Written evidence submitted by the Ministry of Defence
Defence and Climate Change Inquiry

Introduction

1. Defence and our Allies and Partners all face the same challenge: the need to adapt and become resilient to a climate-changed world enabling us to at the very least preserve military capability. The Integrated Review (IR) and Defence Command Paper (DCP) describe a deteriorating global security environment, the increasing and evolving nature of the threats posed to the UK, and how the UK's Armed Forces must adapt to operate, fight, and win in this increasingly competitive age.

2. Climate change's direct impacts, their socio-economic consequences and global responses to both will also continue to shape the strategic context within which future conflicts occur and are fought. The MOD acknowledges climate change as a threat multiplier that is already reshaping the global security landscape and amplifying many of these traditional security challenges whilst giving rise to new ones. This view is echoed by many of our key allies and partners with the recent US National Intelligence Estimate stating that *'climate change will increasingly exacerbate risks to [US] national security interests as the physical impacts increase and geopolitical tensions mount'*.[1]

3. The Ministry of Defence (MOD) conducted a 2020 review, led by Lt Gen Richard Nugee, of its preparedness to respond to the implications to its Departmental outputs and capabilities. This review was the driving factor behind the publication in March 2021 of the MOD's Climate Change and Sustainability (CC&S) Strategic Approach. The Strategic Approach is the foundation stone for UK Defence's response and sets out Defence's three strategic long-term ambitions:

- Defence has **adapted** to be able to fight and win in ever more hostile and unforgiving physical environment;
- Defence has **reduced its emissions and increased its sustainability** activity and as a department is contributing to the achievement of the UK legal commitment to reach net zero emissions by 2050; and,
- Defence **acts and is recognised as a global leader** in response to emerging geopolitical and conflict-related threats exacerbated by climate change.

4. The Strategic Approach also contained a set of guiding principles and an initial action plan which when delivered will would give Defence a firm foundation for the further transformational activity required across the three Epochs.

5. The Strategic Approach's First Epoch (2021-25) – "Setting the Foundation" – highlighted that Defence will deliver a step change in the projects already planned. It focused on: supply chain engagement; the building of a skills base; the identification of a comprehensive emissions baseline and database to enable detailed planning for subsequent Epochs; and the disaggregation of targets, through the Defence Plan to Defence organisations. Epoch 2 (2026-35) – "Minimising and fitting for the Future" and Epoch 3 (2036-50) – "Harnessing the Future". Each Epoch builds on the last and towards the delivery long-term ambitions. A summary of the outcomes for each Epoch is at Annex A.

6. A newly formed CC&S Directorate is leading efforts within Defence, across Whitehall and internationally cohering activity and acting as a catalyst to ensure that climate and sustainability considerations are normalised as part of Defence Business.

[1] National Intelligence Estimate on Climate Change (dni.gov)

Q1 - What needs to be done to achieve the Integrated Review of Security, Defence, Development and Foreign Policy's number one international priority of meeting climate change and biodiversity loss commitments over the next decade?

7. The IR sets out the vision for a Global Britain in a more competitive age, by integrating foreign, security, defence and development policies (or the '3Ds' Development, Diplomacy and Defence e.g. FCDO, DIT and MOD). It addresses the unprecedented challenges and geopolitical shifts posed by a deteriorating global security environment, such as the growing importance of the Indo-Pacific to global prosperity and security, intensifying competition between states, a widening range of security threats, and rapid technological change. Defence's programme is a key pillar of the delivery of the IR.

8. The DCP outlines how Defence must prepare for more persistent global engagement and constant campaigning, to respond to threats and adversaries at speed. The threat of climate change is part of that response and aligns to the overarching objectives set out in the IR to 2025: sustaining strategic advantage through science and technology, shaping the open international order of the future, strengthening security and building resilience at home and overseas.

9. To prepare Defence to confront climate and security risks effectively, the newly formed CC&S Directorate is leading efforts within Defence, across Whitehall and internationally to raise awareness of climate and security as a strategic policy issue, build understanding of threats, and increase literacy. It must be an integral part of the 3Ds and HMG's internal thought process and reflected within all relevant outputs, including strategic assessments, planning, strategy and policy and international engagement. The MOD has established a Climate Security Forum to encourage joint working on development of policies and strategies by routinely bring together colleagues from across HMG.

10. The CC&S Strategic Approach actively encourages cross sector collaboration with other Government departments, industry, academia and international partners. Acknowledging that we all share the same adaptation challenges, there is significant interest in the UK MOD's CC&S work from our Allies and Partners. We need to develop a shared understanding of the threat picture, share research and initiatives, and jointly plan future work programmes both bi-laterally and multilaterally through 5 Eyes, NATO and beyond collaboration fora.

