

An aerial photograph of a dense forest with a narrow road winding through it. A small car is visible on the road, driving away from the viewer. The trees are lush green, and the lighting suggests a bright day.

Powering the Drive to Net Zero

Unlocking Public and
Private Capital for the
UK Battery Sector

The Coalition for the
Decarbonisation of Road Transport

The transition to net zero necessitates a parallel transition in transport, from ICE vehicles to low carbon alternatives, which will be predominantly battery powered.



A vertical photograph on the left side of the page shows a highway at night. The lights from cars create long, vibrant red and orange streaks that curve across the road, leading towards a distant horizon. A road sign is visible in the background.

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Introduction

The global automotive manufacturing market was sized at \$2.7 trillion in 2021.¹ The future of this market faces a challenge: its current output (internal combustion engine – ICE – vehicles) is responsible for almost a quarter of global energy-related CO₂ emissions.²

In order to achieve the goals of the Paris agreement, and meet decarbonisation targets, the industry needs to transition to manufacturing zero emission vehicles. For investors in today's automotive sector, this presents both a transition risk and a significant new market opportunity.

Experts are converging on the view that the road to cleaner transport is led by one technology: the battery.³ The International Energy Agency (IEA) describe lithium-ion batteries as “the key technology for electrifying transport”, though other technologies such as hydrogen could have a role in decarbonising transport especially in hard to abate sectors such as heavy-duty transport, shipping or aviation.^{4,5} Unlike other sectors such as buildings or energy, which still have multiple decarbonisation technology pathways, road transport no longer has technological debates delaying progress; what is needed for scale up is greater flows of finance.

The International Energy Agency describe lithium-ion batteries as “the key technology for electrifying transport.”

The financial transition will be significant. To meet demand for EV manufacturing, the battery market will need to grow rapidly. Estimates for the market value in 2030 range from \$116 billion⁶ to \$278 billion⁷ from a global market value of around \$46bn in 2021.⁸ The huge opportunity presented by the move to battery

powered EVs is attracting the attention of governments, companies and investors.

Though this report focuses on battery manufacturing in the context of electric vehicles (EVs), the need for batteries extends beyond road transport, spanning aviation, shipping, and energy grid infrastructure.

The critical need for batteries for future economies means competition for a share of the market is often described as a battery arms race.⁹ The key players are already established: China holds 85% of the current market^{10,11} and is expected to remain the market leader.¹² But the scale of demand, estimated to exceed 90GWh for UK car and van manufacturing alone, means there are opportunities for other countries, including the UK, to secure a piece of the market. This could be achieved either by attracting existing battery manufacturers to establish local supply chains, or through scaling new start-ups.

The UK Government has bold ambitions to secure a domestic battery manufacturing sector. The Ten Point Plan for a Green Industrial Revolution¹³ includes “accelerating the transition to EVs”, and “building a UK supply chain”, as key government priorities. The battery supply chain will likely be localised around wider EV manufacturing. As such, if a battery sector does not emerge in the UK, there is both the lost opportunity cost of the economic benefits of battery production being captured elsewhere, and in turn a risk that the existing automotive industry in the UK could diminish through moving to co-locate with battery production overseas.

The automotive manufacturing sector within the UK currently generates annual revenues of £78.9 billion.¹⁴ As the 2030 deadline for ending the sale of new ICE vehicles approaches, investors benefiting from these revenue streams face both stranded asset and revenue

risks if the manufacturers do not pivot to producing EVs. EV battery supply chains represent a significant investment opportunity; analysis by the Advanced Propulsion Centre (APC) suggests there are niches of the supply chain where the UK can compete and capture some of the global value in batteries, power electronics, and electric machines, rather than relying on imports. This opportunity to the UK's supply chain is forecast to be worth £24 billion annually.¹⁵

The UK battery sector is already developing, with strong R&D capability and several gigafactory announcements. UK strengths include a highly competitive chemicals industry, strong capability in automotive manufacturing productivity, and leading academic research and development of new low carbon automotive propulsion technologies. However, in order to scale, there are challenges to be overcome, including access to financial solutions which can enable the sector's growth.

The Green Finance Institute's Coalition for the Decarbonisation of Road Transport (CDRT) has been exploring the barriers to scaling up the UK's battery supply chain, and has identified a portfolio of seven demonstrator solutions, set out in this report, which have the potential to mobilise finance at the pace and scale needed to develop the sector. The CDRT will continue to work with our members and the wider sector, to bring these solutions to market, and mobilise the necessary capital flows into developing battery supply chains.

5 BNEF Electric Vehicle Outlook states fuel cell vehicles will start to be sold at volume in a few markets in the 2030s, but with just 8.6 million on the road in 2040 (up from only 30,000 today), this is well below 1% of the global passenger vehicle fleet.

10 Specifically, this is 85% of the market for cathodes, separators and electrolytes. Together, these four components account for around 60% of a battery cell's cost.

The Coalition for the Decarbonisation of Road Transport

Established by the Green Finance Institute in January 2021, the Coalition for the Decarbonisation of Road Transport (CDRT) brings together an expert multi-stakeholder group focused on identifying the most promising market solutions to scale up the investment in zero emission road transport and supporting infrastructure.

Transport is the largest sector of UK Greenhouse gas emissions, responsible for around a quarter of emissions.¹⁶ Road transport in turn is the key source of these emissions accounting for around 90%. The use of internal combustion vehicles also has wider impacts, such as air pollution responsible for 40,000 excess deaths per year.¹⁷

As such it is essential that the sector is decarbonised. The CDRT inaugural report, covering charging infrastructure and consumer purchase and leasing for electric vehicles, was published in November 2021. This found an estimated £150 billion of gross capital investment is needed by 2030 to support the transition through new consumer demand for electric vehicles (EVs) and charging infrastructure.¹⁸

Private finance needs to be mobilised to deliver this transition. The CDRT seeks to identify barriers to financial flows, and develop and demonstrate solutions to catalyse investment.

Market Context

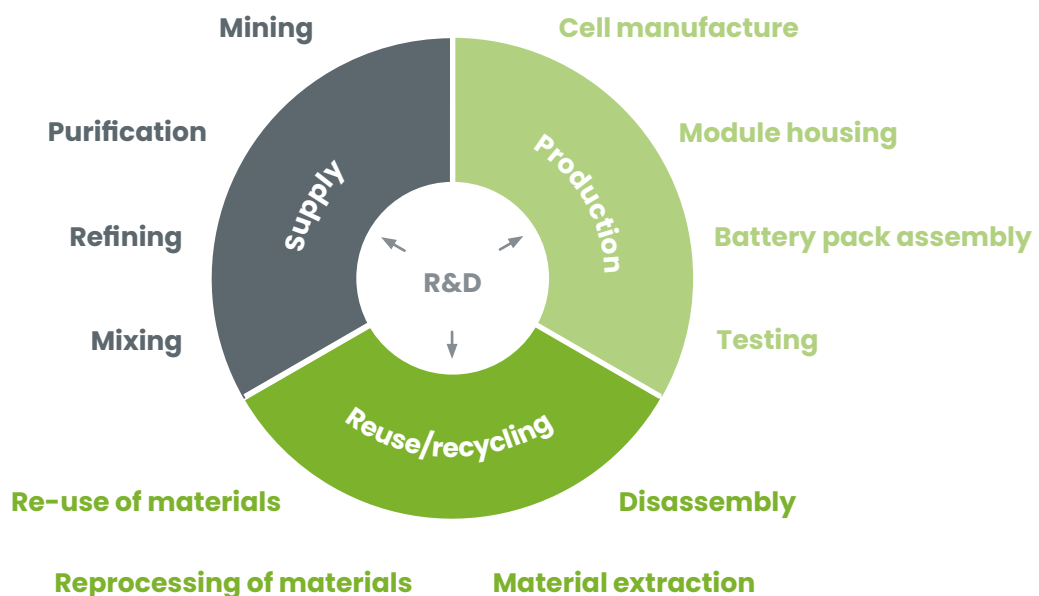
The Battery Supply Chain

The battery supply chain stretches from the supply of raw materials upstream, to re-use and recycling downstream.

Figure 1 shows the key materials for current battery chemistries, including nickel, cobalt, lithium, graphite and manganese.¹⁹ After extraction, these raw materials require processing before they can enter manufacturing processes to produce the building blocks of the battery. These constituent parts include the cathode, anode, electrolyte and others, that together make up the cell. The next steps involve combining cells to make modules. These are then assembled into the battery pack, before being incorporated into a motor vehicle or other end use product.

Downstream of battery assembly, there are further steps at the end of a battery's first use through re-use (refurbishment and redeployment of batteries for secondary uses such as energy storage) and recycling (extracting parts and eventually materials at end of life for use in new battery manufacturing). Recycling end of life battery materials could mitigate some of the challenges of supplying raw materials, and facilitate the evolution of battery production from a linear to circular economy approach.

Figure 1 **The battery supply chain**



The Global Battery Market Today

The automotive sector has a clear transition pathway, from ICE vehicles to EVs.

At COP26, over 100 national governments, cities, states and major businesses signed the Glasgow Declaration on Zero-Emission Cars and Vans to end the sale of internal combustion engines by 2035 in certain leading markets and by 2040 worldwide.²⁰

Alongside Government regulatory interventions for ICE phase outs, automakers are also setting out their own timetables. Some, such as PSA Group and Volkswagen, have announced they will end ICE investment, and others such as Jaguar Land Rover, Ford, Volvo, General Motors and Honda, have announced ICE vehicle production phase outs over the coming years (see Figure 2). As these target dates approach, investment in the battery supply chain urgently needs to scale to enable battery manufacturers to meet demand and enable the automotive sector to transition successfully.

In 2021, the global lithium-ion battery market size was sized at \$46 billion.²¹ By 2030, it is expected to grow rapidly, with estimates for the market value in 2030 ranging from \$116

billion²² to \$278 billion.²³ While some of this huge range can be attributed to variations in modelling, it also highlights the relatively high level of uncertainty regarding the scale of the opportunity in this market.

The battery market today is dominated by China. The country now accounts for up to 85% of the global market for anodes, cathodes, separators and electrolytes; together, these four components account for around 60% of a battery cell's cost.²⁴ The ten biggest companies are currently all headquartered in Asia, including CATL (32.6% market share), LG Energy Solution (20.3% market share), Panasonic (12.2%) and BYD (8.8%).²⁵ However manufacturing capacity in the USA and Europe is now growing, as Figure 3: a map of battery assets, shows.

Analysts predict market share in Europe in particular is set to grow significantly, based on current rates of investment. This is expected to reduce China's market share from 65% to 50% between 2020 and 2030.^{25a}

Figure 2 Automakers' targets for the phase out of ICE vehicles.

