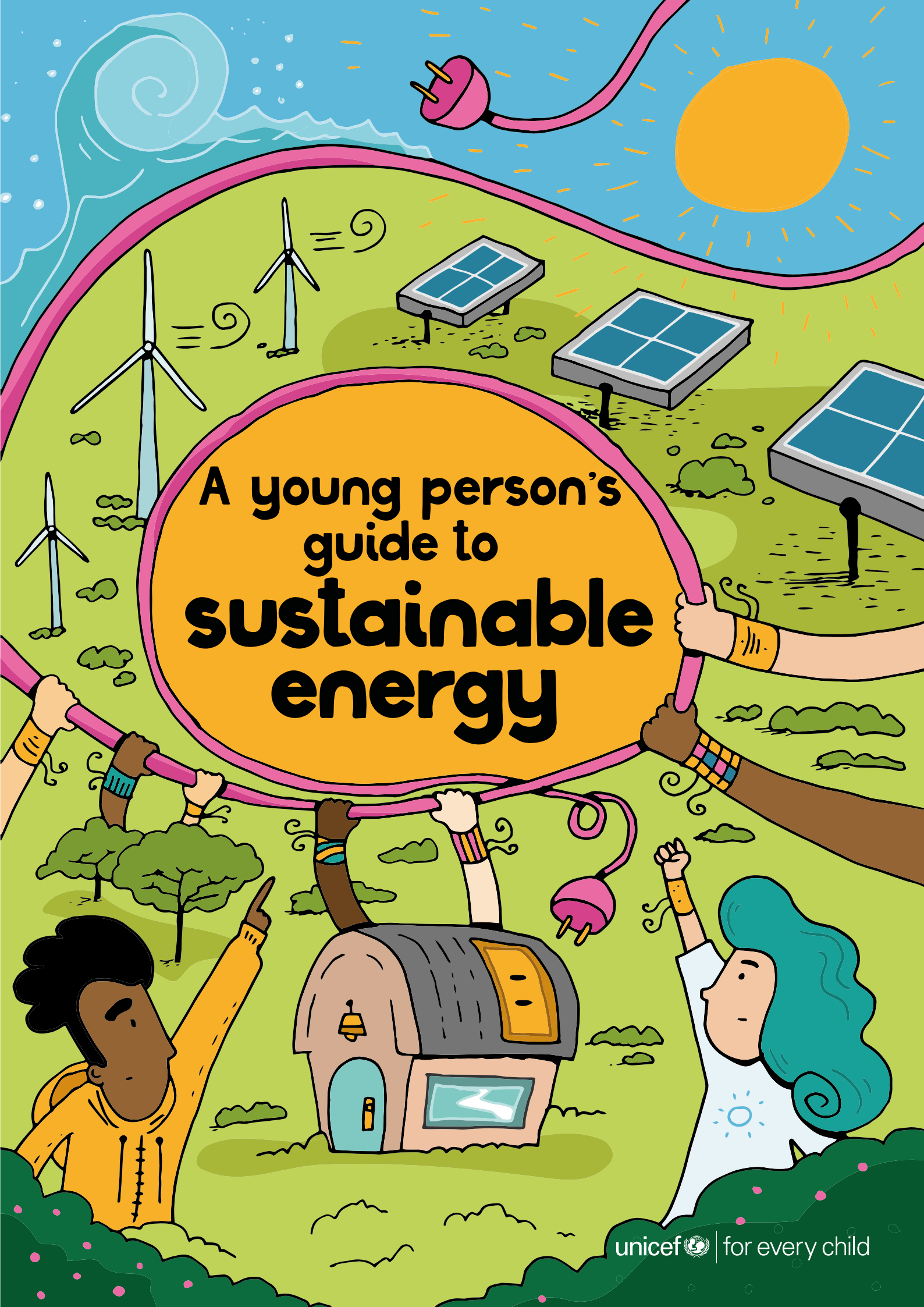
A young person's guide to
sustainable energy
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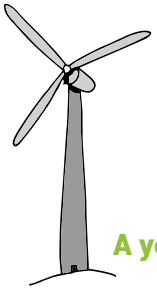

A young person's guide to sustainable energy

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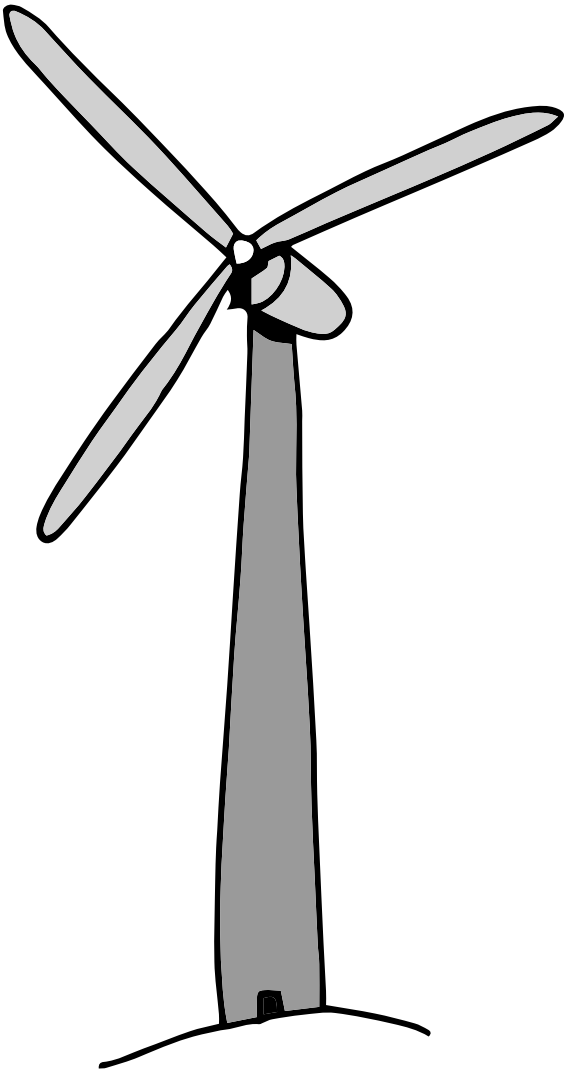

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A young person's guide to sustainable energy

Key concepts to understanding sustainable energy and its relationship with climate change, the role of young people, and why the world needs a just energy transition.

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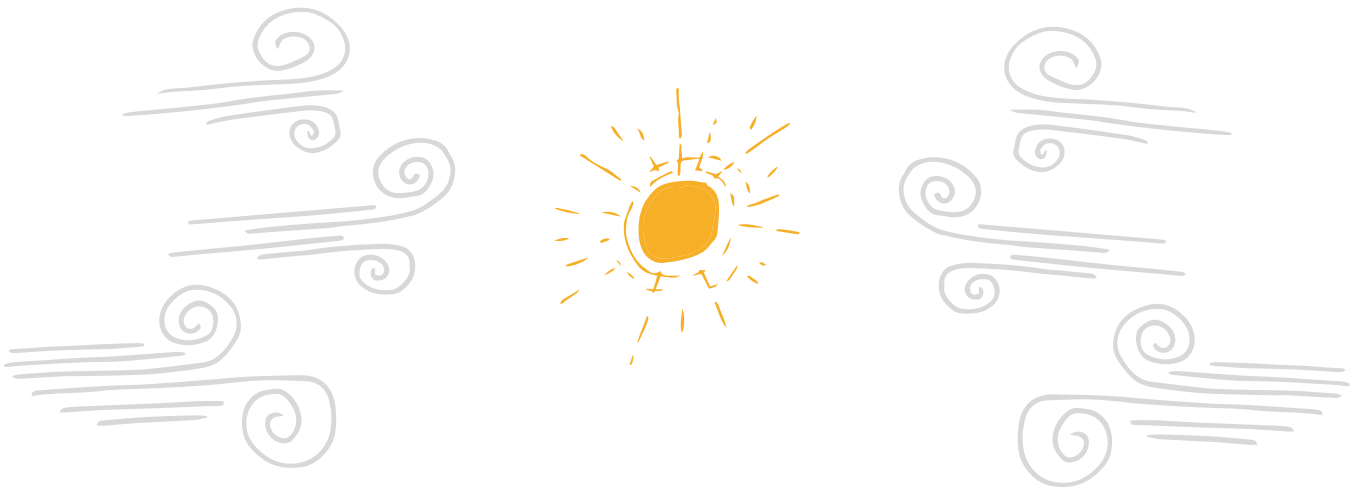

Foreword

"We, as young people, are agents of change in different areas of society. We have not been left behind in climate action: our voices are increasingly heard, and we are demanding the right to participate fully. Our participation is also a right that must prevail in the formulation of public policies."

The Toolkit for Young Climate Activists **in Latin America and the Caribbean** was created by young people who, like you, are concerned about our planet and, as activists, have faced many challenges in advocating and working for change. The goal of the toolkit is to share clear and concise information in simple language to help you understand global, regional and national climate action, and prepare you for full and informed participation. The toolkit contains several complementary thematic guides that help readers understand climate action and expand their knowledge in different topics. You can read these guides consecutively and deepen your knowledge in each one of the topics or you can consult only the ones that interest you.

A young person's guide to sustainable energy is the second publication of this thematic series that supports young people in climate and environmental action. It includes essential information to help readers understand energy and energy transition across the globe and help them take action for a sustainable energy future.

A young person's guide to sustainable energy complements the first guide of this thematic series, Air quality: It's time to act! and together, they provide crucial information for young climate activists.

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IRENA
International Renewable Energy Agency

SDG7 YOUTH CONSTITUENCY
YOUTH IN SUSTAINABLE ENERGY

This guide uses the terms "youth" and "young people" to refer to adolescents and young people between 15 and 24 years old.

0 to 18 | 10 to 19 | 15 to 24 | 10 to 24

Acknowledgements

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Contents

Acronyms and Abbreviations

- **CO2:** Carbon dioxide
- **COP:** Conference of Parties
- **GGA:** Global Geothermal Alliance
- **GHG:** Greenhouse gases
- **GIS:** Geographic Information System
- **GW:** Gigawatts; a unit of power equivalent to one billion Watts
- **GYEO:** Global Youth Energy Outlook
- **ICS:** Information Computer Systems
- **IPCC:** Intergovernmental Panel on Climate Change
- **IRENA:** International Renewable Energy Agency
- **kW:** Kilowatts
- **MW:** Megawatts unit of power equivalent to a thousand watts
- **MAHB:** Millennium Alliance for Humanity and the Biosphere
- **PM:** Particulate Matter, including microscopic matter suspended in air or water
- **SDGs:** Sustainable Development Goals
- **STEM:** Science, Technology, Engineering and Mathematics
- **UN ENERGY:** United Nations Energy
- **UNCRC:** United Nations Convention on the Rights of the Child
- **UNEP:** United Nations Environmental Programme
- **UNFCCC:** United Nations Framework Convention on Climate Change
- **UNICEF:** United Nations Children's Fund
- **UNIDO:** The United Nations Industrial Development Organization
- **MGCY:** Major Group for Children and Youth
- **VRE:** Variable renewable energy
- **W:** Watts, International System of Units' standard unit of power, equivalent to one joule per second
- **WETO:** World Energy Transitions Outlook
- **WHO:** World Health Organization

Introduction

This guide offers an introduction to sustainable energy. It presents key concepts on sustainable energy, explains existing energy options and their impacts, and highlights the need for a just energy transition. It also explores actions you, as a young person, can promote to build a sustainable energy future.

Globally, young people are calling for a just energy transition, but how do we get there? We created this guide to support this process. Many of the concepts we will discuss are addressed in other information sources and educational materials on sustainable energy, but we have adapted the contents to a simpler language. We also conducted extensive desk research and consulted with other young people and youth organizations to write this guide. You can refer to the original sources for more details or information on the concepts.

First, we will start by learning the basics, such as what energy is and where it comes from. We will learn how electricity is distributed in our communities and explore the different types of energy sources, starting with conventional, then renewable energy, while taking a closer look at each subcategory.

Next, we will focus on the challenges of fossil fuels and the importance of sustainable energy. We will provide a snapshot of the current state of sustainable energy across the globe and in Latin America and the Caribbean, and how it has evolved over the years.

We will then discuss energy governance, the various global and regional actors in the energy sector and their roles, and the policies necessary to achieve an energy-sustainable world. We will also emphasize why we need a just energy transition and how this can be achieved, while highlighting the critical role of energy in achieving the Sustainable Development Goals (SDGs).

Lastly, we will look at ideas of actions that young people can take to support a just, sustainable, and healthy energy transition, exploring youth experiences that show us that acting for sustainable energy is possible.

At the end of the guide, you'll find a glossary that you can refer to if you want to learn more about a particular concept.

Energy: The ability to do work

In this section, we will define energy and identify the different ways energy is part of our daily lives.

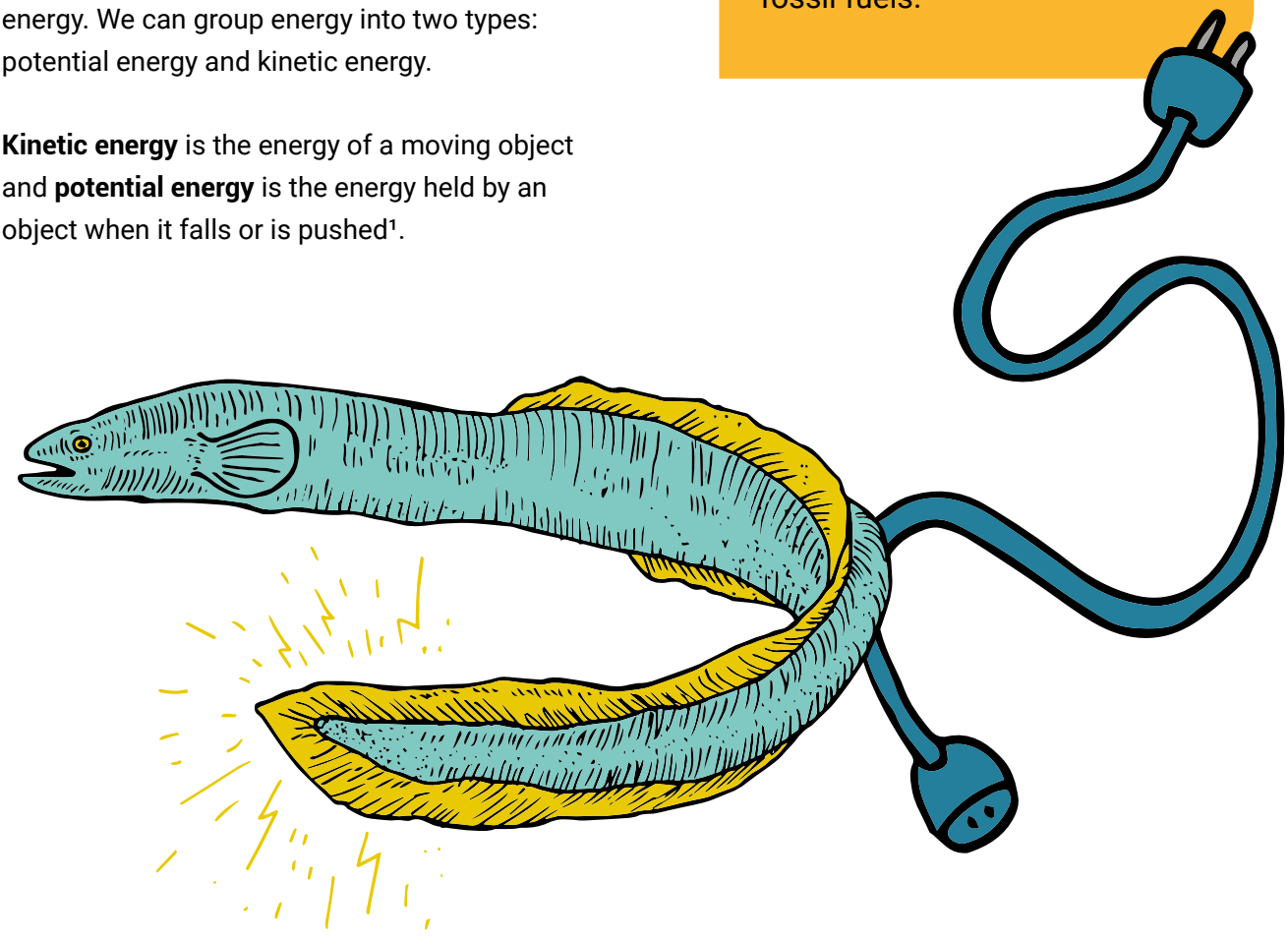
Energy is defined as the ability to do work. Modernization and innovation is possible because humans have learnt to transform energy from one form to another and use it to work. Humans need energy to do many things: take walks, bike, drive, fly on planes, cook food, freeze ice, light homes and offices, manufacture products, and search for life on other planets. There are different forms of energy such as thermal energy, radiant energy, chemical energy, nuclear energy, electrical energy, motion energy, sound energy, elastic energy and gravitation energy. We can group energy into two types: potential energy and kinetic energy.

