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Australian Defence Technologies Amidst Shifting Global Economic Dynamics

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As global economic dynamics evolve, Australia's defence sector faces challenges and opportunities in maintaining technological advancement and strategic autonomy. This paper examines the role of Australian defence technologies in adapting to economic shifts, exploring partnerships, innovation and resource management within a global context. It highlights the importance of resilience in supply chains, enhanced research and development in emerging technologies, and collaboration with allies to mitigate risks and drive growth. With strategic investments in artificial intelligence, cybersecurity and renewable energy, Australia's defence industry can strengthen its position, ensuring national security while contributing to a stable, adaptive global defence ecosystem.

1. Introduction

The strategic environment of the Indo-Pacific has become increasingly complex due to numerous factors, including climate change, geopolitical shifts, technological advancements and economic competition (Varghese, 2019). China's rise has altered the regional balance by expanding its economic influence through the Belt and Road Initiative, modernising its military, asserting control in the Indo-Pacific, and challenging Western dominance (Lindley, 2022; Singh & Marwah, 2023). Concurrently, the current political landscape in the United States (US) marked by uncertain foreign policies has created strategic vacuums (Shah & Kirchhoff, 2024). This has affected alliances such as the North Atlantic Treaty Organization (NATO); Five Eyes alliance between Australia, Canada, New Zealand, the United Kingdom (UK) and the US; and AUKUS agreement between Australia, the UK and the US, prompting nations to reassess partnerships and security frameworks (Berzina, 2024; Lyons, 2025). The Middle East crises and the instability in major oil-supplying nations further strain global energy markets and intensify geopolitical rivalries. Together, these shifts have reshaped global power dynamics, driving a multipolar order (Ball, 2024). Australia, an island nation with significant reliance on maritime and air supply chains, finds itself at the centre of this transformation (Scott, 2013). In response, Australia is adopting a multifaceted approach to strengthening its defence capabilities, aligning with emerging global power dynamics, and preparing for the challenges posed by new methods of conflict engagement (Taylor, 2013).

In recent years, there has been a shift in the methods of conventional engagement through which military conflicts are fought. Technological advancements can significantly contribute to the formation of a focused and agile military force within defence forces by enhancing operational efficiency, precision and adaptability, which can lead to force multiplication, improved decision-making, enhanced training and simulation, energy resilience, and cyber and electronic warfare (Thee, 2025). Asymmetric warfare, which emphasises innovation and technological superiority, has become a key feature of military strategy (Thomas, 2024). For Australia, this underscores the importance of developing and implementing cutting-edge defence technologies to ensure the country's security in an increasingly volatile region (Field, 2019). Australia's proactive approach is further demonstrated by its recent policies like the Future Made in Australia policy, an ambitious initiative designed to bolster the nation's economic, industrial and defence capabilities (*Future Made in Australia Bill 2024*, n.d.).

This paper investigates Australia's strategic approaches in the region, with a particular focus on the integration of advanced defence technologies to address evolving security challenges. As the global security environment continues to shift, Australia needs to align its defence capabilities with national security priorities. The analysis will examine the incorporation of emerging technologies into Australia's defence strategy to address both regional and global security concerns. Furthermore, it will assess the implications of these technological advancements for the nation's security, defence posture and regional influence. Additionally, the paper will evaluate recent government policies aimed at fostering the growth of domestic industries and promoting innovation, strengthening Australia's defence capabilities, and advancing sustainable energy transitions for operational deployments.

2. Shifting geopolitical and economic landscapes in the Indo-Pacific

The Indo-Pacific region, with its immense economic potential and strategic significance, has become a focal point of global attention, exemplified by the establishment of the Quadrilateral Security Dialogue (QUAD) alliance in 2007.

Evolving environmental and political dynamics in the region are increasingly shaping defence strategies and security priorities. Major powers, such as the US and China, are engaged in an intense competition for influence, reshaping the regional order (Heath, 2021). Consequently, the Indo-Pacific remains central to global security and economic stability, demanding a nuanced and adaptive approach to regional cooperation.

