EFFICIENCY FOR ACCESS

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ENGINEERS WITHOUT BORDERS UK

Efficiency for Access Design Challenge

Challenge Brief 2020 – 21

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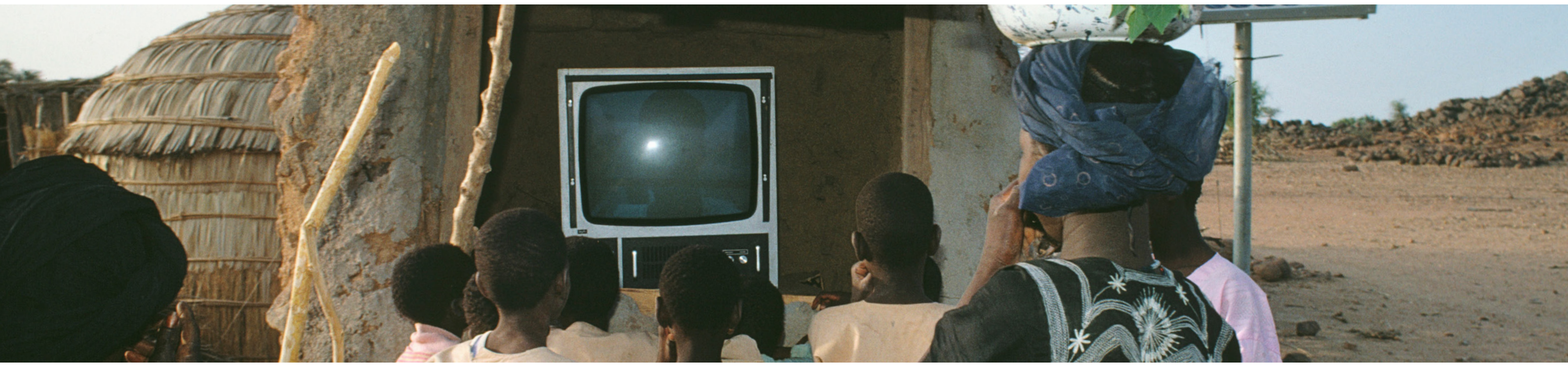


Overview

840 million people live without access to electricity, or access to electric appliances that boost productivity or provide cooling, refrigeration and communications. The world is also facing a climate emergency. As such, it is more important than ever to enhance access to modern energy services that are powered by renewable energy. We also need to empower innovators to create appliances that meet the needs of people living in emerging economies.

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 affordability and efficiency of high performing appliances.

Over the year, you have the opportunity to join students from around the world to deliver design and innovation projects that focus on affordable and high-performing off-grid appliances and supportive technologies. The Efficiency for Access Design Challenge team is excited that you are part of the competition, and we are looking forward to the solutions you will submit.

This brief will enhance your understanding of energy access and off-grid appliances, helping you frame your project and design your solution.

Last year's competition started in September 2019. There were 20 participating teams from nine universities in Bangladesh, Kenya, Uganda and the UK. This year, the competition is open to students from 20 universities in Bangladesh, Ethiopia, Kenya, India, Nepal, Uganda and the UK. Details on the competition and more resources, including last year's project submissions and Grand Final recording, are available here.

Context

The UN Sustainable Development Goals (SDGs) recognise that access to affordable, reliable and modern energy services is crucial to poverty reduction, sustainable agriculture and more.

Distributed clean energy technologies such as off-grid solar home systems and standalone solar mini-grids enable people and enterprises to access life-changing modern energy for the first time. The improvement and expansion of existing grid infrastructure will also play an important role here.

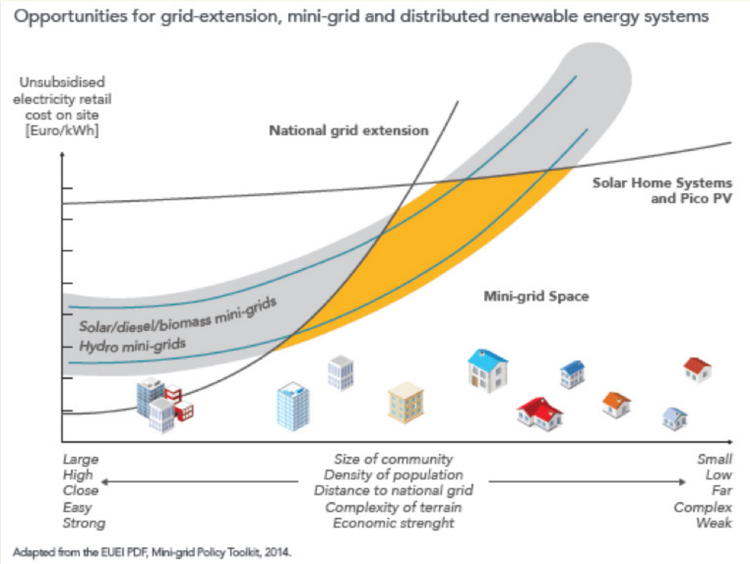
The International Energy Agency has estimated that off-grid solar home systems and solar mini-grids are the most economical ways to reach around 60% of people who are not connected to national grids. As off-grid communities gain access to mobile phone networks, 'Pay-As-You-Go' (PAYGo) financing helps households and businesses access affordable electricity in a flexible way. Customers usually pay an upfront deposit, with regular payments (often via SMS or mobile money), which enables them to own the solar home system outright. The International Energy Agency predicted that more than 600 million people in sub-Saharan Africa will need to be served by off-grid renewable solutions by 2030 to meet the SDG 7 of universal energy access.

Solar Home Systems (SHSs) are stand-alone photovoltaic systems that offer a cost-effective mode of supplying power to remote off-grid households. A solar home system typically includes one or more photovoltaic modules consisting of solar cells, a battery to store energy and a charge controller which distributes power and protects the batteries and appliances from damage. Currently, a typical solar home system operates at a rated voltage of 12V direct current (DC) and provides electricity for low power appliances such as LED light bulbs, radios and small TVs for about three to five hours a day.

