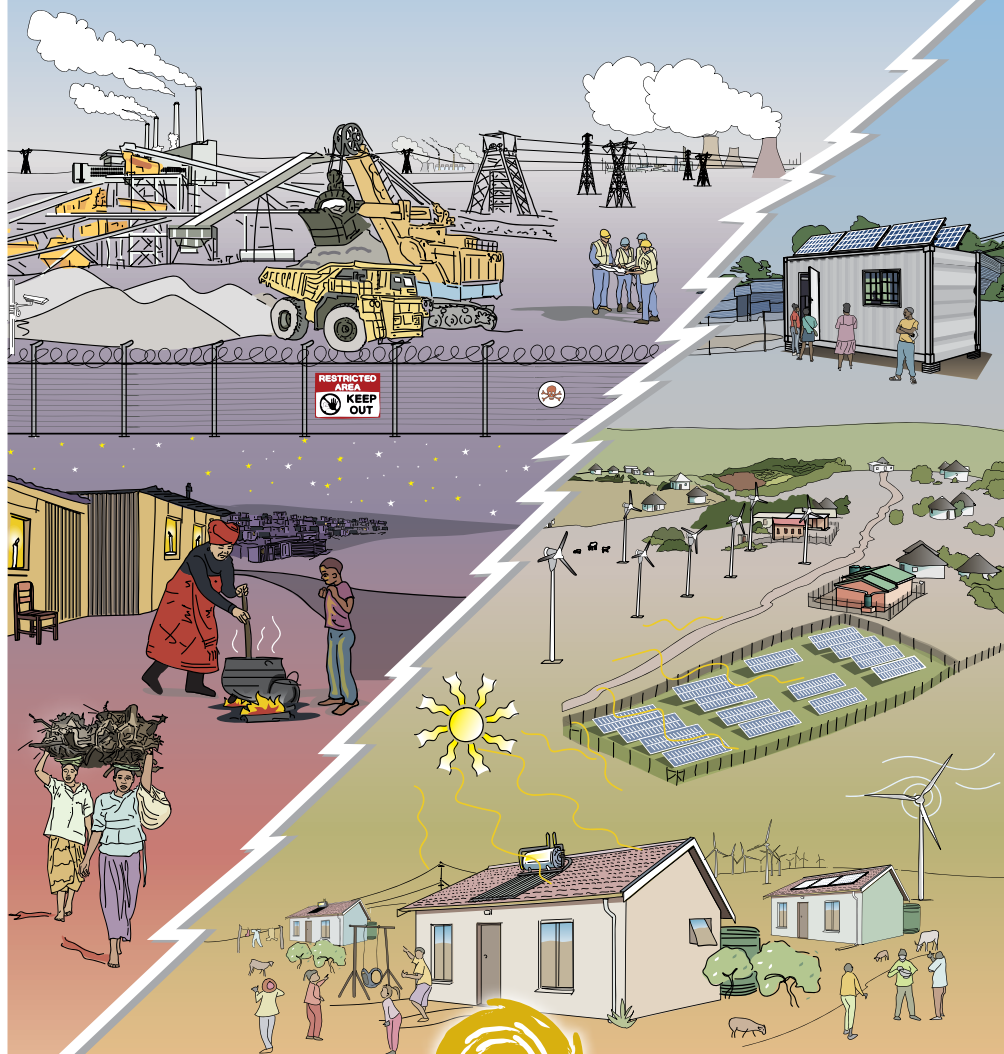


Towards energy sovereignty



Published by groundWork
April 2024



groundWork

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This booklet is part of the resources that groundWork is producing for its Environmental Justice School for Activists.

To move towards a just transition, it is necessary to challenge the extractive economy and to move towards a regenerative economy. The dominant energy system is part of the globalised extractive economy. However, it is not the only possible system for producing energy and needs to be challenged. Energy sovereignty provides an alternative to this destructive system.

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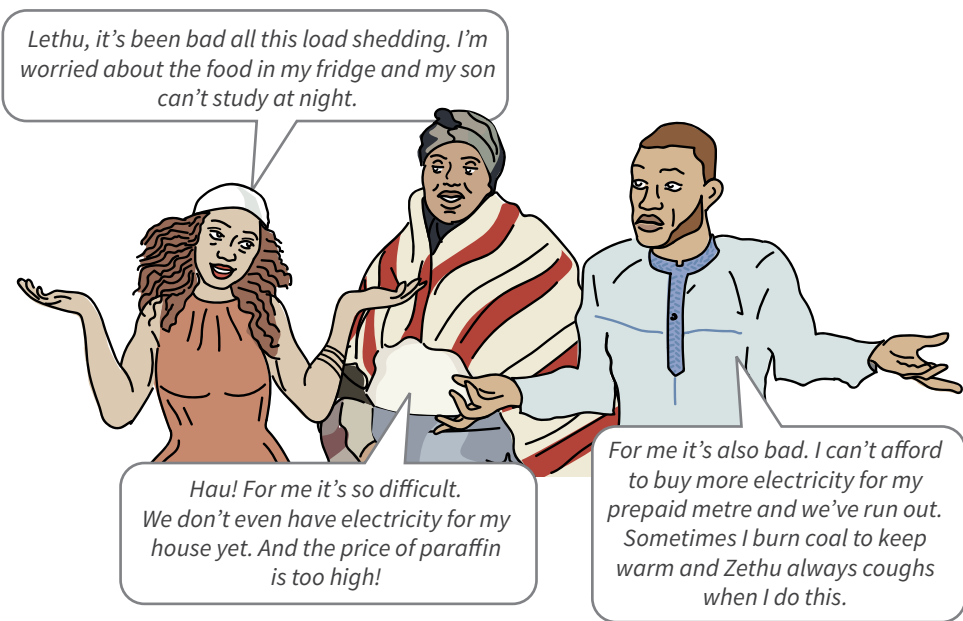
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*Thanks to the groundWork team
for their input*





Many people are worried about electricity. Like them, many don't have enough reliable electricity, some can't afford it, and some simply don't have any. In other words, they are all energy poor in different ways.

This booklet introduces you to energy sovereignty. But, we first discuss energy poverty and electricity. Before we discuss the use of energy, we can speak about what energy sovereignty might be.

Energy poverty and energy extravagance



People who are energy poor don't get the energy services they need for their homes and workplaces. They don't have access to *adequate, affordable and reliable energy*.

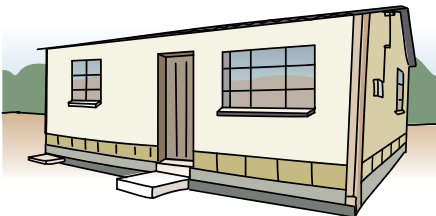
This includes:

- people who do not have electricity provided to their homes
- people who might have electricity lines, but they can only afford to pay for a small amount of electricity
- people who may have illegal connections that can be dangerous
- people who have unreliable power supplies.

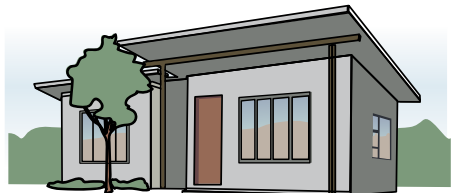


Energy poor people can't warm their homes when it's very cold or cool them down when it's very hot. Even if they are connected to the electricity grid, they often don't have enough electricity for cooking their food, running a fridge or heating their water. People find the cost of electricity too high, especially if they have low income or none at all.

Cheap household appliances like fridges and stoves often use more electricity than more expensive appliances. They have poor energy



Too hot in summer and too cold in winter



Cooler in summer and warmer in winter

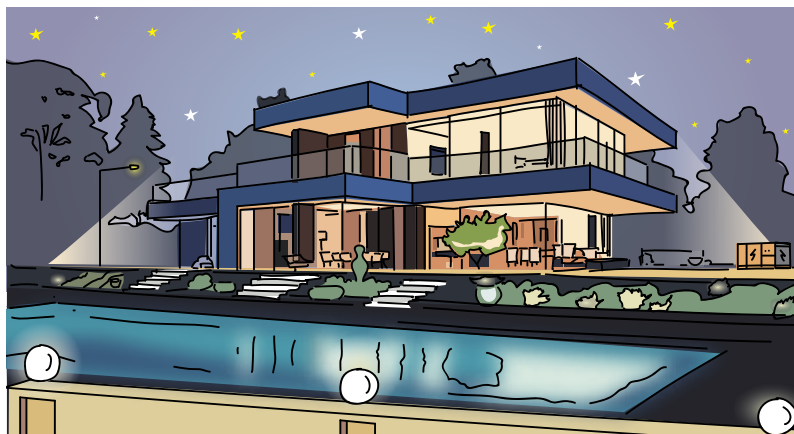
efficiency and so waste the electricity. When we talk about something being energy efficient it means that it uses only a little energy to power it and so it doesn't waste electricity. For example, an LED light bulb is much more energy efficient than a standard light bulb because it uses much less energy. An energy-efficient home is built so you don't spend lots of money on heating or cooling it. The house has a ceiling, a roof overhang and a veranda that helps to insulate it from heat and cold.

The United Nations estimates that In sub-Saharan Africa alone, more than half the population (53%), that is 600 million people, live without access to electricity. In addition, hundreds of millions more have only limited or unreliable electricity. Mostly people then have to rely on

firewood. It is usually women who collect it and in some cases they have to go a long way to get it. Energy-poor people are also more likely to use this wood or fossil fuels (such as coal, paraffin and gas) in their homes to cook and heat their homes. This often leads to poor health like respiratory diseases such as asthma.



While many are energy poor, there are people, organisations and corporates who are very energy extravagant and who use loads of power. Basically, this means they use energy in a very wasteful way. This causes harm to humans and the environment because their heavy usage is greater than what the earth and its ecosystems can withstand. Even when the power supply goes off, they have generators, batteries and other technology to store power so that power outages don't affect them very much.



What we are saying is that there is great inequality between people who are energy poor and those who are energy rich and extravagant. This raises the questions.

- Why is there such unequal access to energy?
- What needs to be done about it?

This booklet sets out to answer these questions, and explain how the main energy system works, and to demand: **WE NEED A NEW ENERGY SYSTEM!**



What is energy?



Energy is really difficult to understand because we can't see it or hold it in our hands. Scientists define energy as the ability to do work. Energy is needed to make everything work, move or live. That's a difficult idea, but perhaps think of it this way. Just to live requires energy for example,

- our bodies need energy (food) to move and grow and do things, like lifting things, chopping and carrying wood
- animals also need energy (food) to live
- plants use energy from the sun to grow.

Then there are the types of energy that humans have harnessed, often by extracting fossil fuels (coal, oil, natural gas), for example,

- a car needs energy to drive along a road
- smelters need loads of energy to smelt the ore
- factories run their machinery using energy
- a geyser on the roof can be heated by the sun.

In fact, nothing can happen without energy. You can probably think of other examples of how energy makes things happen. Even if we can't really see energy, we see the work it does. We can also feel it - a fire gives off heat and we can burn ourselves. We can even get electric shocks if we touch an electric wire that is exposed.

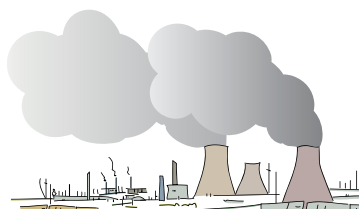


Sources of energy

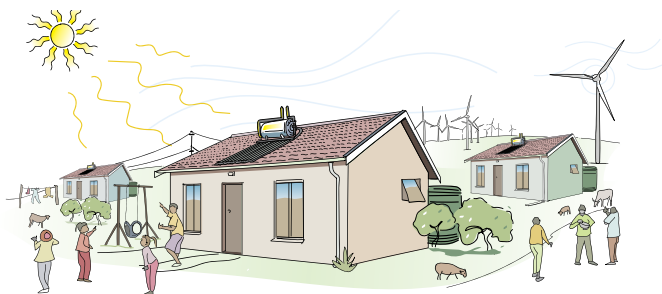


Energy comes from different sources. Some are renewable and others are non-renewable. Electricity can be produced by both renewable and non-renewable energy sources.

