Just Transitions within Sectors and Industries Globally

Enabling a Just Transition in Automotive: Evidence from the West Midlands and South Australia

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About Just Transitions within Sectors and Industries Globally

The programme examines how just transitions whilst tackling climate change and biodiversity is key to supporting inclusive economies and societies in the future. Through the programme, the Academy awarded funding to nine research projects exploring the actions required in sectors and industries globally across supply and value chains, with a focus on key economic emitters or areas of society that will help reduce and/or eliminate greenhouse gas emissions. The programme was funded by the UK's Department for Business, Energy and Industrial Strategy.

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Abstract

Employment in the automotive sector is typically spatially concentrated; hence the impact of the transition to low-carbon technologies will have profound subnational effects. Although there is a rich literature around the spatial impact of automotive plant closures, the novelty of this work lies in its focus on transformation and diversification throughout the supply chain and the impact on workers in the automotive sector. As such, this research study reports on a comparative international piece of research investigating the lessons for supplier firms and workers arising from the West Midlands and South Australia in facilitating a 'just transition' in the automotive sector. The research consisted of mixed methods, comprising of interviews with stakeholders (management, workforce/union representatives and policymakers) throughout the supply chain, coupled with a workforce survey in the UK of members of the Unite union (automotive section). This project is ground-breaking through its explicit examination of the potentials of supplier firms to reorient toward the 'green' automotive production economy.

Executive summary

This report presents the key findings and policy recommendations of a study examining the issues pertaining to a 'just transition'[1] to zero/low-carbon vehicles for the automotive sector, drawing on case study research from the West Midlands region in the UK, and the North Adelaide area of South Australia.

The research drew upon interviews with stakeholders (business, policymaker etc.) pertaining to the automotive supply chain – in the West Midlands this focussed on the capacity (or rather, lack of) of supplier firms to transition to EV; whilst in South Australia, the focus was a retrospective one on the cessation of ICE vehicle manufacturing in Australia in 2017, whether suppliers had diversified into other sectors, and what nascent moves were underway to try and build a domestic EV or hydrogen-powered vehicle industry. This work was augmented with a survey of Unite union members working in automotive in the West Midlands, seeking to assess worker perceptions and concerns underpinning transition.

Key themes explored in the interviews were participants' views on the current state of the EV industry in their region, the dependency on Vehicle Manufacturers (VMs; typically multinational firms) as being key to whether they could transition, what skills mix would be required and where skills gaps were, what the role of government should be to facilitate transition, and any issues pertaining to underpinning infrastructure (namely, the EV charging network). The (UK) survey of workers sought to assess how confident they were of transitioning, whether they had the requisite skills, how secure they felt in their jobs, their expectations of future work, and what government could do to assist them transition successfully.

Findings

Our findings (which focus on the West Midlands, whilst the Australian experience is used to help inform current policy debate) suggest that the automotive value chain in the West Midlands has marked gaps in terms of being able to supply key parts and components for EV production; particularly in EV powertrain systems and all battery components, which will hinder attempts to capture value-added in securing domestic EV production. In this context, the current mania for "gigafactories"[2] in the UK obscures the fact that VMs will determine which aspects of EV production they will conduct in the UK, and where they will source the supplies of components from.

1 A 'just transition' can be defined as *"securing the future and livelihoods of workers and their communities in the transition to a low-carbon economy. It is based on social dialogue between workers and their unions, employers, and government, and consultation with communities and civil society"* (Emden et al., 2021).

2 Gigafactory, using the word Giga which is a unit of measurement meaning "billions", means 'a very large manufacturing facility'. The term was coined in 2013 by Tesla boss Elon Musk, when describing the battery production facility his firm was building in Nevada.

We find that firms in the automotive supply chain in the West Midlands:

- are particularly exposed to the strategic decisions of Jaguar Land Rover (JLR), given its dominance in the region (accounting for approx. 50% of automotive employment in the West Midlands), and the continued uncertainty (at the time of writing) as to JLR's EV strategy;
- lack the capacity or the specialist equipment needed to undertake production of batteries, high value battery components (especially anodes and cathodes) and key components for electric motors (e.g., severe lack of domestic capacity to produce laminations for electric motors);
- suffers from uncompetitive energy prices relative to other European countries, which will hinder production in the UK of energy-intensive parts and components such as battery cells;

In this context, the exposure of the regional supply chain to JLR is critical, given that in contrast to other UK-based manufacturers, who focus on assembly, JLR conducts substantial R&D operations and value-added in the UK.

Policy recommendations

Our analysis strongly suggests that policy needs to focus on two areas: **general support and improvements to the area's infrastructure and general business environment (transport links, potential help with energy costs etc.)** and more significantly **assisting with the transition to an electric vehicle manufacturing focus for West Midlands automotive**. Specifically, helping to secure a battery plant, either an assembly plant or a fully vertically integrated factory which encompasses cell production plant as well as battery assembly, should be top of the local and regional policy makers' objectives – and this has to start with a clear understanding of the needs and intents of VMs in the region. **If production of cells is to take place at a UK gigafactory, then this will in all likelihood need to be presaged by a UK Government 'deal' on a reduced tariff for electricity**. This is because as much as 2/3 of the embedded energy consumed in the production a battery is in the cell production phase; most of the rest is incurred in the raw material mining phase. There is a strong case to be made for cell production to receive support as an energy intensive industry.

Hence, current talk of establishing a 'gigafactory' obscures the problems we have identified in securing as much value-added as possible in the West Midlands. **Helping the region's existing supply chain firms to assess what they need to do re-orientate themselves towards the new EV or zero carbon economy is essential**. There is a case for reinstating a regional service akin the MAS (Manufacturing Advisory Service), which was discontinued in 2016. **It is also essential that a Skills Strategy is developed to ensure that both VMs and supply chain firms can recruit as well as train and retrain workers so that they have the skills needed for electric vehicle production**.

