Developing a UK sustainable battery industry

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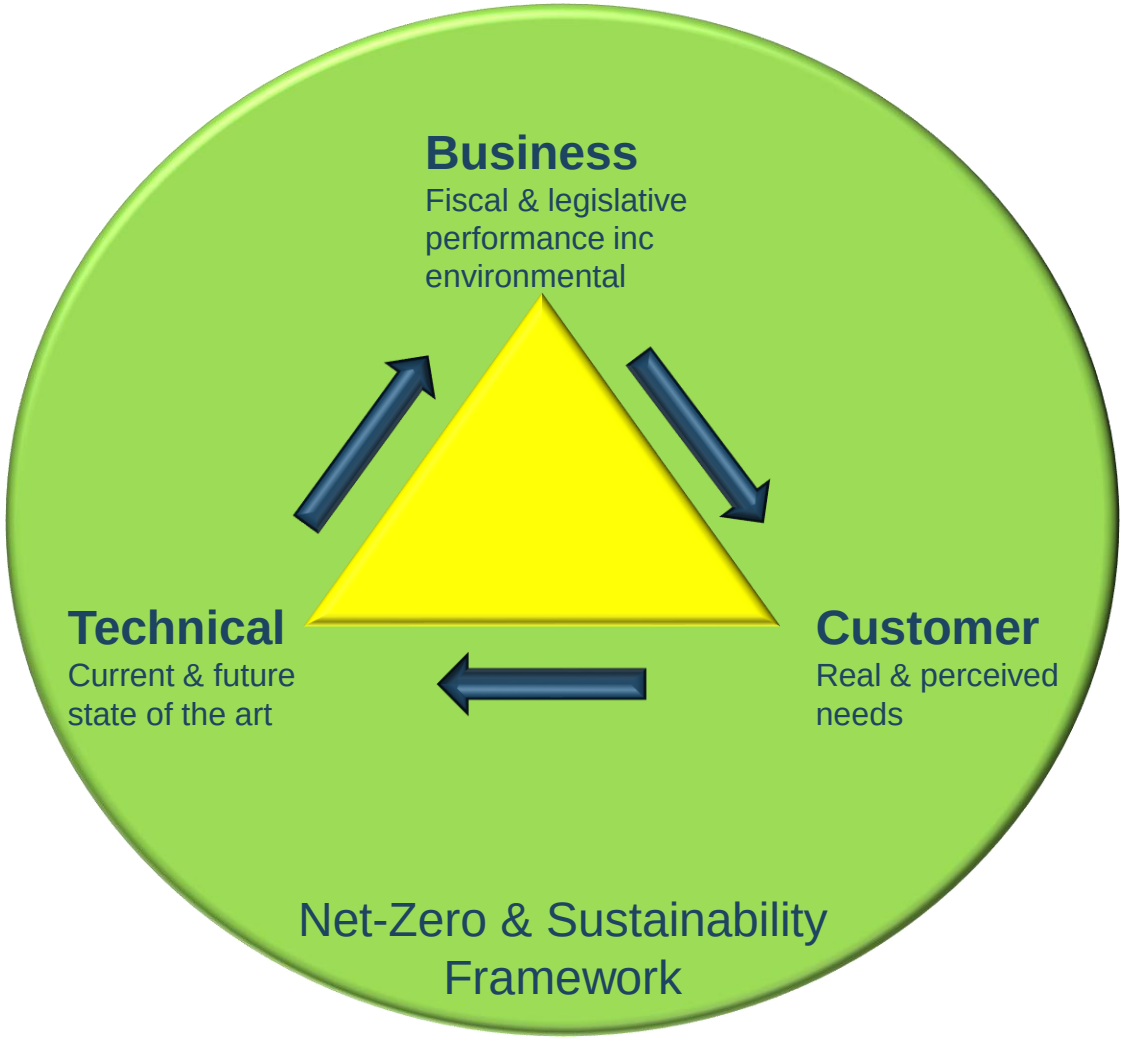
Innovate UK
University of Sheffield AMRC Advanced Manufacturing Research Centre
cpi
mtc Manufacturing Technology Centre
NMIS National Manufacturing Institute Scotland
NATIONAL COMPOSITES CENTRE
NUCLEAR AMRC
WMG THE UNIVERSITY OF WARWICK

Electrification in UK is diversifying across sectors

The techno economics of batteries



Techno economic modelling

- Batteries are a complex balance of techno economic interactions.
- You can't meet all the requirements with the current technology, trades must be made.
- Cost reduction dominates the technical agenda, followed by faster charging, degradation and safety.

