

# **Advancing research, innovation, and economic growth in alignment with Vision 2030**



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



Times  
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Education



# Table of Contents ●

Foreword	04
Executive Summary	06
Introduction: Strategic contribution of KAUST to national transformation	08
KAUST as a national RDI accelerator	10
Engine of economic growth and industrial innovation	16
A talent localization hub fostering the next generation of researchers	22
KAUST as the global science, technology and innovation ambassador for Saudi Arabia	30
KAUST as a strategic national partner for policy and sustainability	38
A legacy of research excellence	44





# Foreword ●

**We live in an age defined by extraordinary complexity – a time in which humanity confronts interwoven challenges in energy, climate, health, food security, and economic resilience.**

In such a world, universities must evolve. It is not enough to create knowledge. We must do so with an urgency that matches the needs of society. That is what it means to be mission-driven. Here at KAUST, this principle defines our purpose, our sense of pace, and our impact. Increasingly, we anchor our focus in areas of national and global priority.

KAUST was established as a beacon of science and innovation in service of Saudi Arabia and the world. Today, that founding vision carries a renewed sense of immediacy and responsibility, and our purpose is clearer than ever.

In alignment with the Kingdom's ambitious Vision 2030 and the Research, Development, and Innovation (RDI) priorities, our mandate is clear: to harness science and technology to

address Saudi Arabia's most pressing challenges. We do so while remaining ever mindful of the broader global good that science must ultimately serve.

Research, by its nature, is often seen as slow, generational work. At KAUST, we respect this "truth" but challenge it. The COVID-19 pandemic demonstrated just how swiftly the world can mobilize knowledge when the stakes are high – a mission to develop a vaccine in 17 months, not 17 years. We apply that same ethos of urgency and relevance across our research, ensuring discoveries are translated into solutions where they can make the greatest difference.

Through our National Transformation Institute (NTI), we are forging new pathways to move scientific discovery from laboratory to market at unprecedented speed. Initiatives such as the Policy Institute ensure our research informs decisions at the highest levels. Our Research Translation Hub bridges academia and industry, delivering innovations that meet society's needs not in the future, but now.

Together, these initiatives reflect a more intentional approach to connecting KAUST's research with the Kingdom's most immediate needs.

Impact is not a metaphor for KAUST. It is measured in our restoration of Red Sea coral reefs, the largest marine regeneration effort in the world. It is seen in the integration of renewables, the creation of sustainable fuels, and the transformation of arid lands into fertile ground. It is evident in our climate resilience advancements, as well as in our development of human capacity through education. These are not ambitions. They are achievements. They are our mission.

This white paper traces how KAUST is reshaping the university model for the 21st century. Along our journey, we have established a foundation of research excellence. We have earned international recognition, ranking as the leading university in the Arab world and among global leaders for impact and citations. Today, we are a strategy-led university – one where purpose, pace, and impact are not aspirations but principles by which we operate.

Hosting the 2025 Times Higher Education (THE) World Academic Summit, the first ever in the Middle East, is a significant milestone in our journey. It affirms KAUST's role not only as the Kingdom's leading research university but also as a global

convenor for ideas, dialogue, and progress.

We share our approach so that others might find resonance and inspiration. By aligning purpose with national and global needs, building the infrastructure to accelerate transformation, and insisting on impact that transforms lives, universities everywhere can become true agents of change.

At KAUST, we believe this is both our responsibility and our opportunity.

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**Sir Edward Byrne AC FMedSci**  
President,  
King Abdullah University  
of Science and Technology  
(KAUST)





# Executive Summary ●

**King Abdullah University of Science and Technology (KAUST) is a mission-driven University, advancing national and global transformation through research, development, and innovation. The University contributes to a sustainable, knowledge-based economy by turning discovery into impact, positioning itself as both a national asset and a global partner.**

Since its founding in 2009, KAUST has been committed to advancing education and research. Today, that commitment carries an even clearer sense of direction, closely attuned to the Kingdom's priorities under Saudi Vision 2030. The University continues to strengthen the nation's talent pipeline, preparing graduates with the skills needed to address both scientific frontiers and applied challenges. This white paper highlights KAUST's pivotal role in supporting sustainable growth across six strategic

pillars: serving as a national RDI accelerator; acting as an engine of economic growth and industrial innovation; strengthening talent localization; serving as an ambassador for global science, technology, and innovation; partnering on national policy and sustainability; and contributing to the Kingdom's Sustainable Development Goal (SDG) commitments. By outlining proven approaches and practical insights, the white paper contributes to a broader dialogue on how universities can support national

and global objectives. Alongside case studies, it also spotlights the exceptional individuals behind KAUST's leadership in research and industry. KAUST's focus establishes it as a catalyst for measurable impact — advancing economic growth, enabling knowledge transfer, and deepening collaboration with industry and government. Its evolving role illustrates how universities can remain globally excellent while sharpening their contributions to national transformation.

## 1.

### KAUST as a National RDI Accelerator

By translating breakthrough research into real-world technologies to address national and regional challenges, KAUST has played a central role in shaping Saudi Arabia's research, development, and innovation landscape. The section examines a carbon elimination technology produced by KAUST researchers, and KAUST's Future Mobility Sandbox.

## 2.

### Engine of Economic Growth and Industrial Innovation

KAUST has supported the Kingdom's economic diversification into a knowledge-based and sustainability-led one through a comprehensive intellectual property portfolio, startup creation, and engagements in technology transfer. This section offers two case studies- a lithium extraction technology, and a construction start-up, which illustrates how KAUST strengthens innovation pipelines and builds strategic relations with government and industry to enhance the Kingdom's industrial competitiveness.

## 3.

### A Talent Localization Hub

KAUST has strengthened local capabilities and workforce development through initiatives targeted at a range of profiles, from high schoolers to early-career researchers. These include tailored mentorship and training programs, as well as partnerships with national universities and the Research, Development, and Innovation Authority (RDIA) to strengthen the Kingdom's talent pipeline. Of note is a cornerstone initiative to equip the younger generation with market-relevant skills in emerging industries- KAUST Academy, and other programs to connect research innovation with talent development.

## 4.

### KAUST as a global science, technology, and innovation ambassador for Saudi Arabia

KAUST has an extensive international engagement portfolio, having hosted several international conferences and policy forums. With 75% of its publications being international collaborations in 2022, KAUST faculty are thoroughly engaged in international research networks. This section highlights KAUST's further breakthroughs in food security and clean energy transport, contributing to the global discourse in science, technology, and innovation.

## 5.

### A Strategic National Partner for Policy and Sustainability

KAUST has advanced Saudi Arabia's national sustainability and climate objectives by providing data-driven guidance to government for evidence-based policymaking. This section covers KAUST's work in blue carbon and coral restoration, highlighting the university's role in environmental stewardship within the Kingdom.

## 6.

### Legacy and Future Outlook: A Kingdom-wide commitment to the SDGs

Since the unveiling of Vision 2030, the Kingdom has engaged in giga-projects and national sustainability initiatives requiring the commitment of all universities and research institutes. This section highlights the Kingdom's progress in sustainability as measured by the Times Higher Education Impact Rankings, highlighting best practices from other Saudi institutions, as well as KAUST's.



# Introduction: Strategic contribution of KAUST to national transformation ●

**King Abdullah University of Science and Technology (KAUST) serves as a model for the role academia can play in advancing research and development while cultivating future leaders in science, engineering, and innovation.**

Since its inception in 2009, KAUST has specialized in interdisciplinary educational experiences, anchored through strategic industry partnerships and structured to address the most pressing challenges facing Saudi Arabia and the world.

The graduate University offers master's and doctoral programs across 14 disciplines, organized under three academic divisions.

Central to KAUST's distinctive educational model are its fully funded postgraduate programs. The University's generous stipend, on-campus housing, and health insurance upon admission allow students to fully commit to academic and research pursuits without the burden of tuition and living expenses. With this approach, KAUST has attracted top-tier talent from across the Kingdom and around the globe.

KAUST education extends beyond its graduate programs, with KAUST Academy specializing in professional and executive training through short courses and certifications that support national workforce development. It serves as a holistic framework for institutions seeking to align academic programming with national development goals.

In 2023, the University launched its Accelerating Impact strategy, aligning its research agenda with Saudi Arabia's Vision 2030 goals and Research, Development, and Innovation Authority (RDIA) priorities.

His Royal Highness Prince Mohammed bin Salman bin Abdulaziz Al-Saud, Crown Prince, Prime Minister, and then Chairman of KAUST's Board of Trustees, recognized KAUST's commitment to knowledge advancement, noting that the University has "distinguished itself with its research, innovations, and faculty, becoming one of the leading research universities in the world."

As global and regional focus shifts toward knowledge-based economies, universities must increasingly strive to be engines of research, development, and innovation (RDI). Since its inception, KAUST has prioritized the Kingdom's RDI advancement through pioneering research and institutional excellence. Other universities can similarly align their research agendas with national priorities and build environments that enable innovation at every level.

Today, KAUST ranks first globally in citations per faculty and leads in the Times Higher Education (THE) Arab University Rankings since 2023. This academic strength has powered the translation of research into real-world impact through new technologies, startup

creation, industry collaboration, and practical solutions to national and global challenges. Bringing research beyond the laboratory is essential to creating value in society.

Among KAUST's many global achievements is the development of Shaheen, an advanced supercomputer. The University has also established deep partnerships with major domestic and international organizations, including Aramco, Google, Boeing, Pfizer, Lockheed Martin, and McLaren Racing. Its extensive collaboration with Saudi government entities further cements its role as a cornerstone of the Kingdom's RDI ecosystem.

