TEAM DEFENCE INFORMATION
www.teamdefence.info

Natural Capital & Infrastructure Community of Practice

27 February 2025

NC&I CoP 27/2/2025 – Agenda 13.00 -16.00

#	Agenda Item	mins
1	Welcome and introductions from participants – Eion Bailey (TD-Info)	10
2	Re-cap, update and latest news – Jenny Allen (Mott McDonald), Phil Anderson (Babcock)	10
3	News from ADS, DSF (DIJC), DASI	5
5	Introduction to UK Business and Bio-diversity Forum – Katherine Tubb (UKBBF)	15
7	Advancing Emerging solar Technologies for Energy Security – Dr Amy Neild (Newcastle University)	20
8	Break	15
9	Sustainable Circular Economy for Defence – Update on Concept Note – Marina Coloni (Strat Com)	20
10	Air Command CC&S – Activities and Challenges - Group Captain Maurice Dixon (AHd Air CC&S)	20
11	Renewable Energy Trials in the Falklands – Flt Lt Richard Griffiths (Innovation | Defence Support | UK Strategic Command)	20
13	Event/Conference – October 2025	15
14	AOB	

NC&I COP – Recap, Update and News

TEAM DEFENCE INFORMATION
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Jenny Allen (Mott McDonald)

Phil Anderson (Babcock)

UK Business & Biodiversity Forum

Introduction

Katherine Tubb, Managing Director

2025

Who we are

UK Business & Biodiversity Forum

- Established in 2022 as a Community Interest Company
- Team of eight Directors
- Supported by a Steering Committee of seven world-leading experts
- 70+ Members

Purpose & Promise

UK Business & Biodiversity Forum

Our Purpose

- By 2030, biodiversity is fully integrated into business decision-making; is valued, conserved, restored, and managed sustainably; delivering benefits to the planet, people, and businesses, across all sectors.

Our Promise

- Accelerate the mainstreaming of biodiversity as a key part of business operations and public decision-making.

Our Strategic Priorities

UK Business & Biodiversity Forum

2024:

- Member Communications
- Policy Engagement
- Knowledge Sharing
- Measurement & Metrics

Member-based Activities:

- Biodiversity Summit, Insight Series, Nature Positive Workshops
- COP16 Programme
- Toolkits, Intelligence & Reports

Nature Positive Business Pledge

UK Business & Biodiversity Forum

Nature Positive Business Pledge

- Network of businesses taking action to halt and reverse their impact on nature
- Start to take steps to understand impacts and dependencies
- Set goals
- Report transparently
- Abide by nature positive principles

UK Business
& Biodiversity
Forum

Questions?

www.business-biodiversity.co.uk

Newcastle University

Advancing Emerging Solar Technologies for Energy Security

Natural Capital & Infrastructure Community of Practice – Feb 2025

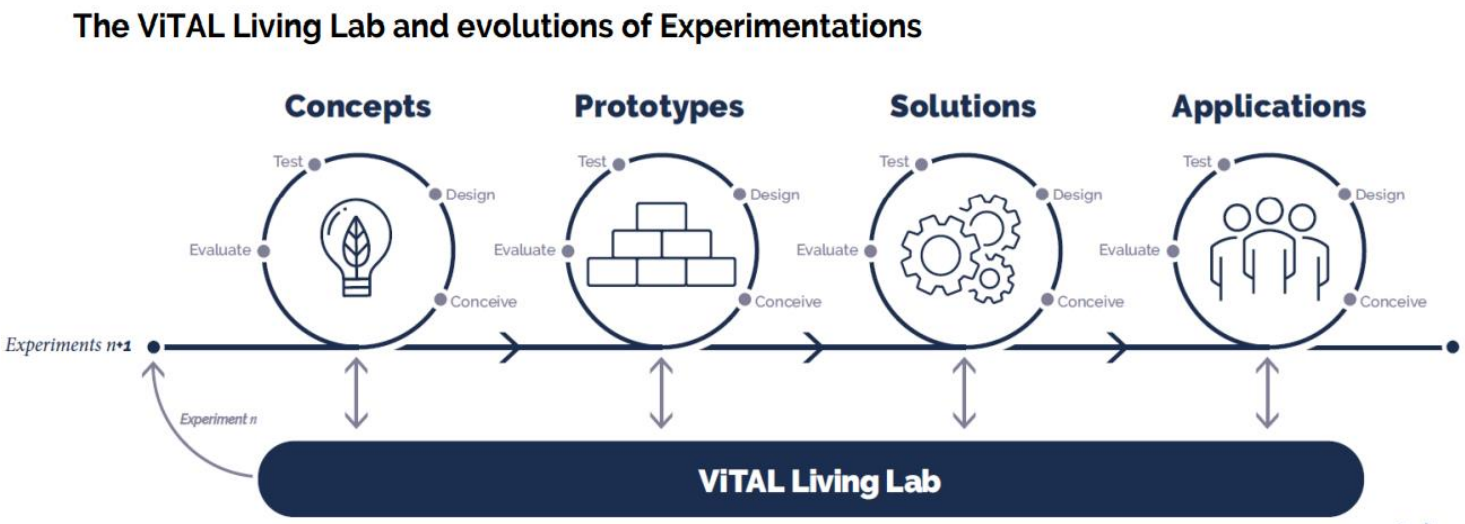
Dr Amy Neild

Amy.Neild@newcastle.ac.uk

Project ViTAL

Aim: To create a living laboratory for the RAF and the MOD to investigate new and emerging technologies for tackling climate change.

Living Lab at RAF Leeming provided a framework to enable rapid assessment of new technologies under real-world conditions.



The methodological framework of ViTAL Experimentations.

Doing the science with **stakeholders embedded** means we can **identify the challenges** that are important to them.

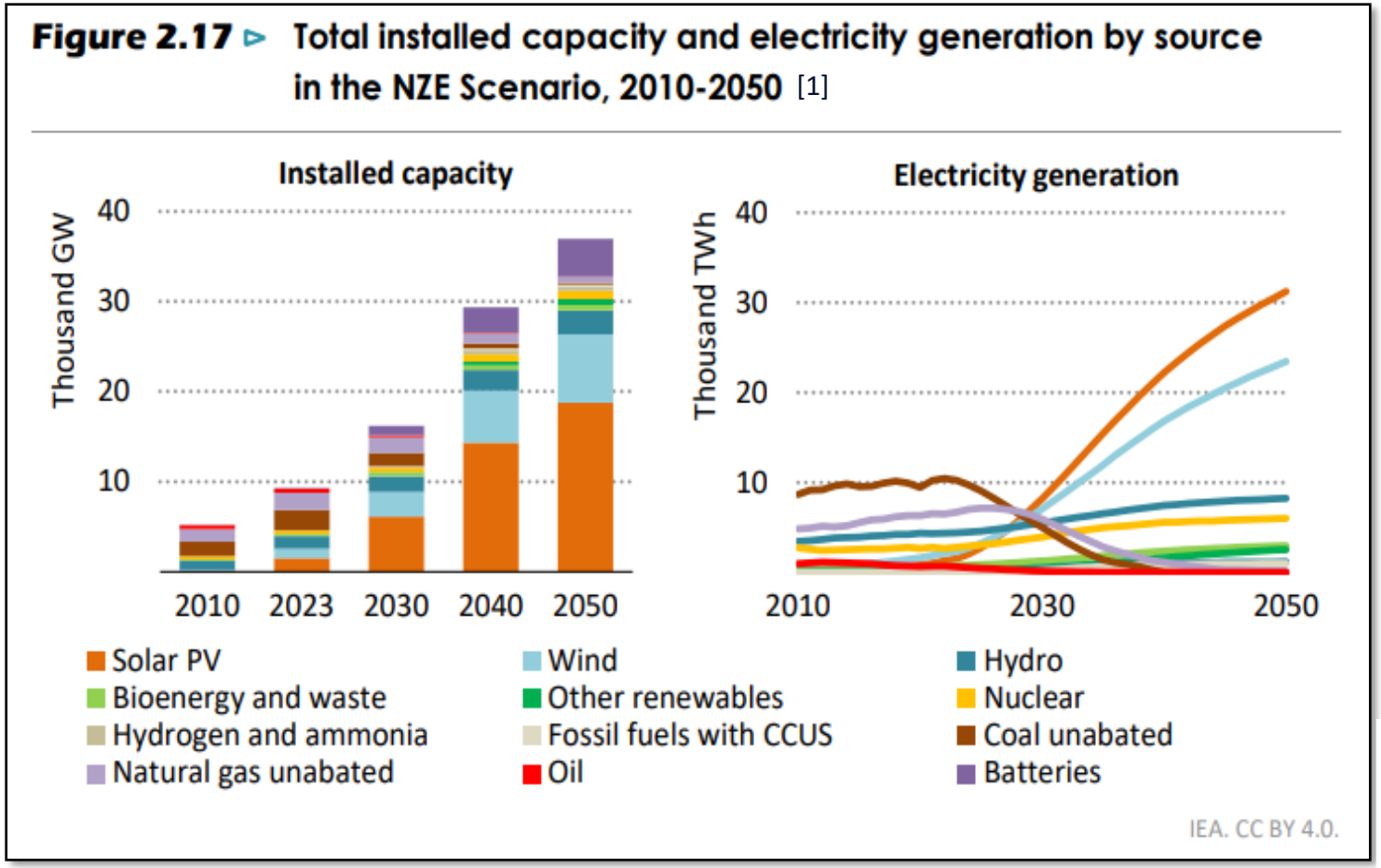
Project ViTAL

Project ViTAL

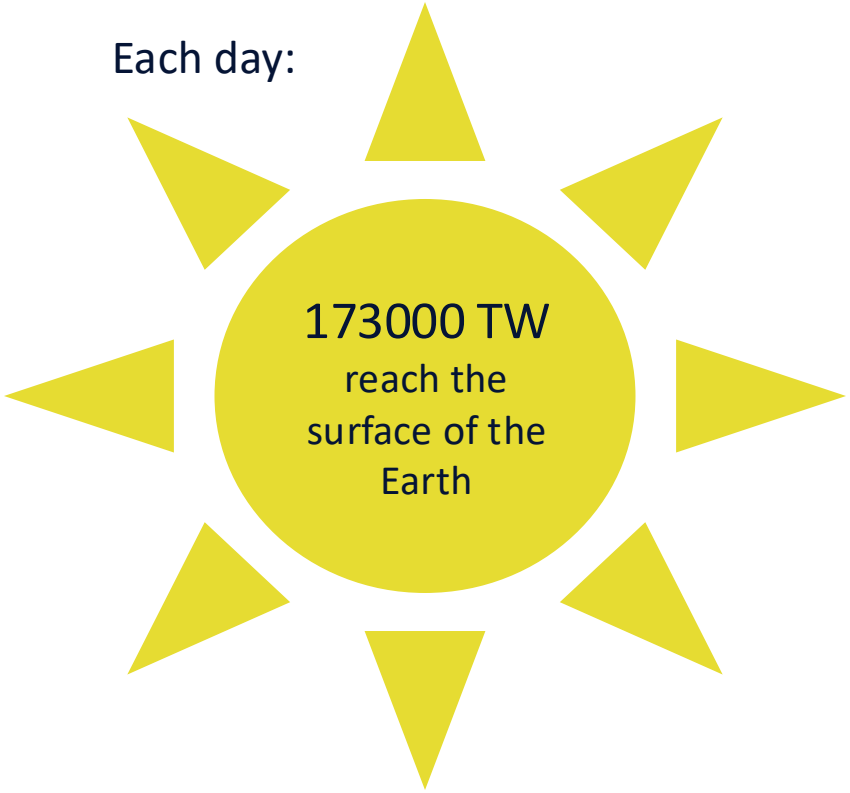
Aim: To create a living laboratory for the RAF and the MOD to investigate new and emerging technologies for tackling climate change.

1. **Carbon accounting –** Prof Oliver Heidrich
2. **Integrated solar technology –** Prof Libby Gibson
3. **Carbon capture –** Prof David Manning
4. **Geothermal system –** Dr Mark Ireland
5. **Hydrogen economy and sustainable transport –** Prof Phil Blythe
6. **Life Cycle Assessment –** Prof Oliver Heidrich

Solar PV in the Net Zero Scenario

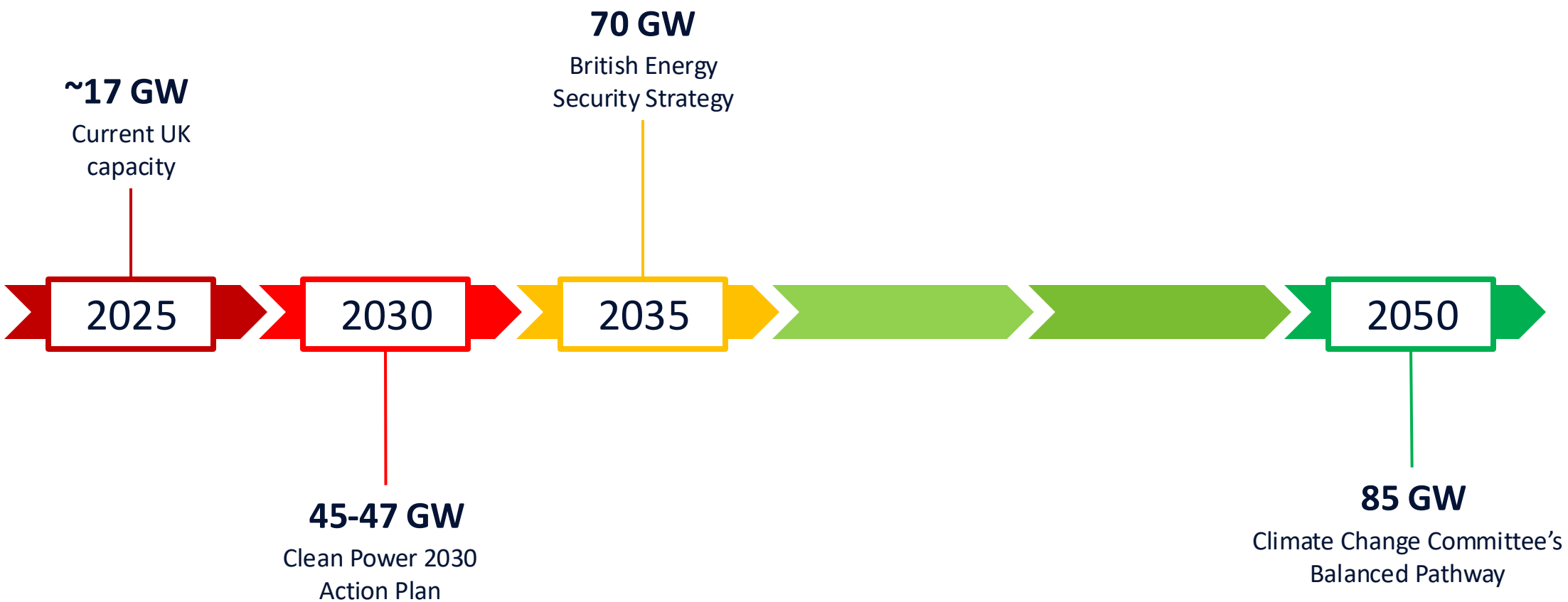


Each day:



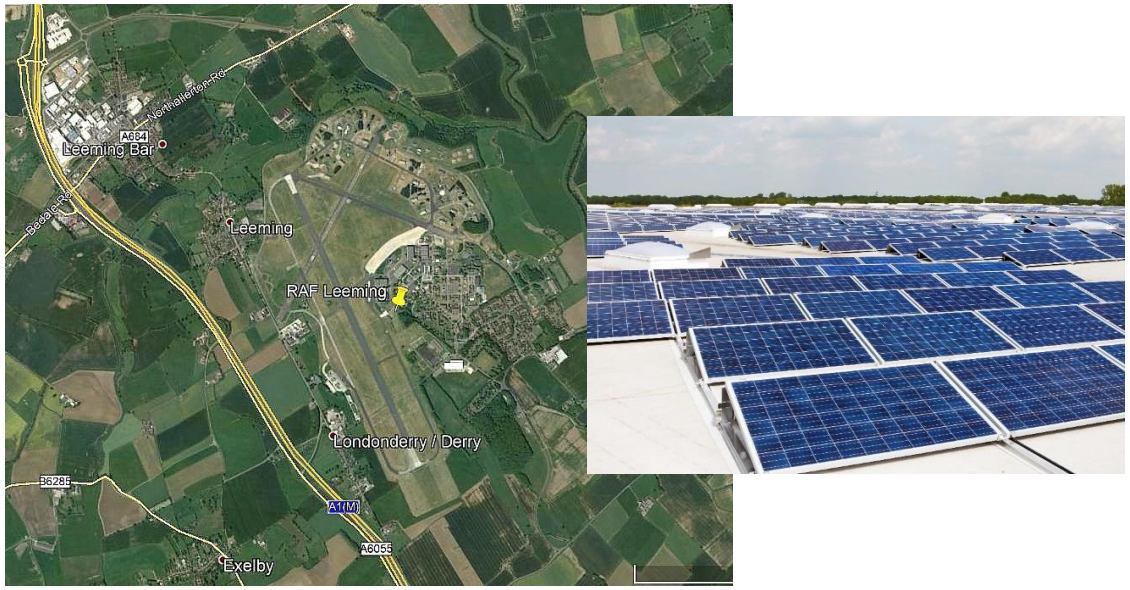
[1] IEA (2023) *Net Zero roadmap: A global pathway to keep the 1.5°C goal in reach*

Solar PV in the Net Zero Scenario



Solar PV in the MOD

- MOD operates over 1.4% of the UK land mass [2]
- McKinsey reports that a typical base could support its annual electricity demand with 40 to 50 acres of solar panels (~ roof area of a mid-sized site) [3]



Decentralised energy reduces reliance on external grids, increasing energy resilience and security.

[2] Ministry of Defence (2024) *MOD Land Holdings: 2000 to 2024*
[3] McKinsey & Company (2021) *Decarbonizing defence: Imperative and opportunity*

Solar PV in the MOD

- Solar PV can also play a critical role in supporting off-grid operations in remote environments.
- NATO exercise Capable Logistician 2015 saw solar panels air dropped to troops, allowing them to be independent from power grids, diesel generators and roads.

Solar PV provides a significant operational advantage, increasing flexibility in remote environments.

[4]

[4] NATO (2015) *NATO "Smart Energy" exercise gets underway in Hungary*

Importance of Innovation

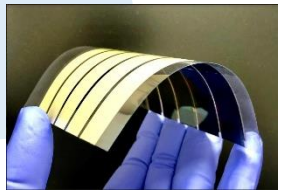
"A **strategic competition** exists between all nations to be the first to capture the military benefits of **new energy types and technologies"**

- Defence Operational Energy Strategy, Foreword by CDLS and DCDS MilCap

Advantages of Emerging PV

Lightweight & Flexible

- Can be integrated onto more surfaces/roofs

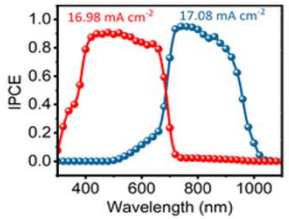


Earth Abundant Materials

- More secure supply chain for UK markets

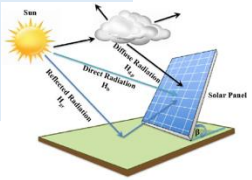
Higher Efficiencies

- Designed to absorb a wider range of light



Low-Light Performance

- Perform better in low light/cloudy conditions

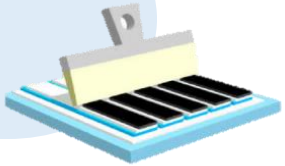


Indoor Compatibility

- Can be tuned to specific lighting types

Simple Fabrication

- No energy intensive refining processes



Emerging PV for Defence

How can these advantages benefit defence operations?