The US is experiencing a period of political change that influences its foreign policy and defence commitments (Shah & Kirchhoff, 2024). With changing administrations, there is often a shift in focus regarding international alliances and defence priorities. These shifts have significant implications for partners and allies, which must navigate the uncertainties while safeguarding their national interests. China's growing economic and military power from the 1990s poses challenges to the Indo-Pacific region by disrupting the balance of power and asserting dominance in contested areas, such as the South China Sea (Lindley, 2022). Its military build-up and establishment of artificial islands have raised concerns over freedom of navigation and regional sovereignty. Through initiatives like Belt and Road, China extends its economic influence, often creating debt dependencies that can undermine the autonomy of smaller nations (Urooj et al., 2024). Additionally, its cyber activities and grey-zone tactics heighten regional security concerns, as these actions often bypass traditional conflict thresholds (Hanson et al., 2024). The combination of strategic competition, coercive diplomacy and territorial ambitions makes China's rise a significant problem for Indo-Pacific stability.

India, too, is emerging as a key player in the Indo-Pacific. India's expanding military capabilities and strategic interests increasingly align with those of Australia, the US and Japan. This alignment is most prominently visible within the QUAD framework (Smith, 2021). While the QUAD is not officially recognised as an alliance by its member states, it functionally exhibits many characteristics of an alliance. By examining the components that constitute an alliance and applying them to the QUAD, it becomes evident that it serves as a platform for advancing shared strategic objectives, especially in the Indo-Pacific region.

India's foreign policy, guided by the Panchsheel principles that include peaceful coexistence, mutual respect and non-aggression, remains central to its diplomatic identity (Rohit, 2024). However, its growing military capabilities, such as acquiring advanced defence systems and modernising naval power, reflect an aspiration for greater regional security leadership. India balances this duality by participating in multilateral forums like the QUAD and conducting joint exercises like Malabar while maintaining strategic autonomy (Marles, 2023b). This approach is also a response to regional challenges, including border disputes with China and maritime threats in the Indian Ocean. By aligning its diplomatic ideals with defence preparedness, India positions itself as a key player in ensuring stability in the Indo-Pacific. The QUAD alliance serves as a platform for India to assert its influence, counter China's regional dominance, and strengthen security cooperation in the Indo-Pacific.

The renewed focus on the Indo-Pacific is both a response to China's growing influence and a strategic pivot following the relative subsidence of Middle Eastern challenges like the Silk Road and critical trade security concerns (Yasmin et al., 2024). While Australia's engagement through alliances like AUKUS Pillars 1 and 2 underscores a commitment to regional security, it also reflects a broader recalibration of priorities toward the economic and strategic potential of the Indo-Pacific (Sharma, 2024). The Middle East remains significant but shifting geopolitical realities have made the Indo-Pacific central to global competition. This region's economic dynamism and its critical role in trade routes, coupled with rising security concerns, demand heightened attention. The focus is not a complete departure from earlier interests but an adjustment to the evolving global order where the Indo-Pacific takes precedence.

3. The rise of asymmetric warfare

Asymmetric warfare demonstrates how unconventional tactics can effectively challenge stronger, more conventionally equipped adversaries. Unlike traditional warfare, which relies on direct engagements between evenly matched forces, asymmetric approaches exploit vulnerabilities through innovative strategies. In the Vietnam and Korean Wars, smaller, less technologically advanced forces used guerrilla tactics, local knowledge and ideological unity to counteract superior firepower and resources (Barr, 2018). Australian troops also employed guerrilla techniques during the Anglo-Boer War, adapting to the rugged terrain to combat the Boers' hit-and-run strategies (Cloete, 2021). Similarly, during the Indonesia–Malaysia Confrontation in Borneo, Commonwealth forces, including Australians, leveraged the jungle environment and booby traps to disrupt enemy operations (James, 2008). These historical examples highlight the adaptability and resilience of asymmetric methods in overcoming conventional military advantages.

Modern conflicts further underscore this approach's relevance. During the Iraq War (2003–2011), insurgents used guerrilla tactics and improvised explosive devices (IEDs) to counter the technologically superior US and allied forces (Diakabana, 2025). These methods allowed smaller forces to prolong resistance, create significant disruption and challenge powerful opponents. Together, these cases illustrate how asymmetric warfare continues to redefine how conflicts are fought and won, emphasising adaptability and innovative tactics over sheer technological superiority. The concept of asymmetric warfare has evolved with technological advancements, making it a prominent feature of modern conflicts. In the ongoing Russia– Ukraine war, Ukraine has effectively used advanced technologies such as drones, satellite imagery and cyber capabilities to counteract Russia's military strength (Dibb, 2022; Haydock & Meeker, 2025).