11. To ensure Defence remains competitive, adapts and becomes resilient we have already:

- Included climate within Defence horizon scanning activities. The implications of climate change for the future strategic context are a key consideration being undertaken as part of Development, Concepts and Doctrine Centre (DCDC) Global Strategic Trends 7;
- Planned further work, in addition to extant MOD-sponsored reports, to investigate the implications of cascading climate risks for Defence and to identify response options. We are also supporting external research including working to identify the skills needed to help future leaders be prepared for a more environmentally destabilised world;
- begun embedding climate security and sustainability within Defence education and training and increased emphasis on climate security within Advanced Command Staff Course (ACSC) including, since January 2022, a new module on environmental security and use of climate war gaming;
- Strengthened interfaces and collaboration with colleagues across HMG and the 3 D's (Development, Diplomacy and Defence), including in FCDO, to better cohere the UK's influence, clarify our shared policy position and leadership on climate security issues;
- Included climate security within Defence policy development e.g. climate insecurity was identified as a key factor within guidance on how to incorporate Human Security into the way Defence operates, as set out in JSP 985, published December 2021; and,
- Begun working with academia to identify critical knowledge gaps to inform MOD response to future threats and opportunities Defence is working with academia to identify critical knowledge gaps.

12. However, these are a set of initial actions to establish the foundation for our longer term response. This will need to be developed in conjunction with key stakeholders both internal and external to Defence.

13. With respect to biodiversity loss, DCDC's Global Strategic Trends 7 is also looking at the long-term drivers of change connected to biodiversity and eco-system services more generally and the MOD is supporting Other Government Departments in their response to international biodiversity loss via skills, advice and our own site management. Operation CORDED represents an example of how the unique skills of the British Army can be deployed as a central component of the fight to Counter the Illegal Wildlife Trade (CIWT) in sub-Saharan Africa. The wildlife rangers on the frontline of wildlife protection in the national parks receive infantry, medic and military police skills training and assistance. Reservist CIWT specialist also assist with analysis to understand and address the roots of the illegal trade.

Q2 - What will be the impacts of climate change on future conflict and how are UK Armed Forces adapting to them?

14. Climate change's direct physical impacts through increasing the frequency, severity and variability of natural hazards and extreme weather events as well as the mitigation and adaption related global transitional risks such energy transition and the geo-political implications amplify the risk of future conflict and instability. Local, national and international responses to climate change will also shape the strategic context within which future conflicts occur and are fought. Defence's analysis of the long-term future impacts concludes that:[2]

- The future physical operating environment will be more extreme: ships, aircraft, vehicles, equipment and our personnel will operate in more extreme environmental conditions;
- Criminal or even terrorist groups could take advantage of the stresses that climate change may bring;
- The requirement to support humanitarian aid and disaster relief operations might be more frequent, while local operating environments may be more complex and contested; and,
- The destruction of homes and livelihoods as a result of natural disasters, could lead to increasing migration disputes, and possibly conflict, particularly in developing countries that do not have the capacity to mitigate these effects.

15. Broader security context impacts include:

- New arenas for systemic competition being created, for example as Arctic-sea ice melts, increased activity in the area might result in intensified competition; and,
- Climate-change induced disruption to international trade and security of supplies exacerbating geopolitical tensions.

16. Climate-change-induced mass migration, diminished food and water security, more frequent global health crises and resource competition – including over resources considered important to climate change responses, such as decarbonisation – will alter power dynamics within and between states and increase strategic competition and the risk of instability. Such disruptions could feasibly strain existing international security arrangements, create new geostrategic flashpoints, and raise the potential for inter-state military competition and conflict (e.g. over competing claims to territory and resources).

17. At the global scale, key conflict risks will include:

- **Displacement and migration.** Climate-related migration risks amplifying inter-state tensions. A World Bank study warned that by 2050, climate change could lead more than 216 million people to migrate within their own countries;[3]

[2] DCDC Strategic Trends programme - GOV.UK (www.gov.uk)
[3] World Bank, 'Groundswell Part 2 : Acting on Internal Climate Migration', 2021. UNCLASSIFIED. Groundswell Part 2 : Acting on Internal Climate Migration (worldbank.org) (Accessed 30 May 2022).