However Automotive still dominates UK Battery demand across sectors

Faraday Battery Challenge
Delivered by Innovate UK

2 GWh	Sector
	Light duty automotive
	Heavy duty automotive
	Energy storage
	Off highway
	Aerospace
	Maritime
	Rail

2 GWh

Unprecedent manufacturing & supply chain growth

2022 UK manufacturing capability

2030 cell sector demand

90 GWh

UK cell manufacture not secured

+ 5 GWh + 4 GWh +

<2 GWh +

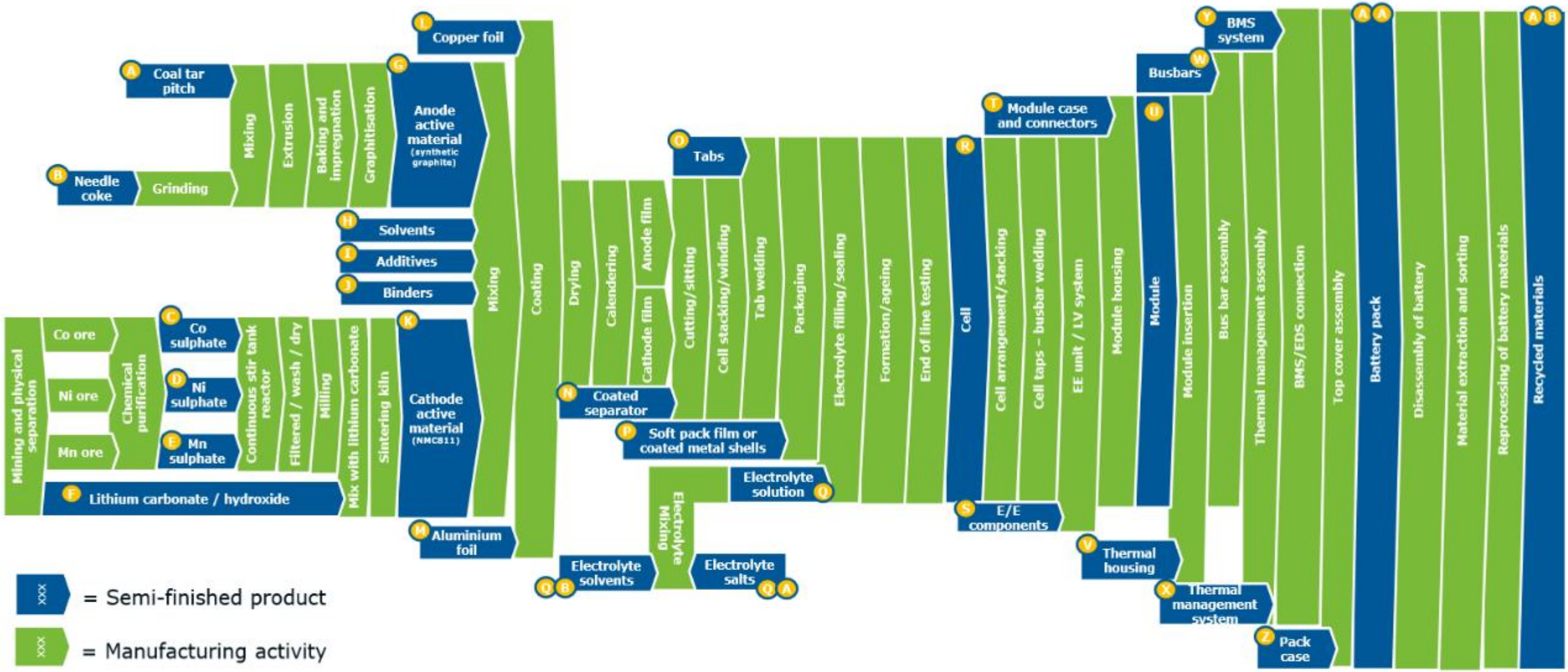
<1 GWh +

<1 GWh +

<1 GWh

Consistent legislation & sustained support is required to enable the R&D and battery manufacturing ramp up to support the £67Bn/yr auto sector

