BATTERIES FOR ELECTRIC CARS

A CASE STUDY IN INDUSTRAL STRATEGY

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INDUSTRIAL STRATEGY CHALLENGE FUND – SIX TARGETS

- Health care and medicine
- Robotics and artificial intelligence
- Batteries for clean and flexible energy storage
- Self-driving vehicles
- Manufacturing and materials of the future
- Satellites and space technology

WHY BATTERIES?

1. **Accelerate shift to electric cars as part of drive to reduce CO2 emissions**
2. **Belief that UK's academic strength in electrochemistry could help UK-based firms win a larger share of world market**
3. **Concern that without a viable battery supply chain in the UK car makers might make their electric cars elsewhere**

PRINCIPAL ELECTRIC CAR TYPES

Hybrid electric vehicle (HEV) – powered by petrol or diesel and battery

Plug-in hybrid electric vehicle (PHEV) – battery recharged via external charging outlet

Battery electric vehicle (BEV or EV) – powered entirely by battery

SALES OF ELECTRIC CARS IN 2017

Country	Total sales
China	1,245,900
US	943,700
Japan	207,200
France	149,800
UK	137,300
Germany	121,500

EVOLUTION OF BATTERY TECHNOLOGY

- LEAD ACID
- NICKEL IRON
- NICKEL CADMIUM
- NICKEL-METAL-HYDRIDE (OVSHINSKY/GM)
- LITHIUM-COBALT-OXIDE (GOODENOUGH/SONY)
- ?SOLID STATE BATTERY
- ?LITHIUM-AIR

TOP LITHIUM-ION BATTERY SUPPLIERS

- Panasonic (Japan)
- Samsung SDI (Korea)
- LG Chem (Korea)
- SK Innovation (Korea)
- CATL (China)
- BYD (China)

LITHIUM-ION BATTERY SUPPLY CHAIN FOR VEHICLES

- Mining and processing of raw materials – lithium, cobalt, nickel etc
- Development and production of materials for anode, cathode, electrolyte
- Manufacture of cells
- Design and production of battery packs
- Production of cars and trucks
- Battery recycling

TOP-SELLING ELECTRIC CARS IN US (Jan-August 2018)

- Tesla Model 3 55,882
- Toyota Prius Prime 18,310
- Tesla Model S 14,649
- Tesla Model X 13,600
- Chevrolet Volt 11,114
- Chevrolet Bolt 10,258

TOP-SELLING ELECTRIC CARS IN EU (Jan-June 2018)

- Nissan Leaf 18,080
- Renault Zoe 17,394
- BMW i3 11,348
- Mitsubishi Outlander 9,771
- VW e-Golf 9,820
- Tesla Model S 7,700

EUROPEAN BATTERY CONSORTIA

- SAFT (FRANCE)
- TERRA-E (GERMANY)
- NORTHVOLT (SWEDEN)

RATIONALE FOR FARADAY PROGRAMME

- “A well-coordinated national research programme would send a strong signal to the automotive industry that the UK government is serious about getting ahead of the game in battery R & D and has an industry-focused strategic vision”
- The research community will need to work together “as a synergistic strategic collective rather than a large number of small uncoordinated groups” – Sir Mark Walport, March 3, 2017

THE £246m SUPPORT PROGRAMME

- £78m for research – Faraday Institution
- £88m for innovation – Innovate UK
- £80m for scale-up – Warwick prototyping and pilot production facility (UK Battery Industrialisation Centre)

QUESTIONS

- Given the expected growth in electric car sales, why does government need to support the battery sector?
- The battery supply chain is global – does the UK need to be represented in all phases?
- How much will the absence of cell-making plants affect investment in the motor industry?
- Is the existing UK battery sector strong enough to be the basis for a world-leading industry?
- Is the government's battery programme a good model for other industries/technologies?