The broader significance of KAUST's research, education, and partnerships is underscored by its measurable contributions to the United Nations Sustainable Development Goals (SDGs). This work has been recognized in the 2025 THE Impact Rankings, where KAUST is ranked among the top 10 universities worldwide for SDG 11 (Sustainable Cities and Communities) and SDG 14 (Life Below Water).

The University has also ranked among the top 20 universities for progress in SDG 6 (Clean Water and Sanitation) and SDG 17 (Partnerships for the Goals).

This white paper highlights KAUST's role as a mission-driven University aligned with Saudi Arabia's Vision 2030

## Ranked 1st

globally in citations per faculty and leads in the Times Higher Education (THE) Arab University Rankings since 2023.



and global scientific priorities. Drawing on KAUST's experience in advancing economic growth, knowledge transfer, and industry collaboration, the paper offers practical insights into how universities can align academic excellence with national priorities and contribute meaningfully to the global scientific discourse.

By outlining key approaches, institutional practices, and lessons learned, the white paper aims to support a broader dialogue on how research universities can drive sustainable development and innovation. It also identifies the exceptional individuals working behind the scenes to enable KAUST's leadership in research and industry.



# KAUST as a national RDI accelerator ●

Since its founding, KAUST has played a central role in shaping Saudi Arabia's Research Development Innovation (RDI) landscape by translating breakthrough research into technologies that address national and regional challenges. Under its Accelerating Impact strategy, the University defines itself as a mission-driven institution that prioritizes research with tangible societal, economic, and environmental outcomes.

## CASE STUDY 1 >

## CASE STUDY 2 >

This commitment includes aligning institutional priorities with Saudi Vision 2030 goals and RDIA objectives — spanning Health and Wellness, Sustainability and Essential Needs, Energy and Industrial Leadership, and Economies of the Future — to ensure scientific excellence contributes directly to the Kingdom's long-term development goals.

KAUST has restructured its research pillars to meet RDIA priorities, launching four Centers of Excellence to enhance research, development, and innovation across key national and global benchmarks. At present, 75 percent of KAUST's research outputs are aligned with the Kingdom's strategic aspirations.

Specifically, the University's four Centers are the following:

The Center of Excellence for Generative AI >

The Center of Excellence for Renewable Energy and Storage Technologies >

The Center of Excellence for Sustainable Food Security >

The Center of Excellence for Smart Health >

Experts in each field lead these Centers, supporting greater economic diversification and competitiveness for the Kingdom. KAUST is establishing mechanisms to track the research output, partnerships, and engagement activities of each Center, ensuring alignment with Vision 2030 and the RDIA.

This section presents two case studies demonstrating how KAUST has accelerated research with clear societal relevance, offering practical insights for institutions seeking to expand their role in advancing national RDI priorities.

## Case Study 1: Future Mobility Sandbox

### KAUST's premier RDI-enabling platform

The KAUST Future Mobility Sandbox marks a landmark collaboration between the University, the Ministry of Transport and Logistic Services (MOTLS), and the Ministry of Industry and Mineral Resources (MIM). Officially announced on April 29, 2025, the Sandbox is the world's first multimodal testing ground for mobility technology across land, air, and sea.

This initiative will advance vehicle technologies and provide a testbed to support regulators in policy development, contributing

to the establishment of national safety, environmental, and operational standards across all transport modes.

### Industry synergy

KAUST's proximity to King Salman Automotive Cluster at King Abdullah Economic City (KAEC) positions the University as a hub for mobility RDI. Major manufacturers such as Ceer Motors, Lucid Motors, and Hyundai have established facilities within the cluster. Lucid, for instance, is leveraging KAUST's research infrastructure and talent pool to expand its R&D footprint.<sup>1</sup>

<sup>1</sup> <https://media.lucidmotors.com/en/newsitem/1020-lucid-and-saudi-arabias-kaust-announce-strategic-partnership-to-advance-ev-technology-leadership-and-grow-autonomous-driving-and-advanced-driver-assist-system-capabilities>



Collaborative ecosystem

The Sandbox fosters collaboration between academia, industry, and government within the Kingdom. To date, it has engaged approximately 27 partners and beneficiaries, including global players such as Nissan, Pirelli, and Hyundai.

27

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NISSAN

PIRELLI

HYUNDAI

Four strategic thrusts

Proving ground for smart testing all year round

The Sandbox replicates Gulf region weather and road conditions to enable year-round smart testing for all vehicle types. It simulates challenges such as tunnels, variable terrain, and extreme weather. This controlled environment supports safer vehicle development and helps reduce future transport-related incidents, aligning with the Kingdom's National Transport and Logistics Strategy.

Safety and regulation

The Sandbox prioritizes safety compliance in the Kingdom's transport sector. Researchers are developing a fully digitized, AI-driven mobility solution for air traffic control, which requires multiple rounds of testing and validation. The goal: to establish intelligent systems that reduce incidents and improve processing times, enhancing overall safety.

In addition to supporting new mobility solutions, the Sandbox enables regulators to develop standards that keep pace with emerging technologies such as autonomous driving. KAUST works closely with authorities to establish national regulations for mobility systems across the automotive, marine, and aerial sectors.

Looking ahead, there are opportunities to formulate region-specific standards tailored to the Kingdom, the Gulf, and the broader Middle East and North Africa (MENA) region.

Innovation hub

The Sandbox serves as an innovation hub and incubator for mobility, leveraging KAUST's faculty and research capabilities for key industry players. Assets include the Center of Excellence for Generative AI and the Center of Excellence for Renewable Energy and Storage Technologies.

It also provides a dedicated space for members of the Fuel Lubricants Efficient Engine

Technology Consortium — including Aramco, Toyota, and Ferrari — to test solutions developed in collaboration with KAUST researchers. Saham Al-Husseini, Director of KAUST's SMART mobility office, said: "KAUST is the best possible location to actually make this a success. We have the right facilities and the right people willing to drive this forward."

Sustainability

Sustainability is embedded at the Sandbox's core through research and testing designed to support cleaner, safer, and more efficient transport systems. Dedicated workshops and labs will enable precise measurement of pollutant emissions, fuel consumption, and energy performance to guide partner strategies for reducing environmental impacts across passenger and heavy-duty vehicles.

Advanced testing of propulsion and energy systems — such as batteries, fuel cells, e-motors, and inverters — will support the development of low- and- zero-emission vehicles. Finally, safety and performance testing will be enhanced through virtual and physical simulations to optimize designs before production, reducing material waste and improving resource efficiency.

The Sandbox also aims to partner with companies such as Ceer,

the Kingdom's first electric vehicle manufacturer, to support co-development of smart, sustainable vehicles in-Kingdom. Collaboration with KAUST's Center of Excellence for Clean Energy and Energy Storage will further amplify the integration of renewable energy and greener storage solutions into mobility systems, advancing the Kingdom's goal of a carbon-neutral transport sector.

As Al-Husseini noted: "By developing and testing the technologies that will power the vehicles of tomorrow, the Sandbox will provide the infrastructure and expertise to enable cleaner and safer mobility for all."



CASE STUDY 1 >

CASE STUDY 2 >

Case Study 2:  
Eliminating carbon dioxide emissions from power plants

The carbon challenge

Power generation is the largest source of carbon emissions within the energy sector, responsible for almost 40 percent of global energy-related emissions. In Saudi Arabia, electricity production relies significantly on fossil fuels, particularly oil and natural gas, resulting in a carbon-intensive economy that contributes to climate change.

**The Kingdom aims to reduce its carbon emissions by 278 million tons per year by 2030, and to achieve net-zero emissions by 2060, as outlined in the Saudi Green Initiative.** In support, KAUST has developed an innovative solution to address these heavy emissions — the world's first cryogenic carbon capture system.

40%

of global energy-related emissions come from power generation, making it the largest source of carbon emissions in the energy sector.

Breakthrough in carbon capture

Spearheaded by KAUST Professor William Roberts, Mechanical Engineering, this patent-pending technology captures more than 98 percent of the carbon dioxide emitted from power plants. The adaptable design allows integration into the Kingdom's existing power plant operations.

KAUST is collaborating with the Saudi Ministry of Energy to commercialize the system. A pilot demonstration unit is under development at NEOM, the Kingdom's planned smart city powered entirely by clean energy. Designed and built for the Duba Green Power Plant, this unit can capture 30 tons of CO<sub>2</sub> per day, stored as pure liquid CO<sub>2</sub>.

According to Roberts, this process is based solely on thermodynamics. **"We cool the flue gas down to cryogenic temperatures, and the carbon dioxide desublimates from a gas directly to a solid, and then we separate that solid, melt it, compress it, purify it, and then deliver it."**

Project leaders expect this facility to be operational by 2028.

A holistic approach to reducing emissions

The technology enables captured CO<sub>2</sub> to be repurposed across multiple sectors. For example, the NEOM–Aramco plant will use a portion for byproduct synthesis, supporting a circular economy approach. Additional captured CO<sub>2</sub> will be supplied to industries such as food and beverage, extending its value beyond emissions reduction.

KAUST has also partnered with the Saudi Electricity Company (SEC) on a pilot study to deploy the technology at SEC's Rabigh power plant, demonstrating the system's unique capability to capture multiple pollutants simultaneously. Competing technologies typically require distinct systems for different pollutants and gases.

The cryogenic carbon capture system marks a significant step forward in aligning university research with national and global climate goals. KAUST's robust industry and government partnerships, coupled with the physical, financial, and human capital readily available for project continuity, accelerates the Kingdom toward a carbon-neutral economy.

