



AGA KHAN SCHOOLS CLIMATE AND ENVIRONMENT CONFERENCE

25-26 September 2026



Friday, 25 September

Day 1

09:00	●	Welcome Remarks
09:30	●	Student Presentations Session 1
10:30	●	Break
11:00	●	Guest Speaker: Dr Muhammad Zafar Khan
12:00	●	Case Competition Part 1
13:00	●	End of Day 1

Saturday, 26 September

Day 2

09:00	●	Welcome to Day 2 and Icebreakers
09:30	●	Student Presentations Session 2
10:30	●	Alumni Panel
11:00	●	Break
12:00	●	Student Presentations Session 3
13:00	●	Case Competition Part 2
14:00	●	Break
14:30	●	Student Presentations Session 4
15:30	●	Case Competition Part 3
16:30	●	Closing Ceremony
17:00	●	End of Day 2

If there are any questions about the schedule or any other aspect of the conference, please email: climate@agakhanacademies.org.

Speakers



Guest Speaker Profile

Dr Muhammad Zafar Khan

Dr Muhammad Zafar Khan holds a PhD in environmental science and completed postdoctoral research in natural resource policy, planning and management at the University of Oregon as a Fulbright Fellow. He is currently Associate Professor and Chair of the Department of Forestry, Range and Wildlife Management at Karakoram International University. With more than 25 years of experience in environmental conservation, sustainable development, climate adaptation and mitigation, and academic research, he has led more than 17 projects and authored more than 70 publications. His professional focus is on advancing environmental conservation, strengthening links between academia and practice, mentoring future conservation leaders, and promoting interdisciplinary research.

Dr Khan is a proud alumnus of the Aga Khan Schools in Pakistan. He attended the Diamond Jubilee Learning Resource High School, Barkulti from 1980 to 1985, and later received the Aga Khan Education Merit Scholarship to pursue his undergraduate studies at the University of Agriculture, Peshawar from 1994 to 1999. He subsequently served on the Regional Education Board for the Aga Khan Education Service, Pakistan for Gupis-Yasin from 2005 to 2006 and volunteered with the Regional Council, Gilgit, from 2019 to 2023.

Alumni Panel Profiles

Simran Khataw

Simran graduated from Aga Khan Academy Mombasa in 2017. She holds a bachelor's degree in environmental geographical science from the University of Cape Town. Following a role at the World Food Programme, Simran now works as a climate change officer at the United Nations Development Programme in Vietnam.

Raghu Vyas

Raghu graduated from Aga Khan Academy Mombasa in 2016. He holds a Bachelor of Arts in global liberal studies: politics, rights, and development from New York University and a master's degree in international and development studies from the Geneva Graduate Institute. He is currently a climate policy analyst and implementation strategist at Climate Analytics in Berlin, Germany.

Student Presentations

SESSION 1



The Hidden Cost of Dine

**PRESENTED BY**

Jannat Abdul
Rahim Lakhani

**SCHOOL**

Sultan Mahomed Shah
Aga Khan School, Karachi

ABOUT THE PROJECT

The Hidden Cost of Dine investigates the environmental impact of food served and consumed within a school environment, focusing specifically on greenhouse gas emissions associated with canteen meals. The project began with a simple question: what environmental cost is hidden behind the food we eat every day?

As part of the project, we examined the carbon emissions associated with commonly purchased canteen items and compared with lower-emission alternatives. The original menu included items such as samosas, fried chicken and spring rolls. We introduced alternatives including vegetable pasta, chana chaat, fruit custard, fresh fruit, shakes and brownies.

Using estimated carbon emissions for each food item, we calculated that the original menu generated approximately 1,600 kilograms of CO₂ per day for 1,000 students. The alternative menu reduced this estimate to approximately 550 kilograms of CO₂ per day, representing a potential saving of 1,050 kilograms of CO₂ per day and more than 250,000 kilograms of CO₂ across a school year.

The project also included student awareness sessions, food tasting and collaboration with the school's Entrepreneur Club. It is planned for the initiative to expand across the campus and eventually to other schools.



