

2022



SLATE

Low Carbon, Green Economy &
Opportunities Handbook

SOCIAL LEARNING THROUGH LOW CARBON AND GREEN ECONOMY OPPORTUNITIES IN CLIMATE ACTION(SLATE)

Table of Contents

Chapter 1: Environment and Climate Change	1
Chapter 2: Circular Business Model	14
Chapter 3: Green Economy	19
Chapter 4: Green Skills	26
Chapter 5: Energy Transition	37
Chapter 6: Low Carbon Strategy	44

SOCIAL LEARNING THROUGH LOW CARBON AND GREEN ECONOMY OPPORTUNITIES IN CLIMATE ACTION

Low Carbon, Green Economy &
Opportunities Handbook



Co-funded by the
Erasmus+ Programme
of the European Union

2021-1-DE02-KA210-VET-000034539

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



ABOUT THE HANDBOOK

The Handbook aims to develop & enhance social learning opportunities through low-carbon and green economy. This would actively accelerate the awareness and skills of the audience including VET learners and staffs, small business owners, who have little or no awareness of climate change issues or sustainable solutions that could be adapted in operating & ensuring energy-saving activities in their personal and work life. The handbook would improve your competences in adopting green technological interventions and integrating climate actions in your daily experiences. You would learn about the rise in global temperature & what all needs to do to limit it to 1.5°C, which would allow us to avoid the most severe consequences of climate change.

Edited by Dr - Ing Ibrahim Muritala and Segun Ajibola

Contributors

Names	Institution
Dr - Ing Ibrahim Muritala	Life Learning Development e.V.
Ronke Adeniyi	Afridat
Sabrina Ibrahim	Life Learning Development e.V.
Imran Mahiaoui	Mobilizing Expertise
Dr. Ing Giampiero Costantini	EUROFORM RFS
Dott.ssa Martina Grasso	EUROFORM RFS

Design

Funsho Olamoyegun	Afridat
Segun Ajibola	Afridat

Introduction

Changes in precipitation levels, likely increase in temperature extremes and rising sea levels will have a wide range of direct and indirect impacts on our world. The emergence and adoption of low carbon technologies have result into drastic change in the way businesses operate across Europe. The EU have proposed to lower greenhouse gas emissions by at least 55% by 2030, which is possible, and this would make Europe on a responsible path to becoming climate neutral by 2050. From energy transition to green economy, the entire business landscape would change from skills and competences to products and service deliveries. VET learners, organizations/institutions, small business owners need to be actively aware of these inevitable changes due to the climate mitigation demands that are requires by all and sundry. Many actions have been put in place by different governments across Europe, but these people are with less experience on these topics.

The insufficient attention might cause the entire Europe in extension the world the opportunity not to meet the target set to achieving the carbon-neutral societies. We have only one world to live, which is the planet earth. The ability of humankind to adopt sustained reductions in greenhouse gas emissions over the next several decades require awareness across all levels through changing household behavior in mitigating climate change. Awareness and education are vital tools in helping to curb climate change. Environmental literacy and business models in green economy are important in achieving the climate neutrality targets set by the European Commission. Rapid intervention measure requires all sectors of the economy and society to contribute and sets out efforts within their businesses and actions to achieve this goal. The e-book provides awareness and knowledge geared towards the fundamentals of climate change, environmental impact of climate actions, less low carbon business process and how to mitigate them.

ORGANISATIONAL PARTNERS



Afridat

The organization develops modules in thematic topics used during trainings and knowledge sharing sessions and uses such data to correlate the interplay between linear and nonlinear quantitative and qualitative determinants of economics to shape public discuss, drive policies in the areas of social entrepreneurship, migration, energy, information technology, and climate change.



Euroform RFS

Euroform RFS is an Italian VET and adult training institution established in 1996 and accredited by the national government of Italian Republic. They organizes meetings, visits, round table discussions in a wide range of subjects, including thematic regarding climate change actions, analysis and the comparison between the effect of climate change in different European countries, international cooperation among them on climate change, comparison and study of innovative methodologies in education and training, comparison and study of innovative methodologies in education and training, orientation and guidance, ICT-based learning, digital literacy and training, validation and assessment of learning outcomes, informal and non- formal learning.



MOBILIZING EXPERTISE AB

A Swedish organization located south of Sweden in Ideon Science Park where you can find all innovative ideas grows. They provide training, creating educational tools, mobilizing volunteers to professionalism, promoting climate change issues among youth and adult



Life Learning Development e.V.

Life Learning Development e.V. (LLD) was founded in Duisburg. They believe that investments in people and the power of education would result into the remarkable transformation of people that would serve as change-makers in creating a better society for all. Through knowledge, skills, right tools, and abilities any society can attain its required advancement and sustainable development. Creative innovations in solving man's daily challenges are inbuilt, can be learnt and acquired if we look at all human beings as an individual and global community where there are opportunities to build a better world with no limitations. LLD provide climate change awareness amongst youth and adults.

Chapter 1

Environment and Climate Change

1.0 Environment and Climate

The Earth is the third-largest planet in the Solar System based on its distance from the Sun, making it the largest of the terrestrial planets.

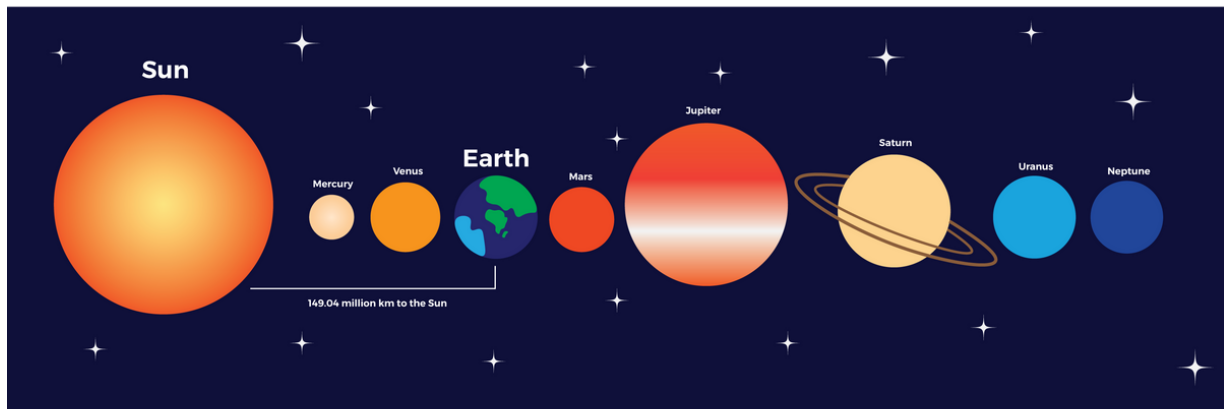


Fig 1.1 Planets and their Position to the Sun

A geoid, an irregular sphere that is flattened at the poles and widened at the equator, is a good approximation of its shape. Its atmosphere is primarily composed of nitrogen and oxygen, and the surface area of the Earth is approximately 510 million square km (5.1×10^8 km²).

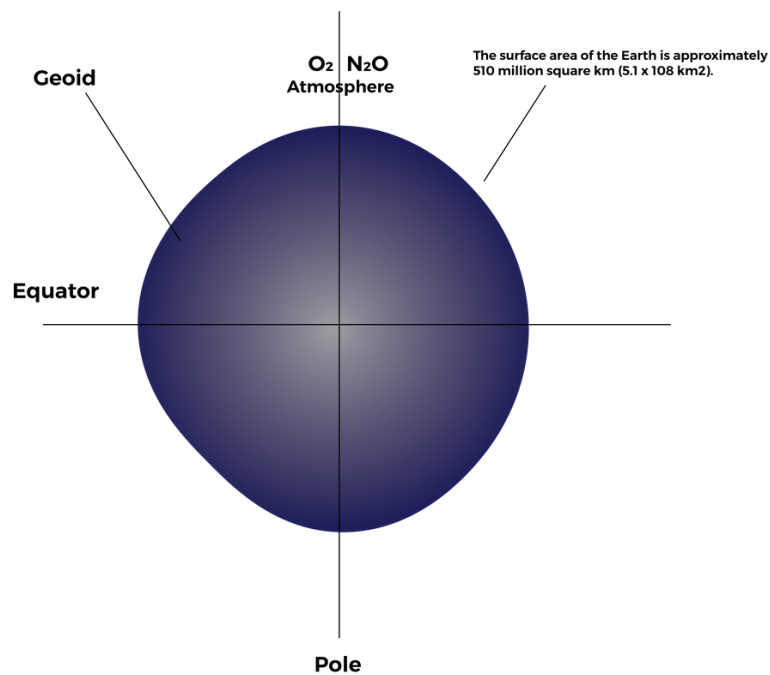


Fig 1.2 A Geoid

Generally speaking, the term "**environment**" refers to Earth or a section of Earth. Human activities have far-reaching effects on the natural world.

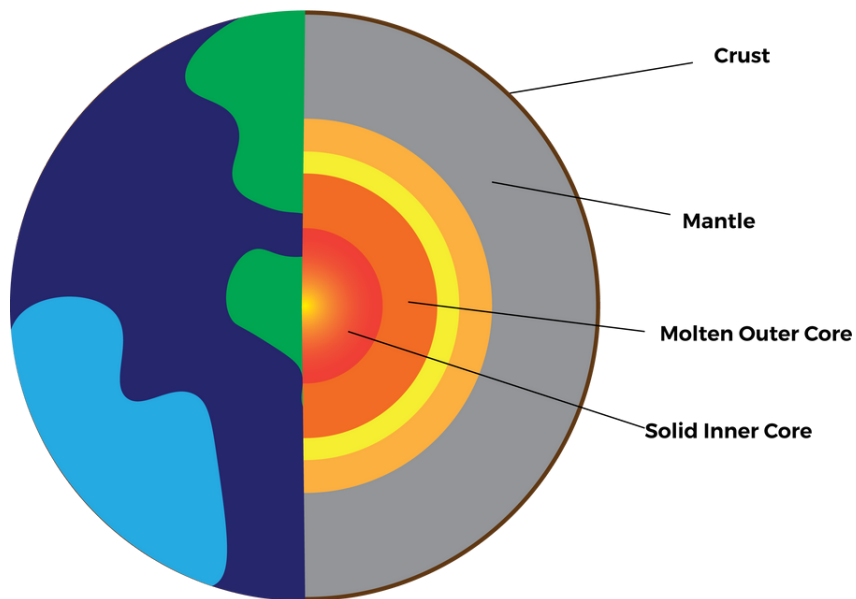


Fig 1.3 A section of the Earth

There are large areas where sources of water can be found, in various states of aggregation. There are roughly five billion years between its formation and now. In particular, rotation and revolution are the two fundamental motions that make up Earth. The first is in sync with Earth's rotation around its axis, the fictitious meridian that runs through the geographic North and South poles. The second has to do with the Earth's orbital motion around the Sun during a solar year, which takes exactly 365 days.

The environment is the sum of all the factors—living and nonliving, climatic and meteorological, natural and artificial—that influence the well-being of all forms of life on **Earth**.

Earth, water, fire, air, and space are the fundamental components of our environment.

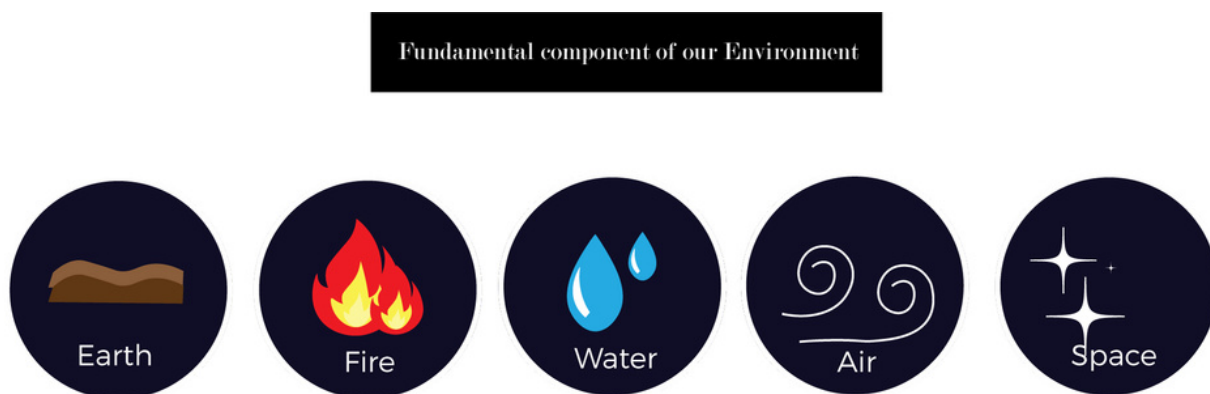


Fig 1.4 Fundamental component of an Environment

It's important to remember that **climate and weather** are two very different things that occur at different times.

Climate is the long-term average weather pattern, typically measured in increments of 30 years. A region's climate is its persistent weather pattern, observed over a long time, and represented by an average of all-weather conditions during that time. Some examples of climatic extremes are the wet and hot conditions of the tropics, and the dryness of the desert. What we call "the weather" is really just the atmosphere's state at any given time. Conditions such as temperature, humidity, cloud cover, wind speed and direction, and visibility could all shift over the course of a few days. Weather, in this context, refers to the state of the atmosphere and how it affects people and their daily routines. The weather is constantly fluctuating, with changes occurring within minutes or even hours [1]. Climate is very hot summer this year. The summer of 2018 is expected to be exceptionally hot.

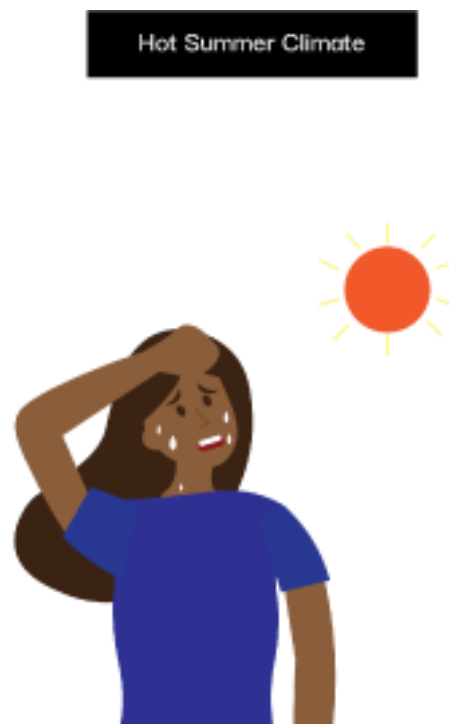


Fig 1.5 Hot Summer Climate

Weather is a rainy day, sunny day, or sudden storm. The day's weather will either be cloudy, sunny, or suddenly stormy.