LEARN MORE:

Research Snapshot, Efficiency for Access Coalition

A mini-grid, sometimes referred to as a micro-grid, can be defined as a set of electricity generators and possibly energy storage systems interconnected to a distribution network that supplies electricity to a localised group of customers. They involve small-scale electricity generation ranging from 10kW to 10MW. These are typically photovoltaic modules, micro-hydro and/or back-up generators, which serve a limited number of consumers via a distribution grid that can operate autonomously without being connected to a centralised grid, often known as a 'standalone'.



This diagram shows the most economical way to achieve electrification in different settings. For dense, highly populated cities, grid extension remains the cheapest option, whereas for remote rural areas, Solar Home Systems are much more viable. There is a sweet spot in between where mini-grids appear to be the preferable options to power communities, living in villages for example. Source: Integrated Electrification Pathways for Universal Access to Electricity: A Primer, 2019, SEforAll.

Conventional, inefficient appliances consume too much energy to be used affordably with off-grid energy systems such as solar home systems and mini-grids. The combined energy demand of inefficient appliances can overload these energy systems, which contributes to load shedding and power outages.

As a result, affordable and high-performing appliances are essential to delivering modern energy services to under-served communities around the world at the lowest possible economic and environmental cost with great potential for social development (Efficiency for Access Coalition, 2017). These efficient appliances can contribute to reduced greenhouse gas emissions by replacing incumbent power generation systems and reducing demand for future carbon-intensive energy supplies.

Families who gain energy access reduce their reliance on, or completely stop using dirty, expensive and dangerous fuel sources. This has a positive impact for their health, reducing their exposure to fine particulate matter (PM2.5) by as much as 50-80%; and for the environment, reducing their CO_2e12 emissions by close to half a tonne per year (60 Decibels, 2020).

Just as super-efficient LED technology has unlocked modern lighting for tens of millions of households and microenterprises, **super-efficient appliances** promise to unlock life-changing modern energy services. These include cooking, cooling, power management or refrigeration. A great deal of technical progress and market development is still needed to reach this goal.

Over 90% of households that replaced toxic kerosene lamps with solar alternatives report that they have experienced improvements in both health and feelings of safety. (GOGLA, 2018)

LEARN MORE:

Research Snapshot, Efficiency for Access Coalition, 2020

Scope of the competition

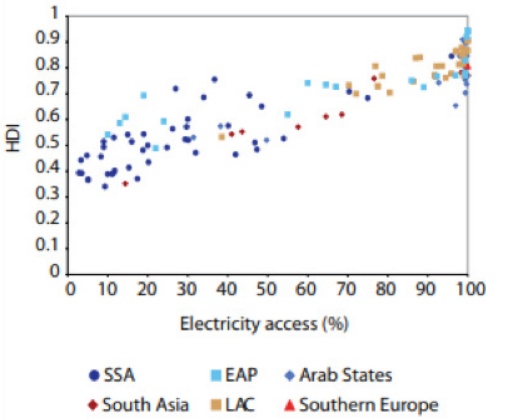
The Efficiency for Access Design Challenge is an opportunity for you to work at the forefront of energy access. You will be required to design affordable, super-efficient appliances that can be used in an off-grid context, i.e. powered by a solar home system or a mini-grid.

You will work on solutions in countries where this need is critical for large numbers of people. Focusing on Sustainable Development Goal 7 – Affordable and Clean Energy, special attention should be given to countries that are lagging the furthest behind. Lack of access to clean energy and other basic services is closely correlated with a country's position on the Human Development Index.

We are interested in affordable and efficient appliances that can help improve people's quality of life or increase business productivity. You must identify an opportunity for an appliance to make a difference in people's lives. Your design should significantly improve on currently available solutions and have the potential to scale.

You can choose one of these two tracks represented in the diagram on the following page. A business can be anything from a micro-enterprise, a small business employing no more than 10 people, or someone working for themselves, such as a smallholder farmer, a small retail shop or a bar, to a medium enterprise.

The focus is on energy consumption and the appliance's primary source of energy should be electricity (DC - Direct Current). The appliance should be directly connected to a solar home system or a standalone DC mini-grid. You are not allowed to design an AC appliance which connects to an inverter. Energy generation is also out of scope.



Human Development Index versus electricity access rate. (Source: The energy access situation in developing countries, 2009, UNDP and WHO.)

The UN Human Development Index (HDI) is a combined measure of life expectancy, education and standard of living in a country.

Choose one of these two tracks

	Improving quality of life in homes	Increasing productivity of businesses
THE PROBLEM	Although access to energy is increasing in off-grid areas, **these homes are significantly different to on-grid homes**. Affordable and efficient appliances powered by solar DC electricity can replace more expensive and polluting alternatives. They can also help improve people's quality of life, safety and health.	Although access to energy is increasing in off-grid areas, people have limited access to affordable and efficient appliances powered by solar DC electricity. **Many income generating activities are still performed manually or with expensive and polluting fuels.**
THE CHALLENGE	Design an affordable and efficient appliance, or an improvement to an existing appliance, that could help **improve quality of life in homes** based off-grid settings.	Design an affordable and efficient appliance, or an improvement to an existing appliance, that could help **increase productivity of microenterprises** based in off-grid settings.

