Submission to the Economics Reference Committee: the Australian manufacturing industry

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Dear Members of the Economic Reference Committee,

I thank you for the opportunity to make this submission to the Committee's inquiry into the Australian manufacturing industry. I make this submission as the Laurie Carmichael Distinguished Research Fellow on behalf of the Carmichael Centre within the Centre for Future Work at The Australia Institute.

The Carmichael Centre at the Centre for Future Work (part of The Australia Institute) is named in honour of Laurie Carmichael, a legendary manufacturing unionist who passed away in 2018 at the age of 93. To carry forth the important ideas that Carmichael promoted throughout his career in the union movement, the Carmichael Centre conducts research on themes related to Carmichael's legacy, including industrial relations, social policy, manufacturing and industry policy, vocational education, and international labour solidarity.

This submission to the Economics Reference Committee's inquiry into the Australian manufacturing industry draws on the Carmichael Centre's promotion of active industrial policy for manufacturing industries and seeks to highlight the ***significant potential for Australia to rebuild its once world-class automotive manufacturing industries in step with a renewable energy driven future***, through the development of Electric Vehicle (EV) manufacturing industries.

Further to making this written submission, I will be happy to provide any additional information as requested.

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1. Summary

Global automotive manufacturing is rapidly transitioning to the production of Electric Vehicles (EVs) in line with the global community's commitment to addressing climate change. This transition represents an enormous opportunity for Australia to focus on efforts to rebuild its manufacturing industries in ways that take advantage of our competitive strengths in renewable energy, innovative transformations to extractive industries and expansion of manufacturing capabilities.

Australia possesses many of the crucial elements for an EV manufacturing industry – rich mineral reserves, an advanced industrial base, a highly skilled workforce, and consumer interest. But what it lacks is an overarching, coordinating and strategic national industry policy at the federal level, which as global experience shows, is central to EV-oriented industrial transformation. Australia can play an important role in global EV manufacturing industries but developing a strategy to make this a reality will require active government policy responses to the challenges and opportunities at hand.

2. The role of the Australian manufacturing industry – past, present, future

Australia's manufacturing sector was shaped around automotive manufacturing industries for nearly 100 years. The production of Internal Combustion Engine (ICE) vehicles and ICE vehicle components by a large range of local Australian enterprises for several major overseas producers provided skilled jobs to thousands of Australians until the last completed Holden rolled off the production line in 2017 at General Motors-Holden (GMH) in Elizabeth, South Australia. A report by the Allen Consulting Group in 2013[1] showed that the automotive industry contributed $21.5 billion to the community annually. It calculated that for an investment of $18 per auto industry worker, $934 was returned to the economy.

Political decisions to end automotive manufacturing in Australia were short-sighted and bucked the trend of strategic, long-term industry policy and planning adopted by the world's leading economies including the United States, Germany, Japan, China, and other advanced industrial nations. The renewed global interest in active industry policy demonstrates an implicit understanding that manufacturing carries a unique strategic importance to economic growth and development.

Manufacturing underpins the historical development of all advanced industrial nations. Manufacturing is a knowledge- and technology-intensive activity central to the process of economic development; its activities form the foundations of more economically complex and competitive economies. This is a fact evidenced throughout modern

[1] Allen Consulting Group (2013), *The Strategic Role of the Australian Automotive Manufacturing Industry*, Report to the Federal Chamber of Automotive Industries (Melbourne, Australia).

history, detailed in studies that highlight the central role of manufacturing in all stages of the development of industrial nations.[2] According to Stanford,[3] manufacturing is not just another sector; rather, it carries strategic importance:

- Manufacturing is the most innovation-intensive sector in the economy.
- Manufacturing anchors hundreds of thousands of other jobs throughout the economy, through its long and complex supply chains.
- Manufacturing offers relatively high-quality jobs, more likely to provide full-time hours and above-average incomes.
- Manufactured goods account for most of international trade, and hence an undersized manufacturing sector will contribute to trade deficits and balance of payments problems.

2.1 Manufacturing industry drivers of growth

The Harvard University concept of 'economic complexity' – in essence, the notion that 'what a country makes is what it knows' – reflects the implications of a nation's strategic choice to position manufacturing as its 'engine of growth'. In its global rankings, Harvard University placed Australia at number 87 of 133 countries on measures of economic complexity. This ranking is unenviable, given the fact that all advanced industrial nations to which Australian politicians often compare our own economy rank well within the top 20 for economic complexity (including those mentioned above).

In terms of industrial development, Australia's economy presently lags far behind virtually all other advanced industrial economies. For several decades, Australia has relied disproportionately on a boom in mining resources and positioned its extractive industries at the forefront of economic growth. This strategic direction has been pursued to the detriment of advanced manufacturing industries that are of higher export value and more competitive and resilient over the longer cycle of economic development.