One of the most notable examples of the use of advanced technologies in asymmetric warfare is Israel's Iron Dome missile defence system. This and the country's capabilities

in intelligence gathering are allowing Israel to defend itself against attacks from non-state actors like Hamas (Landau & Bermant, 2014). These examples highlight how modern technology can shift the balance of power in conflicts, giving technologically advanced nations a strategic edge and emphasising the increasing importance of technological superiority in contemporary warfare (Thornton, 2007).

Another dimension of asymmetric warfare is the increasing reliance on cyber capabilities, artificial intelligence (AI) and autonomous systems. Cyber warfare has become a significant global concern, enabling adversaries to target critical infrastructure, disrupt communications, and undermine national security without resorting to direct military conflict (Robinson et al., 2015). Nations are investing in cyber defence capabilities to protect critical infrastructure and respond to potential attacks on their networks (Molander et al., 1996). The integration of AI and machine learning in cybersecurity offers new opportunities to detect and respond to threats more efficiently, helping to safeguard national security (Adam, 2024).

While autonomous systems introduce innovative technology, the core principle of adapting tactics to leverage available tools remains unchanged throughout history. Each advancement, whether it is tanks, drones or aircraft, aims to improve military strategy and increase effectiveness while reducing risk to personnel. These systems can perform a wide variety of tasks, from intelligence gathering to direct combat operations, acting as a force multiplier that significantly enhances the effectiveness of military forces. In military conflict, this means they can provide real-time data and situational awareness, enabling faster decision-making and more precise targeting (Torossian et al., 2020). Autonomous systems can also mitigate human risk by assuming high-risk missions, such as reconnaissance in hostile territory or direct engagement with enemy forces. By increasing operational efficiency and flexibility, these systems allow militaries to adapt more quickly to changing battlefield conditions, making them more agile and responsive in combat. Additionally, they can work alongside traditional forces, amplifying their capabilities and optimising overall strategic outcomes (Scharre, 2015). The rise of autonomous systems in warfare could lead to a new form of economic attrition, where nations compete to outspend each other on technology development and deployment rather than traditional military resources. This shift may enable smaller or less wealthy nations to leverage low-cost drones and robotic vehicles to challenge more powerful states, creating new vulnerabilities and strategic dynamics in modern conflicts (McGlynn, 2024).

A significant determinant of success in modern warfare is the geographical and contextual landscape in which conflict occurs (Efron et al., 2020). This was particularly evident in Afghanistan, where numerous foreign interventions, including the International Security Assistance Force (ISAF), demonstrated the limitations of technological superiority. Despite possessing advanced military capabilities, NATO forces encountered sustained resistance from insurgent groups and local actors who effectively utilised their familiarity with the terrain and exhibited strong ideological commitment (Herd, 2021). This case illustrates that technological advantage alone does not guarantee military success; rather, factors such as geographic conditions, sociopolitical dynamics and the determination of local forces play a pivotal role in shaping outcomes (Jordan et al., 2016). Furthermore, the conflict underscores the importance of international cooperation and strategic partnerships in enhancing collective defence capabilities and addressing shared security challenges.

4. The AUKUS partnership and Defence Technologies Cooperation

AUKUS marks a pivotal development in trilateral defence collaboration between Australia, the UK and the US, with a strategic emphasis on advancing shared capabilities in areas such as nuclear-powered submarines, artificial intelligence, autonomous systems, cyber defence, quantum technologies and long-range strike platforms (Davis et al., 2022). This strategic partnership not only strengthens the defence posture of the three nations but also underscores a shared commitment to maintaining regional stability and technological superiority in the face of emerging threats, particularly in the Indo-Pacific (Caples et al., 2023).

A central focus of the AUKUS agreement is Australia's acquisition of nuclear-powered submarines, which will significantly enhance its strategic position in the Indo-Pacific (Marles, 2023a). These submarines offer critical advantages, including extended operational ranges, greater endurance and improved stealth, making them more effective than conventional diesel-electric submarines (Ohff, 2017). By partnering with the US to acquire nuclear-powered submarines and train Australian personnel, AUKUS seeks to strengthen Australia's naval capabilities in the face of growing regional competition. However, the successful delivery of this capability faces challenges due to the need for a highly specialised workforce to operate, maintain and secure these advanced submarines. The Australian National Audit Office (ANAO) has emphasised the importance of investing in training, recruitment and retention strategies to build a skilled workforce, particularly engineers, technicians and nuclear experts, to avoid delays and ensure operational effectiveness (Australian National Audit Office, 2022).