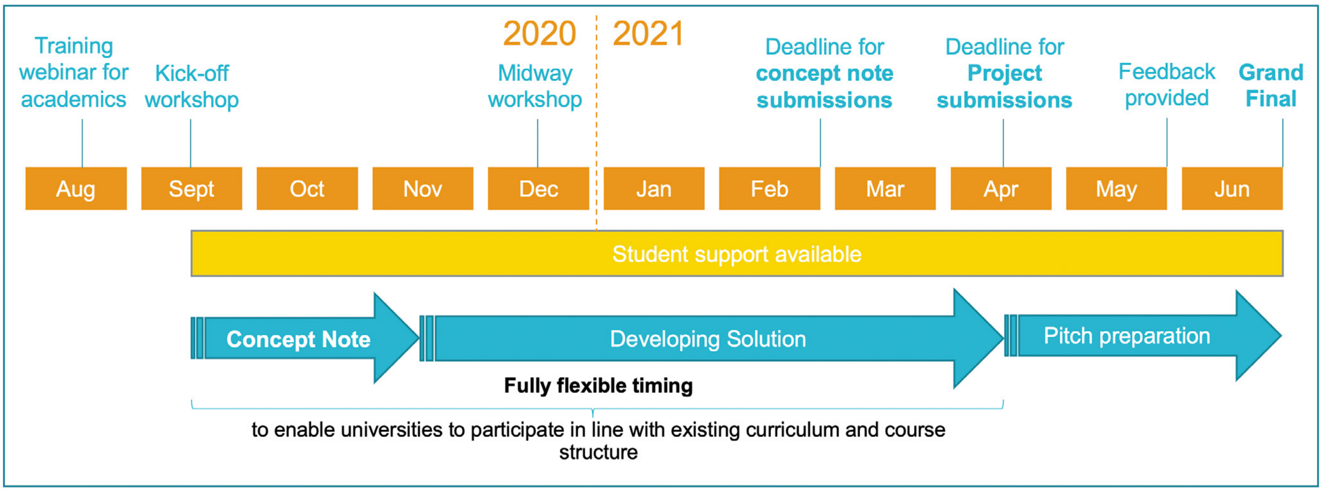
The next sections outline several themes, which you could explore when formulating your problem definition. Each theme contains examples of projects that illustrate what you could develop. These themes represent the main trends in the off-grid appliances industry, but don't feel limited to these alone. You are free to choose your own theme as long as you can clearly present the following:

- The intended end-user
- Improvements offered on existing alternatives
- Intended impacts on the end-user's life
- Scalability of the design

When does it take place?

The Efficiency for Access Design Challenge starts in September 2020 and ends with the Grand Final in June 2021. The timing of the Challenge is flexible, so universities can include the competition in existing curriculum and course structures. Universities decide whether to schedule the project to run over multiple terms or condense the participation period. We anticipate that students will receive credit for participation. The Efficiency for Access Design Challenge team is available to help universities embed the competition in existing curricula.

KEY DATES



The Challenge begins in September: Projects can start at any point from September onwards (depending on your university curriculum). They should start with a digital **kick-off workshop** facilitated by the Efficiency for Access Design Challenge team.

Concept note:

Your team should submit a concept note at any point from September onwards. We encourage you to submit your concept note within a month of the kick-off workshop. The deadline to submit the Concept Note is **28th February 2021**.

The concept note should outline what your team plans to focus on and be no more than four A4 pages long.

The deadline to submit the concept note is **28th February 2021** !

It will help the Efficiency for Access Design Challenge team understand how your team plans to approach the problem you want to work on, so that we can procure appropriate support. You will not be assessed on the concept note and it will not be used to decide whether your team can participate in the competition. When submitting the document, you will also sign up to the Challenge's terms and conditions. This concept note will also help the Efficiency for Access Design Challenge team identify a mentor from the off-grid industry sector who will support your team in developing your project.

Concept note feedback:

Within one month, sector experts will provide feedback on your concept note.

Midway workshop:

Halfway through the competition, the Efficiency for Access Design Challenge team will facilitate a digital workshop to support you in the design process and answer questions. Throughout the year the Efficiency for Access Design Challenge team will provide support with regular check-ins to both universities and students. We will also help connect academics and industry partners. The team will organise a series of webinars for all universities, which will allow you to meet industry experts and learn more about off-grid appliances technologies.

Project submission:

Your team should submit your project - a 4000-word (maximum) report and a three-minute video by **Friday 16th April 2021**. Other supporting documentation can be attached to your submission, if deemed useful. These include posters or prototypes. Your team shall own the Intellectual Property of your work but will be required to give the Efficiency for Access Design Challenge team permission to use the research outcomes for a wider benefit. This will be achieved by you agreeing to license your work under Creative Commons license CC-BY 4.0.

> ! The deadline to submit your project is **16th April 2021**

Feedback:

You will receive feedback on your submission in **May 2021**. You can use this feedback to prepare for the pitching session.

Pitching to a judging panel:

Before the Grand Final, your team will pitch your project to a judging panel in a digital session.

Grand Final:

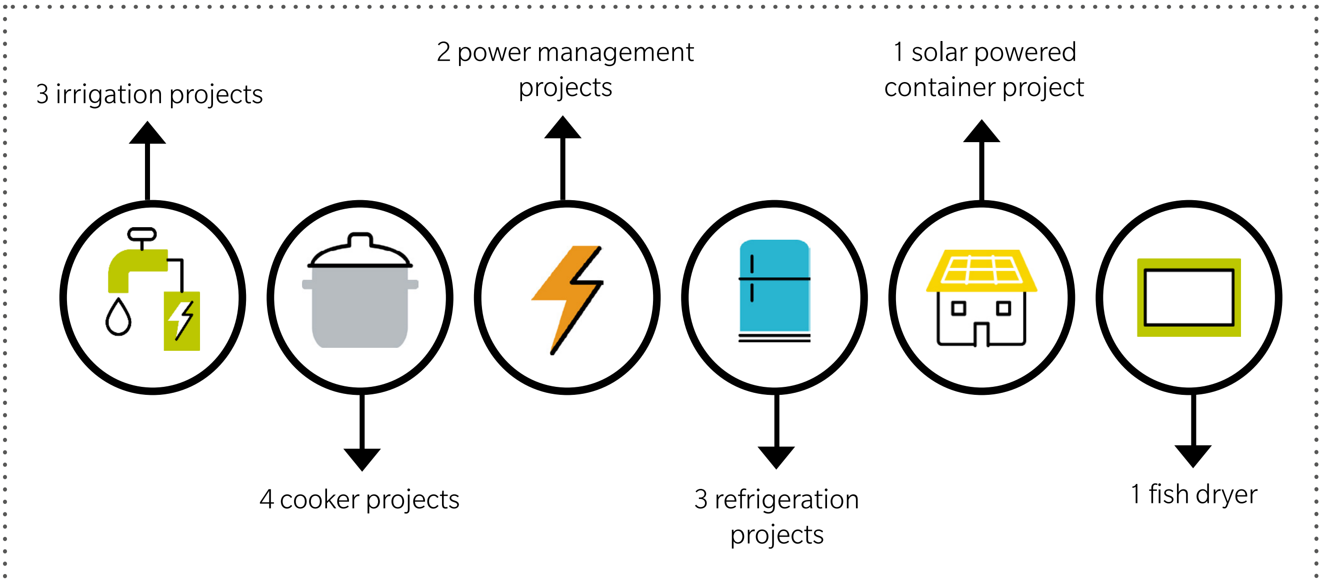
All students participating in the Efficiency for Access Design Challenge will be invited to a digital Grand Final in **June 2021**. The Grand Final will showcase student teams' projects and prototypes, and an interactive panel discussion with experts in the sector. It will also include an awards ceremony that presents teams with gold, silver and bronze awards.

