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**LOW CARBON ENERGY RESEARCH (LCER) PHASE 2
PROGRAMME HYDROGEN AND EMERGING TECHNOLOGIES
FUNDING INITIATIVE (HETFI)**

**EMERGING TECHNOLOGY GRANT CALL
FIRST GRANT CALL
2023**

CALL-FOR-PROPOSALS

The Low Carbon Energy Research Coordinating Office

A National Platform hosted by A*STAR

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INTRODUCTION

1. This document lays out the first call for Proposals under the Low Carbon Energy Research (LCER) Phase 2 Programme's Hydrogen and Emerging Technologies FI (HETFI) – Emerging Technology Grant Call (ETGC).
2. The LCER Programme is a multi-agency initiative governed by a Steering Committee (SC) chaired by Deputy Secretary (Industry), MTI. It comprises of representatives from various Singapore Government Agencies (MTI, EDB, EMA, EnterpriseSG, MOT, MPA, NCCS, NRF, and S&TPPO)¹ and the Singapore Academic Community (A*STAR, CREATE, NTU, and NUS)², with support from a Technical Committee (TC). The programme's main aim is to accelerate the technical and economic viability of low-carbon technologies like hydrogen and carbon capture, utilisation, and storage (CCUS) so as to reduce Singapore's carbon emissions, especially in the power and industry sectors.
3. LCER Programme Phase 1, established under the Research, Innovation and Enterprise (RIE) 2020, awarded 12 low-carbon projects in hydrogen and CCUS. LCER Programme Phase 2, established under RIE2025, had been allocated with \$129 million. HETFI, its first component, consisted of the Directed Hydrogen Programme (DHP) and ETGC. DHP was launched in Aug 2023 as a top-down directed approach in funding key hydrogen technologies that would be critical to Singapore while more details of ETGC will be shared in the subsequent sections.

GRANT

4. Under the ETGC, we invite researchers to submit proposals that develops nascent yet promising low-carbon technologies like hydrogen, CCUS and related areas (i.e. geothermal-related technologies). The intention is for awarded projects to

¹ Ministry of Trade and Industry, Economic Development Board, Energy Market Authority, Enterprise Singapore, Ministry of Transport, Maritime & Port Authority of Singapore, National Climate Change Secretariat, National Research Foundation and Public Sector Science & Technology Policy & Plans Office.

² Agency for Science, Technology & Research, Campus for Research Excellence and Technological Enterprise, Nanyang Technological University, National University of Singapore.

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start at a technology-readiness level (TRL) of 1-2, and attaining a lab-scale prototype stage (i.e. TRL 4) at the end of this grant call. Successful projects selected from the Review Panel will be scaled further via a directed grant call approach (more details in Paras 21 and 22). To this end, awarded projects shall receive funding support for a period of up to three years, capped at a maximum grant quantum of S\$1.2 million per project.

5. ETGC is technology-agnostic so long as the proposed technology can reduce the direct carbon emissions from the power and industry sectors, subject to the following qualifications:

- a. For pathways funded under LCER Phase 1 [i.e. liquid organic hydrogen carriers (LOHCs) for transporting hydrogen] and topics under the DHP as shown in **Annex A**, we are open to considering alternative/emerging pathways which had not been funded before (i.e. formic acid as a hydrogen carrier).
- b. The following technologies will not be covered to minimise overlap with existing ecosystem efforts:
 - i. *Nuclear*: There are existing programmes to support R&D efforts in this area.
 - ii. *Grid-technologies [including energy storage systems (ESS) and Energy Management Systems]*: There are existing programmes to support R&D efforts in these areas.

ELIGIBILITY CRITERIA

6. All public research institutes [Institute of Higher Learning (IHLs), A*STAR Research Institutes (RIs), and other public sector RIs] are eligible to participate in the grant call.

7. Each project shall only have one Lead Principal Investigator (PI). They shall:
- a. Hold at least 70% primary appointment in a public sector research institute or jointly with other public sector research institute(s); and
 - b. Maintain the minimum appointment level for the duration of this award.

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A project can have one or more Co-Investigators (Co-I). They shall:

- a. Hold at least 20% primary appointment in a public sector research institute or jointly with other public sector research institute(s); and
- b. Maintain the minimum appointment level for the duration of this award.

8. Teams may also include Collaborators who are researchers in private companies, overseas universities, or other public sector research institute(s). Collaborators cannot receive any funding, whether directly or indirectly, from the award.

