Friday, 13 November 2020

Modern Manufacturing Strategy consultation
Department of Industry, Science, Energy and Resources
Via email: manufacturing@industry.gov.au

Dear Cameron Byers,

Submission in response to the Modern Manufacturing Strategy consultation – Priority Area 4: Recycling and Clean Energy

The Clean Energy Council (CEC) is pleased to provide input into the scoping and design of the Australian Government's Modern Manufacturing Strategy, specifically regarding Priority Area 4: Recycling and Clean Energy.

The CEC is the peak body for the clean energy industry in Australia. We represent and work with over 850 of the leading businesses operating in renewable energy and energy storage and are committed to accelerating Australia's clean energy transition. This includes a focus on upstream elements – the clean energy supply chain; downstream elements – manufacturing from renewable energy; and responsible waste management and recycling.

We welcome the government's inclusion of recycling and clean energy as a National Manufacturing Priority Area. The following submission takes a broad view of the questions and provides recommendations for developing a zero-emissions manufacturing sector, expanding the Australian manufacture of clean energy components, and minimising the clean energy waste to landfill. All three areas provide benefits to the Australian economy in the form of created jobs, reduced costs, and reduced greenhouse gas emissions. However, all three require government ambition and support plus effective collaboration with the clean energy industry.

1. **Which areas of pre-production, production and post-production do you think should be included in this National Manufacturing Priority?**

and

2. **Why are these areas important to this priority?**

Australia's abundant renewable energy resources provide an important competitive advantage and justify a focus on at least three distinct areas of clean energy manufacturing:

- Manufacturing from clean energy: the use of Australia's renewable energy resources to power an expanded export-focussed manufacturing sector. Australia has a natural abundance of renewable energy resources – greater than any other industrialised nation and all of Australia's key trading partners. Our potential for renewable energy supply exceeds any expectations of domestic demand over the next decades. Adding to this, the cost of generating/storing electricity from wind, solar and batteries has continually fallen over the last 20 years, such that producing and processing goods with renewable energy is likely to be the lowest-cost option to 2050.

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- Clean energy supply chain manufacture: Australia's capacity to produce clean energy technology components for its wind and solar farms, for example. The clean energy supply chain is extensive and diverse – from steel for essential infrastructure to highly specialised electronic components. Currently, Australia captures only a small fraction of the clean energy supply chain across wind, solar and batteries. As a result, opportunities for local jobs and economic growth are being missed – and this missed opportunity will only increase with the expected growth in renewable energy. An 'Australian renewable energy superpower' scenario and strategy would drive the demand needed for an Australian clean energy supply chain manufacturing sector to be competitive in the domestic market. Such a scenario would substantially expand the Australian renewable energy sector through extensive electrification, and energy export in the form of hydrogen, high-voltage direct current (HVDC) transmission, and embodied in energy intensive products, such as zero-emissions metals.
- Clean energy recycling: end-of-life processes for clean energy industry sectors, such as solar PV and wind. A solar PV module lasts on average 20 to 25 years. By 2050 it is expected that there will be over 1,500 kilo-tonnes of waste from retired solar panels. There is currently little incentive for recycling these components because the financial return for key constituents is low. The standard lifetime of a wind turbine is also 20-25 years. However, many are extended by around 10 years with a complete mechanical re-service. There are currently 101 wind farms across Australia – around 15 per cent of these are older than 15 years, and just two are older than 20 years.

3. What are the opportunities for scaling Australian manufacturing in this priority area?

a. Opportunities created by manufacturing from clean energy

Expanding Australian manufacturing capacity through renewables can cut costs, create regional jobs and growth, and reduce Australia's greenhouse gas emissions intensity.

A 2020 study by the Centre for Future Work estimated that by replacing Australia's coal and gas fired electricity with clean energy, the manufacturing sector could save $1.6 billion per year, or 23% of energy bills; and this could grow to $2.2 billion per year, or 33% of energy bills by 2050. The study suggested some key 'low hanging fruit' processes as hydrogen production, steel production, innovative aluminium smelting, zinc refining, and food production.