> ! The Grand Final will take place in **June 2021**

Themes

In the Challenge, you can focus on any appliance, as long as you clearly identify the purpose and need that your design addresses. Last year, 78 students from nine universities in Bangladesh, Kenya, Uganda and the UK submitted 14 projects. You can read the project summaries **here**.

Last year's Efficiency for Access Design Challenge portfolio of projects



> **You can choose any theme and build on projects and ideas from previous years.**
> **You can find further inspiration in the next pages of the Challenge Brief.**

Agriculture

40% of the global population relies on agriculture as a main source of income, but many farmers lack energy access. Smallholder farmers who engage in manual agriculture experience inconsistent, weather-dependent yields compared to farmers with access to energy and agricultural appliances. From incubating eggs to milling grain, solar-powered agricultural appliances can help improve agricultural productivity for farmers living in off-grid areas.

SPOTLIGHT ON: SOLAR MILLS

Communities without energy access often mill grains by hand, a time-consuming task typically performed by women and children. For those with purchasing power, the only off-grid option is diesel-powered mills. This is a polluting, energy inefficient appliance that is not viable for sparsely populated and remote regions.

Milling requirements, preferences and demand vary geographically and seasonally, making the techno-economic case particularly challenging. However, milling has arguably the potential to become the most important productive use technology. This is because off-grid communities need continual access to milling services and it is a uniquely gender-segregated household task – women or girls are always the ones tasked with food processing (Solar Milling: Market Requirements, Efficiency for Access Coalition, 2020).

Recently developed solar mills offer a sustainable alternative, which consume less energy compared to diesel mills. They can also help increase productivity, and help farmers earn more income.

Research suggests that improvements could include:

- Enhanced motors for use in solar mills that increase energy efficiency and are affordable and durable e.g. improved brushless DC motors;
- Improved power electronics to improve efficiency;
- Adaptable machines for different purposes to enhance adaptability to different products;
- New applications relevant to specific local contexts.

EXAMPLES:

Solar Milling Pilot Highlights Important Consumer Voices

How Agsol brings power to poor farmers, examples of solar-powered products such as rice polishers and hullers, coconut scrapers and cassava scrapers.

There are nearly 500 million small-scale farmers worldwide. Research suggests that a 10% increase in agricultural productivity for smallholder farmers in sub-Saharan Africa could lead to a **7% reduction in poverty**. (Efficiency for Access)

Maize is the most commonly produced cereal in sub-Saharan Africa, accounting for **75%** of the continent's total annual harvest of **64 million tonnes** (2015). (Energy 4 Impact, 2019)

LEARN MORE

FAO, Costs and Benefits of Clean Energy Technologies, 2018

IDH, From smallholder to small business, 2016

In certain contexts, agricultural production and commercialisation of agricultural products could be **compromised by expensive and scarce fuel**. Irrigation systems, including solar water pumps, drip irrigation and water tanks, could help vulnerable farmers to overcome fuel related challenges. (FAO, 2020)

In Africa, about **40 billion hours** of off-grid women's unpaid time are spent on processing each year. Automating this process would free up a significant amount of time for women and girls, which could be put towards other productive or educational activities, and support women's empowerment. (Efficiency for Access Coalition, 2020)

SPOTLIGHT ON: SOLAR WATER PUMPS

Moving water using solar pumping systems offer a clean and simple alternative to diesel-driven pump sets. Solar water pumps are often used for farming in remote areas or where an alternative energy source is desired. If properly designed, they can result in significant long-term cost savings and increased agricultural productivity for farmers.

Research suggests that technological improvements could include:

- Remote monitoring systems, including low-cost sensors and controllers that improve efficiency of irrigation using the right amount of water
- Highly efficient motors – e.g. BLDC motors. Experts indicate that the cost for a BLDC motor can be 50 - 100% more expensive than a comparable brushed motor (Efficiency for Access Coalition, 2017)
- Improved saline water tolerance and filtration to increase durability of the pump
- Modularity and operational requirements such as easy to use, easy to service, and availability of spare parts

Solar Water Pump – Technology Road Map, Efficiency for Access Coalition, 2019

EXAMPLES:

Use and benefits of solar water pumps, Kenya, Tanzania and Uganda Consumer Research, Efficiency for Access Coalition, 2019

Low-Energy Inclusive Appliance Technology Summaries, Efficiency for Access Coalition, 2017)

LEARN MORE

Young Engineer's Guide to Solar Water Pump, Kushal Gautam, shared by Engineers Without Borders UK, 2019

Horticulture Value Chains and Potential for Solar Water Pump Technology in Tanzania, Efficiency for Access Coalition, 2019

Solar Water Pump Test Method, Global Leap, 2019

Cooking

The WHO reports that three billion people currently cook with polluting fuels, such as kerosene, coal or biomass, in poorly ventilated areas. Of that three billion, around 3.8 million people a year die prematurely from illness attributable to household air pollution. Manufacturers in the off-grid sector have designed super-efficient cook stoves, but cooking appliances could be more affordable, efficient and respectful of traditional cooking methods.

