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SUSTAINABLE ENERGY

Despite rapid advances in technology, millions of people do not have electricity in their homes, schools, medical centres or businesses.

In addition, almost half of the world's population rely on wood, charcoal or crop waste for cooking and heating. This exposes them to toxic smoke that can cause many serious illnesses.

This edition of *Footsteps* explores how access to sustainable energy can improve people's incomes, health, safety, education and day-to-day lives. In particular, it shows how small-scale, renewable energy solutions can be cheaper, more reliable, quicker to install and less polluting than extending a centralised energy grid.

Sustainable energy comes from sources that are constantly being renewed such as the sun, wind and water. It does not harm people or the environment, and it does not contribute to climate change.

Truly sustainable energy is affordable, accessible, safe and reliable for all community members, not just those with the greatest wealth and influence.

Jude Collins – Editor

Cover photo: Lameck Chibago in Tanzania carefully looks after the solar panel on the roof of his house. Photo: Tom Price – Ecce Opus/Tearfund

By Mike Clifford

ENERGY FOR ALL

Energy is important in almost every area of life including transport, healthcare, industry, education, communication, lighting, security, cooling, heating and cooking.

However, despite significant progress, Sustainable Development Goal 7 – 'Ensure access to affordable, reliable, sustainable and modern energy for all' – is a long way from being achieved by the target year of 2030.

The latest figures from the United Nations show that 790 million people – about one in ten of the world's population – are still living without electricity. Hundreds of millions more have a limited or unreliable supply.

In addition, almost half the world uses wood, charcoal or crop residues as cooking fuel. This results in the degradation of forests and health problems caused by smoke.

The World Health Organization estimates that smoke in homes causes up to 4 million premature deaths each year, largely from pneumonia in children but also from lung diseases in adults. Women and children are particularly at risk because they tend to spend more time in smoky kitchens than men.

Other potential side-effects of cooking with smoky fuels include low birth weights and vision loss due to cataracts. There are also risks of severe burns when cooking on an open fire.

Many people without electricity use candles and kerosene lamps for light. Kerosene can cause impaired lung function, asthma, cancer and increased susceptibility to infectious diseases such as tuberculosis. Other kerosene hazards include poisoning, fire and explosions.

In many countries the energy situation is improving rapidly as technology improves and the cost of renewable energy decreases. But in sub-Saharan Africa and parts of Asia, progress is much slower, particularly in remote, rural areas. While some governments have ambitious plans to connect everyone to energy grids, small-scale, off-grid solutions are likely to be quicker to implement, more cost-effective and more sustainable for many rural communities.

CLIMATE CHANGE

About 80 per cent of the world's energy is currently supplied from fossil fuels such as oil, natural gas and coal. As well as creating pollution which is damaging to health, the burning of fossil fuels is the largest global source of carbon dioxide, a major driver of climate change.

Climate change is already pushing many vulnerable communities further into poverty as the seasons become more unpredictable and floods, storms and periods of drought become more severe. Continued use of fossil fuels will make this worse.

To reduce global emissions of carbon dioxide and other harmful gases it is essential that we shift our energy systems away from fossil fuels towards renewable sources of energy such as hydropower, solar power, wind power and biogas.

However, 'renewable' does not necessarily mean 'sustainable'. Badly planned, non-inclusive renewable energy projects can have severe social and environmental impacts. For example, the construction of some large hydroelectric dams has caused excessive environmental damage and the displacement of communities.

PEOPLE-CENTRED

Renewable energy solutions provide an opportunity to tackle both climate change and poverty. In many areas they are already becoming the cheapest long-term options, opening up new business opportunities and reducing reliance on diesel generators, firewood, disposable batteries, candles and kerosene.

Since hydropower arrived in her village, Shanti has been able to expand her tailoring business by working after dark. She can also use an electric sewing machine and an electric iron. Photo: Kit Powney/Tearfund

However, it is important that these solutions do not cause inequality in communities, or make existing inequalities worse.

RENEWABLE ENERGY SOLUTIONS PROVIDE AN OPPORTUNITY TO TACKLE BOTH CLIMATE CHANGE AND POVERTY

Lucas in Tanzania can now keep his shop open after dark because of the solar panel and light that he was able to buy using a low-interest loan from his self-help group. Photo: Tom Price – Ecce Opus/Tearfund

For example, if only the wealthier families in a community can afford a solar power system, the other families will not have the same opportunities to study, work and socialise in the evenings, leaving them increasingly at a disadvantage. Likewise, if the needs and aspirations of women are overlooked, they may find themselves working longer hours than before in order to complete additional domestic and income-generation tasks.

The most successful sustainable energy initiatives make it a priority to listen to people's views and encourage the full participation of everyone. In this way, empowering and inclusive energy solutions can be found which lead to many new opportunities, and healthier and more resilient communities.

Mike Clifford is an Associate Professor in the Faculty of Engineering at the University of Nottingham, UK. His research interests include appropriate and sustainable technologies, particularly cookstoves for use in low- and middle-income countries.

Email: mike.clifford@nottingham.ac.uk

DEFINITIONS

CLIMATE CHANGE
A large-scale, long-term change in the earth's weather patterns or average temperatures due to a combination of natural causes and human activities.

Naturally occurring gases form a layer around the earth that traps heat and keeps the planet warm. These are called **greenhouse gases**.

In the mid-1800s humans began to burn fossil fuels. This produces energy, but it also releases greenhouse gases such as carbon dioxide, methane and nitrous oxide. There are now more of these gases in the atmosphere than there should be, and too much heat is being trapped. This is causing the planet to heat up, resulting in environmental damage and more unpredictable weather, eg storms, heavy rain and periods of drought.

FOSSIL FUELS
Fuels such as coal, oil and natural gas, formed from the fossilised, buried remains of plants and animals that lived millions of years ago. Fossil fuels are **non-renewable** sources of energy because they will run out one day and cannot be replaced. They produce large quantities of carbon dioxide and other greenhouse gases when burnt, contributing to climate change.

ENERGY GRID
Energy generated in power stations and transported around a region or country using a network of electricity cables or gas pipes.

RENEWABLE ENERGY
Energy from sources that are constantly replenished and do not run out. This includes solar, wind and hydropower. It also includes **biogas**: a fuel produced by the breakdown of organic matter such as food scraps and animal waste. Firewood is renewable if new trees are planted to replace the ones that have been cut down.

SOLAR POWER SYSTEM
Equipment that supplies power by means of photo-voltaic solar panels that absorb sunlight and convert it into electricity. The system may include a battery to store the electricity and an inverter to convert it into a usable form.

SUSTAINABILITY
Meeting today's needs without compromising the ability of future generations to meet their own needs.

SUSTAINABLE DEVELOPMENT GOALS
A set of 17 goals to end poverty, fight inequality and injustice and tackle climate change by 2030. The goals were adopted by most nations of the world at the UN Summit for Sustainable Development in 2015.

By Benita Simón Mendoza

BIBLE STUDY

HOPE FOR CREATION

The beauty of Lake Atitlán in Guatemala reminds us of God's love for us, and for all of creation. Photo: Geoff Crawford/Tearfund

When you think about our planet and the impact that human activities are having on the environment, what makes you feel sad and angry? What specific activities can you identify that go against God's will?

Spend some time thinking about this while you read these words from Isaiah 5:8–10:

'Woe to you who add house to house and join field to field till no space is left and you live alone in the land. The Lord Almighty has declared in my hearing: "Surely the great houses will become desolate, the fine mansions left without occupants. A ten-acre vineyard will produce only a bath of wine; a homer of seed will yield only an ephah of grain."'

WARNING

Chapter 5 of Isaiah contains a series of warnings for a people who were straying a long way from the promise they had made to obey God's laws and serve him forever (Exodus 19).