Non-renewable energy sources come from burning fossil fuels such as coal, oil, gas and even waste. Fossil fuels are sources of energy that contain stored energy (carbon) and this can be changed to different energy (like electricity or fuel). There are two problems with fossil fuels. These sources cannot be replaced once they are used up and they are the main contributors to global warming and climate change. Nuclear energy is another non-renewable resource that produces energy by splitting the nucleus of uranium atoms, usually a very rare type of uranium, U-235.



Renewable energy sources include solar energy from the sun, wind power, geothermal energy from heat within the earth, and hydro power from flowing water. These energy sources are renewed naturally — the sun shines, the wind blows, the heat beneath the surface of the earth generates heat, and surface water flows. We discuss renewable energies in more detail in the second half of the booklet. Renewable energy is mostly good energy, but if it is not used in a way that is sensitive to the natural system, it is bad energy. One example of bad energy would be hydroelectric power that comes from moving many people off their land to build huge dams. It is not good energy even though it is renewable.



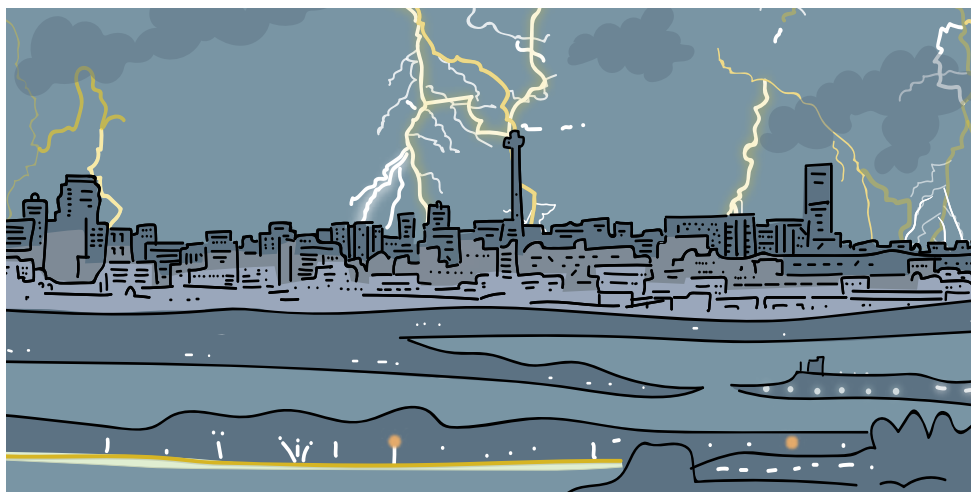
Electricity



There are many forms of energy, but here we focus on electrical power or electricity, the kind of energy that people across the world want and need. Just as energy is difficult to explain, it's not easy to explain what electricity is. However, we often see it in action, for example in thunderstorms when the sky lights up with lightning.

People have always been fascinated by the mystery of electricity. Scientists over centuries knew that it existed but even they did not understand exactly how. At least not until the 1800s, anyway! In 1882 the South African diamond mining town of Kimberley was the first place in the southern hemisphere to install electric street lighting. Government House of the Southern Nigerian Government in 1896 was also among the first to use electricity in Africa. Scientists now describe electricity as the invisible movement of electrons. When we switch on a light, or an electrical appliance, and it works immediately, it might seem like magic.

We often take electricity for granted, and we depend on it for so many everyday activities. However, the electrical power (or electricity) we use in our homes or workplaces is the result of a complicated system.



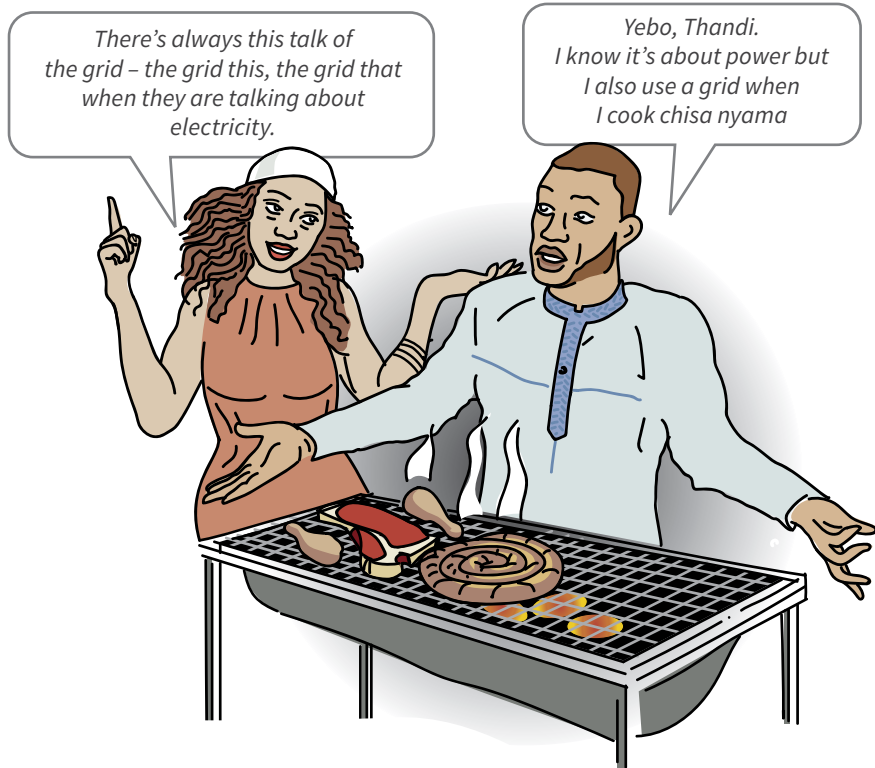
Although electricity can come from both renewable and non-renewable sources, non-renewable fossil fuel sources give off greenhouse gases that have played a huge role in causing global warming and climate change. Nuclear power produces radioactive waste that is extremely toxic and dangerous and can affect large areas for a long time. If we carry on using fossil fuels, we only have a short period of time left before we destroy life on earth. We have to move from this system if we want a world for our children to live in.



Any electrical energy system is about both producers of energy and users of energy. We need to ask what energy is produced for, how it is produced and who it is produced for. So, let's look at the electricity energy system that manages the power we get and use. Most countries depend on an extractivist economy which works in the interests of the elite.

The extractive economy drives the energy system. At present it relies mostly on extracting fossil fuels like coal, oil and gas to produce electricity.

This is an energy system designed mainly to serve big mining and industry, rather than ordinary people. In many countries, including South Africa, large corporates get cheaper energy. Ordinary South African people, for example, only use 18% of all the electricity from the grid and pay a higher price for it.



Well, Thandi and Samkelo, a grid is a bit like a net where the strands are connected to one another! The electrical grid of the electric energy system is a network of wires and cables that are all connected and that distribute electricity throughout a country or area.

Before we go further, let's look at the three stages of the electrical system to help us understand how it all comes together so that with the flick of a switch, we can tune in to the magical picture that pops up on our TVs or allows us to light up a room. The picture on the next pages illustrates the three stages.

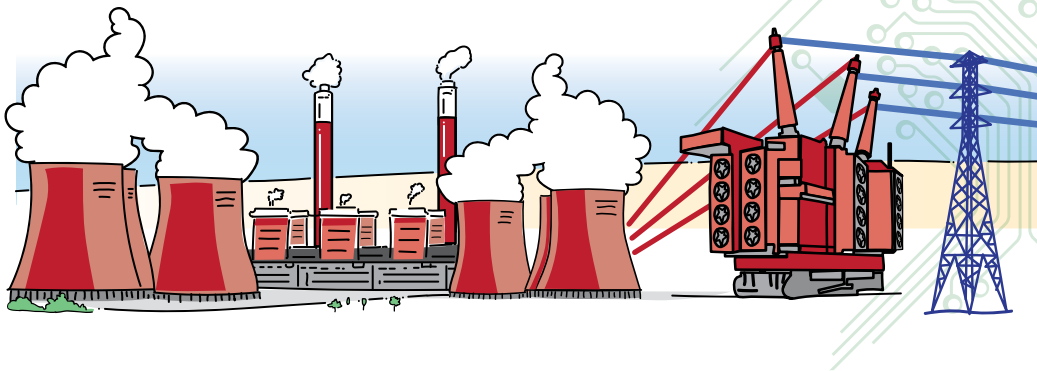
The three-stage process of the electrical energy system



1. Generation

For electricity to enter the grid, it must first be generated from a source of energy. Most electricity in South Africa and the rest of the world is still generated at power stations using non-renewable sources of energy. The process is to burn fossil fuels to boil water at very high temperatures that then creates steam. The steam comes out under pressure to drive turbines that then generate electricity. Some African countries like South Africa and Botswana mainly use coal to generate electricity, while others like Nigeria and Algeria mostly use natural gas. So, energy is converted from one form to another – from coal or gas to electricity. In the process, a lot of energy is lost, and this goes up the chimney in smoke and heat.

However, energy can also be generated by renewable sources like sun, wind and water. However, sun (solar) and wind power have only started recently to be produced in a more consistent way on a large scale. More about this later!



GENERATION

2. Transmission

The electricity has to then move from the power stations to the consumers. This is the transmission stage. Transmission is the large-scale movement of electricity along huge and very thick electrical cables held up by giant metal pylons. These cables carry electricity at very high voltage levels from the power plant to substations.

There this power has to be changed to lower voltages for it to be usable. Very large industries like smelters where metals are heated at high temperatures use higher voltage than homes and small businesses. Higher voltages cause more electricity to flow to a substation or electronic devices than lower voltage. It's much more powerful and highly dangerous!

3. Distribution

When the power has been changed to lower voltages at the substations, it can then be distributed along power lines to people, households, streets, schools, hospitals, factories and businesses.

An important point about producing electricity is that the grid system always has to balance generation and distribution. If the grid does not produce enough power, it cannot distribute it and then we have power cuts.



TRANSMISSION

DISTRIBUTION

Understanding unequal access



So, many people are unhappy that they do not have electricity or cannot access enough of it. To understand this, we apply the Three E's that groundWork has used in its other booklets.



Exclusion from decision-making occurs all along the energy supply chain. At times people are invited to consultations by corporations and government about regulations. However, it is difficult for them to participate meaningfully, and their opinions are often ignored in the face of the powerful voices of corporations and governments. In the same way people are not consulted about where mines and power stations are built or how the pollution that comes out of the stacks of the power stations will be managed. They are also excluded from decision-making on the structure of the energy system, what sources of energy are used, and who produces that energy. They are consulted at times about the costs of electricity or whether industry should get cheaper electricity, but even so the question remains whether it makes any difference at all.

Enclosure of resources takes place when you close something in and fence it off so that other people cannot use it. Enclosure takes place in the industrialised energy system at every step of the energy supply chain. Large mining corporates make sure that they control the digging out of the coal and sell it for burning in the power stations. The mines have closed in the coal resources for their own profit. The same applies to oil and gas extraction. In this process the land is closed in and the water sources too. This is similar to privatisation, but we must remember that governments help industries to do this by issuing licences for mining rights. The state can also enclose people's resources!

Externalisation means that the negative impacts of the industrialised energy system as a whole are felt most by those who benefit the least from the process. Their air and water are polluted by chemicals and greenhouse gases like carbon dioxide and methane; their houses are damaged, their health is negatively affected and at the same time their labour is exploited.