> Household air pollution causes non-communicable diseases including stroke, ischaemic heart disease, chronic obstructive pulmonary disease (COPD) and lung cancer. **(WHO, 2018)**

SPOTLIGHT ON: ELECTRIC PRESSURE COOKERS

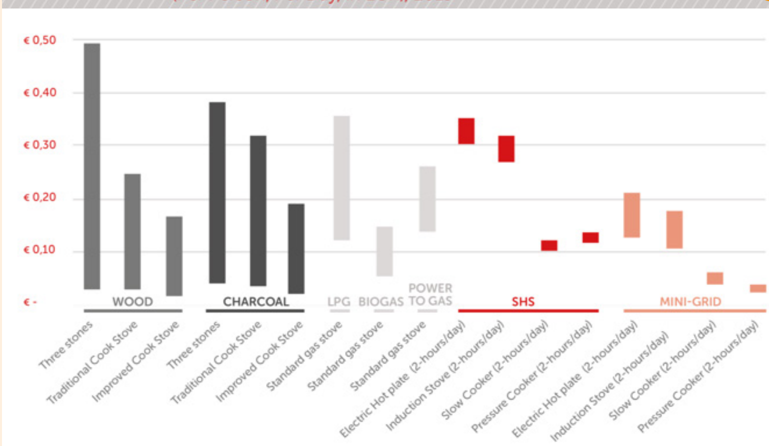
The Electric Pressure Cooker (EPC) or multicooker is an appliance that comprises an electric hotplate, pressure cooker and insulated hotbox with a fully automated control system. Over a one-hour cooking period, a pressure cooker uses approximately 25% of the electricity of an electric hot plate (Green Inclusive Energy, 2019).

Over a four-hour cooking period, the gains increase further. A pressure cooker is twice as efficient as a slow cooker, six times as efficient as an induction stove, and seven times as efficient as an electric hot plate (Green Inclusive Energy, 2019).

Research suggests that challenges include:

- Adapting EPCs to individual communities' way of life
- Integrating EPCs into prevailing cooking habits
- Limited ability to fry food
- Reliability issues including pressure sealing rings, component burn out and circuitry on button interface models
- Lack of manual heat control

FIGURE ES1: COST RANGES OF VARIOUS COOKING TECHNOLOGIES
(Per Person, Per Day, in EUR), 2019



(Source: Beyond Fire: How to achieve electric cooking)

EXAMPLES

The desirability of clean cooking in off-grid households

MECS' e-CookBook

Exploring User Personas

LEARN MORE

Open Access Resources, EIStove

Why Understanding Real Cooks is fundamental to going beyond fire, MECS

Solar electric cooking in Africa: Where will the transition happen first?

Refrigeration

Refrigeration provides a wide range of benefits, from improving health and productivity, to reducing domestic labour for women and children responsible for food preparation. It also enables income generating activities through the cold storage of drinks, food, and other perishable items for later sale. Essential for a sustainable agricultural sector, modern cold chain technology is still often out of reach in some markets due its prohibitive cost and high load requirements. Cold chains manage the temperature of perishable goods from farm or sea to table. This helps ensure quality and safety in the supply chain, reduce food loss, and enhance income-generating opportunities.

Research suggests that **$4 billion** worth of food is lost per year across Africa due to a lack of refrigeration. In sub-Saharan Africa, 50% of perishable fruit and vegetables can be lost. (Power for All, 2017)

SPOTLIGHT ON: FRIDGES

Most current household refrigerating appliances sold in off-grid settings are conventional, low price AC grid household refrigerators. These require inverters and/or charge controllers when used off-grid. Most refrigerators cost around five times the combined value of all other appliances in the typical solar home system and are uneconomical for users and system suppliers (Efficiency for Access Coalition, 2019).

Research suggests that improvements could include:

- Improving variable speed compressors and their controls
- Highly efficient motors
- Appliance and system controls including energy management, energy storage and Pay-As-You-Go (PAYG) compatibility
- Refrigerators with low environmental impact, which use low Global Warming Potential (GWP) refrigerants, for example
- Modular cooling system designs for local assembly
- Tools or software for technical sales to guide appliance selection based on technical parameters and appliance/power system compatibility checks
- Increasing cooling capacity and temperature lift at times of high ambient temperature and high humidity
- Technologies that improve the energy efficiency or effectiveness of ice-making or its end use for cooling, storage and transport of foodstuff
- Approaches that could lead to practical exploitation of Peltier or other solid-state cooling technologies

EXAMPLES:

JUMEME's Mini Grid model used in fish freezing in Tanzania

Solar-powered refrigerator providing cool clean water in Uganda

LEARN MORE

Off Grid Refrigeration – Technology Roadmap

Space cooling

Beyond basic comfort and productivity, access to cooling appliances such fans can enhance well-being and reduce mortality and morbidity during severe heat waves. Fans are in high demand among off-grid consumers, but mainstream fans still consume as much as 10 times the amount of electricity compared to lighting in the same setting.

SPOTLIGHT ON: FANS

Table, pedestal and ceiling fans are relatively simple to design and manufacture, which has made it easy for cheap, generic products to enter and dominate the market. Fans can account for a significant proportion of energy consumption. There are number of challenges in improving fans for off-grid settings, which include inefficient motors, and a lack of efficiency standards (Efficiency for Access Coalition, 2017).

Technological improvements could include:

- Improved motors for use in off-grid fans that increase energy efficiency and are affordable and durable e.g. improved BLDC motors
- Enhanced blade designs that increase air delivery and lead to overall service improvement
- Smart functionalities that can improve the overall efficiency, affordability, performance, or user experience, e.g. occupancy sensors and remote based functions
- Improved electronic controls for adjusting the speed of a motor, enhancing its efficiency
- Alternative approaches and designs for fans in space cooling, enhancing its usability

EXAMPLES:

Efficiency for Access Research and Development Fund Cooling Call Project Spotlights

The socio-economic impact of super-efficient fans in Bangladesh

In countries that are most vulnerable to high temperatures, over **1 billion** people face significant risks from extreme heat every year. (K-Cep, 2019)

A 2017 study predicts that by the end of this century, if carbon emissions continue on their current trajectory, **three-quarters of humanity will face deadly heat**. (WHO, 2015)

Using brushless DC motors, which use permanent magnets and are electronically commutated, instead of typical induction motors, **can improve ceiling fan efficiency by 50%**. Improving the design of fan blades can improve the ceiling fan efficiency further by 15%. (Phadke et all, 2015)

LEARN MORE

Chilling Prospects: Tracking Sustainable Cooling for All 2019, SEforAll

K-CEP: Why Cooling

Power management

The high cost of batteries is a significant barrier to the uptake of appliances in off grid settings. Distributors often oversize them to ensure a constant and consistent supply of electricity to large appliances like fridges. This leads to increased costs and an inefficient use of power. Improved power management can help reduce the size of batteries required, making larger appliances more affordable for people.