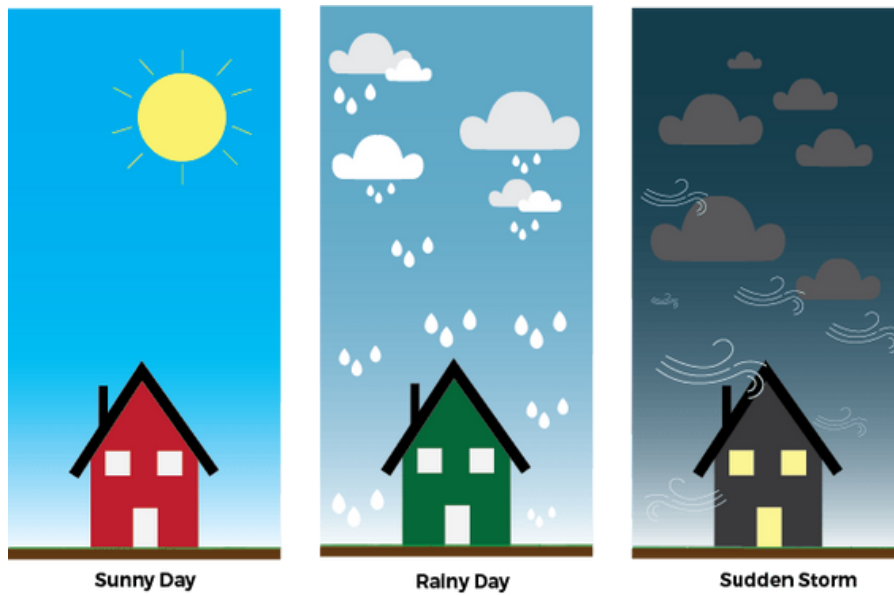


Fig 1.7 The Daily Weather

1.1 What is Climate system?

The United Nations Framework Convention on Climate Change defines the "climate system" as the sum of the atmosphere, hydrosphere, biosphere, and geosphere as well as the interactions between them [2]. The atmosphere is the layer of gases that encircles our planet.

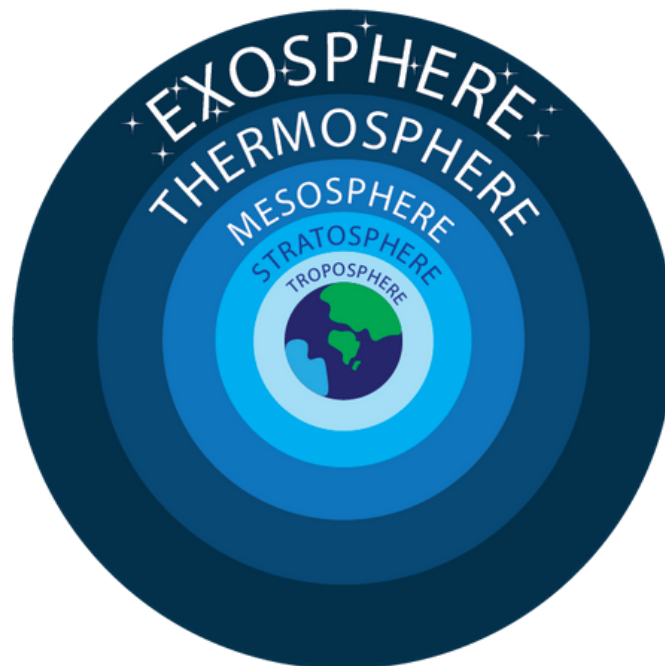


Fig 1.8 The Atmosphere

- **Hydrosphere:** all of the liquid water on Earth, both fresh and salt.



Fig 1.9 Hydrosphere

- **Lithosphere:** The land and ocean floors make up the lithosphere.



Fig 1.10 Lithosphere

- **Biosphere:** the combined marine and terrestrial species of the Earth.

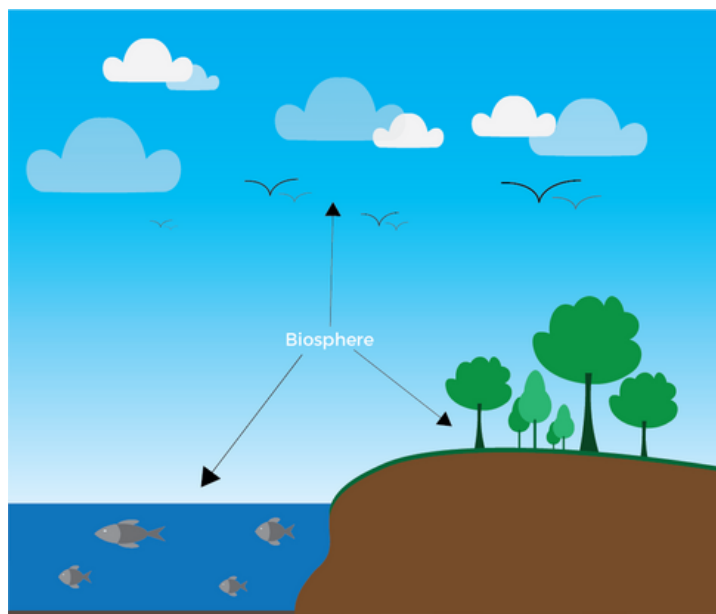


Fig 1.11 Biosphere

- **Geosphere:** Everything from the molten rock and heavy metals in the planet's deep interior to the sand on beaches and peaks of mountains is part of the Earth's geosphere.

1.2 What is climate change?

According to the UNFCCC [2], "**Climate change**" means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

"**Climate change**" refers to the increasing changes in the measures of climate over a long period of time – including precipitation, temperature, and wind patterns [3].

Anthropogenic: Consequence or result of human activity or things that have been generated by humans.

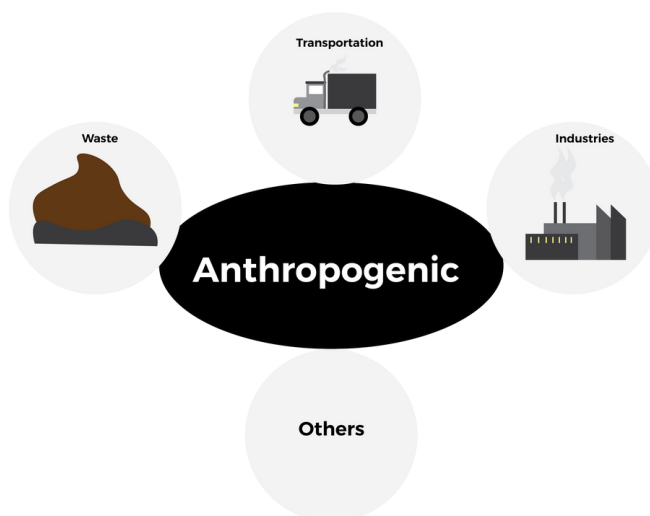


Fig 1.12 The Result of Human activity

So, **Anthropogenic climate change** refers to the human-caused global warming. This is as a result of human-caused emissions. According to the UNFCCC [2], "Emissions" means the release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time.

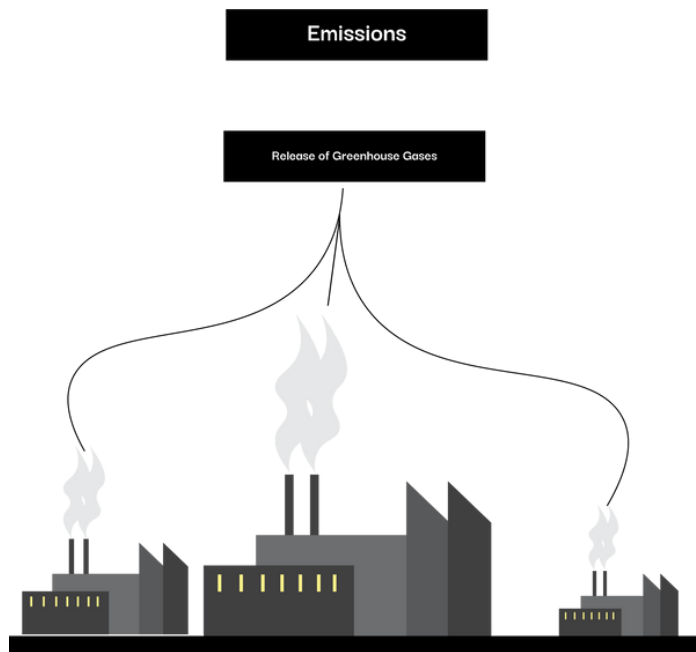


Fig 1.13 The release of Greenhouse gases

1.3 What are the causes of climate change?

Gaseous components of the atmosphere that absorb and re-emit infrared radiation are referred to as "**greenhouse gases**" and this term includes both naturally occurring and anthropogenic gases [2].

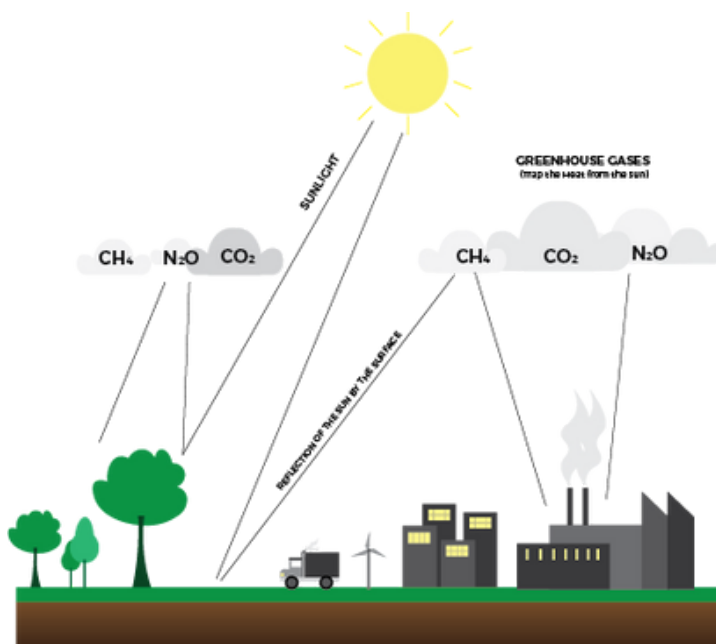


Fig 1.14 Greenhouse gases

Carbon dioxide (CO₂), methane, nitrous oxide, fluorinated gases, etc. are all naturally occurring greenhouse gases, but their atmospheric concentrations are rising as a result of human activity [5].



Fig 1.15 Effect of Global warming

Rising emissions means increases in emissions are due to [5]:

- Carbon dioxide and nitrous oxide are produced when coal, fossil fuels, oil, and gas are burned.

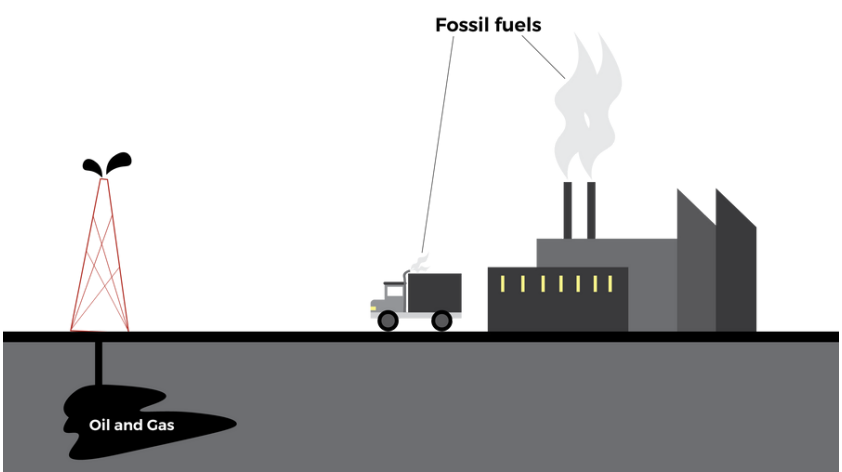


Fig 1.15 Increase in Emission

- Cutting down forests (**deforestation**). By taking in carbon dioxide from the air, trees play an important role in climate regulation. When trees are cut down, the carbon they had stored is released into the atmosphere through burning or the process of cutting down the trees or through no means of taking the CO₂, where all these contribute to the greenhouse effect.



Fig 1.16 Cutting down forest (**Deforestation**)

Developing a larger livestock industry. Methane is produced in large quantities by the digestive processes of cows and sheep.

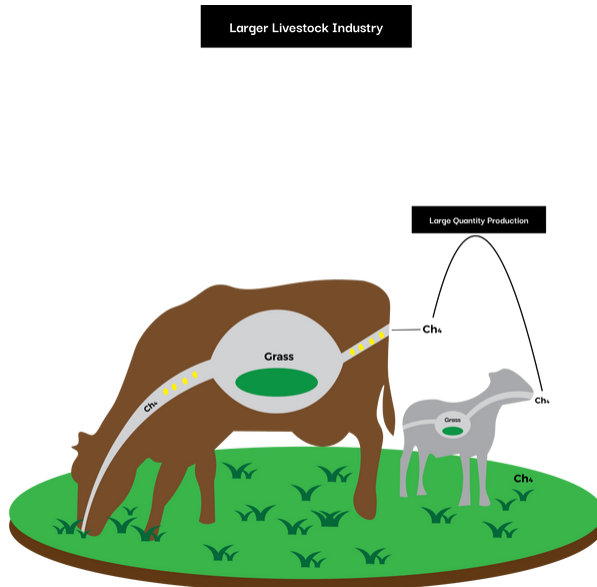


Fig 1.17 Production of Methane in Animals

- Equipment and products that employ fluorinated gases release these gases into the environment. The warming effect of such emissions can be up to 23,000 times that of carbon dioxide.

1.4 What is Greenhouse effect?

The main driver of climate change is the greenhouse effect. Some gases in the Earth's atmosphere (Carbon dioxide, methanes, nitrous oxide) act a bit like the glass in a greenhouse, trapping the sun's heat and stopping it from leaking back into space and causing global warming.

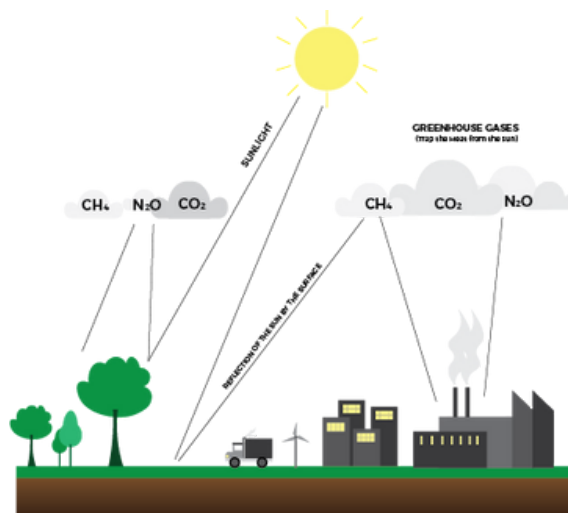


Fig 1.17 Greenhouse effect

- **Global warming:** Increases in atmospheric concentrations of greenhouse gases are primarily responsible for the rise in global average temperatures known as "**global warming**" [3].



