



# Leading the Electric Revolution

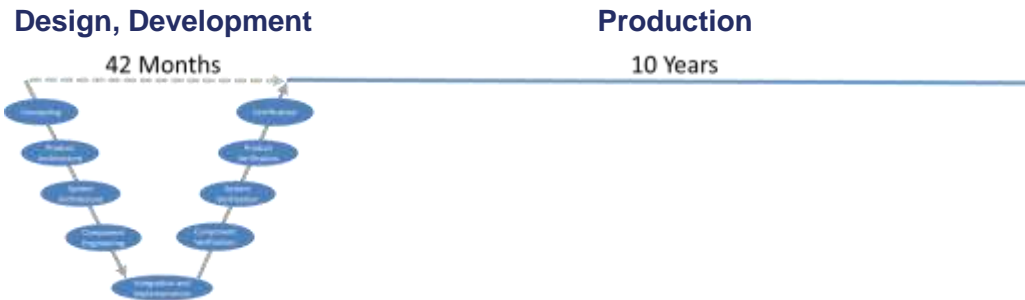
**Tony Harper**

Industrial Strategy Challenge Director  
Faraday Battery Challenge, UKRI

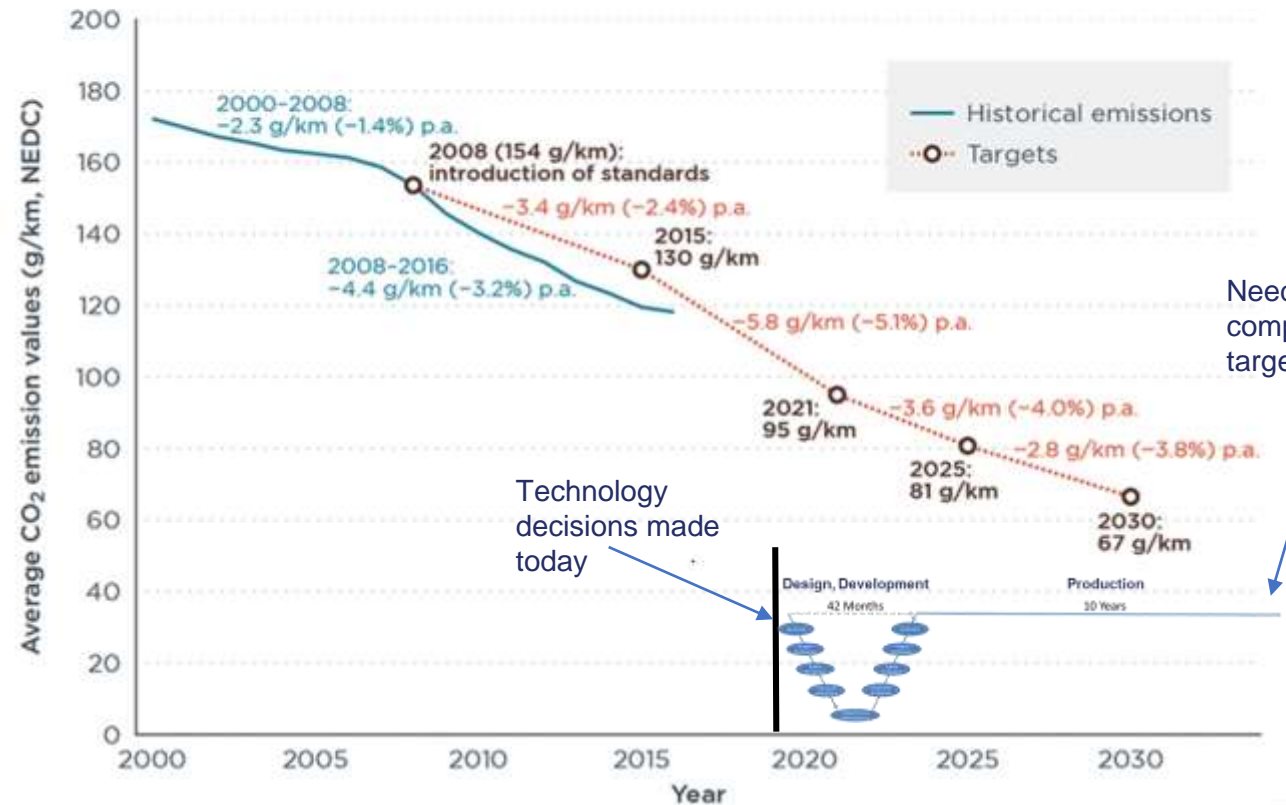
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**GEOTAB**<sup>®</sup>  
management by measurement