Solar home systems and mini-grids have limited power supplies. They have to balance generation and storage through batteries and a limited number of appliances can be run at any one time. Smart scheduling and balancing ensure that people have the services needed and that systems are used optimally.

Improvements could include:

- Systems that integrate different appliances or allow them to communicate to each other
- Widgets that can be included in a range of equipment so that they can connect to each other
- Lower cost embedded controllers and other components for implementation of connectivity/control protocols
- General data communication for appliances and power supply modules
- Smart batteries: collection and optimisation of data using machine learning to improve the overall system efficiency and performance

Healthcare

Safe and adequate environmental conditions in health care facilities are essential to protect and improve the health of patients, staff, visitors, and the wider community. These include the availability of water, sanitation, hygiene, energy and waste management, as well as personal protective equipment.

Clinical equipment needs for health service delivery in off-grid areas is particularly important in the context of the COVID-19 pandemic. This has raised awareness of the importance of electricity to health service provision awareness among many sector stakeholders.

The World Health Organization estimates that **295,000 women died during childbirth in 2017**, and that 86% of these deaths took place in sub-Saharan Africa and South Asia. With many women still giving birth by kerosene lamp or candlelight, LED lighting by itself can serve as a transformative medical intervention. (WHO Trends in maternal mortality, 2017)

Indicators of environmental conditions over almost 130,000 healthcare facilities showed that **50% lack piped water, 33% lack improved sanitation, and 39% lack hand washing soap.** Furthermore, 39% of the above healthcare facilities lack adequate infectious waste disposal, 73% lack sterilisation equipment, and 59% lack reliable energy services. (Environmental conditions in health care facilities, 2018)

SPOTLIGHT ON: HEALTHCARE

Reliable energy in health care facilities is essential for functional services. Intermittent electricity can create facility hazards and limit patient care. For example, sterilisation equipment cannot be operated, lighting is inadequate to perform procedures, and electrically powered tools for procedures cannot be used. Unreliable electricity also impacts the use of information technology and communications to inform decision-making. According to the 2020 Off-Grid Appliance Market Survey Report, the highest scoring clinic infrastructure technologies are LED room lighting, energy storage and backup, ICT equipment, water purifiers and water pumps.

Infrastructure improvements of the health care facilities could include:

- LED room lighting to provide services and procedures during the night and in unlit rooms
- Energy storage and backup that ensure appliances can work continuously
- Water pump to provide access to water on-premise
- ICT equipment to allow health practitioners to communicate with laboratories and external experts
- Water purifiers to ensure proper hydration for both patients and clinicians
- Medical waste and wastewater management to prevent the spread of infection in the wider community

Technological improvements on devices aligned with critical services provided by primary health clinics such as vaccination, diagnostic assessment and patient triage could include:

- Vaccine storage and transport system that ensure controlled temperatures and avoid risk of freezing
- Blood bank refrigerators with continuous power sources
- Oxygen concentrators as an important device in the treatment of COVID-19 patients
- Viral load testing equipment as a diagnosis tool
- Vital sign monitors as a basic tool for triage and clinical care
- Portable ultrasound machines as a tool to monitor pregnancy and reduce maternal mortality

EXAMPLES:

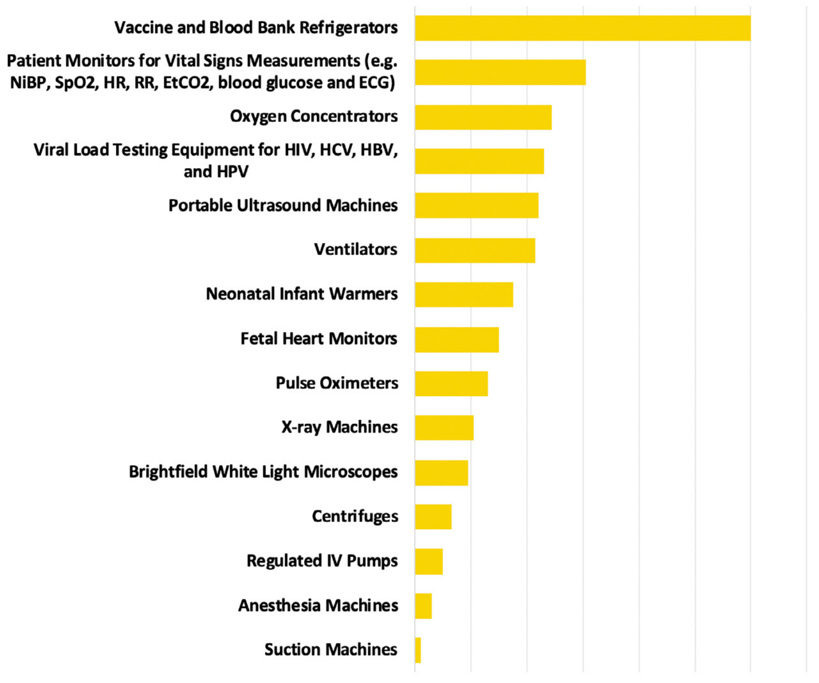
Innovative passive cooling options for vaccines, PATH, WHO, 2013

Modern Energy Services for Health Facilities in Resource-Constrained Settings, WHO 2014