The first warning is focused on the over-exploitation of the land, 'Woe to you who add house to house and join field to field till no space is left…' Through the prophet Isaiah, God was warning his people that their actions were far from his purpose for humanity, and for the earth.

When we read this text, it is not difficult to think of places today where some people continue to take field after field, damaging ecosystems and livelihoods.

In Guatemala, for example, a few years ago the northern part of the country was covered in tropical forests. Over time these forests became fields of pasture for cattle, then fields for sugar cane and African palm. The original inhabitants have been forced to leave or convinced to rent out their land, only to have it returned to them barren and useless.

This does not seem very different from the lament and warnings in the book of Isaiah.

HOPE

Beyond giving value to land, water, forests and animals because of their benefits for human beings, the Bible teaches that the whole of nature has its own value because it is God's creation. He sustains it and delights in it (Psalm 104).

So, in a way, these warnings for those who over-exploit and damage the land are hope for the whole earth. Because it means that God cares about what happens to the land, and he cares about what happens to us. He has a plan for restoration – a new heaven and a new earth – as described in Revelation 21.

God unfolds his history and that of humanity on a stage surrounded by everything that he has created. And God is very clear that, as created beings ourselves, made in his image, we have a duty to look after and care for all that he has made (Genesis 1:26–28; Psalm 8).

DISCUSSION QUESTIONS

- In what ways are people over-exploiting or damaging God's earth? What impact is this having on the air, land, water, plants and animals? What impact is it having on you and your community?

- How can you take action today to help protect and restore God's precious creation? This may include being careful not to waste resources such as energy, water and food. It may also include standing up against injustice and calling for change. Tearfund's *Advocacy toolkit* has many ideas for how you can do this. See page 18 for more details.

Benita Simón Mendoza coordinates the environmental programme of Centro Esdras (Ezra Centre) in Guatemala.

Centro Esdras is an interdenominational ministry focused on biblical growth, leadership development, church and mission.

Email: benita@centroesdras.org
www.centroesdras.org

By Prisca Kambole

LIGHTING CHURCHES AND VILLAGES

Thanks to their new solar-powered lights, Mervis's children are able to complete their homework in the evenings after school Photo: Partners for Life Advancement And Education Promotion, Zambia

Doing schoolwork at home was a huge challenge for Mervis's children because, after walking miles from school and getting home close to sunset, they had to rely on candles for light.

Mervis says, 'Not only are candles expensive, but the light is not good for schoolwork and there is always the danger of my younger children accidentally getting burnt.'

Only about a third of Zambians have access to electricity, and in rural areas this number drops to four per cent. As a result, many households depend on kerosene lamps and candles.

POWER FROM THE SUN

Light My Church Light My Village (LICLIV) was launched in January 2019. The goal of the project is to contribute to a reduction in damaging carbon emissions while increasing affordable access to off-grid renewable energy among households and local churches.

The solar power systems offered by the project include a solar panel, three high-power lights and a battery to store the electricity that is generated. The battery is suitable for charging mobile phones and other small appliances.

Many jobs have been created for young people in the communities who promote the products and provide follow-up support and maintenance. They also raise awareness about solar technologies to protect people from informal traders who sometimes offer low-cost, low-quality products that break after a few weeks.

LICLIV works with churches and self-help groups to ensure that the project is relevant, sustainable and of benefit to everyone. A flexible payment plan allows members of self-help groups to pay for a home solar power system over 12 months.

AFFORDABLE

Mervis was delighted when her self-help group decided to create a solar fund in addition to their existing savings scheme. Members can now buy solar equipment from the LICLIV project on credit and make monthly contributions into the fund until they have paid off their loan. This makes the products more affordable for all group members.

Lumbiwe, the group moderator, explains, 'The group serves as a guarantee, so if anyone defaults on the monthly payment, the group deducts the money from their savings. We are grateful to be able to buy the solar products under flexible terms.'

Mervis says, 'I now have three lights. One light is placed in the children's bedroom, one is outside to provide security lighting and the other one is in the family room. Once fully charged, the lights can work for more than eight hours. The children's school performance has improved because they can study in the evening.'

BUSINESS OPPORTUNITIES

Ted and his wife own a poultry farm but were struggling to make a profit because of the high cost of kerosene for lighting. The flexible payment plan allowed them to buy a solar-powered lighting system through their self-help group.

Ted says, 'The benefits have been enormous. The costs of the business have reduced significantly now that we no longer spend money on kerosene.

'I have extended the chicken run to increase bird capacity up to 400. Because of this our lives have improved and we are now able to make a profit and meet our household needs.'

Members of a self-help group with the lights they have been able to buy using a flexible payment plan. Photo: Partners for Life Advancement And Education Promotion, Zambia

LICLIV is implemented by a consortium of three organisations working in partnership with Tearfund: Chibuluma Baptist Church under the Baptist Convention of Zambia (BCZ), Prison Fellowship of Zambia (PFZ) and Partners for Life Advancement and Education Promotion (PLAEP).

Prisca Kambole is the Executive Director of PLAEP.

Email: priscakambole@plaep.org
www.plaep.org

By David Allan

WOMEN AND ELECTRICITY

Women often have a greater responsibility for household duties than men. This is particularly the case in rural areas, where many women spend a lot of time collecting firewood, preparing food, cooking and cleaning.

Access to electricity has the potential to reduce the time that women and girls spend carrying out these tasks, allowing them to engage in other activities such as education, enterprise and leisure.

However, rather than making assumptions about what women want, it is extremely important that women are asked what their priorities for electricity are, and that they are fully involved in the development and implementation of any electrification projects.

MYANMAR STUDY

Through a combination of focus groups, interviews and surveys, local organisation Spectrum asked women and men across 11 villages in Myanmar to discuss their thoughts about electricity.

The respondents observed five key advantages, and the women prioritised them in the following order: education, care-work, business, leisure, cooking.

1. EDUCATION

The women's primary desire for electricity related to its ability to improve their children's education, including allowing them to study at night. In contrast, only a quarter of men identified this as a key advantage.

2. CARE-WORK

A third of women and ten per cent of men mentioned care-work. Examples ranged from cleaning and ironing to looking after children's healthcare and hygiene needs. Many women said that public lighting would make it safer for them to take their children to the hospital at night.

3. BUSINESS

Among those who did not have electricity, 36 per cent of women and 54 per cent of men wanted to use it to start some form of business.

Most men wanted to start energy-intensive businesses such as carpentry, welding and printing. In contrast, the businesses women mentioned tended to build on activities they were already involved in such as agriculture or cooking food to sell. For many women the only resource required was the additional working time provided by lighting.

4. LEISURE

Both men and women saw leisure as a core benefit with more than a quarter saying they would enjoy watching television, listening to the radio, socialising and buying luxury goods such as cold drinks.

However, the survey also revealed that the use of electricity for leisure activities is often a benefit only available to the wealthy.

5. COOKING

The opportunity to stop using wood-based cooking methods is frequently seen as a particularly important benefit of electricity because it frees up time for other activities, improves health through reduced smoke inhalation and reduces deforestation.

However, while women spoke a lot about their desire for a light in the kitchen, very few said they wanted to use an electric cooker. Many felt that their meals would not be as high quality, or that electric stoves would not allow them to complete other chores at the same time as cooking.

DIFFERENT NEEDS

It is clear that women and men in Myanmar have different needs and priorities for electricity and this is likely to be the case in most, if not all, communities across the world.

It is therefore crucial that community members whose opinions are often overlooked (eg women, children and people living with disabilities) are fully involved in making decisions about electricity schemes and other forms of power such as biogas. Otherwise, the people who benefit the most are likely to be the most wealthy and influential members of society, leaving the vulnerable even further behind.