Australia, arguably, ranks poorly in terms of economic complexity because Australian governments have for decades now explicitly or implicitly embraced an economic development policy posture of 'comparative advantage', meaning that those industries which reflect some 'natural endowment', or attribute are favoured in policy responses to shape economic development and export orientation. Unfortunately for Australia, by this simplistic view our comparative advantage is in resource extraction which, despite

[2] Kaldor, Nicholas (1967). 'Strategic factors in economic development', Frank W. Pierce memorial lecture series, October 1966. New York State School of Industrial and Labor Relations, Cornell University; McCausland, W David, and Ioannis Theodossiou (2012). 'Is manufacturing still the engine of growth?', *Journal of Post Keynesian Economics* 35(1): 79-92; Porter, Michael E. (1990). 'The competitive advantage of nations', *Competitive Intelligence Review* 1(1): 14-14; Wang, Miao (2009). 'Manufacturing FDI and economic growth: evidence from Asian economies', *Applied Economics* 41(8): 991-1002.

[3] Stanford, Jim (2020). *A fair share for Australian manufacturing: manufacturing renewal for the post-COVID economy.* Centre for Future Work at The Australia Institute (Canberra, Australia).

occasional periods of high prices in global commodities markets, does not lead to long-term economic growth or translate to increased economic complexity.

Meanwhile, the top-ranking nations for complexity all pursue policies of 'competitive advantage' – a posture that pro-actively favours industries that lead to greater and increasing returns in the long term. This occurs because of investments that maximise the quality and value added to processes and products for export to global markets, and in turn broaden the scope of economic complexity which promotes innovation and networking through diverse sectors of the economy.

The development of a manufacturing industry policy represents a distinct possibility from which to rebuild Australian manufacturing capabilities and expand our industrial capacities, given our historical knowledge and infrastructure endowments. A rebuilding of Australian manufacturing spurred by the domestic growth of Electric Vehicle (EV) and EV component manufacturing industries is a pathway by which Australian industry can achieve goals of competitive advantage.

It is important for Australia to capture a valuable share of the global shift towards the production of EVs by planning and developing a domestic industrial response to the coming global opportunities for EV production and use, leveraging our capabilities in extractive industries and in residual manufacturing industry supply chains. Australia could capture a significant share of global manufacturing via an industry policy that leverages the possibilities of renewable energy technologies while also making use of our historic presence in automotive manufacturing.

3. Opportunities for developing and expanding existing manufacturing industries

A strategically designed EV industry policy in Australia would build positively on existing industrial capabilities, contribute to innovation in burgeoning renewable energy ventures, and prepare highly skilled workers for a sustainable future of work. Australia's endowments of natural resources, skilled workers, institutions, and industrial capabilities make EV industry development a viable social and economic strategy.

However, the shuttering of automotive manufacturing by 2017 also resulted in the loss of many of Australia's manufacturing capabilities. Some have been retained, but in many ways, these are niche elements that lack integration with other domestic industries. The overall manufacturing sector and the Australian economy at large ought to be strengthened and expanded so that the nation can respond to growing global demand for the new electrified age of vehicle manufacturing.

3.1 Capacities and capabilities in extractive industries

For decades, Australia's manufacturing sector played the primary role in driving the nation's high standards of living. But in recent decades, the commodities boom has overshadowed manufacturing to its detriment. Data compiled by the Department of Foreign Affairs and Trade (DFAT)[4] and summarised in Table 1 below shows that Australia's major exports in 2018-19 were dominated by minerals & fuels exports, with services placing second and manufactured goods at a distant third, just ahead of agricultural (rural) exports.

Table 1: Australian Total Exports by sector* 2018-19 ($b)

Sector	Value ($bn)
Minerals & fuels	239.3
Services	97.1
Manufactures	54.0
Rural	47.9

* Balance of payments basis.
Source: International Trade in Goods and Services, Australia – May 2021 (ABS 2021)[5]

As DFAT further reports, none of Australia's manufactured products feature in its top 20 exported products; instead, a range of minerals & fuels exports and some services comprise this mix. Hence, there is a significant need for Australia to reconsider its over-reliance on commodities exports and develop a strategic plan to shift towards value-adding industries that will help to restore the nation's economic complexity. This will entail driving the share of manufactured goods to higher (if not the highest) position on the export table. A much larger share of manufactured goods in Australia's top net exports will also support the success of high-value services industries, that so often accompany manufacturing industries, in the list of top Australian exports, increasing Australia's GDP and economic complexity overall.