These are all emissions-intensive processes. Metal production alone is responsible for 9% of global greenhouse gas emissions. An Australian manufacturing industry founded on clean energy manufacturing therefore reduces Australia's domestic emissions. At the same time, the carbon constrained future outlined by the 2015 Paris Agreement creates a global market for these Australian zero-emissions products. The University of Adelaide is currently leading a bid for a Heavy Industry Low-carbon Transition CRC that would hasten the "decarbonisation of Australia's heavy industrial processes and produce materials vital to the local and global economies at lower costs and in more sustainable ways".

A focus on establishing new clean energy manufacturing facilities in regional areas, particularly in parts of Australia that are currently 'carbon-intensive' brings the added benefits of creating regional jobs and growth. A 2020 study by the Grattan Institute highlights that regions such as the La Trobe Valley in Victoria, the Hunter Valley in NSW and Gladstone in Queensland present the natural resources, existing infrastructure, skilled workforces and local communities needed to support a strong green steel sector, for example. The Grattan Institute estimated that "[n]ew clean energy industries can plausibly create new jobs at a scale comparable to existing carbon-intensive industries [at] between 40,000 and 55,000 ongoing jobs across green steel, green ammonia, and biofuels for aviation – very similar to today's 55,000 geographically-concentrated carbon workers" (p26). Importantly, and as noted by Professor Garnaut, jobs created for the processing of hydrogen, iron or steel made from renewable energy cannot be lost offshore, because that cheap and abundant renewable energy is in Australia.

The Australian Energy Market Operator (AEMO)'s proposed Renewable Energy Zones (REZs) offer another potential location for new manufacturing plants. As well as generating economic growth within those REZs, locating new sites of electricity usage ('load') close to the power generation has the added benefit of resolving electricity transmission issues.

Clean manufacturing also presents an opportunity for Australian Universities and research groups. Smart manufacturing using clean energy at a precinct level is being discussed within the Australian research sector. Such precincts could offer greater collaboration across the supply/value chain and provide greater access for training and workforce development.

b. Opportunities of clean energy supply chain manufacturing

Meeting the supply chain needs of an expanding clean energy sector locally can generate economic benefits, create quality jobs, and reduce construction times for renewable energy developments – for this, an ambitious renewable energy agenda is needed.

Many of the natural resources and minerals needed to produce components for the clean energy industry are found in Australia. Australia has the largest iron ore reserves, accounting for a quarter of the global total. Australia is the world's largest producer of bauxite, used in the production of aluminium. Australia is the largest producer of lithium – an essential element in the production of most batteries. Australia has the largest reserves of zinc – also used in batteries and for anti-corrosion in steel infrastructure. Australia is the third biggest producer of cobalt – another critical component of batteries. Yet currently, most of the renewable energy supply chain is sourced internationally. Australia has just one solar panel manufacturer and just one manufacturing operation focused uniquely on wind towers, and both already struggle to meet peak demands. Renewable energy developers that prioritise local content have limited options available to them.

Opportunities exist for the Australian manufacture of, for example, transmission towers, wind turbine towers, turbine blades, batteries, solar panel frames and trackers, and electric vehicles. The key factors in the success of establishing any such manufacturing operations in Australia are volume and government support. A large renewable export market, several times larger than the current Australian energy demand, would drive the volume needed over the next decades. With targeted government support to overcome entry barriers, Australia could capture a higher proportion of the clean energy supply chain.

The benefits of refining and processing Australian minerals for the needs of the Australian clean energy sector – and potentially also for an international market – include increased value-added activity, the creation of direct stable manufacturing jobs, plus indirect jobs, export revenue, increased tax revenue for governments, and a multitude of flow-on effects, such as innovation through increased investment in research and development. For example, a development pipeline of wind farms of several gigawatts, such as that outlined in the recent NSW Electricity Infrastructure Roadmap announcement, might support the establishment of up to three new wind tower production plants across NSW and QLD. These could support around 400 new direct jobs and up to 1500 indirect jobs in Australian steel production and other related local products and services. Ideally, these plants would be located strategically to serve the REZs and to benefit workforce transitioning out of the fossil fuel sector.

