

Sustainable Cooling and Cold Chain Solutions

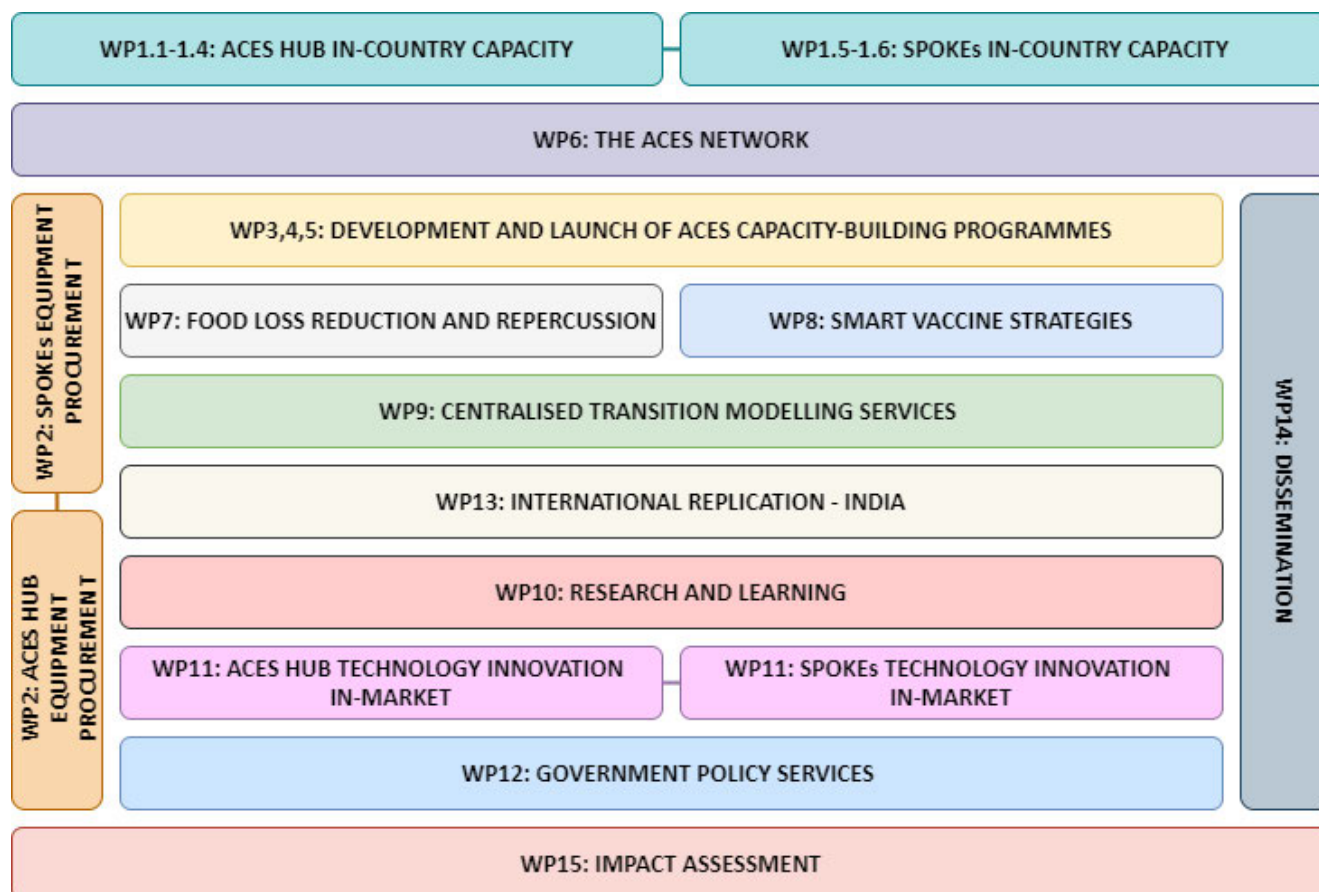
Annexes

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Annex A. Workstream One Work Programmes

ACES WORK PROGRAMMES



WORK PROGRAMME 1 (WP1) ACES STAFFING TO END OF Q1 2025

We will look to recruit and train-up and providing the funding for three years for the full in-country management, staffing and interdisciplinary research capacity (in particular, **Early Career Researchers**) to deliver ACES the Work Programme outlined below.

ACES Headquarters

WP1.1 Leadership (includes Headquarters and SPOKES)

- 1 ACES Director
- 1 Technical Director

WP1.2 Professional Services

- 1 Finance / Operations (OPS) and Human Resources (HR) Director/Senior Manager
- 1 Accounts /HR/ Ops Assistant
- 1 Assistant to the Directors
- 1 Operations and Communications
- 1 x Administration

WP1.3 Network

- Network Manager
- Network Researcher / Support

WP1.4 Academic team

- 3-4 x technicians (2-3 x refrigeration; 1 x PHM)
- 3-4 x lecturers / trainers (this will be developed in line with further funding)
- 3-4 x early career researchers (also support training and teaching)
- 3-6 x PhD students (see supervised PhD programmes, WP10)

ACES SPOKES

WP1.5 For each Spoke

- Manager
- Administration support
- 2-3 x Technical assistance / trainers per site (including business models, etc)
- Overheads and facilities (15% of salary budget)

WP1.6 For overall programme

- 3 x Outreach, mentoring and new market development officers

WORK PROGRAMME 2 (WP2) EQUIPMENT PROCUREMENT

A key objective of ACES is to demonstrate promising technologies (especially off-grid) and improve their performance in localised environments. We will procure for testing and demonstration novel technologies in-market to assess their viability and feasibility (WP9), in particular the use and maximisation of energy efficiency of cooling, freezing and heating processes, more widespread introduction of climate-friendly refrigerants, thermal storage techniques, energy demand/supply strategies, smart integration of cooling and heating, heat pumps, ad/absorption cooling, zero-carbon energy sources as well as zero-emission temperature-controlled transport and sustainable packaging.

The ACES Academic Research Learning Committee (ARLC) will consider conditions influencing technology solutions so as to help ensure that the best and most promising solutions with relevance and impact are developed, tested, shared and co-created with end-users. The ARLC will look to consider external conditions, emerging issues, market changes or trends, new technical developments and changes in economic, social, governance and policy landscapes as well as risks, barriers and opportunities. The innovation management will be a continuous process that requires understanding of both technological developments, market trends, global warming and associated impacts, societal changes, policies, standardisation and other dimensions affecting the choice of solutions.

[Example list to be added plus note that money to be kept in reserve for future technology deployment in 24/25]

WORK PROGRAMME 3,4,5 DEVELOPMENT AND LAUNCH OF ACES CAPACITY-BUILDING PROGRAMMES TO DELIVER SUSTAINABLE COLD-CHAIN

The core structure of ACES is one Centre of Excellence where we undertake research (incl. business models), test new equipment, develop knowledge, training programmes etc and then SPOKES where we demonstrate solutions and cascade knowledge to the local markets to accelerate deployment of sustainable cold-chain and Community Cooling Hubs (CCH). We shall work with industry and other partners to develop and deliver through the SPOKES a series of training programmes and modules around technology and renewable energy programmes, PHM, etc. These will range from basic introductions through to training operational staff, new engineers for installation and maintenance and train the trainer programmes for the SPOKE programme, etc.

We propose to develop and run four over-arching flagship programmes for communities - two as residential and two as outreach.

WP3 RESIDENTIAL PROGRAMMES

WP3.1 HOW TO BUILD A COMMUNITY COOLING HUB AS AN ANCHOR FOR HOLISTIC COLD CHAIN

Three-to-four-week residential programme¹ at ACES and through the SPOKES for community leaders to discover and unlock the economic potential of their communities and build key cold-chain services for resilient and sustainable development. It would also be suitable for community workers and activists/NGOs engaging on the ground with communities. Topics to be covered, through classroom work, workshops and seminars, could include:²

- The value of cold-chain and cooling.
- The value of PHM, including e.g., product requirements for storage, transport, packaging and technology and strategies associated.
- "Market-driven instead of product-driven" strategies and introduction to understanding the market and its potential³.
- Creating and capturing additional value at the farm gate, (e.g., food innovation, packaging and food processing).
- Assessment of community needs, opportunities, risks and barriers.
- The cold-chain needed for vaccine storage and movement.

- Clean energy and cooling technology options and the system level approach.
- Facilitating community dialogue and engaging the community⁴.
 - gender equality and social inclusivity
- Market connectivity.
- Finance and business Models⁵.
- Management strategies for proven success.
- High level intro to legislative issues, Hazard Analysis and Critical Control Points (HACCP) and international certifications.
- Digitalisation of supply chains (e.g., traceability and visibility).
- Development of business plan and financing strategies to support investment.
- Identifying and securing funding for community projects⁶.
 - Proposal framing skills and pitching.
- Introduction to potential partners.

WP3.2 HOW TO OPERATE A COMMUNITY COOLING HUB

As a follow-on programme for community leaders who secure the funding for a CCH, this will be a three-to-four-week residential programme to support the administration and delivery of the CCH - contracting to PHM / quality control to account management and governance, Health & Safety, HACCP and international certifications.⁷ *Programme topics to be developed* ⁸.

WP4 OUTREACH PROGRAMMES

We will then run two outreach mentoring/support programmes (staffing funded in WP1.6 and ACES core academic team).

WP4.1 COMMUNITY CAPACITY BUILDING

We will support the SPOKE through building a community-based project team to engage with and mentor local communities and create the industry and financing partnerships to suit their project needs. The mentoring will be intensive support (even possibly with a mentor embedded in the community for part of the period) over a selection of time periods – two-week, one-month, six-week and three-month programmes to translate ideas into action. The length of course will depend on their stage of development, but we also want the community to be time-bounded so real commitment. There will be a structure to the outreach programme, but it will be tailored to suit the community.⁹

WP4.2 COMMUNITY COOLING HUB DELIVERY

In line with WP2 above, we will support and mentor local communities across the continent in operationalising their CCH over a three / four-month period with perhaps a one-week review after six months and then annual audits for the first three years. Again, there will be a structure to the outreach programme, but it will be tailored to suit the needs of each community.¹⁰

Further outreach programmes could be developed around PHM, including working with, for example, Postharvest Education Foundation as well as supported by industry. Other outreach programmes could also be developed overtime related to the range of cooling services, e.g., for nutrition, human and animal health, space cooling including passive cooling.

WP5 ON-LINE AND OPEN ACCESS TOOLS

Using the materials developed in WPs 3 and 4, we will build a web-based suite of materials as a resource for wider research, policy and practitioners /communities and develop the revenue model.

WORK PROGRAMME 6 (WP6) THE ACES NETWORK

The network consists of a formalised and managed structure to define research needs, enable the co-creation of systems of system solutions, manage engagement and dissemination. Specifically, it will look to define emerging issues - create the forums to engage researchers, users and decision-makers and funders in defining emerging issues and creating funded research programmes.

The number of communities, businesses and international development agencies committing to deliver cooling technology or deploy elements of cold-chain in Africa and other developing markets is growing rapidly. But they operate in silos, not taking a systems approach - mapping the interdependencies, synergies and misalignments across the cold-chain, designing

new equitable finance and business models nor understanding the potential unintended consequences of siloed radical innovation across the system.

Without a systemic approach and science-based framework that offers flexibility to innovate, share-responsibility, multi-stakeholder governance, as well as understand the transition to renewables across the system, develop the new purpose-driven and equitable business models and underpinning policies, financial instruments, partnerships, social interventions and behavioural changes, their collective impact will be strongly limited. As a result, we will not be able to meet our social development and environmental goals and targets synchronously and many stakeholders will be left behind.

ACES Hub and SPOKE model is designed to enable this to be realised through a "bottom-up" and "user-centric" approach, where the search for optimal solutions always starts with users' needs and always ends without reducing users' - in particular SMEs and farmers - well-being (i.e. socially just and economically viable) and scalability, inclusivity and flexibility and overall system sustainability are obtained through the aggregation, sharing and control of the resources of individual users/ stakeholders.

We therefore propose to build a formalised structured "network-style" engagement programme to aggregate and sustain an inclusive and dynamic transdisciplinary comprehensive group of 'innovators' (multidisciplinary researchers, private sector) and 'investors/users in innovation' (from business, government, funders, civil society, etc.) to help stimulate and define the co-design of innovative research around cold-chain at the local, regional and national scale and the accelerated transition to needs-driven, sustainable cold-chain. This would critically be used to ensure ACES understands and focuses on the strategic needs of all stakeholders (farmers, food industry, logistics, retailers, consumers, policy-makers, public health officials).