- **Food and water insecurity.** Almost 50% more food will need to be produced by 2050 in order to meet global demand. But unless emissions are dramatically reduced, Chatham House estimates there will be a 30% fall in yields. Climate change is also predicted to increase the number of people who lack sufficient water to 5 billion by 2050;[4]
- **Resource competition.** The transition from a fossil fuel-based global economic model will alter supply chains and create new dependencies on states with the greatest economically viable reserves of critical minerals (such as China). Demand for rare earth materials is set to rise threefold by 2040;[5] and,
- **Health insecurity.** Changing climate conditions risks expansion of disease vectors due to warmer temperatures, biodiversity loss and extreme precipitation, increasing the likelihood of global pandemics which can contribute to instability and state-based competition.[6]

18. This analysis informed the MOD's stated CC&S ambitions and signalled the need to build resilience to climate change, including through reducing our dependency on fossil fuels, while preserving and strengthening our operational advantage. As such planning for and assuring that future capability decisions are informed by the changing environmental and security context in which they will operate continues to be a key consideration. This is exemplified by the release in March 2022 of the MOD's policy paper *'Contribution in the High North'* which acknowledges the impact of climate change with the region warming three times faster than the rest of the world. The further opening-up of the Arctic also raises the potential for defence and security concerns not just emanating from the region itself but spreading into it from state competition and conflict elsewhere around the globe. In response the MOD will pursue the following objectives: Protect our Critical National Infrastructure and our other national interests, and those of our Allies; ensure our freedom to navigate and operate across the wider region; Reinforce the rules-based international system, particularly UNCLOS; and Contest malign and destabilising behaviours.

How is Defence Adapting?

19. **Departmental Adaption Plan**. Under the new suite of Greening Government Commitments all central Government Departments are directed to develop their own adaption plans for their Estates and Operations by 2025. This will draw in the more mature adaptation work within the Department outlined below as well as adaption pathways for the identified departmental level climate risks:

- **Capability Management and Force Development**. Given its importance, climate change and sustainability is specially embedded into our capability strategy and adapting to the effects of climate change is a key principle that will be considered when we now develop, assess and adapt our capabilities**,** as well as Defence's contribution to Net Zero 2050 to mitigate its effects.[7] Through extant governance controls, such as the Joint Requirements Oversight Committee, and driving requirements through our delivery organisations and contracts, we will be able to assure that defence is assessing and adapting our capabilities appropriately for the effects of climate change and the environment the Armed Forces will be operating in. As well as this, normal Force Development activity and war gaming will enable us to understand the risks in our future force under different scenarios, all of which will take into consideration environmental impacts and challenges.
- **Defence Support**. From a Support perspective there are both challenges and opportunities: rising temperatures will increase the burden of support and impact the efficiency of support activity; the global energy transition threatens higher costs and more complex supply chains; and public policy and social expectations require the decarbonisation of Defence's numerous commodities and materiel. However, lower-impact, more-resilient means of support can be efficient and effective answers to the future operational needs. For example, greater self-sustainment in deployed operations reduces

[4] Chatham House, Climate Change Risk Assessment 2021, September 2021. UNCLASSIFIED. https://www.chathamhouse.org/2021/09/climate-change-risk-assessment-2021 (Accessed 30 May 2022).
[5] International Energy Agency, 'The Role of Critical World Energy Outlook Special Report Minerals in Clean Energy Transitions', May 2021, UNCLASSIFIED https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions (Assessed 30 May 2022).
[6] Carlson, C.J., Albery, G.F., Merow, C. et al. Climate change increases cross-species viral transmission risk. Nature (2022). https://www.nature.com/articles/s41586-022-04788-w (Accessed 30 May 2022).
[7] Joint service publication 656: Capability Assurance available via Knowledge in Defence (KiD) - GOV.UK (www.gov.uk)

environmental impact and logistic drag while increasing resilience and freedom of manoeuvre taking personnel out of harm's way. The development of the MOD's Sustainable Support Strategy (SSS) analyses the challenges and defines the strategic initiatives required to start addressing the climate change challenges to UK Defence logistics and engineering support in the immediate years to 2025, but with headmarks out to 2035 and 2050. The SSS addresses both environmental impacts and threats across Defence logistics, engineering and equipment support activities. It includes low-cost, early-impact opportunities and more complex initiatives with longer lead-times and higher resource requirements as well as areas of procurement activity, maintenance standards and support solutions where positive change can be made to increase equipment availability, reduce cost and deliver more sustainable outcomes. Annex B summarises the six initiatives within the SSS work.

- **Infrastructure**. To enable increased resilience of the estate and infrastructure, the Strategy for Defence Infrastructure (SDI) commits the Department to develop a climate change adaptation plan. The adaptation plan will build on Departmental understanding of climate risks informed by the decade-long programme of establishment climate adaptation risk assessments (using the MOD's Climate Impact Risk Assessment Methodology), both in the UK and overseas. It will mature and further develop adaptation pathways to manage risk at establishment, portfolio and system level.