[5]

[6]

Portable Power Generation

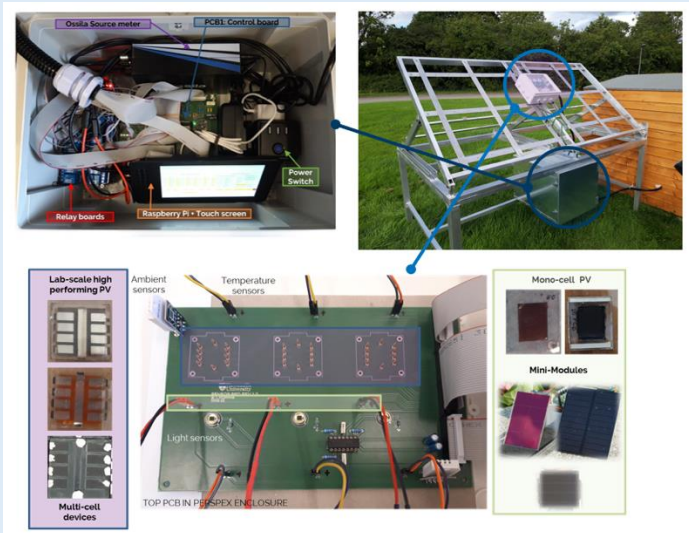
Hangar Roof Deployment

Energy Independence and Security

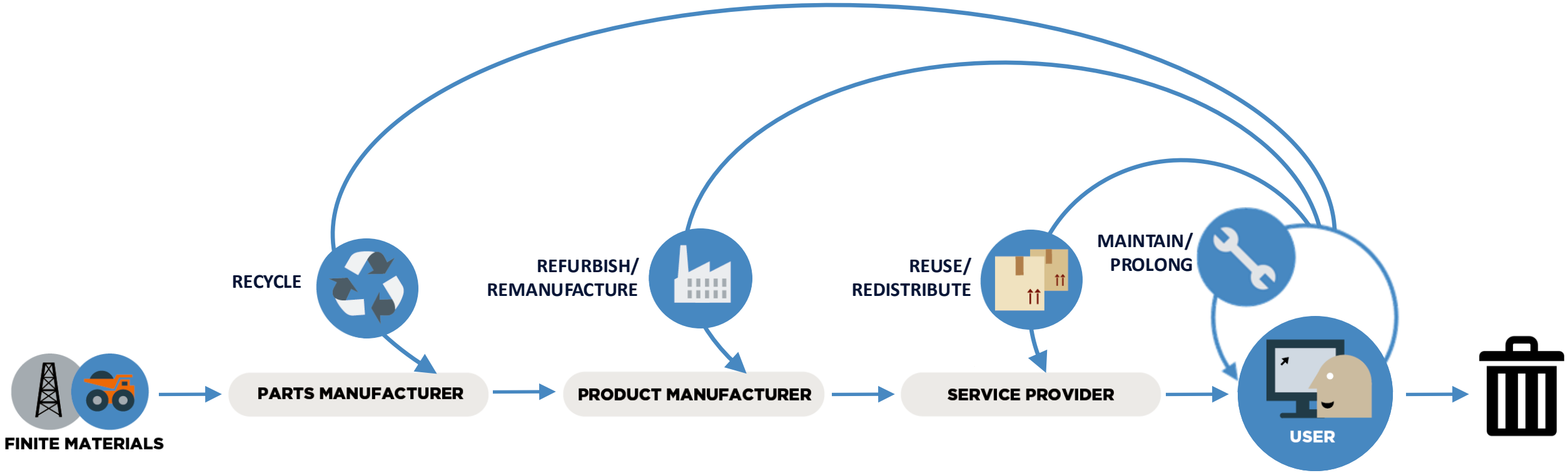
[5] U.S. Army (2010) *Army evaluating transportable solar-powered tents*
[6] U.S. Army (2014) *Soldiers of the future will generate their own power*

Project ViTAL

- Energy Security in Defence
- UK's Sustainability and Defence Goals
- Collaboration and Stakeholder-Driven Science
- Innovation and Technological Advancement
- Real-World Challenges
- **Circularity and Sustainability**



A Linear vs. Circular Economy



The circular economy tackles climate change and other global challenges like biodiversity loss, waste and pollution by decoupling economic activity from the consumption of finite resources. It is based on three principles driven by design:

- Design out waste and pollution
- Keep products and materials in use (at their highest value)
- Regenerate nature

Advantages of Circularity in the MOD

ROYAL AIR FORCE | Newcastle University

Resource Security

- Mitigates risks associated with global supply chain reductions

Drives Innovation

- Advancement in materials science, recycling and repair technologies for defence

Long-Term Readiness

- Extends equipment lifecycle to ensure operational capability

Sustainability

- Aligns defence operations with sustainability goals

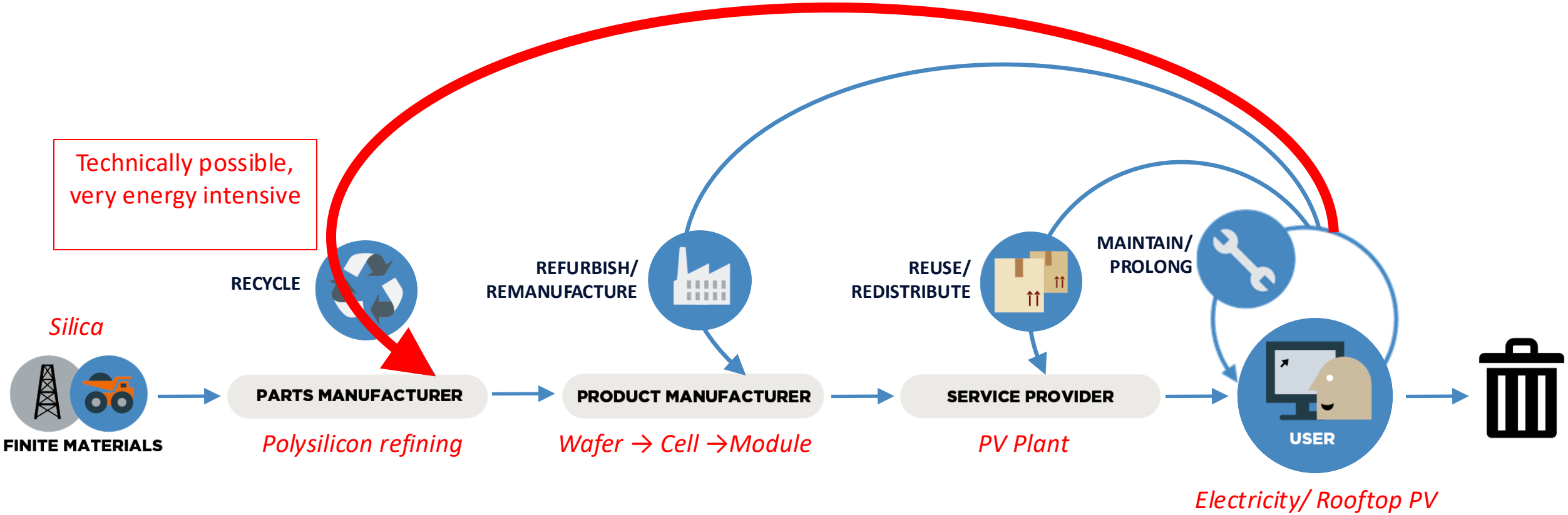
Cost Effectiveness

- Reduces procurement and disposal costs through resource repurposing

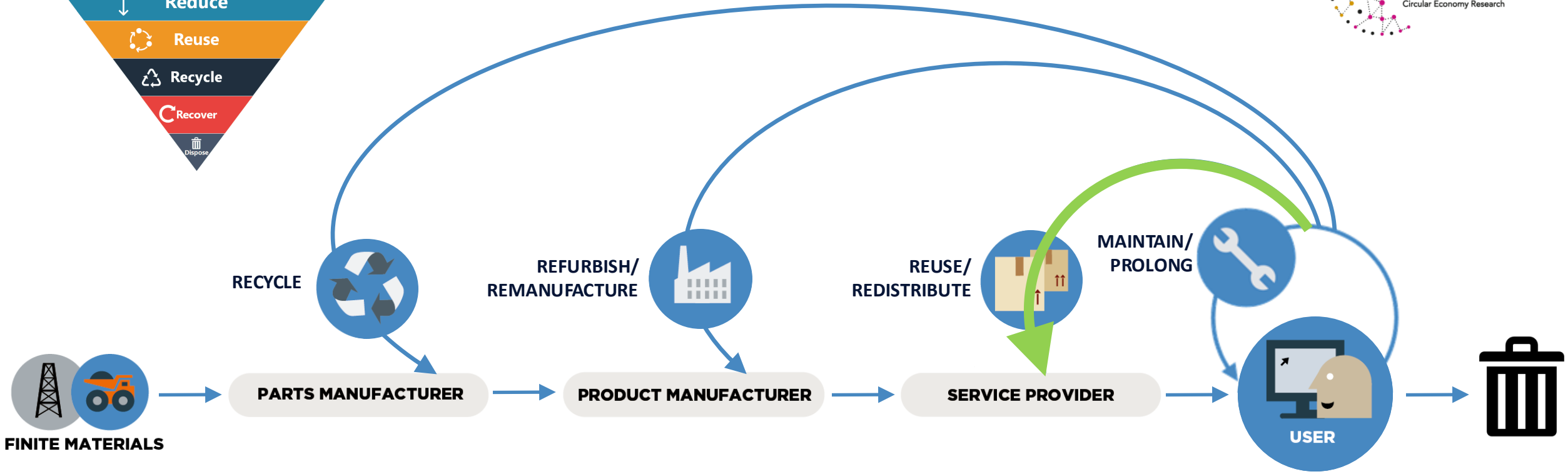
Self-Sufficiency

- Reduces reliance on external resources to enable independent operations

Silicon PV Technology

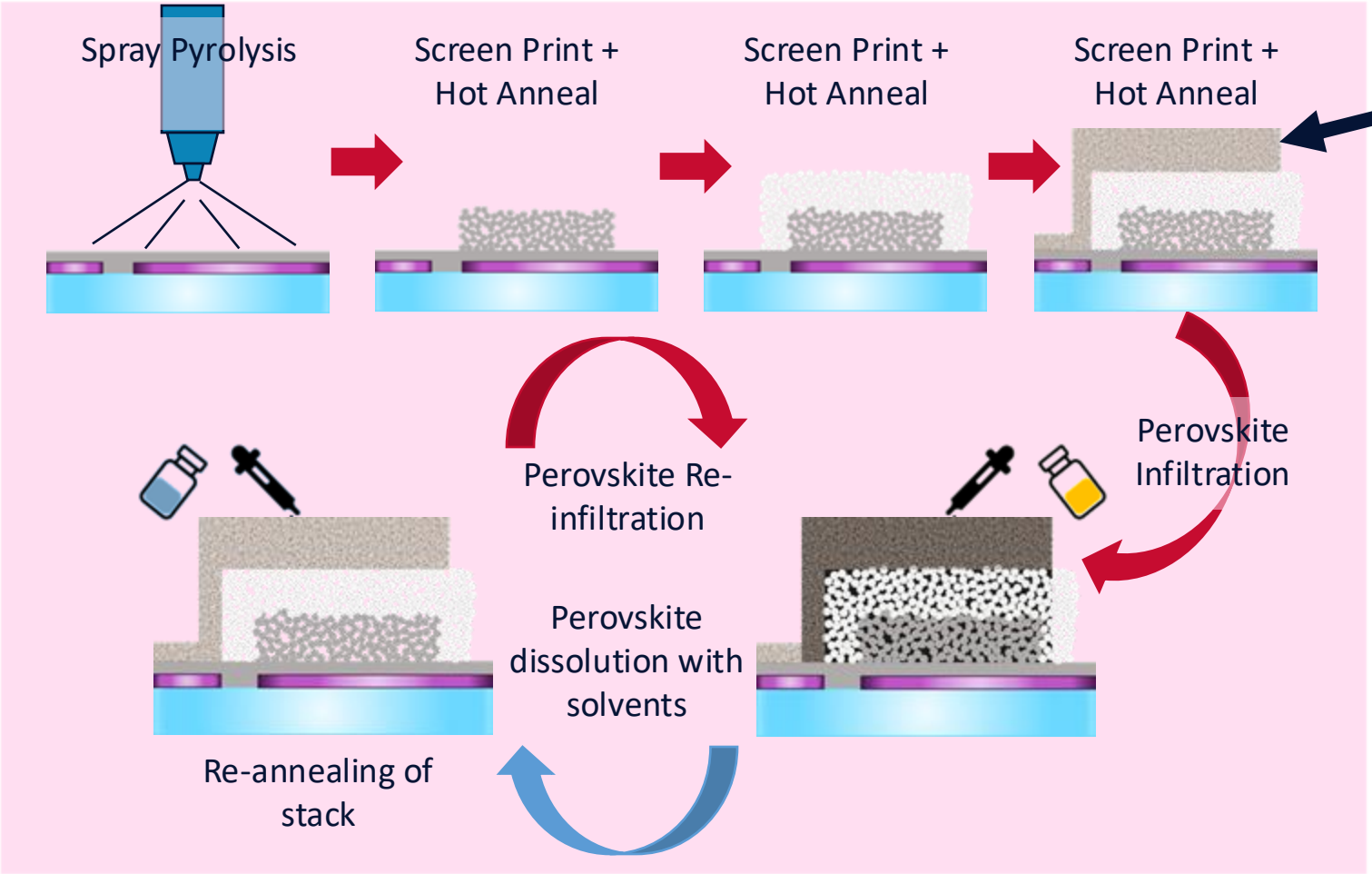


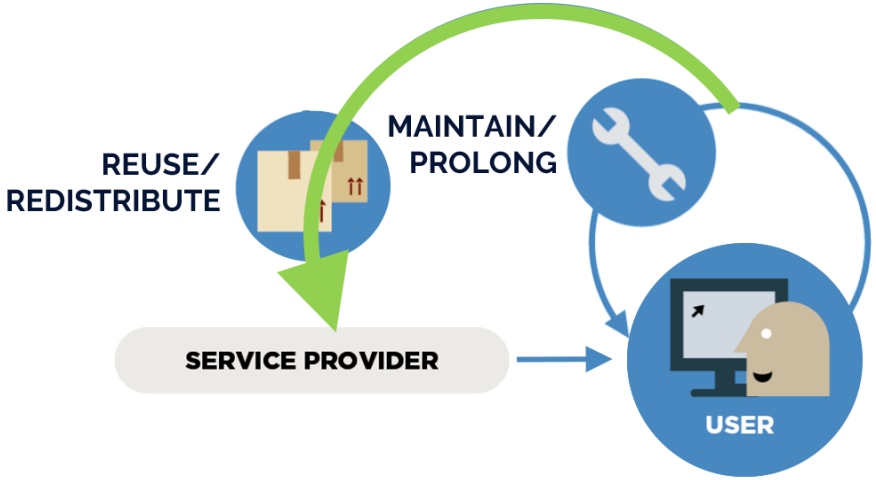
The Circular Economy



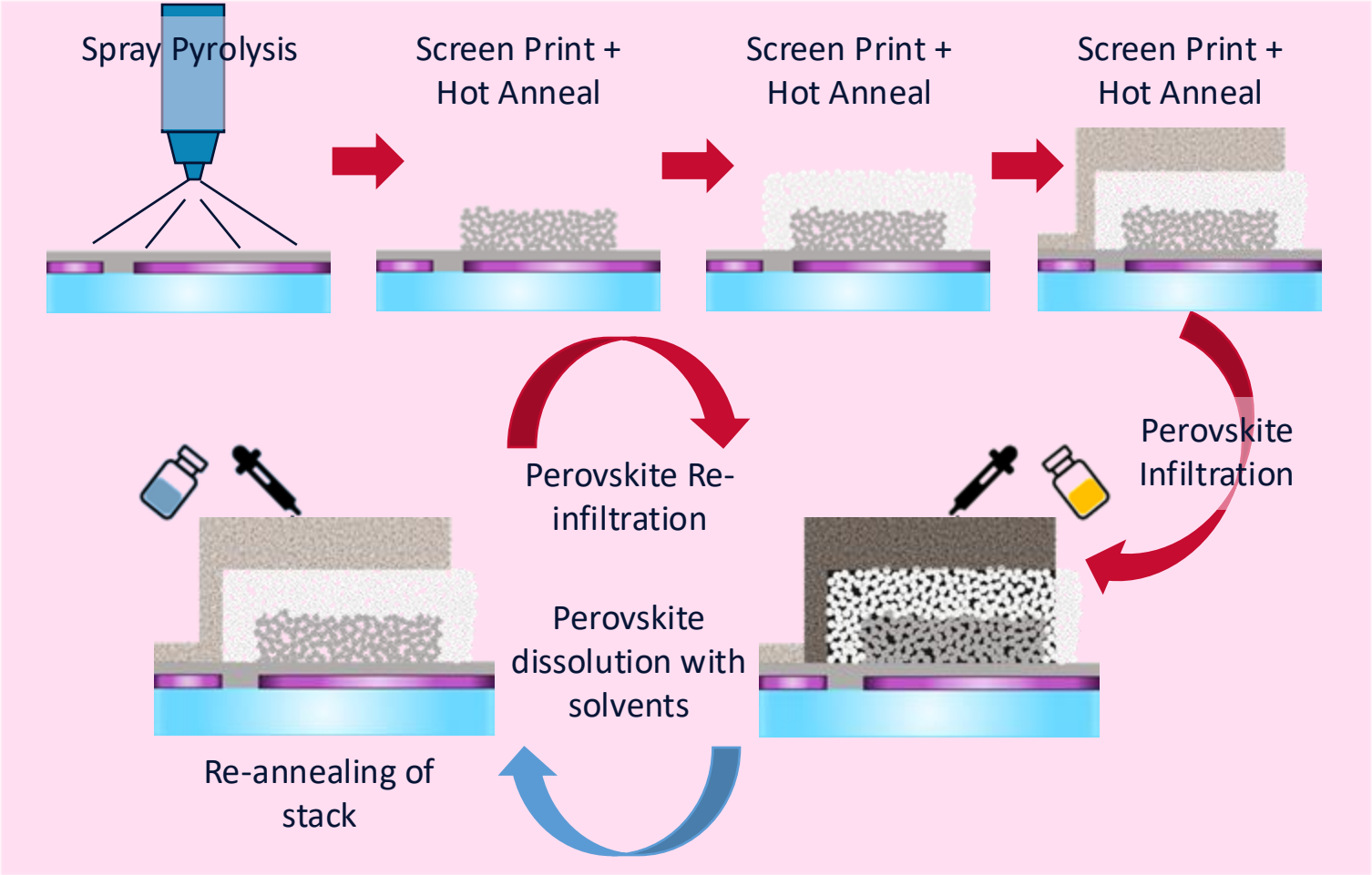
By implementing a device designed for end-of-life reusability, and by offering a service that facilitates this reuse, we effectively close the loop for a circular economy

Project ViTAL: Case Study

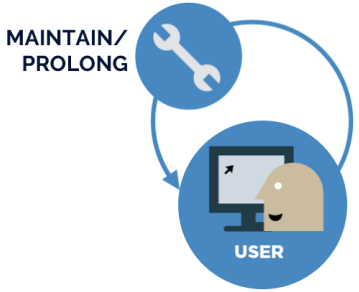




Project ViTAL: Case Study

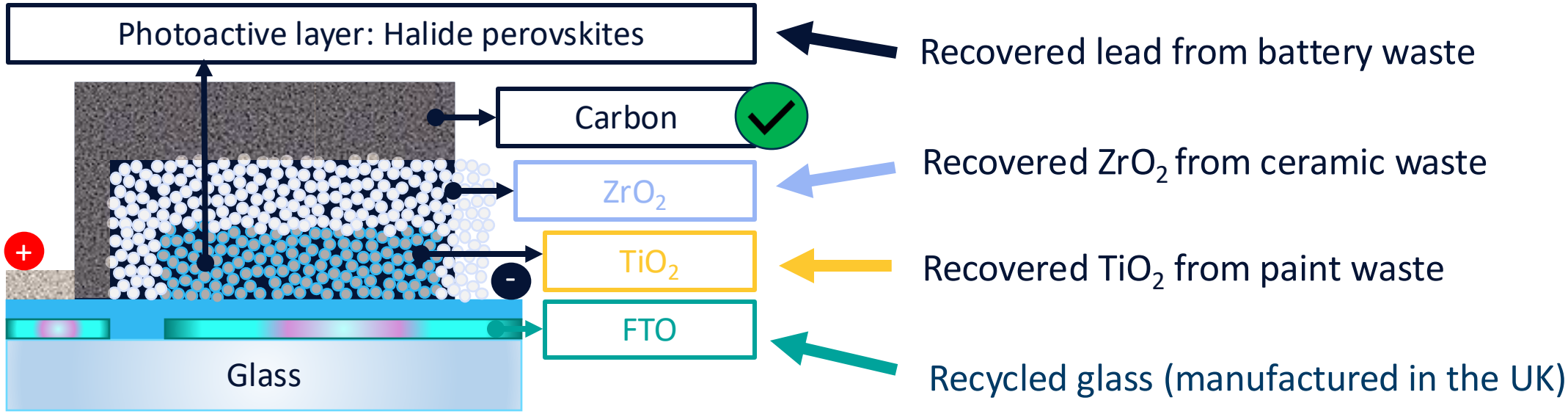


Project ViTAL outdoor data has uncovered a mechanism to maintain and extend the lifespan of the devices!



