Defence Industry: Net Zero by 2050

Defence Industry Leadership Program (DILP)
Research Paper

22 November 2024

Authors:

James Forrest, Scott Gibbons, Shena Howell, Jamie-Leigh Urey, Chris Wright

Defence Teaming Centre

AUTHORS

James Forrest

Aurizn

Scott Gibbons

Airbus Australia Pacific

Shena Howell

Shoal Group

Jamie-Leigh Urey

BAE Systems Australia

Chris Wright

REDARC Electronics

DISCLAIMER & ACKNOWLEDGEMENT

DISCLAIMER

The contents of this research report are the opinions and conclusions of the authors and do not necessarily represent the views of the author's organisations, the contributors, the contributors' organisations, the Defence Industry Leadership Program (DILP) or the Defence Teaming Centre (DTC).

ACKNOWLEDGEMENT

The authors acknowledge Traditional Owners of Country throughout Australia and recognises the continuing connection to lands, waters and communities and pay respect to Aboriginal and Torres Strait Islander Elders past and present.

Throughout the period of our research project, the authors interviewed representatives from the Defence Industry, Government and Non-Government Organisations to gain insight from lived experience and perspective of the research topic and implications to Defence Industry. The authors would like to acknowledge the contributions from the following organisations:

- Defence Teaming Centre
- BAE Systems Australia
- Shoal Group
- Aurizn
- REDARC Electronics
- Defence SA
- Australian Security Leaders Climate Group
- Defence Estate Group

EXECUTIVE SUMMARY

Australia's Defence Industry is facing an ambitious goal of getting to net zero by 2050. The evolution required to achieve this goal aligns with global sustainability trends and domestic climate commitments, presenting both significant opportunities and challenges.

The United Nations states that *"The consequences of climate change now include, among others, intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms and declining biodiversity."*[1] The secondary impacts of these consequences places Australia's National Security at risk.

This report outlines several specific challenges that Defence Industry are currently facing to ensure recent regulatory changes are being met without compromising capability of an already strained supply chain ecosystem.

Key findings highlight the need for technological innovation, supply chain transformation, operational adaptation, secondary policy and regulation changes to support sustainability goals.

The key findings have been validated by the release of the Defence Net Zero Strategy, released in October 2024. This strategy marks a significant shift towards aligning Defence operations with climate action goals and showcases Australia's commitment to reducing the ADF's environmental footprint while maintaining operational readiness and capability.

The recommendations outlined in this report summarise the importance for both Defence Industry and Australia's Department of Defence to implement collaboratively the below:

1. Defence Industry Climate Action Working Group
2. Defence Strategy Including Climate Considerations
3. Defence Capability Development
4. Clarity Around Definitions and Methods of Measurement

While the path to Net Zero by 2050 presents numerous challenges for Australia's Defence Industry, proactive policy measures, strategic investments, and collaborative efforts can facilitate this critical transition, positioning Australia as a leader in sustainable defence practices.

TABLE OF CONTENTS

Disclaimer & Acknowledgement **3**

Executive Summary **4**

Table of Contents **5**

1 Problem Statement **7**
1.1 Research Topic (Updated) 7
1.2 Adjustment of the Research Topic 7

2 Approach and Research Methodology **8**
2.1 Legislative reviews 8
2.2 Benchmarking and information gathering 9
2.3 Interviews 9

3 Key Concepts & Definitions **10**

4 Research Findings **11**
4.1 Climate Change Context 11
4.1.1 Temperature Rise and Climate Change Impacts 11
4.1.2 Australian commitments and obligations 13
4.1.3 Cost of Climate Change 13
4.1.4 Defence 14
4.2 Government Legislation 15
4.2.1 Legislation Changes & Scope 1, 2 & 3 15
4.2.2 Current State 16
4.3 Net Zero 2050 – Defence 17
4.3.1 Defence Context 17
4.3.2 Warfighting is changing with the changing climate 18
4.3.3 Delayed Defence Net Zero Strategy 19
4.3.4 Defence Net Zero Strategy 19
4.3.5 Current and Future Defence defined initiatives and targets 20
4.4 Net Zero 2050 – Defence Industry 21
4.4.1 Defence Industry Context 21
4.4.2 Defence Industry Customer 21
4.4.3 Defence Industry Challenges 22

5 Recommendations **23**
5.1 Defence Industry Climate Action Working Group 23
5.2 Defence Strategy Including Climate Considerations 23
5.3 Defence Capability Development 24
5.4 Clarity Around Definitions and Methods of Measurement 24

6 Conclusion **25**

7 References **26**

End Page **29**

(Image source: images.defence.gov.au; Op Flood Assist 22-2)

Climate Change is a National Security risk.

Can Defence Industry be the Catalyst for Change?

1 PROBLEM STATEMENT

1.1 Research Topic (Updated)

The research topic for DILP-C2-P1 and this paper is:

Achieving net zero emissions in the Defence Industry by 2050. Roles, challenges and policy implications.

1.2 Adjustment of the Research Topic

The original problem statement and supporting questions for the research paper were: "Achieving net carbon neutrality in the Defence Industry by 2050. Roles, challenges and policy implications."

- What provisions or incentives should the government provide to support carbon reduction efforts within the Defence Industry? Should Net Zero be considered as an integral part of the broader environmental, social, and government (ESG) framework and integrated into procurement practices in Australia?
- What roles should Defence and CASG undertake in driving carbon reduction initiatives, and how can they effectively fulfill these roles?
- What actions can industry stakeholders implement to achieve the net carbon neutrality target, and how can they be incentivised to do so?
- Which sectors within the Defence Industry are expected to encounter the most significant challenges in achieving carbon reduction, and what strategies can address these challenges effectively?
- Is achieving net carbon neutrality in the Defence Industry by 2050 feasible?

During the research it was discovered the original problem statement and questions were outdated because the statement focuses on two concepts that have been overcome by recent events.

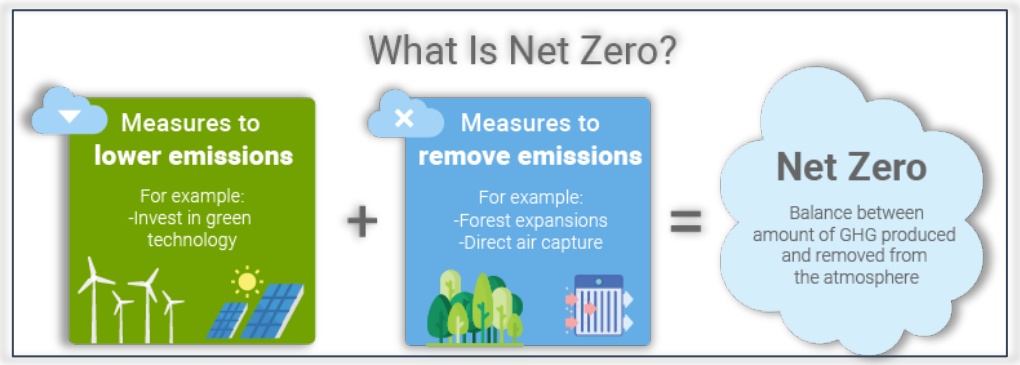


Figure 1. What is Net Zero.[2]

Firstly, the problem statement focuses on "net carbon neutrality" yet the global focus, including agreements Australia is party to focus on net zero emissions – a reduction of all greenhouse gasses, not just carbon. These terms are further explained in Section 3 - Key Concepts & Definitions. Secondly, Australia passed legislation earlier this year requiring all industry above a certain size to report on net zero emission targets, effectively making most of the supporting questions obsolete.

2 APPROACH AND RESEARCH METHODOLOGY

To begin the research for this project, the first step was to define the scope of the activity. Since the research question is specifically about Defence Industry, the scope of the research was set to not include the end-use of any capability delivered to Defence. For example, if a Defence Industry company is contracted to provide a vehicle to defence, the design, manufacturing, testing and validation of that vehicle are within scope since Defence Industry are responsible for these activities, but the use of the vehicle by Defence is not within scope. Additionally, it was important to define key terms, these are documented in Section 3 - Key Concepts & Definitions.

Next, the research was approached through three data-gathering methodologies:

1. Legislative reviews
2. Benchmarking and data gathering
3. Interviews

2.1 Legislative reviews

Since Australia is party to international commitments like the 2015 Paris Agreement on Climate Change, it was important to understand the context and environment for Defence Industry to review the legislative environment.

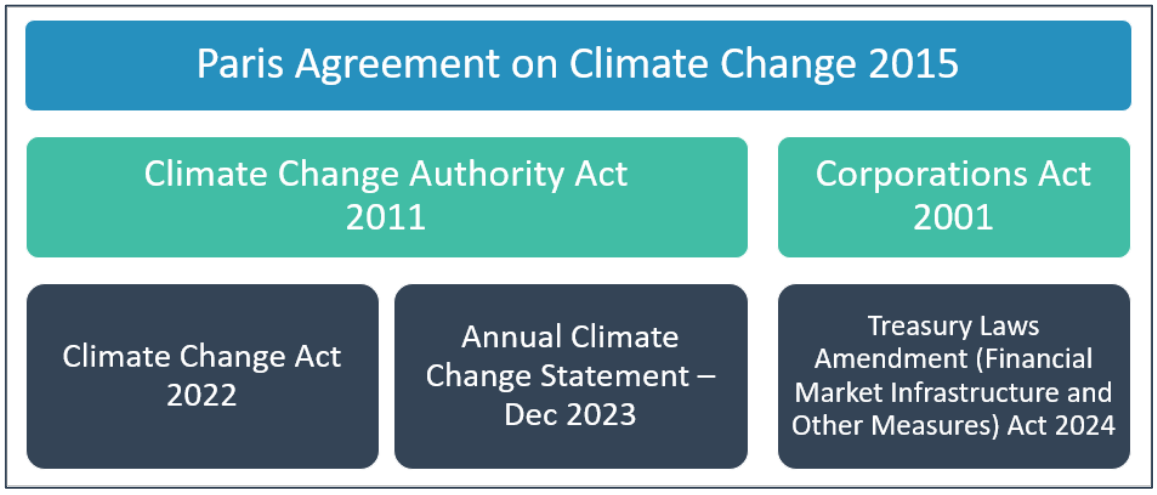


Figure 2. Overview of legislative reviews

The following legislation was reviewed.

