

جامعة الملك عبد الله
للعلوم والتقنية
King Abdullah University of
Science and Technology



KAUST FUTURE FORUM

ACCELERATING IMPACT



KAUST FUTURE FORUM

FEB 12 - 13, 2024

KACST- The Garage, Riyadh, Saudi Arabia

Key Takeaways

- Excellence in Research: Recognized globally, KAUST sets the benchmark for research, innovation and talent development, rapidly becoming a top-tier research university within just 15 years.
- Pioneering Future Technologies: KAUST advances critical sectors like energy, health and environment, in alignment with Saudi Vision 2030 and the national research, development and innovation priorities.
- Building Strong Networks: Join KAUST's extensive network, which includes government bodies, industries, investors and other academic institutions, to foster collaboration and drive impact.

Partner with KAUST

We welcome industry leaders, researchers, investors, startups and governmental authorities to join forces with KAUST.

For more information on collaboration and partnership opportunities, please contact us at future.forum@kaust.edu.sa.

Sponsor



Host and Guide for the Exhibition



Dr. Dana Alsulaiman

**Assistant Professor, Materials Science
and Bioengineering**

Education Profile

Postdoctoral Associate, Massachusetts Institute of Technology, USA, 2021

Postdoctoral Fellow, Massachusetts Institute of Technology, USA, 2020

Ph.D. Bioengineering, Imperial College London, UK, 2019

B.Eng. and M.Eng. Biomedical Engineering, Imperial College London, UK, 2015

Multilingual: Arabic, English, Chinese, Turkish, French

Research Interests

Dr. Alsulaiman's research focuses on developing next-generation biosensing platforms to detect an emerging class of disease biomarkers called circulating cell-free nucleic acids, including microRNA, from liquid biopsies. At the intersection between polymeric biomaterials, nanomaterials, and microtechnologies, her research includes advancements in hydrogel microparticles, microneedles, nanopores, soft bionics and microscale biosensing technologies for applications in personalized medicine. Central to her work is the rational design of synthetic mimics of DNA called xeno-nucleic acids (e.g., peptide nucleic acids) as bioreceptor probes and advanced therapeutics, which are more robust, stable and specific than their natural counterparts. Ultimately, Dr Alsulaiman's research aims to tackle urgent clinical needs in Saudi Arabia and globally, focusing on minimally invasive early cancer diagnosis and monitoring through miniaturized, sustainable, point-of-care technologies.



Technology Exhibition



**Sustainable Environment
and Essential Needs**



**Energy and Industrial
Leadership**



**Economies
of the Future**



**Health and
Wellness**



**Sustainable
Environment and
Essential Needs**



Dr. Jorge Gascon

Professor Chemical Engineering,
Director KAUST Catalysis Center

CLIMATECRETE: SUSTAINABLE CONCRETE FROM LOCAL MATERIALS

Carbon Management / Climate Change Technologies



Dr. Bill McDonough

Co-inventor and Distinguished
Visiting Professor

Technology Background

KAUST has developed a technology to convert the small, smooth, round particles of sand typically found in local sand dunes into the larger rougher particles necessary for concrete production. This creates an entirely new source of building material for Saudi Arabia.



Anastasiya Bavykina

Research Scientist, KAUST
Catalysis Center

Opportunity

Every year 50, billion tons of sand and gravel are used for construction, which has tripled in the last 20 years. Converting local sands, such as dune sand, into a viable source of concrete creates new opportunities for the Saudi construction industry. Moreover, Saudi Arabia currently imports around 150 million tons of construction sand every year.

Solution

Drs. Gascon and McDonough have developed a process that converts the small, smooth, round particles typically found in local sand dunes into the larger rougher particles required to make concrete. ClimateCrete can be formulated with significantly less concrete, which reduces CO² emissions. This has two major strengths in that it can help eliminate a source of greenhouse gas emissions while creating a product for sustainable construction within KSA.

Impact

The Saudi Arabian construction sand market attained a volume of 157.97 MMT in 2022 and is expected to grow further at a CAGR of 3.8% between 2023-2028, reaching a volume of 198.02 MMT by 2028. This novel technology and the utilization of local natural resources will help Saudi Arabia develop a sustainable, cleaner construction industry while reducing the need to import sand for construction.