Reproduced with permission from BloombergNEF.²⁶

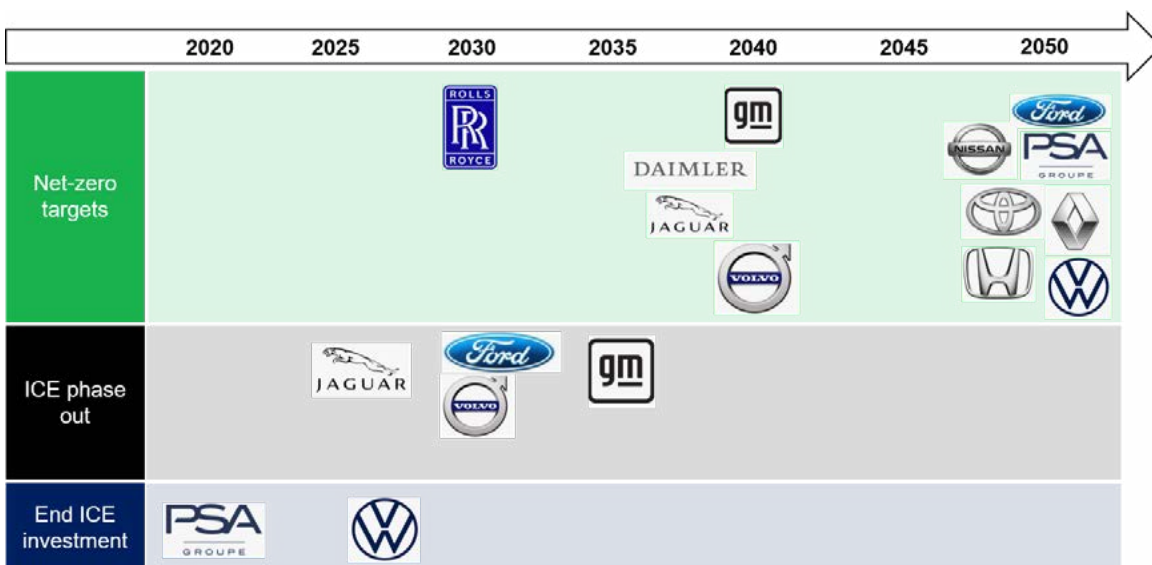
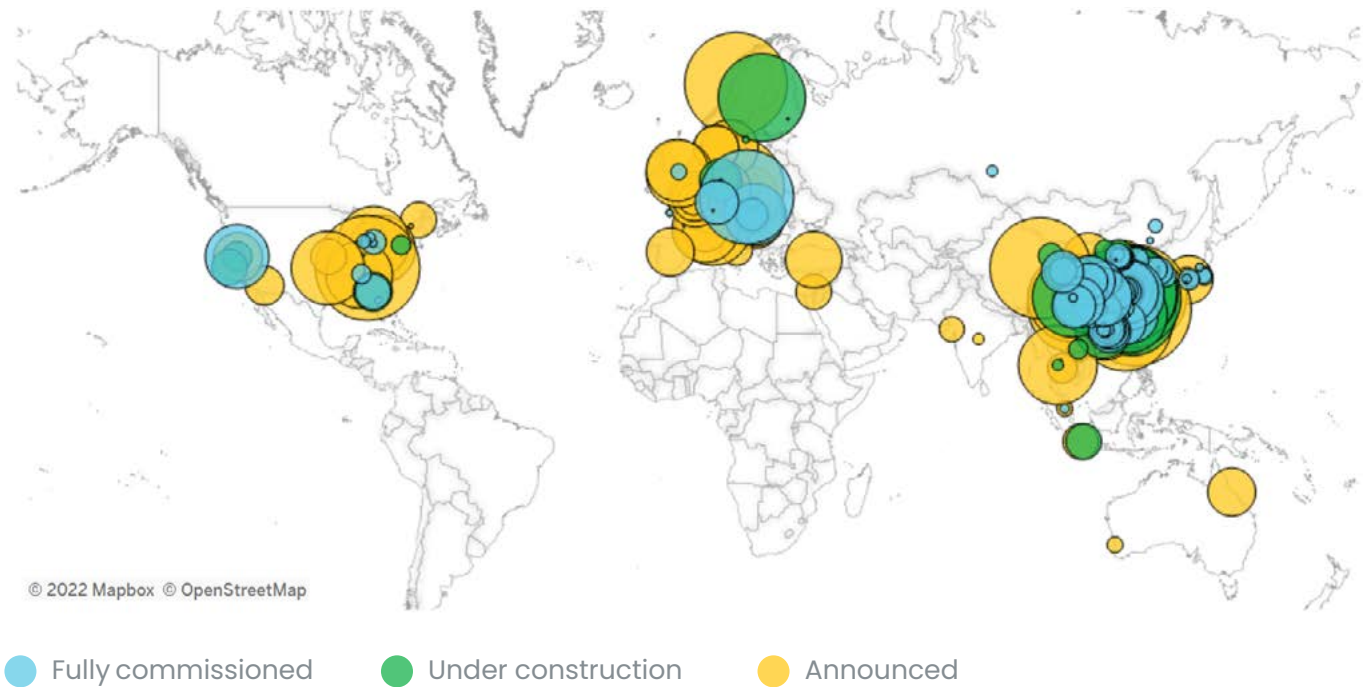


Figure 3 **Lithium-ion battery manufacturing asset map.** Reproduced with permission from BloombergNEF.²⁷

Bloomberg New Energy Finance (BNEF) predicts that the top ten battery makers are expected to nearly triple their manufacturing capacity between 2020 and 2022 to meet future supply commitments and position themselves for an upcoming surge in demand.²⁸ In addition to manufacturing, these suppliers are also increasingly bolstering their upstream supply chains. As existing battery manufacturers mature, they can move from offtake contracts to investing in their own upstream supply chain, however there will still be a need for such contracts for new entrants. This is both in response to capacity expansion, but also to provide resilience against the fluctuating raw material prices.

This expansion requires considerable capital investment. Analysis by BNEF using ten of the biggest battery makers' disclosed plant investment figures (all based in China, Japan, or South Korea) found that building 1GWh of cell manufacturing capacity requires about \$40-50 million in investment (though this varies by location, company, products and plant stage).²⁹ It is important to note that this is cell manufacturing alone, producing precursor materials and the finished battery product would require further investment.

Today, both debt and equity financing are available to support this growth:

- **Initial Public Offerings:** the process of raising equity by selling stocks in a once private company to

investors. There are several examples in which offerings in company's stock has been in high demand from investors and public markets. For example, in April 2021 South Korean energy supplier SK Innovation Co. and SK IE Technology Co. raised \$2 billion in the battery material unit's initial public offering.³⁰

- **Share placement:** raising additional capital by placing more shares in a public company for purchase. For example, in 2021, the biggest manufacturer CATL raised 45 billion yuan (about \$7 billion) to boost capacity, R&D spending and liquidity.³¹
- **Green loans and bonds:** debt financing that requires the borrower to use the proceeds to fund environmentally positive initiatives and outcomes. For example, in July 2020, ING was the lead lender of a \$1.6 billion debt financing package to the Swedish battery manufacture Northvolt as part of its portfolio of sustainable loans.³²

For upstream supply, investment strategies include establishing joint ventures, equity investments and building in-house capacity. For example, in December 2021, Northvolt and Galp (a Portuguese energy corporation) established a 50/50 joint venture "Aurora" to develop a lithium conversion plant.³³

²⁹ This varies by location, company, products and plant stage.

The UK Automotive Market Context

The UK automotive sector involves more than 30 manufacturers building more than 70 models of vehicle, supporting 180,000 people employed directly in manufacturing, and responsible for more than £78.9 billion turnover; adding £15.3 billion value to the UK economy.³⁴

The majority of this industry at present is focused on ICE vehicles – only 5% of the UK's car manufacturing was battery EVs in 2020.³⁵ But that is already changing, with Nissan producing the Nissan Leaf in Sunderland, BMW building the electric Mini in Oxfordshire, and new entrant Arrival manufacturing vans in the UK.³⁶ The Advanced Propulsion Centre (APC) developed a projection (see Figure 4) where in the UK between now and 2025, ICE production will diminish rapidly before largely disappearing by 2030 when low carbon vehicles will account for 95% of production for cars and vans.³⁷

The technological shift represents a balance sheet risk, but there are also new market opportunities for investors.

In the UK, much of the growth in demand for batteries, expected to exceed 90GWh by 2030, is yet to be financed.^{38,39} As Figure 5 shows, although some gigafactories have been announced, they are yet to be fully financed, and there remains significant demand for more battery manufacturing investment. This is solely in light duty vehicles, with other end uses only adding to the demand.

It is important to note the opportunity for finance is not just in multi-billion pound gigafactories, but also in a wide range of businesses of various sizes across the entire supply chain, including recycling. Though the UK is unable to compete in all parts of the supply chain (such as several of the upstream mining and processing elements due to a lack of raw materials, e.g. cobalt), the UK's APC has undertaken analysis to assess the potential market opportunity across 12 key segments of

the battery sector that the UK is well placed to capture from the total global market.⁴⁰ This builds on the UK's existing capabilities and represents areas where the UK can create sustainable competitive advantages globally. These 12 segments were grouped under the three key areas of:

- **Batteries** including cathode and anode manufacturing, electrolyte supply, and final cell assembly.
- **Power electronics** including magnet manufacturing, electrical machine assembly.
- **Electric machines** including semiconductors and sensors.

In total, these 12 segments are forecast by APC to be worth more than £24bn annually by 2025.⁴¹

³⁶ Latest analysis from SMMT found that in 2021, EV cars had risen to over 8% of UK manufacturing.

³⁸ Latest estimates suggest demand could reach 96 GWh.

³⁹ 1GWh of battery demand is equivalent to 25,000 Nissan Leafs, or 17,000 Tesla Models 3s.

Figure 4 **The transition from ICE vehicles to EVs over time. Investment will also need to pivot to follow the transition.** Reproduced with permission from the Advanced Propulsion Centre.