Kinetic energy is the energy of a moving object and **potential energy** is the energy held by an object when it falls or is pushed[1].

What is electricity?

Electricity is a form of energy obtained through the movement of electrical charges (usually small particles called electrons) produced inside conductive materials (for example, metallic cables such as copper), making it possible to switch on a device or a light bulb.

Electricity sources include solar, wind, hydroelectric or nuclear plants, and biomass or burning fossil fuels.



Where does my energy come from?

This section presents an illustrated timeline to show how the world of energy has evolved since the first fire to the latest world records for renewable energy. You can explore the annex for more in-depth information on each stage.

~500,000 B.C.
The first fire.

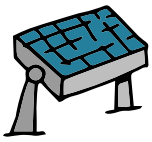
2500 B.C.
The wheel.

1765 A.D.
The steam era begins.

1859
The first oil well drilled.

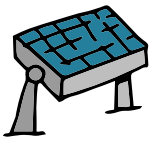
1900
The rise of the oil industry.

1942
The first nuclear reactor.



1963
Mass production of solar cells begins.

1973
The oil crisis.



1974
First solar building "Solar One" is constructed.

1981
International agency dedicated to renewable energy proposed.

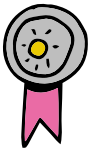
1990
Expansion of hydropower.

2001
Expansion of wind energy.

2015
Renewable energy record.

2017
Wind energy continues to advance.

2020
The cheapest electricity from solar energy in history.



2022
New renewable energy record.

Have you ever wondered how electricity gets into your home?

We know that, globally and regionally, there are significant challenges in ensuring the widespread use of sustainable energy sources. In this section you will learn about energy and how it is distributed and integrated in our cities.

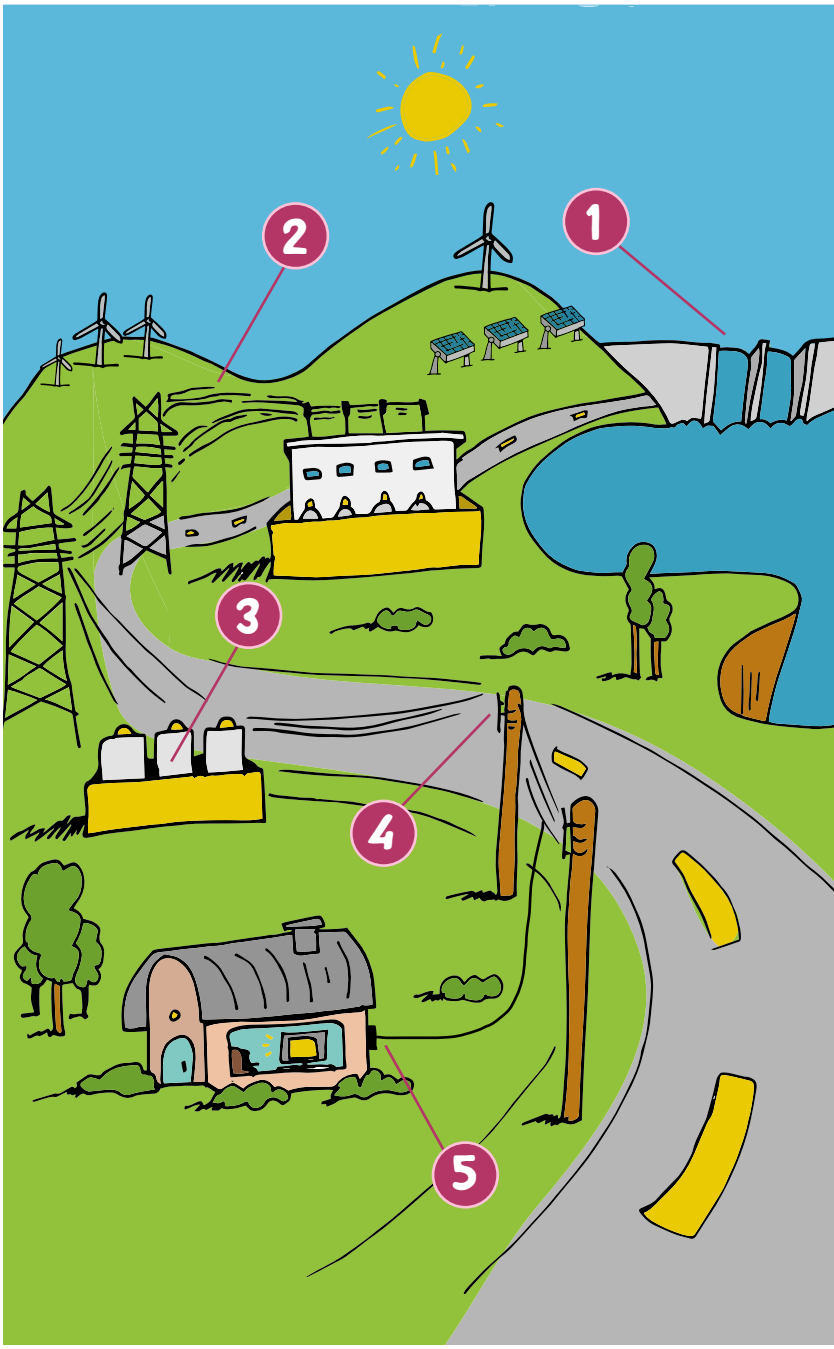
1. Electric power is normally generated in power plants that run on fossil fuels or renewable energy (e.g., off-grid solar or wind power plants).

2. Electricity from power plants travels at very high voltages through cables placed on towers to transmit the energy to cities.

3. Before it is available for use, electricity reaches electrical substations where its high voltage is reduced to transport it to the local electrical network.

4. Once in the local electrical network, electricity passes through electrical transformers where voltage is again reduced to adequate levels for the operation of appliances and devices we use daily.

5. Electricity reaches homes, schools, buildings, and businesses after going through power meters that measure the amount of electricity people use.



Sources and uses of energy

In this section, we will explore the different sources of electricity generation. These are divided into fossil fuels, nuclear energy, and renewable energies. We will explore each type of energy and highlight their main advantages and drawbacks.

Fossil fuels

Fossil fuels are underground deposits composed of combustible organic materials formed by decomposed plants and animals, which were converted into crude oil, coal, and natural gas after being exposed for hundreds of millions of years to the heat and pressure of the earth's crust. **The figures below show the main fossil fuels and the problems associated with their use.**

Coal[2]

Description

It is a black or dark brown solid fuel mineral in the form of sedimentary rocks. Coal is formed by the decomposition of 350 million year old forests that existed on the earth's surface during the Carboniferous period.

Uses

Coal is burnt/combusted to produce heat/power. Its most important uses are electricity generation in coal-fired plants, steel production, cement manufacturing, cooking and liquid fuel production.

In 2017, Latin America and the Caribbean produced about 9 million tons of coal and Africa generated 32 million tons.[3]

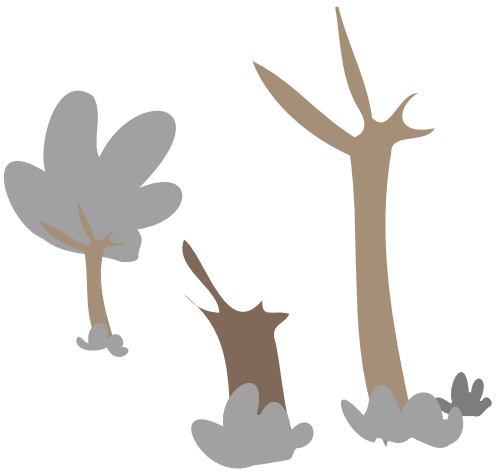
Problem

> It has a huge environmental impact and contributes to global warming.

> Coal produces the most greenhouse gas (GHG) emissions of all fossil fuels.

> Coal requires the most extensive processing, handling, storage, loading and unloading facilities.

> It is not renewable.



Natural Gas[4]

Description

Methane comprises the majority of the mixture of gases that make up natural gas. It is found in large quantities in underground fields.

Uses

It is used at home for heating and cooking. It is also used for electricity production.

It is used for combustion, incineration, and air conditioning in industrial settings.

In transport, some vehicles use gas instead of gasoline and diesel since energy can be saved and is less expensive.

Problem

> Because of its volume, gas requires larger storage places, which are costly to maintain.

> It is not renewable.

> According to the Millennium Alliance for Humanity and the Biosphere (MAHB)[5], considering the current rate of natural gas production and reserves, the earth has about 52.8 years' worth of natural gas reserves left.

> Fracking uses a large amount of water from local water reservoirs and releases methane, a greenhouse gas, into the air, with strong environmental impacts.

> Even though natural gas is considered to be a cleaner fossil fuel than coal it still has a huge environmental impact and contributes to the global warming.

Crude Oil[6]

Description

Crude oil is a liquid fuel with very dark or black minerals. It originates from raw material formed by aquatic organic remains of plants and animals that lived in the ocean, lagoons, river mouth basins or near the sea.

Uses

It is used as a raw material throughout the petrochemical industry.

A whole range of commercial by-products can be obtained at different temperatures (gaseous substances such as methane, ethane, and propane; liquids such as gasoline, kerosene and fuel oil; solids such as paraffin and tars).

60% of the chemical products on the market and 80% of the organic sector come from petrochemicals.

Problem

> Oil spills can pollute streams and rivers; if they soak through the soil and rock, they can contaminate groundwater. Since drinking water supplies often come from rivers and groundwater, we must protect them from pollution.

> Oil is toxic and harmful to plants and animals and threatens their habitats.

> As a fossil fuel, the combustion of crude oil contributes to polluting emissions, especially carbon dioxide.

> There is widespread concern that global oil production will likely decline over the next few years.

Nuclear energy

Nuclear energy is the power stored in an atom's nucleus or core[7]. Like fossil fuels, nuclear energy is not renewable because it requires uranium, a limited resource. Its main use is the generation of electricity, and this is done in nuclear reactors. Whilst the use nuclear energy has declined over the years, it supplied 10% of electricity across the globe in 2018[8].

Nuclear Energy

Description

Nuclear energy is the energy released from reactions in the nucleus or central part of atoms to form electricity.

Uses

The primary use of nuclear energy is the generation of electrical energy. However, this technology is also essential for the industrial sector to develop and improve medicine, agriculture, hydrology, mining, and the space industry processes.

In 2020, the United States was the world's leading consumer of nuclear energy[9], followed by China, France, Russia, South Korea and Canada.

Advantages

> Nuclear energy is carbon-free.

> It does not release greenhouse gases that lead to pollution or global warming into the atmosphere.

Challenges

> Radioactive waste is created during nuclear power plant operation. The treatment of nuclear waste is essential to ensuring safety.

> Radioactivity released in large quantities is lethal and can also cause malformations and diseases in people, plants, and animals that live in the area over several generations.

> Uranium is required for nuclear fission. Although this material is common, access is limited. Therefore, traditional nuclear power is considered a clean but non-renewable energy.

Renewable energy

Energy is renewable when its source is based on using inexhaustible natural resources, such as the sun, wind, water, or biomass. Renewable energy does not use fossil fuels but natural resources that are constantly replenished and do not produce greenhouse gases, the main drivers of climate change. Like fossil fuels, renewable energy can produce electricity, heat, gas, and biofuels without releasing greenhouse gases.

The main advantages of renewable energy are that they are inexhaustible resources. Its use results in improved access and savings on electricity use, reducing energy dependence on other countries and ultimately mitigating climate change. Disadvantages include the lack of stability in energy production and difficulties in storage. The table below shows the various types of energy, their uses, advantages and some of their challenges.

Solar Energy[10]

Description

Solar energy is produced by the sun's rays.
There are two types of solar energy: Solar thermal energy, which relies on the sun to produce heat, and Photovoltaic (PV) energy, which provides light that is converted into electricity through photovoltaic panels.

It is renewable because the heat and the light from the sun is inexhaustible.

Uses

Solar energy can be used for electricity generation, lighting, water heating, and industrial use.

Advantages

> Each household can produce electricity for self-consumption by installing a solar-panel on their roof and therefore safe on energy bill.

> Solar energy is clean energy and does not generate greenhouse gases or pollution. Therefore, it can significantly help reduce the carbon footprint.

> During the COVID-19 pandemic, solar-powered refrigerators played a critical role in some regions, allowing accessible and sustainable means to refrigerate vaccines. It is an inexhaustible energy source.

Challenges

> Solar energy is a source of irregular energy that depends on sunlight and heat. Humidity or cloudy and foggy periods can adversely affect its performance.

> It has high initial costs, and the investment is recovered after several years.

> Storage is expensive and requires high investments.

Wind Energy[11]

Description

It is obtained from the wind/moving air. Wind turbines create energy through movement, converting kinetic energy into electrical energy. It can be produced on land and at sea.

Uses

Wind energy can be used for the production of electrical energy.

It is also used to pump water for agricultural needs.

As of 2020, China has the highest wind energy generation, followed by the USA, Germany, the United Kingdom, India, Italy and Indonesia.

In Latin America, Brazil and Mexico are among the largest producers[12].

Advantages

> Wind energy is renewable. It is carbon free source of energy and approximately 8% of the turbine components can be recycled or reused.

> It is applicable to urban, rural and off-grid locations.

> Wind turbines have a long service life.

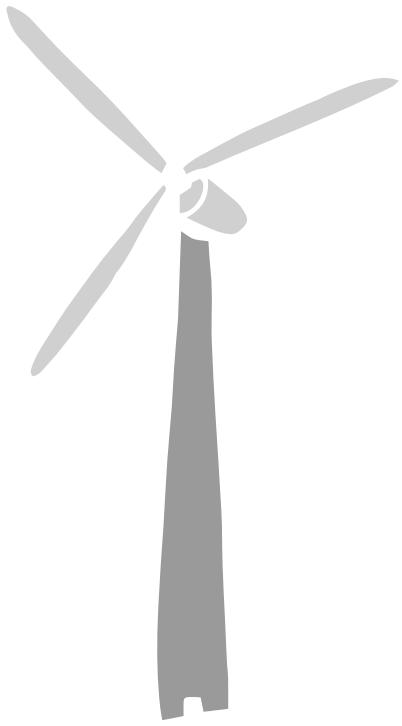
> Wind energy supports job creation.

Challenges

> Wind turbine blades are large and difficult to remove, making long-distance transportation costs very expensive.

> The rotors harm migrating birds and bats because they often collide with wind turbine blades.

> Moving blades create noise that can be uncomfortable for nearby animals and people.



Hydropower[13]

Description

Hydropower uses moving water that goes through turbines to generate electricity.

Dams and reservoirs can be used to store water for short or long periods, which will later be used to meet energy needs.

Uses

Production of electrical energy.

Besides generating electricity, hydropower can also be used for:
- Irrigation.
- Flood control and drought mitigation.
- River navigation.
- Recreation and tourism.

Latin America has 20% of the world's installed hydroelectric capacity and Brazil has become the second largest hydroelectric producer in the world, behind China[14].

Advantages

> Hydropower is flexible because the flow of water passing through the turbines can be adapted to the electricity needs.

> It has a clean production process and does not produce any waste.

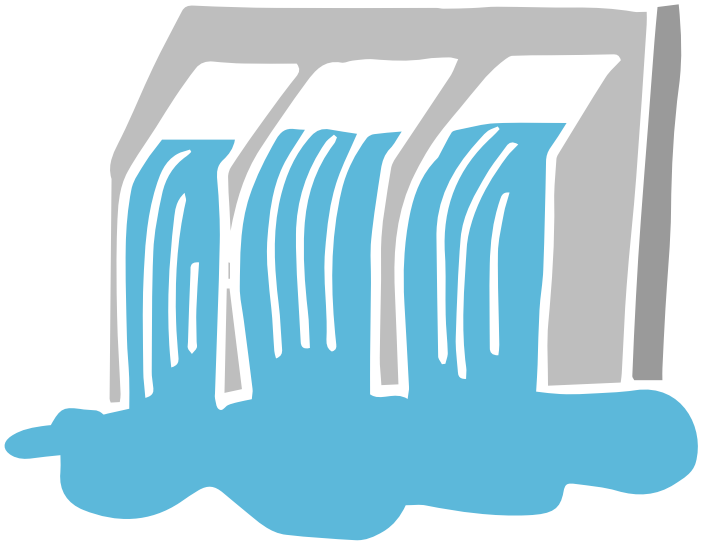
Challenges

> The dam construction needed to build hydropower plants has adverse effects on flora, fauna, and nearby communities.