Solar Water Refinery Rooftop System

**PRESENTED BY**

Baneen Fatima,
Ayelia Batool

**SCHOOL**

Aga Khan Higher Secondary
School, Karachi



ABOUT THE PROJECT

Our project, Solar Water Refinery Rooftop System, is an innovative and eco-friendly method of purifying water using solar energy. The system is designed to be installed on rooftops, where sunlight is easily available and can be used as a natural source of heat and energy. The main purification process combines evaporation, condensation and optical principles based on Snell's Law. According to Snell's Law, light changes direction when it passes between different transparent materials, allowing the system to concentrate or redirect solar radiation towards the water.

For this project, a specially designed glass prism is used to control and redirect sunlight into the system. Solar energy heats contaminated water, causing it to evaporate, while impurities and many dissolved substances remain behind. The water vapour then reaches a cooler surface, where it condenses into purified water. The collected water can then be stored for further use.

The rooftop system aims to provide a sustainable, low-energy and environmentally friendly approach to water purification, especially in areas with abundant sunlight.

Seeds of Change: Using GMO Crops to Fight Climate Change

**PRESENTED BY**

Kaari Muriuki, Dhriti Achala Byreddy,
Haniya Sharif

**SCHOOL**

Aga Khan Academy, Nairobi

ABOUT THE PROJECT

Our research will investigate whether genetically modified (GM) crops can help reduce the impacts of climate change and make agriculture more sustainable. As climate change causes higher temperatures, droughts, changing rainfall patterns and increased pressure on food production, we will explore how genetic modification can help crops adapt to these challenges.

Our presentation will examine examples of GM crops developed for traits such as drought tolerance, heat tolerance, pest resistance and improved nutrient use. We will also investigate whether these crops could reduce greenhouse-gas emissions by lowering pesticide use, improving yields and reducing the amount of land needed for agriculture.

However, the research will also consider potential risks, including effects on biodiversity, ecosystems and long-term sustainability. Using scientific research and case studies, we will evaluate both the benefits and limitations of GM crops and determine whether genetic modification could be a useful tool in addressing climate change.

The Breathable Brick



PRESENTED BY
Maryam Imran,
Humaira Rehman



SCHOOL
Aga Khan Higher Secondary
School, Karachi

ABOUT THE PROJECT

Our project explores a new way to repair cracks in building materials using biology. Conventional concrete bricks can develop cracks over time due to exposure to weather and heavy loads. Repairing these cracks can be costly and can also have environmental impacts.

To address this, we developed a self-healing concrete brick by adding a special type of bacteria called *Bacillus subtilis* and a nutrient called calcium lactate directly into the brick mix. We used an experimental comparative design for this research, creating a standard control brick alongside our modified experimental brick. When a crack develops in the experimental brick, water and air enter the crack, activating the dormant bacteria. Once activated, the bacteria consume the calcium lactate. This causes a natural chemical reaction that produces calcium carbonate, which forms within the crack and helps seal it from the inside out.

In our presentation, we will explain how the bricks were made and demonstrate the tests conducted. The comparative test results indicate that these bio-bricks can self-heal, prevent water from passing through cracks and have greater durability than the standard control bricks.



Carrycoat: Turning waste into sustainable rainwear



PRESENTED BY
Kiana Dossa



SCHOOL
Aga Khan Academy Mombasa

ABOUT THE PROJECT

This project explores the idea of creating sustainable and practical raincoats from gunia bags, which are commonly used for heavy-duty packaging, agricultural storage and shopping.

Growing up in a small rural town known as the country's breadbasket, I saw how people struggled to carry out their daily work during rainy seasons. This inspired me to repurpose an accessible material – gunia bags – into something useful.

I explored how discarded materials can be transformed into functional products, reducing reliance on new resources. I researched suitable materials, developed designs and prototypes, and learnt the sewing and construction skills needed to create the final raincoats, called Carrycoats.

