EFFICIENCY FOR ACCESS

IKEA Foundation

UKaid from the British people

Transforming Energy Access

Efficiency for Access Design Challenge 2023-2024

Final submission summaries

May 2024

Efficiency for Access Coalition

Contents

Abbreviations

AI	Artificial intelligence
DC	Direct current
GHG	Greenhouse gas
GSM	Global system for mobile communications
ICT	Information and communication technology
IoT	Internet of Things
LCD	Liquid crystal display
LED	Light emitting diode
LGA	Local government agencies
NGO	Non-governmental organisation
PV	Photovoltaic
SAS	Smart automated solar
SDG	Sustainable Development Goal
SODIS	Solar water disinfection
UN	United Nations
UV	Ultraviolet
UV-C	Ultraviolet-C
VFD	Variable frequency drive

Sustainable Development Goals (SDG)

Foreword

The Efficiency for Access Design Challenge is a global, multi-disciplinary competition that empowers teams of university students to help accelerate clean energy access. To provide sustainable energy for all, we urgently need to enhance the efficiency and affordability of high performing appliances. The Challenge invites teams of university students to create affordable and high-performing solar appliances and enabling technologies.

By bringing together and inspiring students, the competition aims to foster innovation in the solar appliance sector. It also seeks to help address barriers that limit market expansion in this area. Furthermore, the Challenge seeks to forge beneficial partnerships between universities, researchers, and industry partners at a global level. In this way, it will further strengthen academic capacity within the off-grid sector.

Efficiency for Access and Engineers Without Borders UK are delighted to collaborate on the delivery of the Efficiency for Access Design Challenge. Efficiency for Access is coordinated jointly by CLASP and Energy Saving Trust. The Challenge is funded by UK aid via the Transforming Energy Access programme, and IKEA Foundation. To read more about the Challenge, please take a look at this year's Challenge Brief.

Through this year, the fifth year of the Challenge, over 130 students from 14 universities in Bangladesh, India, Kenya, Nepal, Nigeria, Rwanda, Uganda, the UK, and Zimbabwe have participated and were supported by 30 industry partners. The students have spent the year creating innovative designs for off-grid settings and the final submissions from the top three teams at each university are summarised in this document.

Summary Table

The table below summarises the projects that students submitted as part of the Efficiency for Access Design Challenge 2022-2023.

Team	University	Project title	Theme	Full report	Video submission	Team members
2023-04	Usmanu Danfodiyo University, Sokoto, Nigeria & Tribhuvan University, Nepal	Design and performance evaluation of a solar-powered DC milking machine for dairy cattle	Agriculture	Full report	Video submission	Salihu Aliyu, AbdulAzeez Mohammed, Muhammad Mustapha, Sabin Shrestha
2023-07	Strathmore University, Kenya	Solar system for hospitals using hydrogen as storage	Power management	Full report	Video submission	Trevor Osborne Atela, Andy Onyango
2023-11	Strathmore University, Kenya	Solar-powered smart cereal dryer	Agriculture	Full report	Video submission	Sintila Lekatoo Emmanuel, Ruman Hassan, Ronit Mepani, Isaiah Ochieng, Job Ian Onyango
2023-13	University of Rwanda	Design of SAS-sprayer system	Agriculture	Full report	Video submission	Marthe Nirere, Augustin Nkundimana, Innocent Nsengimana, Jean Bonheur Tuyubahe, Rachel Uwagiriwubuntu
2023-14	Federal University of Technology, Owerri, Nigeria	A dual-functional intelligent farm produce preservation system	Refrigeration	Full report	Video submission	Chukwudi Aniegboka, Chima Echendu, Chibuze Ezebili, Ruth Iloba, Rita Opara
2023-16	Aston University, UK	Portable water cleaning device: improved solar disinfection	Water and sanitation	Full report	Video submission	Ella Buffery-Latham, Maria Hernandez-Solis, Rayyan Khan,

						Ore Lawale
2023-18	Aston University, UK	AQUA - solar-powered rainwater harvesting and purification system for domestic use	Water and sanitation	Full report	Video submission	Ramandeep Kaur, Kamal Preet, Saad Shaiban, Simon Vazhappilly
2023-19	Aston University, UK	Solar fish dryer	Agriculture	Full report	Video submission	Okey Iheagwam, Nnaemeka Sylvanus Nwobodo
2023-20	University of Rwanda	Automated solar-powered fresh produce cooling	Refrigeration	Full report	Video submission	Dushime Dieudonne, Hatangimbabazi Ishimwe Divine, Dushimimana Olivier, Uwicyeza Pamella, Ndayisaba Patrick
2023-21	Strathmore University, Kenya	Solar-powered fish preservation hub	Refrigeration	Full report	Video submission	Innocent Alvin, Noah Midikira
2023-24	Obafemi Awolowo University Ile-Ife, Nigeria	Solar Sentry: real-time monitoring and wireless reporting for solar power system optimisation and diagnostics	Power Management	Full report	Video submission	Abiola Ogundeji, Charles Simeon, Mary Ajose, Michael Adesiyan, Samuel Olowosile
2023-25	University of Rwanda	Precision crop preservation with energy-efficiency and affordable solutions	Refrigeration	Full report	Video submission	Aline Gihozo, Dative Tushabomwe, Francois Bizimana, Samuel Turahimana, Victorien Ukurikiyimfura
2023-27	Usmanu Danfodiyo	Development of a multifunctional	Agriculture	Full report	Video submission	Abdullahi Abdulwaris, Susil

	University, Sokoto, Nigeria & Tribhuvan University, Nepal	corn processing machine				Chhetri, Raihanah Haliru, Uday Raj Kafle
2023-29	University of Nairobi, Kenya	Heat management for sanitary hot water access	Water and sanitation	Full report	Video submission	Victor Baraka, Rebecca Rabera Kimaiga, Timon Mawira, Godfrey Ngeiywa, Ngesa Paul Omondi
2023-30	University of Nairobi, Kenya	Intelligent solar power consumption controller	Power management	Full report	Video submission	Albert Davis, Lynne Kitonyi, Shabaki Lenga, Josphat Muriuki, Erick Ogolla
2023-31	University of Nairobi, Kenya	Solar-powered medical centrifuge	Healthcare	Full report	Video submission	Bul Ayiik Garang, Kenneth Njongwa, Kago Agnes Nyaguthii, Hillary Okode Otieno
2023-32	Independent University, Bangladesh	Design and construction of solar-powered gear pump	Agriculture	Full report	Video submission	Sayed Alam, Celestine Gomes, Sabrine Islam
2023-33	University of Zimbabwe	Design of a DC pill management and lighting device	Healthcare	Full report	Video submission	Masanga Glynnly, Calvin Kuhuni, Chipuriro Tafadzwa, Munorweyi Takudzwa
2023-34	University of Zimbabwe	Bird deterrent device	Agriculture	Full report	Video submission	Terance S Kanhanga, Munyaradzi Matambanadzo, Tafadzwa Mukonya, Simon A Musikavanhu, Leroy L Taderera