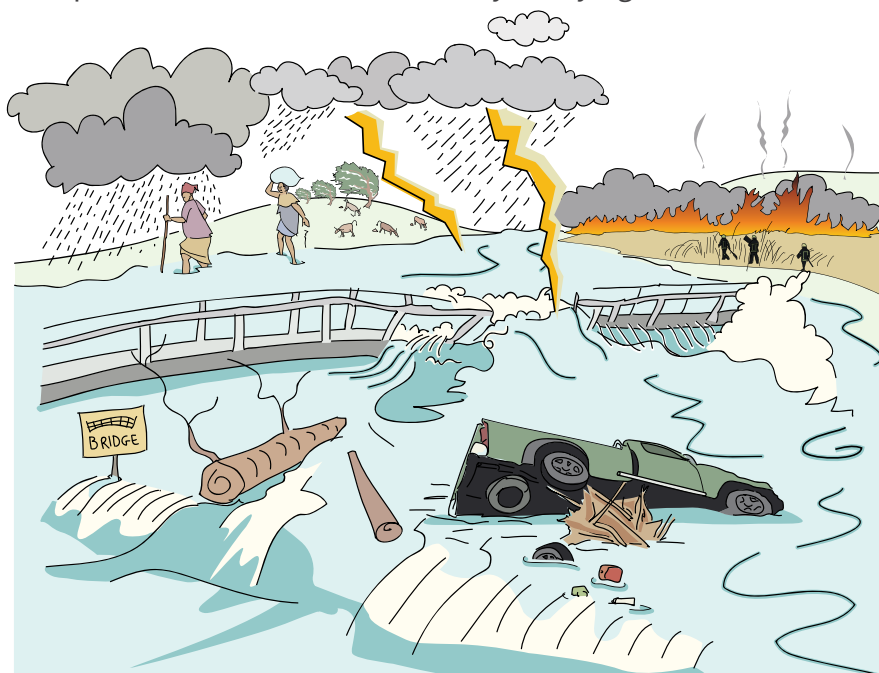
In spite of all this harm caused by these undemocratic practices, corporates and government say that using fossil fuels is good for the economy and that the economy serves the people!

Impact of energy produced from fossil fuels



Using fossil fuels to produce energy has many negative and dangerous effects. When coal is dug up it gives off large amounts of dust and pollution into the air. These small particles affect the health of both the miners and the communities near the mines. Then, when the power stations burn the coal or other fossil fuels, they give off gases like carbon dioxide, sulphur dioxide, nitrogen oxides and many others that affect the quality of the air, water and land. They also give off very tiny particles (particulate matter) which is extremely dangerous to people's health and can get deep into your lungs and even your bloodstream.

When coal and other fossil fuels get burnt to satisfy our human needs they give off huge amounts of carbon dioxide and these emissions give rise to the climate crisis that we face. The most obvious consequence of global warming that we feel are the extreme weather conditions, for example high temperatures, droughts, wildfires, very heavy rains, damaging storms and floods, and cyclones. Temperatures across the whole planet have risen and this is very worrying.



For decades scientists across the world have produced overwhelming evidence that the emissions from fossil fuels affect and destroy the environment. For example, the ice caps and glaciers are melting, and temperatures are rising, causing devastation across the world but especially in the global south.

There is a wealth of scientific evidence that industrial activities, especially the burning of fossil fuels used for electricity as well as transportation and industrial agriculture are major sources of greenhouse gases. There is also overwhelming evidence that this accelerates global warming and climate change. In spite of this, many powerful fossil fuel lobbies deny this and spend billions of dollars on propaganda to spread their ideas and arguments. They also resist attempts to transform the energy system away from fossil fuels. They are motivated by profit potential and not human or environmental well-being.

However, the evidence of the effects of fossil fuel emissions can no longer be denied, and most governments and corporates now agree that it is necessary to transition to different energy sources. Solar and wind power production has increased globally. In addition, the technology for solar and wind power has improved and the costs have come down and now are cheaper than coal burning. However, there is still strong resistance to a transition from fossil fuels, particularly where corporates and politicians have something to lose financially.

Climate change, fossil fuels hurting people's health, says new global report

Fossil fuel industry knew of climate danger as early as 1954, documents show

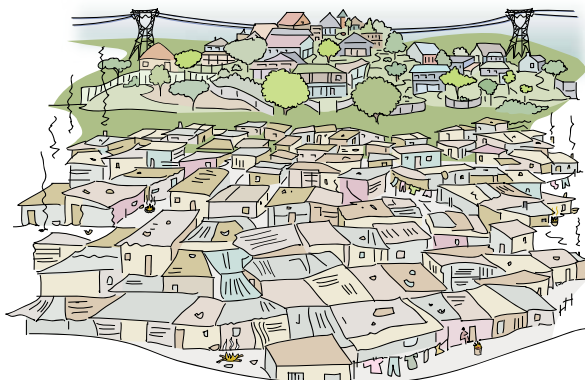
Nations Must Drop Fossil Fuels, Fast, World Energy Body Warns

Electricity access in South Africa — why so unequal?



Let's look at the case of South Africa now. The story of access to electricity in South Africa is about the close link between mining and energy production. The purpose of the mining industry is to extract minerals like gold, diamonds and coal. To do this, it depends heavily on electricity. In South Africa the way this was done was through building large coal-fired power stations. When Escom (later Eskom) was established, it was required to provide cheap electricity at the lowest possible cost without making a profit. The main beneficiary of this cheap electricity was industry

So, if industries got lots of electricity cheaply, what about the people? First, we have to remember that the colonial and apartheid policies remained in place until political transformation in 1994. White and black people were separated physically, and legislation ensured that black men would serve as cheap labour for the mines and industries.



Under apartheid, industry, commerce and nearly all white households had reliable electrical connections. Few black townships and informal settlements had access. Until 1994, only one-third of the population was connected to the grid. The other two thirds (mostly in rural areas and many townships) were not supplied and they had to use other forms of energy. So, at first energy inequality followed racial lines.

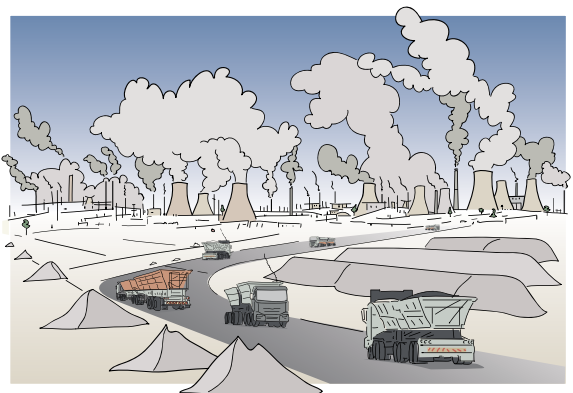
It was only with political transformation in the 1990s and under pressure from activists that Eskom launched campaigns to distribute electricity more widely, especially in townships and some rural areas.

By this stage Eskom was no longer independent, and had become a wholly state-owned entity which was required to expand capacity and was expected to make a profit. In order to do this, in 1998 Eskom proposed the building of two giant coal-fired power stations by 2007 (Medupi and Kusile).

Before this, Eskom's capacity had been declining due to the loss of experienced senior technical and managerial staff, and the deterioration of the existing power stations. Instead of transformation, corruption became more evident through political appointments. However it was during the building of the two new plants that widespread corruption became routine and systemic. For example, coal contracts were given to favoured firms whether they could deliver the right quality of coal or not and senior managers got payoffs for rewarding contracts to corporations who overcharged for goods and services. This routine and systemic looting, spearheaded by then President Jacob Zuma, became known as State Capture in South Africa.

Although State Capture affected many other State Owned Entities, Eskom was the most seriously affected. As a result of this corruption, poor maintenance, and resistance to alternative energy on a large scale, the price of electricity has tripled. Despite various attempts at improvements, a crippled Eskom cannot provide the electricity needed by South Africa. Blackouts (now called 'load shedding') which started in 2007 are now so widespread that industry, the economy and individuals are seriously affected. As usual, it is poor people who are the most seriously affected.

South Africa has a power system developed over the last century for ever bigger coal-fired power stations to supply 'cheap and abundant' power to energy intensive industries. It is unsustainable economically, unjust and socially and environmentally catastrophic.





Power outages put ill people at risk

Dark weekend for Lagos

Gauteng power woes

Zimbabwe back to 20 hour cuts

**Ghana hit by power outages
due to limited gas supplies**

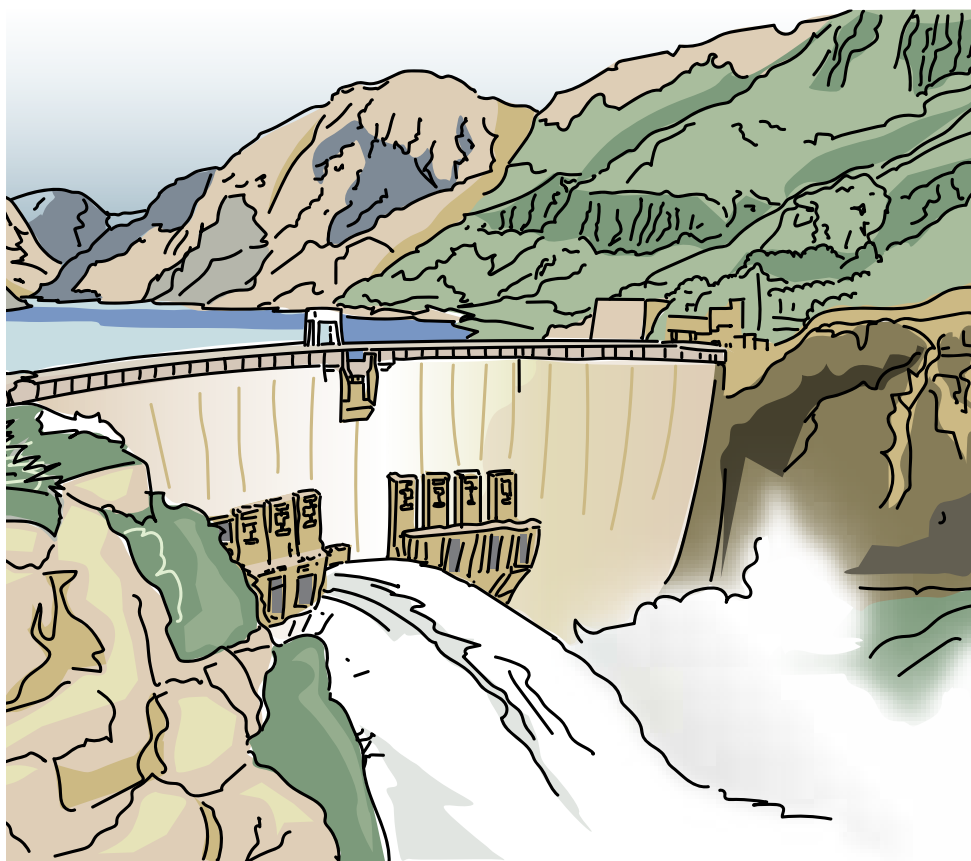
Access to electricity across Africa is very uneven. As the headlines show, many African countries struggle with reliable and safe access to electricity.

The South African case study is not typical of all African countries, but it highlights some of the issues that have impacted on electrical systems across the continent. All were shaped by colonisation and many of the systems have been negatively affected by corruption.

Unlike in the south of the continent where coal has mostly been used for energy generation, many African countries have used other sources of power, including gas and hydroelectric power, each with its own problems. Many of these countries turned to hydroelectric power. In the 1970s and 1980s there were 54 hydroelectric projects built across African countries and these schemes were in part responsible for the debt crisis these countries faced afterwards.

These had negative environmental and social effects. Take the Cabora Bassa dam project as an example. Some 50,000 people were displaced to make way for the construction of the dam. About one million people face the consequences of the damming of the river. The dammed waters mean the flow of water is restricted and has damaged the once fertile agricultural floodplains of the region. It has also brought about a decline in fish and wetland wildlife. Also, low rainfall since 2014 has resulted in blackouts and electricity shortages.

Similarly, the Kariba dam on the Zambezi has been affected by droughts and this has impacted on electricity supplies. Kariba is upstream from Cabora Bassa and supplies almost all of the electricity in Zambia and Zimbabwe.





So far we have discussed energy and we have described the present energy system.

- It is part of the extractive economy that does not worry about the pollution it causes and leaves behind.
- It depends on non-renewable sources.
- Many people are energy poor although they might live right below power lines running overhead.
- Production gives off carbon dioxide, nitrous oxide and other greenhouse gases that contribute hugely to global warming.
- Climate change threatens the life of all living things on planet earth.