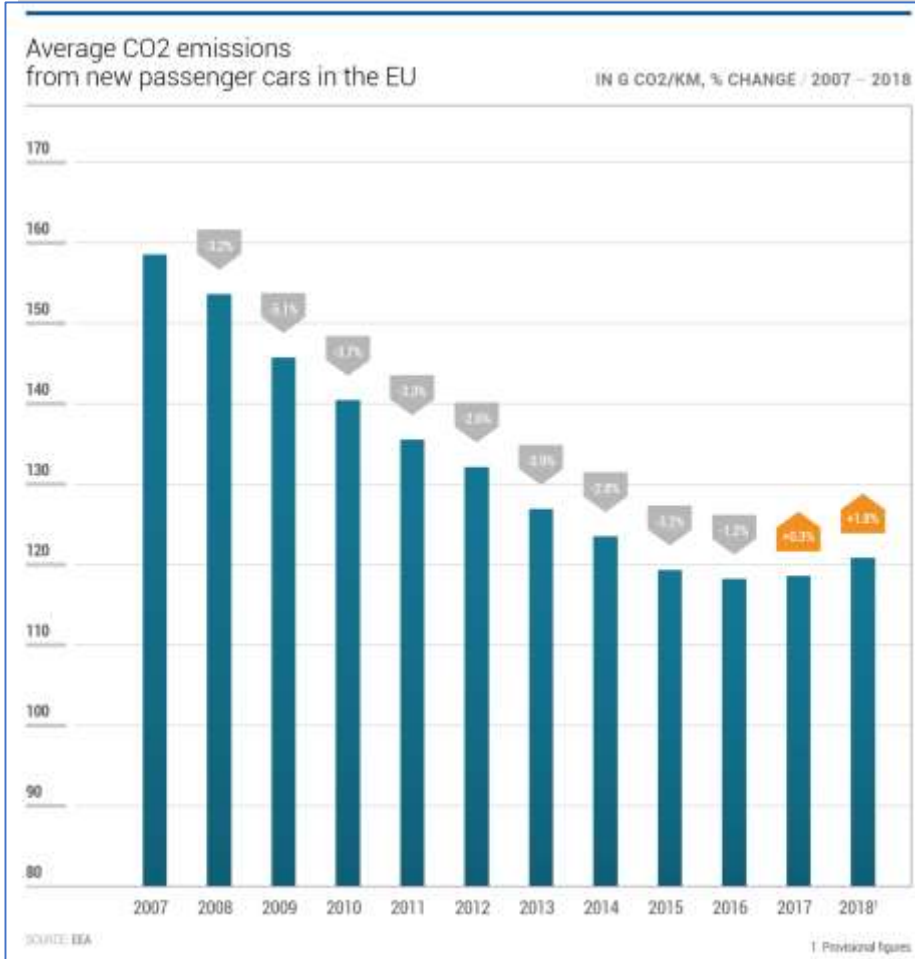
# Automotive technology decisions for 2030s **must be made today!**



Development of average CO<sub>2</sub> emission level for new passenger cars in the EU and current<sup>x</sup> as well as proposed regulatory target values.