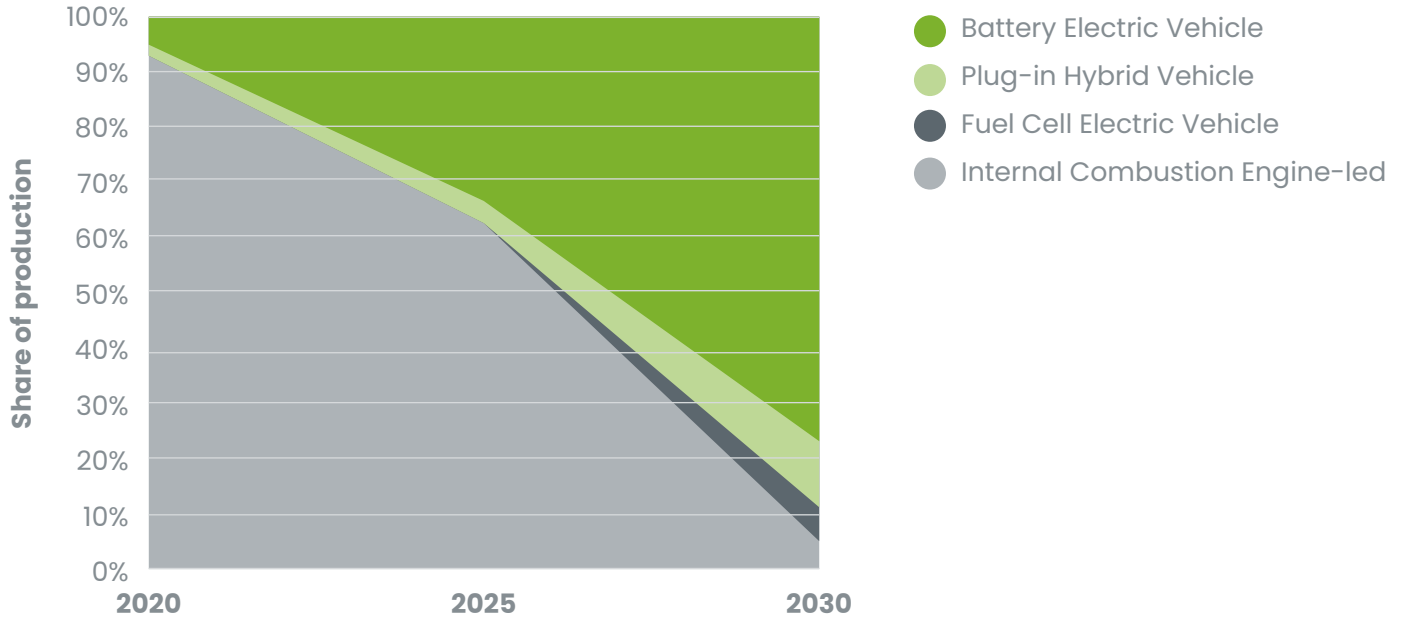
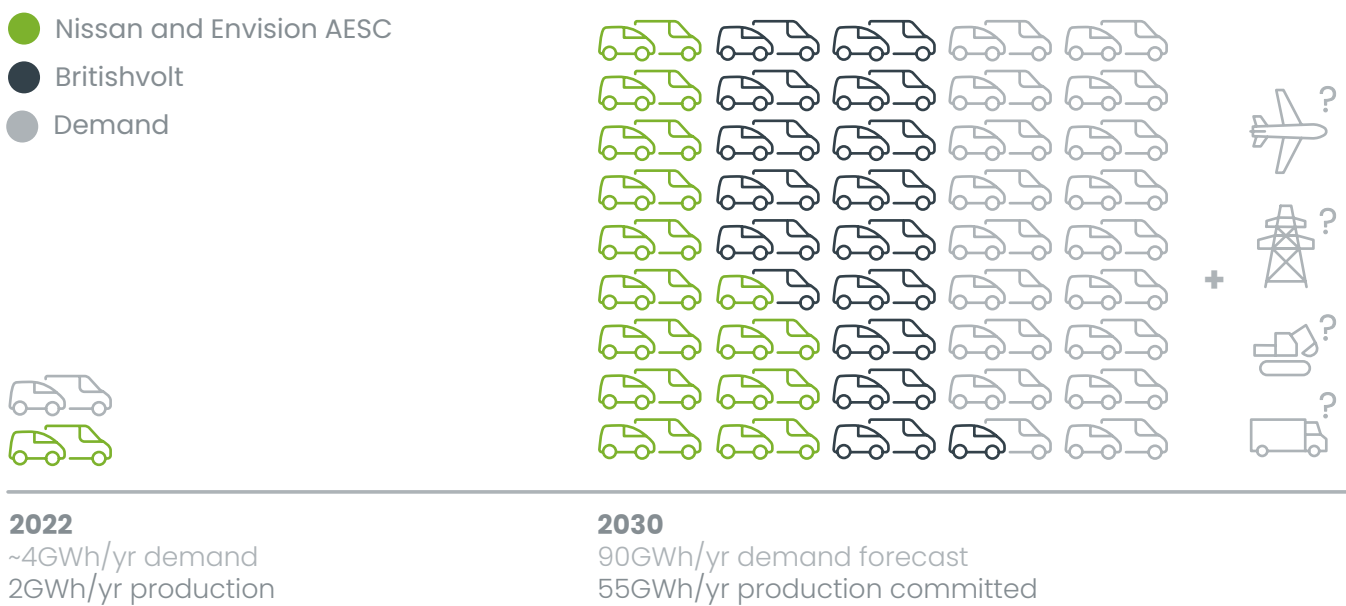


Figure 5 **The growth in demand for battery cells in the UK, 2022 – 2030.** Reproduced with permission from the Advanced Propulsion Centre.



Import vs Make Analysis

Many countries which are competing to secure market share in the growing battery supply sector have existing auto manufacturing capabilities.

The manufacturers in these countries have a choice: import the batteries they need, or support the growth of a domestic supply chain.

This is the choice facing UK auto manufacturers and there are various factors to consider. The cost of production in the UK exceeds that of China but is comparable to competitors such as Germany.

However, the production cost must be combined with shipping costs and tariffs to get the final costs for auto manufacturers. When handled incorrectly, batteries can pose fire and explosion risks, meaning they are classed as 'Dangerous Goods' with complex transport regulations to meet.⁴² This adds to the cost and complexity of shipping, especially for assembled packs.

Tariffs, introduced by the EU and UK, are increasingly driving localisation in supply chains. Rules of Origin requirements for products sold in these markets mean that a set proportion of the product must be created in the UK or EU to allow it to be subject to 0% tariffs.⁴³ This minimum proportion increases over time, and by 2027, EVs must have at least 55% UK/EU content and an originating battery pack, which in turn must have either

65% UK/EU content for the cell or 70% for the battery pack (see Figure 6).⁴⁴ A localised supply chain that allows auto manufacturers to procure batteries more cost effectively reduces costs for themselves and ultimately for their consumers.

The risks of auto manufacturers importing components for assembly in the UK are not purely financial – there are also risks of delays occurring during transportation and supply chain bottlenecks – and a sustainability perspective to consider. Locally produced batteries can be made more sustainably and ethically, with greener electricity and more transparent labour regulation. This is increasingly important as consumers interrogate the origins of their products. In future, cross-border carbon taxes may drive even greater need for local supply chains.

While local supply chains are important, it may not be locally established companies building those supply chains. BNEF notes Asian players have the most operational capacity and established supply chains. The opportunity for the UK is to become an attractive location for existing overseas players, as well as support the creation and scale up of new start-ups.⁴⁵

Figure 6 **Rules of Origin requirements for battery cells, battery packs, and EVs in the UK and EU over time.**

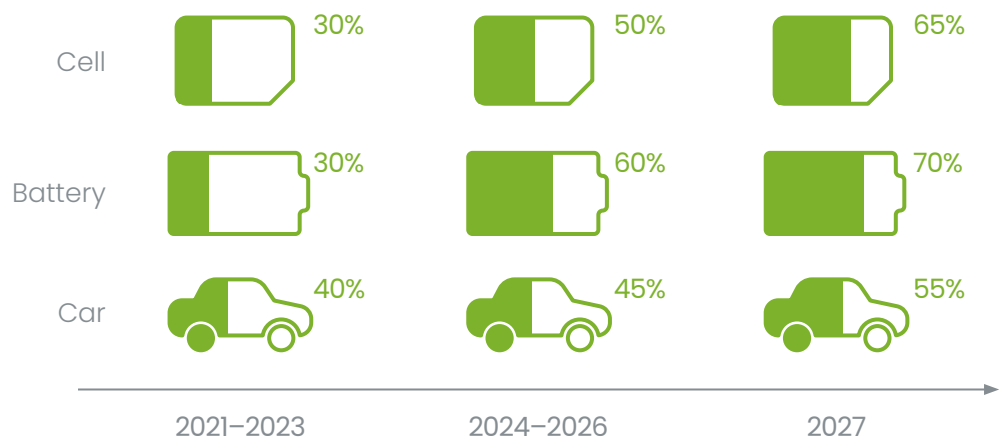
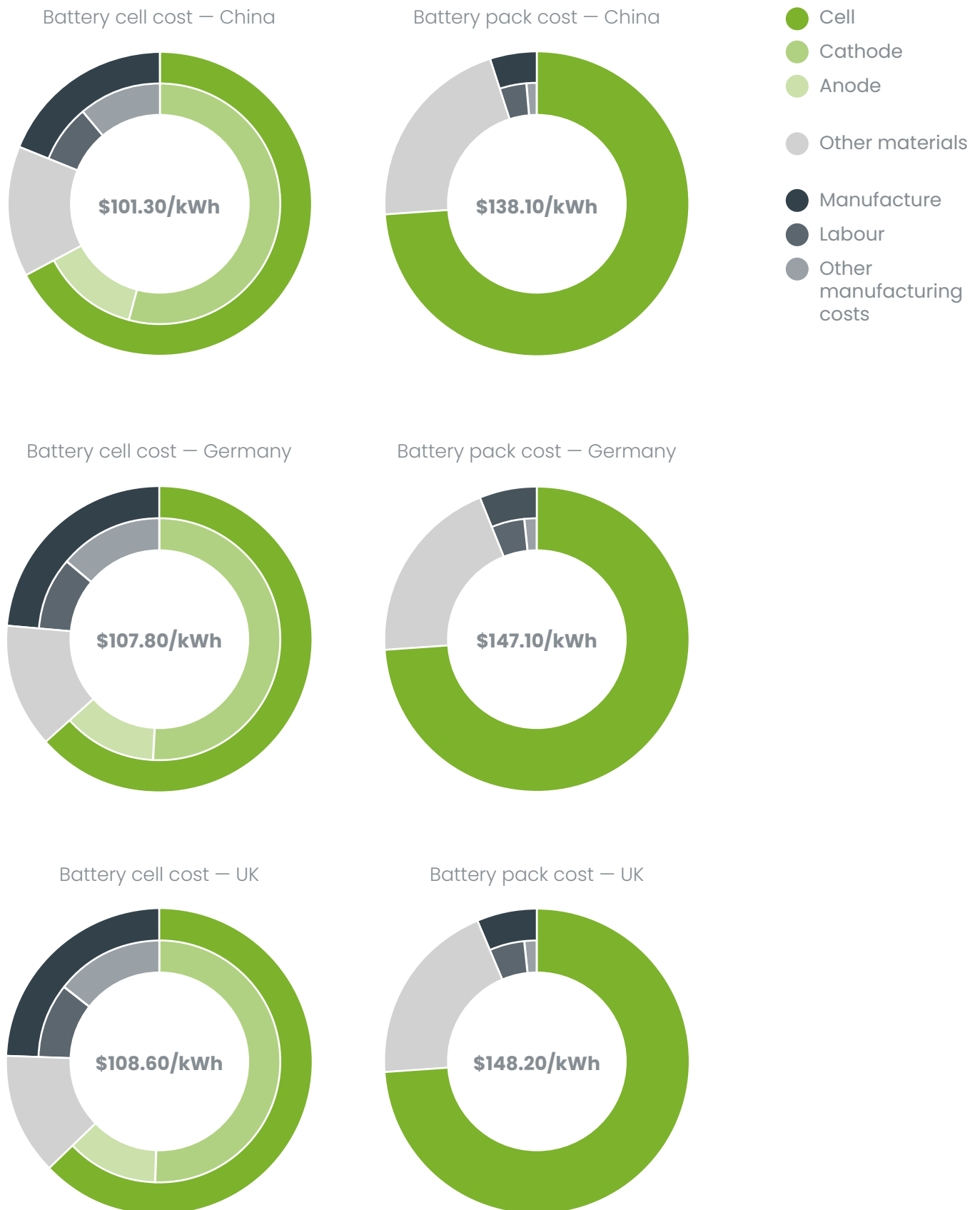


Figure 7 **The cost of making a Cell, and a Battery Pack, in China, Germany, and the UK respectively.** Source: BloombergNEF.



UK Public Capital to Date

The UK Government has already committed significant funding into establishing a UK battery supply chain.

For research and development, £318 million has been invested in the Faraday Battery Challenge with the aim of putting the UK at the forefront of battery design, development, manufacturing and recycling.⁴⁶

For technology commercialisation, the government and automotive industry co-funded the APC with an investment of £1 billion over 10 years to 2023, supporting new Zero Emissions Technology commercialisation, with the government's recent Automotive Roadmap committing long-term funding to the APC to 2025.⁴⁷

The Faraday Battery Challenge and APC are also both involved in the UK Battery Industrialisation Centre (UK BIC): a £130 million centre dedicated to scale-up development of both product and manufacturing processes for the most promising battery prototypes to help them move to mass production.⁴⁸

The Government's Automotive Transformation Fund (ATF) also seeks to develop the automotive supply chain in the UK.⁴⁹ The Automotive Roadmap states the Fund helped secure the UK's first two gigafactories through £500 million of investment. Going forward, the fund has a further £350 million to support localisation of key supply chain capabilities.⁵⁰

This investment represents a strong political signal of support and is intended to catalyse further investment in the UK battery sector, which will be key to meet the scale of capital required. However the scale of capital required, for example £3.8 billion for Britishvolt's gigafactory alone, cannot be solely be funded by public funds.⁵¹ Private finance needs to be crowded in.