The ACES Network will also be used to engage researchers, users and decision-makers in emerging issues. We propose to create a programme of rolling strategy labs (say three at any one time), each coalescing a group to focus on a particular here-now (often controversial) policy topic for a defined period (some as short as 3-6 months). This will ensure that the ACES is relevant, responding in a timely matter as policy challenges arise as well as define research topics and strategies around which to grow funding.

The ACES Network will also ensure ACES engages proactively with other wider investments, networks, research, businesses and policy makers, so as to build on the existing research and networks (avoiding duplication of efforts), facilitate knowledge exchange among both internal network members and external wider networks. And it will be the vehicle to share new data, innovation pathways, methodologies, skills, trainings, practices and policies and synthesise, analyse and disseminate the outcomes of research to inform wider policies and strategies.

WORK PROGRAMME 7 (WP7) FOOD LOSS REDUCTION AND REPERCUSSION

It is key to work towards cold-chain integration with food needs for an optimised supply chain and food loss reduction. Up to date, supply chains rarely take into consideration food needs in terms of: i) cold-chain: optimal temperature requirements; ii) energy: optimal environments to extend storage and shelf life (e.g., gaseous environments, PHM); and iii) optimal conditions when food is packaged. These lead to suboptimal environments for food from farm to fork, causing loss in volume and nutritional traits¹¹. In ACES, we will demonstrate food loss reduction across the supply chain, reducing emissions, preserving natural resources and increasing farmers' income. Adaptation of novel technologies to local products to ensure fresh produce reach the consumer in optimal conditions for markets in country and international exports.

WORK PROGRAMME 8 (WP8) SMART VACCINE STRATEGIES

The need for uninterrupted, monitored (recorded), tightly pre-specified temperature storage conditions for vaccines, in storage or in transit, remains a major logistical obstacle and cause of vaccine waste. We need better vaccine forecasting and stock management in-country to help identify and realise the full potential of a cold-chain that is energy-efficient and a sustainable model for resource-poor settings. Seroepidemiology data¹² can help to estimate population-level and immunity to vaccine-preventable disease in communities, and act as an evidence-base for public health decisions around vaccine deployment. In particular, this can guide vaccine prioritisation (supplying certain vaccines to certain populations who need this first), minimise stock movement of vaccines (and the associated energy expenditure and risk in failure of cold-chain custody), and empower local health care providers and communities (with their own data for decision making).

A real-world, combined assessment of novel cold-chain technologies and use of seroepidemiology data for energy-efficient, robust vaccine cold-chains for vaccine deployment working alongside the ACES virtual modelling work (and modal

innovation like drones) could both help develop flexible, resilient cold-chains for traditional vaccines and health needs but is especially important as we look to deploy the new mRNA vaccines (e.g. for malaria) requiring new sub-zero and potentially ultra-cold cold-chains.

WORK PROGRAMME 9 (WP9) CENTRALISED TRANSITION MODELLING SERVICES

To both de-risk investments and accelerate clean cooling solutions we will use the centralised modelling facility to simulate both the local and cooling whole system over a wide range of cooling/cold-chain needs (food and vaccines/health). The models will be used to select technology and operational models that deliver the most environmentally and economically efficient solutions. Furthermore, the models can be used to assess the robustness and resilience of the proposed system configurations.

As the models are exercised the outcomes will be used to train the model in a supervised learning framework. The models will consequently improve, and this learning will be shared across the SPOKES.

To achieve this, we will:

- Train-up and support an in-country researcher;
- Deploy the models in local environments and cocreate experiments to support local initiatives;
- Provide centralised support for the model development;
- Maintain version control and develop an update strategy;
- Develop and maintain a data architecture for model inputs/outputs;
- Maintain a server-based modelling environment accessible from the hubs

WORK PROGRAMME 10 (WP10) RESEARCH AND LEARNING including through supervised PhDs¹³

We will look to develop a series of early-stage researcher and supervised PhD research programmes. Researchers and PhD Students will be expected to support training and teaching. Supervision would be by both University of Rwanda and UK partners (UoB, LSBU, CU and HW). Examples of projects will include (some research questions can be grouped into single projects)¹⁴

- Better understand how current off grid/semi off grid equipment works and efficiency and climate impacts.
- Postharvest strategies to increase storage temperature and reduce emission and energy consumption.
- Examine the future geo-political, environmental and social landscape likely to occur over the next 10 to 30 years and identify how the food and health cold-chains can become more robust, efficient and resilient.
- With regard to health and vaccines, how we might better combine the cold-chain with seroepidemiology data to forecast vaccine strategy, minimise unnecessary vaccine movement, and anticipate the deployment needs of new vaccines. Better understand the economic value of social (soft) wins and how these can be integrated into investment decisions.
- Development of equitable value business models.
- How to transition to natural refrigerants with no direct global warming potential (or ODP) as working fluids for adapted system architectures that specifically target the cold-chain demands across Africa.
- Design cold-chain systems for climate shocks and humanitarian crisis emergency response and preparedness, (especially linked to climate adaptation).
- Monitoring of equipment in use to find out how systems work in reality and how they are used.
- Define technology gaps.

WORK PROGRAMME 11 (WP11) TECHNOLOGY INNOVATION IN-MARKET

A key objective of ACES is to demonstrate promising technologies (especially off-grid) and improve their performance in localised environments. In WP2, we shall support innovation and research and demonstration around key areas of interest.

WP11.1 Thermal integration to utilise heat resources (including waste).

WP11.2 Develop and test an efficient off-grid mobile (containerised) chiller/store/ packhouse/PCM (ice bank) charging to support mobile cooling as this seems.

WP11.3 Test/develop active coolers for vaccine / health last mile (and food first mile).

WP11.4 Sub -25°C (potentially -70°C cold-chain) for health / new vaccines.

WP11.5 Evaluate the potential impacts of transformational innovations, including digital innovation¹⁵.

WP11.6 Act as a market host and research and testing partner to industry for the development of novel technologies to minimise food refrigeration requirements while maintaining quality and safety.

WORK PROGRAMME 12 (WP12) GOVERNMENT POLICY SERVICES

Build up a range of (fee based) services for Governments. These could include, among others,

- Support Governments to develop holistic market development and transformation strategy on agriculture and health cold-chain supported by robust data and gap analysis (including horizon scanning out to 2050).
- Support Governments with cold-chain emissions projections, carbon budgets and mitigation strategies.
- Quantify investment requirements and impact and value of investment taking a multiple benefits approach across social, economic and environmental dimensions, and identify barriers and risks¹⁶.
- Operating/business models for cold-chain infrastructure that create and share value equitably.
- Use of model to test different systems for food and health/vaccines (different missions).

WORK PROGRAMME 13 (WP13) INTERNATIONAL REPLICATION - INDIA

Second permanent centre to be developed in Telangana¹⁷, the mission of the Centres of Excellence (CoE) in Sustainable Cooling and Cold-Chain Programme is to accelerate the equitable uptake of sustainable cooling and cold-chain solutions in the agriculture and health sectors in developing markets.

As ACES, Telangana Centre of Excellence will conduct state-of-the-art applied research across key pillars of Sustainable Cold-Chain for food and health, as well as provide capacity building and training, an innovation and business hub and technology testing/demonstration centre. It will connect indigenous and the UK (and wider industrial) experts, investors, agri-food businesses, farmer cooperatives, and energy or logistics providers, to support achievement of affordable, equitable, resilient, low GHG emission cooling and cold-chain systems in India.

The co-operation will include activities in the following fields which are indicative but not comprehensive in scope and in accordance with each parties' capacity:

- a. Establishing a **Solutions Development Laboratory** and **Solutions Demonstration Centre**, model pack-house / Community Cooling Hub, mechanism and blue-print for the CoE in sustainable cold-chain with associated in-field SPOKES to act as the deployment and implementation arms;
- b. Creation of capacity building, upskilling and training programmes for farmers and local agri-businesses, agri-start-ups and entrepreneurs, equipment technicians and researchers to build knowledge and awareness, improve post-harvest practices and ensure proper installation, maintenance and operation of technologies deployed;
- c. Areas of joint activities such as jointly holding academic seminars or workshops, exchange and joint research in the field of cold chain systems, encouraging long-term partnerships between the public sector, UK-India industry, academia and scientists in mutually agreed areas;
- d. Collaboration in other agri-innovation areas within the incubation centre of the CoE, step-change pathways to sustainable and resilient cold-chain, best practices for farmers, novel business models and other areas as may be mutually decided.

WORK PROGRAMME 14 (WP14) DISSEMINATION

Alongside the direct training and technical assistance, an important goal of ACES is to exchange and disseminate knowledge with internal members and external networks/communities through reports/academic papers, toolkits, learning materials, 3rd party media and events as well as our own ACES activities (e.g., websites, social media, hosted events, workshops, conferences). This will help share learnings, secure further collaborations with industrial partners and development agencies as well we open-up new markets for ACES SPOKES and sister-CoEs.

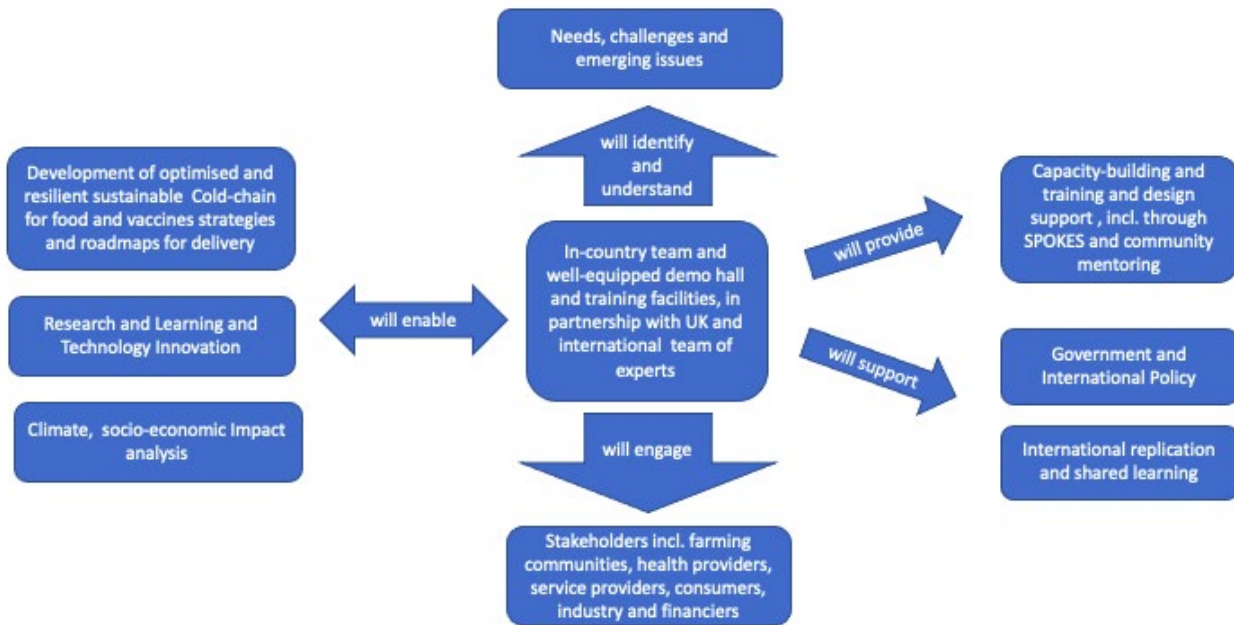
In order to maximise impact and organise messages within a broad collaboration, UoB and U4E will formalise an internal Dissemination Management Team (DMT), guidelines and style guides to manage dissemination throughout the project. This DMT shall be informed of, and approve all dissemination activities such as publications, conference papers, press releases, etc. to keep track of activities and ensure all knowledge sharing activities conform to agreed guidelines and messages are aligned.

WORK PROGRAMME 15 (WP15) IMPACT ASSESSMENTS

Our strategic goal is to deliver a high-quality programme and research that has broad and enduring impact and is transformational well beyond the environment in which it is created. Through our research and its dissemination, we aim to enable transformational change that is of benefit to society, to business, the economy and the environment locally,

nationally and globally. We also aim to transform current paradigms and theories around cold-chain and cooling, our understanding, our methodologies, generating significant new knowledge as well as creating new fields of research. We want to publish and promote research outputs in ways that ensure the new knowledge generated is widely disseminated, and that the quality and significance of the research outcomes are recognised, maximising the potential for impact. We are strongly committed to open research, where that is possible, as means to ensure the global reach of this programme. We shall assess the quality of the project fairly, transparently and in line with the DORA principles (San Francisco Declaration on Research Assessment (DORA) and look to report progress on an annual basis.