# We have reached the limits of ICE to reduce CO2 emissions.



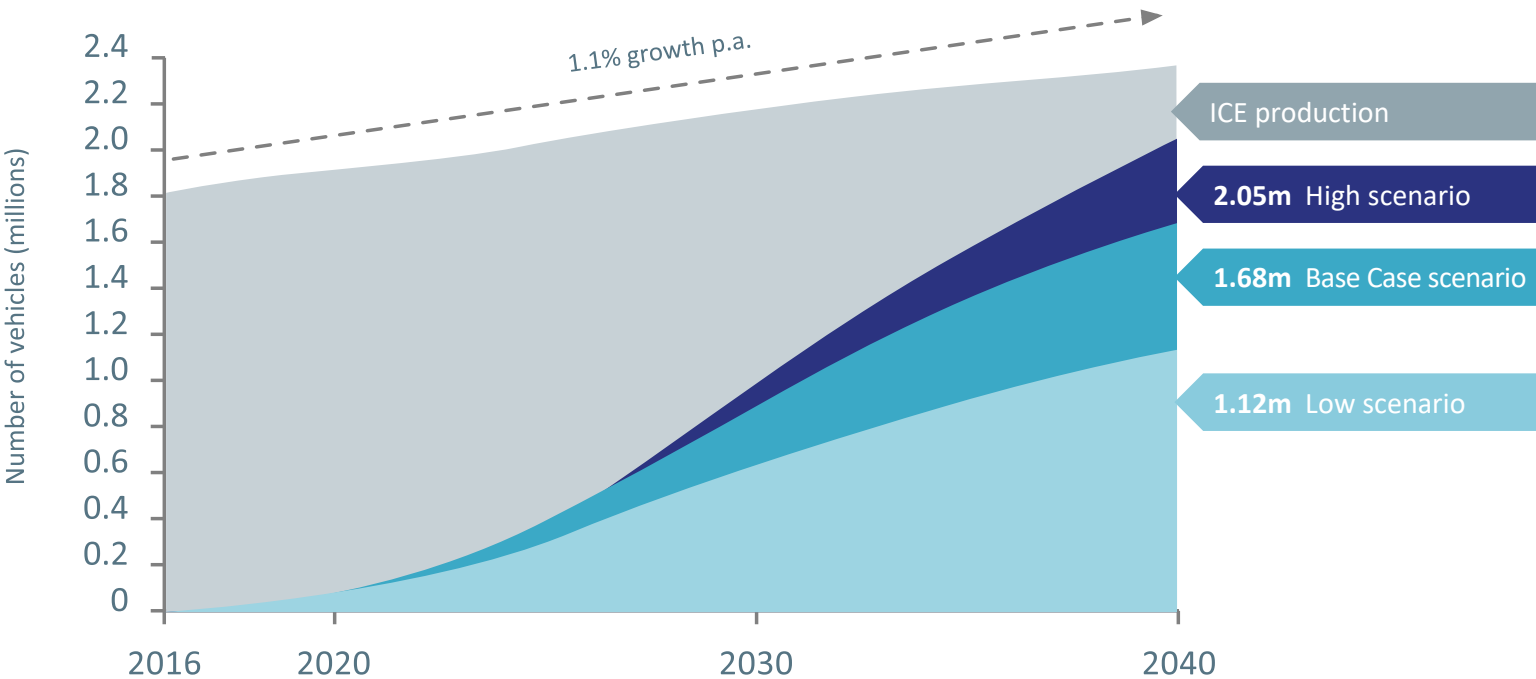
EU Fleet average CO2 has increased in the last 2 years after a prolonged period of steady decline.

The main factors are:

- Reaching the limit of ICE-based technology
- The shift from Diesel to Petrol
- The shift to “real-world” test drive cycles

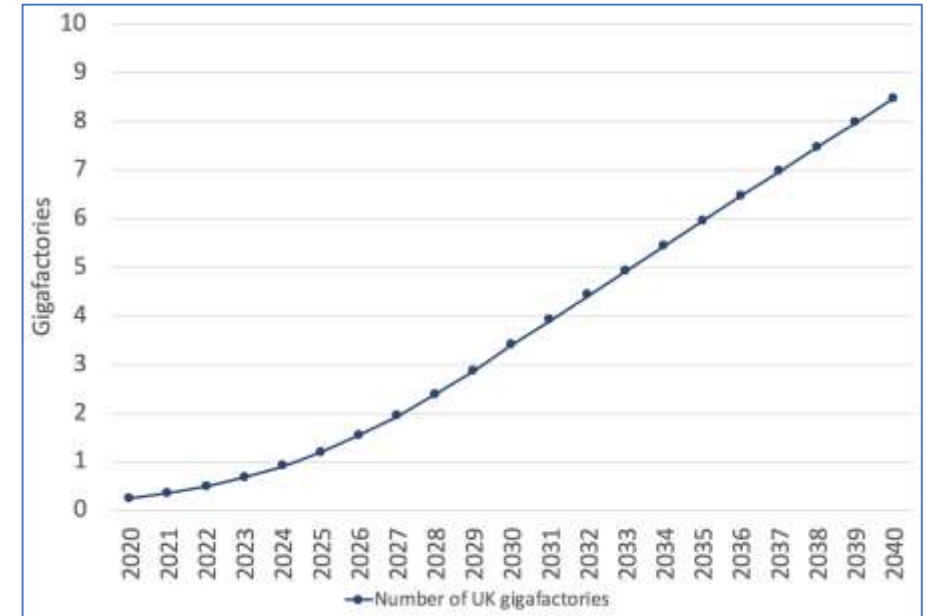
**A technological transition involving 15m passenger cars is required!**

# If decisions must be made now, batteries are the only realistic technology.



## EV vehicles produced in the UK

Maintaining current market shares in its key markets allows UK-based EV manufacturing to capture 1.1 to 2.0m EVs by 2040

