

This event will be recorded

Net Zero Innovation Portfolio: Red Diesel Replacement Phase 1 Competition Launch

BEIS

27 September 2021

NZIP RDR Phase 1 Competition Launch (Virtual)



Department for
Business, Energy
& Industrial Strategy

Introduction



Presenters



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Theme Head


Department for
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Competition Programme
Manager


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Strategic advisor

 **E4tech**
an ERM Group company

Stakeholder co-ordination:



Organisations represented today

Abmec	c3biotech	Dolphin-n2	Imperial College London	Mccloskey International	Queens University Belfast	Steamology
AFC Energy	Case New Holland	Eminox	itm-power	MDS advisory	Rapid Innovation	Swansea University
Algo Fuels	CAVT	Farrans	JCB	Meteor Power	Renewables united	Teconnex
Alternatech	CECA	FET	Jma-systems	Microcab	Ricardo	Terex
Arcola Energy	Clean Air Power	Flogas	Leeds Univeristy	Morris-commercial	Selwood	The CEA
Avanti Gas	CMCL Innovations	Gallagher-Group	Libertine	Nanosun	Sizewell C	Ugiintl
Balfour Beatty	Coryton	Gopower	Libralato	Nottingham University	SMMT	Unyte
Bath University	Covaxe	Granted ltd	Mace Group	OakTec	Soton	Utac
Bennamann Energy	Coventry University	Green Enegy	Mahle	Perkins	Statkraft	Victus Energy
Bramble Energy	Cummins	Green Power Systems	Mannok Build	Pinkh2	William Glider Group	
Brett	Denchi Group	Greenville energy	Marley	Polymfilters		
BTconnect	DfT	IKB		PRR associates		
		Imerys				



Agenda and house keeping

Agenda

Item	Timings
Introduction	10:00 – 10:05
Context	10:05 – 10:20
Red Diesel Replacement Competition	10:20 – 11:00
Comfort break	11:00 – 11:05
Next steps	11:05 – 11:10
Final Q&A session	11:10 – 11:30
Networking	11:30 – 12:00

House keeping

- The recording and slides will be shared after the meeting and published on the [RDR competition page](#)
- The Q&A will be published within 10 working days
- Any follow-up comments should be addressed to:
RDR@beis.gov.uk



Today's objectives

- ✓ **Explain why and how BEIS has created the Red Diesel Replacement Competition**
- ✓ **Introduce the Competition, explain how to apply and answer questions**
- ✓ **Describe next steps and how to find further information**
- ✓ **Provide an opportunity for people to network to assist consortia-building**



Context

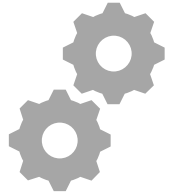


Background

- The Competition forms a key part of the developing government response to tackle the environmental impacts of red diesel use.
- It follows the announced eligibility changes made at Budget 2020 and stakeholder engagements carried out in February and September 2021.

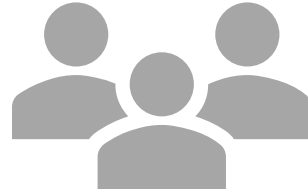


Development process



Pre-workshop analysis

- Desk work by BEIS, E4tech and Cenex
- Assessed over 60 alternative fuel pathway/technology combinations, ranking by cost and carbon impact



Stakeholder workshops

- Workshops with different red-diesel-using sectors
- Pre-workshop analysis was presented and views gathered on innovation needs



Competition design

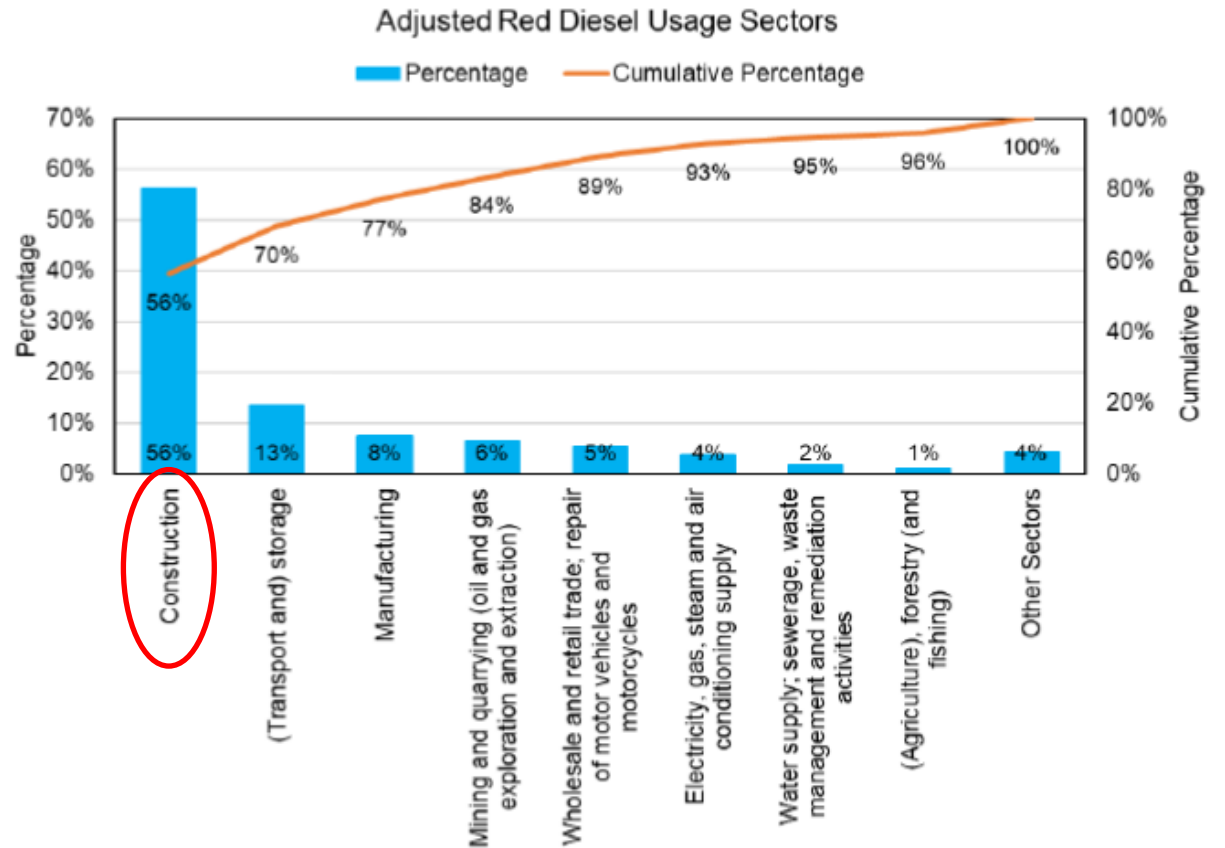
- Findings from the workshops used by BEIS, providing initial scoping work for an innovation funding programme
- Ricardo and E4tech provided technical design aspects
- Stakeholders provided additional input