In a further breakdown of DFAT's data on commodities exports, aluminium ores & concentrates ($11billion) and precious metal ores & concentrates ($1.4billion) are examples of commodities that could be transformed into elaborately manufactured products in Australia through value-adding processes, instead of exported as raw materials with little or no added value.[6] Not only would this increase the value of our

[4] DFAT (2020). *Trade and Investment at a Glance.* Department of Foreign Affairs and Trade, Australian Government (Canberra, Australia).
[5] ABS (2021). International Trade in Goods and Services, Australia – May 2021. Australian Bureau of Statistics (Canberra, Australia).
[6] Even aluminium ore can be refined into 'alumina' which attracts higher export prices than raw bauxite.

exports by an order of magnitude, but it could serve as the basis for further transformations of commodity exports into manufactured components.

3.2 Transforming comparative advantages into competitive strengths: The case of lithium

Australia is the world's largest producer of lithium by a significant margin – 42,000 tonnes in 2019 compared to second-place Chile with 18,000 tonnes.[7] In aiming to build industrial strengths around value-adding to raw lithium deposits onshore, Australia can develop manufacturing capabilities which transform key commodity inputs into lithium-ion batteries and battery components in a domestic industry. Table 2 below summarises figures from the Global Battery Alliance[8] that estimate the far greater GDP and jobs Australia can gain by participating in the higher value-adding phases of battery and component production, as opposed to only extraction and refining.

Table 2: Grid scale battery value chain opportunities to 2030

Phase	Factor share (%)	USD$ (billions)	AUD$ (billions)	New jobs created
Mining	2.8	11.2	14.9	11,180
Refining	24.5	98	130.4	97,829
Active materials	8	32	42.6	31,944
Cell	45.2	180.8	240.6	180,484
Pack	15.7	62.8	83.6	62,290
Reuse and recycle	3.8	15.2	20.2	15,173

Source: Calculations based on data from Global Battery Alliance (2019) and various company reports.

Australia does not possess the industrial scale to match major competitors like China and Germany, nor does it need to. A significant number of high-skilled manufacturing jobs can be created with development focused on secondary processes in the EV value chain that would still add considerable complexity to our economy. Where Australia presently exports its lithium as a commodity, this will not lead to long-term economic growth tied to manufacturing industry development, nor the higher-paid, higher-skilled jobs and advanced industrial base founded on sustainable energy transformations. Taking this approach ultimately builds potential for Australia to become a net exporter of EV batteries (after value-adding processes) to the major automotive industry markets of the world.

[7] USGS (2020). *Mineral Commodity Summaries 2020*. US Department of Interior; US Geological Survey (Washington DC, USA).

[8] Global Battery Alliance (2019). *A Vision for a Sustainable Battery Value Chain in 2030: Unlocking the Full Potential to Power Sustainable Development and Climate Change Mitigation*. World Economic Forum (Geneva, Switzerland).

Taken together, a value-adding approach reorients Australia's mining infrastructure to play a critical role in the transformation of Australian manufacturing industries. Complex, elaborate supply and value chains would link processes from extraction through to processing and production and ideally become the underpinning features of an elaborated industrial strategy. Therefore, a 'greening' of mining initiatives in Australia is a major priority to achieve this.

3.3 Linking manufacturing to Australia's natural advantages in renewable energy

In *Powering Onwards*, Nahum[9] argues that Australia possesses a competitive advantage in the production of renewable energy, and that in turn, this can be utilised to power the value-added processing of raw minerals extracted from Australian mines.

Green hydrogen production, hydrogen-based steel, and aluminium processing using renewable energy are key examples of innovative technologies already being deployed in other parts of the world. If Australia took advantage of its abundant renewable energy reserves, it could sustain mining projects that extend to the manufacture of a host of products – particularly lithium-ion batteries.

With Australia's potential opportunities to push its exports up the value chain, the production of batteries can benefit from the input of workers in labour processes – from initial mining and refining, through to chemical transformation and manufacturing assembly of complex components into batteries. This indicates not only enormous R&D opportunities, but possible advantages driven by workers designing and refining the very processes of EV battery manufacture and potentially a range of other components for installation in EVs for domestic and global markets.

With investment and active government commitment, this strategy is achievable. Australia possesses residual advantages in manufacturing capabilities, engineering, R&D and skilled labour. By forming a strategy around these and other embedded capabilities, Australia can occupy an advantageous position in the global supply chain, building its capacity in niches that reflect enormous renewable energy and technology competitive advantages. The other building blocks of an economic strategy that build on various sectoral strengths in the form of an EV manufacturing industry policy are detailed below.

3.4 Capacities and capabilities – high-skilled workers

Australia will require the skilled labour to drive the growth and development of sophisticated supply chains, adding value to commodities through new EV-related manufacturing initiatives like battery production (discussed further below). Skills for

[9] Nahum, Dan (2020). *Powering Onwards: Australia's Opportunity to Reinvigorate Manufacturing through Renewable Energy.* Centre for Future Work at The Australia Institute (Canberra, Australia).

working in EV-related industries may be underdeveloped in Australia at present, but highly skilled automotive manufacturing workers can be retrained to work in these growing industries with the right policy settings for Vocational Education and Training (VET), chiefly a well-funded TAFE system.

