



SUBMISSION TO SENATE ECONOMICS REFERENCES COMMITTEE INQUIRY INTO THE AUSTRALIAN MANUFACTURING INDUSTRY

Introduction

The Advanced Manufacturing Growth Centre (AMGC) welcomes the Committee's focus on Australia's critically important manufacturing industry. As AMGC's submission discusses, manufacturing is an essential capability¹ that is key to lifting Australia's capacity to create complex products for domestic and global markets.

AMGC was established by the Australian Government in 2015 to support the growth of the manufacturing industry, which comprises close to 47,000 businesses, contributes more than \$100 billion a year to the Australian economy and supports 1.3 million Australian jobs directly and indirectly – or more than 10% of the total workforce.²

Since its inception, AMGC has successfully built a network of members, developed thought leadership research, connected thousands of industry participants, and worked with the Government to provide co-investment to support the commercialisation of manufacturing projects. The first \$19.6 million in such co-investment, plus more than \$50 million in matching contributions from industry, have been used to fund more than 80 projects in areas as diverse as advanced composites and materials, 3D printing, robotics, virtual reality, digital design, and rapid prototyping. These projects are forecast to deliver more than \$1.43 billion in new revenue and 3,204 jobs for Australia.

AMGC is expertly managing a further \$30 million in Commercialisation Funds as part of the Government's Modern Manufacturing Strategy.

Responses

(a) What manufacturing capacities Australia requires for economic growth, national resilience, rising living standards for all Australians, and security in our region.

Manufacturing is ultimately the ability to turn raw materials into higher-value products. For the manufacturing industry to play a leading role in growing Australia's economy, making the nation more resilient and raising living standards, it needs to be globally competitive in completing this process.

This submission discusses numerous ways this can be achieved. The Committee can refer to the extensive research available on AMGC's website (amgc.org.au). However, AMGC emphasises two points:

- **Australia must be able to make complex products.** Harvard University recently ranked Australia as the 8th richest in the world, yet found it was 86th in its complexity – rated in Harvard's Economic Complexity Index.³ Worse, Australia has fallen to this rank of complexity

¹ AMGC strongly rejects the view of manufacturing being a sector (vertical) instead it is a capability, cutting horizontally across all sectors in which something is being made / manufactured.

² Reference: Australian Bureau of Statistics (2020) "8165.0 Counts of Australian Businesses, including Entries and Exits, June 2016 to June 2020 – Annualised Employment Size Ranges". Find the data here: <https://www.abs.gov.au/statistics/economy/business-indicators/counts-australian-businesses-including-entries-and-exits/latest-release#data-download> and see *Advanced Manufacturing – a new definition for a new era*, AMGC, 2017

³ Atlas of Economic Complexity, Growth Lab at Harvard University, <https://atlas.cid.harvard.edu/>.

from 55th in 1995. There is a strong correlation between economic complexity and the income a country derives over time.

As a wealthy economy, Australia will only improve its position by having a manufacturing industry capable of producing complex products that can be sold for relatively high prices locally and globally. In this respect, Australia has significant work to do to diversify beyond its traditional reliance on natural resources and primary industries, agriculture, and other low-complexity activities.

Australia's economy is foreseen to grow by 2.5% annually over the coming decade. This places Australia in the bottom half of all global economies. To improve economic complexity and growth, Australia must shift from its traditionally focussed cost driven commodities to more complex value-driven products. This can include adding value to commodities onshore which is called manufacturing instead of pure commodity extraction ("dig and ship").

- **For manufacturing to make Australia resilient, the industry must be resilient.** The Australian manufacturing industry is one of the nation's most volatile, swelling to 20% above its normal size during upturns then swinging as much as 20% below during downturns.⁴ Further, many manufacturers are heavily dependent on a small number of customers. In fact, one in 10 manufacturers say that the loss of a single customer could force them to close their business. Australia should strive to make its manufacturing businesses more resilient by ensuring they produce superior products, serve diverse markets and are flexible as organisations. This will take a long-term view, and the country should learn from its many long-term manufacturing success stories that have achieved these goals.⁵

(b) The role the Australian manufacturing industry has played, is playing and will play in the future.

The manufacturing industry plays a number of critical roles in the Australian economy. It provides high-value and rewarding jobs, brings in export income and delivers capability supporting all other industries of the economy.

Going forward, manufacturing will be critical in making Australia a 'smart' economy as well as being an economy 'lucky' enough to be endowed with extensive natural resources.