In my presentation, I will discuss my research and design process, the challenges I faced, and the changes I made to improve the coats. I will also consider the environmental potential and limitations of repurposing waste materials into clothing, and what the project taught me about sustainability and resource consumption.

Student Presentations

SESSION 2



A Case Study of Grape Production in Dodoma, Tanzania



PRESENTED BY
Keemaya Bora



SCHOOL
Aga Khan Mzizima Secondary
School, Dar es Salaam

ABOUT THE PROJECT

This research will explore how environmental changes, especially climate change and drought, affect food security in Dodoma, Tanzania using grape production as a case study. Dodoma has a semi-arid climate, and many people in rural areas depend on rain-fed farming and livestock for food and income. Changes in rainfall, longer dry periods, higher temperatures and limited water supplies can make it harder to grow crops, keep livestock healthy and provide enough food for families.

The presentation will look at how environmental change affects the four main dimensions of food security: availability, access, utilisation and stability. By examining grape production in Dodoma, the research will explore how drought can affect crop production, household income, food prices and the livelihoods of rural communities. The research will also examine different ways communities can adapt to these challenges.

Waste to Watts

**PRESENTED BY**

Aimen Faisal,
Syeda Fatima Zahra

**SCHOOL**

Aga Khan Higher Secondary
School, Karachi



ABOUT THE PROJECT

What if the sewage water we dispose of today could be a powerhouse for a more sustainable future?

This question led us down the rabbit hole of microbial fuel cells (MFC), an emerging technology that uses microorganisms to break down organic matter present in sewage water while releasing electrons that can be harnessed as electrical energy with treated water produced as a potential by-product. This not only uses wastewater to generate electricity, but it also treats water at the same time, addressing two challenges simultaneously.

To test this idea, we constructed a simple two-chamber MFC using sewage water in the anode chamber, distilled water in the cathode chamber and graphite electrodes, with a salt bridge to facilitate ion movement. We recorded the open-circuit voltage over several days to observe the development of electrical output. We also explored the scalability and potential for practical deployment in Pakistan, particularly in rural communities as a way to address the country's dual energy crisis.

Although small-scale MFC produces limited electricity, and numerous sustainable alternatives already exist or are being explored for power generation, our project is not intended to compete with other renewable technologies, but to complement them by transforming an otherwise underutilised waste stream into a source of localised energy.

Energy Wise Chitral Home: A Sustainable Household Model



PRESENTED BY

Syed Shahan Ali;
Madiha Umar;
Umme Kulsoom, Andaleeb Nawaz, Manahil Ali



SCHOOL

Aga Khan Higher Secondary School, Chitral;
Aga Khan Higher Secondary School, Karachi;
Aga Khan Higher Secondary School, Kuragh

ABOUT THE PROJECT

Energy Wise Chitral Home: A Sustainable Household Model is a student-led architectural and environmental design project exploring how a traditional one-storey Chitrali homes could be adapted to respond to energy, climate and food-security challenges.

We developed a conceptual house that combines traditional local design with practical sustainable technologies. The design uses thick insulated walls, an energy-efficient roof, natural ventilation, double-glazed windows and a sun-facing orientation to reduce energy demand, particularly during cold winters. Solar panels and battery storage provide renewable electricity, while a household-scale biogas system converts livestock manure into cooking fuel and produces digestate that can be used as a fertiliser. A solar dehydration system is also incorporated to preserve locally grown fruits, vegetables and herbs without relying heavily on electricity or conventional fuels.

Our presentation will explain the reasoning behind the design, show the floor plan, elevations and roof section, and demonstrate how the different systems work together. I will also discuss the potential benefits and limitations of adapting this model for households in Chitral.

Adaptive Root Intelligence (ARI)



PRESENTED BY
Sahran Muzaffar Ali



SCHOOL
Aga Khan Higher Secondary
School, Karachi

ABOUT THE PROJECT

Adaptive Root Intelligence (ARI) is a student-developed research prototype that investigates how artificial intelligence and low-cost environmental sensing can support healthier and more climate resilient crop production. The project combines plant image analysis with measurements of temperature, relative humidity and soil moisture collected through an ESP32-based sensor system.