Broadly speaking, there are policies that could be actioned at a regional level (e.g., in the UK by the West Midlands Combined Authority in concert with local government and other regional agencies), whilst others above would require action at a national level. In terms of regional actions (our specific recommendations focus on the West Midlands, also having drawn on the Australian experience), to augment current efforts to maximise domestic value-added in EV production, these should include:

- Establishing a Register of firms in the supply chain who want to work with VMs in transitioning to EV production, by developing a Capacity Directory which lists what products and processes firms can provide;

- Appointing a Supply Chain Champion to assist in delivering onshoring and growing local supply chain capacity;

- Working with the major VMs to understand which UK firms they wish to work with in the transition to EV component supply;

- Funding for training provision to assist suppliers to retrain and reskill their workers for the transition to EV production (and related areas such as the green energy supply chain).[3] This should include provision of training in digital skills and expertise;

- Establishing a Skills Taskforce consisting of VMs, supply chain firms, universities and colleges as well as private training providers to commission research and intelligence gathering on skills requirements and skills shortages to enable the design of training and degree programmes that will meet skills requirements. The VW experience in Germany demonstrates that it is essential that this is done in a collaborative basis;

- VMs and supply chain firms to work together on skills requirements; supply chain firms to be integrated into training programmes of VMs. This is essential to ensure coordination of skills training in order to improve quality assurance and productivity to achieve competitiveness in the emerging EV production system (the German term is 'ecosystem').[4]

- Shoring up the supply chain by measures (subsidies/tax relief/equity stakes etc.) to make domestic production of NGO steel and key powertrain components such as motor laminations viable;

- Improving information sharing across the supply chain to enhance the potential for innovation;

- Suppliers should be able to access a loan fund to assist with restructuring their operations. This has been a key policy response used in previous plant closures such as that of MG Rover and also in response to the 2008 Global Financial Crisis (GFC);

- Potential business tax/rates holidays – as De Ruyter et al.[5] identify, business rates have generally been seen as a disproportionate cost burden borne by UK

3 This will also be critical for successful adoption of 'Industry 4.0' (see De Propris and Bailey, 2021; for a discussion).

4 Herrmann, F., Beinhauer, W., Borrman, D., Hertwig, M., Mack, J., Potinecke, T., Praeg, C. and Rally, P. (2020) *Employment 2030: Effects of electromobility and digitization on the quality and quantity of employment at Volkswagen; final report*, (Translated from German), Fraunhofer Institut fur Arbeitswirtschaft und Organisation.

5 De Ruyter, A. and Brown, M. (2019), *'The Gig Economy: Old Wine in a New Label?'* Agenda: Newcastle-upon-Tyne.

manufacturing companies, especially when compared to equivalent taxes levied in other EU countries;

- Providing specific diversification support for firms in the industry. This was significant with individual plant closures such as MG Rover, and in response to the GFC (in this case via the Automotive Response Programme);

- Much more investment is needed in increasing the capacity of on-road/car park EV charging infrastructure – this could serve as a key job creation policy as well as augmenting the skills base in green energy workers;

- Set up a National Transition Centre for Sustainable Employment. This can be used to raise awareness of the profound changes that are going to occur in the automotive industry. This to include the development of measures to safeguard jobs or to ensure they are reduced in a socially responsible way. The UK can draw on Volkswagen's experience in this regard;[6]

- Prioritising local procurement strategies for the public sector, in accordance with the UK's obligations under international trade agreements;

- Establishing special enterprise zones with excellent connectivity and a range of tax incentives. These should be centred on existing areas of automotive specialisation, building on existing clusters of expertise and support the growth of cutting-edge technologies in the region. Incubation of scale-up firms is another important area of focus;

- Producing a Green Industrial Strategy prioritising accessible low-cost green energy;

- Developing a Green Business Hub to promote regional buying, selling, sourcing and best practice exchange, and;

- Launching a Green Skills Hub involving West Midlands' schools, colleges, universities and businesses prioritised in light of skills shortages already evident in preparing and readying for the transitional skills required.[7]

6 Herrmann, F., Beinhauer, W., Borrman, D., Hertwig, M., Mack, J., Potinecke, T., Praeg, C. and Rally, P. (2020) *Employment 2030: Effects of electromobility and digitization on the quality and quantity of employment at Volkswagen; final report*, (Translated from German), Fraunhofer Institut fur Arbeitswirtschaft und Organisation.

7 McCabe, S. and Nielsen, B. (2021), 'Green Manufacturing, what this involved and how to achieve success', In Nielsen, B. and McCabe, S. (eds.), *Exploring the Green Economy: Issues, Challenges and Benefits*, chapter 14, Bite-Sized books.

Introduction

The coming decade will see some of the most far-reaching changes the global automotive industry has experienced. In just over a decade, by 2035, significant major world markets anticipate phasing out the sale of new vehicles powered solely by internal combustion engines (ICEs) with a number hoping to do so even sooner.[8]

The imperative to move to low-carbon production is now clear and industry is responding.[9] However, existing supply chains are predicated upon the internal combustion engine as a mode of propulsion and the move to low-carbon technologies is likely to have uneven outcomes, varying across different socio-economic groups and spatially among places. These effects may exacerbate existing inequities. The challenge of ensuring a just transition to new low-carbon technologies is thus profound and comes on top of other (not unrelated) challenges relating to the Fourth Industrial Revolution and the consequent impact of 'Industry 4.0'[10] and attendant digitalisation on the automotive sector with implications for jobs and skills requirements for workers.[11]

As such, the literature (surveyed in our full report) demonstrates that the shift to electric vehicles, low emission public transport and renewable energy sources creates opportunities to expand the industrial reorientation component of a 'just transition'[12] and to integrate it with scholarship on industrial 'path creation' to revitalise affected local economies.[13] In this context, Emden et al. [14] define a Just Transition as:

> *securing the future and livelihoods of workers and their communities in the transition to a low-carbon economy. It is based on social dialogue between workers and their unions, employers, and government, and consultation with communities and civil society.*

As such, any just transition will require a multi-scalar approach to policymaking, in which the interaction between national and regional policies are key. Hence, regional institutions can have a key role in fostering a just transition by supporting the adaptation of regional industries to continuous changing environments.[15] Indeed, the current period of discontent that manifests unevenly across regions,[16] necessitates that those regions that feel far removed from the socio-spatial concentrations of power are offered some meaningful devolution in terms of power and control over resources.[17] [18]

8 Hybrids will continue into the 2030s in some European markets and further afield, so there will be some need for engines – i.e., it won't be a case of the switch taking place overnight.

9 McCabe, S. and Nielsen, B. (2021), 'Green Manufacturing, what this involved and how to achieve success', In Nielsen, B. and McCabe, S. (eds.), *Exploring the Green Economy: Issues, Challenges and Benefits*, chapter 14, Bite-Sized books.

10 De Propris, L. and Bailey, D. (2021), 'Pathways of regional transformation and Industry 4.0', *Regional Studies*, 55(10-11), pp. 1617-1629.

11 Sehgal, R. (2020), *'Industry 4.0 & Just Transition for Workers in the Automotive Industry in India'*, Rosa-Luxemburg-Stiftung.

12 Newell, P. and Mulvaney, D. (2013), 'The political economy of the 'just transition'', *The Geographical Journal*, 179 (2), pp. 132-140.