> Construction costs are high.

> Hydropower plant performance is based on the amount of rainfall available.

> Droughts cause the amount of moving water needed for hydropower to fall.



Bioenergy[15]

Description

The use of bioenergy is divided into two main categories: traditional and modern.

Traditional use refers to the combustion of biomass in forms such as wood, animal waste, and traditional charcoal.

Modern bioenergy technologies include liquid biofuels such as bioethanol produced from wooden pellets and other plants, biorefineries, biogas produced by anaerobic digestion of waste, wood pellet heating systems and other technologies.

Uses

About three-quarters of the world's renewable energy use involves bioenergy, and more than half consists of the traditional use of biomass.

It can be burned directly for heating or power generation or converted into substitutes for oil or gas.

Liquid biofuels, a convenient renewable substitute for gasoline, are mainly used in the transportation sector.

Advantages

> It is cheaper than gasoline or diesel.

> Many different organic feedstocks can be used to produce bioenergy.

> Bioenergy is a low carbon energy source.

Challenges

> Bioenergy provides limited amounts of energy as it is subjected to amount of feedstock available.

> Increased demand for crops to produce fuel can affect food prices and greatly reduce the amount of food available for people.

Marine Energy[16]

Description

Tides, waves, salinity gradients, and currents can be used to produce electricity.

This energy can be harnessed through a tidal barrage also known as a tidal dam or offshore turbines which use the power of moving water to generate electricity.

Uses

The power of tides can be used to create electricity.

Advantages

> Does not produce greenhouse gases or other pollutants.

> Does not use fuel.

> Provides reliable electricity.

> Maintenance is inexpensive.

> Offshore turbines are not too expensive to build and do not have a large environmental impact.

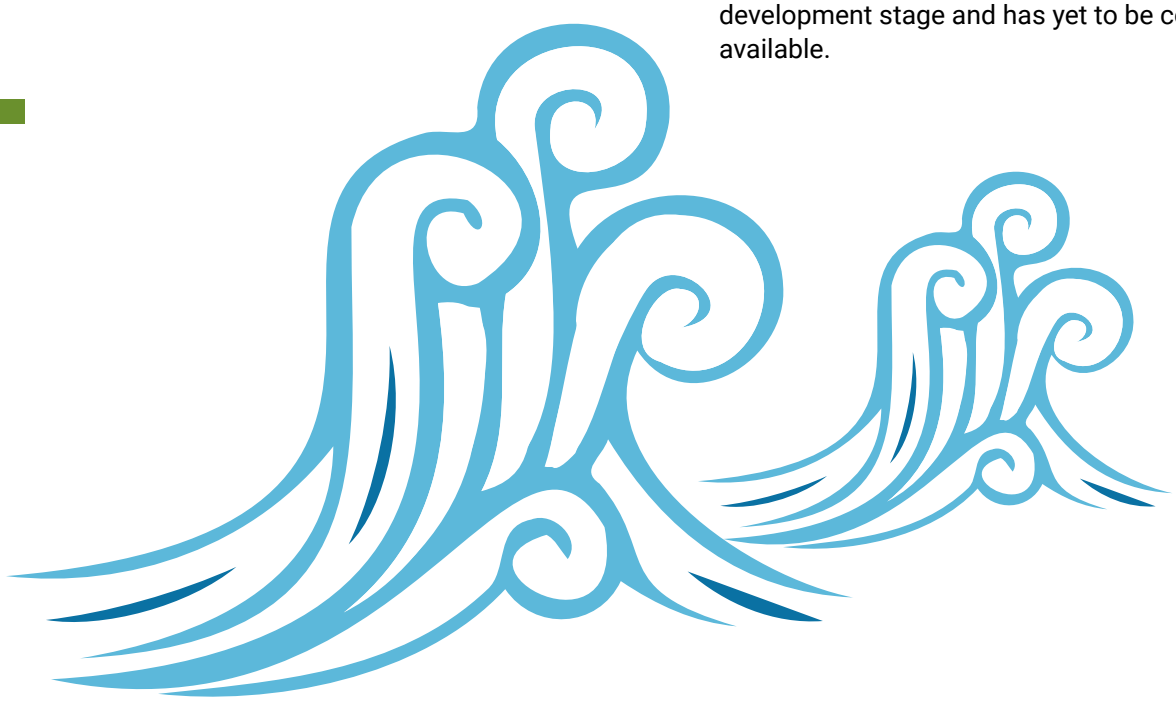
Challenges

> A tidal dam is expensive to build and affects the environment for miles. Birds and fish may not be able to feed or migrate as usual.

> Tidal dams only provide electrical power for about 10 hours a day.

> There are few suitable sites for tidal dams.

> This type of energy is still in the research and development stage and has yet to be commercially available.



Geothermal Energy[17]

Description

It relies on the heat derived from the subsurface of the earth.

Geothermal energy is heat produced in the earth's core, including groundwater.

Uses

This key renewable source covers a significant part of electricity demand in countries such as El Salvador, New Zealand, Kenya, and the Philippines, and more than 90% of the heating demand in Iceland.

International Renewable Energy Agency (IRENA) coordinates and facilitates the work of the Global Geothermal Alliance (GGA) to promote geothermal energy. GGA is a platform that aims to enhance dialogue and knowledge sharing for coordinated action to increase installed geothermal electricity and heat generation worldwide. Learn more.

Advantages

> Geothermal energy does not depend on weather conditions and has very high-capacity factors.

> It has long-term financial savings.

> Minimal maintenance.

> It is ecological and reduces energy dependency.

> It does not depend on energy prices.

> It is inexhaustible and has a long useful life.

> It is considered a safe energy source.

Challenges

> High or medium temperature resources are needed for electricity generation, usually located near tectonically active regions.

> Very high installation price.

> May contaminate aquifers.

> Not suitable for all locations and cannot be transported.

> For use, it requires a rigorous and intense study of the geography, climate and energy load of a home, school or building.

For more information on this section, explore the Energy System Map here.

Green Hydrogen

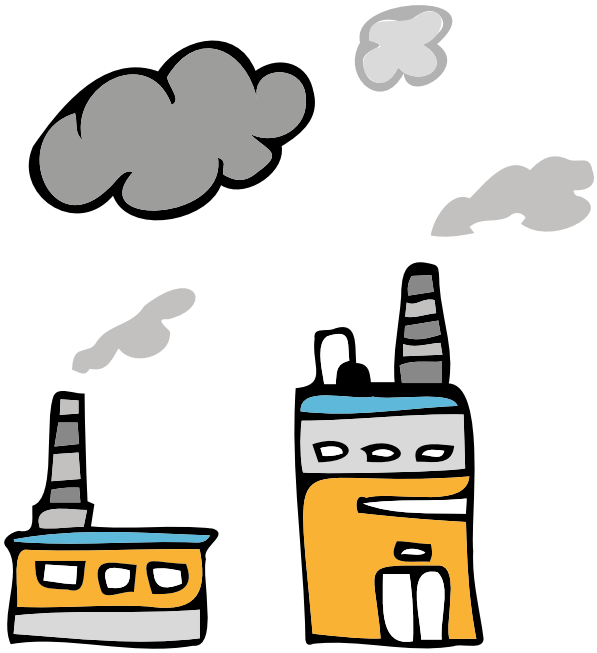
Hydrogen[18] has been gaining popularity in the energy sector. However, the most used type is known as grey hydrogen, which relies on fossil fuels as its energy source. The idea is to transform all hydrogen into green hydrogen, which means that it relies on renewable sources and supports the decarbonization of various sectors. In addition, hydrogen allows large-scale and long-term energy storage, solving the problem of intermittent renewable energy. For example, it would enable storing excess renewable energy during the day and releasing it at night.

In Latin America, Chile is presented as a world power in the production of green hydrogen due to its excellent location in terms of solar and wind radiation. There are more than twenty projects under construction. As of September 2021, Colombia also has a roadmap for the production of green hydrogen. Many countries are advancing along the same lines as Uruguay, Argentina, Peru, Brazil, Costa Rica, and Mexico. This could be a continental decarbonization project to close energy gaps throughout the continent[18].

The problems with fossil fuels

About 80% of current global primary energy demand comes from fossil fuels[19]. The energy system is estimated to generate two-thirds of total global carbon emissions. If fossil fuels remained at their current share and emissions doubled, global temperatures would rise by more than 2 degrees Celsius. Emission levels would have devastating consequences for the Earth's climate.

The most vulnerable communities have been victims of environmental injustice and have been disproportionately affected by air pollution from fossil energy production and consumption. Outdoor air pollution is estimated to be responsible for about 4.2 million annual deaths worldwide[22]. Studies have shown that a rapid phase-out of fossil fuel-related emissions could save millions of lives[23].



The energy system often focuses on energy efficiency and renewable energy as the only solutions to climate goals. This is not true. Besides carbon dioxide capture and storage, other solutions can reduce emissions by 16% per year by 2050[20]. Using renewable energy instead of fossil fuels is not the only solution possible, mainly due to different energy subsectors' varying capacity to achieve the transition. For example, in some industrial applications, such as cement and steel production, emissions come both from energy use and the production process. For now, current technology and production techniques have yet to be available on the scale necessary to achieve zero emissions. However, they are expected to be available in the short to medium term.

Besides releasing emissions, burning fossil fuels also generate localized air pollutants, such as soot (fine particulate matter or PM2.5) and smog (ozone), which can increase people's risk of death from stroke, heart disease, lung cancer and respiratory diseases[21].

Particulate matter is a complex mixture of solid and liquid particles suspended in the air. PM 2.5 is a good indicator of air quality, as it is the air pollutant with the greatest capacity to affect human health. It is therefore one of the most widely used indicators of air pollution in the world[24].

In summary:

1. Using fossil fuels produces GHG emissions that lead to global warming, thereby accelerating climate change and its impacts.

2. Burning fossil fuels produces air pollutants, such as soot (PM2.5) and smog (ozone), which pose great health risks and can lead to a wide range of life-threatening diseases such as stroke, heart disease, lung cancer, and respiratory diseases.

3. Fossil fuels are not renewable. For example, coal takes thousands of years to form and it can only be used once and become depleted.

4. Extracting and processing fossil fuels can lead to land degradation and water pollution from oil spills, resulting in biodiversity loss.

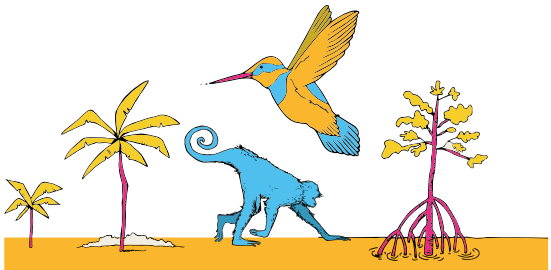
5. Countries relying on fossil fuels but not producing them depend on unsustainable and expensive energy-importing models.

See Air Quality: It's Time to Act!

The impact of fossil fuel energy on biodiversity

Human activity degrades our ecosystems so rapidly that it endangers the value of biodiversity for humankind's well-being, development, and survival.

The direct impacts of fossil fuel extraction on biodiversity include local scale habitat degradation and species loss, among others. The impacts can come from deforestation, species invasions, and illegal wildlife extraction, as well as the consequence of disasters such as catastrophic oil spills.



Latin America is one of the most biodiverse regions in the world. According to the United Nations Environment Programme (UNEP), about 60% of the world's terrestrial life and diverse marine and freshwater species can be found in Latin America and the Caribbean. This region is home to three of the top five countries with the greatest number of birds, amphibians, mammals, reptiles, fish, and plants. The Amazon region alone is home to 10% of the world's biodiversity[25].

The burning of fossil fuels, deforestation, invasion of wildlife habitats, and accelerated climate change have altered the delicate balance of nature[26], changing the system that naturally protected us and creating conditions that allow the spread of pathogens (e.g., microorganisms that can cause diseases).

Pandemics and epidemics show us that destroying biodiversity destroys the system that sustains human life. The more biodiverse an ecosystem is, the more difficult it is for a pathogen to spread quickly or dominate. Conversely, biodiversity loss allows pathogens to more easily be transmitted between animals and humans[27].

Socio-environmental impacts of energy production on vulnerable people and communities

- The loss of tribal land as production companies/firms acquire land for energy production.
- The pollution and contamination of the surrounding land and water resources they depend on.
- An increase in attacks against human rights defenders, who are from affected communities.

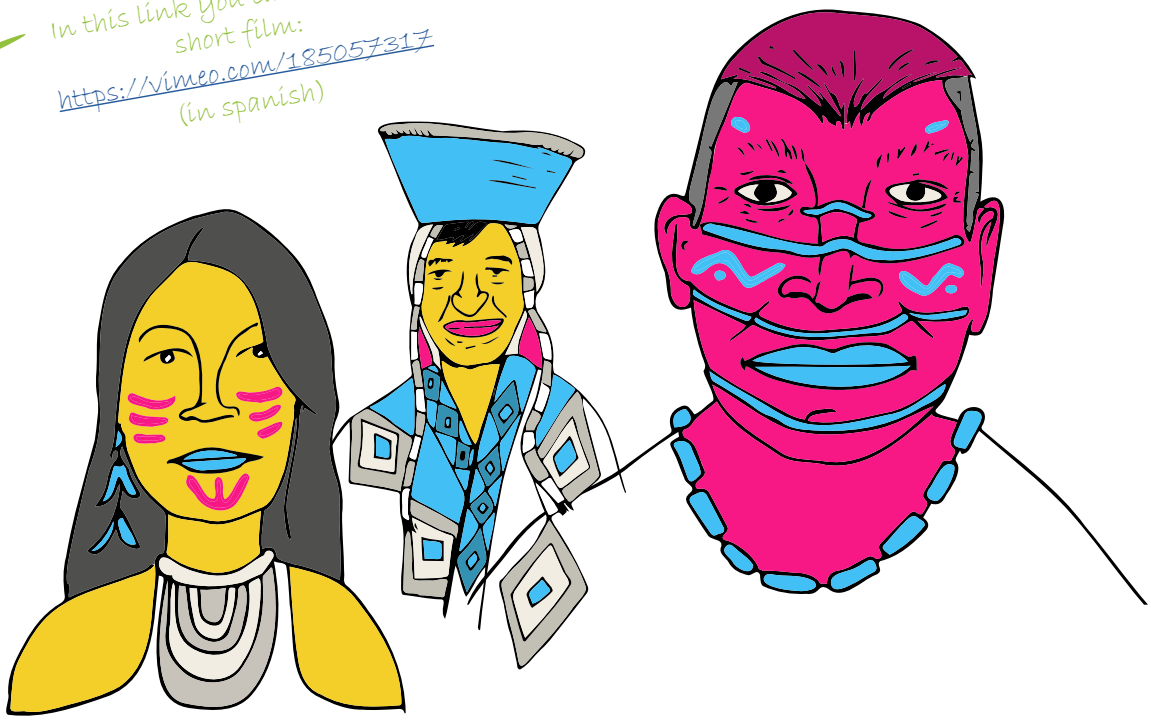
As the global community pushes for a just energy transition towards a net-zero carbon economy, monitoring and addressing the increasing risks to human rights is critical. Without proper regulation, renewable energy initiatives can harm communities, including Indigenous Peoples, who often bear the burden of natural resource exploitation on their lands and waters, which sustain different forms of life.

According to the International Renewable Energy Agency (IRENA), more than a quarter of Latin America's primary energy comes from renewable sources – twice the global average. However, this energy transition has come at a hefty cost, as there have been repeated allegations of human rights abuses linked to renewable energy projects[28].

In the Isthmus of Tehuantepec, in the Álvaro Obregón village, Oaxaca, Mexico, the members of a Binnizá (Zapotec) community have been under constant threat ever since a transnational company attempted to install an offshore wind farm without the community's consent. Herminio and Mariano, two Zapotec fishermen, struggled and became resistance leaders throughout this process. The short film "People of the sea and the wind" tells the story of how villagers were willing to defend their community.

Indigenous peoples have always been innovative. Indigenous innovation may be something wholly new or based on traditional knowledge and practices applied to a unique situation or context (see the Indigenous Innovation Initiative). Research shows that engaging indigenous peoples in the energy transition through a collaborative and solutions-oriented approach can lead to better economic, social, and environmental outcomes[29].

In this link you can watch the short film:
https://vimeo.com/185057317
(in spanish)



Sustainable energy: Why is it essential?