The central research question is whether combining these different sources of information can provide more useful early plant health risk assessment than analysing a plant image alone. Plant images are analysed for visible signs of supported diseases, pests, nutrient related symptoms and other abnormalities, while environmental measurements provide context about the conditions surrounding the plant. Historical observations are also used to identify changes over time.

The project will compare image-based and combined approaches using appropriate performance measures where sufficient experimental data are available. ARI will also explore climate related risks such as heat stress and water stress and investigate how environmental information could support more informed irrigation decisions.

The long-term aim is to develop an affordable decision support system that helps growers respond earlier to crop problems while using agricultural resources more responsibly.



Aqua Zero AI



PRESENTED BY
Muhammad Shaheer



SCHOOL
Aga Khan Higher Secondary
School, Karachi



ABOUT THE PROJECT

Generative artificial intelligence models require substantial computational resources, leading to significant off-site operational water consumption for data centre cooling and thermoelectric power generation. While existing literature focuses primarily on infrastructure-level hardware and algorithmic efficiency, user-side behavioural intervention remains largely unexplored.

This study introduces AquaZero AI, an empirical behavioural investigation conducted in Karachi, Pakistan, evaluating the impact of user-level behavioural protocols and the Digital 7 R Framework (Refuse, Reduce, Reuse, Recycle, Rethink, Reschedule, Remove) on mitigating the indirect operational water footprint of large language model queries. A sample of 50 undergraduate students from a single institution participated in a 28-day trial using paper-based self-reporting logbooks and seven standardised "Water-Smart AI Protocols".

Across 7,000 logged interactions, intervention protocols yielded a 48.4 percent reduction in total query volume and output length, reducing estimated indirect operational water consumption from 2.48 litres per student-day to 1.28 litres per student-day. These findings demonstrate that user-side digital sufficiency models offer a zero-cost, highly scalable behavioural solution to mitigate the environmental footprint of digital infrastructure in water-stressed regions without requiring any custom programming or software development.

Student Presentations

SESSION 3



The Hidden Footprint of Attention



PRESENTED BY

Immara Inayat Ali
Kara, Aayat Maredia



SCHOOL

Aga Khan Higher Secondary
School, Karachi



ABOUT THE PROJECT

The Hidden Footprint of Attention is a project proposal that examines how modern branding and advertising intensify resource use, emissions and waste before a product even reaches the consumer. Instead of evaluating waste only after disposal, the project maps how companies create a significant environmental footprint in the process of capturing consumer attention and driving economic growth. It investigates the direct ecological impacts associated with industries looking to maximise profit, including advertising methods using resource-intensive physical campaigns, temporary sets, printed media and high-energy digital data centres, as well as the manufacturing of artificial desire to fuel the proliferation of nonessential items solely to boost earnings.

This cycle drives severe environmental degradation through early-stage industrial production, raw-material extraction and factory energy use. It also accounts for the extensive carbon footprint generated by complex global transport networks and the excessive multi-layer packaging used solely to create short-lived commercial spectacles. Our presentation will introduce our central idea through the chain: attention → desire → demand → production → packaging → transport → use → disposal. We will present our eight-layer branding footprint audit, which examines materials, resources, production, energy, transport, consumption effects, waste and pollution. The presentation will also include examples of excessive packaging and unnecessary product novelty, connecting these issues to resource use and climate change.

Waste to Wonder

**PRESENTED BY**

Afroza Sardar,
Suhana Muskan

**SCHOOL**

Aga Khan Higher Secondary
School, Kuragh

ABOUT THE PROJECT

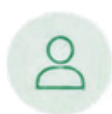
Our project is about producing biogas using cow dung. This is a natural process in which microorganisms called methanogens break down organic matter and produce methane. We are trying to use this natural process to our advantage by creating suitable conditions for these microorganisms to grow and work.