13 Dawley, S. (2014), 'Creating New Paths? Offshore Wind, Policy Activism, and Peripheral Region Development'. *Economic Geography*, 90(1), pp. 91-112.

14 Emden, J., Murphy, L. and Kelleher, M. (2021), *'COP 26: A just transition? Workshop Summary'*, IPPR.

15 Martin, R. (2011), 'Regional economic resilience, hysteresis and recessionary shocks', *Journal of Economic Geography*, 12(1), pp. 1-32.

16 De Ruyter, A., Martin, R. and Tyler, P. (2021), 'Geographies of Discontent: Sources, Manifestations and Consequences', *Cambridge Journal of Regions, Economy and Society*, 14(3), pp. 381–393.

17 De Ruyter, A., Hearne, D., Murshed, S.M., Whittam, G. and Aguma, D. (2021), 'Beyond Remain vs. Leave: understanding changing voter perceptions and attitudes towards Populism – evidence from Scotland and the West Midlands', *Cambridge Journal of Regions, Economy and Society*, 14(3), pp. 507-527.

18 Martin, R., Gardiner, B., Pike, A., Sunley, P. and Tyler, P. (2021), 'Levelling up left behind places: The scale and nature of the economic and policy challenge', *Regional Studies Policy Impact Books*, 3 (2), Regional Studies Association.

Finally, in considering a just transition for the automotive sector, we need to give explicit consideration to smaller firms within the supply chain. In contrast to larger firms which enjoy greater 'resource slack', the smaller firms that typically characterise the supply chain have fewer intangible resources such as the knowledge generated by dedicated corporate units operating in business intelligence, HR or R&D[19] which can be used to anticipate and avoid disruption,[20] which is certainly inherent in a shift to zero-carbon technologies. They are therefore at greater need of policy assistance in ensuring a successful transition.

There is considerable uncertainty around how affected local economies might respond to these threats and opportunities. As such, our research set out to systematically evaluate these issues, and the attendant opportunities and constraints. The central questions addressed in our research (and explored at length in our comprehensive full report) were:

1. What lessons – positive and negative – can be learnt from recent experiences of automotive plant closures?
2. What are the optimal policy settings to manage plant closures, preserve skilled employment, and promote retraining and reskilling into emerging industries?
3. What are the potentials of smaller supplier firms to diversify to viable new specialisations, especially those created by the greening of the automotive sector globally?
4. How can the industrial transition to new forms of transport be optimally coordinated with the labour market transition of automotive workforces?

As such, the analysis underpinning our findings drew upon four complementary sets of data collection. First, an overview of the automotive sector in the West Midlands and the Australian situation, using a variety of secondary data sources. In so doing, the analysis demonstrated both that the West Midlands as a key automotive region is closely connected with international supply chains (particularly in Europe) and that there are real gaps in our knowledge based on aggregate data. The Australian situation demonstrated that an indigenous automotive industry was always reliant on a modicum of government support and subsidy (historically provided by a protective tariff regime). We also conducted a review of relevant academic and policy literature pertaining to transitioning and the shift to EV production.

19 Surroca, J., Tribo, J. and Waddock, S. (2010), 'Corporate Responsibility and Financial Performance: The Role of Intangible Resources', *Strategic Management Journal*, 31(5), pp. 463 – 490.

20 Braunscheidel, M. and Suresh, N. (2009), 'The organizational antecedents of a firm's supply chain agility for risk mitigation and response', *Journal of Operations Management*, 27(2), pp. 119-140.

Third, a series of semi-structured interviews with key regional stakeholders in the West Midlands and South Australia between late November 2021 and February 2022. For each area, 15 interviews of approximately 30-60 minutes duration were undertaken. These individuals consisted of a mix of business owners/senior managers; union representatives; local and regional policymakers (including MPs), universities and representatives of wider industry bodies. Finally, we conducted an online survey of workers (members of Unite, the key sector trade union) in automotive and related industries in the West Midlands in January - February 2022, in order to ascertain workers' preferences and intentions towards transitioning as the automotive sector shifts towards zero-carbon emissions and the rapid reduction in pure ICE vehicle production in the UK in the coming years and their eventual cessation in the 2030s.

In the sections that follow, we summarise our findings from the Australian and UK research, before returning to our policy recommendations.

The Australian experience

In this section, we provide an overview of the Australian experience of automotive production, with a view to informing policy debate in the West Midlands (and similarly the lessons learnt can provide insights for other automotive regions undergoing transition). Table 1 provides a summary of the demise of the Australian automotive industry, noting that both assemblers and supply chain firms were downsizing continuously from about 2007 (Interview 11).

Table 1: Summary of closure events

Closure event	Jobs lost	Date
Ford Production Plant, Broadmeadows, Victoria	450	7 October 2016
Ford Engine, Stamping and Casting Plant, Geelong, Victoria	170	7 October 2016
Ford Broadmeadows and Geelong Plants, Victoria	110	July 2017
GM Port Melbourne Victoria and Elizabeth South Australia (phased)	1,168	Dec 2014 - Oct 2017
GM Holden Cruze Production, Elizabeth, South Australia	280	7 October 2016
GM Holden Engine Plant, Port Melbourne, Victoria	177	29 November 2016
Toyota Production Plant, Altona, Victoria	2,700	3 October 2017
GM Holden Production Plant, Elizabeth, South Australia	805	20 October 2017

Source: DESE [21] (From Information provided by Ford Australia, GM Holden and Toyota).

The DESE[22] estimated that by 2018, 20 of the 75 companies in South Australia's automotive supply chain had closed, and in Victoria 26 of the 140 automotive supply chain companies had closed and around 25 downsized. The report shows that firms accessing assistance considerably reduced their 'automotive exposure', defined as the ratio of automotive sales to total sales. Australian owned firms were more likely to diversify away from automotive activities. DIIS[23] also provided a number of vignettes on successful diversification – mostly in heavy vehicle manufacture – none of which mention electric vehicles. EV was simply not 'on the radar' at the time.

Support for the workforce was funded by topping up the Automotive Industry Structural Adjustment Programme (AISAP) with an additional $15 million. The assistance to workers was also adjudged a success. A government-sponsored evaluation of the diversification effort found that job losses in the supply sector had not been as large as anticipated, and that many firms had continued to operate by providing products to through the automotive-aftermarket and expanding into truck, trailer, and caravan markets. [24]

21 DESE (2020), *The Transition Of The Australian Car Manufacturing Sector: Outcomes and Best Practice*, Report by ACIL-Allen and Wallis Consulting for the Department of Education Skill and Employment.
22 Ibid.
23 DIIS (2020), *Australian Automotive Industry Transition following the end of Australian motor vehicle production*, Department of Industry Innovation and Science.
24 DESE (2020), *The Transition Of The Australian Car Manufacturing Sector: Outcomes and Best Practice*, Report by ACIL-Allen and Wallis Consulting for the Department of Education Skill and Employment.