Project ViTAL: Case Study

Are we able to fabricate an emerging PV in the UK using waste streams to ensure circularity and energy security?



Triple Mesoscopic Stack

Acknowledgements

Prof. Elizabeth Gibson

Solar Project Lead

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Dr Susana Iglesias-Porras

Solar Project RA

ViTAL Living Lab
Project Team
September 2024

RAF Leeming

Project ViTAL

UKRI Interdisciplinary Centre for Circular Chemical Economy

UK Research and Innovation

Newcastle University

Thank you

Any questions?

Power and cost calculations

Peak output of solar panel under ideal conditions (when exposed to direct sunlight at 1000 W/m^2)

For our silicon panels:

- Silicon panel 400 W of peak power with 1.94 m^2
- 4 panels = 7.76 m^2 = 1.6 kW
- Peak power density = 206.2 W/m^2
- Cost of 4 panels = £756

For circular emerging PV technology:

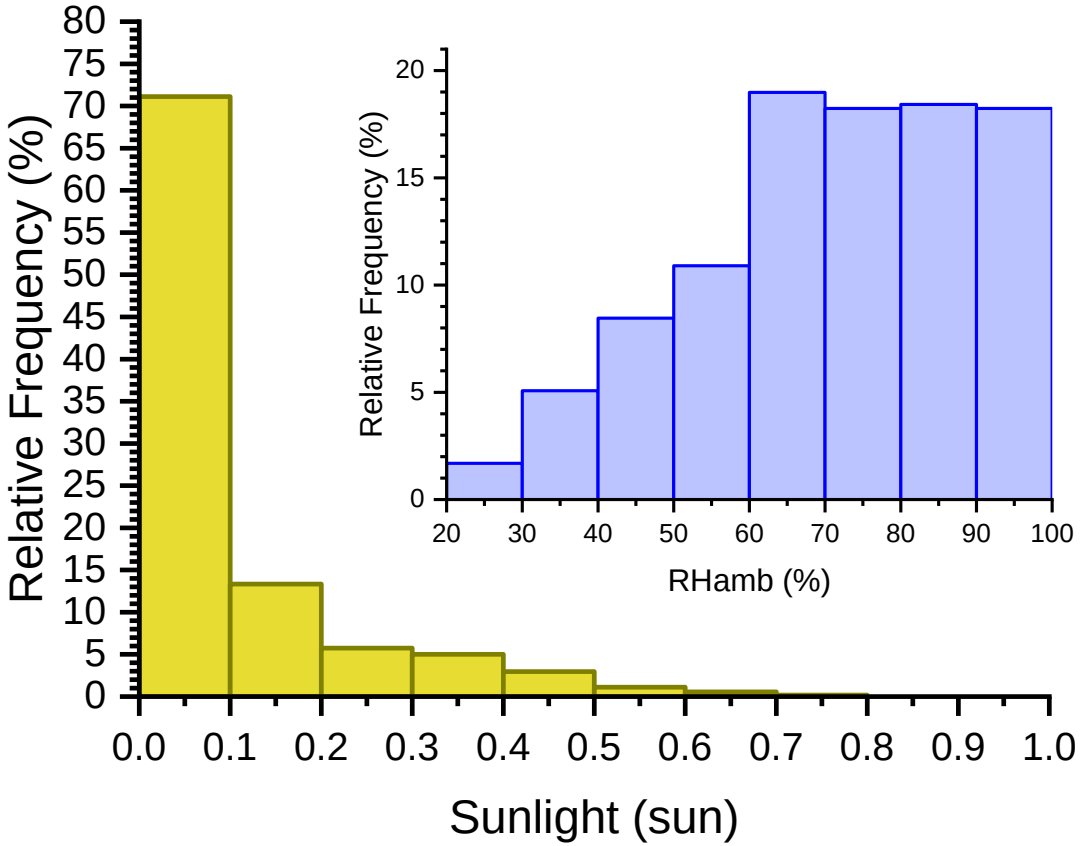
- Good minimodule (12.87%) 0.772 W of peak power with 60.08 cm^2 [1]
- 1 panel seen in picture (0.252 m^2) = 32.47 W
- For same area as silicon system, 7.76 m^2 ≈ 1 kW
- Peak power density = 128.77 W/m^2
- Area of emerging system = 12.43 m^2
- At £40/m^2 [2], cost of emerging system to provide 1.6 kW = £497.20

** general estimate for perovskite module production hovers around $40-$50 per square meter, assuming similar efficiencies and economies of scale as other perovskite technologies. (*ACS Energy Lett.* 2022, 7, 9, 3039–3044)

[1] *Nano Energy*, 2020, 74, 204842 (https://doi.org/10.1016/j.nanoen.2020.104842)
[2] *ACS Energy Lett.* 2022, 7, 9, 3039–3044 (https://doi.org/10.1021/acsenergylett.2c01728)

Outdoor data

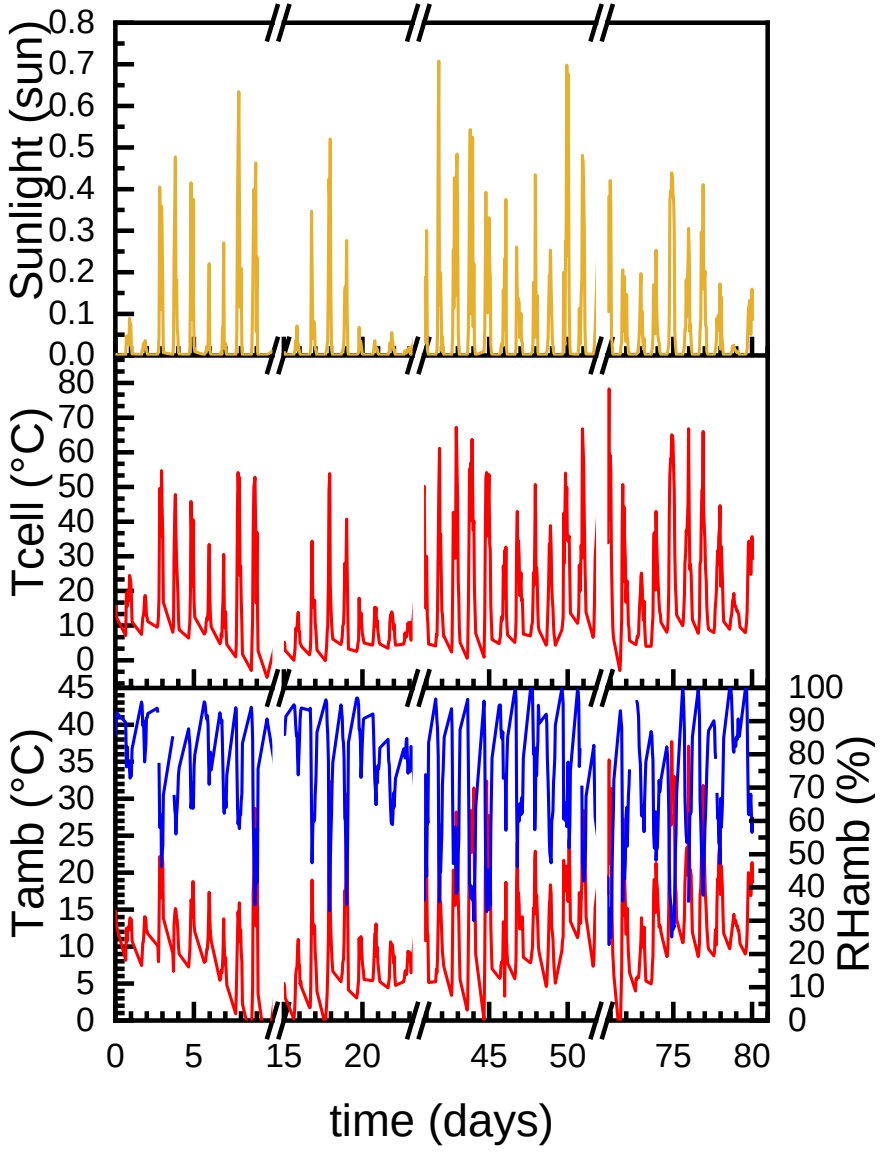
Minimodule outdoor test between February and May 2024



T_{amb} (max) 37.7 °C

T_{amb} (median) 11.88 °C

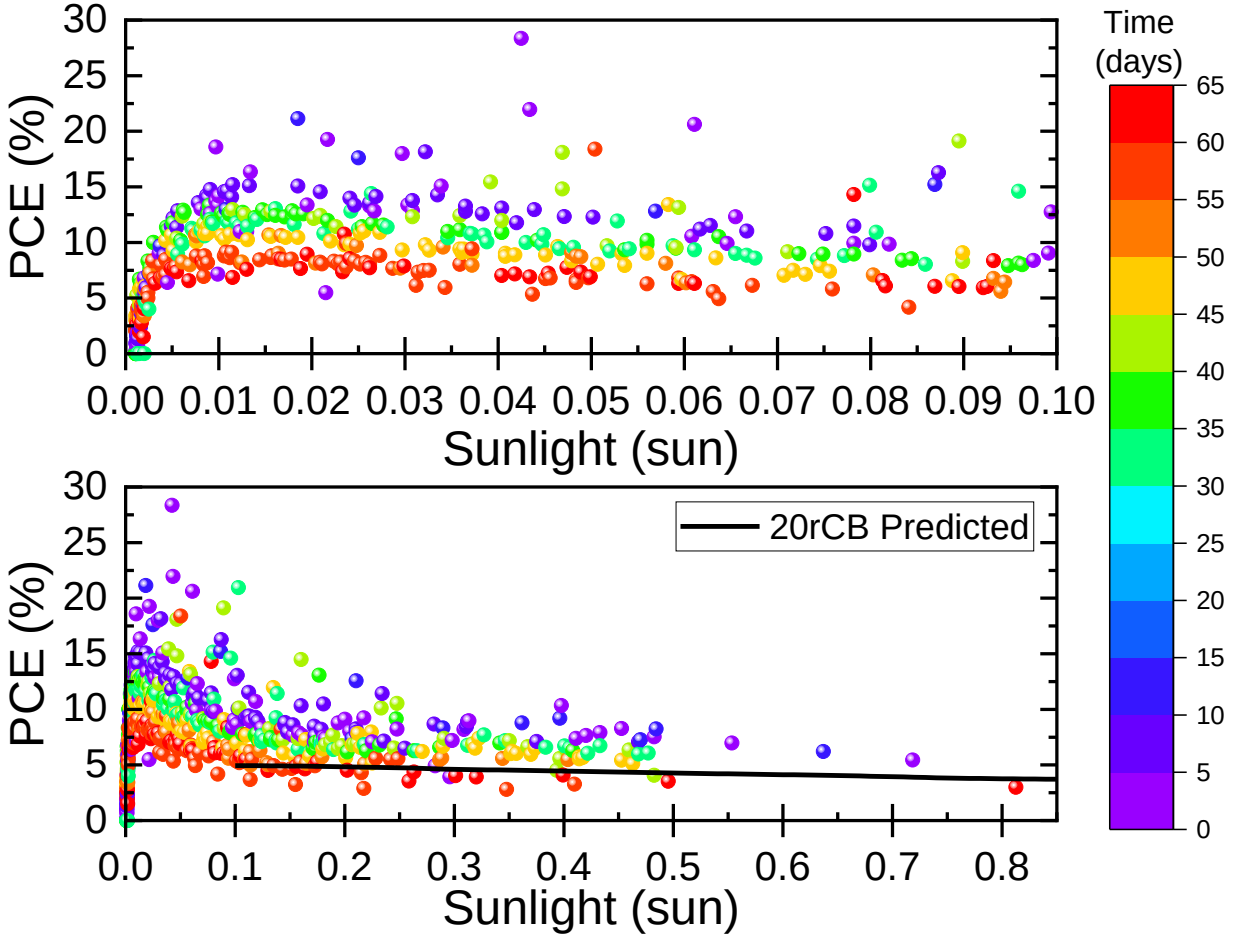
T_{amb} (min) -5.2 °C

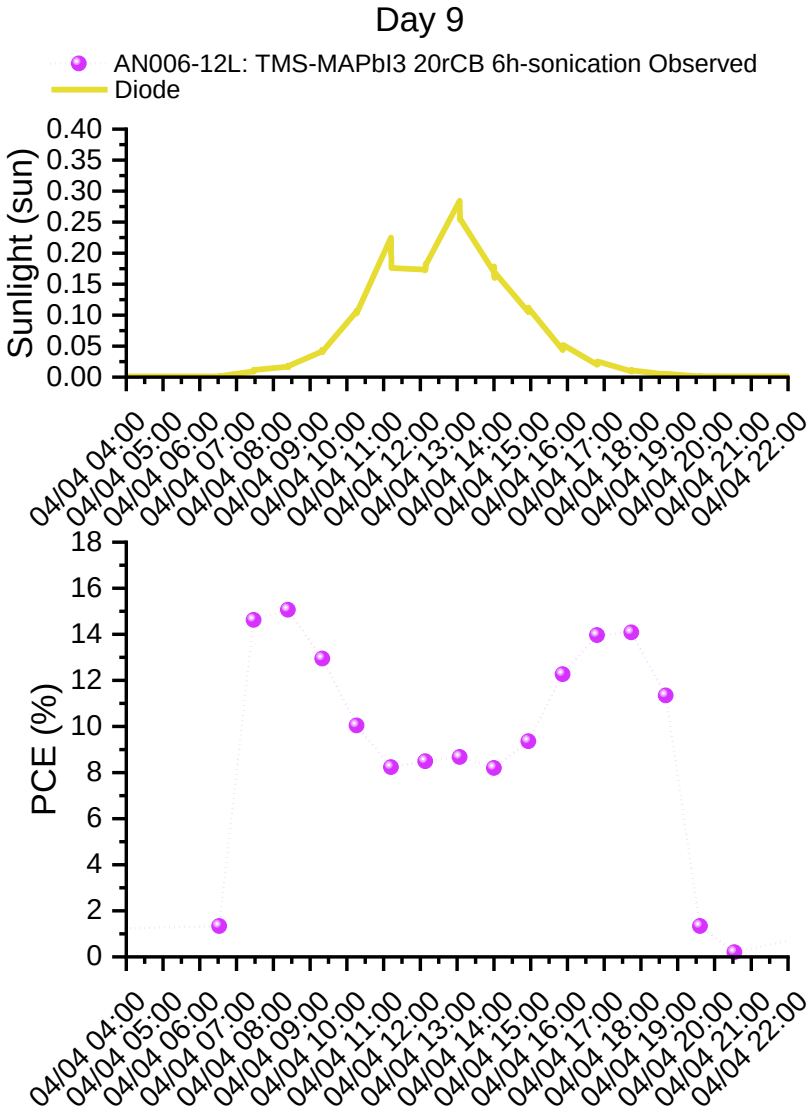


- Over 70% low light (< 0.1 sun or 100 W/m^2)
- Over 55% of high humidity (>70% RH)
- High temperatures reached on the surface of the cell (above 80°C) causing slight heating of the measuring box