This section offers a definition of sustainable energy and describes the global energy situation. This provides an overview of the situation young people face today and intend to change.

Sustainability is defined as being able to meet the needs of the present without compromising the ability of future generations to meet their own needs[30].

It consists of finding clean and renewable energy sources, instead of sources that can run out like fossil fuels, which is why sustainable energy is inexhaustible.

Energy is considered sustainable based on the resources used to generate it, its conservation and its efficiency. Sustainable energy also has a lower environmental impact because it does not emit greenhouse gases or other pollutants.

Investing in sustainable energy allows us to use renewable or inexhaustible resources without damaging ecosystems or the atmosphere like coal and oil do. The energy transition transforms our cities, productive sectors, habits, and lifestyles toward healthier, fairer, and more sustainable development.

Renewable energy and energy efficiency are the main solutions to the challenges of climate change and the reduction of global emissions for the following reasons:

- They have a smaller impact on ecosystems than traditional forms of energy production.
- They have lower greenhouse gas emissions (sometimes zero emissions).
- They pollute less and offer more efficient cooking and heating alternatives.

Renewable energy is important to meet daily social and economic needs because it:

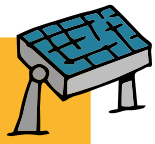
- Provides electricity to communities who are not on their country's power grid, and helps improve their living standards.
- Enables socio-economic empowerment by helping people generate income by using solar pumps for irrigation or providing electricity for a small business, for example.
- Allows businesses to operate and creates new business opportunities and green jobs.
- Provides uninterrupted energy for community health centers and refrigerators to store medicines and vaccines.
- Reduces the time and effort required to collect firewood, often by girls and women
- Allows children and young people to study after sundown.
- Is cheaper and, therefore, more affordable for most households.
- Promotes education focused on the sustainability and behavior change required for the energy transition.
- Enables communities to expand their knowledge to address the growing impacts of climate change and access to energy.

Sustainable energy worldwide

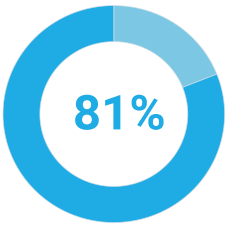
Greenhouse gas emissions from human activity are a key dominant factor responsible for climate change. Energy-related carbon dioxide (CO_2) is the most common GHG, **responsible for approximately 76% of emissions**.

See Data Explorer.

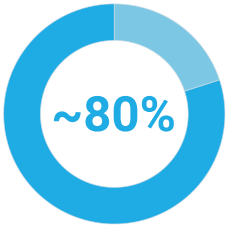
Modern renewable energy sources have grown faster than global energy consumption. As a result, the share of modern renewable energy in total final energy consumption has increased marginally and in 2019 it was estimated at 17.7%.



Global access to energy
Access to energy is the physical availability of affordable modern energy services to meet basic human needs, including electricity and improved appliances such as cooking stoves. These energy services must be reliable and sustainable and, as much as possible, the product of renewable energy or other low-carbon energy sources.



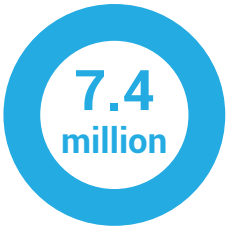
New installed power capacity from renewable energy in 2021[31].



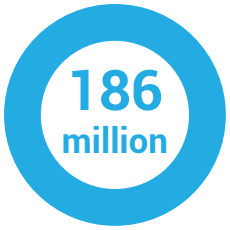
The global population living in energy-importing countries[32].

Number of people without access to electricity[33].

Number of people without access to clean cooking fuels[34].

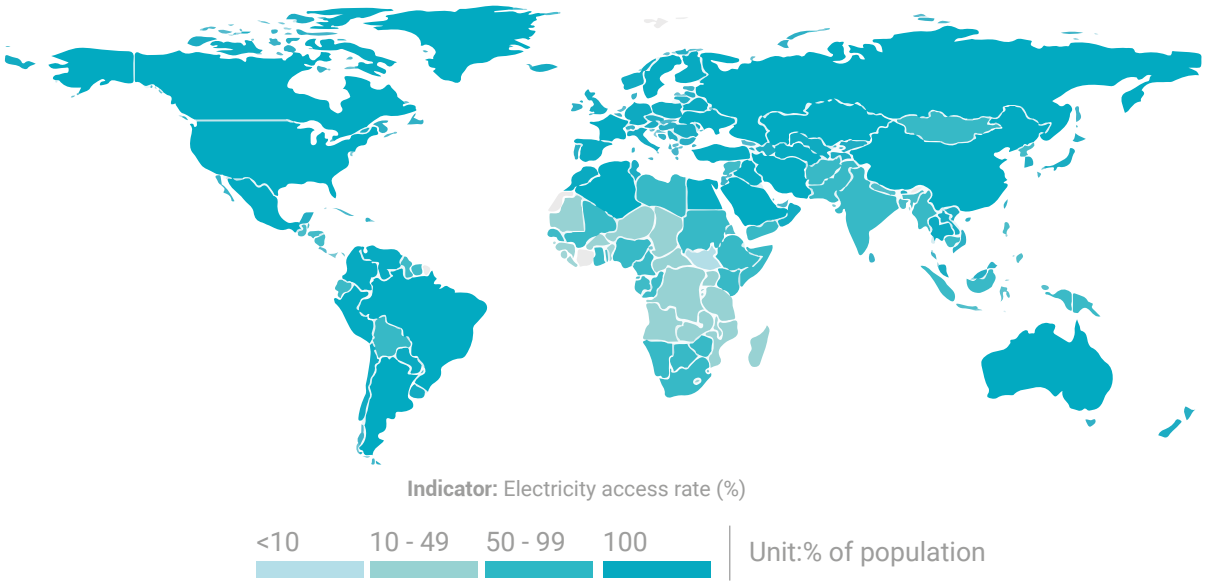


Annual premature deaths due to ambient and household air pollution[35].



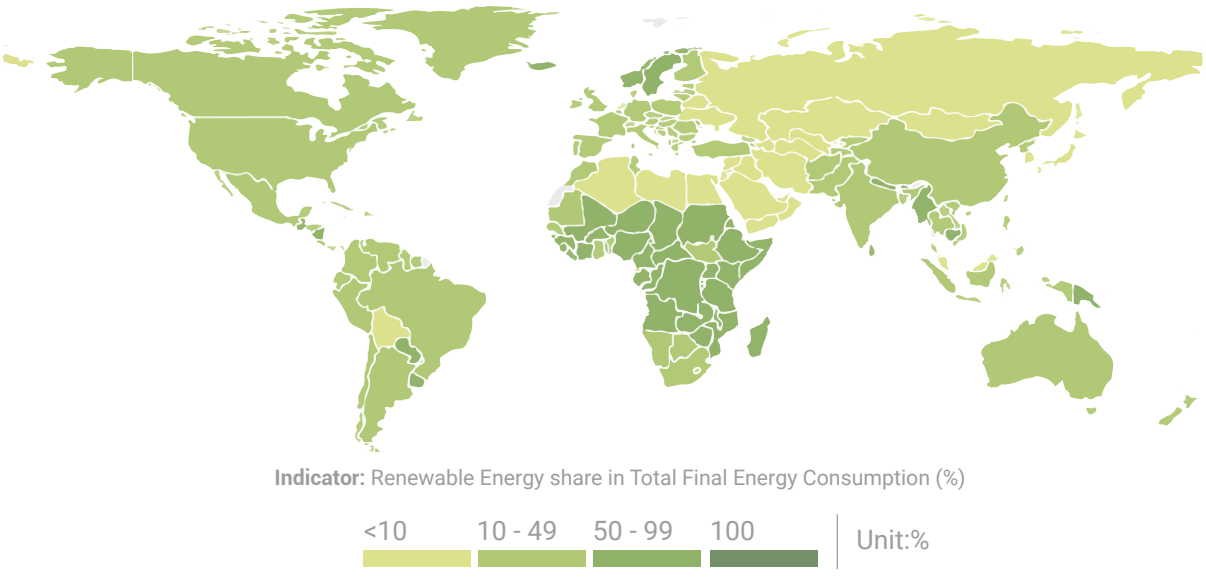
Children around the world attending primary schools without electricity[36].

Let's take a look at the map below depicting energy access across the world. The different colors represent the percentage of people with access to energy. As the map shows, energy poverty is highest in Central Africa and the Sahel region, where less than 10% of the population has access to energy. In Latin America and the Caribbean, a small area is marked in a lighter hue, indicating that between 50% and 99% of the population has access to energy.



Source: International Energy Agency, International Renewable Energy Agency, International Bank for Reconstruction and Development, United Nations Statistics Division, 'Tracking SDG 7: The Energy Progress Report', World Bank, Washington DC, 2022, <www.worldbank.org/en/topic/energy/publication/tracking-sdg-7-the-energy-progress-report-2022>, accessed 15 November 2022.

Now, let's look at the map below showing the share of electricity supplied by renewable energy. As we see in the map, a few countries are marked darker green hues, indicating a higher share of renewables in energy consumption.

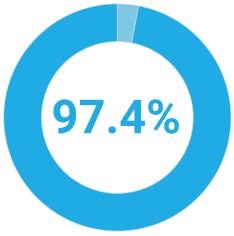


Source: International Energy Agency, International Renewable Energy Agency, International Bank for Reconstruction and Development, United Nations Statistics Division, 'Tracking SDG 7: The Energy Progress Report', World Bank, Washington DC, 2022, <www.worldbank.org/en/topic/energy/publication/tracking-sdg-7-the-energy-progress-report-2022>, accessed 15 November 2022.

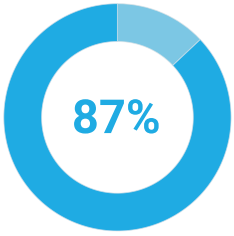
Sustainable energy in Latin America and the Caribbean

This section presents the state of sustainable energy in Latin American and the Caribbean. The following information can help you gain a clearer understanding of the region's challenges and opportunities in building a sustainable energy future.

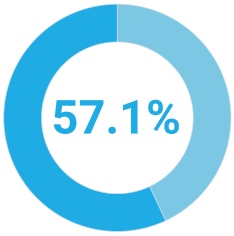
Let's start by presenting critical data that illustrates the challenges ahead:



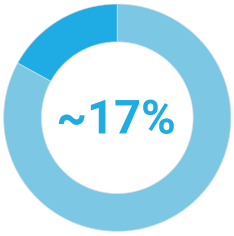
Access to electricity in Latin America and the Caribbean[37].



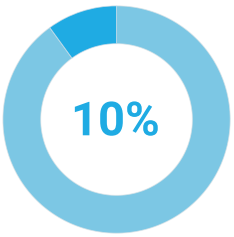
Percentage of the world's 23 largest mining companies subject to complaints regarding human rights violations in land use. 61% of these global complaints have been filed against companies in Latin America and the Caribbean [40].



Percentage of the region's energy consumed by Mexico and Brazil alone[38].

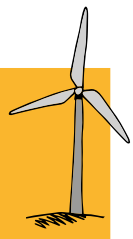


Estimated reduction of energy intensity by 2040 in Latin America and the Caribbean[41].



Population lacking access to clean cooking technologies in Belize, Bolivia, Dominica, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Paraguay, and Peru in 2019[39].

In the framework of the UNFCCC Conference of the Parties 25, 10 Latin American countries signed an agreement committing to reach an average 70% of installed capacity in the renewable energy matrix by 2030[42].



Modern and sustainable energy services are crucial to people's well-being and countries' economic development. Access to modern energy is essential for providing safe drinking water, sanitation, and health care, as well as for reliable and efficient lighting, heating, cooking, mechanical energy, transportation, and telecommunication services.

Sustainable energy governance

Energy governance can be defined as a shared social responsibility. It establishes a principle of collaboration between all stakeholders, which affects local, national, and global energy relations.

Energy is an important factor in both national security and economic growth. Governments have often approached energy as a high politics issue, where national interests predominate over collective interests. Hence the need for effective oversight and policies to govern energy processes.

Becoming familiar with the energy field and knowing who the main decision makers are is critical to understand energy governance at both the local and global levels. Public policies are responsible for directing and ordering development initiatives. Energy policies therefore mainly reflect national or subnational governments' decisions regarding energy production, distribution, and consumption. Energy policy is implemented through:

- Legislation
- International treaties
- Investment incentives
- Guidelines for energy saving or energy efficiency
- Taxes
- Preparation and implementation of medium- and long-term energy plans

Energy policy can legislate commercial activities such as transportation, storage, energy efficiency, and emission levels.

Multilevel climate governance is an ongoing process of discussions and negotiations involving a diverse group of national and local governments, international organizations, the private sector, non-governmental organizations (NGOs) and other social actors. Its purpose is to promote opportunities and timely actions to address climate change. These decision-making and discussion processes may be formal or informal, flexible and adaptive, and take place at local, national, regional, or international levels[43]. Considering historical and current contexts and political agendas is critical to establish a system comprising energy security, access to energy, and climate change.

For more information, see What is climate governance?

Key stakeholders in the global and regional energy sector

Participation in environmental and climate decision-making processes is a human right and a child's right enshrined in the United Nations Convention on the Rights of the Child (UNCRC). Individuals, including children, adolescents and youth and their representative organizations, have the right to participate in climate decision-making processes, including in the energy sector. Governments have a duty to ensure the exercise of this right.

for more information see UN Convention on the Rights of the Child

Did you know?

82.5% of youth surveyed as part of the Global Youth Energy Outlook research project said they would vote for a candidate or political party advocating for policies supporting a sustainable energy future.

To learn more, read about the Global Youth Energy Outlook (GYEO), the first youth-led research project of its kind to engage more than 40,000 young people aged 18 to 30 years to hear their perspectives on the global energy transition.

A wide range of stakeholders participate in the energy sector. The following list helps explain who is involved in decision-making.

Stakeholder	Actors engaged	Functions
Public sector	Stakeholders include public institutions, ministries, and other entities representing national, subnational, or other government levels and branches, as well as public enterprises.	Decision-making, formulating and implementing public policies and regulations at national and subnational levels.
Civil society	There are various types of organizations representing civil society. Members of these groups have the right to participate in climate and energy sector decision-making processes. Child, adolescent, and youth organizations are part of civil society and have the same right to participate as adult-centred organizations.	Civil society issues, opinions, and proposals that significantly contribute to decision-making are often based on members' local, ancestral, traditional, technical, and scientific knowledge and experiences. Civil society can thus influence decision-making processes by placing discussions in the context of how individual members of that society live and on their interests, rights, and opinions.

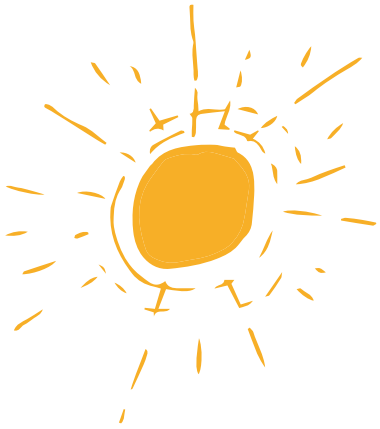
Stakeholder	Actors engaged	Functions
Media	Members of the media are key allies in raising awareness, disseminating information, and promoting behavioral change. There are different types of media, including television, radio, print and/or digital media, which can have international, national, and local or community reach.	The media plays a critical role in teaching people about sustainable energy and climate change. The media can also influence society to act once they are more aware of the reality of the traditional energy model, its effects, causes, and consequences, as well as the benefits of renewable energy.
Private sector	The private sector, as opposed to the public sector, works for profit. Because of this, in some cases, companies try to escape governmental environmental control measures. The private sector can generate impact across multiple sectors and play a crucial role in energy transition processes.	The private sector can lead the transformation of production patterns to make them more sustainable and environmentally friendly. Renewable energy offers the private sector opportunities to prioritize and lead on the development of sustainable and fair distribution and marketing systems.
Academia	Universities, research centers, foundations, international think-tanks, and others in academia all have a role to play in generating and disseminating knowledge and data, especially disaggregated data according to age, gender, ethnicity, migration status, disability, etc.	The academic sector produces knowledge and research that enables evidence-based decision-making. It also provides essential resources and opportunities to strengthen education by building capacities and knowledge to advance the transformation required for a sustainable energy future.

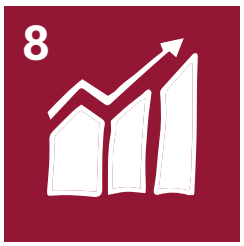
Sustainable energy and the Sustainable Development Goals

This section takes a closer look at the relationship between sustainable energy and the Sustainable Development Goals to identify how we can act and inform ourselves to achieve a sustainable energy future.