The ACIL-Allen study found that in 2019, for many workers about six months after leaving the automotive sector, employment outcomes were positive.[25] Overall, 85% were employed and 15% were retired (6%), taking a break (6%) or studying. Of those in the labour force, 82% were working and 18% were unemployed. Of those who were working, 53% were full-time, 6% were part-time, and 41% were casual or 'other' work categories. A further 4% were self-employed.

The State Governments in South Australia and Victoria complemented these with programs focused on affected supply chain firms and workers:

- South Australian Automotive Workers in Transition Program
- South Australian Government 'Beyond Auto' wellbeing and resilience counselling support
- Victorian Automotive Supply Chain Training Initiative

In South Australia, State level industry programs were effectively located in the affected locations. The South Australian government has (since 2013) embarked on a radical industry modernisation programme in which the State has sought to position itself as Australia's high-tech innovation hub. Important components have been the State government's commitment to move to zero emissions, through large renewable energy investments and the 2017 installation of a large battery to stabilise the State's electric supplies. South Australia is the epicentre of Australia's defence-related innovations and was the site for the manufacture of submarines in an agreement (recently controversially cancelled) where the French contractor agreed to a (disputed) level of 60% local inputs. The State has set up innovation precincts – in particular at Tonsley on the former Mitsubishi production site – to house advanced technology firms. There have been attempts to convert the former Holden site (Lionsgate) into a similar hub. The State has marketed itself in the media as a node in global high-tech networks.

In summary, Beer[26] argues that the process of structural change has been typified by the Federal Government in Australia prioritising overall growth and competitiveness over regional well-being, with state governments and local authorities being left to deal with the "negative consequences of economic change".

EV industry in South Australia and supply chain transition

In January 2019, an Australian Senate Select Committee published a report on Electric Vehicles (EV).[27] It pointed to the importance of government intervention, or the lack of it, in determining the future take-up of EVs:

> *In the absence of appropriate regulatory settings, Australia's near-term EV uptake is likely to be modest. Slow uptake will continue to result in EV manufacturers not prioritising the Australian market and fewer EV models being available to Australian motorists. It will also delay the realisation of substantial economic, environmental and health benefits, and risk seeing opportunities for economic development pass by.*[28]

25 Ibid.
26 Beer, A. (2018), 'The closure of the Australian car manufacturing industry: redundancy, policy and community impacts', *Australian Geographer*, 49(3), pp. 419-438.
27 Commonwealth of Australia (2019), *Select Committee on Electric Vehicles, Report*, Commonwealth of Australia.
28 Ibid., p.xvi.

The Australian automotive sector did not transform into an EV production industry. A number of submissions to the 2019 Senate Committee Inquiry on Electric Vehicles in Australia pointed to the residual value of Australia's car-making skills and experience. The South Australian State Government, for example, put forward the view that:

> *The state also retains an automotive sector following the closure of Holden with many component suppliers, a strong research base and a remnant pool of skilled workers.*[29]

The consequence of Federal inaction is more vigorous regulatory intervention at the State level. Most States now have incentives for EV take-up.[30] [31] Like other States, South Australia has a policy position supporting electrification of the transport system. It has a notional target for EV take-up, currently that all new vehicles sold will be 'fully electric' by 2035.

In 2019-20, there was one example of a global firm making use of the automotive sector's skill resources. The Vietnamese electric vehicle start-up VinFast established a research and development centre in Melbourne in 2020, adjacent to the old Holden headquarters, and purchased the ex-Holden Lang Lang proving ground in late 2020 for $36.3m. There are no plans to sell the VinFast models in the Australian market and the situation in terms of domestic producers remains minimal:

> *… There's no one really involved in the EV sector… The landscape in Australia is pretty tragic in terms of EV. We are the only ones really doing what we do. The others are either importing vehicles or doing conversions (Interview 4).*

Half of Australians say in surveys that they would consider buying an EV, but sales are only 1% of the market. This is because they are unaffordable for ordinary wage-earners. The lack of government action on automotive emissions is making Australia a 'dumping ground' for high emissions ICE.[32]

Supply chain

EVs need lots of lithium, nickel and cobalt. By 2040, the IEA forecasts that demand for lithium will have increased 42 times relative to 2020 levels. Australia is a major global source of these raw materials, but currently the further processing industry is centred in China. The supply chains for batteries seem to be following the pattern established for iron ore and bauxite, where minerals are mined in Australia but is performed elsewhere (China, Latin America, US or Europe). Furthermore, the pace of the transition in Australia is extremely slow compared to other advanced economy contexts.

Conclusion

The policy context and the transformative (or lack thereof) role of the state is pivotal for EVs and their associated supply chains. In this context, the lack of regulations to discourage high emissions vehicles, or to encourage the take-up of zero emissions vehicles, is important. Further impediments to zero-emissions vehicles arise from price constraints, in that Australia is a price-taker on world markets. Australia no longer produces cars locally, so price and model range issues will be a continuing impediment to EV take-up.

29 Ibid., p.51.
30 Gutwein, P. (2020), *'Ambitious 100% Electric Vehicle Target'*, Tasmanian Government, 12 November.
31 Perrottet, D., Constance, A. and Kean, M. (2021), 'NSW leading the charge with electric vehicle revolution', 20 June, NSW Government.
32 Steggall, Z. (2020), 'Canberra needs to fast-track its new car plan'. *The Australian*, 15 November.

The UK (West Midlands) experience

The Australian evidence demonstrates that essential to establishing the prospects for the supply chain to undergo a successful transition in the West Midlands is to establish the nature of their exposure to key VMs – and thereby to ascertain whether diversification (into related or unrelated sectors)[33] is a viable strategy for those that do not wish to, or cannot, transition to zero-carbon production in supplying automotive. However, it also means that companies need to assess their own innate capabilities, particularly in terms of the skills base.

In the West Midlands, the dominance of one VM; Jaguar Land Rover (JLR) is particularly stark, accounting for 50% of employment in the automotive sector in the region. As such, the debate on transitioning in automotive cannot be separated from the significance of the global multinationals that dominate the industry. Thus, it is a non-sequitur to talk of "transitioning" in automotive in the West Midlands, let alone a "just transition" for the workforce, without being cognisant of the corporate strategy of JLR and its parent company, Tata, as any decisions they undertake now will have major ramifications for the workforce, suppliers and the wider region.