A TAFE-based delivery of new and updated Training Packages for apprentices and trainees will be essential to prepare skilled labour for EV manufacturing and service industries. Multiple submissions to the Senate Select Committee on Electric Vehicles[10] highlighted Australia's decades-long labour and trades-related experience in component manufacturing, electrical engineering, body work and even after-sales mechanical servicing and maintenance.

Australia's VET system, particularly the publicly funded TAFE system, is the natural home of skills provision for the automotive industry. It is therefore central to providing these requirements to EV industry workers that would be required for a sector-wide transformation of manufacturing towards the decarbonisation of transport systems. The adequate delivery of training and skills to meet requirements will need to provide new skills in EV qualifications to learners that have already commenced traditional automotive VET pathways (i.e., those related to ICE manufacturing industries); and whole new units of competency and other forms of learning will be required to service what would eventually become an automotive industry centred on EV production, maintenance, and services.

3.5 Capacities and capabilities – capital equipment

The COVID-19 pandemic quickly exposed the gaps in Australia's supply chain and concerning dependence on the import of manufactured equipment needed to fight an unprecedented global health crisis. Once the Abbott government abandoned automotive manufacturing, within years, much of Australia's major industrial infrastructure was shut down, with many expecting the equipment to be sold off and shipped away. However, in a tour of the GMH factory at Elizabeth, South Australia, journalist Royce Kurmelovs reported a situation in which:

> Across the complex, steel towers rise into the air, still able to lift a car body into the ceiling for transport elsewhere. Spare parts sit on old conveyer belts. An entire crane system is in perfect working order.[11]

In numerous submissions to the Senate Select Committee on Electric Vehicles, references to Australia's 'residual engineering capacity' were made, highlighting the potential of existing industrial infrastructure to be revived in the form of an EV industry. Given that presently a great deal of technologically advanced manufacturing capital sits

[10] The Senate (2019). *Select Committee on Electric Vehicles – Report*, Parliament of Australia, Commonwealth of Australia (Canberra, Australia).
[11] Kurmelovs, Royce (2021). '"All the bones are there': could a new electric vehicle be built in Australia?' *The Guardian* (28 February).

idle in unused industrial sites, assembling the capital stock required to build an Australian EV manufacturing industry capacity could have a significant head start.

Further supporting this case, an understanding of Australia's manufacturing history reveals a sector intrinsically shaped by an automotive industrial base, setting in motion a pattern of capital investment, business activity and skills development whose legacy exists to this day. This has positioned automotive manufacturing as the major pillar of the manufacturing sector for generations, driving demand in other industries and sectors and stimulating research and development (R&D) that still ripples throughout the economy and sparks innovation processes far removed from car making.

3.6 Capacities and capabilities – manufacturing enterprises

A significant degree of innovative capacity must be nurtured amongst the Small and Medium Enterprises (SMEs) that make up the bulk of Australia's manufacturing sector. For decades, these firms also helped to support the skilled and knowledgeable manufacturing workers that served the healthy operation of automotive manufacturing in Australia.

Key large firms drove employment growth through expanding business investments when the automotive industry was fully operational in Australia, but more recently this has declined as many of the core capabilities of vehicle manufacturing have left Australia. As Stanford[12] has shown, although 86,000 businesses were registered as operating in the manufacturing sector as of June 2019, there were very few employees in most of these businesses and less than 500 companies in total had over 200 employees (see Table 3 below).

Table 3: Count of Manufacturing Businesses by Size

No. employees	0	1-19	20-199	200+	Total firms
2019	38,430	40,998	6,513	487	86,428
Share Total	44.5%	47.4%	7.5%	0.6%	100.0%
2007	41,182	44,177	10,191	756	96,306
Change, 2007-2019	-6.7%	-7.2%	-36.1%	-35.6%	-10.3%

Source: Stanford (2020), based on Counts of Australian Businesses, including Entries and Exits (ABS 2020).

Although major firms still dominate in terms of R&D spending and innovation, their performance is below international standards. The lack of investment from business can be understood in part by the progressive loss of industrial scale required to support supply chain expansion. It can also be inferred from the above data that in recent

[12] Stanford, Jim (2020). *A fair share for Australian manufacturing: manufacturing renewal for the post-COVID economy.* Centre for Future Work at The Australia Institute (Canberra, Australia), p. 57.

decades, collaborative projects that connected SMEs in supply chains became largely fragmented. Historically, such firms would 'cluster' together geographically, benefiting from the economies of scale and knowledge-sharing achieved by proximity to each other and larger primary firms (i.e. Holden, Ford, Toyota or their 'Tier 1' suppliers that maintained commercial relationships with a host of smaller component manufacturers linked to the primaries). It was common for employees to shift from one employer to another located nearby in the existing cluster of business, taking knowledge with them, and using it to contribute to innovation processes in their new role.