In addition to the nuclear submarine program, Australia has achieved significant progress in developing cutting-edge technologies such as the Trusted Operation of Robotic Vehicles in a Contested Environment (TORVICE), which tests advanced AI in uncrewed robotic vehicles (Department of Defence, 2024c). AI-powered uncrewed vehicles can provide a decisive advantage in warfare by targeting and undermining an adversary's centre of gravity (CoG). By operating autonomously and remotely, these vehicles can disrupt key elements of an enemy's strategy – whether military, logistical or economic – without exposing personnel to direct risk. The ability to strike at an adversary's CoG, particularly their critical vulnerabilities, can decisively shift the balance of power. However, this advantage is contingent on accurately identifying and targeting the true CoG, as

even the most advanced technology may fall short if it does not address the heart of the enemy's strengths.

In addition to these efforts, AUKUS Pillar 2 prioritises the collaborative development of emerging technologies, with particular emphasis on quantum technologies and long-range missile systems (Henneke & Stephens, 2024). The advancement of quantum technologies represents a critical frontier in military innovation. Quantum computing has the potential to transform cryptographic systems, significantly enhancing the security of communications and data protection across defence networks (Defence Media, 2021). In parallel, quantum sensing technologies promise exceptional precision in navigation, positioning and targeting – capabilities that are vital for operating in contested and GPS-denied environments (Thompson, 2025). These technologies align closely with the priorities of the Defence Science and Technology Group (DSTG), which is actively investing in emerging and disruptive technologies to ensure the Australian Defence Force (ADF) maintains a strategic edge in future operational contexts (Department of Defence, 2024b).

Long-range missile systems are another strong emphasis on the collaborative development of emerging technologies under AUKUS Pillar 2. The development of advanced long-range missile technologies under AUKUS aims to improve precision strike capabilities, extend operational reach and strengthen regional deterrence in areas such as the Indo-Pacific, where tensions have risen due to geopolitical competition and security concerns (Department of Defence, 2024a). By fostering technological innovation in long-range strike systems, AUKUS ensures that its member nations maintain a competitive edge in maintaining stability and security within the region. Furthermore, these advancements are aligned with broader defence strategies that prioritise ensuring freedom of navigation, securing critical sea lanes, and preventing adversaries through credible, technologically advanced deterrence.

The AUKUS partnership faces potential challenges due to the International Traffic in Arms Regulations (ITAR) of the US (O'Callaghan et al., 2023). ITAR controls the export of defence and space-related technologies to prevent adversaries from accessing sensitive capabilities. These regulations can hinder the transfer of technology and expertise between the AUKUS partners, potentially slowing the partnership's progress. The 2024 Defence Science and Technology Group ADSTAR Summit discussed strategies to overcome regulatory barriers and develop accelerated procurement between the involved countries in the AUKUS partnership, as well as enhance strategic partnerships with like-minded countries like Singapore (Mei, 2024).

Despite these challenges, the AUKUS partnership represents a significant step forward in international defence cooperation. It highlights the importance of alliances and partnerships in enhancing defence capabilities, particularly in the face of evolving security threats and technological advancements. By combining resources, sharing expertise and collaborating on cutting-edge technologies, the AUKUS partners can strengthen their collective security and maintain a strategic advantage in the Indo-Pacific region.

Another vital aspect of Australia's defence cooperation is the Five Eyes intelligence-sharing alliance (O'Neil, 2017; Tossini, 2020). The Five Eyes alliance is not limited to just intelligence sharing; it also includes various forums and collaborative initiatives focused on enhancing military and defence capabilities. These forums provide a platform for the Five Eyes nations to discuss and develop joint capabilities, ensuring interoperability between their armed forces and fostering deeper defence cooperation. While intelligence sharing remains a core component, these collaborative efforts also aim to strengthen the overall defence and security capabilities of the partner nations.

5. Advancements in global military technologies

The global landscape of military technologies is evolving rapidly as countries race to develop new capabilities in response to emerging security threats. China has made significant strides in developing military technologies, particularly in the areas of hypersonic missiles, AI and autonomous systems (U.S. Department of Defense, 2023a). Hypersonic missiles travel at speeds of Mach 5 or higher, utilising advanced propulsion systems to sustain their velocity while gliding through the upper atmosphere (Bugos, 2021). In addition to their extreme speed, these missiles are equipped with highly manoeuvrable hypersonic glide vehicle payloads, which allow them to evade conventional missile defence systems. This combination of speed and agility makes hypersonic missiles a formidable challenge for current defence technologies, as they can quickly and unpredictably change course, making interception more difficult.

