Written evidence submitted by Ilika

About Ilika

1. Ilika is the leading developer of Solid State Batteries (SSB's) in Europe. A pioneer in the technology, Ilika has grown to be the UK's largest pure-play publicly listed battery company.

2. Ilika developed Stereax, a range of miniaturised SSB for MedTech and industrial IOT sectors due to their unique properties of wide temperature range, small footprint and high energy density.[1]

3. Three years ago, with Faraday Battery Challenge (FBC) support, Ilika began developing large format SSB for automotive applications ("Goliath"). The scale up requires a move from the manufacturing methods used for Stereax, and brings with it many technical materials and processing challenges. During the FBC programmes Ilika designed, built and commissioned a pre-pilot line capable of delivering 1kWh of single SSB cells per week. We have developed materials and processes to create a prototype pouch cell for the automotive market.

4. The company is developing a large format SSB, called Goliath, suitable for automotive and consumer applications.[2] To date, Ilika has accessed £5.2 million in grant funding support from FBC for the Goliath technology, which has in turn leveraged a further £15 million in equity funding from the London capital market.

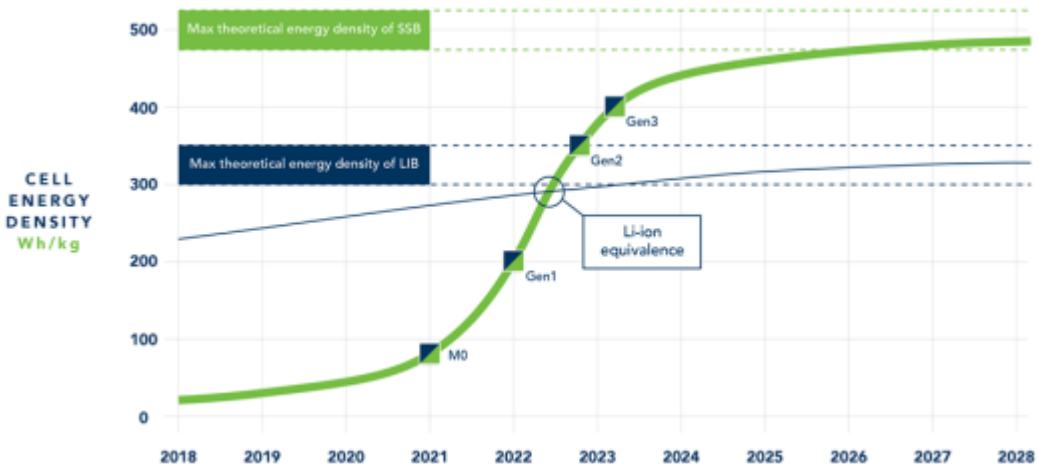
5. The Committee will wish to be aware we have recently contributed to the Science and Technology (Lords) inquiry on "Role of batteries and fuel cells in achieving Net Zero" with a written submission and supplementary evidence.[3] [4]

The need for primary consideration of solid state battery technology in supply chains

6. In considering the supply chain of electric vehicles, the Committee should place the forthcoming transition from conventional lithium-ion batteries (LIB) to SSB as a primary issue for consideration in their inquiry.

7. The output and performance of current LIB technology is predicted to peak in the latter half of this decade. In the same period, SSBs are expected to exceed the maximum theoretical density of conventional LIB technology. Solid-state batteries (SSBs) have the potential to exceed 400Wh/kg (1000Wh/l) over the next 3-5 years, surpassing LIBs, and eventually reaching an energy density of 500Wh/kg. The technology S-Curve for Goliath cells relative to LIBs is shown below (M0, Gen 1, Gen 2 and Gen 3 are Ilika's developmental milestones):

[1] https://www.ilika.com/battery-innovation/stereax-micro-solid-state-batteries
[2] https://www.ilika.com/battery-innovation/goliath
[3] https://committees.parliament.uk/writtenevidence/25162/html/
[4] https://committees.parliament.uk/writtenevidence/36502/html/



8. Specifically, we would encourage examination of the role for Government in providing stable, dedicated research funding for the development of SSB, if the UK is to benefit from the domestic manufacture and associated high-value supply chain in the next decade and beyond.

Question: How well is Government policy aligned with high-level commitment for growth of battery electric vehicles to support its net zero ambition?
Question: Are the UK supply chain opportunities around supply of batteries and power electronics, machines and drive supply chain clear?
Question: What natural advantages in terms of access to raw materials, renewable energy supply, technological readiness, IP or other competitive advantage does the UK have to encourage development of battery manufacture in the UK?