ACES - Phase IV output



Annex B. Workstream One Delivery Plan

While this a collaborative programme with U4E providing overarching project management, sub-groups will be responsible for different Work Programmes

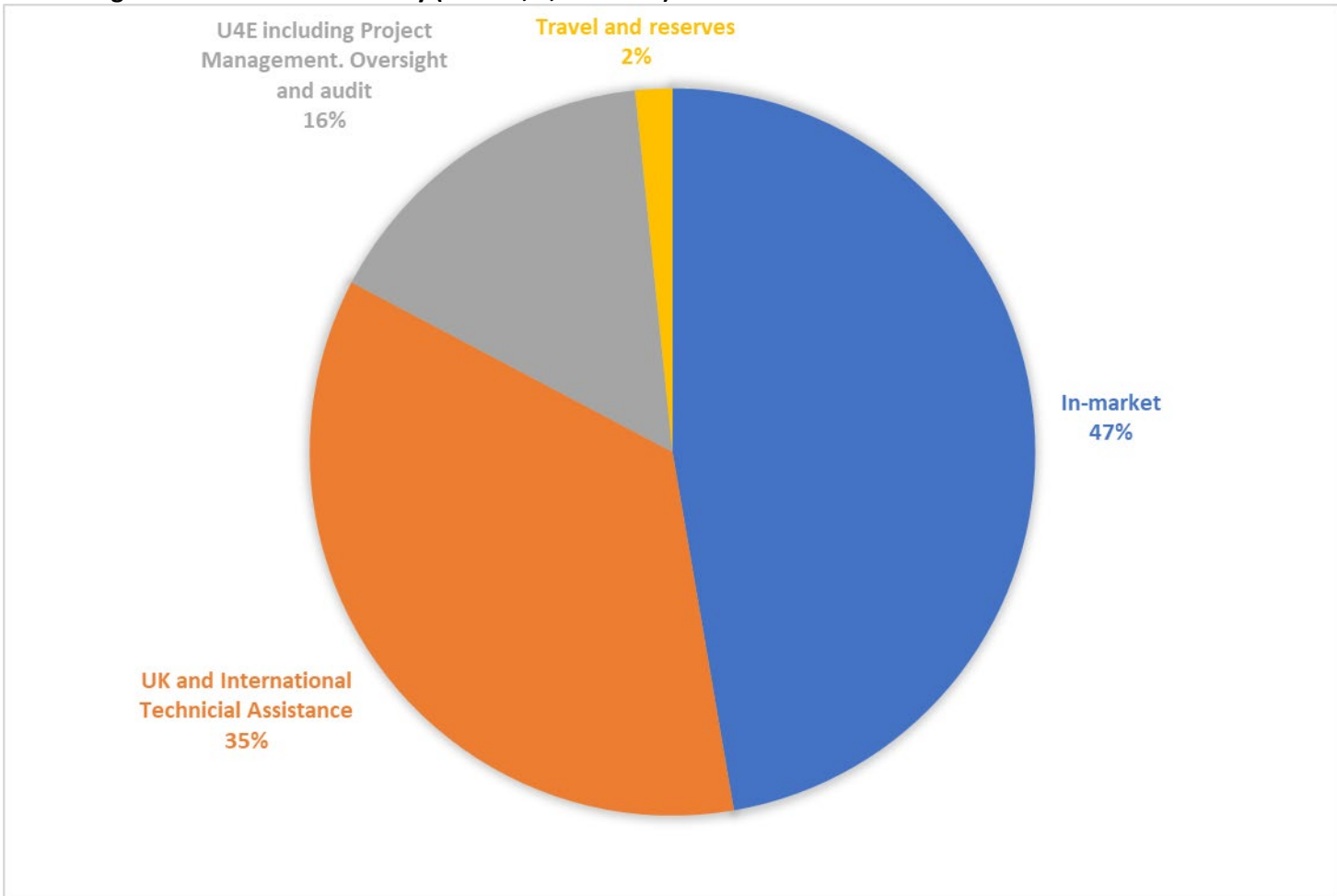
WP1 - IN-COUNTRY CAPACITY	Q3 2022 – Q1 2025	UR to recruit the team supported by UK academics in selection process and U4E in recruitment process
WP2 - EQUIPMENT PROCUREMENT	Q3 2022 – Q4 2023	UR to procure supported by UK academics in specification and selection process and U4E in procurement process
WORK PROGRAMMES 3,4,5 - DEVELOPMENT AND LAUNCH OF ACES CAPACITY-BUILDING PROGRAMMES TO DELIVER SUSTAINABLE COLD-CHAIN	Q4 2022 – Q1 2025	UR to deliver using new ACES team (WP1) supported by UK academic in design and development Online and open access tools to be developed by the new ACES team (WP1) with support from industry and UK academics, supported by Edinburgh Business School in delivery and business model (Could talk to other potential partners such as SHECCO for hosting or development agencies)
WP6 THE ACES NETWORK	Q3 2022 – Q1 2025	UR team to deliver, supported by UK academic (experience in networks) and U4E including their in-market team
WP 7 FOOD LOSS REDUCTION AND REPERCUSSION	Q3 2022 – Q1 2025	Cranfield to lead working with ACES and UR in-country team
WP8 SMART VACCINE STRATEGIES	Q3 2022 – Q1 2025	UoB (vaccine team) to lead working with UR/ACTS in-country team
WP9 CENTRALISED TRANSITION MODELLING SERVICES	Q3 2022 – Q1 2025	HWU to lead working with UR and ACTS to develop in-country capacity
WP 10 RESEARCH AND LEARNING including through supervised PhDs	Q1 2023 – Q1 2025	Collaborative UK/Rwanda supervised academic programmes delivered by ACES researchers/PhDs
WP11 TECHNOLOGY INNOVATION IN-MARKET	Q3 2022 – Q1 2025	Collaborative UK (LSBU-led)/Rwanda supervised programmes delivered by ACES in-country team. Important to have industry engagement
WP12 GOVERNMENT POLICY SERVICES	Q3 2022 – Q1 2025	U4E to lead supported by expertise and outputs from UK/Rwanda team
WP13 INTERNATIONAL REPLICATION - INDIA	Q3 2022 – Q1 2025	UK team to lead working with U4E
WP14 DISSEMINATION	Q3 2022 – Q1 2025	U4E to lead working with partner in-house comms teams (Academic team to write reports and papers)
WP15 IMPACT ASSESSMENTS	Q4 2022, Q4 2023, Q4 2024	UoB and U4E to lead

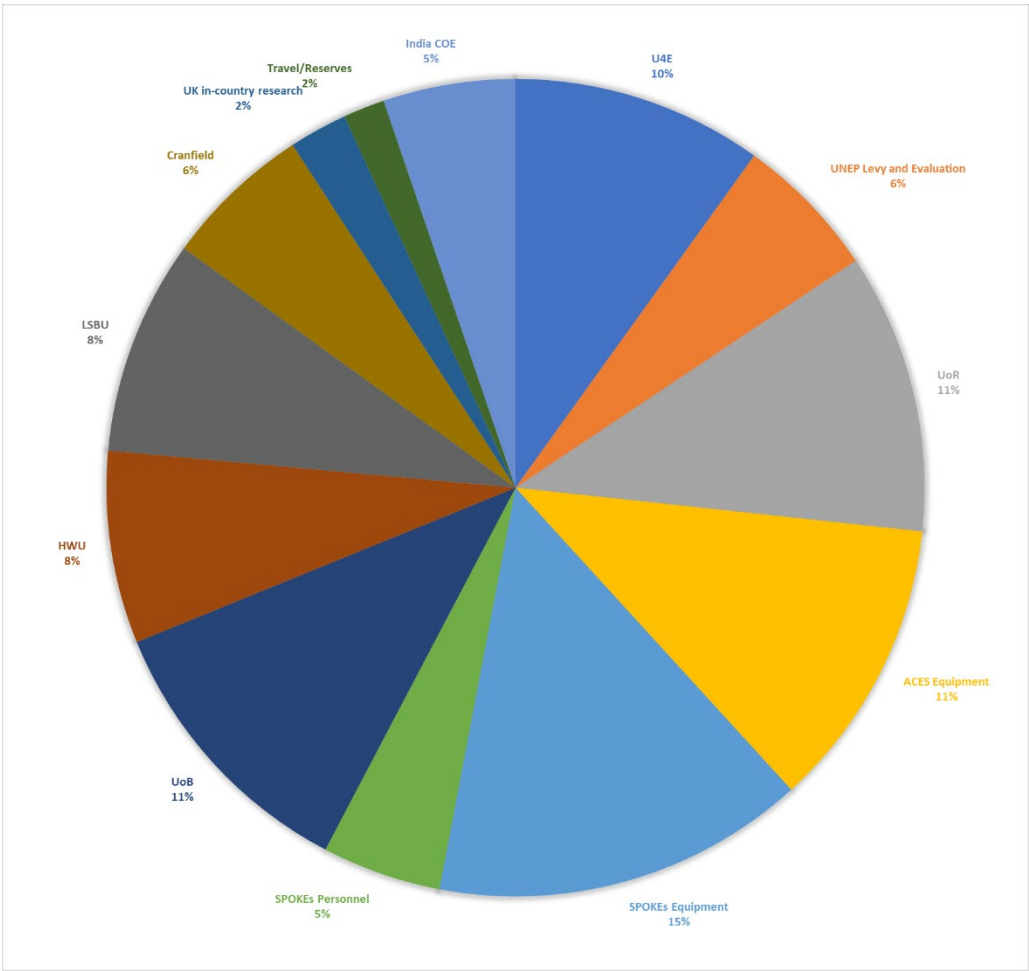
Annex C. Workstream One Resource Breakdown

Phase IV Budget: £9.5M (£8.5M - ACES and SPOKEs programme in AFRICA; £1M - Technical Assistance in INDIA)
Allocation:

Equipment	
Further funding for ACES HQ pipeline equipment (mobile and ULT (Ultra Low Temperature) equipment for vaccines)	£725,000
Further funding for Kenya SPOKE	£100,000
Funding for further SPOKEs, including Rwanda (at ACES or outreach)	£1,650,000
Sub-Total	£2,475,000
ACES Staff costs	
Staffing	£1,143,250
Overheads, travel, visitors and facilities (10% of salary budget)	£114,325
Training (in-country or at partners) (allowance of £25,000 per annum)	£75,000
Sub-Total	£1,332,575
SPIU 5%	£99,129
Spokes programme - funding for four projects (incl. mobile)	
Outreach, mentoring and development	£273,000
Travel, overheads and facilities (25% of salary budget)	£68,250
Staffing for 3 SPOKEs (4th Spoke staffing to be funded by 3rd party)	£306,000
Travel, overheads (15% of budget)	£46,023
Sub- Total	£693,273
India Centre of Excellence	
Staffing	£652,750
Overheads and facilities (15% of salary budget)	£97,913
Travel budget (£1000 per month plus £4k per annum for international)	£42,000
Sub-Total	£792,663
Travel	
U4E / CSC Travel etc for all projects	£130,000
UNEP / UoB	
UNEP - ACES and India staffing	£750,000
UNEP charge 14%	£109,200
Project Evaluation (allowing for overlap with Phase 3)	£30,000
UK Universities - ACES and India academic team and technical assistance	£3,088,100
Sub-Total	£3,977,300
TOTAL:	£9,499,939

Total Budget and Allocation Summary (Phase I, II, III and IV):





Annex D. Workstream One Detailed Funding Breakdown

Please see Excel attached.