2023-35	Kalasalingam Academy of Research and Education, India	Solar based automated drainage cleaning system	Water and sanitation	Full report	Video submission	P. Ajay, A. Hemavardhan, T. Praneeth Krishna, D. Sai Anvesh Varma
2023-38	Kalasalingam Academy of Research and Education, India	Solar primus	Cooking	Full report	Video submission	K. Rachana Chowdary, K. Karthikeyan, B. Padma Bhushan Reddy, P. Shanmukha Sreenivas
2023-39	Gulu University, Uganda	Design of solar-powered groundnut shelling machine	Agriculture	Full report	Video submission	Mirembe Gloria Masika, Odaga Christopher Okwanga, Kidega Fred Opiyo
2023-40	Kalasalingam Academy of Research and Education, India & City, University London, UK	Smart solar-powered garbage monitoring system using IoT	ICT	Full report	Video submission	Sikhakolli Guru Charan, Stephanie Danho, Vijjapu Deekshith, Hirusajini Jeyatharan
2023-42	Gulu University, Uganda	Solar UV sterile storage unit for medical equipment	Healthcare	Full report	Video submission	Denish Olara, Innocent Otim, Allan Nangai Wodada, Norbert Wokorach
2023-43	Gulu University, Uganda	Hybrid water dispenser with UV-C water disinfection and a water refrigeration system	Water and sanitation	Full report	Video submission	Ocayotoo Emmanuel, Bilali Batumbya Geriga, Muhangi Alfred Joshua, Robin Amos Kidega, Abraham Okee
2023-44	Independent University, Bangladesh	Solar based bio-gas production in anaerobic digester with IoT	ICT	Full report	Video submission	Shafin Mahbub, Asif Al Masud, Kazi Habibur Rahman

2023-46	Independent University, Bangladesh	Solar-based air conditioner using VFD for affordable cooling	Other	Full report	Video submission	Marjan Al Haque, Alif Khan, Anika Saima Rahman

Team 2023-04 — Design and performance evaluation of a solar-powered DC milking machine for dairy cattle

Salihu Aliyu, AbdulAzeez Mohammed, Muhammad Mustapha, Sabin Shrestha

Theme: Agriculture

Project summary

This project aims to address the challenges faced by dairy farmers in Northern Nigeria, particularly in Sokoto State, by designing a solar-powered milking machine. The machine uses solar energy to operate, providing a sustainable, affordable and automated solution for milking cattle. The project demonstrates a commitment to addressing key challenges in the dairy industry, while promoting sustainable development and social inclusion in rural communities.

Innovation

The design revolutionises the milking process by using locally available materials and solar energy, while incorporating grassroots innovation principles to meet regional dairy farmers' unique needs. The machine has been designed with specific settings, such as pulsation frequency and vacuum level, to enhance milking performance. Its portability sets it apart from traditional automatic milking systems, offering flexibility and convenience to farmers.

Sustainability

By harnessing solar energy, the project mitigates environmental pollution and reduces greenhouse gas emissions. The design prioritises energy efficiency and affordability, making it a sustainable solution for dairy farming in off-grid areas.

Social impact

The solar-powered milking machine aims to improve the livelihoods of dairy farmers by streamlining the milking process, reducing manual labour, and increasing productivity. It contributes to gender equality by alleviating the physical burden traditionally placed on women and children in rural communities. The design has a simple interface that can be used by people with varied expertise levels.

Scalability

The project aims for the adoption of the solar-powered milking machine across small and large-scale dairy farms. The machine is a more affordable option compared to large-scale milking equipment, and can be used by farmers in remote and off-grid areas. The project proposes a distribution channel involving partnerships with local manufacturers, governments, NGOs, and agricultural organisations to ensure accessibility and affordability.

Full Report
Video submission

Team 2023-07 — Solar systems for hospitals using hydrogen as storage

Trevor Osborne Atela, Andy Onyango

Theme: Power management

Project summary

This project proposes a comprehensive solution to address the energy challenges faced by remote healthcare facilities, focusing on the integration of solar energy and hydrogen storage systems. By using green hydrogen as a clean and reliable power source, hospitals can overcome the limitations of conventional diesel generators and achieve uninterrupted power supply.

Innovation

The integration of solar energy and hydrogen storage technology in the design creates a sustainable and reliable power infrastructure for remote hospitals, ensuring continuous energy availability. The design integrates solar data with hospital consumption patterns to optimise the use of renewable resources. Surplus solar energy drives hospital operations, while replenishing hydrogen reserves via efficient fuel cell technology.

Sustainability

The integration of green hydrogen technology and the reduction in diesel generators, fosters long-term sustainability by reducing carbon emissions, preserving natural resources, and promoting energy independence. The business model ensures the financial viability of the solution, creating a sustainable framework for future energy projects.

Social impact

The solar-powered hydrogen system enhances healthcare access and quality in remote areas, ensuring underserved communities receive better services. Reliable electricity improves diagnostic capabilities, treatment options, and patient care, leading to improved health, community well-being and inclusive development. Green hydrogen infrastructure creates employment opportunities and stimulates economic resilience.

Scalability:

The business model with its structured repayments will ensure a smooth transition for hospitals without burdening their immediate budget, providing a viable solution for a range of facilities in their transition to sustainable energy. By using renewable resources and innovative energy storage techniques, the model can meet the energy needs of diverse healthcare facilities.

Full Report
Video submission

Team 2023-11 — Solar-powered smart cereal dryer

Sintila Lekatoo Emmanuel, Ruman Hassan, Ronit Mepani, Isaiah Ochieng
Job Ian Onyango

Theme: Agriculture

Project summary

This project addresses the challenges of inefficient cereal drying practices in Western Kenya, which lead to post-harvest losses, economic instability, and food insecurity. The solar-powered smart cereal dryer seeks to improve drying methods, contributing to increased food security for subsistence farmers, particularly women.

Innovation

The design provides an efficient, cost-effective and user-friendly solution to cereal drying, using solar energy and advanced drying technology. By incorporating automated control systems and humidity sensors with an enclosed grain drying system, the dryer ensures optimal drying conditions, mitigating contamination risks and enhancing cereal quality.