Sustainable energy is a key driver for the achievement of the United Nations Sustainable Development Goals (SDGs). SDG7 is dedicated to affordable and clean energy and calls for affordable, reliable, sustainable, and modern energy for all. SDG7 is interconnected with other critical SDGs affecting young people. For instance, without electricity, it is impossible to achieve health care for all and to meet major development goals such as reducing child mortality, treating and preventing diseases, ensuring inclusive and quality education for all, and guaranteeing universal access to safe water and sanitation.

SDGs are a collection of 17 global goals set forward by the UN Member States in 2015. These goals aim to provide a more sustainable future for all, protect the world against climate change, and make the world fairer for all by 2030. Learn more.

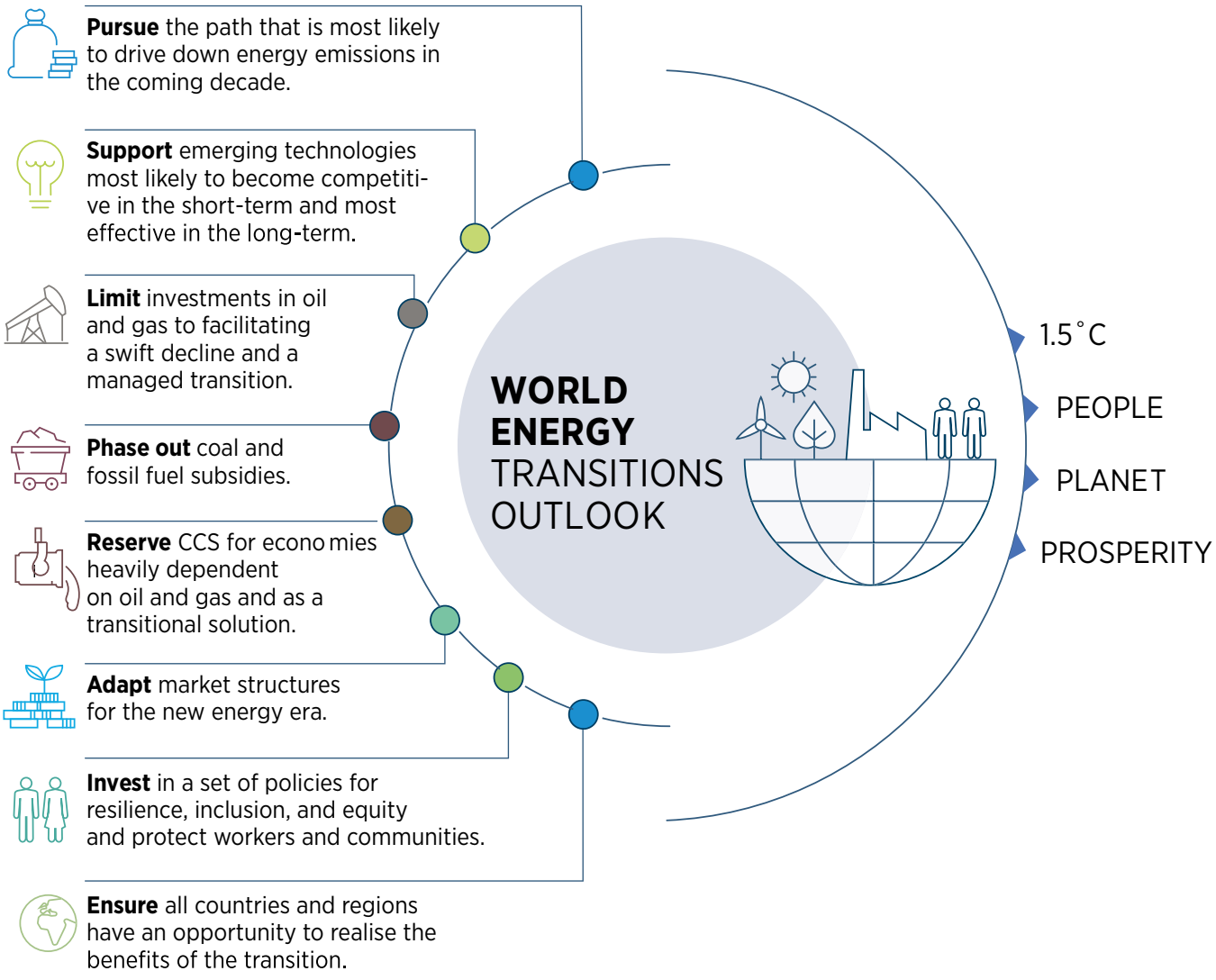


Sustainable Development Goals (SDGs)	How sustainable energy can help achieve these goals
Affordable and clean energy 	Sustainable energy solutions can help achieve better health, education, safe water and sanitation, and social policy outcomes in development and humanitarian situations for the most vulnerable children and young people.
Achieve gender equality and empower all women and girls 	Clean and modern energy services reduce the time people (mainly girls and women) spend on basic energy-related activities, such as collecting firewood. Such services can also significantly reduce the risk of contamination from cooking or engaging in household activities with unsafe energy sources.
Ensure decent work and economic growth 	Sustainable energy innovations increase young people's opportunities to develop green skills and technical capacities essential in the renewable energy workforce, thereby increasing their likelihood of finding decent work.
Engage in climate action 	Sustainable energy use significantly reduces greenhouse gases, air pollution, and climate impacts.

Learn more about the interlinkages of energy to other SDGs here.

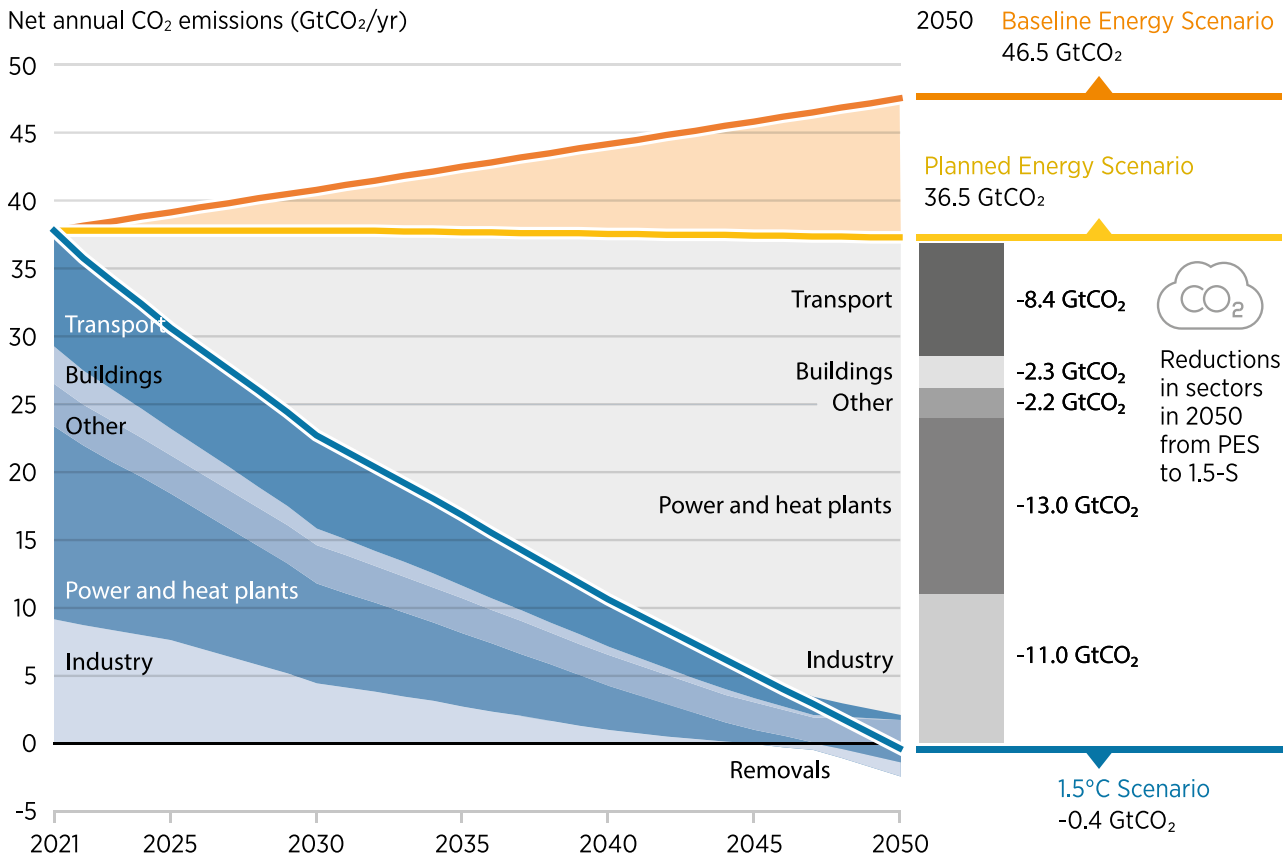
Policies for a just energy transition

This decade will define whether the world has a chance to limit temperature rise to 1.5°C. Different models and scenarios are used to determine pathways from where we stand to where we need to go. For example, IRENA plots a pathway that can limit warming to 1.5°C and bring CO2 emissions to net zero by 2050[44]. This pathway shows the steps required to transition from fossil fuels in terms of technology choices, investment needs, and policy priorities. One of IRENA's key messages is that a sustainable, resilient, and inclusive energy future benefit people, the planet, and the economy.



Source: International Renewable Energy Agency, 'World Energy Transitions Outlook: 1.5°C Pathway', IRENA, Abu Dha-bi, 2021, <https://irena.org/publications/2021/Jun/World-Energy-Transitions-Outlook>, accessed 15 November 2022.

The following chart from IRENA's World Energy Transitions Outlook depicts a grim panorama. The orange line shows the trajectory of our current emissions, the yellow line shows the stabilizing trajectory that emissions would follow if we implemented existing government policies and plans, and the blue line shows the rapid declining trajectory required to meet the 1.5C limit.

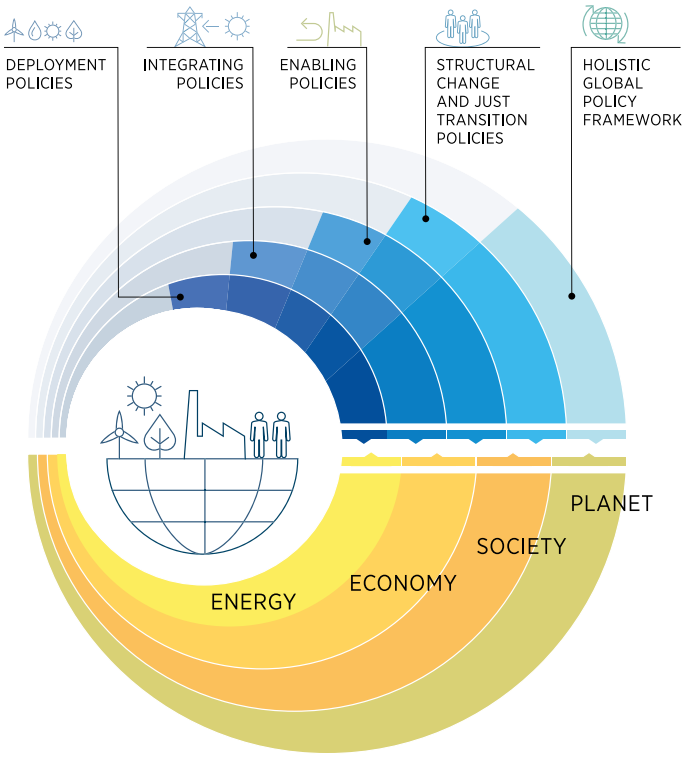


Source: International Renewable Energy Agency, 'World Energy Transitions Outlook: 1.5°C Pathway', IRENA, Abu Dhabi, 2021, <https://irena.org/publications/2021/Jun/World-Energy-Transitions-Outlook>, accessed 15 November 2022.

Strong policies will play an important role in promoting a just energy transition. IRENA emphasizes the importance of a comprehensive policy framework for a just transition and highlights its key components:

- **Enabling policies:** These are policies that set ambitious goals and send clear signals to all actors involved. They also help incentivize the uptake of solutions, support the phasing out of fossil fuels, raise awareness among consumers and citizens, and support innovation.

- **Deployment policies:** These policies support increased use of renewables and the transition away from fossil fuels, including by creating markets and lowering technology costs. For example, policy measures to make renewables more affordable.



- **Integrating policies:** These policies make it easier to integrate energy transition technologies into our energy system, as well as our economy, society, and planet. For example, creating organizational structures for the power sector that enable using more variable renewable energy sources

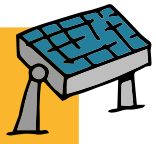
- **Just transition policies:** These policies help ensure that everyone benefits from the energy transition. Examples include labor market and skill-building policies that address mismatches where new jobs are being created and where existing jobs are lost due to transitioning away from fossil fuels. It also includes gender policies ensuring that women can benefit equally from the new opportunities being created.

- **Holistic global policy framework:** In addition to national policies, it is also essential to bring countries together to commit to a just transition leaving no one behind. Key aspects of a holistic global policy framework include strengthening the flow of international finance, capacity and technologies in a way that is fair to all.

Source: International Renewable Energy Agency, 'World Energy Transitions Outlook: 1.5°C Pathway', IRENA, Abu Dhabi, 2021, <https://irena.org/publications/2021/Jun/World-Energy-Transitions-Outlook>, accessed 4 November 2022.

Why do we need a just energy transition?

A just transition to sustainable energy is an important concept that has gained renowned importance both in local, national, and international public discussions.



By the end of this century, the energy transition will transform the global energy sector from fossil fuel-based to zero-carbon sources. Climate change can be mitigated by reducing energy-related CO2 emissions[45].

In a just energy transition, both the processes involved and the results are critical and must meet specific criteria.

A just transition must be collective and inclusive. This means producing capacities and opportunities for meaningful participation and effective representation for all stakeholders to engage in informed decision-making. This includes safeguarding the rights of young people, Indigenous Peoples, local communities, and all vulnerable populations.

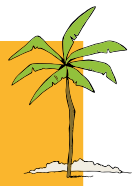
A just energy transition must ensure that benefits and costs are shared equitably among actors and between present and future generations. It must also recognize the different capacities and needs of countries and regions, as well as people's gender, age, disability, economic status, migration status, ethnicity, etc.

Ensuring a just energy transition prevents energy from being wasted as it is produced, distributed, and consumed. We must be energy efficient.

These are some of the many advantages of a just energy transition:

- Reducing emissions of greenhouse gases and other pollutants helps children and young people survive and thrive.
- Ensuring that the energy needs of present and future generations are met through safe, affordable, and sustainable energy solutions can empower historically marginalized communities suffering from energy poverty.
- Accelerating innovative ways to access renewable energy helps ensure that the energy produced serves more people and increases the share of renewable energy.
- Compelling sectors to use cleaner energy can accelerate the energy transition, such as the construction sector that is responsible for 36% of electricity use[46].
- Energy efficiency can generate savings that can be allocated to other areas of the economy.

See: Enabling SDGs through inclusive and just energy transitions.



Indigenous communities are playing a key role in the just transition

On the Hawaiian Island of Moloka'i, many Indigenous communities pay a high price for electricity. This energy inequality has motivated communities to find the best renewable solutions that fit their cultures and the natural environment. Many have turned to their traditions and beliefs by creating a Solar Energy Cooperative that provides renewable, affordable, locally-owned energy to create more equal and just conditions[47].

Critical areas for a just transition to sustainable energy

The following section describes the key areas for a just transition towards sustainable energy.

Human rights and sustainable energy

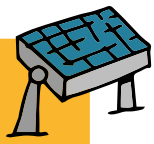
Energy can be an enabler for child-critical services that children and young people depend on, such education and health care. In this way, ensuring access to energy for all is critical for attaining human rights. Like all public policies, energy policies must be consistent with governments' constitutional and conventional obligations. Therefore, when designing and implementing policies, measures should be taken to protect child rights to electricity. This can be done by integrating a sustainable energy roadmap into health and education sector development plans and providing recommendations for sustainable implementation.

For example, electricity provides:

- Energy that can power life-saving machines, vaccine cold-chain equipment, and electricity for clinics and hospitals.
- Lighting for students to do their homework at night.
- Information and Communication Technologies (ICT) such as computers and the internet, which are essential to provide children and young people with high-quality education and information.
- The opportunity to use air ventilation and air conditioning equipment that support good health, including cognitive health. Several studies show that children with good ventilation and air conditioning at school performed better than those without.
- Power for water pumps that enable access to safe water and sanitation, two basic rights.
- Power for household appliances that help save time in household chores such as collecting firewood, washing clothes, ironing, and washing kitchen utensils.
- Alternatives to preserve food and reduce food waste, promoting good health and nutrition and combating hunger.