In the wake of the closure of automotive manufacturing in Australia, because there are very few if any larger firms with which to coordinate production efforts, and thus no reason for firms to share knowledge, the result has been an erosion of the networked knowledge-sharing and commercial collaborations that previously sustained a vibrant manufacturing sector. Efforts to develop new and innovative networks of knowledge-sharing and commercial development can be forged by grasping the enormous potential of manufacturing linked to renewable energies.

The present policy setting of the federal government operates to the detriment of strategic and targeted policy for manufacturing transformation in step with renewable energy technology developments. Table 4, below, contains figures that project how the federal government's current policy position favouring a 'gas-fired' recovery of industry will lead to enormous job losses in fossil fuel-intensive supply chain employment.

Table 4: Supply chain employment – losers, 2020-2050

Industry	2020	2030	2040	2050
Oil	-4,740	-4,550	-4,360	-4,170
Coal	-6,950	-6,780	-6,605	-6,435
Diesel	-4,535	-4,535	-4,535	-4,535
Gas	-3,755	-3,575	-3,395	-3,220
Lignite	-8,045	-7,875	-7,700	-7,535
CHP* Oil	-6,560	-6,295	-6,025	-5,765
CHP Coal	-9,595	-9,360	-9,120	-8,885
CHP Gas	-4,975	-4,870	-4,770	-4,665
CHP Lignite	-9,595	-9,360	-9,120	-8,885
Fossil Fuels total	-58,750	-57,200	-55,630	-54,095

*CHP: Combined Heat & Power
Source: International Energy Agency (IEA 2021)

In Table 5 below, data from the International Energy Agency (IEA)[13] forecasts the enormous employment creation potential of renewables-focused manufacturing

[13] IEA. 2021. *Net Zero by 2050: A Roadmap for the Global Energy Sector*. International Energy Agency (Paris, France).

industry policy. In this sense, the scale of opportunity from a wholescale and rapid decarbonisation of energy and industry is immense.

An EV industry based around battery and component manufacture represents just one significant winner in an entire manufacturing sector competing on sustainable technologies and green innovation. The strategy for an EV industrial transformation holds long-term benefits for not only battery manufacturing, but for the entire gamut of green technology industries and ventures.

Table 5: Supply chain employment – winners, 2020-2050

Industry	2020	2030	2040	2050
Battery manufacturing	n/a	7,878	6,052	7,898
Photovoltaic solar	1,009	2,088	2,753	3,884
Solar thermal	2,823	6,078	9,347	12,524
Wind (offshore)	2,326	4,915	7,215	8,590
Wind (onshore)	790	2,088	3,411	4,936
Geothermal	5,704	10,414	14,063	16,747
Hydro	2,144	5,974	10,059	14,353
Ocean	2,018	3,744	5,052	6,228
Hydrogen	506	1,194	1,940	2,686
Biomass & waste	1,781	4,587	7,150	9,688
CHP* Fuel cell	808	1,942	3,003	4,108
CHP Biomass & waste	2,703	6,294	9,428	12,402
CHP Geothermal	6,845	14,509	19,776	23,695
Small scale biomass & waste	1,492	3,909	6,287	8,608
Nuclear	3,969	10,584	17,199	23,814
Renewable and thermal energy total	34,918	86,200	122,735	160,160

*CHP: Combined Heat & Power
Source: International Energy Agency (IEA 2021)

4. Policy recommendations for an EV-driven future manufacturing industry

To achieve an EV-driven transformation of manufacturing industry in Australia, a transformative level of investment is required. This will need to come from public, private, and civil actors to drive the interventions and investments in the technologies and institutions that will make an EV industry possible.

An active role of government must be embedded in all industrial initiatives and in all market-based programs – developing secondary processes downstream from extractive industries, skills development, value and supply chain enhancement and industrial relations. Public and private partnerships to invest in R&D, market development and

industry nurturing are essential, and a role must be played by unions and other civil organisations in creating benefit for workers, the public and future generations.

A range of policy responses that can be implemented immediately or as part of a future strategic response are listed in Table 6 below with reference to their expected timeframe for implementation and target stakeholders and outlined in full in the following sections. Some of these responses are targeted at consumers and others serve as foundational elements of industry and market creation for EV manufacturing, services and the development of supply and value chain links across the whole of the Australian economy.