Partners





Dr. Claudio Fuentes Grunewald

Algae Program Director,
KAUST Beacon Development

ALGAE PRODUCTION FOR SUSTAINABLE FOOD SYSTEMS

Advanced Agricultural & Food Technologies



Emna Mhedhbi

Bioprocess Lead in the Algae Program

Technology Background

The technology for algae production is well understood and scalable but requires developing and adapting to the country's climatic conditions. KAUST has proven and validated microalgae biomass production under KSA weather conditions, allowing year-round algae biomass production suitable for many industrial applications, including feed for animals.

Opportunity

The technology can significantly reduce the amount of imported raw materials used for animal feed, instead allowing to produce it locally using algae technology. Algae can provide several markets with sustainable and economical alternatives to base chemicals and additives from other sources.

Solution

Using materials and equipment sourced in Saudi Arabia, KAUST has adapted freshwater temperate climate algae to local conditions. Our adapted strains grow in high-salinity seawater in open ponds and are capable of producing biomass and other products at commercial scale throughout the year. This project supports the Kingdom in achieving the goals of Vision 2030, offering a solution to meet the growing national demand for proteins of natural origin, increasing food self-sufficiency and providing raw materials for new markets.

Impact

This project takes a whole value chain approach, combining emerging microalgae concepts with technological and process innovation, creating a scalable solution and developing sustainable animal feed products that will directly impact food security issues for the country. The technology has the capability by 2030 to replace 4,360,396 tons of imported protein worth 1.7 billion USD and to create 200,000 new jobs in rural areas.

Partners





Dr. Pascal Saikaly
Professor of Environmental
Science and Engineering



Mohammed Alomari
Ph.D. Student, Environmental Science
& Engineering

Partners



DECENTRALIZED WASTEWATER TREATMENT AND REUSE

Water Management & Treatment Technologies

Technology Background

Aerobic granular sludge (AGS)–gravity-driven membrane (GDM) technology is an innovative wastewater treatment and reuse technology that enriches microorganisms in large aggregates or bio-granules for the efficient removal of pollutants in wastewater. It is mobile, compact, modular, and plug & play, thus making it an ideal technology for decentralized wastewater treatment and reuse.

Opportunity

Currently, 40% of households in Saudi Arabia do not have access to a centralized sewer network, and wastewater generated from these households is collected and transported to centralized wastewater treatment plants by trucks, which is

costly and contributes to many issues like traffic congestion, pollution and greenhouse gas emissions. Furthermore, centralized wastewater treatment plants in Saudi Arabia are based on a conventional biological wastewater treatment technology that is energy-intensive and does not generate treated sewage effluent suitable for nonpotable reuse. Also, there is a lack of distribution infrastructure for urban reuse.