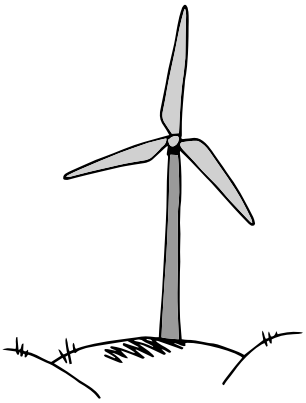
Ending energy poverty

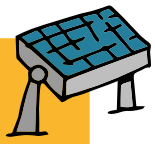
Energy poverty is the lack of access to sustainable or modern energy services and products. It is also when a community lacks adequate, affordable, reliable, quality, safe, and environmentally sound energy services to support development[48]. This situation results in poor service provision, such as a lack of energy to power healthcare facilities, poor lighting, limited or no quality energy for schools, and a lack of safe water for communities.



Approximately 2.4 billion people use firewood or coal as fuel for cooking and 1.6 billion lack electricity at home. It is expected that, by 2030, another 1.4 billion people will be in this same situation50". with It is expected that, by 2030, 2.1 billion people will still lack access to clean fuels[49].

Sustainable energy can improve the quality of life. Electricity is an irreplaceable basic necessity and is part of economic and social human rights[50]. Therefore, governments must ensure electricity services for all as part of the basic rights they are obliged to guarantee.

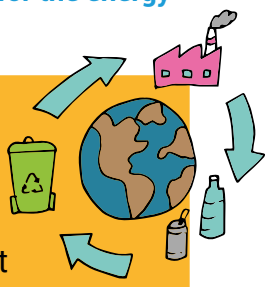




Since 2018, UNICEF has supported more than 60,000 people in rural Mauritania in gaining access to improved water supply through boreholes equipped with solar pumps, reservoirs, and mini networks. Where feasible, these were connected to local schools and healthcare facilities.

See more: A brighter life for every child with sustainable energy

The circular economy: Vital for the energy transition



The circular economy is a production, consumption, and resource management model that seeks to extend the useful life of products by reusing, recycling, repairing, sharing, and upcycling.

The circular economy can reduce mining dependence and become a source of low-carbon materials. It can also ensure the longer-term use of these materials if implemented at scale. Recycling could help recover metals, and reduce GHG emissions. For example, recycled aluminum emits up to 95% less carbon dioxide. Building energy transition infrastructure from secondary materials will help our transition to net-zero emissions.

Sustainable energy education, entrepreneurship, and technology

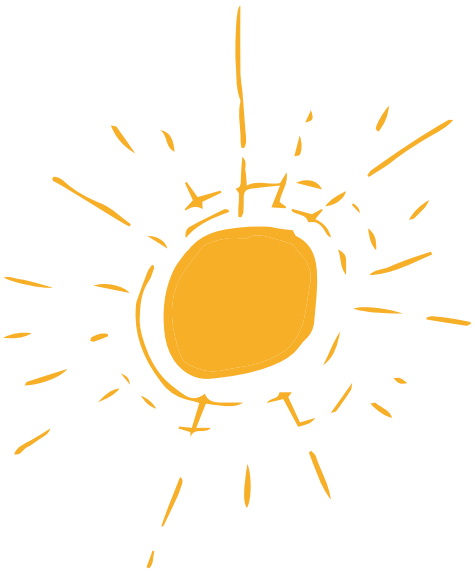
Sustainable energy is an interdisciplinary field; the fundamental concepts of energy are interwoven in almost all academic disciplines. Energy education can support people to learn how much energy they will use daily and where that energy comes from. This can allow them to make smart energy-saving decisions. For example, people can make informed decisions on home energy use and consumer choices and participate in national and international energy policy issues.

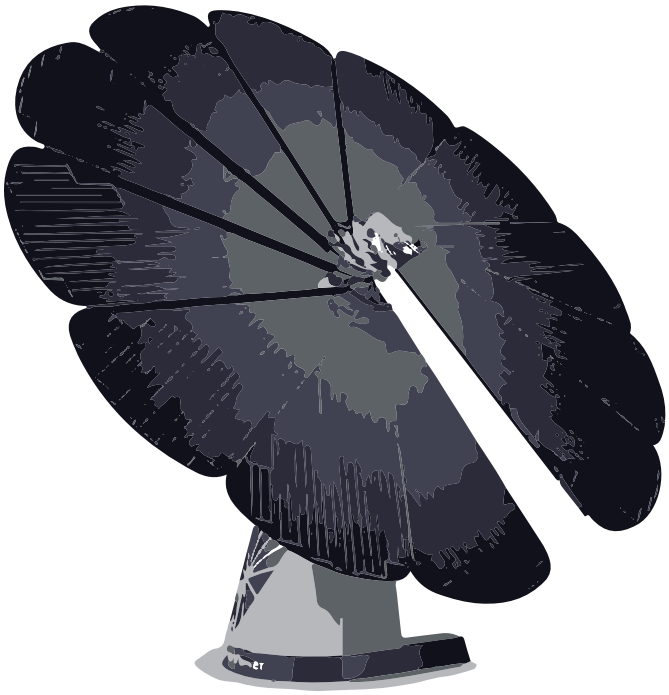
Current national and global issues, such as fossil fuel supply and climate change, call for the need to incorporate energy education in formal and informal learning. We must advocate for energy education to be included in schools and universities across different levels as well as in various awareness platforms such as the media.

Education, entrepreneurship, and technological innovation are important to catalyze a sustainable energy future. Facilitating access to energy education and knowledge means that innovators and entrepreneurs are aware of opportunities in the energy sector that can potentially lead to new ideas and innovations focusing on sustainable energy. This can help create business networks, incubator companies, social enterprises, and startups that help reduce emissions and support the transition to a sustainable energy world.

Youth in Action

"Hi, I am Manuel Golomb from Argentina. In my community, thousands of popular neighborhoods face challenges accessing basic services. In Mar del Plata, Province of Buenos Aires, together with a group of young people, we formed the **"Mission Sovereignty"** space for the "La Herradura" neighborhood. Here, we are building a solar heater and spearheading the use of organic waste to generate biogas using a biodigester. Our goal is to improve access to healthy food and promote people's right to energy, enabling a just energy transition."
Learn more (in Spanish).





Universities promoting sustainable energy

The University of Guadalajara in Mexico launched the eight strategies of the Integral University Program for Energy Transition, which include energy saving and efficiency, construction of solar power plants, photovoltaic power generation in university buildings, support for university workers, and conversion to renewable energy sources, in order to make the educational sector produce its own energy and combat climate change.

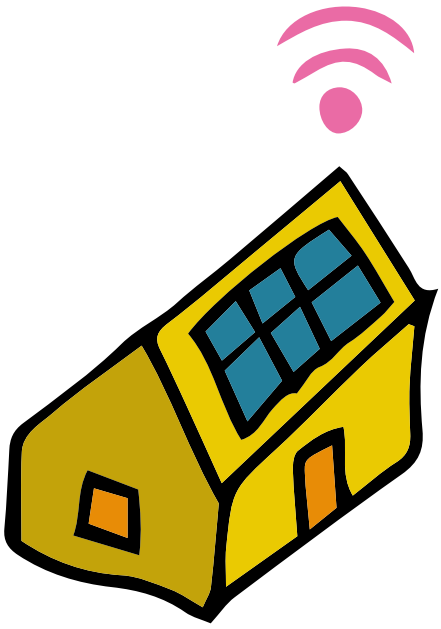
For more information here (in Spanish).

Power consumption and the internet

The world has achieved outstanding technological progress. A day without technology or internet services is almost unimaginable. In 2017 alone, there were 7.7 billion cell phones, but only 7.4 billion people worldwide. This means that there were 4% more cellular devices than humans[51].

Albert Fert, the Nobel Prize for Physics winner in 2007, pointed out that "the energy it takes to perform 30 Google searches would boil a liter of water". There are 5.7 million Google internet searches per minute on average. This means that the internet ecosystem uses a substantial amount of energy[52].

However, the power of the internet can also be harnessed to create innovations that will advance the energy transition as indicated in the next section.

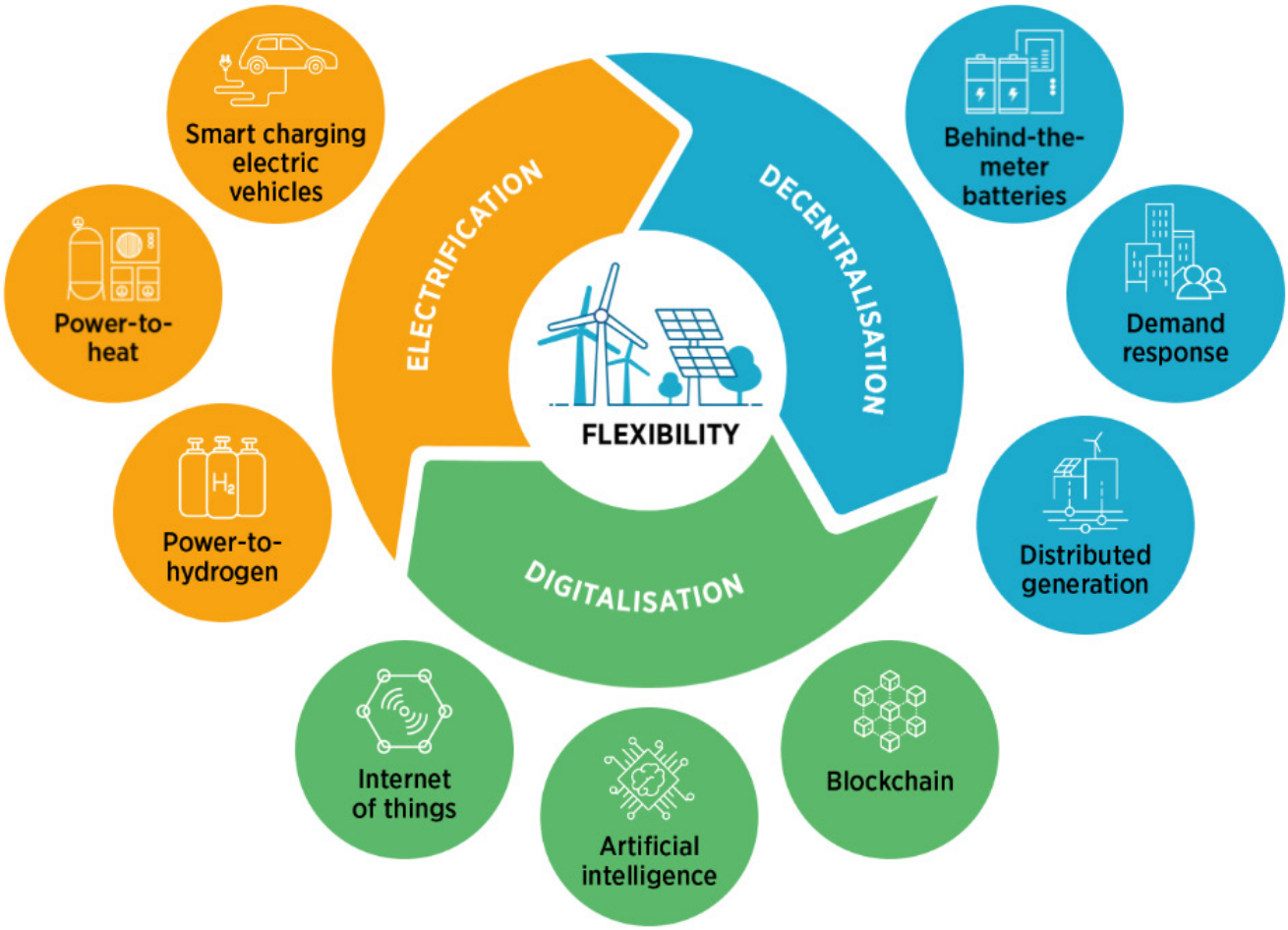


Sustainable energy innovations

Quite often, people think about innovation only in terms of new technologies. However, decarbonizing our energy systems requires many different types of innovations and new approaches. For example, if we are going to integrate solar and wind power – two variable renewable energy (VRE) sources – into our power systems, we need innovative solutions to increase flexibility. IRENA analyzes different types of innovations in its work and its "Innovation Landscape for a Renewable-Powered Future" report highlights four key innovation areas of the power system[53].

- **Enabling technologies:** Technologies that play a key role in facilitating the integration of renewable energy.
- **Business models:** Innovative models make creating new renewable energy technologies easy and profitable and enhance power system flexibility.
- **Market design:** New market structures and policy changes to encourage and stimulate new business opportunities.
- **System operation:** Innovative ways of operating the electricity system, allowing higher shares of renewable power generation.

The figure below shows examples of innovations in each of these areas:

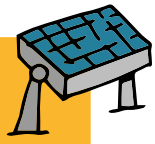


Source: International Renewable Energy Agency, *Innovation landscape for a renewable-powered future: Solutions to integrate variable renewables*, IRENA, Abu Dhabi, 2019.

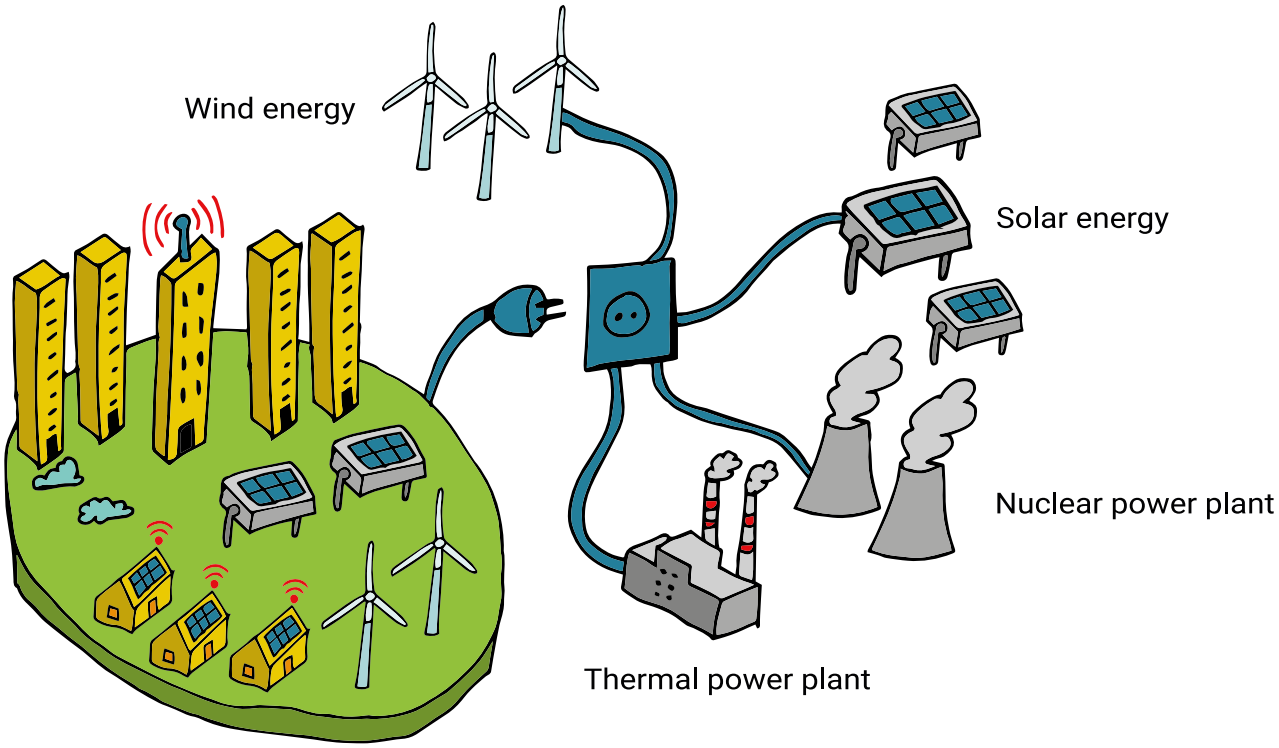
Example: Smart grids for sustainable energy

The term smart grid is used to refer to the intelligent electrical distribution network. Bidirectional networks, capable of transmitting electricity in both directions, are defined as intelligent. This allows, among other things, homes and different businesses to become small electricity producers at a given moment and not just be consumers as they have been up to now.

Smart grids are basically electricity distribution networks combined with modern information technologies, which provide data to both electricity distribution companies and consumers. This is an advantage for both parties, although the operation of this intelligent distribution network is more complex than that of the current electricity network.