Fig 1.17 Global warming

- **Carbon footprint** is the total amount of greenhouse gases (including carbon dioxide and methane) that are generated human actions [4].

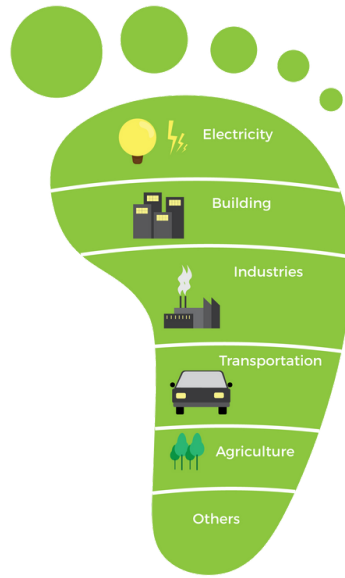


Fig 1.17 Carbon Footprint

- **Climate Risk:** refers to the analysis of consequences, likelihoods, and responses to impacts of climate change, as well as how societal constraints shape adaptation options.
- **Climate Change Impacts:** are consequences of climate change for instance: warming temperatures, severe changes in weather, and changes in precipitation, as well as the effects of Earth's warming, such as rising sea levels, shrinking mountains, and glaciers. Also, ice melting at a faster rate than usual in Greenland, Antarctica and the Arctic is an adverse impact of climate change.

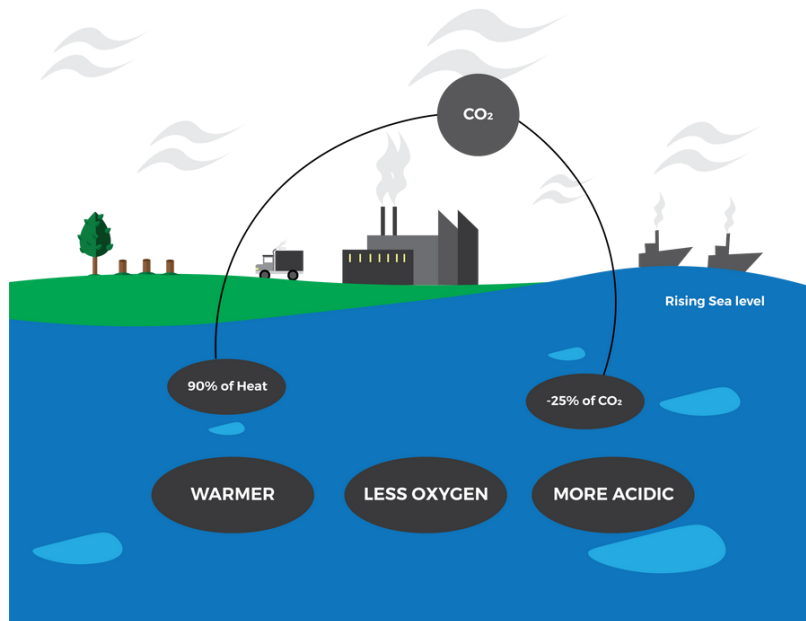


Fig 1.17 Climate change Impact

1.5 What are Climate Actions?

Climate action means [6]:

- Mitigating climate change (helping to cut greenhouse gas emissions).
- Adapting to the impact of climate change by building resilience to phenomena such as flooding, droughts, and other extreme natural disasters.
- Contributing and understanding the cause of climate change.
- **Climate mitigation:** refers to the human interventions or involvement to reduce the sources of greenhouse gases or enhance the sinks that remove them from the atmosphere.
- **Sink:** refers to any process, activity, or mechanism which removes a greenhouse gas, an aerosol, or a precursor of greenhouse gas from the atmosphere [2].

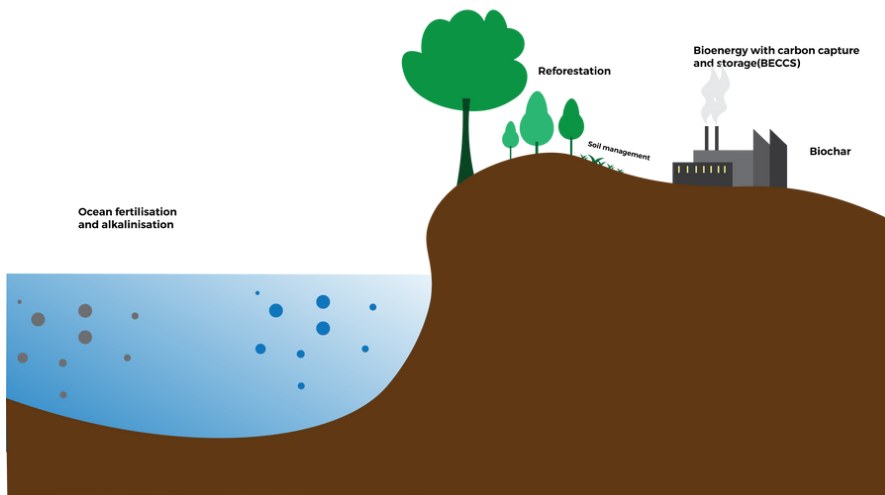


Fig 1.18 Sink

References

- [1] NASA - What's the Difference Between Weather and Climate? (Feb 1, 2005) Retrieved from https://www.nasa.gov/mission_pages/noaa-n/climate/climate_weather.html, Accessed on September 9, 2022.
- [2] UNFCCC: Retrieved from <https://unfccc.int/resource/ccsites/zimbab/conven/text/art01.html>, Accessed on October 3, 2022.
- [3] What is the difference between global warming and climate change? Retrieved from <https://www.usgs.gov/faqs/what-difference-between-global-warming-and-climate-change#:~:text=%E2%80%9CGlobal%20warming%E2%80%9D%20refers%20to%20the,%2C%20temperature%2C%20and%20wind%20patterns>. Accessed on November 12 2022.
- [4] What is a carbon footprint? (August 29, 2022) Retrieved from <https://www.nature.org/en-us/get-involved/how-to-help/carbon-footprint-calculator/> Accessed on August 29, 2022.
- [5] Causes of climate change . Retrieved from https://ec.europa.eu/clima/climate-change/causes-climate-change_en, Accessed on October 3, 2022.
- [6] Climate action and sustainable development Retrieved from https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/climate-sustainable-development_en.html, Accessed on September 23, 2022.

Chapter 2:

Circular Business Model

In order to understand the Circular Business Model (CBM), we first need to talk about the circular economy.

2.1 What is circular economy?

Circular economy, in a nutshell, is an economic system that prioritizes efficiency and sustainability by reducing waste and maximizing the value created from resources. It seeks to depart from the conventional "take, make, and dispose" model by emphasizing the importance of various conservation and recycling techniques.

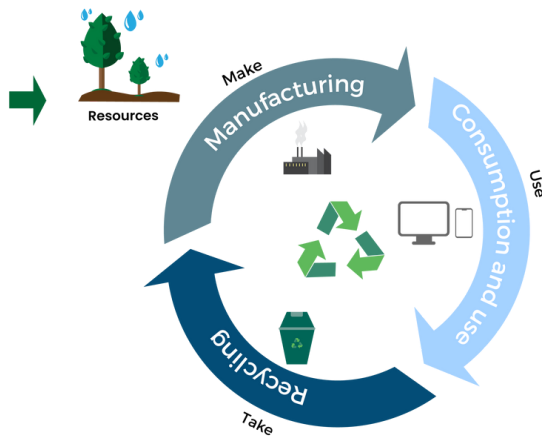


Fig 2.1 Circular Economy

On the other hand, environmental impacts are considered from the very beginning of production. This means that more environmentally friendly products are made and that more recyclable materials are used during production. One of the benefits of a circular economy is that it helps make the world more sustainable without hurting business.

In some cases, it takes more money to buy equipment that uses less energy and is better for the environment, like switching from fossil fuels to renewable energy. However, these investments lead to increased efficiency and positive externalities.

A report from the Ellen MacArthur Foundation in 2012 said that a circular economy could save up to \$630 billion every year in some European manufacturing sectors [1]. As the circular economy grows, it will also create more jobs fixing and reusing things that are no longer needed. The idea of a circular economy doesn't try to stop growth. Instead, it tries to control and localize it in a way that is more sustainable and keeps things going back to where they came from. Changing how things are made and how people buy things will help set up the economic models of the future. This is the problem that the circular economy brings up. It looks at business in a new way, from how products are made to how loyal customers are, and this new way is called a circular business model. Circular Business Models (CBM) have been around since the early 1950s, when they were first thought of. The Ellen MacArthur Foundation probably came up with the first definition and idea for the circular economy. Here, a full definition of CBM is given that includes all of its different parts.

CBM is a way to run a business that aims to:

- Using less materials and resources to make products or provide services.
- Refurbishing and remanufacturing are ways to make products and/or services last longer.
- By recycling, the life cycle of things is closed.

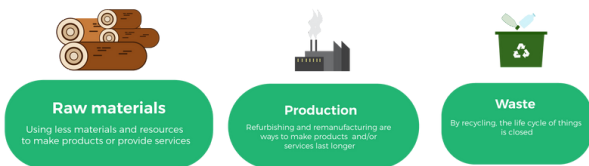


Fig 2.2 Circular Business Model

The model of the Circular Economy is based on three steps:

- Reducing
- Recycling
- Reusing

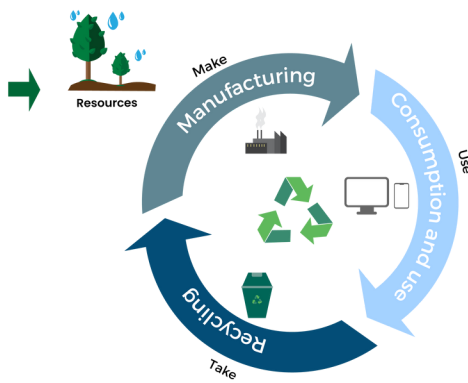


Fig 2.3 Model of the Circular Economy

These are meant to cut down on wasted resources, especially raw materials, by recycling products at the end of their useful lives so they can be used again. The linear economic model is based on extracting or gathering materials and using them as resources to make products, which are then sold on a large scale through networks of distribution. After being bought, these items are thrown away when they are used up, no longer do what they were made to do, or are just out of date. During this cycle, a lot of natural resources and energy are used and then thrown away. This is not a long-term model that can work, so it will be replaced by the circular business model, which can get the same or even better results. The current linear model, which grew out of industrialization, is reaching its limits at the same time that the circular economy is being talked about more and more as a new way of doing things.

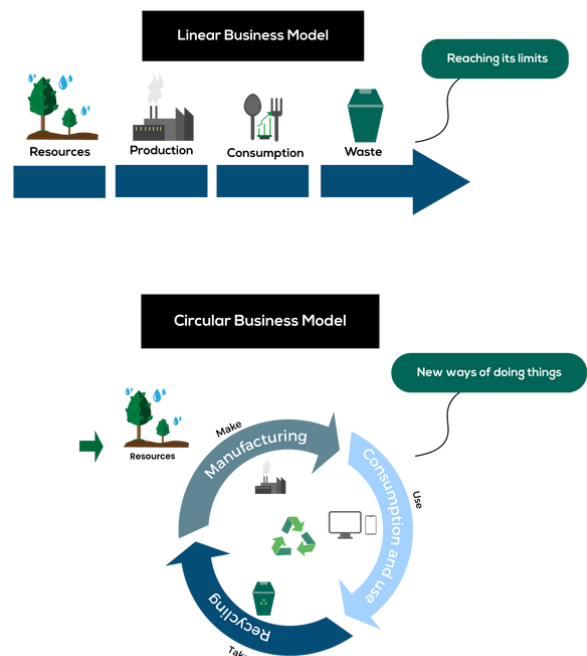


Fig 2.4 Linear business Model and Circular Business Model

There are four areas in particular that could grow and benefit greatly from circular economy:

- Plastic: This can be easily reused or switched out for compostable plastic, which cuts down on waste and keeps soil and water from getting dirty.
- Technology: In this area, too, it's often possible to reuse or recycle materials from unused products and fix up broken appliances so they can be used again instead of being thrown away.
- Health: This is especially true in the medical equipment industry, where it's important to think of long-term solutions that aren't one-time use and let instruments be used more than once.
- Clothing: Large stores, both in person and online, make too much of all kinds of clothing, which leads to more trash. This could be easily avoided by giving vintage clothes a second chance at life through flea markets or apps that let you trade clothes you no longer wear instead of throwing them away.

Many companies are now building their business models on this kind of logic for remodeling, but there are also higher levels. On the highest level, we have a rental or subscription model, where the clothes are used over and over again. This means that companies in the garment industry need to find new ways to create, deliver, and capture value. For example, this means that they have to change their way of thinking from selling a product (a shirt, jeans, or whatever) to a customer who may only use it once or throw it away to thinking about where their money will come from.

For example, by renting out the jeans, shirt, or dress or offering them in some. A subscription-based model can let people use the product more over time. This means that the company needs to find a new way to offer these services. So, the company needs new resources, different kinds of activities, and maybe even new partners. It also needs to find a new way to capture this value, like through a subscription service model. This way of thinking is also related to the sharing economy, which is based on the idea that we want to make better use of the resources that are already there. So, the old linear model of "production-consumption-disposal" must be thrown out and replaced with a model that is better for the environment, free of toxic chemicals and with no emissions. In fact, adopting a circular economy can bring more benefits than just less stress on the environment, such as:

- A better guarantee that raw materials will be available;
- More jobs by the year 2030;
- Innovation and the growth of the economy;
- Putting more durable and innovative products within reach of consumers, which saves money and makes life better.

Many start-ups and projects are now inspired by circularity, such as "Too Good To Go", which sells unsold food at reduced prices, or UpCyclify and its upcycled office furniture solutions.

This model of economy encourages innovation, creativity and often social connection. The new business models, based on a closed-loop approach, include after-sales services that reduce certain costs related to the end-of-life of products, which are now paid twice by the company during production, and through extended producer responsibility.

