UK National Clean Maritime Research Hub

Wave 2 Flexible Funding – Call for Responsive Research Proposals

1. Call Headline Details

Maximum proposal value to be provided by the UK-MaRes Hub per award.	**£50,000 at full economic costing (100% fEC)**
Funding level	**80% of fEC**
Number of awards available in this call	**Funding for up to 7 projects**
Available funding across this call	**Up to £350,000 (100% fEC)**
Call opens	**Tuesday 17th September 2024**
Closing date for application submissions	**Tuesday 5th November 2024 at 16:00**
Deadline for notification of outcome	**Friday 10th January 2025**
Project duration	**Up to 6 months**
Anticipated project start date	**Saturday 1st March 2025**
Project end date	**Sunday 31st August 2025**

2. About the UK-MaRes Hub

Led by Professor Tony Roskilly, the UK National Clean Maritime Research (UK-MaRes) Hub was established in September 2023 with £21.3 million of funding from the Engineering and Physical Sciences Research Council (EPSRC), Department for Transport (DfT), collaborating universities and industry. To support a transition towards a clean maritime sector, the UK-MaRes Hub has brought together 26 experienced academics from 13 universities to conduct innovative research under 5 themes: marine fuel scale up and safety; power and propulsion systems; vessel design and efficiency; port and vessel support infrastructure; as well as digitalisation, maritime operations, and finance. Since the outset, the Hub has been supported by 72 project partners including 39 business and industrial organisations, 8 civic bodies based in the UK as well as 25 international partners. The consortium has been further expanded through the commission of 3 flexible fund projects in the first wave of Responsive Research Calls. The Hub will continue engaging with the wider maritime stakeholder community to stimulate collaboration, accelerate research exploitation, and maximise impact.

3. About our Flexible Funding Calls

Through a total of 4 waves of Responsive Research Calls, the Hub aims to fund up to 30 world-leading responsive research **projects that are eligible for EPSRC funding**. The full economic cost (fEC) of each successful project (excluding any project partner contributions) can be up to **£50,000**, of which the Hub will fund 80% fEC (as is standard for ESPRC funded calls). In addition to the funding requested from the Hub, as a requirement for this call, we also require equivalent **matched funding to be leveraged from your project partners on a 1:1 basis**. For example, if the fEC of your project is £50,000 to cover project costs, you should also include matched contributions from project partners for the same value. This match funding can be made up of in-kind or cash contributions, or a combination of both.

4. About this Call: Wave 2 Flexible Funding

Wave 2 Funding is available for **up to 7 projects** that address any of the following priority areas:

- Real-time vessel data communication.
- Risk and uncertainty regarding marine regulations and policy implications.
- Novel energy-saving devices to improve vessel efficiency.
- Novel cost-effective nuclear propulsion systems.
- Autonomy for vessel efficiency.

These priority areas were identified through engagement and consultation with key stakeholders that represent the maritime sector in the UK.

5. Eligibility

5.1 Who is Eligible to Apply?

- Unlike the Wave 1 Flexible Funding call, our Wave 2 call is **open to applicants from UK-MaRes Hub's consortium universities**. However, **applicants must not have any prior involvement with the existing Principal and Co-Investigators** of the Hub to be considered eligible. We define 'prior involvement' as:
  - being a named researcher/investigator on a project also involving any of the investigators from the Hub,
  - being part of the same research group as any of the investigators from the Hub,
  - having a publication history with any of the investigators from the Hub.

  Please get in touch prior to application if you have any questions concerning your eligibility to apply.
- Academic staff based at a UK institution eligible of receiving EPSRC funding. **Principal and Co-Investigators of the UK-MaRes Hub are not eligible to apply for this flexible funding**.
- Whilst this funding is open to eligible individuals at all career stages, projects **must** be led by an Early Career Researcher (ECR) supported by an experienced academic mentor. We define an ECR as any individual who has been awarded a PhD but has not yet held a research grant of £100,000 or more. Eligible individuals from under-represented groups are particularly encouraged to apply.

Please note: we encourage potential applicants to liaise with their Research Office to discuss any potential implications for applying for future funding from other sources, should they be successful in receiving an award from this funding call.

Standard EPSRC eligibility rules apply in relation to the status of the organisation and the employment status of individuals applying. The term of employment of a fixed-term employee must extend beyond the duration of the proposed research project**.** Any proposal

that is incomplete, does not meet the eligibility criteria of this call, or duplicates the research that is already planned by the UK-MaRes Hub will not be considered for funding.

Please note: Given the short-term nature of these Flexible Fund awards, **there is an expectation that the required resources are available to start the project within the timescales outlined above**. No time allowances will be made to recruit staff, and any project unable to meet this criterion will not be considered for funding. Should a project be selected for funding, and it is later found that the required resources are not in place, the award will be withdrawn.