"The UK battery supply chain presents a real opportunity. Our forecasts show that demand will reach over 90GWh by 2030 but delivering growth on this scale requires a healthy appetite to invest significant capital. To maximise green jobs and economic growth, gigafactories and their supporting supply chains are essential. The right balance of policy and support, as outlined in the CDRT report, is essential to secure investor confidence in the UK EV sector."

Ian Constance,
CEO, Advanced Propulsion Centre

UK Private Capital to Date

The flow of finance from the private sector has been increasing.

The Faraday Battery Challenge’s Battery Gap report⁵² highlighted that deal numbers for the battery technology companies have slowly increased over the 10 years analysed. Much of this to date has been focused on early stage technology, provided by venture capital, as shown in Figure 8, or provided to large established players such as Envision AESC.

The battery supply chain pipeline in the UK has projects at various stages of development. Envision AESC already produces batteries for Nissan EVs at a factory in Sunderland, and in July 2021 Nissan and Envision announced a £1 billion major expansion to their operations, which will include a new gigafactory.⁵³

Britishvolt has also broken ground on a gigafactory in Northumberland. The project is supported through long-

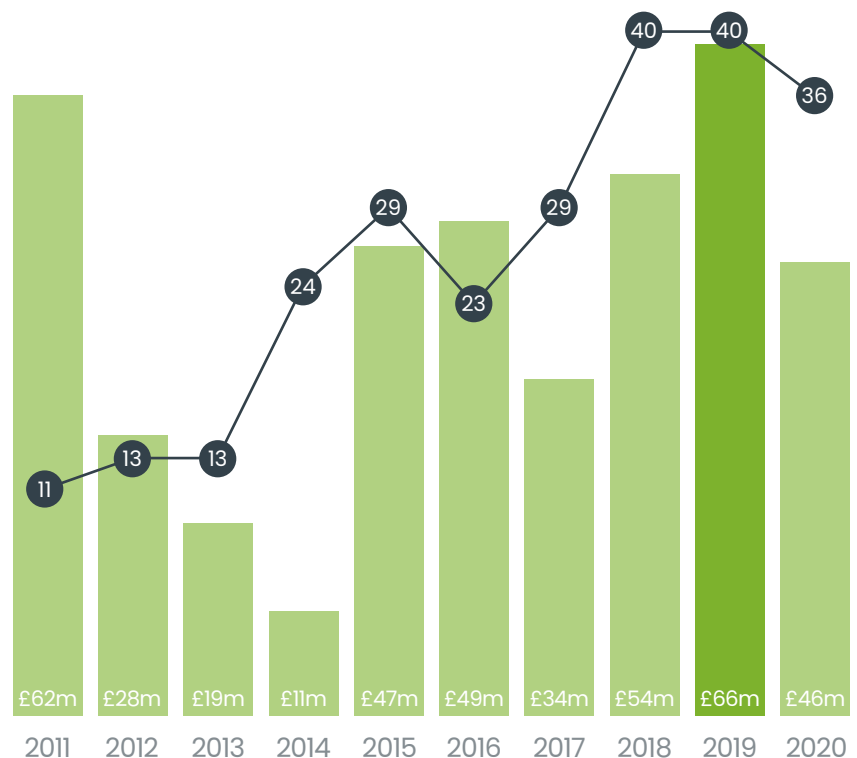
term partnerships with Tritax and abrdn that will deliver £1.7 billion in private funding.⁵⁴

Other major auto manufacturers in the UK include BMW (Mini) in Oxford and Jaguar Land Rover (JLR) in Solihull.⁵⁵ BMW currently imports batteries from a plant in Germany, though there may be scope for expansion and UK supply in future.

There are further manufacturers, such as Ford and Stellantis, that have yet to announce where their batteries will be produced.⁵⁶ There is competition across Europe to secure these plants.⁵⁷

Figure 8 **Equity investment into battery technology companies, 2011-2020. Reproduced with permission from Faraday Battery Challenge.** Source: The Battery Gap, April 2021.⁵⁸

- Number of deals
- Amount invested
- Top figure



The Challenge for Private Capital in the Battery Sector

Despite the progress to date, the battery supply chain continues to face challenges in attracting finance to scale up.

All new companies or products can face what is known as the 'Valley of Death' in their evolution. This refers to the gap between early-stage innovation finance, when companies look to prove their concept, and later stage finance more appropriate for companies as they scale up and consolidate.

The CDRT has identified several barriers, both financial and non-financial, which are preventing scale up happening.

The early stage finance is often a combination of public funding in the form of government grants and venture capital (VC) provided equity. The amount of capital required and risk profiles associated with this stage are attractive to the high-risk high reward VC providers, who typically provide equity to smaller ticket opportunities. However, the VC investment model is primarily focused on quickly scaling and exiting to achieve a return in the short term. Finance to achieve further growth and consolidation more typically comes from private equity, bank finance and pension funds, who have longer investment horizons. However, these capital providers typically prefer larger investment opportunities, have lower risk appetites and require a higher level of cashflow maturity before investing. The challenge for investment is bridging the gap from one stage to the next by providing de-risking mechanisms to the investors who can provide the larger sums of capital required for companies to expand production capacity as they are evolving to cashflow maturity.

For the capital-intensive battery industry, there are at least two valleys to cross in the scale up journey.

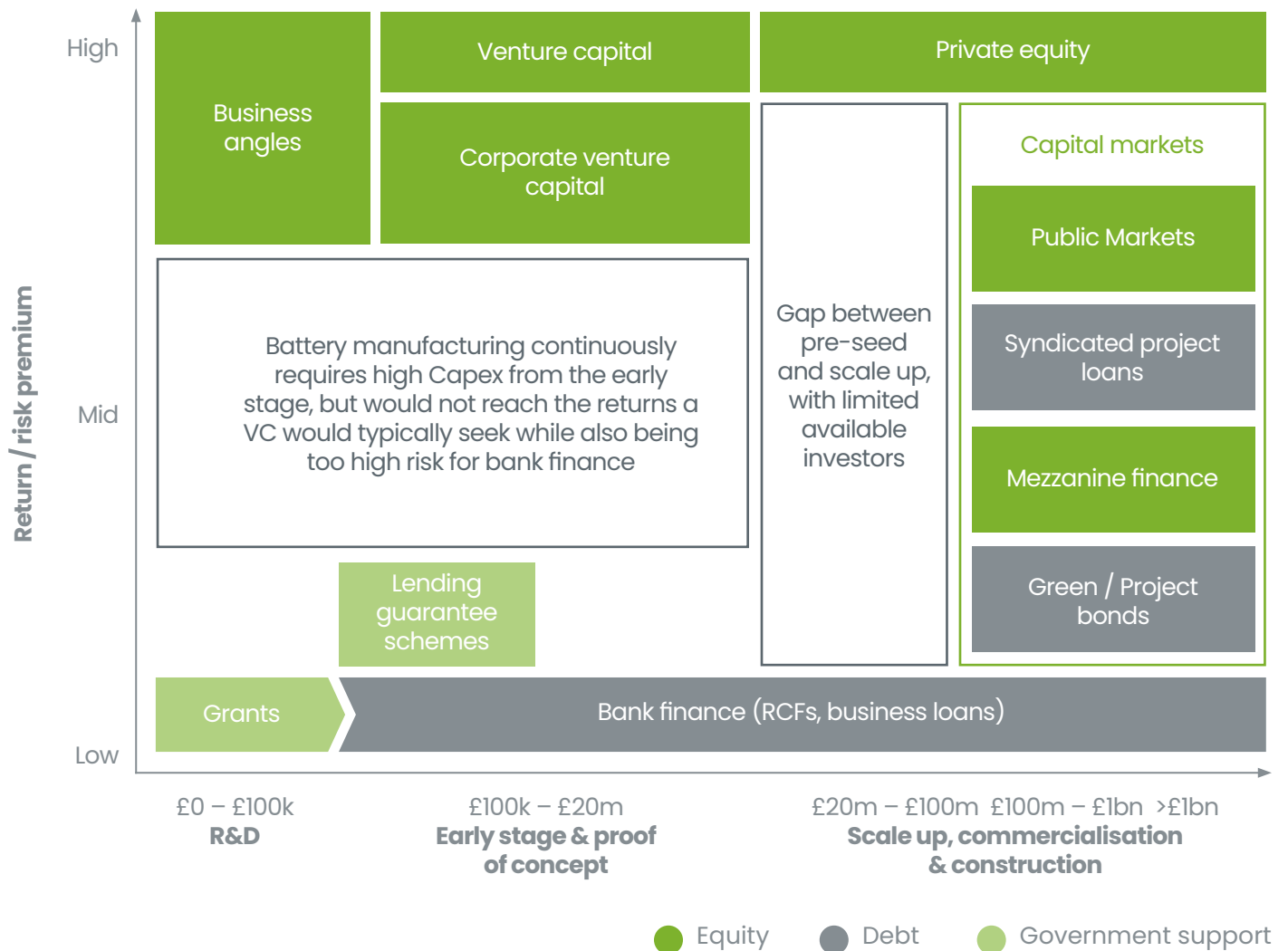
Firstly, after a manufacturer has proved their concept they need to begin to develop manufacturing capabilities at scale. At this stage firms are typically micro and Small and Medium-Sized Enterprises (SMEs), and seek between ££5-50 million; the accompanying risk and rewards profiles do not match VC or bank finance appetite. This is where the public sector can play a de-risking role to attract investments; when announcing the 2021 Innovation Strategy, the Government highlighted that this was a target area for the UK.⁵⁹ Furthermore, capital raises at this part of a company's evolution tend to be lengthy and time consuming processes for management teams. Therefore, solutions which help rapidly growing companies to access capital whilst reducing time spent pitching to broad pools of investors would further support market growth.

Secondly, the later stage companies who are looking to scale up their operations can be seen as high risk, because future revenue generation is still being proven. Investments at this stage often require spreading the risk between several different types of investors. The challenges to securing this investment relate to the scale of investment required, the lack of technology track record, customer concentration risk and lack of off-take agreements. The latter are difficult to secure until production commences, creating a chicken and egg situation. These challenges mean that projects are often deemed as not 'bankable'.

These challenges apply to investments across the supply chain, including production and recycling.

For current investors in, and beneficiaries of, the ICE automotive industry, who are exposed to revenue and stranded asset risk as global phase-out dates for selling ICE vehicles draw nearer, there is a market opportunity to direct private capital towards enabling the automotive sector to transition. Between now and 2030, revenues

Figure 9 **The gaps in finance availability (Valley of Death) in the battery scale up journey.** Source: CDRT.



from new ICE car sales will decrease before stopping altogether.⁶⁰ There are first mover, efficiency, and reputational advantages to pivoting towards investing in these transitional steps well in advance of global phase-out dates.

However, the CDRT has identified several barriers, both financial and non-financial, which are preventing this happening at the pace and scale required.

Finding solutions to overcome these barriers is critical. Many of the facilities involved in the battery supply chain, including gigafactories, have multi-year construction periods. Automotive manufacturers also need

transparency of supply for long vehicle production cycles (~7+ years).⁶¹ Lead times for investment in this emerging sector can also be long. This means the window of opportunity to secure investment into the UK is closing fast. The time for action to catalyse the sector is now.

Barriers

The coalition identified a number of barriers to mobilising private capital into the battery supply chain which if addressed, can unlock the necessary capital flows, and enable a UK battery sector to develop and succeed.

