



## Innovating for a Sustainable Future

*Solutions for Climate, Communities, and Resources*

### Need Statement 1 – Advancing Marine-Based Carbon Sequestration with Algae and Seaweed

The ocean, which holds 50 times more carbon than the atmosphere, presents an immense opportunity for carbon sequestration. Marine algae and seaweed have significant potential to enhance carbon absorption and contribute to emissions reduction. However, optimizing their efficiency for large-scale impact and integrating these systems into global carbon strategies remain critical challenges.

Design innovative solutions that leverage marine algae, seaweed, and other ocean-based resources to enhance global carbon sequestration efforts. Potential areas of focus include:

- **Optimizing Cultivation:** Develop methods to increase the carbon absorption efficiency of algae and seaweed through advanced cultivation techniques, genetic improvements, or nutrient optimization.
- **Scalable Systems:** Design large-scale systems for farming algae and seaweed in marine environments while maintaining ecosystem health and biodiversity.
- **Carbon Storage Solutions:** Explore ways to capture and store carbon absorbed by marine algae and seaweed effectively, ensuring long-term sequestration.
- **Sustainable Integration:** Create strategies to integrate marine-based carbon sequestration with other climate solutions, such as renewable energy projects, coastal restoration, or aquaculture.
- **Innovative Applications:** Investigate uses for harvested algae and seaweed, such as biofuels, biodegradable materials, or soil enhancement, that support a circular economy while maintaining carbon sequestration benefits.

Solutions should prioritize sustainability, scalability, and alignment with global climate goals, ensuring that marine-based systems are both effective and practical in combating climate change.



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# Need Statement 2 – Developing Lower Carbon Solutions for the Energy Sector

The world's major energy companies are committed to reducing their carbon footprint while meeting the growing energy demands of a rapidly developing world. However, transitioning to lower-carbon solutions requires innovative approaches to decarbonize operations and integrate sustainable practices across the energy value chain.

Develop technologies or strategies that enable significant reductions in greenhouse gas emissions. Solutions can focus on areas such as:

- **Advancing carbon capture**, utilization, and storage (CCUS) technologies to scale and reduce costs.
- **Creating systems to monitor**, measure, and minimize methane leaks in upstream operations.
- **Proposing renewable energy solutions** that complement existing infrastructure and operations.
- **Designing innovative energy efficiency solutions** for refining, transportation, and distribution processes.
- **Developing sustainable fuel alternatives**, such as biofuels or hydrogen, to replace traditional fossil fuels.

Solutions should prioritize scalability, cost-effectiveness, and a lower-carbon future while maintaining energy reliability and affordability.



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### **Need Statement 3 – Advancing Carbon Capture and Storage (CCS) Technologies**

Carbon Capture and Storage (CCS) is a critical technology for reducing greenhouse gas emissions and mitigating climate change. However, current CCS systems face challenges such as high costs, scalability, and energy efficiency, limiting their widespread adoption in industrial and energy sectors.

Develop innovative solutions to enhance the effectiveness and affordability of CCS technologies. Ideas can include:

- **Designing advanced capture systems** that increase the efficiency of CO<sub>2</sub> separation and reduce energy consumption.
- **Developing cost-effective methods** for transporting and storing captured carbon, such as pipelines, modular systems, or storage in depleted oil fields.
- **Proposing new applications for captured CO<sub>2</sub>**, turning it into valuable products like building materials, fuels, or chemicals.
- **Creating intelligent monitoring** and verification systems to ensure the safety and reliability of long-term carbon storage.

Solutions should include ways to integrate CCS into existing industrial and energy infrastructures with minimal disruptions and maximum impact.



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### Need Statement 4 – Creating Sustainable Housing Solutions for Expanding Poverty Areas

With more than 20% of the world's population living in poverty housing areas, a severe global housing crisis is unfolding. The challenge is to develop innovative, cost-effective housing solutions that address the needs of rapidly expanding slum populations while ensuring access to sanitation, safe water, and sustainable living conditions. Emerging technologies, such as 3-D printed homes, show potential but require further innovation and adaptation to meet these demands.