Outdoor data

Perovskite PV thrives under low light

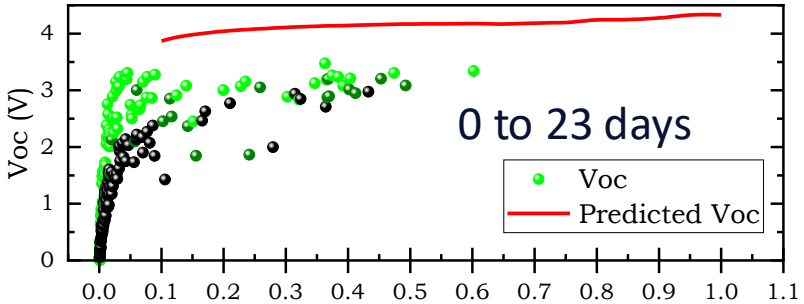


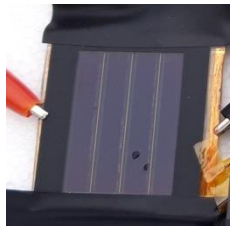


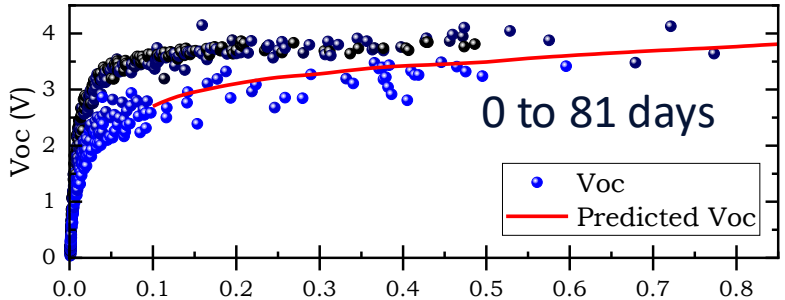
PCE at 0.8 sun (800 W/m^2) ≈ 4%

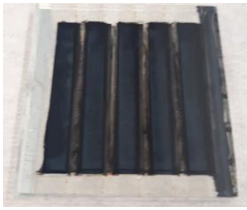
PCE at 0.042 sun (42 W/m^2) ≈ 22%

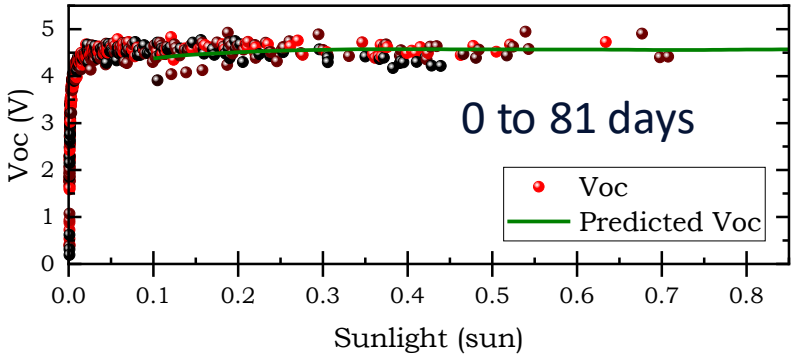
Outdoor data

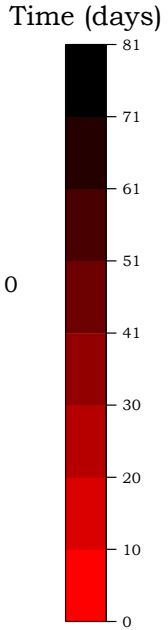






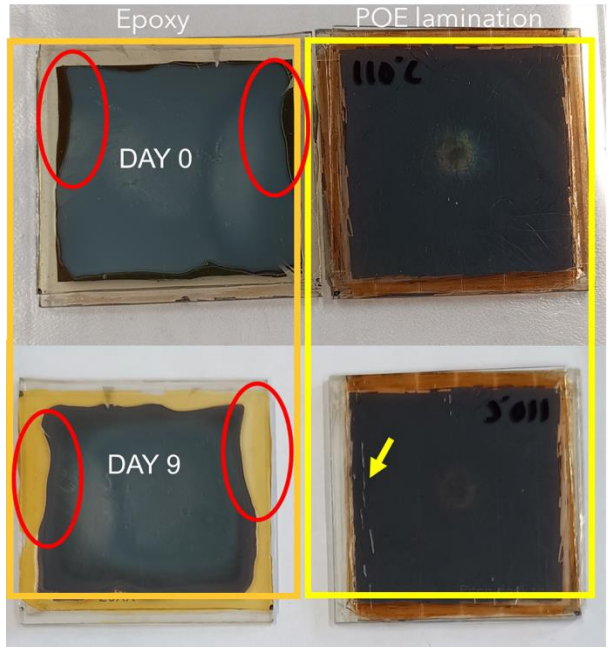




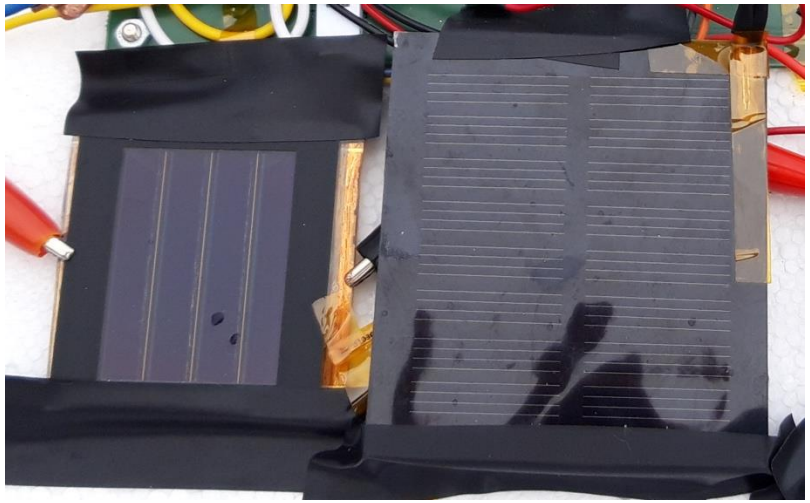


Durability of devices upon outdoor exposure dependent on architecture

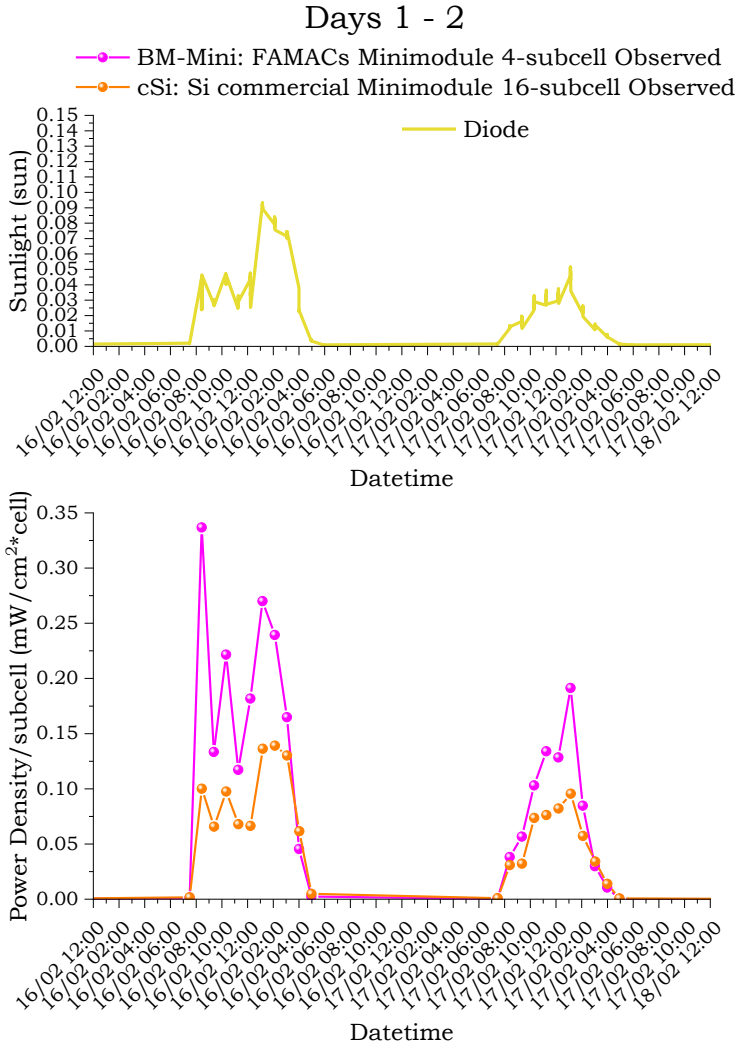
- Failure of encapsulation (Epoxy) upon heat exposure from the sun
  - Degradation below T_{80} of Planar Perovskite within a week
  - Increase in performance for the TMS minimodule and stabilisation for 80 days
  - No changes in Si reference minimodule



Outdoor data – planar perovskite



	Planar perovskite Minimodule	Commercial c-Si Minimodule
Efficiency at 1 sun (%)	14.286	16.067
Active area (cm^2)	8	23.04
Number of subcells	4	16



Considering the number of cells embedded in each device, **perovskite planar minimodules produce comparable or even better power outputs** than the Silicon reference **at low light conditions**.

NC&I COP – Break

Break

https://www.gov.uk/government/publications/sustainable-circular-economics-for-defence-concept-note

Strategic Command
Defence Support

Circular Economics for Defence Concept Note Context and Overview

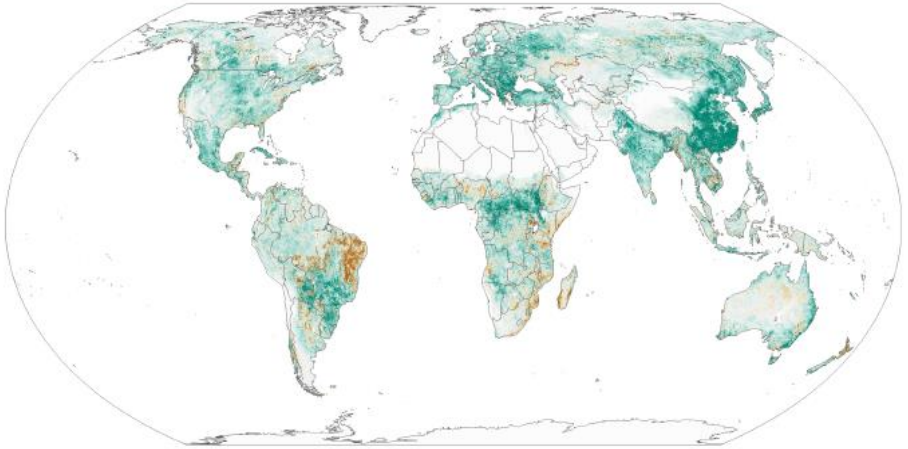
Marina Coloni - February 2025

Climate Change unavoidable Impact

CERTAINTY OF CLIMATE CHANGE

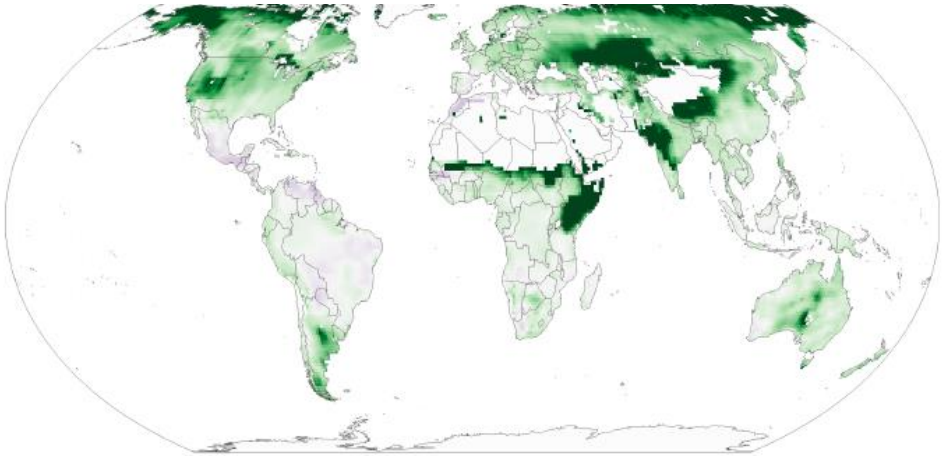
Change in Indicator	Observed (since 1950)	Attributed (since 1950)	Projected at GWL (°C)		
			+1.5	+2	+4
Warm/hot extremes: Frequency or intensity	↑	✓ Main driver	↑	↑	↑
Cold extremes: Frequency or intensity	↓	✓ Main driver	↓	↓	↓
Heavy precipitation events: Frequency, intensity and/or amount	↑ Over majority of land regions with good observational coverage	✓ Main driver of the observed intensification of heavy precipitation in land regions	↑ in most land regions	↑	↑ in most land regions
Agricultural and ecological droughts: Intensity and/or frequency	↑ in some regions	✓ in some regions	↑ in more regions compared to observed changes	↑ in more regions compared to 1.5°C of global warming	↑ in more regions compared to 2°C of global warming
Precipitation associated with tropical cyclones	↑	✓	↑ Rate +11%	↑ Rate +14%	↑ Rate +28%
Tropical cyclones: Proportion of intense cyclones	↑	✓	↑ +10%	↑ +13%	↑ +20%
Compound events: Co-occurrent heatwaves and droughts	↑ (Frequency)	✓ (Frequency)	↑ (Frequency and intensity increases with warming)		
Marine heatwaves: Intensity & frequency	↑ (since 1900)	✓ (since 2006)	↑ Strongest in tropical and Arctic Ocean		
Extreme sea levels: Frequency	↑ (since 1960)	✓	↑ (Scenario-based assessment for 21st century)		

medium confidence | likely/high confidence | very likely | extremely likely | virtually certain



Trend in Growing Season Mean Leaf Area Index (2000-2018, 10^{-3} m²/m²/year)

≤-18 -9 0 9 ≥18



Predicted Change in Growing Season Mean Leaf Area Index (2081-2100, %)

≤-25 0 25 50 75 ≥100

ipcc INTERGOVERNMENTAL PANEL ON climate change

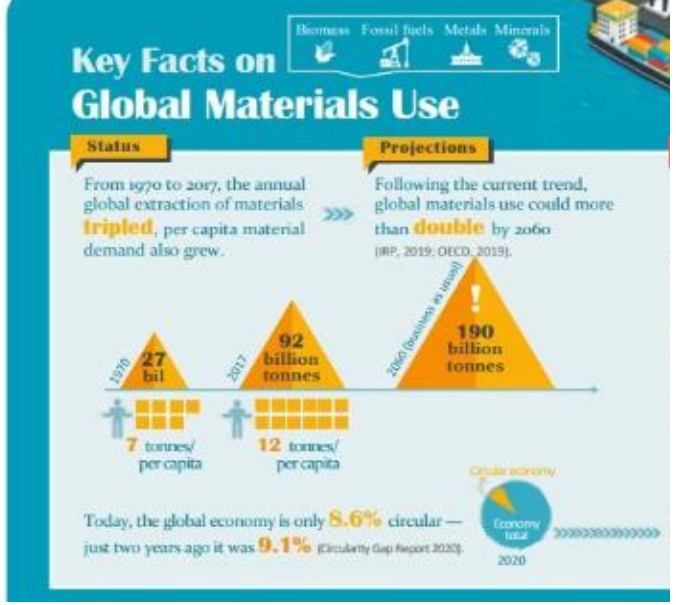
Intergovernmental Panel on Climate Change (IPCC)

IPCC AR6 Working Group 1: Technical Summary | Climate Change 2021: The Physical Science Basis

- It was established that the world is greener early 1980s
- 2000-2018 Increase in global greenness
- Predicted increase in greenness (also in the Arctic)

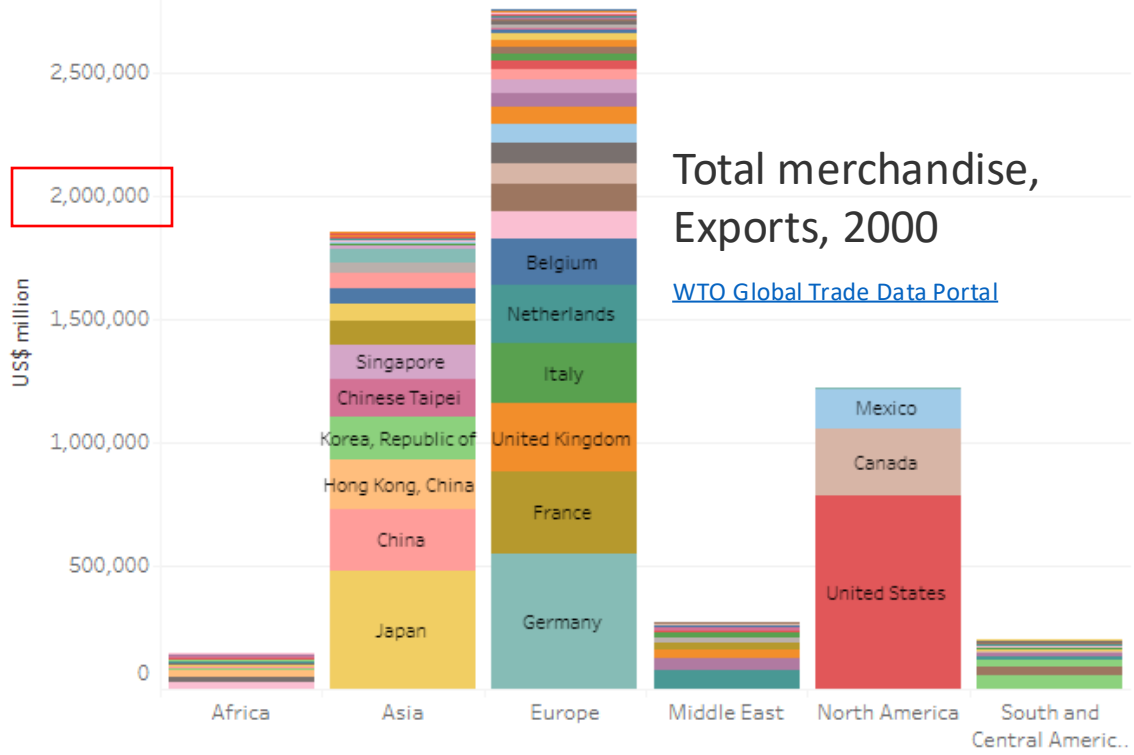
NASA earth observatory

Global Green Up Slows Warming



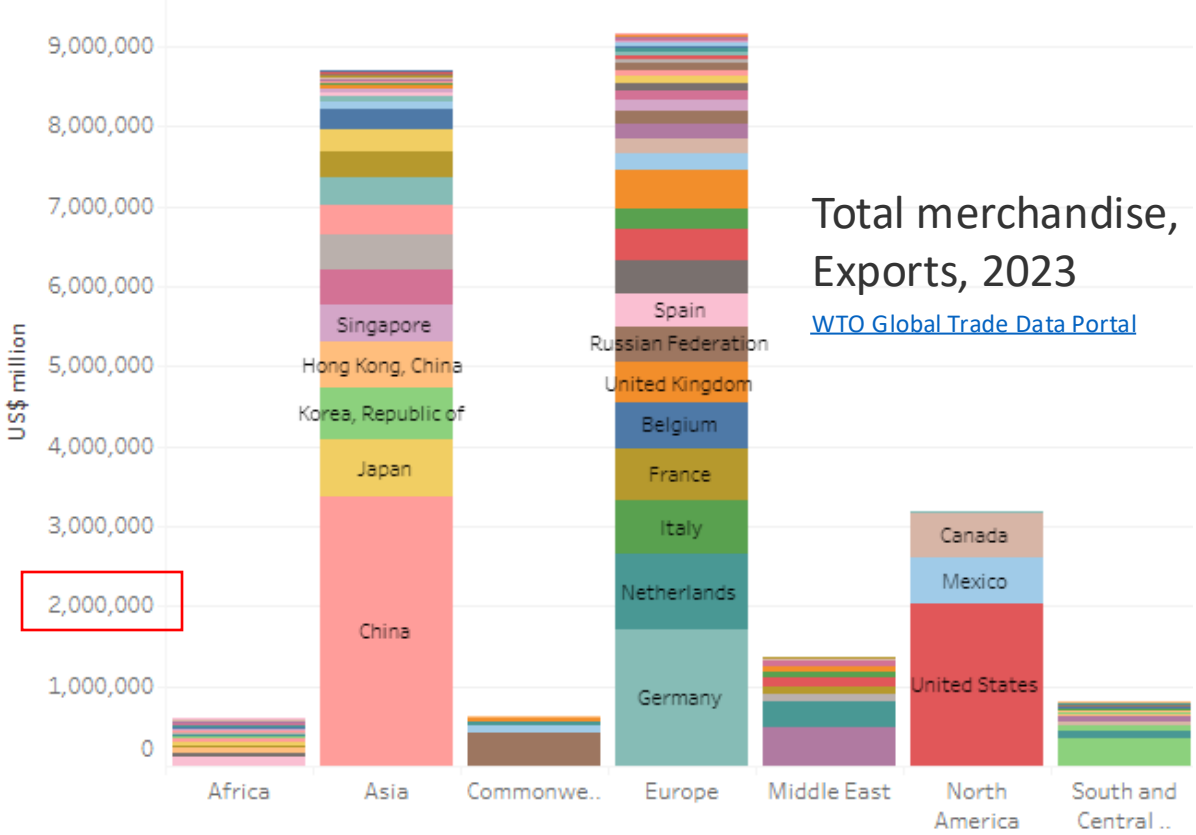
- China became a WTO member in 2001
- China is still considered a 'developing country'
- Developing countries have a WTO differential and more favorable treatment [WTO | Development - Special and differential treatment provisions]
- BRICS+ = around 45% of world's population and 35% of global GDP
- Ultimate impact of BRICS+ will likely be measured and incremental
  [The BRICS group: Overview and recent expansion - House of Commons Library]

UN environment programme International Resource Panel [Global Material Flows Database | Resource Panel]



