Towards Legislation and Standardisation for Lithium-Ion Batteries

Jacqui Murray
Deputy Director – The Faraday Battery Challenge, Innovate UK

Session Sponsor:

WMG
THE UNIVERSITY OF WARWICK

INDUSTRIAL STRATEGY

The Faraday Battery Challenge

Part of the Industrial Strategy Challenge Fund

UK Research and Innovation

Creating a UK Vehicle Battery Industry

Tony Harper, Challenge Director
Jacqui Murray, Deputy Challenge Director
Luke Davis, Deputy Challenge Director

@EPSRC
@Innovateuk
@theapcuk
#industrialstrategy

UK Research and Innovation

The Industrial Strategy Challenge Fund (ISCF) Who are we?

- Operating across the whole of the UK
- A combined budget of more than £6 billion
- Brings together the seven Research Councils, Innovate UK and Research England
- An independent organisation with a strong voice for research and innovation
- Supported and challenged by an independent chair and board
- Principally funded by the Department for Business, Energy and Industrial Strategy (BEIS)

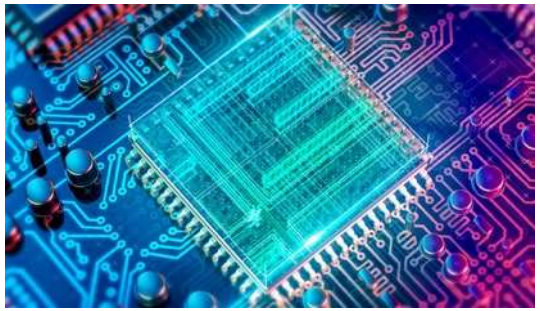
Industrial strategy

INDUSTRIAL STRATEGY

Creating an economy that boosts productivity and earning power throughout the UK

UK Research and Innovation

Industrial Strategy Grand Challenges



AI and Data Economy

Healthy ageing

Clean growth

Future of mobility

UK Research and Innovation

What is the Industrial Strategy Challenge Fund (ISCF)?

The ISCF aims to bring together the UK's world leading research with business to meet the major industrial and societal challenges of our time, as part of the Government's £4.7 billion increase in research and development over the next 4 years.

Creative industry clusters

Transforming food production

Driverless cars

Manufacturing and materials of the future

National Satellite Test Facility

Faraday Battery Challenge

UK Research and Innovation

Next wave of the challenge fund

Transforming construction

From data to early diagnosis and precision medicine

Leading-edge healthcare

Transforming food production

Next generation services

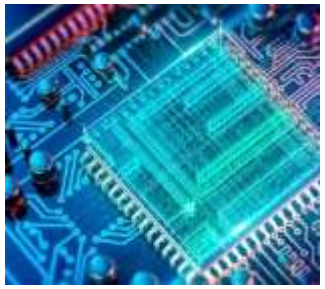
Prospering from the energy revolution

Energy revolution

Healthy ageing

Manufacturing and future materials

Audience of The future



Quantum technology

Robots for a safer world

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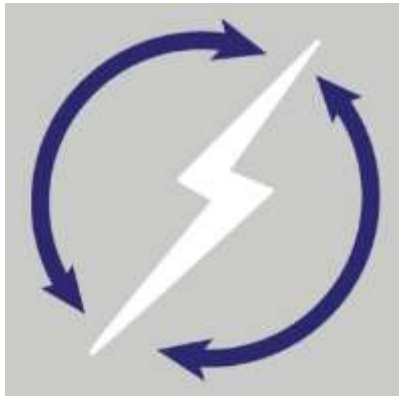
Faraday Battery Challenge – Making the UK the go-to place for batteries

£246m investment until March 2021 to make the UK the go-to place for the research, design, development and manufacture of new battery technologies.