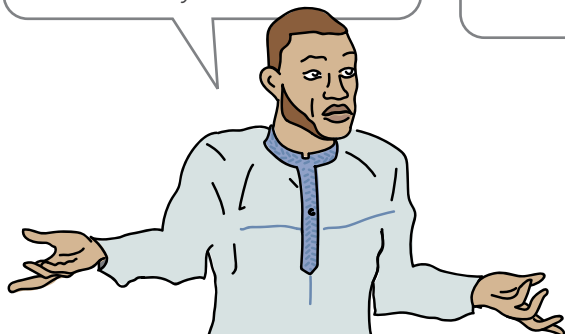
Put simply, a move from coal to renewables is both urgent and necessary. In fact, fossil-fired electricity has become very expensive and unreliable now, and many industries have begun to turn to generating renewable energy themselves. But we must be careful not to simply argue for renewables if this means that people are still excluded and the corporates continue to manage electricity to generate wealth for themselves and their shareholders. There must be a movement towards social equality, and this means we must strive towards energy sovereignty.



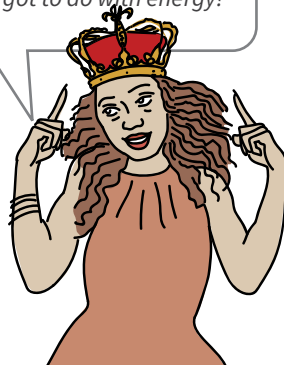
Towards energy sovereignty



People are talking about energy sovereignty this and energy democracy that. I don't know what they mean.



Yebo, Siphiso. I think democracy is about voting and I think sovereignty is something to do with kings and queens. What have they got to do with energy?



Good question, Thandi. One thing we can all agree on is that everyone needs access to energy. No-one should be energy poor, but many are. The present energy system depends on extracting and burning fossil fuels. It is part of a system that is driven by profit for the rich. It damages people's health, drives climate change, and is destroying life on earth. When people talk about energy democracy or energy sovereignty they are talking about a different energy system. You might hear people talking about these terms which are very similar. So let's look at what people mean when they talk about them.

Let's start with the word sovereignty. The word sovereign usually refers to a king, queen, emperor or other royal ruler of a country who holds the power and has authority. If we speak of national sovereignty, it is the state that holds power. On the other hand, people's sovereignty means that the people replace the king or queen or state dominance. The word has everything to do with power and control.

Energy sovereignty also has to do with power and control. But it is power and democratic control of energy production by the people.



Democracy means more than the voting system that Thandi mentioned when political parties and people are voted to positions of authority. The word democracy comes from the Greek words “demos”, meaning people, and “kratos” meaning power, so democracy can be thought of as “power of the people”, not only the power of the voted representatives.

demos + kratos

people + power

democracy

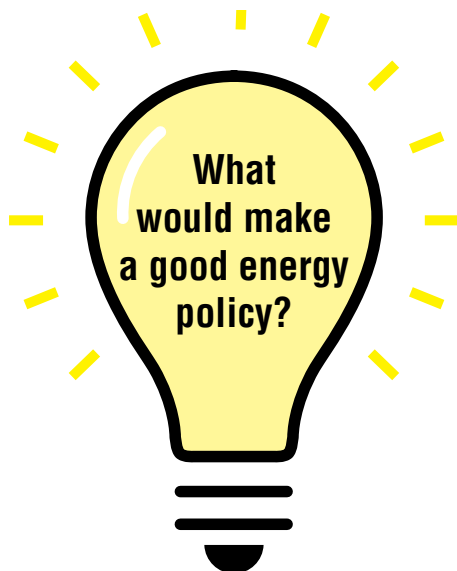


Sometimes people think a country is a democracy if the country is not a dictatorship and because there are elections every few years or so. But taking part in elections is one very small part of a democracy, as activists know well. In fact, for democracy to be effective ordinary people need to take an active role against being exploited. They need to make themselves heard (and not be excluded from decision making).

They need to make use of common resources (and resist when common resources are enclosed). They need to mobilise against the negative impacts (externalities) caused by corporates and government. It is our democratic right and our duty to do so.

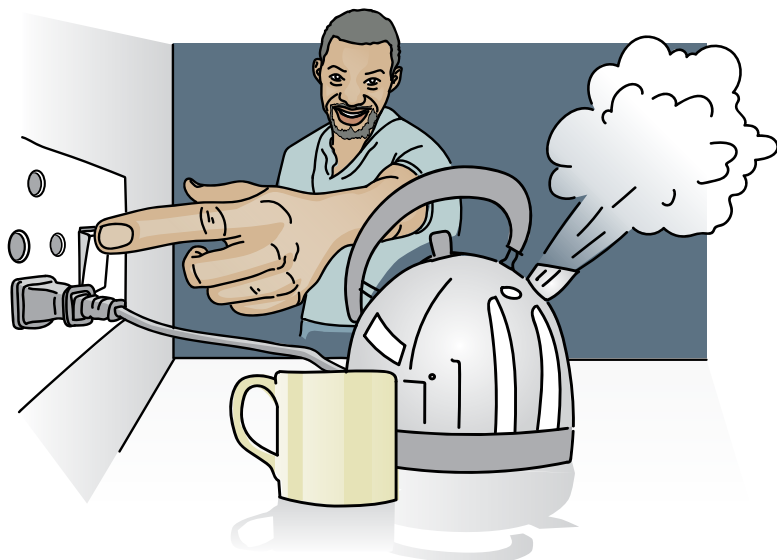
From these descriptions you can see that energy sovereignty and energy democracy both refer to the power of people to take an active role in deciding what type of energy they have access to and how it is managed.

In this booklet we use the term energy sovereignty because it suggests the highest level of democracy. This is a system that requires listening and giving a voice to all, engaging meaningfully with each other and encouraging as many people as possible to do so. This empowers everyone. For people to exercise these democratic rights, they must be well-informed. People need to understand energy, its sources and what impact it has on the environment and people in order to exercise their power responsibly. They need to have the democratic power to decide what kind of energy they want, and how it should be generated, transmitted and distributed. Energy sovereignty does not mean people must do it all on their own. It does not exclude the role of the state! People need to participate in the energy policies of the countries, districts and communities they live in too.





When it comes to energy, people everywhere and over the centuries have used ways to access energy, whether it is burning coal, oil, rubbish, plant matter and wood, or using wind and water. In the last century technologies like steam turbines have made large scale generation, transmission and distribution of electricity possible. People like and want electricity as this kind of energy is very efficient. You can flick a switch and the kettle heats up the water! But it comes at a price, both financial and environmental.



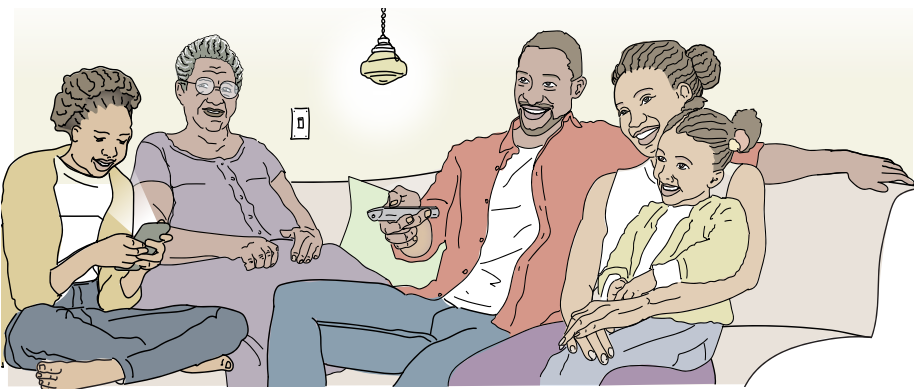
Many African countries have Constitutions and/or other legal frameworks that deal with human rights. Some guarantee particular human rights like the right to life or the right to freedom of conscience and religion, and people have engaged in struggles for these rights over many years. However, electricity is seldom included as a specific right. For example, although South Africa has a progressive Constitution, the right to electricity is not clearly stated (which is also the case in many countries). However, the right to electricity falls under the rights to:

life and dignity,
adequate housing
water
health care.



The right to electricity is necessary for a dignified life. To lead a dignified life, everyone needs access to enough safe, reliable and clean energy.

Put simply, people want access to electricity to live well and to be able to take part in their economic, social and cultural lives.



In this booklet we argue that we need a different system, one that people call energy democracy or energy sovereignty. This new system has to include a shift from unrenovable energy (mainly fossil fuel-fired power and nuclear power) to renewable energy. Polluting other people and places is undemocratic!

However, that is only one part of it. This must be a **just transition**. The central difference between a transition from fossil fuels to renewables, and a **just** transition, lies in the purpose that drives the transition. A just transition is not driven by the profit motives of a corporate system, but by the goal of all people living well. If the goal is mostly still energy for corporates and elites, it is not a just transition. A just transition needs to be open and democratic, one in which people are informed and take part in the decisions that affect them.

Therefore, energy sovereignty requires:

- a focus on renewable energy
- a participatory approach
- a decentralised system.

Because this transition depends on renewable energies, we first outline the different sources of renewable energies that are available. Then we turn to democratic participation and the systems that make it possible.

Renewable energy sources

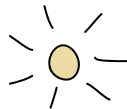


In the first part of this booklet we discussed the difference between renewable and non-renewable energies. It's important to remember that just because a source of energy is renewable, this does not mean that it automatically benefits the environment and communities.

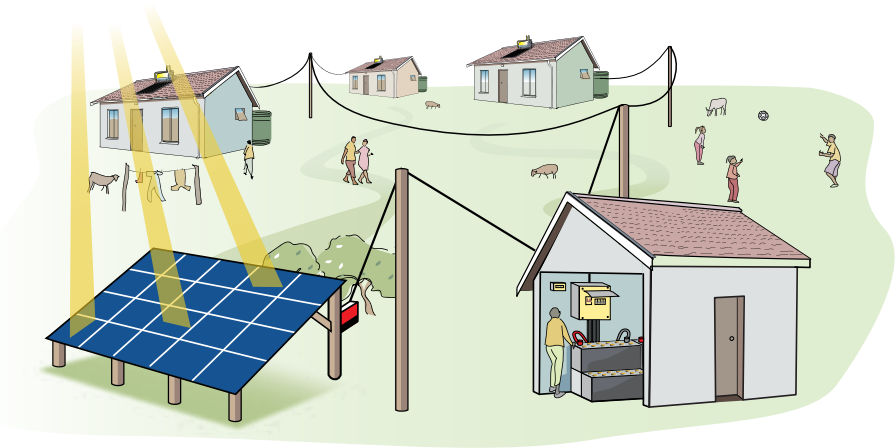
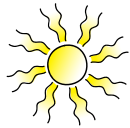
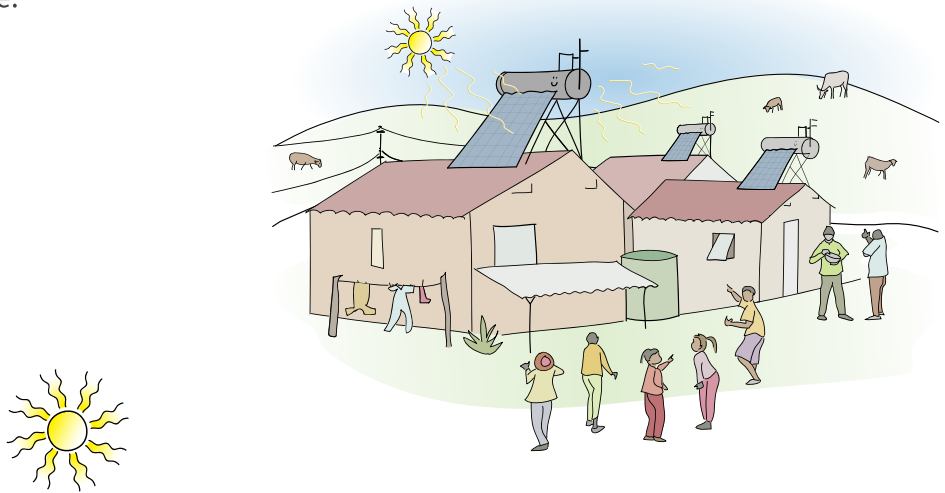
Here we look in a bit more detail at solar, wind, water (hydro), geothermal and biomass as types of renewable energy. At the same time, it's important to know about the negative aspects of these renewables! In this booklet, more time is given to solar and wind power as these are the sources of energy that many people know about and are most commonly used in Africa. In particular, some communities want to set up their own solar energy mini-grids! (A mini-grid is a set of small-scale local electricity generators. They are being constructed in many countries in Africa.)

