ERM

SCOPE 3 PEER GROUP

EigenVentures

Unlocking Demand for Biobased Solvents in Pharma

MAY 2026

MARKET FORMING INTERVENTIONS FOR LOW-CARBON AND RESOURCE EFFICIENT INNOVATIONS

Sustainability is our business

UKRI Innovate UK

Contents

This project addresses the need to accelerate market uptake of low carbon and resource efficient innovations

- The UK is home to a **fertile innovative ecosystem,** resulting in a wide range of novel **low-carbon, resource- efficient** materials, products and circular business models across many industry sectors.
- However, innovators face **economic, technical and organisational barriers**, reinforced by weak market demand and limited market-forming support.
- **Without targeted interventions** to stimulate demand, de-risk investment and align supply chains, high-potential innovations will not commercialise.
- Innovate UK (UKRI) and DESNZ funded this project to identify **market-forming interventions (MFIs)** for the **automotive, chemicals and built environment** sectors.
- The project builds on existing research to define MFIs that drive growth, unlock private capital, enhance competitiveness and strengthen supply-chain resilience while supporting a **net-zero, circular economy**.
- The work was delivered by a combined consulting team between **October 2025 and March 2026.**

- **This report presents the findings of the project. The views and recommendations expressed are those of the authors and do not reflect official policy or government position.**
- This report concentrates on the **chemicals sector**, specifically addressing strategies to promote the adoption **of biobased solvents** within the **pharmaceutical supply chain**.
- The project involved comprehensive stakeholder engagement; however, no individual stakeholders are identified or attributed within the report.

This report has been prepared by:

ERM EigenVentures SCOPE 3 PEER GROUP

Funded by:

UKRI Department for Energy Security & Net Zero

The project was delivered in four distinct phases, with stakeholder engagement throughout, resulting in Market Forming Interventions

Project approach

This project was delivered in four distinct phases:

1. **Sectoral analysis and targeting** – prioritisation of innovative product, or service for intervention design within the sector. Identification of demand-side barriers for selected innovation.
2. **Defining Market Forming Intervention (MFI) types and enablers** – development of an "MFI toolkit" and understanding of suitability of MFIs to address different demand-side barriers
3. **MFI and enabler prioritisation** – shortlisting of suitable MFIs/enablers for design
4. **MFI and enabler design** – development of MFI/enabler design brief

Stakeholder engagement was critical throughout each phase of the project.

What is an MFI?

Within the context of this project, an MFI is defined as a potential demand-side measure that seeks to accelerates the adoption of novel or replacement technologies or business models to reduce carbon emissions.

What are demand-side barriers?

When considering innovative materials, technologies or services, there are often significant barriers associated with supply-side (e.g. technology readiness etc.). However, demand is not always forthcoming, even for innovations that are market-ready. This project focussed on unlocking **demand-side** barriers which have been categorised as:

- **Standards:** inability to describe in quantifiable and verifiable terms the innovation.
- **Value Perception:** Lack of regulation/policy incentives; too high a price premium; lack of quantifiable non-financial benefits.
- **Demand Delivery Ecosystem:** Lack of necessary physical/technology infrastructure.
- **Disincentives:** Existing regulation, concerns on technology lock-in.

Please refer to Appendix A1 for more details.

Biobased solvents in pharmaceuticals emerged as the most promising value chain for targeted market support within the chemicals sector

- Five chemical innovation areas were assessed: **Defossilisation, inorganic e-chemicals, industrial symbiosis, new formulations (green chemistry), and Chemicals as a Service**.
- Across these areas, widespread economic barriers – particularly for bulk commodities – were found to limit the effectiveness of market interventions. This highlighted the need to focus on end-uses with higher tolerance for cost premiums.
- The **pharmaceutical sector** was identified as a strong candidate, with sound understanding in environmental impacts, high importance of raw materials to Scope 3 GHGs, and an established track record of mitigation efforts.
- **Solvents account for over 90% of scope 3 emissions** for pharmaceutical companies, making them a material leverage point for decarbonisation. Two defossilisation pathways are possible: **drop-in** (defossilisation)and **green solvents** enabled through new formulations. *Solvent reduction and recycling were excluded as these should be prioritised in line with circularity principles.*
- In principle, drop-in **biobased solvents**[1] can substitute existing fossil solvents within existing medicine portfolios. The need for these medicines and as such existing solvents is expected to remain due to long commercial production timelines and high regulatory barriers around solvent switching.
- Significant demand-side barriers currently limit scale-up and adoption of innovative biobased solvent production. **This report sets out options to address these barriers and unlock demand.**

1. Definition

In this report, biobased solvents are defined as **drop-in biobased solvents** that contain biogenic carbon.

Production could be from both solid biomass or captured biogenic CO_2.

Food and feed crops are not considered as feedstocks.

Mass balanced/bio-attributed and segregated/dedicated biobased solvents are included.

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The following low carbon and resource efficient innovation areas were evaluated in the UK Chemicals Sector

Innovation areas evaluated

Innovation Areas	Examples
Defossilisation: Carbon Capture and Use (CCU)	Production of organic chemicals (biogenic or recycled carbon) from CO2 plus H2 and/or other feedstocks *e.g. methanol*
Defossilisation: Plastics recycling	Chemical recycling covering different technology types *e.g. pyrolysis, hydrothermal liquefaction, dissolution*
Defossilisation: Biochemicals	Production of chemicals from solid biomass via multiple pathways *e.g. biomass gasification*
Inorganic e-Chemicals	An inorganic chemical whose primary synthesis step is driven by electricity *e.g. 'green' ammonia made from 'green' H2*
Industrial Symbiosis	Use of energy or waste feedstocks from one facility as inputs to another *e.g. biogas from fermentation used as a fuel*
New Formulations	Development of new chemical formulations with lower environmental impacts *e.g. water vs solvent-based coatings*
Chemicals-as-a-Service (CaaS)	Companies shift from selling chemical products by volume to providing chemical-related services based on performance, usage, or outcomes *e.g. solvents, coatings*

Each innovation area was scored and benchmarked against evaluation criteria of a Prioritisation Framework

Scoring used a 5-point scale with 5 being most suitable for intervention targeted and 1 being the least suitable for MFI formation

Innovation Areas	Environmental Factors		Market Factors			Economic Factors				Innovation Factors		
	Carbon reduction potential	Energy and/or Material efficiency gains	Policy and standards alignment	Impact on UK sector resilience	Stakeholder appetite, demand signals and domestic scale for MFI	Investment mobilisation potential	Market size and growth potential - domestic and export	Cost-saving potential	UK Job creation and skills development potential	UK innovation availability, maturity and scalability	Perceived innovator barriers to scale	Existing incentive structures for MFIs
Defossilisation: Carbon Capture and Use (CCU)	5	3	5	4	4	4	4	1	4	4	4	1
Defossilisation: Plastics recycling	3	4	4	4	2	3	4	2	4	3	4	3
Defossilisation: Biochemicals	4	4	2	4	4	3	4	2	3	4	3	1
Inorganic e-Chemicals	4	3	3	4	4	4	4	1	4	3	4	1
Industrial Symbiosis	4		2		2		3					
New Formulations	3		4		3		3					
Chemicals-as-a-Service (CaaS)	3		3		2		4					

Non-negotiables **Deprioritised after 1st round of analysis**

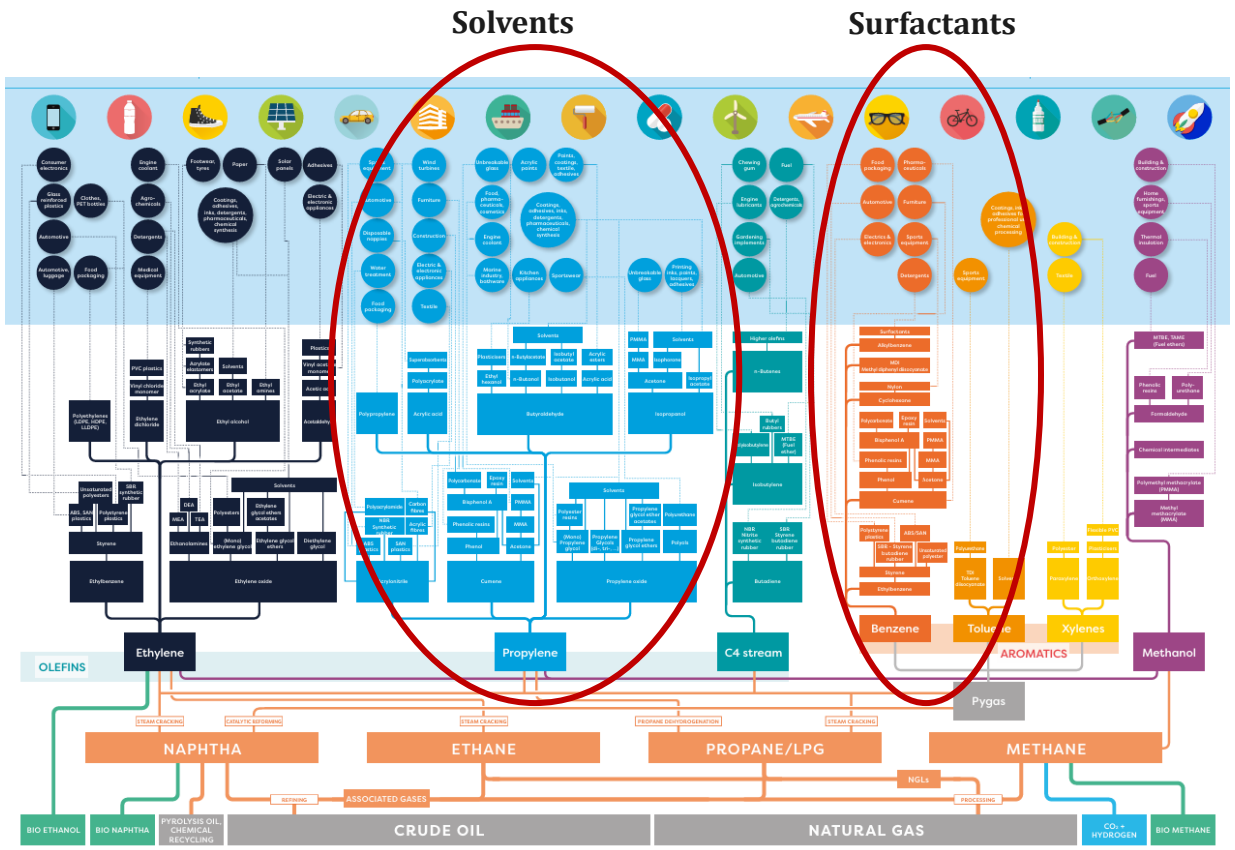
Defossilisation through CCU and biochemicals scored highest in the prioritisation, but advanced plastic recycling was also carried through to initial sector assessment* owing to abundance of domestic plastic waste available as a feedstock