Sustainability

The project promotes environmental sustainability by harnessing renewable solar energy for cereal drying, reducing dependence on fossil fuels and mitigating carbon emissions. By improving the efficiency of post-harvest processes, the solar-powered smart cereal dryer contributes to a more resilient and sustainable agricultural sector in Kenya.

Social impact

Implementation of the solar-powered smart cereal dryer will promote gender equality by reducing the labour burden traditionally placed on women and girls in rural farming communities. By improving drying methods and reducing post-harvest losses, the project empowers farmers economically, enhances food security, and supports sustainable livelihoods.

Scalability

The solar-powered smart cereal dryer is designed to be scalable and adaptable to the needs of subsistence farmers in various regions. The dryer design is both user-friendly and compatible with existing storage structures, which will facilitate its easy adoption and integration into existing storage structures, making it accessible to small-scale farmers.

Full Report
Video submission

Team 2023-13 — Design of SAS-sprayer system

Marthe Nirere, Augustin Nkundimana, Innocent Nsengimana, Jean Bonheur Tuyubahe, Rachel Uwagiriwubuntu

Theme: Agriculture

Project summary

This solar-powered, SAS-sprayer system for pesticide and fertiliser aims to address environmental and health challenges associated with traditional spraying methods used by small-scale farmers. By reducing the use of fossil fuels, and the overuse of pesticides and fertilisers, it can reduce environmental impacts. The design is efficient and user-friendly to ensure safety, comfort and ease of use. The SAS-sprayer aims to minimise waste, enhance precision, and support sustainable farming, thereby empowering farmers and boosting productivity.

Innovation

The innovative SAS-sprayer combines solar power with precision spraying and smart features like leak detection, auto shut-off, auto-levelling, and eco-mode to enhance efficiency, minimise waste, and support sustainable farming practices. It's able to handle various liquids, increasing versatility and simplifying the equipment needs of farmers by reducing the range of sprayers required.

Sustainability

The SAS-Sprayer promotes sustainable practices through efficient resource use and reduced environmental impact, aligning with several Sustainable Development Goals for example, SDG 2 - zero hunger, and SDG 13 - climate action.

Social impact

The project proposes strategies to ensure affordability, accessibility, training, gender equity, and community ownership. With the possibility of partnering with agricultural organisations and prioritising shared ownership and community benefits, it aims to maximise positive social outcomes.

Scalability

The project includes plans for research, development, prototype testing, manufacturing, distribution, training, and monitoring, with future advancements targeting precision application, real-time monitoring, and renewable energy integration, ensuring scalability and long-term impact.

Full Report
Video submission

Team 2023-14 — A dual-functional intelligent farm produce preservation system

Chukwudi Aniegboka, Chima Echendu, Chibuze Ezebili,
Ruth Iloba, Rita Opara

Theme: Refrigeration

Project summary

This project aims to create a dual-functional intelligent farm produce preservation system for drying and cooling, targeting post-harvest losses in rural Nigerian communities. Local farmers typically rely on sun-drying, which is slow, and leaves produce vulnerable. Cooling methods are also uncommon due to limited grid power and high cost. The proposed system offers an affordable, energy-efficient dual-preservation method, aiming to reduce waste and enhance small-scale farmers' livelihoods through cooling and drying.

Innovation

The project introduces innovative design features such as dual functionality for drying and cooling, using a solar DC power source, and a community-based business model. These innovations improve efficiency, reduce costs, and ensure round-the-clock availability of preservation services.

Sustainability

The project promotes environmental sustainability by using renewable solar energy and reducing reliance on fossil fuels. It ensures economic sustainability through a cost-effective business model that enables community-based ownership and maintenance. Overall, the solution offers a sustainable approach to agricultural produce preservation, benefiting both farmers and the environment.

Social impact

By addressing the challenge of post-harvest loss, the project contributes to several Sustainable Development Goals including SDG 1 - no poverty, SDG 2 - zero hunger, SDG 3 — good health and well-being, SDG 7 - affordable and clean energy, and SDG 12 — responsible production and consumption. Cooling and drying facilities can increase farmers' profits and in turn their well-being, enhancing food security, empowering communities and promoting sustainable livelihoods.

Scalability

The design is a modular system that is portable and easy to install, making it easy to deploy in various areas, including off-grid and rural settings. The proposed communal based ownership system reduces costs and improves access, facilitating widespread adoption and scalability across different regions.

Full Report
Video submission

Team 2023-16 — Portable water cleaning device: improved solar disinfection

Ella Buffery-Latham, Maria Hernandez-Solis, Rayyan Khan, Ore Lawale

Aston University
BIRMINGHAM UK

Theme: Water and sanitation

Project summary

The project aims to provide clean drinking water to vulnerable people in temporary camps in Matamoros, Mexico, by using a solar disinfection (SODIS) device. This device uses sunlight, UV radiation, and thermal energy to purify water, addressing the lack of access to clean drinking water in humanitarian camps. The portable design allows for easy transportation, while a centralised solar water pump serves as the main water source. Overall, the SODIS device offers a practical and sustainable solution to address the urgent need for clean drinking water in humanitarian settings, with potential for widespread impact beyond the initial target population.

Innovation

The SODIS device improves upon traditional methods by incorporating an internal heating filament and reflective surfaces to enhance water purification efficiency. Additionally, a solar-powered pump reduces the risks associated with manually filling bottles from contaminated water sources. The device's lid can be opened to allow for rainwater collection.

Sustainability

The project aligns with several Sustainable Development Goals, including SDG 7 - affordable and clean energy, SDG 3 - good health and well-being, and SDG 6 - clean water and sanitation. The use of locally sourced materials and minimal waste production contribute to environmental sustainability.

Social impact

By providing clean drinking water, the project aims to reduce waterborne diseases, dehydration, and improve the overall quality of life for displaced people. Access to safe water is essential for health and well-being, particularly for vulnerable populations like children and refugees.

Scalability

The project is scalable to other humanitarian camps in Mexico and potentially to other displaced people globally. The modular design allows for easy adaptation to different contexts, such as refugee camps and remote communities lacking access to clean water.

Full Report
Video Submission

Team 2023-18 - AQUA - solar-powered rainwater harvesting and purification system for domestic use

Ramandeep Kaur, Kamal Preet, Saad Shaiban, Simon Vazhappilly

Aston University
BIRMINGHAM UK

Theme: Water and sanitation

Project summary

Aiming to address the critical issue of clean water access in rural Punjab, India, the project designs an innovative solar-powered rainwater harvesting and purification system to provide clean, safe drinking water. The design offers a sustainable solution to tackle water scarcity and ensure public health, aligning with the Sustainable Development Goals and addressing the urgent need for accessible and affordable water purification systems in rural communities.