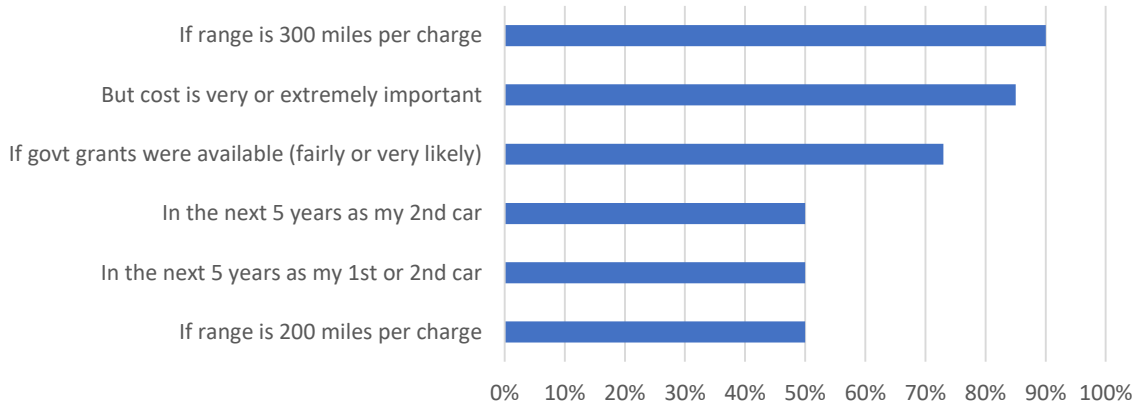


## Demand for UK-produced batteries

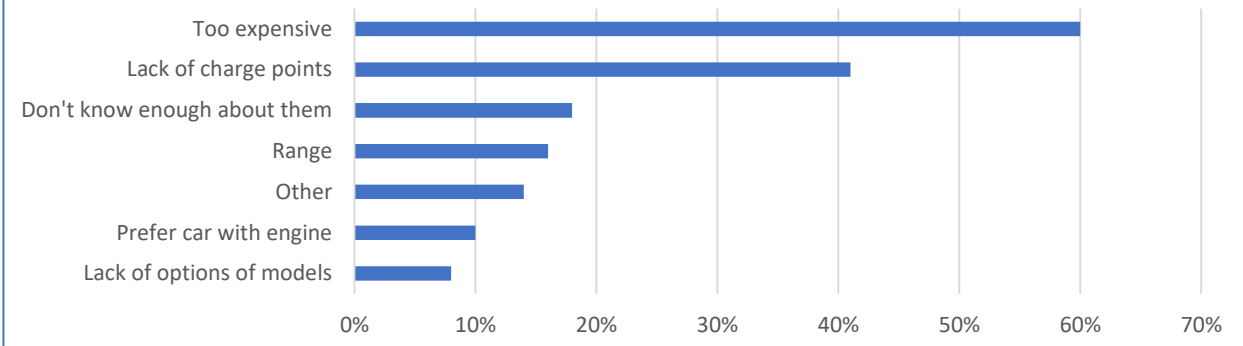
UK and EU demand for UK-produced batteries could reach 120 GWh p.a. by 2040, the equivalent of 8 gigafactories.

# EV uptake happens **one consumer at a time.**

I would consider purchasing an EV....



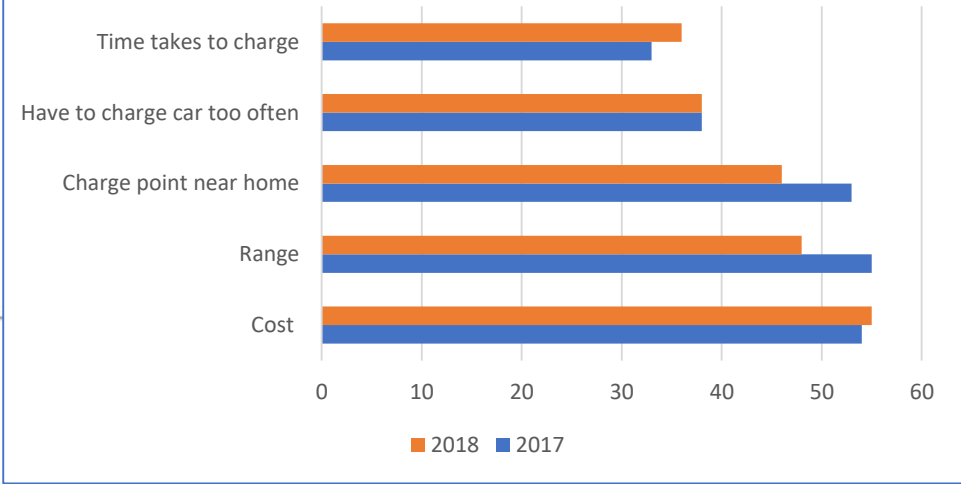
What are main two reasons you will *not* buy an electric vehicle?