Innovation Areas	Ranking	Conclusions on Prioritisation for MFI Development	Innovation Types (products/materials/models)
Defossilisation: Carbon Capture and Use (CCU)	H	• Offers significant carbon reduction potential for hard-to-abate sectors and aligns strongly with UK policy and industrial strategy. • Scaling feasible with incentives despite high capital cost, as it is seen there will be clear long-term strategic value	• Use carbon credits to capture and distribute CO_2 (Store CO_2) • Enhanced rock weathering innovators - but needs huge quantities • CO_2 to chemicals companies (such as CCm) • E-fuels using CO_2 feedstocks (such as Arcadia efuels)
Defossilisation: Biochemicals	H	• Has the ability to substitute petrochemical feedstocks and diversify supply chains, improving resilience and reducing lifecycle emissions. • Scalability is constrained by feedstock availability, higher costs, and limited incentives, making growth slower than CCU.	• SAF production from biobased feedstocks (e.g. Lanzajet) • biobased polymers from plants • Waste-biomass to biochemicals • Waste biomass pyrolysis for power generation
Defossilisation: Advanced Plastic Recycling	M	• Supports circular economy goals and job creation, but its carbon reduction impact and investment attractiveness are moderate compared to CCU and biochemicals. • Barriers such as contamination, collection inefficiencies, and limited offtake willingness reduce its scalability despite regulatory support.	• PVC recycling technology, although off takers are limited (e.g. Halocycle) • Waste packaging to hydrocarbons technology (e.g. Mura ELP) • UKRI circular plastics network • Protos plastic park, aimed for large scale plastic recycling (although no investors found yet)
Inorganic e-Chemicals	M	• While these have strong decarbonisation potential and global interest, UK-specific infrastructure and incentives are lacking. • High dependency on renewable energy costs and technology readiness challenges limit near-term feasibility compared to other innovation areas.	• Green ammonia technology development across a variety of small companies

ERM *See Appendix for approach

Following initial assessment, the best opportunity was deemed to be biobased and/or CCU technologies and materials.

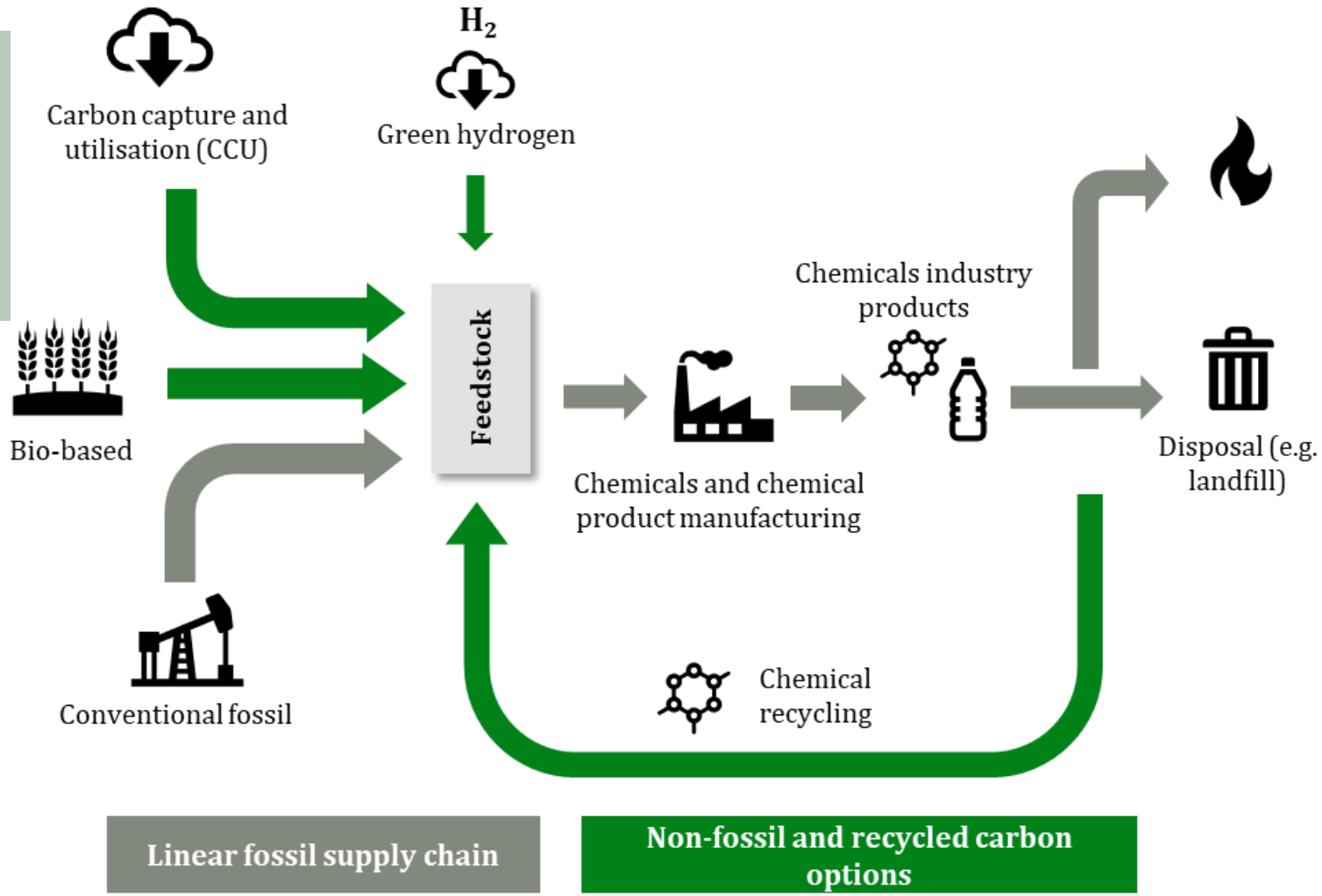
- The petrochemical sector underpins the UK economy, with petrochemicals embedded in ~95% of manufactured goods, from medicines and consumer products to packaging and advanced materials.
- Defossilisation is highly challenging at a system level. While progress is being made in selected value chains (e.g. fuels), large parts of the sector remain difficult to decarbonise and largely untouched by current interventions.
- **Solvents and surfactants** represent priority value chains. They are critical inputs across multiple end-use sectors but are characterised by high complexity, fragmentation and diversity, creating significant barriers to substitution.
- Biobased and CCU technologies offer the most credible near- to mid-term pathways to reduce fossil dependence in these value chains, while maintaining functional performance and regulatory compliance.
- **These value chains are already anchored in the UK**, with major downstream users and formulators such as Unilever, P&G, GSK and Croda, providing a strong foundation for market-forming intervention and domestic scale-up.



Source: Petrochemicals Europe, 2023 [Link]
Note: the aim of this figure is to highlight the complexity of the petrochemical sector, refer to the above link for a readable version.

Biobased materials like solvents and surfactants can be produced from solid biomass or CCU

Biobased materials could be produced from solid biomass or captured biogenic CO_2



Biobased solvents for pharmaceuticals were prioritised as the most suitable innovation for MFI design in the UK

Surfactants

Description:

- Biobased surfactants are produced from non-food/feed biomass and/or biogenic CO_2 and result in significant lifecycle GHG savings.

Drivers/Strengths:

- Support for Scope 3 emissions reduction, with growing demand from both UK and international companies aiming for net zero goals.
- Consumer preference for natural ingredients
- Compliance with ecolabel requirements
- In some cases, superior performance compared to fossil alternatives.

Solvents

Description:

- Biobased solvents produced from non-food/feed biomass or biogenic CO_2 that can replace conventional fossil solvents and result in significant lifecycle GHG emissions savings.

Drivers/Strengths:

- Need to reduce Scope 3 emissions (especially in pharma), meeting customer requirements for lower carbon footprints
- Align with industrial strategies and healthcare procurement standards (such as in the NHS)
- Growing international market opportunities through partnerships and expanding applications

Overall, **solvents has been recommended as the innovation area for MFI design**, over surfactants and advanced plastics. This is largely because there is a path to market within the **pharmaceuticals sector** which is not as sensitive to the wider industry barriers, in addition to there being a clear customer (pharma companies) and GHG reduction potential.

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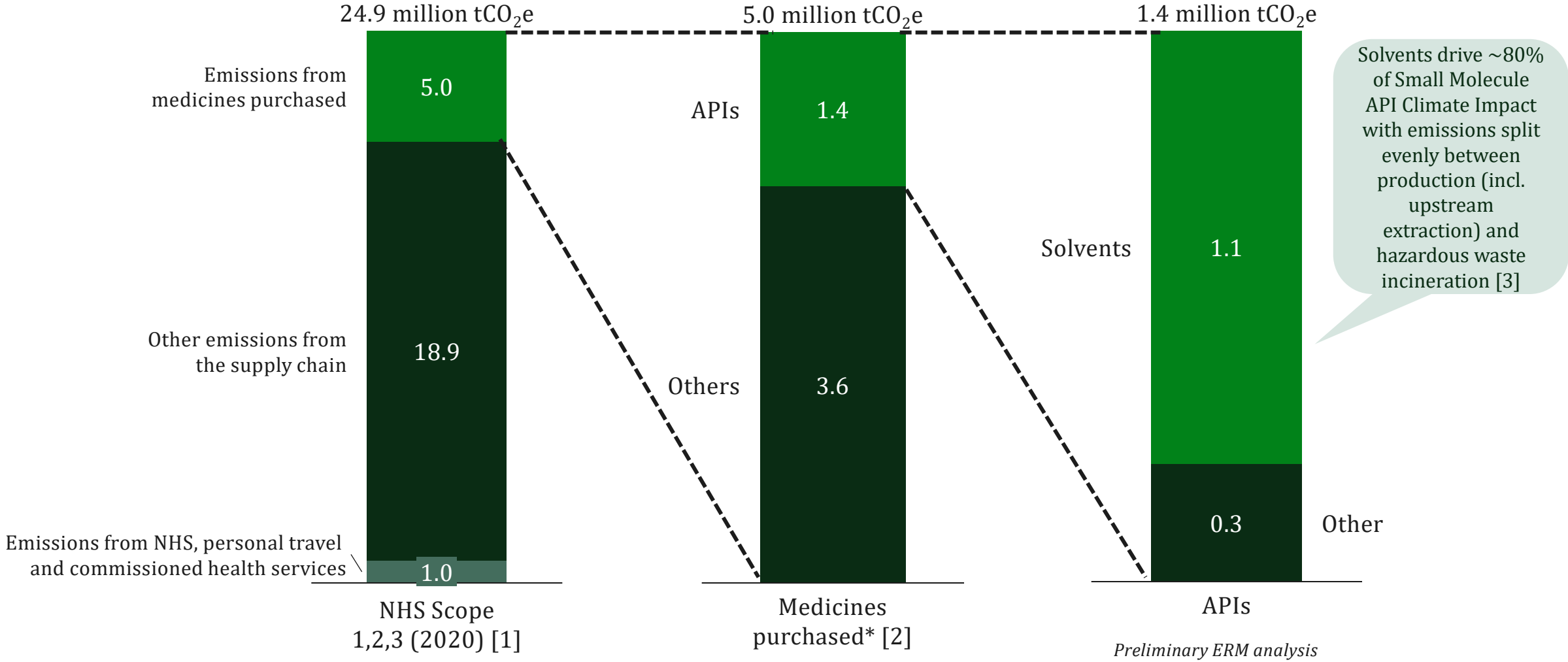
Solvents account for ~5% of NHS's Scope 1-3 emissions

Solvents play a crucial role in the medicine manufacturing process, including in the production of Active Pharmaceutical Ingr edients (APIs). 90% of pharmaceutical drugs are small molecule APIs.