Analysis report: <https://www.e4tech.com/resources/248-e4tech-and-cenex-engage-sectors-that-use-red-diesel-to-identify-innovation-needs-for-low-carbon-alternatives.php>



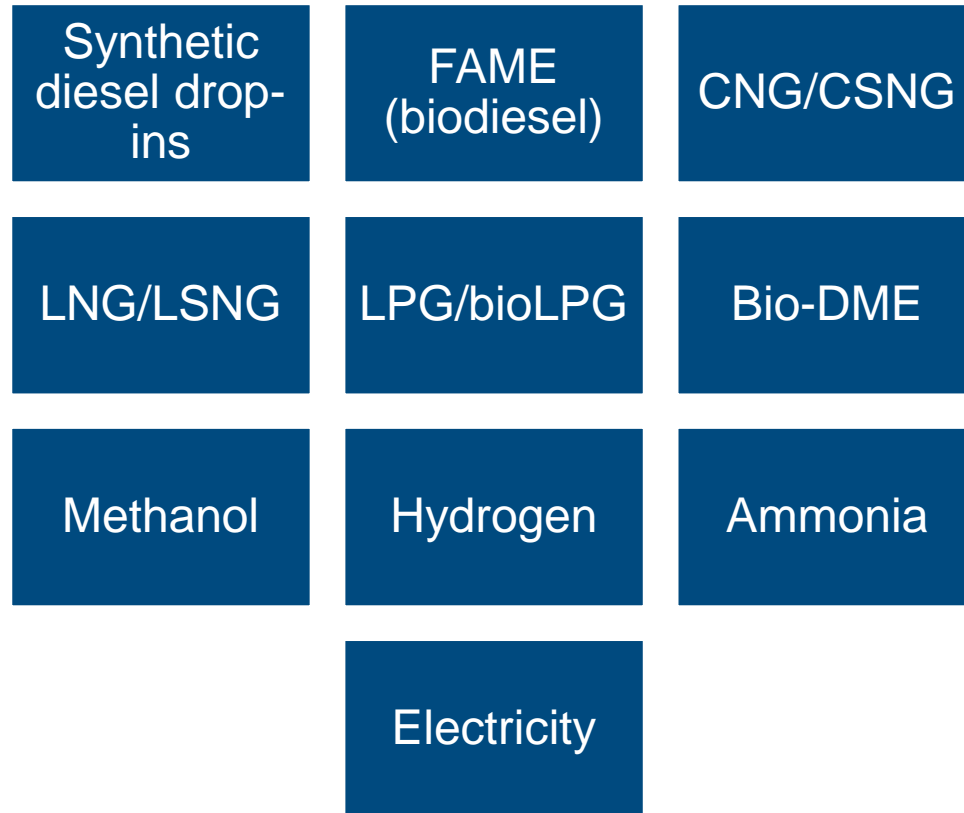
Construction is the most heavily affected sector

- Red diesel accounts for ~15% of all UK diesel usage
- Construction accounts for 56% of the total UK red diesel consumption and a high ability to pass on costs to the consumer