The model also convinces large groups for example:

- Ikea is developing a furniture rental offer in a few markets currently under test,
- Urban Outfitters is now offering a clothing rental concept,
- Nuuly, in the United States.
- Loop, a global platform for reuse, is also part of this idea of closed-loop consumption, and this year launched the first circular e-commerce platform, in partnership with more than 25 multinationals. Through Loop, consumers get their everyday products delivered in durable, returnable containers that are collected, cleaned and reused. Launched in 2019 in Paris and New York, the model will be developed in England, Canada, Japan, and the rest of the United States in 2020, highlighting the emergence of a common awareness among consumers and brands.

Fairphone, a company that offers more ethical smartphones when the phone industry pushes the consumption of objects quickly obsolete and greedy of rare metals. The goal of Fairphone is both to demonstrate that another source of materials is possible and to sell phones that last over time. The company has therefore created easy-to-disassemble devices with parts that can be replaced if necessary and offers the help of a customer support service service that becomes the cornerstone ensuring that the product stays in the loop. Fairphone can thus develop two activities: the sale and rental of products that have a longer lifespan.

But the Circular Business Model (CBM) doesn't mean that one company changes one product. It has to do with how all the companies that make up our infrastructure and economy and how they work together. It has to do with energy, and it also has to do with rethinking the operating system. We have a great chance to see things from new angles and open up new horizons. Instead of staying stuck in the problems of the present, we can use creativity and innovation to rethink and redesign our future.

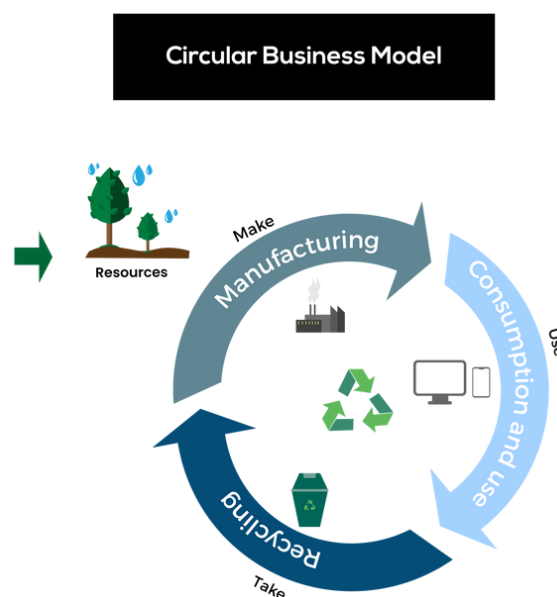


Fig 2.4 Circular Business Model

References

[1] Towards the circular economy Vol. 1: an economic and business rationale for an accelerated transition. Retrieved from <https://ellenmacarthurfoundation.org/towards-the-circular-economy-vol-1-an-economic-and-business-rationale-for-an>, Accessed on September 14 2022.

[2] Towards the circular economy Vol 1: an economic and business rationale for an accelerated transition. Retrieved from <https://emf.thirdlight.com/link/x8ay372a3r11-k6775n/@/preview/1?o>, Accessed on August 21 2022.

Chapter 3

Green Economy

3.1 Why Green Economy?

The green economy is based on what science tells us today, which is the extent of ecological crises.

There are at least three major ecological crises today:

- **climate change,**
- **the destruction of biodiversity, and**
- **the degradation of ecosystems.**

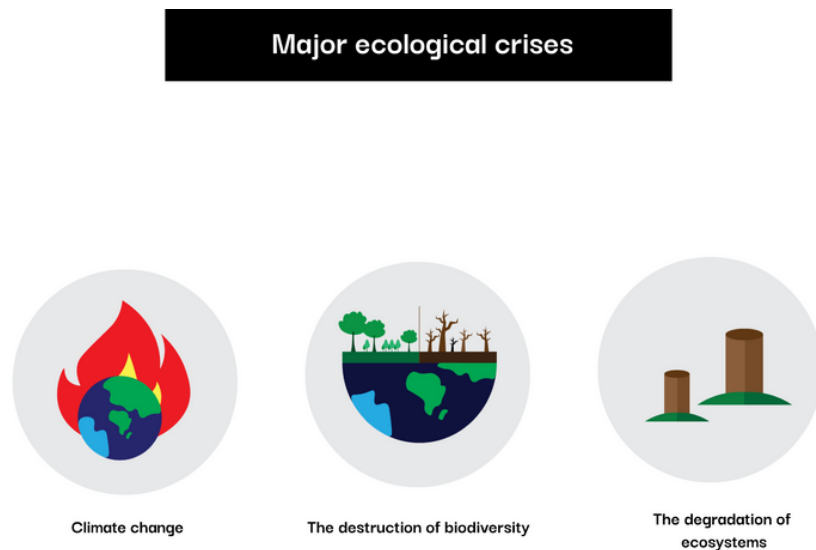


Fig 3.1 Ecological Crises

These pose some new constraints for economies, for societies and for political regimes.

The United Nations Environment Program (UNEP) defines the green economy as “**an economy that promotes improved human well-being and social justice, while significantly reducing environmental risks and ecological shortages**”. The green economy proposes to take these crises as levers, as opportunities to both develop employment, to develop economically, to promote human development (which is even more important than economic development) and also to reduce inequality. So, the green economy explains that we have a new and strong environmental constraint, it is absolutely inevitable, and we cannot look elsewhere and at the same time we can do something about it for human development, for the reduction of inequalities, for the development of employment.

The term 'Green Economy' was first used in 1989 by a group of leading environmental economists. The United Nations Environment Programme defines it as "improving human well-being and social equity by significantly reducing environmental risks and ecological scarcities. It is low-carbon, resource-efficient and socially inclusive" [2]. Therefore, it is an alternative to the current dominant economic model, which exacerbates inequalities and incorporates waste and resource use that undermine the environment and human health, and which is inclusive, produces social equity, and is capable of reducing risks associated with the ecosystem and the people who inhabit it. In other words, there is no contradiction between being able to cope with these ecological crises, and ultimately to mitigate or even resolve them, and therefore to live with them and not to live against them or to live in spite of them or ultimately not to live because of them. But to manage to live with them and truly domesticate them by integrating them into our societies, our democracies, our economic systems and to achieve the balance between economic and ecological systems through the third system, which is the political system. So basically, making ecological crises a lever is a very simple definition of the green economy.

And more precisely these three characteristics:

- the first thing is to develop green jobs and jobs that are in the most reductive sense of the term in eco-activities.
- the second horizon is to change the modes of production and consumption, so it is much further in the transformation of our economic systems by changing the way we produce and consume and there we speak for example of circular economy we speak for example, decoupling between human development and environmental impact and,
- the third horizon, which is a little more distant but quite fundamental, is to change the measure of social value by changing the yardstick by which we judge collective success and therefore to find new indicators both of well-being.

The idea of the Green Economy specifically follows five key principles [2]:

- The ***principle of prosperity***, which would allow all people to create and enjoy prosperity through the growth of wealth, which will sustain the well-being of the population through the provision of opportunities for new jobs and collective action for the public good.

- **Agriculture:** green growth is fundamental for long term food security and poverty reduction. Promoting the use of naturally drought resistant or salt tolerant plants and other environmentally friendly alternatives can help farmers avoid catastrophic losses and improve their income during dry years. Investing in and promoting organic products, green labels, and ecotourism can create green jobs and keep ecosystem services like crop pollination and water purification going.

- **Energy:** we know for example that energy efficient buildings can cut energy costs up to 30%. Policies that encourage people to use less energy and invest in clean energy can boost innovation, increase profits, and improve energy security. Policies that support small-scale renewable energy projects can also help the poor get more access to energy.

- **Transportation:** investing in green, low-cost transportation can not only cut down on traffic and pollution, but it can also help get people out of poverty. Supporting fuel- efficient and electric vehicles, promoting high-speed rail and bus rapid transit, and making pollution standards stricter. And adding new biofuels gives people more options for green transportation and makes new green jobs.

Where and how the Vision Can be Brought to Reality

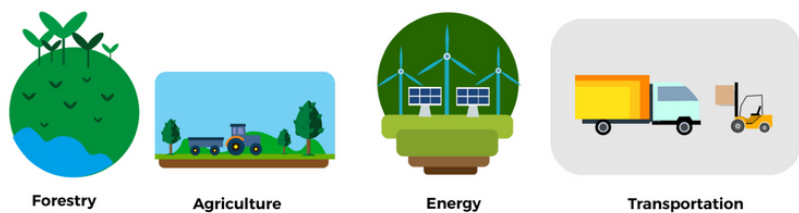


Fig 3.2

It should be noted that the concept of a green economy does not necessarily reject economic growth, but rather seeks to foster growth that is compatible with ecological sustainability. The green economy explicitly rejects the choice between the environment and employment. The green economy is low carbon, resource efficient and socially inclusive. Many countries are already transitioning to this new paradigm. Their experience shows that the right policies, knowledge, skills, and incentives can influence behavior and catalyze investments in green businesses and activities.

- The **principle of justice**, through the promotion of equity within generations and the fair distribution of opportunities and achievements.
- The **principle of planetary boundaries**, aimed at the protection of nature and its values through precautionary and protective principles.
- The **principle of efficiency and sufficiency**, with support for sustainable, low-carbon and circular consumption and production, to limit the consumption of natural resources;
- The **principle of good governance**, as this kind of economy must be driven by integrated, accountable and resilient institutions and include public participation, as well as informed consent.



Fig 3.2 The Five Key Principles that the green economy follows

3.2 Where and how can we translate this vision into reality?

- **Forestry:** planting more trees may sound like an old saying, but forests and trees are important for sustainable development because they provide important services. These ecosystems store carbon, keep different kinds of life alive, control the flow of water, and stop soil from washing away. We need to act right away to protect our forests and peat lands, bring back to life forests that have been damaged or cut down, stop illegal logging and forest clearing, and promote sustainable forest management.

Increasingly, countries are using a low emission development strategy (LEDS) as the foundation for achieving green growth. These national strategic frameworks are developed following careful analysis of a nation's unique strengths and challenges. They outline tangible actions integrated across all sectors of the economy to increase efficiency, reduce greenhouse gases, spur economic growth, and increase resilience to the impacts of climate change. The green economy is set to develop in the coming decades with a significant transformation of organizations and businesses. The circular economy is one component of the green economy. This is a term for an economic model whose goal is to make goods and services in a way that doesn't hurt the environment. It does this by limiting:

- consumption and waste of resources (raw materials, water, energy) (raw materials, water, energy),
- waste generation.

The green growth is based on consideration of environmental impacts and is defined in opposition to “brown/grey” growth, which implicitly refers to the current growth regime. Unlike the term “growth”, however, it is not based on a clearly established economic concept. In the strictest sense, "green growth" means less growth in carbon emissions, a less intense growth pattern for fossil fuels, and levels of greenhouse gas emissions that are in line with what the IPCC recommends to stop global warming. In a more flexible definition, green growth refers to a growth model allowing the increase of the national product but soberer in raw materials, producing less waste and discharges into the environment. The challenge is to take environmental issues into account without adding extra costs that would stop or slow down economic growth. The OECD notes that “a green growth policy is about fostering economic growth and development while ensuring that natural assets continue to provide the environmental resources and services on which our well-being is based. To do this, it needs to encourage investments and new ideas that will lead to long-term growth and new economic opportunities [3]. “Green growth” based on the environment and the economy is part of a broader concept, sustainable development. Simply put, green growth is smart. Developed greening different sectors of the economy as part of a comprehensive leads promotes investment, innovation and job creation, which sustains growth and provides new economic opportunities. Governments, businesses, civil society, and individuals all have a role to play.

Green Growth

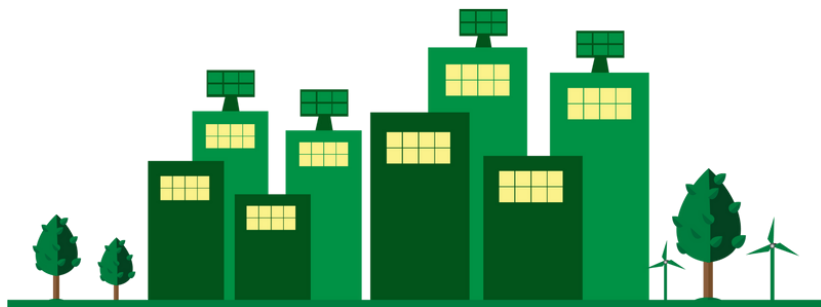


Fig 3.3

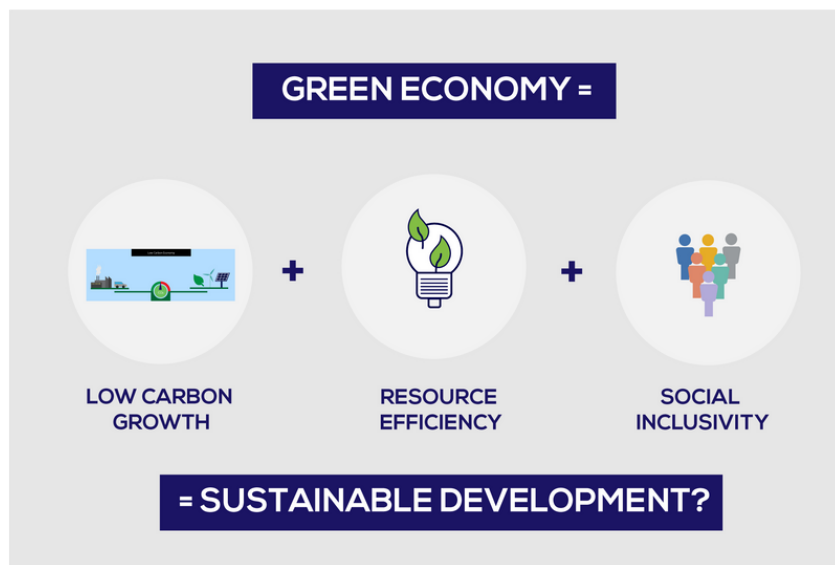


Fig 3.4

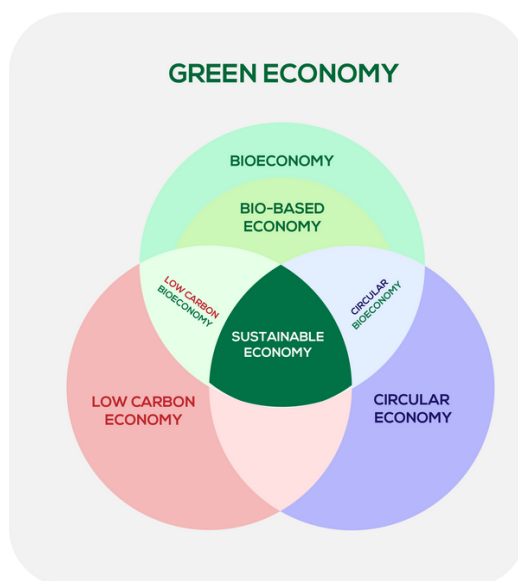


Fig 3.5

References

[1] United Nations Environment Programme, Retrieved from <https://www.unep.org/explore-topics/green-economy/about-green-economy>, Accessed on November 3 2022.