Many women spend a lot of time collecting firewood in Myanmar. Photo: Shutterstock/Spectrum

David Allan is Executive Director of Spectrum – Sustainable Development Knowledge Network – in Myanmar.

Dr Thomas McNamara led the community research team for this study. Visit learn.tearfund.org and search 'Women and electrification' to view the full report.

By Joel and Esther Chaney

MORE THAN BIOGAS

We travelled along dusty, bumpy tracks towards a remote farm in northern Tanzania. I had first visited the farm three years before, just after the construction of the family's biogas digester, and I was eager to see if it had made a difference to family life.

Biogas digesters turn organic matter, such as animal manure and kitchen waste, into a clean fuel that can be used for cooking. The biogas can replace, or significantly reduce, reliance on other fuel sources such as wood or charcoal.

SMOKE-FREE KITCHEN

We sat on the veranda overlooking the farm and Pastor Julius spoke with me about how well the biogas digester was working. Marsha, his wife, served us tea, freshly made on a stove powered by biogas from the digester.

Marsha showed us around her kitchen and I was struck by how different it was to my previous visit. Then, the walls had been black with soot and an open fire had filled the kitchen with eye-watering smoke. Now it was clean and tiled with a raised work surface.

'Biogas is better than firewood because it helps us to simplify our life and shorten the amount of time needed for cooking,' said Marsha. In Tanzania, some women and children spend four hours a day collecting firewood. This adds up to 1,460 hours (61 days) over a year.

'Another thing that is really good is now my husband comes into the kitchen and we can talk about the family,' Marsha continued. 'My husband does not like smoky kitchens, but now I can talk to him while I am cooking.'

Pastor Julius explained that he used to stay out of the kitchen because the smoke made his eyes water and in Maasai culture it is shameful for an elder to be seen crying. Now he enjoys spending much more time in the kitchen with his wife and the rest of the family.

It was quite an emotional moment as we stood chatting near the biogas stove while Marsha cooked a pot of green vegetables for us to eat later.

Pastor Julius with his biodigester and flourishing garden Photo: Tze-Hung Seeto/CREATIVenergie

BIOSLURRY

Walking out of the kitchen we went round the back of the house to see the digester itself. It no longer stood alone in the middle of a muddy plot of land but was surrounded by green leafy vegetables and banana plants.

In addition to producing cleaner fuel, biogas digesters provide a source of rich, organic bioslurry that can be used to improve soil structure, soil fertility and crop yields. Applying bioslurry to crops is more effective than using raw manure because the digestion process increases the availability of nutrients.

FEEDING THE DIGESTER

Holding a bucket in one hand and a shovel in the other, Pastor Julius led us round to his cow shed. He filled the bucket full of cow manure and led us back to the digester where he poured it into the mixing chamber, followed by

a bucket of water. He explained that he leaves the manure in the mixing chamber for a couple of hours to let the sunshine heat it up, before returning and allowing it to flow into the digester.

Pre-heating the manure like this helps the digester to maintain a warmer temperature which, in turn, speeds up the digestion process. Combining this with feeding the digester each day ensures that the family has a constant and reliable supply of biogas fuel for cooking.

Pastor Julius has covered his digester with a protective structure made of transparent plastic (the type of plastic used to make greenhouses). This helps to maintain a higher temperature inside the digester and protects it from being damaged by the sun, birds or animals. Digesters can also be covered by a tin roof, straw thatch or a concrete dome.

ABUNDANT LIFE

As we walked back towards the kitchen, we saw the pipe that carries biogas from the digester to the two-ring stove Marsha placed her saucepans on earlier.

Pastor Julius and Marsha spend a lot more time together now that there is no smoke in the kitchen. Photo: Tze-Hung Seeto/CREATIVenergie

Reflecting on our conversations I was so encouraged. The construction of the digester has not only resulted in greater yields of nutritious crops, a sustainable supply of cooking fuel and cleaner air in the kitchen, it has also enhanced the relationship between husband and wife. What a great example of biogas technology unlocking sustainable energy for abundant life!

Joel Chaney is a Co-Founder, Trustee and Innovation Director of CREATIVenergie and Esther Chaney is the Programme Coordinator.

CREATIVenergie is committed to unlocking sustainable energy for abundant life. The team works with local and international partners to find solutions to energy problems. Join one of their interactive webinars to find out more: www.biogas.eventbrite.co.uk

Email: hello@creativenergie.co.uk
www.creativenergie.co.uk

BITESIZE ENERGY EXCHANGE

Across sub-Saharan Africa, solar panels and biogas digesters provide clean and sustainable electricity and cooking fuel for people whose homes are not connected to national electricity or gas grids.

However, many families are unable to afford their own solar panels or digesters, excluding them from the opportunities and benefits that clean sources of energy bring. At the same time, some of their neighbours have more energy than they need: more solar power is generated than is consumed during the day; biogas systems continually produce gas and the excess is wasted.

After winning an Energy Catalyst award in 2019, CREATIVenergie and several international partners are working to develop a system that will allow the fair distribution of clean energy supplies.

Starting in Uganda, Tanzania and Rwanda, their Bitesize Energy Exchange (BEE) project aims to develop technologies to allow excess solar power and biogas fuel to be packaged, distributed and traded in small quantities.

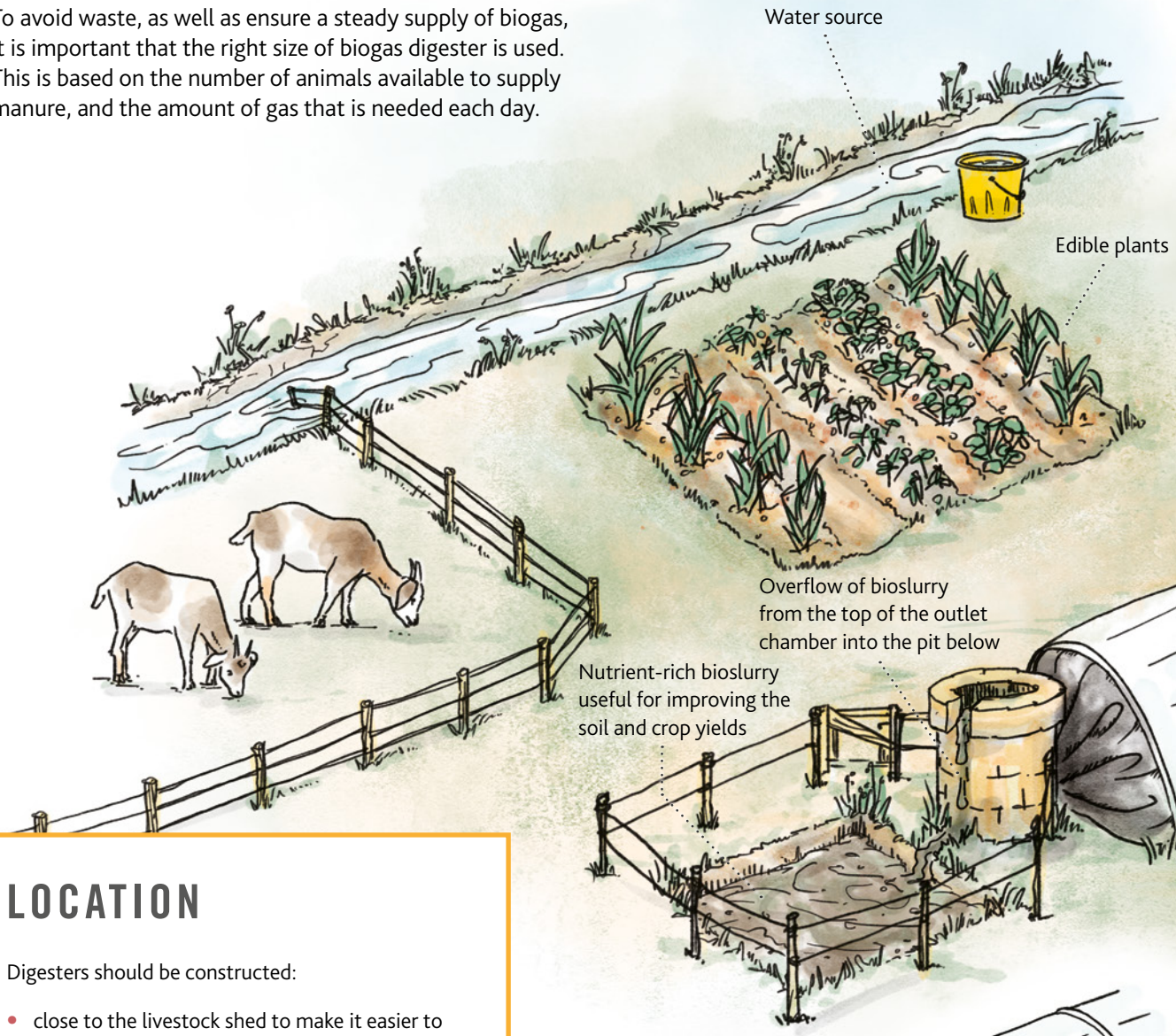
For example, surplus solar power can be used to charge portable batteries. These batteries can then be rented from an energy hub and later returned for recharging. Excess biogas can be packaged into safe, portable containers.