The cryogenic carbon capture system marks a significant step in aligning university research with national and global climate goals. KAUST's robust industry and government partnerships — coupled with the physical, financial, and human capital available for project continuity — accelerate the Kingdom's progress toward a carbon-neutral economy. Roberts noted: **"You get to do good science. You get to do good engineering. And you get to see impact."**





# Engine of economic growth and industrial innovation ●



CASE STUDY 1 &gt;

CASE STUDY 2 &gt;

**A central role of universities worldwide is to contribute to economic growth through research, development, and innovation within their societies. KAUST's RDI efforts align with the Kingdom's strategic shift from a largely oil-based economy to a knowledge-based one, where innovation is a key pillar of sustainable national growth.**

The University supports research commercialization by building a comprehensive intellectual property portfolio, launching startups, and facilitating technology transfer. As of 2025, KAUST has recorded 1,480 invention disclosures, secured 1,079 unique patents across multiple jurisdictions, and raised US\$329 million in startup capital.

Home to more than 80 companies – ranging from startups to multinational corporations such as Aramco, Boeing, and Hewlett Packard Enterprise – KAUST's Research and Technology Park offers facilities, laboratories,

incubators, and technology consulting services to support technology transfer between the University and industry. Many of the startups based at the Park were founded by KAUST researchers and students and receive funding from the University.

This section presents two case studies illustrating the journey of KAUST research from the lab to the marketplace, offering practical insights for institutions seeking to strengthen their innovation pipelines while cultivating strategic partnerships with government and industry.

**1,480**  
disclosures

**1,079**  
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**US\$329  
million**  
raised in startup  
capital



CASE STUDY 1 >

CASE STUDY 2 >

Case study 1:  
Accelerating direct lithium extraction technology

**2 million**  
electric vehicles could be powered by the estimated annual lithium carbonate output.

Lithium shortage, KAUST solution

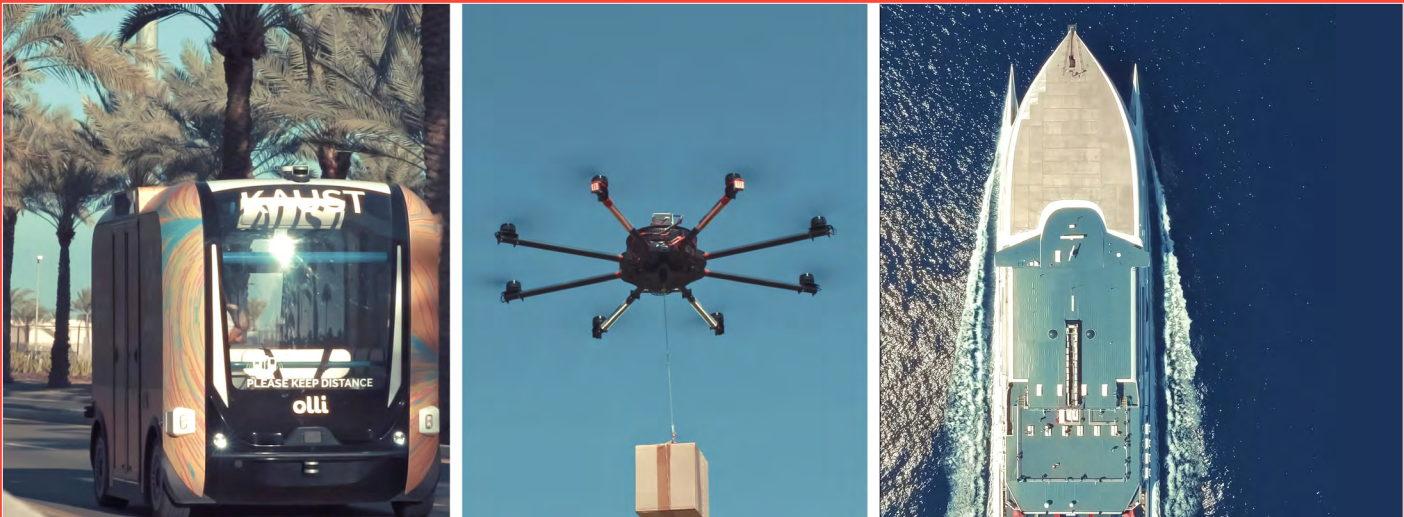
Lithium is essential for rechargeable batteries that power smartphones, electric vehicles (EVs), and grid-scale storage systems supporting solar energy. As global demand for clean energy grows, the need for lithium continues to rise. However, lithium has a limited reserve, and conventional extraction methods carry significant environmental costs, including soil degradation, water contamination, and greenhouse gas emissions.

KAUST Professor Zhiping Lai, Chemistry, is leading efforts to address this challenge by developing high-performance membrane technologies for energy-efficient lithium

separation. He explained: “We developed this technology about four years ago, initially purely based on scientific curiosity.”

The research team discovered a novel membrane method to extract lithium from very low-grade sources, including produced water from oil fields – a breakthrough with major implications for renewable energy and EV supply chains.

To validate the approach, the team built a parallel-scale pilot facility with support from Ma’aden and Aramco, Mahara, a local labor service provider, enabling real-world testing. Nearly 100 tons of produced water have been shipped for experimentation, marking a significant milestone in the project’s development



Contributions to economic diversification

KAUST’s lithium extraction project could help Saudi Arabia establish a localized lithium supply chain, critical for EV manufacturing and renewable energy development. The research has attracted the attention of stakeholders, including Ma’aden, Aramco, and the Ministry of Industry and Mineral Resources.

“Saudi Arabia can benefit a lot from this technology,” Lai said. “It can help the Kingdom establish a localized lithium supply chain critical for electric vehicle

manufacturing and renewable energy development.”

Lithium Infinity, a KAUST startup, is advancing sustainable direct lithium extraction technologies to produce battery-grade lithium from domestic resources, including oilfield runoff water, geothermal water, and desalination brines. The company has secured funding from Ma’aden and KAUST Innovation Ventures.

Estimates suggest the potential to produce up to 100,000 tons of lithium carbonate annually, enough to power approximately

2 million electric vehicles.<sup>2</sup> As of 2025, a KAUST pilot facility has successfully extracted 10 kilograms of battery-grade lithium carbonate from oilfield-produced water. Five mobile units are being deployed across different oilfields in the Kingdom, each capable of extracting up to one ton of lithium carbonate each year.

By 2029, annual production from Lithium Infinity technology is expected to reach 10,000 tons, which is enough to power 250,000 EVs and contribute meaningfully to a domestic lithium supply chain.

<sup>2</sup> Each electrical car needs about 50kg of lithium carbonate.

From the Kingdom to the world

Plans for Lithium Infinity to expand across the Middle East and North Africa further strengthen Saudi Arabia’s position as a global leader in lithium production. The KAUST startup addresses growing lithium demand through a sustainable approach, securing raw materials essential to the global transition to clean transport.

According to Lai, lithium represents “the most important element for energy storage.” He noted that leveraging

technologies such as Lithium Infinity could “significantly increase lithium supply and potentially solve the global lithium shortage, especially for territories like the U.S., Europe, China, and Japan.”

Reflecting on the research team’s culture and environment, he added: “KAUST is small, but we have world-class faculty and a very collaborative culture. We’re able to do research based on curiosity. That freedom is very important for the success of our work.”

**“We have world-class faculty and a very collaborative culture. We’re able to do research based on curiosity. That freedom is very important for the success of our work.”**

**Zhiping Lai**  
Professor, KAUST



CASE STUDY 1 &gt;

CASE STUDY 2 &gt;

## Case study 2: Startup revolutionizes KSA construction sector

### The scarcity of sand and construction materials

A global “sand rush” is underway, putting pressure on natural ecosystems such as rivers, beaches, and lake beds as sources of sand. At the same time, only about five percent of the world’s sand is suitable for making concrete, creating a supply shortage that threatens access to essential construction materials.

The construction industry stands at a crossroads. Sand, the backbone of concrete and modern infrastructure, is facing unprecedented shortages. Traditional sources — riverbeds, quarries, and seaborne imports — are being depleted at alarming rates. Environmental damage, rising costs, and tightening regulations add to the pressure.

As the Kingdom undergoes rapid urbanization, including through planned megaprojects such as NEOM, the demand for construction materials is growing significantly. However, most Saudi desert sand cannot bond effectively with concrete, making it unsuitable for construction.

KAUST research scientist Dr. Anastasiya Bavykina, cofounder and technical product manager at ClimateCrete, explained that dune sand typical to the region is polished by wind, resulting in grains that are too fine and lack the rough texture needed for structural bonding. There is therefore a need for domestic “aggregates” — the industry term for sand suitable for making concrete.

### Modifying sand into aggregates

ClimateCrete, a KAUST startup, exemplifies the type of innovation-driven enterprise that can emerge from a strong university entrepreneurship ecosystem. The company addresses Saudi Arabia’s aggregate needs through proprietary technology that modifies local sand and excavation waste, converting it into aggregates for construction.

The concept originated from KAUST scientists’ observation that many construction sites across the Kingdom contain untapped reserves of excavated materials that could be transformed into concrete-ready aggregate. Founded by both Professor Jorge Gascon, Chemical Engineering, and Dr. Anastasiya

Bavykina, ClimateCrete’s technology repurposes local excavation waste and leaves no by-products, effectively reducing the carbon footprint of the construction industry.

The general methodology involves transforming excavation materials, by processing it into sand that meets construction standards and delivering the sand to batching plants. Bavykina explained: “We apply our methodology to transform excavation waste into construction sand. It’s about using what’s already there, locally.”