- Paris Agreement on Climate Change 2015
- *Climate Change Authority Act 2011* (latest 14 Sept 2022)
- *Climate Change Act 2022* (latest 12 Apr 2023)
- *Treasury Laws Amendment (Financial Market Infrastructure and Other Measures) Act 2024* (effective 17 Sep 2024) (Schedule 4 – Sustainability Reporting amendments to *Corporations Act 2001* and *Australian Securities and Investments Commission Act 2001*)
- Annual Climate Change Statement – Dec 2023

2.2 Benchmarking and information gathering

For benchmarking and information gathering, a broad review of articles, websites, policies and procedures was reviewed to determine what information already existed around Net Zero practises both in Australia and internationally. Additionally, data was gathered around the current state of carbon and net neutrality initiatives in Australia and Australian Defence Industry. This included the review of:

Reports & Plans, such as:

- Australian Public Service (APS) Net Zero Plan
- 2018 Senate Report
- Climate of the Nation, the Australian Institute
- Defence Net Zero Strategy (released 24 October)
- Defence Future Energy Strategy (released 24 October)

Research, articles and news, such as:

- New research shows every Australian pays for extreme weather - Insurance Council of Australia
- Climate and Australia's National Security,
- The Forge, defence.gov.au

2.3 Interviews

To ensure the best outcome from interviews, a consistent interview template was developed, including the use of standard questions. These questions were tailored based on the type of organisation being interviewed. Interviewees were instructed that the questions were starting points for discussion and encouraged to discuss anything that was related to the research topic. To ensure a comprehensive set of information was gathered, interviews were conducted with different types of Defence Industry including:

- Small-Medium Enterprise (SME) service providers,
- SME manufacturers,
- Major International Prime Contractors,
- Government / Australian Public Servants and
- Industry bodies.

The research was compiled, key themes were extracted, and recommendations developed from these findings.

3 KEY CONCEPTS & DEFINITIONS

The following are key concepts and definitions for this report.

Table 1. Key Terms and Definitions

Carbon Neutral	A framework by which an organisation ensures their carbon emissions (CO_2) are neutralised, often achieved through offsetting carbon emissions with paying for carbon capturing activities (tree planting, etc.).
Climate Change	Long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruptions. But since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas.
Defence Industry	Defence Industry is comprised of businesses with an industrial capability used to provide products or services used in, or which can be adapted to be used in, the Australian Department of Defence supply chain and/or an international defence supply chain. This includes businesses that deliver services which contribute to national security outcomes in addition to warfighting outcome
ESG	Environmental, Social, and Governance
Global warming baseline	Global temperature changes are typically measured against the average temperature over a historical, pre-industrial baseline of 1850–1900. This baseline is the earliest period for which high-quality observations of surface temperatures over the land and ocean are available.
Greenhouse Gasses (GHG)	The seven greenhouse gases listed in the Kyoto Protocol— carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); nitrogen trifluoride (NF_3); perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).
Net Zero Emissions	Achieving an overall balance between greenhouse gas emissions produced and greenhouse gas emissions taken out of the atmosphere. (Climate Council https://www.climatecouncil.org.au/resources/what-does-net-zero-emissions-mean/)
Paris Agreement	2015 Agreement signed by over 170 countries, including Australia, with a commitment to cap Global Warming to 2 degrees Celsius over pre-industrial temperatures, and a target of capping the warming to 1.5 degrees Celsius.
Carbon Border Adjustment Mechanism (CBAM)	A tariff, specifically implemented in the EU, that imposes a cost on carbon intensive products imported into the jurisdiction. The purpose is to protect covered industries from cost competition where the difference is based on carbon externalities. For example, carbon intensive steel is cheaper to produce as the carbon emissions are external to the producer, and green steel is more expensive to produce but does not cause these negative externalities to the shared environment.

4 RESEARCH FINDINGS

4.1 Climate Change Context

4.1.1 Temperature Rise and Climate Change Impacts

Australia was one of over 170 parties to sign the Paris Agreement[3] on climate change in April 2016. Under the Agreement, most countries have pledged to reduce greenhouse gas emissions, with the aim to limit global warming to 'well below' 2 degrees Celsius. To this end, Australia has committed to achieving net zero emissions by 2050.

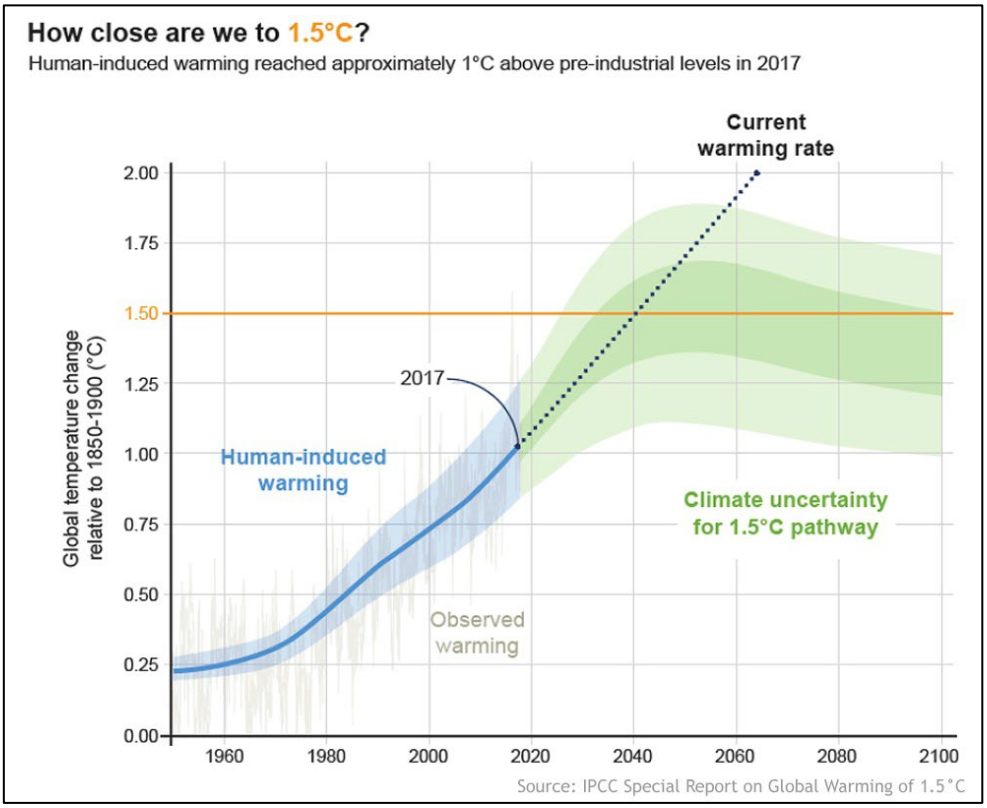


Figure 3. Global Warming temperature rise tracking[4]

The 2015 Paris Agreement commits to a cap in global average temperature rises to 2 degrees C, with a target of 1.5 degrees C. However, as shown in Figure 3, human-induced warming (blue shading) reached approximately 1°C above pre-industrial levels in 2017. At the present rate, global temperatures would reach 1.5°C around 2040.

Importantly, current 2050 Net Zero Emission plans are intended to cap temperature increase (green shading in Figure 3), not reverse the temperature increase. This means the impacts of climate change will continue to worsen until the cap is reached.