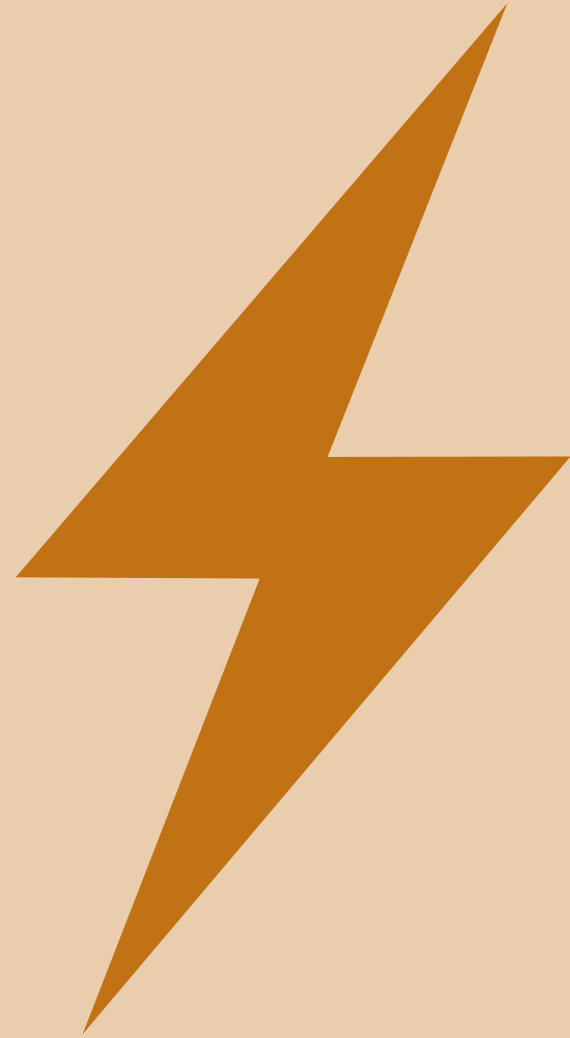
Solution

The KAUST-invented AGS-GDM technology is a decentralized wastewater treatment and reuse technology designed to address these grand challenges in the Kingdom. Each unit can treat wastewater for 1000 to 1500 people. Moreover, it can reduce energy demand by 50% and space footprint by 70% compared to conventional wastewater treatment systems, while generating treated sewage effluent suitable for nonpotable reuse.

Impact

The AGS-GDM technology will improve environmental quality and the overall quality of life by providing clean water locally for landscaping to increase green spaces and contributing to Vision 2030 to achieve 70% water reuse and 100% sanitation by 2030. It also contributes to Sustainable Development Goal 6 to ensure access to clean water and sanitation for all.

**Energy and
Industrial
Leadership**





Dr. William Roberts

Professor of Mechanical Engineering,
Director Clean Combustion
Research Center

CRYOGENIC CARBON CAPTURE

Future Energy Technologies



Dr. Mohammed Al Juaied

Adjunct Professor, Clean Combustion
Research Center



Christopher Wagstaff

Ph.D. Student, Chemical Engineering

Technology Background

Exhaust from power plants, refineries and industrial plants adds carbon dioxide to the atmosphere. Moreover, emissions account for 76% of greenhouse gases. At the same time, current methods of capturing carbon dioxide emissions can be costly and often produce unusable outputs.

Opportunity

Saudi Arabia has set a net zero greenhouse gas emissions target by 2060. Low-cost carbon dioxide capture is vital for businesses to balance competing economic and environmental concerns. When captured in a pure form, carbon dioxide can be used in many industrial processes, including e-fuels, food and beverages, the manufacturing of cement, or it can be stored permanently underground through mineralization.

Solution

KAUST has developed techniques for capturing carbon dioxide emissions from industrial sources at about 20% less cost than other existing techniques. KAUST's process cools plant exhaust down to -130°C to extract frozen carbon dioxide (dry ice) from other permanent gases. Depending on the fuel source, the process can also remove other air pollutants, such as the oxides of nitrogen and sulphur. The process is energy efficient, and the resulting carbon dioxide can be delivered in a very high purity liquid form that is ready for transport and use.

Impact

In partnership with the Ministry of Energy, a pilot-scale facility will be deployed at the new SEC/NEOM power plant at Duba and is expected to capture 30 tons of carbon dioxide daily. Most of this captured CO₂ will be converted into e-gasoline by NEOM and Aramco. This will be the largest demonstration scale-up and deployment of the cryogenic carbon capture process in the world and will pave the way for deployment throughout KSA.

Partners

وزارة الطاقة
MINISTRY OF ENERGY





Dr. Zhiping Lai
Professor Chemical Engineering

LITHIUM POWER FROM SEAWATER

Mining / Future Energy Technologies

Technology Background

The supply of lithium, which is used in batteries and other electronics, is running out. By 2028, there will be significant shortages due to overwhelming demand. Already, high demand for lithium is driving price increases for batteries. Furthermore, land-based lithium mining is water intensive and damaging to the environment.

Opportunity

Demand for lithium is surging. Lithium-ion batteries are used in many electronics, including cell phones, laptops and electric vehicles. Worldwide, lithium demand is growing from 250 thousand tons per year from 2020 to over two million tons per year by 2030, an 800% increase.