[2] The 5 Principles of Green Economy (7th June 2020), retrieved from <https://www.greeneconomycoalition.org/news-and-resources/the-5-principles-of-green-economy>, Accessed on October 25 2022.

[3] Towards Green Growth, May 2021 Retrieved from <https://www.oecd.org/greengrowth/48012345.pdf> Accessed on November 7 2022.

Chapter 4

Green Skills

According to the United Nations Industrial Development Organization, green skills are the knowledge, habits, practices, values, and attitudes that are needed to live in, build, and support a sustainable and resource-efficient society. It is now important for both developed and developing countries to switch to more environmentally friendly ways of making and using things.

4.1 What is Green Economy?

According to UNEP (2011), a green economy is an economy that improves people's well-being and reduces inequality over time without putting future generations at risk of serious environmental problems or ecological shortages. In simple words, we can say that a green economy has low carbon emissions, makes good use of resources, and includes everyone in all human activities.

4.2 What are Green Jobs?

According to Eurostat (2009), green jobs are mostly related to the environment. They include "all jobs that depend on the environment or are created, replaced, or redefined in terms of skill sets and work methods in a transition to greener."

Green jobs, according to the International Labor Organization (ILO), are good jobs that help protect the environment and restore the ecological balance of nature. For example, a green job might involve reducing pollution and carbon emissions, working with renewable energy, and reducing waste.

4.3 What are Green Skills?

The term "**green skills**" refers to the set of competencies that promote environmentally responsible economic activity. Skills in areas such as pollution abatement, waste management, environmentally responsible purchasing, energy generation and management, and so on [1]. All phases of economic activity—from the primary to the secondary and the tertiary— must adhere to strict environmental standards.

Source: <https://aspiringyouths.com/economics/primary-secondary-tertiary-sector/> Raw materials and staple foods are examples of what are gathered by the primary sector of the economy. Some examples include farming, mining, logging, ranching, hunting, fishing, quarrying, and so on. The secondary economy processes the raw materials produced in the primary economy into the final products that people use every day. This industry encompasses the entire production, processing, and building processes. Those involved in the secondary sector include those in metalworking and smelting, automobile production, textile production, the chemical and engineering industries, aerospace manufacturing, energy utilities, breweries and bottlers, construction, shipbuilding, and more.

The tertiary sector, also known as the service economy, is responsible for the distribution and retail of goods and services created in the secondary sector. These are sectors such as retail and wholesale trade, shipping and distribution, food service, administrative and clerical support, the media, travel and tourism, financial services, healthcare, and the law. Due to the scarcity of Earth's natural resources, it is crucial that the aforementioned economies adopt a sustainable path lest they jeopardize the wellbeing of future generations. Adopting the new green economy is practical if we want to create a society that is both resource-efficient and sustainable. Green Economy is a new economic model that seeks development while also safeguarding the environment. While having green skills as its key drivers. Green economy is in tune with sustainability and sustainable development.

Why sustainability? You might be wondering what exactly is sustainability? According to the Brundtland Commission, **sustainability is defined as the capacity to fulfill current demands without jeopardizing the ability to satisfy the needs of future generations [2].**



Fig 4.1 Sustainability

Production, transportation, electricity generation, building, etc. are all major contributors to global warming because of their impact on the environment. Since the middle of the 20th century, the observed warming has been primarily attributable to increasing emissions of greenhouse gases into the atmosphere due to human activities. Diseases, deaths, and mass relocation are all results of these unusually severe weather events. If we keep emitting greenhouse gases at our current rates, we could see a 2.6-4.8 °C increase in global average temperatures by the year 2100. All over the world, people are experiencing the repercussions of climate change, which include higher average temperatures, more frequent heat waves and wildfires, a rise in sea levels that causes erosion and floods that destroy homes and businesses, and other similar disasters. For climate change to have minimal global consequences, a worldwide effort is needed to implement "green economy" processes that will likely result in net-zero emissions of greenhouse gases.

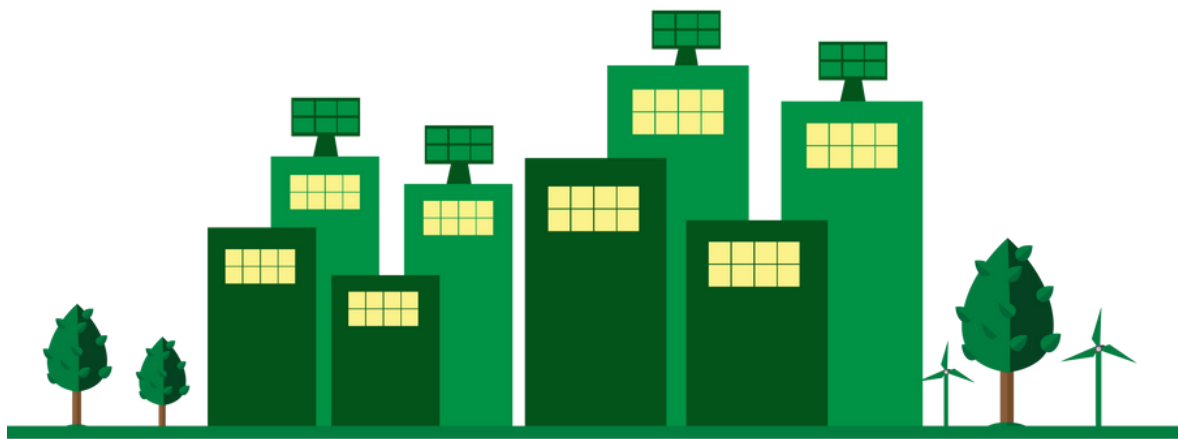


Fig 4.2

4.4 What is Net Zero?

As a definition, "net zero" describes a situation in which no greenhouse gases are released into the atmosphere while none are absorbed by the environment. When our contributions are equal to our losses, we have reached net zero.

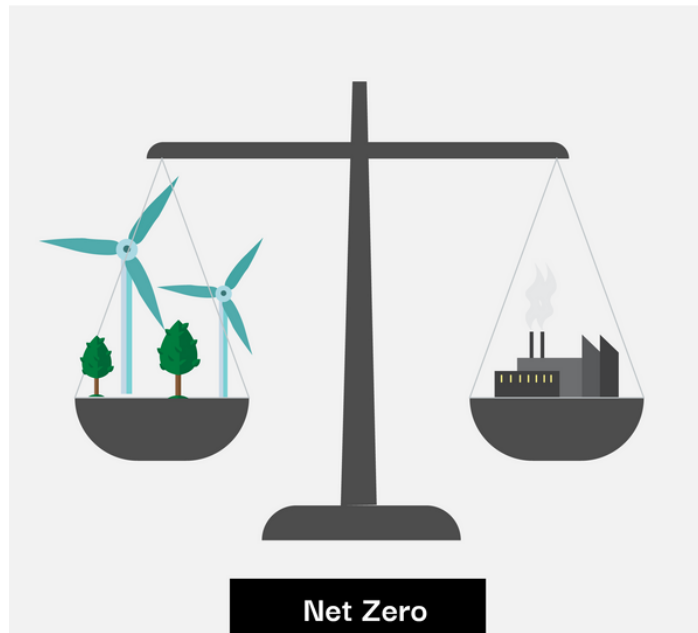


Fig 4.3 Net Zero

Comparable to elementary mathematical operations such as adding and subtracting. But how can we make this happen? Green skills and technologies are the key to achieving this goal.

4.5 What are green technologies?

These are technologies that help to reverse the negative impacts of human explorative and exploitative activities in our environment. These green technologies are highly beneficial because they contribute in restoration, rejuvenation and maintenance of our ecosystem. We can also refer to them as clean technology, renewable technologies, eco-friendly technologies, climate- friendly solutions etc.

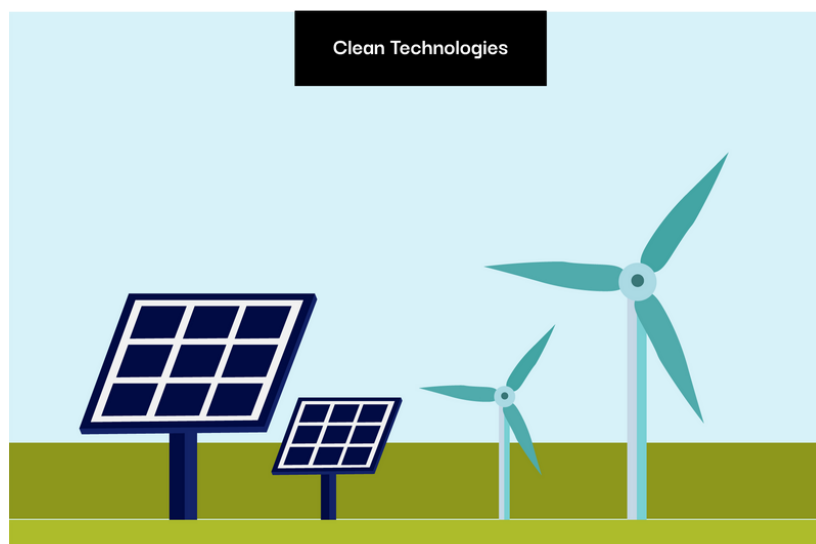


Fig 4.4 Clean technologies

In a nutshell, green technology supports in the conservation of natural resources and the environment.

Benefits of Green Technology

- It minimizes environmental damage around us as it produces little or no greenhouse emissions.
- It promotes a healthy and safe environment for all kinds of life, humans, animals and plants.
- It conserves energy and natural resources such as water and so on.
- It should encourage the usage of renewable resources.

Environmentally friendly technologies aim to lessen society's reliance on nonrenewable energy sources, waste creation, and energy consumption. Additionally, it encourages the reuse and recycling of many common items. In addition, we can do our part by reusing plastic bags and avoiding the landfill by switching to renewable energy sources like wind, water, solar, bio-fuel, and wastewater. The Global Green Skills Report 2022 (LinkedIn Economic Graph) informed that the hiring balance shifted toward green talent, as the green hiring rate outpaced the total hiring rate in most economies across the world. This indicates that green employees were employed at a higher rate than non-green workers throughout the world.

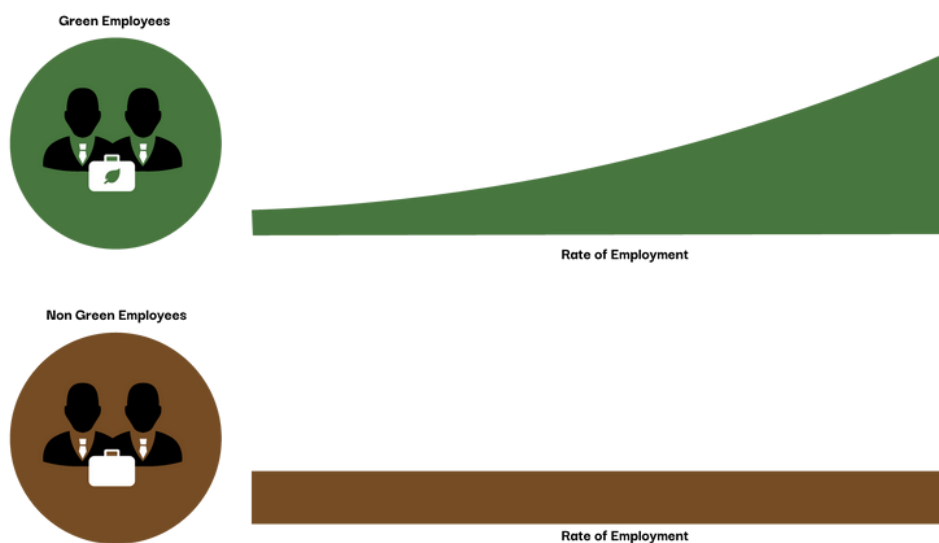


Fig 4.5 Indication of employment rate in green employment

After the pandemic, green skills are shown to be more resilient to economic downturns than non-green skills. Currently there is a growing demand for skills that are economically and environmentally sustainable.

Table 1: Shows the fastest growing Green skills between 2016-2021[1].

Category	Green Skills	Percentage Growth (2016–2021)
Pollution Prevention	Sustainable fashion	90.6%
Ecosystem Management	Environmental services	82.5%
Environmental Remediation	Oil spill response	80.4%
Ecosystem Management	Climate	68.7%
Environmental Auditing	Sustainable Growth	67.2%
Ecosystem Management	Surface water	64.5%
Environmental Policy	Occupational Safety and Health Advisor (OSHA)	57.9%
Pollution Prevention	Sustainable business strategies	56.6%
Energy Generation	Solar systems Renewable	55.5%
Ecosystem Management	Sustainable landscapes	52.9%

The demand for green technology develops when our natural endowments are depleting and pollution grows as a result of the extensive usage of nonrenewable resources like crude oil, natural gas and coal. This brings us to definition of some terms.

Green jobs: are ones that cannot be performed without a thorough understanding of green skills.

Greening jobs: can be done without green talents, although they usually require some upskilling.

Greening potential jobs: can be accomplished without green talents, but may require some level of green skills on occasion.