Solar energy

Conditions for solar energy are excellent in Africa. Sunshine is abundant and more reliable than most other places on earth. As we know well, the rays of the sun bring us light and heat. Many people are most likely to have heard about two forms of solar, namely solar geysers and solar PV (photovoltaic) systems.



Solar water geysers have been added to many houses. These consist of a panel with pipes and a geyser for water storage. The sun heats the water in the pipes and the hot water rises up into the geyser which stores the hot water ready for use.



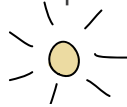
A small-scale stand-alone PV system with PV panels, an inverter and batteries.

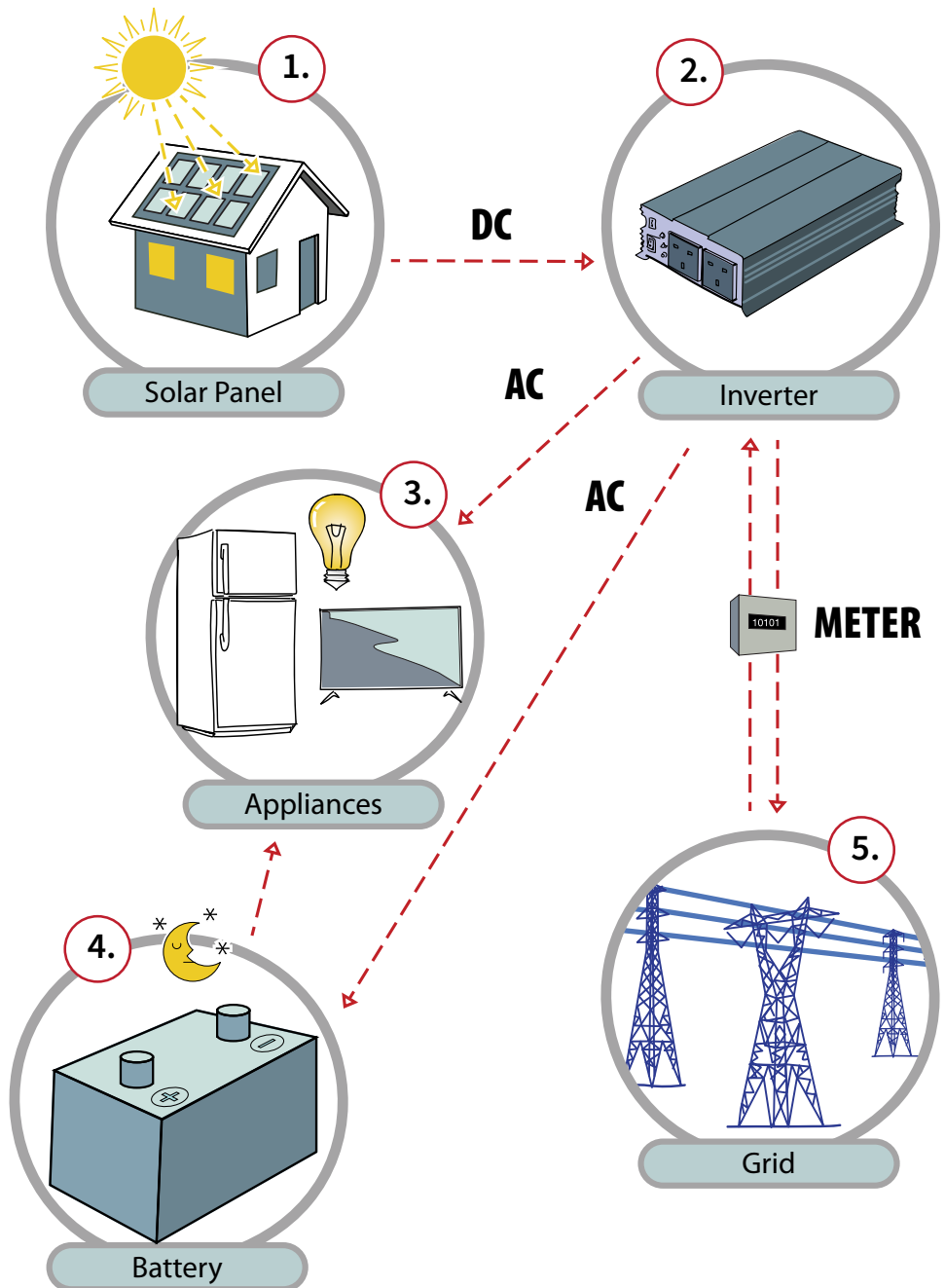
PV solar systems are a form of solar energy which uses more complicated technology. They can be large scale or small scale. A small-scale system

can be a stand-alone one that is not tied to the grid at all. It would then need batteries for energy storage.

Alternatively, it can be connected to a grid and draw electricity from the grid when there has been little sunshine or at night. The grid can provide a backup when people need it and they can also use batteries to store energy.

Solar farms work on a large scale and have a large array of PV panels which feed electricity into the grid. Whether large or small scale, the important thing is that they must be placed so that they can catch the sun's rays.





Let's look at how solar power works

1.

The light from the sun's rays hits the panels and is changed into electricity (a direct current) through a process scientists describe as photovoltaic (PV)

2.

The Direct Current (DC) from the panels goes to the inverter. The work of the inverter is to change the Direct Current to Alternating Current (AC) which is the kind of electricity we use

3.

We can then draw this electricity from the inverter for our appliances such as TVs, fridges and lights

4.

The inverter can also send the electricity to a battery where it is stored and it can then be used for power when the sun is not shining, for example at night

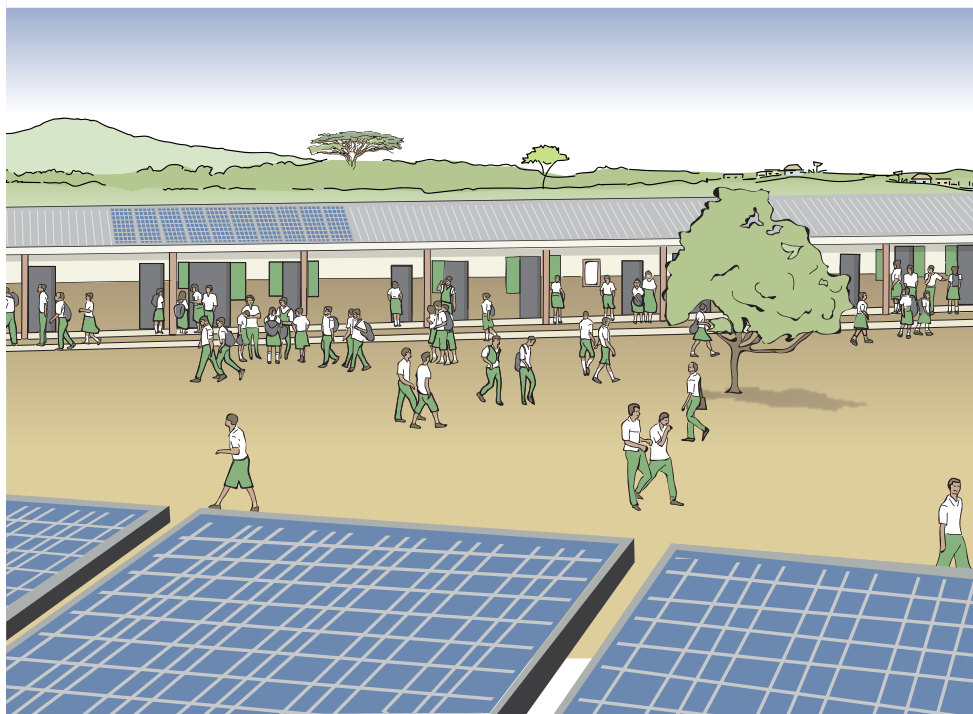
5.

If the solar power system is connected to a grid, it can send electricity back into the electricity system if it is fitted with a meter that allows it to. It's called a bi-directional (two way) meter.

People have realised that for many industries, businesses and office blocks, PVs can be economical and work very well for their purposes. Many businesses run during the day when the sun is shining, and they have a low demand during the dark hours of night. With a PV system, the excess energy can be fed into the grid and can be used when it is needed.

PV is an expensive system and to equip all houses with their own panels, inverters and batteries costs a lot. It is not cost-effective for community energy generation. But, if lots of households club together to produce community power on a bigger scale, then costs come down. For the many places in Africa that are not linked to the grid, solar power becomes an important source of energy for households, but also for schools and other public institutions like clinics.

We also need to be aware that solar energy can come with disadvantages. First, a large-scale solar farm takes up large amounts of space. Second, minerals like silicon, silver, copper, tin, lead and aluminium are used in small quantities to produce the panels. There are different kinds of batteries but they too are produced from a range of minerals like lead, lithium and nickel. The mining of these minerals can be exploitative of the environment and the workers who mine them. Despite these disadvantages, solar power is much less harmful to people and the environment and, if managed well, many of the components are recyclable.



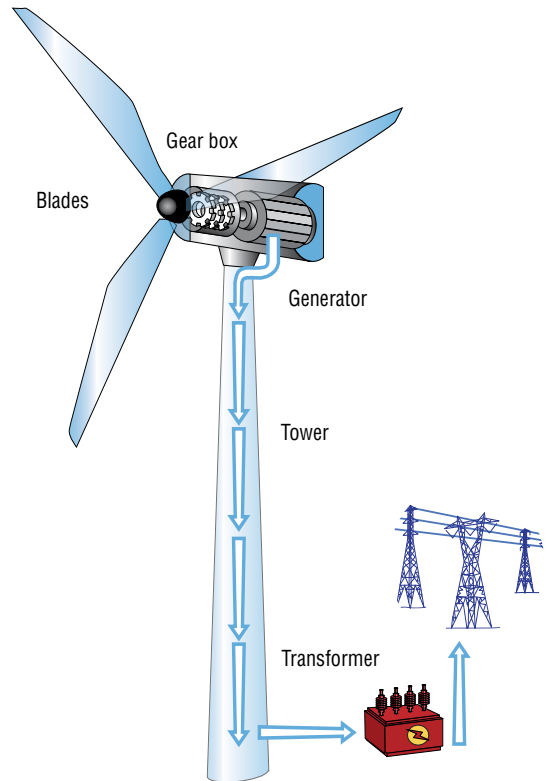
Wind energy

Wind can also be used to generate renewable energy, but this can only happen in places where there is plenty of strong and regular wind. The energy is collected by wind turbines which look like huge modern windmills. They are as tall as skyscraper buildings and their blades are as wide as a huge skyscraper too. The wind turns the blades of the turbines and the energy from the spinning blades is fed into a generator. This is a similar technology to steam turbines used in fossil fuel power stations. It is just that the source of energy is different – and clean and renewable!

How wind turbines generate electricity

There are many locations across the continent of Africa that have strong winds. The ideal places for setting up wind turbines are on hilltops, open plains, the coast or on open water. They can even be constructed in the ocean to harvest wind power.