Solution

Land-based reserves of lithium are limited, with only 22 million tons known to exist. However, the oceans are an untapped source of Lithium that can more than meet ongoing demand, with over 230 billion tons of lithium. KAUST has developed a way to harvest this lithium.

Impact

KAUST's technology can extract lithium from seawater cost-effectively. This technology is an environmentally friendly alternative to the traditional mining of metal. The filtered seawater can safely be returned to the ocean without any major environmental impact. Furthermore, the technology holds the promise of creating novel skills and services while addressing the global demand for lithium as the electrification of ground transport gathers pace.



Kuo-Wei Huang
Professor, Chemistry

Partners





Dr. Frédéric Laquai

Professor, Applied Physics, Interim Director KAUST Solar Center

HIGH-EFFICIENCY PHOTOVOLTAICS

Solar/Future energy Technologies

Technology Background

The high heat and constant direct sunlight found in desert climates diminish solar cell performance. The harsh conditions also cause solar cells to fail sooner, requiring replacement. As a result, solar cells generate less energy, leading to increased costs.

Opportunity

Solar installations in Saudi Arabia are growing. In 2019, Saudi Arabia had over one gigawatt of solar capacity. Aligned with Vision 2030, there will be a growth to 40 GW from solar power alone. To meet this demand, solar cells need to be more energy efficient and reliable.

Solution

Besides improving device performance, KAUST is researching strategies to reduce the impact of "parasitic device heating," which lowers the performance and longevity of solar cells in high-heat conditions. Researchers are also looking at different ways of using glass and encapsulation materials to improve reliability. Combined, these efforts will enhance the cost efficiency of solar cells.

Impact

The technology can potentially be developed into ultra-high-performance solar cells using silicon in combination with perovskite. This could address many market opportunities to combine solar power with sectors like agriculture. KAUST perovskite/silicon tandem solar cells have a certified efficiency of 33.7%, which is the current world record.



Dr. Stefaan De Wolf

Professor, Material Science and Engineering | Interim Associate Director KAUST Solar Center

Partners



Economies of the Future





Dr. Matthew McCabe

Professor of Remote Sensing and Water Security, Director of Climate and Livability Initiative

KAUST CUBESAT

Space Technologies

Technology Background

The KAUST satellite collects high-quality, high-resolution data across global terrestrial, coastal and ocean ecosystems to help Saudi Arabia observe and characterize its unique natural resources. The 6U satellite hosts a hyperspectral camera with advanced on-board processing capabilities in combination with Spire's Global Navigation Satellite System-Reflectometry (GNSS-R) sensor payload to collect insights on Earth's surface, such as the condition of plants, soils and water.

Solution

Being space-based, the KAUST satellite offers capabilities that expand well beyond Saudi Arabia, allowing KAUST researchers and international collaborators to focus their attention on global ecosystems to explore diverse landscapes, seascapes and interconnected environments.

Impact

The hyperspectral imager will be used to characterize terrestrial and marine systems to assess the condition of rangelands, soils, mangroves and other plant communities, thus improving our understanding of Saudi Arabia's unique ecosystems and our ability to monitor and manage their health.

The project reflects Saudi Arabia's increasing footprint in the new space economy, with the development of its space industry as a part of a broader economic diversification strategy. Through this mission, KAUST aims to encourage future generations of scientists and engineers to participate in Saudi Arabia's growing space exploration efforts.



Areej A. Alwahas

Ph.D. Student, Environmental Science & Engineering

Opportunity

The combination of on-board processing with two unique sensors (GNSS-R and the hyperspectral camera) represents one of the first in-orbit demonstrations of such technologies. Data from the satellite can help advance Vision 2030 goals, especially those related to protecting and restoring the environment.

Partners



مركز الوطني للأبحاث
National Center for Earth and Environmental Research

وزارة البيئة والمياه والزراعة
Ministry of Environment, Water & Agriculture
Kingdom of Saudi Arabia - المملكة العربية السعودية





Dr. Mohamed-Slim Alouini

Distinguished Professor, Electrical and Computer Engineering

FREE SPACE OPTICAL (FSO) COMMUNICATION FOR MARITIME & GROUND-AIR-SPACE NETWORKS IN KSA

Next-Gen Connectivity and Wireless Sensors

Technology Background

Wireless communication is now an integral part of daily life and there is a continuously growing demand for data-based internet usage. As a result, the radio frequency (RF) spectrum has become highly congested, and current RF spectrum-based infrastructure will not be sufficient to meet the future demands of wireless communication.