It is particularly important to recognise that the manufacturing industry works across a broad value chain that includes seven areas: research and development, design, logistics, production, distribution, sales, and services, demonstrated in the 'smiley curve' diagram below. By taking this wider view of manufacturing, industry leaders and policy makers can see that supporting Australia's ability to make complex things involves more than focussing on the operation of production facilities.

In fact, it is the activities on either side of production that command a higher share of value, offering Australian businesses the opportunity to carve out a real point of difference, create innovative products, and compete on a global scale. These pre- and post-production activities broaden the scope of occupations within the manufacturing industry considerably.

Contrary to this broad understanding of manufacturing and its broad value chain, assembling cars in Australia is not manufacturing but production. This limited, low value adding activity cannot be competitive and if it was, we never did but would have seen Australian cars being sold into markets such as Japan, Germany and the US as we see Toyota's, BMW's and Ford motorcars on Australia's streets.

⁴ *Building Resilience in Australian Manufacturing*, AMGC, 2018.

⁵ See examples of successfully long-term manufacturing businesses in: *Building Resilience in Australian Manufacturing*, AMGC, 2018

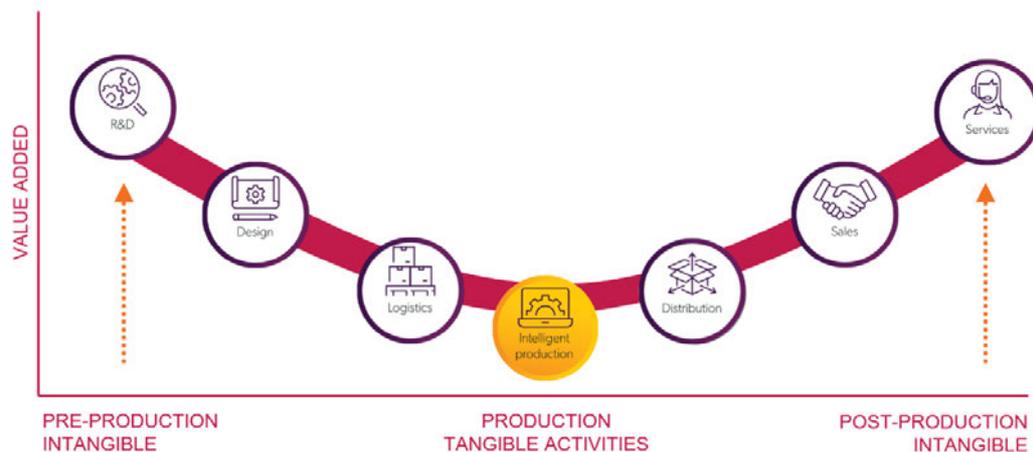


Diagram adapted from: 'Interconnected economies benefiting from global value chains', OECD 2013.

This 'smiley curve' highlights the value-add points. First, more value is often added in the early and late stages of the manufacturing process. For instance, more wealth is generated when Apple designs an iPhone and sells it using superior marketing and services offerings than in the relatively high-volume, low-margin step of making the product. Put differently: Apple has outsourced production of the iPhone to Foxconn in Taiwan, as General Motors has outsourced the production of Holden's to Australia with known outcomes.

The smiley curve demonstrates the opportunity for Australia to compete as a manufacturer in many areas other than running factories. AMGC has found that many of Australia's leading manufacturers are successful due to superior product design and quality standards or more commercial factors such as their ability to deliver products reliably or to provide exceptional after-sales service.

AMGC has forecasted that Australia can increase the output of its manufacturing industry by up to 35% from 2016 to 2026, with about half of the gain coming from areas beyond core production where the country is well placed to differentiate its products and services in the global marketplace.⁶ This could see the economy being an estimated \$9.3 billion larger in the 2026 year – a significant opportunity for growth due to more advanced manufacturing.

(c) The drivers of growth in manufacturing in Australia and around the world.

Manufacturing is undergoing dramatic changes, many of which can be turned to Australia's advantage.

Through the Industry 4.0 revolution, manufacturing processes are becoming digitalised, and mass production of large volumes of identical products is giving way to the creation of mass customisation and consumer-on-demand goods. It is seeing more areas of production becoming automated, through 3D printing and the use of sensors for improved real-time communication. This places more emphasis on design, technology, and customer service – all areas on the manufacturing 'smiley-curve' and areas in which Australia can excel – and less on the ability to produce high volumes of goods at low prices.