Q3 - Are UK Armed Forces prepared for the probable increase in requests for Military Aid to the Civil Authorities (MACA) tasks as a result of more extreme weather conditions in the UK, and the increased risk of flooding and rising sea levels?

20. Defence has a key role supporting lead government departments, devolved administrations, and civil authorities as they prepare, respond and recover from disruptive challenges and major national events. The process and doctrine for Military contributions to the nation's resilience are described on Gov.uk.[8] This publication incorporates the latest UK government policy on Military Aid to the Civil Authorities (MACA). It recognises that resilience is only achieved through a fused, interagency approach to civil contingency. For example, Defra, supported by the Environment Agency (EA), lead on government's preparations for, and resilience to extreme weather events such as flooding. Defra/EA may, where they expect that the feel their capability or capacity to be insufficient, request Defence support through the MACA process.

21. Current UK MACA policy advises that MACA tasks, with very few exceptions, are not 'Force-driving'. Defence is not currently actively looking to enhance its capability exclusively for domestic resilience tasks. However, research commissioned to inform the MOD CC&S Strategic Approach raised the potential implications for Force planning and the balance of national and international Armed Forces commitments.[9] It is informing the Epoch One work and ongoing development of the MOD's response to build understanding, effective long-term relationships and shape our response on our critical national infrastructure, supply chains and equipment to the physical and transitional impacts of a changing climate.

Q4 - With defence alone accounting for half of central government's greenhouse gas emissions, what should be the MoD's contribution towards achieving the UK's net zero target by 2050?

22. Defence has emissions in almost every sector of the UK's Net Zero Strategy covering Transport through to Agriculture and Industry. For example, emissions from our UK based estate, as measured through the Greening Government Commitments (GGC),[10] alone account for 51.5%

[8] Joint Doctrine Publication 02: UK Operations: The Defence Contribution to Resilience (Fourth edition)
[9] 'A changing climate: exploring the implications of climate change for UK defence and security' *(RAND Europe – Commissioned by DCDC) and* 'Crisis response in a changing climate' (Gov.UK)
[10] Scope set for MOD Greening Government Reporting for 2015-20.

of Central Government emissions.[11] When combined with emissions from Operational Capability and emissions from Business Travel, Defence's total reported emission footprint is 2.144 million CO2e.[12]

23. The MOD's CC&S Strategic Approach acknowledges the scale of Defence's emission footprint and the need to move away from how it uses energy today (for both our infrastructure and Capabilities) to products, practices and behaviours that reduce emissions. However, Defence also acknowledges that we must preserve our Operational Capabilities and that we will never compromise military Operational Capability solely for a sustainable solution. Defence is fully committed to contributing to the UK achieving its legal Commitment to be Net Zero by 2050.

Previous Performance

24. **Greening Government Commitments and Estate Emissions**. Prior to the publication of the MOD CC&S Strategic Approach, the MOD had exceeded its GGC emission reduction target with a 50% reduction in emissions from a 2010/11 baseline against a target of 39.9%. A significant proportion of these reductions came from improved estate management including the disposal of built assets and sites as well as the 'greening' of the National Grid. The new GGC 2025 target for the MOD is to reduce Green House Gas emissions from in-scope built assets across the Defence Estate by 30% (see Annex C for MOD scope 1 and 2 coverage). The Department now also has a direct emission reduction target of 10% (scope 1) from a 2017/18 baseline.

25. However, the MOD does not just use energy for heating and lighting buildings. Fossil fuels are used to generate electricity (both grid and self-generated) for use to power ships alongside, air traffic and defence radars, digital assets, training simulators and a range of industrial processes. Therefore, the pace at which defence can decarbonise is not just linked to the use of fossil fuel to produce heat but the use of the building and its linkage to the generation of military capability.

26. **Military Emissions**. The operation of defence equipment (including land vehicles, aircraft and navy vessels) by the Armed Forces, are out of scope for the GGC. These emissions are reported separately in the Department's Annual Report and Accounts and are also included in the UK National Atmospheric Emissions Inventory.[13] In 2020/21 Defence's scope 1 military emissions equated to 1.4Mt CO2e. Military emissions are primarily generated from aviation and maritime platforms. These military emissions can also be driven by world events,[14] as well as the level of Capability that needs to be maintained to meet Defence outputs. Therefore, it is not appropriate to set an overall reduction target on military emissions. When military emissions are included with reported GGC estate emissions, the total Departmental reduction for 2020/21 equate to 54% against a 2010/11 emissions baseline.