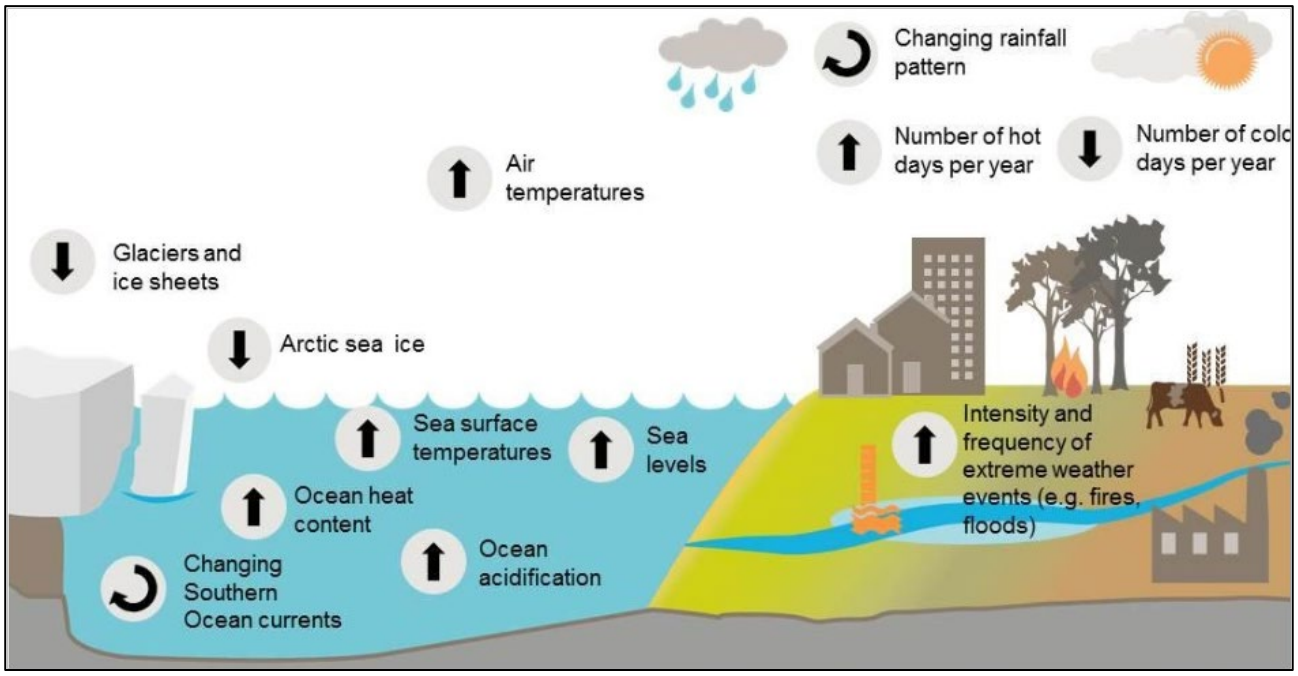


Figure 4. Observed changes of Climate Change

There are multiple lines of evidence that show the climate system is changing. These are shown in Figure 4, and include: record high surface air temperatures, increased average number of hot days per year, decreased average number of cold days per year, increasing intensity and frequency of extreme events (e.g. fires, floods), changing rainfall patterns, increasing sea surface temperatures, rising sea levels, increasing ocean heat content, increasing ocean acidification, changing Southern Ocean currents, melting ice caps and glaciers, and decreasing Arctic sea ice. [5]

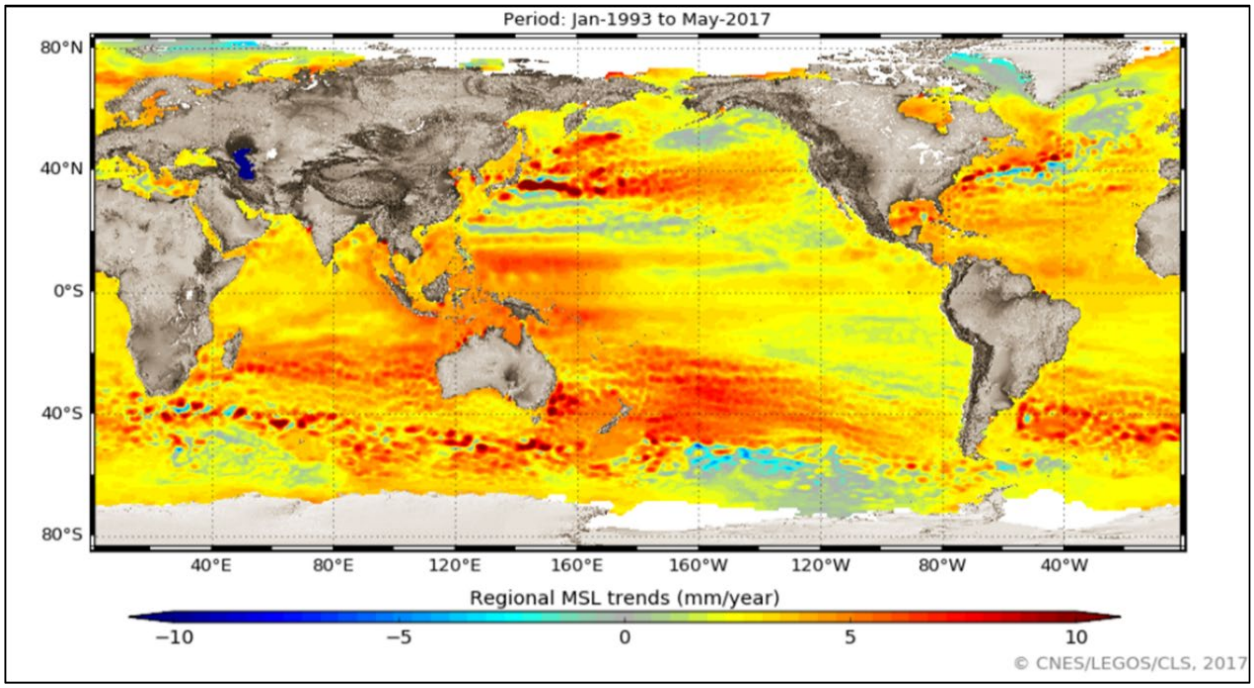


Figure 5. Sea level rise predictions across the globe due to Global Warming

As discussed, sea level rises are expected, but sea level rises are not consistent around the globe. The Australasia region will be impacted disproportionally to other parts of the globe, as shown in Figure 5.[6]

Most land regions will see more hot days, especially in the tropics. At 1.5 degrees Celsius warming, about 14 percent of Earth's population will be exposed to severe heatwaves at least once every five years, while at 2 degrees warming that number jumps to 37 percent. Extreme heatwaves will become widespread at 1.5 degrees Celsius warming[7].

Insurance Council of Australia CEO, Andrew Hall states, "Flood is Australia's most costly natural peril, and it's estimated that around 1.2 million properties face some level of flood risk. Around 230,000 of these have a 1 in 20 chance of a flooding each year, with a further 420,000 properties facing a 1 in 50 or 1 in 100 annual chance of flooding. In Asia, an estimated increase of 63.8 million people (+26%) will be exposed to a so-called "100 year" coastal flooding event between 2020-2040[8].

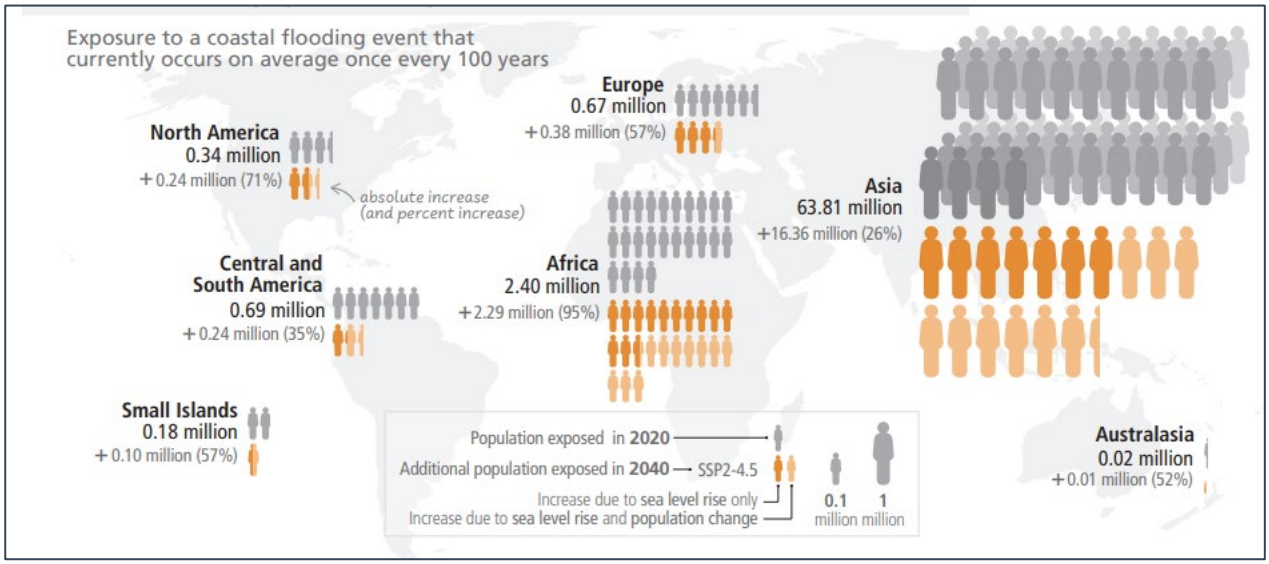


Figure 6. Increase in the population exposed to coastal flooding from 2020 to 2040

4.1.2 Australian commitments and obligations

To meet the 2050 net zero goal, the Australian Senate passed the Climate Change Act 2022[9] to establish the greenhouse gas emissions reduction targets at 43% below 2005 levels by 2030. In September 2024, climate-related financial disclosures were mandated through amendments to the Corporations Act 2001 (Cth) (Corporations Act) and related legislation, requiring large companies to begin reporting on greenhouse emissions from January 2025, with medium size companies (250+ employees) required to report in July 2026, and small companies with more than 100 employees one year after that[10].

In addition, Australian Defence is party to multiple international humanitarian and development agreements. These include the:

- Sendai Framework for Disaster Risk Reduction 2015– 2030,
- Platform on Disaster Displacement, and
- 2030 Agenda for Sustainable Development.

Australia is also part of the FRANZ partnership (France, Australia and New Zealand), which provides coordinated support to Pacific Island countries that require military and humanitarian support for disaster response and early recovery.

4.1.3 Cost of Climate Change

There have been regular devastating natural disasters over the last five years. Looking at the long-term averages, the research shows that these events are increasing in regularity, and in turn the cost to individuals, companies, and industries is increasing.