Today's manufacturers can benefit from playing a more significant role in delivering specific components that are fed into national or international complex supply chains to enable other businesses to assemble final products. For example, Australia is a leader in providing specialised carbon parts that become integral elements in jet planes and cars sold by global organisations. Global trade in intermediate goods continues to grow with over 70 per cent of manufacturing outputs destined for supply chains.

⁶ Industry Competitiveness Plan 2020, AMGC.

While this is likely to remain a feature of manufacturing, the severe disruptions to global supply chains caused by the COVID-19 pandemic led nations to consider their capacity to produce essential items locally. This could be seen in Australia as the nation rushed to ensure it could manufacture ventilators and other supplies that might be urgently required.

Australia's experience in reviewing its capacity to manufacture ventilators – and its success in doing so – revealed a further important point about manufacturing capability. The nation discovered that its ability to make ventilators did not rely on having an existing base of ventilator manufacturers. Instead, it relied on having people and businesses that could quickly design and prototype such products. It relied on businesses having exceptional technical skills and capabilities that could be turned to urgent and critical needs.

This highlights that manufacturing is a broad capability held within thousands of small- and medium-sized companies that identify as manufacturers. Further, it shows that Australia needs to foster this broad, horizontal capability to build its future capacity to create wealth and address new challenges and opportunities as they arise.

(d) The strengths of Australia's existing manufacturing industry and opportunities for its development and expansion.

Australia has numerous strengths that it can build on to grow its manufacturing capabilities. These include a high level of creativity and entrepreneurialism; a reputation for excellence in product quality and service; and its location, which is home to many of the world's largest manufacturing businesses.

Australia enjoys a cost advantage in some areas of skilled labour. For example, AMGC research has shown that the cost of employing high-skill workers such as engineers is 38% below the international benchmark in medical technology and 40% below the benchmark in the aerospace industry.⁷

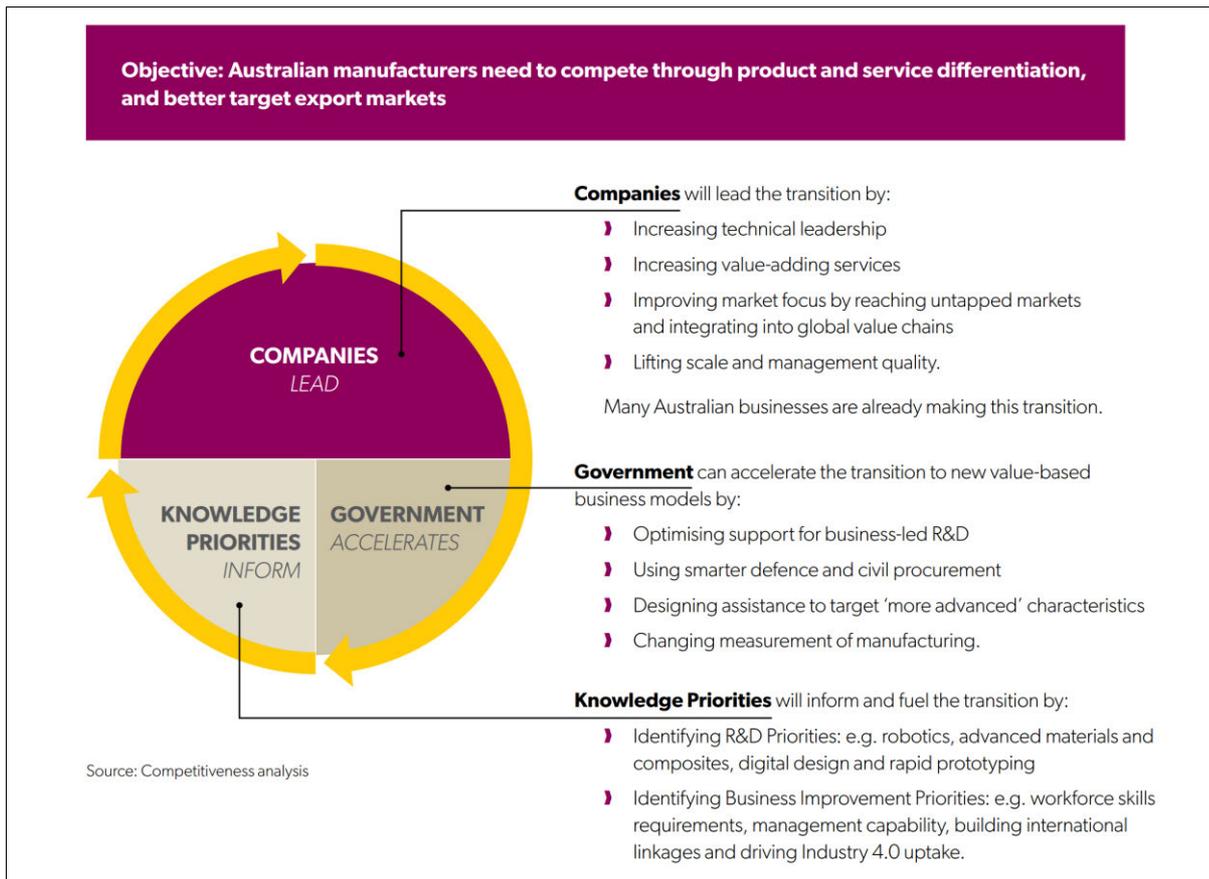
However, there are challenges to address to further develop and expand the industry. These could be overcome by steps to:

- **Improve linkages** – establishing stronger connections between the varied groups that make up Australia's manufacturing ecosystem, including manufacturers connecting with other manufacturers, with researchers, educational institutions, and financial firms
- **Invest in new technology** – reshoring production processes back to Australia by investing in new equipment (such as 3D printers) and/or the redesign of production processes in ways that make it commercially viable to produce goods locally
- **Innovate** – being a global leader in emerging fields such as recycling goods to create new products (known as the circular economy) and using natural resources such as lithium and Australia's capacity to produce green hydrogen to grow the renewable energy industry.

More generally, AMGC has outlined how industry and government can work together, in line with shared knowledge priorities, in the following diagram from the *Industry Competitiveness Plan 2020*.

⁷ *Industry Competitiveness Plan 2020*, AMGC.





(e) The industries in which Australian manufacturers enjoy natural advantages over international competitors in terms of energy production, access to primary resources and numbers of skilled workers, and how to capitalise on those advantages.

Australia has advantages in areas that can and should be exploited. For example, its competitive wages for higher skilled professionals and abundant supply of minerals for producing high-value products such as batteries (which outstanding firms such as Energy Renaissance is doing).

AMGC would encourage policy makers to think more broadly by seeing manufacturing – the ability to invent, make and supply items in ways that are globally competitive – as a broad national capability that permeates every industry of the economy.

By taking this view it becomes clear that Australia must focus on fostering core capabilities such as people’s ability to develop complex products and solutions, use digital technologies, create, and grow businesses, raise financing, and employ people in ways that suit personal choices. This approach will enable Australian businesses to follow market opportunities and to move into adjacent areas as conditions change.

For example, the Australian company, Omni Tanker, was inspired to develop a better system for storing jet fuel after seeing the health impacts of existing systems on RAAF personnel supporting F-111 aircraft. Omni Tanker leveraged its founders’ engineering expertise to develop and patent composite materials technology that is being used to create better solutions for moving and storing dangerous and difficult liquids and gasses. It has actively taken the step to expand into the European and American truck transport market and adjacent areas of market needs, including space exploration and hydrogen energy storage.

(f) Identifying new areas in which the Australian manufacturing industry can establish itself as a global leader.

Technological and market change is opening a range of new possibilities for manufacturers. The following are just some of the areas AMGC has identified as areas of opportunity for Australia and where AMGC member companies are already active.

- **Algae and seaweed.** Australia has a large capacity to produce algae and seaweed, which are being used as sources of core ingredients for a rapidly growing number of food, agricultural and medicinal products. Australia already has companies at the forefront of these areas, based in Queensland (Provectus Algae) and Tasmania (Marinova).
- **Robotics.** As more social and commercial activity moves to the virtual world, there is a need for solutions that replicate touch so that people can lift, feel or complete fine/precise motions using haptic feedback. Australian companies are leading the way in this field by creating solutions to add the sense of touch to robotics. For instance, a Sydney-based company has developed a means to mimic the human finger pad to allow for robotic dexterity.
- **Quantum computing.** Quantum computing promises faster and more efficient computers. Australia is a pioneer in this field, with respected laboratories. A local company is already working to commercialise a viable quantum computer and employing more than 200 people.
- **Graphene.** Graphene is the strongest and thinnest known material, and a conductor of electricity and heat. Several Australian manufacturers are already commercialising graphene for use in paints, coolants, batteries and other items.
- **Recycling.** As the community becomes more environmentally conscious and natural resources become scarcer, there is demand for more manufacturing that involves recycled materials. Australian researchers and companies are addressing this opportunity. One is turning recycled plastics into glasses frames; one is producing kitchen tiles from recycled glass; and another is operating in 50 countries to remove plastic from the ocean (and monitoring ocean health through sensors feeding data back to global monitoring bodies), with plans to remanufacture waste plastics into products.
- **Remote and decentralised infrastructure.** Australia is producing novel products that involve deploying renewable energy, battery storage, solar energy, wind and other critical services in off-the-grid and decentralised systems. One local firm can generate enough electricity to power 120 homes from waste heat energy and has created the world's first home hydrogen generator powered by solar, which allows users to generate and store energy for intra-seasonal use.
- **Precision agriculture.** Companies are using drones, lasers, robots, artificial intelligence, and other technologies to improve crop yields, and reduce waste and chemical use in Australia's agricultural industry.

