NATIONAL RESEARCH FOUNDATION
PRIME MINISTER'S OFFICE
SINGAPORE

Foundational Research Capability (FRC) Studies

The Foundational Research Capability (FRC) Studies are a series of studies commissioned by NRF and led by study teams consisting of members of the Singapore research community to systematically identify areas for fundamental research capability building in Singapore and recommend how these could be grown. Such areas could include i) important nascent areas of foundational science and technology that are emerging in the world, ii) potential peaks of excellence that could emerge from capability already seeded in Singapore, which could benefit from additional capability and resources, or iii) areas where research capability is needed to fulfil near/long term needs of Singapore.

2023 – 2024 FRC Full Studies

Topic	Overview	Link
Green Computing	This report explains that green computing has rapidly gained prominence due to increasing environmental concerns and IT's significant role in energy consumption, necessitating energy-efficient, low-carbon, and environmentally sustainable computing methods to address climate change, resource depletion, and e-waste generation challenges. Building on Singapore's potential to lead in this field, the report conducts detailed analysis of Singapore's green computing research performance compared to global standards, identifies promising long-term scientific and engineering foundations for investment, and reviews essential technologies that could enhance Singapore's position. The research would focus on proposing future green computing research directions and applications to propel Singapore towards a sustainable, low-carbon future whilst highlighting potential economic and environmental impacts of such research on the nation's digital transformation. The NRF would like to thank the study team led by Prof Bingsheng He from NUS for their efforts in bringing together the research community and producing this study report.	https://go.gov.sg/frc-report-green-computing
Green Chemical Production and CO_2 Transformation	This report explains that sustainable molecular manufacturing requires achieving zero or negative net carbon emissions and minimal ecosystem disruption, necessitating radical transformation from current production methods through adoption of fossil-free feedstocks including captured CO2 and implementation of appropriate green chemical methods. Building on detailed analysis conducted through workshops, expert interviews, and literature review of scientific and policy documents, the report identifies four foundational capabilities critical for transition towards sustainable molecule manufacturing: design for function, design of novel synthetic reactions, tools in design and scale processes, and AI-based research methods. The report would focus on five recommended areas for targeted programmatic support including fossil-free chemistry, digital chemistry, new synthetic methods, process technology, and biotechnology and biomaterials to create Singapore's leading scientific and technological position in sustainable molecular manufacturing. The NRF would like to thank the study team led by Prof Alexei Lapkin from CARES-CREATE for their efforts in bringing together the research community and producing this study report.	https://go.gov.sg/frc-report-green-chemical
Next Generation Energy Systems	This report explains that next generation energy systems require fundamental understanding of thermodynamic boundaries and innovative technologies for energy efficiency, necessitating comprehensive investigation into novel materials, physics, and chemistry principles for energy storage systems across automotive and grid applications. Building on Singapore's research landscape through meticulous survey of key areas and scholars, the report identifies five primary research domains: heat engines and fuels for power generation and propulsion, fuel cells and low carbon fuels, electrical energy storage systems, non-electrical energy storage systems, and fusion energy technologies. The report would focus on developing foundational science and engineering capabilities that serve as a versatile toolkit for widespread application across diverse sectors, sustaining Singapore's peaks of excellence whilst nurturing fundamental technologies crucial for maintaining international competitiveness in the global energy transition. The NRF would like to thank the study team led by Prof Chan Siew Hwa from NTU for their efforts in bringing together the research community and producing this study report.	https://go.gov.sg/frc-report-next-gen

Acronym	
NRF	National Research Foundation
NTU	Nanyang Technological University
NUS	National University of Singapore
CARES-CREATE	Cambridge Centre for Advanced Research and Education (CARES) Campus for Research Excellence and Technological Enterprise (CREATE)