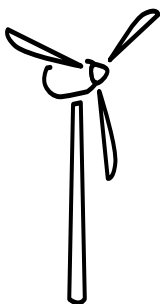
On the other hand, wind power depends on frequent and powerful wind. No wind, no energy! Wind turbines also take up a large amount of space although you can still use the land beneath them. Because they are so large, the blades often kill birds, especially if they are on the birds' migration pathways. Wind-generated energy systems need a large financial investment to construct the steel towers with their fibreglass blades.





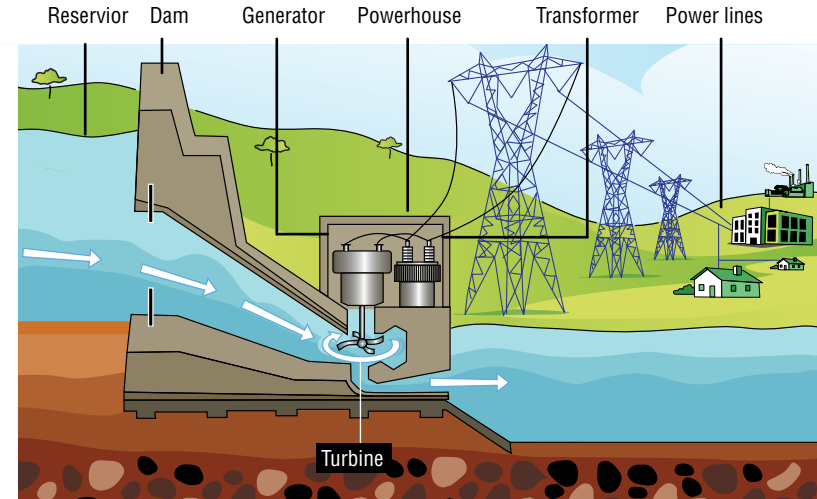
The Lake Turkana Wind Power Project in northwestern Kenya is the largest wind farm in Africa and has 365 turbines. The wind is tunnelled between two mountains and reaches high speeds. The generation of energy using wind power does not produce greenhouse gases and so it is a clean source of renewable energy once it is established.

Like some other kinds of electricity, once it is generated it needs to be transmitted to a grid from which it can be distributed. In other words, large-scale generation of wind-powered electricity cannot be decentralised, and the design means they cannot be community-owned.



Hydroelectric power

Energy can be generated from water (hydro) including rivers, waterfalls, ocean tides and waves. Hydropower or waterpower works in a way that is similar to wind power, except it uses falling or very fast-running water to generate electricity. Falling water is one of the principal sources of energy used to generate electric power. This can be either through natural waterfalls or through damming up rivers.



How hydroelectric power generates electricity

To generate hydroelectric power, the water is stored at a high point. Then the water is run downwards through large pipes. At the lower end of these pipes are turbines housed in a powerhouse along with the generator. The fast-falling water makes the turbines spin. The turbines then drive the generators and convert the hydroelectric power into electricity.

The excess electricity can be stored and is then used at night or at off-peak times to pump the water back up to a higher reservoir or tank so that it can be converted into electricity again. Once established, hydropower produces clean energy without giving off greenhouse gases. The energy can be stored and can serve as a backup when other energy is not available.

However, there are serious concerns about hydropower and the big dam projects that have been built across Africa. They are designed to have a high head of water. In other words there is a big difference in height between the surface of the water and where the turbines are. To make this possible, strong sources of running water are dammed up by the building of enormous dam walls. Then the area above the walls is flooded and so huge dams are created. As a result, many people have to be forcibly removed from their lands above the dam wall, and the areas below the dams lose their water supply because the dam holds back the water. This affects people's livelihoods and upsets the food chains and the fish population that existed before the damming. But, when there are very heavy rains, the water in the dams is released and floods the lands below the wall. This destroys people's crops and homes



When the Akosomba and Kpong dams in Ghana's Lower Volta Basin release water, communities are flooded and cut off by fast-rising flood waters

Low level on Lake Kariba

**Low water levels threaten
Zambian fishers lives**

**Record low Kariba dam levels
see Zimbabwe Zambia
facing drastic power cuts**

Zimbabwe back to 20 hour cuts

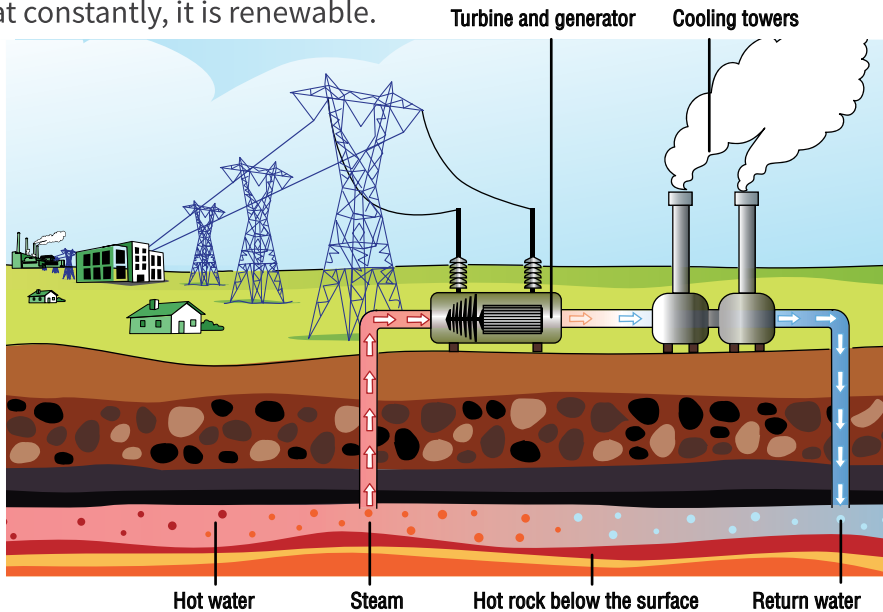
Race against time to save Kariba

In contrast, water levels in these dams are also affected by drought, even in Lake Kariba, one of the world's biggest dams in terms of its capacity to hold water. Zimbabwe and Zambia both rely on it for the bulk of their hydroelectric supply. The low water level caused by droughts has resulted in serious power cuts in both countries.

Wave energy is generated by waves at the coast or on the surface of the sea. Wave energy is used in some countries. This is not widespread yet. It has the potential to expand. Engineers are meanwhile working on various technologies to capture the energy of waves.

Geothermal energy

Deep under the surface of the earth is an extremely hot inner core. It's nearly as hot as the surface of the sun. The heat beneath the surface of the earth is called geothermal heat and because the earth produces this heat constantly, it is renewable.



How geothermal power generates electricity

To make use of this geothermal heat to generate clean energy, engineers have to drill wells kilometres deep into the earth's surface. From these wells, hot water or steam then rises up. This steam is used to turn a turbine which generates electricity. The steam is then cooled down and fed back into the earth. When established, geothermal power is a reliable renewable energy. This system also requires a large investment to establish it.

Geothermal energy is a reliable energy source, but it is only possible in certain places where the heat of the earth can be accessed and where it is possible to drill very deep. The Rift Valley in the east part of Africa is one such place. Africa's geothermal potential is huge, particularly in the Rift Valley, which extends from the Horn of Africa to Malawi. Kenya is the leading producer of geothermal energy in Africa and is ranked among the top ten in the world.

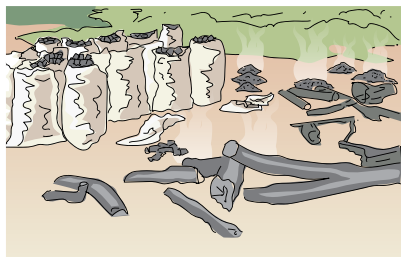
Biomass energy

Biomass is used widely as a source of energy across Africa, mainly as firewood, especially in places that are not connected to the electricity grid and which don't have mini-grids either. It can be used in two ways; first by burning, and second through producing methane as an energy source.



Burning biomass

The first way involves burning wood, charcoal, animal dung, waste from farming crops, and other organic waste. It is often considered renewable because plants and trees can be replanted to replace the material that gets burnt and the carbon that is emitted. This might work in certain remote rural places, and it might also be the only energy accessible that is reliable and plentiful. But smoke from fires pollutes the air and badly affects the health of people who depend on it. It's important to realise that large-scale burning of biomass, for example in power stations, does not produce renewable energy. It either leads to deforestation, or the natural forests and grasslands are replaced with industrial plantations.



It gives off greenhouse gases that cause further global warming. And it drives people off their land as it is enclosed.

Charcoal is used as a source of energy for cooking and heating in several African countries. Trees are cut down, often illegally, to produce the charcoal

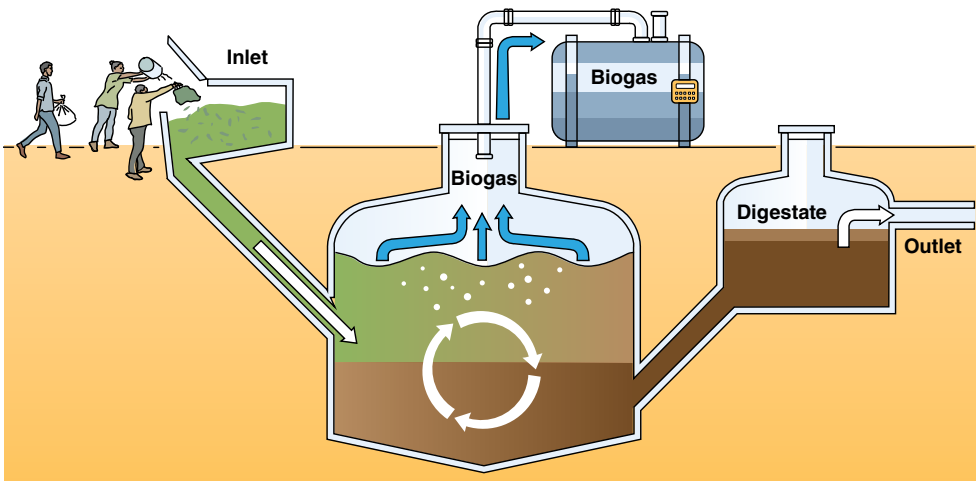
which is then sold on. Populations have increased and, in addition, many people are moving from rural areas to the cities. These factors have led to an increased demand for energy, and charcoal has become the source many people have come to rely on. This dirty source of energy is leading to deforestation as well as loss of biodiversity because certain trees are favoured for producing charcoal. To replace them would take decades!

Biogas

Biogas is produced from organic matter through a process called anaerobic digestion. This gas is methane that can be used for cooking and heating. It is mostly done on a small-scale.

Biogas is produced in an anaerobic digester. Anaerobic means ‘without oxygen’, so the digester is a tank from which air is excluded. Organic waste goes into the airtight tank. The organic matter is broken down by microbes - creatures that are too small to see. The waste can include household and garden waste, animal manure and sewage. Even toilets can be linked directly to a digester. The digester has two outlets, one for the gas and one for ‘digestate’ which is used as compost.

Although biogas is renewable, we must remember that methane is a very powerful greenhouse gas and there is always the risk of releasing methane into the atmosphere unless the biodigesters are carefully designed and built.



How an anaerobic biodigester produces biogas

Industrial farming systems are responsible for producing most of the methane given off especially by livestock. Cattle produce the highest amounts of methane of any livestock. Farming generally produces large amounts of organic waste, including animal manure and the stalks and leaves after the crops are harvested. If farmers think of this ‘waste’ as a resource, they can produce biogas energy to use for their farming and other activities.

Is green hydrogen a renewable energy?

Hydrogen sounds like clean energy, but it is not. It can be produced from fossil fuels or by splitting water molecules into oxygen and hydrogen. Hydrogen is colour-coded according to its source. The colour coding of hydrogen is as follows:

 coal

 gas

 gas combined with carbon capture and storage

 nuclear power used to split water

 renewables used to split water.

Over 99% of hydrogen that is produced now comes from fossil fuels because that’s the cheapest way to do it. The ‘rainbow’ branding was devised by the fossil fuel industries for marketing purposes.