5.2 Eligible Research

Applications to this call **must not** duplicate or be technically related to the research already planned by UK-MaRes Hub.

As mentioned in Section 2, UK-MaRes Hub will focus on the 5 research themes. The related work packages (WPs) are detailed in the table below.

Please review this table to ensure that your proposal does not overlap with the research already being undertaken by UK-MaRes Hub. Applications which duplicate any of the research **will not** be considered for funding.

WPs	Scope and proposed research	Co-Investigators
1.1	Future clean marine fuel production scale-up: achieve rapid reductions in maritime carbon emissions; identify key potential technologies and associated scale; provide technical appraisal of life-cycle appraisal of carbon impact of technology options, techno-economic assessment, wider sustainability assessment, jobs/economic impact & skills, and infrastructure needs.	Professor Patricia Thornley and Professor Rachael Rothman
1.2	Whole system environmental assessment of fuel switching options: material flow analysis (MFA), life cycle assessment (LCA), and technoeconomic assessment (TEA) to assess environmental and economic impacts.	Professor Rachael Rothman
1.3	Marine fuel storage, safety operation and handling: safety of ammonia storage by modelling multi-phase flows from the storage tank, dispersion in the atmosphere, prevention and mitigation strategies; safety engineering of hydrogen onboard storage (development of explosion free in any fire self-venting); hydrogen safety research related to IGF Code; contemporary CFD models of gaseous hydrogen refuelling through entire equipment of refuelling station, and development of refuelling protocols.	Professor Vladimir Molkov
2.1	Disruptive electrical systems: parametric design and analysis of modular generator sets; DC microgrids system integration; short-term energy storage systems integrating batteries and supercapacitors; energy management strategy and control including digital twin models development of hybrid powertrain systems with validation.	Professor Pietro Tricoli and Dr Dawei Wu
2.2	Clean conventional IC engines: deep retrofit with advanced spark ignition; retrofit with dual fuel; and cryogenic energy harvest	Professor Al Cairns
2.3	Disruptive zero emissions hydrogen engines: ultra-low single-digit NOx H2 internal combustion engine concepts; novel-high efficiency linear engines and split cycles	Professor Andrew Smallbone and Dr Cliff Dansoh

	operating; experimental research on NH3 cracking into H2; deployment onboard marine vessels and on ports.	
2.4	High-power fuel cell systems: clean marine fuels in high temperature fuel cells, efficiency and emissions; SOFC utilising methanol via internal reforming; proton conducting oxides (PC-SOFC) with ammonia; integration into power delivery systems; and scaling solutions towards large scale ship scale technology.	Professor John Irvine and Dr Martin Smith
2.5	Pre-/post-CCS integration with marine propulsion system: post-combustion CO_2 scrubbing, pre-combustion molten carbonate fuel cells or molten salt reactors; integration of CCS technologies with marine powertrains; thermodynamic modelling, techno-feasibility analysis, and economic evaluation.	Professor Tony Roskilly
3.1	Decarbonising each port through co-development: identify emissions sources and emission reduction measures in ports; assess different solution measures for port decarbonisation; develop strategic roadmap for port decarbonisation; and optimise port operations to reduce emissions.	Professor Dongping Song and Professor Ying Xie
3.2	Support decarbonisation for vessels and industries as an energy hub: estimate port's energy and fuel demand and supply; plan port's energy logistics capacity and requirements; develop incentive schemes to align objectives among various stakeholders connected to ports	Professor Ying Xie and Professor Dongping Song
4.1	Low-carbon ship design: strategy and action for retrofit and new-build ships; digital twinning for speed-power performance monitoring and optimisation; AI-driven novel design adopting a multi-agent reinforcement learning method to optimise the coupled ship hull and propeller interactive optimisation.	Professor Pengfei Liu, Dr Serkan Turkmen and Dr Xiang Xie
4.2	Integration of novel marine propulsion: design and optimisation of novel marine propulsors for high-efficiency and environmental friendliness; renewable energy generation, conversion, and dual-mode propulsor-turbine propulsion system; systematic D&O of green-fuelled propulsion for hydrodynamic performance to integrate with electric engines; optimise the angle of attack (AOA) and energy consumption for a wind-assisted propulsion vessel.	Professor Pengfei Liu, Dr Serkan Turkmen, Dr Samir Belhenniche and Professor Zhiqiang Hu
4.3	Autonomous ships: a system engineering approach, addressing decarbonisation and safety benefits; safety and reliability assurance challenges; data requirements for valid situational awareness; verification and validation of situational awareness by authorities; safety criteria framework for evaluating safety of autonomous ships in shared situations, considering technical, ethical, and legal factors; key future requirements.	Dr Laurie Wright
4.4	Energy system, energy consumption, lifecycle emissions and cost analysis: develop a decision-making tool to explore decarbonisation alternatives, considering energy consumption, cost, and emissions across various scenarios.	Professor Yaodong Wang and Dr Janie Ling Chin