Future Contribution

27. **Sector Approach**. Since the publication of the MOD CC&S Strategic Approach a key focus of Departmental activity has been testing the applicability of the policy commitments placed upon it by UK Net Zero Strategy Sectoral Strategies. This is being undertaken through Defence's own internal sectoral approach with activity being led by relevant organisational leads. The first phase of activity is due to report before the end of Summer 2022 and will provide an indicative level of decarbonisation that could be achieved by Defence in each sector and therefore in aggregate by the Department.

28. **Delivery of Decarbonisation Activity.** The MOD has a series of decarbonisation initiatives underway that focus on both direct and indirect emissions:

- The **Defence Estate** is a critical enabler or Defence capability and outputs, and is where our people live, work and train, from which we operate and from where we deploy. The Strategy for Defence Infrastructure recognises the estate contribution to delivering the

[11] Source Table 1: Individual Department Greenhouse Gas Emissions Targets from Defra's 'Greening Government Commitments Annual Report April 2019 to March 2020' published Oct 21

[12] Ministry of Defence annual report and accounts 2020 to 2021 - GOV.UK (www.gov.uk)

[13] NAEI, UK National Atmospheric Emissions Inventory - NAEI, UK (beis.gov.uk)

[14] World events can drive decreases in operational tempo such the covid pandemic as well as increases.

Department's contribution to the UK Net Zero and sustainability ambition. A supporting Estate Sustainability Sub-Strategy is under development to plot the route to decarbonise the built estate and enhance carbon sequestration and the natural environment on our rural estate. Key will be revising our estate policy and building standards, exploiting innovation, ensuring we have the right skills and data and building strong partnerships. Initiatives that form part of the early adoption for the sub-strategy are set out in Annex D;

- **Operational fuels** represent the majority contributor to Defence's direct emissions with the move away from fossil fuels to electrification as well as alternative fuel types from sustainable to synthetic fuel and the future use of hydrogen and ammonia all create challenges and opportunities to Defence. Underpinning Defence's own approach to fuels will be the development of a Defence Operational Energy Strategy. The scoping and preparations for this work have begun already with the Strategy due for publication at end FY 2022/23. Activity has already started in to look at lowering the emissions from Defence's aviation and maritime platforms through the sectoral approach;
- **Aviation.** The RAF (as sector lead for military aviation) in conjunction with key industry partners is providing visible leadership in the development and use of both Synthetic and Sustainable Aviation Fuels whilst pioneering the world's first successful flight using 100% synthetic fuel in November 2021.[15] Aircraft including F-35s, Typhoons and Wildcat helicopters currently use conventional aviation fuel, but could use up to 50% sustainable aviation fuel sources in the future, when cost effective to do so and more widely available, after the MOD's changed aviation fuel standards came into effect in November 2020. The MOD is also proactively supporting DfT and the Jet Zero Council with the UK SAF mandate proposals to increase use of sustainable aviation fuel;
- **Maritime.** A new market exploration has been launched with the aim of identifying hybrid powertrain technologies for the Royal Navy and Royal Fleet Auxiliary ships. This exploration sought hybrid technologies to explore options that can be implemented by 2030. With the Net Zero 2050 goals in mind, hybrid engines could reduce the emissions of ships by 20-40% by 2030. The Maritime decarbonisation challenge and work is in collaboration with external and internal stakeholders where it reaches across Commercial and Military sectors such as DfT and MCA;
- **Wider Industry Emissions.** The Defence Suppliers Forum (DSF) is focused on emissions that Defence can't directly influence (i.e. wider scope 3 emissions). A programme to facilitate collaboration across our supply chains and indirect greenhouse gas emission reduction has been established. It is building a shared approach and common level of understanding to tackle the scale of challenge; and,
- **Future Procurement Decisions.** This complements the work to implement the Social Value model within the MOD's procurement process, ensuring contracts deliver against key MOD outcomes and also support wider Government objectives. Social Value Policy is now active for all competitive procurements across the MOD, with a Social Value Centre of Expertise established to enable consistent application of the Social Value Model and engage with industry. The inclusion of Sustainability within potential Social Value outcomes provides options for Defence.