These opportunities are exciting, and AMGC would reiterate that the path to success is not to be confused with 'picking winners' within such new and fast-changing fields. Instead, Australia should focus on having the required skills; connectivity between manufacturers, researchers, and potential customers; and other policy and commercial settings in place to enable entrepreneurial individuals and teams to embrace opportunities and succeed in turning ideas into viable commercial enterprises – and embrace areas in which Australia is already a winner (food & beverages, commodities & critical minerals, pharmaceuticals & medtech) or has chosen to become one (space, defence, renewables & recyclables).

(g) The role that government can play in assisting our domestic manufacturing industry.

Government can play a key role in building Australia's manufacturing capability by putting in place policies that help organisations take risks, find the right staff and partners, and scale their operations. AMGC recognises that these are all complex goals to achieve and believes the government should pay particular attention to the following areas within each point listed in the Terms of Reference.



Research and development

Government support for research and development (R&D) should be focussed on activity that would not otherwise occur. Government should distinguish between short- and long-term R&D with different risk profiles; let industry play a leading role in setting priorities; and foster collaboration between the nation's research institutions, commercial organisations, and industry representative bodies.

Specifically, AMGC believes there is scope to better target the R&D Tax Incentive and to make it easier for companies to migrate from the scheme to other government commercialisation assistance schemes. Under the current system, companies must largely start from scratch to secure commercialisation support, which breaks their momentum and saps resources.

In its own operations, AMGC has streamlined processes to make it relatively straightforward for innovative manufacturers to apply for co-investment funding and then work with government as those funds are deployed. At the same time, AMGC through its industry practitioners holds lead project participants to account of what they claimed wishing to achieve in the co-investments. These could provide a model for other future initiatives.

In addition, AMGC believes that Australia could make significant progress by streamlining and better aligning the suite of incentives that government and industry offer to businesses for projects at Technology Readiness Levels from 1 through to 9 and not stop short at earlier levels.

AMGC believes government could pursue many of the recommendations made in the 2016 *Review of the R&D Tax Incentive* by Bill Ferris AC, Dr Alan Finkel AO and Mr John Fraser, and Innovation and Science Australia's *Australia 2030: Prosperity through Innovation*, released in 2018.

Attracting investment for scale

AMGC has completed extensive surveys and focus groups with manufacturers around Australia, the majority of which are smaller businesses employing fewer than 20 people. They regularly report that banks are unwilling to lend to companies to fund growth or new equipment purchases because banks lack an understanding of what manufacturing looks like today and perceive it to be high risk. Manufacturers report the ability to raise small amounts of funding to create prototypes and prove concepts but find there is a 'valley of death' when it comes to finding the larger amounts of money required to grow their enterprises to commercialisation and meaningful scale.

One way to address these issues is to better educate the financial community about manufacturing and especially how the industry and its capital requirements and prospects are changing. AMGC believes that explaining how much of manufacturing industry activity now requires high-tech equipment and software to be profitable would help shift perceptions of manufacturing being high risk industry. Another way is to provide more risk capital to capable manufacturers and help them scale.

Supply chain support

Based on feedback from manufacturers, one of the biggest supply chain challenges for Australian producers is the delay in obtaining inputs from overseas. These have been exacerbated during the pandemic. For example, one manufacturer said the following in an AMGC focus group:

"Being in Western Australia, a lot of the reagents and chemicals that we require have long lead times compared to other parts of the world. Here in Western Australia, you can wait three or four weeks for a chemical that you could get overseas in a day."

AMGC maintains that Australian manufacturers will often obtain the best commercial outcomes by providing high-value products to other entities as part of global supply chains. It also expects those international supply chains to largely recover after the pandemic.