## Key Barriers to EV Update by Public:

- **Cost** (upfront, total cost of ownership)
- **Range** (comparable to tank of petrol)
- **Availability of Charge Points**

Main barriers to EV car ownership



# Faraday Battery Challenge is addressing these challenges.



**£108m**

**UK Battery  
Industrialisation Centre**

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



**£78m**

**The Faraday Institution**

Harnessing the strengths of  
the UK research base



**£88m**

**Collaborative R&D**

Creating new solutions  
and demonstrations

**Innovate UK** | UK Research  
and Innovation

UK Research  
and Innovation

# Faraday Institution research portfolio

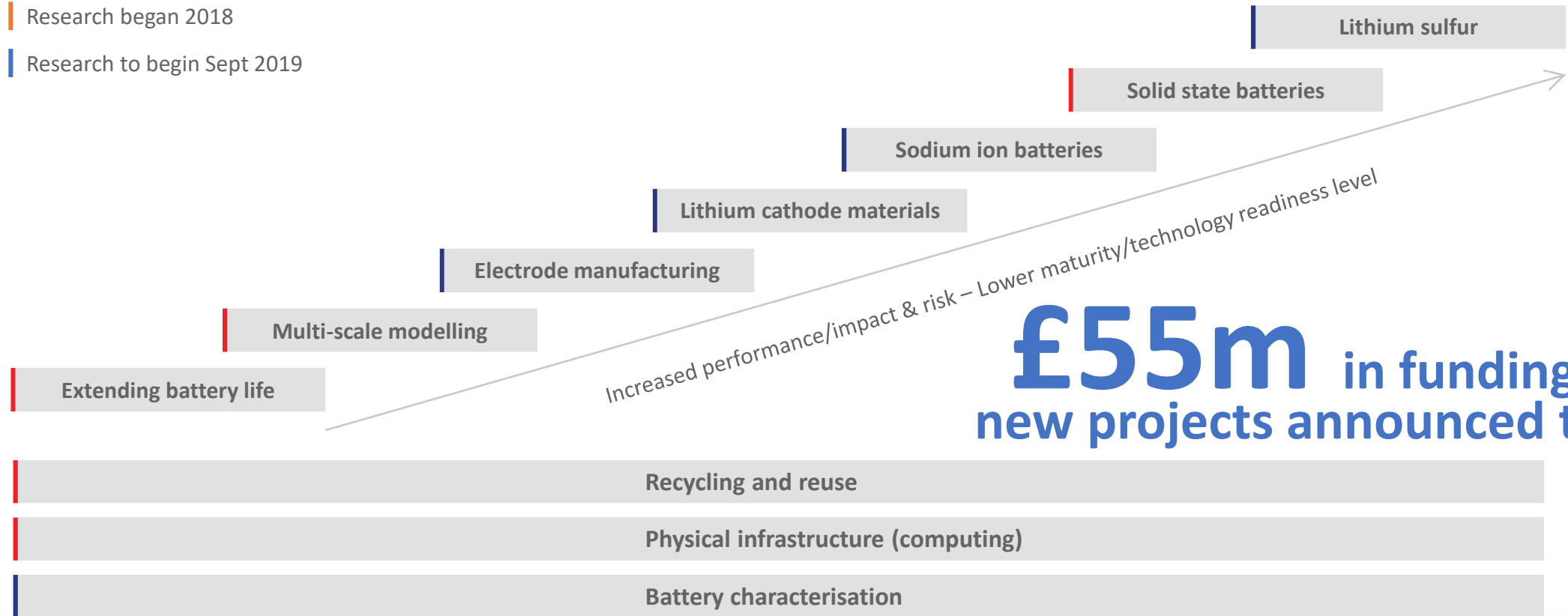


## Scientific research

Application-inspired research to address known technical performance gaps

Research began 2018

Research to begin Sept 2019



**£55m** in funding for new projects announced today

UK Research and Innovation



**22**

Academic partners



**49**

Industry partners



# Faraday Institution Academic Partners

World's best universities working together at scale to solve key scientific battery challenges





## By the Numbers

- £114.5 million invested in 63 projects
  - £82.5 million in innovation funding
  - £32 million investment from industry
- 128 organisations funded
  - Micro companies (42%)
  - Large companies (23%)
  - Academic (20%)
  - Medium companies (10%)
  - Small companies (5%)