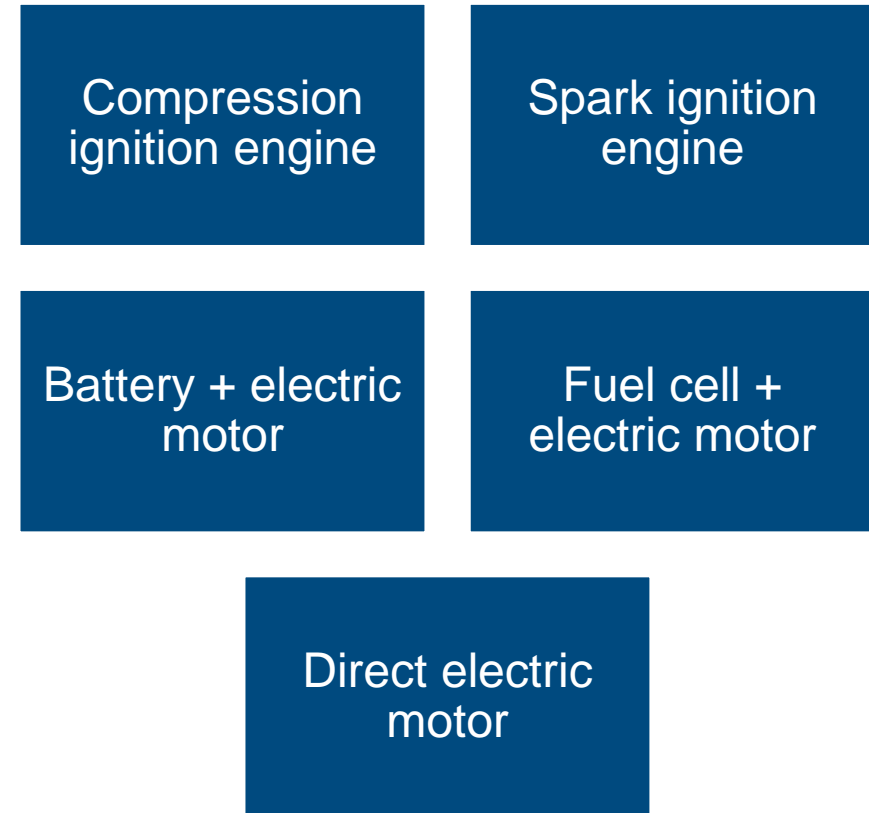


Many alternatives were evaluated

Fuel options

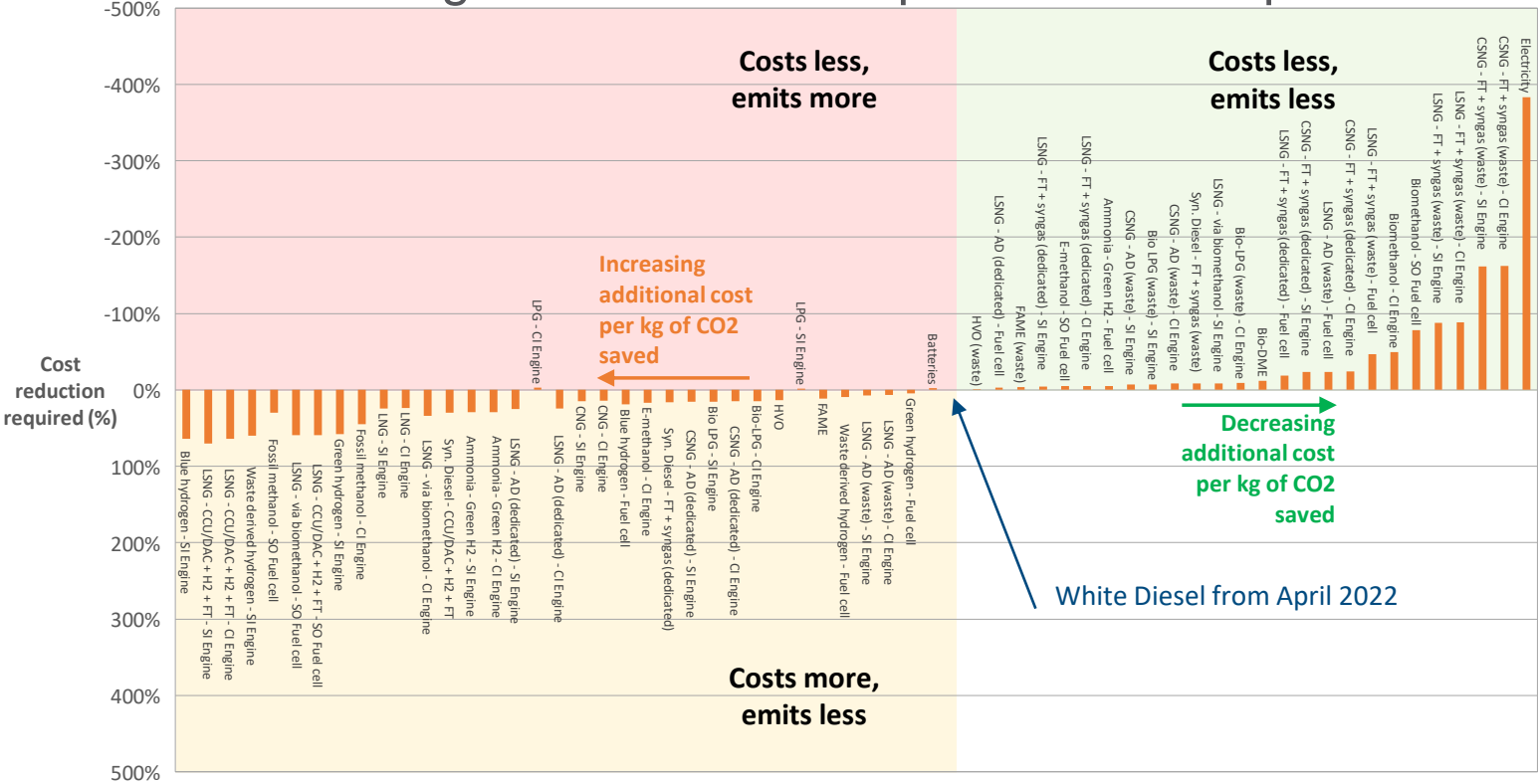


Powertrain options



Future TCO cost effectiveness vs white diesel

Comparison of TCO using nth-of-a-kind fuel production and powertrain capital costs*

