

Climate Impact Science Research (CISR) Programme Grant Call

Grant call ID: N.A

Full proposal closing date: <2nd March 2023, Thursday, 4.00pm> (Singapore Standard time)

Summary

1. The Climate Science Research Programme Office (CSRPO), set up under the Centre for Climate Research Singapore (CCRS), is inviting proposals for the Climate Impact Science Research (CISR) Programme.
2. The CISR Programme will utilise the latest climate projections to understand climate change impact to 2100 and beyond, in five key priority areas - sea level rise; water resource and flood management; biodiversity and food security; human health and energy, and cross-cutting research to help bridge science-policy translation. The programme will contribute towards endeavours in coordinating climate science research and capability building efforts under the Climate Science Research Masterplan to inform climate adaptation through underpinning climate science.

Background

3. Climate change poses existential and long-term challenges to Singapore, a highly urbanised and densely populated low-lying island city-state. To guide the Government's early climate adaptation efforts, CCRS had completed the Second National Climate Change Study ('V2') in 2015, which provided reliable and localised climate change projections for Singapore to 2100 and beyond. The V2 study projected that by 2100, Singapore is likely to experience higher temperatures, some drier months, more intense and frequent heavy rainfall events, and mean sea level rise by up to around 1 metre.
4. The Third National Climate Change Study ('V3') is to be completed by 2023 and will update these findings through downscaling the latest IPCC Global Climate models to higher resolution as well as providing additional scenario and parameter information. Specific data available from V3 will include three scenarios (SSP126, SSP545, SSP585), two resolutions (8km and 2km) over large domains and data frequency from daily to monthly. For further details, refer to **Annex A**.
5. A better understanding of climate change impacts is necessary to help enhance public sector planning and decision making under future warming scenarios. Sea level rise, coupled with extreme tides and surges, could flood the coastline and pose a long-term existential threat to low-lying Singapore. More extreme weather events, such as droughts and intense rainfall, could affect Singapore's water resource and flood management practices. Such extreme weather events could also impact Singapore's biodiversity as well as local and regional crop yield and supply chains. Future warming may exacerbate the urban heat island effect, causing energy demand surges that impact supply and grid transmission. Future warming may also lead to an increase in the threat of vector borne diseases that

impact public health. Such potential impacts of climate change on Singapore will need to be further studied.

Scope of Present Grant Call 1

6. The **main objectives** of this call are to develop scientific capability in climate impact research in Singapore, and to support the development of climate adaptation policies by government agencies. CSRPO invites proposals for Research and Development (R&D) projects to be submitted for consideration toward funding in the following climate impact research area(s):

Item	Research area(s)
A	Biodiversity
B	Impact of Warming Trends on Human Health and the Energy Sector
C	Food Security
D	Science to Policy Translation

7. Please refer to **Annex B** for the problem statements to be addressed under these research area(s).

Key Performance Indicators/Deliverables

8. The Key Performance Indicators (KPIs) to meet the CISR Programme objectives are outlined below:

Proposed KPIs/Deliverables
<i>Research excellence</i>
KPI: Proportion of publications in the top 10% most highly cited worldwide ¹
KPI: Number of publications in top 10% journals ²
<i>Manpower</i>
KPI: Trained university PhD students ³
<i>I&E</i>
KPI: No. of technologies deployed, including licences ⁴
<i>Long-term outcome indicators</i>
KPI: Number of instances of policy influences ⁵

Project Duration

9. The project duration shall not exceed 48 months.

¹ % of Singapore's publications in top 10% citation percentiles (worldwide, field-weighted), excluding self-citations, in year of publications. To be reported by PI using citation tools such as Web of Science, Scival and Scopus.

² Number of publications in the top 10% of S&T journals in the field as tracked in the Thomson Reuters Joint Citation Report.

³ Only projects above \$1.0million will be required to train at least one PhD student.

⁴ Refers to Integrated scientific translation methodology/tools developed to support agencies in adaptation planning.

⁵ Refers to how research outputs informed policy (regardless of outcomes of eventual policy) e.g., change in guidelines/informing of target setting/informing of planning, etc. This KPI will be considered during proposal evaluation to ensure the research translation to policy.

Eligibility and Funding Support

10. Project funding follows the Guidelines for the Management of Research Grants and Terms and Conditions issued by the National Research Foundation (Refer to **Annex C**).

11. This call is open to the following institutions. Only R&D activities conducted in Singapore qualify for funding support (Refer to Table 1).