- Acting now to create a step change in the probability of the UK having a thriving, sustainable battery industry by 2025
- Build on the UK's world class battery research base
- Creating high paid jobs throughout a battery supply chain
- Accelerate the exploitation of the of the most exciting technologies that the UK has to offer the global marketplace

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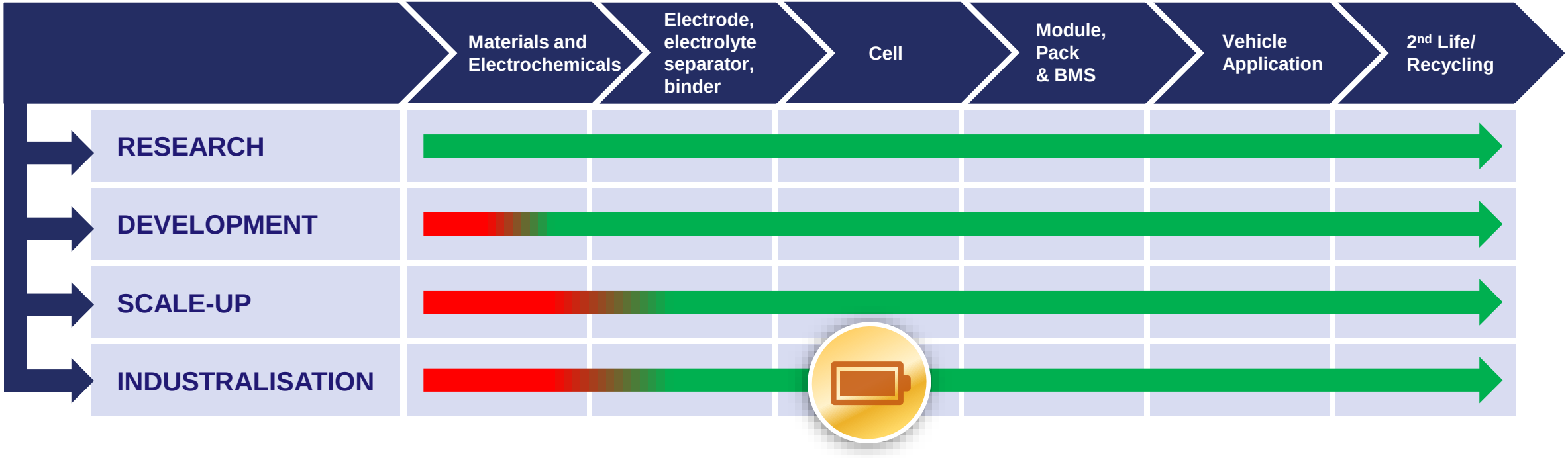
Building a new UK Battery Supply chain



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The opportunity: why does the UK want to be world-class in automotive battery technology?

1.67 million

The UK is the **3rd largest** car producer in Europe, producing **1.67 million** domestic vehicles in 2017

856,000

The auto sector employs **856,000** people across the UK (including supply chain)

The current lithium ion battery was invented in Oxford in 1980

3000 UK companies are active in the auto sector

Productivity levels in the industry are **£90K per person,** 50% higher than the UK average and the highest amongst major car producing nations

£90k

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The technical gaps

Cost

NOW: $130/kWh (cell)
$280/kWh (pack)
2035: $50/kWh (cell)
$100/kWh (pack)

Energy Density

NOW: 700Wh/l,
250Wh/kg(cell)
2035: 1400Wh/l,
500Wh/kg(cell)

Power Density/ Fast Charging

NOW:
3 kW/kg (pack)
2035:
12 kW/kg (pack)

Safety

2035:
Eliminate thermal runaway at pack level to reduce pack complexity

1st Life

NOW: 8 years (pack)
2035: 15 years (pack)

Temperature

NOW: -20˚ to +60˚C (cell)
2035: -40˚ to +80˚C (cell)

Predictability

2035:
Full predictive models for performance and ageing of battery

Recyclability

NOW:
10-50% (pack)
2035:
95% (pack)

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Creating a cross sector battery supply chain

Aerospace

Key challenges:
Weight | Safety

Grid

Key challenges:
Cost

Construction

Key challenges:
Power density

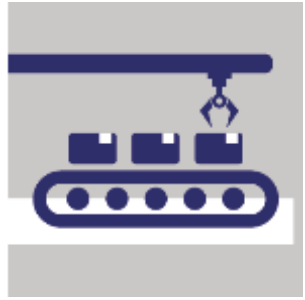
Rail

Key challenges:
Predictability | Life

Marine

Key challenges:
Life | Cost

Manufacturing



Key challenges:
Recyclability

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ISCF Faraday Battery Challenge

£246 million (2017-2021)