Local production of renewable energy components could result in more innovative and resilient designs and cut project development times, for example for solar farms. The Vales Point solar farm is a case in point. The site is an old ash dam with an uneven and unstable foundation that cannot support conventional solar trackers (trackers are mechanisms that allow the face of the panels to track the sun along one axis and improve performance gain by 10 to 15%). Innovative trackers are needed here, that incorporate two points of support and are sufficiently light and robust to endure local climatic conditions. Such a tracker, which supports up to 60 or 70 solar panels, can be delivered as a pre-assembled

structure directly to the site. These logistics require a local production team. Typically, the assembly of solar panels occurs mostly at the solar farm itself through the efforts of a short-term construction workforce. Assembling more of the components off-site before transportation to the site can reduce project development time and results in greater employment of a stable and skilled manufacturing workforce.

c. Opportunities for clean energy recycling

Components of solar PV and wind turbines could feasibly be recycled if incentives were strengthened and certain technical issues addressed.

A typical crystalline silicon PV module consists mostly (75%) of glass, then polymer (10%), aluminium (8%), silicon (5%), copper (1%) and silver, tin, lead (plus other metals and components). In Australia, only the glass and aluminium are recyclable. A technical barrier to recycling is the difficulty in dissolving the glue that binds the componentry. As a result, it is not uncommon for entire systems to be replaced prematurely because of damage to one part, which underlines the importance of minimising waste to landfill.

A typical wind turbine, which is almost as complex to dismantle as it is to construct (costing as much as $150,000 per turbine for dismantling), consists of:

- the foundation, which is made from reinforced concrete and therefore can be recycled and used in fresh cement (if it is not deemed environmental disruptive to remove the foundation)
- the tower and nacelle, which are made of steel derivatives and can therefore be recycled at the steel production plant; and electrical components comprising copper cabling, plastic insulators and aluminium, some of which can be recycled
- the blades, which are made from composite materials (initially fibre glass but now commonly carbon fibre), that present a recycling challenge globally and are the focus of several European research initiatives.

4. What are the challenges to seizing these opportunities, and what are your proposed solutions?

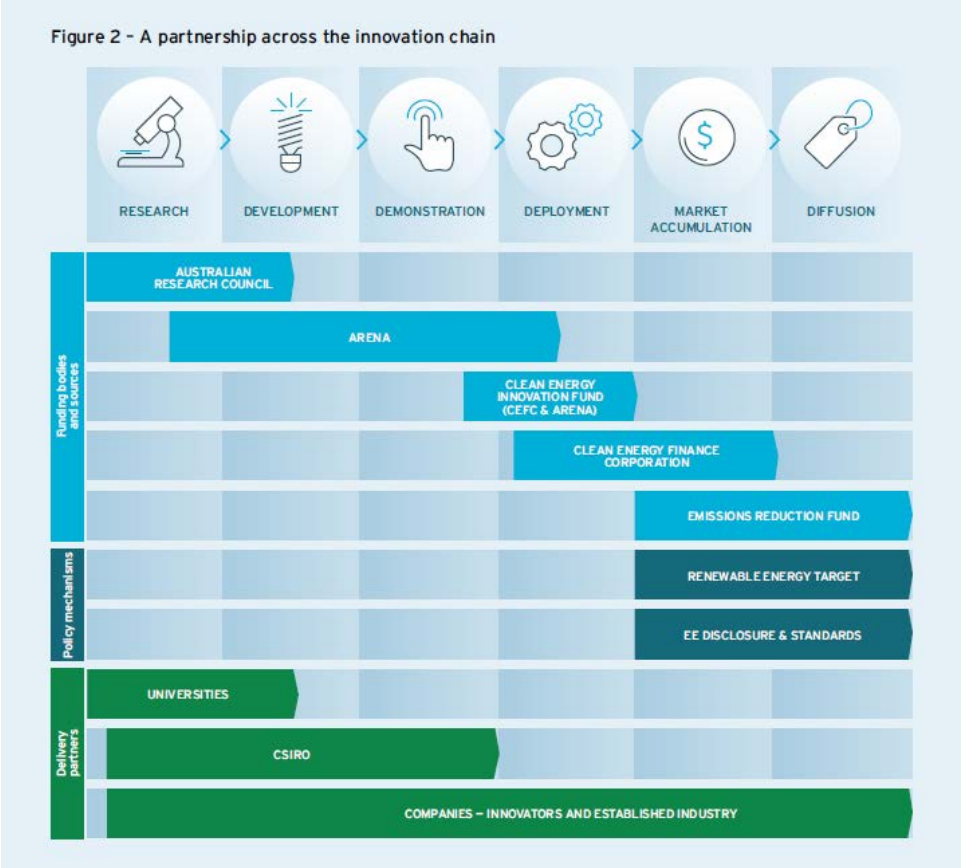
a. Challenges and solutions to manufacturing with clean energy