The technology also allows batching plants to use less cement, the largest source of CO<sub>2</sub> emissions in construction, further lowering the industry’s carbon footprint.

### Strategic collaborations

ClimateCrete has worked with major construction partners and giga projects within the Kingdom to test and experiment with domestic natural sand. ClimateCrete is also a member of the NovusCrete Consortium, a global collaboration to develop and accelerate sustainable concrete adoption.

Now operational in Thuwal, the startup has a demonstration facility producing 100 tons per day, with plans to construct its first industrial plant scheduled for 2026.

### Cost-effective technology

A unique feature of ClimateCrete’s approach is cost-effectiveness. By using local materials and excavation waste, the company avoids the high costs of importing construction aggregate. Placing sand production facilities near excavation or batching plants also reduces transportation and logistical expenses.

To ensure market competitiveness, ClimateCrete’s sand is priced at or below the cost of conventional sand. Bavykina added: “Sustainability has to be affordable — otherwise implementation becomes a utopia rather than reality. That’s what makes us different.”

Based at KAUST, the startup aims to scale production and enter the global US\$400 billion construction aggregates market. It contributes significantly to Vision 2030’s sustainability goals and the RDIA pillars by promoting circular economy practices, reducing imported materials, and supporting regulatory development for sustainable construction.

Saudi Arabia imports more than of  
**30 million tons**  
sand annually for construction, incurring high financial and environmental costs



# A talent localization hub fostering the next generation of researchers ●



CASE STUDY 1 &gt;

CASE STUDY 2 &gt;

CASE STUDY 3 &gt;

**KAUST is shaping the next generation of researchers and innovators through initiatives that engage young talent from high school to early career. These include tailored mentorship and training programs, partnerships with national universities and the RDIA, and other strategic efforts to strengthen the Kingdom's talent pipeline.**

Young researchers affiliated with the University have consistently been recognized for their contributions to science and technology, with some alumni featured on prestigious lists such as Forbes 30 Under 30 MENA, L'Oreal-UNESCO for Women in Science and the MIT Technology Review Innovators Under 35 MENA.

Talent support programs, such as the KAUST Gifted Student Program (KGSP), identify high school graduates in STEM fields and support their undergraduate studies at leading universities in the United States and beyond, preparing them for future admission to KAUST's graduate programs.

Similarly, the National Academic Talent Development Program (NATDP) strengthens the teaching faculty of other national universities by sponsoring further studies at KAUST, attracting and developing multiple teaching assistants and lecturers within the Kingdom.

In 2025, 10 KAUST faculty members received medals at the 50th Geneva International Exhibition of Inventions, one of the world's largest events dedicated to innovation and showcasing inventions from more than 35 countries. This collective achievement reflects the world-class contributions of KAUST faculty today. Such talent does not emerge by chance — the University is cultivating the next generation of scholars to achieve similar global impact tomorrow.

Beyond cultivating talent in research, development, and innovation, KAUST contributes to national workforce development through initiatives such as KAUST Academy and the Elevate Trainee Program, which promote lifelong learning and public engagement.

This section presents three case studies highlighting KAUST's role in advancing the Kingdom's workforce, offering valuable insights for institutions seeking to build talent ecosystems that strengthen national capacity for research and development.

## KAUST Gifted Student Program (KGSP)

Prepares top STEM talent for global undergraduate studies.

## National Academic Talent Development Program (NATDP)

Strengthens teaching faculty across Saudi universities.

## KAUST Academy & Elevate Trainee Program

Promoting lifelong learning and workforce development.





Saudi Arabia faces a projected shortage of

**663,000**

skilled workers by 2030 across public and private sectors.

In 2024, the Academy received

**17,000**

applications selecting just 300 of the Kingdom's top learners through rigorous training and tests.

CASE STUDY 1 >

CASE STUDY 2 >

CASE STUDY 3 >

## Case study 1: Developing Saudi's workforce of the future

### Diverse learning pathways

KAUST Academy offers a range of academic and technical programs for diverse participants – from pre-university students to university students, fresh graduates, and professionals. These include certification programs for Saudi students and graduates through massive open online courses, in-person courses, and summer internships.

In partnership with global online course provider Coursera, KAUST Academy offers accreditation for more than 200 courses and specializations, equipping learners with market-relevant skills in emerging industries. Dr. Sultan Albarakati, Director of KAUST Academy, said: "We see ourselves as a lifelong learning organization."

### Addressing skills gaps

KAUST Academy programs address the growing demand for skills in cybersecurity, artificial intelligence, and software engineering. Like many nations, the Kingdom must navigate market volatility with a highly skilled workforce. Projections indicate a shortage of 663,000 skilled workers across public and private sectors by 2030.

To help meet this demand, KAUST Academy collaborates with national agencies and corporations, designing programs and training for government officials and corporate staff. Partnering with the National Cybersecurity Authority (NCA), the Academy equips students with skills critical to the fulfillment of Vision 2030.

Further, the Academy integrates real-world challenges from companies into student projects, ensuring hands-on learning. Albarakati said: "We cannot do this alone. It has to be a national effort. That's why we work with the Ministry of Education, the NCA, and the Ministry of Energy."

### Reaching students from across the Kingdom

To date, nearly 40,000 of Saudi Arabia's top students have completed KAUST Academy's online training, 5,500 have enrolled in advanced in-person courses, and 300 have participated in summer internships and research programs.

In 2024 alone, the Academy received 17,000 applications, selecting 300 of the Kingdom's best learners through a rigorous series of training and tests. This extensive reach demonstrates the Academy's capacity to address national skills gaps.

KAUST Academy's leadership believes strongly in national-level talent development. Its success is a testament to the power of inclusive education. It is a philosophy any institution seeking similar societal impact can embrace. Albarakati said: "I'm a strong believer that the talent is there. What's missing is just to give them a chance – and believe in them."





Algae biotechnology could replace

**4.36 million tons**

of imported protein, worth US\$1.7 billion annually.

CASE STUDY 1 >

CASE STUDY 2 >

CASE STUDY 3 >

## Case study 2: Localizing talent through sustainable innovation in food security

### Turning algae into animal feed

As Saudi Arabia advances toward its Vision 2030 food security goals, reducing reliance on imported livestock feed has become a priority. The Kingdom currently imports most of the raw materials for livestock and fisheries feed, with demand projected to reach 13 million tons annually by 2030.

KAUST researcher Dr. Claudio Fuentes-Grünwald, Algae Program Director, leads a team developing technology to produce livestock feed from local resources. The work demonstrates how available resources can generate biomass for fish, shrimp, and poultry feed – providing a cheaper, less carbon-intensive alternative to imported feedstock.

The project began with a feasibility study to grow algae in the Saudi desert, leading to the development of a pilot plant and then an industrial-scale facility. The system draws on nutrient-rich water from nearby fish hatcheries, producing algae biomass rich in protein, lipids, and carbohydrates.

Adapting algae to harsh desert conditions posed operational challenges: rising salinity, high pH levels, and extreme sunlight affected growth. In response, the research team trained algae strains to thrive under these extreme conditions using open-pond systems. It is an approach that also reduced energy costs. The resulting biomass is processed into powder or paste form for use in animal feed, proving the feasibility of microalgae production in the Kingdom's climate.

End users have responded positively to the technology, confirming its safety and suitability for animal feed. In poultry trials, chickens fed with algae-based feed showed lower mortality rates and higher omega-3 content in their meat. Similarly, fish trials demonstrated improved survival rates and increased beneficial fatty acids. Fuentes-Grünwald noted: "it's not just safe – it's healthier and more marketable."

### Chickens fed with algae-based feed

showed lower mortality rates and higher omega-3 content in their meat.



### Commercializing for KSA economy and talent

As KAUST's algae project moves toward commercialization, it offers a model for how institutions can align research with national priorities, engage local talent early, and build capacity to meet national needs while fostering partnerships with government and industry.

Industry estimates suggest algae biotechnology could replace 4.36 million tons of imported protein worth US\$1.7 billion annually, create up to 200,000 local jobs, and transform the Kingdom's livestock nutrition sector.

As the initiative advances toward commercialization, researchers such as Sama Mohammed — a lab assistant who joined the project through KAUST's Elevate Program — are contributing to Saudi food security while developing the skills and ambition to become future leaders in the domestic bioeconomy. In this way, the algae biotechnology research cluster also serves as a hub for talent localization.

### Connecting innovation with talent development

The Elevate Program is an on-the-job training initiative that prepares recent graduates from local universities for the workforce. It offers specializations in business, science and engineering, environmental sustainability, technology, and education. Participants gain hands-on experience through real-world projects, develop leadership skills, and build professional networks within KAUST's research ecosystem.

For Sama, working on the algae project has deepened her expertise and passion for a field of national importance. Her experience shows how hands-on research opportunities at KAUST can inspire long-term academic ambitions. She said: "If I get my master's and Ph.D. now, I will get it in this field because I enjoy it very much."

Sama's story illustrates how innovation can be scaled for both national impact and talent development. Her journey reflects KAUST's broader strategy of leveraging innovation ecosystems as training grounds for the next generation of Saudi scientists and researchers.

CASE STUDY 1 &gt;

CASE STUDY 2 &gt;

CASE STUDY 3 &gt;

## Case study 3: Empowering young researchers for the future

### Rooted in heritage, striving for national goals

A defining feature of KAUST's research environment, and one that other institutions could emulate, is its dynamic learning culture, where students and junior staff develop under the guidance of experienced scientists and professors.

