Research Grants

2025 Sustainable Environment

& Essential Needs Priority

Focus Areas

هيئة تنمية البحث
والتطوير والابتكار
Research Development
and Innovation Authority

Contents

Introduction

The Research Grants - 2025 Sustainable Environment & Essential Needs Priority - Focus Areas represent a significant commitment to addressing some of our most pressing Sustainability challenges. At the forefront of these efforts are two prioritized national missions that will guide resource allocations and research activities.

The first mission aims to decrease the withdrawal of non-renewable water by 90% and reduce the cost of water production by 50% by 2035. Addressing the Kingdom's critical water challenges, such as limited groundwater reserves, heavy reliance on desalination, and inefficient water consumption practices. Through innovative solutions in water management, technology, and efficiency, the mission supports socio-economic growth and ambitious national projects.

The second mission aims to develop innovative technologies in food to establish sustainable and resilient food systems, achieving more than 50% self-sufficiency by 2040. By addressing critical challenges in food security and sustainability, this mission focuses on leveraging advanced agricultural practices and cutting-edge technologies to enhance productivity, reduce dependency on imports, and support the Kingdom's long-term socio-economic and environmental goals.

While these two missions are our top priorities and will receive most of the grant funding, we also recognize the importance of other Sustainability & Essential Needs initiatives. These include planting 10 billion trees across KSA, protecting 30% of the Kingdom's land and sea, achieving net-zero emissions, reducing summer surface temperatures by 4C, and developing and adopting innovative cooling technologies to reduce cooling electricity consumption by 30%.

Priority Focus Areas

1. National Mission: Decrease the withdrawal of non-renewable water by 90% and the cost of water production by 50% by 2035

- Increase irrigation and water use efficiency research focus:
  - Irrigation and water management:
    - Pressurized Irrigation Systems Advancements
    - Smart Irrigation Software, Analytics and Modelling
    - Smart Irrigation Hardware
    - Deficit Irrigation
  - Soil amendments for water retention Research Focus:
    - Hydrogel-based Soil Amendments
    - Mulching Techniques
    - Biochar Application
    - Cover Cropping
    - Clay Technology

- Protected agriculture and controlled environment for water efficiency Research Focus:
  - New Crops Development
  - CEA Climate and Energy
  - Lighting Technologies
  - Advanced Systems and Robotics
  - Water and Nutrient Efficiency
  - Advanced Soilless Cultivation Systems
  - Biopesticides and Biological Control Agents

- Substitute groundwater consumption with alternative sources research focus:
  - Desalinated water for agriculture: *
    - Cost-efficient Desalination Technologies
    - Desalinated Irrigation Systems
    - Nutrient-efficient Technologies
  - Treated wastewater for crop irrigation:
    - Rainwater harvesting and storage systems / groundwater recharge for agriculture
    - Treated wastewater for crop irrigation

- Develop water efficient species through biotechnology research focus:
  - Water efficient and drought resistant crops: *
    - Omics Technologies
    - CRISPR
    - Genetic Engineering
    - Cross-breeding
    - Wild Relatives Domestication
  - Saline resistant crops: *
    - Omics Technologies
    - CRISPR
    - Genetic Engineering
    - Cross-breeding
    - Microbiome Management in Soil and Hydroponics

- Reduce RO desalination cost research focus:
  - Advanced pretreatment: *
    - Biofouling technology
    - Nano/ ultra filtration
    - Process configuration and setup in RO
  - Membrane development and manufacturing technologies:
    - Biomimetic membranes
    - Graphene-based membranes
    - Zeolite membranes
    - Carbon-based membranes

* This RDI domain is not available for the Flagship Program.

        - Hydrophobic Membrane development and manufacturing technology
        - Structured Membrane development and manufacturing technology
    - Energy Recovery: *
        - Energy recovery turbines
        - Isobaric Energy Recovery Devices
    - Bring mining:
        - Advanced ZLD
        - Evaporation of brine
        - Valuable products extraction
    - Renewable energy integration & energy storage:
        - RES – PV
        - RES – Wind
        - RES – Salinity gradients
        - Energy Storage
        - Digitization with IoT and AI

- Deploy new desalination methods research focus:
    - Solvent extraction: *
        - Emerging technologies to investigate for seawater desalination
    - Membrane distillation: *
        - Direct contact membrane distillation
        - Air gap membrane distillation
        - Sweeping gas membrane distillation
        - Vacuum membrane distillation
    - Hybrid and other methods: *
        - MSF-RO hybrid
        - Thermal-Geothermal hybrid
        - FO-RO hybrid
        - Two-stage RO
        - Renewable driven evaporation-condensation
    - Electrodialysis: *
        - Electro deionization
        - Shock electrodialysis
    - Forward osmosis: *
        - Ammonium-based draw
        - Glucose-based draw
        - Fertilizer-based draw
    - Direct solar desalination: *
        - Solar humidification-dehumidification
- Deploy new desalination methods research focus:
    - Rain and stormwater harvesting: *
        - Micro-catchment

* This RDI domain is not available for the Flagship Program.