Preliminary ERM analysis

*Including APIs, excipients, packaging production, transport and medicine manufacturing

[1] Delivering a 'Net Zero' National Health Service– Link [2] Piffoux et al., 2024 – Link [3] ERM prior project knowledge in multiple LCAs

Biobased solvents could help pharmaceutical companies target their Scope 3 emissions, paving a way to NHS' 2045 Net Zero

What is the innovation being demanded?

- **Solvents** are used across **many key pharmaceutical processes** including in drug and Active Pharmaceutical Ingredients (API) synthesis, extraction and purification, crystallisation, formulation, coating, cleaning etc.
- These solvents often have much more **stringent quality requirements** vs. wider solvent industry on purity and contaminants. The higher quality specifications lead to higher processing requirements and a premium on the product price.
- (Non food/feed) **Biobased solvents derived from solid biomass or carbon capture and utilisation (CCU)** offer a **unique drop-in alternative** which can yield significantly lower lifecycle GHG emissions (> 60% saving)[1]
- Today, key biobased solvents which are used in relatively high volumes by the pharmaceutical sector are ethanol, 2-methyltetrahydrofuran and mass-balanced acetonitrile. However, there are many others being explored.

Why is there demand?

- The largest customer of the pharmaceutical sector is healthcare, which has recognised climate change as a direct threat to **global public health**.
- **About 90% of pharmaceutical companies' emissions are Scope 3** – a majority of which related to upstream purchased good and services. Major companies have ambitious **GHG reduction targets**.
- There is increasing pressure for decarbonised products through the **NHS sustainable procurement requirements and 2045 Net Zero goals** the first national health system to do so.

Why should this innovation be supported in the UK?

- The ultimate end user of the product is **the government via the NHS**. 100% uptake of biobased solvents within the NHS supply chains could reduce emissions by ~ 0.7 $MtCO_2e$
- **There are ongoing concerns** with the UK chemical industry due to uncompetitiveness caused by lack of raw material and energy advantage as well a slowdown in global demand. Pharma solvents represent an opportunity to bring chemical manufacturing to the UK and a potential for recovery in economic output and jobs from the sector.
- The **UK has innovative technologies** that can be supported, from fermentation, CCU and to membrane tech. There is **potential for new intellectual capital** and the **export opportunities** that come with this (e.g. via licensing catalyst and process technology).
- Potential opportunity to **expand designed initiative** into other solvent sectors and/or tangential materials e.g. surfactants.

[1] Celtic Renewables, 2025. Celtic Renewables: A Low-Carbon Solution for the Future of Grangemouth | Celtic Renewables

There are several key supply-side innovators in the UK, and a high number of end-users across the pharmaceutical space

	Ethanol	Methanol	C6/C7 Alkanes	Acetone	Butanol	Acetonitrile
UK Product Innovators	Flue2CHEM, ensus	JM	OXCCU	Celtic Renewables	Celtic Renewables	University of Leeds, INEOS
biobased Route TRL	TRL 6: CO_2 to ethanol TRL 9: feed crops	TRL 7-8: e-methanol	TRL 6 – 7: SAF by-product	TRL 9: Fermentation	TRL 9: Fermentation	TRL 4: on-purpose TRL 9: mass balancing (INEOS)
Commercial UK production	ensus Not pharma grade	✖	✖	✖	✖	✖

UK solvent suppliers such as BASF are key to the landscape but import most volumes currently

Key UK Consumers

CRODA, GSK, AstraZeneca, ipca | onyx scientific, honeyman GROUP, TM, FUJIFILM Diosynth biotechnologies, Piramal, Quantum Pharmaceutical, Dechra

Based on 2022 data[1] from the UK government there are ~160 CROs and CMOs in the UK with turnover greater than £5M

UK contract manufacturing/research organisations (CMROs) are key consumers of solvents acting on behalf of major pharmaceutical companies

System / platform innovators

EXACTMER, cpi

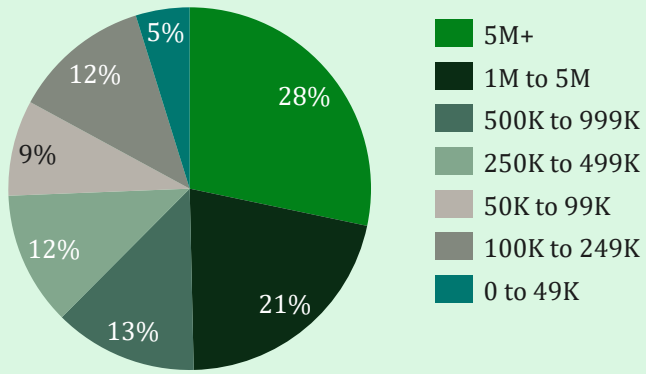
Other Opportunities

- Isopropyl alcohol
- Acetates
- Cyrene
- Tetrahydrofuran
- Aromatics
- Methylene chloride

[1] Bioscience and Health Technology Statistics, 2022 [Link]

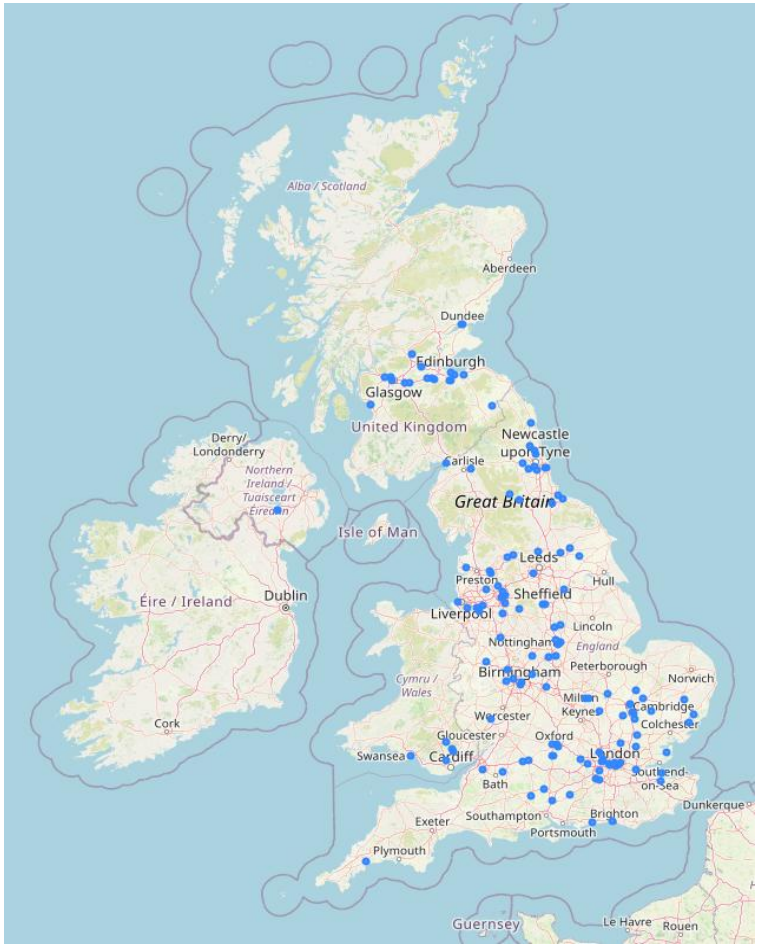
CMROs are vital to the pharmaceutical supply chain, producing an estimated yearly revenue of £2 billion

Breakdown in UK CMRO GBP turnover by magnitude in 2022[1]

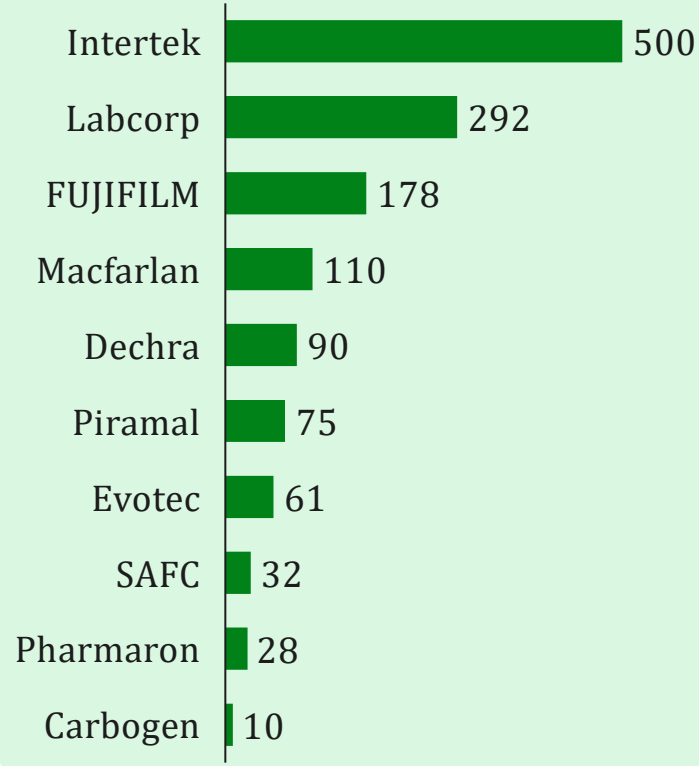


- Contract Manufacturing/Research Organisations (CMROs) provide development and manufacturing services for pharmaceutical drugs
- These companies act on behalf of the major pharmaceutical companies such as AstraZeneca, GSK and Merck.
- These are the key companies that are procuring solvents and other pharmaceutical ingredients although the multinational pharma companies are dictating the drugs and therefore the demand for their ingredients.