For our project, we will mix cow dung with water to make a slurry. We will then place this slurry in an airtight underground chamber so that oxygen cannot enter. Methanogens work well in such oxygen-free conditions. We will try to maintain suitable conditions such as temperature, moisture and enough organic material for the process to continue. The methanogens will break down the organic matter and produce biogas, which contains methane. The gas will collect in the empty space above the slurry and can then be collected through a pipe.

In our presentation, we will explain how methanogens produce methane, how our setup works, the conditions needed for biogas production and how the methane produced can be used as a useful source of energy.



BioBan; Minimising Landslides by 2060



PRESENTED BY

Chloe Nkwanzi, Bradley Katende, Akarunga Marie Migisha, Shanti Olwit, Rachel Kirabo, Janice Obua



SCHOOL

Aga Khan School, Mombasa

ABOUT THE PROJECT

Our presentation will feature BioBan: Minimising Landslides by the Year 2060, a project aimed at transforming local banana agricultural waste into nature-based disaster prevention infrastructure.

Developed to combat recurring, life-threatening landslides and flash floods in vulnerable mountain communities, such as Uganda's Bududa region, this project introduces a low-cost, modular subterranean barrier system. The presentation will cover how BioBan utilises compressed banana fibre panels treated with natural resins alongside soil-filled earthbags. Placed beneath the surface, these porous structures stabilise terrain, absorb heavy rainfall runoff and dissipate soil pressure without relying on expensive, environmentally damaging concrete. I will also highlight the integration of low-cost humidity sensors that act as an early-warning system by sending SMS alerts to residents during severe soil movement.

Finally, the presentation will detail our circular economy model and pilot rollout strategy. By empowering local youth and women's groups to manufacture and instal these barrier kits, BioBan provides rural green jobs while aiming to protect over 5,000 residents. To conclude, a 3-D model of our plan will be displayed.