At the time of writing (February 2022), JLR is still in the midst of its latest transformation programme, 'Project Reimagine', which was announced in February 2021.[34] The implications of this, in particular the practical consequences of the switch to producing primarily electric vehicles and where it will source batteries and other components from, are yet to be divulged to the public. The ongoing uncertainty with JLR thus leaves a major cloud over the region. Hence, the analysis contained within takes the approach of assessing the current state of the industry is in the region, and then identifying what would be needed to be put in place to ensure continued (electric) vehicle production and sourcing within the region. In the material that follows we assess the issues that will impinge on the ability of suppliers to cope with a shift to EV (drawing on insights derived from our interview participants) and to identify any actions they are undertaking to adjust, before examining the perspectives of the workforce (drawing on survey data in Chapter 8 of the full report).

A key element of our research was on was on identifying feasible strategies for shoring up a viable domestic supply chain for EV in the West Midlands in terms of powertrain production (including key components, notably the motor), battery production and stampings and other "supporting" parts needed for batteries. Our findings suggest that UK supplier capability in many of these areas is distinctly patchy. In particular, the lack of domestic supply of electrical steel is a deficiency, following the decision of Tata Steel to close its Orb Electrical Steels plant in Newport (Wales) in 2019 and shift production of this to its plant in Surahammar, Sweden.

33 The regional studies academic literature refers to this as pursuing "related variety" or "unrelated variety" (e.g., Frenken et al., 2007).
34 Jaguar Land Rover Automotive Plc website. Accessed 23/03/2022.

Powertrain issues

Integral to the viability of a domestic EV supply chain - that is, one where as much value-added as possible is done in the UK, as opposed to just final assembly - is the production of electric motors in the UK. However, these motors are essentially constructed from grades of steel that are no longer produced in the UK, which hence will need to be imported into the UK (most likely from the EU) given that domestic production has ceased, a point we return to below. JLR has said it plans to make some motors at its i54 site near Wolverhampton as production of internal combustion engines declines, while Ford has said it will make electric motors at Halewood on Merseyside. However, it is not clear – at either company – whether this will be a full manufacturing activity, using UK suppliers, or if the motors will be assembled from imported components.

For UK assembled motors to use UK made parts, a new supply chain needs to be established. This would start with **a viable economic logistics chain from the steel mill to the UK, to a service centre which can de-coil electrical steel and slit it into strips/blanks ready for stamping into laminations** (a key component) for motors.[35] Each of these stages requires dedicated equipment and for several stages, e.g., producing laminations, this **dedicated machinery does not appear to yet exist in the UK**, certainly not at a level capable of making laminations in the volumes required for the automotive industry; moreover, many of the companies which could make such parts, if they had the right equipment installed do not have automotive supplier qualifications; the barriers to entry for a supplier could be significant.

It is worth noting that the steel used to make laminations is very thin, as thin as <0.2mm, in order to reduce the eddy current[36] losses that can inhibit the efficiency of the motor. As such, the more 'thin laminations' that can be inserted into a motor, the greater the reduction in eddy current losses, and therefore the more power the motor can generate whilst also becoming smaller. In turn, the smaller and more powerful the motor, the less power is needed from the battery. This is why VMs want to control motor development and production, and also why the production process requires new investment in appropriate equipment.

Battery production

Whilst there are opportunities for the UK in terms of battery production, as the current policy focus on the establishment of 'gigafactories' would attest, there remain a number of significant challenges to overcome. All too often, the establishment of a gigafactory is almost seen as a fait accompli, with less attention focussed on the practicalities of securing value-added in the region, for example, this statement in the WMCA[37] Five Year Plan 2021-26: *"Most jobs created in the WMCA will be in manufacturing low emission vehicles, battery packs and modules in gigafactories situated near existing production sites"*[38], which is never unpacked into its necessary subcomponents.

35 For example, see: Motor laminations, E- Mobility Engineering. Accessed 23/03/2022. A motor lamination is a part that forms "the core of an electric motor's stator and rotor. They consist of thin metal sheets that are stacked, welded, or bonded together. By making them from individual pieces of metal rather than a solid piece, they experience less eddy current losses" and thus improve engine efficiency and performance. These parts are typically made from metal alloys such as nickel alloys and cobalt-iron alloys (ibid.).

36 Eddy currents are "closed loops of electric current induced in conductors by changes in magnetic fields, circulating in planes perpendicular to the magnetic fields. According to Lenz's law, eddy currents create their own magnetic fields that oppose changes in the initial magnetic fields that created them," reducing efficiency. See: Motor laminations, E- Mobility Engineering. Accessed 23/03/2022.

37 WMCA stands for West Midlands Combined Authority

38 West Midlands Combined Authority (WMCA) (2020), *'WM2041: Five Year Plan 2021-26'*, p.77. Accessed 12/01/2022.

Hence, it is not automatically the case that opening a gigafactory in the West Midlands (or any other region in the UK) will mean that it will automatically be chosen as the supplier for UK made vehicles, nor lead to an EV plant opening nor an existing ICE-powered vehicle plant being converted to making EVs. Electric versions of the Mini are made in Oxford and there is no battery factory in the UK for this – the batteries come from Germany (with key parts, the cells, coming from Poland and Asia). As such, supplying cells over long distances already takes place and will continue to do so in the future; for example, the distance from Northvolt in Sweden to BMW in Leipzig, the most northerly BMW Germany factory, is at least 1,200kms by road and boat. This suggests that it is not axiomatic that cells especially have to be located close the car plants where they will be used. Even so, it must be recognised that a future gigafactory - such as the proposed one at Coventry airport – will need an anchor tenant or operator and it is difficult to conceive of a gigafactory being kitted out without such an operator winning a UK supply contract.

Moreover, exactly what future battery factories will actually do could vary significantly. Also, there is no standard definition of what a gigafactory is or means; gigafactories could encompass several possibilities:

1. They could be **fully vertically-integrated operations** – as will be the case at Envision for Nissan in the UK – making cells and assembling these into complete batteries.
2. Or it could involve **manufacturing and supplying cells** and/or modules (which are sub-assemblies of a number of cells) to other locations for assembly into finished batteries.
3. Or it could involve **importing cells** for assembly into modules and/or battery packs.
4. Or it could be **a combination of the above**, doing different things for different customers.