Similarly, India is rapidly advancing its military technologies, focusing on modernising its armed forces and enhancing its defence capabilities. India's development of indigenous technologies, such as the BrahMos supersonic cruise missile and the Tejas light combat aircraft, and ballistic missile nuclear submarine classes like the Arihant and Arighat, reflects its commitment to self-reliance in defence and reducing its dependence on foreign suppliers (Kanwal, 2012; Menon, 2024). Other interesting areas, such as sovereign-developed satellite ranges and space technologies, uplift the country to compete with leading global powers (Das et al., 2021).

Despite facing economic challenges, Russia continues to prioritise the development of advanced military technologies, including hypersonic weapons, electronic warfare systems and cyber capabilities. These initiatives reflect Russia's determination to maintain its status as a major military power, ensuring its strategic deterrence remains robust (Parlow, 2024). By focusing on cutting-edge technologies, Russia aims to enhance its ability to counter threats from NATO and other adversaries while strengthening its military arsenal to assert its influence. The integration of these technologies into Russia's defence strategy is designed to bolster its readiness and ability to project power globally.

Meanwhile, the US remains a global leader in military innovation, particularly in the areas of AI, autonomous systems and cybersecurity. The US Department of Defense's Third Offset Strategy, initiated in 2014, aims to maintain

the US's technological edge over its adversaries by investing in next-generation technologies (Gentile et al., 2021). Cyber, energy, AI and machine learning are seen as critical enablers of future US military operations, offering the potential to enhance decision-making, optimise logistics and improve operational efficiency (U.S. Department of Defense, 2023b).

These countries' military technological advancements illustrate the broader trend of global militarisation and the increasing importance of technological superiority in defence strategies. As nations invest in developing cutting-edge capabilities, the international security landscape becomes more complex and competitive, necessitating adaptive and forward-looking approaches to national security (Schmid et al., 2017).

6. Future Made in Australia policy and its impact on Defence

The policy can significantly strengthen the ADF by fostering the domestic manufacturing of advanced defence technologies and reducing reliance on foreign supply chains (Jackett, 2022). It supports the local production of critical equipment, ensuring timely access to high-quality resources tailored to Australia's unique strategic needs. The policy promotes innovation by investing in Australian research and development (R&D), enabling the ADF to adopt cutting-edge solutions for modern warfare (*Future Made in Australia Bill 2024*, n.d.). Additionally, it enhances national security by safeguarding sensitive technologies and creating skilled jobs within the defence industry. By focusing on local capabilities, the policy builds a resilient and self-reliant defence ecosystem that supports long-term operational readiness and sustainability.

The Future Made in Australia policy, introduced in the 2024 Budget, represents a strategic investment in the nation's economic, industrial and security future. With a commitment of $22.7 billion over the next decade, this initiative aims to harness the financial and industrial benefits of transitioning to net-zero emissions while strengthening Australia's strategic position in a rapidly evolving global landscape (Department of Treasury, 2024). By integrating advanced manufacturing, renewable energy solutions and next-generation defence technologies, this policy enhances national resilience, economic security and climate adaptation.

For the defence sector, this initiative presents a critical opportunity to drive innovation and develop sovereign capabilities tailored for asymmetric warfare. Investments in autonomous systems, directed energy weapons, resilient energy infrastructure and AI-driven decision-making will enable Defence to counter emerging threats effectively. By fostering collaboration between industry, academia and Defence, the Future Made in Australia policy ensures that Australia remains at the forefront of technological advancements, reinforcing national security while achieving long-term economic and environmental sustainability.

The Future Made in Australia policy emphasises the importance of building domestic capabilities and reducing reliance on foreign suppliers. This policy supports enhancing Australia's defence capabilities and ensuring its place in the changing global order by fostering innovation and supporting the development of advanced technologies. This approach aligns with the broader trend of nations seeking to achieve self-reliance in defence and reduce dependence on foreign technologies and supply chains.