9. All research work must be conducted in Singapore.

OTHER REQUIREMENTS

10. This grant call covers the development of TRL technologies towards a lab prototype (i.e. TRL 4). All proposals shall state how they meet LCER Programme's objectives and ETGC's criteria as stated in Paras 2 – 5. The proposals must aim to achieve research excellence through the inclusion of KPIs such as publications in the top 10% of most highly cited journals and technology disclosures. Applicants may also choose to add other KPIs if they feel that these KPIs will strengthen the proposal's value proposition.

11. In the proposal, researchers shall establish:

- a. Alignment to Singapore's relevant low-carbon energy policies and initiatives (i.e. Singapore's National Hydrogen Strategy, Singapore Green Plan 2030, Singapore's Energy Story, Sustainable Jurong Island etc). Do state whether there will be a significant amount of direct carbon abatement achieved if the technology is developed to a mature/commercially-viable stage. Do note that the deployment of the technology must take into account Singapore's constraints and limitations (i.e. limited available land and waterfront space, alternative energy disadvantaged status).
- b. Excellent science with distinct differentiation, and competitiveness at the international level.
- c. Strong academia partnership (both domestically and internationally).

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- d. Clear and precise milestones and deliverables. Do note that timeline carved must tie in with the review panel timeline at the project's 30th month. Please refer to Paras 21 and 22 for more information.

12. Proposal shall also include a list of 3 – 5 relevant, independent international peer reviewers with their personal details (name, designation, institution, and email addresses).

SELECTION PROCESS

13. All applications will be evaluated via a two-stage selection process: (i) International Peer Reviewers (IPR), and (ii) the Evaluation Committee (EC), supported by the Advisory Group (AG). This will be a competitive process whereby proposals are evaluated and ranked against each other.

14. Proposals will first be evaluated by the IPR. At least three IPRs will review and rank each proposal based on (i) its scientific merits vis-à-vis global research efforts, and (ii) team composition and capabilities. The IPR's criteria and its corresponding scoring weightages are listed in Table 1.

15. Thereafter, the EC will conduct a qualitative evaluation on the merits of the technology and the proposal's alignment with Singapore's strategic goals for decarbonisation before recommending which projects to fund. The EC will be supported by the AG, which will comprise international technical experts and IHL representatives. The AG will focus on advising on each proposal's technical merits and team capabilities / composition. When evaluating the proposals, the EC will consider the IPR and AG's comments and assessments. The composition of the EC and AG are shown in **Annex B**.

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Table 1: List of evaluation criteria for IPR selection

Requirements	Weightage
<p>Scientific Excellence</p> <p><u>Novelty and Feasibility</u></p> <ul style="list-style-type: none"> • To what extent does the proposal and aims suggest and explore creative and original concepts? • Is the proposed methodology feasible? <p><u>Quality of Science</u></p> <ul style="list-style-type: none"> • Would the proposal lead to scientific excellence in the proposed field of research? <p><u>Competitive and Comparative Advantage</u></p> <ul style="list-style-type: none"> • How competitive is the idea internationally? • Did the applicant acknowledge potential problem areas and consider alternatives? 	<p>75%</p> <p>25%</p> <p>25%</p> <p>25%</p>
<p>Capabilities Excellence</p> <ul style="list-style-type: none"> • Does the research performer/team possess the necessary capabilities to conduct the research successfully? • Does the Lead PI have the track record to lead and conduct the research successfully? • To what extent is the plan for organising and managing the project feasible? 	<p>25%</p>

APPLICATION

16. All proposals shall **only be submitted** through the **iGrants website** (<https://igrants-app.a-star.edu.sg/>). Please fill up the proposal template with the necessary information in Word and PDF, in addition to attaching the list of documents detailed below prior to submission:

- a. Full Proposal (**Annex C**)
- b. Appendix A1. Reference
- c. Appendix A2. Key Publications
- d. Appendix B. Compilation of Curriculum Vitae

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- e. Appendix C. Proposed Budget (**Annex D**)
- f. Appendix D: Other Grant Support (Detailed) (**Annex E**)
- g. [*Where Applicable*] Appendix E. Letters of Commitment
- h. [*Where Applicable*] Other Documents determined by Lead PI

17. Applications will be accepted on iGrants from **16 October to 26 November 2023, 2359hrs**. Late submissions will not be accepted.