Innovation

The system offers an innovative and practical solution to improve public health and mitigate environmental damage caused by water pollution in rural Punjab. It achieves this by integrating with existing underground water storage and using locally sourced vernacular materials such as rice and coconut husk in the filtration system.

Sustainability

The use of vernacular materials, renewable solar energy and efficient water purification techniques contribute to sustainability. The use of rainwater reduces reliance on traditional groundwater sources, mitigating risk of flash flooding. The life-cycle of the system has been considered by suggesting uses and sustainable disposal methods for the materials such as composting.

Social impact

The project aims to make a substantial difference to health in rural communities by providing access to clean, affordable water. It contributes to job creation, gender equality, reduced costs for households, and increased health and well-being as access to clean water increases.

Scalability

The project aims to expand access to clean water solutions to serve the entire rural population of Punjab. By offering potential to use a range of vernacular materials, local sourcing across a range of locations is possible. The design is cost-effective compared to existing alternatives, and the team aims to use government initiatives and NGOs to support the project.

Full Report
Video Submission

Team 2023-19 — Solar fish dryer

Okey Iheagwam, Nnaemeka Sylvanus Nwobodo

Aston University
BIRMINGHAM UK

Theme: Agriculture

Project summary

By harnessing solar energy, this team seeks to provide a sustainable, efficient, and affordable solution for fish drying to help fish farmers swiftly transition away from harmful fossil fuel dependence. The fish dryer will reduce post-harvest losses and improve the nutritional value and market potential of dried fish in Southern Nigeria.

Innovation

The novel solar fish dryer improves upon the current practice of burning firewood for drying fish. The dryer integrates locally sourced materials like cellulose for insulation, graphite for efficient DC heating, and a sand battery for thermal storage into a single package. This innovative approach ensures cost-effectiveness, reliability, and environmental sustainability, contributing to multiple Sustainable Development Goals.

Sustainability

The project lifecycle emphasizes environmental responsibility, with recyclable materials and a repairable design. By reducing reliance on firewood, the solution mitigates deforestation, GHG emissions, and health risks associated with traditional drying methods. Circular economy considerations are at the core of the dryer's design and business model.

Social impact

The solar fish dryer enhances the lives of fish farmers, particularly women, by reducing the burden of firewood collection, improving food security, and reducing the health risks associated with burning firewood. It also fosters economic growth, empowers youth through skill-building, and enhances community well-being by providing clean energy access.

Scalability

The solar fish dryer addresses a growing demand for sustainable alternatives to wood fuel in Nigeria and beyond. Its scalability extends beyond dried fish, a primary protein source for half of Southern Nigeria, to include corn and plantain, catering to diverse dietary preferences. Partnerships with LGAs and NGOs ensure affordability, while plans for local manufacturing and diverse distribution channels enhance accessibility. The team also plans to collaborate with local enterprises to bolster support and strengthen the viability of the business model.

Full Report
Video Submission

Team 2023-20 — Automated solar-powered fresh produce cooling

Dushime Dieudonne, Hatangimbabazi Ishimwe Divine,
Dushimimana Olivier, Uwicyeza Pamella, Ndayisaba Patrick

Theme: Refrigeration

Project summary

This project aims to address the challenge of post-harvest losses in Sub-Saharan Africa by developing an automated solar-powered fresh produce cooling appliance. Using solar energy and advanced cooling technology, the appliance extends the shelf life of fruits and vegetables, offering small-scale farmers an environmentally friendly and energy-efficient solution to mitigate post-harvest losses and improve economic sustainability.

Innovation

The project integrates renewable energy, evaporative cooling technology, smart control systems, and affordability to create a unique and impactful solution. By harnessing locally available resources and using solar power, the appliance provides a cost-effective and scalable means of reducing post-harvest losses and enhancing food security, demonstrating the transformative potential of this technology.

Sustainability

The use of solar power and evaporative cooling technologies offers significant energy savings compared to traditional methods, reducing the project's environmental footprint and contributing to climate change mitigation efforts. Additionally, the integration of locally available materials and sustainable design principles promotes resource efficiency.

Social impact

The project has significant social impact by enhancing food security, economic empowerment, community development, environmental sustainability, inclusivity and equity. By reducing post-harvest losses, increasing income for small-scale farmers, and promoting responsible consumption, the project contributes to achieving Sustainable Development Goals including SDG 1 - zero hunger, SDG 7 - affordable and clean energy, SDG 9 - industry innovation and infrastructure, SDG 12 - responsible consumption and production, SDG 13 - climate action, and SDG 15 - life on land.

Scalability

To scale successfully, the project emphasises conducting market research, increasing production capacity, establishing robust distribution channels, and forming strategic partnerships. The project aims to reach target customers efficiently, especially in remote areas, and drive market acceptance.

Full Report
Video submission

Team 2023-21 — Solar-powered fish preservation hub

Innocent Alvin, Noah Midikira

Theme: Refrigeration

Project summary

The design of a solar-powered fish preservation hub addresses challenges faced by fisherpeople in Western Kenya, such as inadequate storage facilities and poor-quality lighting. The hub reduces yield losses and improves economic opportunities for fishing communities by providing adequate storage and charging stations for solar lamps.

Innovation

The solar-powered fish preservation hub innovatively addresses the dual challenges of inadequate storage and lighting by providing a centralised solution powered by renewable energy. This eliminates the need for kerosene lamps, reducing pollution and health risks for fishermen, and does not require connection to the national grid.

Sustainability

The use of renewable solar energy reduces environmental impact and dependence on fossil fuels, aligning with SDG 7 - affordable and clean energy) and SDG 13 - climate action.

Social impact

The hub is expected to create employment opportunities, particularly for women, and improve living standards for fishing communities. The hub design enhances food security and promotes better health through the use of solar lighting.

Scalability

The standalone nature of the solar-powered hub makes it easily scalable to remote areas without access to the national grid. With fewer components and lower installation costs compared to traditional grid connections, the hub offers a cost-effective solution for communities. Furthermore, the hub's economic viability, demonstrated by its projected return on investment and payback period, ensures its long-term scalability.

Full Report
Video submission

Team 2023-24 — Solar Sentry: real-time monitoring and wireless reporting for solar power system optimisation and diagnostics

Michael Adesiyan, Mary Ajose, Abiola Ogundeji, Samuel Olowosile, Charles Simeon

Theme: Power management

Project summary

This Solar Sentry project aims to enhance the efficiency of solar power systems by providing real-time monitoring and wireless reporting. By tracking power, voltage, and current output, the system enables proactive maintenance, minimising downtime and ensuring optimal performance of connected DC appliances.

Innovation

Using machine learning algorithms for anomaly detection, the system identifies irregularities in solar panel and battery operation, facilitating timely intervention. The integration of GSM modules enables remote data transmission, enhancing accessibility and scalability.

