# Building New Zealand's High-Value Manufacturing Industry for Future Heavy Electrified Transport

# Case Study 2023/2024

## Problem – New Zealand needs a strong high-value manufacturing industry helping to address low labour productivity, capital investment into productive parts of the economy, and environmental challenges

The high-value manufacturing industry in New Zealand is vital for our economic growth and global competitiveness. This sector, focused on producing advanced and innovative products, creates higher-skilled, better paid jobs and career opportunities. New Zealand needs to move beyond commodities into value-added goods, differentiated through innovation, quality, brand and service. A thriving, diverse, high-value manufacturing sector will help us address issues such as labour productivity, low capital investment into productive parts of the economy, and environmental challenges.

The technical goal of our programme is to demonstrate a compact, lightweight superconducting motor enabling low-emission solutions in electrified heavy transport especially aviation. This motor is a sophisticated system composed of numerous advanced components, including superconducting coils and circuits, high-precision and sometimes additively manufactured motor parts, cryogenic equipment such as a cryocoolers and cryogenic components, and power electronic devices [2].

While it is less likely that a New Zealand company will manufacture an electric aircraft the size of a Boeing or Airbus aircraft, or the 40MW superconducting motor to power one of these, we have a significant potential to carve out niches in the industry's global supply chains. By focusing on specialized areas, we can establish a strong network of component suppliers that contribute meaningfully to the global market and grow our high value manufacturing industry.

## Our Approach – Partner with existing New Zealand industry and scout for new opportunities

Our approach is to collaborate with existing New Zealand industries as early as possible in our research and prototype development. This helps to increase understanding of the technology, scout for commercial opportunities, national and international now and in the future, and upskill team members both ways.

For example, last year our programme hit a significant milestone by successfully powering up our superconducting homopolar motor for the first time, also utilizing our own power electronic driving circuits.

Multiple New Zealand companies were involved in this development and other research work in our programme:

- HTS-110 is a manufacturer of high-Tc superconducting magnet systems superconducting system components and custom HTS system design and manufacturing services [3].

They manufactured the superconducting coils for our prototype field windings and are involved in the development of a new HTS saddle coil technology in our programme.

- Fabrum is a supplier of cryogenic, hydrogen and advanced manufacturing solutions [4]. They supplied cryogenic parts and composites for different cryogenic setups e.g. an AC loss rig and provided precision manufacturing e.g. for our prototype stator laminations.

- Industrial Fibreglass Solutions provides fibreglass and composite product solutions, including design, manufacture and repair [5]. They provided composite materials and systems for our cryogenic applications.

- Llama Engineering is a high-precision manufacturing company [6]. They manufactured and helped to balance parts and components for our superconducting prototype motor.

- Shamrock is a precision engineering technology company [7]. They manufactured high precision parts for a cryogenic concept testing rig.

- FI Innovations is a New Zealand leader for 3D plastic printing and resin-based processes, including fibreglass, composites, floor coatings, and flexible urethane manufacturing. [8], They additively manufactured (3D printed) nylon composite parts for the same cryogenic concept testing rig.

- 3d-it is a high-tech custom-tailored printing company including 3D metal printing [9]. They additively manufactured (3D printed) complex shaped metal parts for our prototype motor.

In parallel we actively scout for and monitor new opportunities. This includes securing essential intellectual property and supporting and encouraging New Zealand researchers and former students who want to establish e.g. a startup. For example, Ratu Mataira, a former PhD student from the Robinson Research Institute, founded a company to develop compact fusion reactors based on plasma confinement using superconducting technologies. This company, Open Star, has already raised over NZ$10 million and currently employs over 30 people [10]. Although not directly linked to our programme, our programme contributes to their capacity and capability building, for example, by educating and graduating new researchers in superconducting technologies.

## Impact – Growth of existing and creation of new high value manufacturing industries and industry clusters

Partnering with existing companies in high value manufacturing niches and scouting for new opportunities will create significantly impact for New Zealand's economy e.g. growing new high wage manufacturing job numbers and export income. Having and

providing access to expertise, infrastructure, and market knowledge will help to accelerate the development and commercialization of our technologies.

Securing IP and exploring startup opportunities will create fresh ideas and new industries. They often operate at the cutting edge of technology, driving breakthroughs that can transform industries.

In the long term, we envision creating an industry cluster that can share resources, minimize risks, and expand the limits of what's possible.

Together, our strategies will position New Zealand as a global leader in high-value manufacturing niche areas for electrified heavy transport and ensure long-term economic resilience and growth.

For more information about our programme, please visit electrictransport.co.nz

*References*

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*[2] Kalsi, S.S. et al. (2023) 'Superconducting synchronous motor development for airplane applications - mechanical and electrical design of a prototype 100 kW motor', IEEE Transactions on Applied Superconductivity, 33(5), pp. 1–6. doi:10.1109/tasc.2023.3242629.*

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