Total merchandise, Exports, 2000

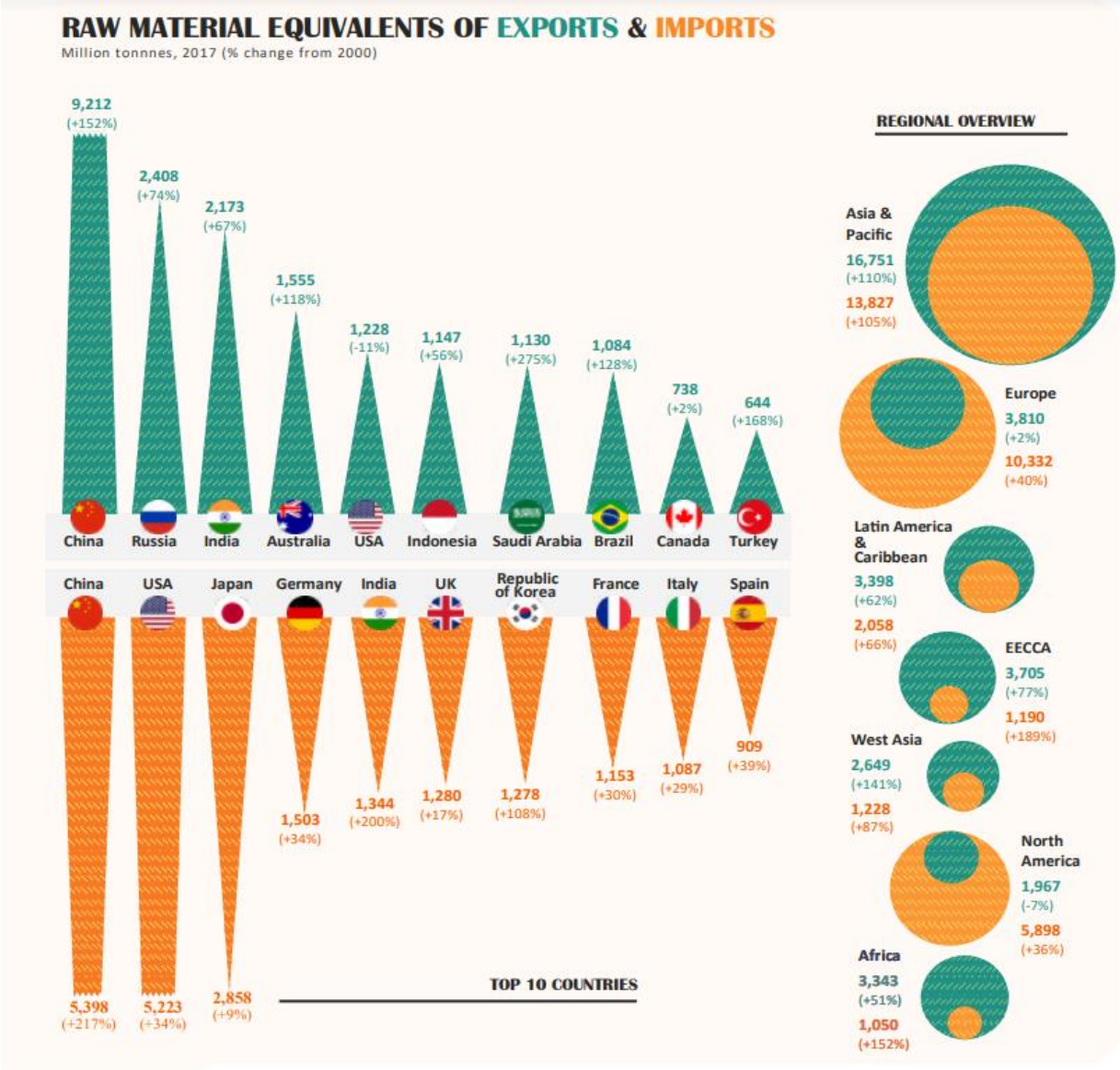
[WTO Global Trade Data Portal]

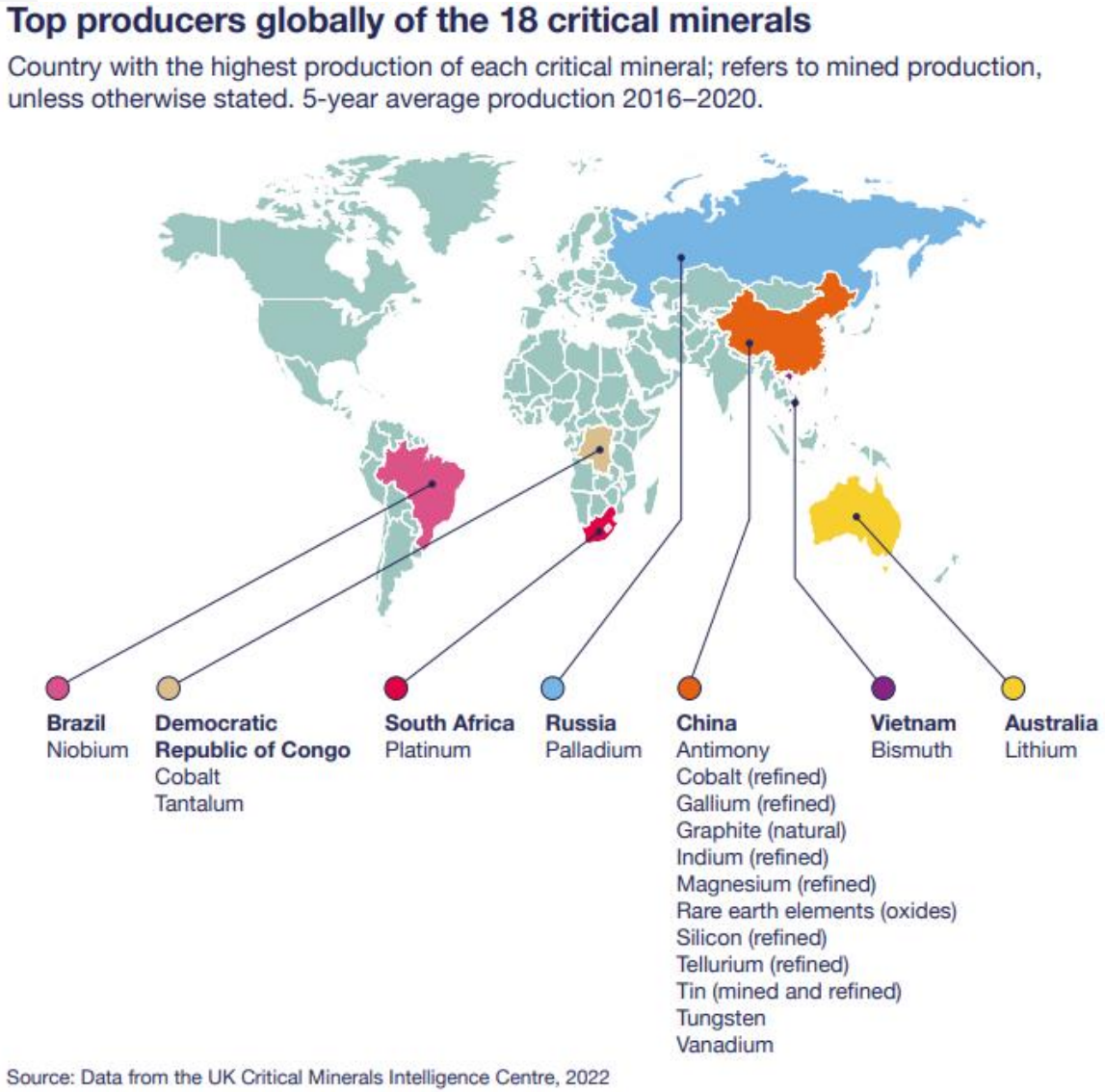


Total merchandise, Exports, 2023

[WTO Global Trade Data Portal]

Raw Materials - Exports and Imports trends





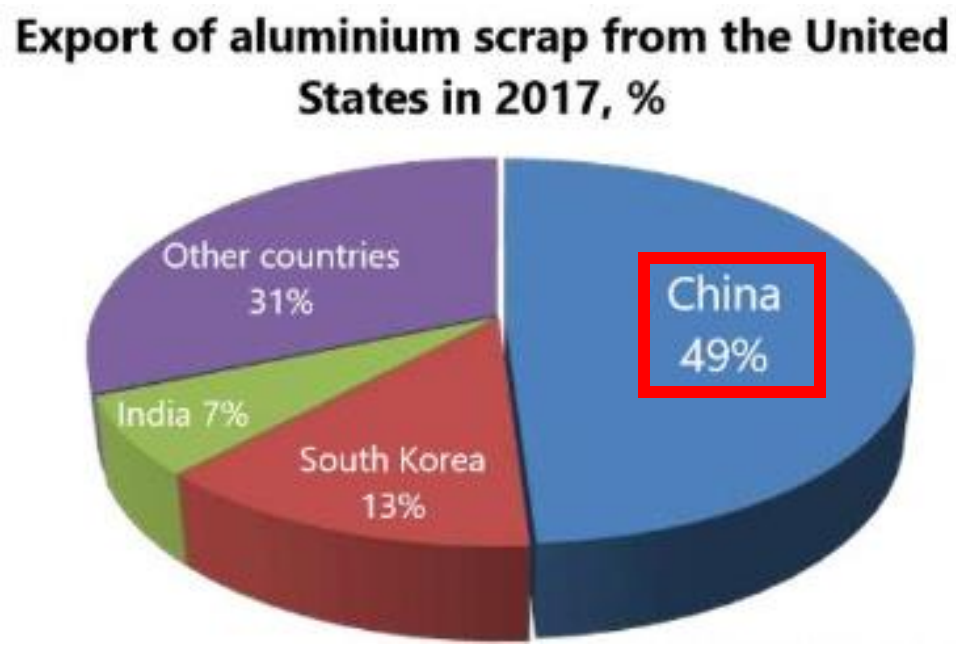
Resilience for the Future: The United Kingdom's Critical Minerals Strategy

UNEP (2020), SUSTAINABLE TRADE IN RESOURCES GLOBAL MATERIAL FLOWS, CIRCULARITY AND TRADE, United Nations Environment Programme Global-Resource-Outlook_2024.pdf

Aluminium trends

Global Aluminium demand will increase by almost 40% by 2030 and 80% by 2050

(Global Economic Forum)



- **In 2023 China has produced 59% of global aluminium production (the second – India - has produced 6%)** Aluminum Production by Country 2024 **Russia, 6.85% (2023 - other source)** Strategic-Raw-Materials-for-Defence-HCSS-2023-V2.pdf
- **In 2023 China imported the 17.3% Aluminium waste and scrap** https://trendeconomy.com/data/commodity_h2/7602
- **In the first 2 months of 2024, China has increased its aluminium import of 19%**
- **Since November 2024 → China is easing restrictions on imported Aluminium**
- **China is the major producer and consumer of Aluminium worldwide**

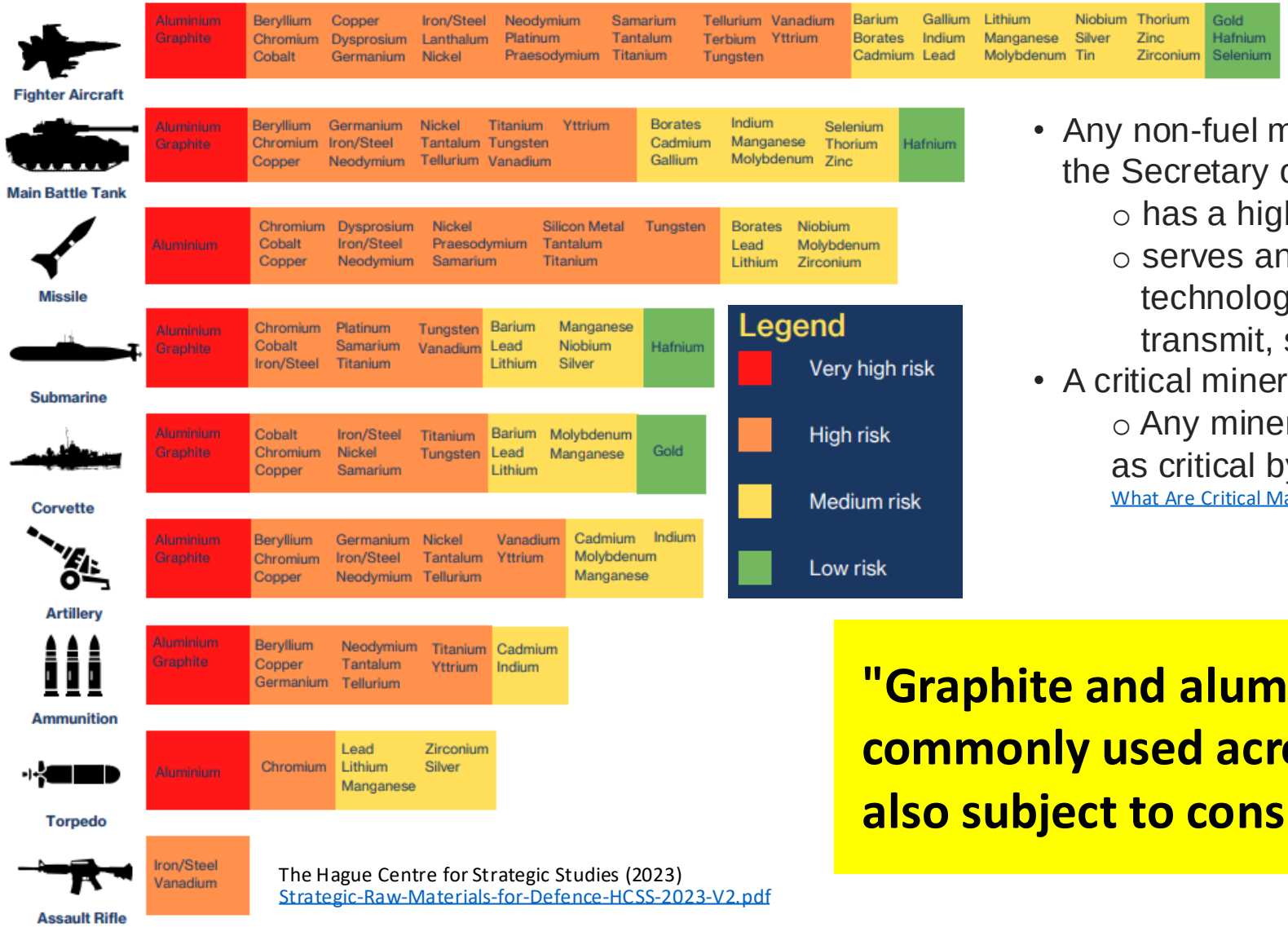
  Li, Q. at al. (2021), Aluminium material flow analysis for production, consumption and trade in China from 2008 to 2017. Journal of cleaner production [online]

China is also the top global supplier of synthetic graphite (replace natural graphite)

Strategic-Raw-Materials-for-Defence-HCSS-2023-V2.pdf

Critical Raw materials and minerals – supply risk

Supply risk for critical raw materials in military applications



The Hague Centre for Strategic Studies (2023)
Strategic-Raw-Materials-for-Defence-HCSS-2023-V2.pdf

US definitions of critical materials/minerals:

- Any non-fuel mineral, element, substance, or material that the Secretary of Energy determines:
  - has a high risk of supply chain disruption; and
  - serves an essential function in one or more energy technologies, including technologies that produce, transmit, store, and conserve energy; or
- A critical mineral, as:
  - Any mineral, element, substance, or material designated as critical by the Secretary of the Interior

What Are Critical Materials and Critical Minerals? | Department of Energy

"Graphite and aluminium are the materials most commonly used across military applications and are also subject to considerable supply security risks"

Raw Materials - Defence needs

Figure 6. Risk assessment matrix for the air domain

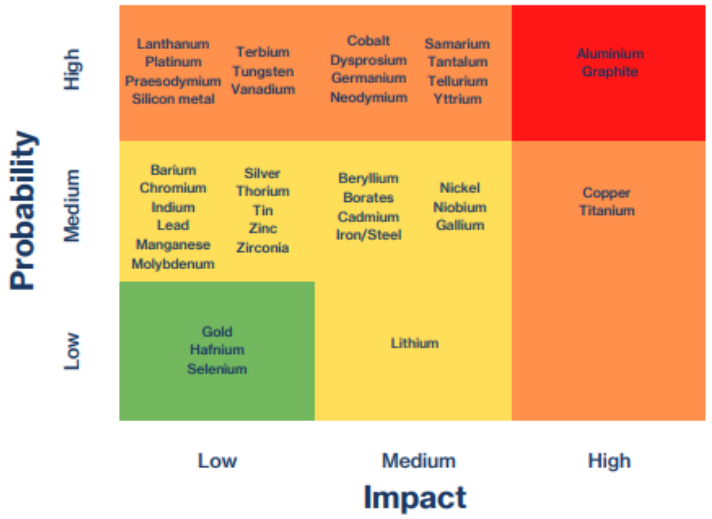


Figure 9. Risk assessment matrix for the sea domain

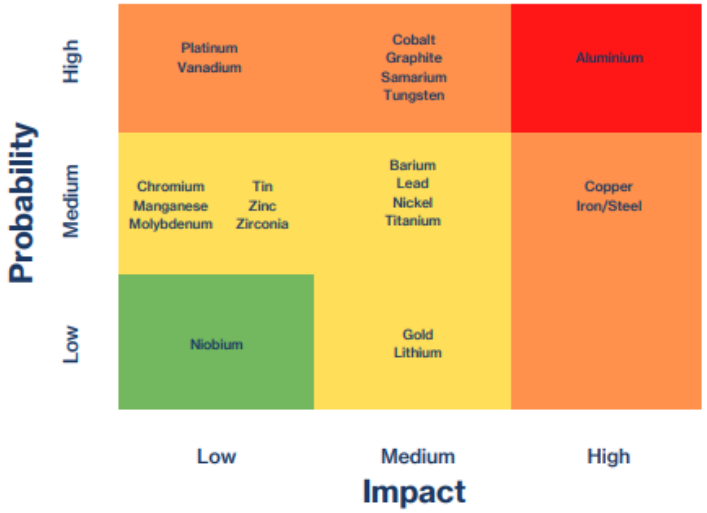
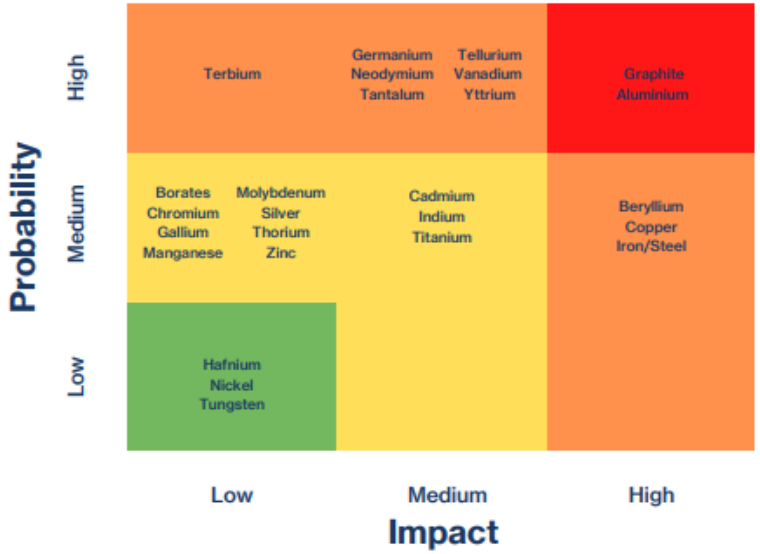


Figure 12. Risk assessment matrix for the land domain



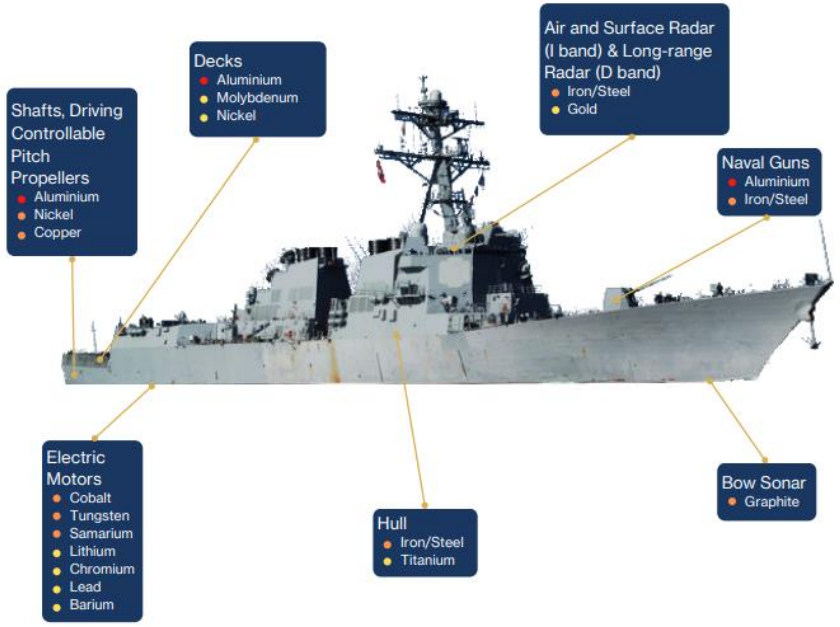
Materials		Graphite	Aluminium
Application Domain		Air, Sea	Air, Sea, Land
Geopolitical challenges	Stability	China 66.9/120 India: 75.3/120 Brazil: 73.9/120	China 66.9/120 Russia 72.6/120 Canada 20.1/120
	Reliability	China: low India: middle Brazil: middle	China: low Russia: low Canada: high
	Geopolitical problems between Europe and suppliers	Europe's minimal market share of graphite makes it highly dependent on Chinese mines. Moreover, graphite mining sites are located in unreliable countries affected by internal issues such as corruption.[126]	Chinese production of aluminium threatens American production capacity.[169] The US also views import dependency from China as a matter of national security, due to the applications of the material, which range from technology to military.