5.1	Data analytics and machine learning to generate actionable knowledge: apply natural language processing and AI to process unstructured and audio data collected from multiple sources to extract actionable knowledge; conduct a feasibility study and a full demonstration to showcase how actionable knowledge can improve business practices for better economic and environmental performances.	Professor Ying Xie and Professor Dongping
5.2	AI enabled optimisation for maritime operations: explore data-enabled smart operations through digitalisation and collaboration, e.g. ocean carriers and port operators collaboratively achieve just in time vessel arrivals; shippers and port operators jointly improve container stacking operations to eliminate reshuffles; truckers and port operators better utilise the vehicle booking system to reduce waiting time and emission.	Professor Dongping and Professor Ying Xie
5.3	Implications from the economic, financial and managerial perspectives: quantify the price differential between eco-friendly and non-eco-friendly vessels and examine its determinants; examine the effects of the decarbonisation regulations on marine insurance; develop an economic model that examines the impact of market-based measures on the operating cash flows of vessels and vessel prices and, thus, on the investment decisions of shipowners; develop a financial model that quantifies the investment risk stemming from the regulatory and technological uncertainty related to the transition to net zero shipping; model the carbon efficiency of vessels in terms of economic output versus carbon emissions; examine what causes shipping energy technology innovation and diffusion.	Dr Ioannis Moutzouris

6. Expected Project Outcomes

All projects awarded under the Wave 2 Flexible Funding call are required to leverage 1:1 match funding from industry project partners (as evidenced by letters of support). Proposals should also embed EDI, skills development, knowledge transfer and impact in the proposed activities. All project teams are expected to disseminate their research findings at a UK-MaRes Hub event, participate in the technical sprint organised by the Hub, and publish at least one journal article.

7. Eligible Costs

Eligible costs may include funding requested for:

- Staff costs (Principal Investigator, Co-Investigator(s), Research and Technical Staff).
- Travel and subsistence.
- Consumables.

Please note: Equipment costs are not eligible under this call.

8. Equality, Diversity and Inclusion (EDI)

EDI is at the heart of all UK-MaRes Hub's activities, and we encourage engagement from under-represented groups across the maritime research community. To promote EDI and support capacity building across the sector, the UK-MaRes Hub invites applications from researchers at all career stages, however projects must be led by ECRs who meet EPSRC

eligibility criteria. Successful proposals will consider and support EDI and skills development as part of their proposed project activity.

9. Submission Process

A submission will consist of a complete application form and letters of support from project partners. Letters of support from each project partner must be on headed paper, signed, and dated within the last 6 months, clearly indicating their meaningful contribution to the project and an auditable monetary value of the match funding.

Applications should be submitted by email to:
admin.clean-maritime-research-hub@durham.ac.uk by 16:00 on Tuesday 5th November 2024.
Any applications received after this date and time **will not** be considered.

10. Evaluation Process

All proposals will go through an initial sift stage by the Hub Manager and Administrator. The sift will focus on the completeness of the proposal, whether the proposal meets the eligibility and evaluation criteria, whether it duplicates the research that is already planned by the UK-MaRes Hub, and whether it is linked with the teams of the Hub's Principal and Co-Investigators (see **Section 4**). The shortlisted proposals will then be assessed by external reviewers in line with the four evaluation criteria below:

(1) Quality, ambition, and novelty.
(2) Strength of the project partnership and matched contributions.
(3) Ability to deliver the proposed research and complete the project by 31st Aug 2025.
(4) Clear plans for the proposed research, project management, engagement, EDI, skill development, and impact.

In line with the feedback provided by the external reviewers, the Responsive Research Working Group (RRWG) of UK-MaRes Hub will rank the proposals and make award recommendations to the Exploration and Responsive Research Council (ERRC) of UK-MaRes Hub. The ERRC will assess the proposals put forward by the RRWG, apply a portfolio view of potential Wave 2 Funding projects, and make the final selection of which responsive research projects are to be funded.

Please note: Should any applications be received from universities already part of the consortium, the investigators of the Hub from the same university, will have no input into the assessment and decision-making process related to the proposal.

Upon announcement of the assessment outcome, each successful application will be assigned an adviser from the Hub's academic consortium to support the project and provide a link to Hub's research portfolio.

11. Point of Contact for Queries

If you have any questions, please do not hesitate to contact us by emailing:
admin.clean-maritime-research-hub@durham.ac.uk