sifted.eu/articles/european-gigafactory-batteries-startups/

[8] https://ukandeu.ac.uk/the-race-for-electric-vehicle-battery-making-is-well-underway-and-the-uk-is-barely-off-the-starting-grid/

[9] https://www.electrive.com/2021/07/01/nissan-confirms-sunderland-battery-plant-new-bev-model/

[10] https://www.faraday.ac.uk/wp-content/uploads/2022/07/Faraday_Insights_2_update_July_2022_FINAL.pdf

[11] https://www.faraday.ac.uk/wp-content/uploads/2022/07/Faraday_Insights_2_update_July_2022_FINAL.pdf

l) Furthermore, if the UK were to enter into future bilateral trade deals that include Rules Of Origin provisions for Electric Vehicle Batteries - but the country lacks its own battery production - OEMs may face tariffs on their final products unless EU content is deemed to be "originating". It is possible that these types of scenarios are already playing into the decision-making processes of OEMs with substantial vehicle assembly in the UK.

4. What are the risks to the UK automotive industry of not establishing sufficient battery manufacturing capacity in the UK?

m) Without battery manufacturing located in the UK, it is very difficult to envisage long-term viability for a UK automotive industry. The automotive industry's need for a secure and reliable supply of batteries has become increasingly urgent and critical. This is due to several factors, including impending legislative targets on new vehicle products and the adoption of minimum sourcing requirements in major markets around the world.

n) It's worth noting that vehicle models generally operate on a 10-year production cycle, and as such, an automotive OEM that is planning to introduce a new car model in 2026 needs to ensure that the model remains available on the market up to 2036. This is particularly important as it coincides with the ban on the sale of new hybrid and petrol/diesel cars. Given that development cycles for new vehicles typically take around four years, OEMs looking to produce models between 2026 and 2036 have already started their development process. Additionally, the initial technology R&D for these models would have been undertaken many years prior to that.

o) With these factors in mind, automotive OEMs have already committed to product decisions that will determine localised production and sourcing for the medium to long-term. As such, the risk is that once these major production investment decisions are made and sited for upcoming models, they will be significantly more difficult to dislodge later.

p) This makes it imperative to create a sustainable cluster of electric vehicle manufacturing in the UK, which would provide OEMs with the confidence they need to invest in the country. Failure to do so would make it extremely challenging to reverse this trend in the future, and the UK may miss out on significant opportunities for growth and development in the electric vehicle market.

5. What other domestic end uses for batteries would provide a market for UK battery production?

q) While the driver for battery technology is the automotive industry the provision of battery energy storage has multiple applications including: providing grid resilience, E bikes and other micro mobility, electric vertical take-off and landing (eVTOL) aircraft, battery powered trains and consumer electronics. These sectors provide massive technological opportunities to for electrification and while currently not subject to as clear regulation regarding decarbonisation and localisation at present there is a strong likelihood that this will take place.

r) The National Grid predicts substantial energy storage demand by 2050 for shifting demand and managing network constraints [12]. Energy storage (typically batteries) is likely to be located near renewable generation to provide resilience through grid-scale storage for solar farms for instance. One example is the Energy Superhub Oxford project funded by the Prospering from the Energy Revolution Challenge, which combines energy storage, EV charging, low-carbon heating, and smart

[12] National Grid says UK could need 13GW of energy storage by 2030 to enable net zero future - Energy Storage News (energy-storage.news)

energy management technologies. It connects a 48MW/50MWh lithium-ion battery energy storage system to the National Grid's transmission system to increase flexibility and resilience [13]. These kinds of advances will assist with electricity security and resilience of supply, enabling the grid to have additional flexibility to help manage peak periods of consumption. Additionally, batteries will increasingly be used for EV applications that could be integrated into the energy system to provide flexibility, if technical and policy/regulatory measures are in place[14].