- Air-to-water technologies: *
  - Warka Tower
  - Fog condensation
  - Wet desiccation
  - Condensate harvesting from AC systems

2. National Mission: Develop technologies in food for sustainable and resilient food systems to achieve more than 50% self-sufficiency by 2040

- Increase production and efficiency of food outputs research focus:
  - Protected agriculture and controlled environment for water efficiency:
    - Advanced Systems and Robotics
    - CEA Climate and Energy
    - Lighting Technologies
    - New Crops Development
    - Water and Nutrient Efficiency
    - Advanced Soilless Cultivation Systems
    - Biopesticides and Biological Control Agents
  - Precision agriculture for crop efficiency: *
    - Satellite and Sensing Technologies
    - Machine Learning
    - Internet of Things
    - Robotics
  - Agriculture biotech. for crop yield improvement:
    - Omics
    - CRISPR
    - Genetic Engineering
    - Hybrid generation
  - Soil and nutrition management for crop efficiency:
    - Precision Nutrient Application System
    - Soil Sensing Technologies – Nutrient and Soil Health
    - Microbial Soil Amendments
  - Crop protection and pest management: *
    - Integrated pest management systems
    - Biotech interventions for crop protection
    - Biocontrol Agents
    - Machine Learning for Detection
    - Precise Pesticide Application
    - Microbiome-based crop protection
  - Reproduction and breeding: *
    - Advanced Assisted Reproductive Technologies
    - Genetic Editing
    - Bioinformatics and Livestock Phenomics

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        - Genomic Selection
    - Precision livestock farming: *
        - Sensing and Monitoring Technologies
        - Smart and Automated Systems
        - Machine Learning
    - Nutrition and feed management: *
        - Nutritional Modelling and Analysis
        - Precision Feeding Systems
        - Feed Additives
    - Health monitoring and disease management: *
        - Wearable Biosensors
        - Genomic Analysis for Disease Resistance
        - AI-Powered Disease Prediction
        - Biotech Vaccines
    - Integrated aquaculture management: *
        - Automated Feeding Systems
        - Fish Behavior Analysis
        - Environment Optimisation
        - Selective Breeding
        - Recirculating Aquaculture Systems
- Increase alternative foods production research focus:
    - Alternative animal feed sources:
        - Insect-based feed
        - Aquatic biomass feed
        - Agricultural byproduct utilization
        - Mycelium and fungi-based feed
    - Plant-based alternatives: *
        - Algae-based alternative foods
        - Fungi and Mycelium-based alternative foods
        - Grain and Legume-based alternative foods
    - Cell-culture and fermentation foods:
        - Cell line development for cell-culture and microbial strain development for precision fermentation
        - Growth medium for cell-culture and nutrient broths for precision fermentation
        - Scaffoldings for cell-culture
        - Bioprocess design for cell-culture
        - Precision fermentation process optimization
- Reduce food loss and waste research focus:
    - Food loss in production and logistics: *
        - Improved Harvesting Equipment
        - Post-Harvest Monitoring Systems
        - Natural Preservatives & Coatings
        - Novel Food Processing Technics
        - Advanced Cold Chain Systems
        - Active and Modified Atmosphere Packaging in Transport and Storage

        - Blockchain and traceability solutions
    - Food waste in distribution and consumption: *
        - Intelligent Retail Packaging
        - Demand Forecasting and Waste Analytics
        - Smart Refrigeration Systems

Other Supported Topics

Research may also be aimed at one of the following national missions, including:

- **Plant 10 billion trees across KSA by 2040.**
- **Protect 30% of the Kingdom's land and sea by 2035.**
- **Reduce summer surface temperatures by 4C by 2040.**
- **Develop and adopt innovative cooling technologies to reduce cooling electricity consumption by 30% by 2040.**

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