Battery Supply Chain — It's not just about the gigafactory



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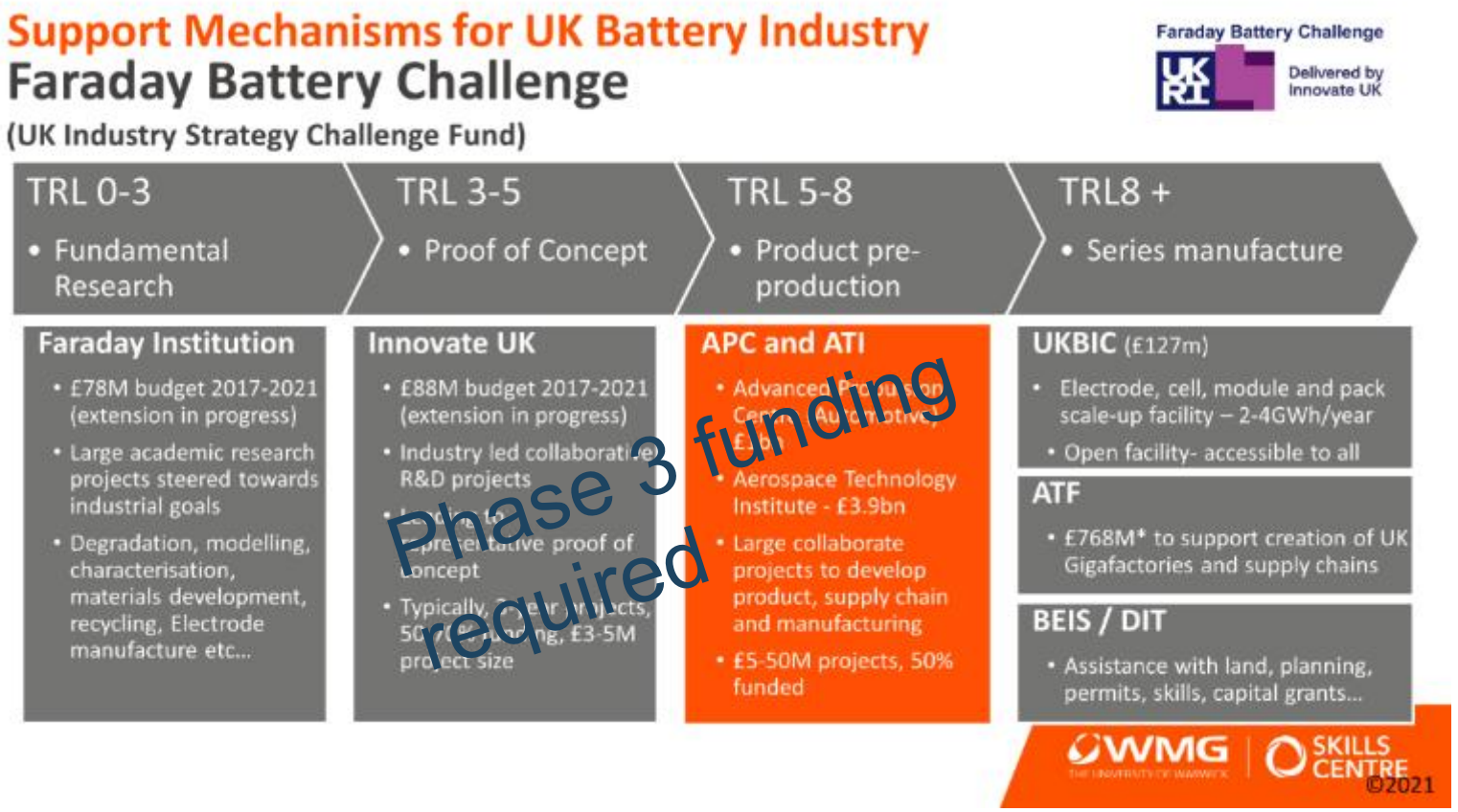
Faraday Battery Challenge

UKRI Delivered by Innovate UK

ADVANCED PROPULSION CENTRE UK

Sustained funding in the right framework is critical



We have created a coherent funding ecosystem to support battery development from research to industrialisation however the job isn't finished. We need continued funding aligned to overall UK Battery strategy.