Smart grids carry significant cyber risks. Considering that smart grids are highly dependent on computers, they are vulnerable to different types of attacks, which could lead to devastating consequences if there are no efficient security measures in place.



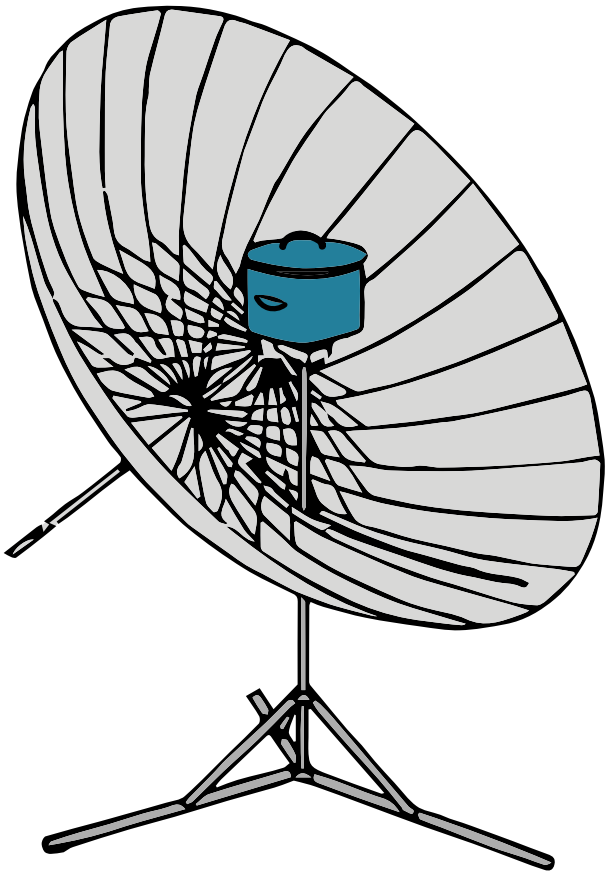
Clean cooking

- Each year, close to 3 million people die prematurely from illnesses attributable to household air pollution caused by inefficient cooking practices using polluting stoves paired with solid fuels and kerosene[54].

- Around 2.4 billion people cook using polluting open fires or stoves fueled by kerosene, biomass (wood, animal dung, and crop waste), and coal.

- Household air pollution can contributes to noncommunicable diseases such as lung cancer, chronic obstructive pulmonary disease (COPD), ischemic heart disease, and stroke.

Clean cooking is about using modern cookstoves and fuels to transform lives by improving health, protecting the climate and the environment, empowering girls and women, and helping consumers save time and money[55]. The cleanest and most renewable options are bioethanol or solar electric energy, which will become more viable in the future. All other fuels, including solid biomass-based firewood or charcoal, coal, and natural and liquefied gas, are classified as polluting because the prevailing stove technologies lead to pollution levels exceeding guidelines.



The following are examples of stoves and fuels used for clean cooking:

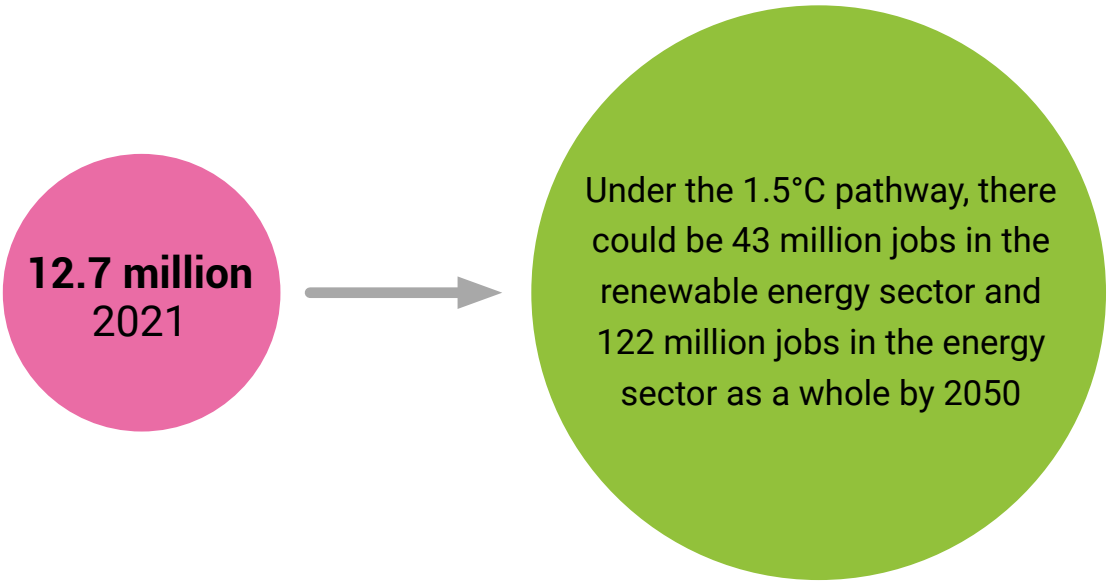
1. Gel stoves
2. Solar stoves
3. Electric or gas stoves
4. Biomass pellets
5. Biogas stoves

Young people's employability and the future of work in the sustainable energy sector

The ongoing transition to green economies has spurred significant changes and will continue to provoke major transformations in the world of work. If well managed, this transition can result in ample decent job opportunities, particularly for young people[56].

During 2021, 12.7 million jobs were created in the renewable energy sector worldwide, and it is estimated that the number of jobs in this sector will reach 43 million by 2050[57].

Renewable energy sector jobs.



Source: International Renewable Energy Agency, International Labour Organization, 'Renewable Energy and Jobs': Annual Review 2022', IRENA, Abu Dhabi, 2022, <www.irena.org/publications/2022/Sep/Renewable-Energy-and-Jobs-Annual-Review-2022>, accessed 15 November 2022.

What skills do young people need to work in the sustainable energy sector?

Young people from different backgrounds can work and contribute to the sustainable energy sector because it cuts across various disciplines and focus areas. For example, energy engineers, product developers, energy policy experts, entrepreneurs, journalists, and researchers can contribute and are contributing to the sustainable energy sector. This means everyone has the opportunity to participate.

These are some examples of the skills required:

- Technical understanding of how energy systems work and how to optimize them to provide sufficient energy where required. This includes practical and hands-on experience. For example, solar photovoltaic systems require individuals with installation, operation, and maintenance skills.
- Business and product management knowledge to ensure the long-term sustainability of business ideas and programmes.
- ICS skills, including in geographic information systems (GIS) and data analysis. These abilities can be used, for example, to track and manage energy systems over large geographical areas.
- Communication skills such as writing and speaking. These are critical for policy development, advocacy, programming, and increasing awareness of the importance of sustainable energy.

How can governments prepare young people to participate in the sustainable energy sector?

Below are some ideas on how governments can play a key role in equipping young people with the necessary knowledge and opportunities to participate in the energy sector effectively:

- Integrating sustainable energy into school curricula and offering practical learning experiences.
- Supporting primary, high school, vocational, and higher education programmes. that focus on renewable energy and energy efficiency.
- Financing young people's ideas and innovations in sustainable energy.
- Engaging young people in policy dialogues and decision-making.

Girls' and women's leading role in energy transition and access to energy

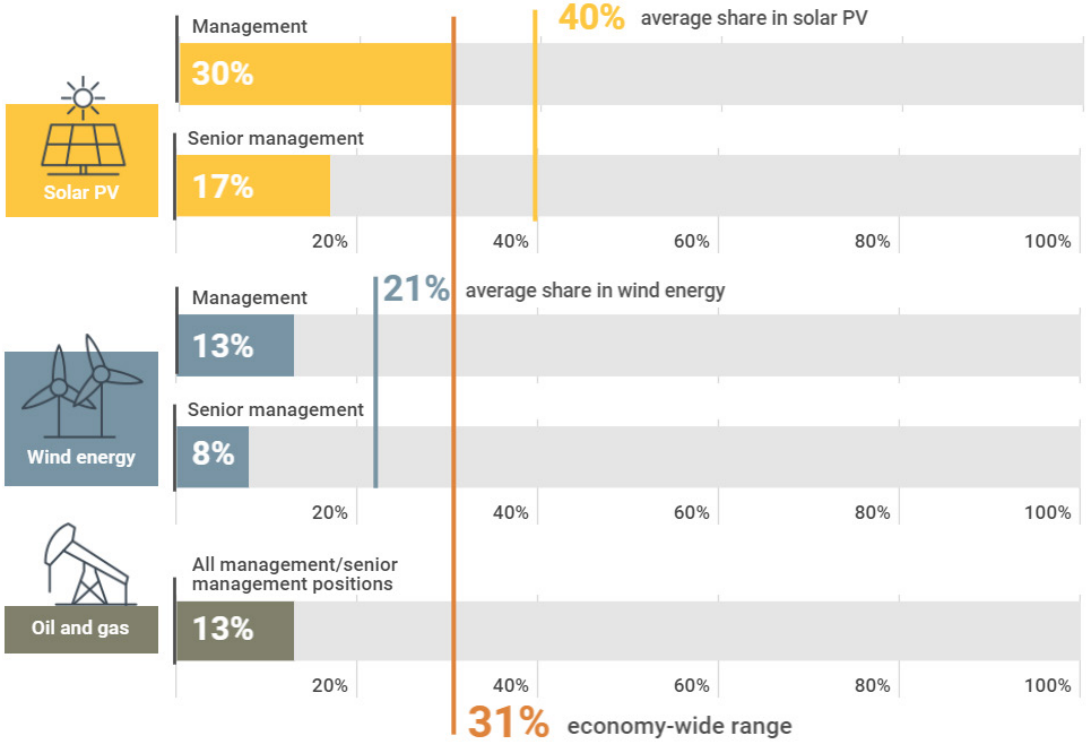
Girls' and women's roles in climate action are fundamental. According to UN Women, women and girls are and will continue to be the most strongly affected by the ravages of climate change[58]. Women account for 80% of all displaced by climate-related disasters[59].

In households with limited energy access, girls and women often bear the burdens of housework; with many spending much of their time looking for traditional fuels like firewood. Moreover, poor energy services, such as inadequate street lighting, pose heightened security risks for girls and women at night.

However women's participation in the energy market task force has been low. According to IRENA's recent data, women's share of renewable energy sector jobs is 32% and is concentrated in administrative areas.

The workforce gap calls for increased action to place girls and women at the center of sustainable energy action. Action is not only in acknowledging their vulnerability, but also realizing the great contributions they can bring to the sector and empowering them to become sustainable energy leaders.

Woman in managment positions in solar PV and wind energy.



Source: International Renewable Energy, "Solar PV: A gender perspective Agency",IRENA (2022), Abu Dhabi.

How are young women driving change?

Columbia University
Eduarda Zoghbi is a Brazilian climate activist with a Public Administration Master's Degree from Columbia University. She has worked with governments to manage and implement sustainable energy transition projects and her ultimate dream is to become Brazil's Minister of Energy. In the meantime, her career focus is on supporting access to energy and the interlinkages between energy, gender, development, and affordability. She was selected for the Atlantic Council's Women Leaders in Energy Fellowship for her outstanding accomplishments.

Nigeria
Oritsejolomisan Stephen, a Nigerian volunteer under the National LPG Expansion Implementation Plan, works with Indigenous communities. She engages with more than 500 women and girls in seven states in Nigeria, educating them on the importance of clean cooking for their own health and their children's health. She also organizes stakeholder policy dialogues and advocates and secures approvals for the installation of Liquefied Petroleum Gas (LPG) facilities for clean cooking in Nigeria.

Dear reader, whether you are a child, a young person or an adult, your participation is essential; your voice can lead to significant changes in this sector and others. Keep your dreams alive and transform them into actions and energy.

Time to Act: Actions for a sustainable energy future

Now that you have learned more about sustainable energy, this section provides useful examples of concrete actions you can undertake to play a part in a just energy transition.

What role can you play as a young person?

Lack of access to reliable, sustainable energy affects children and young people the most. The transition to sustainable energy will have strong intergenerational implications and young people have a key role as stakeholders and drivers of change. Young people can participate as well as act in leadership roles by championing youth-led sustainable initiatives, facilitating intergenerational dialogues, and acting as experts and innovators of various technologies.

Here are some tips on how you can get involved:

Participate in policy making

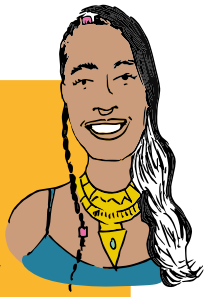
- Actively engage in policy-making spaces in your community or country by attending council and participatory budget meetings and expressing your views and opinions.
- Attend stakeholder meetings hosted by the government or civil society organizations to provide meaningful contributions.
- Engage in implementing activities and monitoring processes, such as meetings and negotiations on climate and energy policies.
- Participate in policy research that can increase young people's and decision-makers' awareness of existing policy gaps.

Youth in action

Hi! I am Riya Mehta an 18-year-old green and solar energy activist from Canada working as an international youth advisor to the UNIDO council. I contribute to research studies on youth involvement across energy industry sectors, which are being compiled into a guidebook and will be shared with the public in the upcoming months. My focus is exploring youth engagement in solar and renewable energy sources and promoting companies to invite youth to their consulting processes. As a champion ambassador to the UN Foundation, I have spoken to senators' offices across the Americas on the importance of investing in renewable energy and moving past fossil fuels.

Participate in international energy forums

- Join or volunteer for organizations with hubs, student chapters, or local headquarters focusing on the 2030 Agenda and the 17 SDGs.
- Identify and join any active Major Group for Children and Youth, such as the SDG7 Youth Constituency, which is the formal mechanism for youth participation in United Nations processes on energy issues.
- Get involved in global mechanisms and opportunities. For example, IRENA hosts a Youth Forum that brings together young people from different countries to drive youth-led action. It also enables them to interact and connect with government representatives and sector leaders.
- Learn about the United Nations' official mechanisms to monitor global processes in sustainable energy, such as the UN Energy and the High-Level Political Forum for Sustainable Development, UNFCCC Conference of the Parties, and Regional Climate Weeks.
- Participate in local, regional or global SDG 7 groups across various social networks. This will ensure that you are always informed of activities or calls taking place.
- Participate in calls for tender, research, and speaking opportunities and conferences. This will help you expand your network, knowledge, and participation opportunities.
- Measure your impact and keep a record of your actions and the benefits you have gained in the process.

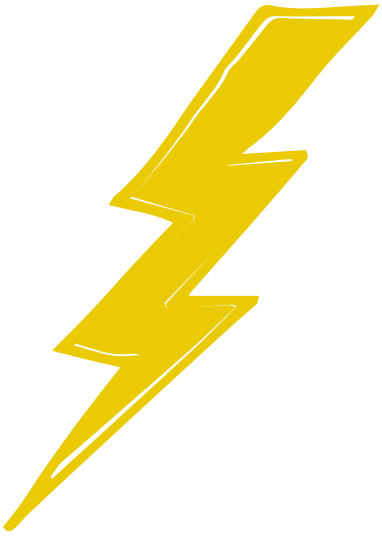


Youth in action

Hi, I am Joyce Mendez, a young migrant and social entrepreneur motivated by my family history of forced displacement caused by coal mining in Colombia. I decided to promote energy justice and youth inclusion by co-founding several grassroots organizations in Latin America and advocating in high-level international and regional forums such as the Sustainable Energy for All Forum and UNFCCC COPs (UNFCCC Conferences of the Parties). I currently represent initiatives such as the SDG7 Youth Constituency, where I act as Focal Point for Latin America and the Caribbean, promoting youth projects and the role of social entrepreneurs, facilitating capacity building and youth empowerment opportunities, and fostering the exchange of knowledge and intergenerational justice.

Advocate for socio-environmental justice

- Be vigilant of any socio-environmental injustice taking place in your community, and how to safely advocate for justice.
- Increase your peers' and fellow community members' awareness of the need to participate actively in cultural spaces and decision-making forums.
- Coordinate your work with cultural centers to support increased knowledge of environmental justice among community members, including children and young people.
- Recognize the value of land and territories and encourage dialogue on this issue.
- Participate in advocacy activities and movements that defend the rights of local communities and Indigenous Peoples.
- Dialogue with local leaders on any environmental injustices, for example, on extractive activities in your community.