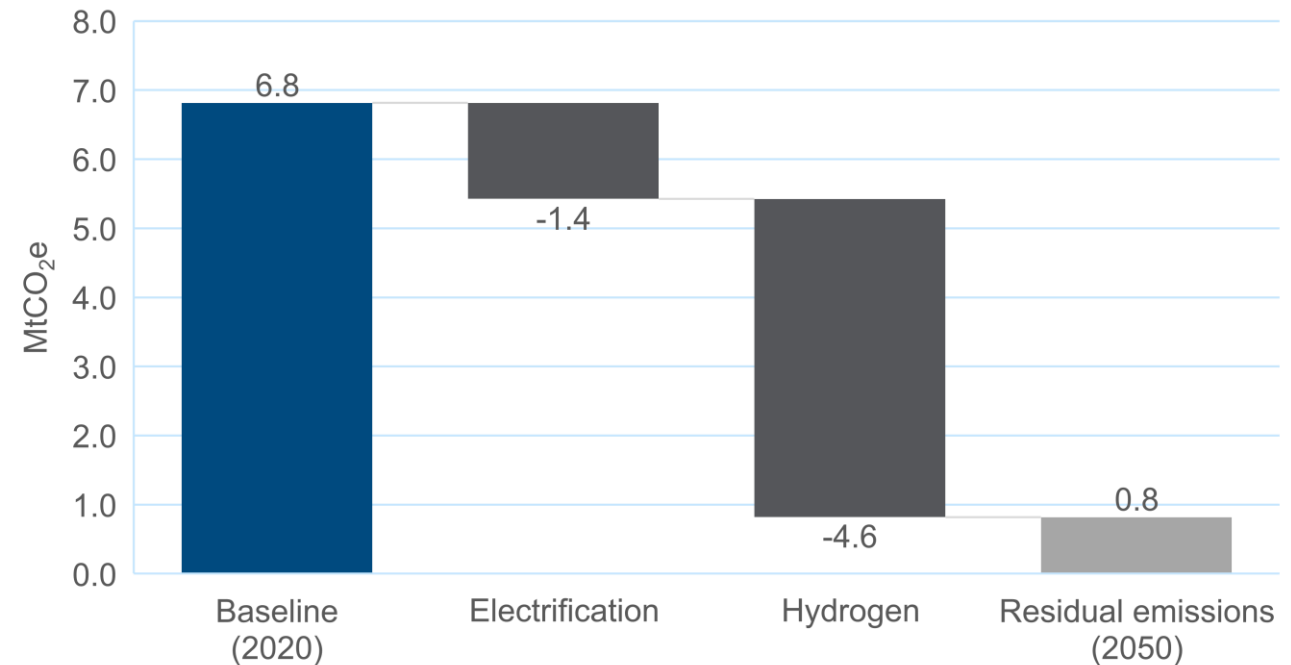


*Graph shows reduction in future total cost of ownership (TCO) required to reach parity with TCO of using Red diesel from 2022 (with RTFO support), sorted by average cost effectiveness. Values are averages taken across a representative archetype group.

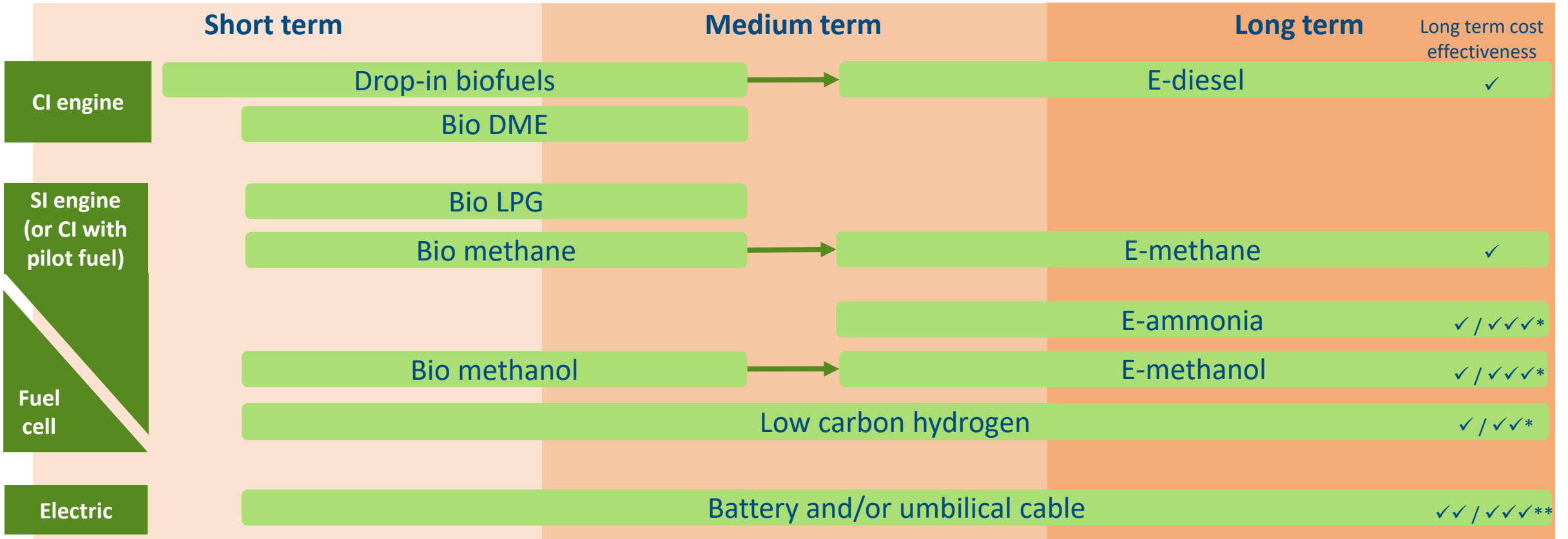
CCC requires biomass to go to other uses by 2050

- According to the Climate Change Committee's net-zero pathways, biomass and waste feedstock will need to be used in sectors where it brings the most GHG reduction benefit post-2040 i.e aviation fuels and biomass power with CCS (BECCS)
- However, biofuels can be used between 2020 and 2040 if:
 1. There is a cost and GHG reduction benefit from doing so;
 2. AND the production plants for these biofuels can be changed to supply fuel to aviation or converted to producing bio-hydrogen with CCS.