Sustainability

The project promotes sustainability by extending the lifespan of solar panels and batteries, reducing energy wastage, and increasing the use of clean, renewable energy sources. Partnerships with local stakeholders and strategic manufacturing decisions aim to minimise environmental impact throughout the product lifecycle.

Social impact

By optimising the performance of solar home systems, the project enhances users' quality of life, reduces reliance on fossil fuels, and mitigates the environmental impact of energy consumption. Additionally, the inclusive design considers the needs of diverse user groups, including people with disabilities and the elderly.

Scalability

With a focus on affordability and accessibility, the project targets homes, businesses, and structures with solar power systems in Nigeria. Collaborations with solar energy installers and consultants aim to streamline distribution and maintenance procedures, ensuring scalability across diverse user groups.

Full Report
Video Submission

Team 2023-25 — Precision crop preservation with energy-efficiency and affordable solutions

Francois Bizimana, Aline Gihozo, Samuel Turahimana, Dative Tushabomwe, Victorien Ukurikiyimfura

Theme: Refrigeration

Project summary

The project addresses post-harvest losses by introducing a solar-powered pre-cooling refrigeration system. The system enhances real-time monitoring of storage conditions, allowing for timely adjustments to temperature, humidity, and other factors to optimise food preservation. The project uses renewable energy and innovative technology to reduce post-harvest losses, ensure food security, and promote environmental sustainability.

Innovation

The project integrates solar-powered refrigeration units, harnessing renewable energy to maintain optimal storage conditions for perishable goods. Incorporating Internet of Things sensors and Artificial Intelligence algorithms, enables real-time monitoring and optimisation, enhancing efficiency and reducing losses, by enabling data-driven decision-making, predictive analytics, and automation in post-harvest processes.

Sustainability

The project seeks to enhance the shelf life and quality of agricultural produce, reducing waste and increasing marketable yields. The project promotes environmental sustainability by reducing food waste and reliance on fossil fuels. Using renewable energy, the project mitigates greenhouse gas emissions and minimises environmental degradation associated with traditional cooling methods.

Social Impact

By improving access to affordable food and reducing post-harvest losses, the project enhances food security and economic opportunities for smallholder farmers. The project seeks to empower local farmers with the knowledge and skills to adopt innovative post-harvest preservation techniques, contributing to poverty alleviation and economic growth.

Scalability

Targeting smallholder farmers globally, the project's scalable design allows for expansion into various agricultural sectors. Collaborations with local stakeholders and international organisations ensure widespread distribution and long-term viability, fostering resilience and prosperity in agricultural communities. The focus on affordability and accessibility ensures broad adoption and long-term impact.

Full Report
Video Submission

Team 2023-27 - Development of a multifunctional corn processing machine

Abdullahi Abdulwaris, Susil Chhetri,
Raihanah Haliru, Uday Raj Kafle

Theme: Agriculture

Project summary

This multifunctional corn processing machine addresses food insecurity and poverty in rural Nepal by efficiently processing corn into valuable products. By using solar power, the design improves upon existing diesel operated machines. The machine streamlines processes by integrating corn processing and briquette making into one machine which de-husks corn, grinds kernels into grits and transforms husks and cobs into briquettes, a cooking fuel.

Innovation

The machine integrates solar power with corn processing mechanisms, offering a sustainable solution tailored to rural Nepal's needs. Its modular design and multifunctionality set it apart from existing machines, providing scalability and customisation options.

Sustainability

The use of renewable energy, reduction of food loss, promotion of eco-friendly briquettes, and design for disassembly contribute to environmental sustainability. The project aligns with many Sustainable Development Goals including SDG 7 — affordable and clean energy, SDG 1 — no poverty, SDG 13 - climate action and SDG 15 — life on land.

Social impact

The multifunctional design improves on existing alternatives, saves time and can lead to increased income for agricultural communities due to the higher value of corn grits compared to unprocessed corn. It increases food security by reducing waste during processing and reduces indoor air pollution through production of clean cooking fuel in the form of briquettes.

Scalability

The modular design contributes to scalability by allowing customisation to meet the needs of different communities. The team plans to use local insights and engagement with users to ensure the machine is relevant and effective in diverse settings. They also intend to explore financing options to increase affordability and accessibility. Targeting low-income households and leveraging local and regional markets, the team aims to reach a wide audience and make a significant impact.

Full Report
Video Submission

Team 2023-29 — Heat management for sanitary hot water access

Victor Baraka, Rebecca Rabera Kimaiga, Timon Mawira, Godfrey Ngeiywa, Ngesa Paul Omondi

Theme: Water and sanitation

Project summary

This project aims to address the challenges of energy efficiency, access to clean water, and environmental sustainability in rural areas of Kenya by integrating a domestic solar water heater with a water filtration system.

Innovation

The project innovatively integrates a domestic solar water heater with a water filtration system to provide clean and temperature-variable water for various domestic needs. The water is treated through a membrane filter and a DC ultraviolet light water treatment system. Heating for the water is sourced through an aluminium element on the back of the solar DC panels capturing their waste heat.

Sustainability

The project promotes sustainability by using renewable energy, reduction in greenhouse gas emissions and air pollutants, and conservation of natural resources used for traditional fuels.

Social impact

The implementation of the project will empower rural communities by freeing women and girls' time from sourcing fuel, improving access to clean water, improving access to sanitation and hygiene practices, reducing reliance on traditional expensive and environmentally damaging heating methods, and creating job opportunities to manufacture, install and maintain the design.

Scalability

This project provides an integrated solution to two key needs in the growing off-grid solar market. The project's usability is not limited to households and the team has identified a potential market in hotels and restaurants, residential apartments, county government buildings, and small businesses. The design also improves affordability by saving users money on power and providing the option to buy a small upgradeable system.

Full Report
Video Submission

Team 2023-30 — Intelligent solar-powered consumption controller

Albert Davis, Lynne Kitonyi, Shabaki Lenga, Josphat Muriuki, Erick Ogolla

UNIVERSITY OF NAIROBI

Theme: Power management

Project Summary

This project addresses the inconsistency of power supply from home solar systems, particularly during low solar intensity periods. The smart solar power control system integrates weather forecasting data to prioritise essential loads, ensuring a reliable energy supply for off-grid communities.

Innovation

The system uses weather forecasting data to predict solar power generation and make proactive adjustments to energy storage and allocation, improving usability and efficiency of the solar home system. It prioritises essential loads and manages battery use intelligently, enhancing reliability. The controller provides users with real-time information on the available power supply and the expected trend for the coming days. Equipped with backup batteries, the system manages power storage and expenditure while prioritising the most vital devices. This intelligent approach aims to provide a more reliable and predictable solar energy supply compared to current home solar systems.