Opportunity

Free Space Optical (FSO) communication is a range form of wireless communication that can be employed in terrestrial, maritime, aerial and space links. The primary transmission principle is similar to optical fibre communication except that, in FSO communication, the modulated transmitted through unguided free space instead of a guided fibre.

Solution

One solution being pursued at KAUST is FSO wireless communication. This technology is capable of transmitting an unprecedented amount of data over a free space channel at a rate of multi-gigabits per second using the abundant and unlicensed optical bands of the electromagnetic spectrum.

Impact

Projects with Red Sea Global and NEOM are exploring the suitability of the territory of KSA for FSO communications in terms of availability, reliability and achievable data rates of high-speed wireless links in various terrestrial, maritime, aerial and space environments. The study includes experimental measurements of atmospheric turbulence on the attenuation (absorption and scattering) and performance of FSO communication systems (signal-to-noise ratio, bit error rate, and outage rate).



Fahad S. Alqurashi

Ph.D. Student, Electrical & Computer Engineering

Partners





Dr. Shehab Ahmed

Professor, Electrical and Computer Engineering Chair, Electrical and Computer Engineering Program

The City of the Future project: focusing on efficient energy use, renewables and the use of AI in combination with IoT

Technology Background

The City of the Future project is focused on leveraging the latest advancements in technology to create a sustainable and efficient city. The project combines the use of renewable energy sources, such as solar and wind power, with cutting-edge technologies like the Internet of Things (IoT) and artificial intelligence (AI). By doing so, the project aims to reduce energy consumption, improve energy efficiency and lower carbon emissions.

Opportunity

The City of the Future project represents a significant opportunity to address some of the most pressing challenges facing modern cities. With the world population expected to reach 9.7 billion by 2050, cities will need to become more sustainable and efficient if

they are to support the needs of their inhabitants. The project also presents an opportunity for businesses and organizations to develop innovative solutions that can be deployed at scale.

Solution

The City of the Future project proposes a comprehensive solution that combines renewable energy sources, IoT, and AI to create a smart and sustainable city. The project involves the installation of IoT sensors throughout the city to collect data on energy consumption, air quality and other environmental factors.

Impact

The City of the Future project has the potential to have a significant impact on the environment and the economy. By reducing energy consumption and carbon emissions, the project can help mitigate the effects of climate change. The use of renewable energy sources can also reduce dependence on fossil fuels, improving energy security and lowering costs. Furthermore, the project can create new business opportunities and drive economic growth by promoting innovation and entrepreneurship.



**Health and
Wellness**



Dr. Pierre Magistretti

Vice President for Research,
Distinguished Professor, Director
KAUST Smart Health Initiative

NOORDX GENOMICS PLATFORM

Applied Genomics

Technology Background

Genetic insights can help people live healthier lives, while genetic testing can reveal an individual's risk profile for cancer, heart disease, and more. However, genetic testing in Saudi Arabia can be expensive and is often outsourced for testing internationally, resulting in complicated logistics.

Solution

The solution by NoorDx, a KAUST startup, has succeeded in many areas, including building a genomics platform for individual access to genome-informed health and wellness insights, creating precision testing based on the genetics of a regional population and developing robust and rapid pathogen screening.



Dr. Sharif Hala

General Manager NoorDx

Opportunity

Billions of SAR are spent annually on genetic testing in Saudi Arabia, with over 60,000 tests being sent abroad for processing, ceding "ownership" of the genetic insights about Saudi populations to international labs. Building genetic testing and innovation capabilities in Saudi Arabia taps into this growing market and protects vital health data for Saudi Arabia.

Impact

NoorDx is building a hub for genetics capabilities for Saudi Arabia. It offers genetic testing services that are inexpensive with low turnaround times. Overall, NoorDx provides an end-to-end value chain of services, including clinical diagnostics, research services and education.