Annex E. Workstreams Two-Four Delivery Plan

a) Workstream Two - Delivery Plan

Model Regulation Guidelines (Workstream Two)	
Activities	Due
<p>1. Summary status list of all known countries with policies and programmes addressing the target product area, and identification of a subset of best practice examples as possible reference by the U4E Model Regulation Guidelines (~3 pages in Word and associated PowerPoint slides). This content feeds into deliverable 3.3.1 and is informed by initial discussions with a core group of volunteer experts who advise on preliminary scoping. Consultation with Defra on preliminary path ahead and work plan for the product area.</p>	<p>Dec 2022 - HP Dec 2023 - WH Dec 2024 - CAC</p>
<p>2. Virtual or in-person kickoff meeting with initial cohort of at least 10 leading organizations interested in volunteering in the project (outlining the workplan, scope and other relevant details to secure their buy-in), organize, host and follow-up from regular check-ins from inception through conclusion of the project with full-group virtual meetings (approximately every 2 months for ~90 minutes) and bilaterally with contributors on an as needed basis to address comments and questions. Recruit additional members as needed for diverse stakeholder input, aiming for approximately 30 expert reviewers that are recognized in the acknowledgements of the document.</p>	<p>Starting in: Feb 2023 - HP Feb 2024 - WH Feb 2025 - CAC</p>
<p>3. Core contents are developed, circulated for approximately 4 rounds of written input, then finalized with a similar level of detail, consistent structure and professional appearance as U4E's existing published Guidelines, in English:</p> <ol style="list-style-type: none"> Supporting Information Document (~20+ pages in Word). Model Regulation Guidelines (~20+ pages in Word). 	<p>First draft in March and final draft in Oct of: 2023 - HP 2024 - WH 2025 - CAC</p>
<p>4. Develop Country Savings Assessments (3 pages in Word per country) for developing and emerging economies (over 100 countries) on energy, climate and consumer bill impacts of adopting the new Model Regulation Guidelines. Cross-check methodology with HFC Outlook and other relevant methodologies and data sets. Post the Assessments and a methodology document on U4E's website. Use findings for promotion and future projects.</p>	<p>Sample regional results in Nov, full results ~ 6 months later: 2023 - HP 2024 - WH 2025 - CAC</p>
<p>5. Communications of the new resources by posting on the U4E and other websites (e.g. Cool Coalition, SEAD, Leonardo, etc.); at least two webinars for priority sub-regions), and a high-profile presentation with UK officials during at least one high-profile Montreal Protocol or Climate Conference event (if in-person is possible and an appropriate slot is secured). Further outreach via UNEP social media and other channels to the extent practicable to engage target audiences.</p>	<p>Feb 2024 - HP Feb 2025 - WH Feb 2026 - CAC</p>
<p>6. Translate the Model Regulation Guidelines into a priority language based on anticipated demand. Cross-checking translations with at least two other experts (from within UNEP or a partner organization).</p>	<p>June 2024 - HP June 2025 - WH June 2026 - CAC</p>

b) Workstream Three - Delivery Plan

Regional Harmonisation (Workstream Three)

Activities	Due
1. Impact Analyses in the form of Excel-based data tables, graphs and accompanying explanatory text on methodology and assumptions that offer decision-grade information for local officials. Insights from the updated HFC Outlook Model provided for a holistic view at refrigerant transition opportunities.	January 2023
2. MEPS and Labelling recommendations tailored from the Technical Note / U4E Model Regulations Guidelines (appr. 20 pages in word)	May 2023
3. Policy Adoption Guidance on the suggested roles and responsibilities of key agencies and stakeholder groups and processes to undertake to secure adoption and initiate implementation (appr. 20 pages in word)	June 2023
4. Content (e.g. graphics, messaging) for inclusion in outreach materials conveying the benefits to domestic audiences from economic (e.g. utility bill savings for consumers and businesses), energy (avoided power plants), and climate (direct and indirect GHG impacts) perspectives - building on the initial insights from the Country Savings Assessments.	Sept 2023
5. At least one web article, live session at a relevant regional or international event (e.g. COP, SEforALL Forum, MOP), webinar or other awareness raising to reach international audiences through U4E channels, the Cool Coalition, and related platforms that can inspire similar actions by other countries.	Jan 2024

National Implementation (MEPS, SPP and Incentives) (Workstream Three)

Activities	Due
1. ToRs for the MEPS/labels Policy Working Group (PWG)	Jun 2022
2. Slides and report from two national PWG meetings which aim to introduce the project and present and discuss the regional MEPS and labels	Aug 2022
3. Cost-benefit analysis for refrigerator and air conditioner MEPS and labels	Jan 2023
4. Draft roadmap to implement MEPS and labels	Jan 2023
5. Slides and report from public consultation workshop	July 2023
6. Slides and report from two PWG meetings which aim to discuss necessary amendments in the wording of the regional MEPS to adopt it to the local context and endorsement of the PWG	Oct 2023
7. Final MEPS and labels, which are tailored to individual countries	Dec 2023
8. ToRs for the SPP and/or Financial Incentive Policy Working Group (PWG)	Jun 2022
9. Slides and report from SPP and/or Financial Incentive PWG kick-off workshop	Aug 2022
10. Analysis of the current public procurement and/or financial incentive processes in the country and identification of SPP toolkit components	May 2023
11. Report with lessons learnt and recommendations	Sept 2023
12. Slides and report from final SPP and/or financial incentive PWG workshop	Oct 2023

b) Workstream Three - Delivery Plan

HFC Outlook (Workstream Four)	
Activities	Due
Completion of current work on regional models and prototype global model	Oct 2022
Initial strategic messaging for Montreal Protocol Parties	Dec 2022
Improved regional and global models	March 2023
Detailed review of options for faster phase-down and improved efficiency	Oct 2023
Updated modelling input assumptions	Dec 2023

Annex F. Workstreams Two-Four Spend and Cost Leverage

Model Regulation Guidelines (Workstream Two)			
Proposed Defra funding*		UNEP and volunteers cost share**	
Deliverables	Request (GBP)	Item	Value (GBP)
Status list and initial Consultation with Defra to inform workplan (18 days of U4E time – 6 per product)	18,000	Participation and inputs by initial core group volunteer experts to advise on first scoping (2 days per person x 6 volunteers x 3 products)	Volunteers: 36,000
Kickoff meeting and regular check-ins with volunteer technical experts (25 days of U4E time – 8.33 per product)	25,000	Participation and inputs by volunteer experts (4 days per person x 20 volunteers x 3 products).	Volunteers: 240,000.
Supporting Information Document and Model Regulation Guidelines in English 228 days of U4E time – 76 per product)	228,000	Anticipated grant from Clean Cooling Collaborative to LBNL for analytical work supporting content development and outreach of next 3 products.	Grant to LBNL: 260,000
Country Savings Assessments (84 days of U4E time – 28 per product)	84,000	Analysis, test methods and value of data sets from key collaborators - GIZ, CLASP, UNDP, World Bank, and industry	120,000 <i>cost share</i>
Communications activities (International flight, DSA and terminal expenses for 1 in-person event; ~7 days of U4E time per product)	30,000	Leveraging UNEP corporate communications networks and events	24,000 <i>cost share</i>
Translation of Model Regulation Guidelines into a priority language	10,000	Translation feedback by expert contributors from relevant areas	12,000 <i>cost share</i>
Sub-total X (PSC 13% + Levy 1%)	55,000		
Total	450,000	Total Leverage	692,000
Regional Implementation through Policy Harmonisation (Workstream Three)			
Proposed Defra funding		UNEP cost share/leverage	
Item	Request (GBP)	Item	Value (GBP)
U4E staff, expert consultants	325,000	GEF Global Project to Leapfrog Markets	200,000
Regional Workshop (flights, DSA and venue)	60,000	GCF Readiness Funding for SADC Market Assessments and National Policy Working Groups	300,000
Travel in-country consultation (flight, DSA and venue)	25,000	Clean Cooling Collaborative	TBD
UNEP overhead	5,000	Participation and inputs by volunteer experts (1.5 days per person x 12 core volunteers);	20,000
Sub-Total for All Activities and Deliverables	415,000	Participation by government officials, civil society, use of local communications networks, use of government venues	150,000
Total with Fees (PSC 13% + Levy 1%)	473,000	Total Leverage	660,000
National Implementation through MEPS and SPP (Workstream Three)			

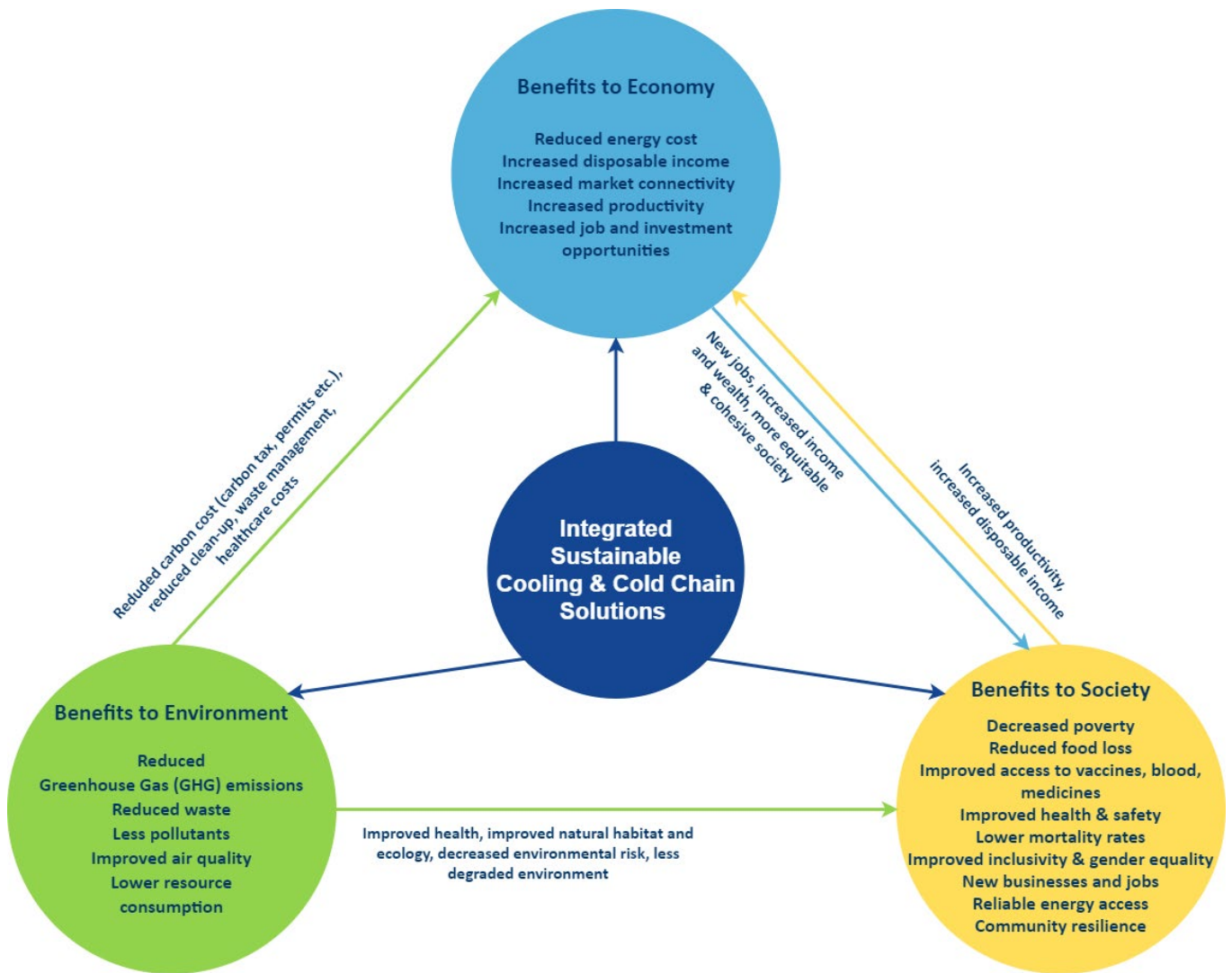
Proposed Defra funding		UNEP cost share/leverage	
Item	Request (GBP)	Item	Value (GBP)
U4E staff, expert consultants	250,000	GEF Global Project to Leapfrog Markets	100,000
Travel in-country consultation (flight, DSA and venue)	25,000	GCF Readiness Funding for SADC Market Assessments and National Policy Working Groups	300,000
UNEP overhead	5,000	Participation and inputs by volunteer experts (1.5 days per person x 12 core volunteers);	20,000
Sub-total per country	280,000	Participation by government officials, civil society, use of local communications networks, use of government venues	100,000
Number of countries	4		
Sub-Total for All Activities and Deliverables	1,120,000		
Total with Fees (PSC 13% + Levy 1%)	1,277,000	Total Leverage	520,000
HFC Outlook (Workstream Four)			
Proposed Defra funding		UNEP cost share/leverage	
Item	Request (GBP)	Item	Value (GBP)
Completion of current work on regional models and prototype global model	51,600	N/A	
Initial strategic messaging for Montreal Protocol Parties	25,800		
Improved regional and global models	103,200		
Detailed review of options for faster phase-down and improved efficiency	38,700		
Updated modelling input assumptions	38,700		
Sub-Total for All Activities and Deliverables	258,000		
Total with Fees (PSC 13% + Levy 1%)	300,000	Total Leverage	N/A

Annex G. LogFrame for Sustainable Cooling Solutions

Please also see attached Excel document.