The 2022 ADF report highlights that addressing critical skill shortages is essential for effectively implementing advanced technologies in defence and securing Australia's future (Nguyen, 2022). The policy can be leveraged to address ADF skill shortage by fostering local talent development, encouraging investment in domestic defence industries, and creating pathways for skilled professionals to enter the workforce. By prioritising local production and innovation, Australia can reduce dependency on foreign expertise while simultaneously building a robust, self-sustaining defence sector capable of meeting future challenges.

In addition to building domestic capabilities, the Future Made in Australia policy emphasises the importance of international cooperation and partnerships in enhancing defence capabilities. The Australian domestic development of Ghost Shark's uncrewed undersea vehicle with the support of the Defence Advanced Strategic Capability Accelerator (ASCA) and its export to the US is a good example that can be considered to be a forerunner for the country's newly introduced policy (Australian Defence Magazine, 2024). Renewable energy is another major industry that gained traction in the country. Announcements from bp Australia to reopen its refinery at Kwinana for biofuel production and Federal government investment in the Arafura rare earths project in Central Australia boost up the Australian goal of sovereign capability development. (Fitzsimmons, 2023; Vivian, 2024). The introduction of incentives and subsidies in the areas of R&D and renewable energy to promote Australian business is adding to that direction (Carroll, 2024; Department of Industry, Science and Resources, n.d.).

By collaborating with allies and partners, such as through the AUKUS partnership, Australia can access innovative technologies, share expertise and strengthen its defence capabilities. However, to truly maximise these benefits, the Future Made in Australia policy plays a crucial role in ensuring that these advancements are not only adopted but also developed domestically. Through this policy, Australia can drive innovation in its defence sector, creating jobs and fostering local industries while leveraging the expertise gained from international collaborations. This approach reflects the importance of strategic alliances in tackling shared security challenges while also reinforcing Australia's self-reliance in developing and deploying its advanced defence technologies. In this way, the AUKUS partnership complements the broader goals of the Future Made in Australia initiative, ensuring that Australia maintains a competitive edge in a rapidly evolving global environment.

7. Ensuring national security through the domestic renewable energy transition

The Australian Government has made the development and adoption of renewable energy a priority as part of its commitment to achieving net-zero emissions (Department

of Finance, 2023). This transition not only addresses climate goals but also directly strengthens national security. As a significant energy consumer, the ADF plays a pivotal role in Australia's broader strategy to mitigate greenhouse gas emissions while enhancing the nation's energy resilience. Both the Defence Climate Change Policy and the 2023 Defence Strategic Review emphasise the importance of integrating clean energy solutions into defence infrastructure to reduce reliance on external energy sources and secure energy supply chains critical for national security (Bowcott et al., 2021; Department of Defence, 2024d; U.S. Department of Defense, 2023b).

To align with the government's net-zero emissions target, the ADF is actively working on implementing clean energy initiatives across its operations. This includes prioritising renewable energy adoption within the Defence estate, particularly focusing on Air Force, the largest energy consumer in the sector. The collaboration between the Security and Estate Group and Joint Capabilities Group aims to achieve a 43% emissions reduction by 2030, directly enhancing national security by mitigating vulnerabilities related to external energy disruptions and strengthening domestic energy resilience (Department of Defence, 2024e, 2024f).

This renewable energy transition is closely aligned with the Future Made in Australia policy, which promotes the growth and deployment of domestically produced technologies. Through investments in renewable fuels like sustainable aviation fuel (SAF) and renewable diesel (RD), the ADF is currently leading its aim to reduce its dependence on imported fossil fuels while fostering the growth of Australia's renewable energy and fuel industries (Cole, 2022; Yildirim, 2022). This strategy not only bolsters energy security but also ensures that the ADF's energy needs are met through locally sourced, Australian-made solutions, reducing reliance on foreign suppliers and fostering a self-sufficient, resilient defence sector.

The electrification of defence infrastructure and platforms is another key ongoing initiative that supports both national security and the Future Made in Australia policy. By integrating electric vehicles and renewable energy-powered equipment, the ADF can reduce reliance on traditional fuel sources while advancing the development of domestically produced electric technologies (Bree, 2022; Woolner & Jones, 2023). In addition to environmental and security benefits, electrification offers operational advantages such as reduced noise, lower heat signatures and improved reliability – factors that enhance the strategic effectiveness of military operations.