6. Does the UK have a sufficient supply of critical materials to support vehicle battery production?

s) Currently, the UK does not have a sufficient supply of critical materials to support BEV production. Many of these materials, including lithium, cobalt, and nickel, are critical to the production of all parts of the EV battery, including the cathode powder, graphite for the anode, and other key chemicals used in the manufacturing process. The UK imports the majority of its critical materials (CMs) [15], and availability and access to CMs is impacted by global demand to supply the renewable energy sector, and batteries in particular.

t) The ready availability of CMs is key to UK manufacturing and productivity across a range of strategically important sectors such as aerospace, automotive, energy and chemicals. As the world moves towards net zero emissions there is greater international competition for key resources both in terms of securing supply of materials already in high demand, as well as needing a diversity of critical raw minerals to develop new materials, both of which are needed for the creation of vital components for low carbon technologies, including electric vehicles, renewable energy infrastructure, and digital technologies.

u) Prices of many minerals and metals that are essential for clean energy technologies have recently soared due to a combination of rising demand, disrupted supply chains and concerns around tightening supply. The International Energy Authority highlighted that the prices of lithium and cobalt more than doubled in 2021, and those for copper, nickel and aluminum all rose by around 25% to 40%[16]. It is predicted that Europe will require 35 times more lithium and seven to 26 times the amount of increasingly scarce rare earth metals compared to today, in order to meet the EU's Green Deal goal of climate neutrality by 2050 [17].

v) The UK government has recently implemented the UK's Critical Minerals Strategy, which seeks to address this challenge by accelerating the growth of the UK's domestic capabilities, collaborating with international partners, and enhancing international markets to make them more responsive, transparent, and responsible. While this strategy is a step in the right direction, more comprehensive action is needed to build a sustainable and efficient supply chain for the production of EV batteries in the UK. Such action should focus on building on the existing supply chain strengths, localising more of the battery supply chain in the UK, utilising the strength of the UK chemicals industry, attracting new cell component suppliers to the UK, and developing a UK lithium battery recycling industry.

w) Whilst the circular economy is part of the solution, recovered materials can be of lower quality than mined materials, difficult to recover, and many metals have no available stocks to recycle, limiting the effectiveness of recycling as a standalone alternative to mines or imports [18]. In addition, for

[13] Energy Superhub Oxford (ESO) – UKRI
[14] Enabling the transition to electric vehicles: the regulator's priorities for a green, fair future (ofgem.gov.uk)
[15] Access to critical materials - POST (parliament.uk)
[16] Critical minerals threaten a decades-long trend of cost declines for clean energy technologies – Analysis - IEA
[17] Europe needs to rapidly ramp up rare metals supply to meet climate goals | E&T Magazine (theiet.org)

recycling of black mass [19] at scale to be economically viable a significant steady state level of material from factory scrap and end of life batteries needs to be in place. Based on the rate of uptake of EVs and expected lifetimes to be 10-15 years, it is likely that recycling would contribute significantly less than 22% to the UK's supply of battery critical minerals[20]. There is a risk that significant End of Life black mass processing will occur outside of the UK unless UK-based processing can be incentivised once economically viable.

x) In summary, public-sector support may be initially needed to encourage the industry to develop at the required pace to tackle the substantial levels of battery waste created. The overarching aim of the Faraday Institution's ReLiB project is to establish a technology pipeline and provide a clear roadmap for the efficient end-of-life management of EV lithium-ion batteries in the UK, encompassing both current and future battery chemistries. This project, along with other initiatives, will be instrumental in supporting the development of a sustainable and efficient supply chain for the production of EV batteries in the UK [21].

y) Research and development needs to continue into batteries that use earth abundant materials in order to mitigate the problems associated with the scarcity of supply.