Location of CMROs with a turnover greater than £5 million in the UK[1]



Top 10 CMROs in terms of UK turnover estimate in 2022[1,2]



[1] Bioscience and Health Technology Statistics, 2022 [Link]
[2] Based on publicly available information – some companies may not publish this data and have not been considered

After speaking with pharma stakeholders, the following list of solvents with high GHG impact were identified for consideration

We have spoken to over **20 stakeholders** across the medicines manufacturing supply chain, including:

Pharmaceutical manufacturers

Research organisations

Chemicals producers

Coordinators and associations

High GHG solvents identified – **bold** highlighting solvents used by multiple manufacturers:

- **Isopropyl alcohol (IPA)**
- **Isopropyl acetate**
- **Ethanol**
- **Methanol**
- **Acetonitrile**
- **Tetrahydrofuran (THF)**
- **Dichloromethane (DCM)**
- **Acetone**
- **Hexane (could be replaced with heptane)**
- Toluene
- Ethyl acetate
- Methyl isobutyl ketone (MIBK)

There are existing direct and indirect interventions supporting biobased solvents in the UK, mainly focussed on supply-side initiatives…

Interventions	biobased or CCU Solvents
Direct	• Direct support is primarily through innovation funding and standards development. Innovate UK programmes (such as Sustainable biobased Materials & Manufacture and Sustainable Medicines Manufacturing and the Medicines Discovery Catapult) fund R&D and demonstration of greener solvent technologies, including biobased and CO_2-derived options. Clear standards exist: BS EN 16766:2017 provides recognised technical criteria for biobased solvents, enabling comparability, certification, and future procurement alignment.
Indirect	• Most UK interventions relevant to biobased or CCU solvents are indirect. Regulatory frameworks (Solvent Emissions Regulations, UK REACH, VOC limits) and carbon/energy pricing instruments (UK ETS, Climate Change Levy) increase the compliance and cost burden on fossil-based, hazardous, or VOC-intensive solvents. • Generic tax incentives (R&D tax relief, full expensing) and guarantee schemes (growth guarantees, UK Export Finance) support investment in low-carbon manufacturing and are accessible but not targeted at pharmaceutical raw materials. Blended-finance vehicles such as the National Wealth Fund may also be accessible for capital-intensive facilities where aligned with net-zero priorities.
Gaps/Emerging	• Public procurement frameworks encourage safer and lower-impact chemicals but stop short of specifying biobased or CCU solvents. For example, the NHS sustainable procurement requirements and 2040 net zero target is driving demand for decarbonised products (e.g. from 2028 new requirements will be introduced overseeing the provision of carbon footprinting for individual products supplied to the NHS). • The UK has no dedicated demand-creation instruments for biobased or CCU solvents or price support or guarantee mechanisms. • Lacking targeted deployment incentives to guarantee long-term market scale-up for biobased or CO_2-derived solvents.

… but these are not enough to overcome the lack of transparency and data, which are fundamental barriers to scale up

Value perception

- While there is a desire to procure biobased solvents, the overall cost (material input and processing) are often multiples higher than for conventional fossil solvents, stemming from feedstock and energy costs as well as limited economies of scale.
- Carbon savings are not sufficiently costed into decision-making by buyers to counterbalance these higher costs.
- There is a technology risk as most biobased solvents are not yet produced at scale; pharmaceutical companies are risk adverse.

Quality

- The pharmaceutical sector has stringent purity requirements for solvents which must be met. The process to change these is both length and costly.
- There is uncertainty in whether impurities present in the biobased alternatives need new tests for characterisation, hence combined with the above results in hesitancy to switch to biobased solvents.

Lack of transparency

- There are several different high GHG solvents used across medicines manufacturing supply chains. The status of biobased alternatives is not homogenous across the different types.
- There is a lack of transparency from both suppliers and end customers as to what is needed.

(A) For suppliers to reach FID e.g. volume of offtake, duration of offtake etc.

(B) What pharma companies are willing to pay for carbon reduction, and for what solvent in what quantities.

- Differing opinions and approaches to mass balance can also significantly impact the above

ERM See Appendix A3 for more details on identified barriers, as surfaced through literature review and stakeholder engagement.

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Establishing a sector "Clean Room" is an opportunity to unlock demand for biobased solvents in medicines

While biobased solvents do face a current price premium with limited and fragmented supply, opaque demand signals present the key near-term challenge in scaling up supply.

A **Clean Room** provides a secure, neutral mechanism for sharing sensitive data – without exposing raw proprietary information - to improve market transparency and enable coordinated action. The **objectives** of the Clean Room are to:

1. **Improve transparency** of future **solvent requirements** (volumes, specifications, delivery constraints, willingness to pay etc.) across pharmaceutical/ medicine value chains.
2. Enable **demand-supply matching**, thus strengthening demand signals for suppliers of biobased solvents.
3. **De-risk investment** and **unlock offtake** by increasing certainty on pipeline demand delivery requirements, potentially through supporting bilateral contracting between Clean Room stakeholders.
4. **Identify** any additional government **MFIs** required through the use of aggregated insights. Multiple interventions could address the barriers to scaling biobased solvents, but selecting the right approach requires business-confidential data.

A Clean Room approach has specifically been selected as:

- Competition and confidentiality constraints mean data sharing needs a secure, neutral, and controlled process, so participants can collaborate without exposing raw proprietary information.
- It can provide this mechanism and create a stronger, more investable demand signal for UK supply.
- Organisations such as the Centre for Green Market Activation (GMA) are examples of entities who have utilised a "**clean room process**" to allow for the safe and secure sharing of data from competitors and their suppliers to implement some type of **"buying" action**, e.g. a Buyers Alliance or H2Global, at a global level.

The Clean Room approach is proposed as a standalone programme, for a finite period of time, but could be run at periodic intervals, e.g. every 2 years, if it is seen as critical for unlocking future demand.

Outcomes and impact: the Clean Room aims to unlocks UK demand for low-GHG biobased solvents and enables value creation from UK innovation

Outcomes

Demand transparency: Clarify future solvent needs

- Build shared value chain alignment
- Improve transparency on future solvent requirements across medicines value chains
- Create a shared, trusted view of pipeline solvent demand, reducing ambiguity and information asymmetry between buyers and suppliers.

Biobased solvent uptake: Accelerate demand

- Enable structured demand–supply matching by aggregating and validating requirements across participants.
- Strengthen demand signals to suppliers, supporting earlier project development decisions and more targeted scale-up.
- Support offtake creation, including potential facilitation of bilateral contracting between Clean Room participants where appropriate.

Interventions: Inform future policy

- Use aggregated insights to identify additional MFIs to further unlock and accelerate market uptake.
- Target policy, procurement and innovation support interventions to where they will have the greatest impact.

Impact

Biobased solvent market creation

A new UK demand centre for biobased solvents or low carbon medicines, created through clearer demand signals and reduced market risk, encouraging UK onshore solvent/medicines production and scale-up.

Reduced solvent supply chain emissions

Greater uptake of lower-GHG biobased solvents produced in the UK* reduces emissions from fossil solvent use and lowers embodied emissions associated with imports.

*This could also be achieved through UK IP exploitation with commitment to serve UK market.

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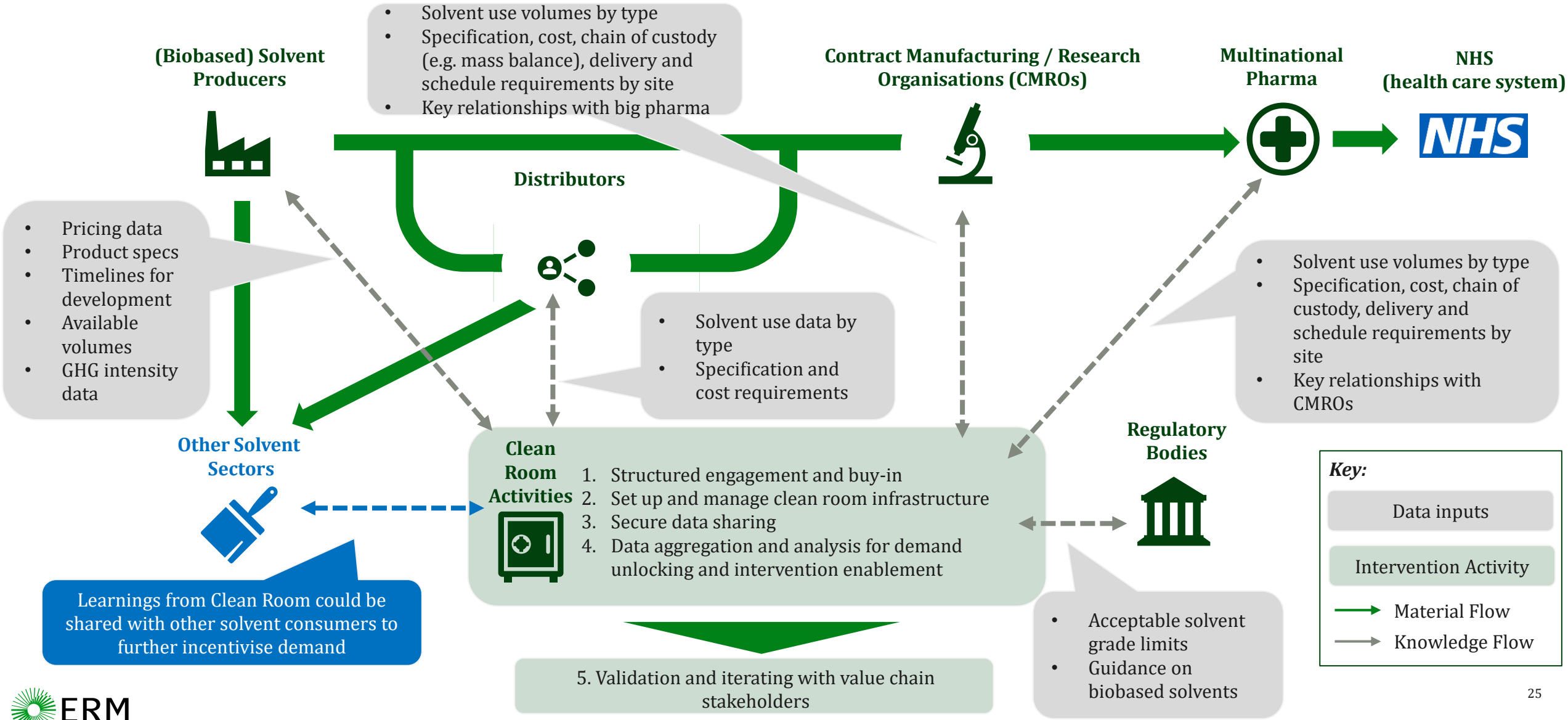
The Clean Room end-state delivers market certainty by clarifying supply potential, future demand and willingness to pay



A1: Structured engagement and buy in – critical to the success of the Clean Room

OUTCOME OBJECTIVE Establish a secure Clean Room to drive coordinated market interventions for biobased solvent uptake in the pharmaceutical sector through data sharing and analysis.