An added complication is that there are several different battery cells – cylindrical (the "AA" style cells used by Tesla), pouch or prismatic cells. Each cell type offers different options in terms of packing configuration and the shape and size of the battery pack; the power output and driving ranges required may lead a vehicle company to prefer one cell type over another.[39] The manufacturing process for each cell type is different, i.e., a cell manufacturing line cannot make more than one type of cell, so knowing the requirements of the end customers is essential. In addition, the battery cell market is still evolving technologically and there is no guarantee that the currently favoured types of cells will end up as the long-term dominant technology choice of the industry; BMW, Ford and Toyota for example are especially active in the development of solid-state batteries, which are a different design entirely to cell-based batteries; and a solid-state battery factory would employ very different manufacturing equipment to a cell factory.

Hence, in a similar fashion to the powertrain production chain production issues explained above, the same imperative must be to capture as much value-added (mining, refining, cathode production, the production of cells etc.) in the UK as possible. The attitudes of major companies, including VW, Mercedes and Stellantis, and their recognition of the value-added which batteries represent, have been made clear regularly in these companies' statements regarding new battery plants, which

39 There is also a lot of innovation in battery design, with new batteries – using different combinations of minerals and electrolytes - for longer life and better durability. It is unclear whether any gigafactory proposals could "pick a winner" in terms of battery cell types for example.

will either owned by or directly controlled by the vehicle companies.[40] There is thus a trend to more vertical integration, with the possibility that it will increase given resource scarcity in battery minerals.

Battery sourcing options for JLR

Battery sourcing options for JLR remain unconfirmed; CEO Thierry Bolloré had suggested that JLR would confirm its battery sourcing plans by the end of 2021. In an interview in the Financial Times in June 2021,[41] Bolloré also said he wanted to secure as much of the battery chain as possible close to JLR's UK plants. At the time of writing there has been no formal announcement of JLR's battery sourcing plans. JLR will likely outsource cell production (it does not have the volumes to justify its own cell production, nor arguably the financial resources to fund this). The key issues at stake are the cell suppliers and their location(s) for the assembly of modules and full battery packs.

Some UK press outlets have suggested that JLR will use Britishvolt, but this is far from certain; the backers of the proposed gigafactory at the former Coventry airport site also hope that JLR will source batteries from this site. JLR already has experience of using LG for the batteries for the I-PACE made in Austria, so LG has a potential advantage here especially in terms of how it is perceived by JLR as a supplier. Battery sourcing for the new Jaguar range will be partly determined by the base platform used for these vehicles; if the base platform for the new Jaguar range is bought-in, then it is highly likely that the cells and possibly complete batteries will be sourced outside the UK from the same supplier(s) as for the base platform.

It is also worth noting that JLR could actually carry out the final assembly of some batteries at Castle Bromwich (it has committed to re-purposing this plant once vehicle assembly stops and battery assembly would be an obvious task for the factory, possibly assembling imported cells). That said, depending on the volumes involved in the first JLR UK-made EV (due in 2024), this could well have a battery which is fully assembled outside the UK, but over time we would expect at least some of the module and battery assembly to take place in the UK, for the UK-made vehicles. JLR will also want to make full use of the Castle Bromwich site and its relative proximity to Solihull – and the lack of space there at Solihull – means that Castle Bromwich could be used for battery assembly.

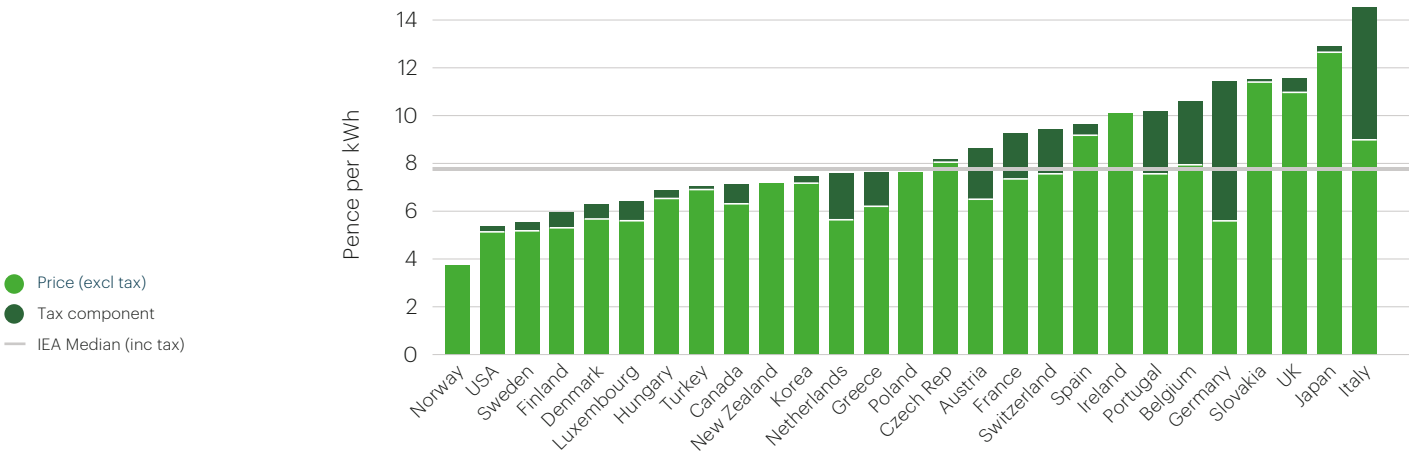
The cost of electricity

The rising cost of electricity will be a major concern for companies seeking to undertake battery production, particularly in components such as cells, which are energy-intensive to produce. There is certainly a strong logic in sourcing batteries close to where EV production takes place, but it is counterbalanced by a logic to locate battery production near a reliable and inexpensive renewable energy source. As such, as alluded to above, it could be that only some elements of battery production can economically take place in the UK, as the costs of energy could be a deciding factor in how much value-added is done in the UK. Accordingly, we provide information on the comparative costs of electricity per KwH for IEA countries, as depicted in Figure 1 below.

40 'VW, Stellantis, Renault enter new Battlefields EV race', *Automotive News*, from August 2021 is a very good summary of the situation. Accessed 23/03/2022.

41 'Jaguar Land Rover to overhaul supply chain to avoid factory closures' *Financial Times*. Accessed 23/03/2022.