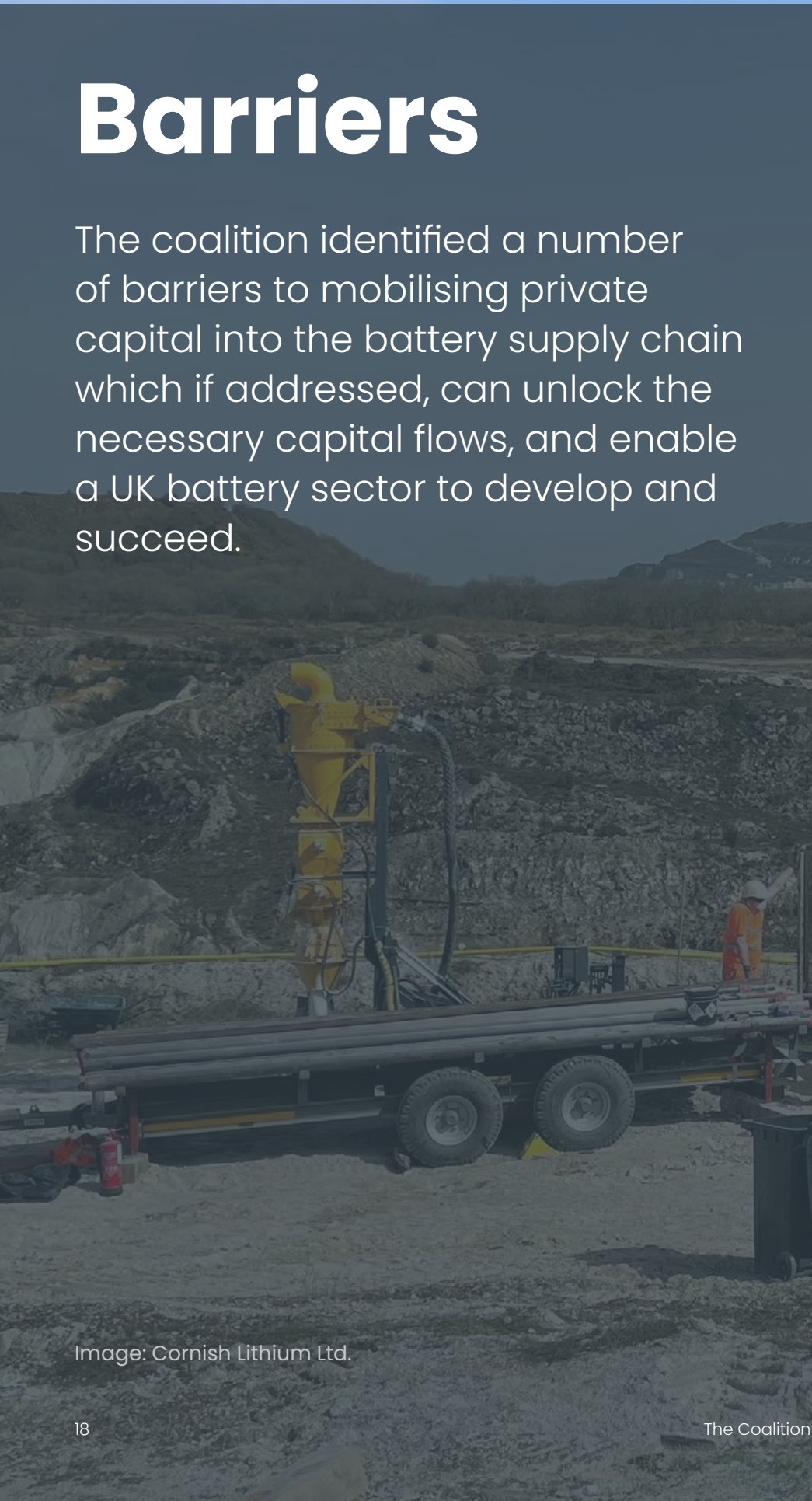


Image: Cornish Lithium Ltd.



The risk to supply of raw materials

Access to the raw materials necessary to build batteries is a crucial part of the supply chain. There are three different specific challenges of supply: affordability, sustainability and security.



Difficulties in matching available capital with investment opportunities

Battery manufacturers face two risks when accessing investment. First, they fall into the gap between early-stage innovation finance, when companies look to prove their concept, and later-stage finance more appropriate for companies as they scale up and consolidate. Second, many companies evolve from universities, led by engineers, and don't have the financial expertise to source investors.



Supply chain demand uncertainty

For new entrants to the battery market, a 'chicken and egg' situation is slowing development. A battery manufacturer requires offtake agreements for the manufactured product to demonstrate future revenue generation to investors. However, offtake agreements rely on battery manufacturers being able to demonstrate they have technology that works, they can manufacture at scale, and they have secured the necessary finance to scale up.



Risk of technology obsolescence

Batteries are a rapidly developing technology, creating concern amongst investors that investing today could leave them with stranded assets if newer, better battery chemistries are developed.



Relative competitiveness of the UK

The UK has several qualities that make it attractive for battery supply chain investment; its automotive heritage and skilled workforce, highly competitive chemicals industry and its clean energy supply. However, in some areas – such as higher energy and employment costs, limited suitable land availability, construction costs, and challenges with planning and grid connections – the UK is less competitive than other countries.



Lack of incentives for creation of a recycling market

There are several factors deterring investment into battery recycling; the limited quantities of battery materials to reuse and recycle, the lack of recycling processes, and the relatively low cost of raw materials.

The Risks to Supply of Raw Materials

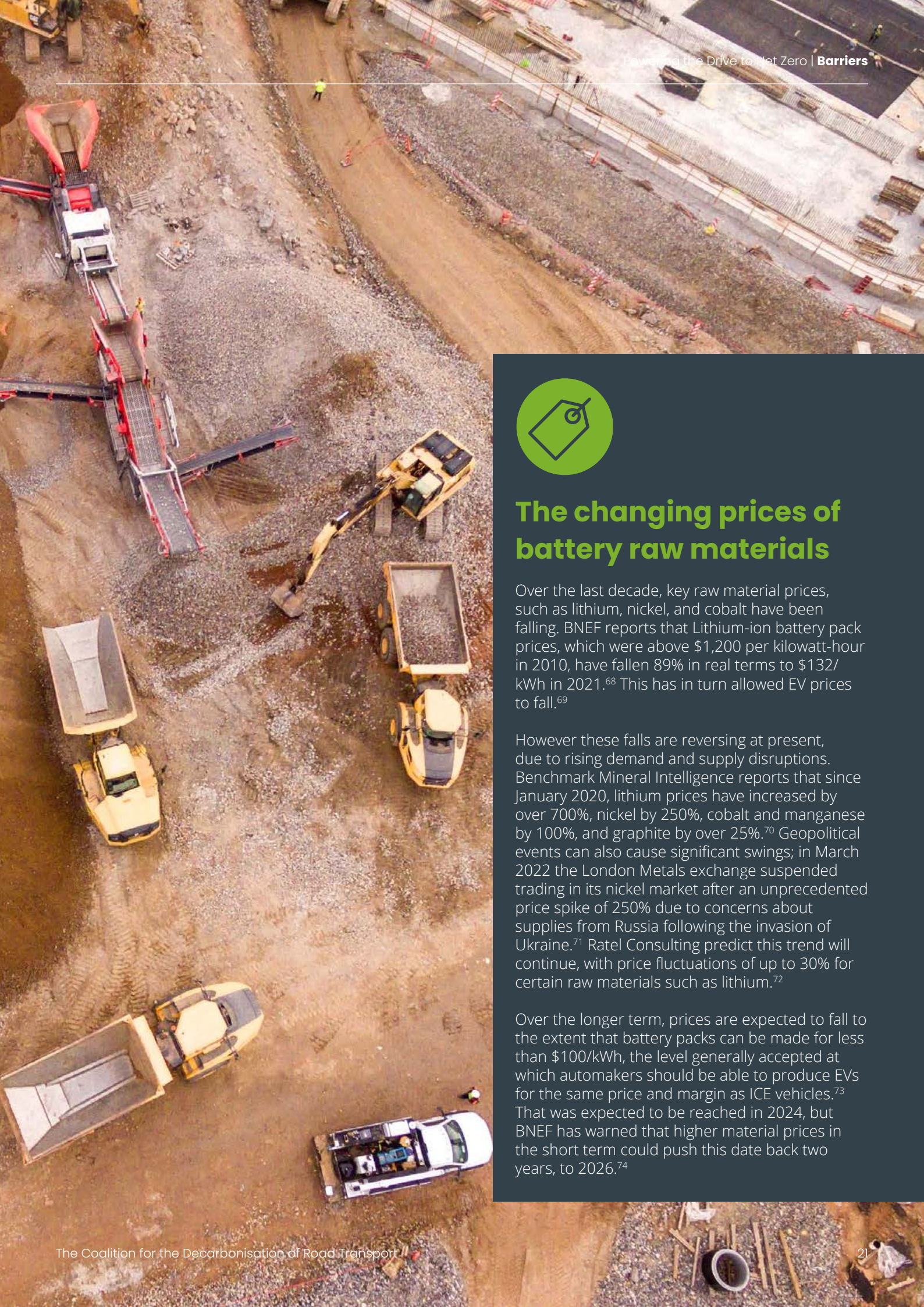
Access to the raw materials necessary to build a battery is a crucial part of the supply chain. There are three different specific challenges of supply: affordability, sustainability and security.

The raw material content of a battery makes up 35% of its value,⁶² which is in turn 30-40% of the car's value.⁶³ Failure to secure affordable raw materials to produce batteries will undermine the sector's ability to manufacture EVs and put the transition to net zero at risk for all. The fluctuations in the cost which auto manufacturers must grapple with are set out in the box on the next page.

In addition to cost concerns, the scramble for raw materials also highlights the importance of security of supply. The current issues in global supply chains, combined with some political risks in some key mining countries, both contribute to an overall challenge of security of supply. The UK does not have domestic supply of all of the key raw materials needed for battery production. Though some supplies are being explored, namely Cornish and British Lithium,⁶⁴ the UK will continue to rely on imports to some degree. Some battery manufacturers are already seeking investments from key strategic upstream companies. For example, Britishvolt has announced a deal with the mining company Glencore to secure supplies of cobalt.⁶⁵

The risks to the supply of raw materials extend beyond the financial. Rising demand for cobalt is leading to a rise in artisanal mining in places such as the Democratic Republic of Congo, where regulation is limited and child labour is widespread.⁶⁶ Given their market share of this critical material, it is unrealistic for global companies to avoid doing business there. Supply chains therefore need to formalise standards and metrics to govern the mining process and improve conditions.⁶⁷ Financial tools have a role to play in rewarding those companies who transform their supply chains.

Solutions such as the Sustainable Import Guarantee (Demonstrator Solution 2) and Battery Passports (Demonstrator Solution 6) can improve supply chain transparency and traceability, whilst offtake guarantees (Demonstrator Solution 3) can help establish secure supply chains. Recycling of batteries at end of life, as well as continued investment into research and development to reduce the need for earth minerals will also be important actions in reducing the need for mining of raw materials.



The changing prices of battery raw materials

Over the last decade, key raw material prices, such as lithium, nickel, and cobalt have been falling. BNEF reports that Lithium-ion battery pack prices, which were above \$1,200 per kilowatt-hour in 2010, have fallen 89% in real terms to \$132/kWh in 2021.⁶⁸ This has in turn allowed EV prices to fall.⁶⁹

However these falls are reversing at present, due to rising demand and supply disruptions. Benchmark Mineral Intelligence reports that since January 2020, lithium prices have increased by over 700%, nickel by 250%, cobalt and manganese by 100%, and graphite by over 25%.⁷⁰ Geopolitical events can also cause significant swings; in March 2022 the London Metals exchange suspended trading in its nickel market after an unprecedented price spike of 250% due to concerns about supplies from Russia following the invasion of Ukraine.⁷¹ Ratel Consulting predict this trend will continue, with price fluctuations of up to 30% for certain raw materials such as lithium.⁷²

Over the longer term, prices are expected to fall to the extent that battery packs can be made for less than \$100/kWh, the level generally accepted at which automakers should be able to produce EVs for the same price and margin as ICE vehicles.⁷³ That was expected to be reached in 2024, but BNEF has warned that higher material prices in the short term could push this date back two years, to 2026.⁷⁴

Difficulties in Matching Available Capital with Investment Opportunities

All new companies or products can face what is known as the 'Valley of Death' in their evolution.