Insurance payouts are a good dataset to use for overall severity of climate events, as there is long-running data in a well-understood metric of dollars. The Insurance Council of Australia's (ICA) Insurance Catastrophe Resilience Report states that the average insurance payouts over the five-year period to June 2024 were more than double the 30-year average. Data released by the Insurance Council of Australia (ICA) shows that the impact of extreme weather on the Australian economy has more than tripled over the last three decades. In monetary terms, over the last 30 years insurers paid an average of $2.1 billion per year to customers impacted by extreme weather events, but looking at just the last five years the average annual cost of extreme weather claims has more than doubled to $4.5 billion, driven largely by the growing cost of flood.[11]

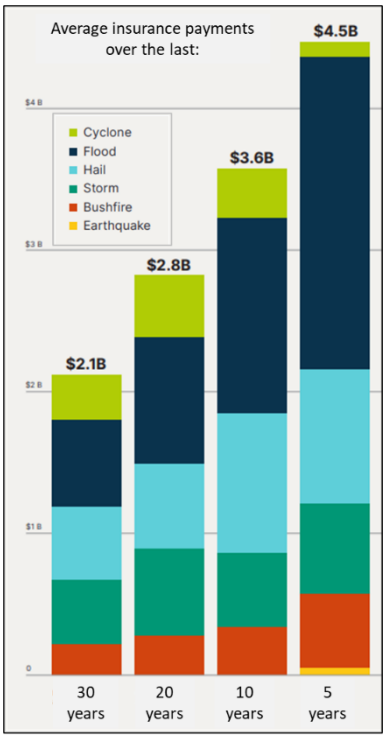


Figure 7. ICA Insurance payment trends

Additionally, the report shows that the cost of extreme weather as a proportion of GDP has nearly tripled over that same 30-year period. The ultimate effect of this is a sharp rise in insurance premiums for those in areas vulnerable to the effects of climate change. Rising premiums can eventually mean that many areas are deemed uninsurable, which risks breaking the social contract of insurance in Australia and creating economic dead-zones.

The McKell Institute estimate in the 2021 report Cost of Extreme Weather that Australian households will be paying $2,509.16 each year in direct costs due to increasing extreme weather events[12]. This is only the direct cost to replace assets, not the wider indirect costs of lost business, or other non-direct impacts of natural disasters. The wider economic costs are therefore even greater, meaning that the cost of extreme weather events as a proportion of GDP is being squeezed from both ends.

Research from the insurance industry, presented by Zali Steggall MP in Parliament and at Southern Space 2024, found that every $1 spent investing in reducing our carbon footprint and on climate change mitigation will save $11 in recovery costs from these extreme weather events. This is backed by Treasury modelling from 2019, "The Treasury's modelling demonstrates that early global action is less expensive than later action."[13]

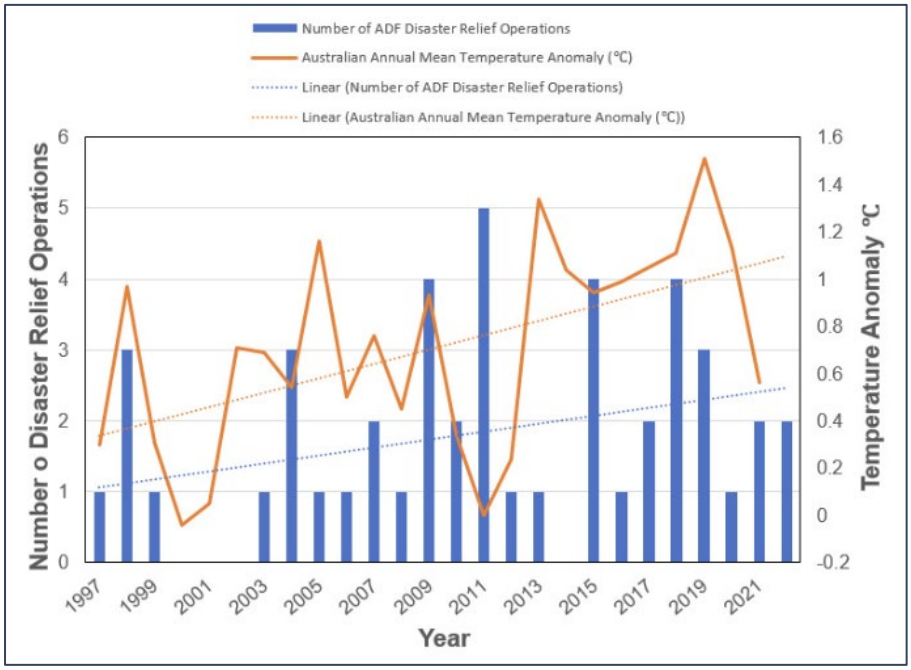


Figure 8. Military disaster relief operations

4.1.4 Defence

As shown in Figure 8, the impacts of Climate Change are directly affecting Defence. The Australian Defence Force (ADF) are responding to increased numbers of emergency events correlating with the temperature rise. In recent history this has been primarily domestic responses, with overseas responses expected to increase due to the factors discussed above[14].

4.2 Government Legislation

4.2.1 Legislation Changes & Scope 1, 2 & 3

In 2024, new mandatory climate-related financial reporting legislation was published. This legislation is aligned with the two standards: International Sustainability Standards Board (ISSB) and International Financial Reporting Standards (IFRS) released in June 2023[15].

First annual reporting periods starting on or after	Large entities and their controlled entities meeting at least two of three criteria:		
	Consolidated revenue	EOFY consolidated gross assets	EOFY employees
1 January 25 Group 1	$500 million or more	$1 billion or more	500 or more
1 July 2026 Group 2	$200 million or more	$500 million or more	250 or more
1 July 2027 Group 3	$50 million or more	$25 million or more	100 or more

Source: treasury.gov.au, Mandatory climate-related financial disclosures, Policy Statement

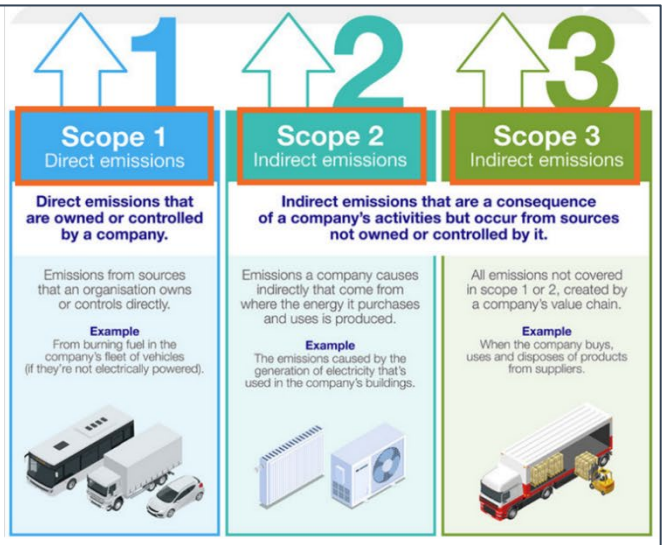


Image source: National Grid

Figure 9. Financial reporting legislation in graphics - groups and scopes

Regulators in major jurisdictions around the world including Europe, the UK and the U.S. have introduced or are also preparing mandatory sustainability reporting requirements for companies. An entity will be phased in based on the size or level of emissions, categorised by groups 1, 2 & 3 as shown in Figure 10.

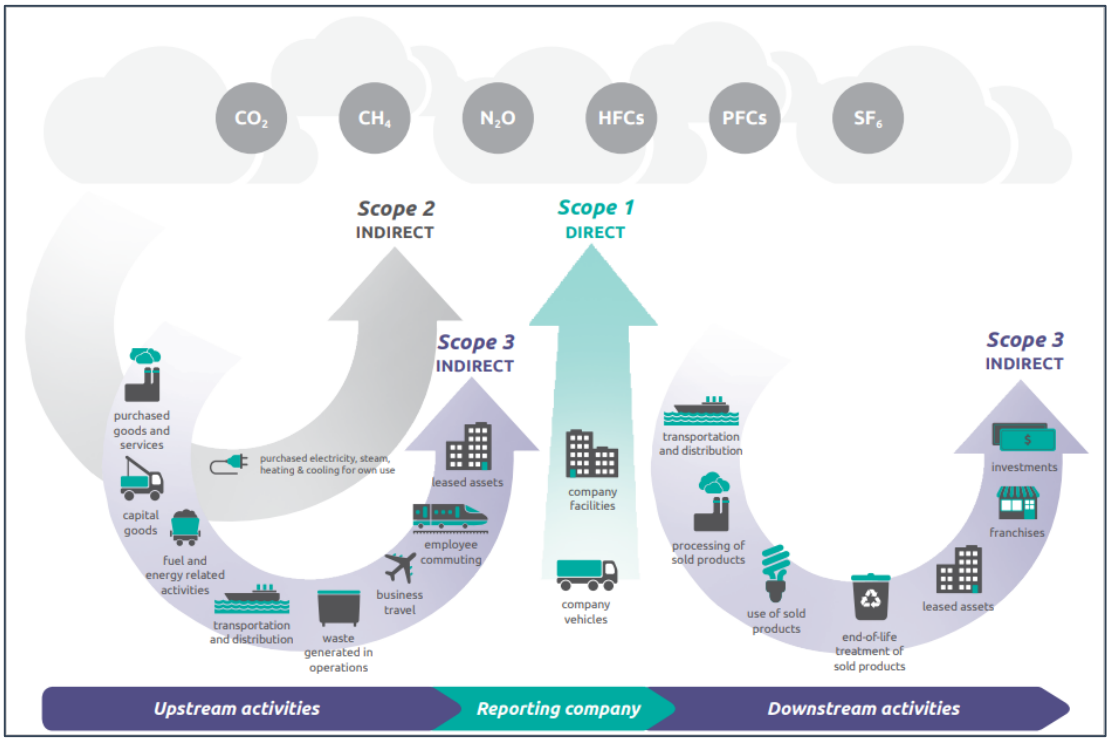


Figure 10. Overview of GHG Protocol scopes and emissions across the value chain

Figure 10 also shows the differences between the legislation's Scope 1, 2, & 3, which define the types of emissions that must be accounted for. Scope 1 is direct emissions owned or controlled by a company. Scope 2 & 3 are indirect emissions that are secondary consequences from sources not owned or controlled by the company. It is evident from our interviews and research that the largest challenge is in quantifying Scope 3 emissions further down the value chain, the second and third tier suppliers to a company.