Figure 1: Pence per kWh for IEA countries, 2019



Source: BEIS[42]

Evident from the above is that the UK faces a significant competitive disadvantage in the production of any battery component that is energy-intensive; especially that of cell production. Indeed, battery cells represent approximately 40% of the value-added in an electric vehicle[43]. From the table it is apparent that Sweden, Hungary and Poland, plus France to a lesser extent, have much lower energy costs than the UK – and Sweden, Hungary and Poland all feature prominently in the planned growth in battery cell production over the next few years.[44] In this context, the more recent inflation rise to a thirty year high of 5.4% in the 12 months leading up to December 2021[45] will only add to the costs of production in the UK. With the lifting of price caps on energy in April 2022 expected to contribute to a 65% increase in energy bills since 2020 for energy-intensive sectors including automotive, the severe cost pressures facing any UK-based manufacturer will only be compounded.[46]

As an example for illustrative purposes, Yuan et al. conclude that making a 24kWh LMO graphite battery pack (e.g., for the Nissan Leaf which has 192 cells) uses approximately 89GJ of energy, of which nearly 30GJ is embedded in battery materials (mining etc.), nearly 59GJ in cell production and 0.3GJ in assembly.[47] Hence, a key policy implication here is **if production of cells is to take place at a UK gigafactory, then this will need to be presaged by a UK Government 'deal' on a reduced tariff for electricity**. There is a strong case to be made for cell production to receive support as an energy intensive industry.

42 BEIS (Department of Business Energy and Industrial Strategy) (2022), *Industrial electricity prices in the IEA* (QEP 5.3.1). Accessed 6/01/2022.
43 EES, 2022.
44 Ibid.
45 'Inflation rises to 5.4% in December 2021: can any savings rates beat it?', *Which*, 19 January 2022. Accessed 23/03/2022.
46 'Businesses warn of a joint £1bn energy bill amid price rises', *Energy Live News*, 1 February 2022. Accessed 23/03/2022.
47 Yuan, C., Deng, Y., Li, T. and Yang, F. (2017) 'Manufacturing energy analysis of lithium ion battery pack for electric vehicles' *CIRP Annals*, 66(1), pp. 53-56.

Skills gaps

In considering the implications of skills gaps emerging in the sector, we agree with Bauer et al., who argue that **it is necessary to develop digital technologies (sic. Industry 4.0) as a core competence in the automotive industry** and as a means of value creation and employment in cell production, mobility services and autonomous driving.[48] This is discussed at length in our full report. However, it is notable that our survey of workers found that a (surprising) majority stated that they had not received any training from their employer to help them adjust - 85% of our respondents reported that they had not been offered any training or upskilling by their employer to help them prepare for the transition to the production of the new vehicles, and only 11% had undertaken any training of their own volition.

In this context, workers were asked to rank what they considered the top 3 government policy priorities should be to assist transitioning within the automotive industry. Of the number 1 policy priority, 25.4% reported that this should consist of 'access to training for workers to acquire new skills', 19.7% suggested this should consist of focussing on 'supporting as much of the existing workforce as possible', whilst 14.8% reported that this should consist of a 'phased end (i.e., beyond 2030) to petrol and diesel vehicles to give companies and workers time to adjust'.

There are thus clear implications for policy and practice in terms of developing an integrated skills strategy, and the need for this to be formulated on a collaborative basis, which we discuss at length in our full report.

Innovation support and EV infrastructure issues

Additional issues arise around the implications of skills gaps for innovation and the types of support available to help suppliers adjust. This will require more innovation funding and sufficient available venture capital for businesses. Whilst our participants were generally supportive of Government initiatives in this regard, there were some criticisms that bodies such as the Manufacturing Technology Centre (MTC) in Coventry or Innovate UK lacked penetration with smaller businesses further up the supply chain:

> *…. it's sometimes difficult to get the right lead, and the right company who's going to show commercialisation, the stage that we're at, so I think opportunities within Innovate UK type structure to help smaller collections, to innovate would be really great for us, we don't necessarily need to be part of a 2-million-pound consortium, we can do really useful stuff on a smaller budget, or perhaps we just need a bit of help. Being properly introduced, kind of getting those schemes going would be really useful to us (Interview 3).*

However, there were also criticisms that they were not always "ahead of the curve" in terms of promoting new technology:

> *… it's like, well, how are you [the MTC] going to advise us on pieces of kit that we got and had for years that are better than yours? It was never, you know, so there's some elements of it that are flawed. I think generally its good, the reach of them, but the benefits of them not well articulated or shouted about at all. Considering I've been in stamping for 15 years, it was only last year that I found out there was an advanced manufacturing catapult in Strathclyde, for metal forming, so that they don't have a machine anywhere near what mine are (Interview 1).*

48 Bauer, W., Riedel, O., Herrmann, F., Borrman, D., Sachs, C., Schmid, S. and Klotzke, M. (2018), *Effects of vehicle electrification on employment in Germany,* ELAB 2.0, Fraunhofer Institut fur Arbeitswirtschaft und Organisation.

Finally, turning to the EV charging network side, our findings suggest that the charging network in the UK is in need of a major expansion, with a lack of capacity to cope with the expected volumes of EVs on the road after 2030. As of January 27th 2022, there were 48,820 connectors and 29,067 devices at 18,266 locations across the UK. Of these, the number of "rapid charging points" consisted of 11,715 connectors for 5,032 devices at 3,273 locations across the UK, for which Tesla Supercharger held the largest market share, at 15.1%.[49] The charging network thus needs to be dramatically expanded if the UK Government's stated target of ceasing ICE vehicle production in 2030 is to be met. These issues can only be met through increased resourcing.

49 Zap-Map (2022), *EV Charging Stats 2022*. Accessed 27/01/2022.

Conclusions

In this study we have sought to analyse the issues pertaining to a Just Transition for the automotive sector, drawing upon primary and secondary data from the UK and Australia, focussing on suppliers and workers. The Australian experience has provided salutary lessons for the UK as to what can happen to jeopardise the continued existence of an automotive industry if market conditions mitigate against the viability of a domestic production sector in the absence of pro-active industry policy at the heart of government. The Australian case highlights that existing production capabilities can disappear, in all likelihood leading to persistent pockets of unemployment in affected regions. This risk can only be avoided by the establishment of new job-creating production capability in emerging industries, such as EV production. The skills-sets held by workers in the existing ICE are a national asset that could be reinvigorated with appropriate investments in the new skills that will be required for industry 4.0.

The importance of the automotive sector to the West Midlands is clear from our analysis. The region is by far the largest employer, turnover generator and value-added creator in the UK automotive industry. Moreover, it is a truism to say that the health of the regional economy depends on the health of JLR especially, and its manufacturing investments in the region. The WMCA[50] are all too aware of the prospects of mass redundancies in the sector as EV switching, fuel switching (HGVs/Buses/Taxis), demand reduction due to working from home (WFH) and trips (e.g., more home deliveries), and an anticipated increased use of public transport and vehicle sharing schemes combine to generate job losses in ICE vehicle manufacturing. Whilst a precise figure of probable job losses is not mentioned, the plan (p. 83) does mention that 140,000 jobs will need to "re-skill as result of transition" (11.1% of the WMCA workforce). Hence, regional policy makers need to liaise closely with JLR as the decisions regarding the location of JLR battery manufacturing and assembly facilities, which may be operated by suppliers as opposed to JLR, have not yet been made.