Partners





Dr. Xin Gao,

Professor Computer Science, Interim
Director of Computational Bioscience
Research Center

Partners



USING ARTIFICIAL INTELLIGENCE (AI) FOR ACCURATE PNEUMONIA DETECTION

AI Technology

Technology Background

Pneumonia causes 2.5 million deaths worldwide every year. Over 50% of those who die are aged 70 or older. Pneumonia also accounts for 15% of all child deaths – making pneumonia the leading cause of childhood mortality.

Opportunity

There are more than 30 types of pneumonia, but they are often hard for doctors to distinguish. This difficulty leads to mistreatment and avoidable deaths. Adding AI to the diagnosis framework can limit human errors and improve patient health outcomes.

Solution

KAUST researchers have recently advanced their AI models by limiting scanner-specific noise to increase CT scan image resolution. They also invented an AI algorithm to segment blood vessels and the trachea to fine resolution. These innovations are part of a pipeline leading to automatic, accurate and rapid pneumonia diagnosis.

Impact

Early in the COVID-19 pandemic, KAUST developed a rapid and accurate method for COVID-19 detection. Researchers developed an AI system that processes CT scans of patients. The image processing takes less than one minute and correctly detected COVID-19 almost 100% of the time.

Startups Exhibition

The startup ecosystem's alignment with the new strategy aims to achieve KAUST's goals of driving entrepreneurship and economic development in Saudi Arabia and beyond.

Technology selection criteria:

- **RDIA Sector**
- **Market Barrier**
- **Solution**
- **Current Investors**
- **Key Customers**

RED SEA FARMS

Founded by world-renowned plant scientist Mark Tester, agriculture engineering expert Ryan Lefers and material scientist Derya Baran.

RDIA Sector

Sustainable Environment and Supply of Essential Needs / Energy and Industrial Leadership.

Market Barrier

Production of sustainable organic food utilizing climate control greenhouse technology in water-scarce, hot climates.

Solution

Roof-to-root innovations for sustainable food production in hot climates that reduces freshwater and energy consumption. Innovations include: 1) iyris: heat-absorbing nanomaterials for greenhouse roofs, 2) Kairos: precision sustainable climate control for greenhouses and poultry barns, 3) Coretex: intelligent greenhouse monitoring systems, and 4) Volcano Plant Genetics: salt, heat, and drought tolerant rootstocks and the production of fresh organic produce).

Current Investors

Cumulative investment, USD \$36.4M. Currently negotiating a USD \$20M Series A.

Key Customers

Company present in KSA, UAE, USA, Egypt.



Dr. Jana Hubbard

Head Of Brand Development,
Red Sea Farms



AbdulRahman bin Mahfuth

R&D Engineer, Red Sea Farms



Investors





WAYAKIT

Founded by two KAUST international students who live in Saudi Arabia

RDIA Sector

Environment and sustainability

Market Barrier

97% of cleaning and disinfection products still contain compounds that negatively impact our health, planet and productivity.

Solution

Wayakit is specialized in the development of hygiene products for cleaning and disinfection through applied biotechnology. Wayakit's cleaners are sustainable, organic, biodegradable, nontoxic, organic, multipurpose and environmentally friendly.

Current Investors

Cumulative investment, US \$2 M.

Key Customers

Presence in KSA and Mexico.



Dr. Luisa Javier

Co-founder and CEO, Wayakit



Sandra Medina

Co-founder and CMO, Wayakit



Investors



TERRAXY

RDIA Sector

Sustainable Environment and Supply of Essential Needs

Market Barrier

How to address a burgeoning societal pain-point (i.e., landfilling of millions of tons of organic waste per year) to unleash a national ambition (i.e., giga-scale desert rehabilitation for food production and greening)?

Solution

Terraxy's CarboSoil™ technology is produced from the pyrolysis of organic waste, such as chicken manure, food waste and sewage sludge. When added to sandy soil, CarboSoil™ acts as a sponge for nutrients and prevents their leaching and volatilization. CarboSoil is stable in the soil for hundreds of years. Terraxy's SandX™ technology (USPTO #11,497,177 B2) reduces the evaporative loss of water from the soil by up to 80% under Saudi conditions.