Food to Farm: Turning Waste Into Food Security



PRESENTED BY

Malkia Mushi, Nalia Ssempereza,
Natalie Mungai, Maya Maina



SCHOOL

Aga Khan Academy Mombasa

ABOUT THE PROJECT

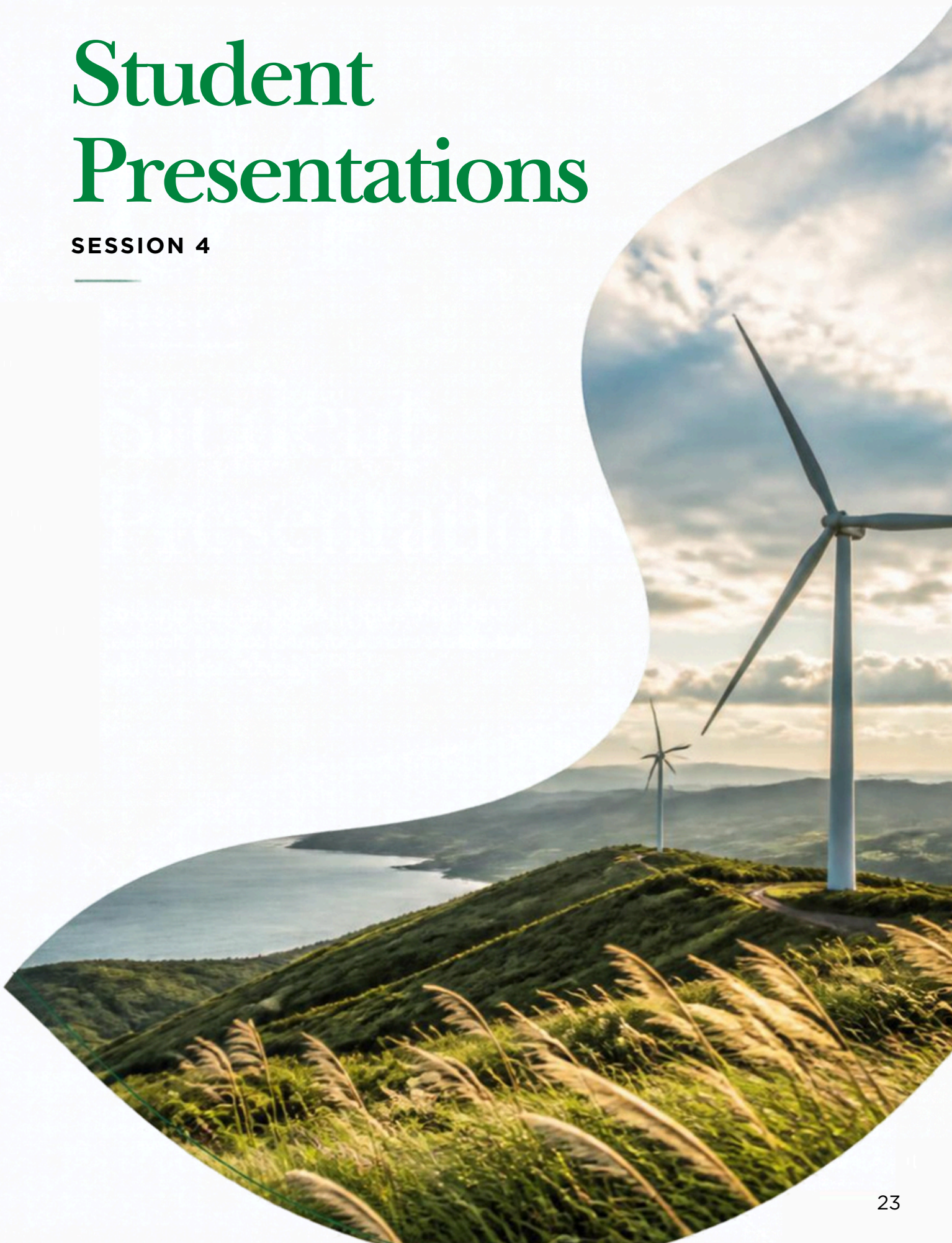
This project focuses on how food waste can be reduced and transformed into a resource for sustainable food production. Food waste is a major environmental issue mostly at our school because the resources used to produce food, such as water, land and energy are wasted when food is just thrown away. Our research investigates the main causes of food waste in schools, most especially in dorms and dining areas, and explores how composting can help address the problem.

In the presentation, we shall explain the connection between food waste, climate change and food security. We researched how food scraps can be turned into compost and how compost can improve soil and support the growth of vegetables and other crops. We explored practical ways schools can reduce food waste, such as encouraging students to take only the food they need, improving food waste sorting and educating students about the environmental impact of wasted food.

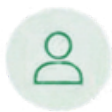
We shall present research findings, possible solutions, the benefits and challenges of the project, and how it can be implemented in our school community or any school. Our aim is to show how small actions can reduce waste while supporting sustainable food production and a more food secure future.

Student Presentations

SESSION 4



The Potassium Paradox: Plant Growth Promoting and Antagonistic Properties of a Potassium-Solubilising Rhizobacterial Isolate from Rhizospheric Soil



PRESENTED BY

Angel Mary Abraham



SCHOOL

Aga Khan Mzizima Secondary
School, Dar es Salaam

ABOUT THE PROJECT

In this work, I investigated a rhizobacterium isolated from rhizospheric soil that is potassium-solubilising and promotes plant growth. Although soil contains a lot of potassium, most of it is not readily available to plants because it is inaccessible. Beneficial rhizobacteria can solubilise potassium and make it accessible to plants, providing sustainable solutions to nutrient management. After isolation, they were screened for potassium-solubilising ability, and a suitable isolate was selected for further investigation.

In our experiment, we tested it on *Vigna unguiculata* and compared bacteria-treated plants with untreated control plants. We then examined and compared different aspects, such as root development, stem growth, chlorophyll content, etc. We also examined additional properties, such as the antagonistic activity of the bacterial isolate and whether the plants could respond to drought stress; a proline analysis was therefore conducted. Our main findings show that treated plants had greater root development, larger root nodules, greater stem growth and higher chlorophyll content, indicating improved plant growth.

