Written evidence submitted by the Department for Business, Energy and Industrial Strategy

1. The automotive sector is going through a period of significant transformation, which will involve building new supply chains. Government is committed to putting the UK at the forefront of the design and manufacturing of zero emission vehicles by strengthening the current R&D ecosystem and manufacturing capability, including for key technologies and components.

2. Developing an internationally competitive supply chain for electric vehicles right here in the UK is an integral part of the Government's plans for green growth, levelling up across our country and driving emissions to net zero by 2050.

What contribution could battery electric vehicles make to achieving net zero by 2050?

3. Cars and vans currently represent one fifth of UK domestic CO_2 emissions and accounted for 70% of domestic UK transport emissions in 2018. The transition to zero emission vehicles (of which battery electric vehicles are expected to play a major part) is expected to reduce these significantly and make a positive contribution to achieving net zero.

4. To achieve this, Government is going further and faster to decarbonise transport. It is phasing out the sale of new petrol and diesel cars and vans by 2030, and – 10 years earlier than planned - from 2035, all new cars and vans must be zero emissions at the tailpipe. This will reduce greenhouse gas emissions faster, with savings equivalent to over 4 million fewer cars on the road each year out to 2050. Emissions from energy production and use of battery electric vehicles in the UK are expected to fall to near zero by 2050 as the electricity grid decarbonises in line with Government projections.

How well is Government policy aligned with high-level commitment for growth of battery electric vehicles to support its net zero ambition?

5. The automotive sector has a key role to play in the Government's plans for green growth, levelling up across our country and driving emissions to net zero by 2050. The Government is providing a comprehensive package of support to facilitate this transition.

6. In addition to the £1.5 billion previously committed between 2015 and 2021 to support the early market and remove barriers to ownership of zero emission vehicles, we have pledged a further £2.8 billion to support industry and consumers to make the switch to cleaner vehicles as part of the 10 Point Plan. This includes:
    - Up to £1 billion to support the electrification of UK vehicles and their supply chains at pace. The first £500 million of this will be made available as late-stage R&D and capital support through the Automotive Transformation Fund

(ATF) over the next four years.
- £1.3 billion over the next four years to support the continued roll-out of chargepoints on motorways and major A roads, in homes and businesses and on-street. Government is also supporting the deployment of rapid chargepoints.
- Government has provided additional funding for the Plug-in Vehicle Grants, bringing the total to £582m and will incentivise consumers to transition to zero emission vehicles.

Are the UK supply chain opportunities around supply of batteries and power electronics, machines and drive supply chain clear?

7. Government and stakeholders have analysed the potential supply chain opportunities, drawing on research findings from partners such as the Faraday Institution and the Advanced Propulsion Centre.

8. Research by the Faraday Institution has found that UK battery demand will reach approximately 140 GWh (approximately 7 gigafactories) per annum by 2040[1]. Looking to other components such as motors and drives, the UK currently has significant capability in R&D but a small industrial base for manufacture. There is great potential to rapidly industrialise this capability as these are expensive components and will contribute towards meeting Rules of Origin requirements in UK FTAs. Research from the Advanced Propulsion Centre (APC) has identified that opportunities for UK suppliers amount to £24 billion over the next four years.

9. Government investment seeks to maximise on this opportunity by targeting strategically important parts of the EV supply chain and focusing on where the UK has an existing comparative advantage or where there is potential to grow.

What natural advantages in terms of access to raw materials, renewable energy supply, technological readiness, IP or other competitive advantage does the UK have to encourage development of battery manufacture in the UK?

10. The UK has a track record of being at the cutting edge of battery research ever since UK researchers discovered the first commercial lithium-ion battery and the resulting technological revolution. We also have the largest installed capacity of offshore wind in the world, with around 10GW in operation off its coasts.

11. The UK's strong incumbent chemical industry currently supply many foundation materials used by the major Asian battery makers. This includes Mitsubishi Chemicals Corporation who have the largest electrolyte capacity in Europe, and

[1] Note: This research was undertaken before the announcement of bringing forward the end of sale of petrol, diesel and hybrid cars and vans to 2030 which is expected to accelerate the trajectory of UK battery demand.

Phillips 66 Ltd world leaders in production of high-quality graphite. These businesses can potentially manufacture and supply many of the inputs needed for EV batteries, both for UK manufacture and for export to Europe.

12. The Government is also supporting opportunities to secure the domestic extraction of critical materials. For example, we are supporting Cornish Lithium and Geothermal Engineering, who are collaborating to build a zero carbon, lithium extraction pilot plant at an existing site in Cornwall.

13. Moreover, the UK Battery Industrialisation Centre (UKBIC) in Coventry is the first of its kind globally and offers investors in battery manufacture open access to trialling manufacturing at scale and accelerate battery development.

What action is needed to support investment and establishment of UK gigafactories?

14. Securing gigafactories is an absolute priority for Government. The Prime Minister has tasked BEIS and the Office for Investment to lead efforts on securing investment in gigafactories, working closely with relevant departments across government.