CCC- Abatement and remaining annual emissions for 'Off-road mobile machinery'



Potential pathways



→ No change in equipment technology or fuelling infrastructure

* via fuel cell
** Umbilical cable



Other factors were considered

	Cost effectiveness*	Density (volumetric)	Change to equipment	Supply & storage	Safety	Air quality	
Battery		*					
Hydrogen	FC					ICE - NOx	FC
Ammonia	ICE					ICE - NOx	FC
E-diesel	ICE						
E-methane (compressed)							FC
E-methane (liquefied)							FC
E-methanol	ICE						FC

*nth-of-a-kind average TCO

**Battery location is very flexible compared to high pressure gas cylinders, so might not be as bad as stated here.



Stakeholders commented on the analysis



Innovation needs

- **Barriers to adoption** of red diesel alternatives reflect challenges relating to **safety, reliability, performance** and **cost**
- End-user concerns extend to the **wider feasibility** of alternatives (e.g. supporting infrastructure, refuelling methods)



Target areas and format

- Many of the barriers to adoption are faced by operators, suggesting **technology demonstration** is favourable
- There was **no emerging consensus** over preferred long-term technology solutions, or a preferred transition pathway



Innovation so far

- Current innovation efforts are generally spread across **multiple technologies** rather than one particular area, and has typically focussed more on component-level technology development rather than demonstration in end-use settings



Implications of no action

- Risks of not supporting uptake of alternatives include the possibility of **deferred investment, costs to end-users** of a confused transition and a **missed opportunity** to promote collaboration across the value chain



Findings were used to create proposals on the Programme design and scope

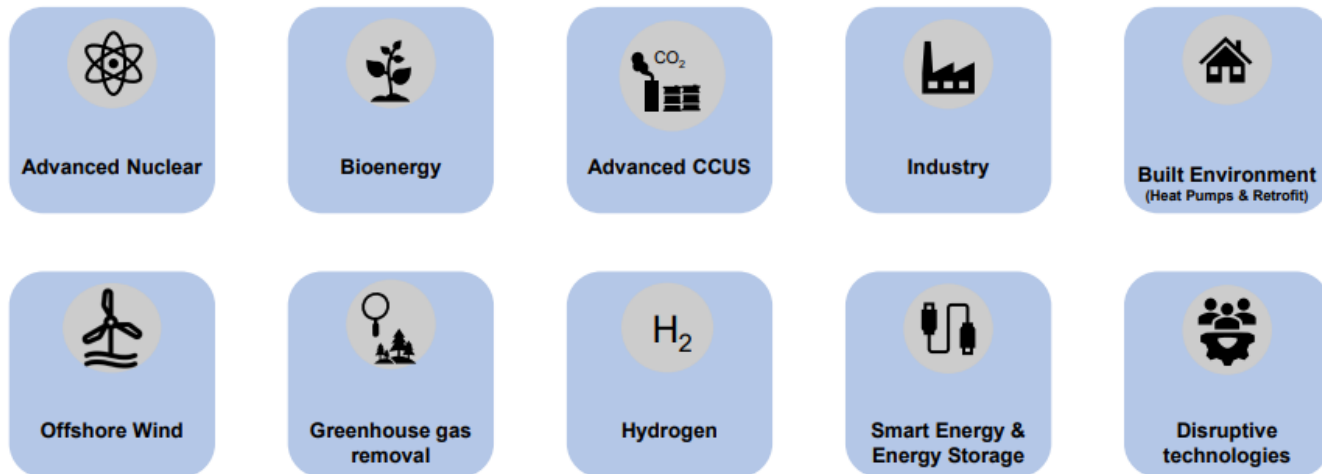


Red Diesel Replacement Competition



Net Zero Innovation Portfolio (NZIP)

NZIP focus areas



Source: BEIS

- £1bn of funding for innovation over 4 years (2021 – 2025)
- As per the “Ten Point Plan for a Green Industrial Revolution”
- Red diesel replacement programme is part of NZIP

Net Zero Innovation Portfolio (NZIP)

- Other competitions under NZIP:
 - [Industrial Fuel Switching \(£55m\)](#): launching 12th October
 - [CCUS Innovation 2.0 \(£20m\)](#)
 - [Industrial Energy Efficiency Accelerator \(£10m\)](#): launching 14th October
 - [Industry of Future \(£4m\)](#): closing on 14th October
- Other competitions:
 - [Industrial Energy Transformation Fund Phase 2 \(£60m\)](#): closing on 6th December



Red Diesel Replacement Innovation Programme

A £40m fund developed in response to the partial removal of the entitlement to use red diesel and rebated biofuels from April 2022, to encourage the red diesel sector to decarbonise

Aim:

To promote and develop low-carbon fuels and systems at a price that is **competitive with fossil fuels** for the **construction, mining and quarrying** sectors. The programme will produce **full system demonstration** of vehicles and energy storage, distribution, and energy delivery for both these sectors.

Programme objectives

1. To develop commercially viable and globally applicable low-carbon alternatives to Red Diesel, looking at long-term solutions
2. To demonstrate an integrated, low-carbon solution at a moderate scale on site for the quarrying and mining sector, and the construction sector.
3. To disseminate the learnings and results of the Red Diesel Replacement programme to international stakeholders, industry and other diesel-using sectors.
4. To inform policy teams on the potential of these low-carbon alternatives and create awareness of the spin-off opportunities for other sectors (e.g. aviation and HGVs).
5. To deliver match funding from industry.
6. To accelerate the commercialisation of low-carbon Red Diesel alternatives.



Programme overview

Phase 1: Separate development of component technologies

- **Lot 1:** Distribution, storage and energy delivery systems development
- **Lot 2:** Development of equipment (components/sub-systems) and fleet management infrastructure (facilities for maintaining, hosting and servicing equipment)
- **Lot 3:** Fuel development

**£9.2m, ~20 projects
11 months duration**



Phase 2: System integration and demonstration

- Consortia developing an integrated end-to-end zero carbon demonstrated solution
- Open to all applicants, not just those who were successful in Phase 1

**£30m, ~3 projects
22 months duration**

Phase 1 Lots

Lot 1: Distribution, storage and energy delivery systems development

- Development of components and systems related to fuel (and/or energy) distribution, storage and delivery, focussed on the NRMM sector and the challenges to overcome in improving efficiency, cost, performance and scalability
- E.g. Innovation of equipment for safely refuelling off-highway equipment with ammonia
- E.g. Robust fast-charging system

Lot 2: Development of equipment and fleet management infrastructure

- Development of components and systems related to the use of fuels (such as engine and drive-chain components) and fleet management infrastructure (such as controls and servicing equipment).
- E.g. Development of ammonia-tolerant fuel cell membrane
- E.g. Battery management system for specific vehicle class