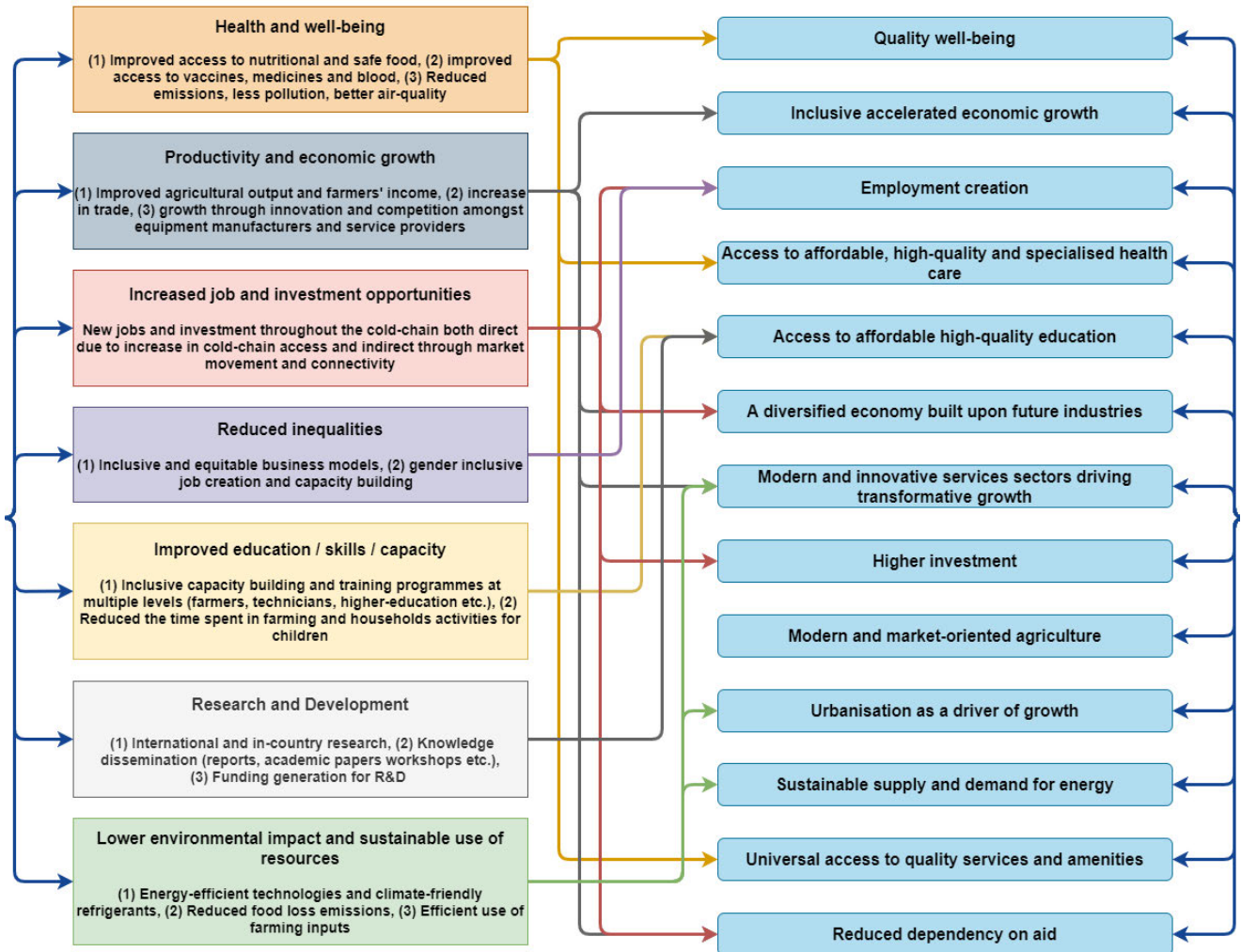
Impact	Increased, early uptake of integrated sustainable cooling and cold-chain solutions in developing countries to accelerate (and double) the climate benefits of the Kigali Amendment to the UN Montreal Protocol.			
	<ol style="list-style-type: none"> 1. Extent to which intervention is likely to lead to Transformational Change (ICF 15) 2. Number of people supported to better adapt to the effects of climate change (ICF 1) 3. Greenhouse gas emissions reduced or avoided (ICF 6) 			
Outcomes	<ol style="list-style-type: none"> 1. Increase in policy and technical capacity within country on sustainable cooling and cold chain solutions to deliver systemic change. 	<ol style="list-style-type: none"> 2. Increase in skills and technical capacity for farmers on sustainable cooling and cold chain solutions to deliver economic and societal benefits. 	<ol style="list-style-type: none"> 3. Increased efficient use of resources due to improved availability of sustainable cooling and cold chain solutions to deliver environmental benefits. 	
	<ol style="list-style-type: none"> 1. Number of policies and plans designed to address sustainable cooling and cold chain in partner countries (disaggregated by countries) Number of technicians trained to maintain cooling and cold chain facilities in partner countries (disaggregated by countries and gender) 	<ol style="list-style-type: none"> 1. Number of farmers applying learnings from training on efficient use of resources and on the importance of sustainable cooling and cold chain (disaggregated by gender) 2. Number of farmers reporting improved post-harvest practices, food processing, storage and transportation (disaggregated by gender) 	<ol style="list-style-type: none"> 1. Solid Waste and Pollution Avoided (t) 2. Reduced dumping of inefficient equipment (disaggregated by country) 3. Increased uptake in energy efficient equipment (disaggregate by country) 	
Outputs	<ol style="list-style-type: none"> 1. Capability and technical capacity of businesses within the supply chain to address sustainable cooling and cold chain enhanced 	<ol style="list-style-type: none"> 2. Improved policy development or implementation to address sustainable cooling and cold chain in a holistic manner that is available and accessible. 	<ol style="list-style-type: none"> 3. Training and access of farmers to address sustainable cooling and cold chain in agriculture enhanced 	<ol style="list-style-type: none"> 4. Increased disposable income of farmers due to reduced food loss leading to increase in value sales
	<ol style="list-style-type: none"> 1. Number of supply chain businesses using the Net Zero Roadmap in partner countries (disaggregated by countries and food and health sectors) 2. Number of supply chain businesses taking part in capacity building and training sessions on sustainable cooling and cold chain (disaggregated by gender, food and health sectors) 3. Number of supply chain businesses using equipment from the ACES innovation centre (disaggregated by food and health sectors) 	<ol style="list-style-type: none"> 1. Number of governments implementing MEPS and Labels (disaggregated by countries) 2. Number of Model Regulation Guidelines translated into different languages 3. Number of governments using the Net Zero Roadmap in partner countries (disaggregated by countries) 4. Number of governments using the HFC Outlook Model in partner countries (disaggregated by countries) 	<ol style="list-style-type: none"> 1. Number of farmers with access to new technologies from the innovation centre at ACES 2. Number of farmers taken part in new business model training. (disaggregated by gender) 	<ol style="list-style-type: none"> 1. Value of food saved due to deployment of new technologies by farmers 2. Value of Energy efficiency savings by farmers

Annex H. Benefits Map



Impacts of Clean Cooling

Rwanda Vision 2050 Objectives



Annex I. Appraisal of Longlisted Options

Longlist option appraisal against each CSFs (Green = Meets CSF, Amber = Partially meets CSF so is less attractive, Red = Fails to meet CSF) and shortlisting decision.

	MLF top up without conditions	MLF top up with conditions	Bilateral work through different delivery body (World Bank, GIZ)	Continue bilateral work through UNEP with £12 million	Continue bilateral work through UNEP with £5 million
Strategic fit	Low Unable to direct funding strategically to areas of priority such as cold chain and EE.	Moderate It could be ring-fenced for early, high value action but no guarantee that good value projects will come forward or the prioritisation of cold-chain or EE in the project.	High Funding can be directed to suit strategic priorities and Defra can provide strategic direction	High Funding directed will support existing activities and outputs which has been designed to contribute to priorities. Allow us to facilitate training and capacity building via previous outputs	High Funding directed will support existing activities and outputs which has been designed to contribute to strategic priorities. [Something here about how we need to go further]
Value for money	Low likely to be unspent at end of budget period, thus just subsidising future developed country contributions	Low likely to be unspent at end of budget period, thus just subsidising future developed country contributions	Low Previous outputs would not be deployed effectively meaning outcomes of previous funding not utilised Delivery partner administration cost	Moderate Full control to maximise value and effective use and deployment of previous funding. Delivery partner administration cost.	Moderate Full control to maximise value and effective use and deployment of previous funding. However full value not of previous funding not realised as X.
Fit with ODA policy	Low Over 80% of MLF funding goes to middle income countries.	Moderate It could be specified for lower income countries.	High Full control over which countries we target.	High Priority countries targeted and full control over which countries to target in the future.	High Priority countries targeted and full control over which countries to target in the future.
Speed/Deliverability	Low	Low	Low	High	High

	<p>payment could be made immediately but unlikely to lead to projects being delivered sooner.</p>	<p>Requires some groundwork lobbying and approval likely to be difficult to achieve.</p> <p>high risk that contribution will be blocked by other parties as was rejected in 2019</p>	<p>Establishment of delivery agency links will take time before projects can be developed.</p> <p>Poor and unstable Experience with other delivery bodies (WB, GIZ) in delivering similar aims with second tranche of funding for WB cancelled.</p>	<p>Donor agreement in place with funding successfully and quickly deployed since 2019.</p>	<p>Donor agreement in place with funding successfully and quickly deployed since 2019.</p> <p>Unlikely that other countries would interfere in delivery</p>
Shortlisted				✓	✓

Annex J. Critical Success Factors

Critical success factors used to assess longlist options and to select options for shortlist.

CSF	Description
Strategic fit	How well the option: <ul style="list-style-type: none"> • Addresses the systemic issues related to cold-chain availability and their connectedness • Supports delivery against UN Montreal Protocol commitments • Supports capacity building and technical development and the replicability of models in
Value for money	How well the option: <ul style="list-style-type: none"> • Utilises previous outputs to support deployment • Has the potential to be self-sustaining
Fit with ODA policy	How well the option: <ul style="list-style-type: none"> • Addresses ODA priority issues – climate change, food waste, biodiversity challenges • Links to the International Development Strategy • Supports ODA eligible and priority countries.
Speed/ deliverability	How well the option: <ul style="list-style-type: none"> • Is likely to be delivered • Can measure outcomes and success • Can deploy money and utilise it given time sensitivity of issues at hand.

Annex K. *Do nothing* and *Option 1* activity breakdown

Details of workstream delivery under *do nothing* and *option 1* is outlined below. For details on deliverables under option 2, please see Annex B.