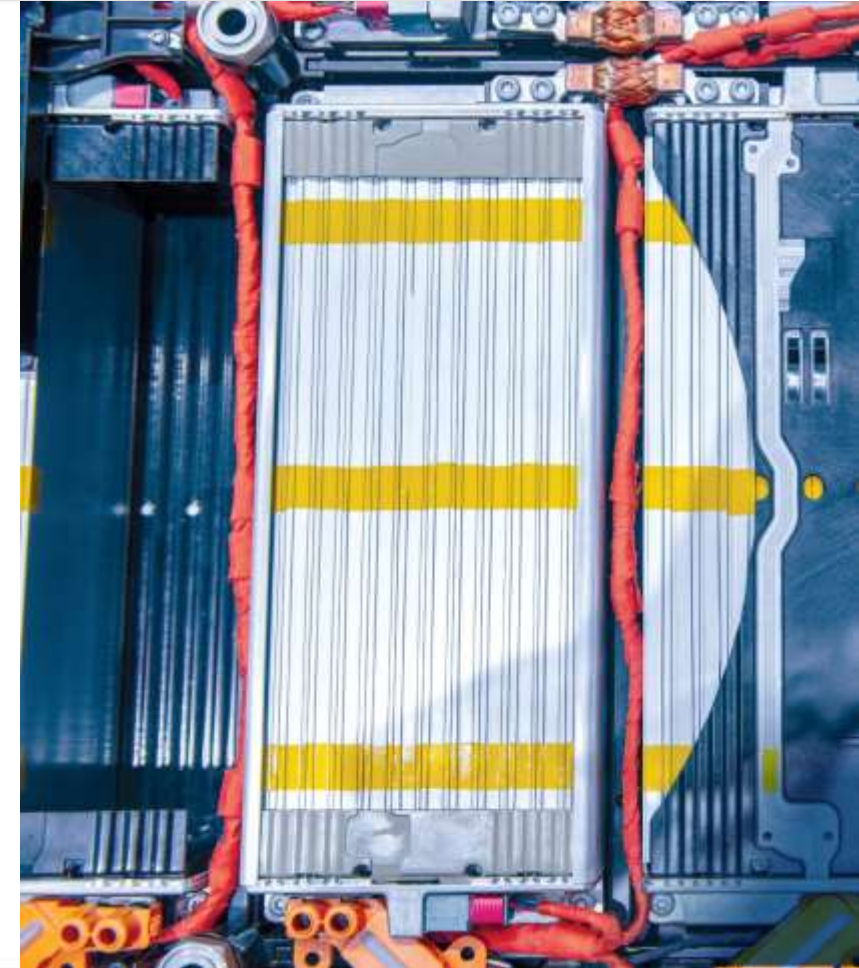
## Project Technical Areas

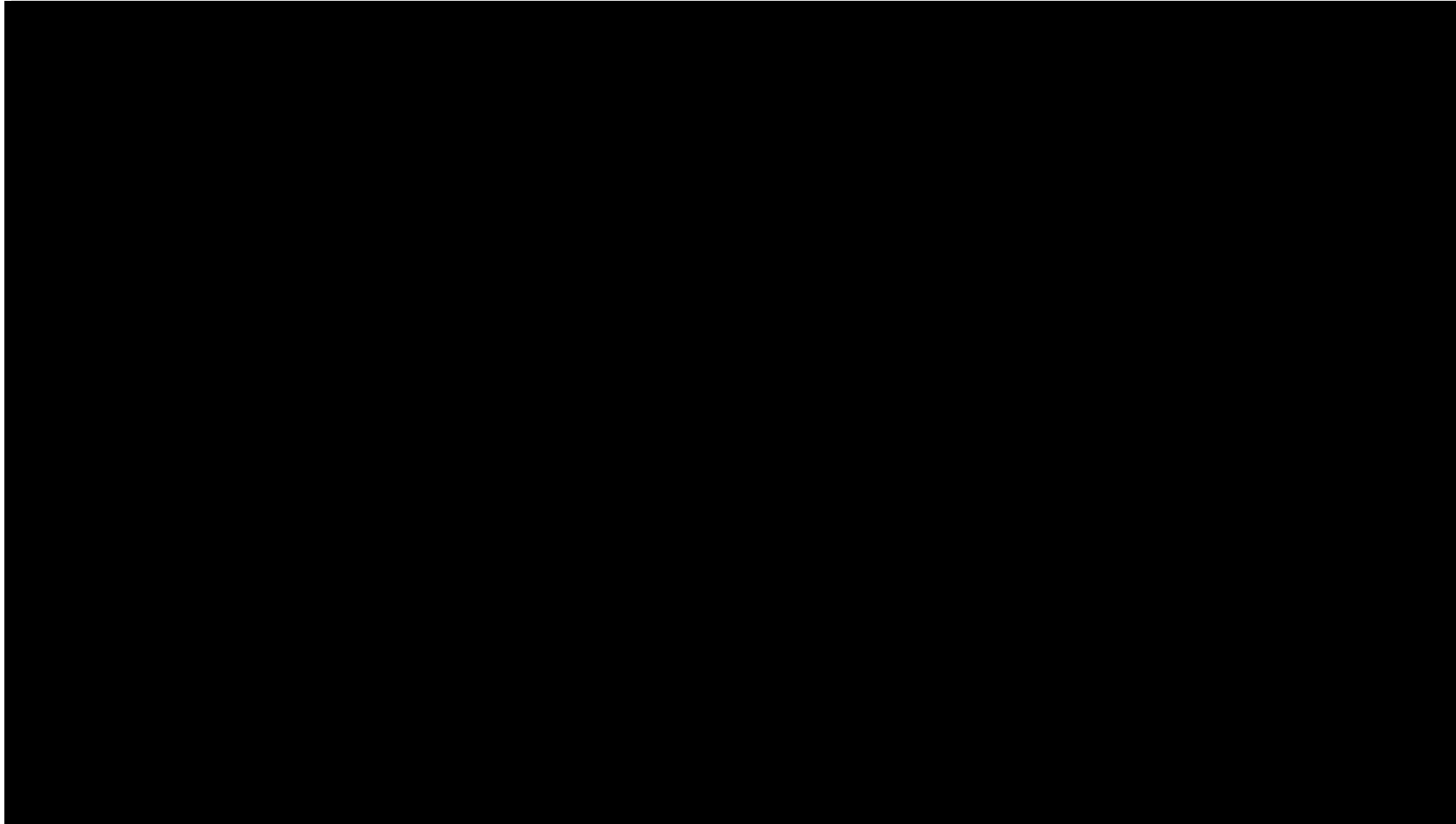
- Cells and cell materials (54%)
- Modules and packs; BMS, thermal (28%)
- Recycling and reuse (9%)
- Safety (7%)
- Diagnostics (2%)