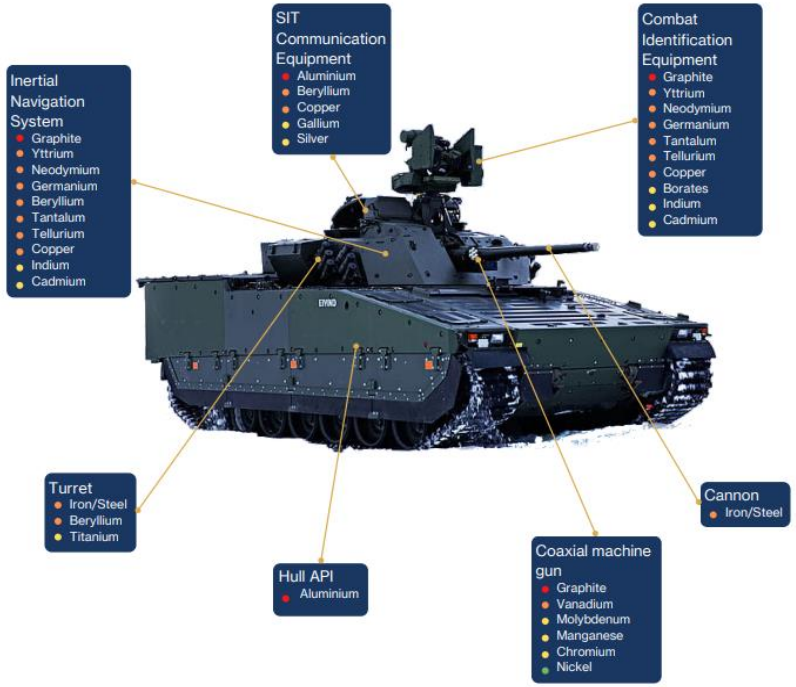
ALUMINIUM*

- The world's most used non-ferrous metal
- Delivers significant energy and CO2 savings
- Enables the decarbonisation of other sectors
- Endless recyclability
- Many countries are phasing out bauxite production, so the availability of the resource could be threatened Strategic-Raw-Materials-for-Defence-HCSS-2023-V2.pdf
- **75% of all aluminium ever produced is still on the market today** Aluminium in Use - European Aluminium

*Aluminum starts out as bauxite ore

41 Critical Materials for Defence

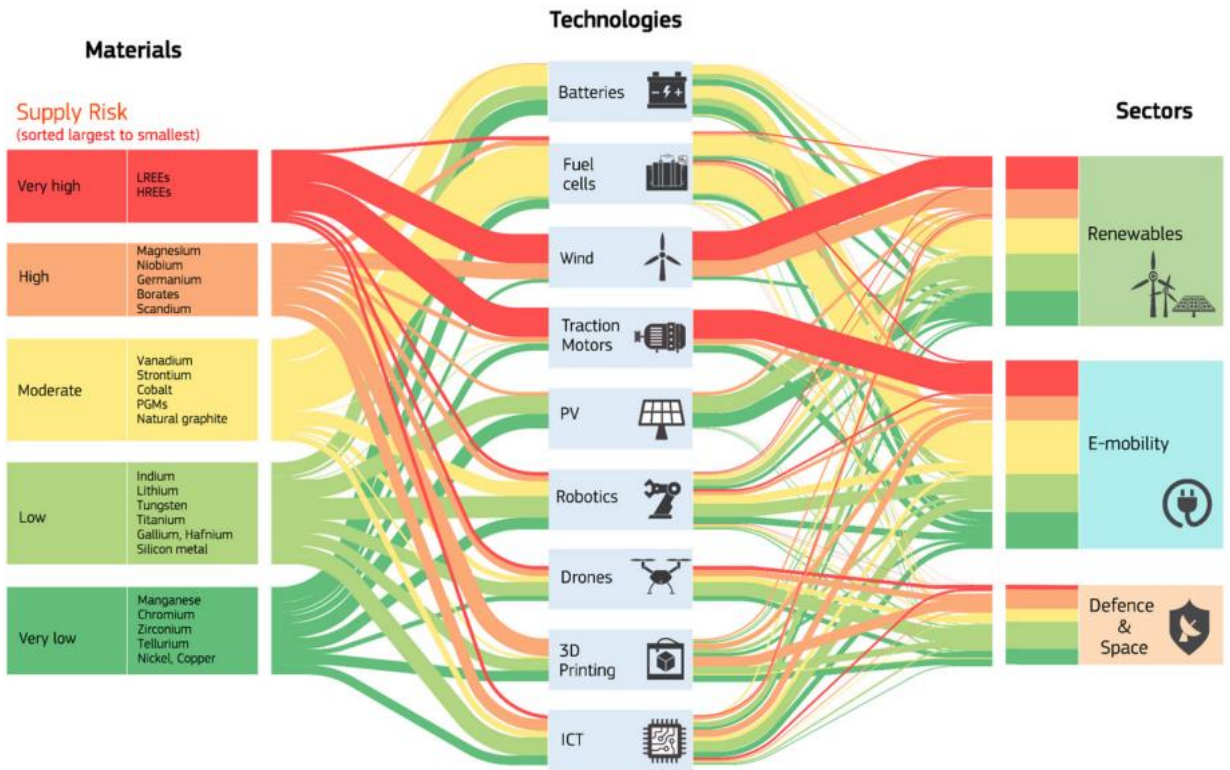




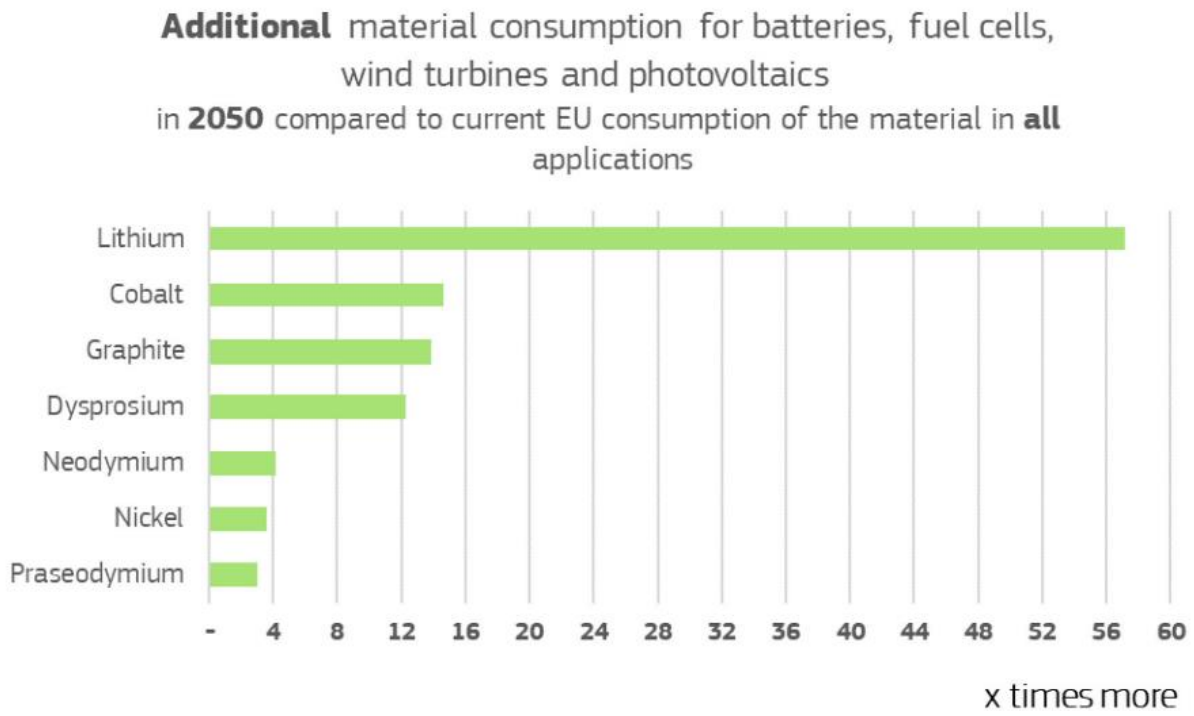
The Hague Centre for Strategic Studies (2023)
Strategic-Raw-Materials-for-Defence-HCSS-2023-V2.pdf

Green Transition and Critical Materials

Clean and digital technologies are heavily dependent on critical raw materials



The green and digital transitions will lead to a drastic increase in European demand for certain critical raw materials by 2050



EU Commission (2020) Action Plan on Critical Raw Materials – factsheet, DocsRoom - European Commission

"The production of graphite, cobalt and lithium may increase by nearly 500% by 2050, to meet the demand for clean energy technologies." Minerals for Climate Action - The Mineral Intensity of the Clean Energy Transition, World Bank Report, 2020.

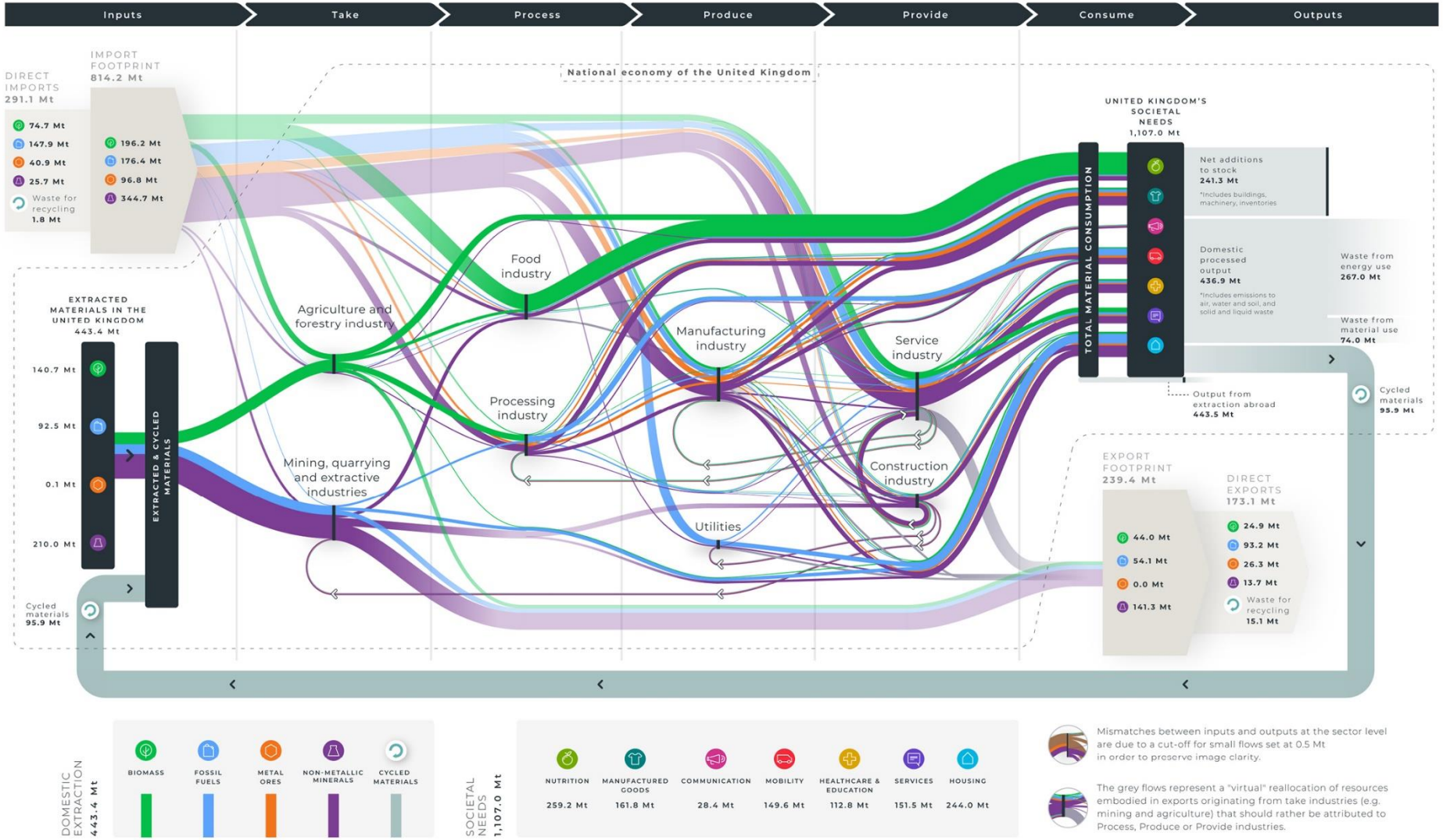
ERMA (2023), Materials for Energy Storage and Conversion A European Call for Action, e33fa4d1.pdf

THE MATERIAL FOOTPRINT
SATISFYING SOCIETAL NEEDS
IN THE UNITED KINGDOM

CIRCLE ECONOMY

Only 7.5% of materials are circled back into the UK economy after use

Recycled materials only?
How much waste is exported for recycling?



CGR UK (circularity-gap.world)

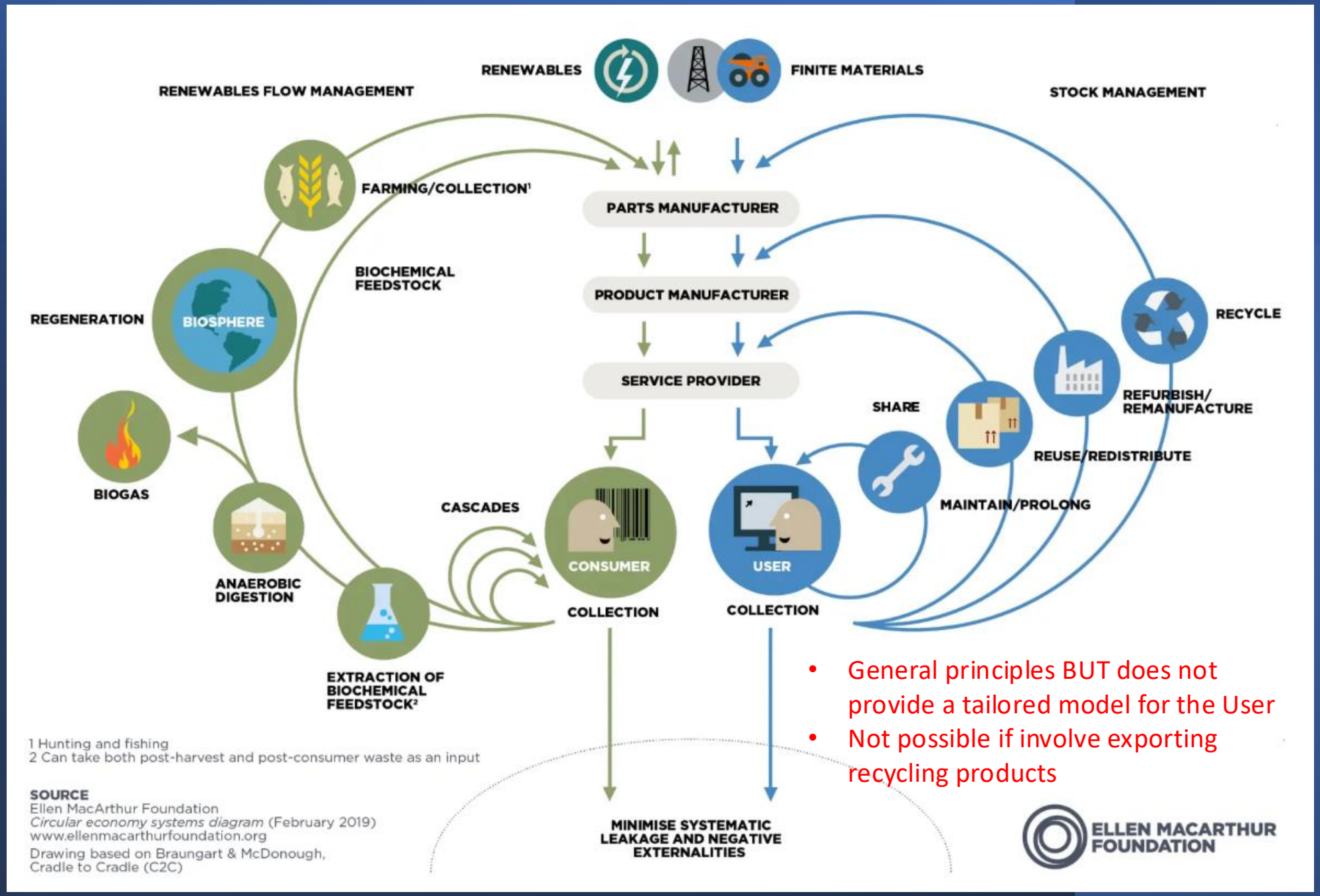
Defence Waste (non-ACTO)?
Critical Materials?

