Deregallera Holdings Ltd

A **disruptive sustainable technology** company that has developed **world-leading electric drive systems** and **nano-scale composite battery materials** to facilitate progression towards and all-electric future

Business Activities Commenced	2011
Business Segments	• Electric Ring Drive • Materials discovery: **Sodium-ion batteries**, supercapacitor.
Entity Type	Private Limited Company

Why **Sodium-ion** batteries (NIB)?

- More sustainable materials
  - → Na is globally abundant
  - → No need for "African Blood Cobalt"

NIB prototype is 60% cost of 30 years mature LIB tech[†].

- Safer
  - → Discharge to 0V
  - → 100x lower thermal runaway

NIB not covered by UN3480/81 transportation regulation.

- "Drop-in" to lithium production lines

Rapid-route-to-market

Why NOT Sodium-ion batteries (NIB)?

- Na^+ is 30% bigger and heavier than Li^+

→ Lattice strain during intercalation is higher

Potentially lower cyclability

- Na has lower electrochemical potential than Li

→ NIB ≈10% lower energy than LIB for similar materials

Current NIB prototype is ≈1.5x bigger and heavier than equivalent kWh automotive LIB (NCA)

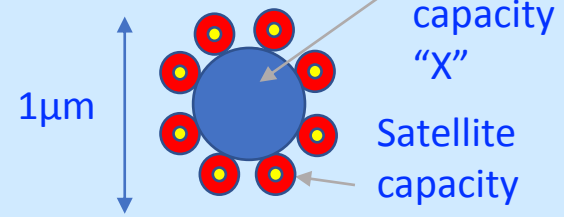
Although NIB are 60% size and weight of Lithium Iron Phosphate (LFP)!

[†] Björn Nykvist. Rapidly falling costs of battery packs for electric vehicles, *Nature Climate Change*, **5**, 329 (2015)

Improving energy density

Faraday battery challenge R1 & R3

High energy core/satellite composite electrode material



Improving power and cyclability

Faraday battery challenge R2

Batteries (energy)

+

Supercapacitors (power)

Hybrid energy storage system (HESS)

Up to end of 2020…

- Improved cell energy density from 40Wh/kg to 155Wh/kg over last 12 months **(400% increase)**
- Anticipate 240Wh/kg over next 18 months **(Further +50%)**

Awarded a further £1.5 million worth projects via Innovate UK Faraday Battery Challenge **to prepare for upscaling these materials**

Innovate UK

- Improved power density by +300%
- Increased battery "1st life" by +50%
- Improving EV pack range by TBC

2021 and beyond

Primary markets to encroach:

- Lithium Iron Phosphate (LFP) - $25bn 2025
- Pb-acid market - $80bn 2025

Faraday battery challenge R4?

Working with Tier 1 EV manufacturers to develop prototype 12V SLI and 48V MH *Sodium-ion / supercapacitor Hybrid Energy Storage System*

Secondary markets

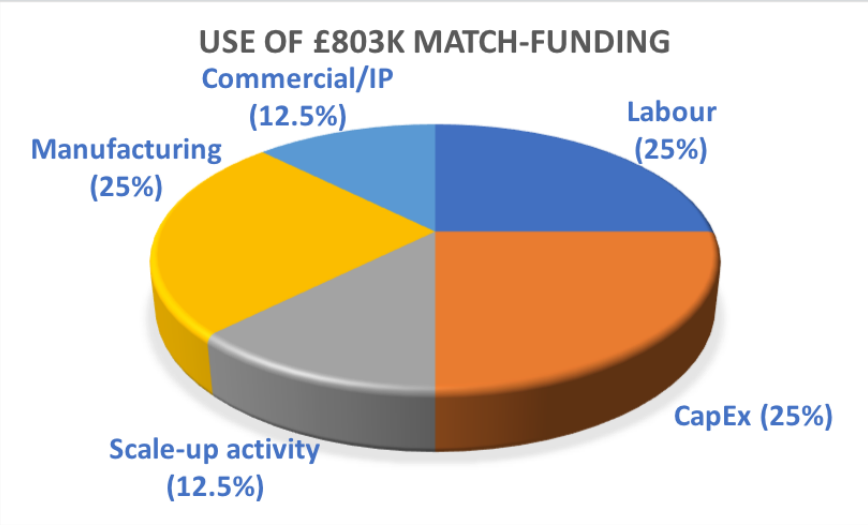
- Sodium-ion into residential and industrial stationary energy storage (USD $16bn 2025)
- HESS into applications ranging from mobile phones to grid storage

Investment opportunity

Investment sought	£802,599*
Timescale	July 2019 – Dec 2020

* Match funds with Innovate UK investment

- The £803k IUK funds will develop processes in preparation of scale-up
- The £803k match-funding will facilitate the scale-up to pilot production and commercialisation



→ Labour: Hire two electrochemists and one technician
→ CapEx: Install pouch cell production line
→ Scale-up: Engage partners to move from 1g to 100kg
→ Manufacturing: Pilot scale production
→ Commercial/IP: Drive marketing activity, maintain patents

Leadership

- Martin Boughtwood, Founder & MD

40+ years experience in motor design & manufacturing

- Dr. Peter Curran, Principal Materials Scientist

Researcher in advanced materials, >15 years in industry and academia.

- Prof. Andrew Hector University of Southampton

30 years experience inorganic chemistry

Key partners

Facilities

Comprehensive battery testing and EV prototyping in Caerphilly

Commercial route-to-market

- Low volume, high value bespoke solutions e.g. MOD
- Partner directly with Tier 1 end-users in e.g. Faraday Round 4 or private collaboration