Lot 3: Fuel development

- Fuel production technology development or testing of fuel properties and performance.
- E.g. Innovation in processes for producing ammonia from low carbon hydrogen



Programme overview – feedback and adjustments

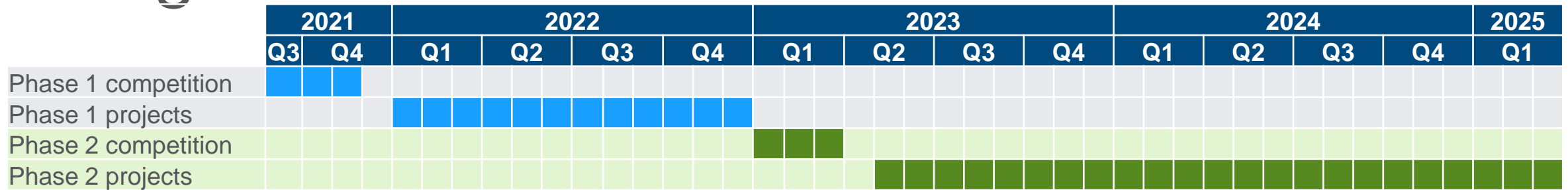
Feedback from stakeholders

- Competition generally welcome
- Some resistance to technology prescriptiveness
- Fuels and infrastructure go hand in hand – Lot structure may cut across this
- On-site fuel distribution and safety is a key challenge so Lot 1 well-suited
- Consortia should be encouraged in Phase 1 as fuel and technology pathways are highly interlinked
- Agriculture and forestry technologies are complementary to those in scope
- Manufacturers need global markets not just UK

Adjustments made

- More precision about Lots in guidance document
- If a project covers multiple Lots then applicant should identify primary Lot (all Lots use same assessment criteria)

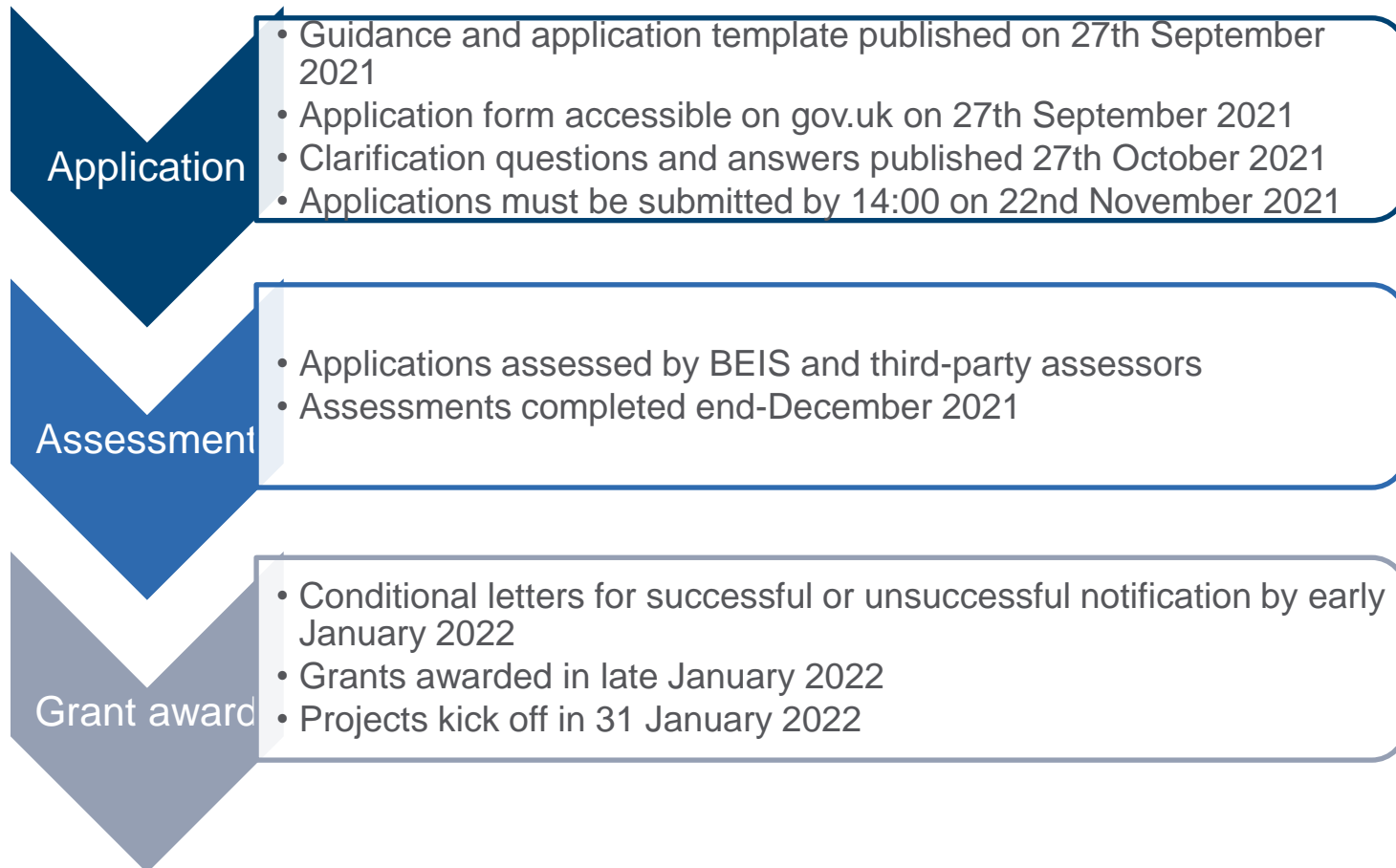
Programme timeline



Activity	Date
Phase 1 competition opens to applicants (8 weeks)	27 September 2021
Phase 1 competition closes to applicants	22 November 2021
Phase 1 grant awards, projects start	31 January 2022
Phase 2 Consortia 'match-making' event	July 2022*
Phase 1 project complete	30 December 2022
Phase 2 competition	Q1 2023
Phase 2 projects	Q2 2023 – Q1 2025
Programme close	31 March 2025