7. How ready are UK vehicle producers for the EU–UK Trade and Cooperation Agreement (TCA) rules of origin (ROO) phasing in from 2024?

z) UK manufacturers need to secure their supply chain for batteries to avoid being affected by the Trade and Cooperation Agreement (TCA) rules of origin (ROO) tariffs. Vehicle producers are ready to meet the TCA ROO phasing in from 2024. Vehicle producers will have locked in the cell supply they need from suppliers who can demonstrate compliance with the ROO in order to meet regulations within the timeframe.

aa) It is crucial that the UK can secure investment in UK gigafactories now, so that UK-based vehicle producers can identify UK-based cell supply and incorporate this into product concepts and development cycles. If there are no serious gigafactory prospects made by 2025, then the automakers will continue to lock-in cell supply from other European sources and with the attendance risks identified in Q4.

8. What can the UK learn from investment in other countries in the establishment of gigafactories?

bb) Clear policy interventions can drive the attractiveness of a location for companies to investment in. The UK understands the interventions necessary, and can also learn from the scale, duration and consistency of purpose of international interventions.

cc) The Automotive Transformation Fund (ATF) is designed to incentivise XXXindustrialisation across the low carbon automotive supply chain. Up to £1 billion of funding will be invested in developing a high-value end-to-end electrified automotive supply chain in the UK. This is a welcome intervention, but the ATF is overshadowed by international investments such as, the U.S. Inflation Reduction Act (IRA) which includes a record $369 billion in spending on climate and energy policies. This includes tax credits for electric cars made in North America. As a result, European and international

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[18] https://pubs.acs.org/doi/10.1021/acs.est.5b04528

[19] "Black mass" is a term used to refer to the mixture of metals and materials that is produced from the recycling of lithium-ion batteries. The mixture is typically a dark or black color, hence the name. The black mass contains valuable metals such as lithium, cobalt, nickel, and manganese, which can be recovered and used to manufacture new batteries. Recycling black mass is an important step in reducing the environmental impact of battery production and promoting the circular economy.

[20] https://faraday.ac.uk/wp-content/uploads/2019/12/Recycling-of-Li-ion-batteries-from-electric-vehicles.pdf

[21] 22350m_wmg_battery_recycling_report_v7.pdf (warwick.ac.uk)

companies, including Volkswagen and Enel, are changing their investment strategies to focus on the US market. Electric van start-up Arrival which achieved "unicorn" status in 2020 abandoned UK production plans for the US due to the tax credits [22] resulting in hundreds of redundancies and a loss of future UK prosperity. This policy intervention has also made it more attractive for European and international companies to invest in the US rather than elsewhere.

dd) The UK has untapped private investment that could be leveraged through a revitalisation of public-private financing and incentives to make the country competitive with the rest of the world, including Europe. It has been has shown that large-scale investments in the UK battery sector are lacking, despite having a $2.7bn battery ecosystem that has grown by 1.8x since 2021. However, there have been no significant "big wins" in the sector yet, with only $1.2bn raised since 2018 compared to $6bn in Sweden[23]. In 2022, investors from the UK and Europe contributed less than 25% of the total investment in the UK's EV battery industry. The dominant investors were from the US and Asia. As a result, UK companies were compelled to look for investment opportunities outside of the UK, which slowed down the investment inflow.The Green Finance Institute has shown that there are gaps in current support, and while the ATF is good, it is only one intervention with a comparatively small pot of money [24]. Therefore, public and private money needs to work together to unlock significant investment and back a few "horses". The private sector will not take the risk on its own when it can invest in other countries that will derisk. A clear strategy is needed, with flexible, fast, and prolonged funding in this sector. In contrast, the USA's Bipartisan Infrastructure Law "Battery Materials Processing and Battery Manufacturing & Recycling Funding" has earmarked $2.8bn to support projects across the supply chain, with the aim of capturing value for the US and supporting IRA initiatives. The injection of $2.8bn in federal investment, complemented by $6.2bn in private investment, has caused a stir in the industry, resulting in the emergence of new companies that will create significant value for the US and reduce its reliance on China/Asia's supply chains [25].