15. Through the £500 million Automotive Transformation Fund we are proactively engaging with potential battery manufacturers. The ATF is open to applications for support from businesses and investors in all parts of the UK. Government is working hand in hand with local authorities and other relevant stakeholders to attract investment.

16. In parallel we are also talking to vehicle manufacturers to better understand their battery requirements and which aspects of their supply chain they would most like to onshore. This information will inform our discussions with investors.

What should the Government do to ensure that gigafactories have a safe, reliable power supply which meets net zero requirements?

17. The Government is committed to ensuring that homes and businesses have the certainty of secure electricity supplies they can rely on, now and in the future. The Capacity Market (CM) is our primary tool for delivering security of electricity supply at least cost to the consumer. It is open to participation by all technologies and ensures there is enough capacity available to meet peak demand in a range of scenarios through auctions held four years and one year ahead of delivery. The capacity auctions held to date have secured the majority of our capacity needs out to 2024/25.

18. We have made a number of reforms since its introduction in 2014, such as opening up participation to wind and solar, implementing carbon emissions

limits, and providing demand side response with access to long term agreements. Our Ten-year Review of the Capacity Market will take place by 2024 and will support net zero requirements by ensuring the mechanism acts in concert with other markets. In the interim, we intend to review some of the issues and improvements identified through the Five-year Review, particularly those which can help ensure the CM is better aligned with our Net Zero ambition.

19. Low-carbon electricity will be a key enabler of our transition to a Net Zero economy, and we are continuing to increase our renewable generation capacity. The UK has the most offshore wind generation built anywhere in the world, with around a third of the global installed capacity. The Prime Minister's ten-point plan announced Government's ambition to advance this sector further, by quadrupling the capacity of offshore wind available to generate to 40GW by 2030.

20. Energy network companies are obliged and incentivised under a framework of price controls, set by the independent regulator Ofgem, to run their networks efficiently in the interests of all consumers, including connecting consumers with appropriate connection agreements and ensuring the networks provide sufficient capacity for all users' needs.

What action is needed to support growth of associated power electronics, machines and drive supply chain, including securing supply of raw materials and material processing?

21. Government is investing £80 million through the Driving the Electric Revolution (DER) Challenge to accelerate the capability and growth of the UK's Power Electronics, Machines & Drives (PEMD) supply chain. DER provides support for collaborative R&D and talent and skills development, as well as funding for a network of Industrialisation Centres which will be used by industry and researchers to develop and scale up PEMD technologies and manufacturing processes.

22. DER has already supported projects relating to the recovery and recycling of Rare Earth Elements, and activities to facilitate the development of Rare Earth Element magnet supply chains in the UK. Government is also supporting innovation in this area, for example by providing innovation support to Greenspur, a company based in Hertfordshire, to trial a new type of magnet – which does not use rare earth minerals - at the Offshore Renewable Energy Catapult.

The Government has announced £1 billion of funding to support the electrification of UK vehicles and their supply chains. Is this figure sufficient? How should it be split between supply chains and gigafactories?

23. As part of the Prime Minister's 10 point plan Government announced that the first £500m of the £1 billion previously committed would be made available

through the Automotive Transformation Fund over the next four years. This commitment will help the UK stay at the forefront of the electric vehicle revolution and seize new opportunities for growth and innovation.

24. The Government has prioritised securing investment in gigafactories, as this is key for anchoring the mass manufacture of electric vehicles in the UK, safeguarding jobs, and driving emissions to net zero by 2050. Investment in other areas (motors, drives, power electronics and fuel cells) is also required.

25. Strategic prioritisation of investments is informed by continuously updated market intelligence and research by the Advanced Propulsion Centre, to ensure that funds support technologies which are key to development of the supply chain and have the greatest potential to be located in the UK.

The £1 billion Net Zero Innovation Portfolio will focus on research into low carbon technologies. What proportion of this funding should be directed towards battery electric vehicle research? What areas should ARIA target in distributing funding for high-risk, high-reward research into battery electric vehicles?

26. The Net Zero Innovation Portfolio (NZIP) provides funding for low-carbon technologies and systems. It does not directly fund electric vehicle battery research, but the Energy Innovation Programme (2015-21) has contributed to the transition of the automotive sector by supporting innovation competitions on smart energy innovation. This includes up to £20 million for an electric vehicle-to-grid programme to invest in demonstrators and feasibility studies for smart EV charging systems.

27. ARIA will set its own research priorities and define its own programmes of work. It will not be given a research mission by Government. The agency's focus will be to fund ground-breaking research; research that sparks transformational societal change through the creation of new technologies and new industries. Giving the agency an open remit will make it more likely to find and fund unusual research that is missed in the current system. If those opportunities exist in battery electric vehicles then ARIA will be expected to find them.