Table 1 Funding support and requirements for different type of institutions

Type of Host Institution / Main Applicant (where the research is conducted)	Funding Support and Requirements
Singapore-based public research performers ⁶	<ul style="list-style-type: none"> • [Direct costs⁷] 100% of the approved qualifying direct costs (Manpower, Equipment, Other Operating Expenses, Overseas Travel, Research Scholarship) of a project. • [Indirect costs⁸] 30% of the total qualifying approved direct costs (i.e., total direct costs (Manpower, Equipment, Other Operating Expenses, Overseas Travel, Research Scholarship) less Research Scholarship cost). • The funding support for each project is capped at \$1.5 million, inclusive of indirect costs. All expenditure should be budgeted inclusive of any applicable Goods and Services Taxes (GST) at the prevailing rates. • Involvement of PhD student(s), if any, should be highlighted in the proposal. Proposals with total requested funding amount (Direct cost and Indirect cost) above \$1 million are required to include at least 1 PhD student in the research team. • Funding is not allowed to be channelled to Collaborator⁹. • Both Private entity's tiers of funding support and Public Research Performer's funding support apply when it is a Partner Institution¹⁰.
Singapore-based private entities (incl. not-for-profit organisations)	<ul style="list-style-type: none"> • [Direct costs⁸] Up to 70% of the approved qualifying direct costs (Manpower, Equipment, Other Operating Expenses, Overseas Travel, Research Scholarship) of a project. <ul style="list-style-type: none"> • 30% for all non-Singapore private entities¹¹ (incl. non-Singapore not-for-profits). • 50% for Singapore Large Local Enterprises¹² (LLEs).

⁶ Public Research Performers refer to CREATE entities, A*STAR research institutes, Autonomous Universities of Singapore, and Healthcare Clusters.

⁷ Direct costs refer to costs directly attributed to the research project (i.e., required to deliver project objectives). Usually covers Expenditure on Manpower (EOM), Equipment (EQP), Other Operating Expenses (OOE), Overseas Travel (OT) and Research Scholarship (RS). More information on the non-fundable Direct costs can be found in Annex C - Guidelines for the Management of Research Grants, page 7.

⁸ Indirect costs refer to costs that are incurred for common or joint objectives and cannot be identified readily and specifically with a Project but contribute to the ability of the Grantee and Authorised Entities to support the project (i.e., providing research space, research administration, utilities), and not through the actual performance of activities under the Project.

⁹ "Collaborator" means any company, institution, incorporated body or other industry or academic collaborator, which is not an Institution or an Investigator but is to be engaged in the Research in collaboration with the Institutions or any of them.

¹⁰ "Partner Institutions" means the bodies or institutions named in the Letter of Award as the "Partner Institutions" as the bodies responsible for working together with the Host Institution to undertake the Research.

¹¹ Defined as entity with <30% local shareholding, determined by the ultimate individual ownership

¹² Defined as entity with ≥30% local shareholding; and more than \$100M in annual turnover

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- 70% for Singapore Small Medium Enterprises¹³ (SMEs), Singapore start-ups¹⁴ and Singapore not-for-profits¹⁵ entities).
 - **[Indirect costs⁹] 0%** of the total qualifying approved direct costs.
 - The funding support for each project is capped at \$1.5 million. All expenditure should be budgeted inclusive of any applicable Goods and Services Taxes (GST) at the prevailing rates.
 - In the proposal submission stage, private entities' applicant is to indicate **up to 70%** of the approved qualifying direct cost (based on the above different tiers of funding) under the budget requested in IGMS.
 - Funding for private entities will be conditional on collaboration with a Singapore public research performer. This is applicable for research projects with grant amount more than \$500K and test bedding/demonstration/scale-up projects with grant amount more than \$2 million. With such collaboration between private entities and Singapore public research performer, main applicant (where the research is conducted) should refer to the private entities' level of funding support accordingly.
 - Involvement of PhD student(s), if any, should be highlighted in the proposal. Proposals with total requested funding amount (Direct cost and Indirect cost) above \$1 million are required to include at least 1 PhD student in the research team.
 - Funding is not allowed to be channelled to Collaborator¹⁰.
 - Both Private entity's tiers of funding support and Public Research Performer's funding support apply when it is a Partner Institution¹¹.
 - Private sector entities are required to submit the audited financial statements for the past 3 years and Additional Declaration form in Annex D.
 - A Singapore Technology Licensing Office (STLO) must be appointed in projects that fund non-Singapore private entities¹², regardless of whether a public research performer is involved in the project to manage the foreground Intellectual Property, if any, in Singapore for maximum utility, and help to provide fair access to Singapore entities in the public and private sector.

Application Process and Requirements

12. Applicant must submit the proposal using the 'CISR Research Proposal Template', which can be downloaded from the Integrated Grant Management System (IGMS). Please refer to **Annex D** for the detailed guidelines on proposal submission in IGMS and FAQs for account creation in IGMS.

13. Applicant can propose project covering only one research area (see items in para 6) and address at least one of the stated problem statements. Proposals that are meant to collaborate in delivering the research should be submitted as a single proposal.