This will increase access to reliable supplies of affordable, clean energy for low-income families who are not able to generate energy for themselves.

HOW BIOGAS DIGESTERS WORK

Biogas digesters use animal manure to provide a clean and sustainable cooking fuel.

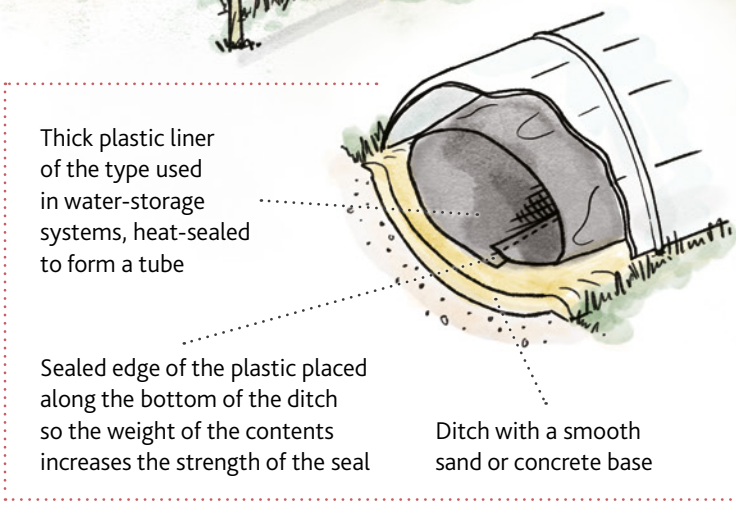
To avoid waste, as well as ensure a steady supply of biogas, it is important that the right size of biogas digester is used. This is based on the number of animals available to supply manure, and the amount of gas that is needed each day.



LOCATION

Digesters should be constructed:

- close to the livestock shed to make it easier to collect the manure and feed it into the digester
- close to a source of water so it can be mixed with the manure when adding it to the digester
- in an open location so the heat from the sun can speed up the digestion process
- not too close to trees because the roots can interfere with construction and the leaves cause too much shade
- close to the place where the biogas fuel will be used.

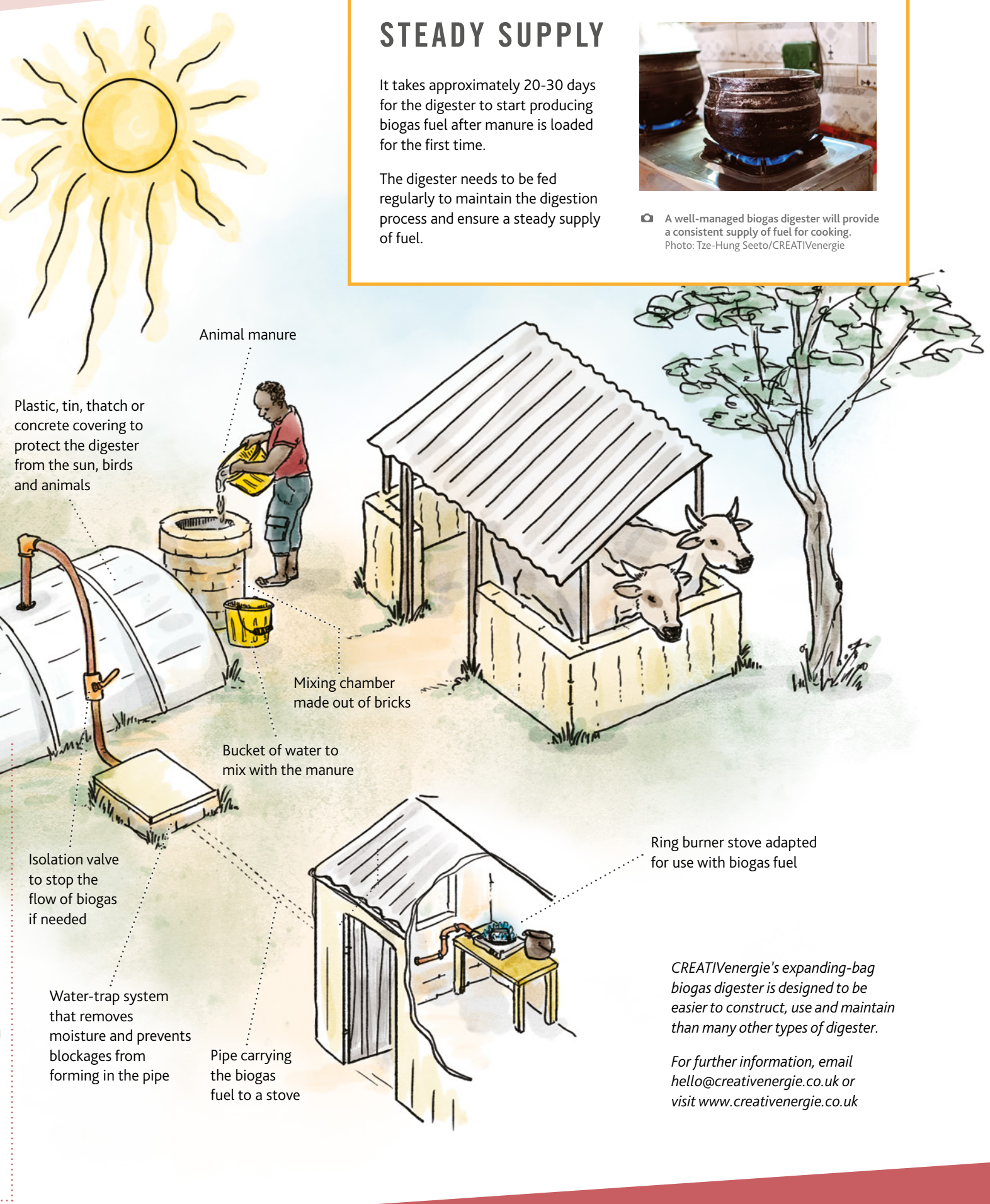


STEADY SUPPLY

It takes approximately 20-30 days for the digester to start producing biogas fuel after manure is loaded for the first time.

The digester needs to be fed regularly to maintain the digestion process and ensure a steady supply of fuel.

A well-managed biogas digester will provide a consistent supply of fuel for cooking.
Photo: Tze-Hung Seeto/CREATIVenergie



CREATIVenergie's expanding-bag biogas digester is designed to be easier to construct, use and maintain than many other types of digester.