Fig 4.6 Green Jobs

Table 2: Fastest-Growing Green and Greening Jobs Globally

Green Jobs	Greening Jobs
Sustainability Manager	Compliance Manager
Ecologist	Regulatory Affairs Consultant
Environmental Health Safety Specialist	Geotechnical Engineer
Solar Consultant	Risk Advisor
Wind Turbine Technician	Programme Manager
Solar photovoltaic engineers and technicians,	Construction Manager
O&M technicians, forest and ocean guards	Technical Sales Representative
Sensors developers	Farm Manager
off-grid energy system managers	Safety Technician
Environment engineers and technicians,	Environmental economists,
Municipal workers,	-
Energy-efficient systems installers	-
Biofuel process engineers	-
Horticulture and landscaping	-

Table 3: Emerging green jobs and their functions

FIELD	SUSTAINABLE JOBS	FUNCTION
Green financing	Bankers, accountants, financial correspondents, and mobile payment operators.	To enable disadvantaged people to obtain renewable energy through innovative payment structures, lowering prices and increasing efficiency
Sustainable transport	Engineers, surveyors, bus operators, manufacturers, urban planners, and fare collectors	Awareness of sustainable transportation systems, bus rapid transit corridor design and management, more efficient engines, hybrids, fuel cells, and alternative fuels
Green Cities Development	Green architects, planners, financiers, green building technicians, and recycling plants	Green buildings, green areas, bicycle lanes, recycling plants, and water-harvesting structures are all examples of environmentally friendly constructions.
Financing innovations for sustainable energy	Off-grid finance specialists, mobile apps and techs Managers of off-grid energy systems and O&M technicians	Off-grid clients can use pay-as-you-go utilities and energy services.
Renewable energy	O&M technicians, solar photovoltaic engineers and technicians	Renewable energy, both distributed and off-grid, access to contemporary energy sources, biomass and biogas for cooking, and motive power for agro processing and watermills
Energy efficiency	Engineers, technicians, construction workers, and installers	Appliances that save energy, industrial operations, electric motors, and insulation
Smart Cities	Parking solutions, lighting solutions, and Wi-Fi providers, sensor makers, development firms, or software suppliers	Cities that are digitally linked, with connectivity infrastructure, connected gadgets, and automated municipal operations
Environmental services	Environmental engineers and technicians, financial specialists, environmental economists, and installers of energy-efficient systems	Environmental mgt plan/compliance/monitoring auditing, environmental impact assessment, resource mgt studies, water resource mgt systems/ISO 14001, environmental risk assessment

Sectors	What can we do?
<p>Agriculture</p> <p>Agriculture means growing crops, and producing food for our daily lives. It is the largest part of our economy and the most important because it provides us with food to survive. Agriculture may harm the efficiency environment by</p> <ul style="list-style-type: none"> • overusing land resources, • cutting forests, • and polluting air, water, and land by using harmful chemical fertilizers and pesticides 	<ul style="list-style-type: none"> • Support local, organic and natural farming (farming without the use of harmful fertilizers and pesticides) • Choose a sustainable method of farming and crop production • Use technology for production efficiency • Eat in-season and locally produced food • Grow our own vegetables if possible
<p>Energy Resources</p> <p>We use energy in our everyday life and demand for energy is increasing day by day. Common energy sources, such as oil, coal, gas, etc., are harmful to health and the environment. They are limited natural resources and non-renewable.</p>	<p>Select clean, renewable energy sources like solar and wind energy whenever possible.</p> <ul style="list-style-type: none"> • Use a renewable source of energy • Avoid wasting electricity. Turn off lights and unplug appliances when you are not using them • Avoid cars and use cycles or public transport
<p>Transport</p> <ul style="list-style-type: none"> • The transport sector consumes maximum petrol and diesel and causes a lot of pollution. Also, too much dependency on a natural resource like oil fuel, cause economic cost. The transport sector of a green economy aims at • Using cleaner fuels like electricity for vehicles. • Providing public transport, promoting cycling, etc., to discourage the use of cars. 	<ul style="list-style-type: none"> • Use public transport like buses or trains • Walk or cycle when possible • Use electric (battery-operated) vehicles if possible
<p>Waste Management</p> <ul style="list-style-type: none"> • Throwing something away means losing the chance to reuse materials and can lead to land, air, and water pollution. Proper waste management reduces the negative impact on the environment. 	<ul style="list-style-type: none"> • Reduce, reuse and recycle before throwing away things • Separate the waste substances so that some products can be recycled and food waste can be composted

Sectors	What can we do?
<p>Water Management</p> <p>Water is one of our most important resources. Billions of people worldwide lack access to clean drinking water or improved sanitation services – and population growth is making the problem more serious.</p>	<ul style="list-style-type: none"> • Use water wisely • Turn off the tap when you are not using it • Get leaking taps and pipes fixed immediately • Don't let polluted water flow back to the land or water source before it gets a wastewater treatment.
<p>Manufacturing Industry</p> <p>Industries help in employment and economic growth but harm the environment in many ways. Industries should use methods to avoid and reduce pollution and to use clean sources of energy.</p>	<ul style="list-style-type: none"> • Industries make items according to what customers prefer to buy • If we buy 'green' or environment-friendly products (fewer plastics, clothes made without chemical dyes, etc.) more industries will start making such products
<p>Construction</p> <ul style="list-style-type: none"> • and buildings affect global resources and climate. The use of sand and stones causes the destruction of river beds and quarrying in mountains. These activities cause landslides, earthquakes, and destruction due to flooding. Construction activities also cause air pollution and breathing problems. Faulty and incorrectly designed buildings need more air-conditioning and electric lights, waste more water and use more energy overall. 	<ul style="list-style-type: none"> • Energy-efficient or green buildings save electricity and water and use clean energy like solar and wind energy. • We need to use cleaner energy in our buildings and avoid wastage of energy. • We should talk to people about the advantages of using local construction materials. • If a large-scale construction project is causing pollution we should inform the local authorities about them.
<p>Fisheries</p> <ul style="list-style-type: none"> • Overfishing has led to the depletion of future fish supplies. • Some species of sharks, turtles, and fish are becoming extinct. This will disturb the ecological balance and food chains in our ecosystem. • This will also cause more dependence on other forms of food causing more pressure on agriculture sectors. • Fishermen may lose their livelihood. 	<ul style="list-style-type: none"> • We can avoid the problems of over-fishing by telling people, and making them aware of sustainable fishing practices which control fishing and provide enough time for fish to breed and multiply. If you eat fish, but only those which are plentifully available and also in season (not during breeding season).

Sectors	What can we do?
<p>Forestry</p> <ul style="list-style-type: none"> • Forests are an important part of our ecosystem. It provides habitat for animals and livelihood for humans. It also protects us from drastic climate change. It is important for rainfall and to protect our land resources, many tribes survive on forest products. Deforestation or loss of forests leads to • climate change, • soil erosion, • loss of wildlife and damage to food chain and ecosystems, and • less tree coverage which results in less rainfall and less oxygen, and more pollution. 	<p>Sustainably managed forests can continue to support communities and ecosystems without damaging the environment and climate.</p> <ul style="list-style-type: none"> • Reduce, reuse and recycle paper so that fewer trees are cut. • Avoid buying products, such as ivory which we can get only by harming animals. • Buy only those products which are collected safely, such as honey collected without breaking beehives.
<p>Tourism</p> <ul style="list-style-type: none"> • can be great for local economies, but not if it harms the environment. 	<p>While traveling, travel in groups, limit water and energy use, and avoid wastage.</p> <ul style="list-style-type: none"> • There are hotels and travel companies that support ecotourism (tourism that protects the environment). Find out more about them and tell people about how to travel without harming the environment.

References

- [1] LinkedIn Economic Graph. (2022). Global green skills report 2022, Accessed on November 19, 2022.
- [2] Maclean, R., Jagannathan, S., & Panth, B. (2018). Education and skills for inclusive growth, green jobs and the greening of economies in Asia: case study summaries of India, Indonesia, Sri Lanka and Viet Nam. Springer Nature Accessed on October 25, 2022.
- [3] Green Skills, Retrieved from <https://ncert.nic.in/vocational/pdf/kees105.pdf> Accessed on September 13, 2022.

Chapter 5

Energy Transition

IRENE (Industrial Renewable Energy Agency) defined Energy transition as the pathway toward the transformation of the global energy sector ranging from coal, oil, and fossil-based to renewable energy (zero carbon). It is a structural change in the energy system from transforming fuel-based energy to eco-friendly energy.

5.1 Why do we need energy transition?

Traditional energy methods are harmful to human health as well as the environment. Burning fuel, coal, fuel, and fossil produce tons of carbon emissions worldwide and cause climate change. Depending on traditional energy sources is not a sustainable solution for the future world. As the climate is changing faster than before, to protect our planet and natural environment, it is essential to introduce Green renewable energy. The term "energy transition" refers to the change in the global energy industry away from fossil-based energy production and consumption systems, such as oil, natural gas, and coal, and towards renewable energy sources, such as biomass, wind, solar, and lithium-ion batteries.

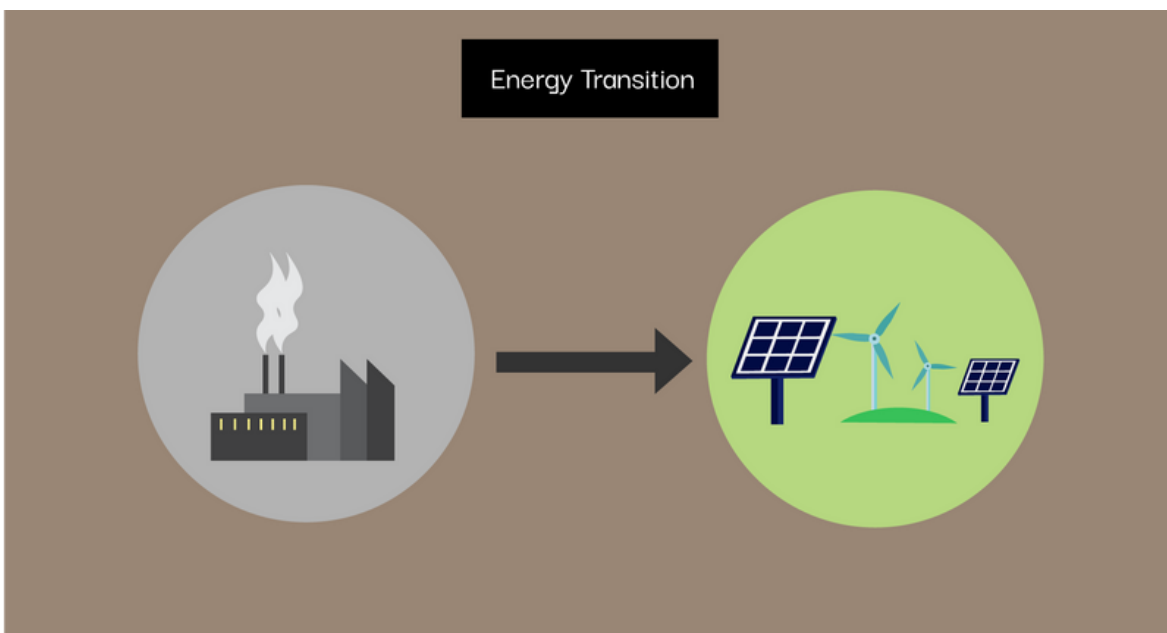


Fig 5.1 Energy Transition

Here we have two words: **energy + transition**.

5.2 What is energy?

In a simple language, it is "the ability to perform work." Energy is what causes things to change and move. It can be seen around us for example movement, swimming, driving and so on requires energy.

Energy can be categorized broadly in two.

- The kinetic energy which is energy in motion i.e. it is found in moving objects eg when we run, a moving vehicle, cycling etc.
- Potential energy is stored energy or possess by a body at rest.

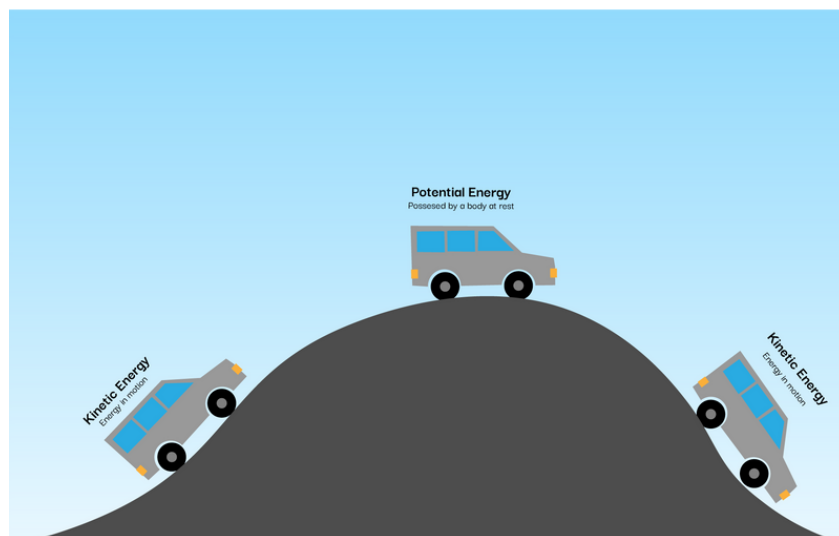


Fig 5.2 categories of Energy

Types of energy

- **Heat energy** is also known as thermal energy is generated from the interaction of molecules at different temperatures. When there is rise in temperature atoms and molecules moves faster and collides with each other resulting into heat.
- **Electrical energy** from the movement of electrons.
- **Gravitational energy** is produced by large objects such as the Earth also known as earth gravity. It has been said that there is no gravity in the moon but scientist have said that for the fact that the astronauts comes back to that earth means that are some minimal level of those energy in the moon.
- **Chemical energy** is derived from the interaction of atoms and molecules. The food we at gives us chemical energy we eat food to gain energy which is later converted into kinetic energy when we move. Whereas, **Light is also known as radiant energy** is gotten from the sun.

Energy are stored in form of potential energy. Energy is stored in the wood, coal and biomass.

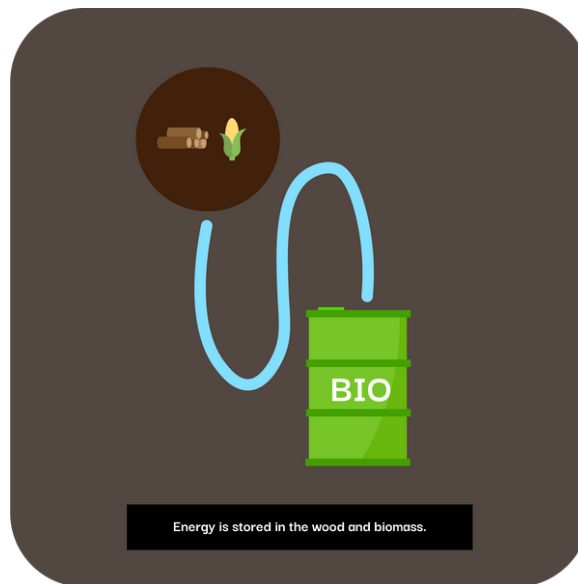


Fig 5.3 Energy Storage

Energy has evolved throughout history, as population of humans increases the need for energy also has increased. In the earliest of time, Energy was provided by the sun and wind. The sun continues to emit heat and light in the same way it did when the earth was formed. Humans later discovered the power of fire. People used fire to cook and also as an additional source of light and heat. Wind and water energy have also been used for centuries to power mills and transport across bodies of water. They also made use of the power of horses and oxen for transportation and work. Humans have made numerous discoveries concerning energy use. People used the energy stored in wood, dung, and straw to heat their homes long before modern energy was discovered. Humans relied heavily on those earlier mentioned sources until the Industrial Revolution, which occurred only a few centuries ago. That is when coal entered the energy timeline.

Energy Right Now is that this century has seen a rapid evolution of energy. There are now more options for powering our homes, cars, and other daily needs. The primary energy sources used today are listed below.