Design solutions that provide livable, sanitary, and affordable housing for impoverished communities. Key considerations include:

- **Innovative Construction Methods:** Explore using emerging construction technologies, such as 3-D printing, modular housing, or recyclable materials, to create affordable and scalable housing solutions.
- **Sanitation and Clean Water Access:** Develop integrated systems for safe, clean water supply and waste management within housing designs, drawing inspiration from sustainable water management practices in developed countries.
- **Sustainability and Durability:** Ensure housing designs are environmentally sustainable, energy-efficient, and resilient to climate-related risks such as flooding or extreme weather.
- **Community-Centered Design:** Incorporate the preferences, culture, and needs of the inhabitants to create practical solutions, culturally appropriate, and improve overall quality of life.
- **Scalability and Cost-Effectiveness:** Focus on solutions that can be rapidly implemented on a large scale at a low cost to address the growing demand for affordable housing.

Solutions should balance innovation with practicality, offering sustainable and scalable approaches to alleviate the global housing crisis while improving living conditions in the most vulnerable communities.



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### Need Statement 5 – Innovative Solutions to Mitigate and Adapt to Climate Change

Climate change is one of the most pressing global challenges, with rising temperatures, extreme weather events, and environmental degradation threatening ecosystems, economies, and communities worldwide. While efforts to reduce greenhouse gas emissions are critical, innovative solutions are needed to both mitigate the causes of climate change and help societies adapt to its inevitable impacts.

Design solutions that address the dual goals of climate change mitigation and adaptation. Key areas of focus may include:

- **Carbon Emission Reduction:** Develop technologies or strategies that reduce emissions in key sectors such as energy, transportation, agriculture, and industry.
- **Renewable Energy Innovations:** Propose solutions to enhance the efficiency, accessibility, and scalability of renewable energy systems like solar, wind, and geothermal.
- **Climate Resilience:** Design systems or infrastructure that help communities adapt to extreme weather events, rising sea levels, or changing agricultural conditions.
- **Nature-Based Solutions:** Explore ways to leverage ecosystems, such as forests, wetlands, or mangroves, to enhance carbon sequestration, protect biodiversity, and build climate resilience.
- **Sustainable Urban Development:** Develop smart city technologies or green infrastructure to reduce urban heat islands, improve energy efficiency, and support sustainable living.
- **Global Collaboration and Accessibility:** Ensure solutions are scalable and can be adapted to different regions, prioritizing vulnerable communities disproportionately affected by climate change.

Solutions should balance environmental, economic, and social sustainability while focusing on scalability, practicality, and long-term impact in addressing the global climate crisis.



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### Need Statement 6 – Improving Sanitation in Riverine Communities

Inadequate sanitation systems contribute to the spread of waterborne diseases, poor hygiene, and environmental degradation. Some communities lack access to proper sewage treatment, waste disposal infrastructure, and safe drinking water, putting residents at risk of preventable illnesses and limiting their overall quality of life.

Develop sustainable and context-specific sanitation solutions that improve riverine communities' health outcomes and environmental conditions. Areas of focus include:

- **Affordable Wastewater Treatment:** Design low-cost, scalable wastewater treatment systems adaptable to remote riverine environments and capable of processing household and community waste.
- **Safe Drinking Water Systems:** Develop filtration or purification technologies that ensure access to safe and clean water tailored to local water sources such as rivers or wells.
- **Waste Management Solutions:** Propose systems for waste collection and disposal that prevent contamination of local water bodies and reduce the environmental impact of waste accumulation.
- **Community Education on Hygiene:** Develop programs or tools to raise awareness about hygiene practices and the importance of sanitation to improve public health outcomes.
- **Sustainability and Maintenance:** Ensure that proposed systems are easy to maintain, cost-effective, and durable, providing long-term benefits for communities.

Solutions should take into consideration the community-specific needs, resources, and environmental context, to create effective and sustainable sanitation systems.