28 June 2022

[15] World record RAF flight powered by synthetic fuel - https://www.gov.uk/government/news/world-record-raf-flight-powered-by-synthetic-fuel

ANNEX A - MOD CLIMATE CHANGE AND SUSTAINABILITY APPROACH – EPOCH BY EPOCH

The route to achieving our ambition: an epoch by epoch approach

Defence must start to address the 2050 ambitions now in order to achieve success. An epoch by epoch approach is envisaged. Defence is embarking on its first epoch, kick-starting with the initial action plan on the next pages. We will constantly review and align principles, ambitions and actions. A new team is to be established immediately which will turn ambition and early-stage action into implementation. The epoch by epoch approach for the longer-term envisages:

Epoch one – setting the foundations - 2021-2025: Defence will deliver a step change in the projects that are already planned; initially, most of these will be opportunities on the estate. The first epoch will include working with suppliers to identify ways to reduce emissions in the supply chain through the equipment we use and contract conditions we set. We will create the skills base to be able to better apportion carbon targets and develop a fuller cross Departmental understanding of sustainability in the broadest sense. A comprehensive baseline and database will be built to allow decisions on a detailed plan for all themes in epochs two and three. Carbon targets as well as wider sustainability and GGC targets will run through the yearly Defence Plans. These will be disaggregated across Defence's organisations.

Epoch two - minimising and fitting for the future – 2026-2035: Building on the successes from epoch one, in the subsequent years Defence will look to reduce emissions significantly using existing and emerging technology, maximise opportunity to enhance the global response to the threat that climate change poses to current and future operational capability and build further resilience into the estate, supply chain and future equipment. Defence should be committing exploitation, development and innovation funding through the next Defence/Spending Review, to determine how to use emerging technologies for its benefit.

Epoch three - harnessing the future - 2036-2050: In the final 15 year period, Defence must be doing everything it can to harness novel technologies which further build resilience and further reduce emissions. We will deliver on any successor to the UN Sustainable Development Goals. Efficiency and operational effectiveness will depend on the innovation and foresight of previous epochs.

ANNEX B - MOD SUSTAINABLE SUPPORT STRATEGY - STRATEGIC INITIATIVES

- **Sustainable delivery of platform availability.** Environmental change will alter the conditions in which our platforms and equipment must operate, will increase the burden of support and make support harder to deliver. Defence Support (DefSp) will shape and accelerate the expected transformation of engineering and equipment support so that it also addresses the environmental impact of, and threat to, those areas of activities. This will include defining the environmental standards for platforms against future climate scenarios and setting greater ambitions within support policies.

- **Building resilience in global logistics and support network**. A changing climate will affect the locations at which support activity is delivered and way it is provided. The SSS assessed four overseas bases with detailed climate modelling and revealed significant risks to DefSp activities. This includes: a worsening of extreme heat in Oman at Duqm that both limits payloads and the amount of time our people can operate, rising sea levels at Gibraltar or stronger winds threatening access to Akrotiri port. Defence will need to mitigate these risks through infrastructure upgrades, building redundancy into our networks, developing alternative ways to deliver to deployed forces and assessing the benefit of forward storage. These options will require capital and resource investment. DefSp will, therefore, conduct a data-driven assessment of priority locations to future-proof our capabilities.