For further information, email hello@creativenergie.co.uk or visit www.creativenergie.co.uk

By Benedikt van den Boom

INCLUSIVE ENERGY

Sustainable Development Goal 7 is straightforward: 'Ensure access to affordable, reliable, sustainable and modern energy for all'. The last two words are key. We can only achieve the goal of clean energy for all if we take into account the needs and hopes of the one in seven people across the world who are living with a disability.

The widespread, global replacement of fossil fuels with renewable energy will help to reduce climate change and its impact on the most vulnerable.

This is particularly important for people living with disabilities who may find it difficult to adapt to changes in the climate or cope with climate-induced natural disasters.

In addition, small-scale renewable energy systems can provide affordable electricity and biogas for communities that are not yet connected to energy grids.

This can open up new opportunities for people with disabilities to access education and training, find computer-based employment or start new small businesses such as sewing workshops.

It also allows the use of assistive devices such as electric wheelchairs.

The smoke from cooking fires can cause illness and disability by affecting people's lungs and eyes, or it can make existing impairments worse. Increased use of cleaner appliances such as biogas stoves or solar-powered cookers will reduce disability and contribute to better health for all.

Electric lights increase safety and security at night and reduce the risk of accidents caused by candles, kerosene lamps and open fires.

INCLUSIVE PLANNING

As increasing attention is given to sustainable energy initiatives and strategies, it is crucial that people with disabilities and their representative organisations are involved in all aspects of planning and decision-making. To help achieve this, project planners should:

- collect information on energy use, needs and the impact of climate change on individuals and communities, paying specific attention to disability, gender and age
- use this information to inform decision-making and advocate for the rights of people who are in danger of being overlooked
- make community meetings accessible for people with different needs and provide project information in multiple formats such as sign language, radio broadcasts and easy-to-read leaflets
- consider providing training to equip people with disabilities for new jobs, eg the maintenance of wind turbines or solar panels.

This will help to ensure that the benefits of affordable, reliable and sustainable energy reach everyone in the community in a just and inclusive way.

DISCUSSION QUESTIONS

- Are there people in your community whose energy needs are not being met, or whose opinions are frequently ignored when projects are being planned?
- If so, how can you help to change this situation?

For advocacy ideas and resources, please see page 18.

Electricity is allowing people living with cerebral palsy in Rwanda to learn new skills.
Photo: Marjan van der Lingen/Light for the World

Benedikt van den Boom is the Advocacy Coordinator at Light for the World, an international disability and development organisation.

Email:
b.vandenboom@light-for-the-world.org
www.light-for-the-world.org

By Peter Lockwood and Prakash Timalsina

THE POWER OF WATER

Water, flowing from the high Himalayan mountains, is one of Nepal's most important natural resources. The abundance of rivers and streams means the country has great potential for hydropower, and several schemes already provide electricity to people in Nepal's larger towns and cities.

Phul Kumari brings grain to a mill powered by water flowing from the micro-hydropower plant above. Photo: Kit Powney/Tearfund

However, the mountainous terrain and remote nature of many of Nepal's villages mean it is too technically difficult and expensive to connect everyone to the national electricity grid. As a result, many people in rural communities still rely on firewood for cooking and kerosene lamps and candles for lighting.

MICRO-HYDROPOWER

One effective solution is the installation of community-owned and operated micro-hydropower schemes in rural areas.

Malekhu Khola micro-hydropower plant was established in 2010 and provides electricity for about 260 households. Phul Kumari, who lives nearby with her family, says, 'Before the hydropower plant was constructed, the community was dark. We had to walk for several hours to Malekhu to get kerosene because there was no transport. There would be shortages of kerosene sometimes meaning the children could not do their homework in the evening.

'The kerosene lamp gave out a lot of smoke. We had to sit close to the lamp to read, to be able to see everything. The smoke would get into our noses and mouths. Now that we have the hydropower plant and lights, our children can easily study in the evenings and our health is better.'

NEW OPPORTUNITIES

As well as providing electricity for light, refrigeration and the charging of appliances, the micro-hydropower plant has allowed the community to develop new small enterprises including sawmills, tailoring workshops and poultry farms.

The water leaving the plant can be redirected into fields or vegetable patches for irrigation, or can be used to power small mills. These mills are used to hull rice, grind grains into flour and press oil from seeds. Some of the mills have been upgraded to run off electricity as well, making them more efficient.

Phul Kumari says, 'Before the mill, everything took us a lot of time to do. We used to get up at 4am to prepare the rice and maize using a *dhiki* or *janto* (traditional manual grinders). Only after we had finished doing this, at 6 or 7am, could we do other work. It was hard when the children were small.

'We now take the grains to the mill once a week and leave them there to be ground. We can then pick them up later. It saves a lot of time.

'Our children's education depends on the income we make. If we make enough money, we will send them to a good school. That is why I am interested in business. I am starting a poultry farm and I grow vegetables too whenever I have time.'

Ram Bahadur is the manager of the Malekhu Khola hydropower plant. He says, 'Having electricity has made a huge difference. Students can study when they want to and they can learn how to use computers. The health centre can keep medicines cool and it is safer for women delivering babies at night. We can use a rice cooker and fridge at home.

'Being able to watch television offers us a chance to see, hear and understand the world. Without electricity, we would not have made as much progress as we have. Electricity has resulted in positive changes across many areas of life.'

Prakash Timalsina is Project Manager and Peter Lockwood is Programme Advisor with United Mission to Nepal's Dhading Disaster Response Programme.

Email: umn@umn.org.np
www.umn.org.np

COOKING WITHOUT FIRE

Fireless cookers are a simple and effective way to reduce the amount of firewood, gas or electricity needed to cook a meal.

The food is partially cooked using a fire or stove. The covered pot is then placed in the fireless cooker where insulation keeps the pot warm and allows the food to carry on cooking.

As well as saving fuel, fireless cookers can reduce the amount of water used in cooking by a quarter. This is because water is prevented from evaporating, preserving nutrients and flavours.

Fireless cookers are also known as hay boxes, straw boxes, insulation cookers or retained-heat cookers.

HOW TO MAKE A FIRELESS COOKER

1. Prepare or make a basket, box or other container, making sure that it is big enough for both the cooking pot and the insulating material.

2. Line the inside of the container with strong fabric, leaving space for insulation to be placed between the container and the lining.

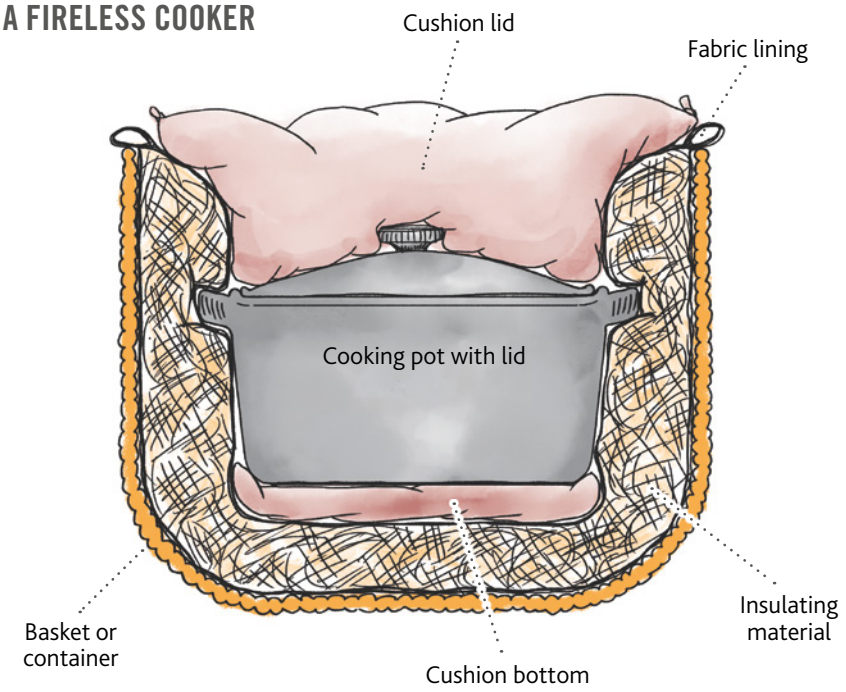
3. Tightly pack insulating material such as hay, sawdust, rice husks or recycled clothing between the container and the lining, ensuring that there are no gaps which would allow heat to escape.

