



SUBMISSION TO AVIATION GREEN PAPER

Li-S Energy Ltd

November 2023

Electric Aviation is cited as a key future opportunity to decarbonise domestic aviation. However, today's electric aircraft have limited range due to the heavy lithium-ion batteries they must carry. We draw the Government's attention to the opportunity to invest in the sovereign domestic scale-up of Australian lightweight eAviation battery technologies that will position Australia as a global leader in electric aviation, leverage Australian critical minerals and secure the domestic supply chain.

Dr Lee J Finniar
Chief Executive Officer

Li-S Energy Limited (ABN 37 640 988 302)

Submission to Aviation Green Paper

November 2023

Introduction

Li-S Energy Limited welcomes to the opportunity to provide a submission on the Aviation Green Paper of September 2023 to help inform the Aviation White Paper.

Li-S Energy Limited (ASX:LIS) is an ASX listed Australian company specialising in advanced battery technology, particularly in lithium-sulfur (Li-S) and lithium-metal battery cells and chemistries. The company focuses on developing and commercializing lightweight, high-energy density batteries for electric aviation, drones, security and defence. Our Manufacturing and jobs are located in Geelong, commercialising sovereign IP from Deakin University.

For more detail on Li-S Energy is in the attached 2-page summary.

Submission Recommendations

Green Paper Section 5.3

- *How can policy and regulatory settings support research and development and subsequent investment in emerging low and zero emission technologies and related infrastructure?*
- *What information and guidance is needed to support regional aviation's net zero transition in the context of these emerging technologies*

Li-S Energy Ltd fully agrees the new propulsion technologies are an opportunity to decarbonise the aviation sector in the long-term.

Electric Aviation will prove to be a critically important technology to support regional aviation's net zero transition.

However, electric aircraft will continue to be unduly limited in range and payload due to the heavy lithium-ion batteries they use.

Policy and regulatory settings for the aviation sector should include support for development and production scale-up of lightweight, high energy density batteries.

Lightweight, high energy density batteries will in turn drive a far earlier, broader, and more practical adoption of electric aviation to support regional aviation's net zero transition. Production of these batteries in Australia will ensure a well-protected sovereign supply chain, and position Australia at the forefront of carbon zero aviation technology, giving opportunities for global export.

Green Paper Chapter 9

- *How can we build on Australia's strengths to ensure that Australian industry in the sector is able to be competitive internationally?*

Australia has many strengths that can be applied to de-carbonising the aviation sector, including world leading IP, advanced R&D, a skilled workforce and the potential for large scale advanced manufacturing.

Electric Aviation will be a major part of this transition, and lightweight batteries are the most critical component for this sector to be successful. Supporting a sovereign domestic manufacturing capability, using Australian technology and IP, will enable the Government to provide security of domestic supply, while positioning Australia in an internationally competitive position to dominate the electric aviation industry globally.

- *How could the Australian Government create an environment that fosters private investment in emerging aviation technologies?*

The Australian Government can create an environment that fosters private investment by providing grant and project funding to industry in the critical scale-up phase from product development to commercial manufacture. This is often the growth stage when Australian technology companies are forced to move off-shore in order to find funding and foreign government support, with the consequence being the manufacturing and profits also go offshore.

Agile, rapid decision making in project selection and support is vital. Government must empower, indeed compel, relevant agencies to make rapid commercially appropriate funding decisions on commercial timelines. It is only with this cadence that companies can maximise the opportunity to secure private investment alongside public sector support.

- *How can the Australian Government best work with states and territories to foster a supportive environment for investment in manufacturing of these technologies?*

In our view the Federal Government, through the IRF, ARENA and other funding regimes, is well placed to work more closely with State and Territory government agencies. Where State & Territory Governments offer grant and co-funding to the industry, Federal Government has the opportunity to further support these proposed scale-up and manufacturing projects.

However, private investment co-funding opportunities can be lost unless the Government adopts agile, rapid decision making, so that companies can develop their manufacturing growth within a commercially reasonable timeframe.

Green Paper Chapter 10

- *How should governments and industry prepare Australian workers for the new skills required for the technological transition and net zero fuels?*

For eAviation, AAM and drone industries is an urgent need to develop training programs at TAFE and University Level for specialist technicians in robotics, automation, advanced manufacturing and engineering. Additional programs to permit industry to take on advanced internships and

apprenticeships are important. In addition, specialist roles in, for example, battery manufacturing as a critical component of electric aviation and drone systems, are likely to be sourced from overseas in the short term.

- *What role can reforms to skilled migration pathways play in addressing immediate aviation personnel shortages?*

From our experience, the acquisition of Global Talent Visas is a lengthy, difficult, and expensive process, often leading to the company and Australia missing out on key talent. We urgently need reforms to the visa and PR process to allow us to attract key overseas talent that can drive our leadership in this industry.

Contact

Dr Lee J Finniar, CEO, l.finni@lis.energy

There's a better battery on the horizon



Li-S Energy (LIS) is an Australian ASX-listed company – headquartered in Brisbane with a manufacturing facility in Geelong – that is developing next generation lithium sulfur batteries for a number of important electrification applications including heavy EVs, long-range drones, and commercial eAviation.