Current Investors

KAUST Innovation Ventures US \$1 M.

International presence:

Company present in KSA and has appeared and won several international platforms/competitions (World Economic Forum's Uplink Platform, ITAS Arab Youth Competition, Prototypes for Humanity, InFlavour's Expo)



HIMANSHU MISHRA

Co-founder and Chief Scientific Officer



Adair Gallo

Co-founder and CEO



Investors





KAUST Reefscape Restoration Initiative

Initiative Major Elements

1- Reefscape

The reefscape was divided into operational grids to facilitate efficient planning and execution. The grids enabled a systematic approach to the restoration strategy across the 100 ha.

Each grid underwent a detailed assessment of its ecological condition (e.g., coral cover, species diversity and habitat) and the need for restoration or enhancement. The zonation plan also includes areas for various uses, such as areas suitable for coral nurseries, KAUST research and visitor experiences.



A- In-situ nurseries

A key goal of the project is to develop underwater nurseries capable of sustaining the production of up to 100,000 corals per year. To achieve this goal and to develop efficient methods of out-planting corals, KRRRI has initiated a Trial Phase in 2023, which has the following major goals; (1) to develop and evaluate a range of in-water coral nursery structures to identify the most promising culture methods for large-scale cultivation; (2) to test and evaluate methods of out-planting that can improve efficiency, reduce diver's coral planting duration, and leverage the capacity of the land-based nursery facilities; (3) develop and test reef enhancement structures that provide suitable habitat in areas that lack substrate for coral growth; (4) collect information on coral spawning to guide future initiatives in the employment of sexual reproduction for diversifying and improving coral resiliency at larger scales; (5) develop methods to efficiently monitor and track corals in the nurseries and coral out-plants at scale.

B- Marine Operations

KRRRI is preparing for extraordinary marine operations. Over five years, the Initiative aims to deploy an unprecedented number of corals—targeting over 5,000 asexually produced corals daily, alongside millions of sexual recruits per year, and thousands of carefully designed habitat enhancement structures. This involves 50+ divers, with several small to large vessels on a daily basis operating from our base at Haddah Beach.

2- Monitoring, Visualization and Data Management

Monitoring is critical in tracking the project's success, impact and progress. KRRRI is committed to developing the tools to effectively monitor, visualize and manage the data of a large-scale coral reef restoration project, the largest in the world to date. KRRRI will be designing and employing innovative methods to monitor both the reefscape and the Development and Primary Nurseries—steering away from diver/person-based data collection to semi-and fully-automated/ autonomous collection and processing.



3- Land-based Nursery

A-Development Nursery

Covering an area of 1,000 square meters, the KAUST Development Nursery at Haddah Beach in NEOM serves as a pilot facility for testing different methods and technologies before being implemented on a larger scale through the Primary Nursery. This testing process allows for optimizing operational plans, propagation techniques and strategy, including essential Life Support Systems (LSS) and the refinement of methodologies ensuring the effective execution of marine and dive operations.

The Development Nursery will be essential to the training of personnel engaged in aquaculture, and later, in marine and dive operations. It also represents a critical step to developing fully integrated operations between the land- and ocean-based elements of the project, such as coral transportation.

B-Primary Nursery

KAUST is building a pioneering land-based coral nursery at Haddah Beach. This facility aims to be the world's largest and most advanced, producing up to 400,000 corals annually. By incorporating innovative techniques and cutting-edge technology, KAUST ensures efficient and effective coral production. This nursery supports broader restoration efforts, providing an ideal environment for diverse coral species to grow. It revolutionizes cultivation through automation and industrialization, optimizing production with advanced LSS. This facility enhances the preservation of coral biodiversity by elevating the standard for coral nurseries.

4- Research Center

This center aims to create a space dedicated to improving the understanding of the coral reef ecosystem in the region through data collection and sample analysis. Equipped with state-of-the-art laboratories and cutting-edge research facilities, the Research Center will enable researchers to conduct pioneering studies in various fields, including oceanography and geology.