Proposed Activities

A.1: Structured engagement and buy-in

1. Map out key stakeholders
2. Devise engagement plan
3. Conduct interviews with stakeholders

A.1 Proposed Requirements

- Identify and prioritise key stakeholders across the value chain based on influence, interest, and decision-making role.
  - Recommend to focus on NHS strategic suppliers (~8 medicine suppliers), with these companies initially managing CMRO use. This will encompass both generic and innovative suppliers. Include key existing UK solvent suppliers (e.g. BASF) and both UK and non-UK biobased solvent suppliers.
- Develop a targeted engagement plan outlining purpose, messaging, timing, and engagement format for each stakeholder group. This should include case studies of potential government support that could be realised through engagement in the Clean Room.
- Conduct structured interviews (2 per organisation) to gather insights on priorities, constraints, and views on proposed approaches, including quantification of the "value of carbon".
- Commence NDA (or equivalent) procedure as appropriate with each stakeholder.
- Capture and synthesise feedback to identify common themes, risks, and opportunities for alignment.
- Use insights to refine the approach and build early alignment and commitment.

A.1 Activity Outputs

Stakeholder map, engagement plan and interview material

- Stakeholder map and engagement plan covering full value chain, including roles, influence and decision-making relevance (at least 8 NHS suppliers included)
- Structured stakeholder interviews (2 per organisation) and engagement materials: interview guides, briefing packs, case-studies used consistently across engagements

Agreement of stakeholders to participate in Clean Room

- Legally sound agreements to participate, e.g. through NDAs

Interview outcomes and steering reports

- Synthetised themes, risks and alignment opportunities
- Steering Group materials and records

A2: Set up and manage Clean Room infrastructure

OUTCOME OBJECTIVE Establish a secure Clean Room to drive coordinated market interventions for biobased solvent uptake in the pharmaceutical sector through data sharing and analysis.

Proposed Activities	A.2 Proposed Activity Requirements	A.2 Activity Outputs
A.2: Set up and manage Clean Room infrastructure 1. Research into available software 2. Confirm stakeholder requirements 3. Set up and manage Clean Room	• Define the purpose, scope, and governance requirements for the Clean Room, including data types, access controls, and usage rules. Facilitator should engage legal counsel to understand best practices and ensure compliance. • Confirm stakeholder requirements, including confidentiality constraints, reporting needs, and technical capabilities. • Assess available Clean Room software solutions against agreed functional, security, encryption and compliance criteria. • Implement and manage the Clean Room, including onboarding users, maintaining governance, and overseeing ongoing operation.	**Clean Room infrastructure with agreed rules and governance** • Defined Clean Room scope and governance framework • Assessed and selected Clean Room solution • Operational Clean Room infrastructure configured with agreed access controls, encryption governance processes and onboarding procedures • Data privacy and legal assurance documentation

A3: Secure data sharing on both supplier and buyer side

OUTCOME OBJECTIVE Establish a secure Clean Room to drive coordinated market interventions for biobased solvent uptake in the pharmaceutical sector through data sharing and analysis.

Proposed Activities

A.3: Secure data sharing

1. Define scope and data needs
2. Engage stakeholders and collect data
3. Validate data for completeness and address gaps

A.3 Proposed Activity Requirements

- Define a **limited, decision-relevant data scope** aligned to unlocking demand (e.g. volumes, specifications, delivery requirements, cost ranges, timelines).
- Engage value-chain participants and agree data **definitions, safeguards and submission protocols**.
- Collect data through secure Clean Room channels and store it in a **controlled, confidential environment**.
- Validate inputs for completeness and consistency, addressing gaps through targeted follow-up only where necessary.

A.3 Activity Outputs

Validated demand datasets from demand-side participants

- From pharmaceutical buyers, focused on decision-relevant parameters (e.g. priority solvents, volumes, specifications, delivery and timing requirements).
  - A staged approach may be used (e.g. initial focus on top three priority solvents to 2030).
- Clear documentation of assumptions, data gaps and confidence levels, ensuring transparency over uncertainty.

Validated supply datasets from UK solvent producers

- from UK solvent producers covering availability, scale-up pathways and key constraints.
- Clear documentation of assumptions, data gaps and confidence levels, ensuring transparency over uncertainty.

A4: Data aggregation and analysis – to develop evidenced-based recommendations

OUTCOME OBJECTIVE Establish a secure Clean Room to drive coordinated market interventions for biobased solvent uptake in the pharmaceutical sector through data sharing and analysis.

Proposed Activities	A.4 Proposed Activity Requirements	A.4 Activity Outputs
A.4: Data aggregation and analysis 1. Analyse data to understand solvent requirements and identify additional interventions 2. Draft materials for dissemination	• Aggregate and analyse data to improve transparency of future solvent requirements across the pharma supply chain. • Apply a neutral, evidence-based analytical approach using consistent assumptions to ensure fairness and credibility. • Where possible, identify viable demand–supply matches, aligning buyer requirements with supplier capabilities and delivery timelines. • Translate insights into clear, aggregated outputs that **strengthen demand signals**, **reduce uncertainty** for suppliers and investors and **enable bilateral offtake discussions** or **coordinated action** in the form of further government interventions. • Confirm with participants that proposed outputs are appropriate for dissemination, compliant with competition law and consistent with confidentiality commitments.	**Synthesised, aggregated insights presented in a neutral, transparent format suitable for decision-making, including:** ◦ **Demand-side requirements**, including priority applications, performance thresholds, acceptable cost premiums, and volume signals. ◦ **Supply-side readiness,** covering current availability, scale-up pathways, key cost drivers and de-risking needs. ◦ **Demand-supply misalignments,** where specification uncertainty or risk allocation is constraining uptake. ◦ **Decision-focussed demand-unlocking recommendations**, such as preferred specification and procurement approaches, demand aggregation or coordinated options, and **targeted MFIs** where evidence shows additional intervention is required to unlock demand or reduce residual risk

A5: Validation and iteration with value chain stakeholders – to confirm demand signals, risk allocation and readiness to act

OUTCOME OBJECTIVE Establish a secure Clean Room to drive coordinated market interventions for biobased solvent uptake in the pharmaceutical sector through data sharing and analysis.

Proposed Activities

A.5: Validation and iteration with value chain stakeholders

1. Present analysis with stakeholders about the value chain requirements for future solvents
2. Test and validate recommendations

A.5 Proposed Activity Requirements

- Present **synthesised, anonymised Clean Room outputs** on solvent performance, availability, cost drivers and demand signals (volume, willingness to pay, location etc.) in a neutral, transparent format.
- **Test and validate demand-side and supply-side assumptions**, including specification requirements, risk allocation, delivery constraints and cost sensitivities across pharma companies, CMROs and suppliers.
- Confirm where **greater standardisation** (e.g. common specifications, data definitions or decision criteria) could reduce transaction costs and accelerate uptake.
- Validate whether **market transparency and alignment alone are sufficient to unlock demand**, or whether residual barriers **justify targeted government-supported MFIs**.
- Capture structured feedback to refine outputs, strengthen alignment and confirm **credible, evidence-based pathways to market action.**

Data privacy and confidentiality protections of the clean room will be maintained.

A.5 Activity Outputs

Transparent articulation of demand and supply requirements

- **Clear, value-chain-wide synthesis** of future pharmaceutical solvent requirements (demand side)
- **Anonymised, standardised summaries** of solvent performance, availability, cost drivers and supply readiness, enabling like-for-like comparison and reducing information asymmetry (supply side)

Corroborated demand blocks and enabling conditions

- Clear identification of where misalignment, uncertainty or risk allocation suppresses demand, and which conditions would unlock procurement or offtake.

Validated, evidenced-based pathways to unlock demand

- Evidence-backed decision pathway, setting out:
  - Where market transparent and alignment are sufficient to unlock uptake
  - Where changes to specifications, aggregation of demand or procurement approaches could unlock uptake
  - Where government-supported MFIs are justified

Stakeholder participation, data and IT inputs are critical, and must be underpinned by strong governance and legal frameworks

Suggested Input Requirements

Strategic framing inputs	• There needs to be clear decision objective – what is the clean room meant to inform? • Defined scope of "market needs" – what demand side questions need to be explored? • Agreed value proposition – why should stakeholders contribute/provide data?
Stakeholder Participation	• Identified data holders – solvent suppliers, pharma companies etc. • Participation commitments – willingness to contribute data under set conditions, e.g. through signing of NDAs • Trust relationships – facilitator should be a neutral/independent party
Data inputs	• Definition of data requirements covering: commercial, technical, operational and sustainability. • Data provision by stakeholders (demand-side and supply-side)
IT infrastructure	• Clean room architecture • Security / encryption and anonymisation capabilities • Analytical tooling and frameworks • Interoperability
Governance and Legal	• Data governance framework • Privacy and competition safeguards • Data contribution agreements • Independent governance body /steering group
Resourcing and Capability inputs	• Operational funding • Analytical capabilities • Facilitation capacity

Key risks include inadequate data through lack of willingness to contribute and misunderstanding of data needs

Risk	Description	Mitigation
Competition law breach (CMA)	Sharing of non-public current or future pricing or plans	• Request only historic detailed data for volumes, plus aggregated (non-commercially sensitive) industry projections • Legal advice on how best to obtain and document stakeholders' willingness to pay a green premium • Data and Security Management Plan including Output Control to ensure no company-identifiable current/future data is released
Confidentiality breach	Leakage or theft of data, particularly company-identifiable data	• Data and Security Management Plan, including deletion controls • Output Control, with Supervisory Committee approving release of aggregated solvent flow summaries and MFI recommendations • Cybersecurity protocols • NDAs between data providers and the Clean Room Operator
Privacy risk (ICO)	Release of individuals' personal data such as contact details	• Data and Security Management Plan including Output Control • No storage of personal data
Inadequate data	Insufficient or poor quality data collected, so no useful output, for example due to low industry participation, misunderstanding on the data required and objectives or over-reach	• Ensure initial buy-in by stakeholders, focus on sign up of critical suppliers e.g. GSK, AstraZeneca, Teva. Leverage existing motivation from stakeholder workshops • Circulate and agree on Data and Security Management Plan including Output Control and Data Request Table • Limit the number of solvents being researched and sectors e.g. solvent flows only relating to NHS supply chain • Focus on solvents recommended by industry
Governance failure, Conflict of Interest	NHS, Government or other entities having access to private company data. Inadequate supervision	• Steering Committee with regular reporting by the Clean Room Operator, but anonymised where appropriate • NHS and Government at Steering Committee level only, with no access to raw data
MFI recommendations not implementable	Inconclusive data analysis; solvent premium needed is too high for industry; lack of funding required	• Clean Room Operator regularly assessing data gathered to date, in terms of consistency and approximate mass balance • Liaison with Steering Committee when new data gathering is required