Life-through data needed

UK ALUMINIUM

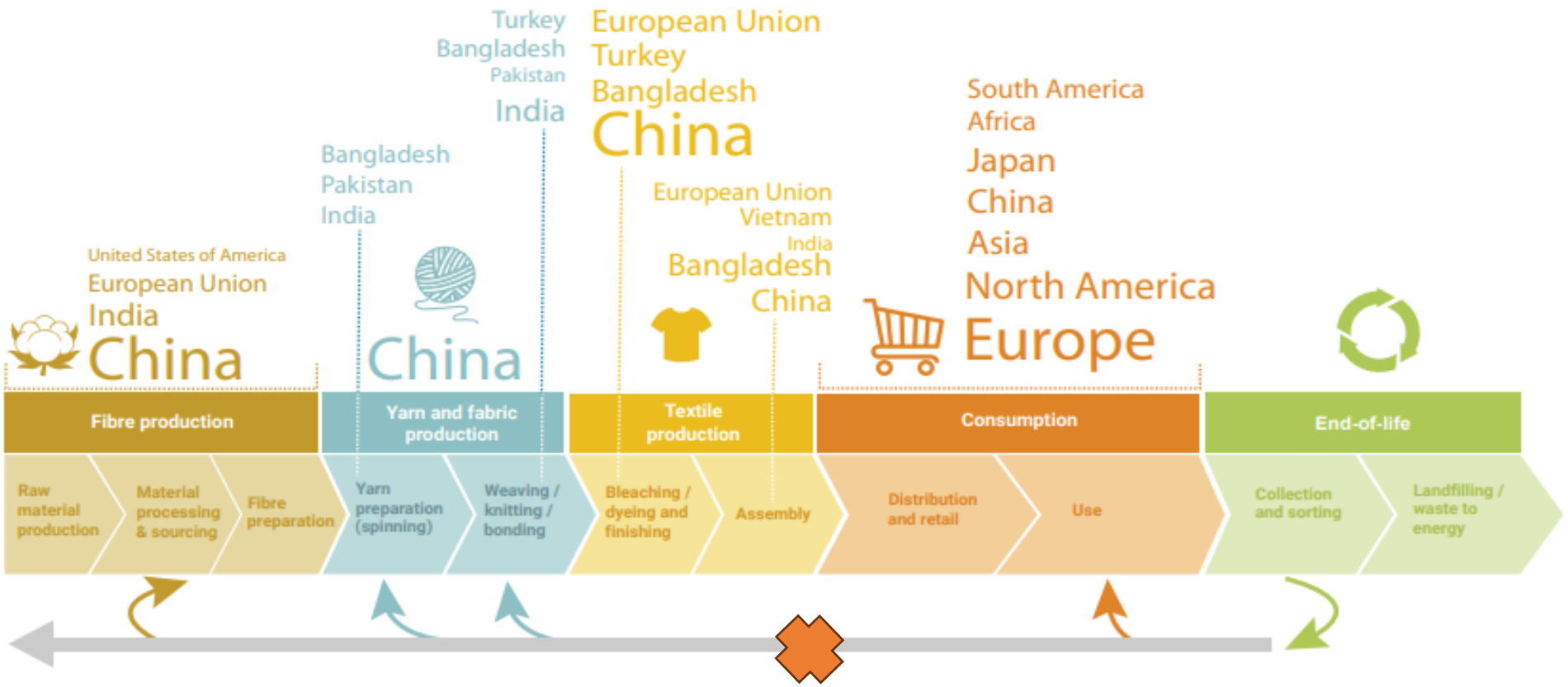
- Limited impact re Ukraine war
- US protectionism will influence the market
- UK aluminium supply chain remains vulnerable to unfair competition and trade tensions ALFED - The Voice of the UK Aluminium Industry

ALFED ALUMINIUM FEDERATION



- General principles BUT does not provide a tailored model for the User
- Not possible if involve exporting recycling products

Textiles Circularity Case Study

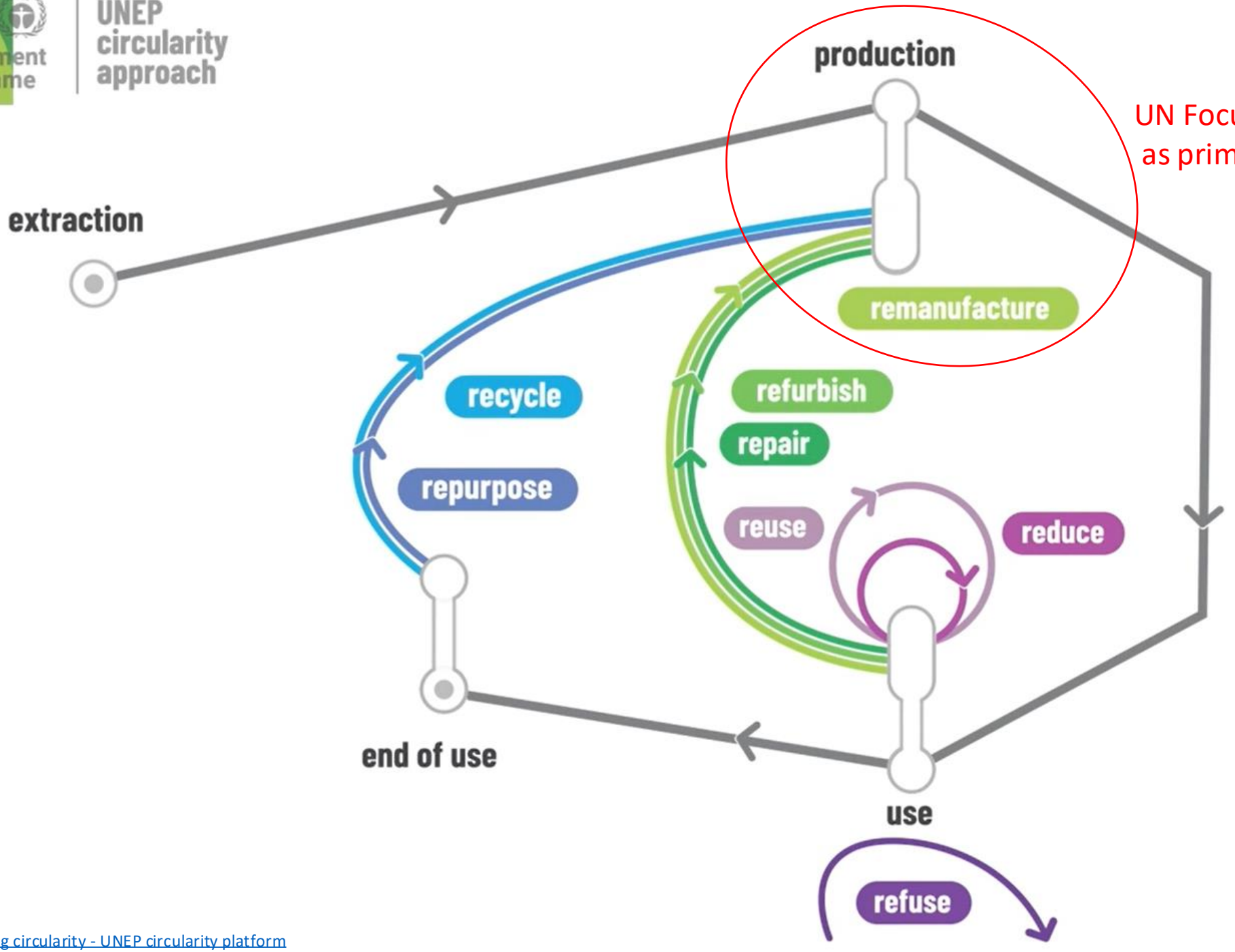


- Global Textile industry (UNEP)
- Fibre/textile production → China
- Distribution → low impact
- Consumption → Europe
- Disposals → Europe
- Recycling → Asia? (close to manufactures?)

To note → It may be difficult to intervene in the first stages of the production due to overseas locations

Asian Countries (mainly China) may take the opportunity to close the cycle by recovering materials and to be in control of the whole supply

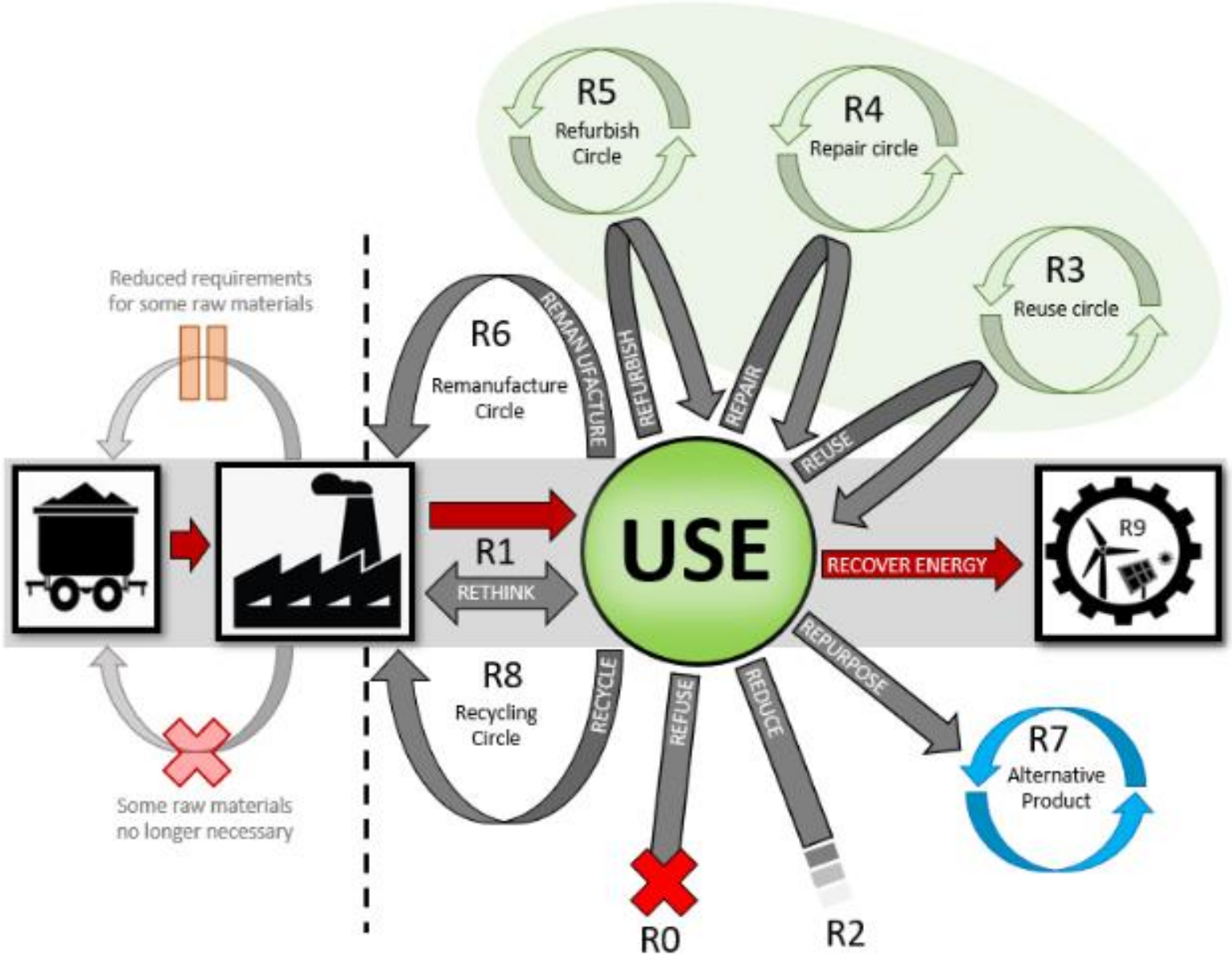
UN environment programme | UNEP circularity approach



UN Focus on Manufacturers as primary actors for CE

Understanding circularity - UNEP circularity platform

CE Model for Defence



Circular Economy principles
R0 Refuse
R1 Rethink
R2 Reduce
R3 Reuse
R4 Repair
R5 Refurbish
R6 Remanufacture
R7 Repurpose
R8 Recycle
R9 Recover energy

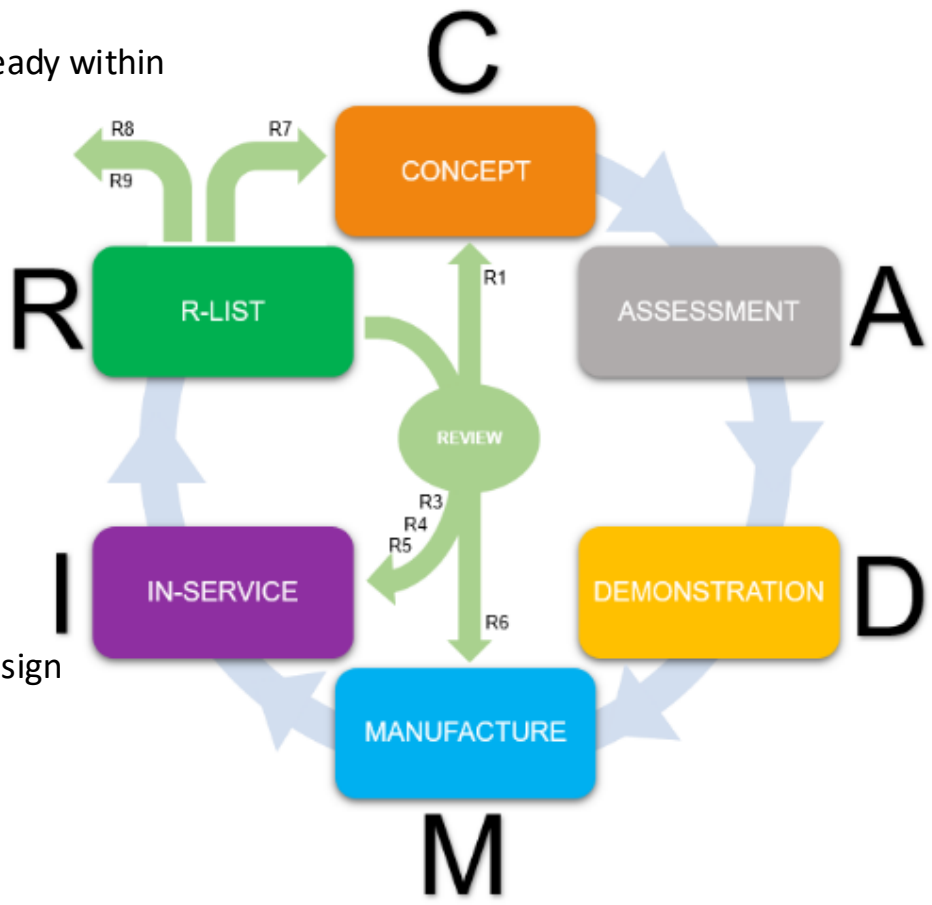
Van Buren et al., 2016

CADMID to CADMIR

A new acquisition framework to implement circular economy principles into the acquisition lifecycle.

Benefits

- Aid in the identification of critical minerals, rare earths and raw (already within its inventory)
- Reduce Defence's reliance on the sourcing of critical resources
- Reduce materials competition (also with Allies)
- Increase resilience supply chain
- Decreased down time of assets
- greater value for money from its inventory
- enhanced delivery of operational advantage
- Implement the R3 (Reuse), R4 (Repair), and R5 (Refurbish) principles
- The Rs also involved the Concept phase, such as R1 (Rethink) to redesign unaligned acquisitions
- Manufacture phase can incorporate R6 (Remanufacture).
- Considerations must be given to R7 (Alternative product)
- R8 (Recycling) and R9 (Recover energy) considered as final options in the circular economy approach



Circular Economy principles
R0 Refuse
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R5 Refurbish
R6 Remanufacture
R7 Repurpose
R8 Recycle
R9 Recover energy

Van Buren et al., 2016

Application hypothesis

Technical cycle	Cycle(s) within the social system through which resources are used, recovered, restored and utilised within existing or new solutions (ISO59004)
Biological cycle	Cycle(s) through which biological nutrients are used by living organisms and subsequently restored into or within the biosphere, in a way that rebuilds ecosystem resilience and natural capital and enables the regrowth of renewable resources (ISO59004)
Mixed cycles	Cycle(s) that involves biological nutrients or living organisms to create a technical cycle (study ongoing – including processed food and repurpose of biological waste)

Group 1 - Green Cycle (reuse, repair, refurbish) technical, mixed

Group 2 – Biological cycle (recover energy, return to biosphere) biological, mixed

Group 3 – Alternative Cycle (recycle, remanufacture, repurpose) technical

Group 4 – Non-CE Cycle (refuse, reduce) technical, biological

Rethink

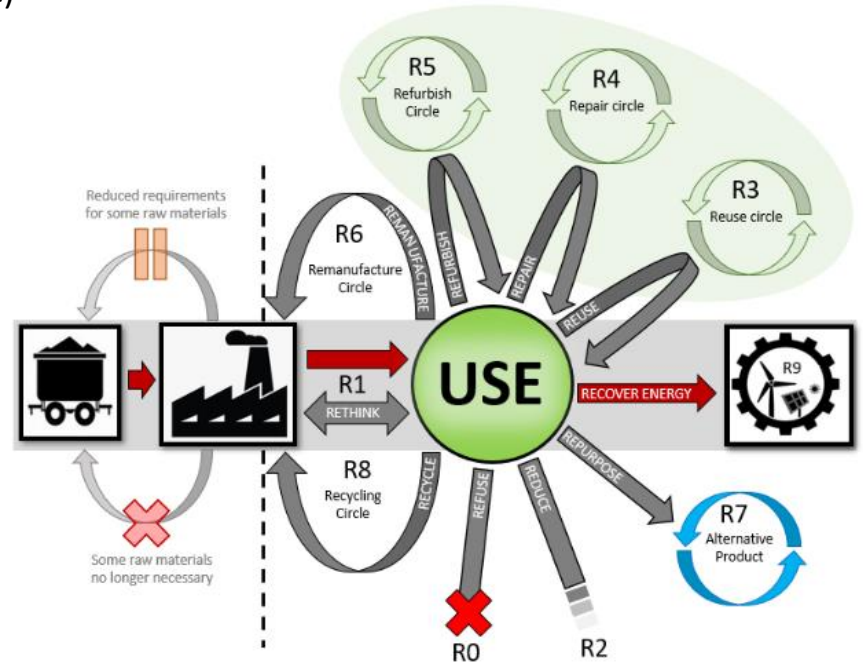


Figure 1 — ISO 59000 family of standards

ISO 59004, *Circular economy — Vocabulary, principles and guidance for implementation*

ISO 59010	ISO 59020	ISO 59040	ISO 59014
Circular economy — Guidance on the transition of business models and value networks	*Circular economy — Measuring and assessing circularity performance*	*Circular economy — Product circularity data sheet*	*Environmental management and circular economy — Sustainability and traceability of the recovery of secondary materials — Principles and requirements*

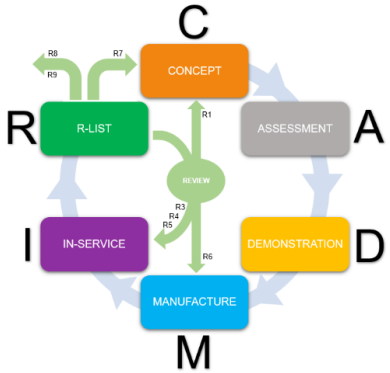
ISO/TR 59031, *Circular economy — Performance-based approach — Analysis of case studies*
ISO/TR 59032, *Circular economy — Review of existing value networks*

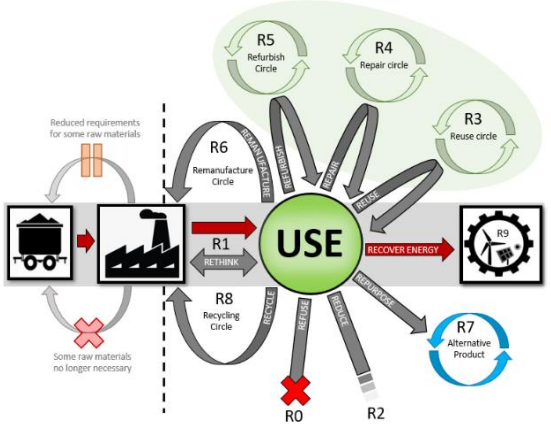
Understand applicability of ISO 59020:

- Create a Circularity framework for implementation in BAU
- Within industry community (supply chain, life-through product, Communication issues)
- Within Defence (operations, supply, resilience)

Life-through Diagnostic Questions

- **Absence of a specific innovation branch for CE**
  - Risk of dispersion BUT creates opportunities for
  - wider innovation
  - Model flexibility depending on requirements
  - Tailor CE on individual products
  - Cohere business models depending
- **Diagnostic questions**
  - Develop a circular thinking process
  - Provide a holistic approach
  - Increase opportunities for implementing innovation





DEVELOPING LEGISLATION

EU Environment and climate policies on corporate social responsibility

Carbon Border Adjustment Mechanism (CBAM)

Ecodesign for Sustainable Products

The Net-Zero Industry Act

Environmental Liability Directive

	Diagnostic questions
Means	**Mobilisation of means** - Are all relevant product chain partners actively involved in realising CE solutions? - Is there sufficient funding for realising CE solutions? - Are there specific physical means limiting the realisation of CE solutions?
	Knowledge development - Does the available knowledge suffice to develop CE solutions (with regard to technology, patents, consumer and chain actor behaviour)?
Activities	**Knowledge exchange** - Is the level of knowledge exchange on CE solutions high enough in the product chain?
	Experimenting by entrepreneurs - Are entrepreneurs experimenting sufficiently with CE solutions and revenue models? - Is upscaling of CE solutions already taking place?
	Giving direction to search (vision, expectations of governments and core-actors, regulations) - Is there a clear vision among product chain partners of the pursued circularity strategy? - Do product chain partners broadly share this circularity strategy? - Does this circularity strategy structure the activities of the product chain partners?
	Opening markets - Are product chain partners active in creating consumer awareness of CE solutions? - Are companies investing sufficiently? - Does the government have supplementary policies, and do they help in opening markets?
	Overcoming resistance - Is there resistance against CE solutions (among product chain partners, or in the form of regulatory barriers)? - Is sufficient action being taken to overcome resistance against CE solutions?
Achievements	**CE design** - What is the present lifespan of a product and has it increased compared to its original lifespan? - Have products become easier to disassemble? - Does the design foresee the use of recycled materials? - Are the components designed for high-grade recycling (without increasing environmental pressure)?
	Production - Is the overall (primary and secondary) consumption of materials by companies decreasing? - Do companies use fewer substances which are hazardous to human health and ecosystems? - Is production moving towards lower levels of waste generation? - Are companies moving to CE revenue models with increased reuse of products and components, or models based on providing a service rather than offering a product?
	Consumption - Is the consumption of CE products increasing (compared to conventional products)? - Do CE products have a longer lifespan or are they used more intensively? - Is reuse of products leading to less waste?
	Waste - Is the volume of landfill decreasing in favour of incineration? - To what extent is high grade-recycling applied? - To what degree is recycling effective with regards to costs and environment?
Effects	**Circularity (resource efficiency)** - Is primary material consumption decreasing (in kg per functional product unit)? - Is primary material consumption decreasing for the whole sector (in kg)?
	Environment For all product groups (over the whole life cycle of a product): - Is cumulative energy consumption decreasing per functional product unit? - Is cumulative energy consumption decreasing for the whole sector? Environmental pressure caused by specific product groups (over the whole life cycle of a product): - Is cumulative environmental pressure decreasing per functional product unit? - Is cumulative environmental pressure decreasing for the whole sector?
	Economy - Is the added value of products and product services increasing? - Are employment levels in the product chain increasing?