28. The Government has a comprehensive system of support for electric vehicle research, including the £318m Faraday Battery Challenge, which seeks to put the UK at the global forefront of the design, development, manufacturing, and recycling of electric batteries. This challenge takes a coordinated approach to join up R&D from fundamental research, applied development, and manufacturing scale-up through the UK Battery Industrialisation Centre. Late-stage battery R&D is also in scope of the Advanced Propulsion Centre (APC) core competitions which is a key part of the UK's automotive transformation strategy. Government and industry have committed around £1 billion over 10

years to 2023 though the APC for collaborative projects to research, develop, and commercialise the next generation of low carbon and zero emission vehicle technologies. The APC has a proven track record of success: it has awarded funding for 70 collaborative R&D projects which have helped create and safeguard nearly 47,000 jobs (person years equivalent) and are projected to save 244 million tonnes of CO_2.

What steps should be taken to ensure the UK workforce has the necessary skills to staff gigafactories and their supporting supply chains?

29. We recognise the need to ensure the existing workforce is upskilled/re-skilled and that new entrants to the automotive industry are appropriately trained and we have been working through the Automotive Council and others to support these efforts.

30. The Automotive Skills Working Group (part of the Automotive Council) works with Government to identify and deliver skills for the current and future workforce. In addition, the Green Jobs Taskforce is currently developing policy options to ensure the UK has the required skills across sector – including automotive – to achieve Net Zero.

31. Skills development in the electric vehicle supply chain is also supported by the Driving the Electric Revolution Challenge which has allocated up to £6 million to support development of skills in electrification technologies and provide training at all levels to help upskill and grow the workforce while the Emerging Skills Project, led by the High Value Manufacturing Catapult, aims to address the future skills gap in manufacturing and the wider engineering workforce.

What measures should the Government take to ensure that minerals for battery electric vehicles are sourced in a responsible way?

32. We are aware of the social, environmental and supply concerns surrounding the mining of raw materials for EV batteries and are working to address these:
    1. Technology and recycling: Government and industry are funding research to develop new battery chemistries which reduce the percentages of critical raw materials (such as cobalt) in EV batteries. Additionally, the Faraday Battery Challenge and the Advanced Propulsion Centre are looking to localise more of the battery supply chain to the UK. Recycling will also reduce the raw materials needed for battery production.
    2. International collaboration and guidance: The Faraday Institution participates in the Global Battery Alliance (a World Economic Forum initiative) seeking to address the human, health and environmental challenges of batteries. Additionally, as an active member of the Organisation for Economic Cooperation and Development (OECD), we encourage states and those working in the industry to implement the OECD's Due Diligence Guidance for

Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas.

3. Responsible sourcing and governance programmes: The Government is committed to ending modern slavery, forced labour and human trafficking worldwide by 2030 (part of the UN Global Goals for Sustainable Development). The FCDO is also working on strengthening transparency, improving governance, and the resolution of complex challenges around cobalt from artisanal mines. FCDO are working directly with civil society and mining companies to develop innovative approaches for ending child labour and human rights abuses. DIT also supported the London Metal Exchange in developing responsible sourcing requirements, which all listed brands must adhere to.

What action can Government take to support growth of secondary markets to extend lifetime use of EV batteries?

33. We are keen to create a circular economy for electric vehicle batteries to maximise the economic and environmental opportunities of the transition to zero emission vehicles. This involves work in three areas:
    1. Innovation: The £318m Faraday Battery Challenge is tackling the technical challenges of reusing and recycling battery components, with an aim of making them 95% recyclable by 2035, up from 10-50% today.
    2. Infrastructure: We are supporting research to develop UK battery recycling infrastructure.
    3. Regulatory environment: The 2009 Waste Batteries Regulations bans the disposal of EV batteries to landfill or incineration. Battery producers are obligated to take back EV batteries free-of-charge and treat them at approved facilities.

34. Lithium ion batteries slowly degrade in performance with time and hold less charge as they age. When EVs reach end-of-life, remaining battery storage capacity is expected to be over 70%. To extract maximum economic value and minimise environmental impacts, EV batteries can then be recycled for use in other applications where performance requirements are less demanding such as in grid power systems. An example where this is being done by a UK company for home electricity storage systems is Powervault, which were funded under the Government's Energy Entrepreneurs Fund innovation programme.

35. Government is facilitating the deployment of storage through the joint Ofgem and BEIS Smart Systems and Flexibility Plan which sets out actions that Government, Ofgem and industry will take to harness the benefits of smart energy solutions. Our approach centres on creating a best-in-class regulatory framework for storage by removing regulatory and policy barriers, ensuring that markets reflect the value of flexibility to the system and investing in innovation. In partnership with Ofgem we are developing a new Smart Systems

and Flexibility Plan which we will publish later this Spring, this will set out the next phase of policies that will take us towards a net zero energy system.

What steps should be taken to ensure that EV batteries are recycled at the end of their lives and not simply sent to landfill?

36. Regulation 56 of the Waste Batteries and Accumulator Regulations 2009 already bans the disposal of electric vehicle batteries to landfill, as well as their incineration. The 2009 regulations also contain producer responsibility measures to provide for the take back and recycling of these batteries at end of life. In addition, the support for innovation and infrastructure set out above will facilitate increased recycling and reuse.

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