5- National Talent Development Program

Background:

In 2023, the Reefscape Restoration Stream, a training program, was launched through a collaborative effort between the KRRI team and the KAUST HR department as part of the HR Elevate program. This training program served as a unique avenue for KRRI to impart education and training to Saudi Nationals, igniting their interest in coral restoration and simultaneously addressing the imperative of enhancing local expertise in the field as part of KRRI's social responsibility.

Designed for high-potential recent graduates, the program provides an unparalleled opportunity to kickstart their technical careers within the ambit of the world's largest coral restoration initiative. Beyond bridging the knowledge gap between higher education and the dynamic demands of the labor market, the program is crafted to deliver the theoretical knowledge and required

hands-on experience in coral restoration. Participants advance through a specialized curriculum and hands-on training modules, applying their gained knowledge within the KRRI coral nurseries. Throughout this transformative journey, they benefit from mentorship by expert instructors, ensuring a holistic and impactful learning experience.

National Talent Development Program's mission: Our mission is to equip Saudi fresh graduates with the expertise needed in coral conservation, enhancement and restoration. By the end of their journey, they'll be poised to play a pivotal role in the growth and development of the Kingdom, safeguarding its natural treasures for generations to come.

About the Program:

- The program aims to cultivate professionals in alignment with KRRI's mission and the Saudi 2030 vision.
- Offering a one-year training program to selected talented Saudi candidates in the World's Largest Reefscape Restoration Initiative.
- Integrating practical experience with theoretical knowledge.
- Providing holistic training covers a spectrum of subjects ranging from basic coral biology and marine life identification to hands-on coral reef restoration operations. This includes land-based nursery training, exposure to various restoration techniques, establishment of ocean-based coral nurseries, utilization of micro-fragmentation techniques, maintenance procedures, out-planting methods, data collection, photomosaic capture, image analysis, monitoring techniques, and more.



KAUST Semiconductor Initiative

Semiconductors are materials with electrical conductivity between conductors and insulators. Over the past 70 years semiconductors have emerged as a foundational technology and a cornerstone for our information age. Since the invention of the point-contact transistor in 1947, semiconductor technology has become the electronic brain and muscle of almost every hightech product. These technological breakthroughs have not only redefined the way we work and communicate, but also how we shop, educate and entertain ourselves.

This remarkable technological progress is the result of continuous innovation in the electronics industry and in particular advances in the science and technology of semiconductors. Recently, semiconductors have once again entered the spotlight because of the global shortage of chips that threatens to impact the livelihoods of millions of people by crippling key industries worldwide. These recent events highlight the strategic importance of semiconductors globally but also the emerging opportunities for further transformative impact.

In this booth we exhibit several pioneering and leading semiconductor technologies developed at KAUST. Since its establishment in 2009, KAUST has become a hotbed of innovation clustering more than 25 world-leading faculty and hundreds of researchers developing cutting-edge semiconductor technologies for a plethora of applications. The world-class nanofabrication and characterization facilities located on the campus are dedicated to advancing the scientific ambitions of the University while breaking new ground. KAUST semiconductor research has enormous impact on a variety of technologies, including digital, energy, environment, health and food.

- **Neutral stimulation and sensing device**
Sahika Inal
- **Flexible in-memory light sensors for neuromorphic vision application**
Nazek El-Atab
- **VO₂ Switches and mm-Wave SoC**
Atif Shamim
- **10 Vertically-stacked Transistor Logic ICs for Moore's Law**
Saravanan Yuvaraja/Xiaohang Li
- **Micro-LEDs for Novel Displays**
Kazuhiro Ohkawa
- **3D printed Conductive composites for electronic skin**
Derya Baran
- **KAUSTat—A Compact Reconfigurable Electrochemical Station**
Jose Ilton/Khaled Salama
- **Portable gas sensor system for pollution monitoring** Jose Ilton/Khaled Salama
- **Examples from the Nanofabrication Core Lab**
Kenneth Kennedy
- **Flexible ultrawide bandgap devices for power electronics and sensing**
Yi Lu/Xiaohang Li