This refers to the gap (shown in Figure 10) between early-stage innovation finance, when companies look to prove their concept, and later stage finance more appropriate for companies as they scale up and consolidate.

There are two core challenges for battery developers, the lack of investors open to investing in this relatively nascent sector, and connecting those investors with appetite with companies looking for finance.

There are two core challenges for battery developers, the lack of investors open to investing in this sector, and connecting those investors with companies looking for finance.

The lack of finance is due to the issues set out above, the profile of investments not matching the requirements of investors. Battery manufacturers have high capital expenditure requirements to establish premises and equip with plant and machinery. At the same time, they are deemed high risk.⁷⁵ This means they do not fall neatly into the target groups for either VC or equity investors. Mechanisms to de-risk the investment are needed to make them more attractive.

The challenge of finding investors is common to many emerging businesses. Within the battery supply chain,

many companies have evolved from universities, led by engineers, and/or do not have the financial expertise or management capacity to source investors, or the funds to access professional advisors to connect them to receptive investors. Mechanisms to connect companies to finance are needed to streamline this process and allow management to focus on core business activities.

The Battery Investment Facility (Demonstrator Solution 1) aims to use public capital to de-risk investment in this sector. The Investor Showcase (Demonstrator solution 5) can help connect companies looking for finance, with sources of capital and the Lenders' Handbook (Demonstrator Solution 7) can help inform lenders looking to invest in this space.

Case Study: The Clean Transport Accelerator Programme

To help remove barriers and encourage growth, NatWest, together with WMG, an academic department at the University of Warwick, recently created a Clean Transport Specialist Accelerator. The programme combines access to state of the art manufacturing equipment to test ideas, coaching and mentoring from experts, and access to a network of stakeholders across business, academia and government. The CDRT solutions in this report build on innovations such as these to further remove barriers to financial flows.⁷⁶

Supply Chain Demand Uncertainty

There exists, for new entrants to the battery market, another chicken and egg situation where a battery manufacturer requires offtake agreements for the manufactured product to demonstrate future revenue generation.

However, offtake agreements rely on battery manufacturers being able to demonstrate they have technology that works, they can manufacture at scale, and they have secured the necessary finance to scale up. This is replicated up and down the supply chain. Offtake agreements with vehicle manufacturers require a 33-4 year lead time with limited opportunity for a mid-cycle refresh⁷⁷ and with global commitments to end the sale of new ICE vehicles between 2030 and 2040, the window to connect new battery manufacturers with vehicle manufacturers is closing.

The challenge also exists in the battery recycling industry where in the short-term their input materials are limited to battery manufacturing waste, and batteries that have either failed or been damaged. Volumes are expected to become sustainable in around 5-8 years⁷⁸ when tens of thousands of tonnes of batteries will require processing, but forecasting the profile of used batteries/waste material supply into a recycling plant is challenging today since the useful life of a battery (both in a vehicle and then in second life use) remains unclear.

Offtake Support Mechanisms (Demonstrator Solution 3) could facilitate wider use of offtake agreements and de-risk supply chains.

“UK automotive manufacturing and its supply chain has benefitted from decades of significant investment to make it successful. At least £10.8 billion has been committed to EV production since 2011, but as the transition to zero emission motoring gathers pace so too does the need for fresh investment. To ensure the UK remains globally competitive as an EV manufacturer we need urgent backing to help transition our supply chain, bolster retraining and skills programmes and, crucially, increase our domestic battery production capability.”

Mike Hawes,
Chief Executive, Society of Motor
Manufacturers and Traders (SMMT)

Risk of Technology Obsolescence

Batteries are a rapidly developing technology, and the source of much research and development funding and attention.

Investors are unclear whether new developments such as solid-state batteries will render existing battery chemistries obsolete, and lack knowledge about the different chemistries already in the market.⁷⁹ There is therefore concern from investors that emerging new technologies will result in stranded assets and write-down of investments, leading to a reluctance to invest in the sector too early. This issue can be heightened by press reports overstating “breakthroughs” which can send incorrect signals to investors.⁸⁰

Solutions that inform investors of market developments, manufacturing technologies that are chemistry and/or technology neutral and can easily be transferred to new products, and a market understanding that the scale of demand means new technologies may well be additional rather than cannibalise existing solutions, can all help create investor confidence. Solutions such as the Investor Showcase (Demonstrator Solution 5) and Lenders’ Handbook (Demonstrator Solution 7) are designed to address this.

The often high capital expenditure and long-term nature of investments in the battery supply chain, combined with the uncertainty of a fast moving sector, limits the appeal of the sector to certain investors.

The often high capex and long-term nature of investments in the battery supply chain, combined with this uncertainty of a fast moving sector, limits the appeal of the sector to certain investors. This is particularly true of certain asset classes, such as institutional investors for whom early-stage technology is not historically a core market.

“The window of opportunity to secure investment into the UK is closing fast. Announcements about battery production investments and supply contracts are now time critical for the UK, and all stakeholders, including the finance industry, must collaborate at pace if the existing auto sector is to be maintained and new opportunities exploited.”

Richard Hill,
Head of Automotive & Manufacturing,
NatWest



Relative Competitiveness of the UK

Countries around the world are trying to capitalise on the opportunity of the battery supply chain,⁸¹ and attract companies and investors looking for the best places to build their battery plants.

The UK has several aspects that make it attractive: its automotive heritage and skilled workforce, highly competitive chemicals industry and its clean energy supply. However, coalition members highlighted several areas that if not addressed, could make the UK less competitive than other markets.

A longstanding major issue for any UK manufacturing business, including batteries, is energy prices. The UK has one of the cleanest energy supplies in the world,⁸² but also one of the most expensive.⁸³ Battery manufacturing is very energy intensive and this cost is a significant barrier when companies are looking at locating a factory in the UK compared to other competing nations. The UK energy regulator Ofgem has found that between 2016 and 2020, average electricity prices in the UK for energy intensive industries were by far the highest in Europe; averaging at over £100/MWh while other EU prices were under £80/MWh.⁸⁴

The UK has one of the cleanest energy supplies in the world, but also one of the most expensive.

The UK had the highest wholesale costs, but the overall price was compounded by higher network and policy costs, which other countries often subsidise. Ofgem apportioned the high wholesale cost to a generation mix with a high proportion of gas, comparatively low levels of interconnection, and the cost of the carbon price support policy.⁸⁵ Over time, greater renewable capacity

replacing gas, and more interconnection, may improve the imbalance.

There are other challenges too, including higher employment costs, limited suitable land availability, construction costs, and challenges with planning and grid connections. These can make the UK less attractive compared to other competing nations.

Solving for these issues would not just benefit the UK in terms of attracting the battery supply chain, but also support various other UK manufacturing industries. Many of these, such as steel, are also key for net zero. Addressing these challenges does not only support UK goals for net zero, but also supports wider political ambitions, such as a just transition, and industrial strategy. From the perspective of holders of private capital, addressing these political challenges will aid in creating an attractive environment for investment, with skills, supporting infrastructure and policy aligning to de-risk projects, generating long term returns.

To address these barriers, the CDRT has proposed several policy measures for the UK Government to consider. Coalition members also highlighted the potential of microgrids, whereby developers build their own electricity generation and grid to power their factories. This could help address the challenge of high energy costs, whilst also supporting the wider transition to net zero by providing new renewable generation and grid services to the energy system. Several of the challenges for financing microgrids would be the same as those for financing the battery supply chain. As such, some of the demonstrator solutions could have potential to be utilised for microgrids. This includes the Battery Investment Facility (Demonstrator Solution 1), and the Investor Showcase (Demonstrator Solution 5).

Lack of Incentives for Creation of a Recycling Market

Recycling is a key stage of the battery supply chain. As battery demand grows, the requirement for raw materials will also increase, and so too the supply of batteries that have completed their first use and are at risk of becoming waste.

Currently around 1.5 million cars are scrapped each year in the UK, and 1.3 million cars manufactured.⁸⁶ Research by Green Alliance found in 2019, that the UK's still small fleet of electric cars and vans contained over 1,400 tonnes of lithium and 800 tonnes of cobalt, worth £26.3 million and £31.5 million respectively.⁸⁷ Green Alliance's analysis suggests, if recycled, that volume of lithium and cobalt would be enough to make 220,000 battery electric cars.⁸⁸

The UK's still small fleet of electric cars and vans contained over 1,400 tonnes of lithium and 800 tonnes of cobalt, worth £26.3 million and £31.5 million respectively.⁸⁷

As such, there is huge potential for this future supply of used materials to mitigate the challenge of sourcing raw materials, and enable a more circular economy whereby used batteries can be deployed to second uses, recycled or broken down to parts that can re-enter the supply chain. The EU has already taken steps to address this;

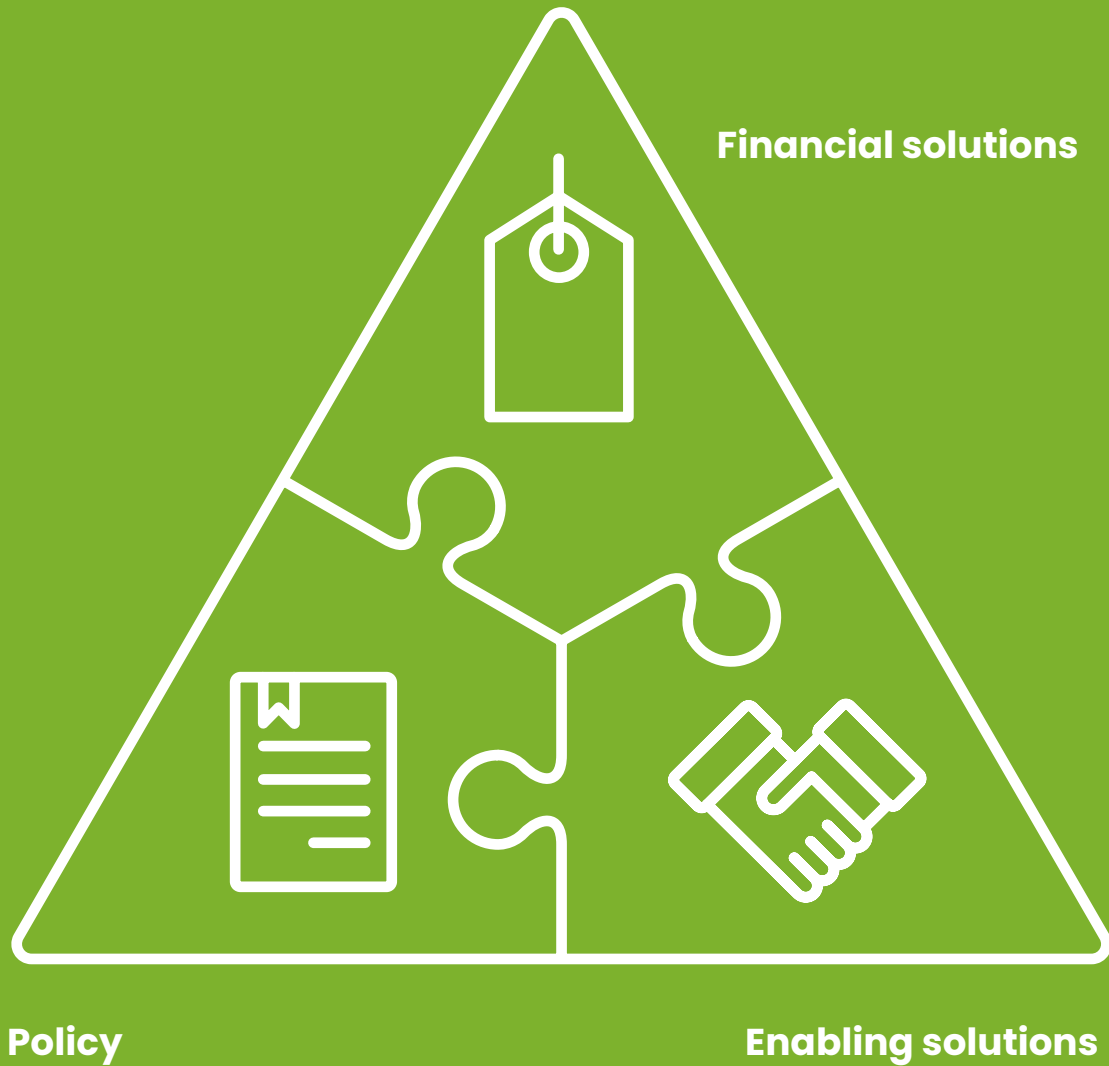
in December 2020, the proposal for a new Sustainable Batteries Regulation was published,⁸⁹ aiming to create a legal framework on the sustainability, traceability and circularity of battery production throughout a product's life cycle.