In KAUST's advanced agricultural research clusters, master's student Renad Al Ahmadi is contributing to work on wheat disease resistance. Raised in Medina, a region known for Ajwa dates and where both her grandfathers were date farmers,

Al Ahmadi aspired to work in agriculture to continue her family's legacy. She joined KAUST through a one-year bridging program, which allowed her to explore research opportunities.

Al Ahmadi began working on a project focused on Ajwa dates — a meaningful undertaking given her background — before pursuing her master's degree under Professor Brande Wulff, Plant Science, and faculty member of the Center of Excellence for Desert Agriculture. Her thesis examines yellow rust disease, a major threat to wheat crops, with the aim of introducing

resistance genes into wheat varieties suited to the Kingdom's climate.

The goal is to help reduce reliance on wheat imports by developing a local supply of disease-resistant wheat. Al Ahmadi is also part of Wulff's research cluster on cloning disease-resistant wheat. She credits her research progress to the global opportunities available at KAUST, noting the "hundred different nationalities in one place," all willing to help the student community in any way they can. "This really makes me excited to go to work every day."

### A supportive research environment

KAUST routinely organizes seminars where international scientists present to entire departments. The Bioscience Department hosts internal seminars for faculty-student engagement as well, where principal investigators present their work and interested students can collaborate with them. The University strives for a consultative research environment where students are

encouraged to take ownership of their involvement in cutting-edge projects.

In the future, Al Ahmadi plans to complete her thesis and earn her Ph.D. She intends to continue contributing to national food security, working in agricultural think tanks or seed banks as part of her personal motivation to invest in the local agriculture sector.

Her experience reflects how a collaborative research environment, in addition to

formal programs, motivates young Saudi talent to realize personal ambitions while giving back to their communities. As Al Ahmadi put it: "This is the best experience that shaped me and gave me independence. It's a really welcoming home, and so I want to participate in an amazing community that can actually give back to the country that developed and shaped my growth."



# KAUST as a global science, technology, and innovation ambassador for Saudi Arabia ●

# 75%

of KAUST's publications were international collaborations — a clear indicator of faculty engagement in global research networks.

## CASE STUDY 1 >

## CASE STUDY 2 >

**The 2025 Times Higher Education (THE) World Academic Summit is the latest in a series of international conferences and policy forums KAUST has hosted over the years, contributing to the global discourse on science, technology, and innovation.**

Previous high-profile events have included the 15th General Conference of the UNESCO World Academy of Sciences (2021), organized in collaboration

with the Islamic Development Bank (IsDB), and the annual 6G mobile network technology conferences.

Beyond hosting events, the University engages with the global science, technology, and innovation community through its internationalized research portfolio. As of 2022, 75 percent of KAUST's publications were international collaborations — a clear indicator of faculty engagement in global research networks.

KAUST's internationalization approach has been recognized in multiple global assessments and offers a model for other institutions seeking to strengthen their global reach.

The University performed strongly in the THE Arab University Rankings 2024 metrics related to the internationalization of research and teaching. The University also featured prominently in the Nature Index — a database measuring the scientific output of institutions and nations. In 2022, KAUST ranked first in Saudi Arabia, fourth in Western Asia, and 152nd globally.

Aligning strategic research areas with both national and global scientific priorities is central to KAUST's approach. This section presents two case studies that offer key insights for institutions aiming to achieve similar alignment on an international scale.

### Case Study 1: Cultivating disease resistance in wheat for food security

#### The global crop disease issue

Improving global crop supply by addressing plant diseases is critical. According to Professor Brande Wulff, Associate Professor of Plant Science and Faculty Member of the Center of Excellence in Sustainable Food Security, approximately 21 percent of projected global wheat yield is lost annually to pests and diseases, which is enough to fill 105,000 Olympic-sized swimming pools and feed the world for nearly one month.

This challenge is particularly acute in the MENA region, where rust diseases and drought are prevalent. In the Kingdom, ensuring food security is further

complicated by arid desert conditions. Saudi Vision 2030 calls for reducing dependency on food imports by increasing local supply.<sup>3</sup>

Plant diseases not only damage crops directly but also drive significant energy use. Farmers often respond with pesticide applications, while premature fertilizer use before the onset of pests and diseases leads to unnecessary energy waste due to the high costs of fertilizer production and transport. Wulff estimates that wheat losses from disease are equivalent to the energy contained in 120 tanker ships of crude oil, or about 0.6 percent of the crude extracted globally each year.

<sup>3</sup> Kingdom of Saudi Arabia, Vision 2030, <https://www.vision2030.gov.sa/media/quudi5wq/vision-2030-overview.pdf>, page 65



Collaboration with the Ministry of Environment, Water, and Agriculture (MEWA) is helping build capacity for Saudi researchers to engineer wheat independently of KAUST labs.



### Modifying common crops to grow in Saudi Arabia's extreme climate

Wulff and his team combat crop disease through genetic resistance, which is a more sustainable approach than conventional pesticide use. They are cloning disease resistance genes from wild wheat relatives and introducing them into commercial varieties. Their goal is to produce disease-resistant wheat suited to the MENA region, where both rust diseases and drought are widespread.

### Robust global exposure

The research group works with multiple industry and government partners, including a new collaboration with the Ministry of Environment, Water, and Agriculture (MEWA) to build capacity for Saudi researchers to engineer wheat independently of KAUST laboratories.

KAUST expects collaborations with academic wheat breeders worldwide to expand as the team advances its research, development, and implementation, Wulff said. These networks enhance global knowledge exchange and reflect a holistic approach to agricultural

innovation. The research team is itself highly diverse, with members from China, India, Turkey, Denmark, and the U.K., among other countries.

Researchers — from highly trained postdoctoral fellows to early-career master's students — bring a mosaic of experiences and perspectives. This diversity enables the team to tackle scientific challenges from multiple angles and encourages cross-cultural collaboration, a hallmark of the KAUST research environment. "It's an incredibly diverse group in terms of nationality, culture, and language," Wulff said.





CASE STUDY 1 >

CASE STUDY 2 >

Case Study 2:  
Breakthrough in clean  
energy transport

Hydrogen matters

The hydrogen revolution promises significant energy output with minimal carbon emissions, aligning with the global drive toward sustainability and offering a compelling alternative for societies and economies seeking to reduce reliance on fossil fuels.

Saudi Arabia unveiled its National Hydrogen Strategy in 2020, aiming to increase production and meet 10 percent of global demand by 2030. However, hydrogen — the smallest element on the periodic table — is notoriously difficult and energy-intensive to store and transport. This is due to its low density

and the need for specialized infrastructure, such as high-pressure tanks, cryogenic systems, or chemical carriers—factors that significantly raise costs and limit accessibility compared to conventional fuels. These challenges have slowed progress toward a hydrogen economy.

In contrast, ammonia emerges as an ideal hydrogen carrier: it is energy-dense, easily liquefied under moderate conditions, and compatible with existing storage and transport infrastructure. However, its widespread viability is limited by the high energy demands of the cracking process, which typically requires temperatures above 700 C.



My research has benefited tremendously from the Kingdom’s bold ambitions to **use oil more sustainably and accelerate the transition to cleaner fuels**—goals that have created a unique environment for innovation and impactful science,”

**Jorge Gascon**  
Professor, KAUST

Breakthrough in ammonia  
cracking

In collaboration with Aramco, KAUST has developed an advanced catalyst for ammonia cracking, enabling ammonia to serve as a viable hydrogen storage medium. This catalyst has been successfully scaled for industrial use this breakthrough will help make hydrogen a more accessible and cost-effective clean fuel.

Led by Professor Jorge Gascon, the partnership has produced technologies at various stages of commercialization, underscoring KAUST’s expertise in delivering sustainable, real-world impact. While KAUST researchers continue important work on crude oil refinement, Gascon

noted that the “real opportunity” lies in transitioning to cleaner, more sustainable applications — including advances in hydrogen storage.

“My research has benefited tremendously from the Kingdom’s bold ambitions to use oil more sustainably and accelerate the transition to cleaner fuels—goals that have created a unique environment for innovation and impactful science,” he said.

This technology positions the Kingdom as a leader in the hydrogen revolution, enabling efficient clean-energy transport and export. KAUST’s initiative will decarbonize industries and promote clean-fuel adoption, in alignment with Saudi Vision 2030 and the Saudi Green Initiative.





### Talent development and industrial collaboration

KAUST's research platform also fosters collaborative talent development. Several Aramco employees have completed postdoctoral research at KAUST before returning to the company to advance industry solutions. The University also attracts researchers from around the world, including Dr. Jean Marcel Gallo, a chemist and former professor from Brazil who works in projects at the interface of KAUST and industry, particularly in the hydrogenation of CO<sub>2</sub>.

"We develop catalysts and processes to convert CO<sub>2</sub> into valuable products, and I think we all feel that we have the opportunity to make an impact that our children and grandchildren will appreciate in the future," he said.

### Driving holistic national impact

In addition to this research, the cluster was previously involved in the KAUST Circular Carbon Initiative, a university-wide effort across disciplines to explore sustainable carbon solutions. Researchers across KAUST divisions, from biologists working on blue carbon and mangroves to engineers focused on carbon capture and conversion. By addressing a key national priority and galvanizing the broader research community through knowledge transfer, their efforts are advancing the Kingdom's progress toward its 2060 net-zero carbon emissions goal and the wider adoption of clean fuels.