¹³ Defined as entity with ≥30% local shareholding; and has Group Annual Sales Turnover of not more than \$100M, or maximum employment of 200 employees

¹⁴ Defined as entity with ≥30% local shareholding; registered for less than 5 years at time of grant application; has individual ownership of more than 50% at reference year; employs at least 1 worker

¹⁵ To qualify as a not for profit, the entity must meet all 3 of the following criteria: (1) Registered and physically present in Singapore; (2) Core funding (i.e., excl. competitive grant funding) is derived entirely/mostly from Singapore entities; (3) Managed by a Board, which is at least half appointed by Singapore entities

14. Applicants shall highlight partnerships with other local and/or international collaborators (if any) and articulate the value that such partnerships will bring to the project. This includes connecting with other researchers while developing their proposal and indicating the likely synergies between their respective submissions.
15. Upon award, projects will be required to explore collaborations with researchers from the CCRS to ensure complementarity of research goals and potential pathways to stakeholder impact.
16. The proposal shall include, but not limited to:
 - i. Executive summary (maximum 1 page) – indicate project title, scientific abstract, lay abstract and deliverables
 - ii. Objectives – clearly articulate the objectives of the project
 - iii. Project description – full technical details on the approach and methodology of the proposal to deliver the expected outcome
 - iv. Project team composition – proposed team members’ expertise, previous related work and experience (maximum 2-page CVs shall be submitted for the Lead Principal Investigator, as well as for all co-PIs and Collaborators)
 - v. Project management – an overview of the proposed project management structure and its plans to increase the success rate of achieving the project objectives
 - vi. Detailed project schedule and deliverables – include a detailed project schedule (e.g. project timeline, Gantt chart) of major project activities and the milestone checkpoints
 - vii. Proposed KPIs – state targets for KPIs in fulfilment of the CISR Programme
 - viii. Data requirements (if applicable):
 - i. USS domain agencies are compiling a metadata catalogue to improve data discoverability for researchers. The intent is to encourage early (i.e. pre-award) data-related discussions between Lead agencies and Investigators and will serve as a central reference for datasets available within agencies for request, to be used exclusively for the Research.
 - ii. Datasets potentially useful for the Research would be highlighted in the respective call topics. Interested Investigators may write in to NEA_CSRPO@nea.gov.sg to request for the metadata catalogue. Please note that access to the metadata catalogue, as well as any data subsequently requested from the Government and/or public agencies require the signing of non-disclosure agreements (NDA) as a pre-requisite.

- iii. Proposers are to specify and describe datasets¹⁶ essential for the success of the project required from Public Sector Agencies and highlight possible alternatives if the data requested is not available for sharing.
- iv. Highlight all the datasets to be measured/collected within this project. Include details on data parameters to be measured, data collection plans, potential challenges, and mitigation measures.
- v. To facilitate data sharing, Host institutions are required to submit cleaned data that is collected or generated in the Research as identified by CSRPO. Please note that data may be shared with other NRF-funded projects in the future through the metadata catalogue, unless they are commercial data or bounded by non-disclosure agreements (NDAs), to maximise synergies across projects and minimise duplicative works.

Evaluation Criteria

17. All proposals are evaluated based on the impact of the proposed solutions in addressing national needs, the scientific/technical merits¹⁷ and the robustness of management/governance. The detailed evaluation criteria for proposal applications are as follows:

1. **Impact:** The proposal should address national strategic needs, with clear alignment with the Urban Solutions and Sustainability mission and other national priorities. There should be justification on build vs buy to ensure that the research funds are supporting niche R&D areas where technologies/capabilities are unavailable, and to sharpen Singapore's competitive advantages, where possible. The proposal should also articulate the pathway for deployment and/or commercialisation upon successful completion of the research;
2. **Scientific/technical merits:** The proposal should involve innovative and cutting-edge research or technology and encourage collaboration within Singapore's research ecosystem to strengthen research capabilities and core competencies. The quality and experience of the R&D team would also be considered. The lead PI should have a track record of leadership ability in coordinating research programmes and providing mentorship to research teams, as well as having productive research outcomes; and
3. **Robust management/governance:** The proposal should have defined objectives, quantifiable stretched targets with reasonable milestones and deliverables, and a clear structure of accountability. The proposal should also address the funding gap and not duplicate existing/past initiatives.

¹⁶ Implementing Agency (NEA) is not obliged to secure the list of data within the proposal from data owner. PIs and Host Institutions to undertake mitigation measures to ensure successful completion of projects if awarded.

¹⁷ Scientific/technical merits are assessed by a Scientific Advisory Panel comprising of an eminent group of local and international climate impact scientists with multidisciplinary expertise in the key research areas.