Work Programme		Do nothing	Option 1: Minimum funding
WS1: ACES		£0 - Reprioritise budgets of existing funding to extend life of ACES.	£3.374M - <i>Make the most of existing facilities procured through Phase 2/3 while look for other funding sources to expand out SPOKES and wider activities</i>
WP1	Staffing for ACES	Current staffing funded through until end of 2023; will be harder to recruit new staff i.e technicians and lecturers under short-term contract. Would look to repurpose budgets from SPOKE to provide extensions to contract	<p>Leadership (includes Headquarters and SPOKES)</p> <p>No Director – oversight provided by [REDACTED]</p> <p>Technical Director</p> <p>Professional Services</p> <p>Finance / Operations (OPS) and Human Resources (HR) Director/Senior Manager</p> <p>General Assistant, Receptionist and Admin</p> <p>Supported by UK team</p> <p>No network team (WP6)</p> <p>Academic team</p> <p>2 x technicians, 2 x lecturers / trainers, 3 x early career researchers (also support training and teaching)</p> <p>No PHD students undertaking research and supporting training and teaching</p>
	Staffing for SPOKES	No SPOKE – repurpose funding to extend life of ACES	<p>For Kenya</p> <p>Manager, Administration support, 2 x Technical assistance / trainers (including business models, etc), Overheads and facilities</p> <p>No further SPOKES</p>
WP2	Equipment procurement	No budget for further equipment; would also scale back / repurpose planned equipment from Phase 2/3 to have a smaller, longer functioning set of services aligned to staffing levels	No budget for further equipment

WP3	Residential programmes	Would try to run a scaled back training programmes, repurposing funding for delivery team; however we need to meet health and safety standards for any training on equipment	Design and build-up to running 2 x residential programmes a year and one train the trainer programme per year plus support industry programmes
WP4	<i>Community Capacity building and Community Cooling Hub Delivery</i>	None	1 demonstration hub with no outreach team
WP5	On line and open access tools	None	No on-line tools
WP6	The ACES Network	None	No network – annual meeting
WP7	Food loss reduction and repercussion	Industry funded research	Industry funded research as contracted, rather than building up a valuable knowledge base on which to generate fee-based work
WP8	Smart Vaccine strategies	None	No vaccine strategy work including to align with the two new in-country manufacturing centres (Pfizer and Serum Institute)
WP9	Centralised Transition Modelling Services	Fee-based service housed in UK	Fee-based service housed in UK (ACES researcher used for data gathering) rather than building up a valuable knowledge base and capacity in-market on which to generate fee-based work
WP10	Research and learning	We will look to develop a series of early-stage researcher and supervised PhD research programmes. Researchers and PhD Students will be expected to support training and teaching.	No programme reducing down novel research, grant-funded programmes and teaching capacity.
WP11	Technology innovation in-market	Offer space to industry as no new technologies deployed	Offer space to industry as no new technologies deployed
WP12	Government Policy services	None	Produce an annual policy report
WP13	International Replication - India	None	No international programme
WP14	Dissemination	Website	Website, annual event and ad hoc social media. Limited use of conference facilities
WP15	Impact Assessment	continued	continued

WS2: Model Regulation Guidelines	£0 – no other guidelines will be developed.	£270,000 - Three new guidelines will be developed, but no Country Savings Assessments, communications or translations will be able to take place
Development of guidelines	none	Yes – 4 guidelines developed for Heat Pumps, commercial refrigeration and Water Heaters
Country savings assessment	none	None
Translation	none	none
Communication and engagement	none	none
WS3: Technical assistance	£0 – no further assistance deployed.	£470,000-Not possible to implement national implementation, only regional
Regional policy harmonisation	None	yes
Implementation of technical assistance	none	yes
National implementation	None	none
WS4: HFC Outlook	£0- no further support given.	£100,000- Cannot support global model development
Global model prototype	None	None
Improve regional and global model	None	Regional model can be improved. Global model not developed
Updating model assumptions	None	Regional model can be updated. Global model not developed
Review of policy options for faster phase-down	None	none

Annex L. Workstream One Economic impact – food saved

To compare the benefits of the shortlisted options, we assessed the economic impact of ACES based on the food saved as a result of ACES activities. FAO has developed and applied a methodology that enables the full-cost accounting (FCA) of food loss and waste (food wastage) footprint¹. Based on the best knowledge and techniques available, FCA measures and values in monetary terms the externality costs associated with the environmental impacts of food wastage.

With food wastage of 1.2 billion tonnes a year of food, a tonne of food lost or wasted has £614 of economic cost, £429 of environmental costs and £552 of social costs per year. These figures are global and cover both food waste and loss. For developing countries, the total cost (inc. economic, social, environmental) is then approximately £1,100 per tonne per year³. Therefore, the estimate presented in this analysis recognises the social and environmental value in addition to the economic. This excludes the ancillary benefits of wider job creation within ACES, and the wider refrigeration equipment maintained through the engineer training programmes or the health vaccine cold-chain programme.

An overview of the assumptions and data used to support the economic impact of ACES based on food saved is below. This data assumes that training activity continues at the same level from 2025 – 2031 (given the expectation of self-sustained activities post 2025). Sensitivity analysis has been conducted to assess what the impact would be on results should the self-sustaining model not be as effective as assumed. However, under *no further funding*, there is no training after 2023 as no activity can be confirmed beyond 2023.

¹ The loss and waste is from the FAO's 2011 Food Loss and Waste Assessment and the associated (economic, environmental, social) costs are again from FAO published in 2014, which uses the 2011 assessment and costs are calculated for the year of 2012 (which is the latest). FAO's figures are still widely used and accepted, and more comprehensive compared to other estimates in the sense that it covers economic, social and environmental cost. FAO documents are still the go to references in this field today. Source: <https://www.fao.org/3/i3991e/i3991e.pdf>

² Estimates have not been adjusted for inflation due to a lack of a reasonable and robust method for doing so. All figures quoted are thus in 2012 terms, and therefore may underestimate the value of food waste avoided in present value terms. FAO has not yet provided an update of these figures, and the relevant reliable data does not exist to make a meaningful adjustment (simple general inflation index adjustment would be misleading). Inflation adjustment would not impact overall results to an extent that would affect the choice of preferred option.

³ Roughly the same quantities of food are lost and wasted (in total) in developed and developing countries. Total economic cost is roughly twice in the developed world compared to the developing world. For simplicity, we will assume the same ratio applies to social and environmental cost as well.

	No further funding	Option 1 - Minimum Funding	Option 2 – Preferred Option	Option 2 – Worst Case Scenario (Sensitivity)
Additional Cost	£0	£3.43 million	£9.5 million	
SPOKEs opened	1	1	4	3
Courses held over 3 years – ACES HUB	2	7	20	16
Courses held over 3 years - SPOKES	1	5	27	25
Students per course	30	30	30	20
Conversion %	50%	60%	80%	50%
Co-ops implementing cold chain solutions per year after 10 years	35	90	576	180
Tonnes of food loss saved per co-op per year	432 (26.7% of food loss avoided)	432 (26.7% of food loss avoided)	583 (36% of food loss avoided)	432 (26.7% of food loss avoided)
Economic return after 3 years	£48.3m	£174m	£1.17bn	£326.4m
Economic return after 10 years⁴	£161m	£1.729bn	£10.04bn	£2.51 bn

⁴ Assumes self-sustaining model in operation, with consistent numbers continuing to be trained and implementing cold chain solutions as a result.

Annex M. Workstream One Revenue Generation Streams

ACES is funded for its first three years of establishment and operation (out to 2025). During this period ACES will transition to a financially self-sufficient business model with multiple income-generating service offerings (including in-kind). ACES will also apply for project grants and donor funding to support marginalised communities and farmers as its SPOKES are expanded across the continent. Potential Revenue streams and value attributed to stream per year is outlined below:

Example income streams after 3 years			Per Year
Industry Membership	Companies sign-up etc. The strategy would be for companies to be invited to join on a tiered membership. During the first years we would invite SMEs to join for a very basic membership for as little as £5,000 per annum to enable them to build up trust and confidence.	20 SMEs x £10,000 (average)	£200,000
		10 OEMS x £40,000 (average)	£400,000
		3 x OEMs - major project / new Hubs x £200,000	£600,000
FCO Membership	Look to sign up FCOs throughout Africa (average 250 farmers per FCO) on a life-long learning and knowledge transfer service, to include an outreach programme, regular updates on regs, markets, technologies, business models, entrepreneurship, etc, and access to information materials for their farmers, places at conferences, etc. £5,000 per year = £20 per farmer per year. Ideally would also have discounts from membership	175 x £5,000	£875,000
Training	The Indo-Israeli CoE in Haryana has 16,000 farmers visit per year and it charges everyone for training (at 1,000 rupees (approx. £10) per session. If we had 100 farmers per week across ACES and SPOKES attending a variety of training courses, that is 5,000 farmers per annum. We would also run outreach training.	5,000 x £10	£50,000
Industry trials	Offer a service to industry to test technology or processes for food storage, at pilot and product stage, both in the lab and the field - produce a report (performance, LCA, LCC, etc.) and localization recommendations	10 projects a year at £30k per project	£300,000
Industry	Conduct joint research and localisation projects with industry and take on	10 projects at average of	£750,000

research and market intelligence	market intelligence assignments for companies exploring Indian market entry (incl. localization recommendations).	£75k a year funding	
Events	Conferences, inbound (from UK) and outbound (to UK) study tours, etc. plus in-country to in-country.	8 a year, each generating £6- £10k surplus as income	£60,000
Donors	Philanthropic Donors		£1 million
Design Service	Design services for sustainable pack houses using clean technologies, renewable energy and digital ('fork-to-farm-to-fork'), both new builds and retrofits, including simulation and business models. The CoE will also support the design by assessing and validating the projects developed by local engineers.	30 assignments per year at average of £15,000	£450,000
On-line learning and higher education	On-line e-learning including technical and business subjects – CPD and post- grad courses.		
Knowledge Centre and Incubator	Bespoke support services to FPOs, micro-businesses and entrepreneurs – market intelligence, business model development, product demonstration, maintenance, 'train the trainers', start-up incubation etc.		£150,000
Grants	Continuing to apply for UK, EU and other major grant funding		£600,000

Annex N. ARLC Overview

Commencing in June 2022, ARLC members will provide strategic guidance for the first two years (initial term of 'office' for members) in order to establish a strong foundation for ACES. Key governance arrangements include:

- Members will meet at least bi-monthly for first 12 months and then the frequency will be reviewed with the Steering Committee (SC).
- The developed Terms of Reference for the ARLC will be reviewed annually to ensure that the purpose, responsibilities, and members remain relevant to ACES.
- *ARLC's Composition* Occupying senior roles at the University partners and other relevant organizations. Furthermore, senior leaders can invite experts specialized in ACES areas of intervention when needed. United Nations Environment Program's United for Efficiency initiative (UNEP U4E) is invited to attend ARLC meetings as one of the founders of ACES to facilitate overall project management. Other academics and guests will be invited to participate from time to time.

ARLC composition should include expertise in line with the key areas of:

- Postharvest Handling, storage and quality including pre-harvest and harvest quality assurance
- Refrigeration and cooling technologies and thermal symbiosis, retail and domestic refrigeration, Refrigeration System,
- Cold-chain and Distribution, Sustainable Logistics
- Retail and domestic refrigeration
- Vaccines & Health
- Demand Mitigation & Materials
- Energy Systems (Africa), Distributed Generation, Sustainable/Renewable Energy, Energy storage
- Refrigerants and transition to Natural Refrigerants
- Data and Digital Transformation including development and use of Digital Twins for system design
- Techno-Social-Economic Business Models and Finance, Modelling and impact/sustainability analysis

Founder Members

S/N	Academic institution	Position	Current leaders in the position	Expertise
Rwanda				
1	University of Rwanda (UR)			Environmental Engineering

2				Agronomist/Soil Science
3				Environmental Engineering
4	Rwanda Polytechnic			Civil Engineer
5	(RP)/ Integrated Polytechnic			Mechanical Manufacturing and Automation
6	Regional College (IPRC)			Air-conditioning and Refrigeration
International				
7	University of Birmingham (UoB)			System-level approaches, energy policy and thermal energy storage
8				Logistics and cold-chain for vaccines and health
9	London South Bank University			Refrigeration and cooling technologies, food cold chain
10	Cranfield University			Postharvest Management and Agri-Engineering and Agri-policy
11	Heriot-Watt University			Sustainable Logistics and Finance and business models
Invited to be in attendance		U4E Defra		

Annex O. AO Test checklist sustainable cooling and cold chain

HMT MANAGING PUBLIC MONEY: MEETING THE ACCOUNTING OFFICER TESTS – A CHECKLIST

HMT *Managing Public Money* has 4 Accounting Officer (AO) tests which must be considered for any spending decision to proceed. Defra applies a discrete fifth test of Affordability (which is embedded within the Propriety test) because of its critical importance.

This checklist has been produced to assist decision-makers in assessing if a spending decision meets the AO tests. Depending on the degree and circumstances on any non-compliance, the need to seek a Ministerial Direction may be required. More details can be found in *Managing Public Money* Chapter 3 at this [link](#)

Decision-makers should engage with their local Finance Business Partner (FBP) support to help navigate these tests.