ee) In the UK there are numerous well researched and evidenced policy documents and reports such as Build back better – plan for growth[26], Council Of Science & Technology Report Jan 2020 [27], 10 Point pan for a green industrial revolution [28], House Of Lords Battery strategy: Science and Technology Committee report[29], UK Innovation Strategy: leading the future by creating it [30], Net Zero Research & Innovation framework [31] . So, in many respects the UK leads in terms of an understanding of the interventions required to secure gigafactories. This understanding can be summerised by one of the recommendations of the recent Net Zero Review led by Rt Hon Chris Skidmore MP: "To effectively compete the UK must invest more now and provide policy and public funding certainty. This will crowd-in the levels of estimated investment need from private firms and individuals [32]." What we

[22] Electric-van start-up Arrival to cut half its remaining staff | Financial Times (ft.com)

[23] Electric vehicle battery tech in the UK | Dealroom.co
[24] Powering-The-Drive-To-Net-Zero-Report.pdf (greenfinanceinstitute.co.uk)
[25] DOE BIL Battery FOA-2678 Selectee Fact Sheets (energy.gov)
[26] Build Back Better: our plan for growth - GOV.UK (www.gov.uk)
[27] CST reports on science and technology - GOV.UK (www.gov.uk)
[28] The ten point plan for a green industrial revolution - GOV.UK (www.gov.uk)
[29] Battery strategy: Science and Technology Committee report - House of Lords Library (parliament.uk)
[30] UK Innovation Strategy: leading the future by creating it - GOV.UK (www.gov.uk)
[31] Net Zero Research and Innovation Framework - GOV.UK (www.gov.uk)
[32] Net Zero Review: UK could do more to reap economic benefits of green growth - GOV.UK (www.gov.uk)

can learn from other countries is the scale and duration of intervention required to turn this from a strategy to reality.

9. Do we have the skills in the workforce required for the production of batteries? If not what needs to be done?

ff) A skilled workforce of the right quality and quantity is a critical factor considered by businesses when selecting a location for their gigafactory. The UK currently does not have the trained workforce nor the training provision to train the workforce for the production of batteries. The majority of the battery production workforce required are production staff at qualification level 2-3. The Faraday Battery Challenge and delivery partners are working with stakeholders to fill the gaps in training provision.

gg) Globally, across the entire value chain, the battery sector could contribute to up to 18 million jobs in 2030, securing existing positions and creating new ones[33] . There is a tremendous opportunity if a skilled workforce is available to attract investment and secure economic prosperity, but with 63% of current jobs roles being subject to significant change there is a need to undertaking significant re-skilling, up-skilling and provide new skills training.

hh) Having a skilled workforce is vital to achieve the goal of a thriving battery manufacturing industry in the UK. The FBC is collaborating with partners to create a pipeline of battery sector talent and provide the framework for apprenticeship schemes and training in electrification. FBC is also working towards the delivery of the vision for a National Electrification Skills Framework and Forum [34] . The vision proposes a coordinated, national approach to developing electrification workforce training initiatives based on technology developments and current and future industry need [35]. Currently there is limited training provision to provide skilled employees to this sector.

ii) It is predicted that up to 35,000 new jobs will be supported in the UK in 2040 by battery manufacturing plants with a further 65,000 new jobs across the battery manufacturing supply chain.[36] Table 1 indicates the make-up of the gigafactory workforce:

Division (percentage of total workforce)	Job Type	Qualification Level
Production staff (50%)	Material handling	2
	Machine loading	2
	Machine unloading	2
	Module assembly	2
	Pack assembly	2
	Logistics	2/3
Maintenance and engineering (30%)	Technicians	3
	Senior engineers	7
	Process/production engineers	6
	Facility engineers	6
Quality (10%)	Engineers	6
	Practitioners	4
Other (9%)	IT	6
	Data management	6