4. Check that the cooking pot will fit snugly inside the insulated container.

5. Stitch the lining to hold the insulation in place, sewing the top of the lining to the outside of the container.

6. Add an insulated cushion to the bottom of the container and make a second cushion to put on top of the cooking pot.

A FIRELESS COOKER



For more information, visit www.answers.practicalaction.org and search 'fireless cooker'

Using a fireless cooker in Kenya.
Photo: Practical Action

HOW TO USE THE COOKER

- Using your normal stove, cook soft foods, such as bananas, for around three minutes and harder foods, such as beans and meat, for 20 to 25 minutes.

- Place the hot, covered pot in the fireless cooker and put the cushion on top so it fits as closely as possible.

- Allow soft food to continue cooking for about 25 minutes and harder foods to cook for two to three hours.

- Remove the pot of food and enjoy your meal!

WARNING

If the food is left too long in the fireless cooker at 50–60 degrees Centigrade it may result in the growth of harmful bacteria. To avoid this problem, make sure the food is cooked for long enough at a high temperature before it is placed in the fireless cooker as this will kill any bacteria. If in doubt, reheat the food to boiling point on your normal stove before eating.

MAKE A WINDMILL!

When the wind blows, you can see how powerful it is. It makes trees sway and the washing on the line dance. Sometimes it can cause damage, but most of the time it is just a normal part of everyday life.

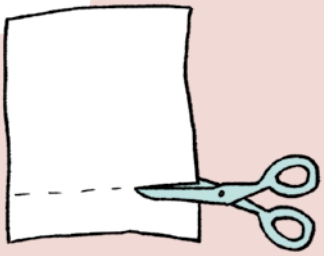
For hundreds of years, people have used windmills to provide power for pumping water or grinding grain. Now, they are increasingly being used to make electricity. The wind turns the sails, and this causes a machine called a generator to produce electricity.

Follow the steps below to make your own version of a windmill called a pinwheel. Have fun watching it turn in the wind!

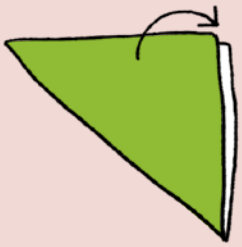
WHAT YOU NEED

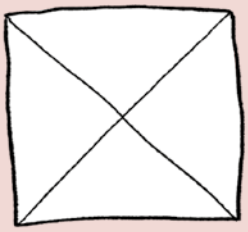
- A piece of paper
- Scissors
- A straight pin or thin nail
- A pencil or soft stick

1 Cut the piece of paper into a square.

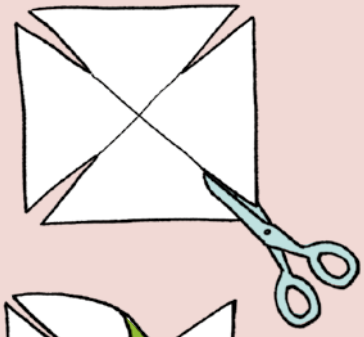


2 Fold the paper diagonally so it turns into a triangle and crease it lightly. Repeat this for the opposite direction as well. Unfold the paper and you will have a creased 'X' on the page.



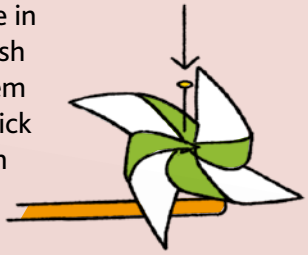


3 Cut along the creases, about halfway towards the middle of the paper. Be careful not to cut all the way.



4 Bend the left part of each corner into the middle so they overlap each other slightly.

5 Once all four corners are in the middle, carefully push a pin or nail through them and into the pencil or stick (you may need to ask an adult to help with this).



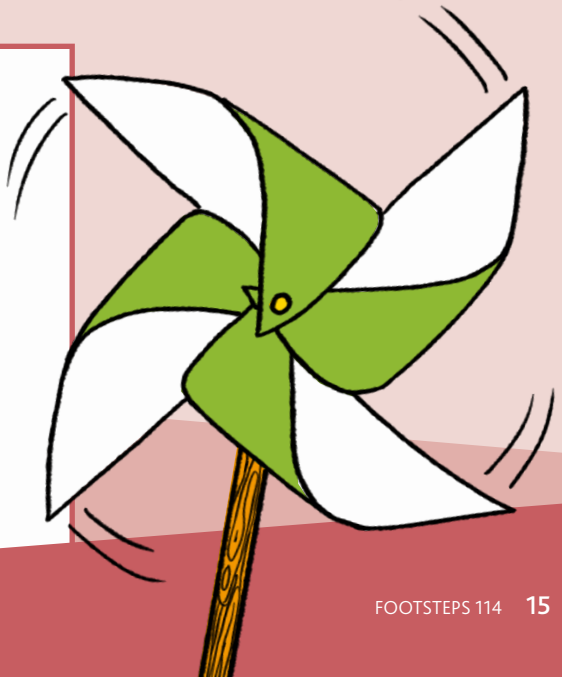
GOD MADE THE SUN AND THE WIND

Do you know what causes the wind to blow? It is actually the sun! As the sun heats the earth in different places, it causes air to move around in the form of wind.

Can you learn this Bible verse?

'Both day and night belong to you; you made the starlight and the sun' (Psalm 74:16 New Living Translation).

Spend some time thanking God for the wonderful world that he has created.



By Jono West

MOBILE POWER

Many people in rural Sierra Leone consider their mobile phones to be their most valuable and important assets.

As well as their use for business and personal communication, mobile phones make it possible for people to stay up to date with what is happening in the rest of the country and the world. They can improve personal safety in the event of an emergency and allow people to quickly respond to outbreaks of diseases such as Ebola and Covid-19.

However, few people have access to electricity at home so they have to travel, sometimes long distances, to charge their phones at generator-powered 'telecentres'.