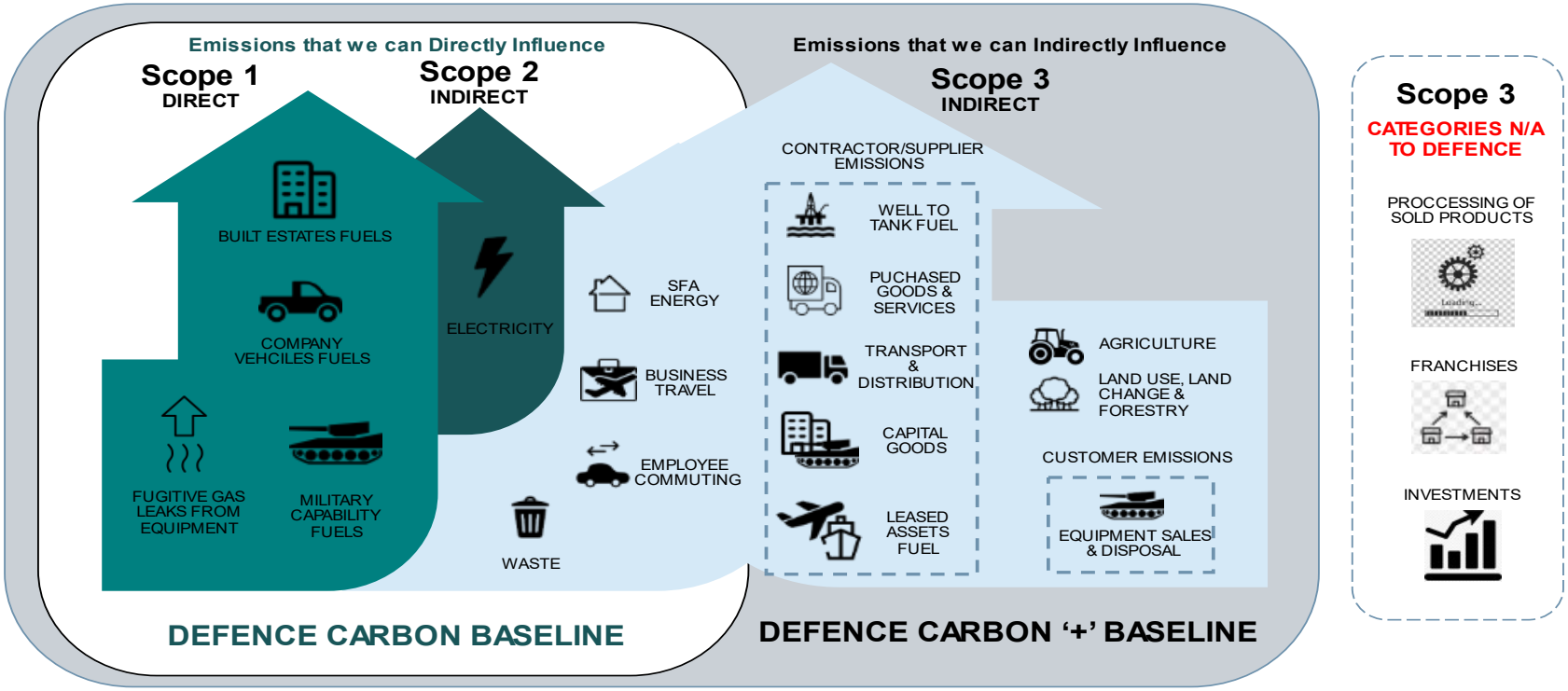
- **Supply capability power through the energy transition**. Defence must ensure energy supplies and interoperability through a global transition from fossil fuels that will be of unprecedented pace, complexity and uncertainty. The challenge and approach will vary by sector/domain from ‘mass adopter’ to ‘innovator’ and will be further defined in the Defence Operational Energy Strategy. This will take a domain-specific, data-driven approach so that the decisions affecting each platform can be made with the minimum of risk.

- **Increasing self-sustainment of operations**. The Integrated Operating Concept identifies a future in which forces will be persistently engaged, operating at reach and at varying levels of intensity, and pulsing through cycles of dispersal and reaggregation. This demands a support function that has greater agility, a smaller footprint and which is more responsive and precise. This design presents many opportunities to deliver a force that is inherently more sustainable by reducing the logistic ‘tail’. Operations in Mali, as an exemplar, suggests there are significant opportunities to reduce cost and emissions by adopting technologies to give more self-sustaining capabilities: for example, increasing photo-voltaic cell use to reduce diesel consumption, a greater focus on circularity/recycling to reduce demand, or the local production of food and water to minimise lengthy supply chains. Defence Support will investigate and adopt a more flexible approach to how to sustain deployed forces based on a programme of experimentation and research**.**

- **Decarbonising defence commodities.** About 80% of the emissions associated with commodities are embedded upstream in materials used and their manufacture and distribution. Developing opportunities to decarbonise defence materiel is a longer-term programme and need to match the dual needs of cost and quality as well. Much of this will be subsumed in the re-tendering process of the Logistics Commodities and Services Transformation (LCST) contract over the next couple of years. In the meantime, DefSp will identify the changes required, pilot new approaches and build capacity to contract for decarbonisation.

- **Reducing the impact of deployed food.** Whilst food and agricultural systems are a major global emitter, Defence’s food supply is comparatively modest. However, improvements can be made to the food we procure that will still provide rations that are nutritious, calorific, satisfying and affordable. Such changes will also match the changing dietary preferences of our people and will be a tangible demonstration of Defence’s commitment to changing the way in which we operate. Any changes will need to be evidence-based; Defence Support is developing a detailed assessment for food emissions, costs and preferences.

ANNEX C – DEFENCE CARBON FOOTPRINT SCOPES 1, 2 AND 3 COVERAGE



ANNEX D – DEFENCE EMISSIONS REDUCTION AND RESILIENCE INITIATIVES
Decarbonisation Measures on the Estate

- Co-ordinated data and analysis to help formulate a coherent pan Defence Infrastructure Approach to the Sectoral Approach (paragraph 26). Defence Infrastructure Organisation (DIO) in collaboration with relevant Defence organisations, have recently been developing a programmatic approach to form a picture of net zero and sustainability estate initiatives, technology pilots and projects. The scope of the approach includes the following aspects:
  - Highest emitting sites;
  - Age;
  - Current and future heat sources;
  - Ease of conversion;
  - Maturing technologies; and,
  - Future Energy Provision.