However at present, there are limited incentives for this market to scale up. There are several factors deterring investment: the limited quantities of battery materials to reuse and recycle at present, the lack of technological development of recycling processes, and the relatively low cost of raw materials, especially compared to recycling. Investing today will ensure the opportunity to process the growing volume of recyclable materials is captured, securing materials for UK battery manufacturing and creating a circular economy.

The Battery Investment Facility (Demonstrator Solution 1) can provide a mechanism through which recycling facilities can be financed. Offtake Support Mechanisms (Demonstrator Solution 3) and a Battery Value Guarantee (Demonstrator Solution 4) can help secure future flow of materials into battery recycling, unlocking investment.

Solutions

Solutions to facilitate the mobilisation of capital in the battery supply chain.



Solutions

The Coalition has selected the most promising interventions to scale up investment in battery manufacturing and the associated supply chain.

Some solutions aim to build market knowledge and expertise, others have potential to de-risk private investment into all parts of the battery supply chain. In addition to the financial solutions, a policy and regulatory environment conducive to accelerating investment in the battery supply chain is needed.

The following section sets out the list of potential demonstrator solutions in more detail and provides further information on each. Each template includes an overview of the solution, its intended outcomes and key delivery partners.

The solutions fall into three broad categories: financial, enabling, and policy.

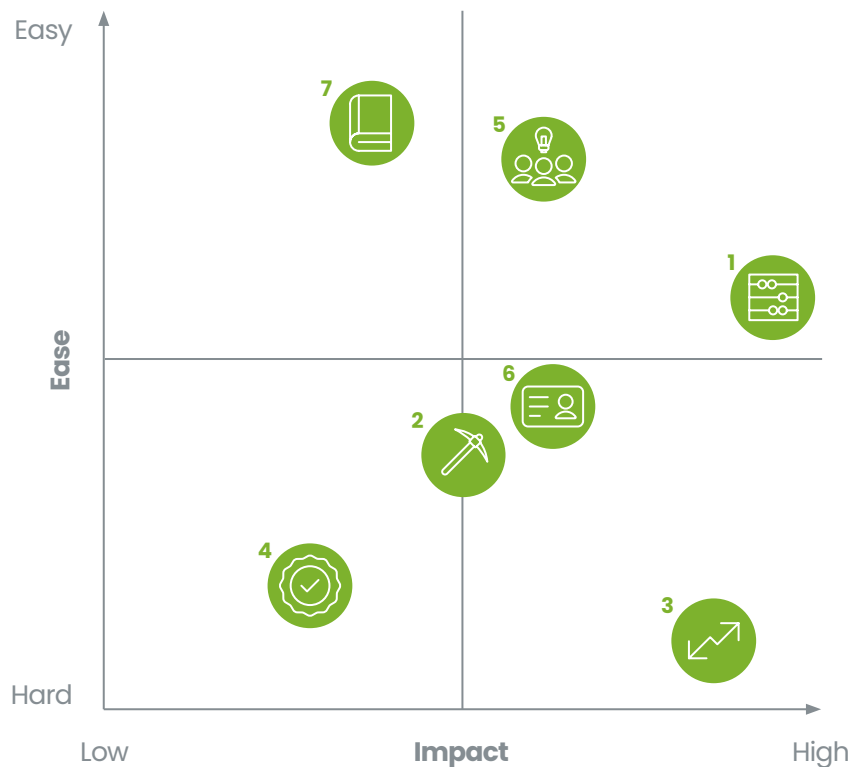
The CDRT is focused on bringing to market the portfolio of financial and enabling solutions. These range in ease of implementation, and level of impact, as set out in Figure 10.

Figure 10 **Demonstrator Solutions Overview | Ease versus Impact.**

Source: CDRT stakeholder interviews.

Demonstrators

1. Battery Investment Facility
2. Sustainable Import Guarantee
3. Offtake Support Mechanism
4. Battery value guarantee
5. Investor Showcase
6. Battery passport
7. Lenders' Handbook





Role Of The Public Sector

Though the solutions in this report are primarily focused on the private sector, there are key roles for the public sector through developing supporting policy, facilitating enabling measures, and providing capital where needed to de-risk private investment.

The newly established UK Infrastructure Bank (UKIB) has potential to play a key role in providing the patient capital required to finance and de-risk investment in this sector. This could be through providing guarantees, or co-financing some of these projects, retaining equity in companies investing in high-risk, higher-reward technologies.

Financial Solutions



Demonstrator Solution 1: Battery Investment Facility (BIF)

Overview:

The Battery Investment Facility seeks to bring together public and private capital to unlock investment into companies who are a critical building block in a successful battery supply chain. Public finance could be used to de-risk investments in key businesses in the supply chain by the private sector, which would otherwise sit outside of traditional risk appetite. Several options for the most impactful intervention of such a blended facility are being explored with key stakeholders including the creation of a specific battery sector fund using public capital as a cornerstone investment to crowd in private capital, revenue and credit enhancement guarantees for individual deals, financial loss against construction risk, or first loss mechanisms to supplement the UK government’s investment in the battery sector through the ATF, further leveraging this funding.

Outcome:

De-risks specific investments for private sector financiers, enabling businesses to access finance for scale up. For early stage organisations, the BIF can unlock funding for organisations to cross the “valley of death” and bridge the gap to mainstream financing. For later stage scale-up organisations, the BIF can de-risk debt funding, unlocking the scale of capital required for companies to succeed. The BIF has potential to apply to adjacent sectors including power electronics and hydrogen fuel cells.

Barrier Addressed:

The BIF seeks to help organisations cross the “valley of death” when scaling their operations, by enabling investors to provide capital which would otherwise be outside of risk appetite.

Key Delivery Partners:

Government (e.g. Department for Business, Energy and Industrial Strategy (BEIS) and Department for International Trade (DIT))

Financial institutions (VC, private equity, retail, funds, and institutional)

The Advanced Propulsion Centre / Faraday Battery Challenge

Role:

Provide public capital through e.g. first loss guarantee structures, cornerstone funding or credit enhancement guarantees to de-risk private capital

Provide supporting policy environment

Advise and support on facilitating deals.

Target audience for private capital, once de-risked with guarantee

Identify suitable organisations requiring support from the BIF



Demonstrator Solution 2: Sustainable Import Guarantee (SIG)

Overview:

The SIG is a new financial instrument to incentivise sustainable supply chains, specifically through trade finance. It is intended to assist companies in their transition to more sustainable operations. A UK government or equivalent investment grade guarantee is provided to a financial institution (e.g. bank) to raise the credit profile, and therefore lower the cost of trade loans, for importers. A pricing benefit is passed on to importers of raw materials used for the battery supply chain (such as lithium or cobalt) only if the sustainability credentials of the import are verified. The SIG could be used across various imports as well as in supply chain finance mechanisms. The GFI supported the Global Resource Initiative report in 2020 which called for this product in relation to agriculture and has since been exploring this product and wider potential uses, including for battery raw materials.

Outcome:

The SIG provides an incentive to organisations to import sustainably sourced materials through a financial discount offered to clients as part of a just transition to net zero. There is an ability to scale significantly across different clients and product type and apply this to various trade finance mechanisms.

Barrier Addressed:

The SIG addresses the barriers relating to the sustainability of supply of raw materials.

Key Delivery Partners:

Investment grade guarantor

Verification body for sustainability

Financial institutions

Platform manager

Role:

Government body or public finance providing the guarantee

An independent organisation reviewing and verifying the ESG record of the supplier

Provider of the trade loan and recipient of the guarantee

To host the guarantee and provide connections between suppliers, customers and guarantor



Demonstrator Solution 3: **Offtake Support Mechanism**

Overview:

Offtake agreements are an important tool in providing supply chain stability within a new supply chain. If the supply chain has one point of certainty that is de-risked through an offtake agreement this will provide investors with additional comfort around future cashflows, unlocking investment upstream and downstream. Additional tools to facilitate offtake agreements, for example through the use of third party offtake guarantees, could help to de-risk the high capex and long timeframes involved in constructing new production facilities by providing certainty of future demand for a particular technology.

Outcome:

Offtake agreements can provide the certainty at one end of the manufacturing supply chain that facilitates confidence for investment to fall into place across the preceding links.

Barrier Addressed:

Offtake agreements seek to address the barriers of a supply of raw materials, supply chain demand uncertainty, and the lack of incentives for a recycling market. Facilitating their use increases the likelihood of agreements being used and these barriers being overcome sooner, speeding the creation of the supply chain.

Key Delivery Partners:

Role:

Battery manufacturers (or organisations within the supply chain)

Holder or provider of an offtake agreement within the supply chain

Public finance

Provider of a third party guarantee to facilitate an offtake agreement

Financial institutions

Advise and support on facilitating the financial requirements of agreements

Provider of third party guarantee

Lawyers

Advise on structures of offtake agreements and guarantees

Advanced Propulsion Centre / Department for International Trade

Facilitator between new entrants into supply chain and potential customers



Demonstrator Solution 4: Battery Value Guarantee

Overview:

A battery value guarantee is a mechanism for a battery within an EV to have a guaranteed end-of-life value and owner, ensuring a disposal value at end of life. The guarantee provider could also include a mid-cycle swap mechanism in the event of battery failure.

When a battery is manufactured and installed in a vehicle, it would be assigned a final value and final owner. The final owner is likely to be auto manufacturers (that are liable to dispose of batteries), battery recyclers or second life storage facilities. As such the guarantee supports both the consumer by providing confidence of vehicle depreciation, and the battery re-use and recycling market through guaranteeing a value at the end of each battery use-case and a future supply of materials into those markets. To operate effectively, the battery passport solution identified in Demonstrator Solution 6 would also be needed.

Outcome:

The mechanism ensures a supply of batteries into second life storage and/or “raw” materials into recycling, reducing waste, reducing the cost of disposal and providing a source of throughput into these second hand markets.

Barrier Addressed:

The Battery Value Guarantee seeks to address the barrier of lack of incentives for a recycling market, through ensuring future supply of inputs and therefore revenue.