Scope 3 greenhouse gas emissions are categorised into 15 categories, as described in the Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard (2011) shown in Figure 10: purchased goods and services; capital goods; fuel- and energy-related activities not included in Scope 1 greenhouse gas emissions or Scope 2 greenhouse gas emissions; upstream transportation and distribution; waste generated in operations; business travel; employee commuting; upstream leased assets; downstream transportation and distribution; processing of sold products; use of sold products; end-of-life treatment of sold products; downstream leased assets; franchises; and investments. [16]

4.2.2 Current State

The government is also developing the Net Zero Plan to guide the transition to the legislated target of net zero greenhouse gas emissions by 2050. The Department of Climate Change, Energy, the Environment and Water (DCCEEW) has outlined the following six (6) sectoral emission reduction plans to support the Net Zero Plan:

- Electricity and energy
- Transport
- Industry
- Agriculture and land
- Resources
- The built environment.

Defence Industry crosses several of these sectorial lines.

Box 1.1: Australia's plan to become a renewable energy superpower

The Government is capitalising on the opportunities of the net zero transition and strengthening domestic resilience through its plan to become a renewable energy superpower.

Achieving this goal will require strengthening supply chains, accelerating approval processes, attracting capital, and building a clean energy workforce.

Most importantly, more work is needed to secure sufficient renewable energy generation, transmission and storage, to decarbonise the economy and realise the clean industrial opportunities of the future.

The Government is committed to its longer-term ambitions to help develop the clean energy industries of the future as part of its plan to become a renewable energy superpower. Initial work has identified priority areas for focus, including green metals; green hydrogen and derivative products like ammonia; critical minerals; and storage and generation technologies such as batteries.

In addition to its previous commitment of over $40 billion towards its ambition to become a renewable superpower, the Government has further committed around $3 billion this MYEFO, including via:

- $2.5 billion to support the *Critical Minerals Strategy 2023–2030*, including an additional $2 billion in funding for the Critical Minerals Facility and $500 million for critical minerals projects in Northern Australia through the Northern Australia Infrastructure Facility.
- $5.4 million for a Battery Supply Chain and Research Working Group to enable collaboration with the United States Government on battery supply chains, battery manufacturing capabilities and battery technology research and development.
- $359.0 million over four years to unlock the benefits of cleaner, cheaper and more reliable energy, as a critical enabler of future clean industries and broader decarbonisation. This includes an expansion of the Capacity Investment Scheme to boost renewable generation, firm our electricity supply and secure Australia's energy transformation.

Figure 11. Government Net Zero Investment

In November 2023, the Government released the Net Zero in Government Operations Strategy[17]. The strategy commits to reducing the Australian Public Service's (APS) emissions to Net Zero by 2030. The plan excludes the Australian Defence Force and other 'Security' organisations, but requires that those organisations develop separate plans. The Net Zero Plan is intended to:

- transitioning to renewable energy, facilitated through a whole of government coordinated procurement of electricity
- improving building energy efficiency and electrification
- transitioning the APS fleet to Zero Emission Vehicles where appropriate.

In the Mid-Year Economic and Fiscal Outlook (MYEFO) 2023-24, the Government committed around $3 billion from 2023-24 to 2029-30 in additional funding to support Australia's net zero economic transformation, including renewable, reliable and affordable energy sources and developing clean energy industries.[18]

4.3 Net Zero 2050 – Defence

4.3.1 Defence Context

Climate Change is a National Security Risk. In the March 2018 paper "Implications of climate change for Australia's national security", the Senate Foreign Affairs, Defence and Trade References Committee identified that the security threat from climate change is current and existential, detailing how climate change is contributing to threats to the health of Australian individuals, communities, and the economy.[19] The impacts include extreme weather events, food and water security, disproportionate impacts to vulnerable populations, and the less obvious impacts like spread of infectious disease (like dengue fever being predicted to reach New South Wales in 2100) as well as aeroallergens, occupational health, and mental health impacts.

The security threat of climate change is another layer of an increasingly complex security environment with higher regional and global tensions, and the needs by the Australian Defence Force (ADF) for more capability, innovation, etc.

Figure 12 shows that the projected temperatures in Australia's northern regions reaching 'near unliveable' temperatures if global average temperatures increase to +2.7 degrees C. The extreme temperature across critical bases will likely impact on the operation of support equipment and defence materiel, as well as posing an additional strain on the human operatives required to operate across what is arguably our most vulnerable border.

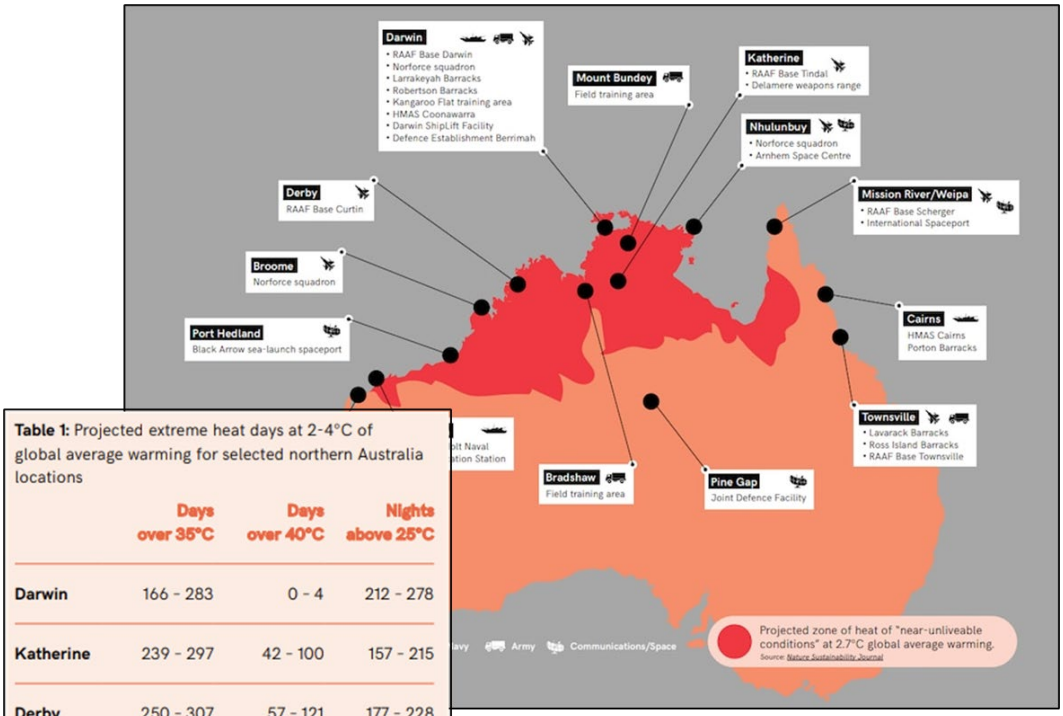


Table 1: Projected extreme heat days at 2-4°C of global average warming for selected northern Australia locations

	Days over 35°C	Days over 40°C	Nights above 25°C
Darwin	166 - 283	0 - 4	212 - 278
Katherine	239 - 297	42 - 100	157 - 215
Derby	250 - 307	57 - 121	177 - 228
Bradshaw	228 - 289	33 - 92	150 - 213

Source: Australian Security Leaders Climate Group, "Too Hot to Handle: The Scorching Reality of Australia's Climate–Security Failure"

Figure 12. Anticipated temperature changes versus strategic Australian bases

Again, looking at the Defence context, Commonwealth Procurement Rules state that Value for Money includes sustainability; specifically to be considered are energy efficiency, circularity of goods, and use of recycled products. Environmental sustainability has been a part of the Defence value for money assessment since 2014.[20]

Since late 2020, the Sustainable Procurement Guide has been available to support government departments and agencies to embed environmental sustainability into planning and procurement processes in support of the value for money assessment criteria. Furthering the ambition across government, the Environmentally Sustainable Procurement Policy (ESP Policy) and Reporting Framework has been released in 2024, which aims to begin enforcing sustainable procurement and reporting on some portion of government procurement including construction, furniture, fittings, equipment, ICT goods and textiles.[21]

4.3.2 Warfighting is changing with the changing climate

Warfighting in the last century has been shaped by the long-standing challenges transporting fuel to front lines, and the importance of primacy in logistics has been made apparent in the Russia-Ukraine conflict. In that conflict, it is contended that logistics frequently has primacy over strategy, and that it is the success or failure of logistics at lower levels of war which exerts the greater effect. Yet, Australia only has a 27-day reserve of fuel.[22] Logistics are costly, and delays create vulnerabilities in our defence. Migrating to fuels that can be renewed at the point of combat will, therefore, offer strategic advantage in kinetic conflicts.