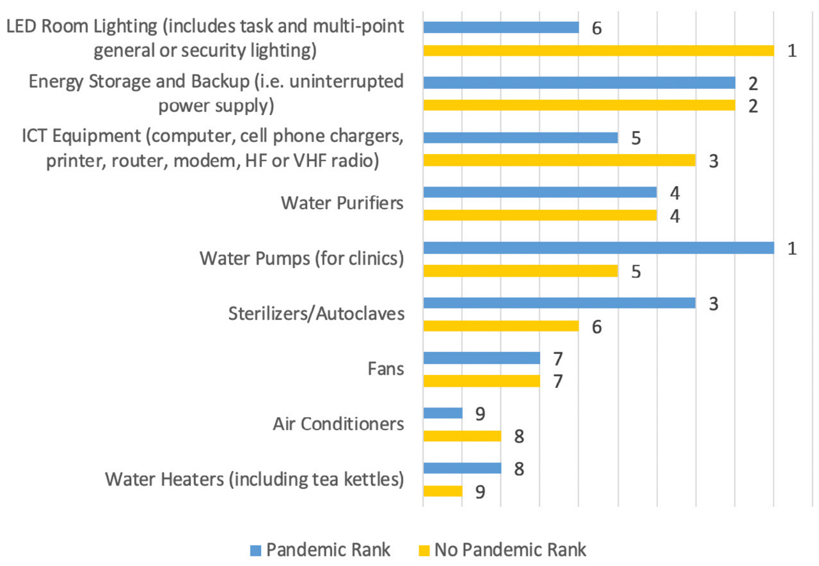
Preventing the degradation of vaccines and medicines also requires integrated, innovative and affordable systems for temperature control in rural areas and sometimes over long distances. The World Health Organization (WHO) estimates that **nearly 50% of freeze-dried and 25% of liquid vaccines are wasted each year**, with cold chain disruptions being one of the biggest reasons why. (**Monitoring vaccine waste at country level, WHO, 2005**)

These two graphics illustrate the importance of medical devices for health service delivery and a comparison of clinic infrastructure for general health service delivery versus COVID-19 Response. The 2020 survey included clinic infrastructure as well as medical devices required for provision of health services to provide a holistic perspective on clinic electrification needs. Source: 2020 Off-Grid Appliance Market Survey Report, Efficiency for Access Coalition, 2020.

Importance of Medical Devices for Health Service Delivery



Comparison of Clinic Infrastructure for General Health Service Delivery Versus COVID-19 Response



LEARN MORE

Interagency List of Medical Devices for Essential Interventions, FAO 2015

Limited electricity access in health facilities of sub-Saharan Africa, Global Health: Science and Practice, 2013

Other subjects

SPOTLIGHT ON: ELECTRIC REELING MACHINES

Resham Sutra has developed a range of affordable, mostly solar powered electric reeling machines that improve working conditions and create a predictable, dramatically higher income for over 9,000 silk workers.

SPOTLIGHT ON: WELDING

50% of young people aged between 15 and 24 years old are unemployed in sub-Saharan Africa. Mobisol's solar workstation runs welding machines, electric drills and saws – opening up the potential of entrepreneurship to more people.

SPOTLIGHT ON: EGG INCUBATION

Many houses in Africa keep chickens for eggs and meat. A hen can hatch about 20 to 30 chicks per year. However, using an incubator with the same hen could procure a farmer up to 300 chicks per year (Sure Hatch 2018).

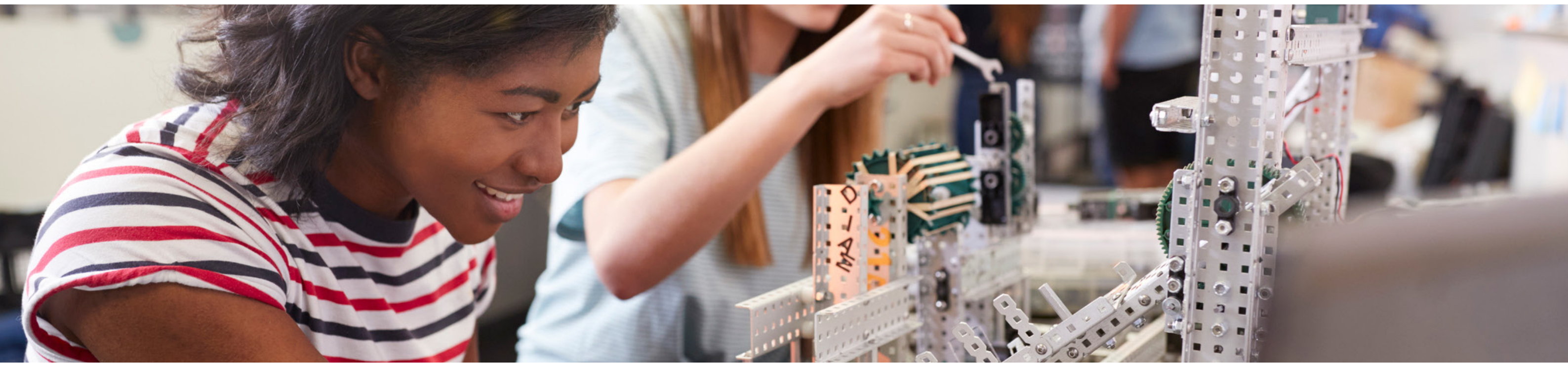
SPOTLIGHT ON: ICE MAKERS

Ice can be used to store freshly caught fish, or cool drinks. Ice making can be done on a small scale to make a living, particularly in remote and hot areas. (Off-grid Refrigeration Technology Road Map, 2019)

LEARN MORE

Sustainable Energy and Livelihoods - A collection of 50 livelihood applications, SELCO Foundation

Off- and Weak-Grid Solar Appliance Market: India, Efficiency for Access Coalition, 2020



Student support

The Efficiency for Access Design Challenge team will provide a curated programme of support to students, including:

Mentoring

The Efficiency for Access Coalition has an extensive network of contacts with specialists from the off-grid industry. Each student team will be introduced to a relevant industry mentor, who will guide and support your team throughout the development of your project.

Prototyping Grants

Grants to support your team in developing a prototype will be available throughout the year. This is a great opportunity to build on the project concepts developed by your team and develop these ideas from the design process. Prototype development is optional, though it may have an added benefit and value for your team.

This opportunity can help bring your project one step closer to market. It will also assist you in visually demonstrating your concept to the judging panel during your pitching session. The application for funding from your team for the prototype development grant should include a needs statement signed off by your academic supervisor and a detailed budget. More details and deadlines on the application process will be available once the Challenge starts in September.

Resources

You will have access to a comprehensive digital library of reports, market surveys and research papers from the Efficiency for Access Coalition. These resources will support your team in developing your concept note and solution. You will also have access to VeraSol-Certified Products Database, which is an off-grid appliance data platform. Industry partners will deliver thematic webinars throughout the year and previous year recorded webinars will also be available.

"The Efficiency for Access Design Challenge is building awareness and excitement for the off-grid industry where it really counts – in the minds of young students who are eager to apply their aptitudes to design solutions that can make a meaningful difference in off-grid markets."