Table 6: Recommended government policy responses

Policy	Timeframe	Target stakeholders
Emissions reduction targets	Short-term	Industry
Investment in research and development	Short-term	Public sector, industry
A role for unions and the labour movement in shaping an EV manufacturing industry	Short-term Medium-term	Government, industry
EV pricing policies	Medium-term	Industry, consumers
Decarbonisation of capital stock	Medium-term	Industry, unions
Public procurement of EVs and EV infrastructure	Medium-term	Public sector, industry

4.1 Emissions reduction targets

An Australian policy approach to emissions reductions must strengthen emissions standards for ICE vehicles in the transitionary process, and ultimately EVs when they eventually comprise most Australian fleets and future sales. At present, Australia's low standards for fuel quality have contributed to a major lag in investments in R&D, innovation, and technology by domestic petroleum producers. The result of lagging fuel quality standards in Australia is that the "dirty, cheap fuel" manufactured by domestic producers ranks Australia among the worst of the OECD nations, making us ineligible to receive many new model ICEs that cannot run on low-quality of Australian fuel.

ICEs imported to Australia presently meet our own standards but have not met the more stringent regulations of nations in Europe, Asia, and North America. As a result, Australia is vulnerable to the 'dumping' of lower-standard vehicles from global producers where overseas markets have stricter emissions regulations that ban their

sale.[14] Quicke has explained that "Australia is one of the only OECD countries with no fuel efficiency standards" and given that "[f]uel efficiency standards are key policy levers for driving EV uptake and increasing EV model availability", on its present course, Australia will be stuck buying lower quality ICE vehicles and EVs until the government intervenes with strict minimum standards.[15]

Quicke has further shown that in Europe, stronger emissions standards have contributed to the EV market share more than tripling in 12 months from 2019 to 2020, and that the largest decrease in CO_2 emissions from new vehicles (since data has been available) also occurred over this period. Government policy for a fuel efficiency standard must be the first component of a broadened strategy to increase Australia's regulatory measures for the import and production of ICEs and the transition to EVs. This is a major first step on a planned trajectory to phasing out ICEs and growing a domestic industry based on EVs.

Meeting emissions reductions targets must also increase the focus of manufacturing industry on mass transit and encouraging a transformation in how Australians travel. This can help to make public transport systems (powered by renewable energy) a priority in policy at federal, state, and local levels of planning and infrastructure development.

4.2 Investment in research and development

To help develop the technologies that support stronger emissions reduction targets, it is also critical for the government to invest extensively in R&D funding for the EV industry. As Australia's EV capabilities develop and expand, the industry's growth must be projected forward in terms of the competitive advantages that Australian industries can harness. This would also ideally include support for value chains that link mining industries to manufacturing research, development, and production. This is essential to building capacity for value-adding processes in Australia. This will drive development of the key foundations of an EV manufacturing industry: more processing of Australia's rare earth commodity exports onshore before being elaborately transformed into batteries and other EV components in the nation's own supply chains.

The initial seed funding for government-backed initiatives is already within the scope of public budgeting. In Senator Rex Patrick's additional comments as part of the Senate Select Committee on Electric Vehicles, he noted that a significant amount of funding remains unspent in the Automotive Transition Scheme (ATS). Senator Patrick estimated

[14] Kurmelovs, Royce (2019). 'Among the worst in OECD': Australia's addiction to cheap, dirty petrol. *The Guardian* (5 February).
[15] Quicke, Audrey (2021). *Submission on the Future Fuels Discussion Paper*. The Australia Institute (Canberra, Australia), p. 9.

an ATS underspend of approximately $740 million, which "could and should be utilised for EV manufacturing and value chain support."[16]

Industry groups have also argued for the ATS to be re-targeted to EV and ultra-low emissions vehicles, and specifically to assist EV manufacturing start-up firms to avoid hurdles applied to the traditional industry (i.e. requirements of a certain level of unit production). This is a potential starting point for government funding – previously allocated to the automotive industry but largely unspent – to seed initial funding of EV industry development in ways that pursue rapid transformation of manufacturing within automotive industries, and far beyond in terms of delivering mass transit-related solutions to public transport needs.

4.3 A role for unions and the labour movement in shaping an EV manufacturing industry

Critical studies of some of the world's most sophisticated automotive supply chains have determined that even in this most heavily automated industries, the experiential knowledge and skills of workers are essential in highly advanced, digitalized and automated industrial systems.[17] Human skills become critical inputs in firms that acknowledge workers' first-hand knowledge of production processes is more than just 'routine' (and therefore presumably replaceable by robotics and other automation). The ramifications for transforming VET-based skills provision are therefore enormous. Industry policy that places skills at its centre will manage the transition to advanced manufacturing workplaces by ensuring competent workers are active in innovations to labour processes.

Unions must play a critical role in skills formation and industrial knowledge to shape EV industry developments. Where experienced and knowledgeable workers will transfer skills and expertise from traditional automotive manufacturing to new EV manufacturing, they are amongst the most critical inputs to innovation processes. Even as new digital technologies drive increased digitalisation and automation of manufacturing, the role of workers will remain pivotal to the productivity and efficiency of such highly skilled and complex manufacturing processes.