Phase 1 timeline



Activity	Date
RDR competition Phase 1 Guidance published	27 th September 2021
Applications open (online form)	27 th September 2021
Deadline to submit questions about the competition (RDR Questions Form)	15 th October 2021
Anonymised Final Q&A published	27 th October 2021
Deadline to register for Applications	15 th November 2021
Deadline for Applications	22 nd November 2021
Conditional successful/unsuccessful letters	January 2022

Timeline – feedback and adjustments

Feedback from stakeholders

- Mixed views on Phase 1 completion 1 year:
 - Ambitious but achievable vs.
 - Challenging – short application window, Xmas start/end, 11 months limits options for fuel development, long sign-off process for large organisations (up to 3 months)
- Match-making – more events needed and/or earlier
- Avoid gap between Phases 1 and 2, consider allowing continued development i.e. prototyping in Phase 2 not Phase 1
- Lead times for specialist components is a timing constraint (Phase 2)
- Need about 1 year of operation to prove concepts (Phase 2)
- Starting with demonstration could help prove demand and further innovation needs

Adjustments made

- (Tight timeline is acknowledged but unfortunately it is not possible to extend the Programme deadlines)

Phase 1 eligibility criteria

Innovation and technology readiness

- TRL 4 and above, and below TRL 8

Technology scope

- Must fit in competition scope for Phase 1 outlined in later slide

Maximum allowable funding

- Not more than £2.5m funding to any single applicant, whether leading or partnering
- No single project funding request to exceed £460k

Project status

- Unable to fund retrospective work
- Funding levels may be affected by cumulative public subsidy

Project location

- Over 50% of the projects costs must be incurred in the UK

Delivering multiple projects

- Lead applicants can submit more than one bid in Phase 1, if materially different
- One application per lead in each Lot
- Must be able to deliver on all bids if multiple are successful
- Must not be the same piece of work if multiple bids are successful

Project duration

- Funding offered for up to 11 months
- Phase 1 projects must end no later than 30th December 2022

Match-funding

- Private match-funding will be needed within 3 months of grant offer agreement
- Need to show credible plan to raise match-funding before grant is issued

General conditions

- Companies of any size are eligible to seek funding.
- Projects must qualify under at least one of the definitions of:
 - a feasibility study;
 - industrial research; or
 - experimental development



Maximum public funding for projects qualifying under 'Aid for Research and Development'

	Size of Enterprise	Maximum amount of aid towards eligible Project Costs
Feasibility Study	Small	70%
	Medium	60%
	Large	50%
Industrial Research - Single Companies	Small	70%
	Medium	60%
	Large	50%
Industrial Research - Collaborations can be Business to Business; Business and Research Organisation(s); or between Research Organisations	Small	80%
	Medium	75%
	Large	65%
Experimental Development - Single Companies	Small	45%
	Medium	35%
	Large	25%
Experimental Development - Collaborations can be Business to Business; Business and Research Organisation(s); or between Research Organisations	Small	60%
	Medium	50%
	Large	40%



Eligibility criteria – feedback and adjustments

Feedback from stakeholders

- Multiple bids per applicant necessary to address different parts of the solution
- Allow more than one application per lead in each Lot
- >50% UK cost will narrow opportunities
- Clarify match funding levels
- Budgets for 2022 being frozen now – hard to find match funding
- Views on £460k cap mixed (higher TRL needs more)

Adjustments made

- Maximum funding per single organisation (lead or partner) raised from £1.5m to £2.5m (can take part in several bids, but inadvisable to bid above this total)

Technology scope

- **TRL 4 to 7** at the start of the project
- Underlying technology must be suitable for a full system demonstration at moderate scale at a **mining and quarrying or construction site by Phase 2**
- Technologies must have a **clear progression pathway in reducing:**
 - greenhouse gas emissions;
 - air pollution emissions;
 - reliance on biomass (long-term solution must not be a biofuel).

1. Projects must support or align to a technology that uses one of the following long-term solutions:

Electricity (direct or battery)	Hydrogen	E-diesel
E-methanol	E-methane	Ammonia

2. Eligible fuels that are not hydrogen or electricity-based:

RTFO Development Fuels*	RCF Recycled carbon fuels*
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*At 100% concentrations (excluding additives) without blending with any fossil fuel derived fuels



Technology scope – feedback and adjustments

Feedback from stakeholders

- Biomass can be low carbon & long term
- Reward solutions that can scale
- Focus on near term savings
- Build in a cost target as a filter
- Viability of technologies should be considered without the RTFC
- ICEs (hybrids) needed long term
- What about enablers e.g. lubricants?
- Clarify feedstocks allowed
- Reward other environmental impacts (pollution, noise)

Adjustments made

- Requirement to show that non-green hydrogen produced is consistent with proposed UK Low Carbon Hydrogen Standard and to a similar standard for ammonia
- Requirement to show why fuels from electricity are needed rather than direct electricity
- Fuels not made from hydrogen or electricity to be Development Fuels under RTFO (including Recycled Carbon Fuels). Post 2040 pathway to hydrogen or electricity-based fuel must be convincingly described

Phase 1 activities



Phase 1 funding would be expected to cover:

- Feasibility studies and FEED studies
- Outline component or system design work
- Detailed component or system design and analysis
- Manufacturing, assembly and integration
- Testing and small-scale demonstration of the fuel, component or system
- Provision of a platform for safe and efficient low carbon fuel distribution, refuelling and storage
- Development of evidence of initial routes to market for proposed technology and fuel
- Development of promotional materials for a consortia match-making workshop

Phase 1 outputs



Phase 1 final, publishable report should include:

1. A **project description** for the Phase 1 development project
2. **Technical report** containing high-level engineering design for the demonstrated component(s)/prototype
3. An assessment of the **benefits and challenges** of the solution
4. A **costed development plan** for the solution
5. A **route to market assessment** describing the key steps to commercialisation
6. **Lessons learned** during the project

Project completion and deliverables submitted by 30 December 2022



Outputs – feedback and adjustments

Feedback from stakeholders

- Outputs are reasonable however challenging to achieve within the timeframe
- Ensure Phase 1 outputs have clear integration with industry's needs
- Include more than one output session to help Phase 2 matchmaking
- IP protection will take longer than the Phase 1 project duration
- Can UK supply chain evolve sufficiently?
- Operational trials require a lot of risks to be managed
- HSE is key for fuels
- Include learning legacy/resource for end users to support further uptake of technology

Adjustments made

- More definition around outputs, especially on safety aspects for fuel distribution, refuelling and storage
- Planned dissemination activities to encourage technology adoption in targeted sectors and beyond

Assessment criteria

Criterion	Section	Weighting (%)
1. Project relevance	1. Clarity of the project objectives and relevance to the competition objectives	5
	2a. Level of innovation and progress as a result of the Phase 1 project	10
2. Technical concept	2b. Credibility of the technical approach and relevance to the specific challenge of reaching net zero by 2050	10
	2c. Credibility of the proposed cost reductions and/or performance improvements that the innovation would enable	10
	3a. Level of GHG emissions savings expected at commercial scale	10
3. Environmental impacts	3b. Other environmental impacts such as air quality impacts and noise impacts	5
	4a. Realistic potential for scalability of the component within and/or across sectors	10
4. Commercial case	4b. Strength of case for BEIS funding, included status of Phase 1 matched funding (if required)	10
	5a. Confidence in skills and experience of the project team	10
5. Project Implementation	5b. Credibility of the Phase 1 project work plan	10
	5c. Understanding of the project risks and their management	5
	5d. Credibility of Phase 1 project activities costing	5

Minimum score of 60% in application to be eligible for funding

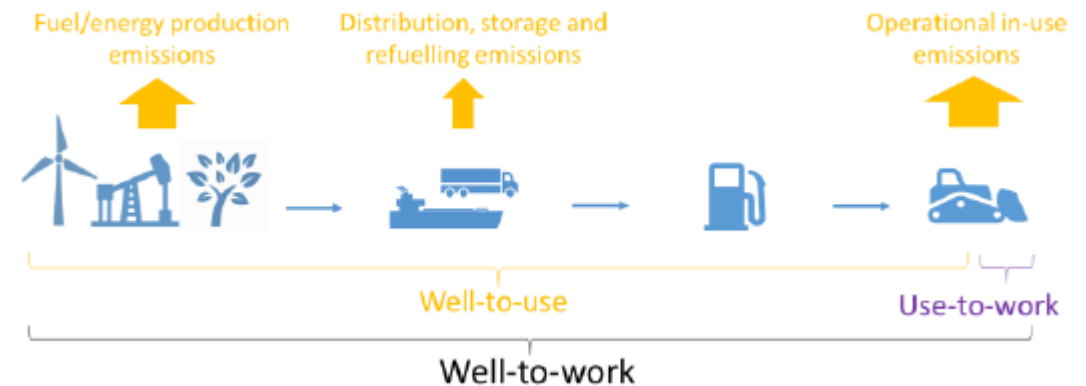


Assessment criteria – Environmental impacts

Criterion	Section	Weighting (%)
3. Environmental impacts	3a. Level of GHG emissions savings expected at commercial scale	10
	3b. Other environmental impacts such as air quality impacts and noise impacts	5

3a. Predicted GHG savings vs red diesel on a well-to-work basis, using GHG emission factors provided and machinery efficiency estimate. Ammonia or methane slip to be accounted for, 2030 values for electricity to be used.

Those projects with the highest potential GHG savings and robust evidence will score best, and those that only just meet a 50% reduction (at a component/system/equipment level), or do not provide enough credible evidence, will score poorly.



3b. Likely air quality, noise and other benefits of the solution

Assessment criteria – feedback and adjustments

Feedback from stakeholders

- Standardise the GHG methodology. Note that some pathways could feature negative emissions
- 50% reduction may not be enough to get on a path for 2050, reward earlier reductions
- Phase 1 is about innovation but cost reduction is highly scored
- Air quality has a low weighting
- Consider international exploitation

Adjustments made

- Details of the GHG accounting approach for well-to-use provided including default values
- Savings that can either be made directly or *are enabled by* their technology within a commercial scale integrated system will score higher than those with lower quality estimates, or those that meet a minimum GHG emissions saving target of 50% against a Red Diesel counterfactual.

Comfort break

Back at 11:05



Next steps



Next steps

Phase 1 competition guidance published and application form accessible on **27th September 2021** on RDR competition webpage (gov.uk)

Applications will be entered via an online form, **you will need to register before 14:00 GMT 15th November 2021** to gain access to the online form

Previous correspondence relating to Expressions of Interest or attendance at any Stakeholder Engagement Events does not result in automatic registration

All applications must be submitted via the online application form with any supporting documents uploaded

Applications are due in by **14:00 GMT 22nd November 2021**. Please ensure sufficient time to complete your application and upload your documents as **we will not be accepting submissions after the deadline**

Feedback to be provided by **early January 2022** (dependent on the number of applications)

Award of grants for Phase 1 by **end January 2022**



Questions

- The anonymised Q&A from this session will be published within 10 working days.
- Please submit further questions via the RDR Questions Form found on the RDR competition webpage (gov.uk).
- All questions should be submitted **by 12 noon BST, 15th October 2021**. Questions submitted after this date may not be answered.
- The questions submitted via email, which in our judgement, are of material significance will be addressed and published on the competition website.
- A final anonymised Q&A sheet will be published on **27th October 2021**.



Q&A



Thank you for attending

Networking until 12:00