Financial, technical, and logistical challenges hinder the development of a green manufacturing sector in Australia, but these can be overcome with coordinated government and industry actions.

A new manufacturing sector based on clean energy would require investment in and construction of new energy infrastructure plus new processing machinery/equipment for such products as hydrogen, green steel, or green aluminium. For many existing producers in traditional manufacturing sectors, it would require the acceptance that conventional equipment become stranded assets and a willingness to invest in and adopt a decade-long view of return on any new equipment. This is a risky venture within the context of low profit margins; strong international competition; the likely need for new supply chain relationships (and the demise of old ones built on years of investments and trust); considerable transport distances for many trading partners, and currency risks. Adding to this, many of the technologies that will form the basis of zero-emissions manufacture are still in development stages and yet to be commercialised. Yet appetite for this is clear in for example, Infrabuild's GREENSTEEL strategy announcement aiming for carbon neutrality by 2030.

The Australian Government first established the Australian Renewable Energy Agency (ARENA) in 2012 to provide financial assistance to activities that improve the competitiveness of renewable energy

technologies and increase the supply of renewable energy in Australia. Manufacturing from renewable energy is thus a viable activity for ARENA funding and proponents can receive support for demonstration stages of technology. However, as evidenced by the figure below, ARENA funding is the only eligible mechanism for funding of this type in Australia. While other institutions support ARENA in the stages of R&D, deployment, market accumulation and diffusion, there is no other backing for demonstration projects. This suggests a weakness in the Australian clean energy innovation chain. It is likely that other nations, such as Germany, the UK and Sweden, that partner more closely with industry in the piloting stage of innovation will surpass Australia's efforts in zero-emissions manufacturing despite our clear advantage in cheap and plentiful natural resources.



Source: ARENA general funding strategy 2019-22

To adequately support a zero-emission manufacturing industry in Australia a targeted government strategy is needed, similar perhaps to the National Hydrogen Strategy. Such a strategy will need to provide financial and policy support to both upstream and downstream activities, from R&D, through demonstration and commercialisation, to procurement and trading. Internationally recognised certification of such zero-emissions products is a necessary enabler and should be a focus of Australian governments: a market for green hydrogen, green steel, green aluminium etc can only exist if there are credible certificate schemes underlying them. However, none of this can occur without the commitment of industry. Either individually, through the Taskforce of Climate-related Financial Disclosures, or more collectively through industry-wide targets (potentially set by the Safeguard Mechanism), the Australian manufacturing sector most commit to and build towards realistic but ambitious emission reduction targets.

b. Challenges and solutions to clean energy supply chain manufacturing

An Australian clean energy supply chain manufacturing sector needs high local demand and help in the early days to overcome entry barriers.

As previously noted, Australia owns many of the minerals crucial to the production of renewable energy components but fails to capture the value-added benefits. At least four hurdles must be overcome if we are to develop an Australian clean energy supply chain manufacturing industry: energy/infrastructure, evidence, finance/markets, and people.