4.4 EV pricing policies

Pricing policies have been implemented in international jurisdictions, helping to reduce the sale of ICEs, particularly when combined with EV purchasing incentives (which NSW, the ACT and Tasmania currently use as policy levers). Instead of implementing

[16] See 'Additional Comments by Senator Rex Patrick', 'Australia's Electric Vehicle Policy: Battery Dead, Jump Start Required', Senate Select Committee on Electric Vehicles, Parliament of Australia, Commonwealth of Australia (Canberra, Australia).

[17] Pfeiffer, Sabine and Anne Suphan. 2015. 'The Labouring Capacity Index: Living Labouring Capacity and Experience as Resources on the Road to Industry 4.0'. Working Paper #2, Chair of Sociology, University of Hohenheim (Hohenheim, Germany).

taxes on EV purchases by private consumers before consumer sentiment has shifted to the stronger embrace of EVs as a consumption choice, governments should structure pricing policies and incentives when EVs have reached levels of market share that allow for greater investment in infrastructure which will drive further investment and consumption of EVs and EV-related services

4.5 Decarbonisation of capital stock and re-investment in renewables

A major mobilisation of investment can be achieved by divesting from fossil fuels and investing in renewable technologies and industries that accelerate the Australian economy's decarbonisation. Other nations are taking decisive measures to rapidly shift their economies to renewables and Australia cannot afford to miss out on such opportunities.

Australian governments must not wait for businesses and investors to act but must instead become first-movers, identifying opportunities like EV industry development, as government support for the transition is essential to building investment confidence. Public ownership of assets, infrastructure, and public oversight of investment decisions in a future decarbonisation trajectory are critical to establishing the public's stake in transformation. Identification of potential private investments can be incentivised by government, and in coordinating partnerships with business, companies, and investment groups for the establishment of industries and the securing of supply chain developments.

The federal government could signal its commitment to decarbonisation as an industrial and societal priority with the establishment of an authority to oversee the decarbonisation of transport systems and accompanying support for adaptation in industry, the environment and in communities. This will entail collaboration between all levels of government and rely on the deepening of coordination between economic sectors, intergovernmental policy, innovation systems and public and private institutions. The main instrument with which to manage such complex coordination efforts will be equity funding made available to consortia of public, private, and civil sector stakeholders to pursue decarbonisation ventures that adequately connect industrial transformation goals with similar aims in environmental, technological, and institutional contexts.

Industry superannuation funds also have a major role to play in transitioning investment from fossil fuels to renewable industries. Decarbonisation-oriented investments by superannuation funds can be directed by unions and their members to both accelerate a transition of the energy system that will underpin innovative EV industry growth, and ultimately shape the terrain for further investment in skills, training and R&D that underpins related industries.

4.6 Public procurement of EVs and EV infrastructure

A major way for governments to support the development of the EV industry will be through public procurement of EV fleets. Nahum has reviewed examples of public procurement to conclude that "[a]ctive procurement strategies are always a powerful lever for stimulating domestic investment and employment in strategic sectors."[18]

Gunnar Eliasson has studied the advanced procurement of military technology, highlighting how the planned, strategic role of government is the critical factor in shaping industry policy which has transformative effects that exceed the life of the initial procurement project to become self-sustaining innovative manufacturing clusters.[19]

Eliasson has further shown that when government fulfils the role of a 'demanding customer' for high-quality products, and project co-investor in the innovation process, the primary supplier can be pushed to produce the highest quality outputs. This fundamentally requires investments in high-quality training of local workers so that the supplying firm itself becomes a 'technical university' which informs processes of 'innovative discovery' that drive further knowledge outcomes.[20]

Public procurement is also a visible way for the government to show its confidence in the role EVs will play in transforming Australia's manufacturing industry capabilities and the national transport system. It will build public confidence in the industry's role in economic growth and encourage private companies to invest in EV fleets of their own. Beyond this, rapid turnover of government EV fleets will help to develop a broad and accessible second-hand EV market, providing car hire firms with incentive to build EV fleets (knowing they can sell their used vehicles more easily), and providing consumers with a safe and affordable introduction to EV purchase and ownership experiences.

4.7 Public provision of skills and training

There is a critical role for government to adequately fund the provision of quality VET for the broad range of apprenticeships, traineeships and occupations related to an EV manufacturing industry that will be essential to maintaining it into the future. A manufacturing industry policy that commits government to investing in skills and training through a robust, advanced VET system of delivery driven by state-based TAFE institutes is critical – not just the transformation of the manufacturing sector, but to improving the employment outcomes of thousands of Australian workers.

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[18] Nahum, Dan (2020). *Powering Onwards: Australia's Opportunity to Reinvigorate Manufacturing through Renewable Energy.* Centre for Future Work at The Australia Institute (Canberra, Australia).