KAUST continues to drive change in hydrogen transport, CO<sub>2</sub> conversion, and circular carbon systems. Gascon said the progress he had achieved in eight years at KAUST would have taken two or three full careers elsewhere, calling the accomplishments extraordinary. "What my research group has achieved at KAUST in eight years would have taken us two or three full careers elsewhere. That's what makes KAUST, from my point of view, and especially for the research that I do, one of the best universities, if not the best university in the world."



**We develop catalysts and processes to convert CO<sub>2</sub> into valuable products,** and I think we all feel that we have the opportunity to make an impact that our children and grandchildren will appreciate in the future,

**Dr. Jean Marcel Gallo**  
Chemist and former professor  
KAUST



# KAUST as a strategic national partner for policy and sustainability ●



## CASE STUDY 1 &gt;

## CASE STUDY 2 &gt;

At the 2021 United Nations Climate Change Conference (COP26), Khalid M. Abuleif, senior sustainability advisor to His Royal Highness the Minister of Energy and chief negotiator for climate agreements in the Kingdom, recognized KAUST for its contributions to advancing Saudi Arabia's sustainability goals.<sup>4</sup>

KAUST supports national sustainability and climate objectives by providing data-driven guidance for evidence-based policymaking in clean energy and environmental stewardship. Working closely with national RDI agencies, the University helps ensure that policies are grounded in science and aligned with global best practices.

This section presents three case studies demonstrating how sustainability research can be translated into tangible solutions that support long-term goals. These examples provide practical insights for institutions seeking to achieve similar objectives, both within the Kingdom and beyond.

<sup>4</sup> <https://www.kaust.edu.sa/en/news/representing-the-kaust-research-pillars-at-cop26>

## Case study 1: Sea solutions to climate change

### The blue carbon concept

Global demand for nature-based solutions to stabilize the climate system has driven the rise of the “blue carbon” concept, which underscores the exceptional carbon-capturing capacity of coastal and marine ecosystems.

Blue carbon is stored long-term in plant biomass and oxygen-poor sediments on the ocean floor, where slowed decomposition can lock it away for millennia. This concept was first uncovered

through research on mangrove ecosystems and salt marshes.

These studies then gained traction through the work of KAUST Ibn Sina Distinguished Professor Carlos Duarte and his collaborator, Professor Just Cebrán, at the Centro de Estudios Avanzados de Blanes in Spain. Their research provided evidence that these habitats transform CO<sub>2</sub> into biomass via photosynthesis, with excess organic carbon buried beneath the vegetation.

Blue carbon refers to the **exceptional carbon-capturing capacity of coastal and marine ecosystems** such as mangroves and salt marshes.





**KAUST's commitment to marine science**

KAUST has strategically prioritized marine science, exemplified by Duarte — a world-renowned marine ecologist advancing research on Red Sea marine ecosystems as well as nearby mangrove and seagrass habitats. The Tarek Ahmed Juffali Research Chair in Red Sea Ecology positions KAUST as a leader in blue carbon research and initiatives.

“Having worked in R&D systems around the world, I was impressed by the vision of the KAUST founder King Abdullah, peace be upon him, and the unique potential for KAUST to foster

solution-driven science,” Duarte said. “It was clear that joining KAUST was to become my best opportunity to deliver the best science I was able to conceive.”

In addition to recruiting marine science experts such as Duarte, KAUST has invested in infrastructure to advance blue carbon research. The Ibn Sina Marine Research Station, located on the KAUST shoreline, enables long-term experiments that are not possible at open-access sites. Developed with partners, the station serves as a living laboratory for studying coastal ecosystems and their roles in biodiversity and carbon sequestration.



**From research to policy impact**

KAUST's blue carbon research has influenced national policymaking, placing Red Sea and Gulf ecosystems at the heart of Saudi environmental strategies. Projects such as Red Sea Global have applied blue carbon principles to guide coastal development.

Internationally, these principles are shaping climate change mitigation and adaptation strategies, as countries increasingly include blue carbon in greenhouse gas inventories and Paris Agreement Nationally

Determined Contributions. Duarte has advised blue carbon programs in Australia, China, Japan, South Korea, and Portugal.

Looking ahead, KAUST aims to integrate blue carbon into natural capital frameworks. With rising global investment and policy interest, the University remains at the forefront of marine-based climate solutions. It offers a model for how institutions can link cutting-edge research to both national priorities and global policy frameworks.

CASE STUDY 1 >

CASE STUDY 2 >

Case study 2:  
**World's largest coral restoration effort**

**KAUST Coral Restoration Initiative (KCRI)**

Coral reefs support at least 25 percent of marine life worldwide, yet climate change threatens to reduce reefs by 70-90 percent in areal extent. Restoring healthy, sustainable reefs is crucial for marine-based sectors such as Red Sea tourism and fisheries, but traditional activities remain small and patchy. Current efforts to offset the rate of decline and boost reef recovery have been hindered by challenges to scaling restoration efforts and the long timeframe needed for ecological recovery.

In response, KAUST researchers, in partnership with NEOM, launched the KAUST Coral Restoration Initiative (KCRI), the world's largest and most innovative coral restoration effort. KCRI aims to restore, enhance, and preserve the Red Sea's unique coral reef ecosystems.

Its objectives include propagating and planting two million corals across 100 hectares of reefscape by 2030, advancing coral reef resilience, improving natural capital critical for tourism and the marine economy, and establishing a global demonstration site for reef restoration innovation.

By 2040, KCRI's goal is to re-establish a thriving reefscape.

Spearheaded by a team of global and local experts in reef restoration practice, reef science, aquaculture, and visualization, the project is based in NEOM, operating from KCRI's land-based coral farm at Haddah Beach in support of restoring the nearby Shushah Island reefscape. This approach, growing coral on land before transplanting it to the sea, marks a departure from many restoration projects, which commonly rely on relatively small-scale coral nurseries that are typically in water. The land-based coral farm supports the KCRI goal of planting two million corals over the next five years.

This scale is far beyond that of typical reef restoration projects, which in-water farms are yet to achieve. The hundred-hectare area at Shushah reefscape under restoration is two orders of magnitude larger than most restoration footprints. According to Professor David Suggett, KCRI Director and Chief Scientist, the land-based approach acts as a “factory of coral production,” similar to agricultural systems.



### Innovation to meet timelines

Given its unprecedented scope, the initiative first adopted a “fast-fail” methodology, commonly used in engineering, to pilot multiple restoration tools, practices, and processes from around the world to figure out what shows the best promise to tailor and optimize to the unique conditions of the Red Sea. In the first two years, the team trialed dozens of different techniques, rapidly eliminating ineffective methods and refining workflows for coral propagation, transplantation, and monitoring.

To accelerate progress, KCRI partnered with private sector stakeholders, leveraging their R&D capabilities and translating late-stage research and development work into operations. Collaboration extended beyond marine science to include specialists in biology, manufacturing, and agriculture, and experts in deploying Artificial Intelligence/Machine Learning solutions into real-world applications, creating an efficient, end-to-end restoration pipeline – from research, to land-based operations, to sea deployment.

Of most value – and a critical point of difference to many restoration projects worldwide – has been tapping into KAUST's incredible community. Firstly, the world-leading faculty within KAUST – global leaders spanning the Biological, Environmental, and Physical, Computational and Engineering sciences – provided

**Figure 1: KCRI restoration diver inspects newly grown coral within the in situ coral frame, Shushah Island reefscape.**



*Photo Credit: Charlie Pinder/KCRI*

KCRI with a unique opportunity to closely align diverse research and development opportunities with the needs of their restoration initiative (in parallel generating a ready-made platform for faculty to show impact on in-Kingdom priorities for a more sustainable future). Secondly, alumni specialists are regularly recruited as well, valued for their deep understanding of regional operational challenges.

Professor Suggett highlighted the Elevate program as further supporting talent development, offering Saudi graduates hands-on experience in monitoring,

fieldwork, and nursery operations. Saudi graduates are supported with working opportunities within KCRI's diverse areas of work (e.g., diving-based restoration, land-based aquaculture, data computation and visualization, and business operations). The second cohort of talented Saudi graduates is currently immersed in the program, providing a direct conduit to diverse employment opportunities. To date, 10 Saudis have completed the program, with several joining KCRI in various technical roles or KAUST-based R&D underpinning KCRI delivery.

### Operational excellence

Being the first of its kind, establishing KCRI has come with its share of challenges. Since 2022, Jerry Thomas, KCRI Associate Director, has overseen the initiative's management and stakeholder engagement, covering areas such as risk mitigation, human resources, and infrastructure planning. He said: “We didn't have a playbook to refer to, so we're building a framework that others can follow.”

This is the first major KAUST project conducted outside of campus. KCRI facilities are located 800 kilometers north of the University and require up to 300 staff members at peak, due to its remote location and scale. A major KCRI success factor so

far has been the partnerships that Thomas and his team have cultivated.

NEOM, KCRI's biggest strategic partner, works with the team to ensure smooth delivery of the project, from the strategic viewpoint to daily operations. A strong example of collaboration between the two parties is their joint effort to implement stringent risk and safety measures. With half of the team working in the water daily, NEOM provides robust dive control measures, health and safety protocols, and emergency support.

In addition to strategic partnerships with NEOM and local government entities for policy alignment and regulatory measures, the project works closely with organizations

such as NEOM, The General Organization for Conservation of Coral Reefs and Turtles in The Red Sea (SHAMS), The National Center for Wildlife (NCW) and others to ensure alignment on the mission of marine conservation and restoration. As part of the collaboration with NEOM, KCRI works closely with various sectors there to ensure appropriate infrastructure and external capabilities to support the project's operations. Service providers such as Coral Vita, Digilab, and DigiCorp also provide important services to KCRI to maintain its extensive operations. Thomas added: “We had to start from scratch. That has added to the complexity of how we deliver the project.”