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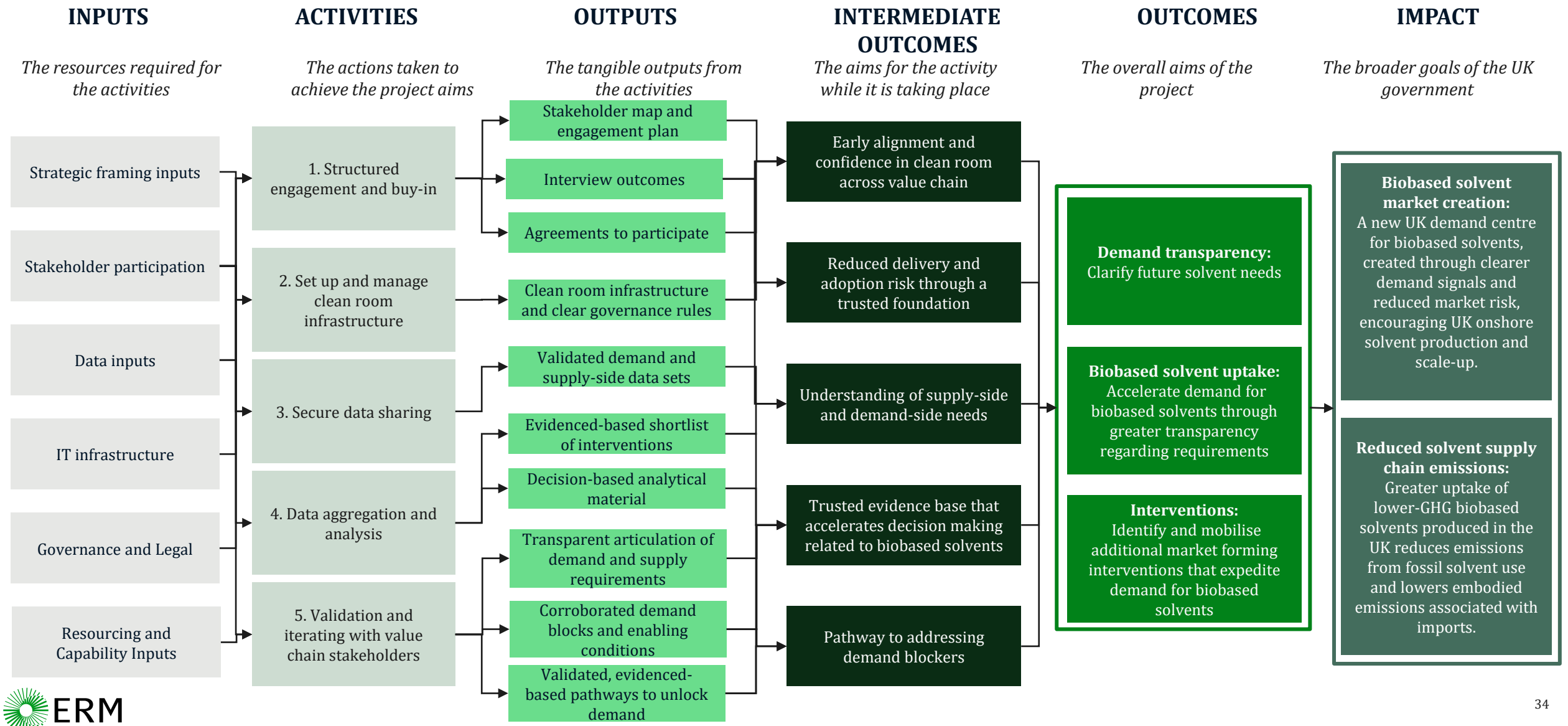
A Logic Framework has been developed to summarise the proposed Clean Room programme



Thank you

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UKRI-MFI Chemicals Final Report – May 2026 – Not Government Policy

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Overview: MFI Toolkit Approach

This Market Forming Interventions (MFI) Toolkit outlines the process used during this research to 1) identify and prioritise innovation area(s) that would benefit from an MFI 2) match specific MFIs types to address innovation demand-side barriers 3) design an MFI concept.

Definitions

1. **Innovation Type:** a new or significantly improved product or service that addresses user problems in a novel way.
2. **Innovation Demand Barriers:** obstacles that prevent new products or services from being adopted.
3. **Market Forming Intervention (MFI):** Measure(s) that seek to accelerate the adoption of replacement innovations.
4. **MFI Enabling Factor:** a standard, policy, financial or business factor necessary for an MFI to be successful.

Categories of Demand Barriers

Innovation adoption barriers have been categorised into the following:

1. **Standards:** inability to describe in quantifiable and verifiable terms the innovation.
2. **Value Perception:** Lack of regulation/policy incentives; too high price premium; lack of quantifiable non-financial benefits.
3. **Demand Delivery Ecosystem:** Lack of necessary physical/technology infrastructure.
4. **Disincentives:** Existing regulation, concerns on technology lock-in.

Categories of MFIs

The 13 specific MFI types have been categorised into the following:

1. **Regulation & Lower Cost:** Encourage adoption of desired solutions by lowering costs or penalising status quo options.
2. **Demand Aggregation:** Consolidate buyers to create predictable demand, reduce market uncertainty, and enable scaling.
3. **Direct Financial Support:** Reduce upfront costs and risks through different financial mechanisms.
4. **Price Support:** Provide predictable revenue or bridge cost gaps between new and incumbent solutions.

The MFI Toolkit: a four-phase approach was used to select priority innovation areas for MFI/enabling activity concept design

Phase 1:
- Prioritising sectoral "innovations" for MFI targeting
- Map demand drivers and barriers to innovation uptake
- Map relevant sector stakeholders
- Validate findings through sector-surveys and Working Group 1

Phase 2:
- Assess innovation/s suitability for MFI (Framing Questions)
- Map MFI types and suitability characteristics
- Map existing UK and global MFIs
- Shortlisting MFI options

Phase 3:
- Map prioritised MFI to innovation demand drivers and barriers
- Define required MFI and enabler activity to unlock barriers
- Identify stakeholder requirements for MFI activity

Phase 4:
- Establish the logic framework for MFI and enabler activity
- Establish MFI governance and delivery roadmap
- Quantify potential impact and define measurement metrics
- Deliver concept and mobilise

1. Innovation targeting and barrier mapping
2. Define MFI Types and Shortlist Options
3. MFI prioritisation against sector barriers
4. Designing MFI

Working Group 1 (WG1)
- Align on innovations for MFI targeting and design
- Prioritise demand-side barriers to address through MFI development

Working Group 2 (WG2)
- Confirm demand barriers and enablers for innovation/s
- Review and prioritise MFI options and enabler activity for concept development

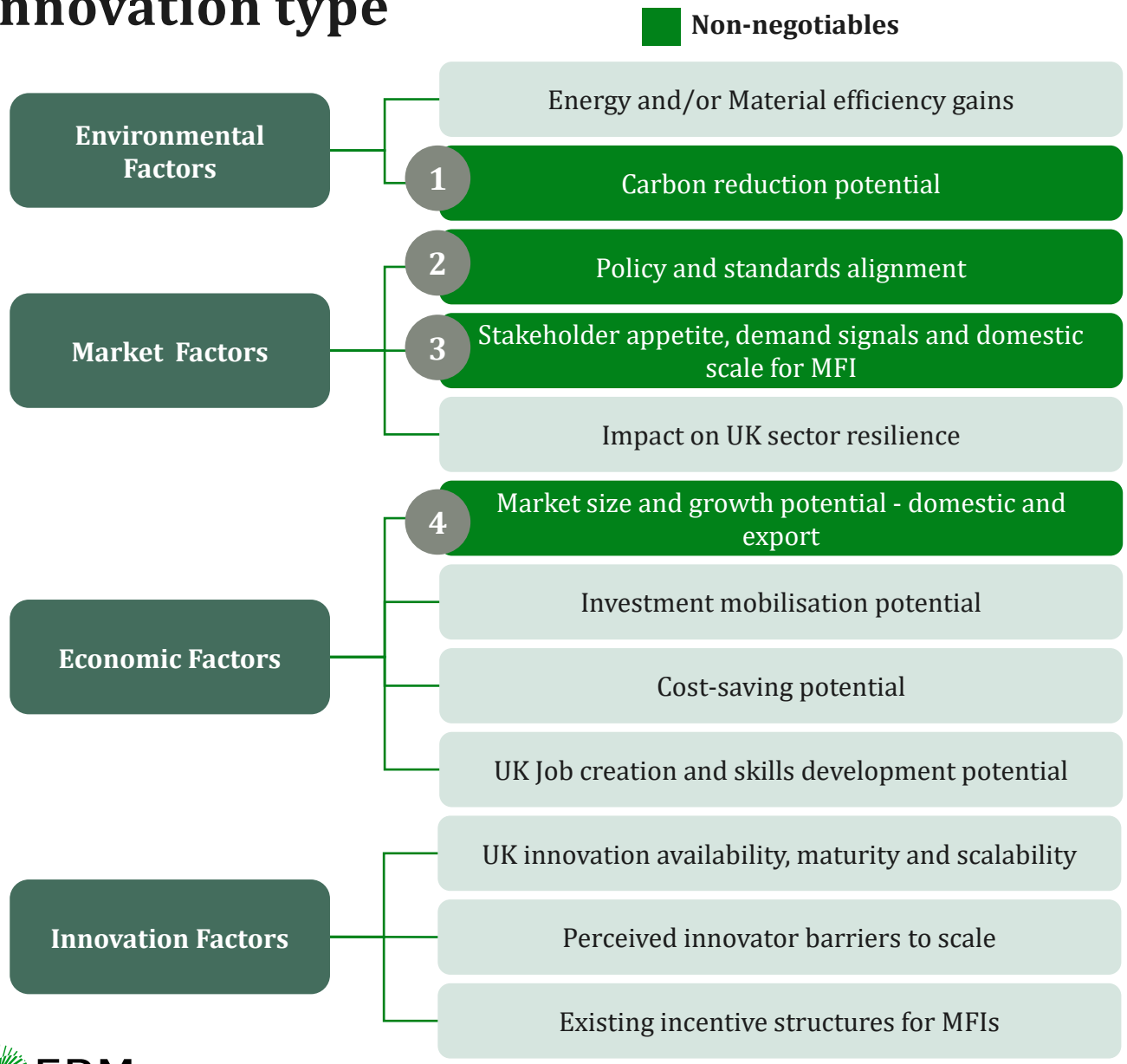
Working Group 3 (WG3)
- Align on MFI requirements
- Validate scope and structure of MFI/enabler activity
- Define stakeholder engagement requirements for activity

Working Groups: Cross Government-Industry workshop engagement to codevelop MFI/enabler activity.