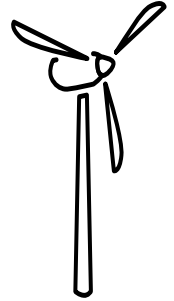
The problem is that it uses an enormous amount of energy to make, but it produces much less energy when it is burnt. So it is energy inefficient. It also uses vast quantities of water. And it is very difficult to transport. It is the lightest element so it leaks out of pipes. And it can only be transported by ship or tanker if it is combined with nitrogen to make a liquid 'green' ammonia. Ammonia is toxic and results in emissions of nitrous oxide – a very potent greenhouse gas.

It would be much better to use renewables for people's energy. However, we may still need limited amounts of green hydrogen to eliminate carbon emissions from industries that we need, for example steel making. Where that is the case, the hydrogen should be produced on site where it is used.

People's power and participation

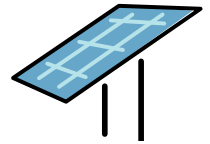


Now that we have looked at different types of energy, we look at how renewable energies can be used to achieve energy sovereignty. These different sources of renewable energy provide ways to transition from non-renewable dirty polluting sources like fossil fuels to using renewable energy sources. So far, so good!



But not good enough!

We have been looking at how energy can be produced from different sources, but generation is only one part of the energy process. We must also ask these questions.



How is it used and what it is used for?

Is the energy used really necessary or are we using it to make up for something else? For example, are we using electricity to cool or heat buildings to make up for buildings that are badly built and energy inefficient?

Is the energy being used unnecessarily and extravagantly? Do we use motor vehicles on short trips when we could easily walk or cycle? Do we use public or shared transport when possible?

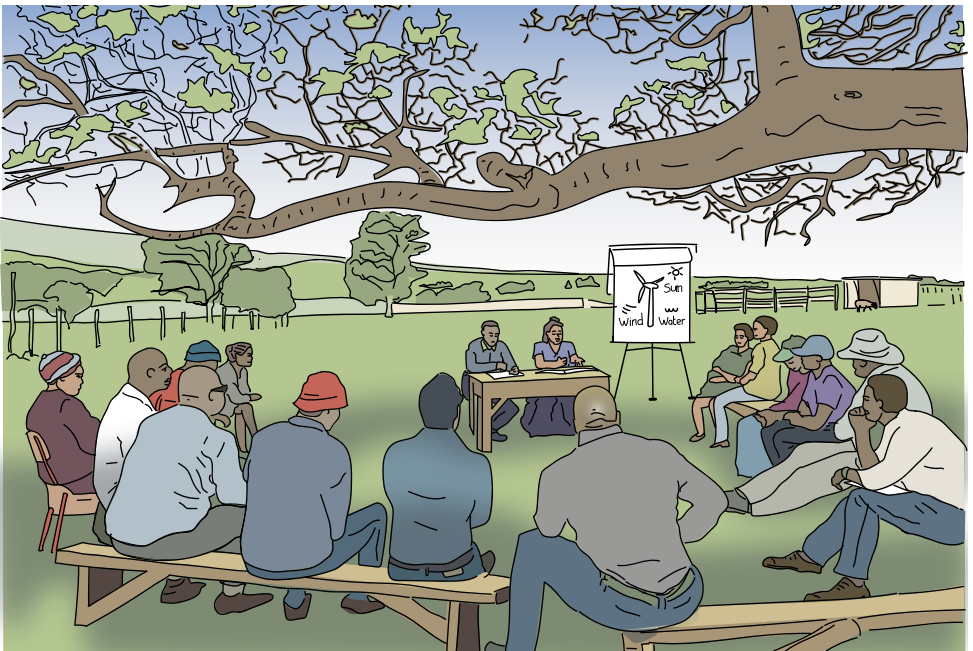
For the transition from non-renewable energy to renewable energies to be just, we must change not only the technologies, but shift the system to a democratic one. It must work towards making it possible for all people to live well with the earth and each other.



Community participation

What would this mean in practice then? It was pointed out earlier how communities have been **excluded** from decision making about the energy systems they have (or don't have) access to, how the resources necessary for this energy system have been **enclosed**, and how communities have carried the burdens that have been **externalised** onto them.

Community ownership is where people are in charge of energy production and how it is used. It is an important aspect of the energy sovereignty approach. This means that communities must not only have the right to engage with government on their energy needs, but they must exercise that right.



When they exercise their rights, they must base their decisions on good information about energy so that they negotiate energy projects and policies that serve their needs. This is a big move from the current system!

Some people are suspicious of renewable energies because they don't have experience of them. For this reason, there is an urgent need to raise awareness about these rights and also about renewable energy itself with community members.

Energy sovereignty requires that the system is a participatory one where people have rights, including:

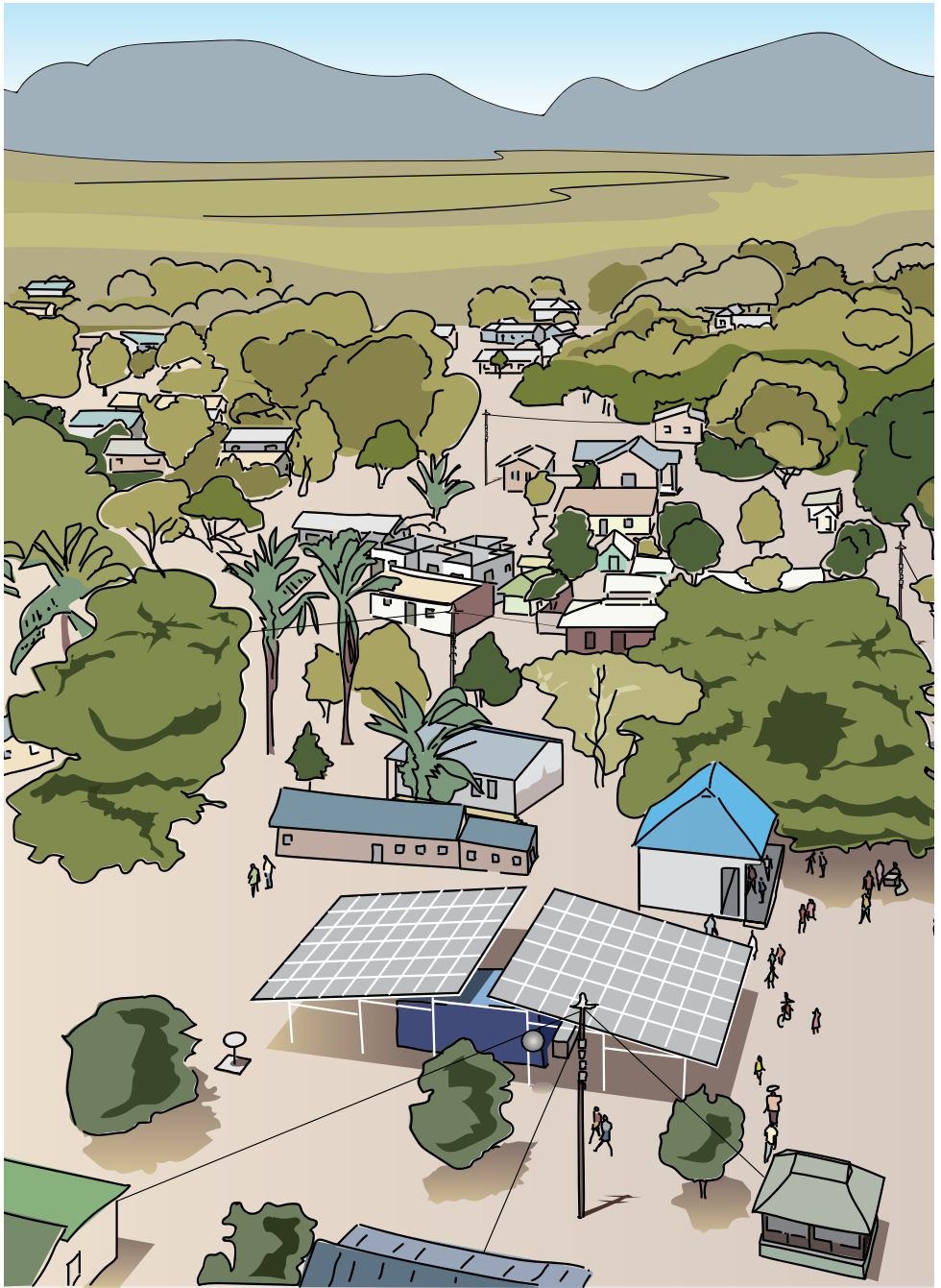
- the right to take part in making decisions about energy and energy policies
- the right of communities to take part in local energy systems
- the right to have good information about energy and their energy rights so that their participation is well informed.

As a democratic energy system, it means communities need to work together to develop decision-making capabilities. Community members need to practice open democracy and take on the responsibility of managing their energy needs in a democratic way.

A decentralised system

As we know, people become used to things as they are and often don't think about doing things differently. Many people are used to the idea that most countries have a centralised grid. The centralised grid in many African countries only reaches some of its population. As we mentioned earlier, in sub-Saharan Africa alone 600 million people, or approximately 53 per cent of the region's population, live without access to electricity.

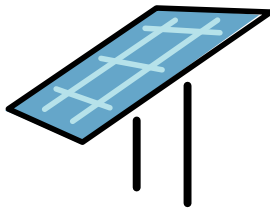
In South Africa, Eskom (a wholly state-owned enterprise) became the only power producer and was tasked with generating, transmitting and distributing electricity through a national centralised grid. Before the creation of a single national grid there was a decentralised system and municipal generators were the norm. In a decentralised system this can once more take place. This is not to say that the common grid should cease to exist, but rather that it should exist alongside smaller scale utilities.



A mini-grid serving a small community

Recently, policies in many African countries including, for example, Kenya, Nigeria, South Africa, Tanzania and Uganda, have allowed for a number of Independent Power Producers (IPPs) who are mostly generating electricity and selling it to the national grid (also referred to as the central grid). Certain IPPs can work collaboratively with communities to provide electricity. However, it's important to note that most private investors are profit driven and most will go where they face least resistance from communities and where they will get good returns on their money. A lot of them use fossil fuels to generate energy and so produce dirty energy.

It does not need to be like this though. In contrast to this extractive and unjust energy system that serves corporate and government interests, energy sovereignty promotes the idea that there should be a national grid that is controlled by a publicly-owned decentralised system rather than being a centralised state-owned enterprise. In other words, it needs to be answerable to, and serve the interests of, the public and not the investors or politicians.



Communities as power producers

Energy sovereignty also endorses independent community power production. In the same way that corporate IPPs are producing electricity as part of the present energy system, communities can become power producers themselves. In other words, they can plan to use renewable energy and develop a mini-grid that is owned by, and serves the needs of, that community. Community-owned renewable energy allows communities to own and run their own energy systems in a way that respects the earth and the people around them. If mini-grids are community-owned (or co-owned) and community-led, it means that communities lead the discussions about their energy needs. If they decide to establish community-owned and -led renewable energy, their planning needs to be done carefully and in a communal way.



Mini-grid

Important principles to ensure energy sovereignty



Community members need to agree on the type of energy system they want to set up in a bottom-up approach. They must hold dialogues in a democratic and transparent way.

Community members must reach broad consensus about what actions to take.

They should consult with other stakeholders to gain as much understanding of the energy system as possible. These might include energy experts, private industry, consultants, etc.

Community members and other stakeholders need to be very clear about the terms of any contract they agree to. This point of discussion is an important aspect of the negotiations.

They must make sure that their decisions and actions do not degrade the environment, people or resources.