However, the pandemic has highlighted the importance of ensuring Australia has broad manufacturing capabilities and is able to create products locally – especially where it is the source of key raw materials, as is often the case around goods created from metals, energy resources and some agricultural produce.



AMGC believes the government should take a balanced approach that seeks to strengthen Australia's links with international supply chains while addressing areas where the country is particularly vulnerable to supply chain disruptions. Furthermore, that government supply chain incentives ensure a clear customer in mind and a long-term procurement strategy. This will avoid short-term financial stimulation and investment of business resources and a surplus of goods and excess capital equipment when there is no end customer identified or demand significantly drops due to the renormalisation of supply chains.

AMGC recommends better monitoring and transparency about the demand side of supply chain vulnerability.

For example, in response to COVID-19, AMGC collaborated with the Department of Industry, Science, Energy and Resources to create the COVID-19 Manufacturer Response Register. This site connects buyers with Australian manufacturers that can provide products such as gowns, cleaning supplies, sneeze guards, hand sanitiser stations and ventilators. By September 2020, over 1,500 businesses had joined the Register, showing how quickly information can be shared and connections made.

Government procurement

As stated in its *Industry Competitiveness Plan 2020*, AMGC believes government can leverage procurement to drive innovation and collaboration between firms, and to create opportunities for Australian manufacturers in global supply chains. The plan recommended that:

"Government procurement support should focus on boosting technical leadership, ideally in areas where Australian manufacturing has a current or potential future comparative advantage. These parts of the economy could then be developed to scale through guaranteed demand. It is vital that support is not provided to prop up industries that were once competitive but are no longer viable.

Innovation requirements should be established so that the technology or product will be a globally distinctive offering. Other industry assistance and capability-building programs offered by federal and state governments could also be better designed to target the characteristics associated with manufacturing advancement."

As part of AMGC's recent focus group, approximately 15 per cent of manufacturers reported government procurement as a challenge to their business specifically.

Trade policy

Nothing further to add

Skills and training

The Australian manufacturing industry employs approximately 1.3 million people directly and indirectly, across a wide range of roles. Even so, AMGC regularly hears from manufacturers that their biggest growth constraint is a shortage of suitable staff. AMGC's studies on peoples' perceptions of the manufacturing industry have also found that the industry is not always attractive to, or well understood by, individuals as they consider where to build their careers.

With these points in mind, AMGC believes the government should consider a range of general and specific measures to increase the supply of, and demand for, the talent Australia needs to build a strong manufacturing industry with diverse capabilities. These include:

- **Change perceptions.** Governments should actively promote careers in manufacturing by highlighting the broad range of roles available, how manufacturing jobs can align with individuals' goals, such as being creative and working with their hands, and other rewards. Requiring TAFE and other tertiary students to gain first-hand experience in manufacturing could raise awareness of the industry and shift perceptions among young people especially.
- **Harmonise and expand qualifications.** Governments should work to harmonise the recognition of qualifications nationally and more actively recognise short-course qualifications.



- **Co-design curricula.** Governments and private educational groups should partner with industry to develop curricula covered in areas of study relevant to manufacturing. This could extend to engaging with industry on the design of high school and tertiary curricula.

(h) The opportunity to create reliable, cheap, renewable energy to keep Australia’s manufactured exports competitive in a carbon-constrained global economy and the role that our manufacturing industry can play in delivering it.

There is an opportunity for Australian manufacturers to leverage the ready local supply of raw materials to become leading suppliers of renewable energy and storage solutions to local businesses.

AMGC is working with manufacturers across Australia to modernise their plants and processes to reduce their energy consumption. This enables companies to become more efficient and profitable and enables them to differentiate their products with buyers concerned about sustainability.

Further resources

The following AMGC research reports and submissions to government provide extensive data and recommendations for policy makers. These and other resources are available at www.amgc.org.au.

- *Industry Knowledge Priorities* (2016)
- *Innovation and Science Australia 2030 Strategic Plan* submission (2017)
- *Building Resilience in Australian Manufacturing* (2018)
- *Industry 4.0 – An opportunity for every Australian manufacturer* submission (2018)
- *Australian Manufacturing, a new definition for a new era* (2019)
- *Industry Competitiveness Plan 2020*
- *Ten Ways to Succeed in Australian Manufacturing* (2020)
- *AMGC Projects Report* (2020)
- *Perceptions of Australian Manufacturing* (2021, forthcoming)

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