Sustainability

The controller reduces dependence on alternative energy sources, increases clean energy production, and extends the lifespan of system components, contributing to long-term sustainability and environmental conservation.

Social impact

By reducing costs through precise component sizing and minimising reliance on fossil fuels like kerosene, the controller improves affordability and reduces environmental impact. It enhances indoor air quality and promotes cleaner energy alternatives.

Scalability

With its user-friendly design and flexible payment options like pay-as-you-go schemes, the controller drives increased adoption of intelligent power management systems. It targets a broad market, including off-grid households and small businesses.

Full Report
Video Submission

Team 2023-31 - Solar-powered medical centrifuge

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UNIVERSITY OF NAIROBI

Theme: Healthcare

Project summary

Access to reliable electricity is crucial for medical services, yet resource-limited regions face challenges due to power shortages. This hampers diagnostic services, delaying treatments and compromising patient care. To address this, the solar-powered medical centrifuge offers a portable, durable, and green energy solution. It enhances diagnostic capabilities, supports disease prevention, and contributes to improved healthcare outcomes, particularly in areas with low levels of energy access including rural areas, refugee camps, and war zones.

Innovation

The centrifuge has significant potential for enhanced energy efficiency compared to existing alternatives. By integrating energy efficient components and optimising power consumption, the centrifuge minimises energy wastage while maintaining optimal performance levels. Energy efficiency contributes to reduced operational costs, while use of cost-effective materials and construction methods contribute to reduced production costs. Additionally, the user-friendly and simple design leads to improved usability.

Sustainability

Through solar energy use and recycled plastic casing, the centrifuge minimises environmental impact and reduces dependency on fossil fuels. Lifecycle design considerations lead to repairability and recycling, ensuring long-term sustainability and positive social impact. User-friendly manuals and local repair services enhance accessibility, affordability, and longevity fostering a resilient healthcare infrastructure for generations.

Social impact

The solar-powered centrifuge enhances healthcare accessibility, reducing disparities between urban and rural areas. Its mobility facilitates medical outreach programs, increasing healthcare accessibility. By empowering frontline healthcare providers with reliable diagnostic tools, it saves lives and fosters sustainable healthcare systems.

Scalability

Targeting established healthcare facilities, the centrifuge complements medical outreach programs, ensuring timely services in off-grid areas. Strategic partnerships with NGOs, private agencies, and local governments facilitate cost subsidisation and broader implementation. Various payment models such as pay-as-you-go and leasing will be explored to increase affordability and accessibility.

Full Report
Video Submission

Team 2023-32 — Design and construction of solar-powered gear pump

Celestine Gomes, Sayed Alam, Sabrine Islam

Theme: Agriculture

Project summary

Inefficient irrigation systems and practices exacerbate water scarcity in countries like Bangladesh. Current systems increase soil moisture content levels, accumulate salt near land surfaces, deplete ground-water tables and emit high levels of carbon. The proposed solar-powered gear pump aims to address irrigation challenges in regions with limited access to traditional power sources. By harnessing solar energy, the pump offers an efficient and sustainable solution to support agricultural activities.

Innovation

The solar-powered gear pump is a type of positive displacement pump. Gear pumps use rotating cogs to transfer fluids which creates a liquid seal within the pump casing and creates a vacuum at the pump inlet, creating smooth pulse-free flow that can be measured and provide the exact volume required. The system provides self-priming, efficient, reliable, and steady water delivery optimal for areas with geographical challenges and irrigation in minor agricultural plots. The gear system is also reversible, allowing users to empty vessels and prevent water standing in pipes.

Sustainability

As opposed to diesel or gasoline pumps the solar-powered gear pump creates no noise or air pollution and creates fewer greenhouse gas emissions over its lifetime. The pump addresses water scarcity challenges and provides efficient and controlled use of water.

Social Impact

By providing affordable and sustainable irrigation solutions, the project aims to improve crop production, enhance living standards for smallholder farmers, promote rural development, and contribute to achieving Sustainable Development Goals related to clean energy, industry, innovation, infrastructure, and sustainable communities.

Scalability

The project targets smallholder farmers, government agencies, commercial farmers, research institutions, and humanitarian NGOs, demonstrating scalability through optimised water usage, reduced operational costs, and potential to meet sustainability targets on a global scale. The team aims to set up distribution channels where innovation in irrigation systems is low through product demos, online and tele-marketing, and by building local partnerships. The team will also provide after-sales services and offer various payment models.

Full Report
Video Submission

Team 2023-33 — Design of a DC pill management and lighting device

Masanga Glynnly, Calvin Kuhuni, Chipuriro Tafadzwa, Munorweyi Takudzwa

Theme: Healthcare

Project Summary

This project is a DC pill management and lighting device to address both, prescribed medication non-adherence and lack of reliable lighting in rural areas. The device integrates solar PV panels, battery storage, a microcontroller for reminders, and LED lighting.

Innovation

The integration of pill management and lighting functions in a single device is novel, aiming to optimise resources and improve usability. A microcontroller unit regulates all the basic operation of the machine including timely dispensing medication and reminders through audio and visual notifications via a simple LCD display unit. The LED lights will provide flash notifications and a buzzer will provide audio notifications to accommodate users with audio or visual impairments. The system includes a fingertip authentication sensor to unlock the devise to refill medications and programme times and doses. Information will be easily accessible on a web application.

Sustainability

By using solar power and second-life batteries, the device reduces reliance on the grid, decreases carbon footprint, and minimises e-waste. At the end of its life cycle, components can be recycled or repurposed to minimise environmental impact. Additionally, the use of second-life batteries promotes sustainability and reduces e-waste.

Social impact

Targeted at the chronically ill, elderly, and those under home-based care, the device aims to improve medication adherence and dosages safety. By helping patients remember to take their medications at the right time and in the correct dosage, a pill management system can help improve health outcomes and reduce the risk of complications. Reliable lighting enhances productivity, education, and safety, particularly in areas with limited access to electricity.

Scalability

The device's design allows for scalability, with potential applications in various rural settings globally. Its low-cost components and simple design facilitate widespread adoption and implementation.

Full Report
Video Submission

Team 2023-34 — Bird deterrent device

Terance S Kanhanga, Munyaradzi Matambanadzo, Tafadzwa Mukonya, Simon A Musikavanhu, Leroy L Taderera

Theme: Agriculture

Project summary

This bird deterrent device aims at reducing the damage birds do to crops without harming the birds themselves. The device combines sound, light, and visual deterrents. Its design prioritizes affordability, ease of use, and effectiveness, making it accessible to farmers of all classes, including those in remote rural areas.