Point of contact

18. For enquiries pertaining to the grant call, please contact NEA_CSRPO@nea.gov.sg.

THE THIRD NATIONAL CLIMATE CHANGE STUDY ('V3') BROCHURE

S/N	Name of attachment(s)	Attachment(s)
1	Singapore's 3 rd National Climate Change Study (V3) brochure	 V3 Brochure.pdf

RESEARCH AREAS & PROBLEM STATEMENTS

Item	Research area(s)
A	Biodiversity
B	Impact of Warming Trends on Human Health and the Energy Sector
C	Food Security
D	Science to Policy Translation

Item A: Biodiversity¹⁸

Context:

1. Climate change impacts biodiversity locally. Dedicated research efforts are needed to understand the implications and interactions of climate change with the local context as well as the implications for the conservation of native biodiversity and for greenery management.
2. The desired outcomes and deliverable of this research area are expected to allow NParks to enhance climate adaptation solutions under the City in Nature by:
 - i. Assessing the risks of impacts of projected localised rainfall and temperature levels and extreme weather events on biodiversity;
 - ii. Identifying gaps, developing improved strategies and prioritising actions for biodiversity conservation, landscape design and forest and urban greenery management to better withstand these predicted impacts¹⁹; and
 - iii. Monitoring leading as opposed to lagging indicators of the potential impacts on biodiversity so that mitigation actions can be triggered on time.

Problem Statements:

Impacts of projected climate change on ecological functionality of ecosystems in Singapore and associated environmental consequences which may impact the individual fitness, populations, and biophysical processes through a variety of pathways.

¹⁸ Does not cover impacts of climate change on marine biodiversity which is under the NParks Marine Climate Change Science (MCCS) Programme.

¹⁹ Findings from the research should enhance NParks' Tree Structural Model (TSM), which is currently used for single tree failure risk quantification and prediction through assessment of a tree's ability to withstand different wind loads. The findings should enhance the current parameters/algorithms used in TSM that relate to wind load estimation on trees and incorporate new parameter/algorithms to take into consideration tree anchorage strength acting through the soil-root interfaces for tree stands as well as individual trees. The enhancements should also include automatically updated geographical information system (GIS) map layers detailing wind speed (in consideration of amplification/sheltering factors), as well as soil moisture availability, for individual trees in different locations in Singapore. Research outcomes should be consolidated into guidelines for tree managers and arborists.

1. What are the impacts²⁰ of projected climate change on the resilience and capacity of forest ecosystems²¹ in Singapore's nature reserves and parks to deliver ecosystem services²²? In addressing this question, the topics should be focused on:
 - i. Key factors that influence the ability of lowland tropical rainforests to resist and adapt to climate change, such as the ability for regeneration, tolerance of temperature and hydrological changes, etc.
 - ii. Understanding how projected climate impacts will interact with and/or alter forest edge effects and the buffering capacity of surrounding vegetation, such as those in nature parks surrounding nature reserves; and
 - iii. Understanding how anticipated changes might affect the key ecosystem services provided by our forests, such as regulation of biogeochemical cycles and environmental quality, and recreational and socio-cultural benefits to the well-being of Singapore residents.

Impacts of projected climate change (changes in wind speed and rainfall patterns) on urban tree failure

2. What are the impacts of climate change on urban tree failure risk:
 - i. What are the projected increases in magnitude, frequency, and duration of average and peak wind gust speeds in different urban landscapes, and the corresponding change in wind loads on whole trees of different functional groups, sizes, and growth forms (e.g., deciduous species from different monsoonal forests, evergreen species from aseasonal forests)²³?
 - ii. What are the projected wet and dry event scenarios (e.g., changes in available soil moisture and impact on the stability of trees of different functional groups, sizes, and growth forms²⁴?
 - iii. How will these different environmental factors (i & ii) interact and impact tree failure risk for tree stands²⁵ (e.g., considering buffering effects of trees planted in proximity in a multi-tiered approach compared to single trees) in different urban landscapes?

²⁰ Develop/enhance working examples (where the data is most complete) of predictive modelling approaches linking and integrating one or more aspects of projected climate change (e.g., warming, drought/rainfall extremes, extreme wind events, etc.) impacts; as part of this, to provide raw data collected during the project and programming code used for modelling.

²¹ Covers demographic processes and population trajectories of species of national interest (e.g., listed on NParks' Species Recovery Programme) or major groups of forest species (e.g., dipterocarps) that perform important ecosystem functions, and ecological/biophysical processes (e.g., primary production, nutrient cycling, evapotranspiration) in Singapore's inland primary and secondary forests.

²² Examples of ecosystem services include carbon sequestration, contributions to thermal comfort, recreational opportunities, conservation of natural heritage, etc.) provided by Singapore's inland forests.

²³ To quantify impacts on tree structural integrity and stability arising from future wind speed scenarios in different urban landscapes, through measurement of actual wind loads on different tree types, derivation of canopy drag coefficients based on leaf area density or other measurable parameters, and establishment of wind amplification/sheltering factors for urban trees taking into consideration the presence of terrain, urban structures, and other surrounding greenery assets.