50 West Midlands Combined Authority (WMCA) (2020), *WM2041: Five Year Plan 2021-26*. Accessed 12/01/2022.

Policy recommendations

Hence, our analysis strongly suggests that policy needs to focus on two areas: **general support and improvements to the area's infrastructure and general business environment (transport links, potential help with energy costs etc.)** and more significantly **assisting with the transition to an electric vehicle manufacturing focus for West Midlands automotive**. Specifically, helping to secure a battery plant, either an assembly plant or a fully vertically integrated factory which encompasses cell production plant as well as battery assembly, should be top of the local and regional policy makers' objectives – and this has to start with a clear understanding of the needs and intents of VMs in the region. **If production of cells is to take place at a UK gigafactory, then this will in all likelihood need to be presaged by a UK Government 'deal' on a reduced tariff for electricity**. This is because as much as 2/3 of the embedded energy consumed in the production a battery is in the cell production phase; most of the rest is incurred in the raw material mining phase. There is a strong case to be made for cell production to receive support as an energy intensive industry.

Hence, current talk of a establishing a 'gigafactory' obscures the problems we have identified in securing as much value-added as possible in the West Midlands. **Helping the region's existing supply chain firms to assess what they need to do re-orientate themselves towards the new EV or zero carbon economy is essential**. There is a case for reinstating a regional service akin the MAS (Manufacturing Advisory Service), which was discontinued in 2016. **It is also essential that a Skills Strategy is developed to ensure that both VMs and supply chain firms can recruit as well as train and retrain workers so that they have the skills needed for electric vehicle production**.

Broadly speaking, there are policies that could be actioned at a regional level (e.g., in the UK by the West Midlands Combined Authority in concert with local government and other regional agencies), whilst others above would require action at a national level. In terms of regional actions (our specific recommendations focus on the West Midlands, also having drawn on the Australian experience), to augment current efforts to maximise domestic value-added in EV production, these should include:

- Establishing a Register of firms in the supply chain who want to work with VMs in transitioning to EV production, by developing a Capacity Directory which lists what products and processes firms can provide;
- Appointing a Supply Chain Champion to assist in delivering onshoring and growing local supply chain capacity;
- Working with the major VMs to understand which UK firms they wish to work with in the transition to EV component supply;
- Funding for training provision to assist suppliers to retrain and reskill their workers for the transition to EV production (and related areas such as the green energy supply chain).[51] This should include provision of training in digital skills and expertise;
- Establishing a Skills Taskforce consisting of VMs, supply chain firms, universities and colleges as well as private training providers to commission research and

51 This will also be critical for successful adoption of 'Industry 4.0' (see De Propris and Bailey, 2021; for a discussion).

intelligence gathering on skills requirements and skills shortages to enable the design of training and degree programmes that will meet skills requirements. The VW experience in Germany demonstrates that it is essential that this is done in a collaborative basis;

- VMs and supply chain firms to work together on skills requirements; supply chain firms to be integrated into training programmes of VMs. This is essential to ensure coordination of skills training in order to improve quality assurance and productivity to achieve competitiveness in the emerging EV production system (the German term is 'ecosystem').[52]
- Shoring up the supply chain by measures (subsidies/tax relief/equity stakes etc.) to make domestic production of key powertrain components such as motor laminations viable;
- Improving information sharing across the supply chain to enhance the potential for innovation;
- Suppliers should be able to access a loan fund to assist with restructuring their operations. This has been a key policy response used in previous plant closures such as that of MG Rover and also in response to the 2008 Global Financial Crisis (GFC);
- Potential business tax/rates holidays – as De Ruyter et al.[53] identified, business rates have generally been seen as a disproportionate cost burden borne by UK manufacturing companies, especially when compared to equivalent taxes levied in other EU countries;
- Providing specific diversification support for firms in the industry. This was significant with individual plant closures such as MG Rover, and in response to the GFC (in this case via the Automotive Response Programme);
- Much more investment is needed in increasing the capacity of on-road/car park EV charging infrastructure – this could serve as a key job creation policy as well as augmenting the skills base in green energy workers;
- Set up a National Transition Centre for Sustainable Employment. This can be used to raise awareness of the profound changes that are going to occur in the automotive industry. This to include the development of measures to safeguard jobs or to ensure they are reduced in a socially responsible way. The UK can draw on Volkswagen's experience in this regard[54];
- Prioritising local procurement strategies for the public sector, in accordance with the UK's obligations under international trade agreements;
- Establishing special enterprise zones with excellent connectivity and a range of tax incentives. These should be centred on existing areas of automotive specialisation, building on existing clusters of expertise and support the growth of cutting-edge technologies in the region. Incubation of scale-up firms is another important area of focus;
- Producing a Green Industrial Strategy prioritising accessible low-cost green energy;
- Developing a Green Business Hub to promote regional buying, selling, sourcing and best practice exchange, and;

52 Herrmann, F., Beinhauer, W., Borrman, D., Hertwig, M., Mack, J., Potinecke, T., Praeg, C. and Rally, P. (2020) *Employment 2030: Effects of electromobility and digitization on the quality and quantity of employment at Volkswagen; final report*, (Translated from German), Fraunhofer Institut fur Arbeitswirtschaft und Organisation.

53 De Ruyter, A. and Brown, M. (2019), *'The Gig Economy: Old Wine in a New Label?'* Agenda: Newcastle-upon-Tyne.

54 Herrmann, F., Beinhauer, W., Borrman, D., Hertwig, M., Mack, J., Potinecke, T., Praeg, C. and Rally, P. (2020a) *Employment 2030: Effects of electromobility and digitization on the quality and quantity of employment at Volkswagen;* final report'. Stuttgart: Fraunhofer IAO

- Launching a Green Skills Hub involving West Midlands' schools, colleges, universities and businesses prioritised in light of skills shortages already evident in preparing and readying for the transitional skills required.[55]

55 McCabe, S. and Nielsen, B. (2021), 'Green Manufacturing, what this involved and how to achieve success', In Nielsen, B. and McCabe, S. (eds.), *Exploring the Green Economy: Issues, Challenges and Benefits*, chapter 14, Bite-Sized books.

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