Renewable Energy

Today people are looking to the sun and the wind to provide clean energy for their homes, vehicles, and workplaces. Clean energy sources include wind, water, hydrogen fuel cells, and geothermal. Each of these is renewable, which means it will last indefinitely.

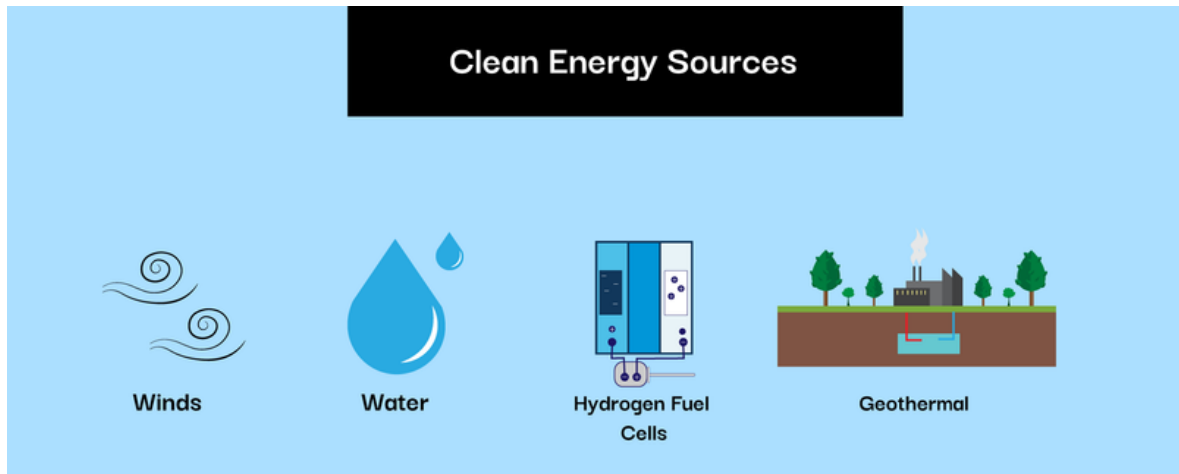


Fig 5.4 Clean energy sources

5.3 Importance of Renewable energy:

- Provides reliable energy sources, and secured energy supply.
- It also helps to preserve natural resources.
- It helps to protect the environment
- limits climate change
- reduces greenhouse gas emissions
- It causes less water pollution
- It helps to protect wildlife

Sources and distribution of renewable energy in Europe

- **Windpower:** Wind power is wind energy that generates electricity with help of wind turbine. Wind power is a popular, sustainable renewable energy source, that has a very little impact on the environment than fossil fuels. (Wikipedia)



Fig 5.5 Wind power

- **Hydropower:** Hydropower also known as water power is the form of using fast running water to produce electricity. It is a sustainable method of energy production. (Wikipedia)

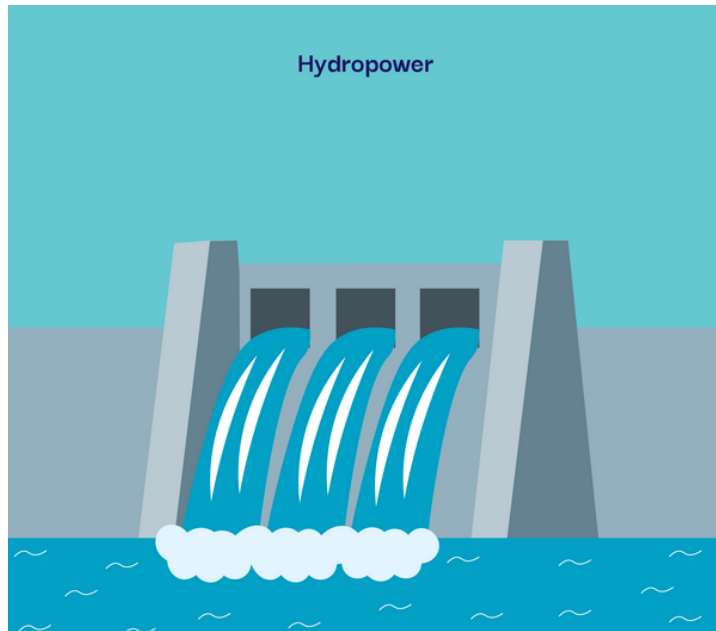


Fig 5.5 Hydropower

- **Solar Power:** Solar power is the conversion of energy from sunlight into electricity. It can be generated from direct use of Photovoltaics, indirect use of concentrated solar power, or a combination of both. Solar power from sunlight is also a source of renewable energy.

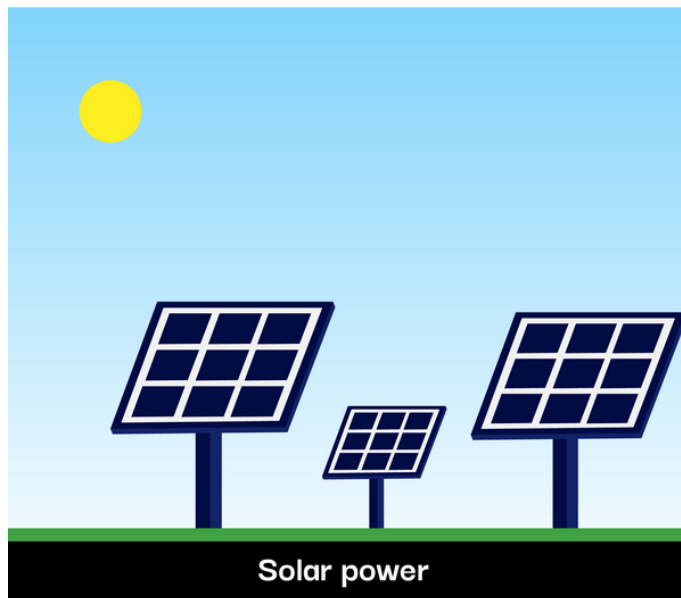


Fig 5.5 Solar power

- **Solid Biofuels:** Biofuels are a type of fuel that is produced over a short span of time. It can be produced from plants, agricultural or industrial waste. (Wikipedia). On the other hand, solid biofuel.

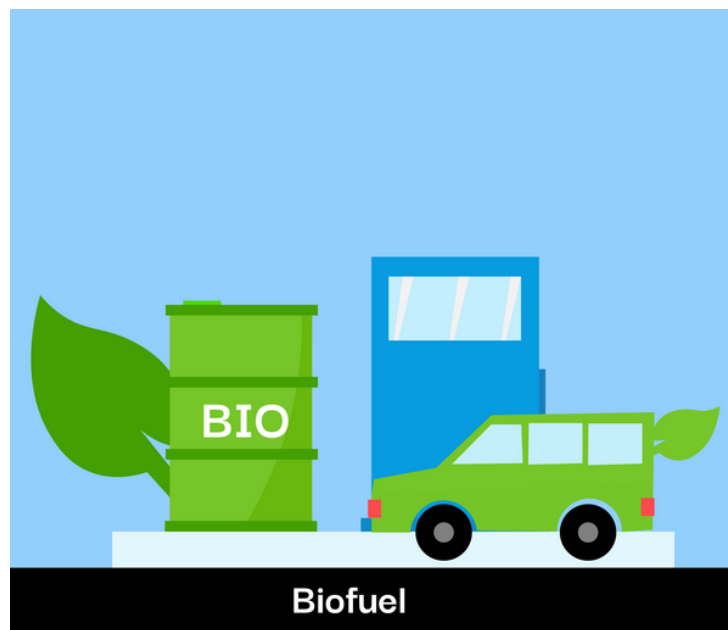


Fig 5.5 Solid biofuels

5.4 Actions for Energy Transition

European Union policy brief report (2021) recommended some skills and actions that are needed for the future energy transition in Europe.

- **EU policy & support:** A strong climate action and policy is required under European Union Green Deal. EU targets reducing greenhouse gas carbon neutrality by 2030 and implementing the Paris agreement is necessary to achieve this target.
- **Training and Education:** Organize upskilling and reskilling programs, and workshops in regional schemes based on the results of a thorough analysis to identify the required skills for upgrading in key sectors. Also, to integrate energy efficiency into vocational education and training (VET) programs can be an opportunity for many to promote energy transition education.
- **Dedicated structures:** Developing a dedicated structure with a definite mission and vision to promote skills for energy transition is required at the national and regional levels. This initiative can be taken by well-established energy agency at regional level. Example: Upper Austria Energy saving Agency and training centre is committed to boosting energy efficiency skills at regional level.

- **Awareness-raising & initial advice:** Promote awareness rising activities and entity of professionals, trainers to facilitate breakthrough of energy efficiency into people's lives. Example: Gozo (Malta). Implant the free of charge energy advices, services for household and business in local region. Ex: Slovenian Eco Fund. Build local partnership to energy agency for delivering energy efficiency advic. Ex: Warm and Well (UK)
- **Creating demand for skills:** Design a mechanism to stimulate the growth of green jobs, where energy skills acquired by workers through trainings. Introduce incentive based sustainable construction promotion program, engage SMEs in energy efficiency. Ex: Andalusia (Spain).

Chapter 6

Low Carbon Strategy

Low carbon simply means less carbon dioxide (CO₂). Carbon dioxide is a key greenhouse gas that drives global climate change.

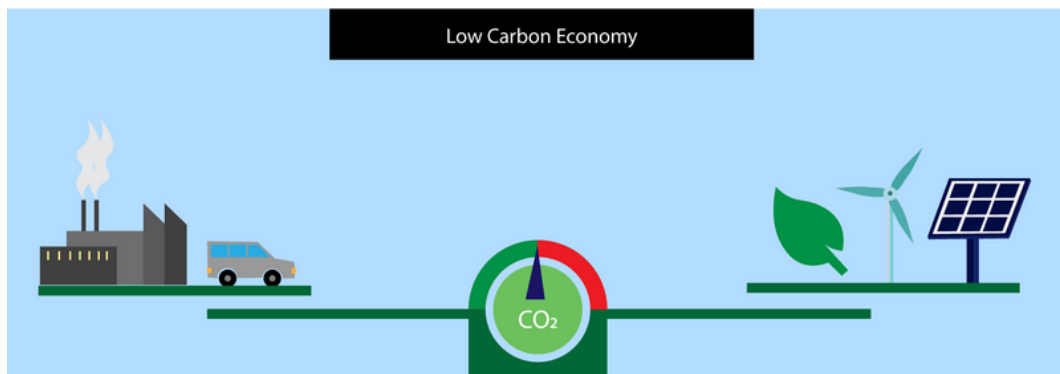


Fig 6.1 Low carbon economy

It is released through lots of different types of activities, such as deforestation, burning fossil fuels and production. Therefore, by lowering the amount of CO₂ we produce, we are being kind to our planet. To date, no definition of low-carbon strategy has been established and formally agreed. In the context of the UNFCCC process, low-carbon development strategies are also referred to as:

- long-term low greenhouse gas emission development strategies,
- low-emission development strategies (LEDS), as well as
- low-carbon growth plans (LCGP).

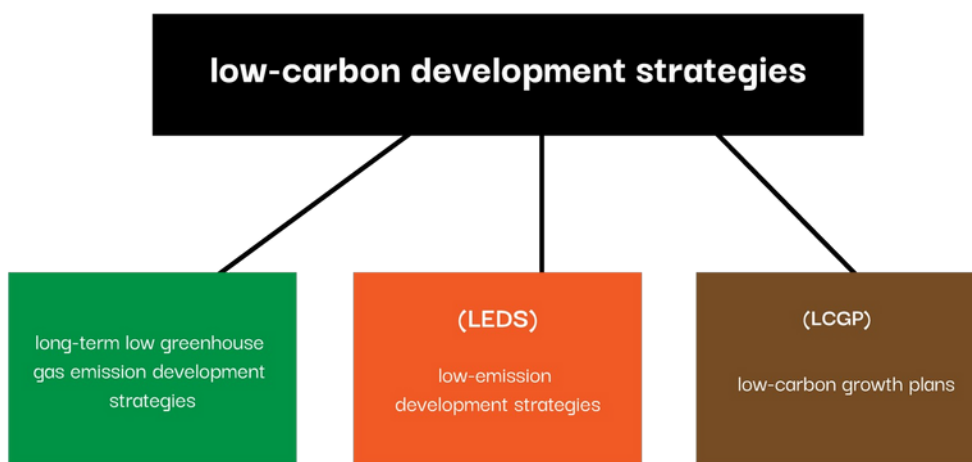


Fig 6.2 Low carbon development Strategies

In the scientific literature the terms are generally used to describe forward-looking national economic development plans or strategies, that focus on low-emission and/or climate-resilient economic growth. Many national and subnational governments, and even some companies, are in the implementation phase of their first low carbon development strategy on the road to meeting their Paris Agreement targets. This is a complex phase composed of negotiations with different actors, recalibration or redesign, and technical discussions on the different implementation routes and projections of complex monitoring systems, as well as their design. For example: Eiffage and Ikea who managed to reduce internal emissions in all their group's business lines and developing new low-carbon products and services or extending those currently provided by the different divisions.

These low carbon strategies are created to be applied to the main actor in carbon emission, companies. Indeed, the mass production and the unrelenting need to make more profit pushed by the world economic system are the main cause of this last 50 years massive increase in pollution. Also, as humans, we assumed the nature and economic growth are incompatible and therefore companies don't tend to be careful about their ecologic repercussion. This is when the governments should start acting and remind the companies, especially the big ones, to be cautious about it. Governments should be a hundred percent dedicated to applying low carbon strategy throughout all their infrastructure and they should be pushing the rules and practices provided by low carbon strategies. Because governments have a power that companies don't, they should be at the frontline of the energy transition. Modern societies have been hardwired to run on fossil fuels. This influences how we design cities and transport systems grow our food, produce electricity, raise revenues from taxes and trade with other countries. 80% of the world's energy is derived from fossil fuels. This came about before we understood how carbon dioxide emissions damage our climate. Even our policies have evolved around fossil fuels. To shift our economy to low carbon, we need strong climate policies, but these will not work if existing policies in different areas of government work against them. We must realign the world economy towards low carbon. 2/3 of investments in energy supplies still go to fossil fuels. Financial market rules, favor short term investments, but we need long term investments in low carbon infrastructure for sustainable growth. Many of our innovation policies still support brown technologies in firms. In the 29 oil importing countries that make up the International Energy Agency, the share of energy in public research and development spending has dropped from 11% to 4%, since 1980. A trend that can still be reversed.

Today's mobility systems carry a high cost to the climate of local environment. Cities can plan, land use and public transport systems more efficiently if local and national governments work together.