9. SSBs in development promise a leap forward with improved safety, higher energy density, faster charging times, and longer life. The technology represents a critical piece of a nascent industry and a huge economic opportunity for the UK, not just in assembling SSB in the UK, but in developing the supply chain for manufacture. Over two-thirds of the value of the end product will be in the materials, processes and equipment required – these should be developed in the UK.[5]

10. Gigafactories assemble conventional LIB materials that are manufactured in extremely high volumes in East Asia. In contrast, the opportunity with SSB in the UK is to develop and own the intellectual property, process the raw materials and develop the supporting supply chain, generating exports and creating high value jobs in the UK.

11. Conventional LIB technology was invented in the UK (Oxford) but was exploited and commercialised outside of the UK – a missed opportunity. The race to manufacture LIB technology is largely over. LIB development continues both in and out of the UK, but the technology is fast reaching its limitations. Instead, the opportunity is in developing next generation battery technologies, and the new, high-value materials that will be used in these batteries.

[5] Exawatt Report 'Solid-state cell materials cost analysis' October 2020

12. UK gigafactories will licence a number of SSB technologies but unless the infrastructure in terms of materials, processes, equipment, training and skills is put in place, then UK will be importing cells for assembly only and may have to look overseas for expertise and trained employees. Britishvolt has suggested that a gigafactory delivering 10GWh will create 1,500 jobs at cell assembly level. A manufacturing assembly house, receiving cells from overseas, could expect to see a 20% value add for the UK. However, with the UK as a battery components exporter there is scope to deliver 3x the number of skilled jobs through development of a UK materials supply chain, plus a typical UK value add of >50%.

Question: What action is needed to support investment and establishment of UK gigafactories?

13. **Importance of adaptive capabilities** - For the development of healthy domestic supply chain for EV manufacture it is essential that gigafactories are developed with an element of flexibility and can adapt to next generation technology. The required areas for gigafactory adaptation should be identified through collaboration with developers such as Ilika. The development of supply chains will go hand-in-hand alongside the development of the technology and gigafactory provision.

14. To identify adaptation requirements, Ilika has recently finished a joint FBC funded programme with AMTE Power, a developer and manufacturer of lithium-ion battery cells for specialist markets, providing a gap analysis of similarities and potential differences between LIB and SSB. The report identified many similarities in process, but also a number of significant changes which would be required to enable gigafactories to switch over to SSB. Understanding these changes in process at any early opportunity will give essential development time for new equipment design, up-skilling of labour and process and materials development.

Question: The Government has announced £1 billion of funding to support the electrification of UK vehicles and their supply chains. Is this figure sufficient? How should it be split between supply chains and gigafactories?
Question: The £1 billion Net Zero Innovation Portfolio will focus on research into low carbon technologies. What proportion of this funding should be directed towards battery electric vehicle research? What areas should ARIA target in distributing funding for high-risk, high-reward research into battery electric vehicles?

15. **UK behind in allocation of dedicated funding for SSB** - The United Kingdom is at risk of being left behind in SSB commercialisation, with other countries already recognised the importance of making dedicated funding for SSB. To quote BloombergNEF *"Both the Japanese and German government have funded solid-state battery commercialization projects. More support is likely, as Europe and Japan are actively supporting their domestic battery industries. In the U.S., solid-state start-ups might also attract more government funding under Biden's ambitious electrification plans"* and Chinese companies have prioritised SSB.[6]

16. **Limited, under pressure funding risks loss of momentum in SSB development –** The FBC has completed good work since being established, but now faces losing momentum as funding comes under pressure. Battery research and development is at a critical juncture in the UK – although significant progress has been made, a failure to put in place secure,

[6] "A Route For Solid-State Battery Adoption: Europe and U.S.", Bloomberg NEF, April 14 2021

dedicated, and long-term funding for SSB risks many good UK companies failing before their products are ready for market.

17. **Hope of ARIA funding, but not expected to arrive in time –** SSB should be an area of interest for ARIA. However, considering the time it will take to begin allocating research funding, means that it cannot answer critical and urgent need for funding in this area. Failure to put in place such funding now will likely mean that a UK will lack the technology and IP on which a supply chain for SSB can be built and sustained.

18. **Example: Oxis Energy Ltd entering in administration –** Without additional, dedicated funding more UK R&D battery companies will fail. As Ilika reported to the Lords Committee, last month Oxis Energy Ltd, a UK lithium-sulphur battery company was put into administration. Oxis, like Ilika, has been the recipient of UK grant funding for its low TRL technology but unfortunately has not survived for long enough to reap the rewards. This is a great loss for Oxis but also for the UK, which has invested millions for which it will never see a return. This is a clear example of the need for sustained support.

19. Ilika would welcome the opportunity to present evidence in session directly to the Committee, representing the voice of the world class innovative SME in the UK, and share in detail further examples and expertise to inform the inquiry.

June 2021