Our difference: twice the energy density

The LIS lithium sulfur battery is protected by a number of patents and is the outcome of a decade of research at Deakin University and the commercialisation expertise of Brisbane-based PPK Group.

This collaboration has enabled the embedding of commercially manufactured nanomaterials in lithium sulfur batteries that have twice the gravimetric energy density (stored energy per unit mass) and equivalent volumetric density (stored energy per unit volume) than current lithium-ion.

Li-S Energy is now driving the optimisation of this technology and is scaling up the production and delivery of these revolutionary batteries.

Our new facility: producing 1,000 cells per week

Li-S Energy's Phase 3, 2MWh automated production facility is now under construction in Geelong. When it is finished later in 2023, the Phase 3 facility will increase LIS's production capacity to over 1,000 high-quality commercial sized cells per week, enabling large-scale customer trials that demonstrate the firm's commercial capabilities. It will also enable LIS to examine how Li-ion manufacturing plant and equipment can be adapted to suit the manufacture of lithium sulfur and lithium metal cells. The facility will include a new 220sqm dry room, the largest in Australia.

Our test partners: Boeing InSitu, magniX & more

At the same time, Li-S Energy has been busy collaborating with future customers and partners in Australia and around the world. These include magniX

(eAviation partner), Insitu Boeing, VTOL Aerospace and Janus Electric (ePrime Movers) as well as the Fraunhofer Institute in Germany, one of the world's leading applied research organisations and specialists in battery materials coating processes.

Committed to driving innovation in Australia

Batteries are increasingly a global industry but LIS remains committed to its roots in Australian R&D. It is a foundational partner in the Deakin Recycling and Renewable Energy Commercialisation Hub under the Trailblazer Universities Program, and is partnering with the ARC Research Hub for Safe and Reliable Energy to support solid-state lithium sulfur battery cell development. It is also a co-founder of the Advanced Materials and Battery Council and is a member of the Future Battery Industry CRC.

Opportunities



Scoping a Phase 4 commercial facility at a cost of ~\$100m



Developing high performance drone batteries



Supporting a local eAviation and drone industry



Looking to support the critical minerals value chain with lithium ingot and foil production



Why Li-S Energy's technologies are important

Electrification is central in progressing towards global carbon zero, and energy storage is a fundamental part of this transition.

The demand for batteries is expected to increase 10-fold by 2030¹ due to climate change driving the move to renewable energy and electric vehicles (EVs). The GWh demand from EVs alone is forecast to grow more than five times by 2025, and more than 50 times by 2040.

This once-in-a-century shift to electric land transport vehicles includes cars, trucks and buses. In electronic aviation and long-range drones, safe, light batteries with a high energy density are critical, while demand for carbon free batteries in consumer devices and for the 'Internet of Things' is expected to nearly double in the next ten years.

Li-ion: already reaching its limits

To date, lithium-ion (Li-ion) battery technologies have been used to meet the increasing demand for electric vehicles and more broadly. Nearly 80% of Li-ion battery manufacturing occurs in China with Australia contributing an estimated 0.1% of global Li-ion battery manufacturing capacity².

It is difficult for Li-ion battery technology to improve significantly. Li-ion batteries cannot be made significantly smaller or lighter, and fast charging times and cycle life are also reaching their limits. This means there needs to be breakthrough in battery technology to drive more efficient clean energy storage innovation and adoption.

Lithium sulfur batteries are superior to Li-ion in many ways. They are a light-weight, high capacity battery compared to Li-ion. This means they are ideal for a range of high-performance applications where weight and space are critical considerations, including larger electric vehicles, electric planes and drones. Lithium sulfur batteries are also cleaner and greener with no nickel, cobalt or manganese reducing mining and disposal impacts.

1. Electric Vehicle Outlook 2020', Bloomberg NEF (Bloomberg Finance L.P.)

2. S&P Global Market Intelligence, data from 2021

Proudly Australian made

Li-S Energy's research and development has been undertaken in Australia. The company is Australian owned, run and headquartered. It holds the global patents in the technologies that are inherent in the successful commercial production of high-performance lithium sulfur batteries and address the life cycle issue. It is scaling up the manufacture of its batteries in Geelong working with leading global and domestic partners and future customers, as well as world-leading battery technology research institutions.

Australia's opportunity to keep production onshore

Li-S Energy's breakthrough technology provides the opportunity for Australia to have a greatly enhanced role in the evolution of rechargeable batteries for storage in transport applications – and more broadly. With all indications that Li-S Energy's batteries can be manufactured at scale for highly significant parts of the land transport and aviation sectors, the time is approaching where decisions will need to be taken about whether the fully commercialised production will occur in Australia or have to be taken offshore.



HS1023



Contact us

Dr Lee Finniear | CEO | l.finniear@lis.energy

Ben Spincer | Chairman | b.spincer@lis.energy