Hydrogen fuel, produced from renewable sources within Australia, presents a promising opportunity for future defence applications (Soboń et al., 2021). It can potentially power various defence technologies, including ground vehicles, aircraft and ships, further contributing to the ADF's energy resilience. However, a thorough evaluation of hydrogen's performance, storage and logistical challenges is necessary before large-scale implementation within military operations.

Although Australia has made significant investments in the nuclear submarine program under the AUKUS partnership, the broader application of nuclear power within defence remains uncertain (Beazley, 2023; Douglas, 2024). While nuclear energy offers a low-carbon alternative, its integration presents substantial safety, security and political challenges, making widespread adoption in defence operations premature. This cautious approach aligns with both national security priorities and the Future Made in Australia policy, ensuring that Australia's defence energy solutions are secure, domestically sourced and resilient to external threats.

By prioritising renewable energy transitions and promoting Australian-made technologies, Australia strengthens its national security while supporting the growth of domestic industries that contribute to both defence capabilities and sustainable energy solutions.

8. Strategies for achieving sustainability goals in Defence

Further, this paper makes recommendations for the ADF in its journey for the clean energy transition. To effectively transition to renewable energy, the ADF must focus on several strategic areas:

1. Investing in R&D is essential for driving innovation and adapting technologies to meet the unique and evolving needs of the defence sector. This includes advancing capabilities in battery storage, alternative fuels and energy-efficient systems that can function reliably across diverse and challenging environments. ARENA's funding initiatives under the Future Made in Australia program – particularly in alternative energies and low-carbon liquid fuels – represent a promising step toward achieving Defence's long-term sustainability and energy resilience objectives (Australian Renewable Energy Agency, 2024).
2. Collaboration with industry and academia: Working with industries and academic institutions plays a vital role in accelerating innovation and enabling effective technology transfer. By leveraging the diverse expertise, infrastructure and resources across these sectors, Defence can fast-track the development of cutting-edge solutions tailored to operational needs. Partnerships like Defence Trailblazer foster a multidisciplinary approach that enhances capability development and strengthens Australia's sovereign industrial base (Defence Trailblazer, 2025).
3. Infrastructure development: Establishing the necessary infrastructure is critical to enabling the widespread adoption of renewable energy within Defence. This includes developing refuelling and recharging facilities for electric-powered vehicles, as well as deploying renewable energy installations – such as solar arrays and wind farms – across military bases (Todd, 2024). These investments not only support sustainability objectives but also enhance energy resilience and operational self-sufficiency in both domestic and deployed environments.

By adopting a proactive approach to sustainability, the ADF can enhance its operational capabilities while reducing its environmental impact. This commitment to greener practices supports Australia's national and global climate goals and positions the ADF as a leader in sustainable defence practices. By integrating renewable energy into its operations, the ADF can contribute to a more sustainable future and ensure its capabilities are resilient, adaptable and aligned with contemporary environmental and strategic imperatives.

9. Conclusion

The global landscape is undergoing significant transformations, shaped by geopolitical shifts, technological advancements and the emergence of new economic powers. In this dynamic environment, defence strategies must evolve to ensure national security and maintain strategic advantage. Asymmetric warfare, marked by unconventional tactics and cutting-edge technologies, underscores the importance of technological superiority and innovation in modern conflicts.

International collaboration, as exemplified by the AUKUS partnership, further enhances Australia's defence modern warfare capabilities. Through shared expertise and the development of advanced technologies, AUKUS partners can collectively strengthen their security posture, particularly in the Indo-Pacific region.

Australia's Future Made in Australia policy reflects a strategic push toward building domestic capabilities, driving innovation and achieving self-reliance in defence. By investing in advanced technologies, renewable energy solutions and education in STEM fields, Australia is positioning itself to secure its place in the shifting global order while contributing to global stability.

Australia's commitment to a renewable energy transition within the ADF plays a key role in adapting to this evolving security environment. By investing in renewable energy technologies such as sustainable fuels, electrification and hydrogen, ADF is not only advancing its capabilities but also enhancing its energy resilience and reducing dependence on external energy sources. This transition supports national security by reducing vulnerabilities to supply chain disruptions and fostering greater self-sufficiency in modern defence warfare.

As the global landscape continues to evolve, adaptive and forward-looking approaches to national security are essential. By embracing technological innovation, fostering international cooperation and leading the renewable energy transition in defence, Australia can maintain its strategic advantage, strengthen its defence posture and contribute to a more secure and sustainable global future.

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