[33] Lithium-ion battery demand 2030: Resilient, sustainable, and circular | McKinsey
[34] National-Electrification-Skills-Forum-Brochure-FINAL.pdf (catapult.org.uk)
[35] National-Electrification-Skills-Forum-Brochure-FINAL.pdf (catapult.org.uk)
[36] UK Electric Vehicle and Battery Production Potential to 2040 (faraday.ac.uk)

Management (1%)	Process leadership	4
	Engineering management	7

i. Table 1 – composition of typical gigafactory workforce

jj) From table 1 it is clear to see that 50% of the gigafactory workforce is comprised of level 2-3 production staff. Currently there is no training provision within the UK that meets the training needs for this portion of the workforce. Engagement with industry indicates that there are wider skills gaps across level 2-5 qualification levels with businesses struggling to recruit technicians and engineers with the right capabilities.

kk) Envision AESC's learning and development team have said "*When we started battery manufacturing in Sunderland 10 years ago we employed around 200 people. Today it is ~500. By 2024 it will be over 1,000. The industry is growing at phenomenal pace, not just in Sunderland and the UK but globally. This is creating a huge demand (and competition) for talent. As the EV battery sector grows in scale it will increasingly compete with the existing OEMs and automotive supply chain for a skilled workforce (not just manufacturing/maintenance/engineering but also administration and office functions). We need to develop a skilled workforce to enable the battery industry to grow without impacting our existing automotive sector.*"

ll) The FBC is providing interventions and delivering a regionally focused training initiative for battery manufacturing skills. The funding will be used to provide support for equipment, facilities and trainers. It will join up the regional training ecosystem and encourage partnership with regional businesses to meet their workforce development needs.

mm) The UK Battery Industrialisation Centre (UKBIC) is facilitating the development of a battery manufacturing technician apprenticeship standard, focusing initially on upskilling Level 2 manufacturing production operatives and Level 3 technicians. UKBIC is also developing an internal training programme for their own engineers and technicians to train customers using their facilities. The Faraday Institution (FI) is leading the development of battery skills at higher levels through their enhanced PhD programme and undergraduate internship programme. Over 50 PhD studentships have been funded to date, and the FI's internship programme encourages around 40 undergraduate students to train with world-leading scientists in battery research. The FI has also made significant strides in achieving gender parity and promoting diversity and inclusion in their training programmes.

nn) These interventions are good start but need backing at a higher scale and pace as it is forecast that the overall industry workforce in the UK of the EV and EV battery ecosystem could grow to 220,000 employees by 2040 [37]. Investing significantly more in this area is essential to ensure skills required by industry are available and act as a draw to investment.

10. Will the cost of UK batteries be competitive compared with batteries produced elsewhere?

oo) The cost competitiveness of UK batteries depends on various factors such as production costs, access to capital, economies of scale, technological advancements, and government policies. The UK can compete but will need strategic interventions to ensure businesses select the UK for their battery manufacturing operations. While the UK has comparable material costs to the EU, there are cost differences associated with energy, labour, capital, and land. Clean, stable cost competitive energy supply is essential for gigafactories.

[37] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/653324/future_of_mobility.pdf

pp) The US government has provided strong support for battery manufacturing through roadmaps such as the National Blueprint for Lithium Batteries and additional support through the IRA. As a result, 882 battery manufacturing projects with $108 billion in investment have been started or announced since 2009 [38]. It is essential for the UK Government to take measures to maintain its competitiveness with the EU, especially with the added range of incentives offered by the EU's Green Industrial Plan.

qq) With appropriate intervention, the UK has the opportunity to seize the technological benefits of the net zero transition. The country has a strong foundation for competitive battery manufacturing, including advanced research and scale-up facilities. However, the UK must maintain its competitiveness with the EU and take measures to ensure that it attracts battery manufacturing operations. The range of incentives offered by the EU's Green Industrial Plan further emphasize the importance of appropriate strategic interventions.

11. What impact will the European Union's proposed Carbon Border Adjustment Mechanism have on UK production?

rr) No comment.

[38] Electric Car Battery Revolution Finally Arrives in US - Bloomberg