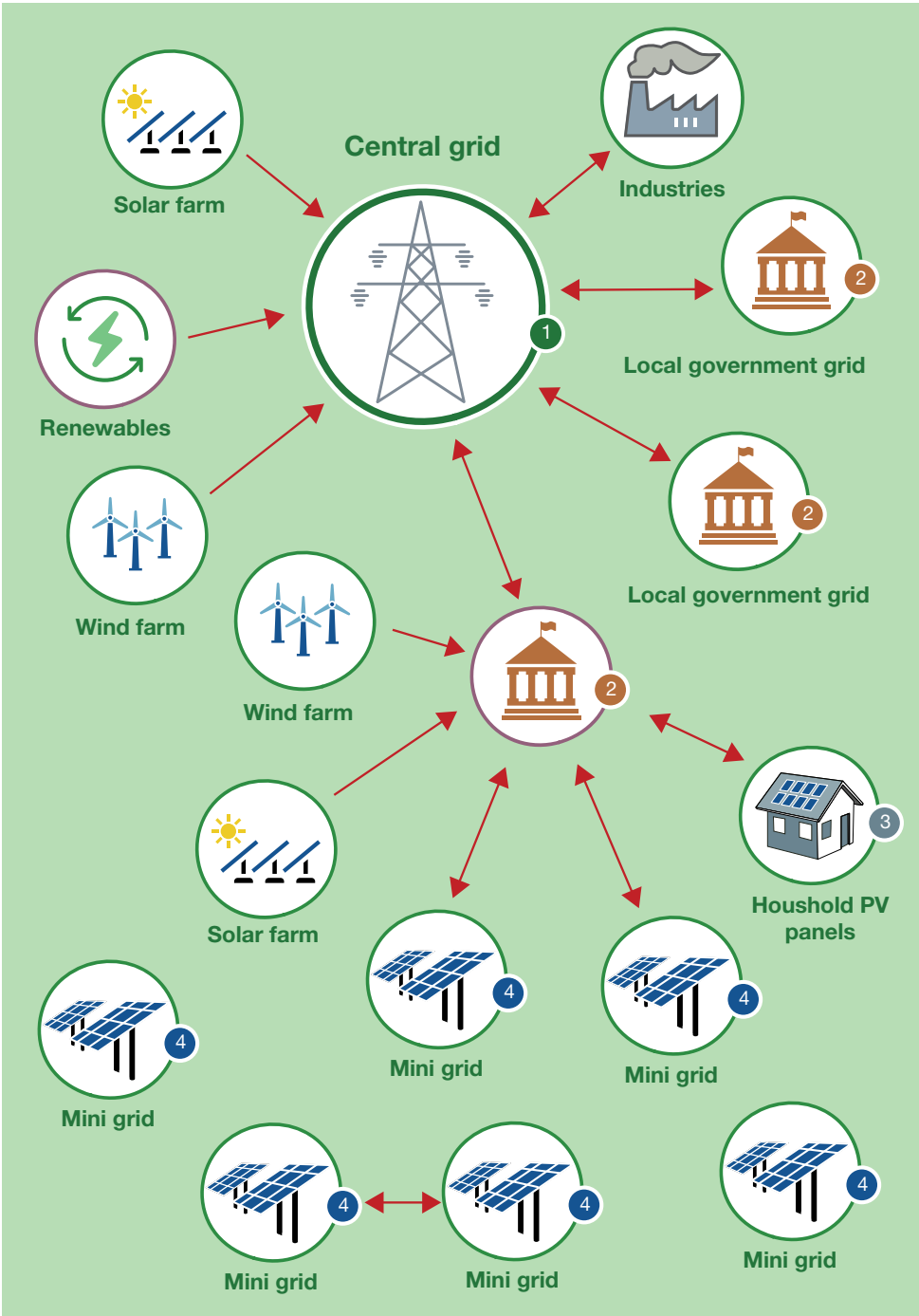


Diagram of a proposed renewable energy system

This system diagram gives us a picture of how a decentralised, sustainable energy system can work.

A central grid (1) draws on renewable sources, for example solar, wind, geothermal, etc. The central grid provides electricity directly to some large industries, and to local governments for distribution.

The local government grids (2) can receive electricity from four different sources - from the central grid, from renewable energy farms, from rooftop solar panels (3), and from mini-grids (4). Rooftop solar panels and mini-grids are able to feed electricity back to the central grid if they have a surplus that has been generated by the renewable sources.

If the central grid, local government grids and mini-grids are connected to each other, they can both supply and receive electricity (see double arrows in the diagram).

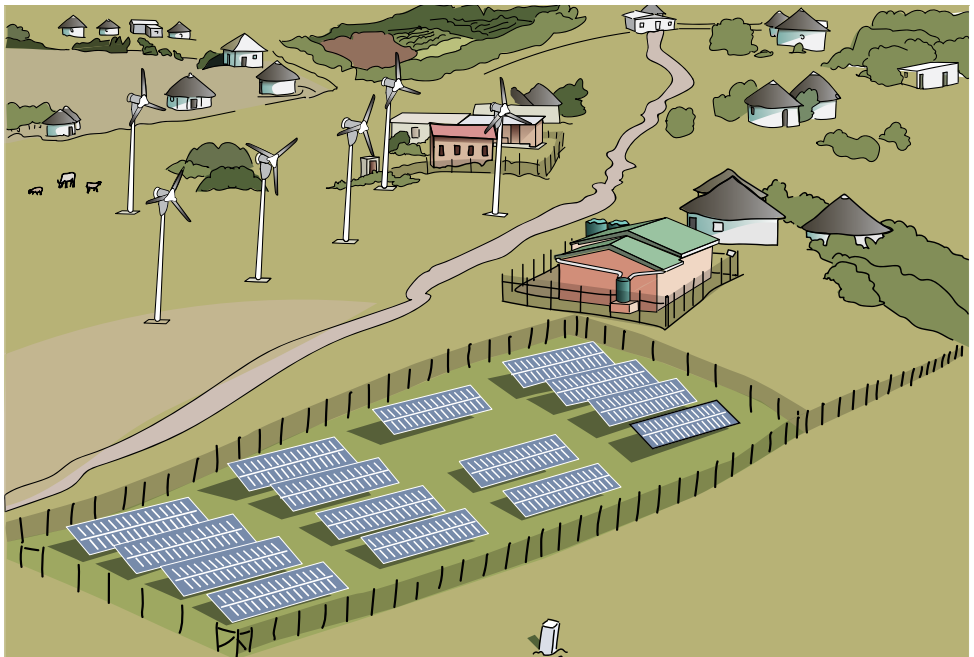
Mini-grids (4) can also be stand-alone (4) and this is valuable in remote rural places which have no links to a local government or central grid. They can provide electricity for a community (as is the case at Blinkwater in South Africa described below). It is also possible that one mini-grid can link to other mini-grids under the right conditions. In this way they can share surplus energy if they have more than they need.

Community-owned renewable energy production requires investment and maintenance. Just because it will be community-owned does not mean that the community should be responsible for the investment in the system. Government would still be required to fulfil its role of governance and meeting the rights of all, including the right to electricity.

The difference between the present system and energy sovereignty lies in a different relationship between the community and local government. Rather than a top-down approach, the community and local government should work co-operatively. Together they should negotiate the system which would be locally owned and democratically controlled. Mini-grids that are community owned are central to this changed system.

Mini-grid in Blinkwater

An example of a stand-alone mini-grid exists in Blinkwater in the Eastern Cape province of South Africa. Blinkwater was a remote town without access to the national or municipal grid. Local government managed to respond to the community's needs for electricity by constructing a mini-grid powered by solar and wind energy, together with converters, battery storage and a generator. Before this project was implemented, people collected wood to make fires to cook, make coffee or tea, and even boil water to wash. This mini-grid produces enough energy for each household to run a mobile-phone charger, a TV satellite dish and a kettle. There are also a few communal washing machines and some



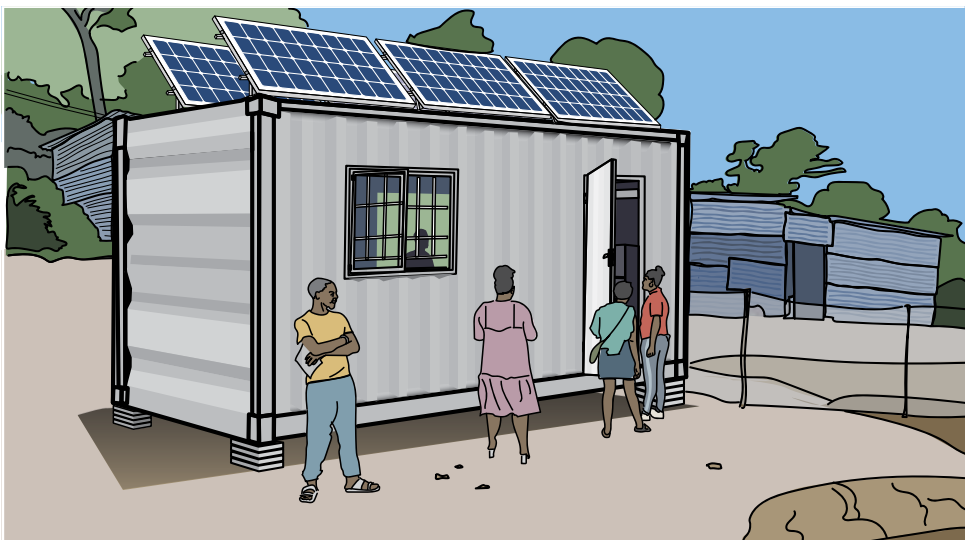
machinery linked to economic activities. At a later stage it might be possible for this mini-grid to link up to the national grid or other mini-grids. This is an interesting example of renewable energy use. Although this mini-grid was installed by local government, it is a useful example of how a mini-grid can work for a community.

Solar power pilot projects

Called “Mobilising Social Movements for Energy Democracy and Sovereignty in South Africa”, this pilot project’s purpose is to empower communities to negotiate effectively with local government and other stakeholders so that they can get clean, safe, reliable and affordable renewable energy. This energy should be community-led and socially-owned.

Pilot projects came out of a partnership of three South African community-based organisations, namely South Durban Community Environmental Alliance (SDCEA), Vukani Environmental Movement (VEM), Abahlali baseMjondolo (AbM), in partnership with groundWork and Sustainable Energy Africa.

Solar PV panels have been set up as demonstration units at the three sites.



These sites are on the roofs of SDCEA and VEM's office and on a container at the Ekhanana informal settlement. These are used to show how renewables can work, producing power even during load shedding. They provide hubs that serve as information centres where community members can charge their cell phones and children can do homework. The system creates the opportunity for local communities to experience PV powered solar systems, exposing them to the possibilities of renewable energy access.

The shift away from fossil fuels to renewable systems will require thoughtful action through education. People have been socialised into accepting the system as it is. Now we need a new approach that resists the old one, that demands clean energy, and that is considerate of people and the environment.

The system must factor in the changes that this will bring for workers who presently work in the fossil-fuel industry. Community-owned renewable energy has the potential for new employment opportunities, including for unemployed youth, which will be different from those available currently.

groundWork takes the position that a world that is seriously addressing climate change is a world that needs to transform the economic system and the energy system that powers it. Energy planning must be made to fit with this system and contribute to a just transition. If this does not happen, we must expect catastrophic climate change.

This system needs a clean and democratic government that:

- upholds people's constitutional rights
- supplies the energy needs of their people
- avoids catastrophic climate change while ensuring a just transition to clean energy
- conserves land and water and prevents the further destruction of whole watersheds and
- avoids bankrupting the country.

It is necessary to focus national resources on developing renewables under democratic control while shutting down dirty energy plants.

Finally, an energy sovereignty system would include the characteristics listed here.

Renewable energies must replace fossil fuels to supply clean energy. This is necessary to slow down global warming and to benefit people's health.

People must have a say in the energy system they use and ensure that the energy is accessible and affordable for all.

The system must first serve the needs of the people, not corporates and government.

The system itself will have to change to fit these purposes – it does not need to remain a centralised system with a single grid.

Energy sovereignty is not an approach that overlooks the government's role in providing energy, but insists that it should fulfil this role to meet the needs of the people it is elected to serve.





Archbishop Emeritus Desmond Tutu



‘We all have a responsibility to learn how to live and develop sustainably in a world of finite resources’



To learn more about the topics covered
in this booklet please visit

<https://groundwork.org.za/the-groundwork-environmental-justice-education-campaign/resources/>