Additionally, fluctuating temperatures impact technological effectiveness. As stated by Scientific American, this is due to thermal stress: "At the molecular scale, temperature is a measure of how much molecules are vibrating. So, the hotter it is, the more the molecules that make up everything from the air to the ground to materials in machinery vibrate. As the temperature increases and the molecules vibrate more, the average space between them grows, causing most materials to expand as they heat up. Roads are one place to see this – hot concrete expands, gets constricted and eventually cracks. This phenomenon can happen to machinery, too, and thermal stresses are just the beginning of the problem".[23]

Figure 13. Arctic Open for Commerce

To further this point, per the NATO 2023 Climate Change and Security Impact Assessment, temperature projections indicate the Earth will reach heats which may result in serious changes to engineering requirements and may even exceed the safe working limits of equipment and platforms.[24]

Lastly, the changing climate means new threats are possible. As seen in Figure 13, the polar caps melting opens new transport corridors. This opens new entry for commerce, but also lines of threat to Australia's allies.[25]

4.3.3 Delayed Defence Net Zero Strategy

The premise that Climate Change is a National Security risk is not revolutionary. For around 20 years there have been global publications stating the risk. Below is a list of examples:

- 2007 – UN, 'Security Council Holds First-Ever Debate On Impact Of Climate Change On Peace, Security, Hearing Over 50 Speakers', 5663rd Meeting, Media release, 17 April 2007
- Sept 2015 – Climate Council, “Climate change must be a national security priority”
- Mar 2018 – Australian Senate Report

Our allies in the UK and US have long-published strategies:

- July 2015 – US DoD, *National Security Implications of Climate-Related Risks and a Changing Climate*
- Mar 2021 – UK Ministry of Defence *Climate Change and Sustainability Strategic Approach*

In Australia, the 2016 Defence White Paper described climate change as 'a major challenge for countries in Australia's immediate region', and committed Australia to provide leadership and support in the region. However, no significant Climate Change content was evident in the Defence Strategic Review (DSR) 2023, National Defence Strategy 2024, or Integrated Investment Program (IIP) 2024. Defence also did not publish an unclassified version of the climate-security risk assessment, authored by the Office of National Intelligence (ONI).

On 25 October 2024, Defence finally joined its global allies, publishing the Defence Net Zero Strategy and a related Defence Future Energy Strategy.

4.3.4 Defence Net Zero Strategy

On 25 October 2024, the Defence Net Zero Strategy and the Future Energy Strategy were released. Minister for Defence Industry and Capability Delivery Pat Conroy stated “Climate change is a national security issue

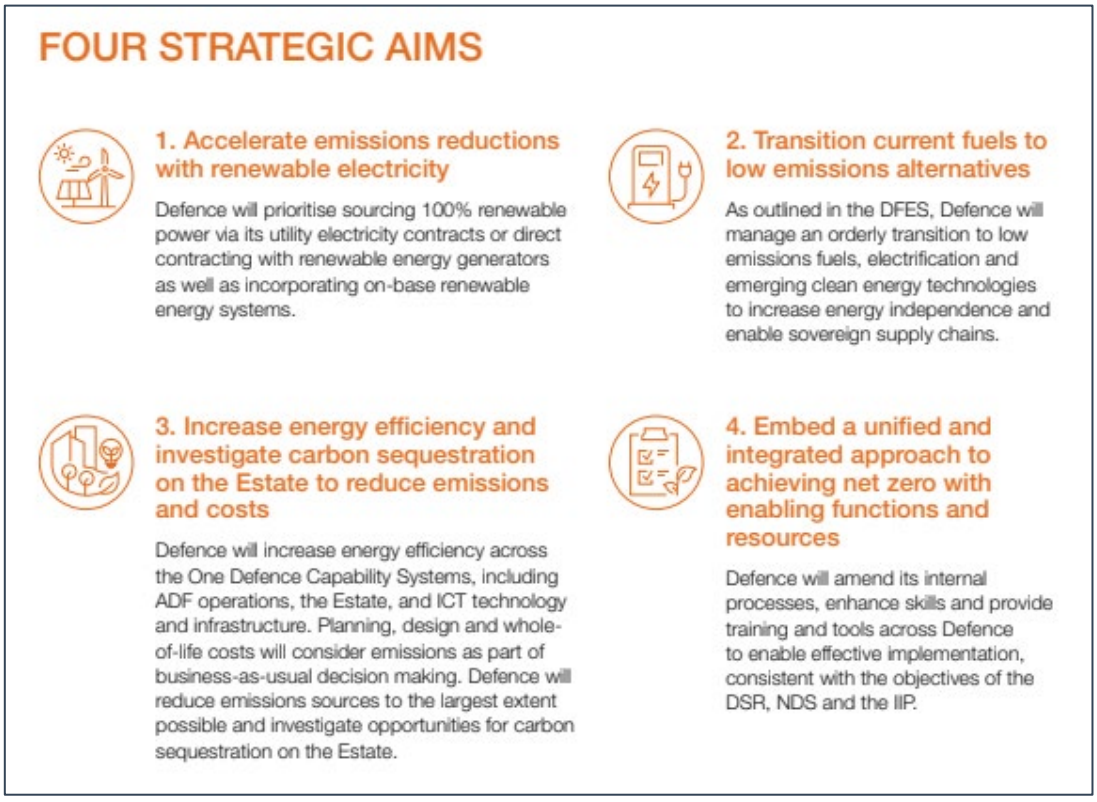


Figure 14. Defence Net Zero Strategy - Strategic Aims

that will increase challenges for Australia, Defence and our region. The challenges arising from climate change are recognised in the National Defence Strategy and Defence is taking action".[26]

The Defence Net Zero Strategy, sets out 4 strategic aims outlined in Figure 14.[27]

The Defence Net Zero Strategy outlines the Australian Defence Force's (ADF) commitment to achieving net-zero emissions by 2050 and commits to reducing Defence's greenhouse gas emissions to net zero by 2050, aligning with Australia's broader climate goals and the global push to limit global warming to 1.5°C. A significant focus is placed on transitioning to renewable energy sources for Defence facilities, including using solar power, wind energy, and green hydrogen to reduce dependency on fossil fuels.

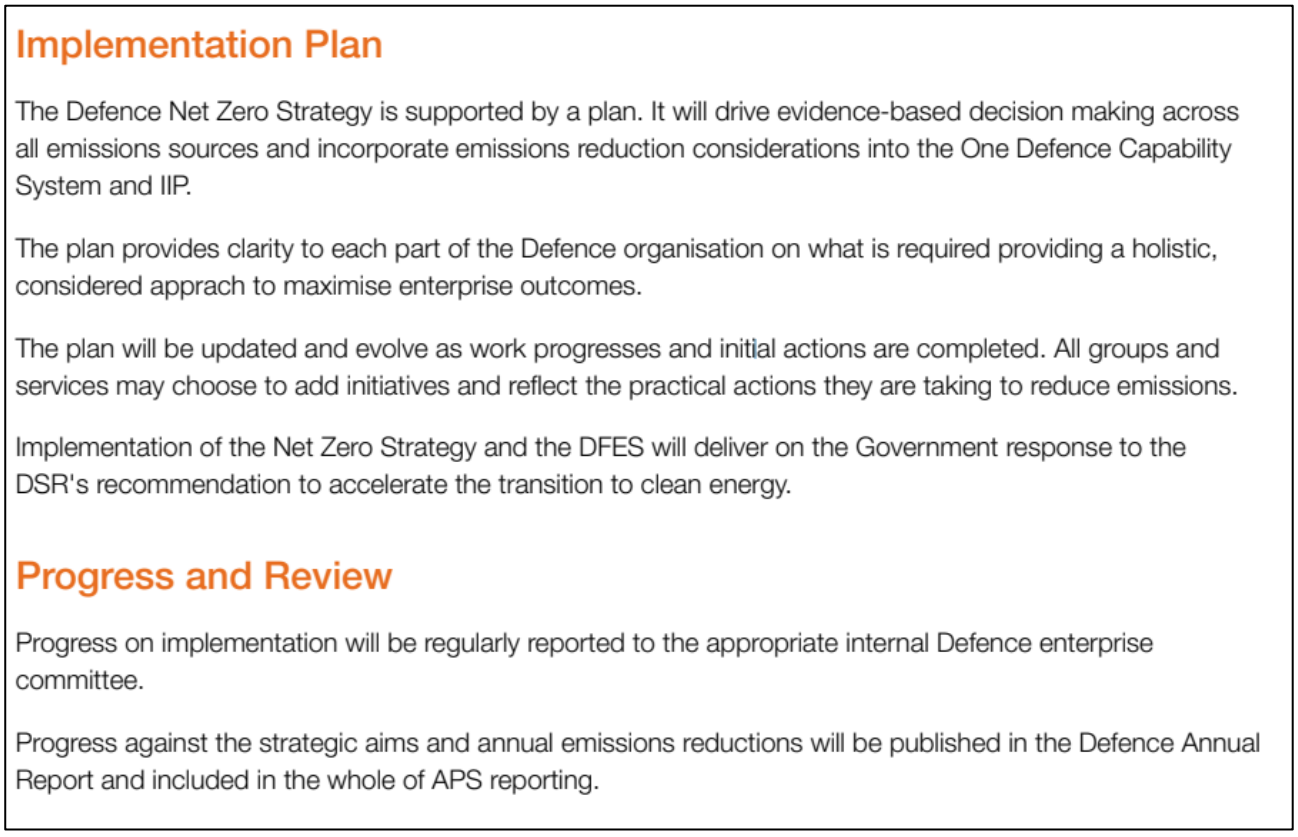
The strategy also emphasizes collaboration with industry partners, particularly in the defence and energy sectors, to develop and deploy innovative, low-emission technologies that can support Defence operations while meeting the net-zero target.

This strategy marks a significant shift towards aligning Defence operations with climate action goals and showcases Australia's commitment to reducing the ADF's environmental footprint while maintaining operational readiness and capability.

4.3.5 Current and Future Defence defined initiatives and targets

The newly-released Defence targets are in line with Government legislation and policy, as defined in section 4.1.2. According to the Defence Net Zero Strategy, "Where practical, Defence will use industry standards and benchmarks (e.g., NABERS, Green Star), as well as disclosure and reporting requirements that align with those required by the private sector". [**Error! Bookmark not defined.**]

The Strategy states there is an implementation plan as seen in Figure 15, future initiatives will be outlined.