- **Energy and infrastructure:** The history of energy policy in Australia over the last decade has been tumultuous. Ambitious and consistent clean energy policy is needed to spur investment in supply chain manufacture, and this must be supported by investments in the requisite infrastructure (transmission, storage etc).
- **Evidence:** Australian labour-intensive manufacturing cannot compete against countries with low-labour costs. Research and analysis are needed to understand where in the clean energy supply chain Australia's competitive manufacturing advantage lies. The Victorian government has begun this process by producing Victorian Renewable Energy Supply Chain Maps for wind, solar PV and batteries using a traffic light system for existing, partial or limited capability within the state. Developing such a tool at the national level would be useful but should be taken to the next step in understanding where Australia's competitive advantage lies and how to incentivise early movers.
- **Finance and markets:** Through the early stages, and to compete with incumbent market players, Australian producers need access to local finance that can support them, and to a market that recognises the benefits of Australian-made. Local financiers require a degree of certainty that is difficult to achieve where mineral spot markets do not exist. As a result, miners may access funding through sale of equity to foreign investors with a more strategic perspective. Availability of local financing options (or equity partners) would avoid Australian companies having to sell Australian mineral assets to fund new mining operations. Some support options for Australian producers might include targeted government procurement policies; trade remedies policy; participation plans; the inclusion of the Australian renewable energy generation sector in the development stage of new manufacturing areas to ensure that the concepts are in line with end-user requirements; the facilitation of industry clusters within AEMO's REZs.
- **People:** To deliver the workforce needed for an expanded clean energy supply chain manufacturing sector, Australia's vocational education and training system must become more dynamic and responsive to the needs of industry – this includes training and retraining of workers from complementary sectors. The manufacturing workforce has the advantage of long-term, stable work. It can become an integral part of a local community and provide sustainable careers if supported by a network of skills and training pathways into and beyond the industry.

c. Challenges and solutions to clean energy recycling

Incentives are needed to support clean energy components, and to be commercially viable these should be supported by consistent long-term renewable energy policy.

For solar PV panels, programs that incentivise the re-use of panels by creating a secondary market for older modules that have been tested and approved, are a near-term option for driving more recycling and reuse. A complementary option is a product stewardship scheme for solar panels to avoid these ending up in landfill, potentially directing these to central sites so as to access economies of scale.

For wind power componentry, the recycling challenges lie in the composite blades. Cement co-processing is one option for used composite materials, but to be commercially feasible, such schemes require large volumes of material. Governments could incentivise and facilitate cross-sectoral

collaboration (marine, transport, wind etc) for composite recycling. There may also be niche applications for repurposing parts of wind turbines for playgrounds, street furniture, bicycle shelters and walkways.

Secondary markets are also an option for wind turbines. There is an emerging global trend for repowered second-hand turbines mainly from developing countries and smaller investors. Rather than decommissioning and recycling the turbines at end-of-life these could also be repowered in Australia by a local company and either resold or, with support from government, donated to our Pacific and South-East Asian neighbours (examples exist of such practices from European countries).

5. What do you think are the measures of success for Australian manufacturing in this priority area?

- **Reduced energy costs for manufacturing based on renewable energy:** as noted in the earlier section, energy costs could be reduced by as much as one third by 2050 according to one study.
- **Reduced domestic and embodied emissions:** certification of zero-emissions products such as green hydrogen, green steel and green aluminium could create a global market for Australian manufactured products.
- **Creation of skilled jobs:** as noted in the previous sections, the creation of skilled jobs, particularly in rural areas, are important metrics of success for all expanded manufacturing capabilities. Research commissioned by the CEC in 2020 found that employment factors per installed megawatt of renewable energy capacity in Australia are 2 to 4 times lower than internationally, depending on the technology. The higher employment factors in Europe and the US are due to the much higher share of domestic supply chain provision. Australian employment across the clean energy supply chain should at least match those of our industrialised trading partners.
- **Capturing as much of the supply chain as possible:** once the clean energy supply chain has been mapped and assessed against Australia's comparative advantage, we should strive to maximise the coverage of Australian manufacturing.
- **Minimising waste to landfill:** although it may not be feasible to do so initially, a zero-waste target should be the ultimate target for the clean energy sector. This can only be accomplished with government assistance and collaboration across countries and sectors.

6. Are there any action plans, strategies or related documents which should be considered in the development of the road maps?