²⁴ To quantify impacts on tree root anchorage strength and tree stability arising from changes in soil-water availability and under different climate scenarios and soil conditions in different urban landscapes.

²⁵ To determine how these factors interact and impact tree failure risk under different climate scenarios, for single trees compared to tree stands in different urban landscapes.

Impacts of projected climate change on leading indicators of environmental and physiological thresholds to determine high risk of tree death

3. What are the thresholds of exposure to climate change (e.g. temperature, rainfall, dry spell duration, etc.) and corresponding adaptive capacity in trees which when exceeded leads to high risks of severe reduction in tree health and eventual tree mortality²⁶?

Item B: Impact of Warming Trends on Human Health & the Energy Sector

Context:

1. Future warming, increasing urbanisation, and potential increase in humidity levels will exacerbate the Urban Heat Island (UHI) effect in Singapore. This may negatively affect outdoor thermal comfort and human health. In addition, extreme temperature and changes in rainfall and humidity could influence the intensity and magnitude of vector-borne diseases such as dengue outbreaks or other infectious diseases. Lastly, extreme temperatures may have an impact on electricity supply and demand.
2. The desired outcomes and deliverable of this research area are expected to:

Human Health

3. Allow MOH to better assess the health impact of rising urban heat on the general population, including impact on physical activity, morbidity and mortality or healthcare utilisation. This will enable better understanding of the need for better general population awareness of heat stress, designing safe physical or sports-related activities, developing targeted medical interventions, and future planning of healthcare services.
4. Allow URA to better assess the impacts of warming trends on human health and enable them to factor this into the planning and design of the city (e.g. adopt measures to improve thermal comfort and reduce the impact of rising temperatures on health), and
5. Allow NEA and NParks to enhance risk assessment on incursion and spread of vector-borne and zoonotic diseases in Singapore, and the strategies and management options for their prevention and mitigation under the City in Nature and Bio surveillance Framework, by:
 - i. better characterisation of the range of climate scenarios that impact the threshold conditions for vectors' ability to spread diseases among humans e.g. increased rainfall leading to more breeding sites and higher vector populations, higher temperatures favouring faster development of vectors and shortening extrinsic incubation period of pathogens;

²⁶ To develop a set of leading environmental and physiological indicators and the functional group and species-specific thresholds for trees in Singapore that may signal elevated risk of tree mortality arising from climate change. An evaluation framework (consisting of indicators and methodologies of measurement) to monitor and predict impending tree mortality arising from the impacts of projected climate change should be developed, for a range of species representing the spectrum of functional traits and tree architectural types most commonly found among the trees in horticultural landscaping, including native species.

- ii. Improved understanding of the diversity, distribution, abundance, ecology behaviour and vectorial status of biting arthropods and impact of climate change on these components viz a viz changes in the distribution of companion animal and wildlife hosts e.g. shifts in spatial and density distributions, allowing early detection with the use of prevalence maps in bio-surveillance programmes; and
- iii. Using a predictive analytical model to forecast zoonotic and vector-borne diseases against climate change using abovementioned study outcomes.

Energy Sector

6. Allow EMA to better project electricity demand arising from extreme temperatures for the planning of power system transmission and distribution network, and generation infrastructure. This will enable them to develop more targeted adaptation measures that address the impacts of extreme temperature scenarios on electricity demand and power network infrastructure.

Problem Statements:

Human Health

1. How can future UHI projections be used to estimate impacts on human health and healthcare services? Note: this can include investigating metrics that measure impacts on the resident population and visitors:
 - i. Physical impacts e.g. impact on safe physical or sports activities; mortality/morbidity from heat exhaustion or arising from exacerbations of existing chronic diseases; disability-adjusted life years, years of life lost, or life expectancy; and
 - ii. Mental health impacts e.g., arising from reduction in physical activity, climate anxiety
2. What are the impacts of variations in global and local climates on the ecology, diversity, distribution and behaviour of biting arthropods and free-ranging animal-hosts (such as wild birds, free-roaming chickens, wild boars, monkeys and rats) in Singapore, including through changes in local habitats and migratory flyways, which will inform emerging zoonotic disease risk incursion and spread in Singapore? Note: The studies could propose work on 1) migratory and local wild birds and mammals; 2) mosquitoes from common genera (groups) in Singapore such as *Aedes*, *Culex* and *Anopheles*; and 3) other biting arthropods such as ticks, fleas, biting midges, sandflies.
3. What are the impacts of variations in global and local climates on disease dynamics (e.g., pathogen characterization, evolution, epidemiology and proliferation) of vector borne and zoonotic diseases of significant public health concern in Singapore (e.g., arboviruses such as dengue, West Nile virus and Japanese Encephalitis virus, and avian-borne zoonoses such as avian influenza or parasitic zoonoses such as leishmaniasis, malaria and toxoplasmosis)? How will the climate-associated changes in animal host-vector-pathogen interaction affect human health in terms of disease incidence and seasonality?

