THE FARADAY INSTITUTION


# Energy Storage Research and Clean Energy

**10th anniversary Cleanpower Smart Grids Conference 2019**
**www.cir-strategy.com/events**

Ian Ellerington
Head of Technology Transfer
02 July 2019

# THE FARADAY INSTITUTION

We are the **UK's independent institute for energy storage** science and technology, supporting research, training and analysis.

## Mission

**Accelerating breakthroughs** in energy storage and conversion technologies to benefit the UK in the global race to electrification.

- **Lead the world in energy storage science and innovation**
- **Create battery jobs of the future – at many levels, across sectors**
- **Provide policy advice on electrification to make best choices**
- **Secure a cleaner, greener future for the UK**

# FARADAY BATTERY CHALLENGE
## £274M OVER 4 YEARS

Exploit vehicle electrification with world-leading batteries developed, designed and manufactured in the UK

### THE FARADAY INSTITUTION

Harnessing the strengths of the UK research base

**£78M from EPSRC**


### UK BIC

Open access, scale up centre, rapidly moving products to market

**£108M from Advanced Propulsion Centre / BEIS**

### COLLABORATIVE R&D

Creating new solutions and demonstrations

**£88M from Innovate UK**

INDUSTRIAL STRATEGY

# OUR KEY STAFF

**Neil Morris**
**Chief Executive Officer**

**Susan Robertson**
**Chief Financial Officer**

**Matthew Howard**
**Head of Engagement & Education**

**Stephen Gifford**
**Head of Economics & Market Insights**

**Ian Ellerington**
**Head of Technology Transfer**

**Allan Paterson**
**Head of Programme Management**

**Louise Gould**
**Communications Lead**

**Fran Long, Education and Training Coordinator**

# KEY DIRECTIONS AND CHALLENGES

## REDEFINE THE RESEARCH MODEL

1. Unify the UK's research agenda for energy storage.
2. Gain focus of the research community.
3. Develop centres of excellence and infrastructure.

## CREATE NEW KNOWLEDGE

1. Make significant breakthroughs in energy storage research.
2. Develop discovery into intellectual property.
3. Publish important papers in leading scientific journals.

## BUILD CAPABILITIES

1. Develop diverse pipeline of talent from undergraduate through PhD.
2. Establish UK scientists as world-leaders in energy storage research.
3. Lead STEM engagement and attraction programmes.

## GROW ECONOMIC VALUE

1. Generate patents and license it for benefit of UK industry.
2. Transfer UK technologies to the marketplace.
3. Foster growth of energy storage entrepreneurship.

## DEVELOP NATIONAL & INTERNATIONAL REPUTATION

1. Drive the national conversation around energy storage.
2. Strategically partner with industry, government, and academia..
3. Establish international cooperation toward research goals.

## ENABLE UK TO ELECTRIFY

1. Address economic and social issues through studies.
2. Inform policymakers and regulatory bodies.
3. Partner with charities, trade associations, and think tanks.

# Technology improvements are accelerating

## 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°C to +60°C (cell)
**2035: -40°C to +80°C (cell)**

## Predictability

**2035:**
**Full predictive models for performance and ageing of battery**

## Recyclability

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

THE FARADAY INSTITUTION

- Volume Automotive
- Motorsport and Premium Auto
- Aerospace
- Consumer Electronics
- Marine

- Mining equipment
- Rail
- Defence applications
- Second life including grid storage
- Power for emerging markets

# “Niche” Market potential drives technology

# OUR RESEARCH AGENDA

Application-inspired research topics to address known technical performance gaps

**EXTENDING BATTERY LIFE**

**Cambridge**, Imperial College, Liverpool Manchester, Newcastle, Sheffield, Southampton, UCL, Warwick, + 10 industry partners

**MULTI-SCALE MODELLING**

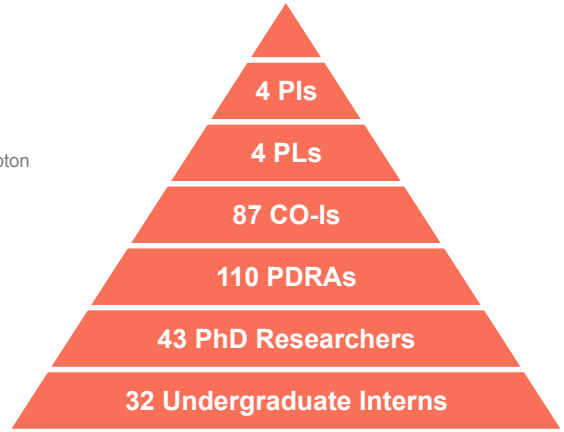
**Imperial College**, Bath, Birmingham, Lancaster, Oxford, Southampton UCL, Warwick + 17 industry partners

**RECYCLING AND REUSE**

**Birmingham**, Cardiff, Edinburgh, Leicester, Liverpool Newcastle, Oxford Brookes, STFC + 14 industry partners

**SOLID-STATE BATTERIES**

**Oxford**, Cambridge, Liverpool, St. Andrews, Sheffield, UCL + 10 industry partners




250+ researchers from many disciplines

Launching in September 2019:

**BATTERY CHARACTERISATION**

**NEXT GEN LI-ION CATHODE MATERIALS**

**NEXT GEN NA-ION BATTERIES**

**ELECTRODE MANUFACTURING**

**ALTERNATIVE CELL CHEMISTRIES BEYOND LI-ION**

Four large, collaborative research projects launched in 2018
30+ industry partners & 20 academic partners

## REDEFINING THE RESEARCH MODEL

Fundamentally changing how basic research is carried out

Accessing the best UK researchers and universities

Bringing together academics and industry partners

Large, coordinated research teams

Drawing on many disciplines

Funding teams to allow them to work faster

Adapting quickly as priorities change

Monitoring closely for commercial opportunities

# DEVELOPING A NATIONAL AND INTERNATIONAL REPUTATION

Working with media outlets, learned societies, trade associations, and think tanks to ensure our research, leadership, and community is part of a national narrative on decarbonisation and electrification.

Enable the UK and other key governments to partner on energy storage research: US, Korea, Japan notably

Launch of a programme with DfID on energy storage in emerging economies

*“New International Partnership Established to Increase the Use of Energy Storage in Developing Countries”*

## ENABLING THE UK TO ELECTRIFY

Independent, third-party source

Provides evidence-based understanding of battery science, economics, capabilities and competitive position

Bridge knowledge gaps across industry, academia and government

”Faraday Insights”

Economic EV study, with McKinsey Energy Insights and University of Oxford

UK capabilities study

Royal Society long term storage Technology study

# Thank-you

Ian.Ellerington@faraday.ac.uk