Phase 1 (1/2): Innovation types were prioritised for MFI targeting using 12 evaluation criteria of a structured Prioritisation Framework

Environmental Factors	Energy and/or Material efficiency gains	MWh saved or efficiency gains per unit of output; tonnes of raw material avoided, recycled, or substituted
	Carbon reduction potential	Absolute $MtCO_2e$ reduction achievable within the subsector
Market Factors	Policy and standards alignment	Fit with current UK Industrial Strategy, Net Zero Strategy, sectoral roadmaps, codes and regulatory frameworks
	Stakeholder appetite, demand signals and domestic scale for MFI	Willingness of industry offtakers, financiers, policymakers and innovators to engage in collaborative MFIs
	Impact on UK sector resilience	To international supply-chains disruptions, price-shocks, energy costs etc.
Economic Factors	Market size and growth potential - domestic and export	Sector/subsector value, demand forecasts, and growth rate
	Investment mobilisation potential	Public and private capital attracted by subsector innovations
	Cost-saving potential	Estimated savings for firms and UK consumers through adoption
	UK Job creation and skills development potential	Direct and indirect employment supported
Innovation Factors	UK innovation availability, maturity and scalability	TRLs of available solutions, readiness for commercialisation, and scale-up potential, sufficient solutions to support MFI and market development).
	Perceived innovator barriers to scale	Strength and type of innovation barriers e.g. tech lock-in, infrastructure gaps, financing hurdles, market fragmentation, low offtake willingness
	Existing incentive structures for MFIs	Presence of subsidies, standards, CfDs, or other supportive measures that could complement MFIs

Phase 1 (2/2): This considered four key Non-Negotiables to select the targeted innovation type



Rationale for non-negotiables

1. The **carbon reduction** achievable through adoption of the innovation must be able to deliver substantive impact on carbon reporting metrics and enable offtakers to meet current or future reporting standards within the next 2–5 years.

2. The innovation area should be aligned with the **UK government Industrial Strategy, Sectoral Roadmaps and spending priorities**, for MFIs to be implementable within the next 2-5 years.

3. There is both a **strong local industry appetite** and an **urgent need for adoption** of the innovation area within the next 2–5 years, driven by supportive interventions, evolving policy mandates, competitive pressures, and market disruptions.

4. There should be a **sufficient domestic and export market size, or growth opportunity** to justify the establishment of an MFI.

Phase 2 (1/2): Framing Questions were then used to assess the suitability and nature of prioritised innovation types for MFI development

Framing Questions		
Type of innovation	Product or process? Does a definition of what "it" is exist, (preferably in the form of a standard with certification scheme)?	Prioritise innovations that have an agreed upon standard and associated certification scheme.
Maturity	If product, what Technology Readiness Level (TRL)? If process, how long in existence?	There are MFIs best suited for early-stage innovations (TRL 6 or below) and later stage (TRL 6 and above). Segment innovations into early or late stage.
Substitution/Disrupter	Is the innovation replacing something already there (i.e. "green" steel) or is it disrupter (brand new with no existing demand)?	Majority of govt. MFIs have been utilised to support replacement innovations. Prioritise replacement innovations.
User	Are users UK, international or both? Can you list specific companies who are users or who benefit directly?	Leverage existing user base for feedback via industry workshops.
Motivation & Need	Why are the users adopting this product/process? What need of theirs is it meeting?	Prioritise innovations that meet user motivations and needs. Understanding motivations of current users assists in understanding barriers to adoption of replacement innovations.
Existing policy/regulatory impact	Are there regulations and/or policies that support or detract from this product or process? Intentionally or unintentionally?	Understand the policy landscape to identify existing policies to leverage and ones that serve as disincentive.
Risk	How is the risk of the product/process covered, i.e. grants, subsidies, insurance?	Prioritise innovations where there are existing mechanisms to mitigate the adoption risk.

Phase 2 (2/2): MFI Types were defined and a shortlist of options developed

There are **13 MFI types** to stimulate the demand for ***substitution (replacement)*** and/or ***disruptive*** innovations**.** Key to identifying the most suitable MFI for a specific innovation is understanding the innovation's existing demand barriers. When potential MFIs have been linked to an innovation, one should consider:

- Are there any necessary enabling factors that will influence the potential success of the MFI?
- Do the demand barriers benefit from a govt. sponsored MFI or is the private sector capable of addressing these?

MFI Category	MFI Type	Description
Regulation and Lower Cost	1. Regulations and/or Policy requirements	Legal requirements compelling market behaviour
	2. Government (National/Local) Subsidies	Govt. monies to support R&D, production, and/or deployment that usually do not have to be repaid
	3. Government (National/Local) Tax Incentives	Tax credits or reliefs that lower cost
	4. Government (National/Local) Tax Disincentives	Taxes or levies on existing activity to shift market demand to alternative
Demand Aggregation	5. Buyers Clubs (Aggregated Demand)	Aggregation of buyers behind one contract to increase demand for product/service
	6. Public Procurement (Framework/Bulk Procurement)	Government's use of preferences and/or award weighting within its own procurements
	7. Double-sided Auction	Intermediary signs a long-term offtake agreement with supplier and resells, via auctions, to buyers with govt funds used to cover gap between supplier and buyer price.
	8. Offtake Agreements	Long-term contract guaranteeing purchase of supplier's future output
	9. Advanced Market Commitments	Specific type of offtake agreement for products in prototype/demo stage
Direct Financial Support	10. Blended Finance (Philanthropy/Public/Private Funding)	Combining concessional (public & philanthropy) funds with private funds to reduce risk
	11. Prizes/challenges (private or public sector to fund or procure new materials/products)	Public call for innovations to solve industry challenges, potentially combined with grant offer
	12. Support for solution Guarantees and Insurance	Instruments to mitigate performance or credit risk
Price Support	13. Contract for Difference (or other Price Support Mechanisms)	Guarantees price and revenue per unit by covering the difference between market and strike price (or within a range e.g. cap-and-floor)

Phase 3 (1/5): MFIs were prioritised based on their suitability to address sector-specific demand-side barriers to scaling innovations

There are innovation adoption barriers for demand, supply or both. This Toolkit is focussed on identifying demand-side barriers, including *enabling factors*, which are barriers that, if not addressed, greatly decrease the likelihood of an MFI's success. One of the most common enabling factor barriers is the lack of standards, since they are essential to defining what is being demanded.

Standards

- Lack of accepted standard differentiating the innovation from existing product/process. Includes standards covering production processes and safety considerations.

Value perception

- **Policies/Regulations**: lack of regulations or policy requirements for innovation
- **Price competitiveness:** innovation priced higher than existing product/process with no quantifiable alternative business benefit. Competition between existing recycled vs. potential repair/reuse/remanufacture financial gains.
- **Non-financial benefits:** lack of accepted mechanism to account for benefits (carbon reduction, book & claim).

Demand delivery ecosystem

- **Infrastructure (including technology and/or material dependencies):** lack of physical infrastructure to acquire, store, utilise and/or dispose of innovation (disposal particularly relevant when required). Inability to access technologies and/or material inputs needed for production/use/disposal of innovation.
- **Volume and timing:** inability to address risk associated with guaranteed volume and timing of delivery.

Disincentives

- **Policies/Regulations**: existing policies that hinder the demand; frequently unintended.
- **Innovation cycle:** concerns about technology lock-in (e.g. methanol/ammonia for maritime shipping) and changes in recycling infrastructure investment (e.g. silicon-based or thin-film-based solar panels)

Phase 3 (2/5): An MFI Suitability Matrix was developed to identify under which circumstances the different types of MFI are best applied

MFI Category: Regulation and Lower Cost

Category	Market-Forming Intervention	Description	When most suitable	When less suitable
Regulation and Lower Cost	**Regulations and/or Policy Requirements**	Legal requirements compelling market behaviour	**Best once credible alternatives are available, but adoption needs rapid scaling.** Creates assured demand, levels the playing field, and drives widespread industry compliance.	Less suitable for early-stage technologies that cannot yet meet regulatory requirements, or for solutions still under R&D.
	Government (National/Local) Subsidies/Loans	Govt. monies to support R&D, production, and/or deployment that usually do not have to be repaid	**Best for early- to mid-stage technologies where cost is the dominant barrier**. Highly suitable when capital intensity is high, first-of-a-kind facilities are needed, or production costs are significantly above incumbent benchmarks. Effective at accelerating adoption and de-risking scale-up.	Less suitable for mature, commercially competitive solutions where costs are already comparable to incumbents, as subsidies may distort market pricing and reduce incentives for efficiency.
	Government (National/Local) Tax Incentives	Tax credits or reliefs that lower cost	**Most suitable when technologies are technically proven but not yet cost-competitive**. Works well where tax relief can close a moderate cost gap and stimulate adoption without requiring direct subsidies. Encourages corporate investment in low-carbon upgrades and innovation.	Less suitable for very early-stage prototypes lacking revenue or profitability, as tax incentives require a tax liability to benefit from.
	Government (National/Local) Tax Disincentives	Taxes or levies on existing activity to shift market demand to alternative	**Best for shifting demand away from incumbents once viable alternatives exist**. Suitable when behavioural change is needed across large markets and when cost penalties can make low-carbon options comparatively more attractive.	Less suitable when low-carbon alternatives are not commercially available, as disincentives could lead to unintended cost or supply issues without feasible substitutes.

Phase 3 (3/5): An MFI Suitability Matrix was developed to identify under which circumstances the different types of MFI are best applied

MFI Category: Demand Aggregation

Category	Market-Forming Intervention	Description	When most suitable	When less suitable
Demand Aggregation	**Buyers Clubs (Aggregated Demand)[1]**	Aggregation of buyers behind one contract to increase demand for product/service	**Best** where fragmented demand prevents suppliers from investing in new capacity. Creates a strong, credible, bankable demand signal needed to unlock financing and scale early-commercial low-carbon products.	Less suitable when demand is already sufficient, or the market is highly concentrated, as aggregation adds complexity without additional benefit.
	Public Procurement (Framework/Bulk Procurement	Governments use of preferences and/or award weighting within its own procurements	**Most effective** when early market demand is insufficient to justify investment. Suitable when public sector volume can anchor supply, build confidence for private buyers, and normalise emerging low-carbon solutions.	Less suitable for immature technologies not yet compliant with procurement requirements, or in markets where public demand is too small to influence private adoption.
	Double Auctions / Competitive Bidding Mechanisms	Intermediary signs a long-term offtake agreement with supplier and resells, via auctions, to buyers with govt funds used to cover gap between supplier and buyer price.	**Best for early-mid stage** technologies with variable availability and price premiums. Works when performance specifications are clear and price competition can drive down subsidy needs over time.	Less suitable for early-stage or prototype technologies lacking sufficient capacity or performance certainty to bid competitively.
	Purchase Agreements (PPAs / Offtake Agreements)	Long-term contract guaranteeing purchase of supplier's future output	**Best for mid-late stage technologies** where the main barrier is immediate availability and supply manufacturing investments. Provides supply side the bankability needed for financing production capabilities.	Less suitable for very early-stage prototypes or high-risk pilots, as buyers may not commit without performance or supply certainty.
	Advance Market Commitments (Prototype/Demo Stage)	Specific type of offtake agreement for products in prototype/demo stage	**Best for** prototype or demonstration technologies that need assurance of future demand. Reduces market uncertainty and incentivises developers to invest in commercial readiness and certification.	Less suitable for mature technologies already commercially proven, as AMCs provide limited additional value.