Energy Sector

Impacts of extreme temperature on energy supply - durability of gas and electrical transmission infrastructure

1. Impact of extreme and sustained rising temperatures (ambient temperature) be used to evaluate the impact on the durability and operations, particularly efficiency and output of the conventional thermal power plants, solar PV, and Energy Storage Systems (ESS), as well as electricity and gas network equipment e.g., substation equipment. Examples of specific research areas include:
 - i. Impact of higher temperatures on the durability and operations, particularly efficiency and output of Singapore's Combined Cycle Gas Turbines (CCGTs)' gas turbines and compressors.
 - ii. How will changes in temperature and humidity affect the efficiency of solar PV and Singapore's maximum solar potential?
 - iii. Impact of higher temperatures on the operability of Singapore's existing gas transmission infrastructure including SLNG Terminal equipment, Natural Gas Onshore Receiving Facilities' equipment, and gas pipelines. This is to better understand how higher temperature may impact pipelines in terms of:
 - a) physical expansion of pipelines; b) increase rate of corrosion; c) formation of free liquids in natural gas pipelines which are potentially damaging to gas transmission equipment, and

Impacts of climate change on energy supply - renewable resources in Asia Pacific

2. How will extreme weather conditions (ambient temperature, solar radiation, wind speed, flood, and drought) impact the renewable resources in Asia Pacific supplying electricity imports, and what are the potential risks brought about by climate change? The study should cover the impacts on:
 - i. the various generation technologies including solar, hydropower, wind, biomass, geothermal (with greater focus on the first three renewable energy sources).

Impacts of extreme temperature on electricity demand

3. What are the impacts of extreme temperature on electricity demand for residential and non-residential sectors (e.g., conducting a study on Cooling Degree Day (CDD) and ambient temperatures/power consumption on electricity demand by geographical locations which are primarily dominated by residential or non-residential sectors).

Item C: Food Security

Context:

1. Climate change impacts food security on a local and global dimension, hence, dedicated research efforts are needed to understand the implications and interactions of each.
2. The desired outcomes and deliverable of this research area are expected to allow SFA to enhance climate adaptation solutions such as strengthening food security and resiliency under the National Food S&T Masterplan in response to climate impacts such as:
 - i. Understanding the impact of robust rainfall, humidity, wind speed and temperature projections on local production, overseas food sources and food supply chains; and
 - ii. Develop a research model that translate projected climate change to impacts on food supply, especially key food items from major import sources. e.g. using past 20 years historical data of Cameron Highlands to understand the climate patterns and project the impact of climate change on the productivity and yield of vegetables.

Problem Statements:

1. How will projected climate change e.g. rainfall and temperature impact local and regional (Southeast Asia) food supply chains, focusing on key food items? For example, to assess the climate sensitivity and the impact on food safety of key food items from the Singapore Food Statistics²⁷, e.g.
 - i. Leafy vegetables
 - ii. Fish
 - iii. Oil palm trees (source of cooking oil)
2. How will projected climate change affect productivity and yield of key food items above as well as the shift in suitable cropland/production areas?

Item D: Science Translation to Policy

Context:

1. Existing works on science translation to policy involve planning for climate change based on projections for a single scenario e.g. worst-case scenario. There are no existing works that incorporate the Shared Socioeconomic Pathways (SSPs)²⁸ to study the various scenarios e.g. “worst case”, “best case” scenarios as well as the consideration of High Impact-Low Likelihood (HILL) scenarios for climate adaptation planning.
2. The desired outcomes and deliverable of this research area are expected to:

²⁷ Available at: <https://www.sfa.gov.sg/publications/sgfs>

²⁸ SSP climate scenarios consider socioeconomic conditions and RCP scenarios (GHG concentrations/emissions).

- i. Develop a generic risk assessment framework to enable translation of climate projections to policy.
- ii. Research and development of training materials to support cross sector use of a generic risk assessment framework, including comms materials, workshops, training, etc.

Problem Statements:

1. What are the most effective tools and impactful applications of climate change science information in a risk-based assessment framework?