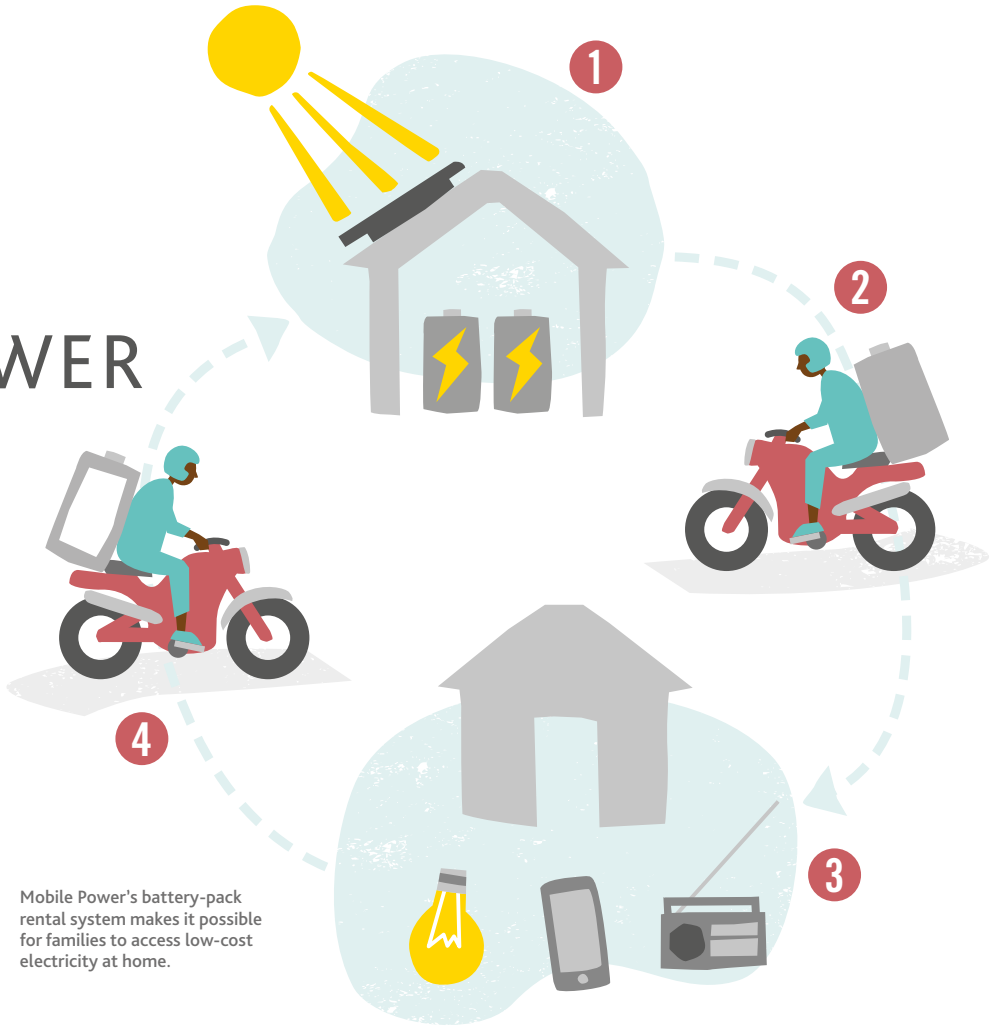
Phones left at these centres are at risk of being stolen, or batteries and memory cards may be switched for less valuable ones. In order to protect their phones, people often wait at the centres for many hours while they are charging.

In response to this, Mobile Power has developed a flexible battery-pack rental system that requires no deposit and no fixed payments. It works in areas with no network coverage and customers can pay with cash – an important benefit for people who do not have a bank account.

The battery-packs, known as MOPO batteries, contain enough stored energy to charge up to eight mobile phones or run the built-in high-power light for 16 hours.

MOPO batteries can also be used to power small appliances such as light bulbs, fans, radios and television sets.

There are four main steps: charge, distribute, use, return.



Mobile Power's battery-pack rental system makes it possible for families to access low-cost electricity at home.

1 CHARGE

Charging hubs are established in rural locations where there is a need for off-grid renewable energy. In consultation with the community, Mobile Power's team installs solar panels on a central building in the village. Alternatively, the hubs are connected to existing solar power systems in schools, clinics or water purification plants where they help to fund the maintenance of these systems.

> *'Mobile Power helps to maintain the solar panels on the school… It also makes the school's electricity available to poorer people in the community.'*
> Rev Kumah – School founder

The hubs are managed by teams of local men and women who receive training in the technical and financial aspects of the programme, as well as customer service and support.

The MOPO batteries are charged at the hubs, ready for rental.

2 DISTRIBUTE

After taking advice from community leaders, local distribution agents are recruited and trained. The agents deliver the battery-packs and are paid in cash by the customers (homes and businesses).

Once payment is received, the agents activate the MOPO batteries using a mobile phone application and credits they have previously bought using Mobile Money. Agents are paid a commission on the rental and return of battery-packs, encouraging them to circulate as many as possible.

> *'I used to travel two hours each way to charge my phone. I only did it once a week. Now I can get a MOPO battery with no waiting time. I have saved a huge amount of time and money.'*
> Musa Musari – Miner

3 USE

Each battery-pack has enough stored energy to meet basic household lighting and charging needs for 24 hours.

> *'The best thing about MOPO batteries is that I can charge my phone wherever I am without having to go to the telecentre. Now I can keep in touch with my family, and my grandchildren use the light to study.'*
> Fanta Kabba – Farmer

4 RETURN

After 24 hours the battery-pack automatically locks and the agent collects it and returns it to the hub for charging. The customer can hire multiple battery-packs each week, or just one if they prefer.

> *'My family rents one pack and we share the light for study between me and the younger children. Before MOPO batteries we could not study at night. I also use the light for safety, especially when going to the toilet at night.'*
> Roseline Kamara – Student

SAVING MONEY

Rural households in Sierra Leone often spend up to 20 per cent of their income on phone charging and the purchase of disposable batteries. The use of MOPO batteries can help customers save up to 75 per cent of these costs.

When asked what they are using these savings for, customers said they are buying more or better food, investing in businesses, paying school fees and using the money for leisure activities.

Jono West is Co-founder and Chair of Mobile Power Ltd.

Mobile Power aims to make solar power debt-free and affordable for low-income off-grid communities.

Email: jono@mobile-power.co.uk
www.mobile-power.co.uk

CASE STUDY: EMPOWERING WOMEN

One of Mobile Power's goals is to provide business opportunities for both women and men, but the local teams were struggling to recruit and retain female agents.

Discrimination and concerns about safety meant that community leaders almost always recommended men rather than women for the role, despite a high level of unemployment among women. One community chief stated that 'women are not serious', implying that they would not be able to make a success of the business.

To try to find a solution, in partnership with World Hope International, Mobile Power engaged the services of a Gender Equality Field Officer, Bintu Kanneh. Bintu encourages community leaders to promote the recruitment of female agents and helps to provide training in the technical aspects of the role, as well as safety and business skills.

Bintu coaches the women, pointing out their strengths and also areas for improvement. She believes in them and wants to see them succeed. She encourages the women to work as a team and to support each other. She does this through regular phone calls, visits to their different communities and WhatsApp communications.

Checking the MOPO batteries at a charging hub. Photo: Matt Miller/OneSixOne

HAWA

Hawa, a young woman of 22, is determined to make a success of her business so she can pay for her school exams. She will then be able to go to college. Hawa has 75 MOPO batteries that she can rent out daily. If all are rented out, she makes a daily profit of 75,000 Leones (7.5 USD).

Hawa is regularly meeting her targets and Bintu is very impressed by Hawa's abilities and determination. She says, 'As women, we should help and push each other. The chief rejected Hawa because he said she is "not serious". Now she is one of my best agents!'

World Hope International works to alleviate poverty by providing opportunity, dignity and hope.

www.worldhope.org

RESOURCES BOOKS • WEBSITES • TRAINING MATERIAL

PREVIOUS FOOTSTEPS

- FOOTSTEPS 110: Farming for the future
- FOOTSTEPS 108: Living with disability
- FOOTSTEPS 107: Waste
- FOOTSTEPS 105: Land rights
- FOOTSTEPS 103: Entrepreneurship
- FOOTSTEPS 99: Climate change

Download from **learn.tearfund.org** or contact us to order paper copies in English, French, Portuguese or Spanish.

POWERING PAST OIL AND GAS

This briefing paper, published by CAFOD, Tearfund and Christian Aid, examines the relationship between oil, gas and poverty, as well as the key things that need to be considered when transitioning to low-carbon development. Download from **learn.tearfund.org**

ADVOCACY TOOLKIT

By Joanna Watson

A comprehensive, practical and accessible guide to the theory and practice of advocacy. Download from **learn.tearfund.org** or contact us to order paper copies in English, French, Portuguese or Spanish.