Utilising the infrastructure data and information gained from pan estate initiatives, we will allows us to analysis and consider the most appropriate technology and its application to scale fast and deliver the infrastructure contribution to decarbonisation.

- Robust and accurate data. This granular level of detail is a key aspect of future decision making with regards to decarbonisation. Currently the MOD estate does not have 100% Automatic Metering Reader (AMR) capabilities. This has been identified as a key priority. Using the newly established Utility Management Bureaus (UMBs) across the Future Defence Infrastructure Services (FDIS) contracts, data will be used to identify poorly performing buildings and provide a proactive lead to resolving potential problems.

- Estate Management Planning (EMPs). All new EMPs now include a decarbonisation study. EMP net zero studies will highlight investment required and guide the establishment with the best progressive route to contribute to decarbonisation across the estate. TLBs will use this information to help with their future budgeting and Command Infrastructure Development Plans (CIPDs).

- Innovation In Construction. New creative technologies and methods of construction are being utilised to push the art of the possible and lessons shared. An example is the REDS 10 project,[16] which is delivering of over 50 modular buildings providing 2,500 new bed spaces across several locations across the Defence Training Estate (DTE). The programme has delivered the DTE's first carbon negative buildings, achieved by installing SMART technology. This technology monitors and adjusts energy usage, using data to drive down Energy Performance Certificate (EPC) rating from 12 to -10. These buildings now generate more energy than they use, reducing electricity and maintenance costs. The project won the Net Zero & Resource Efficiency category in the 2021 MOD Sanctuary awards.

- Sustainable Maintenance. Defence's new FM Industry Partners – FDIS have recently mobilised moving away from a more reactive approach to a more positive sustainable/proactive approach. Already our new contractor partners are focussed on metering and Building Management System (BMS) improvements and are eager to progress with "No-Regret" measures such was LED light upgrades, improving building fabric and insulation and making building more energy efficient.

- RAF Leeming is the RAF's Net Zero showcase Living Laboratory site. The site has set itself an ambitious target of being as close as possible to net zero by end FY 2025/26. Successes from this work will be shared and considered for exploitation across the wider MOD estate. They are currently working closely with academia (Project ViTAL) on multiple practical experiments in the following decarbonisation activities:

[16] Reds10 deliver Net Zero modular accommodation on the Defence Training Estate - https://www.reds10.com/2021/01/25/reds10-deliver-first-new-modular-accommodation-on-the-defence-training-estate/

- Carbon Accounting;
- Lightweight SolarPV Technologies;
- Carbon Capture and Sequestration via the estate and soil improvement;
- Geothermal Energy;
- Sustainable Ground Transport and a hydrogen economy;
- Life Cycle Assessments; and,
- Behaviour Change.

Energy and Estate Resilience

- Prometheus – Solar PV Farms. Leconfield is the first of four pilot sites to open this year. With the knowledge and expertise from these pilots the Army will be able to upscale and deliver a total of 80 solar farms across the Army managed estate within the decade. Additionally, the increased use of renewable, on-site energy generation will also provide increased resilience against energy prices rises and future supply pressures.

- Future Energy provisioning (FEP). Working closely with Crown Commercial Services (CCS), DIO are currently looking for innovative/creative FEP procurement routes to market. Helping to shape future provision and allowing access to third party investment bringing in new and exciting sustainable / renewable energy generation pathways that balance with and support the resilience and de-carbonisation of Defence outputs.

- Natural Capital and Sequestration. In addition to its primary use of supporting military training and capability, the Defence estate also provides valuable habitats and natural carbon stocks including over 24,500 hectares (ha) of woodland and forests, 21,000ha of peat soils and 100,000ha of permanent grasslands with no/little history of cultivation. Defence has mapped the carbon flows from these habitats and the land use of its UK estate. Work has now begun on a complete natural capital asset register, valuation statement and decision support tool. Taking a natural capital approach to decision making will allow investment prioritisation and land use change to be assessed against the operational training requirements and wider carbon, biodiversity and nature recovery benefits. Current investment and targeted work programmes on woodland creation and peatland restoration will contribute to net zero ambitions by balancing residual emissions from Defence activities. Wider carbon sequestration initiatives as blue carbon in marine environments such as sea grass meadows are being explored.