Innovation

The device combines multiple deterrent methods and customises targeting for specific bird types, offering a more comprehensive solution, integrating sound, light, and visual deterrents. Additionally, the device offers customisation options to target specific types of birds, allowing for greater adaptability to varying environmental conditions and bird behaviours. This innovative approach increases the device's efficacy while minimising harm to birds, making it a more humane and sustainable solution to bird-related crop damage.

Sustainability

The device promotes eco-friendly farming practices by eliminating the need for harmful chemicals to deter birds from damaging crops, thus supporting environmental sustainability

Social Impact

By reducing crop damage, the device contributes to improved food security, potentially benefiting farmers' livelihoods and local communities.

Scalability

Designed to be effective, affordable, and easy to use, the device has the potential for widespread adoption across diverse agricultural settings including remote farms, potentially addressing bird-related crop losses on a larger scale. The flexibility to address specific bird species and environmental conditions, enhances its versatility and applicability across different regions and farming practices. Furthermore, the device's modular design and compatibility with existing agricultural infrastructure facilitate seamless integration into farming operations, enabling scalable deployment on both smallholder and large-scale agricultural landscapes.

Full Report
Video Submission

Team 2023-35 — Solar-based automated drainage cleaning system

P. Ajay, A. Hemavardhan, T. Praneeth Krishna,
D. Sai Anvesh Varma

Theme: Water and sanitation

Project summary

The solar-based automated drainage cleaning system is an innovative solution to the challenges facing drainage maintenance in India. It employs solar power and advanced sensor technology to autonomously clean drainage systems, reducing reliance on manual labour and promoting sustainability. By integrating real-time monitoring and data-driven decision-making, the system enhances efficiency and worker safety.

Innovation

The system integrates cutting-edge sensor technology and solar power to automate drainage cleaning operations, offering a scalable and environmentally friendly solution to traditional manual methods.

Sustainability

By harnessing solar energy and minimising resource consumption through automation, the system promotes environmental sustainability and reduces carbon footprint. Its long-term cost-effectiveness makes it a viable solution for sustainable drainage maintenance.

Social Impact

The system prioritises worker safety by minimising manual intervention, thus reducing health risks associated with traditional drainage cleaning practices. It also contributes to better sanitation and hygiene in communities by ensuring the efficient operation of drainage systems.

Scalability

With its automated operation and cloud-based data management, the system is designed to be scalable, adaptable, and suitable for deployment in various civic drainage structures across India.

Full Report
Video Submission

Team 2023-38 — Solar Primus

K. Rachana Chowdary, K. Karthikeyan, B. Padma Bhushan Reddy,
P. Shanmukha Sreenivas

Theme: Cooking

Project summary

Solar Primus was developed to address energy poverty by leveraging solar energy for cooking purposes. By harnessing sunlight to generate electricity, Solar Primus offers an eco-friendly alternative to traditional cooking methods, reducing carbon emissions and indoor air pollution.

Innovation

Solar Primus aims to improve upon existing solar PV stoves with the integration of high-capacity and efficient batteries. This allows for the system to operate outside of peak sunlight hours, which will improve the reliability and usability of the solar PV stove. The project also uses smart energy management systems for optimal energy use.

Sustainability

Solar Primus promotes environmental sustainability by reducing reliance on fossil fuels and minimising carbon emissions associated with cooking. The project prioritizes the use of durable materials, ensuring long-term sustainability.

Social impact

The Solar Primus would improve health outcomes by reducing exposure to indoor air pollution from traditional cooking methods. Moreover, Solar Primus empowers communities by promoting self-sufficiency and resilience through access to renewable energy.

Scalability

Solar Primus is designed for scalability, with the potential to be implemented in various regions with different levels of sunlight exposure. It provides a cost-effective cooking solution that despite high upfront costs reduces household fuel expenses.

Full Report
Video Submission

Team 2023-39 — Design of a solar-powered groundnut shelling machine

Mirembe Gloria Masika, Odaga Christopher Okwanga, Kidega Fred Opiyo

Theme: Agriculture

Project summary

This solar-powered groundnut shelling machine addresses the post-harvest challenges of smallholder farmers in Uganda using traditional manual methods for groundnut shelling. This innovation aims to enhance productivity, reduce labour-intensive processes, and promote sustainable post-harvest handling practices.

Innovation

The solar-powered groundnut shelling machine offers an efficient and environmentally friendly alternative to traditional hand-shelling methods and fossil fuel-powered machines. Its design incorporates user-centred principles and locally available materials, ensuring accessibility and affordability for small-scale farmers.

Sustainability

The solar-powered groundnut shelling machine reduces reliance on fossil fuels, thereby lowering carbon emissions and mitigating climate change effects. Additionally, its use of renewable energy minimizes environmental pollution and noise disturbance, offering a cleaner and quieter alternative to traditional machines. Overall, the project tackles SDG 2 - zero hunger, SDG 7- affordable and clean energy, SDG 9 - industry, innovation, and infrastructure, SDG 13 - climate action, and SDG 15 - life on land.

Social Impact

This design contributes to reducing drudgery by increasing productivity and efficiency while contributing to food security in northern Uganda. By using solar energy and reducing noise pollution, the design promotes environmental sustainability and mitigates health risks associated with labour-intensive methods, ultimately improving farmers' economic status and quality of life.

Scalability

Designed for use in remote areas with limited grid power supply, the shelling machine has a user-friendly design and uses locally available raw materials. This approach reduces production costs, making the machine more accessible to farmers and promoting widespread adoption.

Full Report
Video Submission

Team 2023-40 — Smart solar-powered garbage monitoring system using IoT

Sikhakolli Guru Charan, Stephanie Danho,
Vijjapu Deekshith, Hirusajini Jeyatharan

Theme: ICT

Project summary

This smart solar-powered garbage monitoring system using IoT aims to enhance waste management efficiency, reduce carbon emissions, and promote environmental sustainability. The system uses solar energy and IoT sensors to monitor garbage levels in real-time, optimising collection routes and operational effectiveness. Through user-friendly interfaces and community engagement, it aims to revolutionise waste management practices in urban and rural areas.

Innovation

The design combines solar power and IoT technology to create an innovative waste management solution. Real-time monitoring, predictive analytics, and remote management enhance operational efficiency and environmental impact.

Sustainability

Using solar energy and IoT sensors, the system enhances resource efficiency by enabling tailored waste collection routes, timetables, and resource allocation, thereby reducing fuel consumption and carbon emissions.

Social impact

The system promotes community involvement and public health. By reducing overflowing bins, minimising littering, and optimising resource allocation, it enhances public health, cleanliness, and overall well-being. Additionally, it empowers individuals to actively participate in waste reduction efforts.