Three recent projects underway to **lower cost and improve range**:

- **Nexeon** led project on Si/carbon anodes
  - Increase energy density by increasing Si content
  - Goal is to **double** the energy density
- **Oxis** led project on Li-S batteries aimed at bus market.
  - Lower cost possible due to cost of sulfur (<\$200/tonne)
  - Targeting 500 Wh/kg by end of 2019
- **M&I Materials** led project on using synthetic ester cooling systems in battery modules
  - Reduced cost
  - Improved energy density are desired outcomes





## UKBIC

**DE-RISKING GROWTH  
TO HIGH VOLUME  
MANUFACTURING**

### STEPS IN CELL DEVELOPMENT

**Gramme Scale**  
University scale  
Research

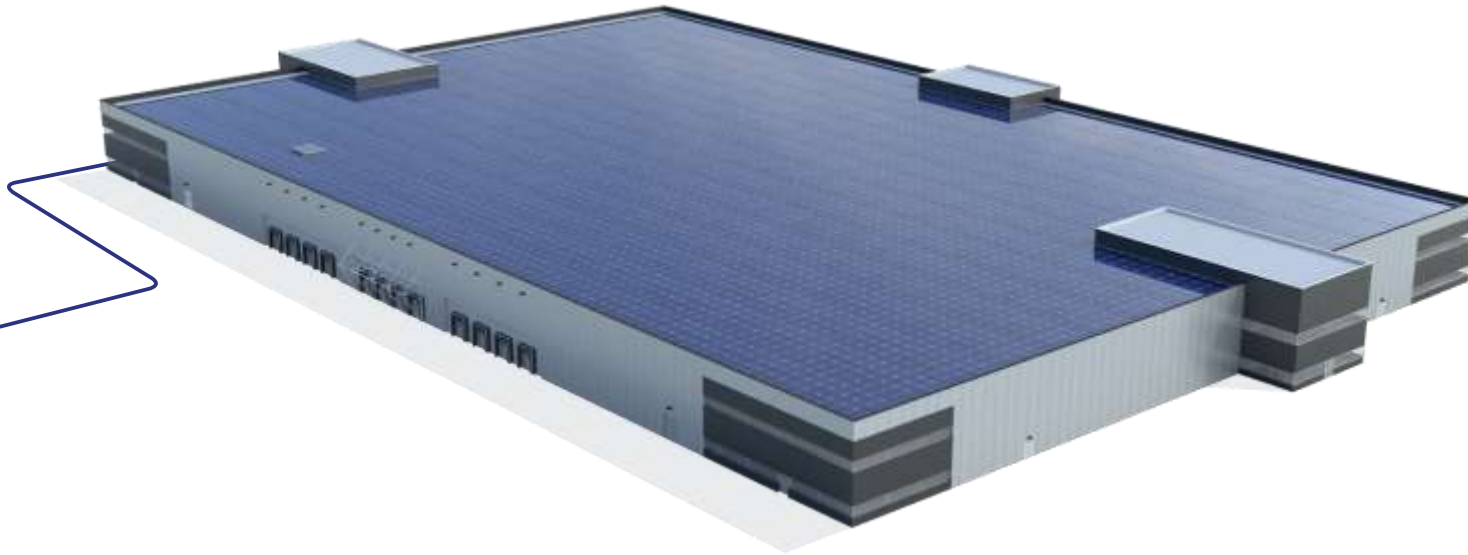
**Kilogramme Scale**  
Corporate R&D  
or specialist Uni facilities