The race is on due to EU rules of origin

- The EU trade agreement requires a percentage of local content for EV's and batteries going forward.
- This is driving the race to secure the battery supply chain into the EU to avoid tariffs.
- The existential risk to the EU auto industry is that vehicle manufacture will be closely tied to battery manufacturing location!
- Therefore, it is both an opportunity to grow a new battery supply chain and a risk to existing vehicle manufacturing supply chains if we fail in the UK.

EU rules of origin	1 May 2021 to 31 Dec 2026	From 1 January 2027
Vehicle value	40 %	55 %
Battery pack	30 %	70 %
Battery cell	30 %	60 %

Have a strategy for funding Faraday 6 Battery "Big Plays"

Secure the supply chain in the UK

- "Double down" on all efforts to secure competitive, sustainable UK manufacturing of Nickel-rich batteries & associated supply chain.
- UK supply chain for very high performance, high value, relatively modest volume solutions at cell, module & pack level. (Synergies with aerospace).

Develop the next generation technologies

- UK technical capability and physical supply chain for Li metal anode solutions.
- Low cost / Good enough (for high volume auto) energy density pack level solutions. Lower cost cells.

Make it all sustainable

- Total end-to-end life cycle assessment optimisation, use of earth-abundant materials, manufacturing energy reduction, end-to-end cost of ownership optimisation, robustness to first use duty cycles, efficient recovery and recycling.

Leverage digital tech developments

- The "5 Dimensions of Digital" - Big Data & AI for materials discovery- Digital Design Optimisation Performance Verification- Test and field data analytics- Digitisation of the end-to-end bill of process- Digitisation of "Provenance" and State

Battery scale up ecosystem why it's critical

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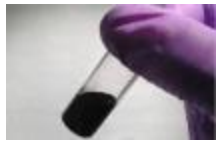
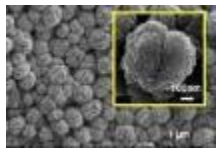
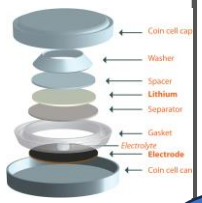
Gramme Scale







Typically, university scale research using small quantities of hand-made materials

Used for fundamental materials research and initial half-cell experiments at coin cell scale

Funders typically EPSRC, Faraday Institution

Kilogramme Scale

Typically, corporate R&D lab or University / Catapult centre

Used to demonstrate scalability of materials to full size cell, and to develop electrode mixtures, deposition processes and cell formats.

Funders typically Innovate UK, EPSRC, Faraday Institution

50kg - Tonne Scale

Typically, full scale manufacturing facilities used at low rate. Expensive, inflexible, and impossible to access except by owner. **UKBIC provides bespoke facility for this purpose.**

Used to develop and prove materials, cell design, manufacturing processes and parameters "at-rate" prior to full plant investment

Kilotonne Scale

Full-scale, high-volume manufacturing plant. Typically, 6-50GWh/year

Used to deliver very large volumes of cells with no variation or flexibility to chemistry, format or quality. Cost/kWh and process consistency are critical

Academic scale

HVMC scale up

UKBIC / WMG FIL

UKBIC VIL

Volume manufacture

Innovation must be proven at each scale of manufacture and needs the ecosystem to support this

Key Take Outs

- Whole life battery cost reduction is the key factor driving innovation in electrochemistry, battery design, manufacturing processes and recycling.
- Batteries are critical to automotive UK manufacturing, and the key building block to our NetZero and sustainability targets.
- Strategic alignment is required to ensure the development of skills, investment in research and investment in the supply chain happens in a timely manner to meet the needs of industry.
- If left to the free-market economy, then we will lose the race.
- Sustained policy and intervention is required.