Challenge Director, Advisory Group, Programme Board

INDUSTRIAL STRATEGY

Research: **£78m**

EPSRC

- ‘Application-inspired’ research programme coordinated at national scale
- Creation of the **Faraday Institution** for coordination of research and training programmes
- Four ‘fast-start’ projects announced 23rd Jan 2018 (£42m) – Battery Degradation, Multi-scale Modelling, Recycling, Solid State Batteries
- £12M per annum available to tackle identified challenges: Next generation Li-ion cathode materials; Electrode manufacturing; Next generation Na-ion batteries; Alternative cell chemistry beyond lithium ion batteries
- £2M available for up to four awards to develop battery characterisation analytical techniques and capabilities

THE FARADAY INSTITUTION

Innovate: **£88m**

Innovate UK

Scale: **£80m**

ADVANCED PROPULSION CENTRE UK

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- Innovation programme to support business-led collaborative R&D with co-investment from industry
- Address technical challenges and build UK supply chain
- £40m committed in **Round 1** (2017) to Collaborative **R&D** and **Feasibility Study** projects– projects addressing range of areas from cell materials to pack integration and BMS to recycling
- £25 million **Round 2** competition closed 28th March 2018
- **Round 3** CR&D and Feasibility Study project to be announced shortly

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ADVANCED PROPULSION CENTRE UK

- Scale up programme to allow companies of all sizes to rapidly move new battery technologies to market
- Develop manufacturing tools and methods for mass production
- Demonstrate production-rate reliability and quality
- **CWLEP & WMG** building open-access scale up facility: **UK Battery Industrialisation Centre**

CWLEP Coventry & Warwickshire Local Enterprise Partnership

Coventry City Council

UK BATTERY INDUSTRIALISATION CENTRE

WMG THE UNIVERSITY OF WARWICK

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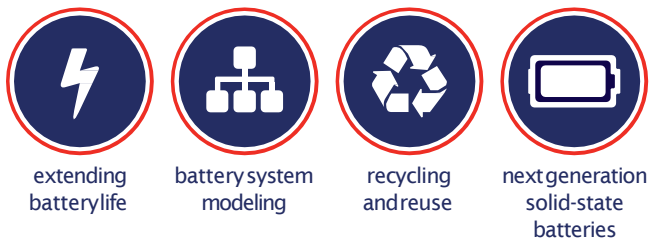
INDUSTRIAL STRATEGY

Development for the UK

Research for the Faraday Institution

£78 million

4 initial research projects



£42 million project investment

20 universities

30 industry partners

Innovation In funding

£88 million

128 organisations **funded** → across **63** projects

£60 million spent with **£24 million** additional investment from industry so far

Scale-up **80 million** For UK Battery Industrialisation Centre

opens in 2020 in Coventry

UK Research and Innovation

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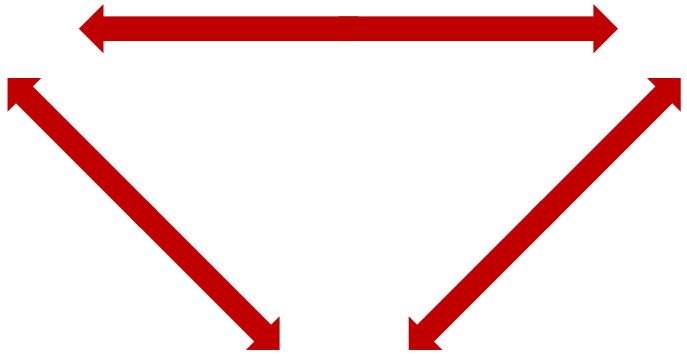

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- **Three elements spanning all TRLs interact to support the development of future technologies and to accelerate path to market for more mature technology**
- **Skills critical to establish a workforce to support this industry**
  Programme being developed across the Faraday Battery Challenge to support skills training at all

Creating a UK Vehicle Battery Industry

How to get involved:

- **Faraday Battery Challenge Website**
  www.ukri.org/innovation/industrial-strategy-challenge-fund/faraday-battery-challenge
- **Faraday Institution**
  Seeking industry input on future calls for research projects: www.faraday.ac.uk
- **UK Battery Industrialisation Centre**
  www.ukbic.co.uk

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