PIONEERING POWER

This report, published by the Overseas Development Institute and Tearfund, examines the challenge of how to bring power to more than 1 billion people who live without electricity. Download from **learn.tearfund.org**

WHY ADVOCATE ON WASTE AND A CIRCULAR ECONOMY?

By Julia Kendal

This booklet sets out why advocacy on waste is important and suggests strategies for individuals and organisations to use at local and national level.

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ENVIRONMENTAL SUSTAINABILITY – A ROOTS GUIDE

Edited by Rachel Blackman and Isabel Carter

This guide discusses how projects, organisational practices and lifestyles can be made more environmentally sustainable.

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LIVE JUSTLY

Edited by Jason Fileta

A series of in-depth scriptural and practical studies covering several key areas including advocacy and creation care. The global edition was published in 2017 by Micah Challenge USA and Tearfund.

Download from **learn.tearfund.org** or contact us to order paper copies in English, French, Portuguese or Spanish.

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answers.practicalaction.org
Practical information on all aspects of development, plus the opportunity to submit questions to technical experts.

biogas.eventbrite.co.uk
Join one of a series of online webinars organised by CREATIVenergie and learn about biogas fuel and expanding-bag biogas digesters. Visit **eepurl.com/dq20PT** to sign up to receive CREATIVenergie's digital newsletter.

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SOLAR POWER IN YEMEN

With diesel and petrol supply interrupted by the conflict, many Yemenis have started using solar power systems to generate electricity. However, because of a lack of knowledge and limited experience with solar, many people end up with systems that destroy batteries, are inefficient, break down and frustrate their owners. This is reducing acceptance of the technology.

To help address this, Tearfund's partner is taking solar training to remote urban and rural communities. Students receive ten days of hands-on training in design, installation and maintenance of battery-based solar power systems.

One graduate of the course said, 'As a female, people in my village could not believe, at first, that I could work on the installation of solar panels. This gave me greater confidence that I can successfully achieve difficult things.'

The students also learn how to build inexpensive solar cookers from cardboard, aluminium foil and recycled satellite dishes. One of the top energy needs in Yemen is fuel for cooking, but firewood is scarce and bottled gas is expensive and difficult for people to get hold of. Solar cookers, even when used for only one meal each day, can cut cooking fuel costs by 30 per cent or more.

Course participants show how the foil-covered satellite dish of their simple solar cooker reflects the heat of the sun onto the cooking pot suspended above it. Photo: Tearfund's partner

A member of Tearfund partner staff says, 'It is extremely important that Yemenis have a positive experience with solar energy systems so that when the conflict ends and access to diesel and petrol is restored, they will continue to use solar to provide for their energy needs.'

AN EXCITING ANNOUNCEMENT!

We are delighted to announce that, in partnership with Arukah Network, *Footsteps* is now a regular contributor to the successful *How to build community* podcast and radio show.

The first joint episode was broadcast in February 2021. It brought together *Footsteps* contributors from Guatemala, Kenya, Iraq and the USA to talk about how churches and communities can help support the mental health of young people.

The aim of the podcast is to explore different community issues by giving people the opportunity to talk about things they are passionate about. We hope that listeners will be inspired and encouraged.

You can listen to all episodes of *How to build community*, free of charge, by visiting **learn.tearfund.org** and searching for 'podcast'.

Please write to: The Editor, Footsteps, 100 Church Road, Teddington, TW11 8QE, UK

publications@tearfund.org facebook.com/tearfundlearn

FOOTSTEPS

ISSN 0962 28619

Featuring practical solutions to development challenges, *Footsteps* magazine inspires and equips people to work with their local communities to bring positive change.

Footsteps is free of charge to grassroots development workers and church leaders. Those who are able to pay can buy a subscription by contacting the Editor. This enables us to continue providing free copies to those most in need.

Readers are invited to contribute views, articles, letters and photos.

Footsteps is available in French as *Pas à Pas*, in Portuguese as *Passo a Passo* and in Spanish as *Paso a Paso*. It is also available in Hindi.

Editor Jude Collins

Tearfund, 100 Church Road, Teddington, TW11 8QE, UK

Tel: +44 20 3906 3906
Fax: +44 20 8943 3594

Email: publications@tearfund.org
Website: learn.tearfund.org

Translations Editors Carolina Kuzaks-Cardenas, Kaline Fernandes, Alexia Haywood, Helen Machin

Editorial Committee Barbara Almond, María Andrade, J Mark Bowers, Dickon Crawford, Rei Crizaldo, Mike Clifford, Paul Dean, Helen Gaw, Ted Lankester, Liu Liu, Roland Lubett, Ambrose Murangira, Rebecca Weaver-Boyes, Joy Wright

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Tearfund is a Christian relief and development agency working with partners and local churches to bring whole-life transformation to the poorest communities.

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INTERVIEW

FROM E-WASTE TO ELECTRICITY

Young people at Jos Green Centre learn how to make and fit solar power systems. Photo: Ben Osawe/Tearfund

Ben Osawe is Tearfund's Advocacy Manager based in Jos, Nigeria. Here he explains how a local project is helping to solve the growing problem of electronic waste (known as e-waste), while at the same time creating jobs and a sustainable source of electricity.

How did this project start?

In 2015 we invited some young people to an evening of music which included a talk by a well-known environmental activist. The aim was to introduce the young people to environmental issues and encourage them to think about their response.

Those who attended the event were asked if they would like to study a course called *Live Justly*. This course covers ten key areas including advocacy, prayer, biblical justice, generosity, relationships and creation care. The studies are designed to help young people learn how to live justly at church, at work and in their communities.

Before the course had even finished the young people were asking for more training! They wanted us to equip them with the advocacy tools they needed to build a movement. Tearfund provided this training and the young people formed the Jos Green Centre.

THEIR MOTTO IS 'BROKEN THINGS MADE WHOLE'

Their motto is 'Broken things made whole' and they are united around a vision for Nigeria in which the poor have enough and the natural world is protected.

What is Jos Green Centre doing now?

Jos Green Centre has become a hub for eco-entrepreneurship: businesses that aim to operate sustainably and help to solve environmental problems. A lot of their initiatives are based on a way of thinking called the 'circular economy'.

Our current way of doing things is linear: we take natural resources, make items, use them and then throw them away. At this end point all the energy, water and materials used in making the items are thrown away too.

The circular economy keeps resources in use for as long as possible. Many items such as computers, phones and other electrical goods can be repaired or the parts reused for something else when they break. This creates job opportunities and reduces damaging waste.

Can you tell us about the e-waste project?

By recycling e-waste into solar units and batteries, the young people are making renewable energy more accessible for people living in poverty and reducing the use of fuels such as kerosene and diesel. They are also providing training and new opportunities in an area where youth unemployment is very high.

For example, Tina is a hairdresser but she was unable to run her salon properly without electricity. In the end she bought a generator, but the cost of running it was too high and it was impossible for her to make a profit.

She attended a training course at Jos Green Centre and learnt how to make and fit a solar power system, which she then installed on the roof of her salon. Now her salon is the only one in the area with reliable electricity and she attracts many more customers each day. She no longer needs the generator and she uses the money that she used to spend on diesel to buy beauty supplies for her business. She is now earning enough to save and plan for the future.

At the moment Nigeria produces 1.1 million tonnes of e-waste each year. Globally, this figure is 50 million tonnes. Projects like this have the potential to dramatically reduce this level of waste with multiple environmental, economic and social benefits.

Jos Green Centre won a Green Heart Hero Award for this project from The Climate Coalition and its work has led to changes in local government environmental policy and practice.

Email: benjamin.osawe@tearfund.org

www.josgreencentre.wixsite.com/mysite
www.theclimatecoalition.org

For more information about the Live Justly *course and how to advocate on waste and the circular economy, see page 18.*

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