### Leaving a legacy for the Kingdom and the world

KCRI aims to create a framework for large-scale coral restoration that translates to future projects in the Kingdom and worldwide. The team is documenting methodologies, processes, and strategies underpinning scalability, so that other institutions can replicate its best practices.

Within the coral farm, KCRI will establish a visitor center to showcase coral propagation and restoration processes and to raise public awareness about reef conservation. Future outreach

strategies intend to provide public and educational tours once the site is ready.

Above all, the initiative has reinforced the importance of collaboration in achieving its mission. Thomas noted: “We are continuing to rely on partners and therefore will be happy to partner with others to deliver their projects if they wish to do something similar to this.”



# Legacy and outlook: A Kingdom-wide commitment to the SDGs



Since its inception, KAUST has advanced research and innovation addressing both national priorities and major global challenges, pioneering breakthroughs in food security, climate resilience, and clean energy. As the Kingdom pursues its Vision 2030 agenda, giga-projects, and national sustainability goals, success will require the collective commitment of every research institute and university — not just one.

The case studies in this section showcase sustainability progress in the Kingdom, illustrating how ongoing research supports long-term environmental goals and offering models that other institutions domestically and globally can adapt.

## CASE STUDY 1 >

## CASE STUDY 2 >

### Case study 1: Saudi Arabia's progress in the U.N. SDGs

#### The U.N. Sustainable Development Goals (SDGs)

In 2015, the United Nations launched its 2030 Agenda, a shared blueprint for global peace and prosperity built around 17 Sustainable Development Goals (SDGs). These goals have become central to many national strategies for sustainable development, driven by the urgency of climate change and growing international cooperation.

<sup>5</sup> <https://sdgs.un.org/goals>

<sup>6</sup> United Nations, "The Sustainable Development Goals Report 2025" (2025), <https://unstats.un.org/sdgs/report/2025/The-Sustainable-Development-Goals-Report-2025.pdf> (4).

The SDGs provide a framework for evaluating and guiding policies and initiatives that advance sustainable progress. Each year, the United Nations issues a progress report tracking countries' performance using regional data and statistical systems.<sup>5</sup> As of 2025, approximately 35 percent of targets were on track.<sup>6</sup>

## 17 SDGs

launched in 2015 as part of the U.N.'s 2030 Agenda — a global blueprint for peace, prosperity, and sustainability.

#### THE Impact Rankings methodology

While the SDG Progress Report offers a high-level view of national performance, the Times Higher Education (THE) Impact Rankings provide a complementary perspective, showing how universities contribute to these goals. The rankings measure institutional progress toward the SDGs using criteria closely aligned with U.N. targets.

#### The rankings evaluate institutions in four key areas:

##### Research output

The quantity and quality of publications linked to SDGs, and their citation impact.

##### Stewardship

How effectively the university mobilizes faculty, students, staff, infrastructure, and other resources to advance SDG progress.

##### Outreach

Engagement with local and global communities.

##### Education

integration of sustainability principles into curricula for students and staff.<sup>7</sup>

Assessment considers the university's SDG 17 (Partnerships for the Goals) score, along with its top three results across the remaining 16 SDGs.

For a university to be ranked in the THE Impact Rankings, participation in SDG 17 is compulsory. This reflects the importance of international cooperation for global sustainability as a shared responsibility of universities, industry, and governments. Rankings are based on data submitted by universities, as well as research activities related to the SDGs, tracked through a document search of the Scopus database.<sup>8</sup>

<sup>7</sup> Times Higher Education, Impact rankings methodology 2025 (2025)

<sup>8</sup> Ibid



Saudi Arabia's engagement in THE impact

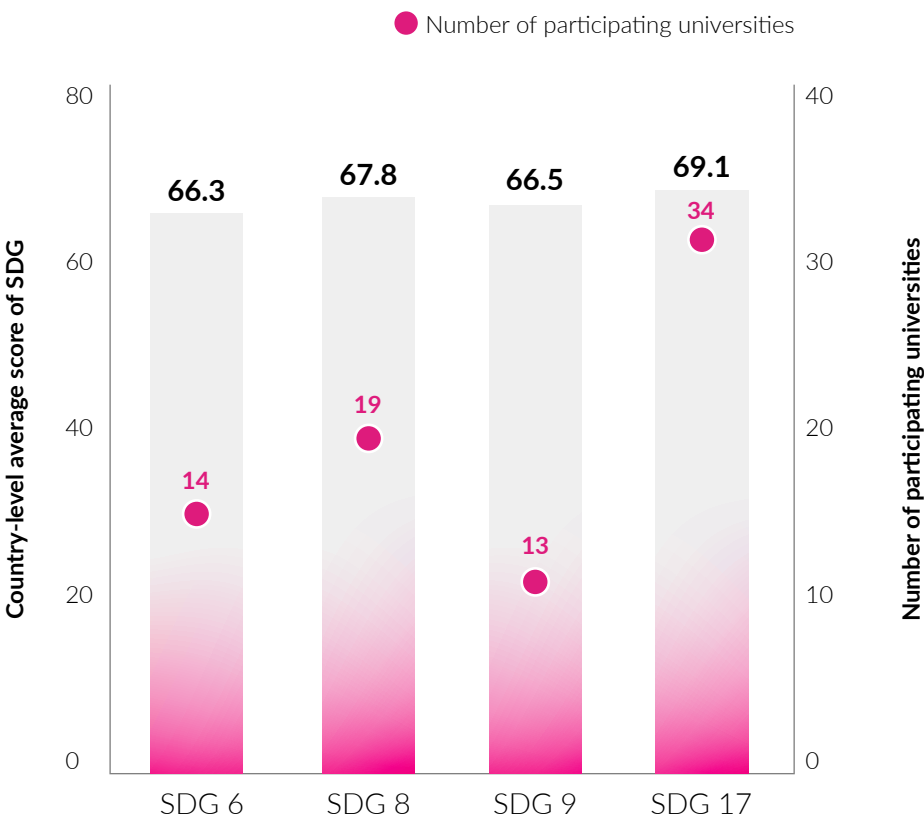
The THE Impact Rankings 2025 data reveals that the Middle East and North Africa (MENA) region<sup>9</sup> has been increasingly engaged with progress in the SDGs, with 315 institutions having participated in the overall rankings.<sup>10</sup>

Among MENA countries, Saudi Arabia ranked fourth for engagement, with 34 universities participating,<sup>11</sup> which is two more than in 2024. The Kingdom recorded strong progress in SDG 6 (Clean Water and Sanitation), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), and the compulsory SDG 17 (Partnerships for the Goals).

The Kingdom's universities are increasingly embedding sustainability into their institutional strategies through joint research projects, participation in global academic networks, and the adoption of sustainability reporting practices.

King Fahd University of Petroleum and Minerals (KFUPM) collaborates with the Ministry of Labor and Social Development to support the nonprofit sector and promote volunteering for sustainable impact, amongst many others. Recently, KFUPM participated in the MENA Climate Week and

Figure 2: Top three SDGs and SDG 17 performance in Saudi Arabia, 2025



introduced its inaugural Circular Carbon Economy course in collaboration with the University of Oxford and the King Abdullah Petroleum Studies and Research Center.<sup>12</sup>

Imam Abdulrahman Bin Faisal University (IAU) has launched programs and initiatives integrating healthcare, water security and social empowerment in partnership with other entities.<sup>13</sup> The university has collaborated with the Saudi Water Academy to launch programs for educating and engaging youth in water sustainability.

IAU maintains strong relationships with institutions such as the Johns Hopkins Aramco Healthcare and the Gulf Medical Company, to enhance medical education and healthcare innovation, in pursuit of SDG 3 (Good Health and Well-being) and SDG 4 (Quality Education).

These insights reflect the ongoing efforts of the Saudi higher education sector to align institutional and research priorities with national goals such as the Saudi Green Initiative, which emphasizes international cooperation to address climate

change and promote sustainable economic growth.<sup>14</sup> This national drive is evident at KAUST and across Saudi institutions, each contributing uniquely to the Kingdom's sustainability agenda.

For institutions elsewhere, it highlights how national momentum can amplify local research impact and accelerate progress toward shared global goals.

<sup>9</sup> The MENA region includes 19 countries: Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Syria, Tunisia, the United Arab Emirates, and Yemen.  
<sup>10</sup> Times Higher Education, Impact Rankings (2025).  
<sup>11</sup> Ibid.  
<sup>12</sup> <https://sustainability.kfupm.edu.sa/partnerships-for-the-goals/>  
<sup>13</sup> [https://www.iau.edu.sa/sites/default/files/resources/sdg\\_17\\_-\\_partnerships\\_for\\_goals.pdf](https://www.iau.edu.sa/sites/default/files/resources/sdg_17_-_partnerships_for_goals.pdf)  
<sup>14</sup> Saudi Green Initiative: <https://www.sgi.gov.sa/saudi-climate-vision/?csrt=14938768986712525654>.

Figure 3: Saudi universities within Top 200 for SDG 17 (Partnerships for the Goals), 2025.