Key Delivery Partners:

Role:

Battery/automotive manufacturers

Design and manufacture batteries which can be recycled. Retain “ownership” of, or disposal responsibility for battery through life of vehicle

Recycling / Second life users

Form agreements with manufacturers or auto manufacturers to secure end of life batteries

Third Party Guarantor

Provide third party offtake guarantee if required, between battery owner and recycler

Data provider

Host and track battery passport data to enable tracking of batteries through lifecycle



Enabling Solutions



Demonstrator Solution 5: Investor Showcase

Overview:

An interactive knowledge hub to connect businesses seeking investment to knowledgeable investors looking for investment opportunities. The knowledge hub would help identify and map organisations across the battery value chain to enable investment. The organisations and projects shown on the hub would highlight the different stages of maturity, allowing for targeted pitching and investment, and identify their role in the end to end supply chain. While there is no guarantee of investment, such a tool could provide an opportunity for organisations to get in front of the right investors and reduce the need for numerous individual investor/ business meetings and could be expanded to provide organisations with access to non-financial support such as management expertise. The hub could also have a role in upskilling investors interested in starting in the sector and address some investor concerns about technology obsolescence.

Outcome:

Ultimately, the showcase would help match companies and investors and assist companies struggling to raise investment. The showcase has been identified as a missing link for investors keen to invest in the battery tech space, but unable to narrow down their specific criteria. Further, the concept identifies domestic finance funding pools for investees to approach for investment and could be expanded to other green tech sectors.

Barrier Addressed:

The investor showcase seeks to address the barriers of difficulties in matching available capital with investment opportunities, and some aspects of UK competitiveness issues, such as by financing microgrids.

Key Delivery Partners:

Role:

Faraday Battery Challenge / Advanced Propulsion Centre

Provide deep sector knowledge for curation of the showcase

Platform provider

Design and host interactive showcase online, supported by in-person events, connecting businesses to investors

Investor community

Provide feedback on design of showcase, and ultimately capital for organisations seeking finance

Battery supply chain organisations

Provide feedback on design of showcase, and ultimately be the beneficiary of capital provided by investors



Demonstrator Solution 6: Battery Passport

Overview:

A UK battery passport scheme would allow a record to be kept of an individual battery's constituent parts and ensure transparency through the supply chain. This would incentivise sustainable supply chains, and could include metrics such as embedded carbon to highlight the better carbon credentials of domestic over imported batteries for consumers. It also enables investors to more readily verify investments in the supply chain as being ESG compliant, mitigating the risk of greenwashing.

Some battery passports are already in operation globally and individual auto manufacturers have made efforts to ensure transparency. The market however needs consistency; some existing consortiums have been established to seek to standardise battery passports. The UK market, and investors, need to be involved in these discussions.

Passports also enable products to be attached to the battery specifically, such as a battery value guarantee (Demonstrator Solution 6), and battery health certificate (see demonstrator solution 4 in the CDRT Road to Zero: Unlocking public and private capital to decarbonise road transport report).

Outcome:

By providing greater transparency, the passport could be a critical enabler to attract capital to support more sustainable production. As green taxonomies become more important globally, it also enables investors to report alignment, provided activities are in line with the technical screening criteria of taxonomies.

Barrier Addressed:

The battery passport seeks to enable solutions which can attach a specified value to a battery during and at the end of its life, overcoming the barrier of uncertain supply of raw materials and materials into the recycling sector.

Key Delivery Partners:

Role:

Battery manufacturers

Ensure materials can be identified and tracked through the manufacturing process

Faraday Battery Challenge

Provide deep sector knowledge to support creation of battery passports

Government

Implement regulation requiring vehicle batteries to have passports and a traceable supply chain

Data provider

To host and track battery passport data

Investors

Input into the development of the passport, including the details needed in the passport to allow investments to be identified as taxonomy-aligned.

Existing battery passport consortiums

For example, the German Battery Passport for Europe project. Working together with these groups will allow sharing of learning and delivery processes to remove duplication and encourage alignment of passports globally.



Demonstrator Solution 7: **Lenders' Handbook**

Overview:

A practical guide to help potential investors understand the key battery technologies that are currently available and under development. This would draw on existing knowledge products, such as the APC roadmaps, but with an explicit focus on meeting the knowledge gaps of investors looking to support the transition or invest in a new asset class. This would be similar to the Lenders' Handbook which has already been produced by the GFI's Coalition for the Energy Efficiency of Buildings.

Outcome:

The handbook will provide an independent source of information to investors seeking to build their knowledge of the battery sector.

Barrier Addressed:

The handbook aims to increase investor knowledge of the battery sector, bringing new sources of finance in at all points of the value chain, increasing access to finance. This will mitigate barriers to investment including investor uncertainty around supply chains, and concerns about technology obsolescence.

Key Delivery Partners

Faraday Battery Challenge / APC

Investors

Academia

Role:

Contributor to the handbook, bringing learned experiences from projects to date

Intended audience of the handbook

Contributors to the handbook with technical expertise

Policy



Coalition members also identified a number of recommendations where government policy intervention could improve the attractiveness of the UK to the battery supply chain and facilitate investment.

While other business groups, such as the Aldersgate group, have set out detailed recommendations for establishing supply chains for low carbon industrial products in general,⁹⁰ there are some specific areas that were highlighted by coalition members in relation to finance for batteries. Some areas of policy that financial stakeholders highlighted could unlock investment include:

Carbon Border Adjustment

- A Carbon Border Adjustment Mechanism (CBAM) is a tax on the embedded carbon of imported products. Such a mechanism would incentivise industries at home and abroad to reduce the emissions associated with their goods, and protect UK manufacturers from competitive price undercutting by more carbon intensive production abroad.⁹¹
- The Aldersgate Group have recommended that the Government put forward proposals for a CBAM to prevent high carbon imports from gaining a growing market share at the expense of low carbon goods produced by UK firms.⁹²

Energy Costs

- Several stakeholders raised the issues that UK energy costs are higher than elsewhere in Europe. As detailed above, the UK energy regulator Ofgem has found that between 2016 and 2020, average electricity prices in the UK for energy intensive industries were by far the highest in Europe; averaging at over £100/MWh while other EU prices were under £80.⁹³
- There are well established calls across energy intensive industries for action to exempt or compensate industry for some policy costs, and to provide relief from network costs.⁹⁴
- However, such changes need to be delivered without impacting negatively on consumers facing a cost of living crisis given the UK is facing rapid increases in domestic bills, and associated impacts on fuel poverty.⁹⁵
- Aside from managing this balance, there are practical steps the UK Government could take to support both industry and net zero. This could include supporting and accelerating the deployment of microgrids at infrastructure sites, with fast tracked planning and support with grid connections.

Recycling

- Regulatory change could help improve the speed of scale-up in the nascent recycling market.
- The House of Lords Science and Technology Select Committee recommended that the Government could, for instance, require manufacturers to incorporate plans for recycling into their battery design.⁹⁶
- Similarly the Aldersgate Group recommended that the Government could use tax incentives, such as reduced business rates on waste materials sold to incentivise recycling, or reduced VAT on resource efficient products to improve price competitiveness with virgin materials.⁹⁷

Capital Allowance Super Deduction

- The capital allowance super deduction is due to come to an end in March 2023.⁹⁸ Consideration should be given to extending this tax incentive for businesses investing in plant and machinery which is critical to net zero, including the battery sector, in order to encourage investment to be brought forward.

Skills

- Investment in upskilling the UK workforce to ensure the right capabilities for battery production and reconditioning are available is key to attracting companies to invest in the UK. Apprenticeships and reskilling programmes targeted at existing automotive sector employees can support development of a skilled labour force and make the UK a more attractive market for inward investment.
- The Government's Automotive roadmap⁹⁹ included commitments on this area, including £1 billion government commitment to support EV supply chains; to support EV supply chains, and wider support through the Green Jobs Taskforce, Green apprenticeships, and Emerging Skills Electrification project. These will help lay the groundwork for the skills the sector needs.
- Analysis by Vivid Economics for the Climate Change Committee found that a growth in EV production could create 89,000 new green jobs in the UK EV industry.¹⁰⁰

Research and Development Solutions

- Continued financial support for alternative battery technologies through the Faraday Battery Challenge will be important, especially given existing partnerships between universities, research centres and industry, which could accelerate commercialisation.

Call To Action

Call to Action

To conclude, the transition to net zero will not be achieved without an orderly transition in road transport from ICE vehicles to low carbon alternatives, which will be predominantly battery powered.

The necessary manufacturing shift presents a significant opportunity for finance. The global market is racing to scale up the battery supply chain, and as such is seeing rapid growth in market value. The scale of the demand means new opportunities for investment, including within the UK.

The UK's existing automotive manufacturing sector will need a supply of batteries to continue to thrive. Hosting parts of the battery supply chain domestically supports the Government's aim to phase out ICE vehicles by 2030. Failing to secure a share of the supply chain in the UK carries significant risks; the financial gains of the battery supply chain could be captured elsewhere, and in turn the existing automotive industry in the UK could diminish through moving to co-locate with battery production overseas. While the UK already has significant potential for a battery sector, with strong research and innovation capabilities, crowding in private finance at pace is what is now needed to achieve scale up. The opportunities for finance are clear; the value of the market for the UK supply chain could be worth £24 billion annually by 2025.¹⁰¹

However, as this report has outlined, CDRT engagement with industry has highlighted that there are a number of barriers to realising this opportunity. The seven solutions identified by the CDRT have potential to mobilise private capital at the pace and scale required to accelerate investment in the battery supply chain.

We now invite finance and industry organisations to join the Coalition and work with us to pilot and launch these demonstrator solutions. Collectively we can catalyse investment opportunities for the battery supply chain which will underpin the future of road transport.

We look forward to you joining us on this journey.

“The global EV market is racing to scale up the battery supply chain. This demand means new opportunities for investment in the UK, but only if the barriers to realising these opportunities are removed. Cross-sector collaboration has been critical to identifying the solutions that will de-risk investment, and unlock the capital required to build the battery supply chain that will secure the future of the UK's automotive industry.”

Lauren Pamma,
Programme Director, CDRT

Abbreviations/Glossary

APC	Advanced Propulsion Centre	ICE	Internal Combustion Engine
ATF	Automotive Transformation Fund	IEA	International Energy Agency
BEIS	Department for Business, Energy and Industrial Strategy	OFGEM	Office of Gas and Electricity Markets
BEV	Battery Electric Vehicles	R&D	Research and Development
BIF	Battery Investment Facility	SIG	Sustainable Import Guarantee
BNEF	Bloomberg New Energy Finance	SMEs	Small and Medium-Sized Enterprises
CBAM	Carbon Border Adjustment Mechanism	SMMT	Society of Motor Manufacturers and Traders
CO₂	Carbon Dioxide - a key greenhouse gas	UK BIC	UK Battery Industrialisation Centre
DfT	Department for Transport	UKIB	UK Infrastructure Bank
DIT	Department for International Trade	VC	Venture Capital
ESG	Environmental, Social and Governance	VAT	Value Added Tax
EU	European Union	ZEV	Zero-Emission Vehicle (includes battery and hydrogen fuel cell electric vehicles)
EV	Electric Vehicle – for the purpose of this report an EV is a zero-tailpipe emission battery vehicle and does not include hybrid vehicles		

Acknowledgements:

The CDRT depends on the expertise of its members and friends across the transport sector. We are grateful to all who contributed their time and expertise to this report. Our specific thanks go to Josh Denne and Ian Constance at the Advanced Propulsion Centre, Jacqui Murray at The Faraday Battery Challenge, Richard Hill of Natwest and Charlie Parker of Ratel Consulting, for their insights. We would also like to thank the Future Mobility team at KPMG, UK BIC for hosting us at their facility, and BNEF, for access to their invaluable resources. We look forward to working with you all again through the next stages of our work.

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