Some reports or sources referred to in this submission and relevant to the discussion are:

- The CEC's 2020 Clean Energy at Work report (plus full UTS report and methods report)
- The CEC's response to the House of Representatives Committee Inquiry into Waste Management and Recycling
- The Grattan Institute's 2020 Start with steel report
- The Energy Transition Hub's From mining to making report
- The Centre for Future Work's 2020 A Fair Share for Australian Manufacturing report
- The Centre for Future Work's 2020 Powering Onwards report
- The WA government's Future Battery Industry Strategy
- Austrade - The lithium-ion battery value chain
- Victorian Renewable Energy Supply Chain Map through the ICN Gateway

- Wind turbines marketplace
- Wind powering solutions – used wind turbines for sale
- The Heavy Industry Low-carbon Transition CRC prospectus
- The Energy Transition Hub's Innovation and export opportunities of the energy transition
- The Energy Transition Hub's Australia's power advantage: Energy transition and hydrogen export scenarios

Other Australian Government initiatives relevant to the recommendations made in this submission and which may be suitable vehicles for driving manufacturing activities include the National Hydrogen Strategy, ARENA, the Clean Energy Finance Corporation, AusTrade and the Clean Energy Investment Fund.

The CEC is establishing a Decommissioning and Recycling Working Group for its wind power members to come together, share ideas and discuss potential avenues; and a Manufacturing and Product Life Cycle Working Group for manufacturers and importers of solar PV modules, inverters and batteries. The CEC is also providing in-kind contributions in the form of technical advice and accredited installer data and analysis for organisations around Australia to build a solution to reuse and recycle solar PV panels. We are involved in several proposed solar PV recycling projects across Australia, which are anticipated to commence over the next three years, all of which could be fast-tracked with Federal funding:

- Integrating Circular Economy into Photovoltaic Product Stewardship Design - Griffith University (Status: Commencement subject to funding): This project is working to develop a managerial toolbox that will assist planning and investment of existing and potential industry-led photovoltaic product stewardship schemes to expand their operational scope and capabilities.
- Product Stewardship options for Solar PV panels - University of South Australia (Status: Commencement subject to funding): This project intends to inform the detailed design of a product stewardship scheme for solar PV panels to complement the National Project agenda and provide the development and uptake of related recycling technologies guidance to satisfy stakeholder expectations.
- NSW EPA Circular Solar Trials potential - PV Industries, ReSource and MRI e-cycles solutions (Status: Commencement subject to funding): This potential project plans to collect data on solar PV panels and batteries that are being decommissioned to gain a greater understanding of decommissioning, waste management and disposal practices.

The CEC has worked with the Gippsland Climate Change Network on a Statement of Opportunity in relation to the reuse of solar panels and is planning to collaborate with Task Group 15 of the PV Quality Assurance Taskforce to explore options on the reuse/repair and recycling of solar PV panels.

The CEC is also aware of the following national solar PV recycling research projects/funding taking place:

- The NSW Government has committed $10M to boost solar panel recycling.
- Researchers at Deakin University are working to develop a solar panel recycling solution to recycle silicon.
- A total of $15.14 million has been awarded through ARENA to support research teams at six Australian universities to undertake research projects on solar PV module efficiency and cost-effectiveness including a focus on end-of-life processing.

7. Do you have anything else you'd like to share with us in relation to the national priority areas or the manufacturing strategy?

Prioritising Australia's competitive manufacturing advantage directly justifies a focus on clean energy. However, this should be accompanied by a set of values that support the long-term development and

competitiveness of the expanded industry. Values of environmental and social sustainability provide a framework to differentiate Australian production even if our products are not the cheapest available. Supporting a diverse and inclusive workforce is central to tenets of sustainability and should extend to reskilling workers from industries that have become or are becoming obsolete. A Modern Manufacturing Strategy should also align with other government priorities from large flagships programs, such as the National Hydrogen Strategy, to smaller compliance measures, such as the Risks of Modern Slavery legislation. Moving manufacturing onshore allows a clearer view and better management of such risks.

Kind regards,

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