<b>Rank 14</b> King Abdullah University of Science and Technology	<b>Rank 27</b> King Fahd University of Petroleum and Minerals
<b>Rank 43</b> King Faisal University	<b>Rank 67</b> Qassim University
<b>Rank 71</b> Prince Mohammad Bin Fahd University	<b>Rank 101-200</b> Imam Abdulrahman Bin Faisal University
<b>Rank 101-200</b> Prince Sattam Bin Abdulaziz University	





CASE STUDY 1 >

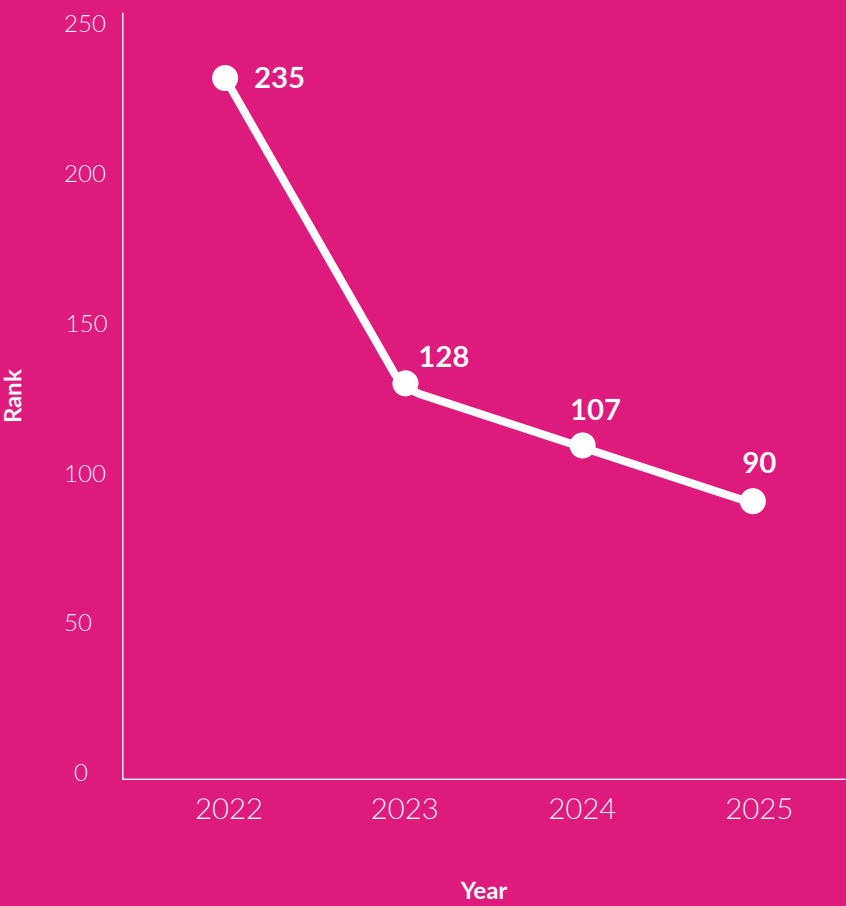
CASE STUDY 2 >

Case study 2:  
KAUST’s progress in the THE Impact Rankings

Over time, KAUST has achieved a 62 percent increase in its overall performance in the THE Impact Rankings. In 2022, its first year participating, KAUST placed 235 out of 1,410 universities. By 2025, it ranked within the global top 100 out of 2,318 universities for progress toward the SDGs (Figure 4).

“KAUST’s rise in the Impact Rankings reflects our sustained commitment to sustainability, rooted in scientific excellence and strategic collaboration,” said KAUST Professor and Chief Sustainability Officer Ana Margarida Costa. “By aligning with national priorities and global goals, we continue to translate knowledge into real-world impact.”

Figure 4: KAUST’s overall Impact rank over time



Within Saudi Arabia, KAUST ranks among the top three institutions overall. It leads nationally in SDG 17 (Partnerships for the Goals) and is among the top 20 institutions globally for SDG 11 (Sustainable Cities and Communities) and SDG 14 (Life Below Water).

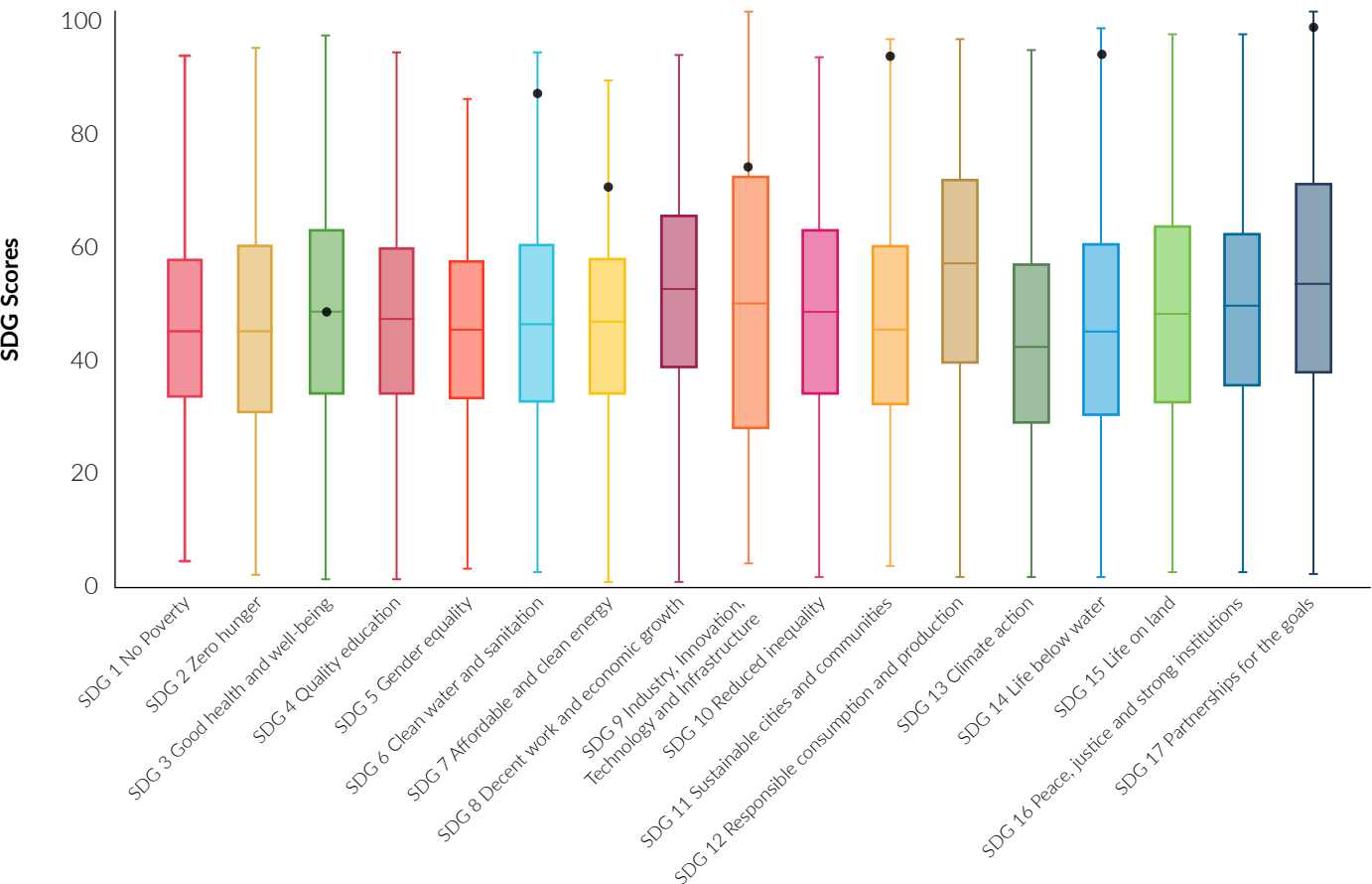
KAUST invests in initiatives aligned with the U.N. SDGs and Saudi Vision 2030. Since 2021, the details and impact of these initiatives have been compiled into an annual SDG Highlight Report, which outlines actions for each of the 17 SDGs. These include breakthroughs in science and technology and engagement with the community and government in areas such as marine restoration, carbon capture, and renewable energy. Among KAUST’s contributions to SDG literacy is the SDG Collection, created in partnership with the U.N. Development Programme (UNDP) Saudi Arabia and Frontiers for Young Minds. The initiative takes research from KAUST’s laboratories and translates it into engaging articles for children — each one linked to a specific Sustainable Development Goal, resulting in a complete series of 17 articles.

Every piece is available in English and Arabic and is authored and edited by KAUST experts, then reviewed by The KAUST School students to ensure the language and concepts are clear and accessible for young readers. To date, the Collection has attracted more than 125,000 views and was featured in a

dedicated event at the United Nations Convention to Combat Desertification (UNCCD) COP16 — the only session to bring school children to the stage — spotlighting the importance of the Goals and inspiring the next generation to join the conversation on what is needed to achieve them.

KAUST’s integrated approach to sustainability in research, operations, education, and outreach serves both as a progress record and as a blueprint for other institutions seeking to enhance SDG performance through evidence-based strategies.

Figure 5: KAUST’s performance across 7 SDGs, benchmarked against all participating universities in the Impact Rankings





# KAUST Case Studies ●

## KAUST Campus, Thuwal, Saudi Arabia

Future Mobility Sandbox

Startup revolutionizes KSA construction sector

Localizing talent through sustainable innovation in food security

Breakthrough in clean energy transport

## KAUST Research and Technology Park

Accelerating direct lithium extraction technology

## Ibn Sina Marine Research Station, KAUST shoreline, Saudi Arabia

Sea solutions to climate change

## NEOM, Saudi Arabia

Eliminating carbon dioxide emissions from power plants

## KAUST Coral Restoration Initiative, Saudi Arabia

World's largest coral restoration effort