18. Applicants are required to ensure that the information submitted complies with the guidelines in **Annex F1** and terms and conditions (T&Cs) in **Annex F2**. The following may be rejected without review:

- a. Lead PI is in the Grant Blacklist;
- b. Missing or wrong version of application forms;
- c. Inappropriate format (i.e. small font size and tight para spacing) or incomplete applications (i.e. sections left blank, missing CVs, etc.);
- d. Late submission on iGrants;
- e. Revisions to proposals made after the call closes (26 November, 2359hrs);
- f. Proposals that do not align with the LCER and ETGC objectives as outlined in Paras 2 – 5;
- g. Duplicates of proposals submitted to any other public funding agencies for simultaneous considerations; and
- h. Applications that do not meet the eligibility criteria outlined in Paras 6 – 11.

19. A*STAR shall not be liable for the release of information concerning proposals to third parties by individuals involved in the evaluation process. LCER CO also reserves the right to modify the grant call process and applicants will be notified of any relevant modification(s) to the review process where appropriate.

POST AWARD PROJECT REVIEW AND MONITORING

20. Awarded projects will be reviewed regularly, and research teams will be required to submit annual and final progress reports. Information shall include but are not limited to the following: progress, deliverables, KPIs, budget and post-project plans.

21. Awardees will also be required to undergo a review (where they will be required to submit a report), set at the project's 30th month, to assess whether these projects shall be recommended for a further round of R&D funding immediately after the conclusion of the ongoing project. The review shall cover how the project intends to scale up post-project, what is the technological maturity at current level, how it benefits Singapore, and which industry partners they will collaborate with. Relevant information like the life cycle analysis (LCA) and techno-economic analysis (TEA) shall be included to substantiate claims.

22. For avoidance of any doubt, the review referred in Para 21 is different from the annual progress and final reports. If successful, findings from the review will form the basis for potential funding of the project (to start immediately after the conclusion of the ETGC project).

23. LCER CO and its appointed reviewers will oversee the progress of the funded projects and will provide guidance over the research directions and intended deliverables.

24. The proposals shall comply with all guidelines and T&Cs stated in **Annex F** of the Grant Call documents.

REQUEST OF METADATA CATALOGUE

25. The Urban Solutions and Sustainability (USS)³ domain agencies are compiling a metadata catalogue to improve data discoverability for researchers. It

³ The USS domain helps strengthen capabilities in building a liveable, resilient, sustainable and economically vibrant Singapore as a city.

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seeks to encourage early (i.e. pre-award) data-related discussions between Lead agencies and Researchers and will serve as a central reference for datasets available within agencies for request, to be used exclusively for the Research.

26. Interested researchers from:

- a. Public Institutions (i.e. AUs, Polytechnics, A*STAR Research Entities, and Temasek Life Science Laboratory) may approach your respective Research Offices, who will assist to write in to request for the metadata catalogue.
- b. Local Entities (that are not part of the list of public institutions) may write in to request for the metadata catalogue directly. If approved, an authorised signatory from the organisation must agree to a non-disclosure undertaking before the metadata catalogue is shared.

27. Agencies will assess the requests based on the grant call topic (i.e. if sharing of agencies' data is indeed useful given the nature of the topic) and may request for further substantiations. Please note that agencies reserve the right to approve/deny any requests for the metadata catalogue, and that any data subsequently requested from the Government and/or public agencies will require the signing of separate non-disclosure agreements (NDA).

CONTACT INFORMATION

28. A list of Frequently Asked Questions has been attached as **Annex G**. For further enquiries, please email LCER CO at LCERFI_secretariat@hq.a-star.edu.sg.

Please address queries to the following officers:

- a. Mr Desmond Chua (Director/LCER CO)
- b. Dr Seah Kang Yee (Senior Manager/LCER CO)
- c. Mr Tan Ray (Manager/LCER CO)

29. We look forward to your support for this grant call.

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LIST OF ANNEXES (TO BE ATTACHED SEPARATELY)

Annex A – List of LCER Phase 1 Project and DHP Topics

Annex B – Evaluation Committee and Advisory Group Composition

Annex C – Full Proposal Template

Annex D – Grant Call Budget Template

Annex E – Other Grant Support (Detailed)

Annex F1 – Guidelines for the Management of Research Grants (with effect from 1 Jan 2020)

Annex F2 – Terms & Conditions of Grant (with effect from 1 Jan 2020)

Annex G – Frequently Asked Questions