Katherine Owens,
Head of M-KOPA Labs

M-KOPA SOLAR

"It was amazing to bring an entrepreneurial experience to my studies. Our project involved a lot of innovation, design thinking, uncertainty unlike structured academic projects, pushing us outside our comfort zone continuously. In the end, it was incredibly rewarding. For me, this made the experience very enjoyable and incredibly valuable."

Joris Simaitis,
Student,
University College London

"Participating in the Challenge has enabled me to realise how important the off-grid sector is in responding to the climate emergency we face in our world today"

Fredrick Amariati,
Student, Strathmore University

Learning and networking opportunities

The Efficiency for Access Design Challenge team is developing a programme of online workshops (kick-off and midway workshops), live webinars, career conversations and digital events to enhance learning and networking opportunities for you and your university departments. This will include sessions to help you better understand the off-grid context and ensure that end-users are at the centre of your design.

The career conversations will also allow you to engage with industry experts. This will be an opportunity for you to learn more about the off-grid industry and build relationships with industry leaders.

The Efficiency for Access Design Challenge team will use the concept note you submit to assess the specific needs of your team and adapt the planned activities accordingly.

Online discussion forum

Through the Efficiency for Access Design Challenge Forum, you will be able to contact other students currently participating in the Challenge, as well as students that participated last year. This platform offers you an opportunity to ask questions, collaborate, and share ideas with students from other universities in Bangladesh, Ethiopia, India, Kenya, Nepal, Uganda, and the UK. You will be able to connect with students working like you to accelerate clean energy access to provide affordable and efficient high performing appliances.

Assessment

You will work in teams to deliver design and innovation projects that focus on affordable and high-performing off-grid appliances and supportive technologies.

PROJECT SUBMISSIONS:

Your team will need to submit your project by the **16th April 2021**. It will consist of a 4000-word (maximum) report and a three minute video. Other supporting documentation e.g. posters or prototypes can be photographed or included in the submission, if deemed useful.

Your team will own the Intellectual Property of your work but will be required to give the Efficiency for Access Design Challenge team permission to use the research outcomes for a wider benefit. This will be achieved by you agreeing to license your work under Creative Commons license CC-BY 4.0.

Stages of assessment

The project submissions will be evaluated in two stages and informed by the assessment framework below.

First stage:

A review panel, comprised of sector experts, will review the submissions (including the video) and provide feedback to your team in **May 2021**.

Second stage:

A judging panel, comprised of funders, industry experts and investors in the sector, will assess your team's project submission in **June 2021**.

The Grand Final:

The last stage of the competition, the Grand Final, will be held online in **June 2021**. All students and universities participating in the Efficiency for Access Design Challenge will be invited to the Grand Final. The Grand Final will include many opportunities for networking between students and specialists from the off-grid industry and the chance to showcase some of the submissions from the year. It will also include presentations from off-grid industry experts and engaging panel discussions. In addition, many experts and investors from the sector will also be invited. The Grand Final will include a prize giving ceremony to award teams with gold, silver and bronze prizes.

"The Efficiency for Access Challenge is a fantastic idea, engaging students in project-based learning to address the challenges of the next generation of appliances while partnering with an impressive range of industrial partners."

Jonathan Bowes,
Student,
University of Strathclyde

University of Strathclyde

Assessment framework

The assessment framework below provides guidance on what the reviewing and judging panels will be looking for in your solution. It should help your team to structure your project submission. Regardless of the selected appliance, your team should demonstrate how your solution addresses a need and represents an improvement on existing alternatives. Depending on your solution, some criteria may not be applicable. All nine criteria weigh the same and each will be scored 1 to 5.

SCORING (1-5): 1 2 3 4 5

INNOVATION How does your design improve on solutions that are currently available to your target end-user?

Judges will want to see that you have demonstrated and understood the technological context that you are targeting, and that you have gone through a well-informed design process to improve on solutions currently available to the end user.

What is the potential of your design to improve energy efficiency compared to existing alternatives? Consider how you define energy efficiency (energy used per service provided) and what the baseline is for comparison.	**Potential to improve efficiency**	Poor	Moderate	Strong
What is the potential of your design to reduce production costs compared to existing alternatives? Consider materials used, price of components and cost of assembly.	**Potential to reduce production cost**	Poor	Moderate	Strong
What is the potential of your design to improve usability compared to existing alternatives? Consider its ease of use, reliability and safety.	**Potential to improve usability**	Poor	Moderate	Strong
Is your design improving the environmental impact throughout its lifecycle compared to existing alternatives? Consider materials used, reparability and end of life.	**Potential to improve environmental impact**	Poor	Moderate	Strong

SOCIAL IMPACT What difference does your design make to people's lives?

Judges will want to see how you have researched the needs of your target end-user. They will want to understand why you think your design will improve peoples' lives, and how you have considered social inclusion and equality in your solution.

How well has your target end-user been considered in the design?	**Research and understanding of end user**	Poor	Moderate	Strong
What is the likely potential of the design to improve quality of life for your target end-user?	**Potential to positively impact the target end user**	Poor	Moderate	Strong
How well has your design considered the SDG commitment to '**Leave no one behind**'? In particular, consider gender equality and disability inclusion.	**Research and understanding**	Poor	Moderate	Strong

SCALABILITY How feasible is it that your design could get to market at scale?

Judges will want to see that you have considered the business case. Including considering the market opportunity, including market size, for your solution, and demonstrated how people will be able to access and afford this.

How well have you considered the potential market for your product? Consider the target customer, size of market and customer value proposition.	**Research and understanding of market**	Poor	Moderate	Strong
How well have you considered how people will be able to access and afford your product? In your business case, consider affordability, potential customer payment models, existing supply chains, distribution channels and local partners.	**Research and understanding of accessibility and affordability**	Poor	Moderate	Strong

EFFICIENCY FOR ACCESS

Supported by:

ENGINEERS WITHOUT BORDERS UK

You will find more details and information on the Efficiency for Access Design Challenge web page.

You can access the Efficiency for Access Design Challenge Forum here.

Contact Us

If you have any question about the Efficiency for Access Design Challenge, please contact Efficiency for Access Design Challenge team at:

eforachallenge@est.org.uk

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