Scalability

The system is designed to be scalable and adaptable to diverse environmental conditions and waste management needs. Its modular architecture facilitates easy integration with existing infrastructure, while user feedback mechanisms and partnerships with local distributors ensure broad accessibility and affordability.

Full Report
Video Submission

Team 2023-42 — Solar UV sterile storage unit for medical equipment

Denish Olara, Innocent Otim, Allan Nangai Wodada, Norbert Wokorach

Theme: Healthcare

Project summary

This project presents a solar-powered UV sterile storage unit for medical equipment designed to address the challenge of keeping medical tools sterile in areas with unreliable electricity access, such as rural Uganda. Unreliable electricity access has pushed medical practitioners to resort to inefficient traditional methods such as boiling the equipment or the costly practice of replacing equipment after use. The system uses solar energy to power a DC-powered storage unit, providing an efficient and accessible solution for healthcare facilities.

Innovation

Medical professionals will be able to hang their equipment in the storage unit where a UV LED lamp emitting a wavelength suitable for inactivating pathogens will sterilise the equipment. The mirrored floor of the unit will be tilted at a 10-degree angle to drain water droplets from possibly wet medical equipment. An LED panel on the outside of the unit will display the status of the sterilisation process.

Sustainability

The system is environmentally friendly and minimises waste. It requires minimal maintenance and incorporates a charge controller to lengthen the battery lifespan. It avoids the use of fossil fuels, toxic chemicals, or wood combustion for boiling water that are typically used in medical equipment sterilisation.

Social impact

The solar-powered sterile storage unit will have a significant impact on rural communities by improving access to sterile medical equipment. It will reduce the risk of infections transmitted through inadequately sterilized tools, ultimately promoting better health outcomes and increasing productivity in the community.

Scalability

The design is suitable for small scale and rural health centre demands in Uganda and similar settings. It has been developed using locally available raw materials and can be easily fabricated locally. The product will also be subsidised for local health centres.

Full Report
Video Submission

Team 2023-43 - Hybrid water dispenser with UV-C water disinfection and a water refrigeration system

Ocayotoo Emmanuel, Bilali Batumbya Geriga, Muhangi Alfred Joshua, Robin Amos Kidega, Abraham Okee

Theme: Water and sanitation

Project Summary

This design is a hybrid water dispenser integrating ultraviolet-C (UV-C) light for water disinfection and a water refrigeration system that prevents microbial regrowth. This innovative design aims to tackle water insecurity by providing a comprehensive off-grid solution tailored to the needs of communities in Uganda. This system allows households to purify water at the point of use without relying on centralised infrastructure.

Innovation

The UV-C LEDs are strategically positioned within the treatment chamber to ensure uniform exposure of filtered water to UV radiation. The thermoelectric cooling system uses two conductive ceramic plates interconnected by multiple thermocouples and will include energy-saving measures such as insulation of water tanks and optimising the cooling process to minimise energy consumption.

Sustainability

This system prevents the use of biomass for boiling water or chemicals for water treatment, benefiting the environment by reduced carbon emissions and pollutants.

Social impact

By improving access to safe drinking water, empowering local communities, generating economic opportunities, promoting environmental sustainability, enhancing climate resilience, and fostering education and capacity building, this system contributes to the well-being and development of rural populations while safeguarding the natural environment for future generations.

Scalability

The system will be available to individual households, businesses and humanitarian NGO's delivering water and sanitation services. The project will offer different payments approaches either as one upfront payment or as pay-as-you-go where households will be able to pay for what they use.

Full Report
Video Submission

Team 2023-44 - Solar-based biogas production in anaerobic digester with IoT

Shafin Mahbub, Asif Al Masud, Kazi Habibur Rahman

Theme: ICT

Project summary

This project is a remote control and management system connected to an anaerobic biogas digestor. The enhanced system aims to tackle waste management and biogas production in Bangladesh and Kenya with the goal to generate biogas from food waste, offering a sustainable energy option.

Innovation

This remote monitoring system based on Internet of Things (IoT) includes an Arduino Uno microcontroller and various sensors for temperature, humidity, pH, and methane concentration. The system has a user-friendly interface and uses data analytics to enhance performance management. The system will contribute to waste management cost savings compared to sending waste to landfills, and reduced reliance on fossil fuels.

Sustainability

The system is designed to enhance the benefits of a biodigester produced gas used for cooking. The overall system is more energy-efficient than natural gas, using organic waste to lower methane emissions and supply a renewable energy source.

Social impact

This project has the potential to enhance education as the app interface will be available to inform those benefiting from the cooking gas about the anaerobic digestion process, waste management and the importance of renewable energy sources. The system will contribute to waste management cost savings compared to sending waste to landfills, and reduced reliance on fossil fuels.

Scalability

The system has the potential for use in households, businesses and the industrial sector. It has a wide spectrum of applications including use by government aid agencies. As it expands adoption into rural areas, it will include a pay-as-you-go mechanism to ensure affordability. The modular design facilitates adaptability and installation.

Full Report
Video Submission

Team 2023-46 — Solar-based air conditioner using VFD for affordable cooling

Marjan Al Haque, Alif Khan, Anika Saima Rahman

Theme: Other

Project summary

This solar-powered air conditioner reduces reliance on traditional grid electricity and lowers utility costs for users. The design aims at providing an affordable and sustainable cooling solution, critical for comfortable living, particularly in regions with extreme weather.

Innovation

The design includes a solar-powered air conditioner machine equipped with a Variable Frequency Drive and a 48V DC compressor. This addresses challenges such as high energy consumption, grid dependency, and limited affordability. By using solar energy and optimising circuit design, the innovation promotes energy efficiency and environmental sustainability.

Sustainability

Through the reduction of carbon emissions, and implementation of a recycling program for solar panels and batteries, the project contributes to environmental preservation and long-term sustainability. Additionally, financial plans such as microfinancing and revenue sharing facilitate the adoption of solar-powered air conditioning systems, promoting economic and environmental resilience.

Social impact

The project addresses the need for affordable cooling solutions, particularly in vulnerable communities facing health risks due to extreme temperatures. By offering economical and environmentally friendly options, it promotes well-being, resource conservation, and social inclusion, aligning with Sustainable Development Goals related to health, economic growth, and environmental sustainability.

Scalability

With a global market size projected to reach billions, the project targets both individual consumers and organisations, particularly in low-income countries with a low percentage of air conditioner users. Using recycled air conditioner parts and establishing strategic partnerships with suppliers, the project aims to enhance affordability and accessibility on a large scale.

Full Report
Video Submission

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