Accounting Officer Test	Explanation	Decision-Maker's Assessment	Met/Not Met/Partially Met
Regularity	<p>A proposal must be supported by clear legal powers. This is normally via two routes: (a) specific legislation; or (b) the department's common law powers. Common law powers are based around what is a reasonable expectation of what is required to deliver existing policy.</p> <p>If a proposal is dependent upon new legislation, normally expenditure cannot be permitted until after Royal Assent. However in certain circumstances, limited spend is allowed if a Bill has passed Second Reading. Anything in advance of this normally requires a Ministerial Direction.</p> <p><i>Managing Public Money</i> does allow, in limited circumstances and with HMT approval, the Supply and Appropriation Act to be used where no specific legislation is in place and none is going through Parliament. This is normally for one-off projects or pilot exercises that will last no more than 2 years.</p>	<p>The International Development Act 2002 provides the legal power to invest funds for the purposes of official development assistance. Defra's investment will be made using funds allocated to Defra under SR20</p> <p>The programme funds will be managed in accordance with HMT's Managing Public Money guidance and ODA guidance.</p> <p>Funding will support and scale up existing activities which are supported by the Departments common law powers.</p>	Met
Propriety	<p>The use of public funds needs to be proper as well as regular (i.e. supported by law). Therefore it needs to comply with the standards set out in <i>Managing Public Money</i> which includes obtaining the necessary internal and if necessary external HMT approvals. This test is not definitive, but it basically expects the</p>	<p>The proposal meet and complies with all relevant protocols and checks. A full business case has been developed in</p>	Met

	<p>spending decision to apply all the established protocols and checks which support the premise that all public expenditure is proper and auditable.</p>	<p>line with HMG Smart rules and operating framework.</p>	
<p>Value for Money</p>	<p>The proposal must be good value for money for the Exchequer as a whole and not just the department and where possible a full evaluation should be undertaken. It may not always be possible to measure intended benefits and alternative options should include a 'do nothing' option.</p>	<p>The proposal offers good vfm through co-funding leverage and in kind support. Existing funding has attracted a cost leverage of over £3.5m. In workstream one, further Defra funding in ACES and the associated SPOKES is expected to generate co-funding from the private sector with business engagement officers working to secure match-funding and industry sustained commitments, delivering investment for the deployment of products and input into training and certification programmes. We are moving to MOUs with Carrier and Daikin as a lead industry partners and wider industry engagement will follow, including deployment of an industry engagement brochure. Furthermore, ACES acts as an incubator for in-market agri-businesses and entrepreneurial companies and provides market access for technology developers, SMEs and service providers.</p> <p>The business case includes a comprehensive appraisal, economic rationale and the activities have been developed through consideration and appraisal of a range of potential options.</p>	<p>Met</p>
<p>Feasibility</p>	<p>This is a fairly new criterion and overlaps with propriety and value for money. In essence it asks whether the proposed policy can be carried out effectively and credibly. In short, are we confident it can be delivered in line with policy intentions?</p>	<p>The need for this investment has been explored fully in the strategic case of the full business case and assessed to ensure that it can be realistically implemented and delivered within the</p>	<p>Met</p>

		proposed timeframe. Existing activities are performing well and there is no reason to doubt that activities won't continue to be delivered as intended.	
Affordability	<p>This is a Defra AO Test and a sub-set of the HMT Propriety test; but given its own assessment because of its critical importance. Therefore we ask the explicit question as to how the proposal will be funded and has it got full budget cover?</p> <p>Consideration also needs to be given to the classification of spend and how much will be scored as Administration, Programme or Capital costs. There are separate Control Totals in Defra's budget for Administration, Resource DEL and Capital DEL. It is also important that all administration costs are properly recorded. There is some leeway to classify certain administration costs as Programme; but the default is that they score as Admin. This is something your FBP can advise on.</p>	Activities will be funded through available funding in the Montreal Protocol ODA budget line secured in the SR20 settlement budget and have been approved by Ministers and the responsible SRO. The programme budget is RDEL. The end date is beyond this FY and further funding is being committed as part of the SR21 ODA settlement.	Met
Overall Assessment	Ultimately this is a personal judgment for the AO. The acid test is whether the AO can confidently defend the policy as a satisfactory use of public money. For large and complex project decisions, it would not be unusual to apply the AO tests at several stages and key decision-points.	These activities represent a good use of funding and will directly support objectives under the Montreal Protocol and a key policy for Defra.	Met

Annex P. 2022/2023 Management Delivery Plan

Governance delivery plan for 2022/2023 with key governance milestones for this year.

Timeline	Key governance activities
May 2022	ACES steering committee meet
June 2022	Quarterly delivery partner meetings with project team to discuss key milestones, risks, cost and lessons learned. Quarterly project report received from delivery bodies on reporting metrics.
July 2022	Investment Committee to agree SR21 funding
Aug 2022	Trance 1 of funding scheduled Logframe and benefits realisation plan development. ACES steering committee meet
Sept 2022	Quarterly delivery partner meetings with project team to discuss key milestones, risks, cost and lessons learned. Quarterly project report received from delivery bodies on reporting metrics.
October 2022	Informal delivery partner meetings
November 2022	ACES steering committee meet
December 2022	Quarterly delivery partner meetings with project team to discuss key milestones, risks, cost and lessons learned. Quarterly project report received from delivery bodies on reporting metrics.
January 2023	Informal delivery partner meetings
February 2023	ACES steering committee meet
March 2023	Quarterly delivery partner meetings with project team to discuss key milestones, risks, cost and lessons learned. Quarterly project report received from delivery bodies on reporting metrics.
April 2023	Informal delivery partner meetings

Critical Path to Day one Readiness (New Funding)

While these workstreams are currently established and its current funding ongoing, below we note the Critical Path to Day One Readiness to account for this Business Case, and to support the Delivery Plan for 2022/23 which is above.

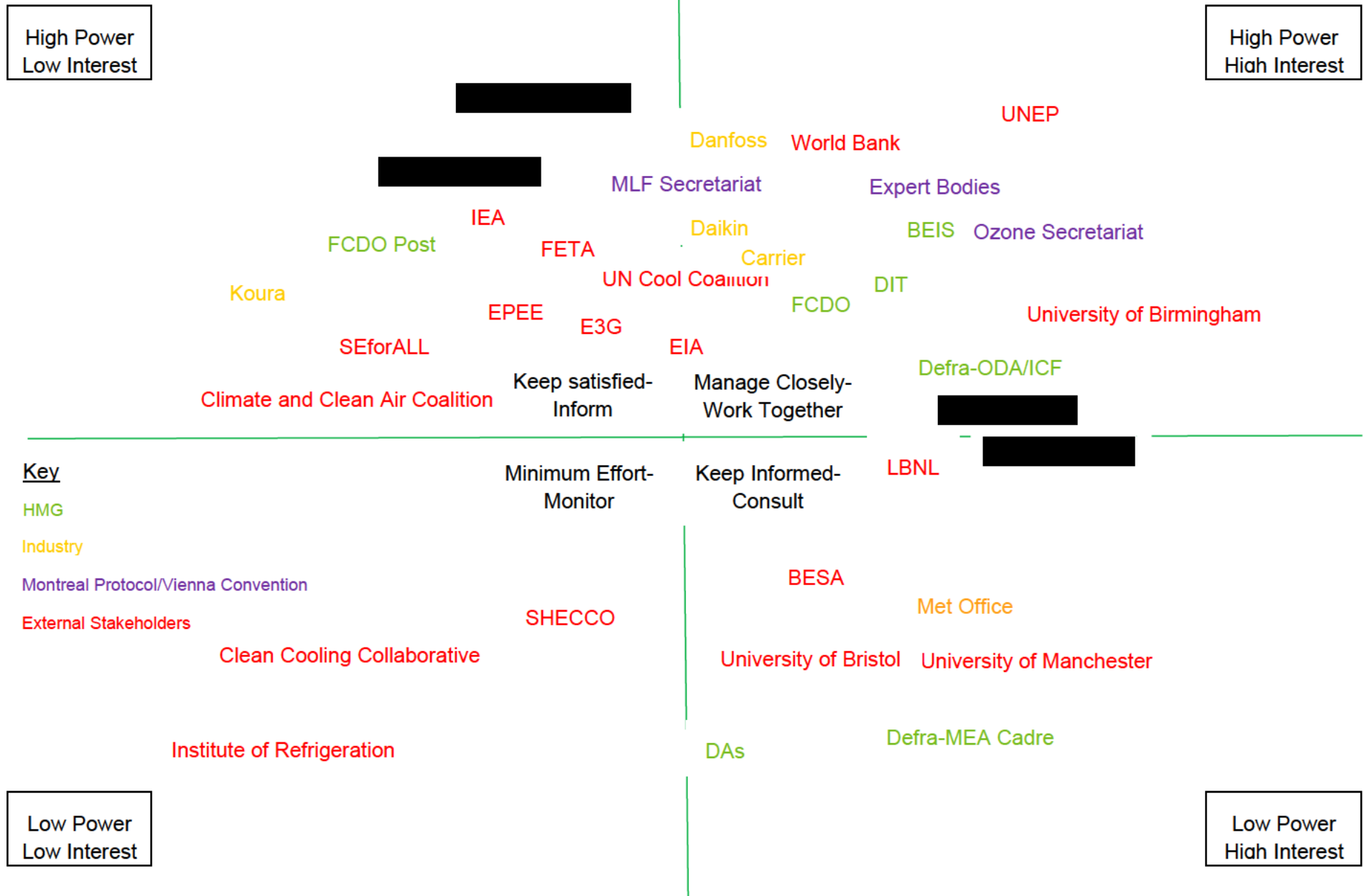
Date (2022)	Milestone
Late May/ Jun	Finalise Red Team processes
June	ODA board clearance
July	Investment Committee
August	First tranche of funding expected

Annex Q. Governance arrangements Workstream One

Governance	Remit	Frequency
In-country Director	<p>Day-to-day management of the Centre will be overseen by the in-Country Director.</p> <p>Reporting to the UR Deputy Vice-Chancellor and the ARLC. The Director is responsible for the day-to-day leadership, management and financial control of ACES. This includes overall responsibility for the economic success; scientific, teaching, learning and functional excellence, and the overall impact of the Centre.</p>	Day to day management
Steering Committee (SC)	<p>Governs ACES and evaluates progress within the context of strategic priorities. It provides overarching guidance, leadership, and authorization for critical activities</p> <p><i>Members:</i></p> <p>The Permanent Secretary of the MoE is the SC chair and the deputy vice chancellor of UR is the vice chair. Members are senior officials/leaders from their organizations</p>	Every three months
<p>National Technical Advisory Committee (NTAC)</p> <p>(more details see Annex X)</p>	<p>NTAC provides sectoral expertise on an on-going basis to facilitate effective implementation of the Centre.</p> <p>The Chair of NTAC reports to Permanent Secretary of MoE, the chair of SC. Members of the group have expertise to provide crucial inputs and ability to authorize staff time and resources to fulfil the work-plan.</p> <p><i>Members:</i></p> <p>The Director General of REMA is the NTAC Chair and Deputy Director General of REMA is the Vice Chair. Members are at the Director General or Head of Programme level from their organizations</p>	Every two months
Academic Research and Learning	<p>It provides the technical and academic expertise and will be the operating authority to set the research agenda, learning and teaching curricular, skills development strategy and overarching technical 'champion'. It has oversight for the day-to-day operations, tracking impact with the in-country Director reporting to it.</p>	Every three months

Committee (ARLC)	<p>ARLC includes academics and (through an Advisory Panel) invited industrial and technical lay experts from UK, Rwanda and beyond to provide the strategic, research and academic direction, support and sign-off on the selection of senior personnel.</p> <p>The ARLC feeds into the discussion of NTAC as a sounding board and guiding authority given its wide membership and will work closely with the Centre’s senior management team.</p> <p><i>Members:</i></p> <p>Chaired jointly by the UR Deputy Vice-Chancellor and the Director of the CSC.</p>	
Single Project Implementation Unit (SPIU) of University of Rwanda	<p>The Single Project Implementation Unit (SPIU) of University of Rwanda will be assigned to assist in the daily operational work of the Centre.</p>	<p>Day to day management</p>