NRF GUIDELINES, TERMS & CONDITIONS

S/N	Name of attachment(s)	Attachment(s)
1	Guidelines for the Management of Research Grants	 Guidelines for the Management of Rese:
2	Terms and Conditions issued by the National Research Foundation	 Terms and Conditions.pdf
3	USS Addendum to Terms and Conditions_Vers. 1.0 wef Nov 22	 Addendum to NRF Terms and Conditions

GUIDELINES FOR SUBMISSION OF PROPOSAL IN IGMS AND IGMS ACCOUNT CREATION FAQs

GUIDELINES FOR SUBMISSION OF PROPOSAL IN IGMS

IGMS Closing Date: [2nd March 2023, Thursday], 4:00 pm (Singapore time, GMT)

1. This Request for Proposal (RFP) is a single full proposal stage.
2. Applicants are required to submit the application via the online IGMS at <https://researchgrant.gov.sg/> before the stipulated closing date and time for the RFP. Late or separate submission outside of IGMS will not be considered.
3. **New IGMS user will need to set up a IGMS account using CorpPass.** To set up a CorpPass account, please visit www.CorpPass.gov.sg. Applicants are advised to allow sufficient time (at least 2 weeks) for their respective companies to be registered, including registering their respective researcher profiles in the IGMS prior to submitting proposals. Please refer to **IGMS Account Creation FAQs** below for further information.
4. The Lead PI is required to submit the application online, with all supporting documents, through IGMS. Once PIs have submitted their documents online, their applications will be routed to the Office of Research (ORE) and Director of Research (DOR) (or equivalent) of their respective Host Institution for online endorsement and approval. **Submission is considered complete only when it is endorsed by ORE and approved by DOR in IGMS before the deadline. Incomplete submissions may be rejected.**
5. For collaborative projects, the Lead PI will have to list out him/herself as “LeadPI” in IGMS and the co-PI(s) as “TeamPI”. Both PI and co-PI(s) will need to have an account in IGMS. Only the Lead PI is required to submit the proposal in IGMS. Co-PI(s) will be able to view and edit the proposal submitted by the Lead PI.
6. If the Lead PI and the co-PI(s) are from different entities, the proposal will have to indicate the budget requested for the different entities accordingly. **In IGMS, please ensure that the budget line items are allocated to the correct entity by tagging the items to the correct role i.e., LeadPI or TeamPI.**
7. As for private entity’s applicant, the proposal will have to indicate the budget requested based on the different levels of funding support for each enterprise type. For example, Singapore Large Local Enterprises are to indicate 50% (i.e., \$500k) of the total project cost (i.e., \$1 million) under the requested budget in IGMS.
8. All relevant sections of the online IGMS proposal research template must be completed, with the CISR Programme research template and supporting

documents uploaded as separate attachments.

9. The documents to be submitted are:
 - a. CISR Programme Research Proposal Template
 - b. Curriculum Vitae of Lead PIs, Co-PIs, and Collaborators
 - c. Additional Declaration form for Private Entity's Applicant

Please restrict each attachment to be less than 4MB.

S/N	Name of attachment(s)	Attachment(s)
1	CISR Research Proposal Template	 CISRP RESEARCH PROPOSAL TEMPLATE
2	CV Template	 Climate Impact Science Research (CIS
3	Additional Declaration Form for Private Entity's Applicant	 Additional Declaration Form for I

10. Please follow the naming convention and format for labelling of softcopy attachments:

Attachment	Naming Convention	Format of attachment
Proposal Template	<i>Proposal_Host Institution name_ Proposal title</i>	MS Word
CVs	<i>CV_ Name of PI/Co- PI/Collaborator</i>	MS Word
Additional Declaration form	<i>Additional Declaration form_Private Entity's name_Proposal title</i>	MS Word
Other supporting documents	<i>Supporting Doc_ Proposal title</i>	MS Word or pdf

Important: Where relevant privileged or confidential information is needed to help convey a better understanding of the project, such information should be disclosed and must be clearly marked in the proposal.

11. Should there be revisions to the submitted proposal, Lead PI must delete previous submission(s) and only keep the final proposal in the IGMS.
12. Please download the Integrated Grant Management System (IGMS) User Guide from <https://researchgrant.gov.sg/Pages/TrainingGuides.aspx> for all instructions on the submission process via IGMS system.
13. For enquiries pertaining to IGMS system, please email IGMS helpdesk at Helpdesk@researchgrant.gov.sg

IGMS ACCOUNT CREATION FAQs

1. Before you begin, please familiarise yourself with the various training guides on navigating the IGMS system.
2. The various guides and manuals will help you understand the roles of various users in the IGMS and the application process. These documents can be downloaded from <https://researchgrant.gov.sg/Pages/TrainingGuides.aspx>
3. The registration of the company / institution within IGMS is mandatory as part of the proposal submission workflow.
4. Please refer to the Standard Operating Procedures below for the creation of a new company / institution within IGMS.

Creation of Account for Local Users

Step 1:

To create IGMS Account for local users, companies / institutions will need to send an email to NEA_CSRPO@nea.gov.sg, by **<30th January, Monday, 4.00pm>**, with the following details:

Email Subject: *Creation of new Company / Institution Account in IGMS for [Insert Company/Institution name]*

Details of the New Company/Institution to be Created in IGMS

- Full Name of Company:
- Indicate Local Company or Foreign Company:
- Indicate Public Company or Private Company:
- UEN (for local company) or Unique Identifier (for foreign Company):

The CSRPO will inform the companies / institutions when their accounts have been created.