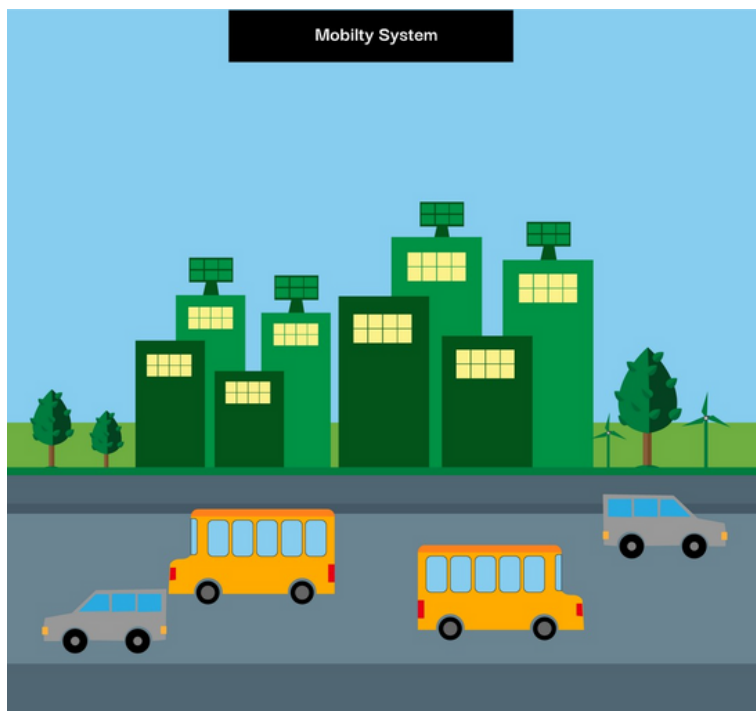


Fig 6.3 Mobility system

Almost half of the agriculture subsidies in OECD countries could have harmful consequences on the environment and climate. More sustainable land management practices could contribute to the climate change effort and increased productivity. Tax codes can encourage more fossil fuel use, like the generous treatment of company cars in advanced economies, which results in more CO₂. Tariffs on climate friendly goods need to stop holding back investment in low carbon technologies. We have structured electricity markets around fossil fuel technologies. They should be structured to send long-term price signals, to invest in low carbon technologies. Layer upon layer these misalignments are standing in the way of the world's climate goals. We need to broaden the circle of climate action. Different government departments must work together to overcome policies that stand in the way and align them to facilitate the transition to a low carbon economy.

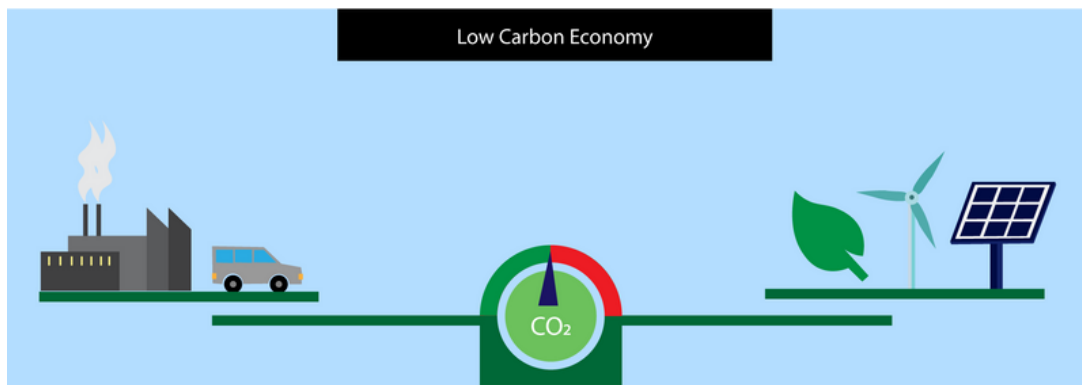


Fig 6.4 Low carbon economy

All along, civil society has hoped that through its influence, the big institutions of business and government would change their behavior. The business would move away from profligacy and very high carbon intensive activities and try and cut that waste. And the government would introduce regulations and taxes. And so on. And to some extent that has happened. The world the economy is in a very different place to what it was ten or twenty years ago. It's much more aware about carbon, much more aware of the impacts of our decisions on the climate. But in the wake of the COP26, at the end of 2021, it's quite hard to be optimistic. Quite hard to be sanguine about whether enough will be done quickly enough to really reduce the enormous input of CO₂ into the atmosphere, particularly at a time when countries like China and India are industrializing fast at consuming ever more cars, consumer goods, and so on. And that's why we looked at what civil society could be doing now to try and have the biggest possible influence on climate change, because this probably is the biggest test faced by any generation alive today from the point of view of the future. We argue for a series of actions which can be taken now by charities, by social enterprises, by cooperatives and mutuals, wither or not, their environmentally focused organizations, but to do their bit to reduce carbon emissions. Part of that means building up as fast as we can a truly low carbon economy, which has to mean much more locally rooted economy, with Community transport, community owned energy, community, food production and waste management. Done right, these can create wealth and jobs and reduce our impact on the environment, and this could be a way of building up community owned assets for the next generation rather as housing provided a base for assets at the end of the 20th century. We also argue that civil society has to maintain the pressure as an advocate arguing for policy innovation to accelerate the shift to low carbon economies. That may mean the occasional windfall taxes on carbon energy industries may mean creating green investment banks, allowing new kinds of financial products, or encouraging regulatory reforms, which make it possible for individuals and indeed communities to sell low carbon energy into the grid, we need to be on the forefront of all of those arguments. And finally, we argue that as in other areas, civil society has to be there to scrutinize.

What others are doing to hold them to account, to show if businesses are simply involved in greenwash projects, which look green but aren't at all showing. Which governments are really making a difference in terms of their laws and their regulations and their taxation, and using all of the instruments which civil society has at its disposal?

Green Wash Projects



Fig 6.5 Green wash project

Nonviolent direct action through to research and advocacy, to try and change the way in which we think, as well as the change in which we do things. At the heart of this, I guess is a sense that we may be on the cusp of a possible shift to a very different kind of economy, much more local, much more sustainable. Much more rooted in our daily lives, but there's no guarantee we will make that shift. And unless civil society mobilizes all of its powers, all of its energies, all of its assets, to help this shift, and in ten, twenty, thirty years' time, future generations will look back at us and think we really failed the ultimate test of our era.

Low carbon sources

Solar, wind, hydro, and nuclear power are the four main sources of low-carbon energy. They are renewable, which means they are excellent for the environment. Renewable energy is an unlimited resource that never runs out. Unlike fossil fuels, which are limited in supply and will eventually run out. Due to the increasing population of human on earth, it takes a lot of energy to power all of our homes! We travel using fossil fuel powered means of transportation, food consumption especially animal sources, and energy use at home and in commercial buildings, manufacturing and processing plants et. All these are the key contributors to a high carbon footprint. Reducing our carbon footprints is our first step in climate action. In order to imbibe the Low carbon lifestyle, all hands must be on deck to utilize the following strategies:

Low carbon strategies

- **Transportation** is the leading source of greenhouse gas emissions in the United States, owing primarily to the use of gasoline and diesel fuel in automobiles and trucks. These emissions can be reduced through Improved Fuel Efficiency. The Federal agencies, California, and the auto industry have agreed on standards that will increase average fuel economy for passenger cars to up to 54.5 miles per gallon (mpg) for the model year 2025. All electric and "plug-in" hybrid vehicles can be charged at home or at a public charging station. These vehicles run on the same electricity generated by local power plants, which is often cleaner than gasoline or diesel.
- **Fuel Blending:** Blending biofuels with gasoline reduces emissions and has the potential to offset 10-24% of total emissions. In the United States, corn-based ethanol is the dominant biofuel. Cellulosic ethanol and sugarcane-based ethanol may enable reductions of up to 100 percent in the future.
- **Advanced and Hybrids:** Diesel and hybrids engines that are different from the standard internal combustion engine also use different fuels. When compared to other cars and trucks, these technologies both offer significant improvements in fuel economy because they use less gas and produce fewer greenhouse gas emissions. When both technologies are combined in a diesel hybrid vehicle, greenhouse gas emissions per mile can be reduced by 65 percent.
- **Hydrogen Fuel Cells:** Hydrogen fuel cells generate electricity by combining oxygen and hydrogen, with the only "tailpipe emission" being water vapor. Technological advancements and cost reductions associated with fuel cells may pave the way for a future with more hydrogen-based transportation options. Major automobile manufacturers are already experimenting with hydrogen vehicles.
- **Industrial Processes:** accounts for roughly one-fifth of all greenhouse gas emissions including the production of iron and steel, cement, and aluminum.

- Capturing, recovering, and/or reprocessing emissions for another industrial product or process can help to reduce emissions. Increasing collaboration among industries that could benefit from captured emissions would also be beneficial. Many businesses have set emissions targets and are taking steps to reduce emissions from industrial processes.
- **Agricultural practices.** Such as the use of inorganic fertilizers, herbicides, pesticides in crop agriculture, land preparation methods such as bush burning etc generates carbon. We can reduce emissions by changing the way we grow and manage our crops. Heavy chemicals and petroleum-based fertilizers account for half of the sector's emissions.
- **Livestock** (particularly cows) emit significant amounts of methane, reducing our reliance on livestock for food and improving feeding management would help reduce emissions.
- **Manure** is a byproduct of livestock and accounts for 14% of the sector's emissions. Finding innovative manure management solutions, such as aerobic containment, would reduce emissions.
- **Land use** includes land-use change and forestry. This industry stores more greenhouse gas emissions in the soil and plants than it emits. Thus, land use is considered a "sink," and experts estimate that it captures 11% of US emissions.
- **Nuclear Power:** Nuclear power generates roughly 20% of US electricity while emitting almost no greenhouse gases. However, for nuclear power to play a larger role, the industry must overcome high costs and concerns about nuclear waste disposal.
- **Carbon Capture and Storage (CCS)** is a term that refers to the process of capturing and storing carbon emissions. Computers, refrigerators, and cell phones are collected from factories and power plants and stored underground. CCS technologies can capture up to 90% of a facility's carbon emissions. Around the world, nearly a dozen commercial-scale carbon capture projects are in operation, with 22 more in the planning stages.
- Building energy efficiency can be improved in a variety of ways, including the installation of more efficient lighting, Energy Star-certified appliances such as water heaters, and improved insulation.
- To power everything from our cell phones to our homes, offices, and factories, we need to use more clean energy and use it more efficiently.
- We need to drive cars and trucks that use less gasoline or run on alternative fuels such as hydrogen, algae fuel, etc.

Electricity: The vast majority of electricity is consumed in our homes, offices, and factories to power everything from heating and cooling systems to lighting. Computers, refrigerators, and cell phones are all examples of electronic devices.

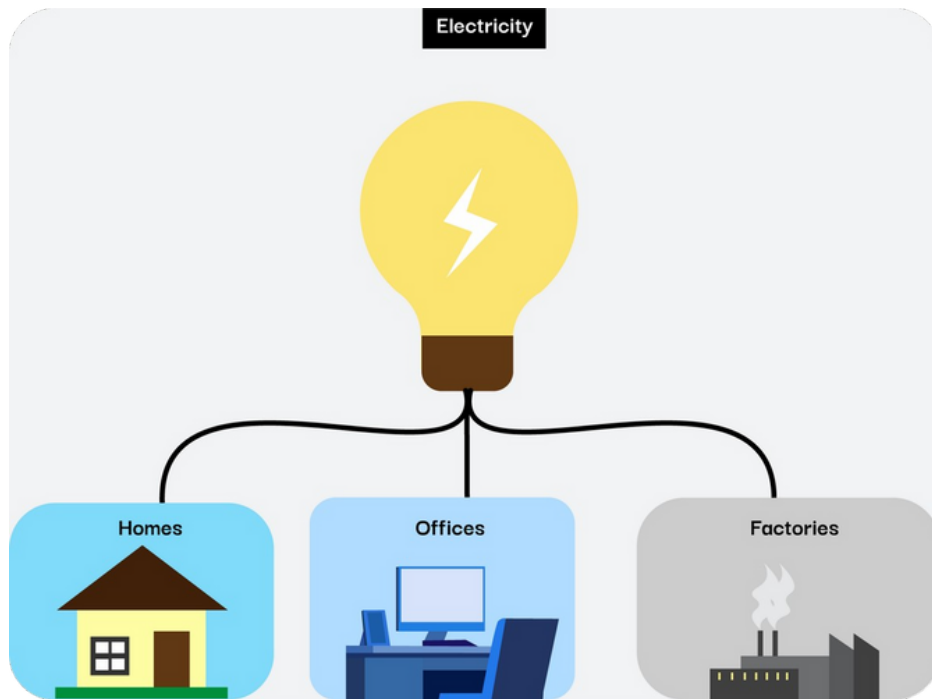


Fig 6.6 Electricity

Greenhouse gas emissions can be reduced by **generating electricity on-site using renewable and other environmentally friendly energy sources**. Rooftop solar panels, solar water heating, small-scale wind generation, natural gas, or renewable hydrogen fuel cells are some as seen below. In conclusion, while we strategize and implement actions to reduce greenhouse gas emissions, we must also prepare for consequences such as the sea-level rise and more frequent and severe weather events in form of Adaptation strategies. We can't avoid the intense extreme weather, due to vulnerability. A lot of countries, and even some parts of the United States, Europe and Asia, are constrained by economic or technological resources, making preparation more difficult. Adaption for building resilience to climate change necessitates considering how a changing climate will affect where and how we grow our food, as well as where and how we build our homes, bridges, and roads. It also entails weighing the costs and benefits of planning versus reacting. Acting now through the creation of awareness on green economy and its drivers which are green jobs and green skills for the new energy transition into a low carbon society will definitely limit the damage caused by climate change. Therefore, it is often smarter and less expensive when we act now than later.

References

[1] Australia can get to zero carbon emissions, and grow the economy(Sept 23, 2014)
Retrieved from, <https://theconversation.com/australia-can-get-to-zero-carbon-emissions-and-grow-the-economy-32015> Accessed on August 3 2022.

The **SLATE** eBook aims at providing fundamental understanding about climate change actions and green economy opportunities. It serves as a guide to raise awareness of climate change issues, mitigation strategies and sustainable solution to protecting environment. The e-book can be found on www.sameconnects.com, a community platform for climate change, inclusion & diversity and social entrepreneurship. The E-book is the final result of a project SLATE co-funded Erasmus+ programme of the European Union. As a sustainability strategy, we will further adapt some of its content as e-courses in MP4 format under the project NET-ZERO Emission: Climate Change advocacy through green transportation (N-ZERO) that would be available on the platform www.erasmuslearn.com .



Co-funded by the
Erasmus+ Programme
of the European Union

GRANT AGREEMENT NO: 2021-1-DE02-KA210-VET-000034539