**Tonne Scale**  
Manufacturing process  
development at industrial rates

**Kilotonne Scale**  
Full scale, high  
volume manufacture

# Need for Gigafactory Scale Battery Production

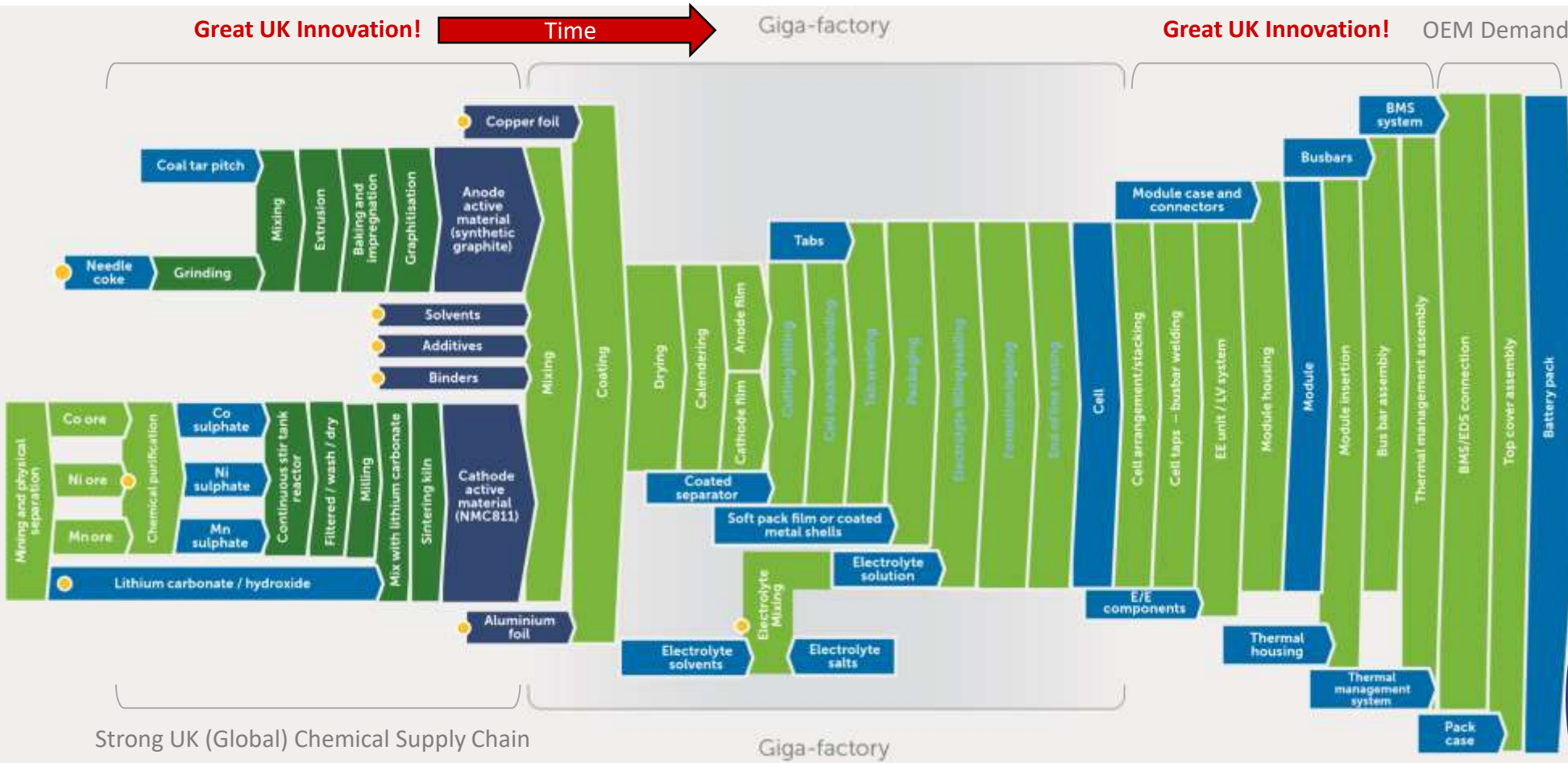
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**£1.3bn**  
investment  
per 15 GWh p.a.  
gigafactory



# End-to-end value chain provides ecosystem for the commercial exploitation of great UK Science & Innovation.



**Great UK Innovation!**



**£4.8bn**  
**annual potential**  
 for chemical sector from  
 supply chain

UK Research  
 and Innovation

- 
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  - **Correct misperceptions**
    - With authenticated data, facts, the truth