Annex R. Stakeholder Map



Annex S. Key Stakeholder Biographies

Academia

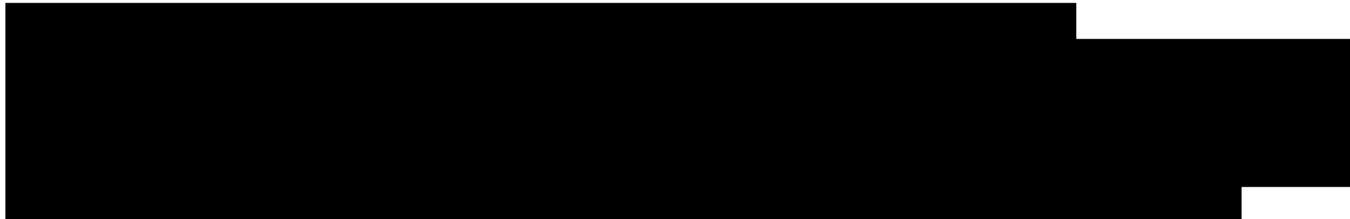
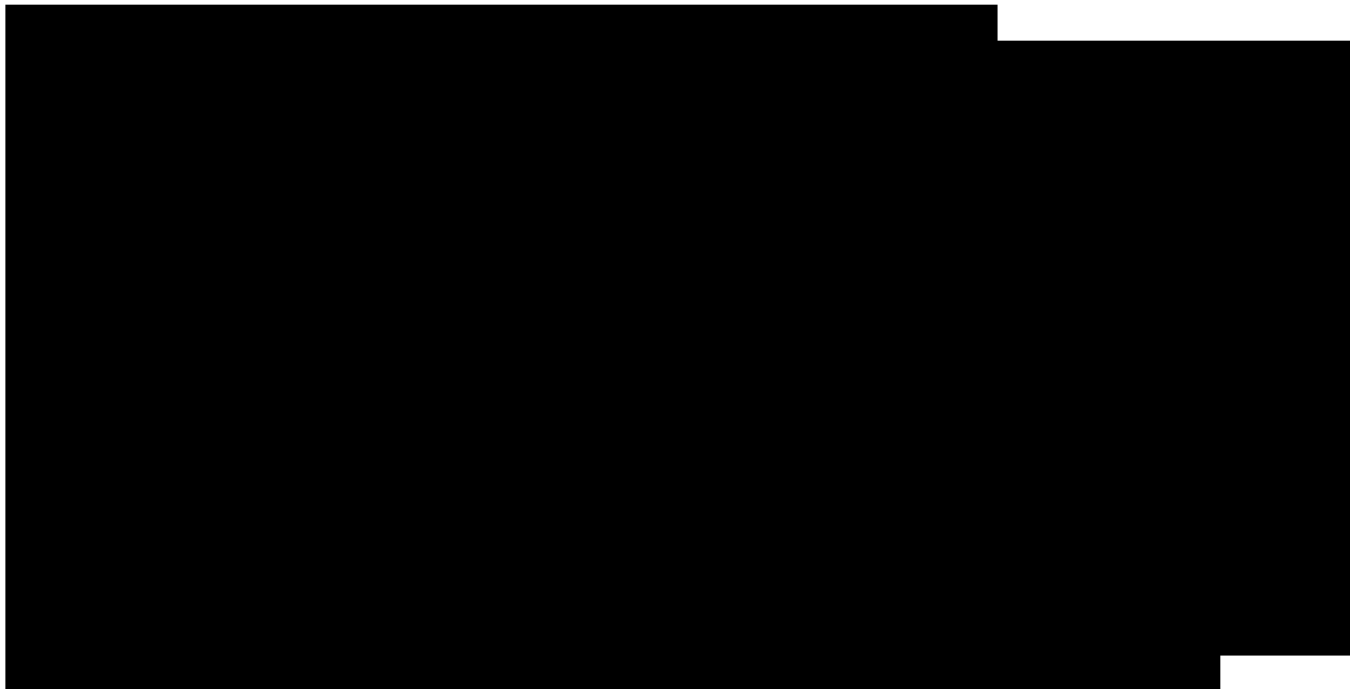
[REDACTED]

[REDACTED]

Cranfield University (Top 100 Global Universities) hosts the Plant Science Laboratory, one of the largest and best equipped postharvest research groups worldwide. Cranfield leads, together with Reading University, the UK Government funded 'Horticultural Quality and Food Loss Network'. Cranfield is also the UK Reference Centre for soil, holding national and international soils data accessible through the Land Information System and the World Soil Survey and Archive Catalogue. The Theme is also host to significant UKRI investment in infrastructure. This includes two of the four UK Government-sponsored Agri-tech Centres: Agri-Epi (Agricultural Engineering Precision Innovation Centre) and CHaP (Crop Health and Protection), where Cranfield is a key partner with over £13 million invested in new infrastructure on campus since 2017 as well as the UKCRIC Urban Observatory.

The Centre of Sustainable Road Freight (and Logistics) is a collaboration between Cambridge and Heriot-Watt Universities and organizations in the freight and logistics sectors, with a significant grant from EPSRC. It researches engineering and organizational solutions to make national and global logistics economically, socially and environmentally sustainable. The Centre has unique foundational work with its agent-based modelling work and also research looking at resilient system design against different parameters and to re-configure the distribution network to incorporate e-vehicles through the chains. It works internationally including in Africa.

In December 2019, University of Birmingham and partners launched the multi-disciplinary Centre for Sustainable Cooling that brings together a broad consortium of academic institutions from across the globe. [REDACTED], the aim of the Centre is to work collaboratively to develop new systems approaches to deliver sustainable solutions that manage growing demand for cooling whilst ensuring access to cooling for all. Systems approaches will integrate technological, policy, social, economic, energy, finance and business pathways in a developing portfolio of research projects.


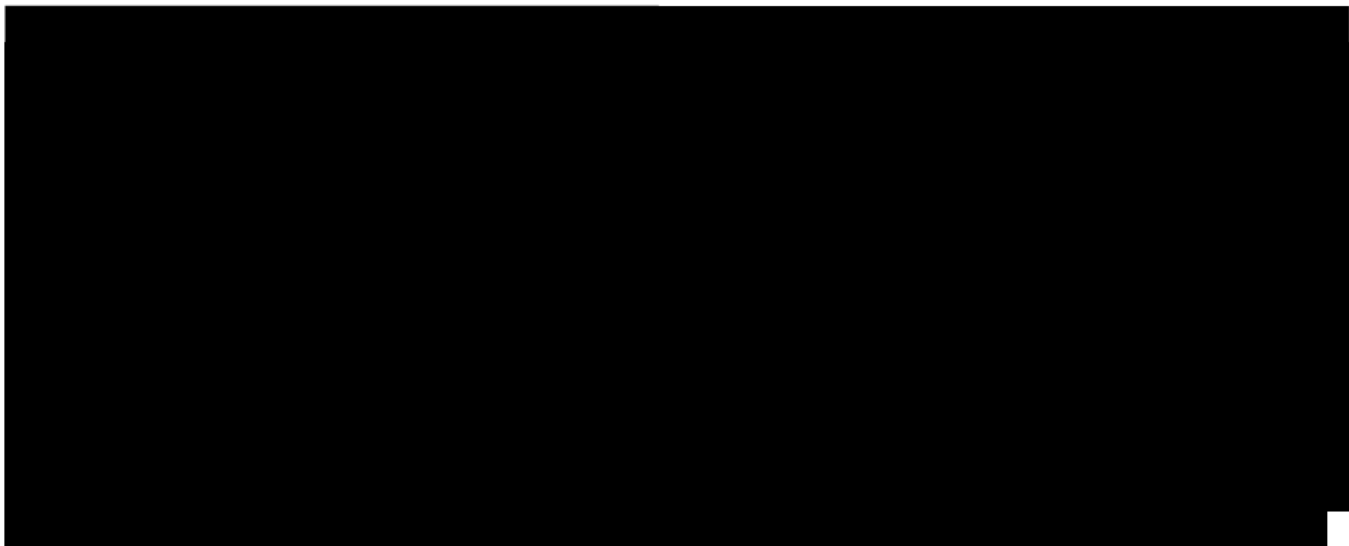


The African Centre for Technology Studies (ACTS) - Kenya

The African Centre for Technology Studies (ACTS) is a pioneering development research think tank on harnessing applications of science, technology and innovation policies for sustainable development in Africa. ACTS is an Intergovernmental organization founded in 1988 to pursue policy oriented research towards strengthening the capacity of African countries and institutions to harness science and technology for sustainable development. ACTS envisions a sustainable economic, social and environmental future for Africa, through science, technology and innovation. Article 3 of the Charter of ACTS, empowers the Organization to undertake capacity building, conduct research, provide advisory services and disseminate information on the policy aspects of the application of science and technology to sustainable development in Africa. It also requires ACTS to:

- Promote capacity building in the developing countries in the field of policy analysis related to sustainable development.
- Monitor international trends in science and technology, undertake technology assessment and forecasting and analyze the impacts of new technologies for purposes of providing policy options to African and other developing country governments.
- Promote, enhance, inspire, study and conduct the building of the institutional framework requisite for the management, assessment, sustainable utilization and conservation of natural resources.
- Foster the exchange of information and networking between the Centre and other governmental and private institutions and individuals that have similar or related interests at the local, national, regional and international levels, with particular emphasis on policy matters.
- Promote, encourage, inspire and undertake technical cooperation activities between and within nations.

Since its founding, ACTS has been instrumental in enlarging the range of policy choices for sustainable development in Africa and is rated among the leading institutions working on sustainable development in Africa.



UNEP U4E

U4E has rich experience in implementing major cooling initiatives in a variety of developing and emerging economies. Projects are conducted at the regional level, where practicable, to encourage collaboration across borders. National and local projects are also pursued based on the needs and interests of the participants. U4E has national projects in over 30 countries and regional initiatives in Southern Africa (16 countries), East Africa (6 countries), Caribbean (5 countries), Southeast Asia (10 countries). Together with regional and international partners, U4E is supporting harmonization of MEPS and labelling with regional groupings of countries. By developing policies in an aligned manner, it assists in reducing trade barriers between, reducing implementation costs (e.g. through shared testing laboratories) and sharing between countries of best practices and lessons learned on national implementation. Some examples of ongoing efforts are provided below.

Some example of projects including [ECOFRIDGES](#) in West Africa which has just launched a [Green On-Wage \(GO\)](#) financial mechanism to help make these cooling products more affordable, RCOOL& RCOOL FI in Rwanda, [ACES](#) targeting the continent of Africa, [regional harmonisation](#) of MEPS on room air conditioners and residential refrigerators (cooling products) in the East African Community (EAC) and Southern African Development Community (SADC) regions. At global level, U4E has organised global Twinning Training programme alongside OzonAction.

U4E has a suite of tools and resources to support countries with taking action with strategies, policies and projects for energy efficient lighting and appliances. The contents are developed in a consultative and collective process

with U4E partners and stakeholders, such as country officials, NGOs, academic institutions, regional energy centres, manufacturers. The tools and resources are used by U4E and many other organizations and consultants. Some examples tools and resources include:

- 150+ Country Savings Assessments identify energy and GHG mitigation opportunities for all [developing & emerging economies](#) available in English, Spanish and French. The reports have been released in 2015, 2017, 2019 and 2020.
- 5 Policy Guides on how to conduct comprehensive market transformation projects, including for [refrigerators](#) (English, Spanish, Arabic), [air conditioners](#) (English)
- 5 Model Regulations Guidelines, including for [Air Conditioners](#) (English, Spanish, French, Portuguese, Chinese), [Refrigerators](#) (English, Spanish, French, Portuguese, Chinese) with minimum energy performance standards and refrigerant GWP limits for cooling products; aiming for regional harmonization by deploying across Africa, and beyond.
- 4 Product Registration Guidance Notes along with a Prototype Product Registration, all available [here](#).
- 1 [Manual](#) of Financing Mechanisms and Business Models for Energy Efficiency with case studies from around the world on best practices to follow.
- 3 Practical Guides to complement the Model Regulation Guidelines on 1) Protocols to Conduct Market and Impact Assessments 2) Energy Labelling for Refrigerating Appliances and Room Air Conditioners 3) Ensuring Compliance with MEPS and Energy Labels.
- [SPP Toolkit](#) for Lighting, Appliances and Equipment.

Additional upcoming tools and resources to be released, including:

- Model Regulation Guidelines for additional scope of products – 1) Linear Lamps 2) Commercial Refrigeration.
- 3 Sustainable Public Procurement Guidelines for lighting, air conditioning and refrigeration.



[Redacted]

Rwanda In-country research team leaders

[Redacted]

[Redacted]

Cold-chain and Logistics Experts

[Redacted]

[Redacted]

Professor Judith Evans, London South Bank University

[Redacted]

[Redacted]

[Redacted]

Agriculture and Post-harvest Management advisory experts

[Redacted]

[REDACTED]

[REDACTED]

[REDACTED]

Annex T. Benefits Realisation Strategy

Benefits realisation responsibilities outlined below. These will be developed further in developing the benefits realisation plan.

Key Area	Project team	ODA team	Delivery Partners	ACES Steering Committee
Governance arrangements	Oversees overall benefits realisation at project level and works with delivery partner to support it's development.	Reviews project level MEL plans, logframes and benefits realisation (how often).	Plan and model potential project benefits along with MEL.	
Monitoring and reporting of benefits	Reviews quarterly evaluation reports to ensure benefits realisation on track. Reviews and publishes logframe, including benefits realisation.	Reviews programme level report and programme logframes. Receives annual synthesis report, and makes recommendations to Defra on benefits realisation.	Tracks benefit Reports benefits against the agreed project-level MEL framework. Reports benefits quarterly, annually and end of Business Case cycle. Updates programme logframe, including benefits realisation as needed but at least quarterly.	Review progress against agreed benefits.