[19] Eliasson, Gunnar (2010). *Advanced Public Procurement as Industrial Policy: The Aircraft Industry as a Technical University*. Springer (New York, USA).

[20] Eliasson, Gunnar (2011). 'Advanced purchasing, spillovers and innovative discovery', *Journal of Evolutionary Economics*, 21: 121-139.

Retraining manufacturing workers must be a priority for Australia to ensure it captures the value-added benefits of EV manufacturing, where a highly skilled workforce possessing residual experience given their previous involvement in automotive manufacturing, represents untapped labour potential. Furthermore, training and skills development should be offered free to workers transitioning to new industries and occupations or entering the manufacturing sector. Provision of skills and training should be fully funded by government and offered in person and in online or remote learning contexts where it assists the regional development of EV industries.

4.8 Public-private investment and partnership in the EV manufacturing future

An EV industry policy for the 21st century should see government hold a financial stake in the industry through either outright ownership of nationalised ventures, shares in firms or co-investment in joint ventures with private enterprise. Initiatives in which public money should be invested include EV battery R&D, skills development, and industrial capability building developed through innovation funds and equity investments.

In nations including France, Germany and the United States, such initiatives ensure that EV manufacturing contains a significant public policy element, guaranteeing investment and jobs. Further to ensuring that high-quality EVs are produced, government co-investment would represent a means of pushing the industry to remain competitive and innovative and provide extensive opportunities to engage in collaboration with private enterprise, universities, and education systems.

5.Conclusion

An Australian EV manufacturing industry can restore automotive manufacturing as a major source of employment, innovation, and exports in Australia. But this will require a nation-building industrial policy response that views pro-active efforts to build an EV industry as a driver of a much broader industrial, social, and environmental transformation. A focused, powerful industrial strategy will address obligations to mitigate climate change through rapid decarbonisation; it will also play a nation-building role, spurring future economic growth through investment in advanced skills, complex industries, public infrastructure, and innovative technologies.

Considering its industrial base and capabilities, Australia is especially well positioned to develop value-adding industries that complement and enhance its lithium and aluminium mining production. Nahum has already suggested that Australia's integration of domestic lithium-ion battery and hydrogen fuel cell industries with a revived domestic car manufacturing industry would position Australia "to add substantial value all the way up the value chain: starting from the extraction of raw

materials right through to domestic vehicle sales and reinvigorated export industry in vehicles and parts".[21]
This means that over the long term, Australia can potentially become a net exporter of EVs. Australian manufacturing industries could export fully assembled EVs that are made of many components produced overseas – but crucially, contain Australian-made EV batteries and battery-related components, which represent the most sophisticated and economically complex component of the entire vehicle and manufacturing process. Positioning an Australian EV manufacturing industry at the centre of a sophisticated and interlinked Australian economy will drive higher levels of economic complexity and hence, major global competitive advantages.

Australia possesses many of the crucial elements for an EV industry – rich mineral reserves, an advanced industrial base, a highly skilled workforce, and consumer interest. But what it lacks is an overarching, coordinating and strategic national industry policy at the federal level, which as global experience shows, is central to EV-oriented industrial transformation.

The development and growth of a sophisticated EV manufacturing industry in Australia can be achieved through policy that focuses industrial production on an EV industry in the broadest terms and committed efforts to power manufacturing industries with renewable energy. This strategy would prioritise the role of societal and environmentally focused solutions to climate change-related problems in our transport and energy systems.

Hence, the largest challenge facing Australia's decision on its industrial future is one of moral values and political will. Australia can choose to pursue a renewed industrial future via an EV industry and its environmentally and socially transformative potential, or it can continue to neglect supporting the initiatives that will address our climate change responsibilities and revive our strong industrial history by making us a leading renewable energy innovator. As such, Australia's participation in the exponentially growing global EV industry exists on a spectrum of policy choices, illustrated by the following options:

- Australia can import EVs and train workers to maintain and repair them;
- Australia can assemble imported EVs and EV components in Australia and train workers to maintain and repair them; or
- Australia can manufacture EVs and EV components in Australia, maintain and repair them and ultimately export them to the rest of the world after massive value-adding production processes have occurred in domestic Australian industries.

[21] Nahum, Dan. 2020. *Powering Onwards: Australia's Opportunity to Reinvigorate Manufacturing through Renewable Energy.* Centre for Future Work at The Australia Institute (Canberra, Australia), p. 41.

The third option is optimal but can only be achieved by stimulating the domestic development of an EV-manufacturing industry supported by interventionist government action. The array of industries that contribute to this new industry's growth and success will be internationally competitive and contain skilled workforces with high incomes. But to make all of this happen, the federal government must commit to industry policy that is both active and interventionist, which in turn requires a break with the market-focused orientation of Australia's recent industrial policy.