Implementation Plan

The Defence Net Zero Strategy is supported by a plan. It will drive evidence-based decision making across all emissions sources and incorporate emissions reduction considerations into the One Defence Capability System and IIP.

The plan provides clarity to each part of the Defence organisation on what is required providing a holistic, considered apprach to maximise enterprise outcomes.

The plan will be updated and evolve as work progresses and initial actions are completed. All groups and services may choose to add initiatives and reflect the practical actions they are taking to reduce emissions.

Implementation of the Net Zero Strategy and the DFES will deliver on the Government response to the DSR's recommendation to accelerate the transition to clean energy.

Progress and Review

Progress on implementation will be regularly reported to the appropriate internal Defence enterprise committee.

Progress against the strategic aims and annual emissions reductions will be published in the Defence Annual Report and included in the whole of APS reporting.

Figure 15. Defence Net Zero Strategy – Implementation Plan [27]

4.4 Net Zero 2050 – Defence Industry

4.4.1 Defence Industry Context

Australia's Defence Industry is at a pivotal moment where achieving net zero is not just a national legislative requirement, but also a strategic opportunity. Aligning with global climate requirements, embracing innovative technologies, and collaborating with key sectors, particularly energy, will be essential in ensuring the industry's growth, sustainability, and competitiveness. This can be characterized by a few key factors.

Focus on Innovation: Advanced technologies such as Artificial Intelligence (AI), cybersecurity, and unmanned systems are essential for modernising defence capabilities. These technologies can also be used to reduce Defence operational energy use, optimize logistics, and decrease reliance on fossil fuels. Therefore, Defence Industry can focus on the development of new and innovative technologies that provide Defence an competitive advantage and improve sustainability.

Global Partnerships: Australia's Defence Industry can benefit from global partnerships, but these partnerships are increasingly conditional on aligning with international climate requirements. Countries and Defence partners are prioritising environmental sustainability and climate action. In an article in the Financial Review, it stated "Global capital markets and supply chains are increasingly demanding demonstrable progress on climate commitments. A medium-sized trading country like Australia needs to be part of these efforts."[28]

Sustainability and Climate Action: Industry is increasingly focusing on sustainability by aligning business operations with both Australia's legislation (such as the Net Zero Strategy and Future Energy Strategy) and international procurement requirements. This alignment ensures Defence meets both national and international climate goals. Meeting these sustainability targets requires substantial investment in clean technologies, such as renewable energy integration and the development of low-emission defence technologies.

Multiple Industry Influence: The energy sector will play a significant role in shaping Defence Industry climate policy. As one of the largest contributors to Australia's emissions (32.6%)[29] the energy sector's transition to renewable and low-emission sources is essential for Defence's emissions reduction strategy. Defence Industry will need to collaborate with the energy sector to ensure that its infrastructure and operations are powered by green energy to meet net-zero goals.

Defence Industry stakeholders will need to review both the Defence Net Zero Strategy and the Future Energy Strategy to ensure alignment with climate commitments and operational efficiency goals. This will involve adapting business models, operational strategies, and procurement processes to ensure compliance with net-zero targets and sustainability standards.

4.4.2 Defence Industry Customer

The Commonwealth of Australia is the main client of the Australian Defence Industry. This means that the policy positions and preferences of the government has a large bearing on the business practices of the Defence Industry.

There is also a strong export presence in Defence Industry. The top three destinations for exports by value from 2019 to 2023 are Canada, Chile, and USA (32%, 28%, and 11% respectively), while the USA accounted for 80% of Australia's defence imports[30]. All three of these economic partner countries have stated targets of net zero carbon emissions by 2050 along with Australia. Additionally, Canada and Chile are considering forms of border carbon adjustment tariffs on imported goods. This provides long-term pressure on the Defence Industry to move towards net zero.

4.4.3 Defence Industry Challenges

Through interviews with a broad range of Defence Industry stakeholders, including subject matter experts from both large Defence primes and small-to-medium enterprises (SMEs), we identified five common challenges that are impacting the industry. These challenges, summarised in Table 2, will serve as key topics for discussion in the proposed working group outlined in section 5 Recommendations.

Table 2. Interview Observations

Challenge	Findings
Affordability	Both direct and indirect emissions reductions come at a cost. Interviewees reported a growing need for larger ESG teams, with some organisations expanding roles or creating larger sustainability teams. Additionally, the cost of "green" technologies—such as green steel—can be up to 25% higher than traditionally produced materials, resulting in higher costs for customers.
Technology infancy	The development and adoption of green technologies are hindered not only by their higher costs but also by slow market adoption and regulatory frameworks that may complicate the path to net zero product development.
Legislation Changes	SMEs expressed concerns with meeting legislation reporting changes which will be costly and resource-intensive. Success for Scope 3 will be underpinned by the value chain openly sharing data and information. Organisations have already expressed hesitation due to sensitive data (IP/competitive edge/cyber security).
Delayed impact/ perceived benefit	The benefits of sustainability often materialise over years or decades, making it hard for businesses to see immediate gains. Coupled with key stakeholder turnover, this delay can slow the adoption of sustainable initiatives.
Disconnect between Defence and Defence Industry	Impact of Defence Net Zero Strategy on Defence Industry is not yet understood. The release of this strategy is a key milestone for Defence and Defence Industry, indicating how Defence will operate in the future.

These challenges highlight critical areas where industry needs support and collaboration to meet climate goals effectively. Further exploration of solutions to these challenges needs to be explored by Defence Industry.

5 RECOMMENDATIONS

5.1 Defence Industry Climate Action Working Group

Australia's Defence Industry is composed of both large prime contractors and smaller businesses. Larger primes often have access to international expertise from their foreign parent companies, allowing them to develop structured approaches for measuring and reducing carbon emissions. Many of these larger companies have dedicated executive roles and teams focused on sustainability, keeping pace with the evolving regulations and expectations surrounding environmental responsibility.

In contrast, smaller businesses in the Defence sector tend to have one or two staff members handling ESG (Environmental, Social, and Governance) responsibilities, often alongside other duties. While these individuals are highly motivated, they may lack formal training in ESG practices and the resources to provide comprehensive advice to their management teams.

As government regulations become more comprehensive across industries, all enterprises above a certain size will be required to engage in carbon reporting and reduction activities. There is no commercial sensitivity around carbon measurement techniques, or the availability and quality of carbon offset programs, making it critical for Defence Industry to collaboratively share insights and best practices.

A Defence Industry Climate Action Working Group would serve as a platform for smaller and medium-sized businesses to share their experiences and improve carbon reporting and reduction efforts collectively. Larger primes, with their international expertise, can contribute valuable knowledge and support, potentially aiding smaller firms within commercial arrangements. This collaborative approach would ensure that the industry moves forward together, accelerating the adoption of sustainable practices across the sector.

Similar working groups have worked on topics like Export Controls, driven by the Defence Teaming Centre and Communities of Practice.

5.2 Defence Strategy Including Climate Considerations

The release of the Defence Net Zero Strategy and Future Energy Strategy demonstrates a clear commitment to climate adaptation and energy resilience. However, research suggests that Defence has not yet fully addressed the direct impacts of climate change on its bases, particularly in terms of the liveability of these locations (refer to Figure 12). Only recently has Defence begun to discuss these issues publicly and include them in strategic documents.

Over the next decade, Defence will need to accelerate its actions to adapt to climate change, particularly for bases in Australia's northern regions, where rising temperatures and extreme weather events are likely to exacerbate challenges. Furthermore, the Net Zero Strategy outlines Defence's responsibility to assist regional nations that are most vulnerable to climate change. The strategy's goals must be fully implemented, with continuous action and accountability to ensure Defence is resilient to climate impacts both domestically and internationally.

The Net Zero Strategy and Future Energy Strategy are critical steps in this process and must be considered foundational documents. Defence's commitment to these strategies should be unwavering, with progress tracked and achieved as promised.

This recommendation has been outlined, in principle, by the Defence Net Zero Strategy. The unpublished Implementation Plan, mentioned in the Strategy, requires clear objectives, initiatives and regulations for Defence Industry, such as introducing an Environmental Sustainability Group (ESG) standard under the International Organization for Standardization (ISO). There is also opportunity for the ASDEFCON framework to have an ESG section introduced, similar to the Australian Industry Content (AIC) amendment introduced within the framework in 2020.

5.3 Defence Capability Development

For Australia's Defence sector to remain effective in the future, it must begin developing sustainable capabilities today. By 2050, Defence Industry will be required to operate using less carbon-intensive, more sustainable practices, in line with the government's Net Zero Plans for key industry sectors. This shift will have significant implications for the types of platforms and operations that can be supported by sovereign capabilities.

If Defence does not transition towards more sustainable practices, it risks being left with obsolete, carbon-heavy systems and procedures that cannot be integrated into future operations. To avoid this, Defence needs to proactively allocate budget and schedule allowances in capability development projects, ensuring that sustainability is considered as a core element of the strategy, embracing a controlled-risk approach to enable the development of the nascent capabilities.

A strong example of this approach is the collaboration between the Defence Science and Technology Group (DSTG), the Australian Army Research Centre (AARC), and Australian company 3ME Technology. Together, they developed an electrified Bushmaster vehicle, which is lighter, quieter, and has a lower thermal footprint. [26] This vehicle has already demonstrated its utility in providing power to medical treatment teams during exercises. Furthermore, AARC is exploring the use of renewable energy for sustainable military operations, providing a blueprint for future Defence capability development that is both effective and sustainable.