Step 2:

For Lead PI who will be submitting the application under their company / institution, the role of HI Admin is necessary for the assignment of relevant roles (“ORE” and “DOR”)²⁹ to other IGMS users in the company / institution.

After the company / institution has been created in IGMS, NRF IGMS team would grant him/her the Principal Investigator (PI) role by default. The CSRPO will inform them to nominate an HI Admin. Thereafter, the CSRPO will arrange with NRF IGMS

²⁹ To complete a proposal submission in IGMS, **3 distinct roles** are required from any company / institution to endorse the proposal, namely: Lead Principal Investigator (PI), Office of Research (ORE) and Director of Research (DOR). HI Admin and PI can be held by the same person, while DOR and ORE have to be held by 2 different persons.

team to change the role of the person from a Principal Investigator (PI) to an HI Admin. The following steps will apply:

1. The company / institution will need to nominate an HI Admin. The HI Admin (including all other intended IGMS users) will need to ensure that his/her **CorpPass** account has been setup. Guide for CorpPass creation could be found on <https://www.iras.gov.sg/IRASHome/e-Services/Other-Taxes/CorpPass/>
2. The HI Admin will need to login to IGMS using his/her **CorpPass** account to **register/update** his/her profile in IGMS. Please note that the NRF IGMS would grant him/her the **PI** role by default.
3. After the HI Admin has been successfully registered in IGMS, the HI Admin will notify the CSRPO with the information below. The CSRPO will then email to NRF IGMS (cc NRF Directorate) to change the role of the person from a **Principal Investigator (PI)** to a **HI Admin**:
 - a. Full Name of HI Admin:
 - b. Email Address of HI Admin:
 - c. Designation of HI Admin in his/her company:

Once granted the role as an HI Admin, he/she can proceed to assign the relevant roles (e.g., “DOR”, “ORE”, etc.) to the various users within his/her organisation.

ORE’s actions on IGMS: Verify proposals, deviation requests and progress reports. An ORE can also raise certain deviation requests on behalf of the PI.

DOR’s actions on IGMS: Endorse proposals, deviation requests and progress reports.

Since an HI Admin can concurrently hold the role of Lead PI, he/she will be able to select different profiles upon login to IGMS:

- a. Login as HI Admin – to maintain institution & user profiles
- b. Login as PI – to apply for grant call.

Creation of Account for Foreign Users

For local companies / institutions with foreign staffs without access to CorpPass/SingPass. The following steps apply:

1. All foreign users from the company (i.e., **HI Admin, DOR, ORE, PI**) will “**Register**” themselves in IGMS via “**Login for overseas users without CorpPass/SingPass**” from <https://researchgrant.gov.sg/eservices/Account/Login>.



2. After all the foreign users have been successfully registered in IGMS, the **HI Admin** will notify the CSRPO with the information below. The CSRPO will then email NRF IGMS (cc NRF Directorate), so that NRF IGMS can **add** all the users, **tag** them to their company, and **assign** the correct roles to all the users in IGMS:

- a. Full Name of HI Admin:
- b. Email Address of HI Admin:
- c. Designation of HI Admin in his/her company:
- d. Full Name of DOR (if DOR is foreign user):
- e. Email Address of DOR (if DOR is foreign user):
- f. Designation of DOR in his/her company (if DOR is foreign user):
- g. Full Name of ORE (if ORE is foreign user):
- h. E-mail Address of ORE (if ORE is foreign user)
- i. Designation of ORE in his/her company (if ORE is foreign user):
- j. Full Name of Foreign Lead PI/Co-PI(s)*:
- k. E-mail Address of Foreign Lead PI/Co-PI(s)*:
- l. Designation of Foreign Lead PI/Co-PI(s)* in his/her company

**List down all the foreign users that requires tagging to a company/institution*

3. To complete a proposal submission in IGMS, 3 distinct roles are required to endorse the proposal, namely: Lead Principal Investigator (PI), Office of Research (ORE) and Director of Research (DOR). HI Admin and PI can be held by the same person, while DOR and ORE have to be held by 2 different persons.

ORE's actions on IGMS: Verify proposals, deviation requests and progress reports. An ORE can also raise certain deviation requests on behalf of the PI.

DOR's actions on IGMS: Endorse proposals, deviation requests and progress reports.

4. Once the above foreign users have been added, tagged and assigned in IGMS, they can then proceed to login to IGMS, <https://researchgrant.gov.sg/eservices/Account/Login> via the "**Login for overseas users without CorpPass/SingPass**" section.
5. **Note:** The **HI Admin** in the foreign companies cannot add a new foreign user.

However, the **HI Admin** in the foreign companies can change the role of a user or delete an existing user in his/her company.