[1] See an overview of buyers clubs from Mission Possible Partnership - Link

Phase 3 (4/5): An MFI Suitability Matrix was developed to identify under which circumstances the different types of MFI are best applied

MFI Category: Financial Support

Category	Market-Forming Intervention	Description	When most suitable	When less suitable
Direct Financial Support	**Blended Finance (Philanthropy/Public/ Private Funding)[1]**	Combining concessional (public & philanthropy) funds with private funds to reduce risk	**Optimal for high-risk, capital-intensive, or first-commercial deployments**. Suitable when private finance is reluctant due to technology, commercial, or scale-up risk. Unlocks private investment and accelerates demonstration-to-commercial transition.	Less suitable for low-risk, mature projects that can be financed commercially, as blending may be unnecessary and administratively complex.
	Prizes/challenges (private or public sector to fund or procure new materials/products)	Public call for innovations to solve industry challenges, potentially combined with grant offer	**Best for early R&D or prototype phases where market pathways are unclear**. Stimulates high-risk, high-reward innovation and draws talent/ideas into new solution areas. Effective where conventional funding mechanisms are too risk-averse.	Less suitable for technologies that are commercially ready, as prizes do not provide sufficient scale or market demand.
	Support for solution Guarantees and Insurance	Instruments to mitigate performance or credit risk	**Best where the key barrier is investor or lender risk perception**, not technical viability. Supports capital access for new low-carbon production capacity and reduces the risk premium associated with unproven technologies or business models.	Less suitable for low-risk, mature technologies where traditional finance is sufficient; adds unnecessary cost and complexity.

[1] See for example, "Practical tools for Blended Finance Fund design" - Link

Phase 3 (5/5): An MFI Suitability Matrix was developed to identify under which circumstances the different types of MFI are best applied

MFI Category: Price Support

Category	Market-Forming Intervention	Description / Mechanism	When most suitable	When less suitable
Price Support	**Contract for Difference (or other Price Support Mechanisms)[1]**	Guarantees price and revenue per unit by covering the difference between market and strike price (or within a range e.g. cap-and-floor)	**Most effective where operating costs for products remain structurally higher than incumbents**. Provides predictable revenue streams that enable investment and accelerate commercial deployment.	Less suitable for low-cost mature solutions, as guaranteed price support may distort competition and reduce incentive for efficiency improvements.

[1] See an overview of energy CfDs- Link

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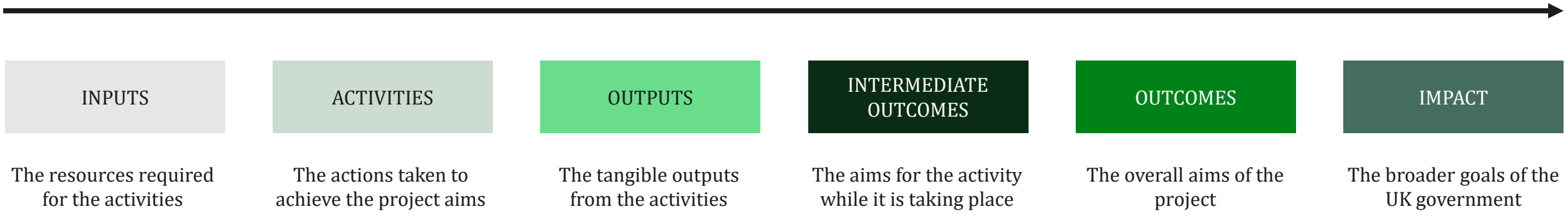
The operational model for the programme applies a Logic Framework approach to define inputs, activities, outputs and intermediate outcomes

The operational model has been developed by applying a Logic Framework, as shown on this slide.

The components of the Logic Framework are defined below.



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Intervention Mapping – biobased solvents– direct support

MFI Category*	MFI Type*	Commentary
Direct Financial Support	Prizes/ challenges (private or public sector to fund or procure new materials/products)	• Innovate UK funds programmes such as **Sustainable biobased Materials and Manufacture**(£14m) and the **Sustainable Medicines Manufacturing Innovation Programme** (£54m) to subsidise R&D and drive scale up (including biobased solvents). Recent rounds include funding (ERM and Ayming) to develop a consortium to scale green solvents for pharmaceuticals, explicitly recognising the need for biobased or recycled-carbon solvents to cut emissions and toxicity. These are time-bound R&D and demonstration competitions rather than enduring deployment subsidies.
MFI Enabling Factor Activity	Directly undertaking or facilitating standard(s) development	• The UK has adopted **BS EN 16766:2017** "biobased solvents – Requirements and test methods", which defines classes of biobased solvents by biobased carbon content and sets performance and safety requirements. This standard, implemented via BSI, provides technical certainty and comparability, supporting claims, procurement specifications and potential future regulation or labelling for biobased solvents.

*See here for definitions of intervention types

Intervention Mapping –biobased solvents– indirect support [1/2]

MFI Category*	MFI Type*	Commentary
Regulation & Lower Cost	Govt. National/Local Tax Incentives	• **None biobased solvent specific**. General UK tax incentives apply however, including R&D tax relief and full expensing for qualifying plant and machinery to reduce the effective cost of innovation and capital investment.
	Govt. National/Local Tax Disincentives	• Carbon and energy taxes (e.g. UK ETS, Climate Change Levy) increase costs for energy- and carbon-intensive processes and for some VOC-emitting activities, indirectly improving the business case for lower-emission solvents.
	Regulations (mandatory) incentivising material, technology or circular business model adoption	• The Solvent Emissions Regulations and associated environmental-permitting guidance, plus VOC limits in paints and varnishes and UK REACH chemicals regulation, restrict emissions and use of hazardous or high-VOC solvents. This regulatory pressure encourages substitution towards lower-emission, less-toxic options, which can include biobased solvents, although **no regulation specifically mandates "biobased" or "CO_2-derived" solvent use.**
Demand Aggregation	Public Procurement (including framework and/or bulk procurement)	• UK Government Buying Standards (GBS) and The NHS Net Zero and Sustainable Procurement programme restrict hazardous chemicals and VOCs, nudging demand toward safer, lower-impact formulations such as biobased solvents.

*See here for definitions of intervention types

Intervention Mapping –biobased solvents– indirect support [2/2]

MFI Category*	MFI Type*	Commentary
Direct Financial Support	Blended Finance (philanthropy/ public/private funding)	• The British Business Bank and National Wealth Fund can blend public and private finance for green and strategic projects. While not tailored to biobased solvents, capital-intensive solvent or CCU-chemical plants could in principle access such facilities where they align with net-zero or regional growth priorities, alongside generic innovation and industrial-decarbonisation grants.
	Support for solution guarantees and insurance	• No sector-specific guarantee facility for biobased solvent projects/ products found.

*See here for definitions of intervention types

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Systemic barriers within the industry will hinder effective market interventions in any part of the sector, particularly in bulk commodities, and need to be considered in MFI concept design

UK chemical industry is largely at risk due to economics:

1. **More competitive imports** from China, Middle East and USA where production costs are lower (e.g. low-cost ethane feedstocks and natural gas in USA and Middle East, coal to chemicals in China), plants are newer and more efficient, and there are fewer carbon and policy costs. The China economic model is aimed at maximising output and employment with top-down directives and subsidies that have created global over-capacity.

2. **Closures of commodity chemicals plants has a knock-on effect** of limiting the domestic availability of intermediates to feed current as well as new markets, so reducing overall resilience. Closures also limit flexibility in innovation e.g. there is no UK naphtha cracker now to take pyrolysis oil from waste plastics processing. Chemicals supply chains can be long and complex, exacerbating the economic and employment impacts of closures.

3. **New investment** is also **not happening** because of **uncertainty over policy** and longer-term Government commitment to the chemicals industry e.g. the wider implementation of CBAM, long term policy on escalating recycling taxes. Interventions are often tax-based rather than mandate-based, which limits bankability. The UK Modern Industrial Strategy (2025) lists chemicals as a **foundational industry** that provides critical inputs and infrastructure across all the priority sectors.

4. **UK has world-leading expertise in innovating chemistry pathways**, such as in biochemicals and CCU. But biotech has not been able to scale up to compete with thermocatalytic processes; and many of the UK innovations are still at low TRL and are in niche markets that need government support to grow.

Demand side barriers include strict and inflexible standards in the pharmaceutical industry, with limited demand side policy support (compared to fuels)

Type of Barrier	Barrier	Pharma raw materials
Standards	Stringent regulatory requirements in sectors like pharma for APIs, add technical complexity to projects and requirements may differ across end users. These standards may also not accurately reflect impurities that are present in the biobased materials.	🔴
Standards	Pharmaceutical companies set raw material specifications and source materials directly or via contract manufacturers (CMOs). These materials require specialist producers and distributors (e.g., Croda) to meet strict grades which are named in regulatory documentation (e.g. n-butanol specification at 97% purity). Furthermore, standards vary from company to company making production campaigns difficult for solvent manufacturers.	🔴
Value Perception	The cost of producing biobased solvents compared to fossil solvents is currently significantly higher (maybe 10x the incumbent price in some cases). If they are from biomass via fermentation this is normally due to the high cost of boiling off water to get a dry solvent. For CCU routes, cost is high, generally because of the renewable H_2 cost.	🔴
Value Perception	Technology/project developers prioritising higher volume applications are unaware of the potential for pharmaceuticals e.g. FT processes are focused on e-Fuels SAF (for aviation), or e-methanol, despite pharmaceuticals being a higher-value market.	🟡
Value Perception	Challenges for biobased producers to secure sufficient long-term offtake agreements to prove project viability and secure investment, due to the typically small volumes required from individual customers	🔴
Demand Delivery Ecosystem	Limited suppliers of biobased solvents in UK or EU, mainly because of the very high manufacturing costs and disparate demand (need to aggregate demand to justify building a plant), so no existing supply chain. History of bankruptcies in the sector.	🔴
Disincentives	Changing suppliers is highly unattractive, complex and costly. The key suppliers are not necessarily those with the solutions, but the industry would like to purchase the solutions via its existing named suppliers.	🟡
Disincentives	Not all innovations are at commercial readiness, with long timelines for scaling up new production capacity	🟡

Key: 🔴 High significance 🟡 Medium significance