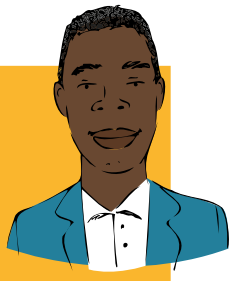


Youth in action

My name is Felix Santiago, and I am from Oaxaca, Mexico. Indigenous Peoples' current situation regarding access to justice and our new forms of relating to renewable and clean energies is threatening how we interact with Mother Earth. Today, there are wind farms in the Isthmus Region that have yet to guarantee access to electricity and have not helped improve our living standards. As human rights defenders and Indigenous Peoples, we supported our brothers' and sisters' struggles and their demands for justice. Transnational corporations must focus on working with the state and the communities to meet these demands, because the wind passes through our lands and territories, and we must be provided with the tools to address the situations that have historically afflicted us.

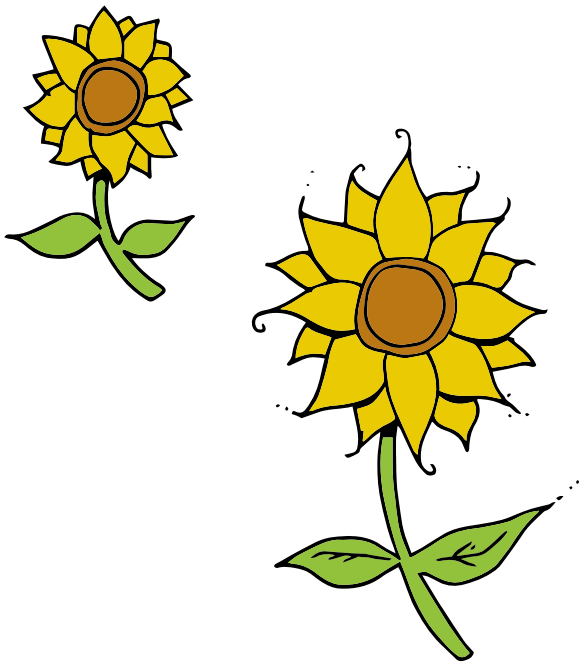
Create capacities and skills for young people involved in the sustainable energy sector

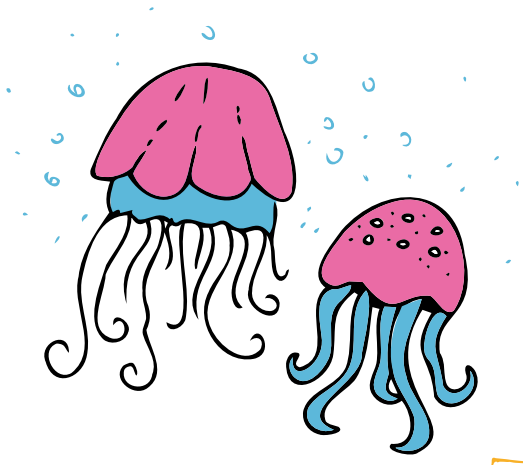
- Share your knowledge on sustainable energy with people close to you, such as friends, classmates, parents, or neighbors, and encourage dialogue on this issue.
- Use your social media to explain what you have learned about energy transition and renewable energy and invite your followers to become more energy conscious and act.
- Sensitize educational spaces such as primary schools, high schools, and universities, approaching young peoples' groups or niches of interest to teach them about the origins and use of electricity.
- Demonstrate how you can use leadership to impact different communities, generating benefits through initiatives and mobilizing more youth groups.



Youth in action

Hello, my name is Wendpayangé Dimitri Tientega, I am a 23-year-old Youth Minister of Energy in Burkina Faso. I lead several initiatives to improve youth capacities such as the "Energy Debates" (in French), a scientific competition initiated in 2013 to promote renewable energies, energy efficiency, and youth employability. Its objective is to encourage young people to propose ideas and influence the formulation and implementation of public policies. We have mobilized around 1,500 people per year with more than 20 competing universities. In 2021, I also ran a summer camp for young people and disadvantaged individuals to learn trades and skills in renewable energies.





Empower and support girls' and women's roles in sustainable energy

- Learn about the connection between gender and energy and the disproportionate impacts of climate change and energy access on girls and women.
- Advocate for girls' and women's education, technical training, and professional development.
- Elevate girls' and women's critical role in energy and advocate for their inclusion in decision-making and policy processes.
- Support the mainstreaming of women-led enterprises by advocating for equal access to financing, business development, supply chain, and marketing platforms.
- Support community initiatives that promote equal access to energy and lobby for girls' and women's empowerment.

Youth in action

Hello, my name is Esther Wanza from Kenya. Growing up, access to energy was a challenge for my family; my mother used to walk 60 km to charge a phone. This encouraged me to take a course in renewable energy. My first project was solarizing my home. I trained my mother and a few other women in the distribution of solar home systems. I have supported more than 300 women-led companies in clean cooking, briquette use, and off-grid solar energy value chains, with the purpose of encouraging innovative models in these areas. In addition, Raynow Energy is a start-up focused on bringing sustainable energy solutions to healthcare facilities in most off-grid regions in Kenya.

Promote the use of renewable energy

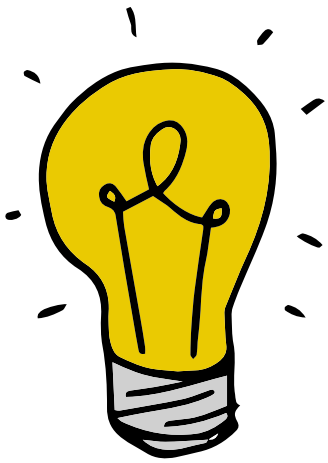
- Research and learn about local laws or regulations on sustainable energy and climate change.
- Identify the main local emissions sources and the annual emissions released.
- Request information on the main emissions source, where key data can be obtained to build more evidence, and make the information transparent for citizens.
- Implement solutions to measure emissions that include the participation of the most vulnerable and/or affected communities. Share the results and work with the corresponding governmental authorities.
- Propose and design a roadmap specifying the current sources of energy production and pollution and how to transition to renewable energies, thereby reducing environmental and social consequences.
- Promote day-to-day sustainable energy practices such as self-consumption, which implies a radical change in our culture of electricity generation and consumption.

Youth in action

My name is Arabel Ali, and I am from Colima, the least populated state in Mexico. This state borders with the Municipality of Manzanillo, which holds the highest electricity generation capacity and is also home to the country's most important port.

The numerous vessels, the burning of heavy fuel oil and other hydrocarbons, the growing vehicle fleet, and the lack of a people-centered urban design have impacted the quality of air, affected human and environmental health and living conditions, and made this one of Mexico's five most polluted municipalities.

To address this problem, we decided to start by requesting information from the polluting company, specifically on its emissions. Once they responded, we realized we needed to carry out a more detailed measurement. So together with the neighbors and others, we began using sensors to obtain more precise information about which gases are being released and the exact amounts. With this information, we intend to support the formulation of public policies that promote sustainable energy to regulate air quality.



You may also:

- Acquire the necessary skills to participate in energy transition through different alternatives, such as studying and pursuing a career related to renewable energy.
- Amplify the potential of young people globally through various digital channels such as social media. Connect ideas and push for change towards a sustainable energy society.
- Create bridges by building relationships with local communities, youth groups, civil society, the private sector, governments, and academia to include everyone's voice in strategies for adopting a more sustainable future.
- Support mobilization efforts to engage more people in the sustainable energy revolution, demanding increased access to renewable and fair energy.
- Make changes in individual and collective behavior to prioritize essential energy needs to reduce demand and strengthen community members' abilities to manage the production of the energy they consume. For example, use energy saving appliances for cooking, laundry, and day- to-day tasks; turn off lights and unplug devices when not in use; and reduce heating and air conditioning to only when necessary.

Glossary

Anaerobic: Pertaining to, requiring, or involving the absence of oxygen.

Briquette: A briquette is a compressed block of combustible biomass material used for fuel and kindling to start a fire.

Biorefinery: A biorefinery is a facility (or network of facilities) that integrates biomass conversion processes and equipment to produce transportation biofuels, power, and chemicals from biomass.

Capacity generation: The amount of electricity a generator can produce when it's running at full blast.

Carbon footprint: The amount of carbon dioxide and other carbon compounds emitted due to the consumption of fossil fuels by a particular person, group, etc.

Distillation: Distillation is a process in which a liquid mixture is separated by vaporization and condensation.

Electron: A particle found around the atom's nucleus with a negative electrical charge.

Fracking: Hydraulic fracturing is a technique to enable or increase the extraction of gas and oil from the subsoil, being one of the well stimulation techniques in hydrocarbon deposits.

Fuel: A material used to produce heat or power by burning.

Greenhouse gases: Atmospheric gases that are capable of absorbing infrared radiation. These are necessary for life, but in excess, they cause climatic alterations. In its classification, the United Nations Framework Convention on Climate Change recognizes the following gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and sulfur hexafluoride (SF_6).

Incineration: The act of burning something to destruction, especially waste material.

Kerosene: A light fuel oil produced by distilling petroleum that is mostly used in jet engines, home heaters, lamps, and as a cleaning solvent.

Kilowatt: A unit of power, equal to 1000 watts. *Abbreviation*: kW, kw.

Recycle: The action or process of converting waste into reusable material.

Sedimentary: Sedimentary rocks are formed from pre-existing rocks or pieces of once-living organisms. They develop from deposits that build up on the surface of the Earth.

Self-consumption: It is when a large part of the population establishes energy production and consumption mechanisms independent of electric companies.

Substation: Devices that establish the appropriate voltage levels for the transmission and distribution of electrical energy.

UNFCCC COP: The United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties is an Annual Summit that brings together 198 countries (plus the European Union) that are Parties to the Convention.

Upcycling: The use of products, waste materials, or residues to manufacture new materials or products of higher quality, greater ecological value, and greater economic value.

Wind turbine: An electric power generator driven by the force of the wind.

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Complementary annex

Timeline: "Where does my energy come from?"

This timeline illustrates the evolution of energy from the first fire to the latest world records for renewable energy.

~ 500,000 B.C.: The first fire. From the first fire to renewable energy, humans have always depended on energy to survive. From a historical perspective, humanity has been shaped by the discovery and use of energy. Empirical evidence shows that the higher energy consumption per capita, the larger and stronger human institutions become (Fix, 2017). Using and mastering fire was one of humankind's main achievements. This discovery allowed us to cook, heat and preserve food.

2500 B.C: The wheel. Advances in agricultural and livestock use as a source of energy in the form of food, as well as the appearance of transportation with the invention of the wheel.

1765 A.D.: The steam era begins. The first experiments using steam as an energy source were carried out at the end of the eighteenth century. Almost a hundred years later, James Watt built the **first steam engine**, which became the basis of mechanized civilization. As a result of this invention, much of the world population adopted steam to power machinery and were motivated to abandon the fields and take up domestic industries, initiating the **Industrial Revolution**.

1859: The first oil well drilled. The first oil well was drilled in the United States of America in 1859. As a result, many devices relying on this source of energy were invented, such as electric generators, internal combustion engines, electric light, and automobiles. The invention of the first power plant also marked the beginning of an energy distribution system for everyday use, such as electricity.

1900: The rise of the oil industry. From the early 20th century, energy use began to increase vigorously. As coal production began to decline after the First World War, oil production rose and surpassed coal just after World War II and has continued to grow to this day.

1942: The first nuclear reactor. The first nuclear chain reaction was achieved in 1942 and the **first nuclear reactor** was built this same year in the United States of America.

1963: Mass production of solar cells begins. Sharp had advanced in its successful production of mass-produced solar cells, cementing its position as the industry's top supplier of such cells. Being the most promising clean energy source for the 21st century in these days of global concern over environmental preservation, this was a significant step for the company.

1973: The oil crisis. In 1973, an oil embargo led to severe shortages across the world. As a result, the world was unable to access enough oil to satisfy its demand of over 6,000 tons, giving rise to the so-called oil crisis.

1974: First solar building "Solar One" is constructed. Solar One was the first house running on a hybrid supply of solar thermal and solar PV power using roof-top solar panels

1981: International agency dedicated to renewable energy proposed: After this, the sharp population growth and the increasing energy needs highlighted the need to implement energy policies. During the United Nations Conference on New and Renewable Sources of Energy, governments and international organizations proposed a renewable energy focused agency that would oversee policy, finance and technology needs in the energy sector.

1990: Expansion of hydropower. In the nineties, renewable energies gained ground among world powers. The first hydroelectric power plants were built in Canada and the United States. Canada gets 60% of its electricity from hydropower plants.

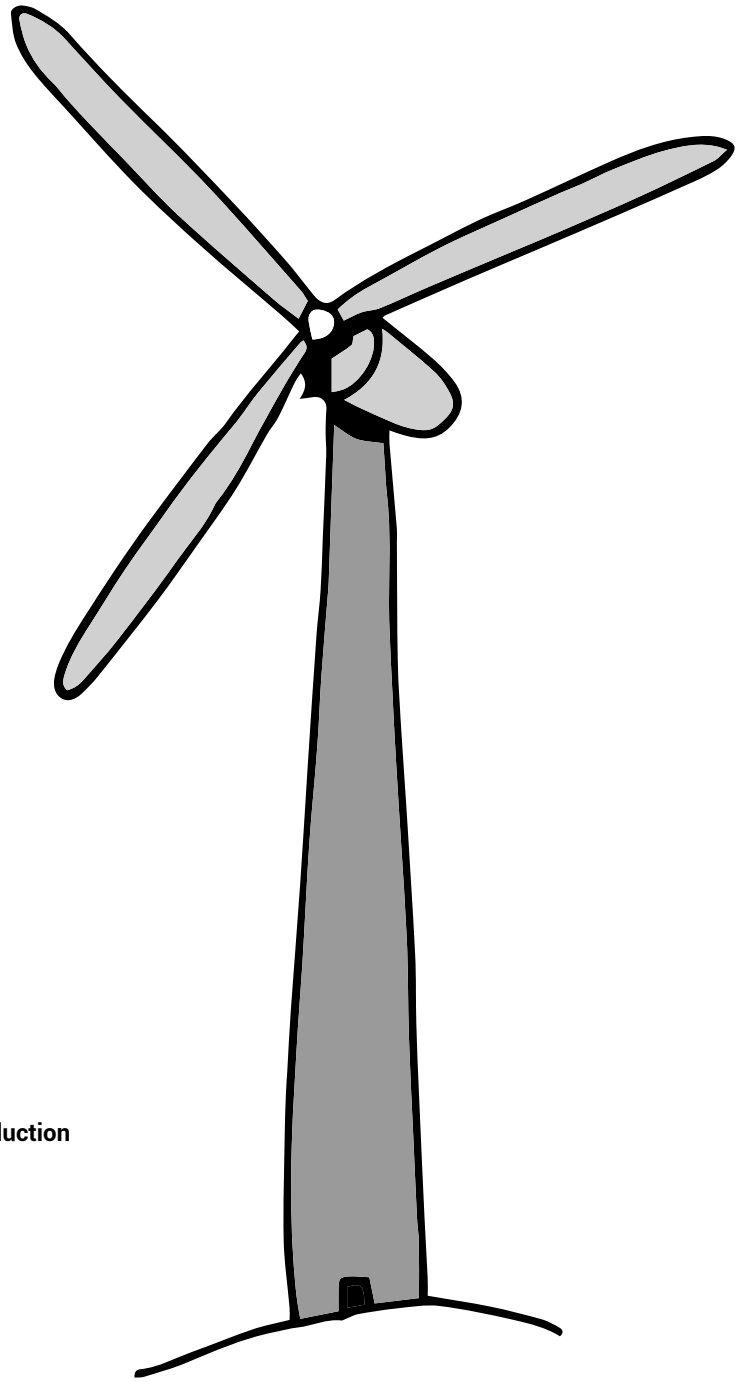
2001: The expansion of wind energy. Wind power generation became more important in the early years of the new millennium. Prototypes were manufactured for wind energy, with a power of 1,500 kW, projecting machines of 2,500 kW and 3000 kW.

2015: Renewable energy record. This year marked a milestone in the history of clean energy. Worldwide, there was an unprecedented increase in solar panels and wind turbine plants, both in terms of installed renewable capacity and investment.

2017: Wind energy continues to advance. It reaches grid parity and is now among the most competitive source of new generation in countries such as Brazil, India, Canada, Germany, Mexico, and Morocco.

2020: The cheapest solar energy in history. The cheapest electricity in the world was generated in 2020, in the Mexican state of Coahuila (north of the country). Italian ENEL Green Power offered the lowest price: 1.77 cents per kW generated by photovoltaic energy, breaking the previous record held by a Saudi Arabian company, which offered 1.79 cents per kW.

2022: New renewable energy record. According to IRENA, renewable energy continues breaking world records while demonstrating its energy security benefits amid market turmoil. Because of the strong policy support in China, the European Union, and Latin America, the growth of renewable energy this year has been much faster than initially anticipated.



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