I'll take part in that circular economy when it comes by again.
M.

Thank You

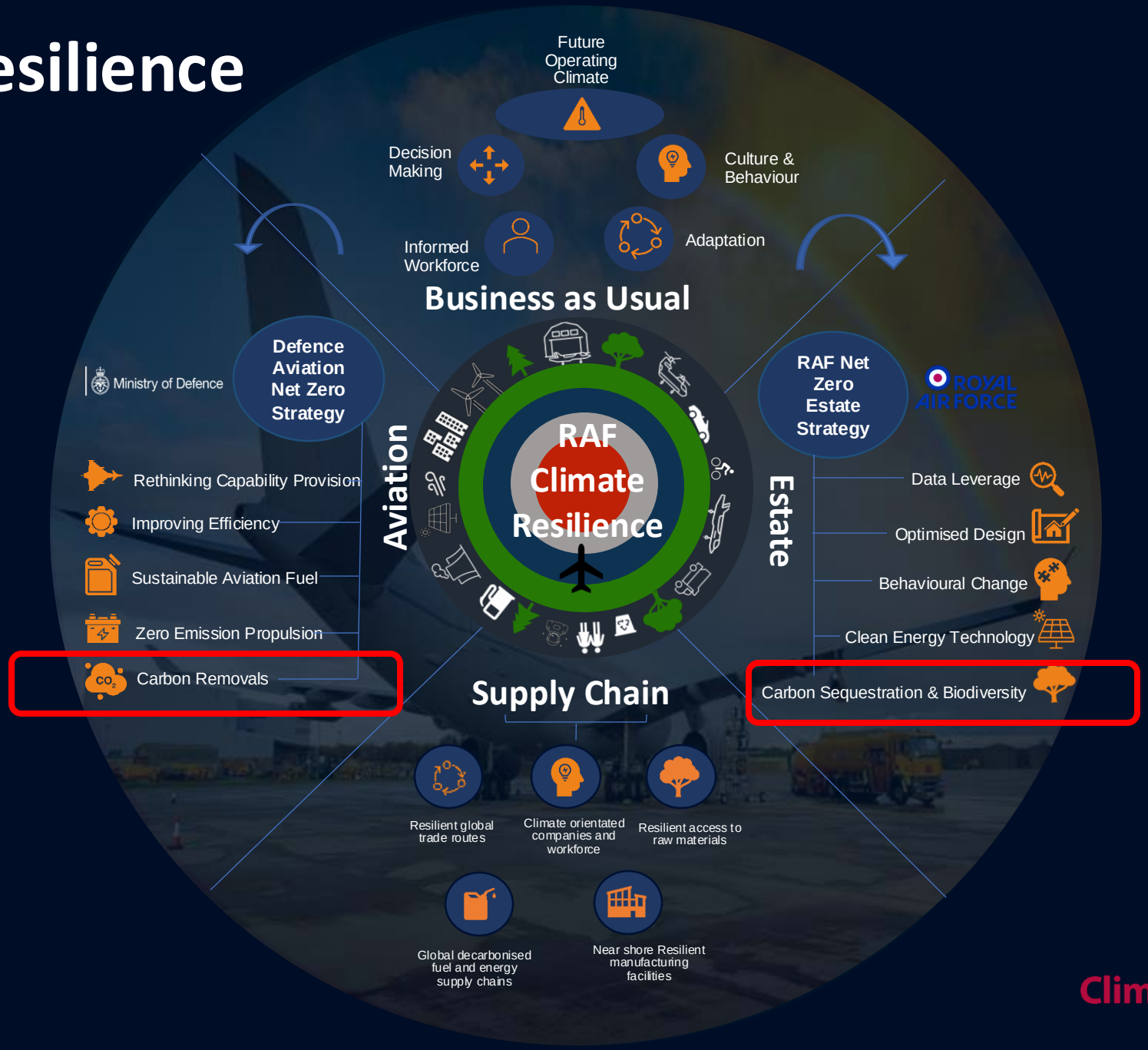
Natural Capital & Infrastructure Community of Practice

27th February 2025

Gp Capt Maurice Dixon
Air Climate Change & Sustainability Assistant Head

ROYAL AIR FORCE
Climate Change and Sustainability

RAF Climate Resilience



ROYAL AIR FORCE
Climate Change and Sustainability

Opportunities to Improve & Leverage the Air Estate

Biophilic Design

By connecting to the natural environment, we improve the living and working environment whilst also improving mental health of personnel on our stations. Project Wellbeing at RAF Leeming demonstrates this concept.

Defence Land Use Framework

This framework lays out a methodology to assess the value of a parcel (or parcels) of land against its natural capital, biodiversity, critical mineral and renewable energy capability suitability, benefits and values to inform best use of that land.

Food & Energy Security – Agrivoltaics

As we develop solar farms, we can also utilise the land for food. Crops can be planted underneath the solar panels which reduces evaporation, maintains humidity and reduces the amount of water we may otherwise need to grow crops.

Opportunities to Improve & Leverage the Air Estate

Biodiversity

The integration of landscaping and biodiversity enhancements across the RAF can be framed as a holistic approach that builds on detailed habitat data and long-term management recommendations.

Potential Future Habitat & Estate Management Activity

- Introduce Drought and Flood Tolerant Grass Species
- Improve Grass Root Depth and Carbon Storage
- Use of Perennial Cover Crops
- Pest Management through Biological Control
- Implement Targeted Rotational or Zoned Mowing Practices
- Native Wildflower Integration
- Buffer Zones and Safety Considerations
- Strategic Tree Planting for Carbon Sequestration
- Tree Management Techniques for Habitat Health

RAF Lossiemouth - Christmas Trees & Coastal Erosion

Personnel from RAF Lossiemouth have been working alongside Lossiemouth Community Council to collect and transport used Christmas trees to Moray Town's East Beach in a bid to combat coastal erosion. The trees are placed into a trench along the dunes to build them back up. Then later, the plan is to sew marram grass on top in hope that new eco-systems will develop.

Thank you – Any Questions?

Gp Capt Maurice Dixon
Air CC&S AHd
Maurice.Dixon399@mod.gov.uk

ROYAL AIR FORCE
Climate Change and Sustainability

NC&I COP – Renewable Energy Trials in the Falklands

Flt Lt Richard Griffiths

NC&I COP – Event/Conference – Oct 2025

TEAM DEFENCE INFORMATION
www.teamdefence.info

- Joint MOD/TDI/ADS/DJIC event in October 2025
- Plan is to hold a morning and afternoon session with presentations and workshops
- Venue – TBD. Somewhere in the Southwest. Would anyone like to host or sponsor?
- Approx. 60 to 100 people

NC&I COP – Event/Conference – Oct 2025

TEAM DEFENCE INFORMATION
www.teamdefence.info

Potential Topics of Interest (from TD-Info members survey 2025)

- Policy and strategy from CCE
- Alignment on reporting climate related financial disclosures.
- How do we get climate risk integrated into the decisions
- How the MOD wants to calculate its carbon footprint at the organisational level
- Climate change adaptation and mitigation. Nature recovery options for defence organisations.
- What does the state of play look like in 2050
- Decarbonising the defence estate collaboratively
- Accessing public funding
- Understanding and addressing climate related risks
- Potential for restoration and nature based solutions across Defence land
- Sustainable Support. Implementation of 'Environmental Supportability CCT6 in the SSE
- Operational Delivery Function responsibilities
- How Environmental Management community (engineering) can work with the ILS/TLS community for sustainable support
- Update on/implications of the Strategic Defence Review and the recently-announced uplift in Defence spending.
- The sustainability supply chain, avoiding dependence on potentially hostile states while progressing towards Net Zero
- MOD's journey to Net Zero and how that can also contribute to improved operational resilience.

NC&I COP – AOB, Next Meeting

- AOB
- Next Meeting – 10th April 2025

NC&I COP – Back up slides

Back up slides

NC&I COP – Potential WG Topics

TEAM DEFENCE INFORMATION
www.teamdefence.info

- Working Group being established by Babcock on developing Eco system, Biodiversity Net Gain and Natural Capital assessments on MOD establishments (Devonport as an example)
- Investigate the impact of the circular economy on re-use of assets, resilience and operations
- Investigate how Nature Based Solutions (NBS) benefits (e.g. carbon management (PAS2080), cleaner air, biodiversity, wellbeing etc.) can be quantified and embedded in business cases and outcome-based procurement
- DSF – 1st draft of enablers and blockers paper should be available soon. Potential WG activity on outcome?
- Map the Natural Capital assessment/appraisal methodologies utilised across Defence
- Map the various groups, standards and initiatives involved
- Identify opportunities for MOD to access natural capital finance

NC&I CoP 19/9/24 – MOD CC&SS Epochs

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- 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.

NC&I CoP 30/4/24 – Notes

- Greg Hughes to assist with Defence Support work and contacts (Ang Baker)
- ADS happy to support and collaborate on OCT/Nov conference and signposted Social Value guide on ADS website
- DSF – 1st draft of enablers and blockers paper should be available soon. Potential WG activity on outcome?
- Note: 7/5/24 - DASA innovation call for proposals on sustainability & self sufficiency
- Mathew Bacon – Mott MacDonald
  - Biodiversity net gain (BNG) metric tool available from DEFRA
  - Create an MOD land register for BNG/Natural capital
- Robin Phillips – STS
  - Developing practical examples to build one vision for Defence (sanctuary magazine does this)
  - Some interesting next steps on attached slide
- Phil Anderson – Babcock
  - Emerging international drivers for businesses
  - Biodiversity process map
  - Identify shared drivers for public and private sectors (see following slide).
  - Undertake joint project on MOD shared estate. Potential WG activity?
- Approach DIO to provide co-chair and direction on focus and challenges

NC&I CoP 30/4/24 – Notes

- Reference documents from meeting chat
  - https://www.teamdefence.info/natural-capital-infrastructure-community-of-practice/
  - https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/996095/20210616-Sustainable_Digital_Technology_and_Services-FINAL.pdf
  - https://www.gov.uk/government/publications/social-value-act-information-and-resources/social-value-act-information-and-resources
  - https://assets.publishing.service.gov.uk/media/5f6ccf89d3bf7f7237cf4015/PPN-06_20-Taking-Account-of-Social-Value-in-the-Award-of-Central-Government-Contracts.pdf
  - https://www.gov.uk/government/publications/procurement-policy-note-0621-taking-account-of-carbon-reduction-plans-in-the-procurement-of-major-government-contracts
  - https://assets.publishing.service.gov.uk/media/5a7f5fe2e5274a2e8ab4bcb1/Balanced_Scorecard_PPN_09_16.pdf
  - https://sustainableict.blog.gov.uk/welcome-to-the-government-digital-sustainability-alliance/

Suggested Next Steps

- **Water Resources**: Increase awareness of water stress and importance of minimising wastage and increasing recycling
- **SuDS & NBS**: Identify sites and locations for example installations
- **Rainwater Harvesting**: Identify potential trial sites before wider rollout
- **Fleet Decarbonisation**: Bring together interested parties across Defence
- **Sustainability Data**: Develop metrics to encourage the right behaviours
  - Net Zero: Increase engagement with MOD
  - Community: Identify worthwhile joint volunteering events
- **Estate Development**: Vital that plans for future increases in infrastructure footprint and personnel consider water and wastewater requirements

Official Unmarked

NC&I COP – Introductions and Objectives

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Team Defence has defined this activity as focusing on **Natural capital,** which is the world's stock of natural resources, which includes geology, soils, air, water, and all living organisms. Some natural capital assets provide people with free goods and services, often called ecosystem services and **Infrastructure** - the basic physical and organisational structures and facilities (e.g. buildings, roads, power supplies) needed for the operation of a society or enterprise.

Community of Practice (COP)

Co-chaired by Industry and MOD. A group of people who share a common concern, a set of problems, or an interest in a topic and who come together to fulfil both individual and group goals.
Communities of practice share best practices creating new knowledge to advance a domain of professional practice. Interaction on an ongoing basis is an important part of this.
The COP relies on face-to-face meetings as well as web-based collaborative environments to communicate, connect and conduct community activities.

NC&I COP – Introductions and Objectives

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Why get involved?
Ability to understand the direction of travel from within Defence, shape, influence and assist MOD in its future direction for NC&I. Working as part of a team with equally capable and knowledgeable organisations within Defence and the wider community. This is an opportunity for wider industry experience and best practice to be showcased within the Defence environment.

Todays objectives
Determine issues and challenges
Understand potential focus areas and topics of interest
Define purpose of the group and potential future collaborative working groups
Identify MOD co-chair
Anything else from participants?

NC&I COP – Context, Interest and Scope

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Natural capital and infrastructure have a two-way relationship.
Infrastructure can:

- positively or negatively impact NC assets (e.g. water quality)
- deliver NC benefits (e.g. linear infra and biodiversity corridors)
- be hit by increased costs from nature risks e.g. climate resilience costs
- be avoided or new structures minimised by using NC approaches (e.g. NBS)

There is an urgency to change our approach to the built environment and to deliver solutions to address the complex integrated challenges of climate change, biodiversity loss, population growth and contribute to real change through using our sustainability and infrastructure expertise to help navigate a response that leads to positive outcomes across the entire lifecycle – including feasibility, optioneering, design, planning, building and construction, managing the assets, adapting and decommissioning.

This topic needs diverse disciplines within the infrastructure, nature and sustainability communities and innovative approaches to drive solutions forward.

There is a lot going on already...

NC&I COP – Context, Interest and Scope

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Defence requirements, strategies, delivery, networks and groups

UK GOVERNMENT

Greening Government Commitments

The 25 Year Environment Plan

The Agriculture Act 2020

The Environment Act 2021

The Green Book 2022

MOD Strategies

MOD Climate Change & Sustainability Strategic Approach, 2021

DSTL – Sustainability Strategic Direction, 2022

Army – Land Industrial Strategy, 2022

Defence Support – Sustainable Support Strategy, 2022

RAF – Defence Aviation Net Zero Strategy, 2023

Rural Estate Land Use Strategy

Operation Nightingale (Archaeology)

DIO

DIO Sustainability Strategy

DIO – Strategy for Defence Infrastructure, 2022

DASI – Defence Approach to Sustainable Infrastructure (wip)

Peatland Strategy

Defence Nature Recovery Strategy

Defence Woodland Masterplan

DIO Conservation Stewardship and Overseas Stewardship Funds

DIO Environmental Engagement Team

DEFENCE GREEN NETWORK

Platform for sharing knowledge, best practices, and innovative solutions.

Goal to make sustainability BAU within defence.

DEFENCE STANDARDS

JSP850 and BPS - DREAM / SEAT / Sustainability Appraisals

ADS / DSF

ADS Infrastructure Group

ADS working groups on - Sustainable procurement, Sustainability, sustainable aerospace, sustainable materials

DSF Climate Change and Sustainability

DSF Buildings and Construction

TDi

FUTURES: Sustainable defence support (HMT, Digital Twin, Robotics, AI, future energy)

Asset Management COP

DISIC workshops 2022

NC&I COP – Context, Interest and Scope

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Other working groups and communities outside Defence

UK Green Building Council – business network UKGBC - The UK Green Building Council

Architecture 2030 (and the Climate Action Communique) – research Architecture 2030

World Economic Forum – international organisation The World Economic Forum (weforum.org)

Westminster Energy Forum – strategic intelligence Westminster Energy Forum

World Building Council for Sustainable Development – global community World Business Council For Sustainable Development (WBCSD)

Supply Chain Sustainability School – skills and knowledge sharing Home - Supply Chain Sustainability School (supplychainschool.co.uk)

Net Zero Infrastructure Industry Coalition – contractors

UN Global Compact Network

Environment Analyst – business expert network Market Intelligence Service | UK (environment-analyst.com)

Professional Institutes e.g. IEMA, CIWEM, CIEEM, IES, ICE, etc

NC&I COP – Context, Interest and Scope

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Defence Stakeholders

MOD CC&S Directorate

DIO, Army, Navy, RAF, StratCom

Land and Estate managers

Asset operators

Suppliers

Government

Energy and Emissions

Decarbonisation and Net Zero, New Build and Retrofit

Biodiversity, Environmental Conservation and Natural Capital

Compliance and Environmental Planning

Resilience and Adaptation to Climate Change

Waste, Resource Efficiency, Circularity, Food

Water Management

Archaeology and Heritage Assets

Access and Recreation

Data Management and Reporting

Efficiency and Operational Advantage

Sustainable Procurement

Skills and Capability

Social Value, Social Outcomes

NC&I COP – Context, Interest and Scope

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What is the vision and purpose of this community?

How will this community align with Defence work or activities, and other groups?

What are the outcomes that this community wants to drive or benefit from?

How do we achieve actions? What working groups do we want within this community (aligned to the outcomes for the community)

Can this community help the MOD with challenges and bandwidth to help accelerate delivery?

How can we draw upon the existing wealth of information and research to support Defence ambition and delivery?

What?

Improve standards / specifications

Optioneering and Risk Assessment

Impact Assessment and Reporting

Optimising Design and Environmental Proposals

Building the Business Case

Stakeholder Engagement and Communications

Improved Asset Operation and Management

Strategies for Improved / Sustainable Land Management

Building competency / addressing skills shortage.