Cropcool: Using agricultural waste to cool homes

**PRESENTED BY**

Syeda Aamna Binte
Umair, Anaya Khurram

**SCHOOL**

Aga Khan Higher Secondary
School, Karachi

ABOUT THE PROJECT

Pakistan experiences increasingly intense summer temperatures and frequent heat waves, particularly in its central and southern regions. As temperatures rise, households increasingly depend on fans and air conditioning to maintain thermal comfort. However, rising electricity costs can make extensive use of active cooling inaccessible to many low- and middle-income households. This creates a need for affordable methods of reducing heat entering buildings rather than relying entirely on energy-intensive cooling systems.

One way to address this problem is through thermal insulation. Insulation does not generate cooling; rather, it reduces the rate at which heat is transferred between the external environment and the interior of a building. Conventional insulation materials such as fiberglass and polystyrene can provide effective thermal resistance, but their manufacturing can require considerable energy and resources. At the same time, Pakistan's agricultural sector produces large quantities of crop residues that are often underutilised and, in some cases, burned or discarded.

This research proposes CropCool Panels, a low-cost thermal insulation material made from sugarcane bagasse, the fibrous residue remaining after sugarcane is crushed to extract its juice. Instead of treating bagasse solely as agricultural waste, the project investigates its potential as a useful construction material.

Sugarcane bagasse is primarily composed of cellulose, hemicellulose and lignin. Its fibrous structure can create small air spaces when processed into a panel. These air spaces can help slow heat transfer, making bagasse a promising material for investigation as a bio-based insulation material.

The Fast Fashion Trap



PRESENTED BY
Romaisa Fatima



SCHOOL
Aga Khan Higher Secondary
School, Karachi

ABOUT THE PROJECT

My project investigates how the modern fashion industry contributes to environmental and social pressures through a system of continuous consumption and increasing production. The presentation will examine the fashion-to-environment chain, beginning with marketing, social media, micro-trends, influencer culture and consumer psychology, and continuing through fibre production, manufacturing, transportation, garment use and disposal. I will explore the environmental impacts of major materials including polyester, cotton, organic cotton and leather, while demonstrating why no single fibre can simply be labelled “sustainable.”

The presentation will also examine greenhouse-gas emissions, microplastic pollution, water consumption, soil degradation, chemical pollution and the global textile-waste crisis. A key part of the project will be the connection between fashion and food security, particularly competition for land, freshwater, energy and agricultural resources. Finally, I will discuss solutions including circular fashion, durability and repairability, reuse and resale, fibre-to-fibre recycling, extended producer responsibility, supply-chain transparency, greenwashing regulation, and responsible consumer behaviour. The central argument is that fashion sustainability requires reducing unnecessary production and consumption while protecting people and ecosystems



Eyes in the Sky, Food on the Ground



PRESENTED BY
Chetan Tadikamalla



SCHOOL
Aga Khan Mzizima Secondary
School, Dar es Salaam

ABOUT THE PROJECT

My presentation explores how satellite technology can help improve food security by giving farmers and governments better information to respond to climate change. As weather patterns become less predictable, farmers face challenges such as droughts, floods, changing rainfall and declining crop yields. I wanted to investigate how space-based technologies, particularly Earth observation satellites, can provide practical solutions to these problems.

The presentation examines how satellite data is used to monitor crop health, forecast rainfall, detect drought conditions and support precision agriculture. I also include examples from India's Indian Space Research Organisation programmes and global satellite initiatives, showing how these technologies can help farmers make informed decisions about planting, irrigation and harvesting. Finally, I discuss how similar approaches could benefit countries such as Tanzania, where agriculture supports a large proportion of the population.

Rather than viewing space technology as something distant from everyday life, my research shows how it can become a practical tool for protecting livelihoods and strengthening food systems. My goal is to demonstrate that scientific innovation, when combined with accessible policies, can help communities become more resilient to climate-related challenges.