5.4 Clarity Around Definitions and Methods of Measurement

A recurring theme from industry interviews is the lack of clarity about the detail of the upcoming changes to carbon reporting and reduction regulations. This uncertainty is felt across businesses of all sizes, as well as within some government agencies. The ambiguity surrounding carbon measurement and reporting introduces risk, particularly when organisations are asked to invest in systems and processes that may change or evolve in the near future.

More agile companies are able to invest in carbon reduction programs ahead of the curve, while smaller or more risk-averse organisations may hesitate, unsure of how to proceed with investments that may need frequent revisions. The sooner the government provides clarity on an endorsed carbon measurement framework and establishes clear boundaries for the various regulatory scopes, the sooner companies will have the certainty required to be able to invest in change.

Defining these measurement methods early will reduce risk and help flatten the carbon reduction curve, ensuring the goal of net zero by 2050 remains achievable. By providing clear guidance, the government can facilitate more rapid and effective carbon reduction across the Defence Industry, ensuring a smoother path to sustainability.

6 CONCLUSION

Achieving Net Zero in the Defence industry by 2050 is an ambitious but essential goal that will require a collaborative approach involving Government, Defence, and Defence Industry stakeholders. While there are significant challenges, including technological limitations, regulatory uncertainties, and financial constraints, the path is feasible with the right provisions, incentives, and policy frameworks in place.

As highlighted through the research, climate change already presents a significant national security risk, with impacts ranging from disruptions in operational logistics to increased natural disasters. Australia's commitment to net zero emissions by 2050, supported by recent legislative changes and the Defence Net Zero Strategy, reflects the growing recognition that environmental sustainability is an important part of national security and defence capability.

Regardless, the journey to Net Zero is challenging. The Defence Industry, while committed to aligning with national and international climate goals, faces several hurdles, including the high costs of green technologies, regulatory complexities, and the infancy of long-term sustainable technologies. These challenges are intensified by the delayed impacts of climate change, which complicate the appetite for immediate investment in sustainability measures. There is a need for greater coordination between Defence and industry, with a focus on understanding the implications of the Defence Net Zero Strategy and adapting procurement practices accordingly.

To support carbon reduction efforts, the Government should consider offering targeted incentives such as tax breaks or funding for research and development. Integrating Net Zero into broader ESG frameworks and procurement practices will help align Defence industry goals with national climate objectives and global standards.

Defence and CASG must play a pivotal role in driving this transition by setting clear sustainability targets and ensuring these are embedded in capability development and fostering a culture of innovation and cooperation within the sector. To effectively support this transition and to meet their organisational obligations, industry stakeholders need to take ownership of their emissions by investing in green technologies, adapting supply chains, and aligning with carbon reduction targets.

Certain sectors, particularly manufacturing, energy-intensive operations, and logistics, will face more significant challenges in achieving Net Zero. Strategic investments, by both Government and industry, in renewable energy, sustainable manufacturing practices, and energy-efficient technologies will be crucial in overcoming these barriers.

While the journey to net zero by 2050 will require overcoming substantial challenges, it is both necessary and achievable for the Defence Industry to adapt and meet defined carbon reduction goals. By aligning policy, incentives, and industry efforts, Australia's Defence Industry can position itself as a global leader in sustainable defence practices, ensuring national security while mitigating climate risks.

7 REFERENCES

1 United Nations, What is Climate Change? Accessed 21 Nov 2024, https://www.un.org/en/climatechange/what-is-climate-change#:~:text=The%20consequences%20of%20climate%20change,catastrophic%20storms%20and%20declining%20biodiversity

[2] What is Net Zero, Accessed 21 Nov 2024, www.greenmatch.co.uk

3 Paris Agreement, 2015. FCC/CP/2015/I0/Add.1. Accessed 23 Sept 2024 at https://www8.austlii.edu.au/au/other/dfat/treaties/ATS/2016/24.pdf

4 "How Close are We to 1.5C", US National Oceanic and Atmospheric Administration (NOAA), FAQ 1.2 in the Frequently Asked Questions supplement to the IPCC Special Report on Global Warming of 1.5°, accessed 23 September 2024. https://www.climate.gov/media/10080

5 "Understanding climate change", Australian Department of Climate Change, Energy, the Environment, and Water (DCEEW), accessed 20 November 2024. https://www.dcceew.gov.au/climate-change/policy/climate-science/understanding-climate-change

6 "Sea Level" – Essential Climate Variable (ECV) Fact Sheet, Global Climate Observing System (GCOS), accessed 24 November 2024. https://gcos.wmo.int/en/essential-climate-variables/sea-level

7 "A Degree of Concern: Why Global Temperatures Matter", US National Aeronautics and Space Administration (NASA), accessed 20 November 2024. https://climate.nasa.gov/news/2865/a-degree-of-concern-why-global-temperatures-matter

8 Lee, H et al, "Climate Change 2023: Synthesis Report", Intergovernmental Panel on Climate Change (IPCC), doi: 10.59327/IPCC/AR6-9789291691647, available at https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_FullVolume.pdf

9 Climate Change Act 2022, compilation 12 April 2023. Accessed 23 Sept 2024 at https://www.legislation.gov.au/C2022A00037/latest/text

10 Treasury Department, Mandatory climate-related financial disclosures - Policy position statement. Accessed 23 Sept 2024 at https://treasury.gov.au/sites/default/files/2024-01/c2024-466491-policy-state.pdf

11 "New data shows long-term cost of extreme weather", Insurance Council of Australia (ICA), accessed 24 Nov 2024. https://insurancecouncil.com.au/resource/new-data-shows-long-term-cost-of-extreme-weather/

12 Lefebvre, M and Reinhard, "The Cost of Extreme Whether: Building Resilience in the Face of Natural Disaster", September 2022. Available at: https://insurancecouncil.com.au/wp-content/uploads/2022/09/McKell_Cost-of-Natural-Disasters_SINGLES_WEB.pdf

13 "Australia's Low Pollution Future The Economics Of Climate Change Mitigation", Commonwealth of Australia, 2008. Available at https://treasury.gov.au/sites/default/files/2019-03/Australias_Low_Pollution_Future_Summary.pdf

14 Source: Gosling Clarke, A. (2023). "Military Challenges From Climate Change". Contemporary Issues in Air and Space Power."

15 "Sustainability Disclosure Standard: Climate-related Disclosures", International Sustainability Standards Board (ISSB), June 2023, available at https://www.ifrs.org/content/dam/ifrs/publications/pdf-standards-issb/english/2023/issued/part-a/issb-2023-a-ifrs-s2-climate-related-disclosures.pdf?bypass=on

16 Bhatia, P, et al. "Corporate Value Chain (Scope 3) Accounting and Reporting Standard: Supplement to the GHG Protocol Corporate Accounting and Reporting Standard",

17 "Net Zero in Government Operations Strategy", Commonwealth of Australia 2023, ISBN 978-1-925205-56-5, available at https://www.finance.gov.au/sites/default/files/2023-11/Net_Zero_Government_Operations_Strategy.pdf

18 "Mid-Year Economic And Fiscal Outlook 2023–24", Commonwealth of Australia, available at https://archive.budget.gov.au/2023-24/myefo/download/myefo2023-24.pdf

19 The Senate Foreign Affairs, Defence and Trade References Committee, "Implications of climate change for Australia's national security", Mar 2018. Accessed 7 October 2024 at https://www.aph.gov.au/-/media/Committees/fadt_ctte/Nationalsecurity/report.pdf

20 Commonwealth Procurement Rules - July 2014. Accessed 7 October 2024 at https://www.legislation.gov.au/F2014L00912

21 "Environmentally Sustainable Procurement Policy", Commonwealth of Australia, July 2024, available at https://www.dcceew.gov.au/sites/default/files/documents/environmentally-sustainable-procurement-policy.pdf

22 “Australia's fuel reserves boosted to strengthen resilience and supply”, accessed 24 October 2024, available at https://www.energy.gov.au/news-media/news/australias-fuel-reserves-boosted-strengthen-resilience-and-supply
23 Physicists Explain How Heat Kills Machines and Electronics, September 2023, Accessed 21 Nov 2024, https://www.scientificamerican.com/article/physicists-explain-how-heat-kills-machines-and-electronics/
24 “Environment, climate change and security”, North Atlantic Treaty Organization (NATO), accessed 24 Nov 2024, available at https://www.nato.int/cps/en/natohq/topics_91048.htm
25 National Security and the Accelerating Risks of Climate Change, Accessed on 21 Nov 2024, https://www.cna.org/reports/2014/national-security-and-the-accelerating-risks-of-climate-change
26 Defence Net Zero Strategy and Future Energy Strategy released, Oct 2024. Accessed 21 Nov 2024, https://www.minister.defence.gov.au/media-releases/2024-10-25/defence-net-zero-strategy-and-future-energy-strategy-released
27 Defence Net Zero Strategy, Oct 2024, Accessed on 21 Nov 2024, https://www.defence.gov.au/about/strategic-planning/defence-net-zero-strategy
28 It’s critical that Australia gets to net zero at the lowest cost, Accessed on 21 Nov 2024, https://www.afr.com/policy/energy-and-climate/it-s-critical-that-australia-gets-to-net-zero-at-the-lowest-cost-20241002-p5kf7f
29 What are the sources of carbon dioxide in the atmosphere? Accessed on 21 Nov 2024, https://www.csiro.au/en/research/environmental-impacts/climate-change/climate-change-qa/sources-of-co2
30 Trends In International Arms Transfers, 2023 https://www.sipri.org/sites/default/files/2024-03/fs_2403_at_2023.pdf

This Page Intentionally Left Blank

Defence Teaming Centre